BALLUFF

sensors worldwide

Micropulse Transducers BTL/BIW

Linear position sensing – high precision with extreme reliability

Micropulse Transducers

Linear position sensing for greater efficiency

With over 50 years of sensor experience, Balluff is a leading global sensor specialist that has developed well-engineered distance measurement technology and its own line of connectivity products for every area of factory automation. Balluff is based in Germany and has a tight international network of 54 representatives and subsidiaries.

Balluff stands for comprehensive systems from a single source, continuous innovation, the most modern technology, highest quality and greatest reliability and prides itself on distinctive customer orientation, custom-tailored solutions, fast worldwide service and outstanding application assistance.

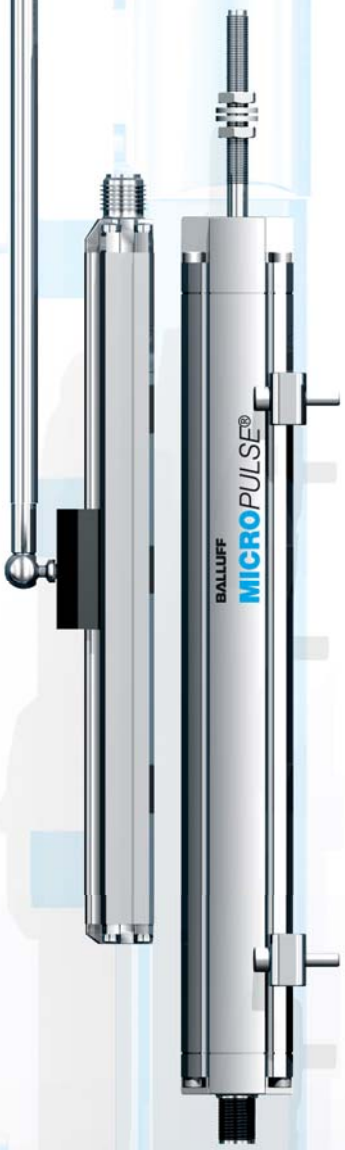
High-quality, innovative products tested in our own accredited laboratory and a quality management system certified according to DIN ISO 9001 (EN 2008) form a secure foundation for optimized added value for our customers and reliable partnership with deliveries and logistics organized according to requirements.

Whether electronic and mechanical sensors, rotary and linear transducers, identification systems or optimized connection technology for high-performance automation, Balluff masters not only the entire technological variety with all of the different operating principles, but Balluff technology fulfills regional quality standards and is suitable for use worldwide. Wherever you are in the world, Balluff technology is never far away. You won't have to look far for you nearest Balluff expert.

Balluff products increase performance, quality and productivity around the world every day. They satisfy prerequisites for meeting demands for greater performance and cost reductions on the global market. Even in the most demanding areas. No matter how stringent your requirements may be, Balluff provides state-of-the-art solutions.

Fully exploit the potential of high quality with sophisticated distance measurement technology for greater efficiency

ALPHA



Micropulse Transducers

MICROPULSE®

MICROPULSE®

Magnetic linear encoder system BML – High precision and extended lengths

BML 48000 mm

Micropulse transducers BTL/Inductive linear position sensor BIW – Extremely robust and reliable

BTL/BIW 7500 mm

Photoelectric distance sensors BOD – Independent of material and color

BOD 6000 mm

Magneto-inductive position sensors BIL – Compact and absolute

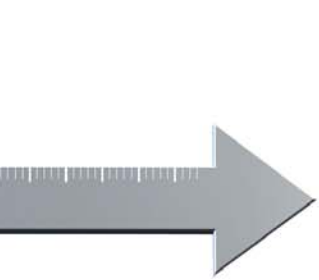
BIL 160 mm

Inductive distance sensors BAW – For short strokes

BAW 20 mm

more added value

– Full-range assortment for greater flexibility
– Greater efficiency with optimized solutions
– Superior distance measurement technology for increased productivity



Balluff distance measurement – the right solution for you
Balluff distance measurement offers efficient individual solutions that are adapted to your specific requirements.
Different working principles are available for distances from 1 to 48000 mm and resolutions from 1 to 100 µm.
From position detection to distance measurement.
Fully exploit the benefits available.
Choose the option that's right for you and increase your added value with superior Balluff distance measurement technology.
Robust industrial Balluff distance measurement technology is accurate, reliable, non-contact, wear-free and brings out the best from your machines.

Micropulse Transducers
Overview
Distance measurement

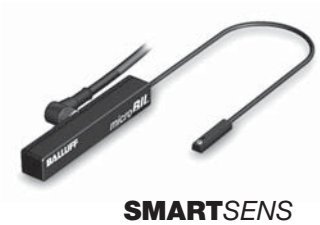
Series	Profile P	Profile PF	Profile A1	Profile BIW	Rod B, A, Z, Y	Rod compact	
Internal fitting version e.g. in hydraulic cylinders					■	■	
External fitting version e.g. on machine frames	■	■	■	■			
Filling level sensor e.g. device filling systems							
Special approvals							
Magnet	free/captive	free/captive	free	captive push rod	free or floating	free or floating	
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			■				
From page	30	48	56	68	74	102	

Micropulse transducers BTL
Inductive linear position sensor BIW
... extremely robust and reliable

Micropulse Transducers
Overview
Distance measurement

	Rod pro compact	Rod AR	Compact rod DEX B/J	Rod DEX C	Rod NEX	Rod PEX	Rod T	Rod 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	Flameproof "d", zone 0, zone 1, ATEX, CENELEC, FM, CSA	protection type "n" zone 2	Dust protection zone 22	Increased safety 2 or 3-way 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
	■	■	■	■	■		■	■
	■	■	■	■	■		■	■
	■		■	■				
			■	■				
	■			■				
				■				
	■	■	■	■	■	■	■	
	108	118	130	132	135	134	138	142

MICROPULSE®



SMARTSENS

SMARTSENS

SMARTSENS

Magneto-inductive distance sensors BIL		Micro-BIL	BIL 60	BIL 160
Working range		0...10 mm	0...60 mm	0...160 mm
Resolution			±0.15 mm	±0.4 mm
Linearity		±0.3 mm	±1 mm	±2.4 mm
Repeat accuracy		±30 µm	±60 µm	±0.5 mm
Housing size		28×6.2×4.4 mm	95×15.2×15.2 mm	230×15.2×15.2 mm
Output	0...10 V	■	■	■
	4...20 mA	■	■	■
Special features		Mounted in T-slot		

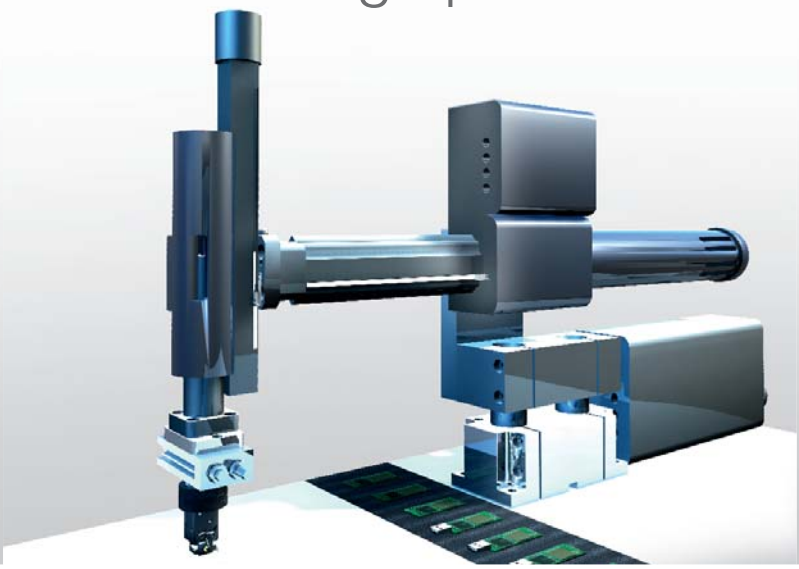
Magneto-inductive distance sensors BIL

... compact and absolute

Refer to our
Linear Position Sensing catalog
for more information on
BIL magneto-inductive position sensors
or visit our website at www.balluff.com

Magnetic linear encoder system BML	BML-S1A_-Q... digital	BML-S1A_-A... analog sin/cos, 1 V_{ss}	BML-S1F_-Q... digital	BML-S1F_-A... analog sin/cos, 1 V_{ss}	BML-S1B0-Q... digital	BML-S1E0-Q... digital	BML-S1C0-Q... digital
Resolution	1...10 µm		1...10 µm		5...50 µm	5...50 µm	100...2000 µm
System accuracy	±10 µm/ ±20 µm	±10 µm/ ±20 µm	±10 µm	±10 µm	±50 µm/ ±60 µm	±100 µm	±100 µm
Distance to tape	0.1... 0.35 mm	0.1... 0.35 mm	0.1... 0.35 mm	0.1... 0.35 mm	0.1...2 mm	0.1...2 mm	0.1...2 mm
Digital output signal RS422 (TTL)	■		■		■	■	
Digital output signal HTL (as operating voltage 10...30 V)					■	■	■
Analog output signal os (1 V_{ss})		■		■			
Linear tape up to 48 m	■	■	■	■	■	■	■
Rotary magnetic tape (magnetic ring) Ø 30...300 mm			■	■	■	■	■

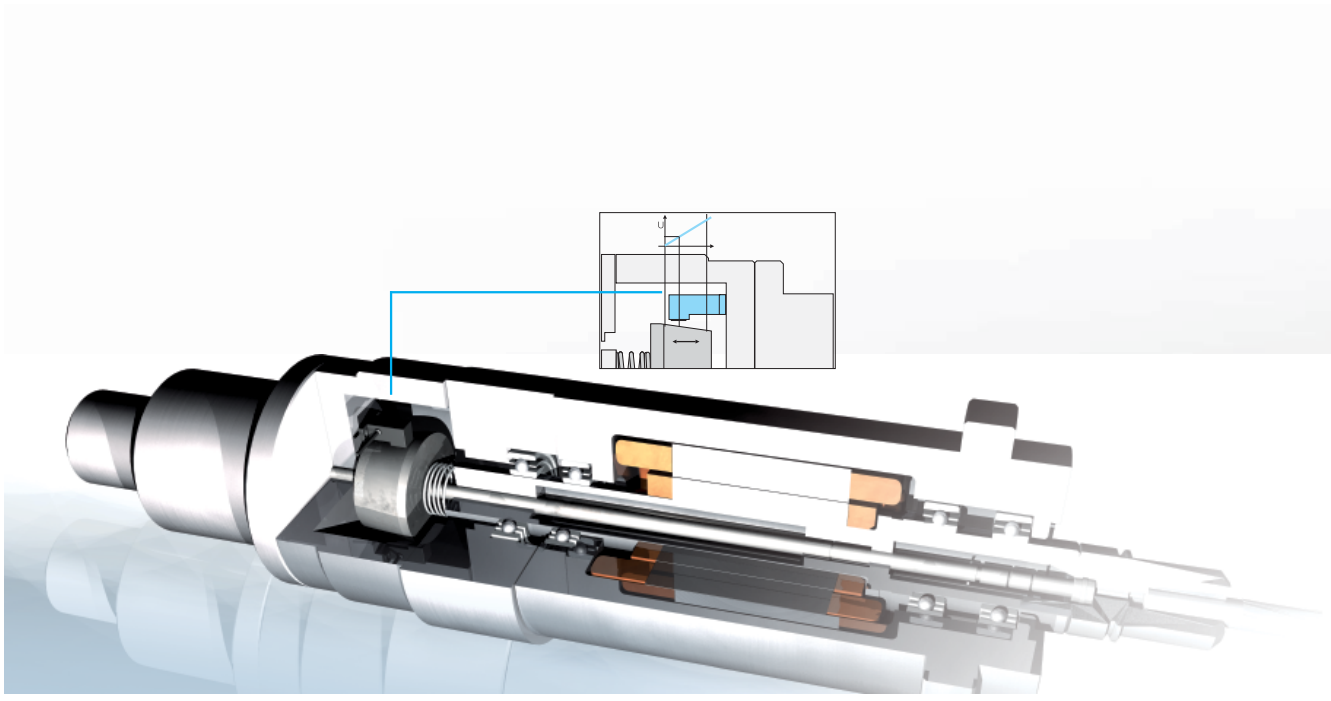
Magnetic linear encoder system BML
... high precision and extended lengths



Refer to our catalog
Magnetic Linear Encoder Systems BML
for more information
or visit our website at www.balluff.com

Inductive distance sensors BAW		BAW Ø 6.5 mm	BAW M12	BAW M18	BAW R03	BAW PG 36	BAW 80×80 mm
Linear range	Flush	0.5...2 mm	0.5...2 mm	1...5 mm	1...4 mm	0...20 mm	
	Not flush		1...4 mm	2...16 mm			0...50 mm
Housing size		Ø 6.5 mm	M12×1	M12×1	10×30×6 mm	PG 36	80×80 mm
Output	0...10 V	■	■	■	■	■	■
	0...20 mA		■	■			
	4...20 mA		■	■			
Connection	Connectors	■	■	■	■	■	■
	Cable	■	■	■	■		
Special features				Teachable switching output			

Inductive distance sensors BAW
... for short strokes



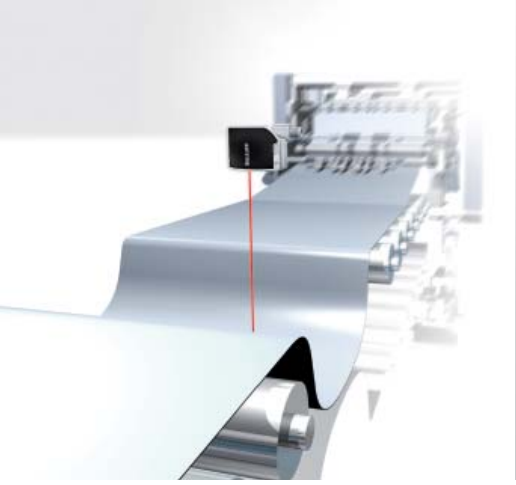




Photoelectric distance sensors BOD		BOD 6K	BOD 18K	BOD 26K	BOD 63M	BOD 66M
Distance sensor measuring range		20...80 mm	50...100 mm	45...85 mm 30...100 mm 80...300 mm	200...2000 mm 200...6000 mm	100...600 mm 200...2000 mm
Diffuse sensor measuring range with background suppression		20...80 mm		30...100 mm 80...300 mm	200...2000 mm 200...6000 mm	100...600 mm 200...2000 mm
Housing size		20 × 32 mm	M18×1	50 × 50 mm	90 × 70 mm	73 × 90 mm
Output	0...10 V	■	■	■	■	■
	4...20 mA			■	■	■
Connection	Connectors	■	■	■	■	■
	Cable	■	■	■	■	■
Special features		Teachable switching output		Teachable switching output, adjustable measuring range	Teachable switching output	Teachable switching output

Photoelectric distance sensors BOD

... independent of material and color



Refer to our catalog Linear Position Sensing for more information on photoelectric distance sensors BOD or visit our website at www.balluff.com

Micropulse Transducers
Applications

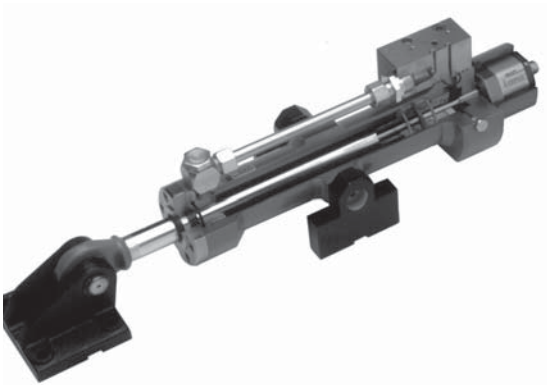
Micropulse transducers are perfect for applications that require a high degree of reliability and precision.
Suitable for measurement lengths between 25 and 7500 mm, integrable and compact Micropulse displacement systems are extremely versatile.
The non-contact working principle of the systems ensures a complete absence of wear and a virtually endless service life. The high-precision output signal serves as an absolute signal for the controller in a wide range of different interfaces.

Integrated in the pressure section of hydraulic cylinders, Micropulse transducers are used as displacement systems for position sensing in a wide variety of sectors.

Application areas:
- Pitch movement on wind generators
- Monitoring reflection channels on thermosolar power stations
- Large hydraulically powered valves
- Casting and rolling mills
- Lift controls
- Flight simulators
- Foundries
- Logging machines
- Automation engineering
- Hydroelectric power stations
- Locks and floodgates
- Construction machinery
- Combine harvesters

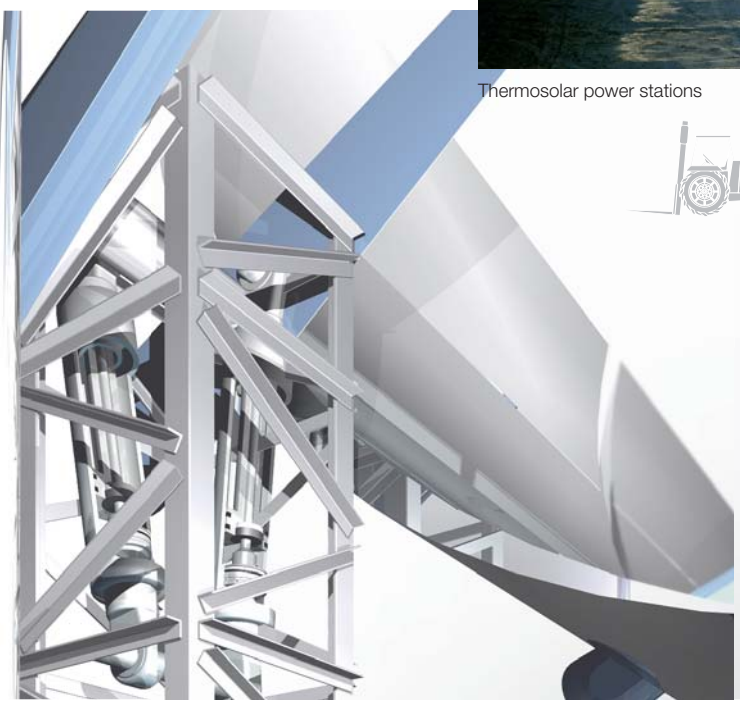
Integrated in construction machinery

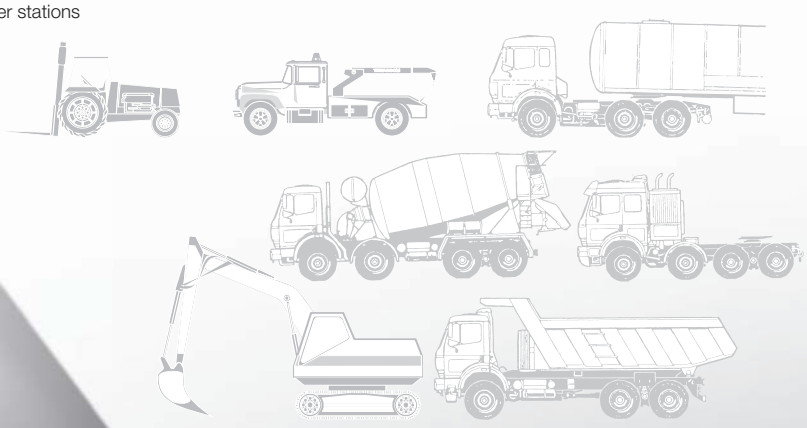
Hydraulic press



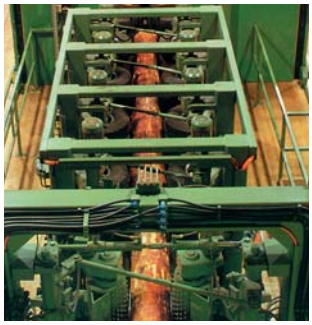
Hydraulic axis with integrated Micropulse transducer

Thermosolar power stations

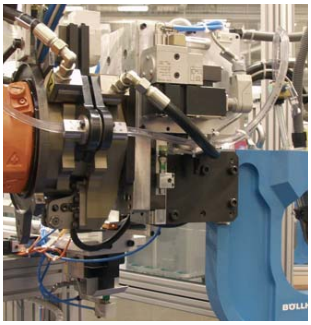




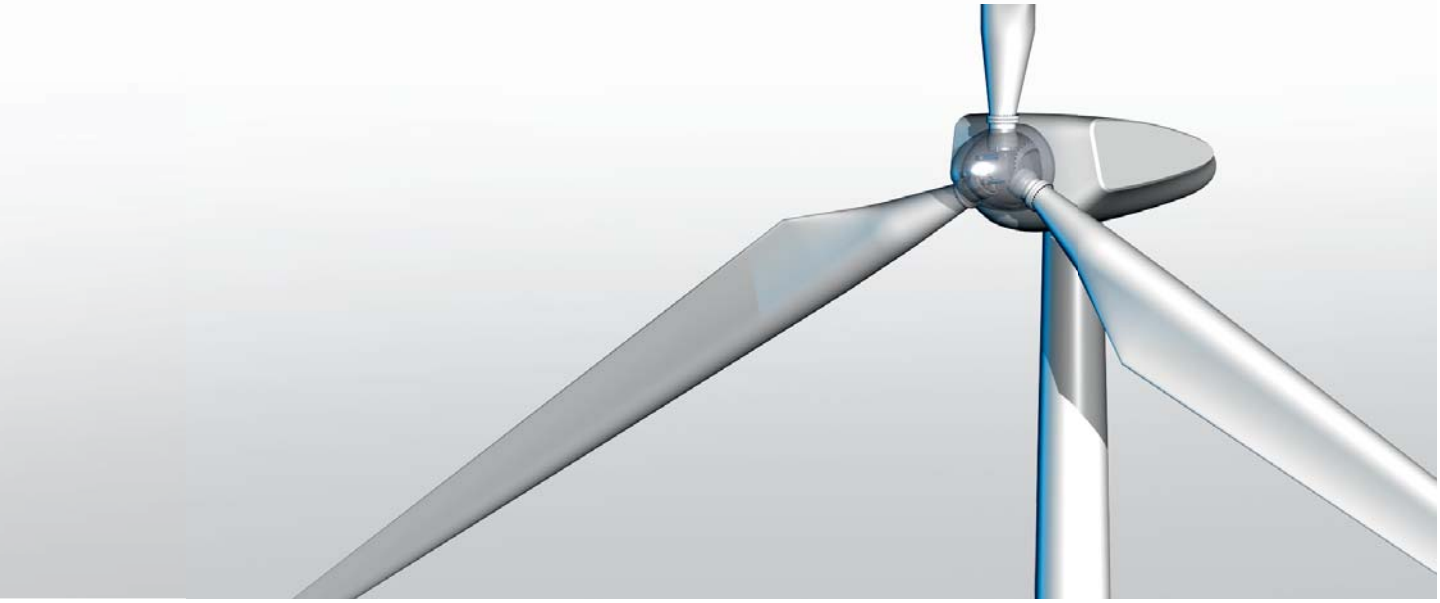
Wind power generator



Sawmill machinery



Hydraulic riveting system



Micropulse Transducers
Applications

In the automation of a wide range of different machine types, the most important requirements include maximum precision, no wear, easy installation, a high degree of protection and a low price. Micropulse transducers in a profile housing fulfill requirements in the automation industry 100 %.

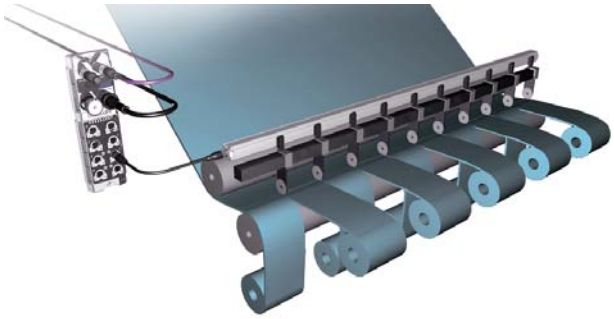
Application areas:
- Injection molding
- Presses
- Handling systems
- Portal robots
- Woodworking machinery
- Packaging machines
- Conveying
- Leveling machines
- Operating tables
- Concrete blockmaking machines

Equipped for the future !
- Extremely flexible
- Product changes using keyboard
- Longer cycle times
- Increased availability
- Short set-up times
- Downtimes prevented
- Greater degree of automation

are just some of the requirements designers and developers must fulfill for future machine generations.

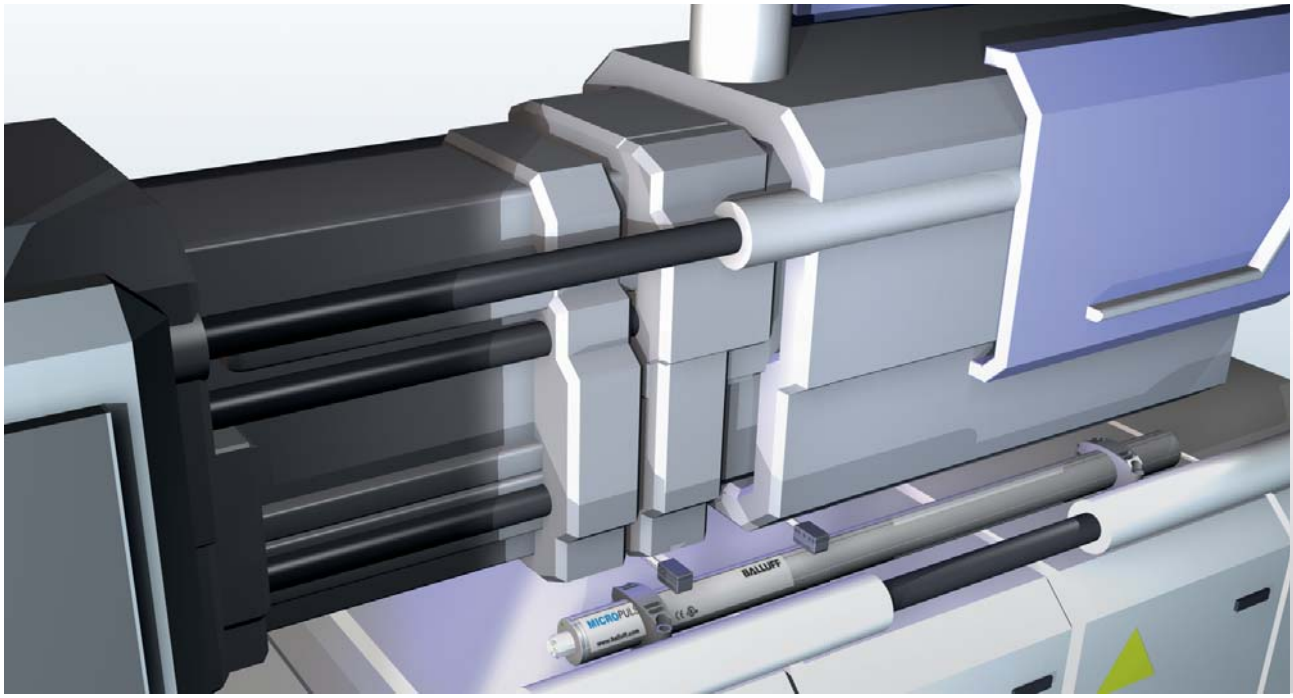
The perfect solution for your application !
From the Balluff full-range assortment of distance measurement technology, we can work out the most economical and technically appropriate solution for you.

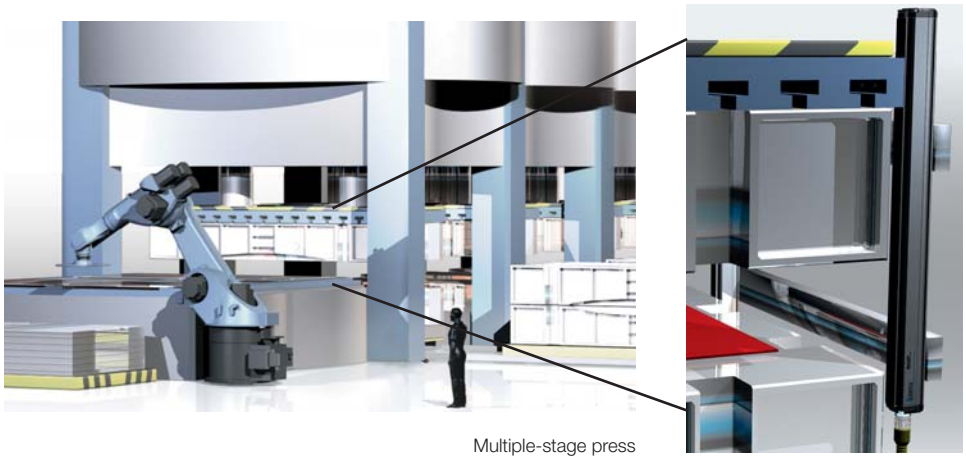
Competent application consultation:
Phone: +49 7158 173-370 or +49 7158 173-777
tsm@balluff.de bzw.
service@balluff.de



Film slitting machine

Injection molding machine

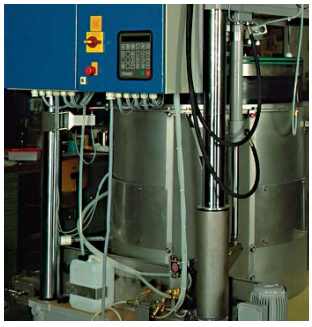




Multiple-stage press

Automation engineering

Concrete construction machinery



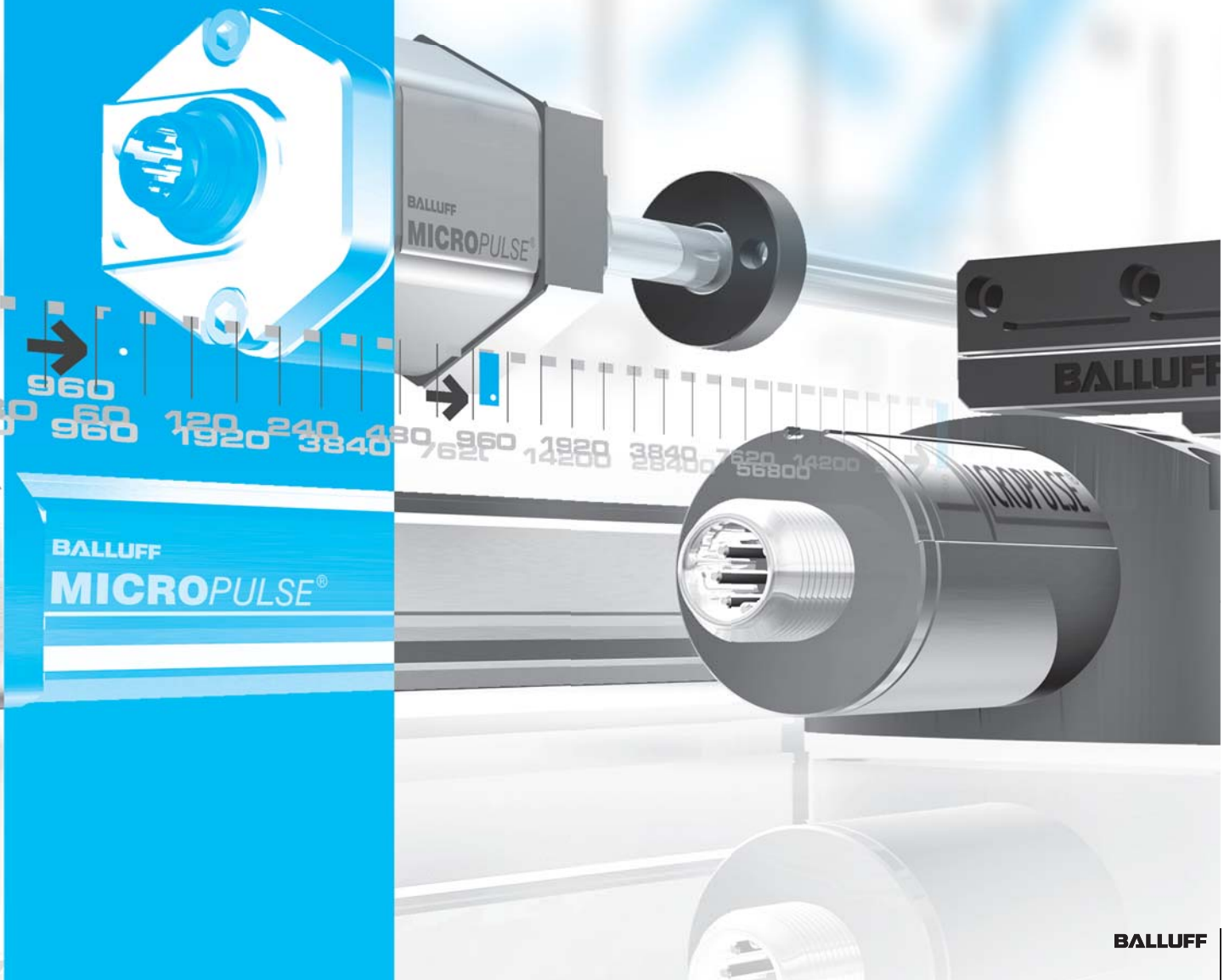
Laundry press

Level monitoring

The non-contact magnetostrictive working principle is also ideal for special applications.

Application areas:
- Process technology
- Filling of foodstuffs
- Level monitoring in milk tanks
- Dosimetry
- Perfume manufacture
- Pharmaceuticals
- Alcohol production

Basic Information and Definitions
Contents

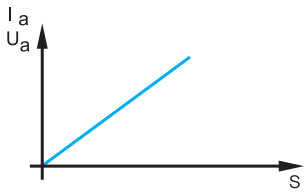


Output signal, characteristic curve, resolution, sensitivity

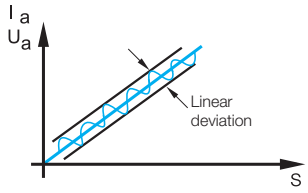
The characteristic curve describes the relationship between the output signal and the input signal. The slope of the curve represents the sensitivity of the device.
The sensitivity (resolution) is the quotient of the input signal change and the change in the output signal. On Micropulse transducers, the input signal change is the change in the position of the magnet 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.



Linear function



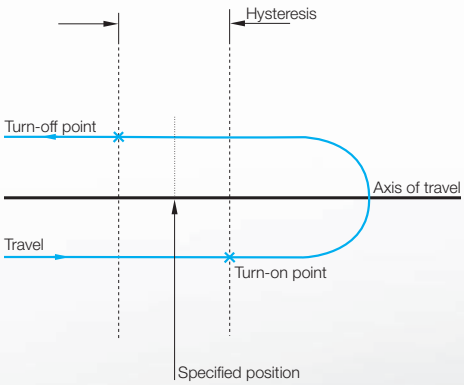
Linear deviation from a linear function

Non-linearity

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

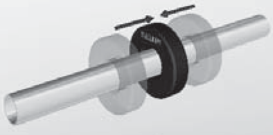
Hysteresis

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.



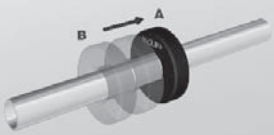
Repeatability

Repeatability is moving to a certain position from both directions. Repeatability 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.



SYNC mode

The absolute positioning information of the displacement system is established and transmitted synchronously to the read cycle of the processing electronics, e.g. an axis controller or a regulating controller.

Incremental

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

Absolute

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

Temperature coefficient, formula

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

Temperature coefficient

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

Null point

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

Sampling rate

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

Nominal stroke

The nominal stroke is the usable area along the transducer, and is represented by the length indication in the part number (see also Characteristic curve). The nominal stroke 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 magnet 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 which 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 the electrical and electronic circuits.
In addition the permissible load on the components as compared with normal industrial applications must be reduced:
– with respect to the voltage in terms of dielectric strength, and
– with respect to the current in terms of thermal effects.

Flameproof enclosure "d"
Designation "Ex d"

Parts which could ignite a potentially explosive atmosphere must be housed in an enclosure:
– which in case of an explosion of an explosive mixture inside the housing can contain the pressure, and
– which prevents the internal explosion from igniting the atmosphere surrounding the enclosure.

Protection type "n"
designation "Ex n"

Devices in these categories 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 space of time.
A manufacturer's certificate is provided, confirming that the product satisfies requirements for the use of electrical equipment in potentially explosive areas according to EN 60079-15.
Several methods of flameproofing are combined under the designation.

e1 type approval

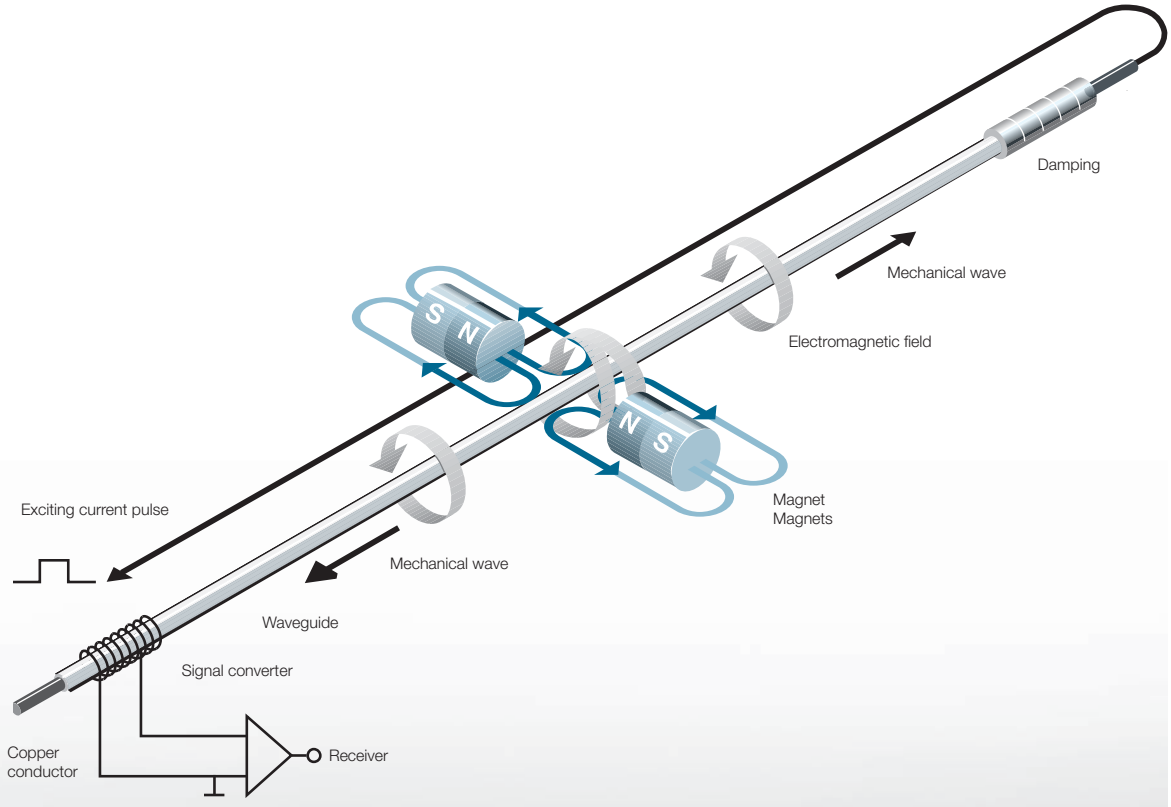
The e1 type approval is granted by the German Federal Motor Transport Authority KBA and confirms that special motor vehicle standards have been maintained.
The devices may be mounted on vehicles which travel on public roads. The standards describe EMC conditions under which the devices must operate without failure. e1 approved Micropulse transducers are indicated by "-SA265-" in the Part number.

FDA

The FDA (Food and Drug Administration) oversees the US food and pharmaceutical industry and certifies devices, materials, systems and machines from these sectors. A product designation of this kind makes your system eligible for FDA approval.

Principles of operation

The measuring element ("waveguide") consists of a special nickel-iron alloy with 0.7 mm outer and 0.5 mm inner diameter. A copper conductor is introduced through the length of this tube. A short current pulse initiates the measurement process. This current generates a circular magnetic field which rotates around the waveguide. A permanent magnet at the point of measurement is used as the marker element, whose lines of field run at right angles to the electromagnetic field.
In the area on the waveguide where the two fields intersect, a magnetostrictive effect causes an elastic deformation of the waveguide (in the microrange), which propagates along the waveguide in both directions in the form of a mechanical wave.
The propagation velocity of this wave in the waveguide is 2830 m/s, and is almost completely insensitive to environmental effects such as temperature, shock and contamination.
The component of the wave which reaches the far end of the waveguide is damped, whereas the component which arrives at the signal converter is changed into 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.



MICROPULSE®

Rod housings

Rod housings are mainly used in hydraulic drive applications. When installed in the pressure section of the hydraulic cylinder, the distance 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 face end with a welded plug. An O-ring seal in the flange at the opposite end seals off the high-pressure section. An magnet ring with magnets slides over the tube or rod with internal waveguide to mark the position prior to detection.

Profile housings

The electronics and waveguide are enclosed in an aluminum profiled housing. The aluminum housing is hermetically sealed according to degree of protection IP67. The magnets on the magnet act on the waveguide through the wall of the aluminum profile.
There are two different versions of magnet, namely captive and free magnets. Free magnets 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 a lateral and upward offset of several millimeters. If these generous tolerances are exceeded, you can always revert to using captive magnets. With captive magnets, the profile housing of the distance sensor acts as a sliding rail along which the magnet travels. In this case, a control arm with spherical heads compensates for unparallel movements.

Explosion-proof versions

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

Redundancy increases safety

Magnetostrictive distance sensors are ideal for applications requiring a high degree of safety or availability. The sensors often have a 2-way or even 3-way redundant design in order to ensure mutual monitoring or provide a reserve channel when required. A distance sensor with a redundant 3-way design incorporates 3 adjacent waveguides offset by 120°C and housed in a collective outer tube along which an magnet moves in much the same way as on standard housings. The magnets on the magnet act on all three waveguides simultaneously. The three positions are evaluated by three interdependent, completely separate electronics modules that can be integrated in the same housing. Application examples include ship propulsion drives, power stations and tilting technology in trains.

Filling level sensor

The magnetostrictive working principle is also ideal for the continuous high-precision measurement of fluid filling levels. Waveguides and processing electronics 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.

3-A 74-03

FDA

ECOLAB

EHEDG

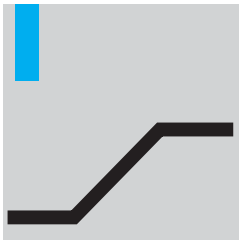
CE cULus LISTED

ALPHA

MICROPULSE®

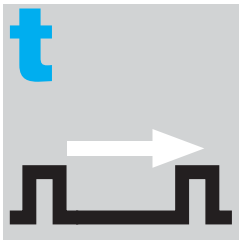
Analog
voltage output
The output voltage is directly proportional to the position of the magnet along the waveguide.
The most important parameter for analog outputs is the refresh rate and the ripple of the output signal. Many transducers on the market attain the specified values for output ripple only 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 an improved circuit design. This means fast update times with low levels of ripple and noise on the output signal.
Micropulse transducers with voltage output have 2 outputs, one rising and one falling.
Available versions include: 0...10 V (10...0 V) and –10...10 V (10...–10 V).

See technical data on page 32



Analog
current output
The output current is directly proportional to the position of the magnet along the waveguide.
Analog current interfaces of 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 convert the 0...20 mA signal into a voltage of 0...10 V.
The 4...20 mA signal provides a simple form of cable break monitoring, since a current of 4 mA must flow even at the null point of the stroke.
Micropulse transducers with current output are available with rising or falling signals.

See technical data on page 32



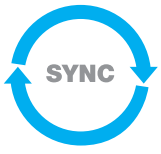
Pulse interface

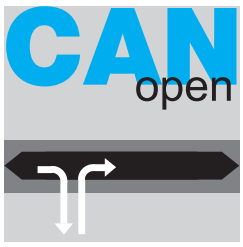
The time between an interrogation and the reply signal is directly proportional to the position of the magnet along the waveguide.
These pulses are transmitted using RS485/422 differential line drivers, guaranteeing noise-free signal transmission over distances of up to 500 m.
The great advantage of 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.

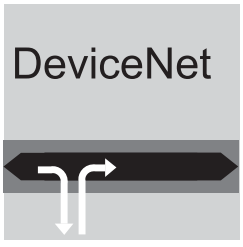
See technical data on page 34

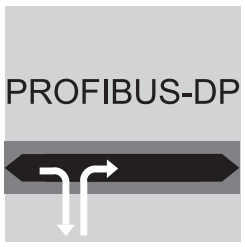
Synchronous serial
SSI interface
The position of the magnet along the waveguide is sent to the controller serially in a data word.
Micropulse transducers with SSI interface can be connected directly to controllers or to axis control cards with SSI interface. The transmission of data from the sensor to the controller is synchronized by a clock pulse from the controller.
Transducers with 16, 24 or 25-bit data words are available depending on the required resolution.
The maximum non-linearity of the SSI Micropulse transducer of ±30 µm over the entire stroke, the update frequency of 5 kHz and a resolution of 1 µm make SSI Micropulse transducers an ideal feedback sensor – even in the most demanding positioning and control applications.

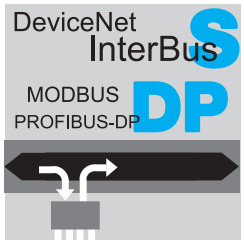
See technical data on page 36











CANopen

The position of the magnet along the waveguide is sent over the CAN bus to the controller in so-called **P**rocess **D**ata **O**bjects 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 µm – depending on your application. Alternatively you can select whether both position and velocity information are sent to your controller. Cyclically or on-demand.
And there's more:
Up to 4 so-called software cams can be defined in the active measuring range. Each time the status of one of these cams changes, high-priority emergency messages are sent to the controller.

See technical data on page 38

DeviceNet

DeviceNet is a fieldbus network which 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 parameterized using the electronic device data sheet (EDS file).

See technical data on page 40

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 as well as multi-magnet operation.
Micropulse transducers can be parameterized using the GSD file. The position resolution can be configured in 5 µm increments and the velocity resolution in increments of 0.1 mm/s.
Working ranges and the null point can be configured individually for each magnet.

See technical data on page 42

Bus interface modules WAGO/Phoenix Contact

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

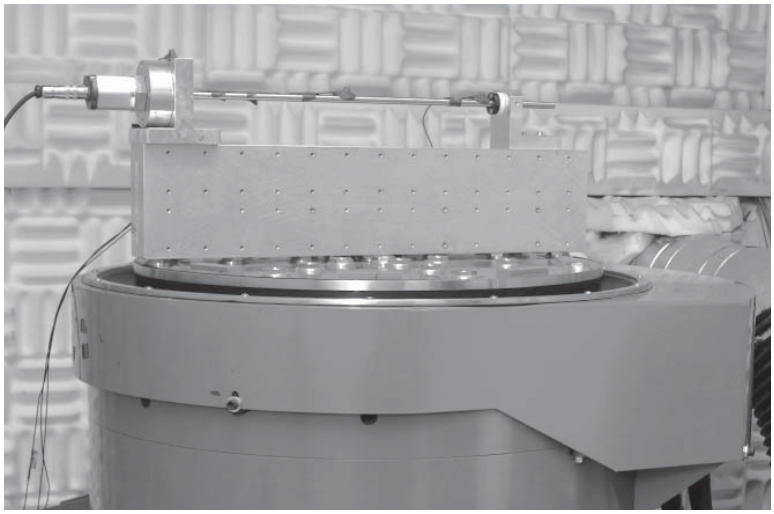
See technical data on page 162

VARAN bus

VARAN is an open realtime Ethernet bus system. Micropulse AT VARAN linear displacement systems detect the movements of highly dynamic axes in complex applications.
The realtime Ethernet system is extremely economical, easy to implement and simple to program. Widely available on the market, VARAN networks are used in combination with Sigmatek controllers, for example.
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.

See technical data on page 64

Reliability doesn't happen by chance!
Maximum quality and reliability always take top priority at Balluff. All EMC, shock and vibration tests relevant to products are conducted in our internal company testing laboratory, which has been certified for 15 years.
The sophisticated test equipment in the testing laboratory can be used to implement special, more stringent tests that extend beyond standard specifications. Each product series must pass the specified tests prior to obtaining approval for the customer.



Tests for reliability and quality:

	Tests
1. Electromagnetic compatibility (EMC)	Immunity from discharge of static electricity (EN 61000-4-2)
	Immunity from electro-magnetic fields (EN 61000-4-3)
	Immunity from rapid transient interference (bursts) (EN 61000-4-4)
	Immunity from surge voltages (EN 61000-4-5)
	Immunity from line-borne high-frequency interference (EN 61000-4-6)
	Immunity from magnetic fields with power transmission frequencies (EN 61000-4-8)
	Immunity from voltage dips, short breaks in power supply and voltage fluctuations (EN 61000-4-11)
	Radiated emissions (EN 55011)
	Mains-borne emissions (EN 55011)
	Emissions, HF magnetic field (DIN EN 300 330-1)
2. Product-specific tests	Making capacity / breaking capacity (EN 60947-5-2) Testing cable anchoring of devices with integral connection cables (EN 60947-5-2)
	Short circuit testing (EN 60947-5-2)
3. Shock, sinusoidal and noise testing	Shock, sinusoidal and noise testing (EN 60068-2-6) (EN 60068-2-27; EN 60068-2-29) (EN 60068-2-64)
4. Other	X-ray analysis

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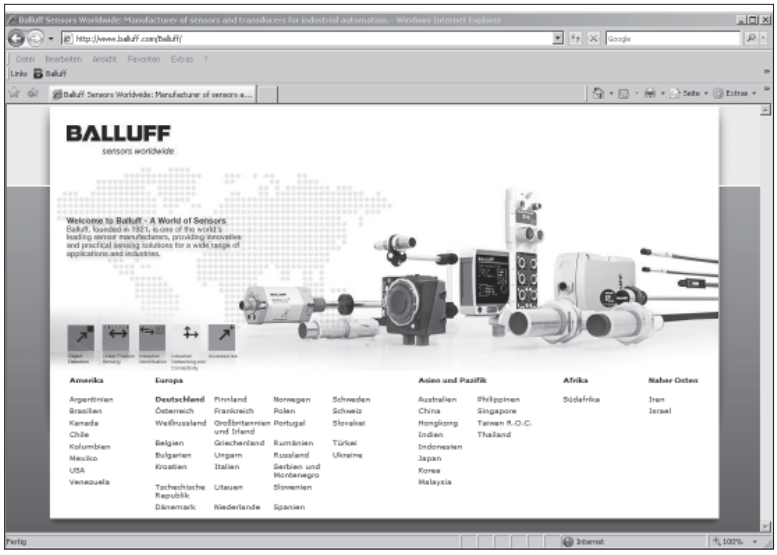
Global online availability
The latest product information from our databases.

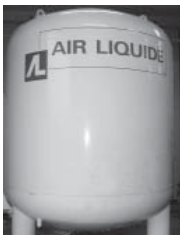
We offer the latest
- Data sheets
- CAD drawings in 2D or 3D
- Catalogs
- Brochures
- Manuals
- Software descriptions
- Operating manuals
- FAQs
- Worldwide addresses

and much more.

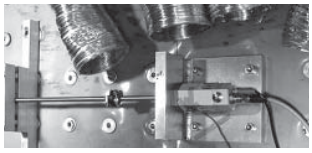


HALT – High Accelerated Lifetime Test
... highest function security over years

HALT tests were designed to detect weaknesses early during the product development phase and eliminate them
The result is linear displacement systems and sensors of the highest quality and reliability which will continue to perform with the same safety and precision for years to come. The tests reduce equipment downtimes, prevent service and repair costs and achieve significantly greater efficiency. Rapid temperature cycles from –100 °C to +200 °C and vibration loads between 10 °C and 50 °C can simulate aging of a sensor. This procedure is used to test the specifications of products to determine the degree of reliability, load capacity and life expectancy of the sensor. The sample is intentionally destroyed so that we can immediately improve the first component to fail. Both sensors and transducers can be tested in the HALT system.



Nitrogen tank for the cooling system


Stress on the sample

Multifunctional climate chamber

HALT system	
Manufacturer	Thermotron Industries USA
Frequency range	2...10000 Hz
Acceleration	up to 50 g
Excitation	9 pneumatic cylinders, noise spectrum, 3-axis, 3 linear and 3 rotary degrees of freedom
Temperature range	–100 °C...+200 °C
Temperature gradient	70 K/min
Electrical power	96 kW
Procedure	Electric heater, liquid nitrogen for cooling

Service Center
... competent customer service

We offer ...
- Qualified technical consultation on the complete Balluff product range
- Technical solutions for all your applications
- Flexible assistance in dealing with your specific questions and problems
- Support whenever you need it
- Know-how for integrating controllers
- Product repair service

We will gladly answer any questions relating to ...
- Technical product features
- Suitability of products for your application
- Operating instructions and data sheets
- Conversion of models from other manufacturers
- Balluff successor products

We are happy to help!
Phone: +49 7158 173-370
E-mail: service@balluff.de
Fax: +49 7158 173-691

Weekdays 7am to 8pm
Saturdays 8am to 12pm

Do you have a claim?
You are welcome to return your Balluff product to us for inspection and repair.
Request a return consignment number from the "Technical Service" area on our website.


BALLUFF
MICROPULSE®

MICROPULSE®

The electronics and waveguide are enclosed in an aluminum profiled housing. The aluminum housing is hermetically sealed according to degree of protection IP67. The magnets on the magnet act on the waveguide through the wall of the aluminum profile.
There are two different versions of magnet, namely captive and free magnets. Free magnets 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 a lateral and upward offset of several millimeters. If these generous tolerances are exceeded, you can always revert to using captive magnets. With captive magnets, the profile housing of the distance sensor acts as a sliding rail along which the magnet travels. In this case, a control arm with spherical heads compensates for unparallel movements.

Floating or captive magnets!

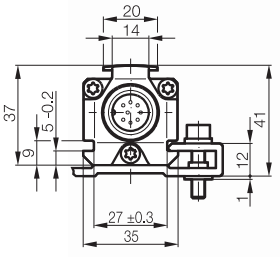
The structural design, high degree of protection and simple installation of Balluff Micropulse transducers in a profiled housing makes them an excellent alternative to linear transducers, e.g. potentiometers, glass rulers and LVDTs. The linear sensing element is protected inside an extruded aluminum profile. A passive magnet with no power supply marks the measuring point along the waveguide without making contact. Measuring ranges between 50 and 5000 mm are available.

- Non-contact detection of the actual position
- Insensitive to dirt, IP 67
- Wear-free
- Insensitive to shock and vibration
- Absolute output signal
- Resolution up to 0.001 mm (depending on processing electronics used)
- Direct signal processing or in conjunction with processors for all control and regulating systems

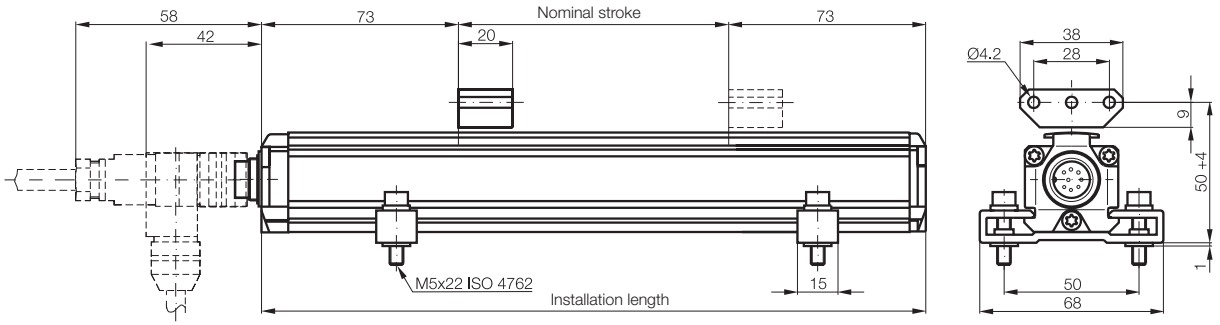
Series	BTL5 profile P
Shock load	100 g/6 ms per IEC 60068-2-27
Vibration	12 g, 10...2000 Hz as per IEC 60068-2-6
Polarity reversal protected	yes
Overvoltage protection	Transzorb protection diodes
Dielectric strength	500 V (GND to housing)
Degree of protection as per IEC 60529	IP 67 (with BKS-S... IP 67 connector attached)
Housing material	Anodized aluminum
Housing attachment	Compression clamps
Connection type	Connectors/cables
EMC testing:	
RF emission	EN 55016 Group 1, Class A
Static electricity (ESD)	IEC 61000-4-2 Severity Level 3
Electromagnetic fields (RFI)	IEC 61000-4-3 Severity Level 3
Fast transients (BURST)	IEC 61000-4-4 Severity Level 4
Conducted interference induced by high-frequency fields	IEC 61000-4-6 Severity Level 3
Standard nominal strokes [mm]	0050, 0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750, 4000, (4250, 4500, 4750, 5000, 5250, 5500) or in 5 mm increments (depending on interface) on request

■ Included:
- Transducer (select your interface from page 32)
- Short user's guide
- Mounting clamps with isolation washers and screws

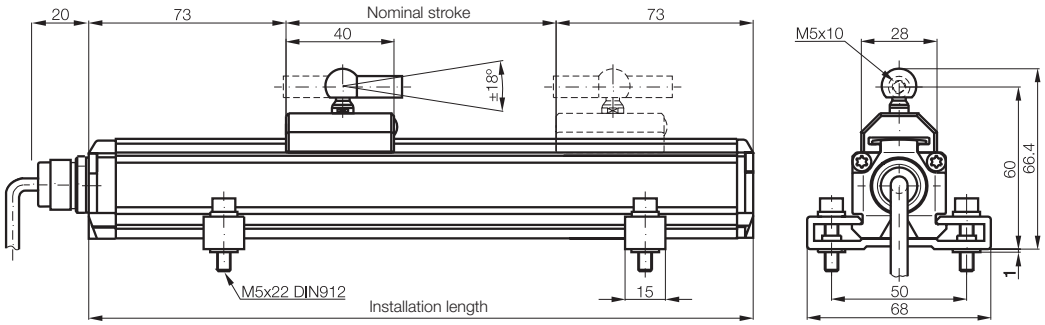
Please order separately:
Magnets from page 44
Connectors, page 148



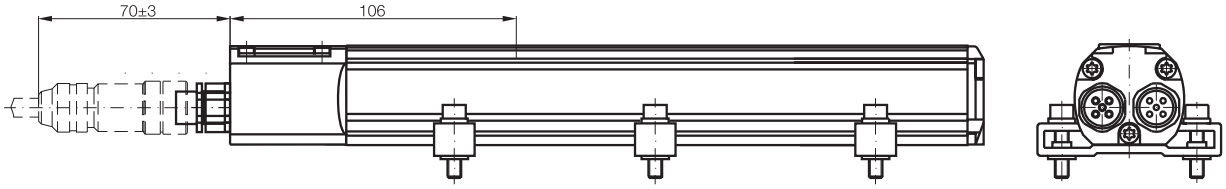
Transducer with floating magnet, S 32 connection with BKS-S 32M/BKS-S 32M-C/BKS-S 33M connector for transducers with analog interface, digital pulse interface and SSI interface, from page 32



Transducers with captive magnets and cable outlet for transducers with analog interface, digital pulse interface and SSI interface, from page 32

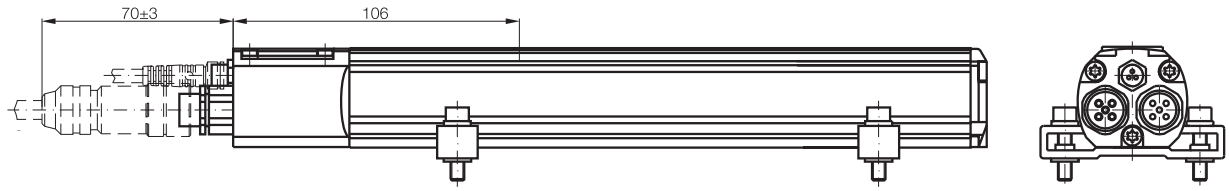


CANopen connection S 94 with connectors BKS-S 94-00 and BKS-S 92-00 for transducers with CANopen interface, page 38



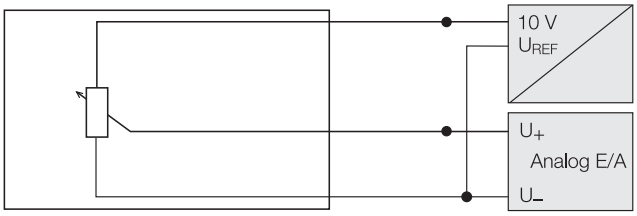
CANopen connection S 92 with connector BKS-S 92-00 for transducers with CANopen interface, page 38

DeviceNet connection S 93 with connectors BKS-S 92-00, BKS-S 93-00 and BKS-S 48-15-CP-_ _, page 40
PROFIBUS-DP plug connector S103 with connectors BKS-S 103-00, BKS-S 105-00 and BKS-S 48-15-CP-_ _ page 42

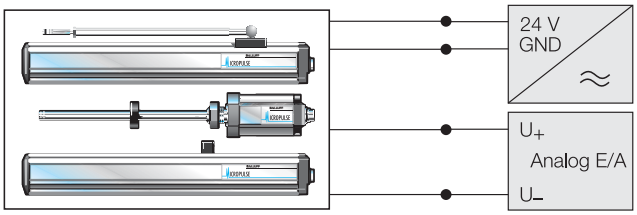


The analog outputs of the profile series are potential-free with respect to the input voltage. The isolation is galvanic using DC/DC converters.
Analog type BTL transducers are available in various output configurations: 0...10 V, 4...20 mA, 0...20 mA and –10...10 V, with rising and falling output slope.

Micropulse transducers – a non-contact alternative to contacting feedback devices



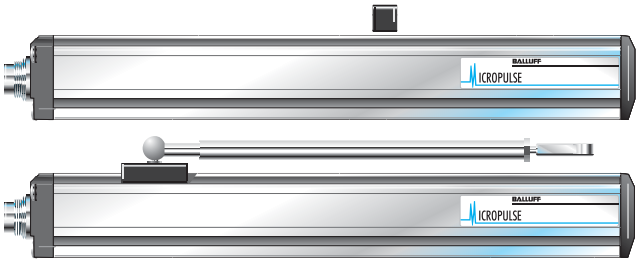
Potentiometer connections, block diagram



Micropulse transducer connections, block diagram

Series		
Output signal		
Transducer interface		
Input interface		
Part number		
Output		
Output voltage		
Output current		
Load current		
max. ripple		
Load resistance		
System resolution		
Hysteresis		
Repeat accuracy		
Sampling rate		
Max. non-linearity		
Temperature coefficient	Voltage output	
	Current output	
Operating voltage		
Current consumption		
Polarity reversal protected		
Overvoltage protection		
Dielectric strength		
Operating temperature		
Storage temperature range		
Pin assignments	Pin	Color
Output signals	1	YE
	2	GY
	3	PK
	5	GN
Operating voltage	6	BU
	7	BN
	8	WH

Connect shield to housing



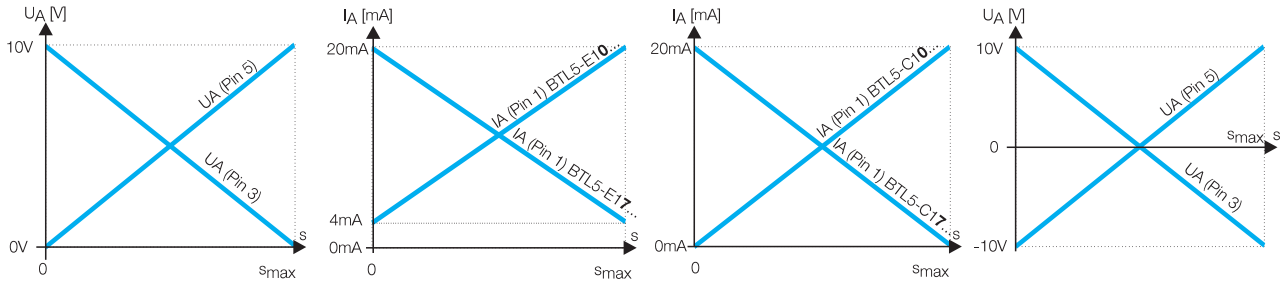
■ Please enter the code for the output signal and nominal stroke length in the ordering code.

Preferred models interface A11 and E10
BTL5-A11-M_ _ _ _-P-S32
BTL5-E10-M_ _ _ _-P-S32
are available from stock in the nominal lengths highlighted in blue.

■ Included:
– Transducer
– Mounting clamps with isolation washers and screws
– Short user's guide

Please order separately:
Magnets from page 44
Connectors, page 148/149

	BTL5 profile P	**BTL5 profile P**		**BTL5 profile P**		**BTL5 profile P**
	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-_ _ _ _
	potential-free	potential-free		potential-free		potential-free
	0...10 V and 10...0 V					**–10...10 V and 10...–10 V**
		4...20 mA or 20...4 mA		**0...20 mA or 20...0 mA**		
	max. 5 mA					max. 5 mA
	≤ 5 mV					≤ 5 mV
		≤ 500 ohms		≤ 500 ohms		
	≤ 0.1 mV	≤ 0.2 µA		≤ 0.2 µA		≤ 0.1 mV
	≤ 4 µm	≤ 4 µm		≤ 4 µm		≤ 4 µm
	System resolution/min. 2 µm	System resolution/min. 2 µm		System resolution/min. 2 µm		System resolution/min. 2 µm
	$f_{STANDARD}$ = 1 kHz	$f_{STANDARD}$ = 1 kHz		$f_{STANDARD}$ = 1 kHz		$f_{STANDARD}$ = 1 kHz
	±100 µm up to 500 mm nominal stroke	±100 µm up to 500 mm nominal stroke		±100 µm up to 500 mm nominal stroke		±100 µm up to 500 mm nominal stroke
	±0.02 % 500... max. nominal stroke	±0.02 % 500... max. nominal stroke		±0.02 % 500... max. nominal stroke		±0.02 % 500... max. nominal stroke
	[150 µV/°C + (5 ppm/°C x P x U/L)] x ΔT					[150 µV/°C + (5 ppm/°C x P x U/L)] x ΔT
		[0.6 µA/°C + (10 ppm/°C x P x I/L)] x ΔT		[0.6 µA/°C + (10 ppm/°C x P x I/L)] x ΔT		
	20...28 V DC	20...28 V DC		20...28 V DC		20...28 V DC
	≤ 150 mA	≤ 150 mA		≤ 150 mA		≤ 150 mA
	yes	yes		yes		yes
	Transzorb protection diodes	Transzorb protection diodes		Transzorb protection diodes		Transzorb protection diodes
	500 V DC (ground to housing)	500 V DC (ground to housing)		500 V DC (ground to housing)		500 V DC (ground to housing)
	–40...+85 °C	–40...+85 °C		–40...+85 °C		–40...+85 °C
	–40...+100 °C	–40...+100 °C		–40...+100 °C		–40...+100 °C
	BTL5-**A**11...	BTL5-**E**10...	BTL5-**E**17...	BTL5-**C**10...	BTL5-**C**17...	BTL5-**G**11...
		4...20 mA	20...4 mA	0...20 mA	20...0 mA	
	0 V Output	0 V Output	0 V Output	0 V Output	0 V Output	0 V Output
	10...0 V	10...0 V	10...0 V	10...0 V	10...0 V	10...–10 V
	0...10 V	0...10 V	0...10 V	0...10 V	0...10 V	–10...10 V
	GND	GND	GND	GND	GND	GND
	+24 V DC	+24 V DC	+24 V DC	+24 V DC	+24 V DC	+24 V DC
	(GND)	(GND)	(GND)	(GND)	(GND)	(GND)



Ordering example:

BTL5-E1_-M_ _ _ _-P-_ _ _ _

Output signal

1	Rising and falling (with A and G)
0	Rising
7	Falling (with C and E)

Standard nominal stroke [mm]

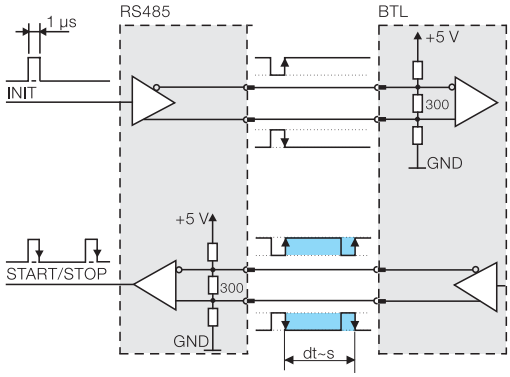
0050, 0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750, 4000, 4250, 4500 or in 5 mm increments (depending on interface) on request

Connection type

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

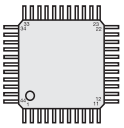
P Interface
Compatible with BTA/BTM processors as well as controllers and modules from various manufacturers, including Siemens, B & R, Phoenix Contact, Mitsubishi, Sigmatek, Esitron and WAGO. Reliable signal transmission, even over cable lengths up to 500 m between BTA and BTL, is assured by the noise-immune RS485 differential line drivers and receivers. Noise signals are effectively suppressed.

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

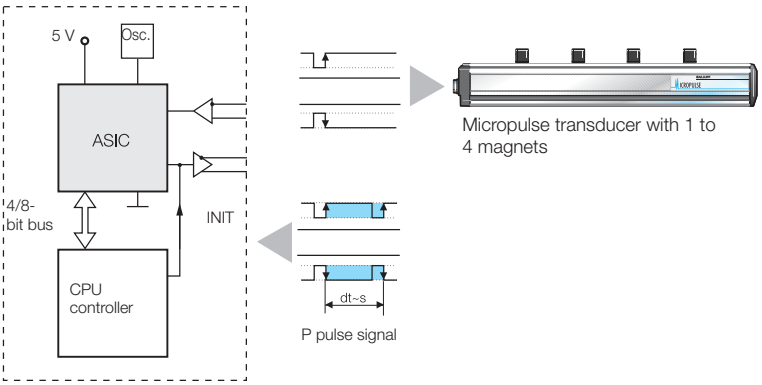


Block diagram of P interface

Highly precise digitizing of the P pulse signal
Companies developing their own control and processing electronics 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 interface.


Digitizing chip 44QFP

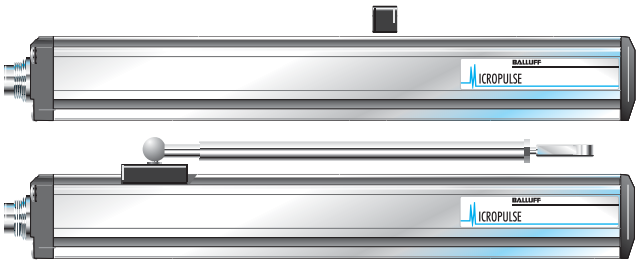
Advantages:
- Position resolution 1 µm!
  The 1 µm resolution of the Micropulse distance measurement system is achieved by the high resolution of the digitizing chip (133 pS). (Clock frequency 2 or 20 MHz)
- Position data from 4 magnets can be processed simultaneously
- 4/8-bit processor interface



Controller or
processing electronics

Micropulse transducer with 1 to 4 magnets

P pulse signal



ASIC INFO:
+49 7158 173-370

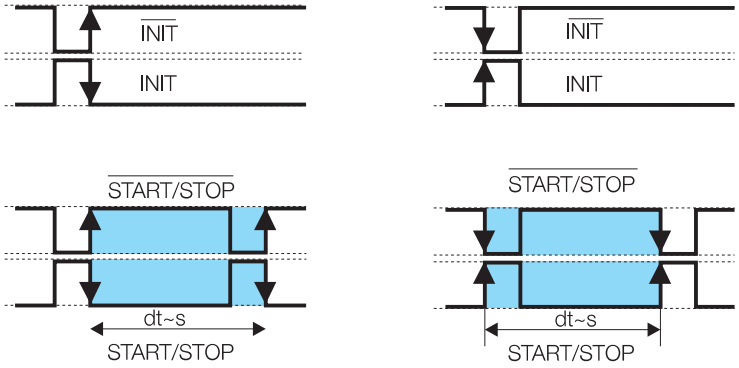
Series				**BTL5 profile P**	**BTL5 profile P**
Transducer interface				Pulse **P**	Pulse **M**
Input interface				Pulse **P**	Pulse **M**
Part number				BTL5-**P**1-M_ _ _ _-P-_ _ _ _	BTL5-**M**1-M_ _ _ _-P-_ _ _ _
System resolution				processing-dependent	processing-dependent
Repeat accuracy				2 µm or ±1 digit depending on processing electronics	2 µm or ±1 digit depending on processing electronics
Resolution				≤ 2 µm	≤ 2 µm
Hysteresis				≤ 4 µm	≤ 4 µm
Sampling rate				3 kHz...500 Hz depending on nominal stroke	3 kHz...500 Hz depending on nominal stroke
Max. non-linearity				±100 µm up to 500 mm nominal stroke ±0.02 % 500...5000 mm nominal stroke	±100 µm up to 500 mm nominal stroke ±0.02 % 500...5000 mm nominal stroke
Temperature coefficient of overall system				(6 µm + 5 ppm × L)/°C	(6 µm + 5 ppm × L)/°C
Operating 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 range				–40...+100 °C	–40...+100 °C
Pin assignments		Pin	Color	BTL5-**P**1-M...	BTL5-**M**1-M...
Input/Output signals	Input	1	YE	INIT	INIT
	Output	2	GY	START/STOP	START/STOP
	Input	3	PK	$\overline{\text{INIT}}$	$\overline{\text{INIT}}$
	Output	5	GN	$\overline{\text{START/STOP}}$	$\overline{\text{START/STOP}}$
Operating voltage		6	BU	GND	GND
		7	BN	+24 V DC	+24 V DC
		8	WH	(GND)	(GND)

■ Please enter the code for the nominal stroke in the ordering code!

Preferred models interface P
BTL5-P1-M_ _ _ _-P-S32
are available from stock in the nominal lengths highlighted in blue.

■ Included:
– Transducer
– Mounting clamps with isolation washers and screws
– Short user's guide

Please order separately:
Magnets from page 44
Connectors from page 148/149



Ordering example:

BTL5-P1-M_ _ _ _-P-_ _ _ _

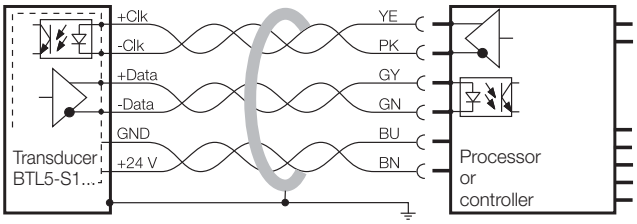
Standard nominal stroke [mm]

0050, 0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750, 4000, 4250, 4500, 5000, 5250, 5500 or in 5 mm increments (depending on interface) on request

Connection type

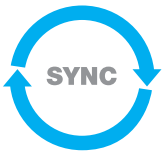
S32	Connector
KA02	PUR cable 2 m
KA05	PUR cable 5 m
KA10	PUR cable 10 m
KA15	PUR cable 15 m

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



BTL5-S1... with processor/controller, wiring example

Synchronized SSI interface BTL5-S1_ _B-M_ _ _ _-P-_ _ _ _
Micropulse transducers with synchronized SSI interface are suitable for dynamic control applications. The data acquisition in the transducer is synchronized with the external clock of the controller, permitting an optimum calculation of the velocity in the controller. The prerequisite for this synchronous mode of transducer operation is consistent clock signal timing.
The **maximum sampling frequency f_A**, at which a new current value is generated for each sample, can be derived from the following table:

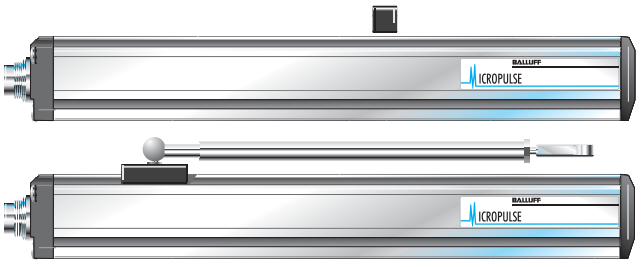


mm		mm		Hz
	< Nominal stroke	≤ 100	:	1500
120	< Nominal stroke	≤ 1000	:	1000
475	< Nominal stroke	≤ 1400	:	666
750	< Nominal stroke	≤ 2600	:	500
1250	< Nominal stroke	≤ 4000	:	333

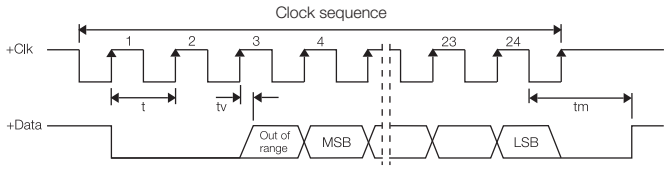
Clock frequency depends on the cable length

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



Series			**BTL5 profile P**
Output signal			synchronous serial
Transducer interface			**S**
Input interface			synchronous serial (SSI)
Part number			BTL5-**S**1_ _-M_ _ _ _-P-_ _ _ _
Part number synchronization			BTL5-**S**1_ _B-M_ _ _ _-P-_ _ _ _
System resolution depending on version (LSB)			1, 2, 5, 10, 20, 40 or 100 µm
Repeat accuracy			±5 µm
Hysteresis			≤ 4 µm or ≤ 1 digit
Sampling rate			$f_{STANDARD}$ = 2 kHz
Max. non-linearity			±30 µm at ≤ 10 µm resolution or ≤ ±2 LSB at > 10 µm resolution
Temperature coefficient of overall system			(6 µm + 5 ppm × L)/°C
Operating voltage			20...28 V DC
Current consumption			≤ 80 mA
Operating temperature			–40...+85 °C
Storage temperature range			–40...+100 °C
Pin assignments	Pin	Color	
Control and data signals	1	YE	+Clk
	2	GY	+Data
	3	PK	–Clk
	5	GN	–Data
Operating voltage (external)	6	BU	GND
	7	BN	+24 V DC
	8	WH	must remain unconnected



■ Please enter the code for the coding, system resolution and nominal stroke in the ordering code!

Preferred models interface S
BTL5-S112-M_ _ _ _-P-S32 are available from stock in the nominal lengths highlighted in blue.

■ Included:
– Transducer
– Mounting clamps with isolation washers and screws
– Short user's guide

Please order separately:
Magnets from page 44
Connectors, page 148/149

Ordering example:

BTL5-S1_ _-M_ _ _ _-P-_ _ _ _

Coding

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

System resolution

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

Standard nominal stroke [mm]

0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750, 4000 or in 5 mm increments (depending on interface) on request

Connection type

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

Ordering code for SSI interface with synchronization to clock (dynamic control applications) insert the letter B! BTL5-S1_ _**B**-M_ _ _ _-P-_ _ _ _

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 station 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.

CAN-BUS features
- Line topology, star structure also possible via repeaters
- Low-cost wiring with two-wire cable
- Fast response times, high data integrity using CRC, hamming distance of 6
- 1 MBit/s with cable lengths < 25 m
- Protocol limits number of stations to 127
- Using multiple magnets: A minimum spacing of > 65 mm must be maintained.

CANopen offers a high level of flexibility with respect to 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 magnet position with resolution in 5 µm increments
- Current velocity of the magnet with resolution selectable in 0.1mm/s increments
- Current status of the four freely programmable cams per magnet.

Synchronization Object (SYNC)
Serves as a net-wide trigger for synchronizing all network participants. 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 to DS303-3

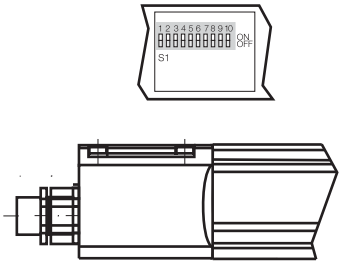
FMM
The sensor can be operated as a 4-magnet type, whereby the sensor itself recognizes how many magnets are currently active.
So if only two magnets are positioned in the measuring range, a valid value is output for the first two positions and a defined error value for positions 3 and 4.

Emergency Object
This object is sent with the highest priority and is used for example for error messages when the 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 using a PC with a configuration tool which runs under Windows. The configuration is stored in the non-volatile memory of the transducer.

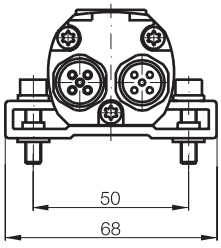
CiA 199911-301v30/11-009

Use of multiple magnets
A minimum spacing of > 65 mm must be maintained.



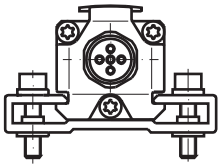
Position of the DIP switch S1,
only on BTL-H1_ _ _ _-P-S94

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



Node ID can be set by DIP switch.

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

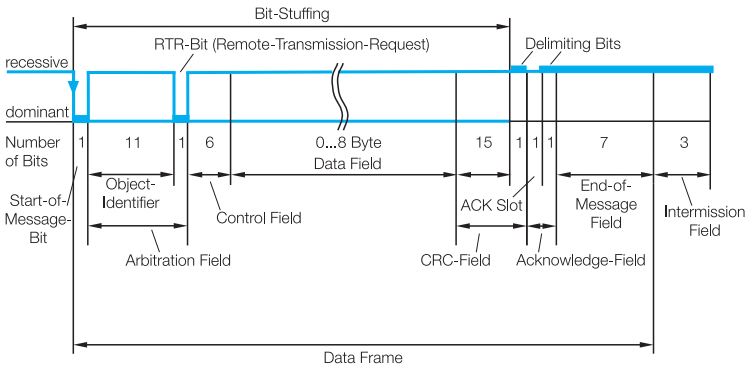


Series			**BTL5 profile P**						
Output signal			CANopen						
Transducer interface			**H**						
Input interface			CANopen						
Part number			BTL5-**H**1_ _-M_ _ _ _-P-S92						
			BTL5-**H**1_ _-M_ _ _ _-P-S94						
CANopen Version			DS301, DS406						
Repeat accuracy			±1 digit						
System resolution	Position		5 µm increments configurable						
Configurable	Velocity		0.1 mm/s increments configurable						
Hysteresis			≤ 1 digit						
Sampling rate			$f_{STANDARD}$ = 1 kHz						
Max. non-linearity			±30 µm at 5 µm resolution						
Temperature coefficient of overall system			(6 µm + 5 ppm × L)/°C						
Magnet traverse velocity			any						
Operating voltage			20...28 V DC						
Current consumption			≤ 100 mA						
Operating temperature			–40...+85 °C						
Storage temperature range			–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
Pin assignments	Pin	Color								
Control and	1	WH	CAN_GND							
data signals	4	GY	CAN_HIGH							
	5	GN	CAN_LOW							
Operating	2	BN	+24 V							
voltage (external)	3	BU	0 V (GND)							

■ Please enter the code for the software configuration, baud rate and nominal stroke length in the ordering code.

■ Included:
– Transducer
– Mounting clamps with isolation washers and screws
– Short user's guide

Please order separately:
Magnets from page 44
Connectors, page 150/151



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 noise immunity of the connection is achieved using differential drivers and by the data monitoring scheme.

Ordering example:

BTL5-H1_ _-M_ _ _ _-P-S92
BTL5-H1_ _-M_ _ _ _-P-S94

Software configuration

1	1 × position and 1 × velocity
2	2 × position and 2 × velocity

Baud rate

0	1 MBaud
1	800 kBaud
2	500 kBaud
3	250 kBaud
4	125 kBaud
5	100 kBaud
6	50 kBaud
7	20 kBaud
8	10 kBaud

Standard nominal stroke [mm]

0050, 0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750, 4000 or in 5 mm increments (depending on interface) on request

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 I/O modules.
The transmission speed is between 125 kBit/s and 500 kBit/s depending on type and length of the cable.

Master
DeviceNet is multi-master capable, i.e. several DeviceNet devices can simultaneously request the current position. The data transfer is controlled by the priority of the message. Messages on the DeviceNet carry an identifier.
The message that was sent can be received by all devices simultaneously (broadcast). Message filtering is performed by the device only for messages intended for it. The criterion for this decision is
the identifier, with which each message is transmitted.

EDS
DeviceNet offers parameterization 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.

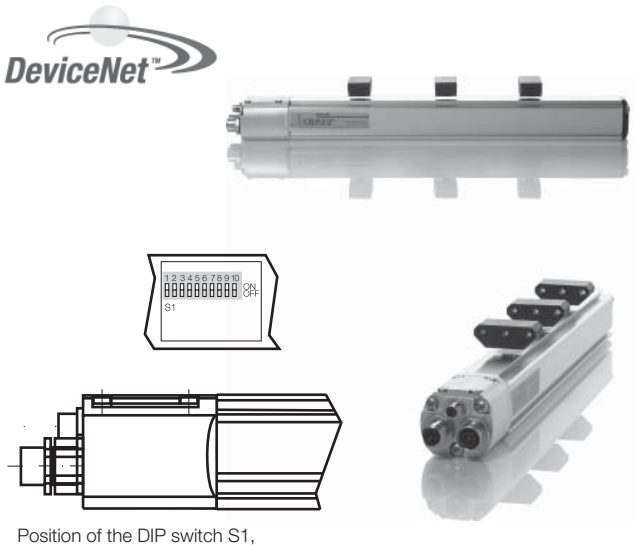
DeviceNet features:
- Linear topology
- Low-cost wiring with two-wire cable
- Fast response times
- High data security due to CRC checking
- Hamming distance of 6
- Potential-free data transmission (RS485)
- 125 Kb/s at cable length < 500 m
  250 Kb/s at cable length < 250 m
  500 Kb/s at cable length < 100 m
- Protocol limits number of stations 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 measurement values in an entity of the Position Sensor Objects as a 32-bit value.

The following information can be sent:
- Current magnet position with resolution in 5 µm increments
- Current magnet velocity in increments of 0.1 nm/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

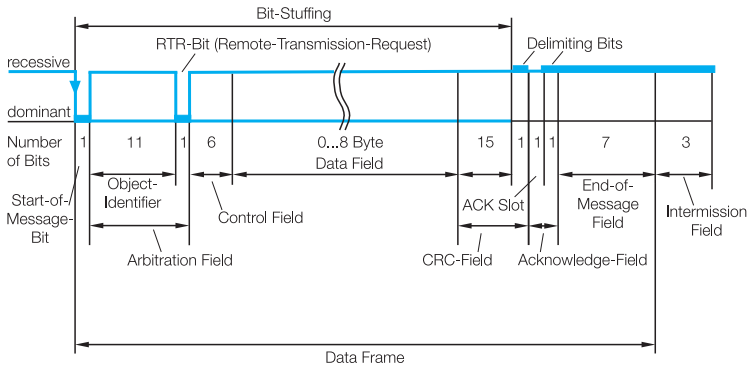
Use of multiple magnets
A minimum spacing of > 65 mm must be maintained.

Series		**BTL5 profile P**		
Output signal		DeviceNet		
Transducer interface		**D**		
Input interface		DeviceNet		
Part number plug version S103		BTL5-**D**1_ _-M_ _ _ _-P-S93		
Profibus version		Encoder profile		
Profibus interface		potential-free		
Repeat accuracy		±1 digit		
System resolution	Position	5 µm increments configurable		
Configurable	Velocity	0.1 mm/s increments configurable		
Hysteresis		≤ 1 digit		
Sampling rate		$f_{STANDARD}$ = 1 kHz		
Max. non-linearity		±30 µm at 5 µm resolution		
Temperature coefficient of overall system		(6 µm + 5 ppm × L)/°C		
Magnet traverse velocity		any		
Operating voltage		20...28 V DC		
Current consumption		≤ 100 mA		
Operating temperature		–40...+85 °C		
Storage temperature range		–40...+100 °C		
Address assignment		mechanical switches or DeviceNet		
Cable length [m]		100 250 500		
Baud rate [Kbps]		500 250 125		
Pin assignments			S93 5-pin	S93 3-pin
Control and data signals		CAN GND	1	
		V+	2	
		V– (GND)	3	
		CAN HIGH	4	
		CAN LOW	5	
Operating voltage and shielding		+24 V		1
		GND		3
		Shield supply		4

■ Please enter the code for the software configuration, baud rate and nominal stroke length in the ordering code.

■ Included:
– Transducer
– Mounting clamps with isolation washers and screws
– Short user's guide

Please order separately:
Magnets from page 44
Connectors, page 150/151



Ordering example:

BTL5-D1_ _-M_ _ _ _-P-S93

Software configuration		**Baud rate**		**Standard nominal stroke [mm]**
1	Magnet FMM	2	500 kBaud	0050, 0100, 0130, 0150, 0175, 0200,
		3	250 kBaud	0225, 0250, 0300, 0350, 0360, 0400,
		4	125 kBaud	0450, 0500, 0550, 0600, 0650, 0700,
				0750, 0800, 0850, 0900, 0950, 1000,
				1100, 1200, 1250, 1300, 1400, 1500,
				1600, 1700, 1750, 1800, 1900, 2000,
				2250, 2500, 2750, 3000, 3250, 3500,
				3550, 3750, 4000 or in 5 mm increments
				(depending on interface) on request

User-friendly hardware and software set-up

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 station. The BTL5-T uses max. 32 bytes (max. 4 position values and max. 4 velocity values) for process data transmission. Up to 126 active stations (Address 0...125) can be connected on PROFIBUS-DP. User data cannot be sent with station address 126. This address is used as the default address for bus stations that have to be parameterized by a Class 2 master (for setting the device address if there are no mechanical switches available). Each PROFIBUS station has the same priority. Prioritizing of 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 Mbps, the transmission time for an average data telegram is in the 100 µs range.

Master
There are two types of possible masters for PROFIBUS-DP. Master Class 1 carries out the user data interchange with the connected slaves. Master Class 2 is intended for startup and diagnostic purposes and may be used to briefly assume control of a slave.

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 when the system is configured.
The BTL5-T is a modular device with the possibility of selecting the number of magnets (position values).

Slave
Once a PROFIBUS master has received the parameter set defined for the slave, it is able to exchange data. The parameter set consists of slave parameters and configuration data.
The parameter data contain the description of the slave settings (e.g. resolution of a position value). The configuration data describe the length and structure of the data telegram.

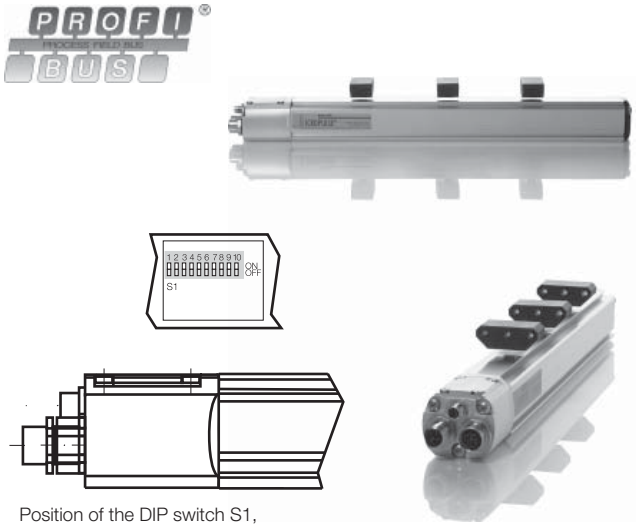
Process data
Under PROFIBUS-DP the default is for process data to be sent from the master to slaves acyclically and for the slave data to then be queried. To ensure synchronization of multiple devices, the master may use the SYNC and FREEZE services.

DP/V1 and DP/V2 isochronous mode
Isochronous mode enables quick and deterministic
data exchange through the synchronicity of cycles on the bus system. A cyclic equidistant clock signal is sent by the master to all bus devices. This signal allows master and slaves to be synchronized irrespective of application – with an accuracy < 1 µs.

Cross traffic between slaves
Cross traffic permits two DP slaves to exchange data directly with each other: the master ensures that the slave publishes its data on the bus with a request for "Data-eXchange-Broadcast" (DXB-Request) and thus makes it available to other slaves. Since the process data is available in the process periphery without being diverted through the master application, cross-traffic permits very fast control system responses.

Acyclic services
The DP functions for prioritized communication
allow the transfer of acyclic read and write functions between master and slaves, independently of the cyclic user data traffic. The transfer of acyclic data is performed at a lower priority in parallel to the high speed cyclic data exchange – as if in the background. The background / foreground split means the ratio of cyclic to acyclic data can be adjusted if required.

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

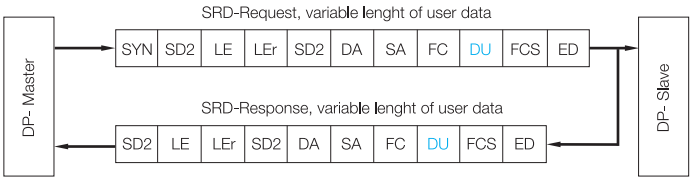
Use of multiple magnets
A minimum spacing of > 65 mm must be maintained.

Series		**BTL5 profile P**				
Output signal		PROFIBUS-DP				
Transducer interface		**T**				
Input interface		PROFIBUS-DP				
Part number plug version S103		BTL5-**T**1_ 0-M_ _ _ _-P-S103				
Profibus version		DPV1/DPV2 EN 50170, encoder profile				
Profibus interface		potential-free				
Repeat accuracy		±1 digit				
System resolution configurable	Position	5 µm increments configurable				
	Velocity	0.1 mm/s increments configurable				
Hysteresis		≤ 1 digit				
Sampling rate		$f_{STANDARD}$ = 1 kHz				
Max. non-linearity		±30 µm at 5 µm resolution				
Temperature coefficient of overall system		(6 µm + 5 ppm × L)/°C				
Magnet traverse velocity		any				
Operating voltage		20...28 V DC				
Current consumption		≤ 120 mA				
Operating temperature		–40...+85 °C				
Storage temperature range		–40...+100 °C				
GSD file		BTL504B2.GSD				
Address assignment		mechanical switches and Master Class 2				
Cable length [m]		< 100	< 200	< 400	< 1000	< 1200
Baud rate [Kbps]		12000	1500	900	187,5	93,7/19,2/9,6
Pin assignments				S103 5-pin		S103 3-pin
Control and data signals		Data GND		3		
		RxD/TxD-N (A)		2		
		RxD/TxD-P (B)		4		
		VP +5 V		1		
		+24 V				1
Operating voltage and shielding		0 V (GND)				3
		Ground PROFIBUS-DP		5		
		Shield supply				4

■ Please enter the code for the software configuration and nominal stroke length in the ordering code!

■ Included:
– Transducer
– Mounting clamps with isolation washers and screws
– Short user's guide

Please order separately:
Magnets from page 44
Connectors from page 153



Ordering example:

BTL5-T1_ 0-M_ _ _ _-P-S103

Software configuration

1	1 Magnet 1 Position 1 Velocity
2	2 Position 2 Velocity

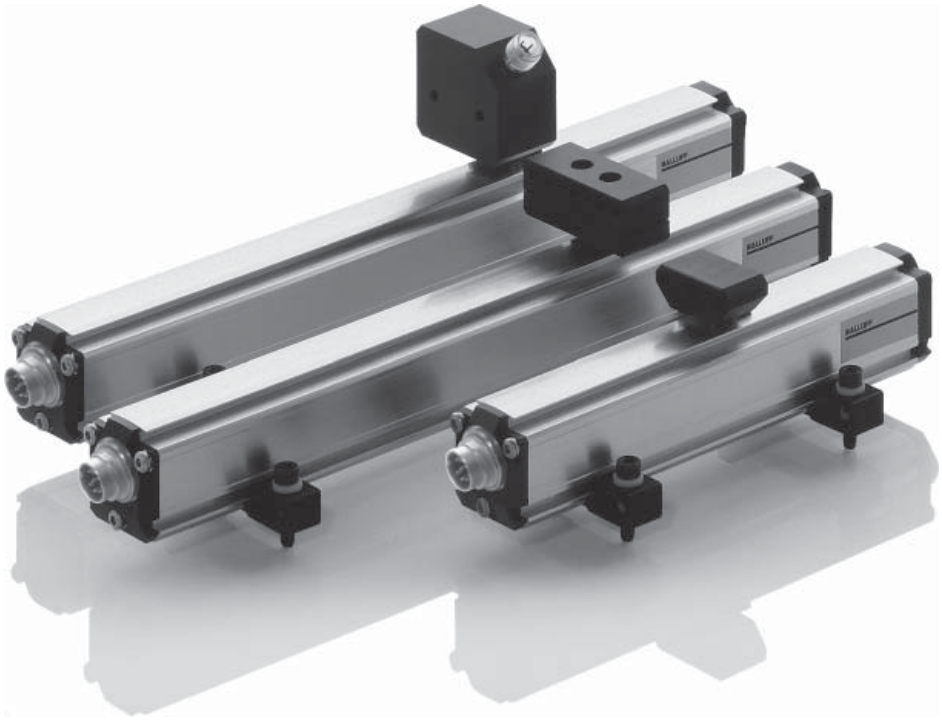
Standard nominal stroke [mm]

0050, 0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750, 4000 or in 5 mm increments (depending on interface) on request

Non-contact!
Vertical offset
0.1...4 mm or 5...15 mm

Balluff magnets are available in captive or floating design. Maximum resolution and repeatability are achieved using transducers with captive magnets.
The 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 magnets on a single transducer, since only one magnet is active at a time.

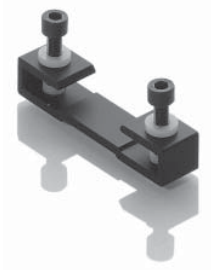
Description	
for series	
Version	
Part number	
Housing material	
Weight	
Magnet traverse velocity	
Operating voltage	
Current consumption	
Operating temperature/Storage temperature range	
Included	
Accessories (please order separately)	



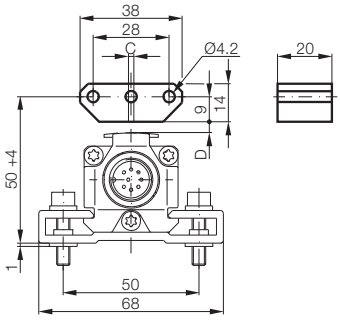
Length			Number of mounting clamp pairs
	to	250 mm	1
251	to	750 mm	2
751	to	1250 mm	3
1251	to	1750 mm	4
1751	to	2250 mm	5
2251	to	2750 mm	6
2751	to	3250 mm	7
	more than	3251 mm	8

Mounting clamps with isolation washers and screws included with transducer.

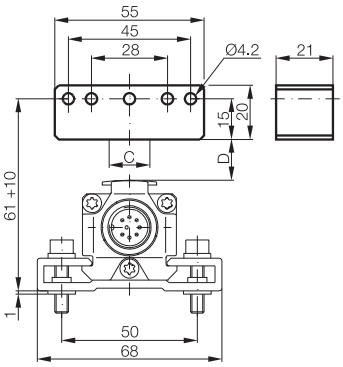
1 pair of replacement clamps and screws, item no.: 110404



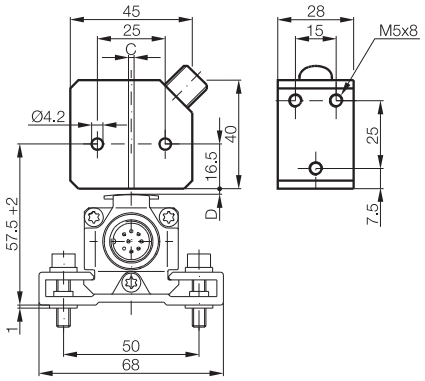
	Magnet	Magnet	Magnet
	BTL5 profile P	BTL5 profile P	BTL5 profile P
	free	free	free
	BTL5-P-3800-2	**BTL5-P-5500-2**	**BTL5-P-4500-1**
	Plastic	Plastic	Plastic
	approx. 12 g	approx. 40 g	approx. 90 g
	any	any	any
			24 V DC
			100 mA
	–40...+85 °C	–40...+85 °C	–40...+60 °C
	Magnet 2 fastening screws DIN 84 M4×35-A2 with washers and nuts	Magnet	Magnet
			Straight connector BKS-B 19-1-_ _ Right-angle connector BKS-B 20-1-_ _



Lateral offset:
C = ±2 mm
Vertical distance of magnet:
D = 0.1...4 mm

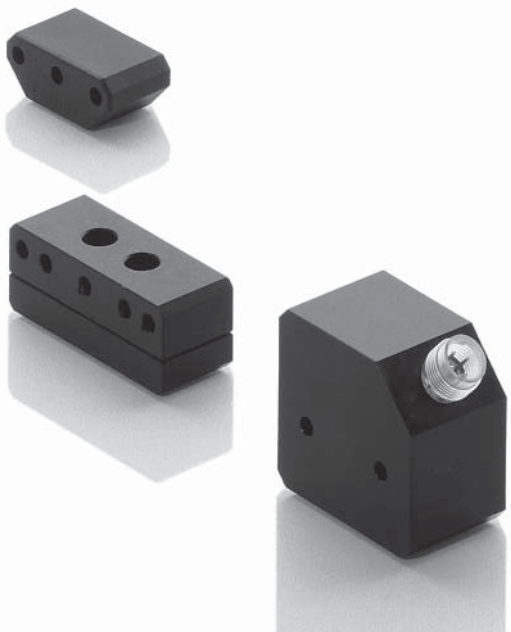


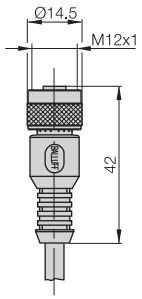
Lateral offset:
C = ±15 mm
Vertical distance of magnet:
D = 5...15 mm

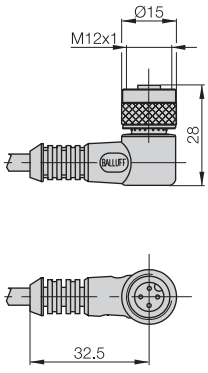


Lateral offset:
C = ±2 mm
Vertical distance of magnet:
D = 0.1...2 mm

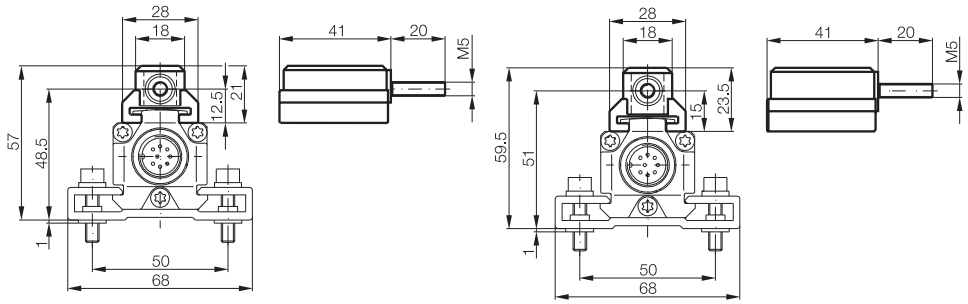
■ Please indicate the cable length in the ordering code!
03, 05, 10, 15
= PVC, 3 m, 5 m, 10 m or 15 m
PU-03, PU-05, PU-10, PU-15
= PUR, 3 m, 5 m, 10 m or 15 m

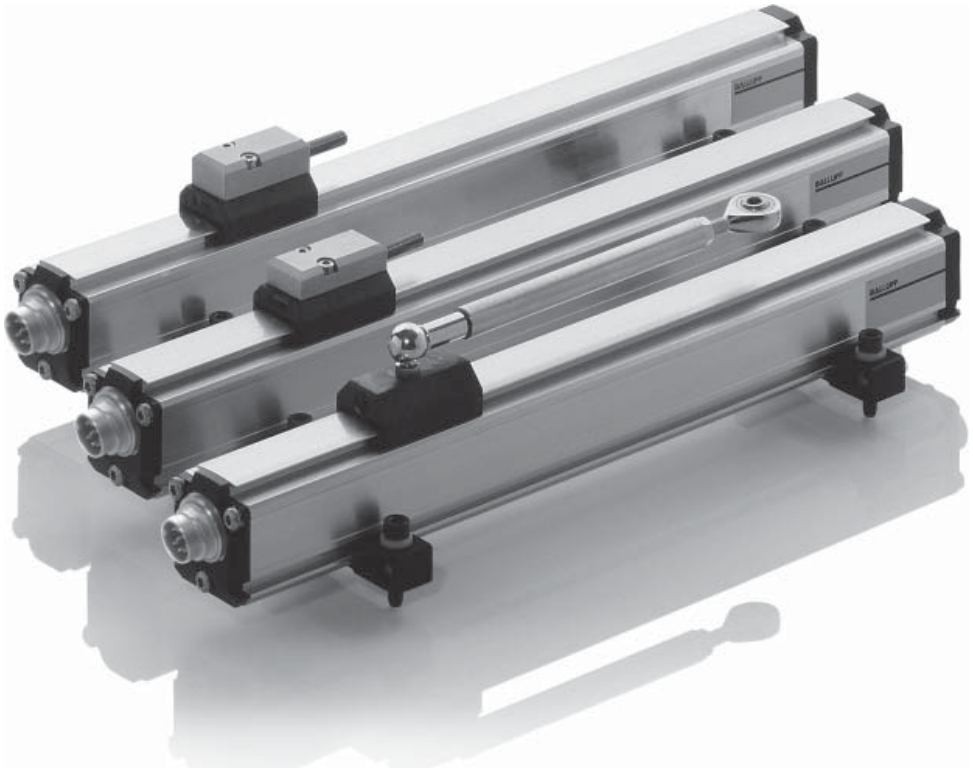






Description		**Magnet**	**Magnet**
for series		BTL5 profile P	BTL5 profile P
Version		captive	captive
Part number		**BTL5-M-2814-1S**	**BTL5-N-2814-1S**
Material	Housing	Anodized aluminum	Anodized aluminum
	Sliding surface	Plastic	Plastic
Weight		approx. 32 g	approx. 35 g
Magnet traverse velocity		any	any
Operating temperature/Storage temperature range		–40...+85 °C	–40...+85 °C

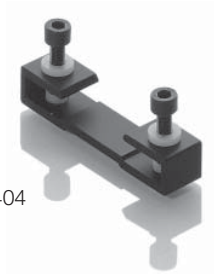




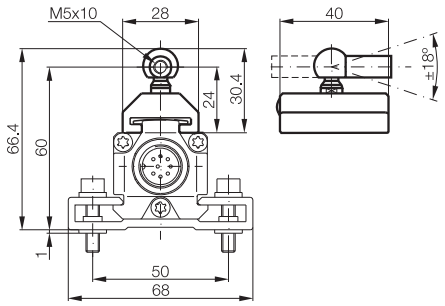
Length			Number of mounting clamp pairs
	to	250 mm	1
251	to	750 mm	2
751	to	1250 mm	3
1251	to	1750 mm	4
1751	to	2250 mm	5
2251	to	2750 mm	6
2751	to	3250 mm	7
	more than	3251 mm	8

Mounting clamps with isolation washers and screws included with transducer.

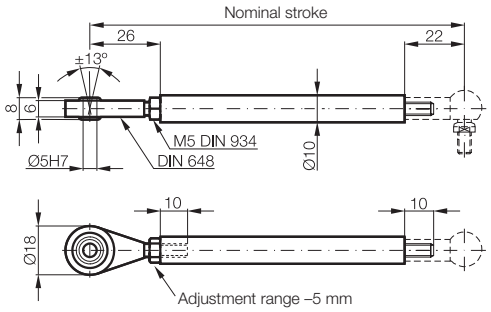
1 pair of replacement mounting clamps and screws, item no.: 110404



	Magnet
	BTL5 profile P
	captive
	BTL5-F-2814-1S
	Anodized aluminum
	Plastic
	approx. 28 g
	any
	–40...+85 °C



Description	Control arm
for series	BTL5 profile P
Version	captive
Part number	**BTL2-GS10-_ _ _ _-A**
Material	Al
Weight	approx. 150 g/m



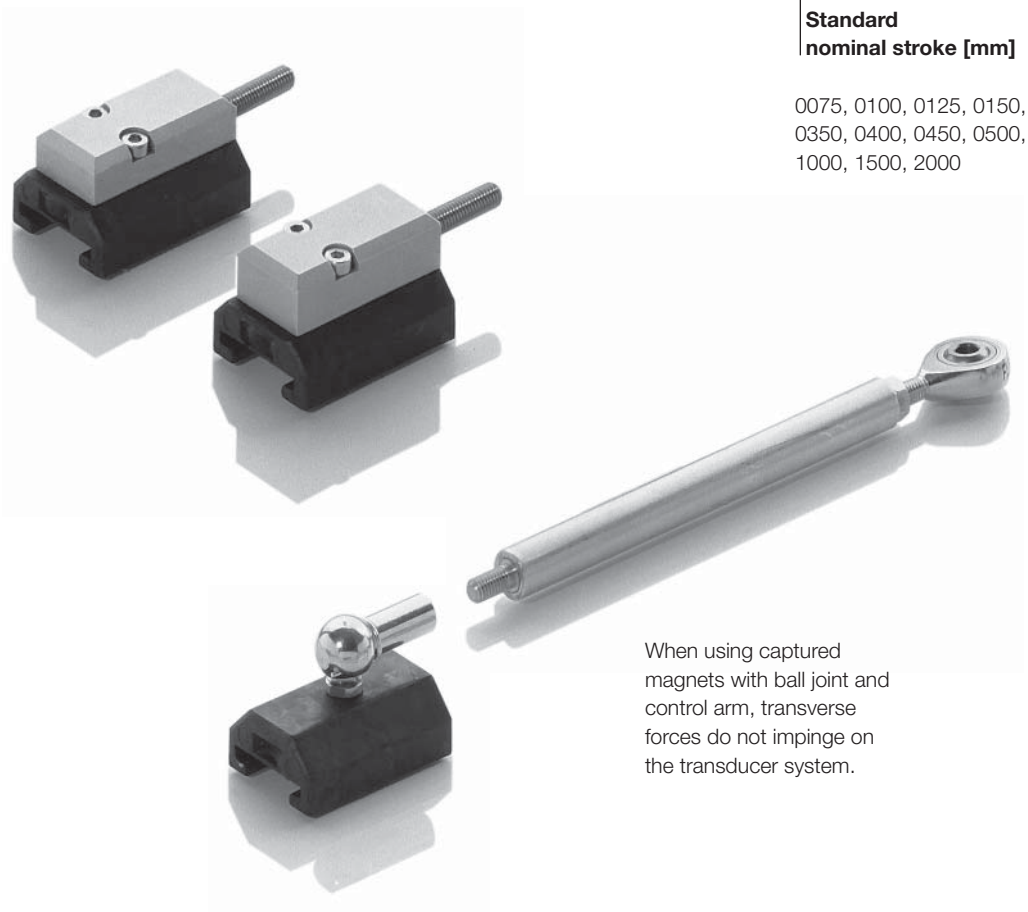
■ Please the enter code for the nominal stroke in the ordering code!

Ordering example:

BTL2-GS10-_ _ _ _-A

Standard nominal stroke [mm]

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

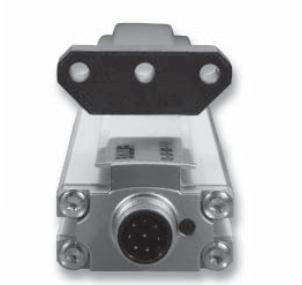


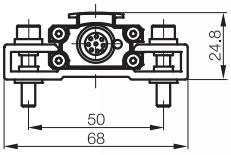
Swivel eye
Material number 714619

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

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 linear sensing element is protected inside an extruded aluminum profile.
A passive magnet with no power supply marks the measuring point along the waveguide without making contact. Measuring ranges between 50 and 4572 mm are possible.

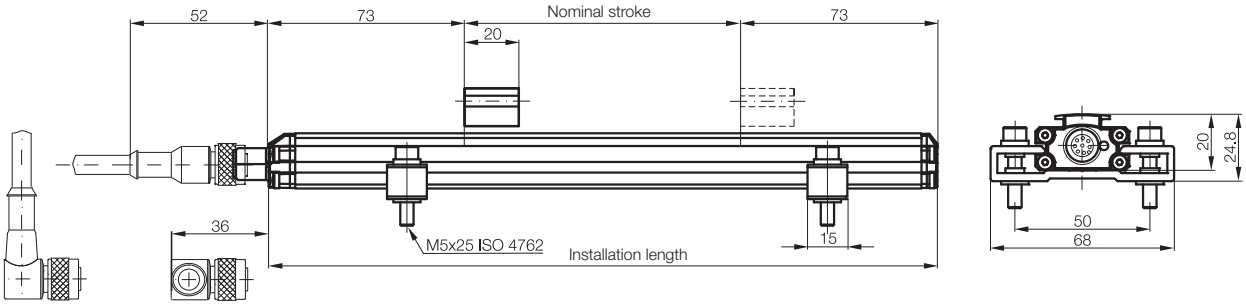
- Non-contact detection of the actual position
- IP 67, insensitive to contamination
- Wear-free
- Insensitive to shock and vibration
- Absolute output signal
- Max. resolution of 0.005 mm (depending on the processing electronics)
- Direct signal processing or in conjunction with processors for all control and regulating systems





Series	**BTL6 profile PF**
Shock load	50 g/6 ms per IEC 60068-2-27
Vibration	12 g, 10...2000 Hz per IEC 60068-2-6
Polarity reversal protected	Yes (up to 36 V)
Overvoltage protection	to 36 V
Dielectric strength	500 VDC (GND to housing)
Degree of protection as per IEC 60529	IP 67 (with BKS-S... IP 67 connector attached)
Housing material	Anodized aluminum
Housing attachment	Compression clamps
Connection type	Connectors
EMC testing:	
RF emission	EN 55016-2-3 Group 1, Class A and B
Static electricity (ESD)	IEC 61000-4-2 Severity Level 3
Electromagnetic fields (RFI)	IEC 61000-4-3 Severity Level 3
Fast transients (BURST)	IEC 61000-4-4 Severity Level 3
Surge voltage	IEC 61000-4-5 Severity Level 2
Conducted interference induced by high-frequency fields	IEC 61000-4-6 Severity Level 3
Magnetic fields	IEC 61000-4-8 Severity Level 4
Standard nominal strokes [mm]	0050, 0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750, 4000, 4250, 4500, 4572

Transducers with floating magnet and S115 connection with BKS-S115/BKS-S116 connector for transducers with analog interface, page 50



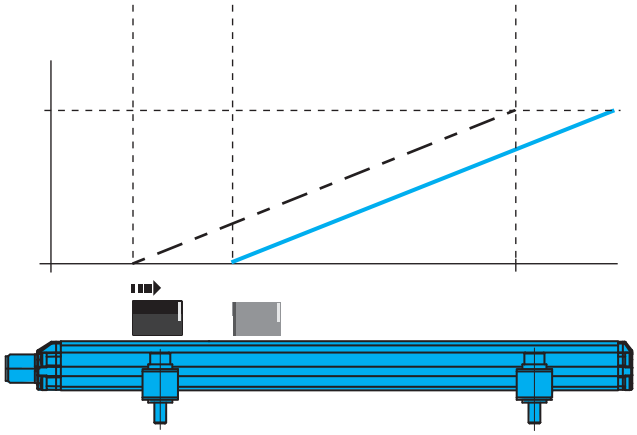
■ Included:
– Transducer (select your interface from page 50)
– Short user's guide
– Mounting clamps with isolation washers and screws

Please order separately:
Magnets from page 52
Connectors, page 156

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.

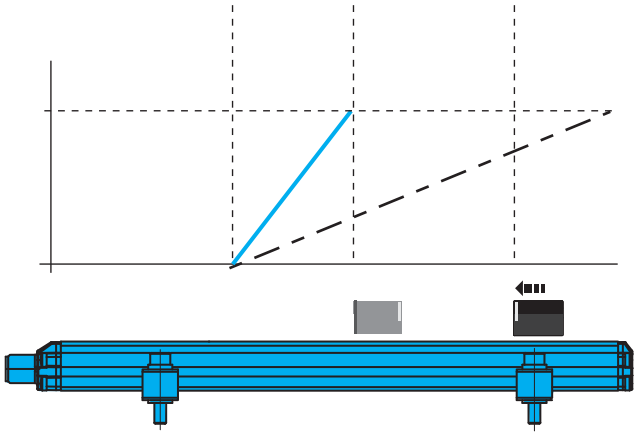
Measuring range adjustment via programming inputs L_a and L_b

1. Place magnet in new start position.



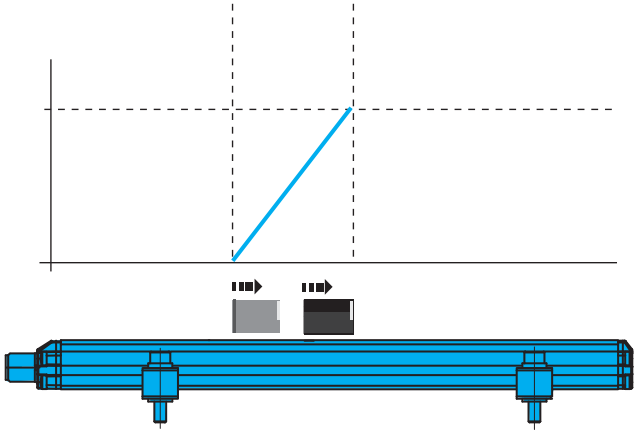
Adopting a new start position

2. Place magnet at new end position.



Adopting a new end position

3. The new measuring range



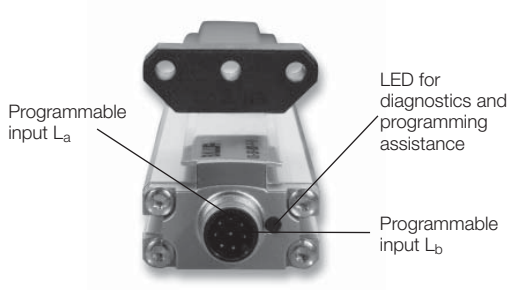
Series			
Output signal			
Transducer interface			
Input interface			
Part number			
Output voltage*			
Output current*			
Load current			
max. ripple			
Load resistance (recommended)			
System resolution			
Sampling rate			
max. non-linearity			
Temperature coefficient			
Operating voltage			
Current consumption			
Operating temperature			
Storage temperature range			
Pin assignments	Pin	Color	
Output signals	1	YE	
	2	GY	
	3	PK	
	4	RD	
	5	GN	
	8	WH	
Operating voltage	6	BU	
	7	BN	

■ Please enter the code for the output signal and the nominal stroke in the ordering code!

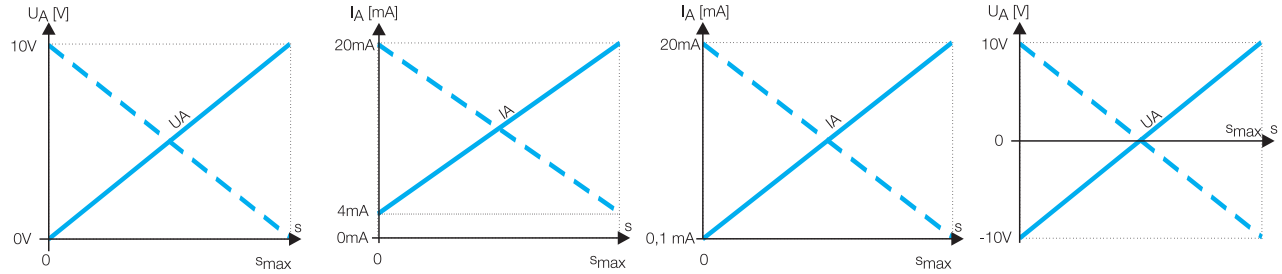
Preferred models interface A500 and E500
BTL6-A500-M_ _ _ _-PF-S115
BTL6-E500-M_ _ _ _-PF-S115
are available from stock in the nominal lengths highlighted in blue.

■ Included:
– Transducer
– Mounting clamps with isolation washers and screws
– Short user's guide

Please order separately:
Magnets from page 52
Connectors, page 156



	BTL6 profile PF	**BTL6 profile PF**	**BTL6 profile PF**	**BTL6 profile PF**
	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			–10...10 V
		4...20 mA	0.1...20 mA	
	max. 5 mA			max. 5 mA
	≤ 5 mV			≤ 5 mV
		≤ 500 ohms (500 ohms)	≤ 500 ohms (500 ohms)	
	≤ 0.35 mV	≤ 0.7 µA	≤ 0.7 µA	≤ 0.35 mV
	f_{max} = 2 kHz	f_{max} = 2 kHz	f_{max} = 2 kHz	f_{max} = 2 kHz
	±200 µm up to 500 mm nominal stroke	±200 µm up to 500 mm nominal stroke	±200 µm up to 500 mm nominal stroke	±200 µm up to 500 mm nominal stroke
	±0.04 % 500... max. nominal stroke	±0.04 % 500... max. nominal stroke	±0.04 % 500... max. nominal stroke	±0.04 % 500... max. nominal stroke
	30 ppm at 500 mm	30 ppm at 500 mm	30 ppm at 500 mm	30 ppm at 500 mm
	10...30 V DC	10...30 V DC	10...30 V DC	10...30 V DC
	≤ 150 mA	≤ 150 mA	≤ 150 mA	≤ 150 mA
	–25...+70 °C	–25...+70 °C	–25...+70 °C	–25...+70 °C
	–40...+100 °C	–40...+100 °C	–40...+100 °C	–40...+100 °C
	BTL6-**A**500...	BTL6-**E**500...	BTL6-**C**500...	BTL6-**G**500...
	0 V	0 V	0 V	0 V
	0 V Output	0 V Output	0 V Output	0 V Output
	L_a (programming input)	L_a (programming input)	L_a (programming input)	L_a (programming input)
	0...10 V	4...20 mA	0.1...20 mA	–10...10 V
	L_b (programming input)	L_b (programming input)	L_b (programming input)	L_b (programming input)
	GND	GND	GND	GND
	10...30 V	10...30 V	10...30 V	10...30 V



* Output signal can be inverted via programming inputs.

Ordering example:

BTL6-_500-M_ _ _ _-PF-S115

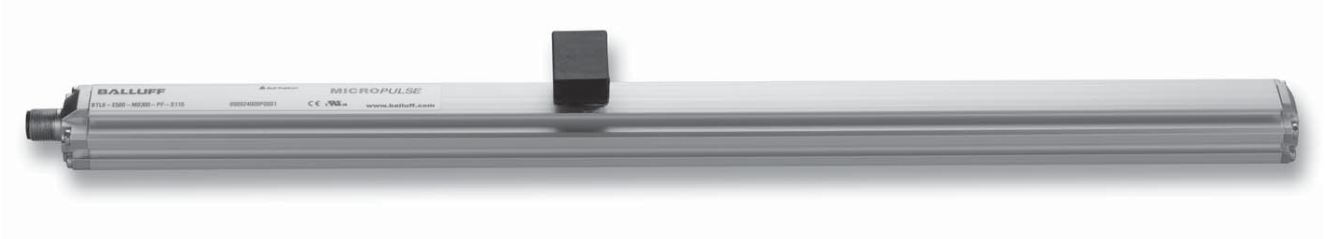
Output signal | **Standard nominal stroke [mm]**

A	0...10 V	0050, 0100, 0130, 0150, 0175, 0200,
E	4...20 mA	0225, 0250, 0300, 0350, 0360, 0400,
C	0.1...20 mA	0450, 0500, 0550, 0600, 0650, 0700,
G	–10...10 V	0750, 0800, 0850, 0900, 0950, 1000,
		1100, 1200, 1250, 1300, 1400, 1500,
		1600, 1700, 1750, 1800, 1900, 2000,
		2250, 2500, 2750, 3000, 3250, 3500,
		3550, 3750, 4000, 4250, 4572

Non-contact!
Vertical offset
0.1...4 mm or 5...15 mm

Balluff magnets are available in captive or floating designs. Maximum resolution and repeatability are achieved using transducers with captive magnets.
The 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 magnets on a single transducer, since only one magnet is active at a time.

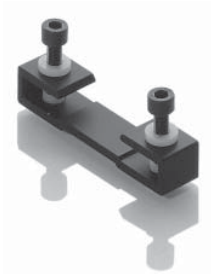
Description	
for series	
Version	
Part number	
Housing material	
Weight	
Magnet traverse velocity	
Operating voltage	
Current consumption	
Operating temperature/Storage temperature range	
Included	
Accessories (please order separately)	



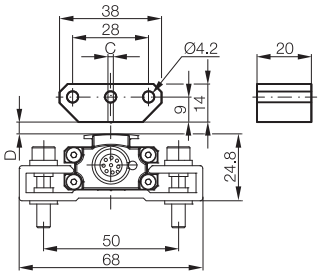
Length			Number of mounting clamp pairs
	to	250 mm	1
251	to	750 mm	2
751	to	1250 mm	3
1251	to	1750 mm	4
1751	to	2250 mm	5
2251	to	2750 mm	6
2751	to	3250 mm	7
3251	to	3750 mm	8
3751	to	4250 mm	9
	more than	4251 mm	10

Mounting clamps with isolation washers and screws included with transducer.

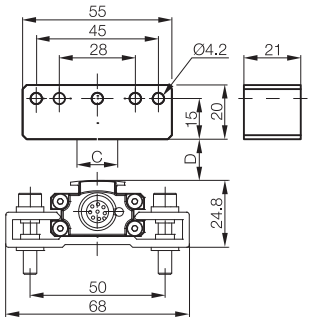
BTL6-A-MF07-A-PF/M5 1 pair of replacement mounting clamps and screws, item no.: 180961



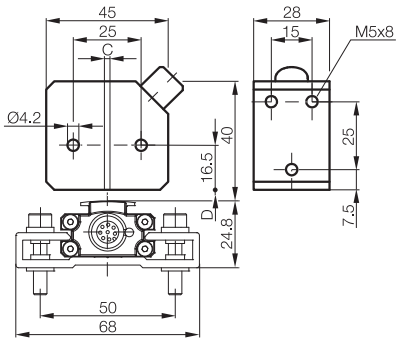
	Magnet	Magnet	Magnet
	BTL6 profile PF	BTL6 profile PF	BTL6 profile PF
	floating	floating	floating
	BTL5-P-3800-2	**BTL5-P-5500-2**	**BTL5-P-4500-1**
	Plastic	Plastic	Plastic
	approx. 12 g	approx. 40 g	approx. 90 g
	any	any	any
			24 V DC
			100 mA
	–40...+85 °C	–40...+85 °C	–40...+60 °C
	Magnet 2 fastening screws DIN 84 M4×35-A2 with washers and nuts	Magnet	Magnet
			Straight connector BKS-B 19-1-_ _ Right-angle connector BKS-B 20-1-_ _



Lateral offset:
C = ±2 mm
Vertical distance of magnet:
D = 0.1...4 mm

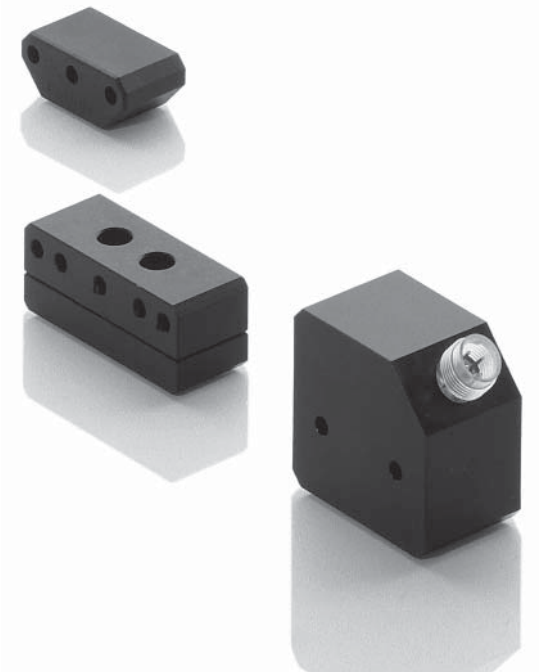


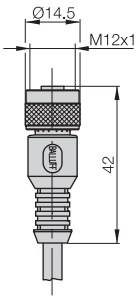
Lateral offset:
C = ±15 mm
Vertical distance of magnet:
D = 5...15 mm

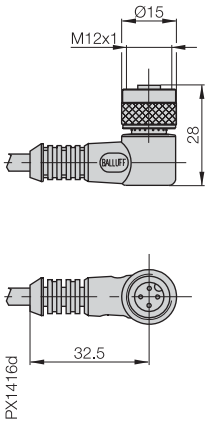


Lateral offset:
C = ±2 mm
Vertical distance of magnet:
D = 0.1...2 mm

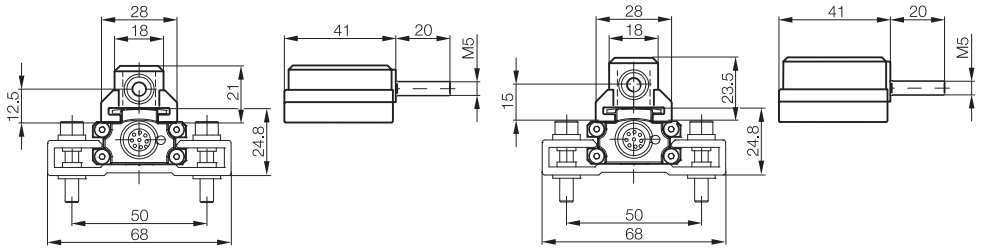
■ Please indicate the cable length in the ordering code!
03, 05, 10, 15
= PVC, 3 m, 5 m, 10 m or 15 m
PU-03, PU-05, PU-10, PU-15
= PUR, 3 m, 5 m, 10 m or 15 m

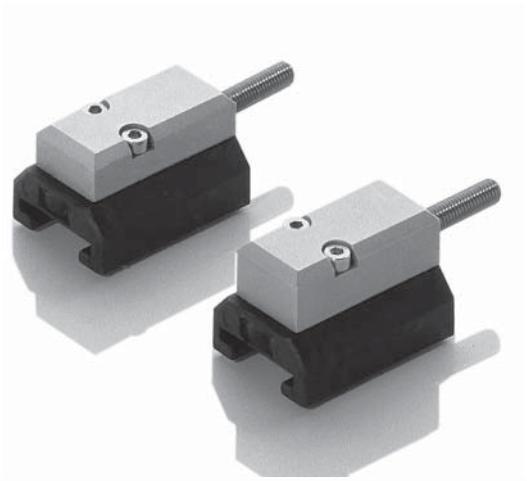


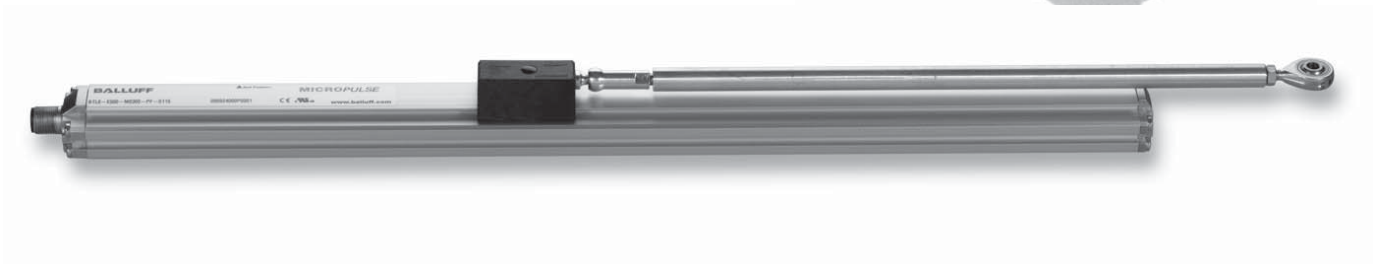




Description		**Magnet**	**Magnet**
for series		BTL6 profile PF	BTL6 profile PF
Version		captive	captive
Part number		**BTL5-M-2814-1S**	**BTL5-N-2814-1S**
Material	Housing	Anodized aluminum	Anodized aluminum
	Sliding surface	Plastic	Plastic
Weight		approx. 32 g	approx. 35 g
Magnet traverse velocity		any	any
Operating temperature/Storage temperature range		–40...+85 °C	–40...+85 °C



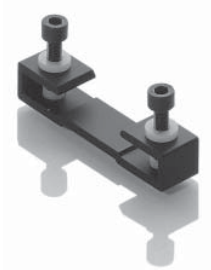




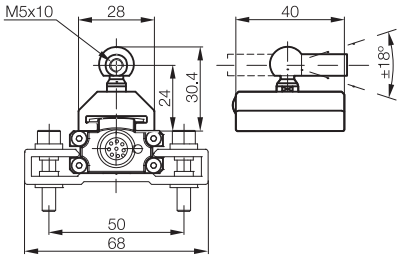
Length			Number of mounting clamp pairs
	to	250 mm	1
251	to	750 mm	2
751	to	1250 mm	3
1251	to	1750 mm	4
1751	to	2250 mm	5
2251	to	2750 mm	6
2751	to	3250 mm	7
3251	to	3750 mm	8
3751	to	4250 mm	9
	more than	4251 mm	10

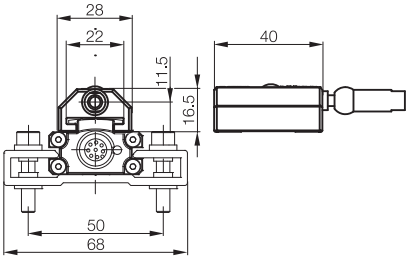
Mounting clamps with isolation washers and screws included with transducer.

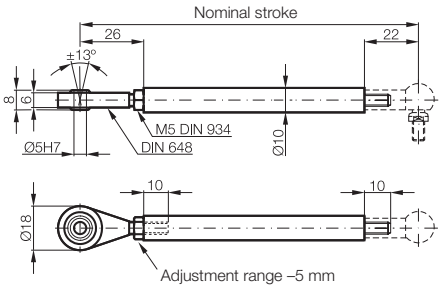
BTL6-A-MF07-A-PF/M5 1 pair of replacement mounting clamps and screws, item no.: 180961



	Magnet	Magnet	Control arm
	BTL6 profile PF	BTL6 profile PF	BTL6 profile PF
	captive	captive	captive
	BTL5-F-2814-1S	**BTL5-T-2814-1S**	**BTL2-GS10-_ _ _ _-A**
	Anodized aluminum	Anodized aluminum	Al
	Plastic	Plastic	
	approx. 28 g	approx. 28 g	approx. 150 g/mg
	any	any	
	–40...+85 °C	–40...+85 °C	







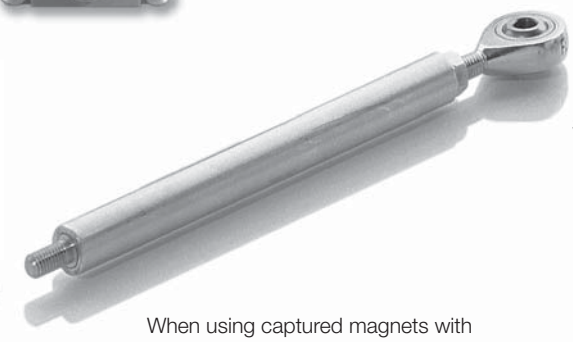
■ Please enter the code for the nominal stroke in the ordering code!

Ordering example:

BTL2-GS10-_ _ _ _-A

Standard nominal stroke [mm]

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

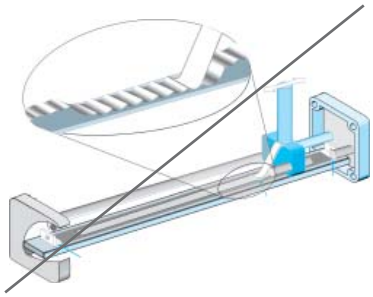


Swivel eye
Material number 714619

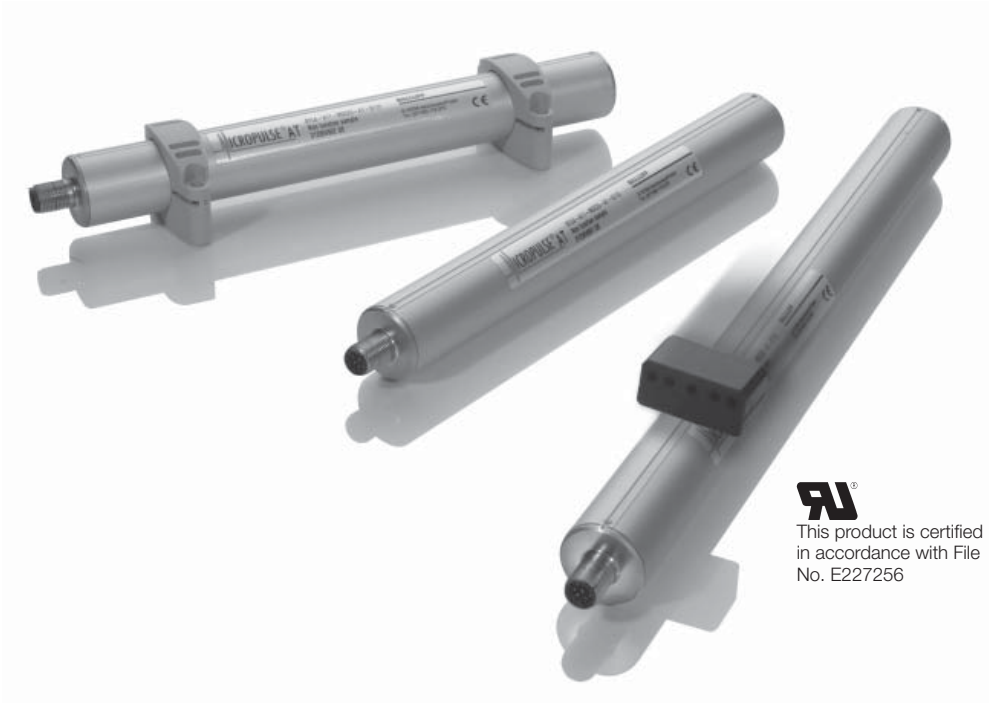
When using captured magnets with ball joint and control arm, transverse forces do not impinge on the transducer system.

Easy and flexible installation

Micropulse transducers – a non-contact alternative to contacting feedback devices
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 linear sensing element is protected inside an extruded aluminum profile.
A passive magnet with no power supply marks the measuring point along the waveguide without making contact. Measuring ranges between 50 and 1500 mm are possible.

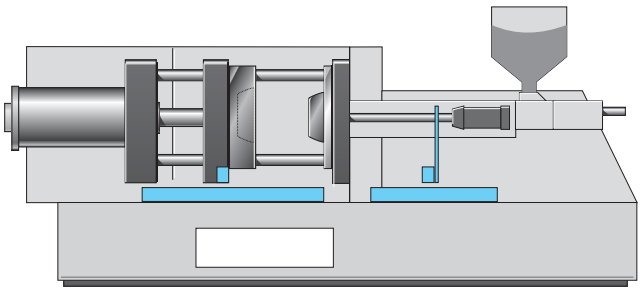


- Non-contact detection of the actual position
- IP 67, insensitive to contamination
- Wear-free
- Insensitive to shock and vibration
- Absolute output signal
- Direct signal processing or in conjunction with processors for all control and regulating systems



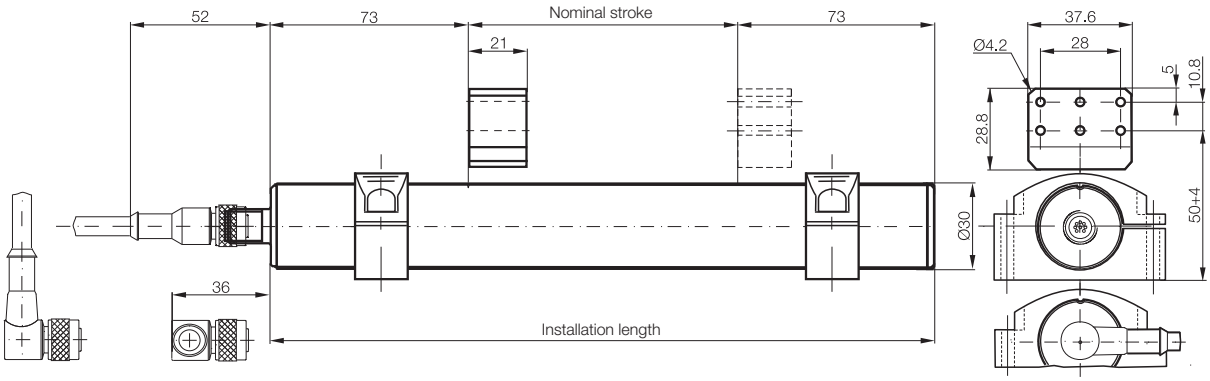
This product is certified in accordance with File No. E227256

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 to 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.



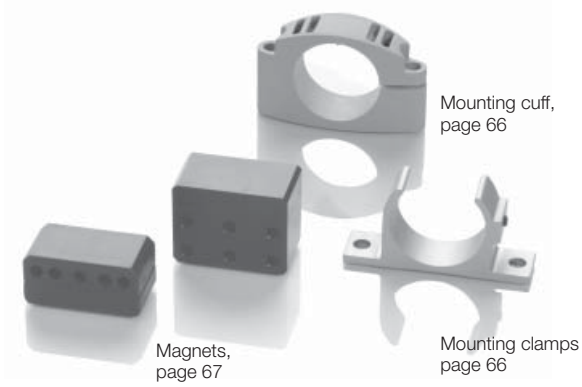
Series	BTL6 Profile A1
Part number	BTL6-_ _ _-M_ _ _ _-A1-S115
	BTL6-**A301**-M_ _ _ _-A1-S115
Shock load	50 g/6 ms per IEC 60068-2-27
Vibration	12 g, 10...2000 Hz per IEC 60068-2-6
Polarity reversal protected	yes
Overvoltage protection	yes
Degree of protection as per IEC 60529	IP 67 (with BKS-S... IP 67 connector attached)
Housing material	Anodized aluminum
Housing attachment	Mounting clamps
Connection type	Connector M12, 8-pin standard
EMC testing:	
RF emission	EN 55016-2-3 Group 1, Class A+B
Static electricity (ESD)	IEC 61000-4-2 Severity Level 3
Electromagnetic fields (RFI)	IEC 61000-4-3 Severity Level 3
Fast transients (BURST)	IEC 61000-4-4 Severity Level 3
Line-induced disturbances,	IEC 61000-4-6 Severity Level 3
induced by high-frequency fields	IEC 61000-4-8 Severity Level 4

Transducers with floating magnet and S115 connection with BKS-S115/BKS-S116 connector
for transducers with analog interface, digital pulse interface and VARAN bus interface from page 58



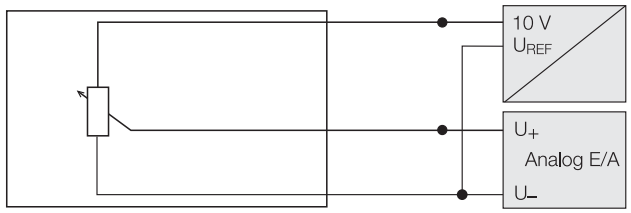
■ Included:
– Transducer (select your interface from page 58)
– Short user's guide

Please order separately:
Magnets, page 67
Mounting clamps/cuff, page 66
Connectors, page 156

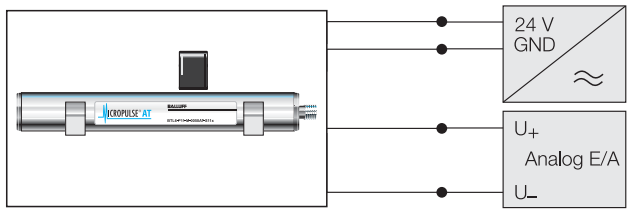


The non-contact potentiometer

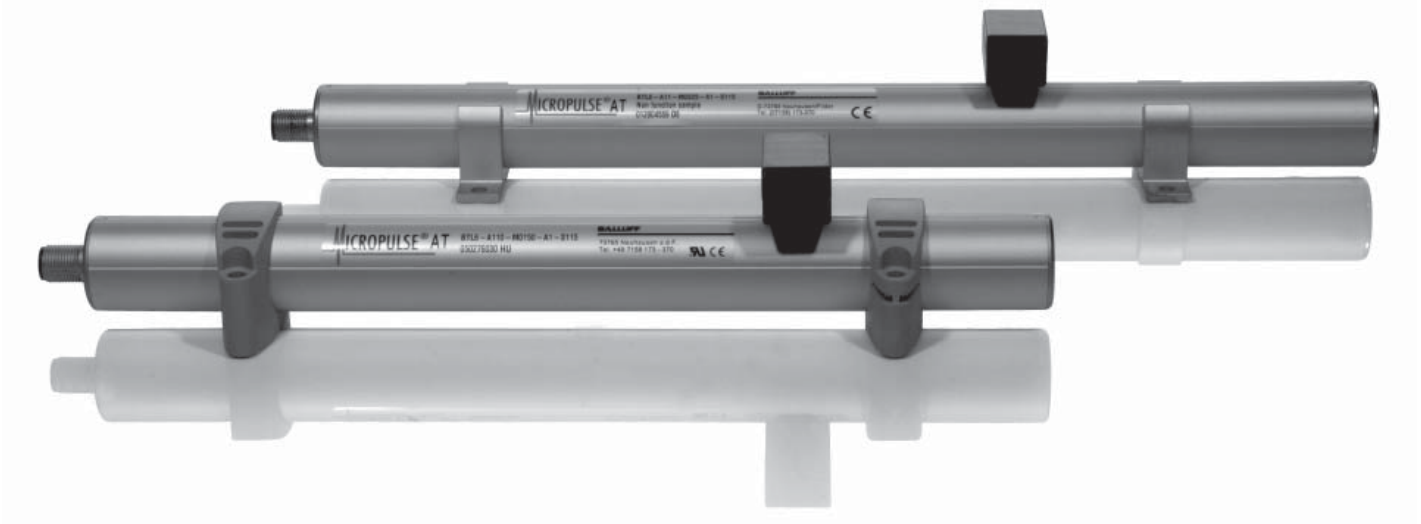
The analog outputs of the standard series BTL6-A110 are potential non-isolated.
BTL6 transducers exist in the variants 0...10 V and –10...10 V with rising and falling characteristics. The version –10...10 V generally has potential isolated output signals.



Potentiometer connections, block diagram

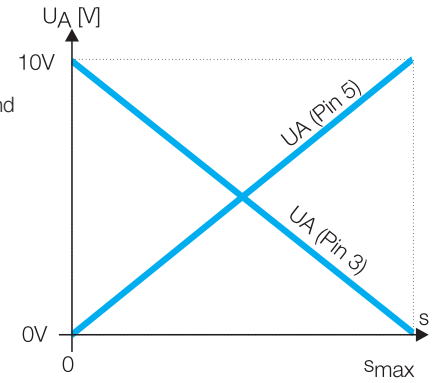


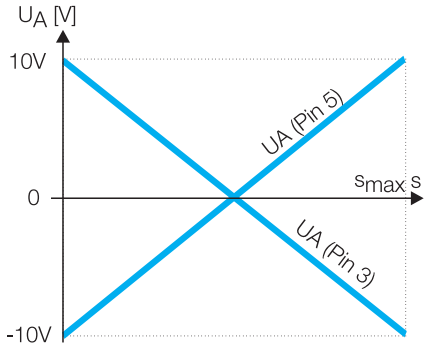
Micropulse transducer connections, block diagram



Series		**BTL6 Profile A1**	**BTL6 Profile A1**
Output signal		analog	analog
Transducer interface		**A**	**G**
Input interface		analog	analog
Part number		BTL6-**A**110-M_ _ _ _-A1-S115	BTL5-**G**310-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. ripple		≤ 5 mV	≤ 5 mV
System resolution		≤ 10 µm	≤ 10 µm
Repeat accuracy		≤ 10 µm	≤ 10 µm
Repeatability		≤ 20 µm	≤ 20 µm
Sampling rate		$f_{STANDARD}$ = 1 kHz	$f_{STANDARD}$ = 1 kHz
Non-linearity		≤ ±200 µm up to 500 mm nominal stroke typ. ±0.02 %, max. ±0.04 % 500...1500 mm nominal stroke	≤ ±200 µm up to 500 mm nominal stroke typ. ±0.02 %, max. ±0.04 % 500...1500 mm nominal stroke
Operating 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 range		–40...+100 °C	–40...+100 °C
Pin assignments	Pin	BTL6-**A**110.../**A**310	BTL6-**G**310...
Output signals	1	0 V Output	0 V Output
	2	0 V Output	0 V Output
	3	10...0 V	–10...10 V
	5	0...10 V	10...–10 V
Operating voltage	6	GND	GND
	7	+24 V DC	+24 V DC

Connect shield to housing,
pins 4 and 8 must remain unconnected.





■ Please enter the code for the output signal and the nominal stroke length in the ordering code.

Preferred models
BTL6-A110-M_ _ _ _-A1-S115 are available from stock in the nominal lengths highlighted in blue.

■ Included:
– Transducer
– Short user's guide

Please order separately:
Magnets, page 67
Mounting clamps/cuff, page 66
Connectors, page 156

Ordering example:

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

Output signal

A	0...10 V 10...0 V
G	–10...10 V 10...–10 V

Output signal

1	potential non-isolated*
3	potential unconnected

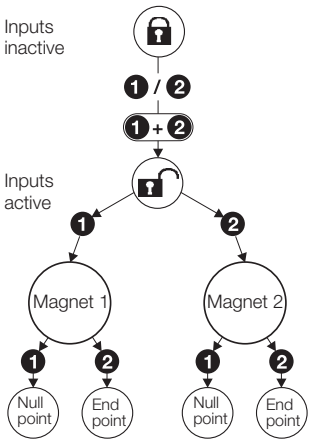
Standard nominal stroke [mm]

0100, 0130, 0150, 0160, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0360, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500,
in 25 mm increments on request

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

BTL6-A301-... 2 in 1

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



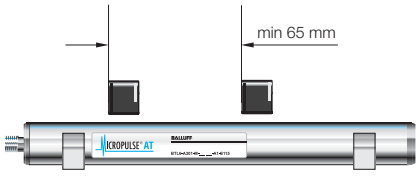
Teach-in

Used for changing the factory set null and end point to a new null and end point. First the magnet must be brought to the new null point and then to the new end position, and the respective values stored by pressing the button.

Example: Programming steps for setting the measuring range

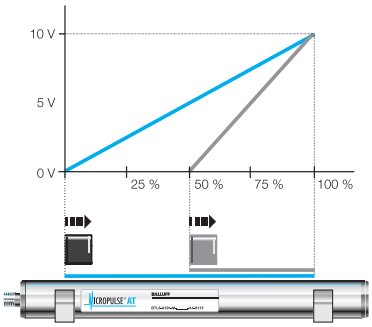
Mode selection

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

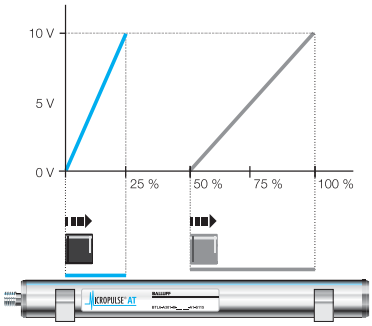


The separation between two magnets should not generally be less than 65 mm.

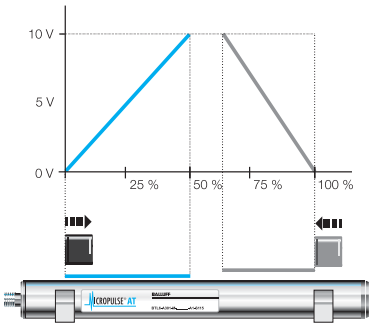
Mode 1: Single measurement of 2 positions (single measurement default setting 100 %/50 %)



Basic default setting

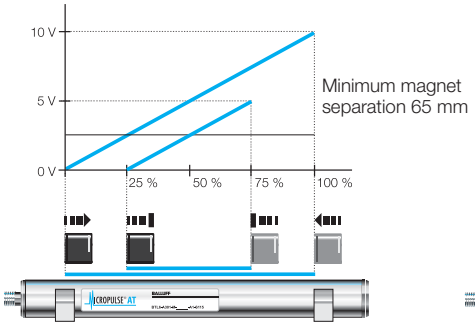


Programming example:
Output 1: 25 % nominal stroke, signal rising
Output 2: 50 % nominal stroke, signal rising

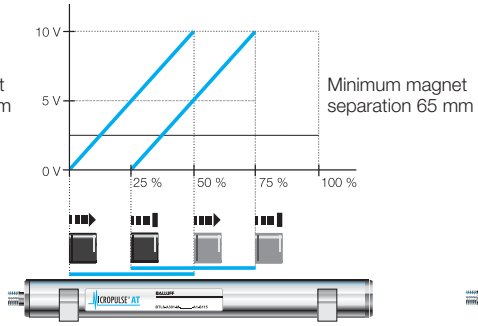


Programming example:
Output 1: 50 % nominal stroke, signal rising
Output 2: 37.5 % nominal stroke, signal falling

Mode 2: Differential measurement between 2 magnets

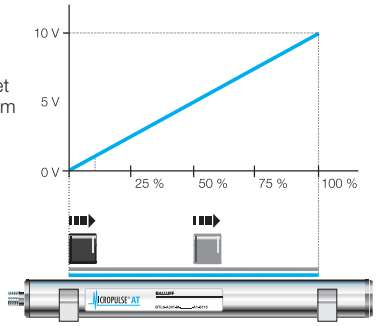


Default setting: Differential measurement
Output 1: Standard travel signal (not shown)
Output 2: differential signal 100 % nominal stroke = 10 V
Programming example:
Differential travel 50 % nominal stroke = 5 V differential signal



Programming example: Differential travel 50 % nominal stroke = 10 V differential signal

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

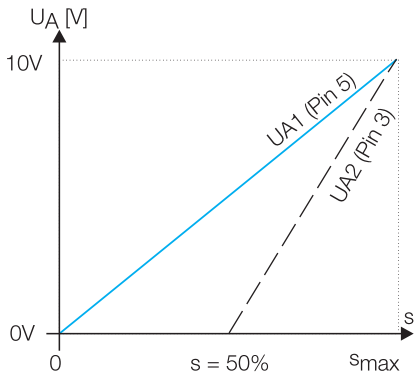


Features of Micropulse BTL6-A
- 100 % adjustment of analog signal
- Error signal, no magnet within measuring range, transducer in calibration mode
- LED indicator for programming assistance
- Separate teach-in for all zero and span points
- Freely selectable single position or differential measurement

Measure two motions with one system
- One transducer senses two motions at the same time
- Significant cost reduction, half the installation costs
- Two 0...10 V analog outputs

Series			**BTL6 Profile A1**
Output signal			analog
Transducer interface			**A**
Input interface			analog
Part number			BTL6-**A**301-M_ _ _ _-A1-S115
Output			potential-free
Output voltage			**0...10 V programmable**
Load current			max. 5 mA
max. ripple			≤ 5 mV
System resolution			≤ 10 µm
Repeat accuracy			≤ 10 µm
Repeatability			≤ 20 µm
Sampling rate			$f_{STANDARD}$ = 1 kHz (< 850 mm)
Non-linearity			≤ ±200 µm up to 500 mm nominal stroke typ. ±0.02 %, max. ±0.04 % 500...1500 mm nominal stroke
Operating voltage			18...30 V DC
Current consumption			≤ 100 mA
Polarity reversal protected			yes
Operating temperature			0...+70 °C
Storage temperature range			–40...+100 °C
Pin assignments	Pin	Color*	BTL6-**A**301...
Output signals	1	YE	Programming input L_a
	2	GY	0 V Output
	3	PK	0...10 V, output 2, programmable
	4	RD	Programming input L_b
	5	GN	0...10 V, output 1, programmable
Operating voltage	6	BU	GND
	7	BN	+24 V DC

Connect shield to housing, pin 8 (WH) must remain unconnected.
*Connector with cable BKS-S115/BKS-S116



■ Please the enter code for the nominal stroke in the ordering code!

Preferred models interface A301
BTL6-A301-M_ _ _ _-A1-S115
are available from stock in the nominal lengths highlighted in blue.

■ Included:
- Transducer
- Short user's guide

Please order separately:
Magnets, page 67
Mounting clamps/cuff, page 66

Ordering example:

BTL6-A301-M_ _ _ _-A1-S115

Output signal

potential isolated
2 analog outputs
Single or differential measurement, rising, falling, zero and end point programmable

Standard nominal stroke [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.

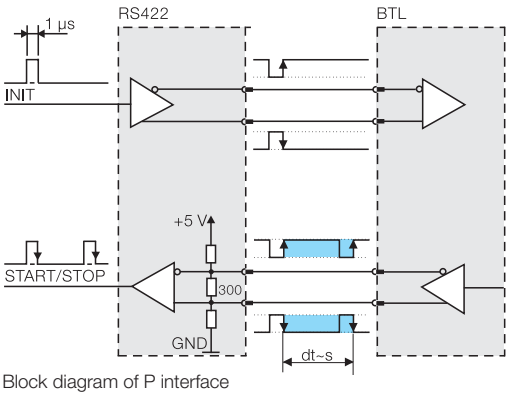
Standard nominal stroke (mm) 0050, 0100, 0130, 0150 for single magnet only

P110 interface
Compatible with BTA processors as well as controllers and modules from various manufacturers including Siemens, B & R, Phoenix Contact, Mitsubishi, Sigmatek, Esitron and WAGO.
Reliable signal transmission, even over cable lengths up to 500 m between BTA and transducer is assured by the noise-immune RS485 differential line drivers and receivers. Noise signals are effectively suppressed.

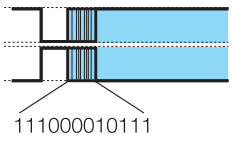
P110 replaces P1 and M1
Based on differing philosophies, two controller-specific interfaces have been established for the digital pulse versions. The difference lies in how the edges are processed. The falling edges are processed in the "P interface" and the rising edges in the "M interface". To reduce 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".

P111 interface – Cost savings using DPI/IP for start-up and installation
DPI/IP is a protocol for direct data interchange between a controller and transducer. The signal lines are used to send additional information such as manufacturer, stroke length and waveguide gradient. This allows start-up or replacement of a transducer without having to make manual changes to the controller parameters. The first to integrate these functions were the controllers from Sigmatek.

Features:
- Bi-directional communication
- Transducer controlled using Init and Start/Stop signals
- Integrated diagnostic functions
- Plug and Play
- Automatic parameterization reduces downtimes
- Sending of sensor model, stroke length, specific parameters
- Measurement length up to 3250 mm

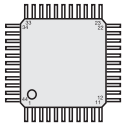


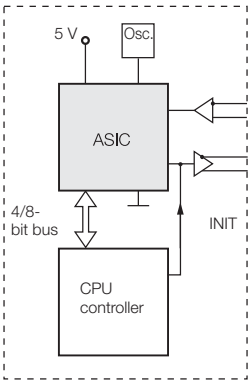
Block diagram of P interface



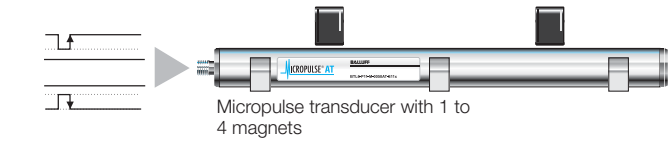
Extremely precise digitizing chip for P110 pulse interface
Companies developing their own control and processing electronics can create a highly accurate P interface cost effectively and with minimum effort using the Balluff digitizing chip. The digitizing chip was developed as a high-resolution, configurable ASIC for Micropulse transducers with P interface.

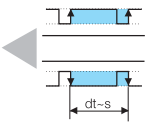
Advantages:
- High resolution: the actual 1 µm of the BTL is fully supported by the 133 ps resolution of the chip (at low clock frequency 2 or 20 MHz)
- Position data from 4 magnets can be processed simultaneously
- 4/8-bit processor interface


Digitizing chip 44QFP



Controller or
processing electronics


Micropulse transducer with 1 to 4 magnets

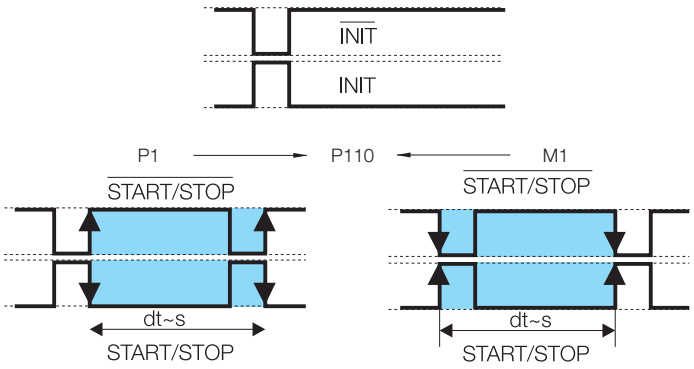


P pulse signal

ASIC INFO:
+49 7158 173-370

Series			**BTL6 Profile A1**
Transducer interface			Pulse **P11**_
Input interface			Pulse **P11**_
Part number			BTL6-**P11**_-M_ _ _ _-A1-S115
System resolution			processing-dependent
Repeat accuracy			≤ 10 µm
Repeatability			≤ 20 µm
Resolution			≤ 10 µm
Non-linearity			≤ ±200 µm up to 500 mm nominal stroke
			typ. ±0.02 %, max. ±0.04 % 500...1500 mm nominal stroke
Operating voltage			20...28 V DC
Current consumption			≤ 60 mA (at 1kHz)
Operating temperature			0...+70 °C
Storage temperature range			–40...+100 °C
Pin assignments		Pin	BTL6-**P11**_-M...
Input/Output signals	Input	1	INIT
	Output	2	START/STOP
	Input	3	$\overline{\text{INIT}}$
	Output	5	$\overline{\text{START/STOP}}$
Operating voltage		6	GND
		7	+24 V DC

Connect shield to housing,
pins 4 and 8 must remain unconnected.



■ Please enter code for the data protocol and nominal stroke length in the ordering code.

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

■ Included:
– Transducer
– Short user's guide

Please order separately:
Magnets, page 67
Mounting clamps/cuff, page 66
Connectors, page 156

Ordering example:

BTL6-P11_-M_ _ _ _-A1-S115

Data protocol		**Standard nominal stroke [mm]**
0	without DPI/IP* (standard)	0050, 0075, 0100, 0130, 0150, 0160, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600,
1	with DPI/IP	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

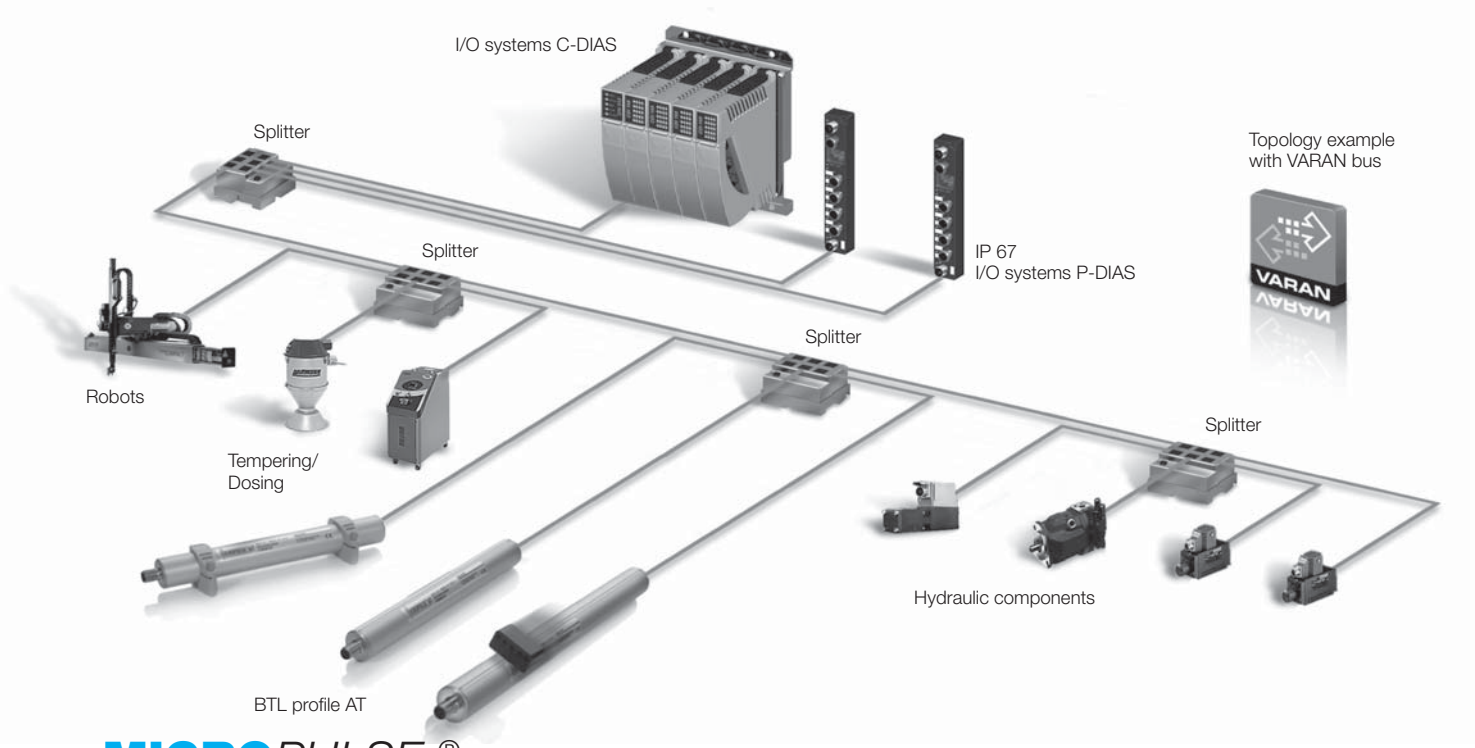
*the version without DPI/IP is only available up to a nominal stroke of 1500

Realtime Ethernet, reliable and economical

VARAN Ethernet technology and non-contact Micropulse distance measurement technology from Balluff form an outstanding team. Micropulse AT VARAN linear displacement systems detect the movements of highly dynamic axes in complex applications.
The realtime Ethernet system is extremely economical, easy to implement and simple to program. Widely available on the market, VARAN networks are used in combination with Sigmatek controllers, for example.
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.

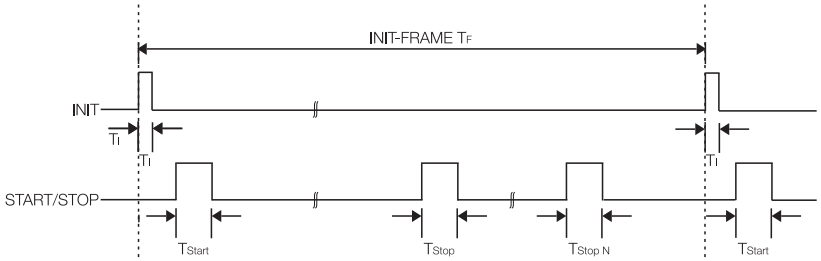
Micropulse AT V11V features:
- Robust non-contact IP 67 sensor – reliable and wear-free
- Simple hardware structure – low system costs
- M12, 8-pin plug connection – simple economical cabling

VARAN features:
- Hard realtime data transfer – cycle times < 100µs
- High reliability – repeat in bus cycle
- Cost-conscious hardware design – low overall system costs
- Open standard – no restrictive dependences
- Easy implementation – cost-effective



MICROPULSE ®

Series			**BTL6 -V11V**
Output signal			VARAN (Ethernet)
Transducer interface			**V11V**
Input interface			VARAN
Part number			BTL6-**V**11V-M_ _ _ _-A1-S115
System resolution			≤ 15 µm
Repeat accuracy			≤ 30 µm
Repeatability			≤ 30 µm
Sampling rate			$f_{STANDARD}$ = 1 kHz (< 850 mm)
Non-linearity			≤ ±200 µm up to 500 mm nominal stroke
			±0.04 % 500...1500 mm nominal stroke
Operating voltage			18...30 V DC
Current consumption			≤ 75 mA
Polarity reversal protected			yes
Operating temperature			0...+70 °C
Storage temperature range			–40...+100 °C
Pin assignments	Pin	Color	BTL6-**V**11V-...
Output signals	1		
	2	OG/WH	Tx+
	3	OG	Tx-
	4		
	5	GN/WH	Rx+
	6	BU	GND
	7	BN	+24 V DC
	8	GN	Rx-



■ Please enter code for the nominal stroke in the ordering code!

■ Included:
– Transducer
– Short user's guide

Please order separately:
Magnets, page 67
Mounting clamps/cuff, page 66

Ordering example:

BTL6-V11V-M_ _ _ _-A1-S115

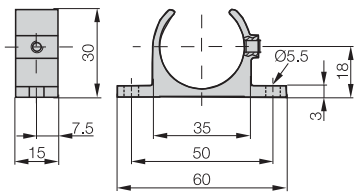
Standard nominal stroke [mm]

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.

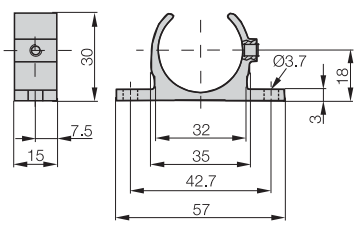
Standard nominal stroke (mm) 0050, 0100, 0130, 0150 for single magnet only

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

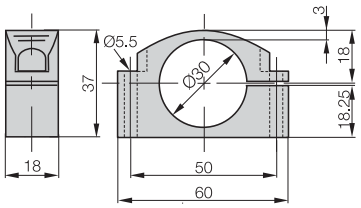
Mounting clamps/cuff



Mounting clamp
Ordering code: BTL6-A-MF01-A-50
Includes: 1 clamp



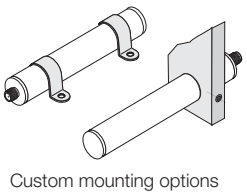
Mounting clamp
Ordering code: BTL6-A-MF01-A-43
Includes: 1 clamp



Mounting cuff
Ordering code: BTL6-A-MF03-K-50
Includes: 1 cuff

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

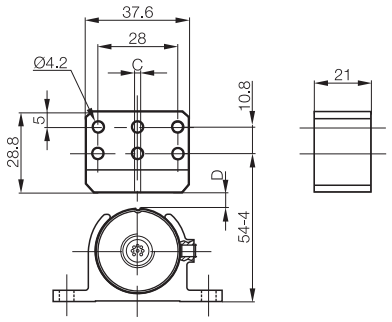
Length			Number of mounting clamp pairs
	to	250 mm	1
251	to	750 mm	2
751	to	1250 mm	3
1251	to	1750 mm	4
1751	to	2250 mm	5
2251	to	2750 mm	6
2751	to	3250 mm	7
	more than	3251 mm	8



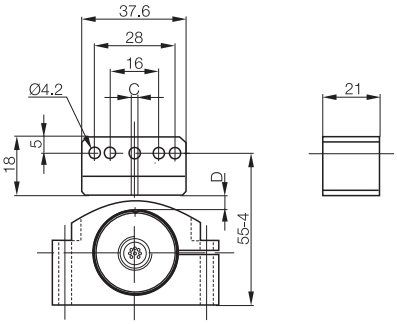
Custom mounting options

Connector accessories, page 156

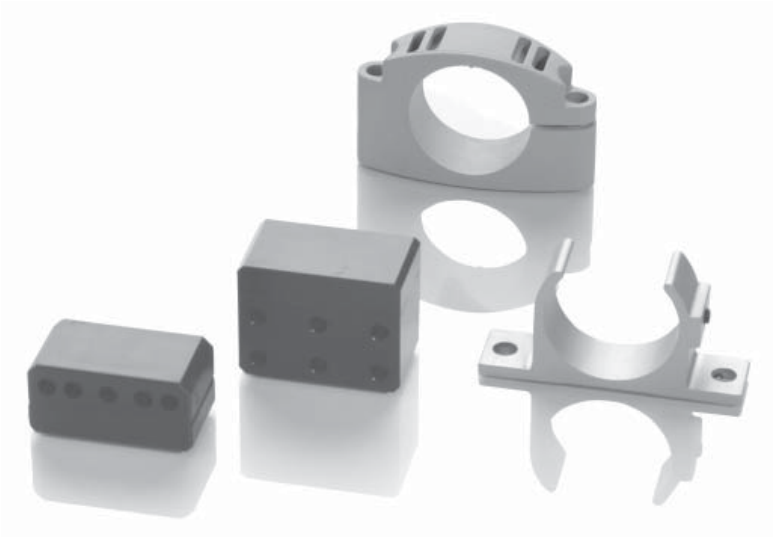
Description	**Magnet**	**Magnet**
for series	BTL6 Profile A1	BTL6 Profile A1
Part number	**BTL6-A-3800-2**	**BTL6-A-3801-2**
Housing material	Plastic	Plastic
Weight	ca. 30 g	ca. 25 g
Magnet traverse velocity	any	any
Operating temperature/Storage temperature range	–40...+85 °C	–40...+85 °C
Included	Magnet	Magnet



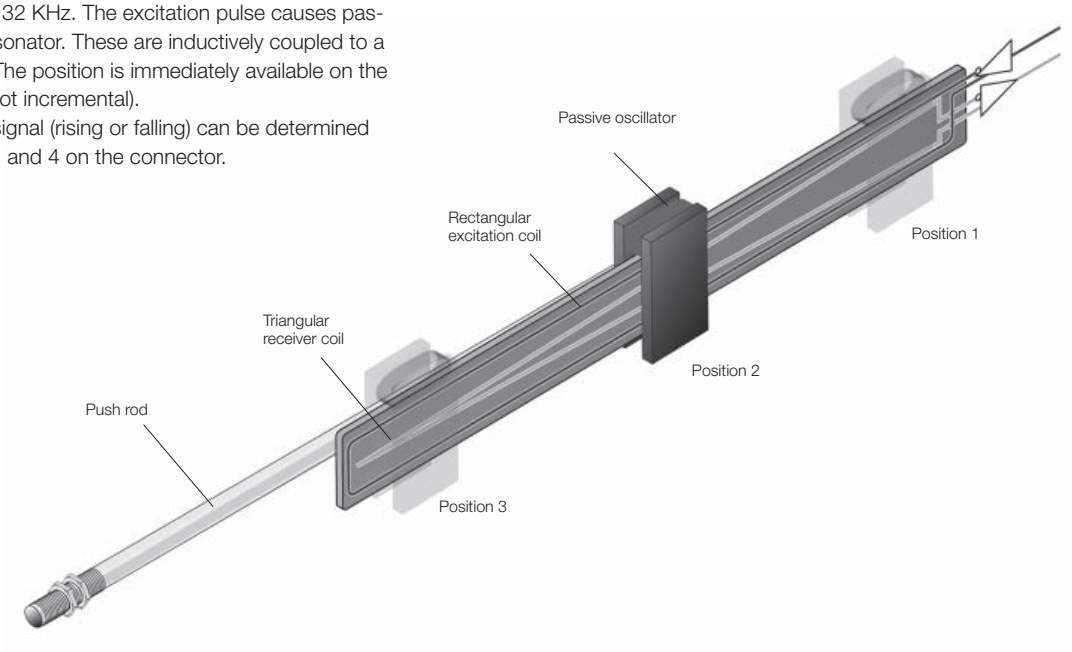
Lateral offset: C = ±5 mm
Vertical distance of magnet:
D = 4...8 mm



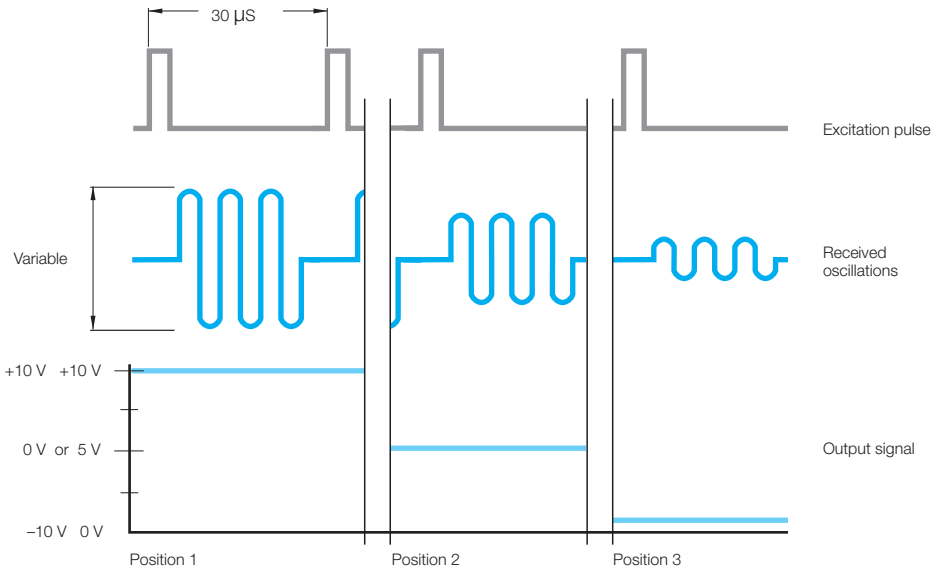
Lateral offset: C = ±5 mm
Vertical distance of magnet:
D = 4...8 mm



The inductive BIW transducer is based on a new, patented operating principle that detects the actual position without making contact.
The BIW transducer contains an excitation/receiving sensor element and an oscillator, protected inside an extruded aluminum housing. The oscillator is attached to a rod which is secured on the moving member of the machine whose position needs to be determined.
A momentary excitation pulse is applied to the rectangular excitation coil at a sampling rate of 32 KHz. The excitation pulse causes passive oscillations in the resonator. These are inductively coupled to a triangular receiving coil. The position is immediately available on the output and is absolute (not incremental).
The slope of the output signal (rising or falling) can be determined through the use of pins 1 and 4 on the connector.

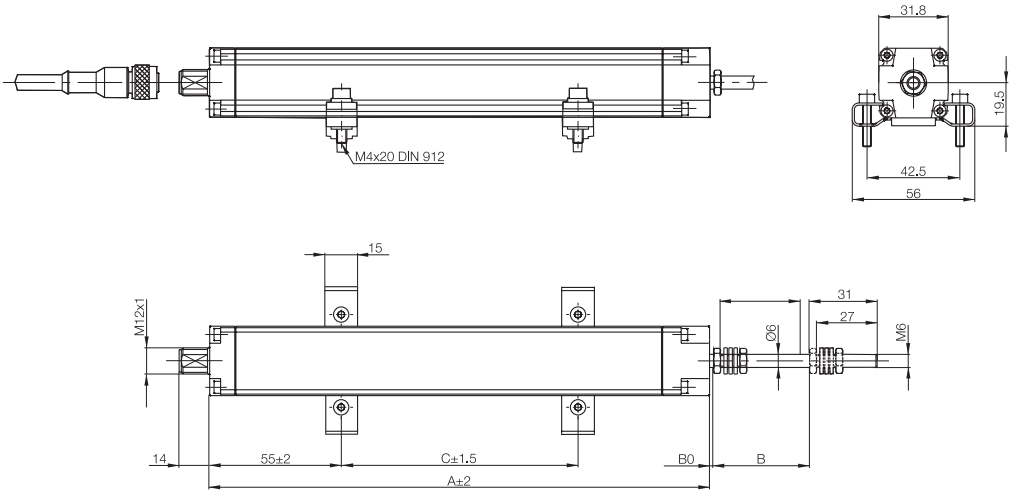


Function of inductive Micropulse BIW technology:
- Short exciter pulses excite the rectangular excitation coil
- The exciter pulses activate the passive oscillator on the magnet via the excitation coil
- The oscillator on the magnet transmits the frequency inductively to the triangular receiver coil without making contact
- The amplitude level varies according to the position of the magnet oscillator. Comparable to the amplitude level, the electronics integrated in the Micropulse BIW issue a standard analog, voltage or current signal



Series	BIW1
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
Mounting	Mounting clamps
Connection type	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

Transducers with floating magnet and S115 connection with BKS-S115/BKS-S116 connector
for transducers with analog interface, from page 70



Housing length	A = nominal stroke + 100 mm
Mechanical null point	B0 = 0 + 2 mm
Electrical null point	B0 + 5 mm
Electrical stroke = mechanical stroke	B = nominal stroke + 10 mm
Recommend clamp distance	
Nominal stroke ≤ 300 mm	C = nominal stroke – 20 mm
Nominal stroke 300 mm to ≤ 600 mm	C = nominal stroke – 15 mm
Nominal stroke 600 mm	C = nominal stroke – 10 mm

Calculation example:

BIW1-...-M0100-P1-S115
Nominal stroke 100
A = 200
B = 110
C = 80

■ Included:
– Transducer
– Short user's guide
– 2 mounting clamps BIW-A-MF01-M-43

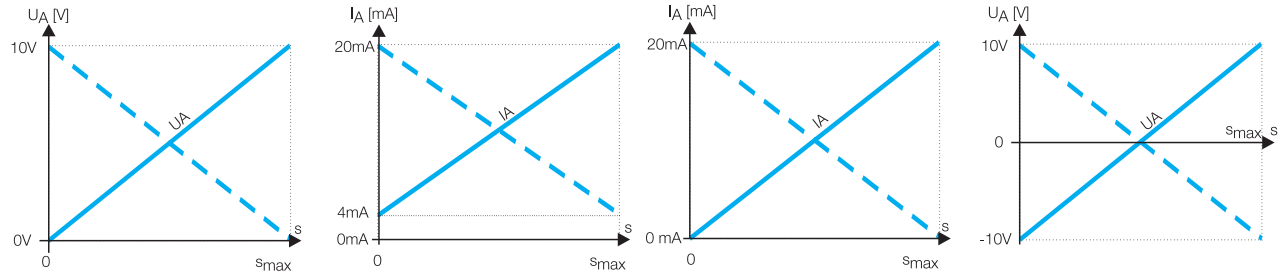
Please order separately:
Connectors, page 156

Profile Series BIW1
Analog interface

Features:
BIW transducers are characterized by:
- High resolution and repeatability
- Resistance to shock, vibration and noise fields
- An absolute rising or falling analog output signal
- A captive sensor element
- 32 kHz sampling rate
- Potential-free
- Non-contact measuring principle

Series		
Output signal		
Transducer interface		
Input interface		
Part number		
Output voltage*U_A		
Output current* I_A		
Max. current load per output		
System resolution		
Repeat accuracy		
Sampling rate		
Max. non-linearity		
Operating voltage		
No-load current consumption		
Operating temperature		
Storage temperature range		
Pin assignments	Pin	
	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
Shock load		
Vibration		
Dielectric strength		
Degree of protection as per IEC 60529		
Housing material		
Mounting		
Connection type		
Housing length A		
Mechanical stroke B		

	BIW1	BIW1	BIW1	BIW1
	analog	analog	analog	analog
	A	**E**	**C**	**G**
	analog	analog	analog	analog
	BIW1-**A**310...	BIW1-**E**310...	BIW1-**C**310...	BIW1-**G**310...
	0...10 V			–10...10 V
		4...20 mA	0...20 mA	
	6 mA			6 mA
	5 µm	5 µm	5 µm	5 µm
	10 µm	10 µm	10 µm	10 µm
	typ. 32 kHz	typ. 32 kHz	typ. 32 kHz	typ. 32 kHz
	≤ 0.02 %	≤ 0.02 %	≤ 0.02 %	≤ 0.02 %
	18...30 V DC	18...30 V DC	18...30 V DC	18...30 V DC
	≤ 80 mA	≤ 80 mA	≤ 80 mA	≤ 80 mA
	–20...+85 °C	–20...+85 °C	–20...+85 °C	–20...+85 °C
	–40...+100 °C	–40...+100 °C	–40...+100 °C	–40...+100 °C
	Slope selector	Slope selector	Slope selector	Slope selector
	0 V Output	0 V Output	0 V Output	0 V Output
	reserved	reserved	reserved	reserved
	Slope selector	Slope selector	Slope selector	Slope selector
	0...10 V	4...20 mA	0...20 mA	–10...10 V
	GND	GND	GND	GND
	+24 V DC	+24 V DC	+24 V DC	+24 V DC
	reserved	reserved	reserved	reserved
	100g/2 ms	100g/2 ms	100g/2 ms	100g/2 ms
	12 g, 10...2000 Hz	12 g, 10...2000 Hz	12 g, 10...2000 Hz	12 g, 10...2000 Hz
	500 V (GND to housing)	500 V (GND to housing)	500 V (GND to housing)	500 V (GND to housing)
	IP 54	IP 54	IP 54	IP 54
	Anodized aluminum	Anodized aluminum	Anodized aluminum	Anodized aluminum
	Mounting clamps	Mounting clamps	Mounting clamps	Mounting clamps
	Connector M12, 8-pin standard	Connector M12, 8-pin standard	Connector M12, 8-pin standard	Connector M12, 8-pin standard
	Nominal stroke + 100 mm	Nominal stroke + 100 mm	Nominal stroke + 100 mm	Nominal stroke + 100 mm
	Nominal stroke + 10 mm	Nominal stroke + 10 mm	Nominal stroke + 10 mm	Nominal stroke + 10 mm



* Output signal can be inverted via programming inputs.

■ Please enter the code for the output signal and nominal stroke length in the ordering code.

■ Included:
– Transducer
– Short user's guide
– 2 mounting clamps BIW-A-MF01-M-43

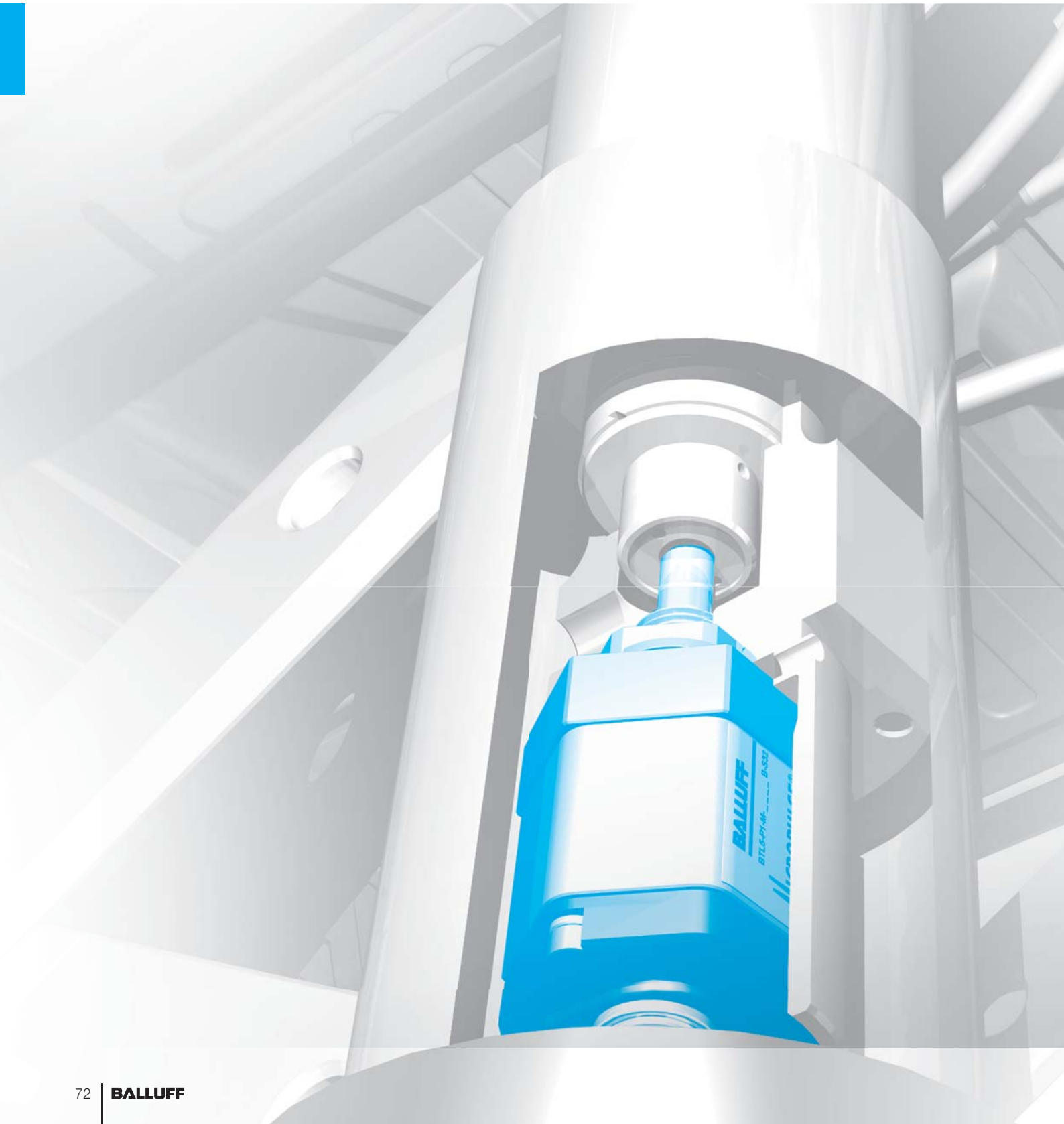
Please order separately:
Connectors, page 156

Ordering example:

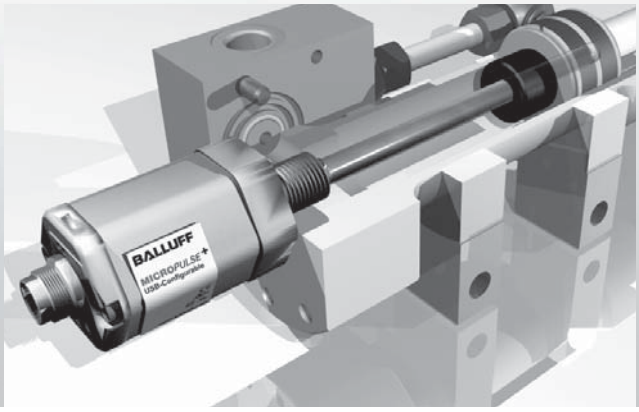
BIW1-_ 310-M_ _ _ _-P1-S115

Output signal | **Standard nominal stroke [mm]**

A	0...+10 V	0075, 0100, 0130, 0150, 0175,
G	–10...+10 V	0225, 0260, 0300, 0360, 0375,
E	4...20 mA	0400, 0450, 0500, 0600, 0650,
C	0...20 mA	0750


BALLUFF

MICROPULSE®



Rod housings are mainly used in hydraulic drive applications. When installed in the pressure section of the hydraulic cylinder, the distance 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 face end with a welded plug. An O-ring seal in the flange at the opposite end seals off the high-pressure section. An magnet ring with magnets slides over the tube or rod with internal waveguide to mark the position prior to detection.

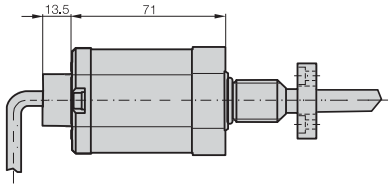
Pressure rated to 600 bar, High repeatability, Non-contacting, rugged

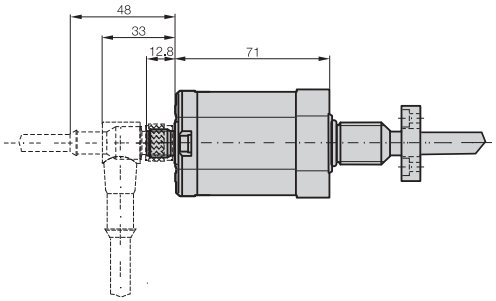
The BTL Micropulse transducer is a robust position feedback system for measuring ranges between 25 and 7620 mm as well as use under extreme ambient conditions.

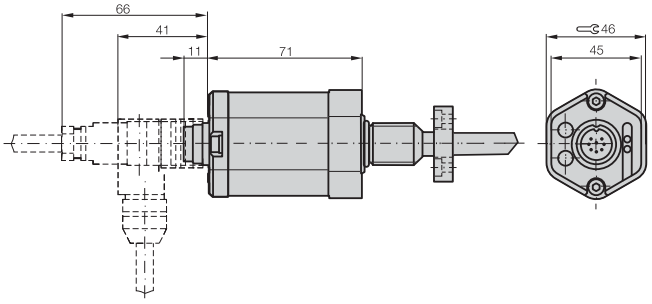
The actual waveguide is protected inside a high-pressure resistant stainless steel tube. The system is ideal for use in hydraulic cylinders for position feedback or as a level monitor with aggressive media in the food and chemical industries.

Series	BTL7 rod
Shock load	150 g/6 ms as per IEC 60068-2-27
Vibration	20 g, 10...2000 Hz as per IEC 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 BKS-S... connector attached
Housing material	Anodized aluminum/1.4571 stainless steel outer tube, 1.3952 stainless steel cast flange
Mounting	Housing B thread M18×1.5, housing Z 3/4"-16UNF
Pressure rating with 10.2 mm outer tube	600 bar installed in hydraulic cylinder
Pressure rating with 8 mm outer tube	250 bar installed in hydraulic cylinder
Connection type	Connector or integral cable
EMC testing:	
RF emission	EN 55016-2-3 Group 1, Class A and B
Static electricity (ESD)	IEC 61000-4-2 Severity Level 3
Electromagnetic fields (RFI)	IEC 61000-4-3 Severity Level 3
Fast transients (BURST)	IEC 61000-4-4 Severity Level 3
Surge voltage	IEC 61000-4-5 Severity Level 2
Conducted interference induced by high-frequency fields	IEC 61000-4-6 Severity Level 3
Magnetic fields	IEC 61000-4-8 Severity Level 4
Standard nominal strokes [mm] with 8 mm outer tube is the max. nominal stroke 1016 mm	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500, 4750, 5000, 5250, 5500, 5750, 6000, 6250, 6500, 6750, 7000, 7250, 7500, 7600, 7620 or in 5 mm increments (depending on interface) on request

Please order separately:
USB communication box, page 81
Magnets/floats, from page 96
Mounting nuts, page 97
Connectors, page 148/156





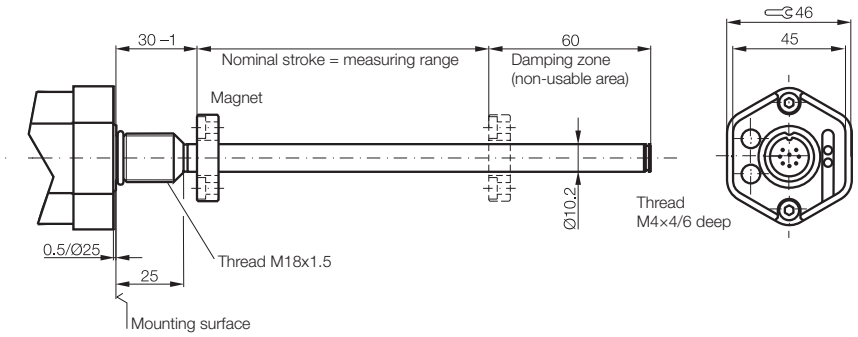


Caution!
Prior to design, installation and startup, please read the instructions in the user guide! www.balluff.com

Housing B
BTL7_ _ _ _ -B-_ _ _ _

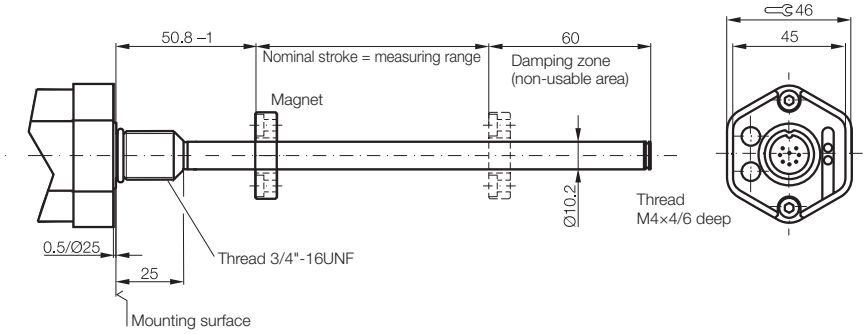
Metric
mounting thread M18×1.5

B = Standard housing



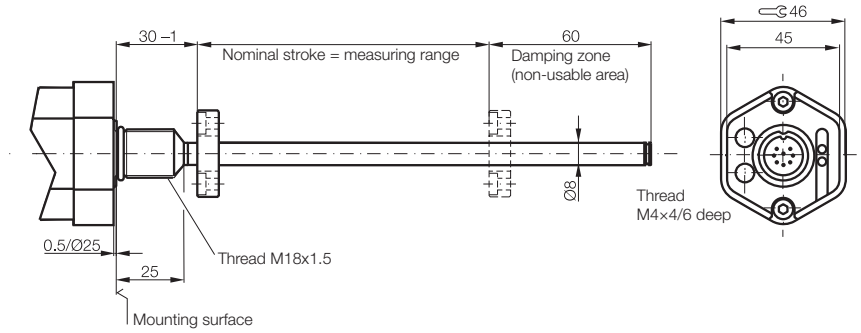
Housing Z
BTL7_ _ _ _ -Z-_ _ _ _

3/4" UNF mounting thread



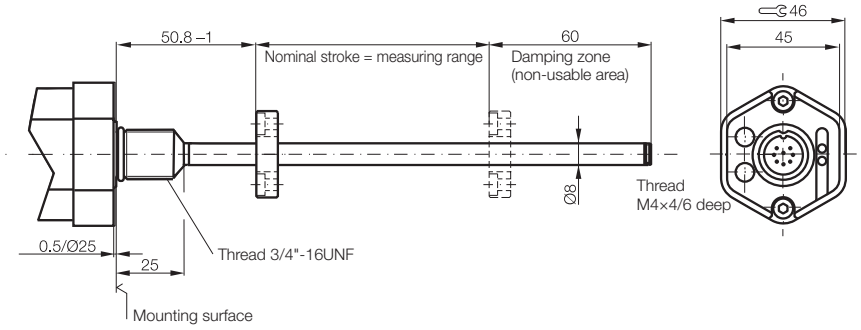
Housing B8
BTL7_ _ _ _ -B8-_ _ _ _

Metric mounting thread
M18×1.5
8 mm outer tube
max. 1016 mm nominal stroke



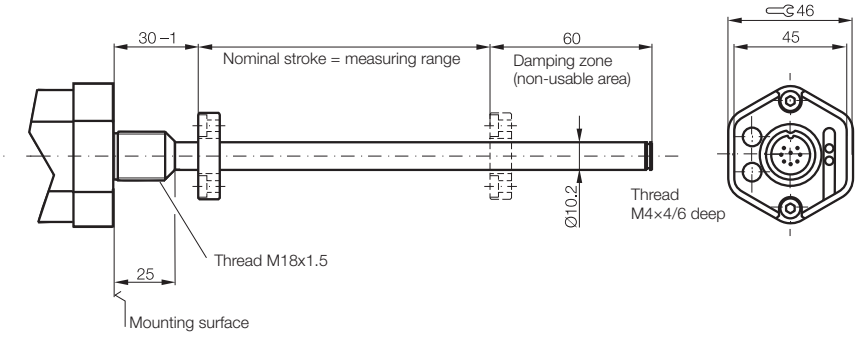
Housing Z8
BTL7_ _ _ _ -Z8-_ _ _ _

3/4" UNF mounting thread
8 mm outer tube
max. 1016 mm nominal stroke



Housing A
BTL7-_ _ _ _-A-_ _ _ _

Metric mounting thread
M18×1.5
Flange without
0.5/Ø 25 mm mounting surface



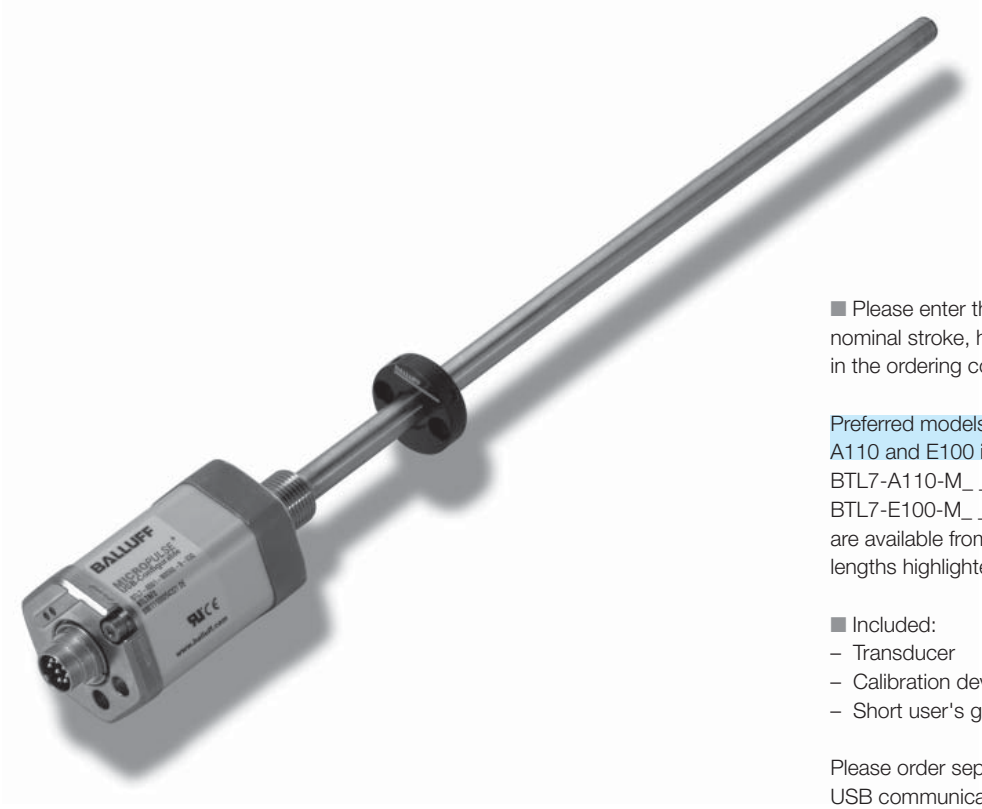
BTL7 Rod Series
Analog interface

Compatible with BTL5

Features of Micropulse BTL7-A/C/E/G...B
- Status LEDs for indicating operating status and diagnostics
- Extended application range with high degree of protection IP 68 (cable version)
- Electronics head can be replaced if needed
- Short housing, saves space
- Error signal, no magnet 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 directly on the unit using the calibration device included or remotely, see page 80.

Series	
Output signal	
Transducer interface	
Input interface	
Part number	
Output voltage	
Output current	
Load current	
max. ripple	
Load resistance	
System resolution	
Hysteresis	
Repeat accuracy	
Sampling rate, length-dependent	
Max. non-linearity	
Temperature coefficient	
Operating voltage	
Current consumption at 24 V DC	
Polarity reversal protected	
Overvoltage protection	
Dielectric strength	
Operating temperature	



Caution!
Prior to design, installation and startup, please read the instructions in the user guide! www.balluff.com

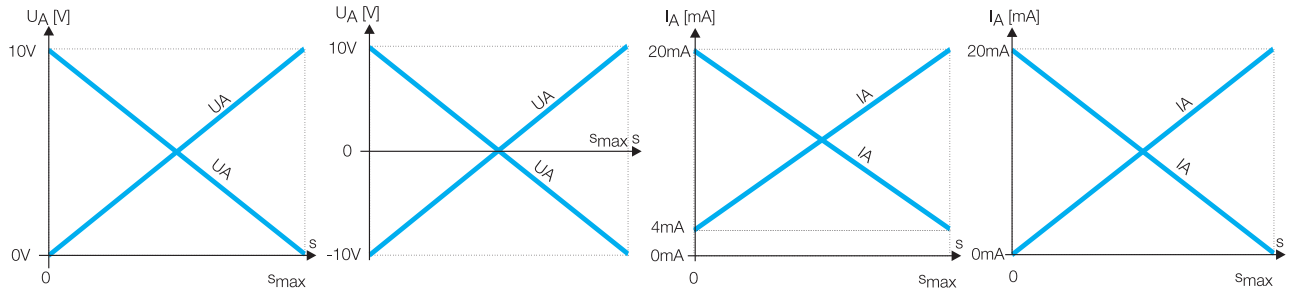
■ Please enter the code for the output signal, nominal stroke, housing and connection type in the ordering code.

Preferred models
A110 and E100 interfaces
BTL7-A110-M_ _ _ _-B-S32,
BTL7-E100-M_ _ _ _-B-S32
are available from stock in the nominal lengths highlighted in blue.

■ Included:
- Transducer
- Calibration device
- Short user's guide

Please order separately:
USB communication box, page 81
Magnets/floats, from page 96
Mounting nuts, page 97
Connectors, page 148/156

	BTL7 rod	**BTL7 rod**	**BTL7 rod**	**BTL7 rod**
	analog	analog	analog	analog
	A	**G**	**E**	**C**
	analog	analog	analog	analog
	BTL7-**A**110-M_ _ _ _-_-_ _ _ _	BTL7-**G**110-M_ _ _ _-_-_ _ _ _	BTL5-**E**1_0-M_ _ _ _-_-_ _ _ _	BTL7-**C**1_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_{ss}	≤ 5 mV_{ss}		
			≤ 500 ohms	≤ 500 ohms
	≤ 0.33 mV	≤ 0.33 mV	≤ 0.66 µA	≤ 0.66 µA
	≤ 5 µm	≤ 5 µm	≤ 5 µm	≤ 5 µm
	System resolution/min. 2 µm	System resolution/min. 2 µm	System resolution/min. 2 µm	System resolution/min. 2 µm
	max. 4 kHz	max. 4 kHz	max. 4 kHz	max. 4 kHz
	±50 µm to ≤ 500 mm nominal stroke	±50 µm to ≤ 500 mm nominal stroke	±50 µm to ≤ 500 mm nominal stroke	±50 µm to ≤ 500 mm nominal stroke
	±0.01 % FS > 5500 mm nominal stroke	±0.01 % FS > 5500 mm nominal stroke	±0.01 % FS > 5500 mm nominal stroke	±0.01 % FS > 5500 mm nominal stroke
	±0.02 % FS > 5500 mm nominal stroke	±0.02 % FS > 5500 mm nominal stroke	±0.02 % FS > 5500 mm nominal stroke	±0.02 % FS > 5500 mm nominal stroke
	≤ 30 ppm/K	≤ 30 ppm/K	≤ 30 ppm/K	≤ 30 ppm/K
	20...28 V DC	20...28 V DC	20...28 V DC	20...28 V DC
	≤ 150 mA	≤ 150 mA	≤ 150 mA	≤ 150 mA
	yes	yes	yes	yes
	yes	yes	yes	yes
	500 V AC (ground to housing)	500 V AC (ground to housing)	500 V AC (ground to housing)	500 V AC (ground to housing)
	–40...+85 °C	–40...+85 °C	–40...+85 °C	–40...+85 °C



Ordering example:

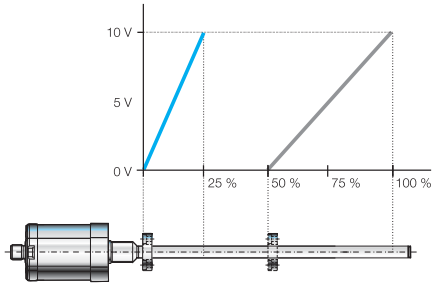
BTL7-_1_0-M_ _ _ _-_-_ _ _ _

Output signal	**Output signal**		**Standard nominal stroke [mm]**	**Housing**	**Connection type**	
A	1	Rising and	0025, 0050, 0075, 0100, 0125, 0150,	B = Standard	S32	Connector
G		falling (with	0175, 0200, 0225, 0250, 0275, 0300,	M 18×1.5	S115	Connector
E		A and G)	0325, 0350, 0375, 0400, 0425, 0450,	Other housings on	KA02	PUR cable 2 m
C	0	Rising (with	0475, 0500, 0550, 0600, 0650, 0700,	page 75	KA05	PUR cable 5 m
		C and E)	0750, 0800, 0850, 0900, 0950, 1000,		KA10	PUR cable 10 m
	7	Falling (with	1100, 1200, 1300, 1400, 1500, 1600,		KA15	PUR cable 15 m
		C and E)	1700, 1800, 1900, 2000, 2250, 2500,			
			2750, 3000, 3250, 3500, 3750, 3850,			
			4000, 4250, 4500, 4750, 5000, 5250,			
			5500, 5750, 6000, 6250, 6500, 6750,			
			7000, 7250, 7500, 7600, 7620 or in 5			
			mm increments (depending on interface)			
			on request			

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

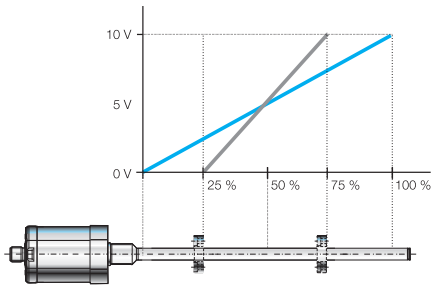
Mode examples:

Double magnet



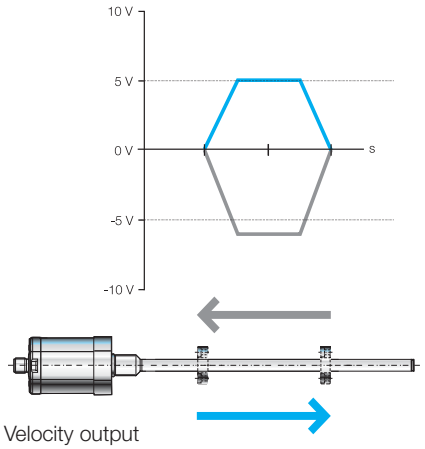
2 magnets, 2 movements, 2 output signals

Differential



Differential signal between
2 magnets, position and difference possible.

Velocity



Velocity output

Series	
Output signal	
Transducer interface	
Position signal input interface	
Part number	
Output signal factory setting	
Output signal adjusted via USB Configurable	
Load current	
max. ripple	
Load resistance	
System resolution	
Current consumption at 24 V DC	
Hysteresis	
Repeat accuracy	
Sampling rate, length-dependent	
Non-linearity, max.	
Temperature coefficient	
Operating voltage	
Polarity reversal protected	
Overvoltage protection	
Dielectric strength	
Operating temperature	

Features of Micropulse⁺ USB-Configurable BTL7-A/E501
- Simple configuration and setting of the start and end point via the USB interface, fast startup
- "Easy Setup" for manual adjustment
- Configurable dual output functions, position and velocity
- Increased operating reliability with status LEDs for indicating the operating status and diagnostic information
- Extended application range with high degree of protection IP 68 (cable version)
- Electronics head can be replaced if needed
- Short housing
- Error signals, no magnet within measuring range

■ Please enter the code for the output signal, nominal stroke, housing and connection type in the ordering code!

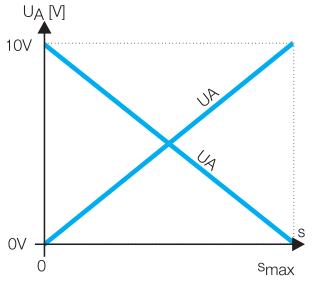
Preferred models
A501 and E501 interfaces
BTL7-A501-M_ _ _ _-B-S32,
BTL7-E501-M_ _ _ _-B-S32
are available from stock in the nominal lengths highlighted in blue.

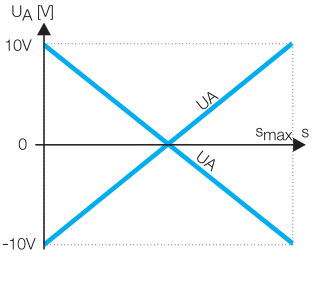
■ Included:
- Transducer
- Calibration device
- Short user's guide

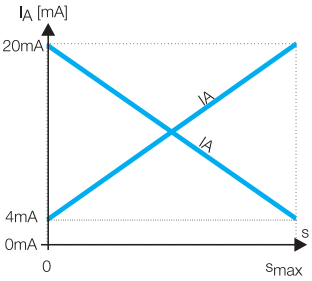
Please order separately:
USB communication box, page 81
Magnets/floats, from page 96
Mounting nuts, page 97
Connectors, page 156

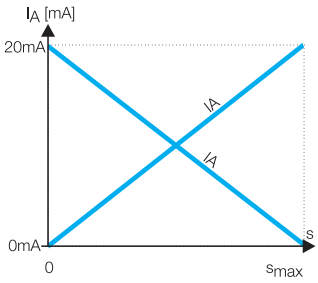
Caution!
Prior to design, installation and startup, please read the instructions in the user guide! www.balluff.com

	BTL7 rod	BTL7 rod
	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	
	≤ 5 mV_{ss}	
		≤ 500 ohms
	≤ 0.33 mV	≤ 0.66 µA
	≤ 150 mA	≤ 180 mA
	≤ 5 µm	≤ 5 µm
	System resolution/min. 2 µm	System resolution/min. 2 µm
	max. 4 kHz	max. 4 kHz
	±50 µm to ≤ 500 mm nominal stroke	±50 µm to ≤ 500 mm nominal stroke
	±0.01 % FS > 500...≤ 5500 mm nominal stroke	±0.01 % FS > 500...≤ 5500 mm nominal stroke
	±0.02 % FS > 5500 mm nominal stroke	±0.02 % FS > 5500 mm nominal stroke
	≤ 30 ppm/K	≤ 30 ppm/K
	10...30 V DC	10...30 V DC
	yes	yes
	yes	yes
	500 V AC (ground to housing)	500 V AC (ground to housing)
	–40...+85 °C	–40...+85 °C









BTL7
General data
Analog interface
Programming

BTL5
General data
Digital pulse interface
SSI interface
CANopen interface
PROFIBUS-DP interface
Position recognition in the hydraulics
Floats
Magnets
Installation notes

Ordering example:

BTL7-_501-M_ _ _ _-_-_ _ _ _

Output signal

A	Voltage
E	Current

Standard nominal stroke [mm]

0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500, 4750, 5000, 5250, 5500, 5750, 6000, 6250, 6500, 6750, 7000, 7250, 7500, 7600, 7620 or in 5 mm increments (depending on interface) on request

Housing

B = Standard M18×1.5
Other housings on page 75

Connection type

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

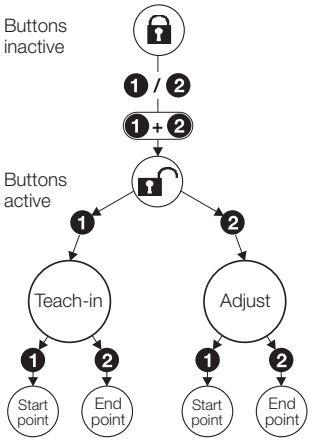
Setting options for the start and end point

	BTL7 Standard	BTL7-A/E501... Micropulse+ USB-Configurable
1. Calibration device	■	■
– Teach-in	■	
– Adjustment	■	
– Online setting	■	
– Easy Setup		■
2. Remote setup	■	
3. USB-Configurate		■

1. Calibration device

100 % start and end point calibration
Start and end point of the analog signal can be set to the desired 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 magnet is brought to the new position. Confirm by pressing a button. The "Adjust" function allows the new value to be fine-tuned for a stationary magnet. No error value is output during the setup procedure.



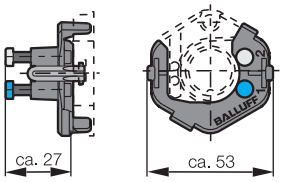
Selecting the calibration procedure BTL7 Standard

Teach-in
Used for changing the factory default start and end point to a new start and end point.
First the magnet must be brought to the new start point and then to the new end position, and the respective values stored by pressing the button.

Adjust
Here you can adjust to a new start and end value. This may be required when you cannot physically move the magnet to the standard start and/or end point. Move the magnet 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 %.

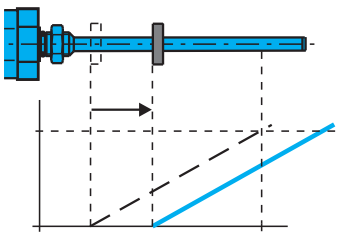
Setting start and end point using the calibration device BTL7-A/E501



Procedure for teach-in, rising signal

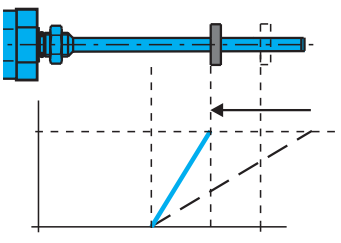
before
after

1. Place magnet in new null position.



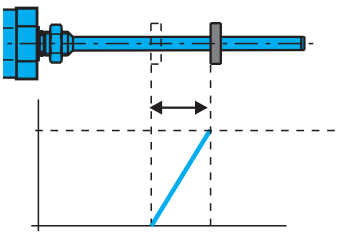
Store new null value

2. Place magnet at new end position.



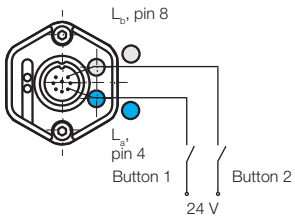
Store new end value

3. Newly set measurement distance



2. Remote setup aid

Remote setting of the start and end point 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 La and button 2 gray to input Lb.



3. USB-Configurate

Start, end value setting and configuration via USB
The Micropulse Configuration Tool allows the quick and easy configuration of Balluff transducers type BTL7-A/E501... on a PC. The most significant features include:
– Online display of the current position of the magnet
– Graphical assistance for setting the functions and characteristic curves
– Display of information about the connected transducer
– Selectable number formats and units for display
– Factory reset 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 installed between the transducer and the controller. The communication box is connected to the PC using a USB cable.

USB communication box

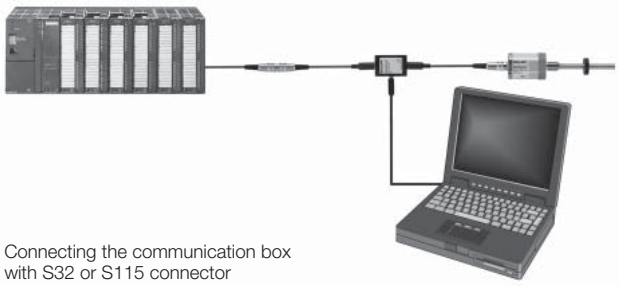
BTL7-A-CB01-USB-S32,
for BTL7-A/E501... with S32 connector

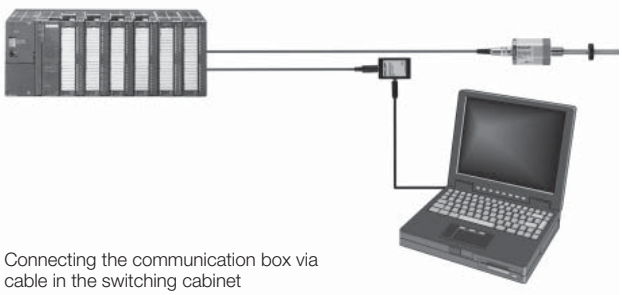
BTL7-A-CB01-USB-S115,
for BTL7-A/E501... with S115 connector

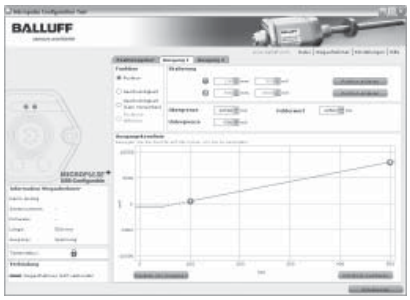
BTL7-A-CB01-USB-KA,
for BTL7-A/E501... with cable connection

Included:
– USB communication box
– Cable set
– Short user's guide

System requirements:
– Standard PC
– Windows 2000/XP/Vista
– Screen resolution at least 1024 × 768 pixels
– 10 MB available hard disk space
– Java Runtime Environment (JRE) version 1.4.2 or higher **http://java.sun.com/getjava**
– USB port


Connecting the communication box with S32 or S115 connector


Connecting the communication box via cable in the switching cabinet



The PC software and associated manual can be downloaded from the Internet at **www.balluff.com/downloads-btl7**

Caution!
Prior to design, installation and startup, please read the instructions in the user guide! www.balluff.com

BTL5 Rod Series
General data

Pressure rated to 600 bar, High repeatability, Non-contact, rugged

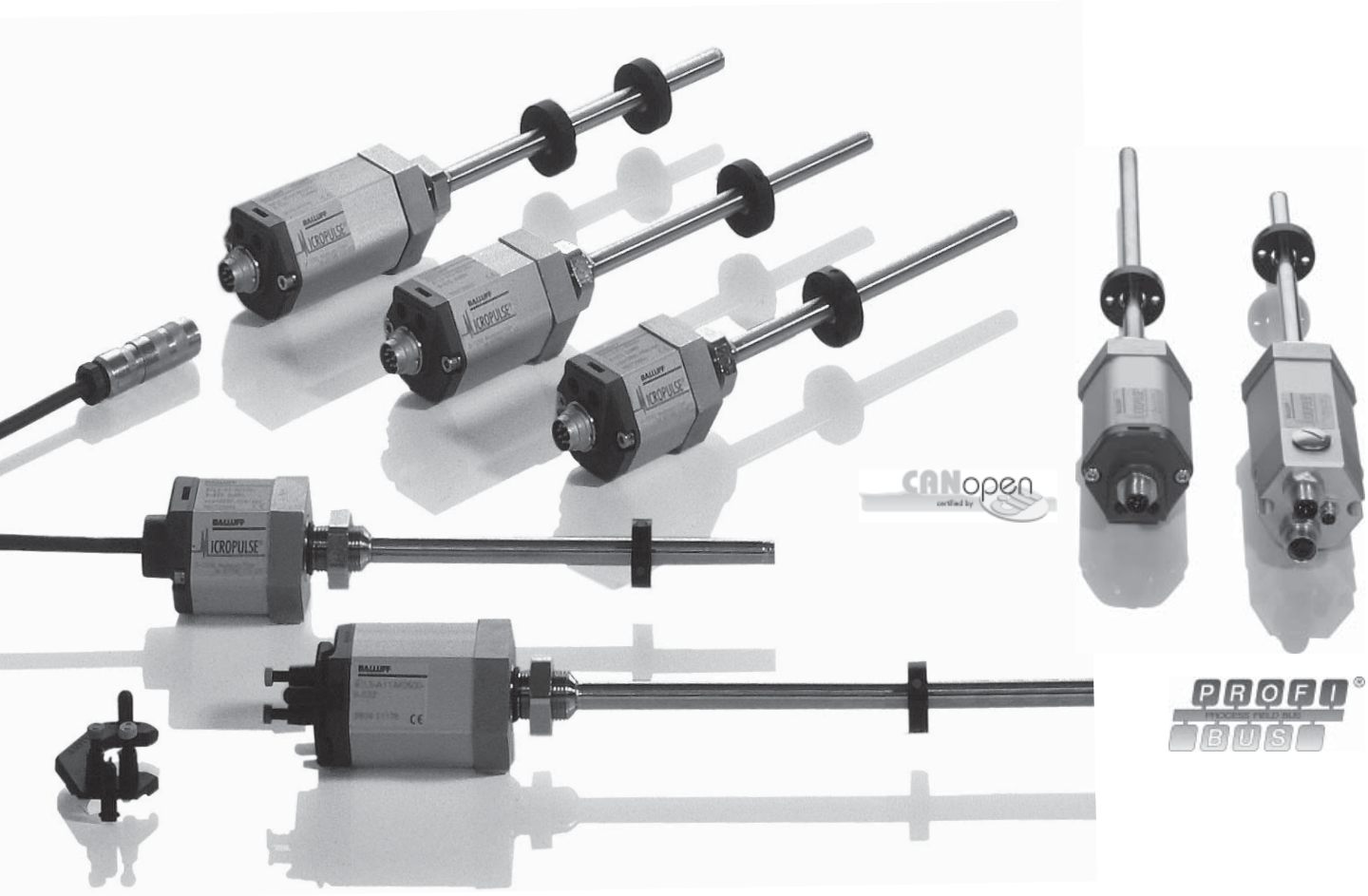
The BTL Micropulse transducer is a rugged position feedback system for use under extreme ambient conditions for measuring ranges between 25 and 5500 mm.

The actual waveguide 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
Shock load	100 g/6 ms per IEC 60068-2-27
Vibration	12 g, 10...2000 Hz per IEC 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 BKS-S... IP 67 connector attached)
Housing material	Anodized aluminum/1.4571 stainless steel outer tube, 1.3952 stainless steel cast flange
Housing attachment	Housing B thread M18×1.5, housing Z 3/4"-16UNF
Pressure rating with 10.2 mm outer tube	600 bar installed in hydraulic cylinder
Pressure rating with 8 mm outer tube	250 bar installed in hydraulic cylinder
Connection type	Connectors/cables
EMC testing:	
RF emission	EN 55016-2-3 Group 1, Class A
Static electricity (ESD)	IEC 61000-4-2 Severity Level 3
Electromagnetic fields (RFI)	IEC 61000-4-3 Severity Level 3
Fast transients (BURST)	IEC 61000-4-4 Severity Level 3
Conducted interference induced by high-frequency fields	IEC 61000-4-6 Severity Level 3
Standard nominal strokes [mm] with 8 mm outer tube is the max. nominal stroke 1016 mm	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000 or in 5 mm increments up to 5500 mm (depending on interface) on request

■ Included:
– Transducer (select your interface from page 84)
– Short user's guide

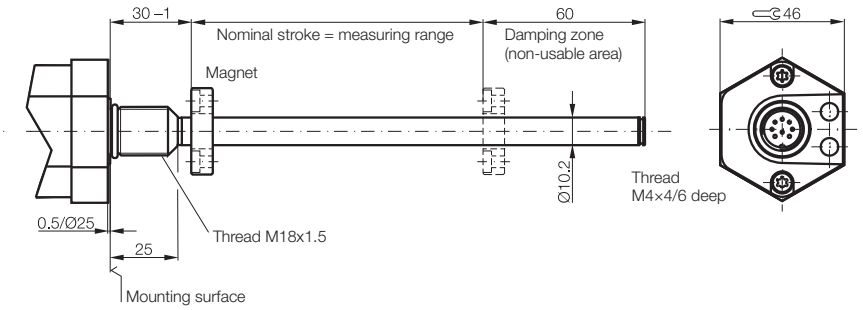
Please order separately:
Magnets/floats, from page 96
Mounting nuts, page 97
Connectors, page 148



Housing B
BTL5_ _ _ _ -B-_ _ _ _

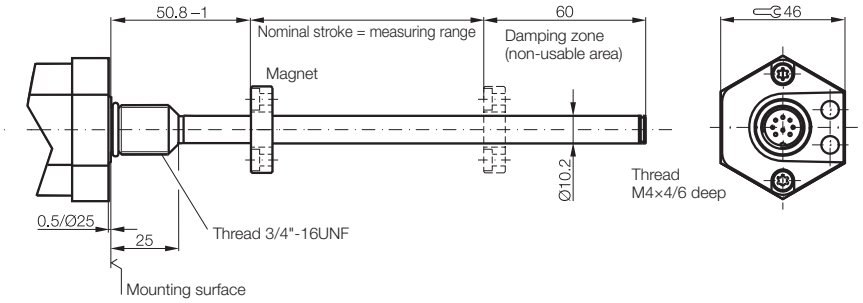
Metric
mounting thread M18×1.5

B = Standard housing



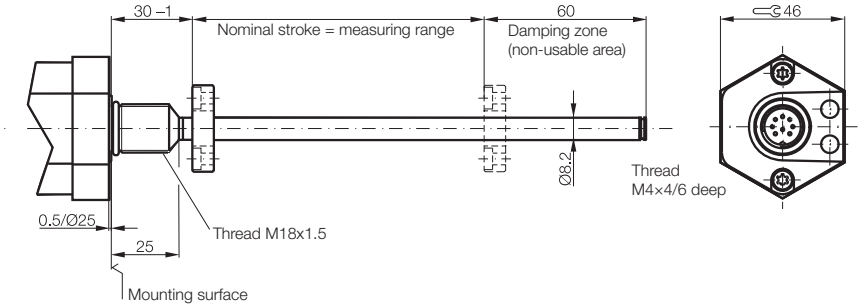
Housing Z
BTL5_ _ _ _ -Z-_ _ _ _

3/4" UNF mounting thread



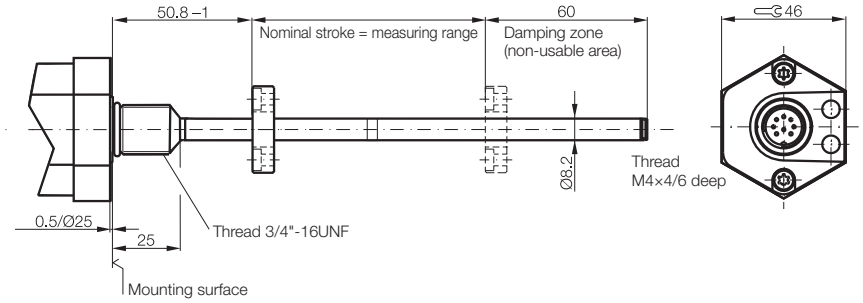
Housing B8
BTL5_ _ _ _ -B8-_ _ _ _

Metric mounting thread
M18×1.5
8 mm outer tube
max. 1016 mm nominal stroke



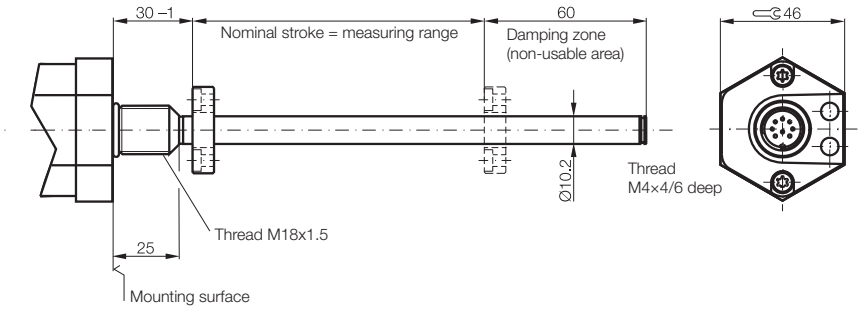
Housing Z8
BTL5_ _ _ _ -Z8-_ _ _ _

3/4" UNF mounting thread
8 mm outer tube
max. 1016 mm nominal stroke



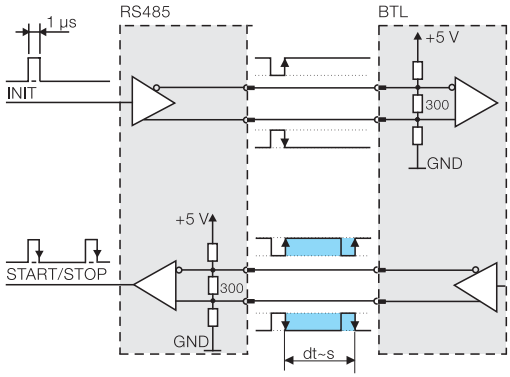
Housing A
BTL5-_ _ _ _-A-_ _ _ _

Metric mounting thread
M18×1.5
Flange without
0.5/Ø 25 mm mounting surface



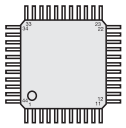
P Interface
Compatible with BTA/BTM processors as well as controllers and modules from various manufacturers including Siemens, B & R, Phoenix Contact, Mitsubishi, Sigmatek, Parker, Esitron and WAGO. Reliable signal transmission, even over cable lengths up to 500 m between BTA and BTL, is assured by the noise-immune RS485 differential line drivers and receivers. Noise signals are effectively suppressed.

M Interface
The M interface is a controller-specific interface variation.

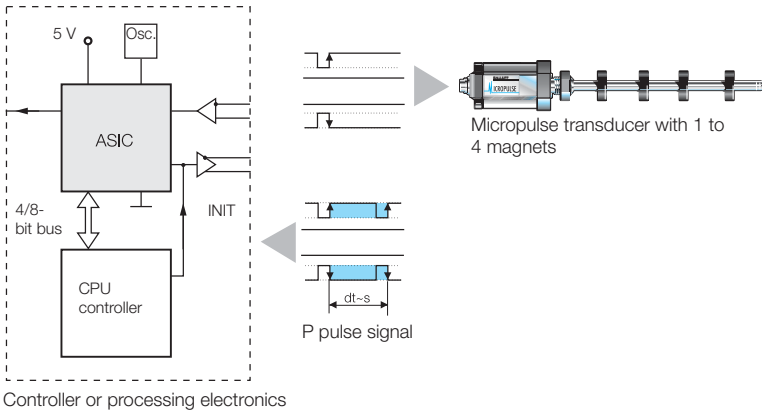


Block diagram of P interface

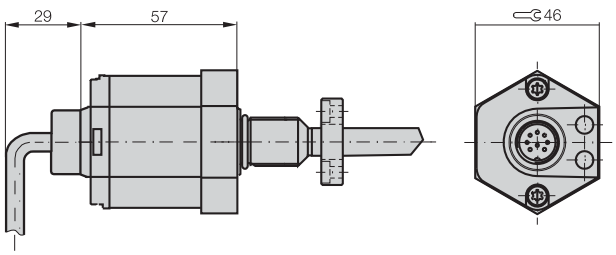
Highly precise digitizing of the P pulse signal
Companies developing their own control and processing electronics can create a highly accurate P interface cost effectively and with minimum effort using the Balluff digitizing chip. The digitizing chip was developed as a high-resolution, configurable ASIC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

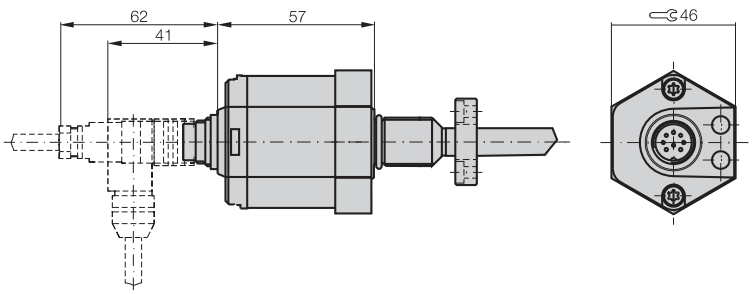

Digitizing chip 44QFP

Advantages:
- Position resolution 1 µm!
  The 1 µm resolution of the Micropulse distance measurement system is achieved by the high resolution of the digitizing chip (133 pS). (Clock frequency 2 or 20 MHz)
- Position data from 4 magnets can be processed simultaneously
- 4/8-bit processor interface



Controller or processing electronics





ASIC INFO: +49 7158 173-370

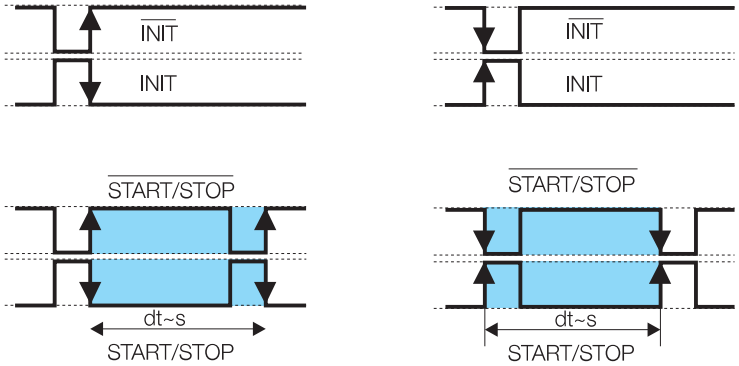
Series				**BTL5 Rod**	**BTL5 Rod**
Transducer interface				Pulse **P**	Pulse **M**
Input interface				Pulse **P**	Pulse **M**
Part number				BTL5-**P**1-M_ _ _ _-_-_ _ _ _	BTL5-**M**1-M_ _ _ _-_-_ _ _ _
System resolution				processing-dependent	processing-dependent
Repeat accuracy				2 µm or ±1 digit depending on processing electronics	2 µm or ±1 digit depending on processing electronics
Resolution				≤ 2 µm	≤ 2 µm
Hysteresis				≤ 4 µm	≤ 4 µm
Sampling rate				$f_{STANDARD}$ = 1 kHz = ≤ 1400 mm	$f_{STANDARD}$ = 1 kHz = ≤ 1400 mm
Max. non-linearity				±100 µm up to 500 mm nominal stroke ±0.02 % 500...5500 mm nominal stroke	±100 µm up to 500 mm nominal stroke ±0.02 % 500...5500 mm nominal stroke
Temperature coefficient of overall system				(6 µm + 5 ppm × L)/°C	(6 µm + 5 ppm × L)/°C
Operating 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 range				–40...+100 °C	–40...+100 °C
Pin assignments		Pin	Color	BTL5-**P**1-M...	BTL5-**M**1-M...
Input/Output signals	Input	1	YE	INIT	INIT
	Output	2	GY	START/STOP	START/STOP
	Input	3	PK	$\overline{\text{INIT}}$	$\overline{\text{INIT}}$
	Output	5	GN	$\overline{\text{START/STOP}}$	$\overline{\text{START/STOP}}$
Operating voltage		6	BU	GND	GND
		7	BN	+24 V DC	+24 V DC
		8	WH	(GND)	(GND)

Connect shield to housing

■ Please enter the code for the nominal stroke, housing and connection type in the ordering code.

Preferred models interface P
BTL5-P1-M_ _ _ _-B-S 32
are available from stock in the nominal lengths highlighted in blue.

■ Included:
– Transducer
– Short user's guide



Please order separately:
Magnets/floats, from page 96
Mounting nuts, page 97
Connectors from page 148

Ordering example:

BTL5-P1-M_ _ _ _-_-_ _ _ _

Standard nominal stroke [mm]

0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500, 5000, 5250, 5500
or in 5 mm increments on request.

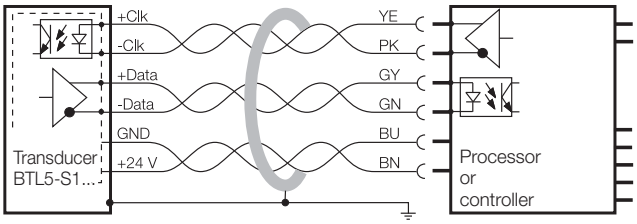
Housing

B = Standard M18×1.5, other housings on page 83

Connection type

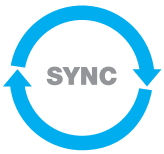
S32	Connector
KA02	PUR cable 2 m
KA05	PUR cable 5 m
KA10	PUR cable 10 m
KA15	PUR cable 15 m

Standard SSI interface
Synchronous serial data transmission for controllers from various manufacturers, including Siemens, Bosch-Rexroth, WAGO, B & R, Parker, Esitron, PEP etc. as well as for Balluff BDD-AM 10-1-SSD and BDD-CC 08-1-SSD displays/controllers. Reliable signal transmission, even over cable lengths of up to 400 m between controller and BTL transducer is assured by especially noise-immune RS485/422 differential line drivers and receivers. Any noise signals are effectively suppressed.



BTL5-S1... with processor/controller, wiring example

Synchronized SSI interface BTL5-S1_ _B-M_ _ _ _-P-_ _ _ _
Micropulse transducers with synchronized SSI interface are suitable for dynamic control applications. The data acquisition in the transducer is synchronized with the external clock of the controller, permitting an optimum calculation of the velocity in the controller. The pre-requirement for this synchronous mode of transducer operation is consistent clock signal timing.
The **maximum sampling frequency f_A**, at which a new current value is generated for each sample, can be derived from the following table:

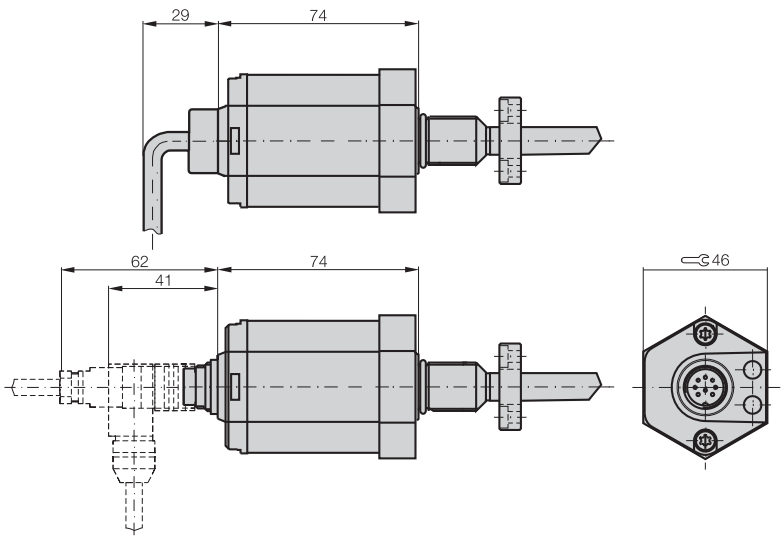


mm		mm		Hz
	< Nominal stroke	≤ 120	:	2500
120	< Nominal stroke	≤ 475	:	2000
475	< Nominal stroke	≤ 750	:	1500
750	< Nominal stroke	≤ 1250	:	1000
1250	< Nominal stroke	≤ 2600	:	500
2600	< Nominal stroke	≤ 4000	:	333

Clock frequency depends on the cable length

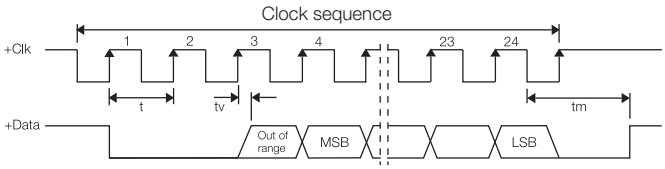
Cable length	Clock frequency
< 25 m	< 1000 kHz
< 50 m	< 500 kHz
< 100 m	< 400 kHz
< 200 m	< 200 kHz
< 400 m	< 100 kHz

Super-fast 2.5 kHz sampling rate



BTL5 Rod Series
SSI interface

Series			**BTL5 Rod**
Output signal			synchronous serial
Transducer interface			**S**
Input interface			synchronous serial
Part number			BTL5-S1_ _-M_ _ _ _-_-_ _ _ _
Part number synchronization			BTL5-S1_ _B-M_ _ _ _-_-_ _ _ _
System resolution depending on version (LSB)			1, 2, 5, 10, 20, 40 or 100 µm
Repeat accuracy			±1 digit
Hysteresis			≤ 1 digit
Sampling rate			$f_{STANDARD}$ = 2 kHz
Max. non-linearity			±30 µm at 5 and 10 µm resolution or ≤ ±2 LSB
Temperature coefficient of overall system			(6 µm + 5 ppm × L) /°C
Operating voltage			20...28 V DC
Current consumption			≤80 mA
Operating temperature			–40...+85 °C
Storage temperature range			–40...+100 °C
Pin assignments	Pin	Color	
Control and data signals	1	YE	+Clk
	2	GY	+Data
	3	PK	–Clk
	5	GN	–Data
Operating voltage (external)	6	BU	GND
	7	BN	+24 V DC
	8	WH	must remain unconnected



■ Please enter the code for the coding, system resolution, nominal stroke, design and connection type in the ordering code!

■ Included:
– Transducer
– Short user's guide

Please order separately:
Magnets/floats, from page 96
Mounting nuts, page 97
Connectors, page 148

Ordering example:

BTL5-S1_ _-M_ _ _ _-_-_ _ _ _

Coding		System resolution		Standard nominal stroke [mm]	Housing	Connection type	
0	Binary code rising (24 bit)	1	1 µm	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000 or in 5 mm increments on request	B = Standard M18×1.5, other housings on page 83	S32	Connector
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				

Ordering code for SSI interface with synchronization to clock (dynamic control applications) insert the letter B! BTL5-S1_ _**B**-M_ _ _ _-B-S32

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 station decides for itself how the received data are 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.

CAN-BUS features
– Line topology, star structure also possible via repeaters
– Low-cost wiring with two-wire cable
– Fast response times, high data integrity using CRC, hamming distance of 6
– 1 MBit/s with cable lengths < 25 m
– Protocol limits number of stations to 127
– Using multiple magnets: A minimum spacing of > 65 mm must be maintained.

CANopen offers a high level of flexibility with respect to 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)
12 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 magnet position with resolution in 5 µm increments
– Current velocity of the magnet with resolution selectable in 0.1mm/s increments
– Current status of the four freely programmable cams per magnet.

Synchronization Object (SYNC)
Serves as a net-wide trigger for synchronizing all network participants. 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 to 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.

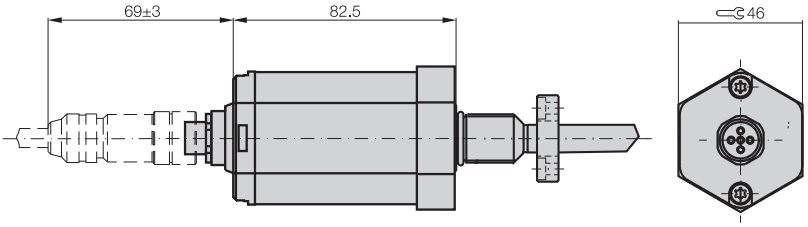
Emergency Object
This object is sent with the highest priority and is used for example for error messages when the cam states change.

Service Data Object (SDO)
Service Data Objects transmit the parameters for the transducer configuration. The transducer may be configured on the bus by the controller or offline using a PC with a configuration tool which runs under Windows. The configuration is stored in the non-volatile memory of the transducer.

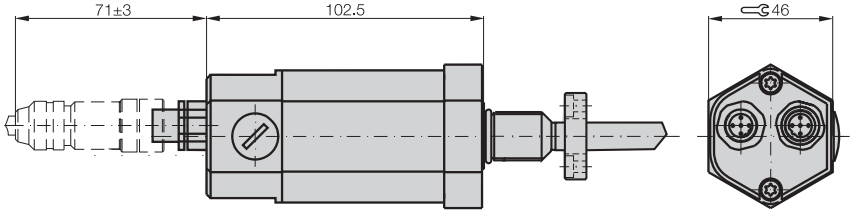
CiA 199911-301v30/11-009

Use of multiple magnets
A minimum spacing of > 65 mm must be maintained.

BTL5-H1_ _-M_ _ _ -B-S92



BTL5-H1_ _-M_ _ _ -B-S94



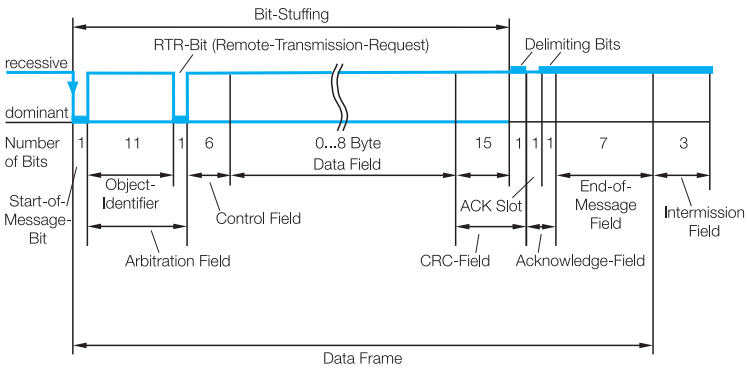
Node ID can be set by DIP switch.

Series			**BTL5 Rod**						
Output signal			CANopen						
Transducer interface			**H**						
Input interface			CANopen						
Part number			BTL5-**H**1_ _-M_ _ _ _-_-S92						
			BTL5-**H**1_ _-M_ _ _ _-_-S94						
Repeat accuracy			±1 digit						
System resolution	Position		5 µm increments						
configurable	Velocity		0.1 mm/s increments						
Hysteresis			≤ 1 digit						
Sampling rate			$f_{STANDARD}$ = 1 kHz						
Max. non-linearity			±30 µm at 5 µm resolution						
Temperature coefficient of overall system			(6 µm + 5 ppm × L)/°C						
Operating voltage			20...28 V DC						
Current consumption			≤ 100 mA						
Operating temperature			–40...+85 °C						
Storage temperature range			–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
Pin assignments	Pin	Color								
Control and	1	WH	CAN_GND							
data signals	2	BN	+24 V							
	3	BU	0 V (GND)							
	4	GY	CAN_HIGH							
	5	GN	CAN_LOW							

■ Please enter the code for the software configuration, baud rate and nominal stroke in the ordering code. Cable upon request.

■ Included:
– Transducer
– Short user's guide

Please order separately:
Magnets/floats, from page 96
Mounting nuts, page 97
Connectors, page 150/151



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 noise immunity of the connection is achieved using differential drivers and by the data monitoring scheme.

Ordering example:

BTL5-H1_ _-M_ _ _ _-_-S92
BTL5-H1_ _-M_ _ _ _-_-S94

Software configuration

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

Baud rate

0	1 MBaud
1	800 kBaud
2	500 kBaud
3	250 kBaud
4	125 kBaud
5	100 kBaud
6	50 kBaud
7	20 kBaud
8	10 kBaud

Standard nominal stroke [mm]

0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000 or in 5 mm increments on request.

Housing

B = Standard M18×1.5, more housings on page 83

BTL7
General data
Analog interface
Programming

BTL5
General data
Digital pulse interface
SSI interface
CANopen interface
PROFIBUS-DP interface
Position recognition in the hydraulics
Floats
Magnets
Installation notes

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. Measured values from the analog sensor can be transmitted to the CAN protocol with ease as a result.
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 analogue 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 (µC).
The analogue 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 -

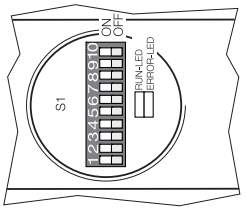
CiA 199911-301v30/11-009

Use of 1-4 magnets

The number of magnets can be preset to 1-4 via CANopen. The transducer is preset to operate with an magnet on delivery. A minimum spacing of > 65 mm must be maintained.

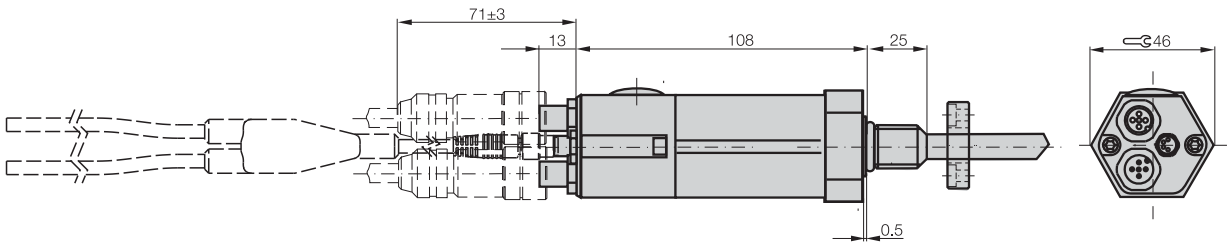
Setting the node ID

For the node ID, values between 0...63 are preset using the DIP switch S1.1...S1.6.



Top view of DIP switch S1

BTL5-H1_ _-M_ _ _ _-_-C001



Node ID can be set by DIP switch.

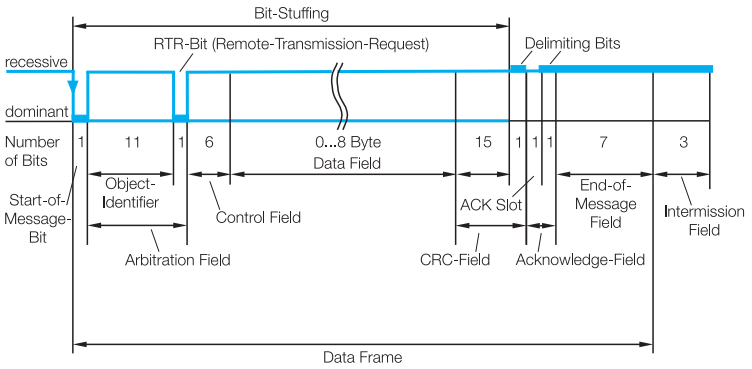
Series			**BTL5 Rod**						
Output signal			CANopen						
Transducer interface			**H**						
Input interface			CANopen						
Part number			BTL5-**H**1_ _-M_ _ _ _-_-_ _ _ _						
CANopen Version			potential-free						
Repeat accuracy			±1 digit						
System resolution	Position		5 µm increments						
configurable	Velocity		0.1 mm/s increments						
Hysteresis			≤ 1 digit						
Sampling rate			$f_{STANDARD}$ = 1 kHz						
Max. non-linearity			±30 µm at 5 µm resolution						
Temperature coefficient of overall system			(6 µm + 5 ppm × L)/°C						
Operating voltage			20...28 V DC						
Current consumption			≤ 100 mA						
Operating temperature			–40...+85 °C						
Storage temperature range			–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
Pin assignments	Pin	Color								
Control and	1	WH	CAN_GND							
data signals	2	BN	+24 V							
	3	BU	0 V (GND)							
	4	GY	CAN_HIGH							
	5	GN	CAN_LOW							
Analog connection	1		+24 V							
Sensor	2		0 V							
	3		Input sensor 1							
	4		Input sensor 2							

BTL7
General data
Analog interface
Programming
BTL5
General data
Digital pulse interface
SSI interface
CANopen interface
PROFIBUS-DP interface
Position recognition in the hydraulics
Floats
Magnets
Installation notes

■ Please enter the code for the input configuration, baud rate and nominal stroke in the ordering code. Cable upon request.

■ Included:
– Transducer
– Short user's guide

Please order separately:
Magnets/floats, from page 96
Mounting nuts, page 97
Connectors from page 150



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 noise immunity of the connection is achieved using differential drivers and by the data monitoring scheme.

Ordering example:

BTL5-H1_ _-M_ _ _ _-_-C001

Input configuration

A	3-wire voltage, 0...+10 V, 12-bit, max. 2 inputs
C	3-wire current, 0...20 mA, 12-bit, max. 2 inputs
E	2-wire current, 4...20 mA, 12-bit, max. 2 inputs

Baud rate

0	1MBaud
1	800 kBaud
2	500 kBaud
3	250 kBaud
4	125 kBaud
5	100 kBaud
6	50 kBaud
7	20 kBaud
8	10 kBaud

Standard nominal stroke [mm]

0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000 or in 5 mm increments on request.

Housing

B = Standard M18×1.5, more housings on page 83

User-friendly hardware and software set-up

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 station. The BTL5-T uses max. 32 bytes (max. 4 position values and max. 4 velocity values) for process data transmission. Up to 126 active stations (Address 0...125) can be connected on PROFIBUS-DP. User data cannot be sent with station address 126. This address is used as the default address for bus stations that have to be parameterized by a Class 2 master (for setting the device address if there are no mechanical switches available).
Each PROFIBUS station has the same priority. Prioritizing of 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 Mbps, the transmission time for an average data telegram is in the 100 µs range.

Master
There are two types of possible masters for PROFIBUS-DP. Master Class 1 carries out the user data interchange with the connected slaves. Master Class 2 is intended for startup and diagnostic purposes and may be used to briefly assume control of a slave.

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 when the system is configured. The BTL5-T is a modular device with the possibility of selecting the number of magnets (position values).

Slave
Once a PROFIBUS master has received the parameter set defined for the slave, it is able to exchange data.
The parameter set consists of slave parameters and configuration data. The parameter data contain the description of the slave settings (e.g. resolution of a position value). The configuration data describe the length and structure of the data telegram.

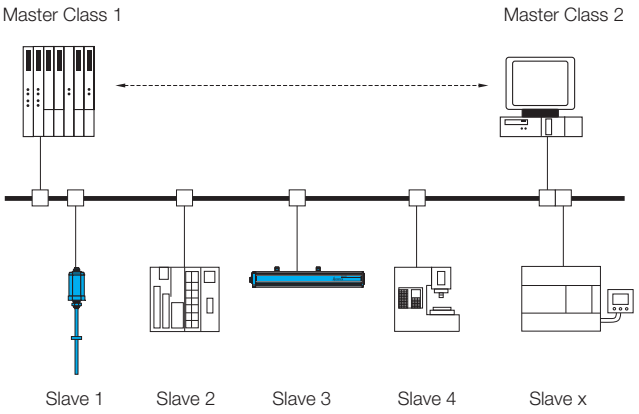
Process data
Under PROFIBUS-DP the default is for process data to be sent from the master to slaves acyclically and for the slave data to then be queried. To ensure synchronization of multiple devices, the master may use the SYNC and FREEZE services.

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 cyclic equidistant clock signal is sent by the master to all bus devices. This signal allows master and slaves to be synchronized irrespective of application – with an accuracy < 1 µs.

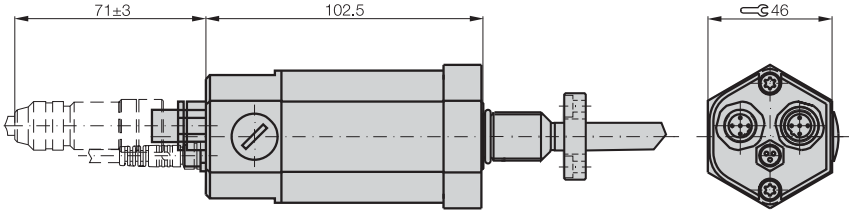
Cross traffic between slaves
Cross traffic permits two DP slaves to exchange data directly with each other: the master ensures that the slave publishes its data on the bus with a request for "Data-eXchange-Broadcast" (DXB-Request) and thus makes it available to other slaves. Since the process data is available in the process periphery without being diverted through the master application, cross-traffic permits very fast control system responses.

Acyclic services
The DP functions for prioritized communication allow the transfer of acyclic read and write functions between master and slaves, independently of the cyclic user data traffic. The transfer of acyclic data is performed at a lower priority in parallel to the high speed cyclic data exchange – as if in the background. The background / foreground split means the ratio of cyclic to acyclic data can be adjusted if required.

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



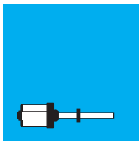
Device address can be set by DIP switch



Address can be set by DIP switch.

BTL5 Rod Series
PROFIBUS-DP interface

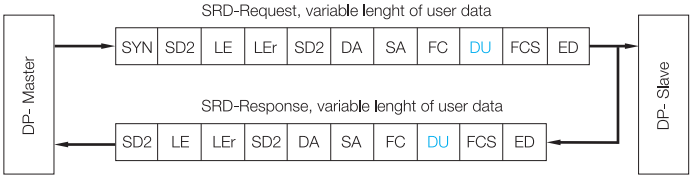
Series		**BTL5 Rod**				
Output signal		PROFIBUS-DP				
Transducer interface		**T**				
Input interface		PROFIBUS-DP				
Part number plug version S103		BTL5-**T**1_ 0-M_ _ _ _-_-S103				
Profibus-Version		EN 50170, Encoder profile				
Profibus interface		potential-free				
Repeat accuracy		±1 digit				
System resolution configurable	Position	5 µm increments configurable				
	Velocity	0.1 mm/s increments configurable				
Hysteresis		≤ 1 digit				
Sampling rate		$f_{STANDARD}$ = 1 kHz				
Max. non-linearity		±30 µm at 5 µm resolution				
Temperature coefficient of overall system		(6 µm + 5 ppm × L)/°C				
Magnet traverse velocity		any				
Operating voltage		20...28 V DC				
Current consumption		≤ 120 mA				
Operating temperature		–40...+85 °C				
Storage temperature range		–40...+100 °C				
GSD file		BTL504B2.GSD				
Address assignment		mechanical switches and Master Class 2				
Cable length [m]		< 100	< 200	< 400	< 1000	< 1200
Baud rate [Kbps]		12000	1500	900	187,5	93,7/19,2/9,6
Pin assignments				S103 5-pin		S103 3-pin
Control and data signals		Data GND		3		
		R×D/T×D-N (A)		2		
		R×D/T×D-P (B)		4		
		VP +5 V		1		
Operating voltage and shielding		+24 V				1
		0 V (GND)				3
		Ground PROFIBUS-DP		5		
		Shield supply				4



BTL7
General data
Analog interface
Programming
BTL5
General data
Digital pulse interface
SSI interface
CANopen interface
PROFIBUS-DP interface
Position recognition in the hydraulics
Floats
Magnets
Installation notes

■ Please enter the code for the software configuration, nominal stroke and housing in the ordering code.

■ Included:
– Transducer
– Short user's guide



Please order separately:
Magnets/floats, from page 96
Mounting nuts, page 97
Connectors from page 153

Ordering example:

BTL5-T1_ 0-M_ _ _ _-_-S103

Software configuration

1 1 Position 1 Velocity
2 2 Position 2 Velocity

Standard nominal stroke [mm]

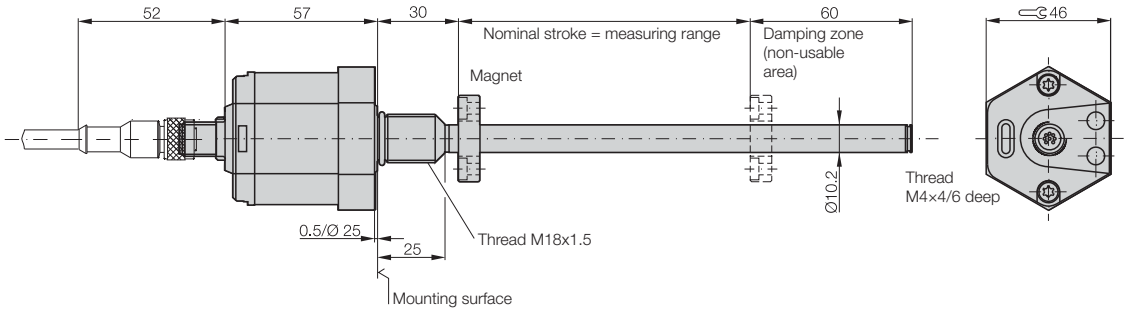
0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000 or in 5 mm increments on request.

Housing

B = Standard M18×1.5, other housings on page 83

BTL5 Rod Series
4 programmable switching points

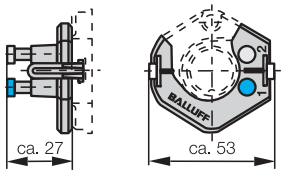
ProSet 4

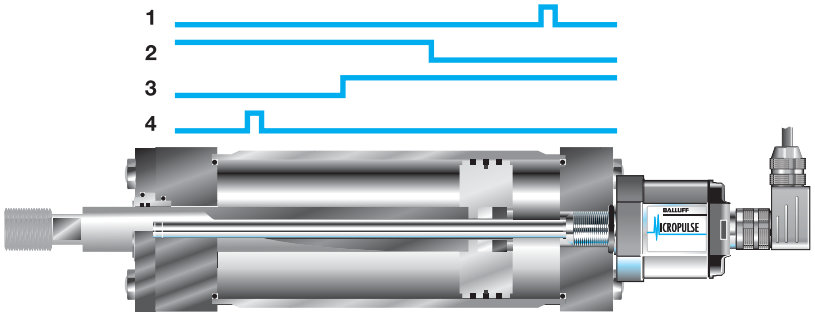


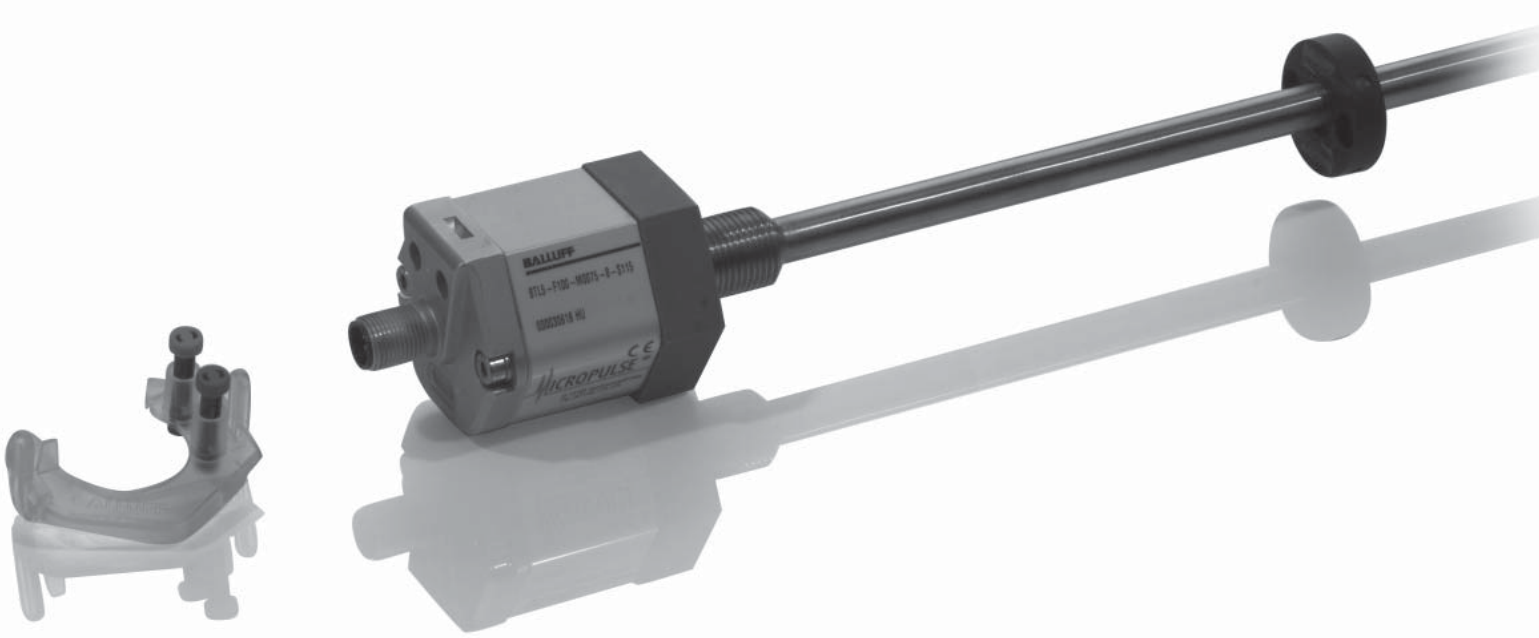
Single position measurement between the piston limits of travel on standard cylinder series

Advantages:
- 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 repeatability
- switching points freely programmable using calibration device or programming inputs

Calibration device BTL5-A-EH01 for programming the outputs





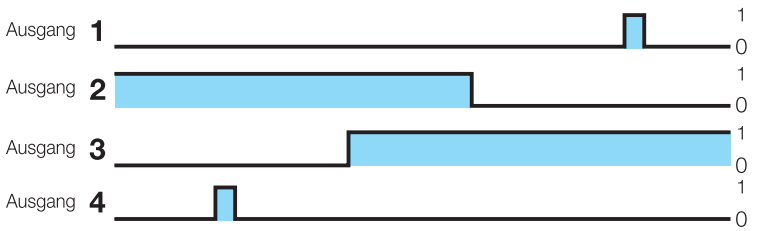


BTL5 Rod Series
4 programmable switching points

Series		**BTL5 Rod**
Transducer interface		**F**
Input interface		digital
Part number		BTL5-**F**1_ 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
Sampling rate		$f_{STANDARD}$ = 1 kHz = ≤ 1400 mm
Operating voltage		24 V DC ±20 %
No-load current consumption		≤ 100 mA
Operating temperature		–40...+85 °C
Storage temperature range		–40...+100 °C
Pin assignments	Pin 1	Output 1
	Pin 2	Output 2
	Pin 3	Output 3
	Pin 4	Output 4
	Pin 5	L_a; Programming input (low-active)
	Pin 6	GND
	Pin 7	+24 V DC
	Pin 8	L_b; Programming input (low-active)
Shock load		100 g/6 ms per IEC 60068-2-27
Vibration		12 g, 10...2000 Hz per IEC 60068-2-6
Dielectric strength		500 V DC (GND to housing)
Degree of protection as per IEC 60529		IP 67 (with BKS-S... IP 67 connector attached)
Housing material		Anodized aluminum/1.4571 stainless steel outer tube, 1.3952 stainless steel cast flange
Mounting		Thread M18×1.5, 3/4"-16UNF on request
Pressure rating		600 bar installed in hydraulic cylinder
Connection type		Connectors

■ Please enter the code for the output, nominal stroke and housing in the ordering code.

■ Included:
– Transducer
– Short user's guide
– Calibration device



Please order separately:
Magnets/floats, from page 96
Mounting nuts, page 97
Connectors, page 156

Ordering example:

BTL5-F1_0-M_ _ _ _-_-S115

Output

0 Output NPN switching
1 Output PNP switching

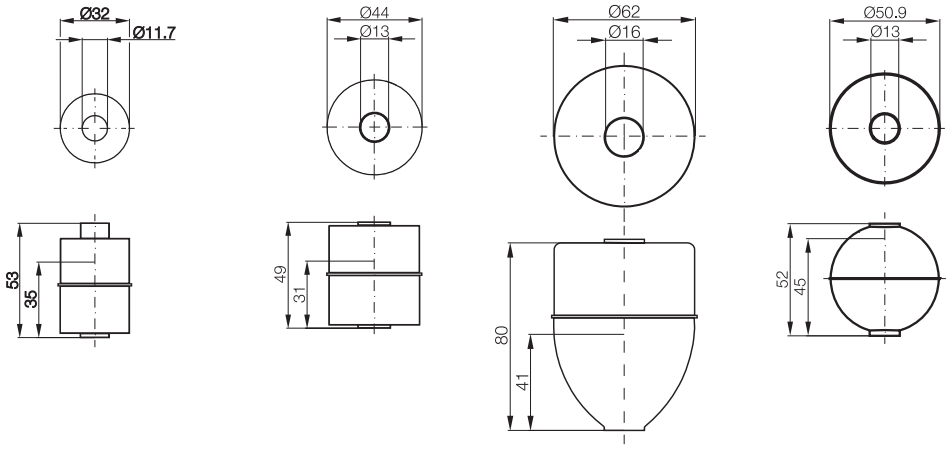
Standard nominal stroke [mm]

0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000 or in 5 mm increments on request.

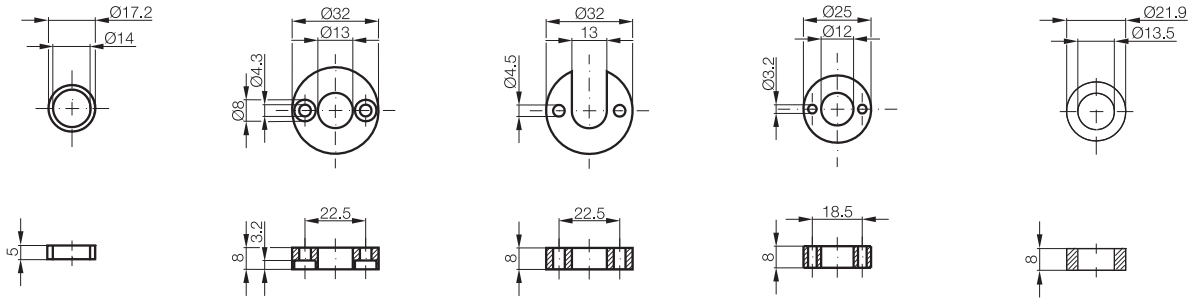
Housing

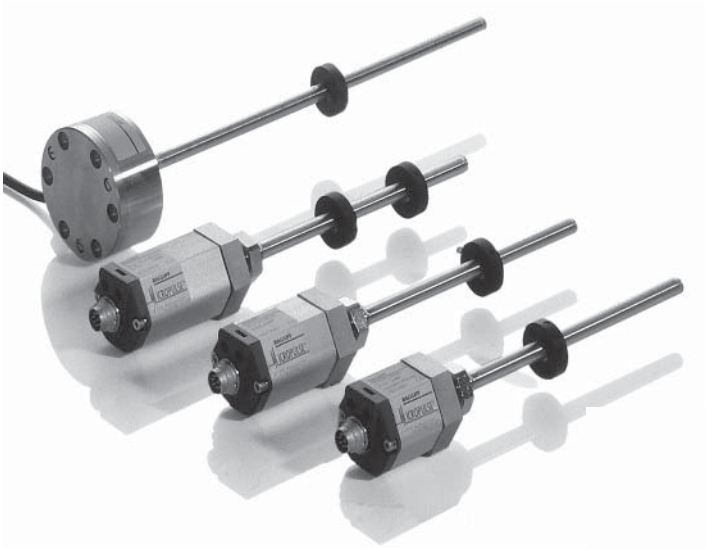
B = Standard M18×1.5, other housings on page xx

Description	**Float**	**Float**	**Float**	**Float**	
for series	BTL rod	BTL rod	BTL rod	BTL rod	
Part number	**BTL2-S-3212-4Z**	**BTL2-S-4414-4Z**	**BTL2-S-6216-8P**	**BTL2-S-5113-4K**	
Material	Stainless steel 1.4404	Stainless steel 1.4404	Stainless steel 1.4404	Stainless steel 1.4404	
Weight	approx. 20 g	approx. 34 g	approx. 69 g	approx. 35 g	
Magnet traverse velocity					
Operating temperature/ Storage temperature range	–20...+120 °C	–20...+120 °C	–20...+120 °C	–20...+120 °C	
Displacement in water	approx. 35 mm	approx. 31 mm	approx. 41 mm	approx. 26 mm	
Pressure rating (static)	24 bar	20 bar	15 bar	40 bar	
Part number PA 60 glass fiber reinforced					
Material					
Weight					
Magnet traverse velocity					
Operating temperature/ Storage temperature range					



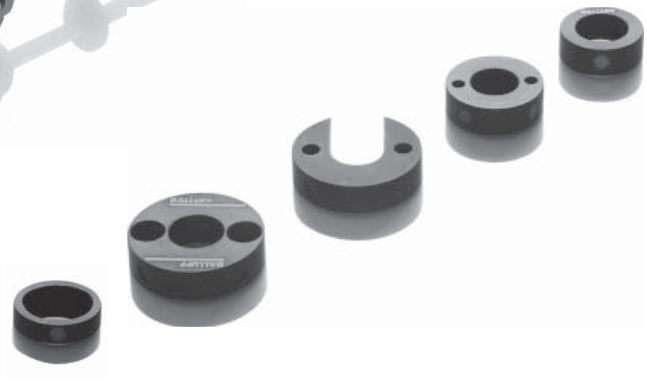
	Magnet	**Magnet**	**Magnet**	**Magnet**	**Magnet**
	BTL rod	BTL rod	BTL rod	BTL rod	BTL rod
	BTL-P-0814-GR-PAF	**BTL-P-1013-4R**	**BTL-P-1013-4S**	**BTL-P-1012-4R**	**BTL-P-1014-2R**
	Ferrite integrated in PA	Al	Al	Al	Al
	approx. 1.5 g	approx. 12 g	approx. 12 g	approx. 12 g	approx. 10 g
	any	any	any	any	any
	–40...+100 °C	–40...+100 °C	–40...+100 °C	–40...+100 °C	–40...+100 °C
		BTL-P-1013-4R-PA		**BTL-P-1012-4R-PA**	
		PA 60 glass fiber reinforced		PA 60 glass fiber reinforced	
		approx. 10 g		approx. 10 g	
		any		any	
		–40...+100 °C		–40...+100 °C	





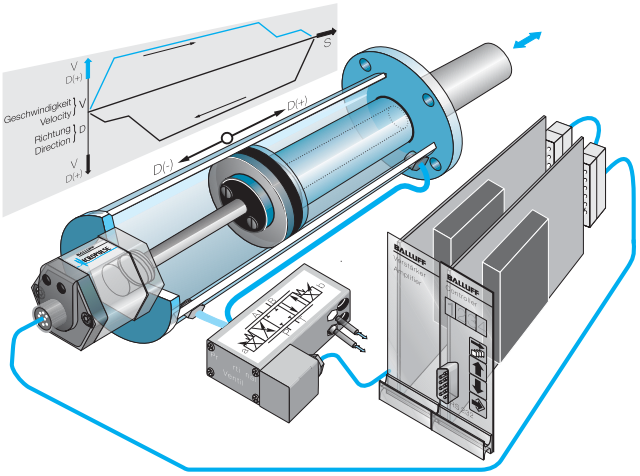
M18×1.5 mounting nut
Order designation:
BTL-A-FK01-E-M18×1.5

3/4"-16 UNF mounting nut
Order designation:
BTL-A-FK01-E-3/4"-16 UNF

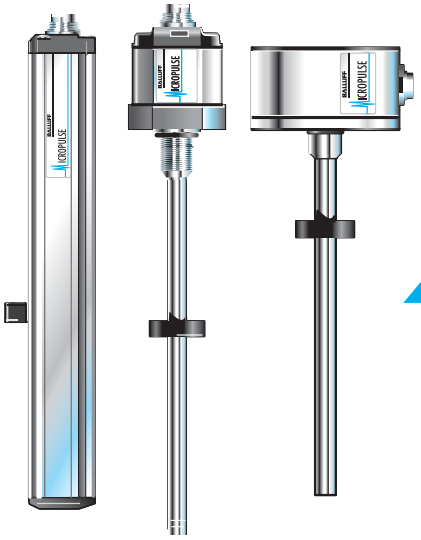


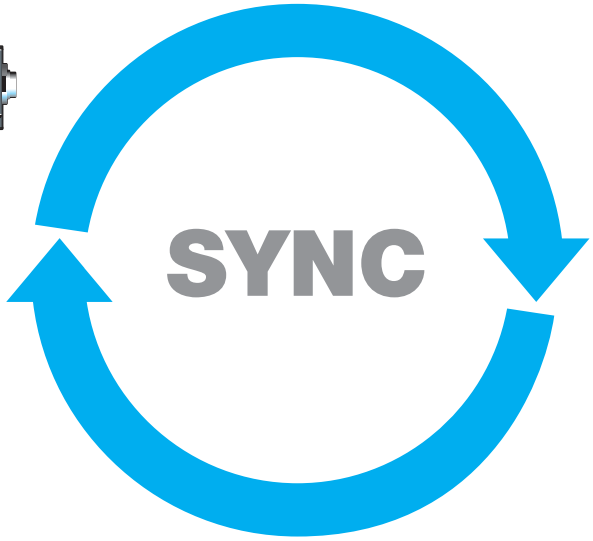
Caution!
Prior to design, installation and startup, please read the instructions in the user guide! www.balluff.com

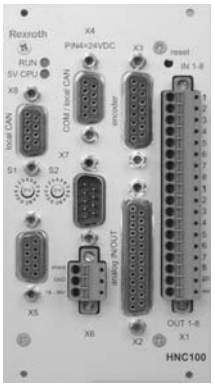
SSI-SYNC –
better control characteristics and higher dynamics
The absolute positioning information from the Micropulse transducer is transmitted synchronously to the axis control card. This synchronous data acquisition enables exact calculation of the velocity and acceleration.
The feedback of these variables (velocity and acceleration) allows the damping and resonant frequency of a hydraulic system to be increased. These measures permit greater loop gain and with it better control behavior and higher dynamics.



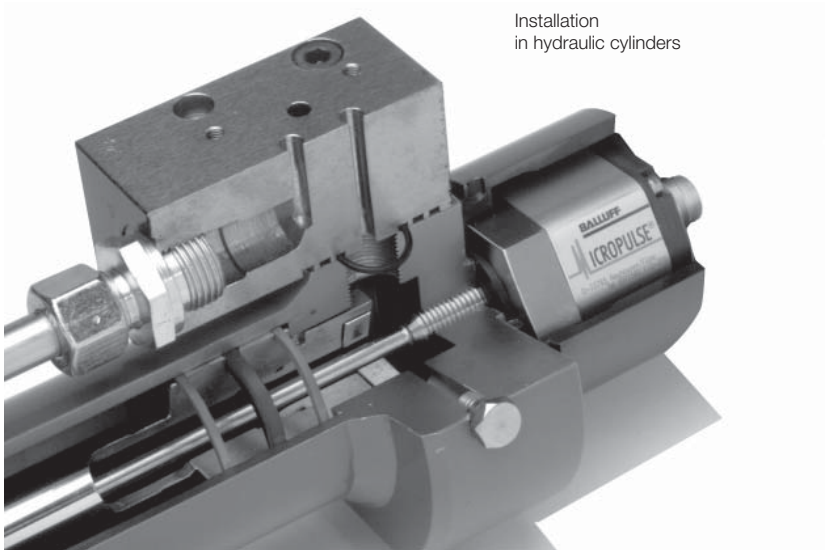
Application with hydraulic cylinder in a control circuit


Micropulse transducer BTL5-S1_ _ -**S1**-...





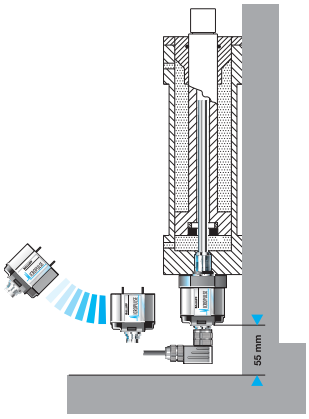
Control card with SSI interface for connecting Micropulse transducers


Installation
in hydraulic cylinders

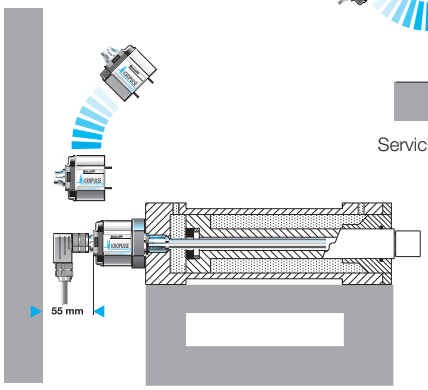
Hassle-free service

Cylinder-mounted transducers are often located in difficult to access spots. If a transducer is damaged or fails, replacing the complete transducer with head and 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 also remains intact, with no draining necessary.



Servicing a vertical installation



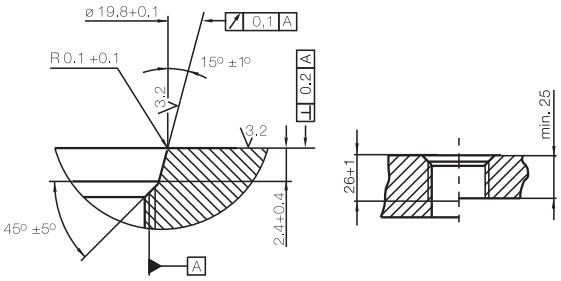
Servicing a horizontal installation

Installation

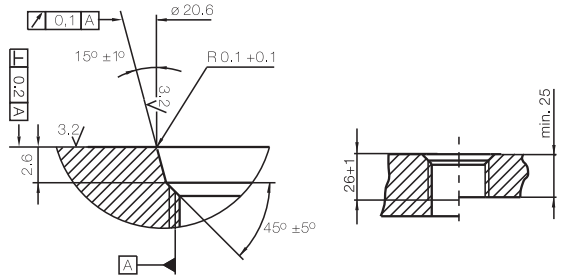
The Micropulse transducer BTL has a mounting thread M18×1.5. We recommend that the mounting is made of non-magnetizable material. If magnetizable materials are used, the installation must be carried out as shown in the drawing below. Sealing is at the flange mounting surface using the supplied O-ring 15.4×2.1 with M18×1.5 thread.

Insertion hole

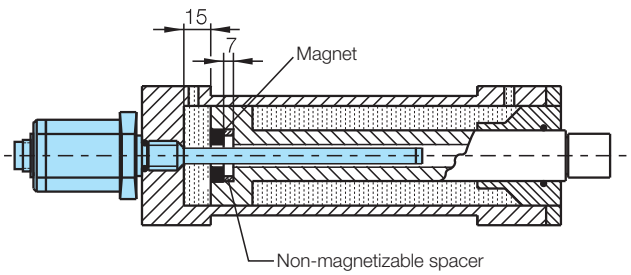
The transducer is fitted with a M18×1.5 (as per ISO) or 3/4“-16UNF (as per SAE) mounting thread. Depending on the version, the insertion hole may have to be manufactured prior to assembly.

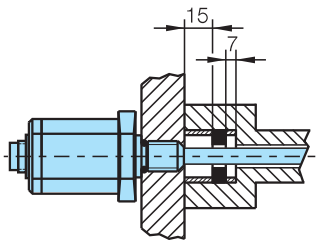


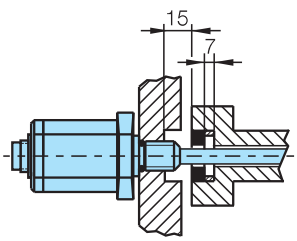
Insertion hole M18×1.5, as per ISO 6149, O-ring 15.4×2.1

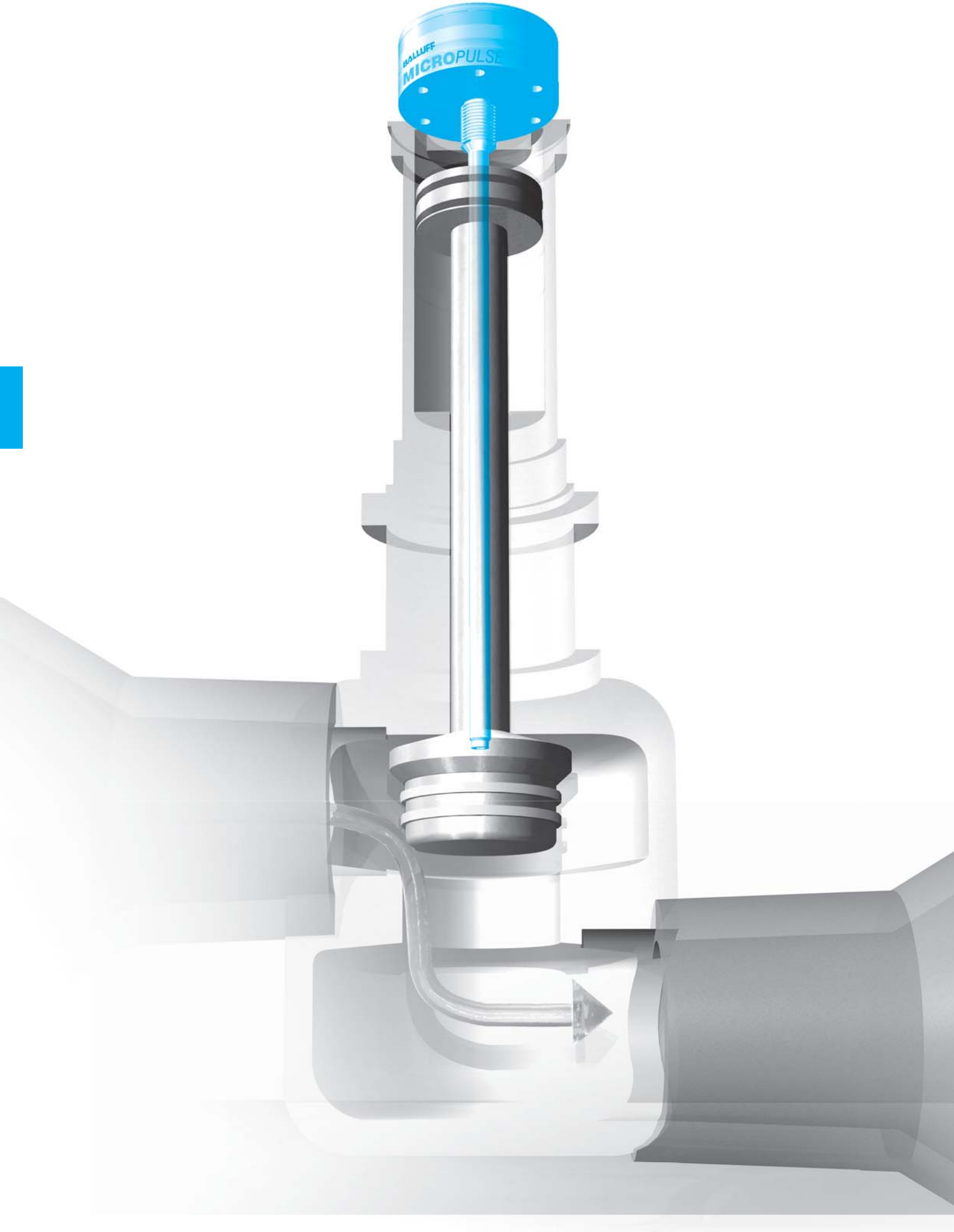


Insertion hole 3/4"-16UNF as per SAE J475, O-ring 15.3×2.4

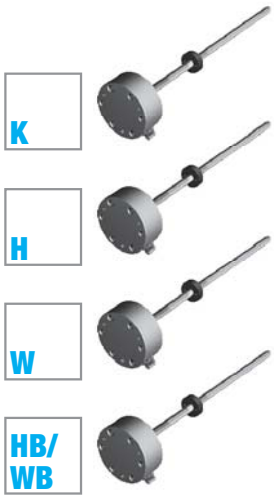







BALLUFF
MICROPULSE

Compact Rod and AR Rod Series
Contents



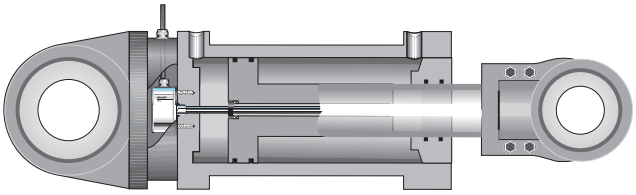
MICROPULSE®

Rod housings are mainly used in hydraulic drive applications. When installed in the pressure section of the hydraulic cylinder, the distance 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 face end with a welded plug. An O-ring seal in the flange at the opposite end seals off the high-pressure section. An magnet ring with magnets slides over the tube or rod with internal waveguide to mark the position prior to detection.

Compact Rod Series K
Installation notes

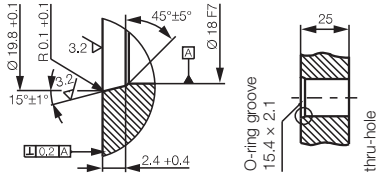
Pressure rated to 600 bar,
high repeatability, non-contact, rugged
The BTL Micropulse transducer is a rugged position feedback system for measuring ranges between 25 and 5500 mm as well as use under extreme ambient conditions.
The actual waveguide is protected inside a high-pressure resistant stainless 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.

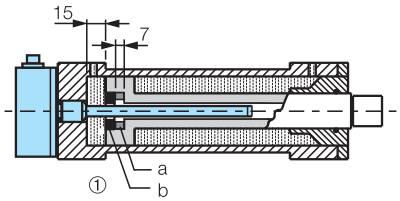
– Stainless
– extremely short 34 mm
– IP 68 with cable

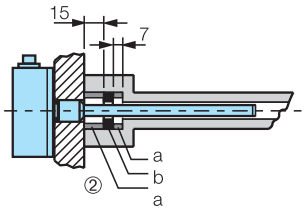


Compact rod Micropulse transducer installed in clevis mount cylinder

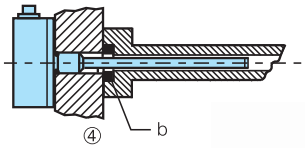
Installation BTL5 Compact rod K
The Micropulse transducer has 6 mounting holes for cylinder head screws (ISO 4762 M6×18 A2-70). We recommend that the mounting is made of non-magnetizable material. If magnetizable materials are used, the installation must be carried out as shown above. Sealing is at the flange mounting surface using the supplied O-ring 15.4×2.1 mm.



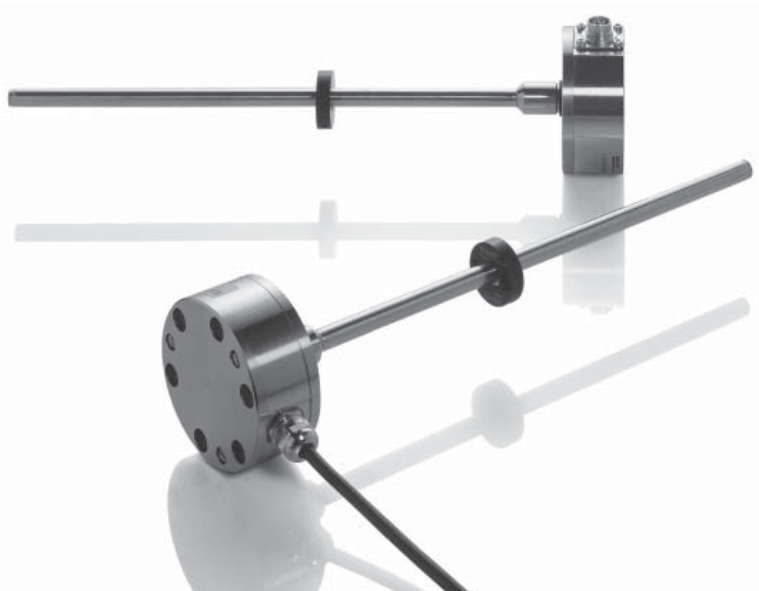




non-magnetizable material



①-② with magnetizable material
④ with non-magnetizable material
a Spacer made from non-magnetizable material
b Magnet



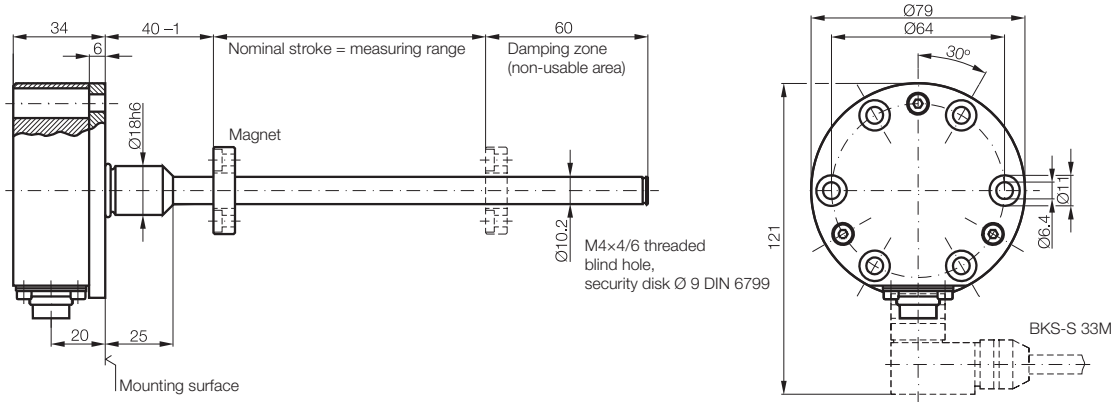
■ Included:
– Transducer (select your interface from page 110)
– Short user's guide

Please order separately:
Magnets/floats, page 96
Mounting nuts, page 97
Connectors, page 148/149

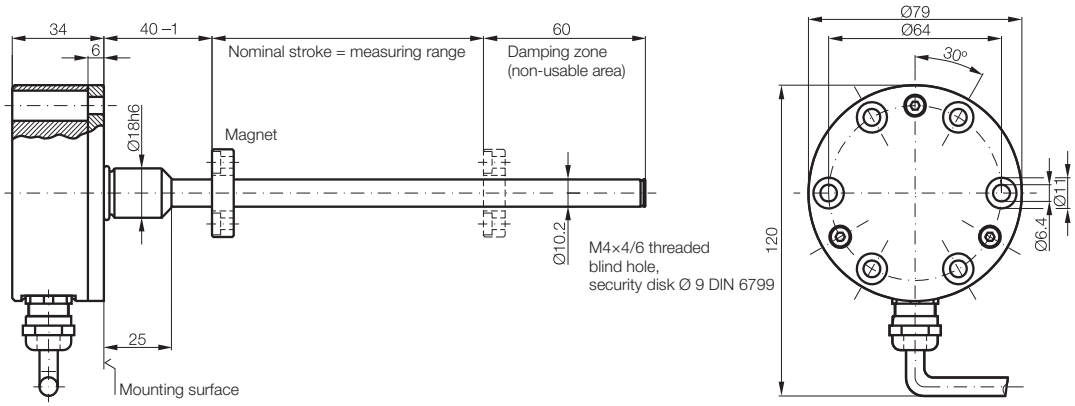
Caution! Prior to design, installation and startup, please read the instructions in the user guide!
www.balluff.com

Series	BTL5 Compact Rod K
Part number	BTL5-...-M_ _ _ _ -K-_ _ _ _
Shock load	100 g/6 ms per IEC 60068-2-27 and 100 g/2 ms per IEC 60068-2-29
Vibration	12 g, 10...2000 Hz per IEC 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 (when BKS-S32/33 is installed); IP 68 connector, 5 bar for cable version
Housing material	Stainless steel 1.4305
Flange and tube material	Tube stainless 1.4571, flange 1.4571 or 1.4429 or 1.4404
Housing attachment	flange with 6 mounting holes
Connection type	connector or integral cable
Recommended connector, see page 148/149	BKS-S 32M/BKS-S 32M-C/BKS-S 33M
EMC testing:	
RF emission	EN 55016-2-3 Group 1, Class A
Static electricity (ESD)	IEC 61000-4-2 Severity Level 3
Electromagnetic fields (RFI)	IEC 61000-4-3 Severity Level 3
Fast transients (BURST)	IEC 61000-4-4 Severity Level 3
Conducted interference induced by high-frequency fields	IEC 61000-4-6 Severity Level 3
Standard nominal strokes [mm]	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500, 4750, 5000, 5250, 5500 or in 5 mm increments (depending on interface) on request

Housing K
BTL5-...-M_ _ _ _-K-SR32
Flange ∅ 18 mm, PCD ∅ 64 mm
Radial connection



Housing K
BTL5-...-M_ _ _ _-K-K_ _
Flange ∅ 18 mm, PCD ∅ 64 mm
Radial cable

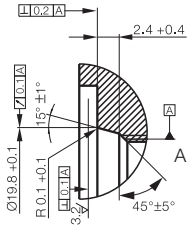


Compact Rod Series H
Installation notes

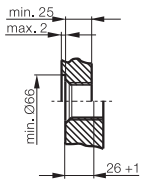
Pressure rated to 600 bar,
high repeatability, non-contact, rugged
The BTL Micropulse transducer is a robust position feedback system for measuring ranges between 25 and 5500 mm as well as use under extreme ambient conditions.
The actual waveguide is protected inside a high-pressure resistant stainless 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.

– Stainless
– IP 68 with cable

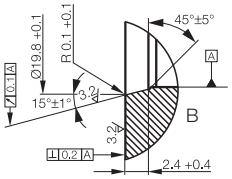
Installation BTL5 Compact rod H
The Micropulse transducer BTL has a mounting thread M18×1.5. We recommend that the mounting is made of non-magnetizable material.
If magnetizable materials are used, the installation must be carried out as shown in the drawing below. Sealing is at the flange mounting surface using the supplied O-ring 15.4×2.1 with M18×1.5 thread.



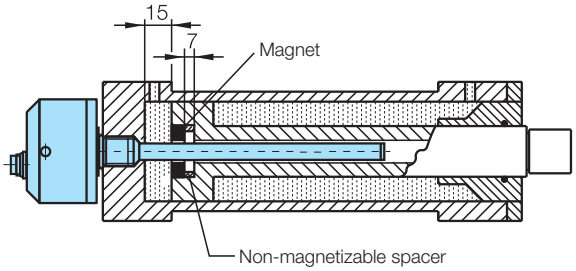
O-ring groove, view A

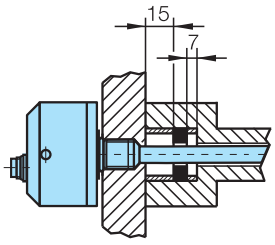


Insertion hole M18×1.5 to ISO 6149, O-ring 15.4×2.1



O-ring groove, view B

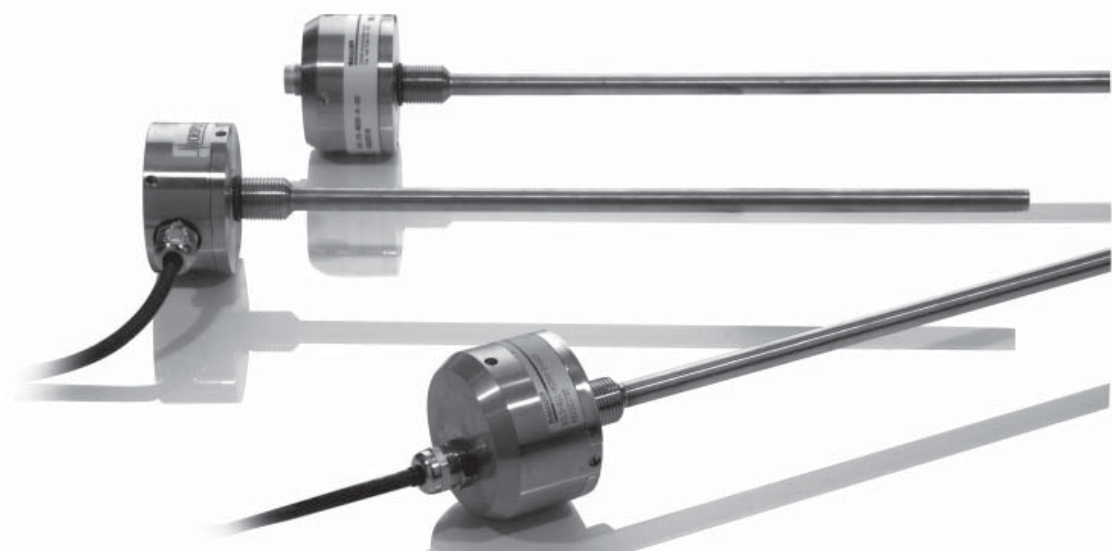




■ Included:
– Transducer (select your interface from page 110)
– Short user's guide

Please order separately:
Magnets/floats, page 96
Mounting nuts, page 97
Connectors, page 148/149

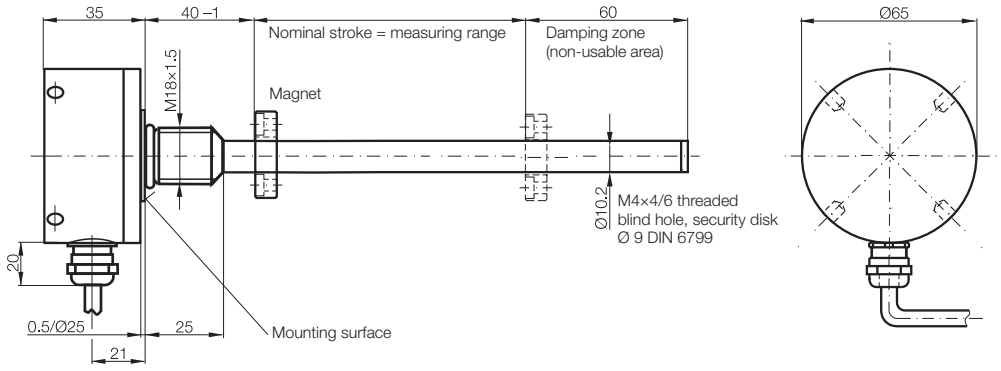
Caution! Prior to design, installation and startup, please read the instructions in the user guide!
www.balluff.com



Series	BTL5 Compact Rod H
Part number	BTL5-...-M_ _ _ _ -H-_ _ _ _
Shock load	100 g/6 ms per IEC 60068-2-27 and 100 g/2 ms per IEC 60068-2-29
Vibration	12 g, 10...2000 Hz per IEC 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 (when BKS-S32/33 is installed); IP 68 connector, 5 bar for cable version
Housing material	Stainless steel 1.4305
Flange and tube material	Tube stainless 1.4571, flange 1.4571 or 1.4429 or 1.4404
Housing attachment	Flange with thread M18×1.5
Connection type	connector or integral cable
Recommended connector, see page 148/149	BKS-S 32M/BKS-S 32M-C/BKS-S 33M
EMC testing:	
RF emission	EN 55016-2-3 Group 1, Class A
Static electricity (ESD)	IEC 61000-4-2 Severity Level 3
Electromagnetic fields (RFI)	IEC 61000-4-3 Severity Level 3
Fast transients (BURST)	IEC 61000-4-4 Severity Level 3
Conducted interference induced by high-frequency fields	IEC 61000-4-6 Severity Level 3
Standard nominal strokes [mm]	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500, 4750, 5000, 5250, 5500 or in 5 mm increments on request.

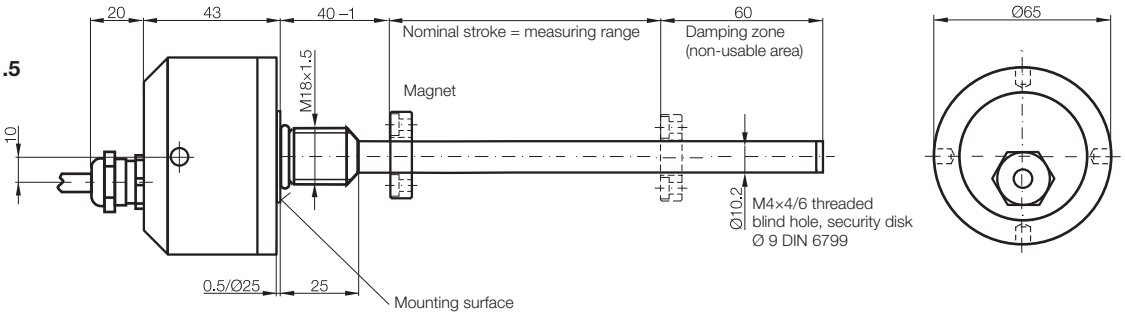
Housing H, BTL5-...-M_ _ _ _-H-K_ _

Mounting thread M18×1.5 Radial cable outlet



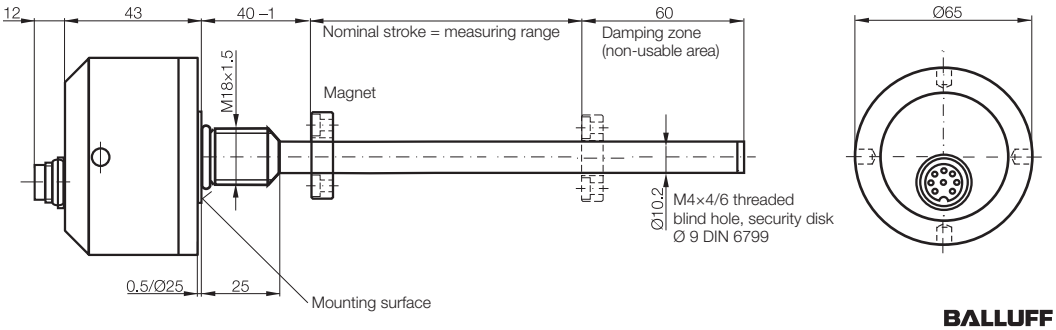
Housing H, BTL5-...-M_ _ _ _-H-KA _ _

Mounting thread M18×1.5 Cable outlet axial



Housing H, BTL5-...-M_ _ _ _-H-S32

Mounting thread M18×1.5 Plug connector Axial

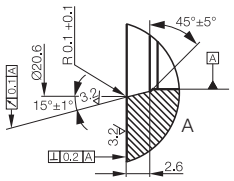


Compact W Rod Series
Installation notes

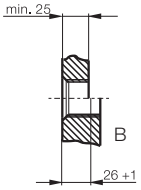
Pressure rated to 600 bar,
high repeatability, non-contact, rugged
The BTL Micropulse transducer is a robust position feedback system for measuring ranges between 25 and 5500 mm as well as use under extreme ambient conditions.
The actual waveguide is protected inside a high-pressure resistant stainless 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.

– Stainless
– IP 68 with cable

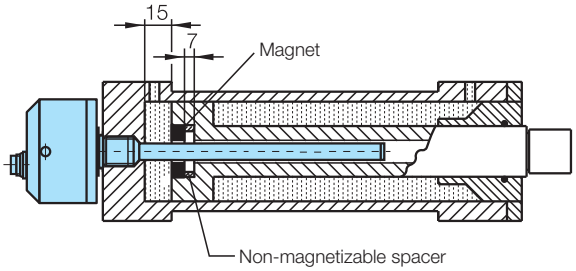
Installation BTL5 Compact rod W
The Micropulse transducer BTL has a mounting thread M18×1.5. We recommend that the mounting is made of non-magnetizable material.
If magnetizable materials are used, the installation must be carried out as shown in the drawing below. Sealing is at the flange mounting surface using the supplied O-ring 15.4×2.1 with M18×1.5 thread.

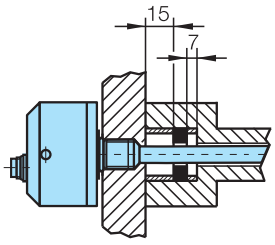


O-ring groove, view A



Insertion hole
thread 3/4"-16 UNF
O-ring groove,
view B

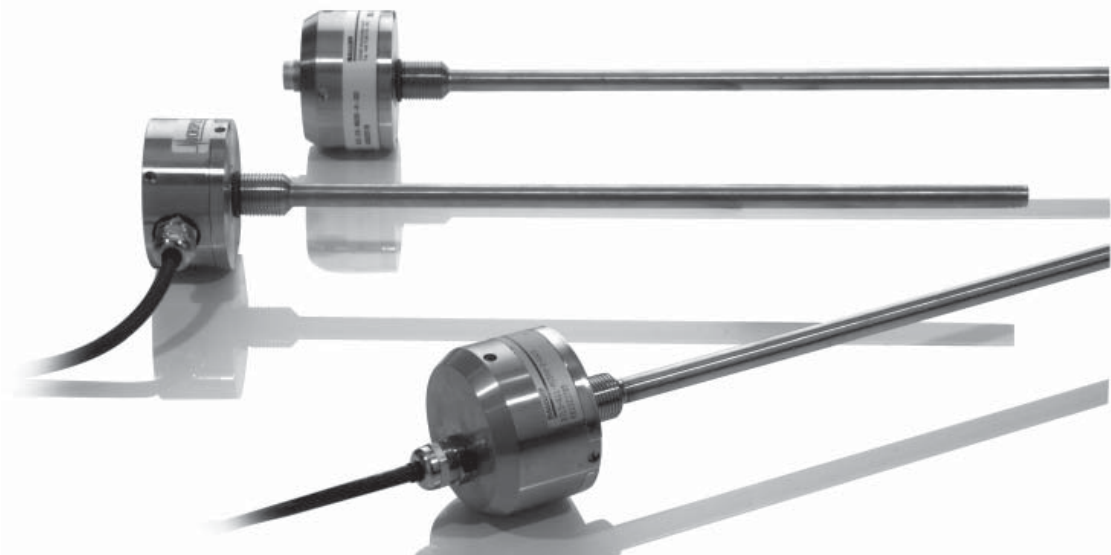




■ Included:
– Transducer (select your interface from page 110)
– Short user's guide

Please order separately:
Magnets/floats, page 96
Mounting nuts, page 97
Connectors, page 148/149

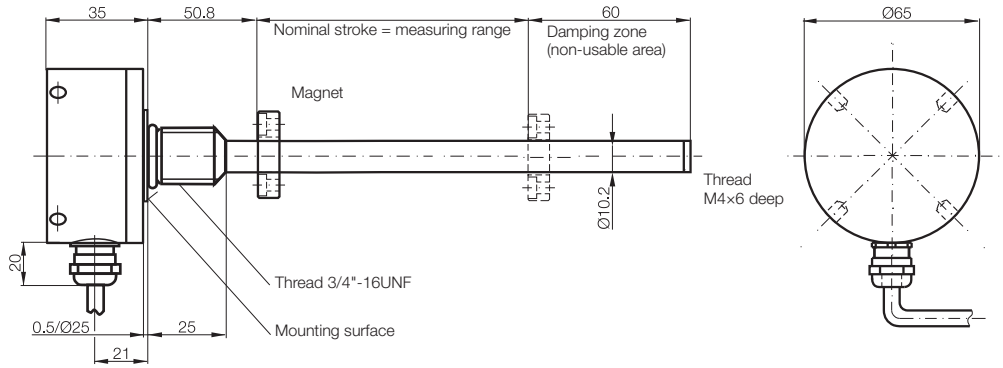
Caution! Prior to design, installation and startup, please read the instructions in the user guide!
www.balluff.com



Series	BTL5 Compact W rod
Part number	BTL5-...-M_ _ _ _ -W-_ _ _ _
Shock load	100 g/6 ms per IEC 60068-2-27 and 100 g/2 ms per IEC 60068-2-29
Vibration	12 g, 10...2000 Hz per IEC 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 (when BKS-S32/33 is installed); IP 68 connector, 5 bar for cable version
Housing material	Stainless steel 1.4305
Flange and tube material	Tube stainless 1.4571, flange 1.4571 or 1.4429 or 1.4404
Housing attachment	Flange with thread 3/4"-UNF
Connection type	connector or integral cable
Recommended connector, see page 148/149	BKS-S 32M/BKS-S 32M-C/BKS-S 33M
EMC testing:	
RF emission	EN 55016-2-3 Group 1, Class A
Static electricity (ESD)	IEC 61000-4-2 Severity Level 3
Electromagnetic fields (RFI)	IEC 61000-4-3 Severity Level 3
Fast transients (BURST)	IEC 61000-4-4 Severity Level 3
Conducted interference induced by high-frequency fields	IEC 61000-4-6 Severity Level 3
Standard nominal strokes [mm]	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500, 4750, 5000, 5250, 5500 or in 5 mm increments on request.

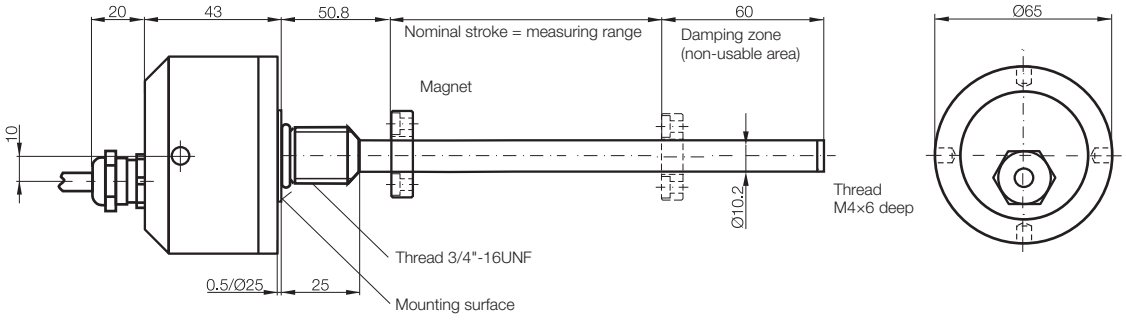
Housing W, BTL5-...-M_ _ _ _-W-K_ _

Thread 3/4"-16 UNF



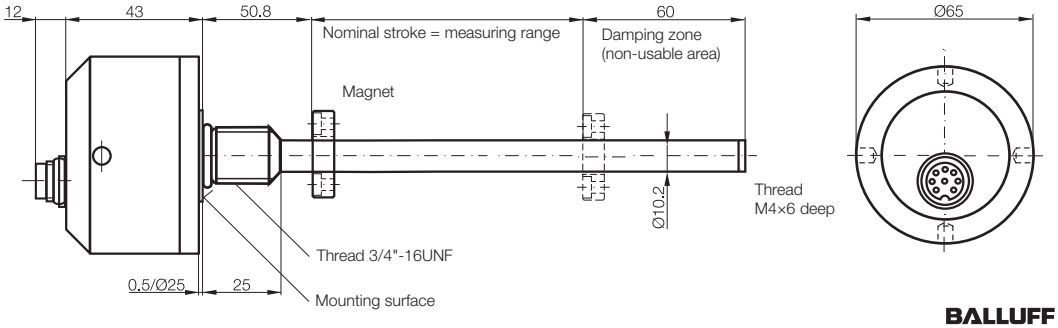
Housing W, BTL5-...-M_ _ _ _-W-KA_ _

Thread 3/4"-16 UNF



Housing W, BTL5-...-M_ _ _ _-W-S 32

Thread 3/4"-16 UNF

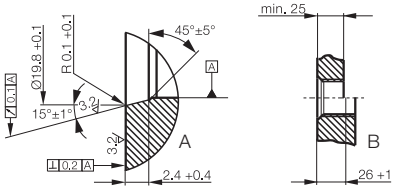


Pro Compact HB/WB Rod Series
Installation notes

Pressure rated to 600 bar,
high repeatability, non-contact, rugged
The BTL Micropulse transducer is a robust position feedback system for measuring ranges between 25 and 5500 mm as well as use under extreme ambient conditions.
The actual waveguide 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.

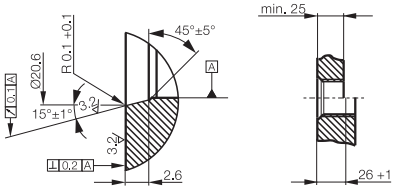
– Stainless
– IP 68 with cable
– IP 69/K
with cable protection system

Installation BTL5 Pro Compact HB/WB rod
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, the installation must be carried out as shown in the drawing below. Sealing is at the flange mounting surface using the supplied O-ring 15.4×2.1 with M18×1.5 thread. The flange and housing are completely sealed and cannot be opened as a result. The measuring range preset in the factory cannot be modified as a result.



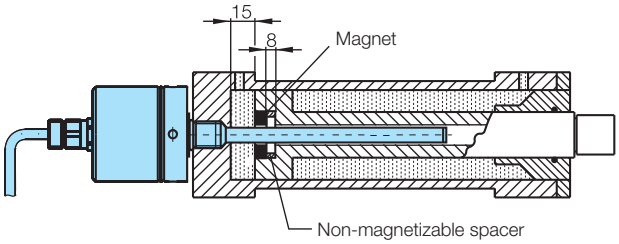
Insertion hole M18×1.5 as per ISO 6149, O-ring 15.4×2.1
O-ring groove, view A

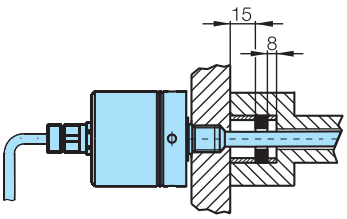
O-ring groove, view B



Insertion hole 3/4",
O-ring 15.3×2.4
O-ring groove, view A

O-ring groove, view B





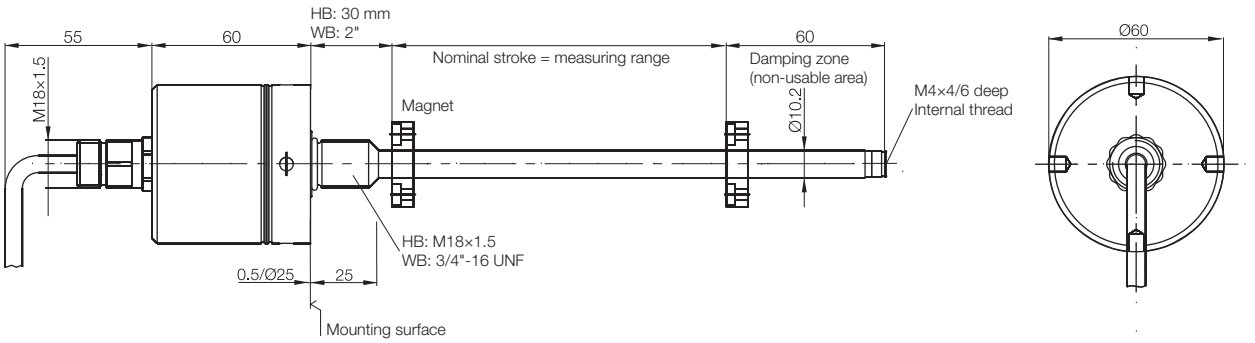
■ Included:
– Transducer (select your interface from page 110)
– Short user's guide

Please order separately:
Magnets/floats, page 96
Mounting nuts, page 97

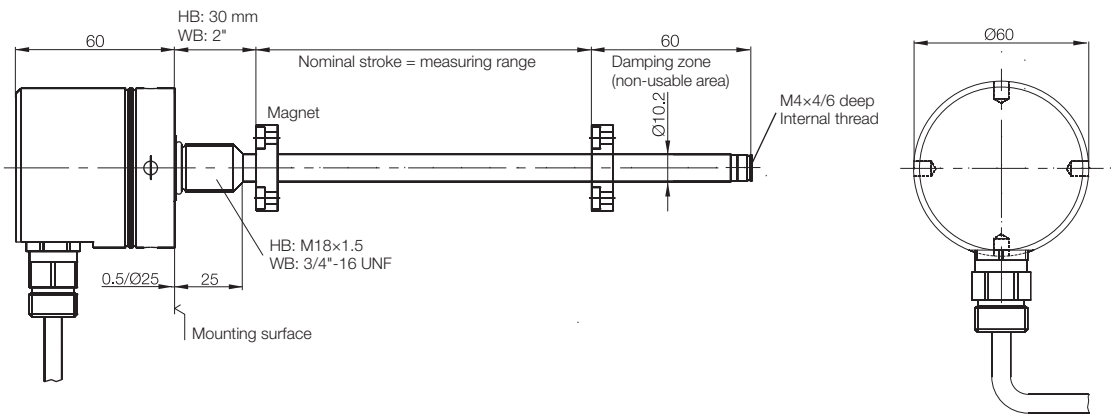
Caution! Prior to design, installation and startup, please read the instructions in the user guide!
www.balluff.com

Series	BTL5 Compact HB/WB rod
Part number	BTL5-...-M_ _ _ _ -HB/WB-_ _ _ _-C
Shock load	100 g/6 ms per IEC 60068-2-27 and 100 g/2 ms per IEC 60068-2-29
Vibration	12 g, 10...2000 Hz per IEC 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 (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 type	Cable connection
EMC testing:	
RF emission	EN 55016-2-3 Group 1, Class A+B
Static electricity (ESD)	IEC 61000-4-2 Severity Level 3
Electromagnetic fields (RFI)	IEC 61000-4-3 Severity Level 3
Fast transients (BURST)	IEC 61000-4-4 Severity Level 3
Conducted interference induced by high-frequency fields	IEC 61000-4-6 Severity Level 3
Standard nominal strokes [mm]	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500, 4750, 5000, 5250, 5500 or in 5 mm increments on request.

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

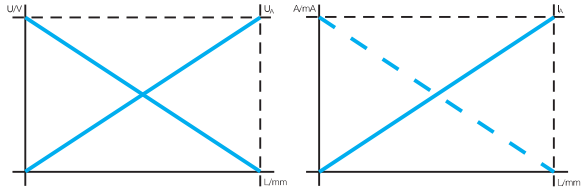


HB/WB housing
BTL5-...-HB/WB-_ _ _ _-C
radial



An integrator circuit provides resolution of better than 0.1 mV. BTL transducers with analog outputs are available for 0...10 V, 4...20 mA, 0...20 mA and –10...10 V as rising or falling signals.

Outputs

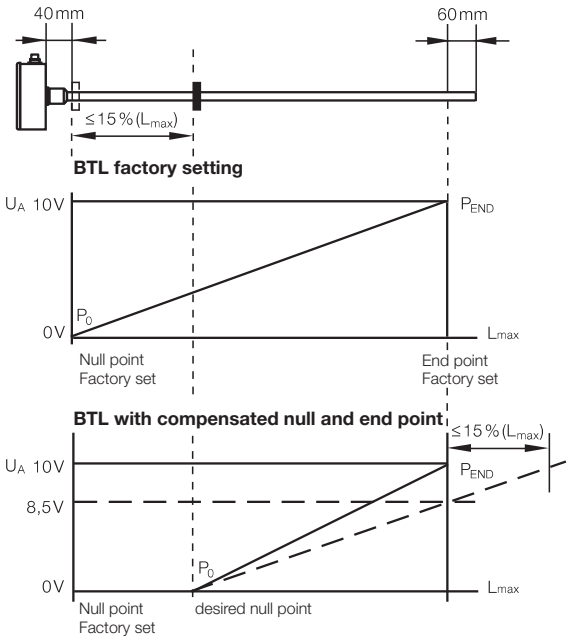


U_A rising and U_A falling are both present

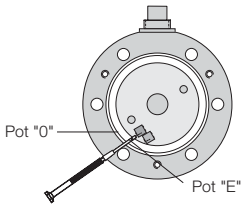
I_A rising or falling

Compensating the output signal

BTL transducers with analog output have two potentiometers for adapting the null and end point of the output signal to the particular application. The null point can be shifted by max. 15 % of the nominal stroke in the direction of the rod end.
The output signal cannot be adjusted on the Compact H, W and Pro Compact HB/WB versions.



Series		
Output signal		
Transducer interface		
Input interface		
Part number		
Output voltage		
Output current		
Load current		
max. ripple		
Load resistance		
System resolution		
Hysteresis		
Repeat accuracy		
Sampling rate		
Max. non-linearity		
Temperature coefficient	Voltage output	
	Current output	
Operating voltage		
Current consumption		
Polarity reversal protected		
Overvoltage protection		
Dielectric strength		
Operating temperature		
Storage temperature range		
Pin assignments	Pin	Color
Output signals	1	YE
	2	GY
	3	PK
	5	GN
Operating voltage	6	BU
	7	BN
	8	WH



slot max. 1.5 mm

Location of trim pots with cover removed

■ Please enter the code for the output signal, nominal stroke, housing and connection type in the ordering code!

■ Included:
– Transducer
– Short user's guide

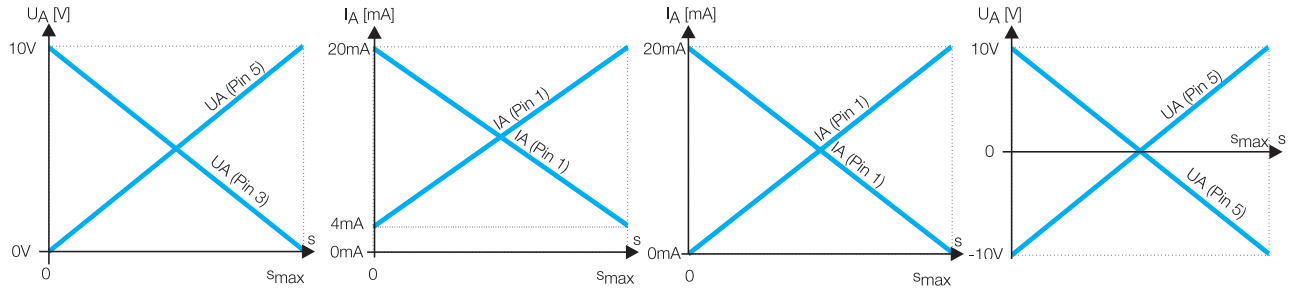
Please order separately:
Magnets/floats, page 96
Mounting nuts, page 97
Connectors, page 148/149

Ordering example:

BTL5-E1_-M_ _ _ _-_ _-_ _ _ _-C

Output signal		Standard nominal stroke [mm]	Housing	Connection type
1	Rising and falling (with A and G)	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500, 5000, 5250, 5500 or in 5 mm increments on request.	HB WB	Radial output F05 Teflon cable 5 m Axial output FA05 Teflon cable 5 m
0	Rising			
7	Falling (with C and E)			

	BTL5 Compact Rod	BTL5 Compact Rod		BTL5 Compact Rod		BTL5 Compact Rod
	analog	analog		analog		analog
	A	**E**		**C**		**G**
	analog	analog		analog		analog
	BTL5-**A11**-M_ _ _ _-_-_ _ _ _	BTL5-**E1**_-M_ _ _ _-_-_ _ _ _		BTL5-**C1**_-M_ _ _ _-_-_ _ _ _		BTL5-**G11**-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					≤ 5 mV
		≤ 500 ohms		≤ 500 ohms		
	≤ 0.1 mV	≤ 0.2 µA		≤ 0.2 µA		≤ 0.1 mV
	≤ 4 µm	≤ 4 µm		≤ 4 µm		≤ 4 µm
	System resolution/min. 2 µm	System resolution/min. 2 µm		System resolution/min. 2 µm		System resolution/min. 2 µm
	$f_{STANDARD}$ = 1 kHz	$f_{STANDARD}$ = 1 kHz		$f_{STANDARD}$ = 1 kHz		$f_{STANDARD}$ = 1 kHz
	±100 µm up to 500 mm nominal stroke	±100 µm up to 500 mm nominal stroke		±100 µm up to 500 mm nominal stroke		±100 µm up to 500 mm nominal stroke
	±0.02 % 500... max. nominal stroke	±0.02 % 500... max. nominal stroke		±0.02 % 500... max. nominal stroke		±0.02 % 500... max. nominal stroke
	[150 µV/°C + (5 ppm/°C x P x U/L)] x ΔT					[150 µV/°C + (5 ppm/°C x P x U/L)] x ΔT
		[0.6 µA/°C + (10 ppm/°C x P x I/L)] x ΔT		[0.6 µA/°C + (10 ppm/°C x P x I/L)] x ΔT		
	20...28 V DC	20...28 V DC		20...28 V DC		20...28 V DC
	≤ 150 mA	≤ 150 mA		≤ 150 mA		≤ 150 mA
	yes	yes		yes		yes
	Transzorb protection diodes	Transzorb protection diodes		Transzorb protection diodes		Transzorb protection diodes
	500 V DC (ground to housing)	500 V DC (ground to housing)		500 V DC (ground to housing)		500 V DC (ground to housing)
	–40...+85 °C	–40...+85 °C		–40...+85 °C		–40...+85 °C
	–40...+100 °C	–40...+100 °C		–40...+100 °C		–40...+100 °C
	BTL5-**A**11...	BTL5-**E**10...	BTL5-**E**17...	BTL5-**C**10...	BTL5-**C**17...	BTL5-**G**11...
		4...20 mA	20...4 mA	0...20 mA	20...0 mA	
	0 V Output	0 V Output	0 V Output	0 V Output	0 V Output	0 V Output
	10...0 V	10...0 V	10...0 V	10...0 V	10...0 V	10...–10 V
	0...10 V	0...10 V	0...10 V	0...10 V	0...10 V	–10...10 V
	GND	GND	GND	GND	GND	GND
	+24 V DC	+24 V DC	+24 V DC	+24 V DC	+24 V DC	+24 V DC
	(GND)	(GND)	(GND)	(GND)	(GND)	(GND)



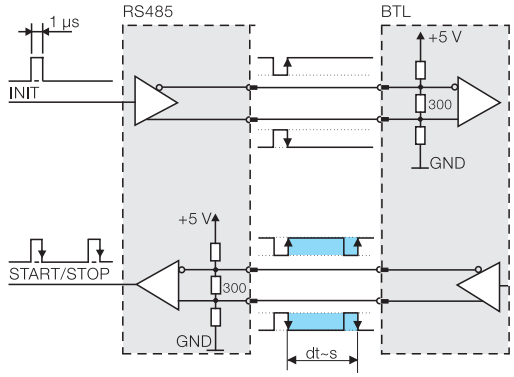
Ordering example:

BTL5-E1_-M_ _ _ _-_-_ _ _ _

Output signal		Standard nominal stroke [mm]	Housing	Connection type		
1	Rising and falling (with A and G)	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500 or in 5 mm increments on request.	K	Radial output		
0	Rising			K02	PUR cable 2 m	
7	Falling (with C and E)			K05	PUR cable 5 m	
				K10	PUR cable 10 m	
				K15	PUR cable 15 m	
				SR32	Connector	
			H	Radial output		Axial output
			W	K02	PUR cable 2 m	KA02 PUR cable 2 m
				K05	PUR cable 5 m	KA05 PUR cable 5 m
				K10	PUR cable 10 m	KA10 PUR cable 10 m
				K15	PUR cable 15 m	KA15 PUR cable 15 m
						S32 Connector

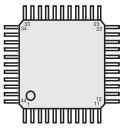
P Interface
Compatible with BTA processors as well as controllers and modules from various manufacturers including Siemens, B & R, Phoenix Contact, Mitsubishi, Sigmatek, Parker, Esitron and WAGO. Reliable signal transmission, even over cable lengths up to 500 m between BTA and BTL, is assured by the noise-immune RS485 differential line drivers and receivers. Noise signals are effectively suppressed.

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

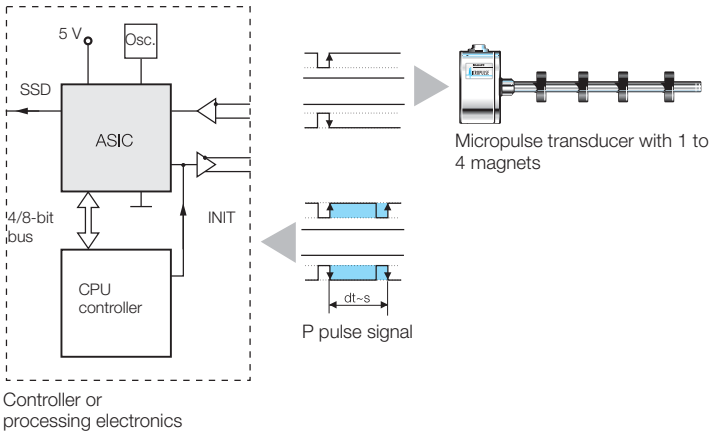


Block diagram of P interface

Highly precise digitizing of the P pulse signal
Companies developing their own control and processing electronics 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 interface.


Digitizing chip 44QFP

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



Controller or
processing electronics

Micropulse transducer with 1 to 4 magnets

P pulse signal

Ordering example:

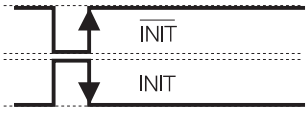
BTL5-P1-M_ _ _ _-_ _-_ _ _ _-C

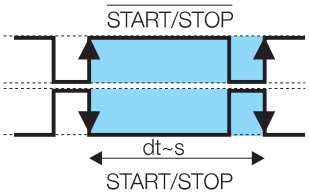
Standard nominal stroke [mm]	**Housing**	**Connection type**
0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500, 5000, 5250, 5500 or in 5 mm increments on request.	HB WB	Radial output F05 Teflon cable 5 m Axial output FA05 Teflon cable 5 m

ASIC INFO:
+49 7158 173-370

Series				**BTL5 Compact rod**
Transducer interface				Pulse **P**
Input interface				Pulse **P**
Part number				BTL5-**P**1-M_ _ _ _-_-_ _ _ _
System resolution				processing-dependent
Repeat accuracy				2 µm or ±1 digit depending on processing electronics
Resolution				≤ 2 µm
Hysteresis				≤ 4 µm
Sampling rate				$f_{STANDARD}$ = 1 kHz = ≤ 1400 mm
max. non-linearity				±100 µm up to 500 mm nominal stroke ±0,02 % 500...5500 mm nominal stroke
Temperature coefficient of overall system				(6 µm + 5 ppm × L)/°C
Operating voltage				20...28 V DC
Current consumption				≤ 100 mA
Operating temperature				–40...+85 °C
Storage temperature range				–40...+100 °C
Pin assignments		Pin	Color	BTL5-**P**1-M...
Input/Output signals	Input	1	YE	INIT
	Output	2	GY	START/STOP
	Input	3	PK	$\overline{\text{INIT}}$
	Output	5	GN	$\overline{\text{START/STOP}}$
Operating voltage		6	BU	GND
		7	BN	+24 V DC
		8	WH	

Connect shield to housing





■ Please enter the code for the nominal stroke, housing and connection type in the ordering code.

■ Included:
– Transducer
– Short user's guide

Please order separately:
Magnets/floats, page 96
Mounting nuts, page 97
(for Compact rod H)
Connectors, page 148/149

Ordering example:

BTL5-P1-M_ _ _ _-_-_ _ _ _

Standard nominal stroke [mm]

0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500, 5000, 5250, 5500 or in 5 mm increments on request.

Housing

K
H
W

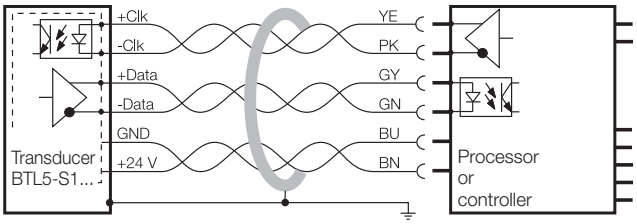
Connection type

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

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

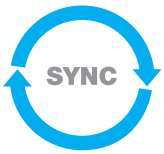
Axial output
KA02 PUR cable 2 m
KA05 PUR cable 5 m
KA10 PUR cable 10 m
KA15 PUR cable 15 m
S32 Connector

Standard SSI interface
Controllers from Siemens, Bosch-Rexroth, WAGO, B & R, Parker, Esitron, PEP etc. as well as Balluff BDD-AM 10-1-SSD and BDD-CC 08-1-SSD display/controllers are used for synchronous serial data transmission.
Reliable signal transmission, even with cable lengths of up to 400 m between controller and BTL transducer is assured by noise-immune RS485/422 differential line drivers and receivers. Any noise signals are effectively suppressed.



BTL5-S1... with processor/controller, wiring example

Synchronized SSI interface BTL5-S1_ _B-M_ _ _ _-P-_ _ _ _
Micropulse transducers with synchronized SSI interface are suitable for dynamic control applications. The data acquisition in the transducer is synchronized with the external clock of the controller, permitting an optimum calculation of the velocity in the controller. The prerequisite for this synchronous mode of transducer operation is consistent clock signal timing.
The **maximum sampling frequency f_A**, at which a new current value is generated for each sample, can be derived from the following table:



mm		mm		Hz
	< Nominal stroke	≤ 120	:	2500
120	< Nominal stroke	≤ 475	:	2000
475	< Nominal stroke	≤ 750	:	1500
750	< Nominal stroke	≤ 1250	:	1000
1250	< Nominal stroke	≤ 2600	:	500
2600	< Nominal stroke	≤ 4000	:	333

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

Coding

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

System resolution

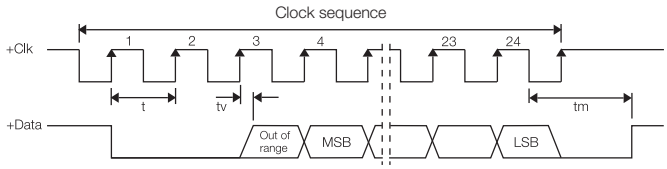
1	1 µm
2	5 µm
3	10 µm
4	20 µm
5	40 µm
6	100 µm
7	2 µm

Standard nominal stroke [mm]
0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000 or in 5 mm increments on request

Housing
HB
WB

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

Series			**BTL5 rod**
Output signal			synchronous serial
Transducer interface			**S**
Input interface			synchronous serial
Part number			BTL5-**S**1_ _-M_ _ _ _-_-_ _ _ _
Part number synchronization			BTL5-**S**1_ _B-M_ _ _ _-_-_ _ _ _
System resolution depending on version (LSB)			1, 2, 5, 10, 20, 40 or 100 µm
Repeat accuracy			±1 digit
Hysteresis			≤ 1 digit
Sampling rate			$f_{STANDARD}$ = 2 kHz
max. non-linearity			±30 µm at 5 and 10 µm resolution or ≤ ±2 LSB
Temperature coefficient of overall system			(6 µm + +5 ppm × L)/°C
Operating voltage			20...28 V DC
Current consumption			≤80 mA
Operating temperature			–40...+85 °C
Storage temperature range			–40...+100 °C
Pin assignments	Pin	Color	
Control and data signals	1	YE	+Clk
	2	GY	+Data
	3	PK	–Clk
	5	GN	–Data
Operating voltage (external)	6	BU	GND
	7	BN	+24 V DC
	8	WH	must remain unconnected



■ Please enter the code for the coding, system resolution, nominal stroke, design and connection type in the ordering code!

■ Included:
– Transducer
– Short user's guide

Please order separately:
Magnets/floats, page 96
Mounting nuts, page 97
Connectors, page 148/149

Ordering example:

BTL5-S1_ _-M_ _ _ _-_-_ _ _ _

Coding		**System resolution**		**Standard nominal stroke [mm]**	**Housing**	**Connection type**
0	Binary code rising (24 bit)	1	1 µm	0025, 0050, 0075, 0100, 0125, 0150,	K	Output radial
		2	5 µm	0175, 0200, 0225, 0250, 0275, 0300,		K02 PUR cable 2 m
		3	10 µm	0325, 0350, 0375, 0400, 0425, 0450,		K05 PUR cable 5 m
1	Gray code rising (24 bit)	4	20 µm	0475, 0500, 0550, 0600, 0650, 0700,		K10 PUR cable 10 m
		5	40 µm	0750, 0800, 0850, 0900, 0950, 1000,		K15 PUR cable 15 m
		6	100 µm	1100, 1200, 1300, 1400, 1500, 1600,		SR32 connector
6	Binary code rising (25 bit)	7	2 µm	1700, 1800, 1900, 2000, 2250, 2500,		
				2750, 3000, 3250, 3500, 3750, 3850,	H	Output radial
				4000 or in 5 mm increments on request	W	K02 PUR cable 2 m
7	Gray code rising (25 bit)					K05 PUR cable 5 m
						K10 PUR cable 10 m
						K15 PUR cable 15 m
						Output axial
						KA02 PUR cable 2 m
						KA05 PUR cable 5 m
						KA10 PUR cable 10 m
						KA15 PUR cable 15 m
						S32 connector

Ordering code for SSI interface with synchronization to clock (dynamic control applications) insert the letter B! BTL5-S1_ _**B**-M_ _ _ _-_-_ _ _ _

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

CAN-BUS features
- Line topology, star structure also possible via repeaters
- Low-cost wiring with two-wire cable
- Fast response times, high data integrity using CRC, hamming distance of 6
- 1 MBit/s with cable lengths < 25 m
- Protocol limits number of stations to 127
- Using multiple magnets: A minimum spacing of > 65 mm must be maintained.

CANopen offers a high level of flexibility with respect to 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)
12 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 magnet position with resolution in 5 µm increments
- Current velocity of the magnet with resolution selectable in 0.1mm/s increments
- Current status of the four freely programmable cams per magnet.

Synchronization Object (SYNC)
Serves as a net-wide trigger for synchronizing all network participants. 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 to 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 and is used for example for error messages when the cam states change.

Service Data Object (SDO)
Service Data Objects transmit the parameters for the transducer configuration. The transducer may be configured on the bus by the controller or offline using a PC with a configuration tool which runs under Windows. The configuration is stored in the non-volatile memory of the transducer.

CiA 199911-301v30/11-009

Use of multiple magnets
A minimum spacing of > 65 mm must be maintained.

Ordering example:

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

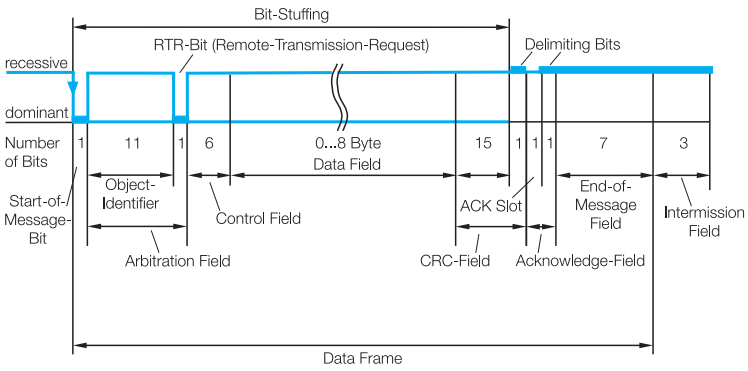
Software configuration		Baud rate		Standard nominal stroke [mm]	Housing	Connection type	
1	1 × position and 1 × velocity	0	1 MBaud	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000 or in 5 mm increments on request.	HB	Radial output	
2	2 × position and 2 × velocity	1	800 kBaud		WB	K05	PUR cable 5 m
3	4 × position	2	500 kBaud			Axial output	
		3	250 kBaud			KA05	PUR cable 5 m
		4	125 kBaud				
		5	100 kBaud				
		6	50 kBaud				
		7	20 kBaud				
		8	10 kBaud				

Series			**BTL5 rod**						
Output signal			CANopen						
Transducer interface			**H**						
Input interface			CANopen						
Part number			BTL5-**H**1_ _-M_ _ _ _-...						
CANopen Version			potential-free						
Repeat accuracy			±1 digit						
System resolution	Position		5 µm increments						
configurable	Velocity		0.1 mm/s increments						
Hysteresis			≤ 1 digit						
Sampling rate			$f_{STANDARD}$ = 1 kHz						
max. non-linearity			±30 µm at 5 µm resolution						
Temperature coefficient of overall system			(6 µm + 5 ppm × L)/°C						
Operating voltage			20...28 V DC						
Current consumption			≤ 100 mA						
Operating temperature			–40...+85 °C						
Storage temperature range			–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
Pin assignments	Pin	Color								
Control and	1	WH	CAN_GND							
data signals	2	BN	+24 V							
	3	BU	0 V (GND)							
	4	GY	CAN_HIGH							
	5	GN	CAN_LOW							

■ Please enter the code for the software configuration, baud rate, nominal stroke and housing in the ordering code. Cable on request.

■ Included:
– Transducer
– Short user's guide

Please order separately:
Magnets/floats, page 96
Mounting nuts, page 97
Connectors, page 148/149



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 noise immunity of the connection is achieved using differential drivers and by the data monitoring scheme.

Ordering example:

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

Software configuration

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

Baud rate

0	1 MBaud
1	800 kBaud
2	500 kBaud
3	250 kBaud
4	125 kBaud
5	100 kBaud
6	50 kBaud
7	20 kBaud
8	10 kBaud

Standard nominal stroke [mm]

0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000 or in 5 mm increments on request.

Housing

K	
H	
W	

Connection type

Radial output	
K02	PUR cable 2 m
K05	PUR cable 5 m
SR92	Connector
Radial output	
K02	PUR cable 2 m
K05	PUR cable 5 m
Axial output	
KA02	PUR cable 2 m
KA05	PUR cable 5 m
S92	Connector

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 from Balluff senses the piston position in mobile hydraulic cylinders.
The sensor operates according to the proven magnetostrictive principle. The compact size of the transducer makes it ideal for use in pivot bearing and spherical eye end cylinders or large bore cylinders. The processing electronics integrated in the transducer have been designed to meet the strict EMC Directives for industrial lift trucks, agricultural and forestry equipment and earthmoving machinery.

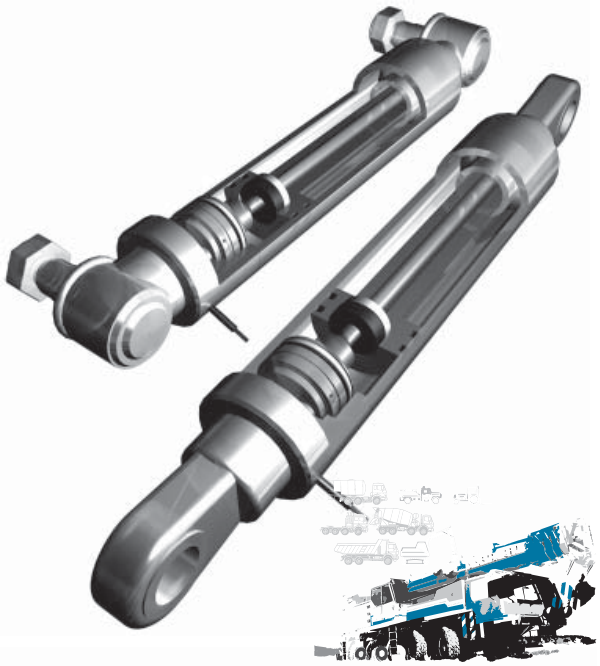
Compatibility testing according to EMC Directives
ISO 14982 Agricultural and Forestry Machinery
ISO 13766 Earthmoving Machinery
ISO 7637-1/2/3
Road Vehicles
EN 12895 Industrial Trucks
EN 50121-3-2
Railway Applications
ISO 11452-5 Electromagnetic HF field, 200 V/m

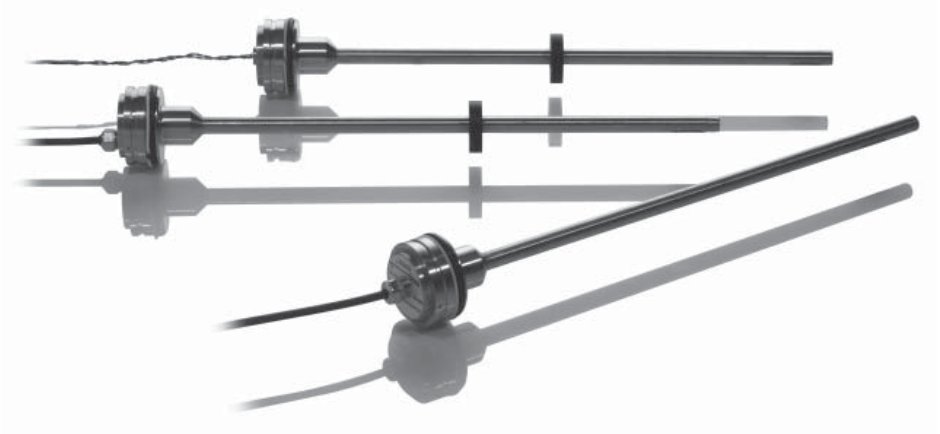
e1 type approval
The e1 type approval is granted by the German Federal Motor Transport Authority KBA and confirms that special motor vehicle standards have been maintained. The devices may be mounted on vehicles which travel on public roads. The standards describe EMC conditions under which the devices must operate without failure. e1 approved Micropulse transducers are indicated by the designation "-SA265-" in the part number.

Caution! Prior to design, installation and startup, please read the instructions in the user guide!
www.balluff.com

Series	BTL6 rod AR
Shock load	100 g/6 ms per IEC 60068-2-27
Continuous shock	50 g/2 ms
Vibration	12 g, 10...2000 Hz per IEC 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 outer tube 1.4571, stainless steel flange 1.4404
Pressure rating with 10.2 mm outer tube E2	350 bar installed in hydraulic cylinder
Pressure rating with 8 mm outer tube E28	250 bar installed in hydraulic cylinder
Connection type	Cable connection or pigtail
EMC tests:	
RF emission	EN 55016-2-3 Group 1, Class A/B
Static electricity (ESD)	IEC 61000-4-2 Severity Level 3
Electromagnetic fields (RFI)	IEC 61000-4-3 Severity Level 3
Fast transients (BURST)	IEC 61000-4-4 Severity Level 3
Surge voltage	IEC 61000-4-5 Severity Level 2
Line-induced disturbances	IEC 61000-4-6 Severity Level 3
Magnetic fields	IEC 61000-4-8 Severity Level 4
Standard nominal strokes [mm] with 8 mm outer tube (style E28) is the max. nominal stroke 1016 mm	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1524 or 1 mm increments on request

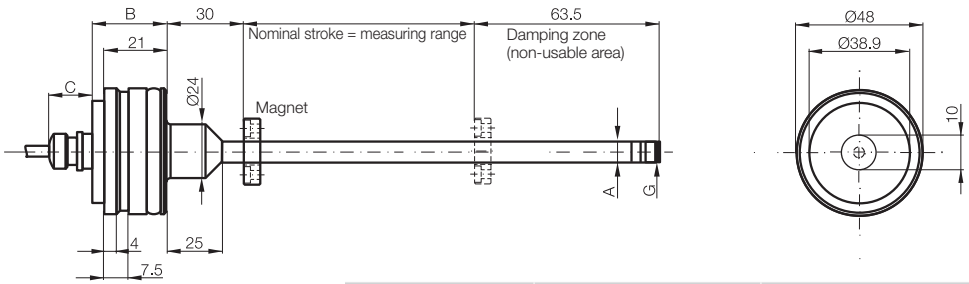
CE
e1





Housing E2/E28
BTL6-...-E2/E28-_ _ _ _-KA

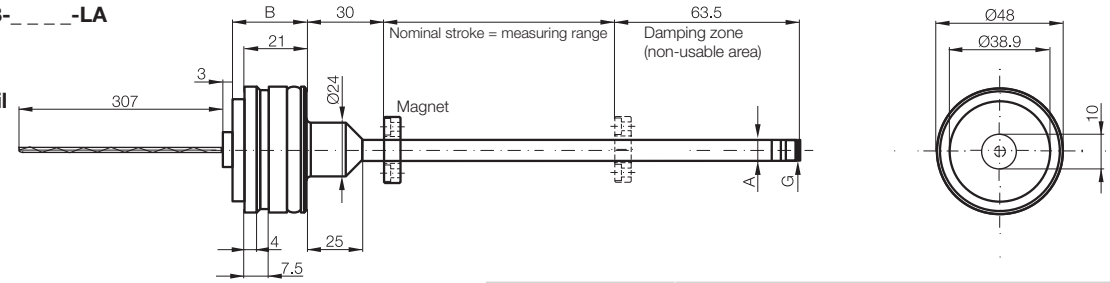
Cable outlet
axial centric



	B	C
BTL6-A/B	25.2	13
BTL6-E	29.75	13
BTL6-P	25.2	16
	A	**G**
E2	10.2	Thread M4×4/6 deep
E28	8	without thread

Housing E2/E28
BTL6-...-E2/E28-_ _ _ _-LA

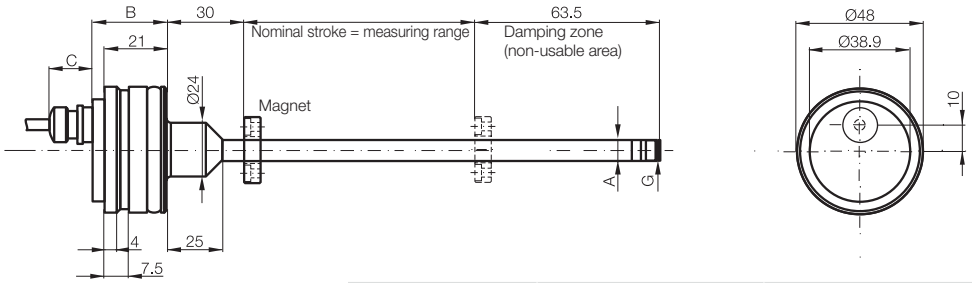
Cable outlet
axial with pigtail



	B	
BTL6-A/B	25.7	
BTL6-E	30.25	
BTL6-P	25.7	
	A	**G**
E2	10.2	Thread M4×4/6 deep
E28	8	without thread

Housing E2/E28
BTL6-...-E2/E28-_ _ _ _-KE

Cable outlet
axial eccentric



	B	C
BTL6-A/B	25.2	13
BTL6-E	29.75	13
BTL6-P	25.2	16
	A	**G**
E2	10.2	Thread M4×4/6 deep
E28	8	without thread

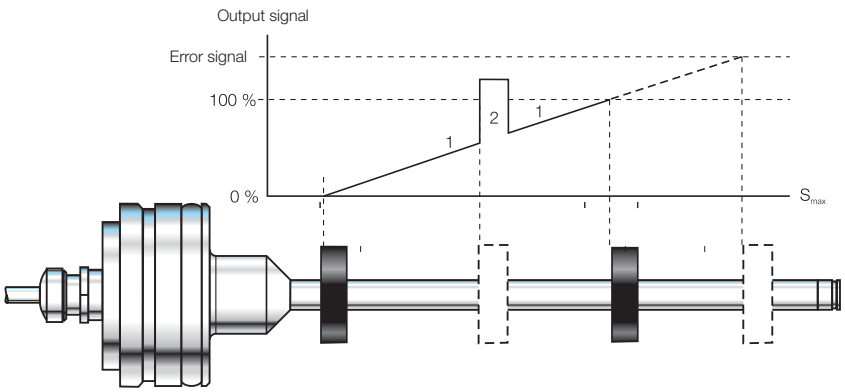
AR Rod Series
Analog interface

The propagation time of an ultrasonic wave induced by magnetostriction is used to determine the position of the magnet.
The position is output as an analog value which rises. This is done with high precision and repeatability within the measuring range designated as the nominal stroke length. If there is no magnet within the measuring range, an error signal is output. There is a damping zone at the rod end. When an magnet is in this zone the output is spurious. The electrical connection between the transducer, the controller and the power supply is established using a cable or pigtail.

Series		
Output signal		
Transducer interface		
Input interface		
Part number		
Output voltage		
Output current		
Load current		
max. ripple		
Load resistance		
System resolution		
Hysteresis		
Repeat accuracy		
Sampling rate		
max. non-linearity		
Temperature coefficient	voltage output Current output	
Operating voltage		
Current consumption		
Polarity reversal protected		
Overvoltage protection		
Dielectric strength		
Operating temperature		
Storage temperature range		
Pin assignments	Color	
Output signals	GY	
	GN	
Operating voltage	BU	
	BN	

Connect shield to housing

Magnet position
1 Within the measuring range
2 Magnet not present



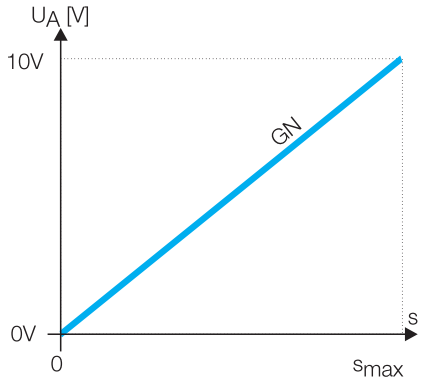
Output signal rising

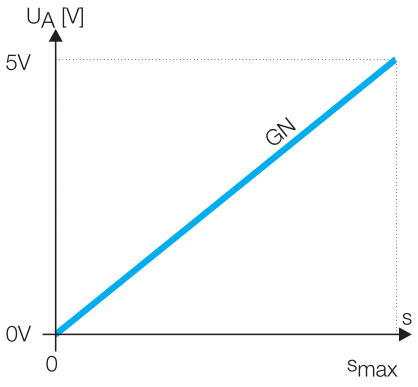
■ Please enter the code for the output signal, nominal stroke, housing and connection type in the ordering code!

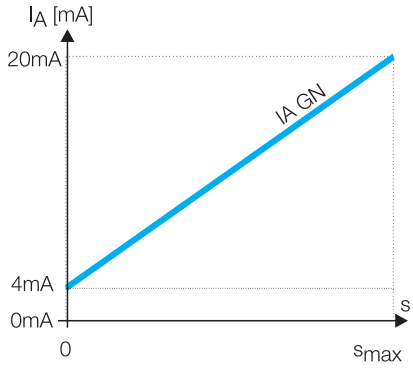
■ Included:
– Transducer
– Short user's guide

Please order separately:
Magnets/floats, page 96

	BTL6 rod AR	**BTL6 rod AR**	**BTL6 rod AR**
	analog	analog	analog
	A	**B**	**E**
	analog	analog	analog
	BTL6-**A**500-M_ _ _ _-_ _ _-_ _ _ _	BTL6-**B**500-M_ _ _ _-_ _ _-_ _ _ _	BTL6-**E**500-M_ _ _ _-_ _ _-_ _ _ _
	0...10 V	0...5 V	
			4...20 mA
	max. 2 mA	max. 2 mA	
	≤ 5 mV	≤ 2 mV	
			≤ 500 ohms
	± 1.5 mV	± 1.5 mV	± 7 µA
	≤ 5 µm	≤ 4 µm	
	System resolution/min. 2 µm	System resolution/min. 2 µm	System resolution/min. 2 µm
	$f_{STANDARD}$ = 1 kHz	$f_{STANDARD}$ = 1 kHz	$f_{STANDARD}$ = 1 kHz
	±200 µm up to 500 mm nominal stroke typ. ±0.02 % ≥ 500 nominal stroke	±200 µm up to 500 mm nominal stroke typ. ±0.02 % ≥ 500 nominal stroke	±200 µm up to 500 mm nominal stroke typ. ±0.02 % ≥ 500 nominal stroke
	[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 (ground to housing)	500 V DC (ground to housing)	500 V DC (ground to housing)
	–40...+85 °C	–40...+85 °C	–40...+85 °C
	–40...+100 °C	–40...+100 °C	–40...+100 °C
	BTL6-**A**500...	BTL6-**B**500...	BTL6-**E**500...
	0 V Output	0 V Output	0 V Output
	0...10 V	0...5 V	4...20 mA
	GND	GND	GND
	10...30 V DC	10...30 V DC	10...30 V DC







Ordering example:

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

Output signal

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

Standard nominal stroke [mm]

0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1524
or in 1 mm increments
on request

Housing

E2 Outer tube Ø 10.2 mm
E28 Outer tube Ø 8 mm, max. nominal stroke 1016 mm

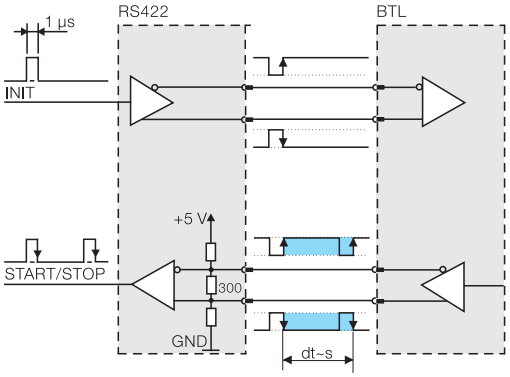
Connection type

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 eccentric output
KE02 PUR cable 2 m
KE05 PUR cable 5 m
KE10 PUR cable 10 m
KE15 PUR cable 15 m
KE20 PUR cable 20 m

Axial output
LA00.3 PUR pigtail 0.3 m

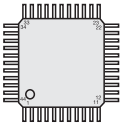
P510 interface
Compatible with Balluff BTA processors as well as controllers and modules from various manufacturers, including Siemens, B & R, Bosch, Phoenix Contact, Mitsubishi, Sigmatek, Parker, Esitron and WAGO. Reliable signal transmission, even over cable lengths up to 500 m between BTA and transducer is assured by the noise-immune RS485 differential line drivers and receivers. Noise signals are effectively suppressed.



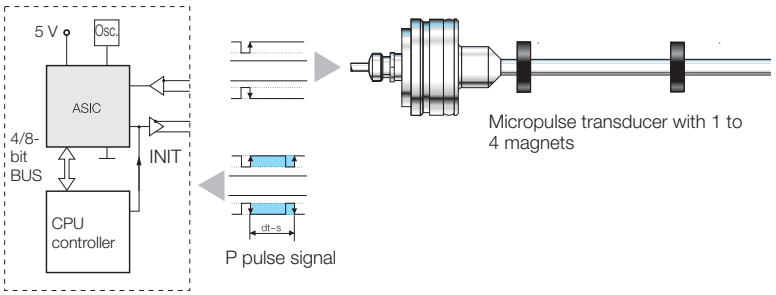
Block diagram of P interface

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

Extremely precise digitizing chip for P510 pulse interface
Companies developing their own control and processing electronics 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 interface.


Digitizing chip 44QFP

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



Controller or processing electronics

P pulse signal

Micropulse transducer with 1 to 4 magnets

ASIC INFO: +49 7158 173-370

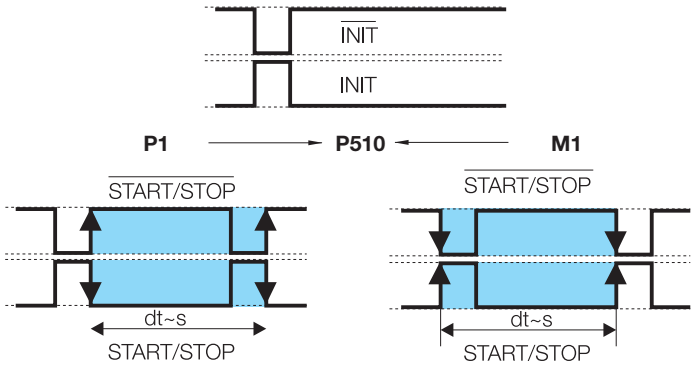
Series			**BTL6 rod AR**
Transducer interface			Pulse **P510**
Input interface			Pulse **P510**
Part number			BTL6-**P**510-M_ _ _ _-_ _ _-_ _ _ _ _
System resolution			processing-dependent
Repeat accuracy			≤ 10 µm
Repeatability			≤ 20 µm
Resolution			≤ 10 µm
Non-linearity			±200 µm up to 500 mm nominal stroke
			typ. ±0.02 %, max.. ±0.04 % 500...1500 mm nominal stroke
Operating voltage			10...30 V DC
Current consumption			≤ 60 mA (at 1kHz)
Operating temperature			–40...+85 °C
Storage temperature range			–40...+100 °C
Pin assignments		Color	BTL6-**P**510-M...
Input/Output signals	Input	YE	INIT
	Output	GY	START/STOP
	Input	PK	$\overline{\text{INIT}}$
	Output	GN	$\overline{\text{START/STOP}}$
Operating voltage		BU	GND
		BN	10...30 V DC

Connect shield to housing

■ Please enter the code for the nominal stroke, housing and connection type in the ordering code.

■ Included:
– Transducer
– Short user's guide

Please order separately:
Magnets/floats, page 96



Ordering example:

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

Standard nominal stroke [mm]

0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1524 or in 1 mm increments on request

Housing

E2	Outer tube Ø 10.2 mm
E28	Outer tube Ø 8 mm, max. nominal stroke 1016 mm

Connection type

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 eccentric output

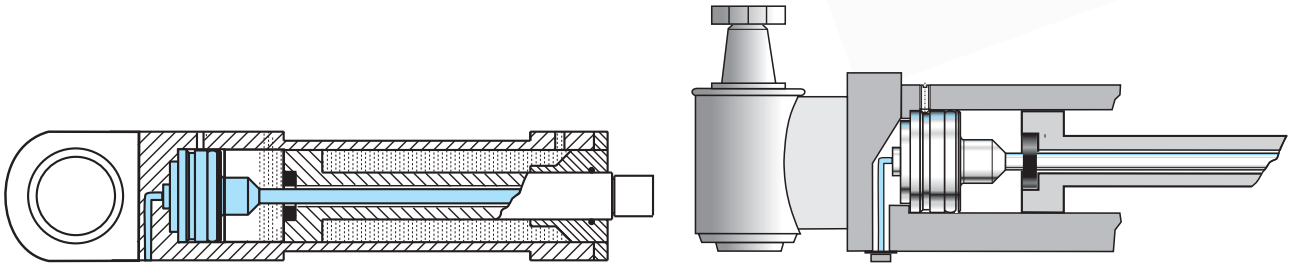
KE02	PUR cable 2 m
KE05	PUR cable 5 m
KE10	PUR cable 10 m
KE15	PUR cable 15 m
KE20	PUR cable 20 m

Axial output

LA00.3	PUR pigtail 0.3 m

AR Rod Series
Installation notes

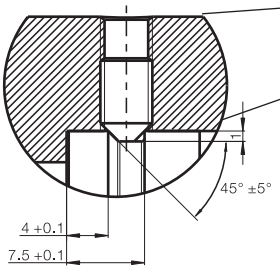
Series AR BTL Micropulse transducers are designed for integration in hydraulic cylinders. The transducer is supported mechanically by the housing. Three M5 set screws spaced at an angle of 120 °C hold the transducer, which fits into a Ø 48 H8 hole.
Sealing is accomplished using the supplied O-ring and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



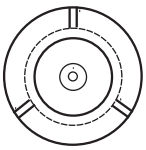
The metal surrounding of the cylinder eliminates the need for a cable shield when the BTL AR...**LA**, cable outlet pigtail version is installed in the cylinder. The pigtail version cannot be used without additional EMC protection (shield).

Caution! Prior to design, installation and startup, please read the instructions in the user guide! www.balluff.com

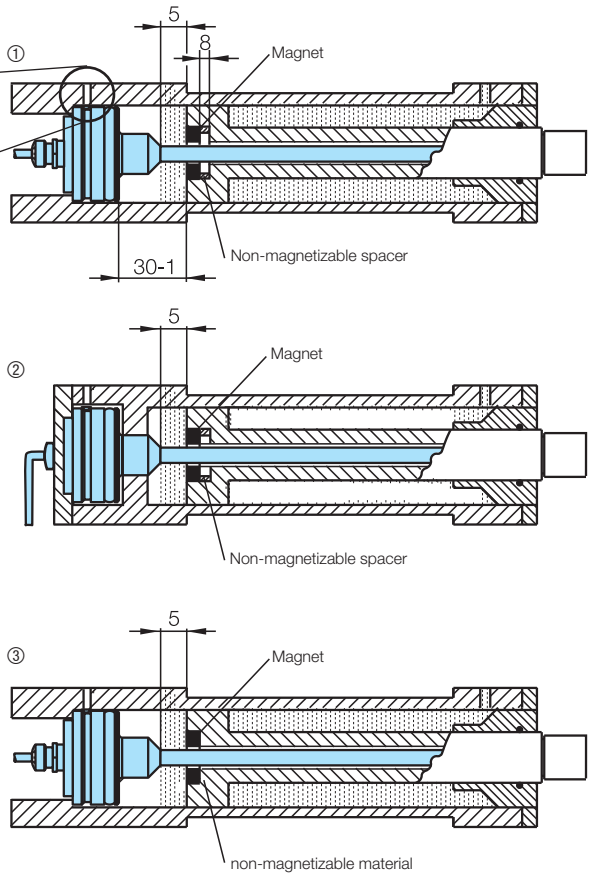
Set screw
DIN 914 M5×8



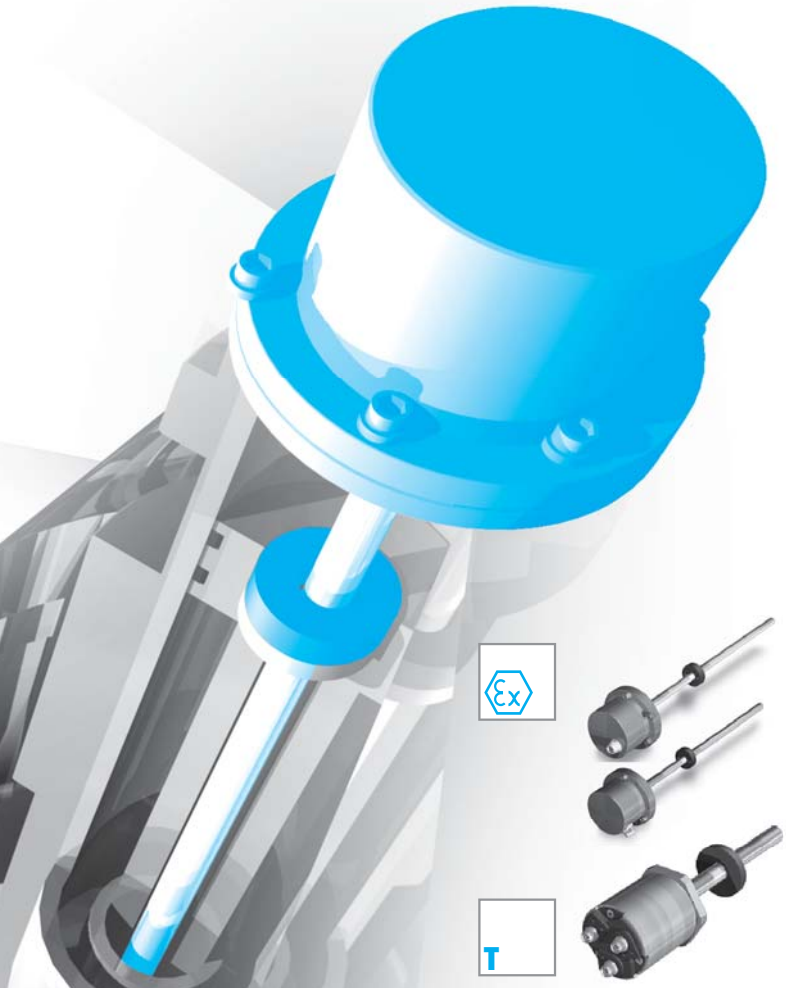
Fixing the transducer using three M5 set screws spaced 120 °C



Installation examples



① Installation on piston side, in magnetic piston material
② Installation from rear, in magnetic piston material
③ Installation on piston side



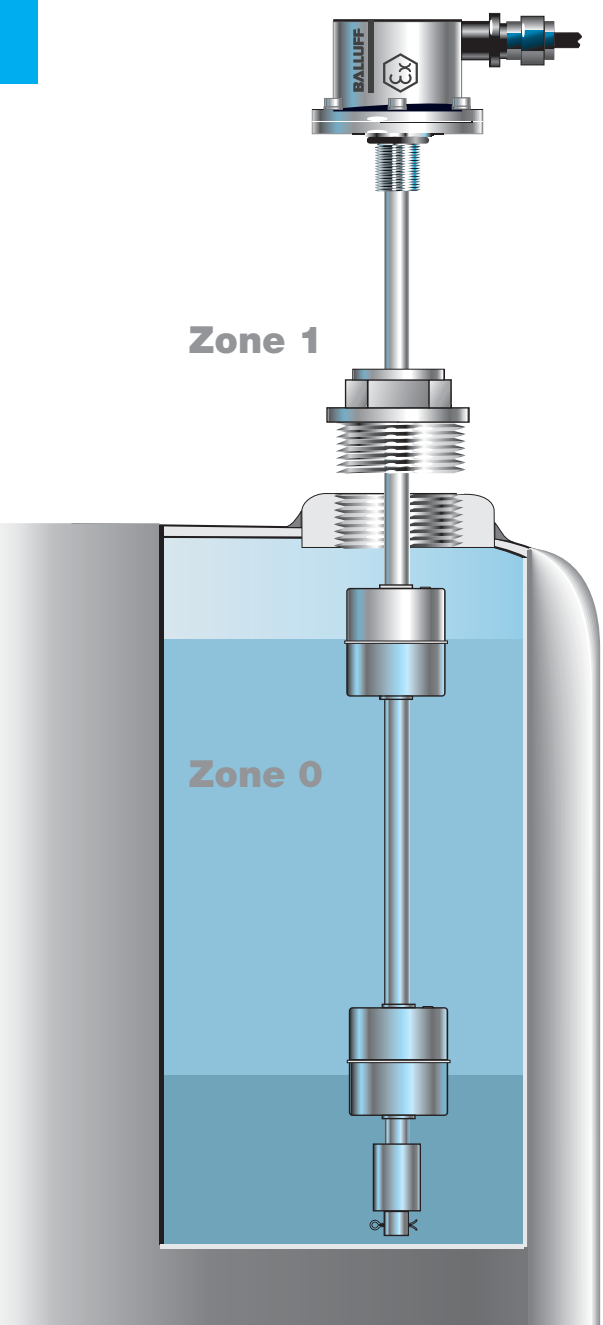
MICROPULSE®

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

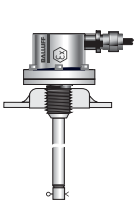
Rod Series EX
Filling level sensor in zone 0/1

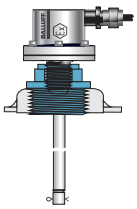
BTL5-_1-M....-B-DEXA-_ _ _
The "DEX**A**" rod version is the safe and reliable approach to level applications in Zone 0. The float is protected against loss by a cotter pin. Floats, page 136

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



Installation examples

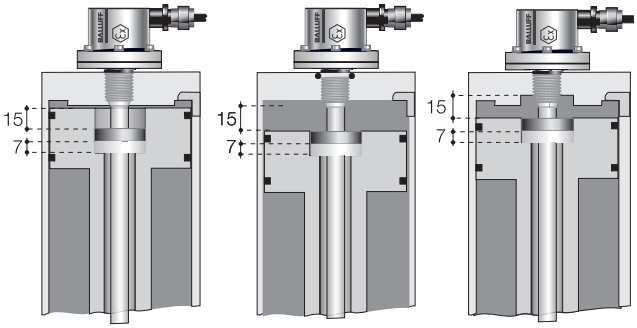




Caution! Prior to design, installation and startup, please read the instructions in the user guide!
www.balluff.com

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 rod section enters a drilled hole in the piston.



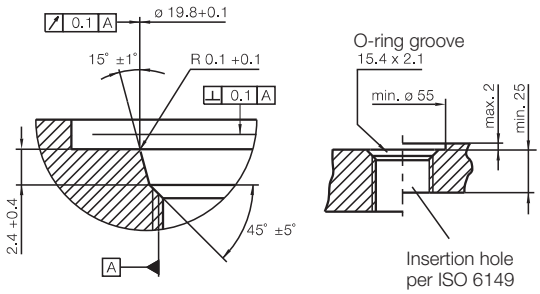
Applications

- Position feedback in hydraulic cylinders
- Valve positioning in power plants
- Dosimetry
- Positioning spray guns

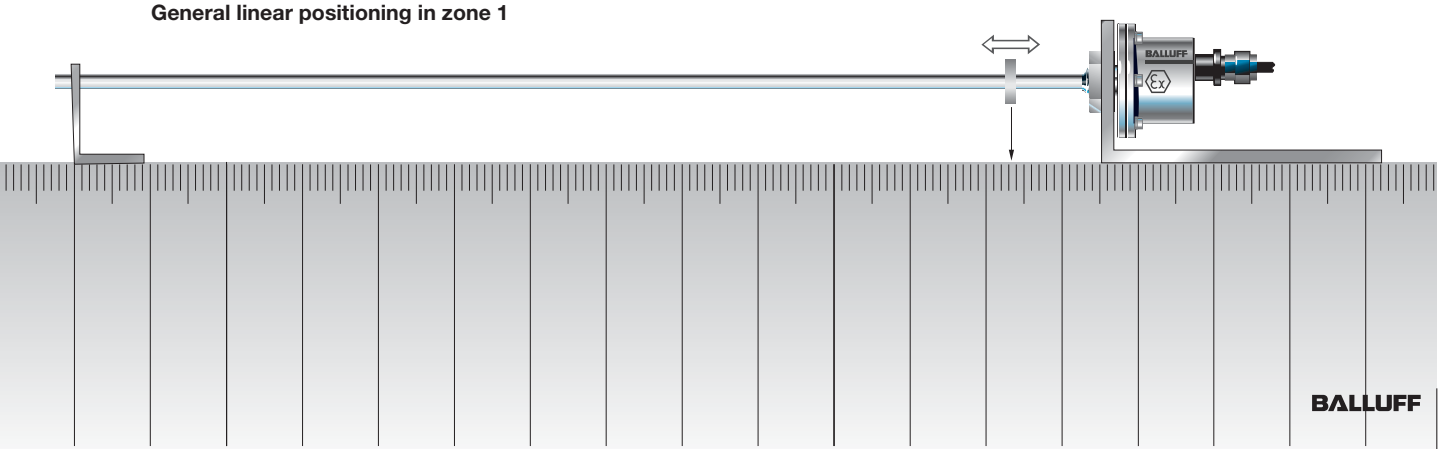
Installation

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, the installation must be carried out as shown in the drawing below. Sealing is at the flange mounting surface using the supplied O-ring 15.4×2.1 with M18×1.5 thread.



General linear positioning in zone 1

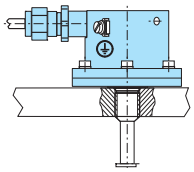


Pressure rated to 600 bar, high repeatability, non-contact, robust
The BTL Micropulse transducer is a robust position feedback system for measuring ranges between 25 and 4000 mm as well as use under extreme ambient conditions.

Ex protection type "d" flameproof enclosure
Transducers designated **Ex d IIB + H_2 T6** meet the requirements for electrical devices in explosive atmospheres. When using you must follow the relevant safety regulations, such as:
– Explosion protection guidelines (EX-RL)
– Constructing electrical equipment in potentially explosive areas (VDE 0165)
– Protection type "d", flameproof enclosure (EN 60079-1)

Transducers from category II 1/2 G designated Ex d IIB+H2 T6 meet the requirements for electrical devices in areas containing potentially explosive gases. Requirements for areas containing flammable dust are also fulfilled in accordance with category II 3D designated Ex tD IP67 T85°C, A zone 22.

ATEX




Physikalisch-Technische Bundesanstalt PTB
EG-Baumusterprüfbescheinigung

Analog interface no null or end point trim possible, see page 110 for technical data
Ordering example:
BTL5-_ _ _-M_ _ _ _-_-DEX_-_ _ _ _

Output signal	Standard nominal stroke [mm]	Housing	Rod end	Connection type
A11 0...10 V and 10...0 V, Rising and falling	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000 or in 5 mm increments on request	B J	A Float stop B Short stop	Axial cable outlet, housing B only KA02 PUR cable 2 m KA05 PUR cable 5 m KA10 PUR cable 10 m KA15 PUR cable 15 m Radial cable outlet K02 PUR cable 2 m K05 PUR cable 5 m K10 PUR cable 10 m K15 PUR cable 15 m
E10 4...20 mA, rising				
E17 20...4 mA, falling				
C10 0...20 mA, rising				
C17 20...0 mA, falling				
G11 –10...10 V and 10...–10 V, Rising and falling				

Digital pulse interface, see page 112 for technical data
Ordering example:
BTL5-_1-M_ _ _ _-B-DEX_-_ _ _ _

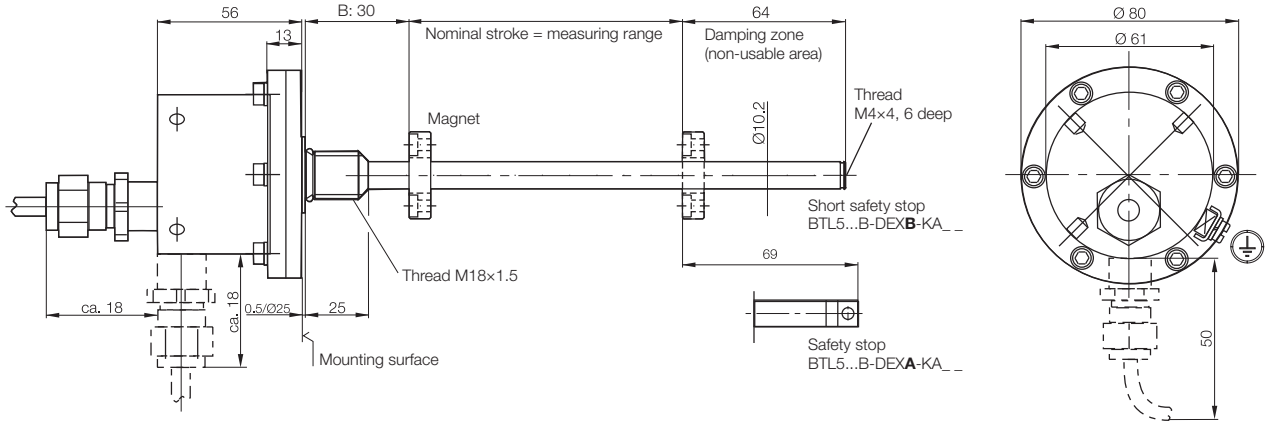
Interface	Standard nominal stroke [mm]	Rod end	Connection type
P Pulse interface P M Pulse interface M I Pulse interface I	see above analog interface DEX	A Float stop B Short stop	see above analog interface DEX

SSI interface, see page 114 for technical data
Ordering example:
BTL5-S1_ _-M_ _ _ _-B-DEX_-_ _ _ _
BTL5-S1_ _-M_ _ _ _-B-DEX _-_ _ _ _

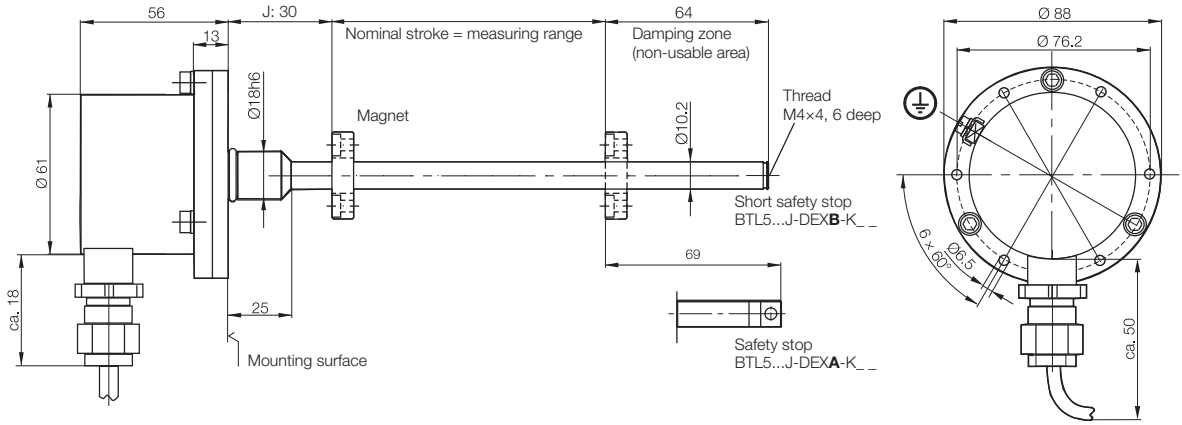
Coding	System resolution	Standard nominal stroke [mm]	Rod end	Connection type
0 Binary code rising (24 bit) 1 Gray code rising (24 bit) 6 Binary code rising (25 bit) 7 Gray code rising (25 bit)	1 1 µm 2 5 µm 3 10 µm 4 20 µm 5 40 µm	see above analog interface DEX	A Float stop B Short stop	see above analog interface DEX

Series	BTL5 Compact rod, Ex
Part number	BTL5-_1-M_ _ _ _ _ -_-DEX_-_ _ _ _
Shock load	100 g/6 ms per IEC 60068-2-27 and 100 g/2 ms per IEC 60068-2-29
Vibration	12 g, 10...2000 Hz per IEC 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	Thread M18×1.5, 3/4"-16 UNF on request
Connection type	Cable connection
EMC testing:	
RF emission	EN 55016-2-3 Group 1, Class A
Static electricity (ESD)	IEC 61000-4-2 Severity Level 3
Electromagnetic fields (RFI)	IEC 61000-4-3 Severity Level 3
Fast transients (BURST)	IEC 61000-4-4 Severity Level 4
Conducted interference induced by high-frequency fields	IEC 61000-4-6 Severity Level 3

Housing B, metric mounting thread
cable outlet axial, radial



Housing J, flange ∅ 18 mm, PCD ∅ 76.2 mm,
Radial cable outlet



■ Please enter the code for the output signal, interface, coding, nominal stroke, housing, rod end and connection type in the ordering code!

■ Included:
– Transducer
– User guide

Please order separately:
Magnets, page 96
Floats, page 136

Caution! Prior to design, installation and startup, please read the instructions in the user guide!
www.balluff.com

Analog interface, see page 76/77 for technical data
Ordering example:
BTL5-_ _ _-M_ _ _ _-J-DEXC-TA12

Output signal	Standard nominal stroke [mm]	Connection type
A51 0...10 V and 10...0 V, rising and falling	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250 or in 5 mm increments on request	TA12 = 1/2" - 14 NPT internal thread
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 null point and end point **BTL5-A-EH03**

Digital pulse interface, see page 84/85 for technical data
Ordering example:
BTL5-_1-M_ _ _ _-J-DEXC-TA12

Interface	Standard nominal stroke [mm]	Connection type
P Pulse interface P	see above	TA12 = 1/2" - 14 NPT internal thread
M Pulse interface M	Analog interface J-DEXC	
I Pulse interface I		

SSI interface, see page 86/87 for technical data
Ordering example:
BTL5-S1_ _-M_ _ _ _-J-DEXC-TA12

Coding	System resolution	Standard nominal stroke [mm]	Connection type
0 Binary code rising (24 bit)	1 1 µm	see above	TA12 = 1/2" - 14 NPT internal thread
1 Gray code rising (24 bit)	2 5 µm	Analog interface	
6 Binary code rising (25 bit)	3 10 µm	J-DEX max. 4000 mm	
7 Gray code rising (25 bit)	4 20 µm		
	5 40 µm		

CANopen interface, see page 88/89 for technical data
Ordering example:
BTL5-H1_ _-M_ _ _ _-J-DEXC-TA12

Software configuration	Baud rate		Standard nominal stroke [mm]	Connection type
1 1 × position and 1 × velocity	0 1 MBaud	4 125 kBaud	see above	TA12 = 1/2" - 14 NPT internal thread
2 2 × position and 2 × velocity	1 800 kBaud	5 100 kBaud	Analog interface	
	2 500 kBaud	6 50 kBaud	J-DEXC max. 4000 mm	
	3 250 kBaud	7 20 kBaud		
		8 10 kBaud		

PROFIBUS DP interface, see page 90/91 for technical data
Ordering example:
BTL5-T1_ 0-M_ _ _ _-J-DEXC-TA12

Software configuration	Standard nominal stroke [mm]	Connection type
1 1 × position and 1 × velocity	see above Analog interface J-DEXC max. 4000 mm	TA12 = 1/2" - 14 NPT internal thread
2 2 × position and 2 × velocity		

CE 0518
II 1/2 GD

FM APPROVED
Class I, Division I, Groups A, B, C and D
Class II/III, Division I, Groups E, F, and G
T6 Ta = 65°C, T5 Ta = 80°C
Version 4X/6P

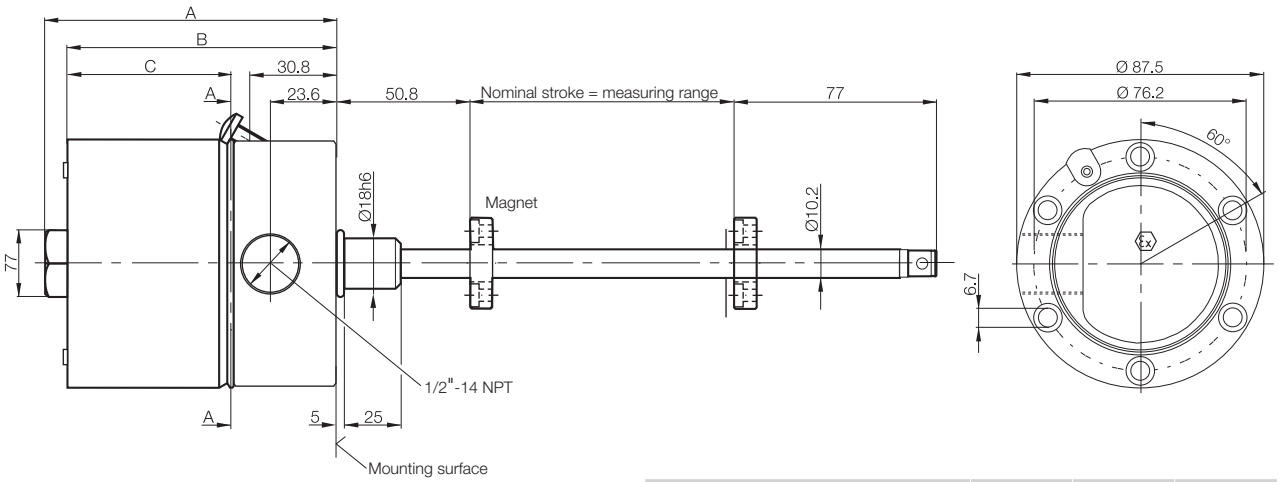
Class I Zone 1
AEx d IIC
T6 Ta = 65°C, T5 Ta = 80°C

EX d IIC T6
Ta = 65°C, T5 Ta = 80°C
IP 68
SIRA 04 ATEX 1290

Caution! Prior to design, installation and startup, please read the instructions in the user guide! www.balluff.com

Series	BTL5_ _-M_ _ _ _-J-DEXC-TA12
Part number	BTL5-_ _-M_ _ _ _-J-DEXC-TA12
Shock load	100 g/6 ms per IEC 60068-2-27
Vibration	12 g, 10...2000 Hz per IEC 60068-2-6
Operating temperature	–20...+80 °C
Storage temperature range	–40...+100 °C
Degree of protection	IP 68
Housing material	Stainless steel Nitronics 60
Outer tube	1.4571 stainless steel
Pressure rating	600 bar max.
Connection type	Screw terminals
Cable entry	Ex cable gland BTL-A-AD09-M-00EX
EMC testing:	
RF emission	EN 55016-2-3 Group 1, Class A
Static electricity (ESD)	IEC 61000-4-2 Severity Level 3
Electromagnetic fields (RFI)	IEC 61000-4-3 Severity Level 3
Fast transients (BURST)	IEC 61000-4-4 Severity Level 3
Conducted interference induced by high-frequency fields	IEC 61000-4-6 Severity Level 3

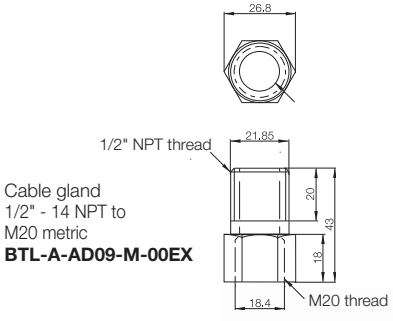
Housing J-DEXC
Flange ∅ 18 mm, PCD ∅ 76.2 mm



The Micropulse transducer J-DEXC has been specially developed for use in hazardous areas. The J-DEXC system fulfills demanding requirements in the oil and gas industry for high reliability and ease of servicing.
J-DEXC comprises a robust flameproof Ex housing and an electronics module that is easily accessed and exchanged for servicing. Spare electronics modules can be ordered from Balluff Service Dept.

Interface	A (mm)	B (mm)	C (mm)
Analog **A, E, C**, digital **P, M, I, SSI**	104.12	96.12	59.5
PROFIBUS-DP, CANopen	135.62	127.62	91

Applications:
- Hydraulic or pneumatically actuated valves
- Clutch travel monitoring for compressors
- Level monitoring
- Level control
- Position sensing for hydraulic cylinders in hazardous areas



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

CSA/AEx
AEx de Class I, Zone I, Groups I & IIC
Class I, Division I & 2, Groups A, B, C, D
Class II & III, Groups E, F, G

CENELEC
SIRA 00A TEX1094
EX de I & IIC
I M2, II 2 GD

■ Please enter the code for the output signal, interface, coding, system solution, software configuration, baud rate, nominal stroke and connection type in the ordering code!

■ Included:
– Transducer
– Short user's guide

Please order separately:
Magnets, page 97
Floats, page 136

Dust protection zone 22 II 3 D T 90°C X

Dust protection zone 22
Devices in these categories are intended for use in areas where swirling dust is not expected to create an explosive atmosphere. The probability is extremely small. Even if it were to occur, it would be only for a short time.
A manufacturer's certificate with the designation

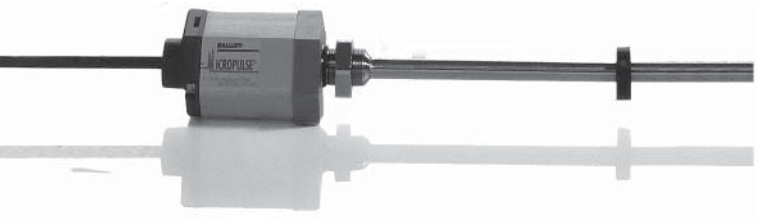
II 3 D T 90°C X
is provided to confirm that the transducer code satisfies requirements for the use of electrical equipment in areas with inflammable dust.


BALLUFF

EG- Konformitätserklärung

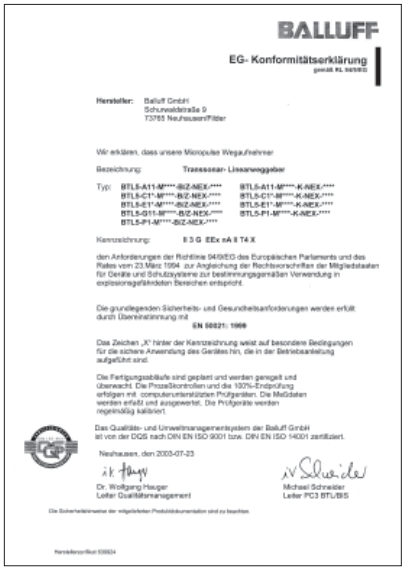
Digital pulse interface, see page 84/85 for technical data
Ordering example:
BTL5-P1-M_ _ _ _-_-PEX-KA02

Standard nominal stroke [mm]	Housing	Connection type
0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500, 4750, 5000, 5250, 5500 or in 5 mm increments on request.	B M18×1.5 Z 3/4"-16UNF	PUR cable 2 m



Caution! Prior to design, installation and startup, please read the instructions in the user guide!
www.balluff.com

Protection type "n"
designated "EEx n"
Devices in these categories 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 certificate is provided, confirming that the product satisfies requirements for the use of electrical equipment in potentially explosive areas.
Several methods of flameproofing are combined under the designation.


BALLUFF

EG- Konformitätserklärung

Hersteller: Balluff GmbH
Schurwaldstraße 9
73765 Neuhausen/Filder

Wir erklären, dass unsere Micropulse Wegaufnehmer

Bezeichnung: Transmitter- Linearweggeber

Typ: BTL5-A11-M****-BIZ-NEX-**** BTL5-A11-M****-K-NEX-****
BTL5-C1*-M****-BIZ-NEX-**** BTL5-C1*-M****-K-NEX-****
BTL5-E1*-M****-BIZ-NEX-**** BTL5-E1*-M****-K-NEX-****
BTL5-G11-M****-BIZ-NEX-**** BTL5-P1-M****-K-NEX-****
BTL5-P1-M****-BIZ-NEX-****

Kennzeichnung: II 3 G EEx nA II T4 X

den Anforderungen der Richtlinie 94/9/EG des Europäischen Parlaments und des Rates vom 23.März 1994 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten für Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen entspricht.

Die grundlegenden Sicherheits- und Gesundheitsanforderungen werden erfüllt durch Übereinstimmung mit
EN 50021: 1999

Das Zeichen „X" hinter der Kennzeichnung weist auf besondere Bedingungen für die sichere Anwendung des Gerätes hin, die in der Betriebsanleitung aufgeführt sind.

Die Fertigungsabläufe sind geplant und werden geregelt und überwacht. Die Prozeßkontrollen und die 100%-Endprüfung erfolgen mit computerunterstützten Prüfgeräten. Die Meßdaten werden erfaßt und ausgewertet. Die Prüfgeräte werden regelmäßig kalibriert.

Das Qualitäts- und Umweltmanagementsystem der Balluff GmbH ist von der DQS nach DIN EN ISO 9001 bzw. DIN EN ISO 14001 zertifiziert.

Neuhausen, den 2003-07-23

Dr. Wolfgang Hauger
Leiter Qualitätsmanagement

Michael Schneider
Leiter PC3 BTL/BIS

Housing K, see page 110/111 for analog interface and page 112/113 for digital pulse interface
Ordering example:
BTL5-_ _ _-M_ _ _ _-K-NEX-_ _ _ _

Output signal

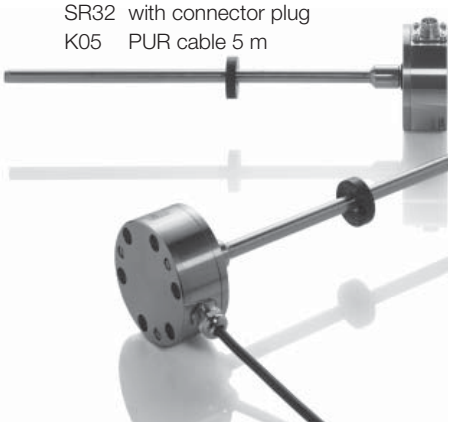
A11	0...10 V and 10...0 V
E10	4...20 mA, rising
E17	20...4 mA, falling
C10	0...20 mA, rising
C17	20...0 mA, falling
P1	Pulse interface P

Standard nominal stroke [mm]

0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500 or in 5 mm increments on request.

Connection type

SR32	with connector plug
K05	PUR cable 5 m



Rod series, see page 76/77 for analog interface and page 84/85 for digital pulse interface
Ordering example:
BTL5-_ _ _-M_ _ _ _-_-NEX-_ _ _ _

Output signal

A11	0...10 V and 10...0 V
E10	4...20 mA, rising
E17	20...4 mA, falling
C10	0...20 mA, rising
C17	20...0 mA, falling
P1	Pulse interface P

Standard nominal stroke [mm]

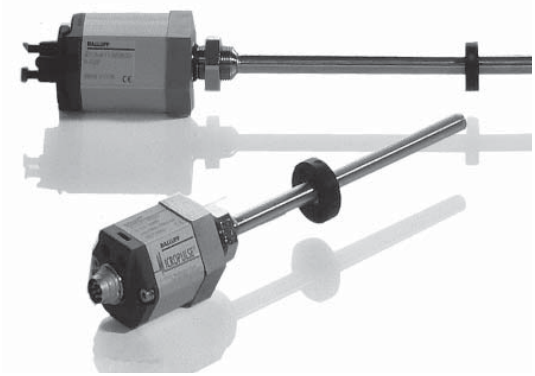
0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500 or
in 5 mm increments on request.

Housing

B	M18×1.5
Z	3/4"-16UNF

Connection type

S32	with connector plug
K05	PUR cable 5 m



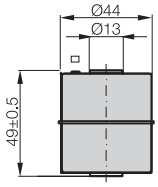
■ Please enter the code for the output signal, nominal stroke, housing and connection type in the ordering code!

Please order separately:
Magnets, page 97
Floats, page 136
Connectors, page 148/149

Floats (Zone 0)

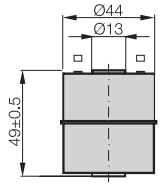
BTL2-S-4414-4Z-Ex
Cylindrical float, zone 0 permitted up to density ρ ≥ 0,7 g/cm³

Orientation:
Raised dimple on upper side of float



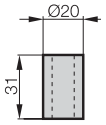
BTL2-S-4414-4Z01-Ex
Cylindrical float, zone 0, density of float ρ = 0.85 g/cm³ for liquid interface sensing

Orientation:
2 raised dimples on upper side of float



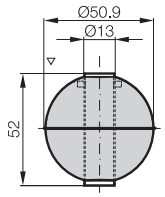
Interface
A second float can be added to measure the position of the interface between two liquids, such as oil and condensed water.
Suitable: BTL2-S-4414-4Z01-Ex.

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.

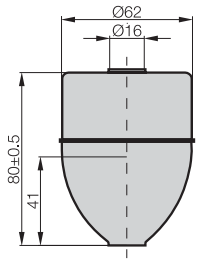


BTL2-S-5113-4K-Ex
Ball float, zone 0 permitted up to density ρ ≥ 0,7 g/cm³

Orientation:
Raised dimple on upper side of float



BTL2-S-6216-8P-Ex
Parabolic float, approved up to ρ ≥ 0,6 g/cm³



Float model	Immersion depths assuming ρ = 1 g/cm³ (H_2O)	ρ = 0.7 g/cm³
BTL2-S-6216-8P-Ex	s_s ~ 41 mm	s_s ~ 57 mm
BTL2-S-5113-4K-Ex	s_s ~ 26 mm	s_s ~ 40 mm
BTL2-S-4414-4Z-Ex	s_s ~ 30 mm	s_s ~ 39 mm
BTL2-S-4414-4Z01-Ex	s_s ~ 45 mm	submerges

See technical data on page 96

Magnets (Zone 1) for installation in hydraulic cylinders

See page 97

Processors, digital displays

See page 163

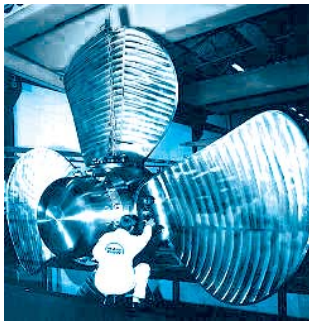
Special series
Difficult applications often make special demands on the sensors. Balluff meets these requirements with transducers that have been specified and developed in conjunction with the system integrator. Behind this is a large, highly motivated Micropulse development team as well as Balluff's own EMC Testing Laboratory and shock and vibration test centers.

The "3-in-1" transducer!
- 2 or 3-way redundant distance measurement system for heightened safety requirements
- One transducer consists of two or three completely separate distance measurement systems
- Start/Stop or analog interfaces
- Compact housing
- Max. nominal stroke 1000 mm

Available outputs:
- Analog 0...10 V, 4...20 mA, 0...20 mA, –10...10 V
- Pulse interface

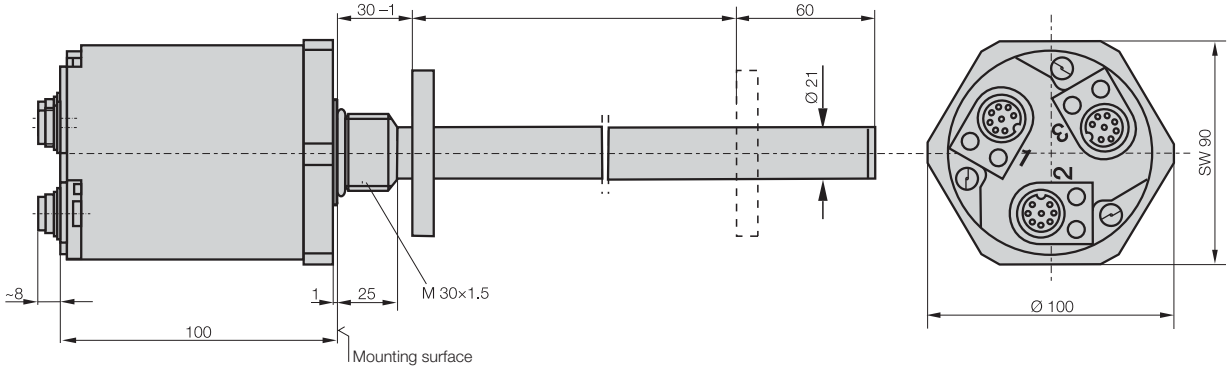
Download the operating instructions from www.balluff.com for more information

Tilting technology on rail cars


Propeller pitch control

Ordering example:
BTL5-_ _ _-M_ _ _ _-T-_S 32

Interfaces	Standard nominal stroke [mm]	Number of redundant systems
Analog:	0025...1000	2 with two independent outputs
Voltage output		
A10 0...10 V		
G10 –10...10 V		3 with three independent outputs
Current output		
C10 0...20 mA, rising		
C17 20...0 mA, falling		
E10 4...20 mA, rising		
E17 20...4 mA, falling		
P1 Pulse interface P		



Rudder control

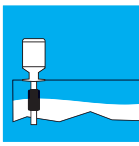
0...10 V
4...20 mA
0...20 mA
–10...10 V


MICROPULSE
MICROPULSE
MICROPULSE

BTL-SF Filling Level Sensor
Contents

SF

MICROPULSE®



The magnetostrictive working principle is ideal for the continuous high-precision measurement of fluid filling levels. Waveguides and processing electronics 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.

BTL-SF Filling Level Sensor
General data

more added value

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

Maximum precision for food hygiene – internationally certified

The BTL-SF filling level sensor ensures continuously precise measurement in applications that demand extreme hygiene. Made from corrosion-free stainless steel with excellent surface quality and rounded edges, the sensor meets the highest international hygiene standards and fulfills all strict requirements of the food industry. 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 ensure flexible installation
- Internationally certified quality guarantees 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 approved.

The EHEDG (European Hygienic Engineering & Design) designation is the European standard for hygiene in the food industry. Our products with this logo conform to EHEDG standards.

The FDA (Food and Drug Administration) oversees the US food and pharmaceutical industry and certifies devices, materials, systems and machines from these sectors. A product designation of this kind makes your system eligible for FDA approval.

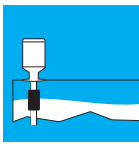
The ECOLAB designation stands for consistency against aggressive cleaning agents. Devices with ECOLAB markings fulfill their standards.

ALPHA

LISTED

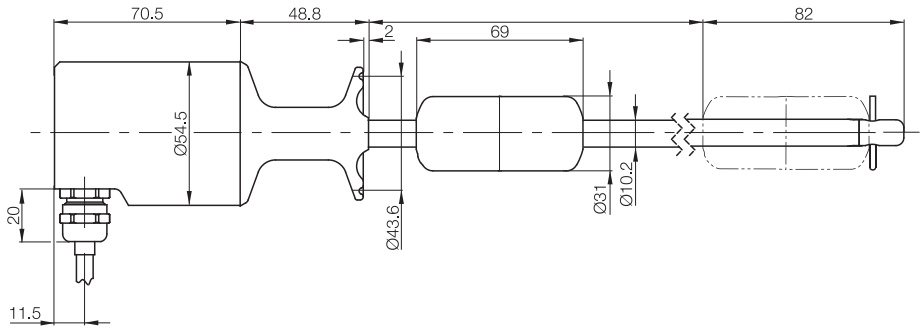
BTL-SF Filling Level Sensor
General data

Series	BTL5 rod SF
Transducer interface	analog
Input interface	analog
Part number	BTL5-...-M_ _ _ _-SF-F_ _ _ _
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
Mounting	1.5" Tri Clamp as per SSI 3A standard 74-03
Pressure rating	300 bar (depending on float)
EMC testing:	
RF emission	EN 55016-2-3 Group 1, Class A and B
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
Fast transients (BURST)	EN 61000-4-4/EN 61000-4-4 Severity Level 3
Line-induced disturbances, 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 nominal stroke (mm)	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500 or in 5 mm increments on request



■ Included:
– Transducer
– Short user's guide

Please order separately:
Tri Clamp, page 146
Floats, page 146
O-ring, page 146
Welded hexagon nipple, page 146



Caution! Prior to design, installation and startup, please read the instructions in the user guide!
www.balluff.com

BTL-SF Filling Level Sensor
Analog interfaces

The industry-standard filling level sensor works with the tried-and-tested Micropulse technology, an 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 accept continuous, (almost) infinitely variable, values between a minimum and a maximum is described as an analog signal.
The output signal of the BTL-SF filling level sensor is analog and directly proportional to the position of the float on the sensor tube.

Features:
- Reasonably priced system solution
- Can be used from each controller
- Cable break monitoring through 4...20 mA signal
- Current signal, interference-free signal transfer
- High resolution and repeatability
- 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		
Input interface		
Part number		
Output voltage		
Output current		
Load current		
max. ripple		
Load resistance		
System resolution		
Hysteresis		
Repeat accuracy		
Sampling rate		
Non-linearity, max.		
Temperature coefficient		
Operating voltage		
Current consumption		
Polarity reversal protected		
Overvoltage protection		
Dielectric strength		
Operating temperature		
Process temperature 130° C for one hour		
Pin assignments	Color	
Output signals	YE	
	GY	
	PK	
	GN	
Operating voltage	BU	
	BN	
	WH	

Connect shield to housing

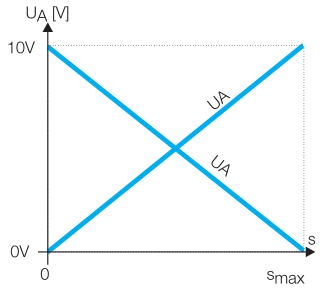
■ Included:
- Transducer
- Short user's guide

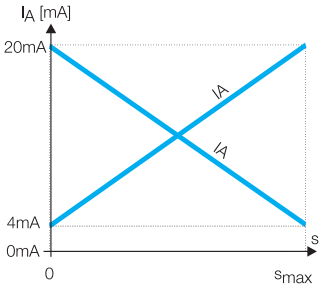
Please order separately:
Tri Clamp, page 146
Floats, page 146
O-ring, page 146
Welded hexagon nipple, page 146

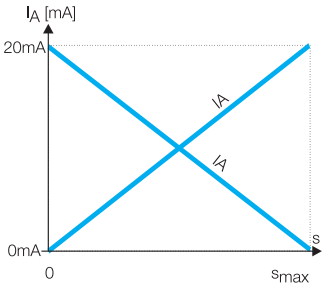
Teflon cable – LIF5Y-FC-5Y (7x0.25mm²):
- Temperature-resistant up to 200 °C
- Good resistance against chemicals and oil

BTL-SF Filling Level Sensor
Analog interfaces

	BTL5 rod SF	**BTL5 rod SF**		**BTL5 rod SF**	
	analog	analog		analog	
	A	**E**		**C**	
	analog	analog		analog	
	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				
		≤ 500 ohms (500 ohms)		≤ 500 ohms (500 ohms)	
	≤ 0.1 mV	≤ 0.2 µA		≤ 0.2 µA	
	≤ 4 µm	≤ 4 µm		≤ 4 µm	
	System resolution/min. 2 µm	System resolution/min. 2 µm		System resolution/min. 2 µm	
	$f_{STANDARD}$ = 500 Hz	$f_{STANDARD}$ = 500 Hz		$f_{STANDARD}$ = 500 Hz	
	±100 µm up to 500 mm nominal stroke	±100 µm up to 500 mm nominal stroke		±100 µm up to 500 mm nominal stroke	
	±0.02 % 500... max. nominal stroke	±0.02 % 500... max. nominal stroke		±0.02 % 500... max. nominal stroke	
	≤ 40 ppm/K for nominal stroke 500 mm, float at center of measuring range	≤ 40 ppm/K for nominal stroke 500 mm, float at center of measuring range		≤ 40 ppm/K for nominal stroke 500 mm, float at center of measuring range	
	20...28 V DC	20...28 V DC		20...28 V DC	
	≤ 150 mA	≤ 150 mA		≤ 150 mA	
	yes	yes		yes	
	36 V	36 V		36 V	
	500 V DC (ground to housing)	500 V DC (ground to housing)		500 V DC (ground to housing)	
	–40...+85 °C	–40...+85 °C		–40...+85 °C	
	–40...+100 °C	–40...+100 °C		–40...+100 °C	
	BTL5-**A**11...	BTL5-**E**10...	BTL5-**E**17...	BTL5-**C**10...	BTL5-**C**17...
		4...20 mA	20...4 mA	0...20 mA	20...0 mA
	0 V Output	0 V Output	0 V Output	0 V Output	0 V Output
	10...0 V				
	0...10 V				
	GND	GND	GND	GND	GND
	+24 V DC	+24 V DC	+24 V DC	+24 V DC	+24 V DC







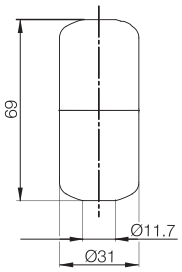
Ordering example:
BTL5-_1_-M_ _ _ _-SF-_ _ _ _

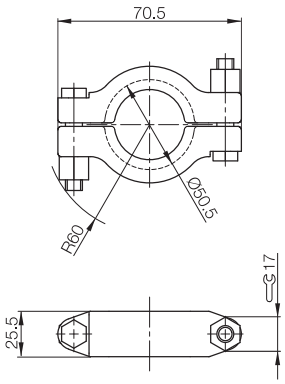
Inter-face	Output signal	Standard nominal stroke [mm]	Radial connection
A	1 Rising	0025, 0050, 0075, 0100, 0125, 0150,	F02 Teflon cable 2 m
E	and falling	0175, 0200, 0225, 0250, 0275, 0300,	F05 Teflon cable 5 m
C	with A	0325, 0350, 0375, 0400, 0425, 0450,	F10 Teflon cable 10 m
	0 Rising	0475, 0500, 0550, 0600, 0650, 0700,	F15 Teflon cable 15 m
	(with C and E)	0750, 0800, 0850, 0900, 0950, 1000,	F20 Teflon cable 20 m
	7 Falling	1100, 1200, 1300, 1400, 1500, 1600,	
	(with C and E)	1700, 1800, 1900, 2000, 2250, 2500	
		or in 5 mm increments on request	

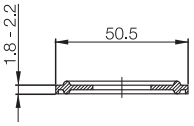
BTL-SF Filling Level Sensor
Floats and accessories

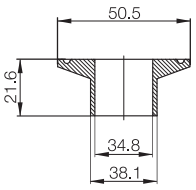


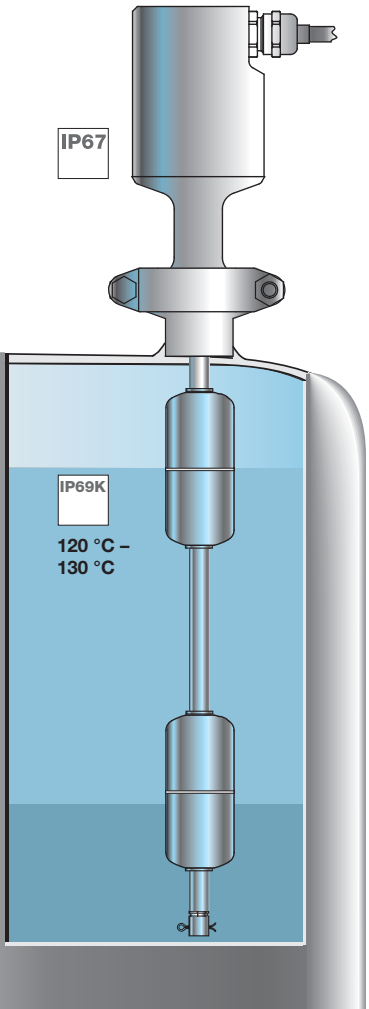

Description	**Float**	**Tri Clamp (DIN 32676)**	**O-ring**	**Welded hexagon nipple**
for series	BTL5 rod SF	BTL5 rod SF	BTL5 rod SF	BTL5 rod SF
Part number	**BTL-S-3112-4Z**	**BAM MC-XA-006-D38.1-5**	**BAM SE-XA-002-D38.1-5**	**BAM-AD-XA-003-D38.1-5**
Material	Stainless steel 1.4404	USA ASTM 316 (1.4401)	Platinum catalyzed silicone	Part no. W. 1.4435 BN2 (Fe ≤ 0.5 %) as per EB 10088
Weight	ca. 30 g			
Operating temperature/ Storage temperature range	–40...+130 °C			
Displacement in water	approx. 31 mm			
Pressure rating (static)	24 bar			







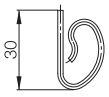




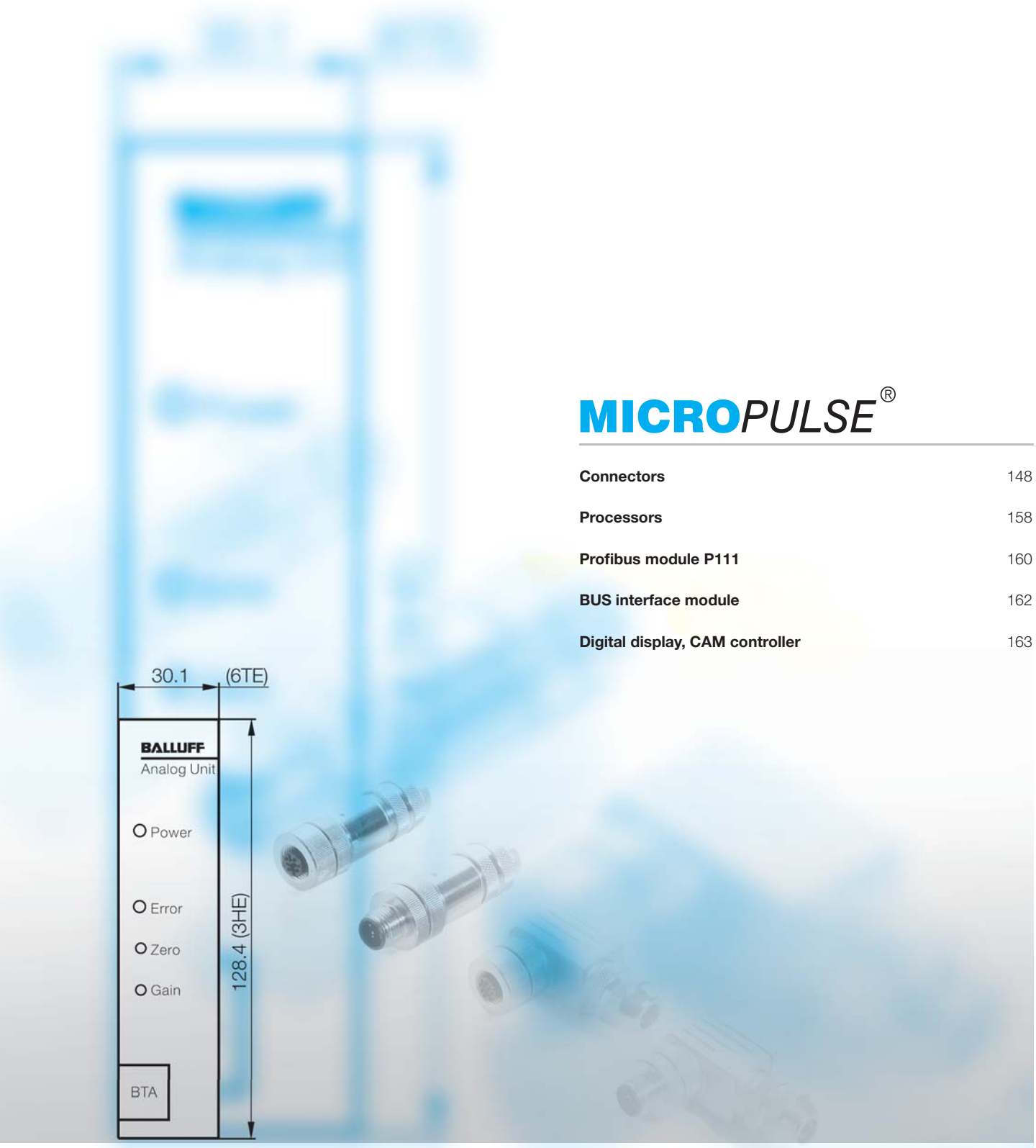
Process temperature:
maximum permissible temperature of the rod under the flange (with media contact).
Certain production processes require, for example sterilization at **120 °C – 130 °C** for 0.5 – 1 hour.

"Junction float" on request.

■ Included in scope of delivery for float:
- Float
- Instructions
- Cotter pin (spring pin 2×30)

Caution!
Approvals only issued through use of these components.
Prior to design, installation and startup, please read the instructions in the user guide!

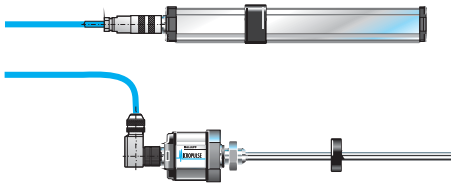


MICROPULSE®

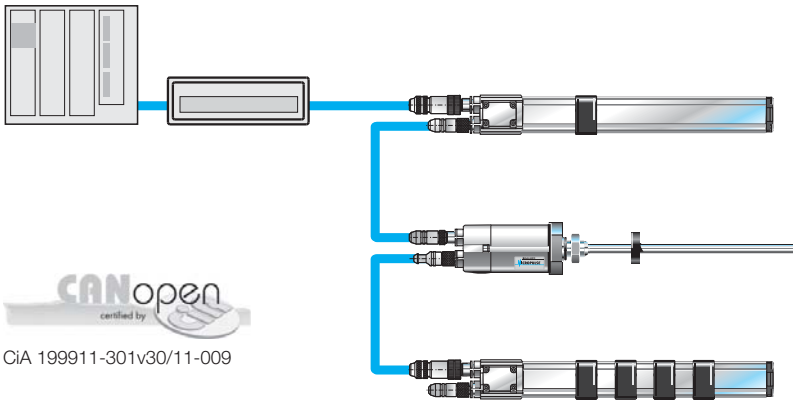
Connectors	**BKS-S 32M**	
for series	BTL5-...-S 32 Soldered connections	
Version	Straight, female	
Part number	**BKS-S 32M-_ _**	
Crimp contacts		
Solder	max. 0.75 mm²	
Housing material	Nickel-plated brass	
Contacts	Brass	
Contact finish	0.8 µm gold plated	
Cable strain relief	PG 9	
Cable diameter min.	6...8 mm	
Cable	Lif2Y-FC-11Y- 0	
No. of wires x conductor cross-section	7×0.25 mm²	
Degree of protection as per IEC 60529	IP 67 (when attached)	
View of female solder side		

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

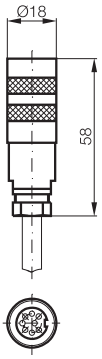
Connector for analog, pulse and SSI interfaces



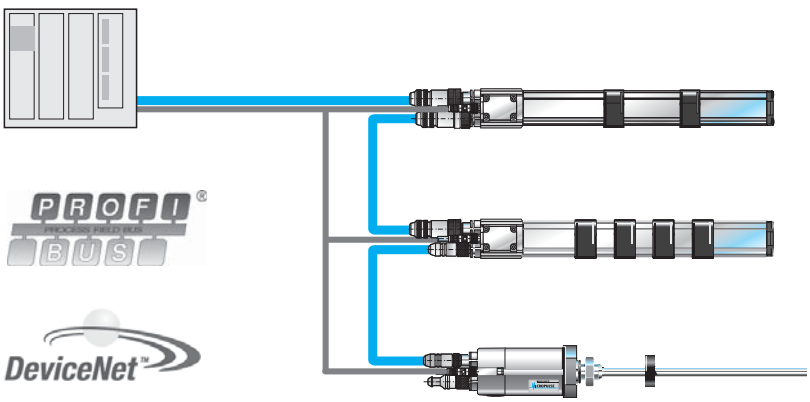
Connectors for CANopen



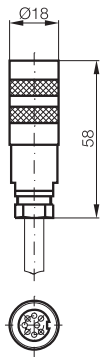
CiA 199911-301v30/11-009

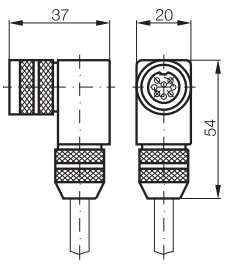


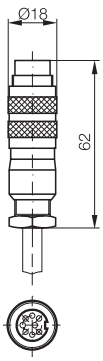
Connectors for PROFIBUS-DP and DeviceNet interfaces

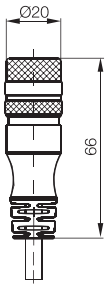


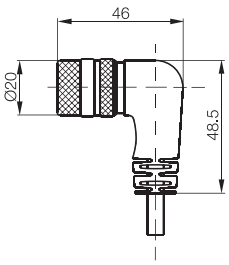
	BKS-S 32M-C	BKS-S 33M	BKS-S 78M	BKS-S232	BKS-S233
	BTL5-...-S 32	BTL5-...-S 32	BTL5-...-S 32	BTL7-_ _ _-S32	BTL7-_ _ _-S32
	Crimp contacts	Soldered connections	Soldered connections		
	Straight, female	Right-angle, female	Straight, male		
	BKS-S 32M-C-_ _	**BKS-S 32M-_ _**	**BKS-S 78M-00**	**BKS-S232-PU-_ _**	**BKS-S233-PU-_ _**
	max. 0.5 mm²				
		max. 0.75 mm²	max. 0.75 mm²		
	Nickel-plated brass	ZnAlCu1 nickel-plated	Nickel-plated brass	PUR	PUR
	Brass	Brass	Brass	Brass	Brass
	0.8 µm gold plated	0.8 µm gold plated	0.8 µm gold plated	0.8 µm gold plated	0.8 µm gold plated
	PG 9	PG 9	PG 9		
	6...8 mm	6...8 mm	6...8 mm		
	Lif2Y-FC-11Y- 0	Lif2Y-FC-11Y- 0		LifgY+LifgY, FC-11Y	LifgY+LifgY, FC-11Y
	7×0.25 mm²	7×0.25 mm²		8×0.25 mm²	8×0.25 mm²
	IP 67 (when attached)	IP 67 (when attached)	IP 67 (when attached)	IP 67 (when attached)	IP 67 (when attached)
					
	PIN Color 1 YE 2 GY 3 PK 5 GN 6 BU 7 BN 8 WH	PIN Color 1 YE 2 GY 3 PK 5 GN 6 BU 7 BN 8 WH	PIN Color 1 YE 2 GY 3 PK 5 GN 6 BU 7 BN 8 WH	PIN Color 1 YE 2 GY 3 PK 5 GN 6 BU 7 BN 8 WH	PIN Color 1 YE 2 GY 3 PK 5 GN 6 BU 7 BN 8 WH



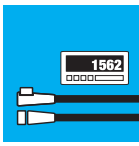








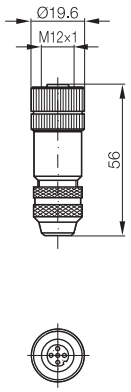
Please include the Part number in the ordering code!
Code 00 for self-assembly
(please use shielded cable).
Code 05, 10, 15, 20, 25, 30 m
for finished cable assembly.

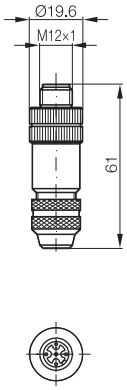


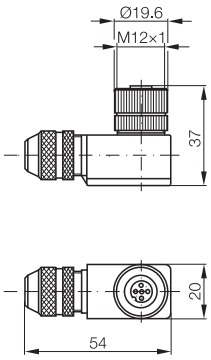
Connectors
Processors
Profibus module P111
BUS interface modules
Digital display CAM controller

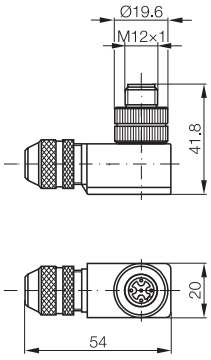
Accessories
Connectors for CANopen and DeviceNet interfaces

Connectors	**BKS-S92-00**	**BKS-S94-00**	**BKS-S93-00**	**BKS-S95-00**
for series	BTL5-H_ _ _-S92/S93/S94 Screw terminals	BTL5-H_ _ _-S92/S93/S94 Screw terminals	BTL5-H_ _ _-S92/S93/S94 Screw terminals	BTL5-H_ _ _-S92/S93/S94 Screw terminals
Version	5-pin, female	5-pin, male	5-pin, female	5-pin, male
Part number	**BKS-S92-00**	**BKS-S94-00**	**BKS-S93-00**	**BKS-S95-00**
Screw terminal	max. 0.75 mm²	max. 0.75 mm²	max. 0.75 mm²	max. 0.75 mm²
Housing material	Nickel-plated brass	Nickel-plated brass	Nickel-plated brass	Nickel-plated brass
Contacts	Brass	Brass	Brass	Brass
Contact finish	0.8 µm gold plated	0.8 µm gold plated	0.8 µm gold plated	0.8 µm gold plated
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
No. of wires x conductor cross-section				
Degree of protection as per IEC 60529	IP 67 (when attached)	IP 67 (when attached)	IP 67 (when attached)	IP 67 (when attached)
Knurled coupling ring				
Finish				
O-ring				
Resistor				
Coding	A	A	A	A
Socket on transducer	1	2	1	2
View of female coupling side				
PIN Signal	1 CAN_GND 2 +24 V 3 GND (0 V) 4 CAN_HIGH 5 CAN_LOW	1 CAN_GND 2 +24 V 3 GND (0 V) 4 CAN_HIGH 5 CAN_LOW	1 CAN_GND 2 +24 V 3 GND (0 V) 4 CAN_HIGH 5 CAN_LOW	1 CAN_GND 2 +24 V 3 GND (0 V) 4 CAN_HIGH 5 CAN_LOW

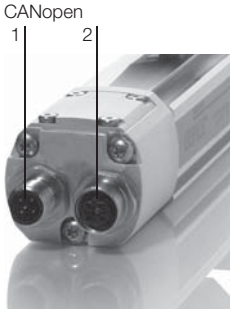








CANopen



DeviceNet

Socket 3
Power supply for DeviceNet:
BKS-S48-15-CP-... page 155

	BKS-S92-TA1	BKS-S137-19-PC-...	BKS-S151-19-PC-...	BKS-S94-R01	BKS-S92-16/GS92-_ _
	BTL5-H_ _ _-S92	BTL5-H_ _ _-S92/S93/S94	BTL5-H_ _ _-S92/S93/S94	BTL5-H_ _ _-S92/S93/S94	BTL5-H_ _ _-S92/S93/S94
	T-splitter, 2 × female, 1 × male	5-pin, female	5-pin, male	Terminating resistor, male	Male/female extension
	BKS-S92-TA1	**BKS-S137-19-PC-...**	**BKS-S151-19-PC-...**	**BKS-S94-R01**	**BKS-S92-16/GS92-_ _**
	PA	PUR	PUR	TPU	PUR
	Brass	Brass	Brass	Brass	Brass
	Ni	0.8 µm gold plated	0.8 µm gold plated	0.8 µm gold plated	0.8 µm gold plated
		5×0.25 mm²	5×0.25 mm²		5×0.34 mm²
	IP 67	IP 67	IP 67	IP 68	IP 67
	Brass	Brass	Brass	Brass	Brass
	2.5 µm Ni	2.5 µm Ni	2.5 µm Ni	2.5 µm Ni	2.5 µm Ni
	HBR	Viton	Viton	Viton	Viton
				121 ohms	
	A	A	A	A	A
	1*	1	2	2	1/2

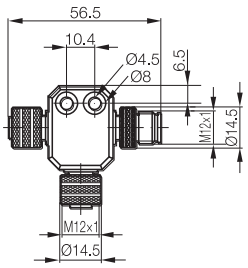
PIN	Signal
1	–
2	–
3	–
4	121 ohms
5	

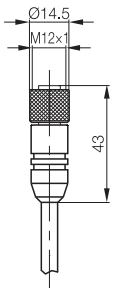
*only for BTL5-H1...-M-P/B-S92

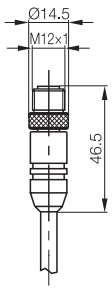
Please include the type designation in the ordering code!
02 = Length 2 m
05 = Length 5 m
10 = Length 10 m

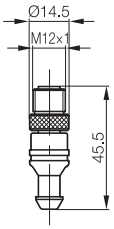
Please include the type designation in the ordering code!
02 = Length 2 m
05 = Length 5 m
10 = Length 10 m

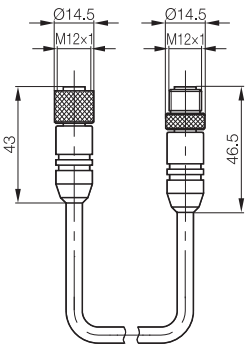
Please include the type designation in the ordering code!
02 = Length 2 m
05 = Length 5 m
10 = Length 10 m





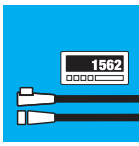






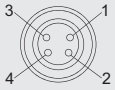
Please order the clear view cover separately!

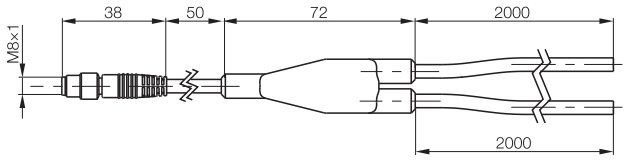
Order designation:
BTL5-A-CP01-K

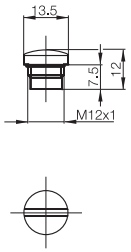


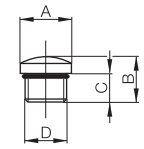
Connectors
Processors
Profibus module P111
BUS interface modules
Digital display CAM controller

Accessories
Y connectors M8 for CANopen®

Connector	1×M8 straight/2×3-wire		
Description	Y connector	M12 screw plug	M12 screw plug
Version	Male		
Use	Splitter boxes	IP 65 screw plug for unused ports	IP 65 screw plug for unused ports
Ordering code		**BAM0114**	**BAM00K7**
Part number	BKS-S 75-TB4-05-PU-00.05/02/02	BKS 12-CS-01	BKS 12-CS-00
Operating voltage U_B	10...30 V DC		
No. of wires × cross-section	4×0.34 mm²		
Cable diameter min.	max. 51 mm		
Connection	molded-in		
Degree of protection as per IEC 60529	IP 67		
Ambient temperature range T_a	–25...+85 °C	–20...+80 °C	–20...+80 °C
Housing material	PUR	Nickel-plated brass	Plastic
View of female/male side	 PIN 1: brown PIN 2: white PIN 3: blue PIN 4: black		







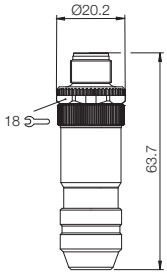
	A	B	C	D
BKS12	Ø13.5	12	7,5	M12×1

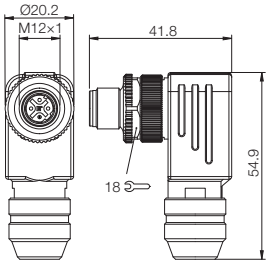


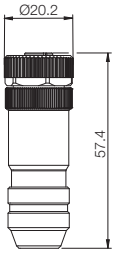

Connectors	M12	M12	M12	M12
Version	B-coded 5-pin	B-coded 5-pin	B-coded 5-pin	B-coded 5-pin
Use	Male	Male	Female	Female
Ordering code	**BCC0714**	**BCC0716**	**BCC0715**	**BCC0717**
Part number	BCC M475-0000-2B-000-01X575-000	BCC M485-0000-2B-000-01X575-000	BCC M475-0000-1B-000-01X575-000	BCC M485-0000-1B-000-01X575-000
Operating voltage U_B	10...30 V DC	10...30 V DC	10...30 V DC	10...30 V DC
No. of wires × cross-section	5× max. 0.75 mm²	5× max. 0.75 mm²	5× max. 0.75 mm²	5× max. 0.75 mm²
Cable diameter min.	Max. 8.0 mm	Max. 8.0 mm	Max. 8.0 mm	Max. 8.0 mm
Connection	Screw terminal	Screw terminal	Screw terminal	Screw terminal
Degree of protection as per IEC 60529	IP 67	IP 67	IP 67	IP 67
Ambient temperature range T_a	–25...+85 °C	–25...+85 °C	–25...+85 °C	–25...+85 °C
Housing material	Brass	Brass	Brass	Brass
Shielded version	Yes*	Yes*	Yes*	Yes*
Coding	B	B	B	B
Socket on transducer	2	2	1	1
View of female/male side				

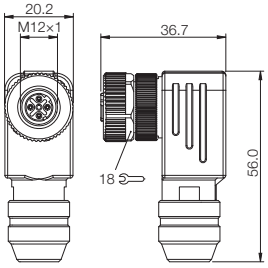
*Knurled ring used for shielding

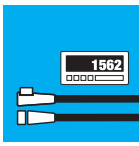
previously	**previously**	**previously**	**previously**
BKS-S 105-00	**BKS-S 106-00**	**BKS-S 103-00**	**BKS-S 104-00**
00.3 = Length 0.3 m	00.3 = Length 0.3 m	00.3 = Length 0.3 m	00.3 = Length 0.3 m
02 = Length 2 m	02 = Length 2 m	02 = Length 2 m	02 = Length 2 m
05 = Length 5 m	05 = Length 5 m	05 = Length 5 m	05 = Length 5 m
10 = Length 10 m	10 = Length 10 m	10 = Length 10 m	10 = Length 10 m











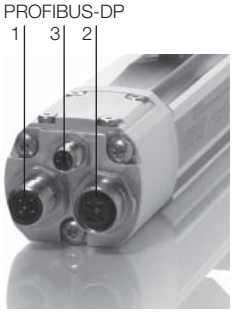
Connectors
Processors
Profibus module P111
BUS interface modules
Digital display CAM controller

more added value

Shielded throughout!

Pin assignments
BTL5-T1_ _-M-_ _ _ -_-S103

		5-pin	3-pin
Control and data signals	Data GND	3	
	RxD/TxD-N (A)	2	
	RxD/TxD-N (B)	4	
	VP +5V	1	
Operating voltage	+24 V		1
	0 V (GND)		3
	Ground PROFIBUS-DP	5	
	Shield supply		4
Socket on transducer		1/2	3



Accessories

M12 connectors, 5-pin, B-coded for PROFIBUS-DP

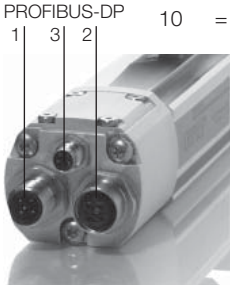
Connector diagram and wiring	 1 NC 2 Line A green 3 NC 4 Line B red 5 NC	 1 NC 2 Line A green 3 NC 4 Line B red 5 NC	
Configuration			
Version			
Use	Female/male	Female	
Operating voltage U_B	300 V	300 V	
Cable	PUR	PUR	
No. of wires × conductor cross-section	2×0.38 mm²	2×0.38 mm²	
Degree of protection as per IEC 60529	IP 67	IP 67	
Ambient temperature range T_a	–25...+80 °C	–25...+80 °C	
Housing material	PUR	PUR	
Knurled coupling ring	Nickel-plated brass	Nickel-plated brass	
Coding	B	B	
Socket on transducer	1/2	1	

Cable material	Color	Length	Ordering code		
			Part number		
PUR	Violet	0.6 m	**BCC070M**		
			BCC M415-M415-3B-329-PS72N1-006		
PUR	Violet	1 m	**BCC070N**		
			BCC M415-M415-3B-329-PS72N1-010		
PUR	Violet	2 m	**BCC070P**	**BCC070Y**	
			BCC M415-M415-3B-329-PS72N1-020	BCC M415-0000-1B-031-PS72N1-020	
PUR	Violet	5 m	**BCC070R**	**BCC070Z**	
			BCC M415-M415-3B-329-PS72N1-050	BCC M415-0000-1B-031-PS72N1-050	
PUR	Violet	10 m	**BCC070T**	**BCC0710**	
			BCC M415-M415-3B-329-PS72N1-100	BCC M415-0000-1B-031-PS72N1-100	
PUR	Violet	15 m	**BCC070U**		
			BCC M415-M415-3B-329-PS72N1-150		
PUR	Violet	20 m	**BCC070W**		
			BCC M415-M415-3B-329-PS72N1-200		
PUR	Black	2 m			
PUR	Black	5 m			
PUR	Black	10 m			

CE

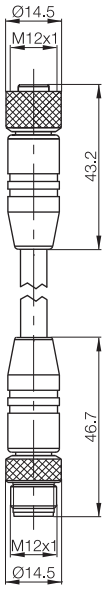
previously BKS-S103/GS103-CP-_ _

00.3 = Length 0.3 m
02 = Length 2 m
05 = Length 5 m
10 = Length 10 m



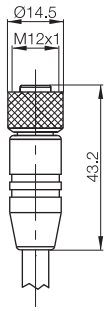
Pin assignments
BTL5-T1_ _-M-_ _ _ -_-S103

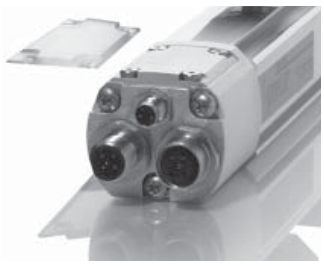
		5-pin	3-pin
Control and data signals	Data GND	3	
	RxD/TxD-N (A)	2	
	RxD/TxD-N (B)	4	
	VP +5V	1	
Operating voltage	+24 V		1
	0 V (GND)		3
	Ground PROFIBUS-DP	5	
	Shield supply		4
Socket on transducer		1/2	3



previously BKS-S103-CP-_ _

00.3 = Length 0.3 m
02 = Length 2 m
05 = Length 5 m
10 = Length 10 m





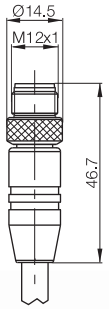
Please order the clear view cover separately!
Order designation: BTL5-A-CP01-K

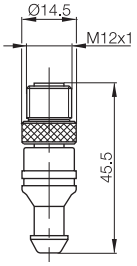
	 1 NC 2 Line A green 3 NC 4 Line B red 5 NC		
		M12 terminating resistor	
		B-coded, 5-pin	
	Male	Male	
	300 V	10...30 V DC	
	PUR		
	2×0.38 mm²		2×0.25 mm²
	IP 67	IP 67	IP 67
	–25...+80 °C	–40...+85 °C	
	PUR	Plastic	PUR
	Nickel-plated brass		
	B	B	
	2	2	3*

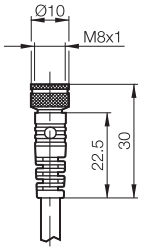
	Ordering code		
	Part number		
	BCC0711		
	BCC M415-0000-2B-031-PS72N1-020		
	BCC0712		
	BCC M415-0000-2B-031-PS72N1-050		
	BCC0713		
	BCC M415-0000-2B-031-PS72N1-100		
			BKS-S 48-15-CP-02
			BKS-S 48-15-CP-05
			BKS-S 48-15-CP-10
		BCC00Y8	
		BKS-S105-R01	

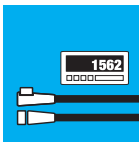
previously BKS-S105-CP-_ _

00.3 = Length 0.3 m
02 = Length 2 m
05 = Length 5 m
10 = Length 10 m









Connectors
Processors
Profibus module P111
BUS interface modules
Digital display CAM controller

Accessories

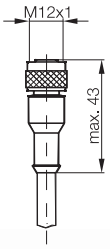
M12 female straight and right-angle connectors, 8-pin, customized assembly

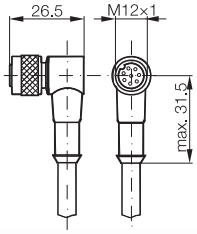
Connectors	**BKS-S115-PU-_ _**	**BKS-S116-PU-_ _**
for series	BTL6-...-S115	BTL6-...-S115
Version	8-pin, straight, female	8-pin, right-angle, female
Part number	**BKS-S115-PU-_ _**	**BKS-S116-PU-_ _**
Screw terminal		
Housing material	PUR	PUR
Contacts	Brass	Brass
Contact finish	0.8 µm gold plated	0.8 µm gold plated
Degree of protection as per IEC 60529	IP 67	IP 67
Knurled coupling ring	Brass	Brass
Finish	2.5 µm Ni	2.5 µm Ni
O-ring	Viton	Viton
Cable	Molded PUR	Molded PUR
No. of wires × conductor cross-section	8×0.25 mm2	8×0.25 mm2
Version	LIYY-CF11Y	LIYY-CF11Y
Conductor configuration	14 × 0.15 mm	14 × 0.15 mm
Outer diameter	6.6 ±0.2 mm	6.6 ±0.2 mm
Min. bending radius	dynamic 4 × D, static 3 × D	dynamic 4 × D, static 3 × D
Pin assignments View of female		

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

Please include the type designation in the ordering code!

02 = Length 2 m
05 = Length 5 m
10 = Length 10 m
15 = Length 15 m
20 = Length 20 m
25 = Length 25 m

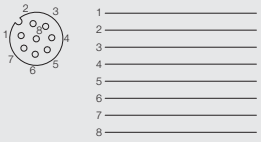
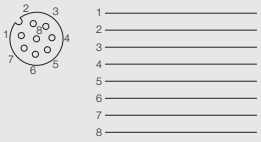




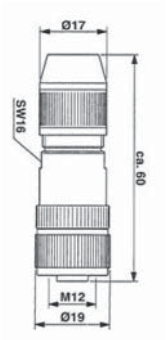
Adapter BKS-S115 to BKS-S 32
Ordering code:
BKS-S115/GS32-PU-00.2

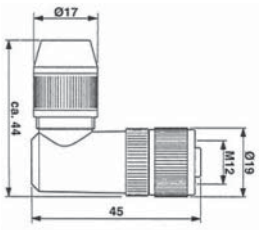
Accessories

M12 female straight and right-angle connector, 8-pin, customized assembly for AT VARAN profile series

View of Female/male side		
Version	M12 female straight, 8-pin	M12 female right-angle, 8-pin
Operating voltage max. U_S	18...30 V DC	18...30 V DC
Rated operating current I_e	250 V DC	250 V DC
Cable	4...8 mm	4...8 mm
No. of wires × conductor cross-section	8×0.14...0.25 mm²	8×0.14...0.25 mm²
Degree of protection as per IEC 60529	IP 67	IP 67
Ambient temperature range T_a	–25...+85° C	–25...+85° C
Housing material	Brass	Brass
Use	BPI, M8, 3-pin, 8-way, BIC	BPI, M8, 3-pin, 8-way, BIC

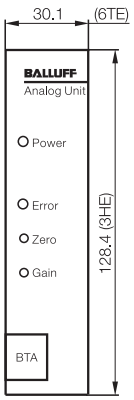
	Ordering code	
	Part number	
	BCC04MC	**BCC050F**
	BCC M478-0000-1A-000-43X834-000	BCC M488-0000-1A-000-43X834-000

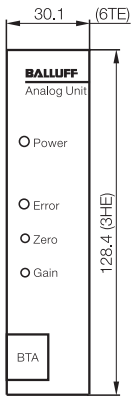


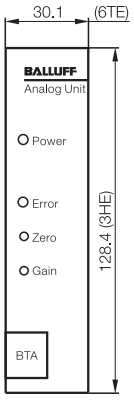


Series		BTA-A	BTA-C	BTA-E
Output signal	Travel signal	analog	analog	analog
	Velocity	analog	analog	analog
Input interface (transducer)		**P**	**P**	**P**
Part number		**BTA-A1_-_ _ _ _**	**BTA-C1_-_ _ _ _**	**BTA-E1_-_ _ _ _**
Features		Resolution 0.1 mV/0.2 µA, LED function indicator, End point adjust 15 %, Span adjust 15 %, Velocity output, Error output (relay)	Resolution 0.1 mV/0.2 µA, LED function indicator, End point adjust 15 %, Span adjust 15 %, Velocity output, Error output (relay)	Resolution 0.1 mV/0.2 µA, LED function indicator, End point adjust 15 %, Span adjust 15 %, Velocity output, Error output (relay)
Nominal stroke of transducer		50...5500 mm	50...5500 mm	50...5500 mm
Housing		Edge connector, 32-pin, DIN 41612 F, 19" plug-in card	Edge connector, 32-pin, DIN 41612 F, 19" plug-in card	Edge connector, 32-pin, DIN 41612 F, 19" plug-in card
Operating voltage		20...28 V DC		
Current consumption		130 mA at 24 V DC	130 mA at 24 V DC	130 mA at 24 V DC
Operating temperature		0...60 °C	0...60 °C	0...60 °C
Update time for standard		1 kHz	1 kHz	1 kHz
Interface		analog voltage	analog voltage, current	analog voltage, current
Output signals	Travel signals	analog 0...10 V and 10...0 V	analog 0...10 V and 10...0 V, 0...20 mA	analog 0...10 V and 10...0 V, 4...20 mA
	Velocity	analog ±10 V at ±2.5 m/s	analog ±10 V at ±2.5 m/s	analog ±10 V at ±2.5 m/s
Accessories (please order separately)		Card holder 48-pin Form F/627164	Card holder 48-pin Form F/627164	Card holder 48-pin Form F/627164

Features:
- The processors are configured in a Eurocard format for use in 19" racks and card holders / top-hat rail fitting
- The position values are updated at a frequency of max. 2 kHz, so that the actual position can be captured even at high traverse speeds with negligible lag error
- High resolution (down to 0.01 mm) provided by micro-controller-controlled digitizing
- Parallel data format selectable binary, BCD or gray.
- Data format SSI (only BTM-H)
- Noise-immune data transmission between processor and transducer provided by RS485/422 differential line drivers, with cable lengths up to 500 m.
- ERROR output for immediate notification of cable break, defective or missing magnet.







Micropulse analog processor
■ Please enter the code for the output signal and nominal stroke in the ordering code!

Ordering examples:
BTA-A1_-_ _ _

Output signal

0 Rising, use only for current output
7 Falling, use only for current output
1 Rising/falling, use only for voltage output

Nominal stroke

Transducer in [mm]

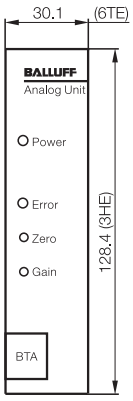
Micropulse digital processor
■ Please enter the code for the output signal and nominal stroke in the ordering code!

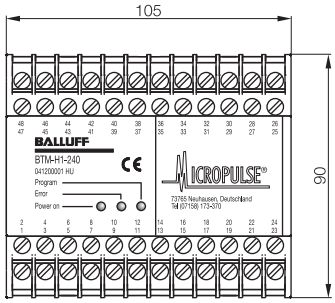
BTM-H1-_ _ _

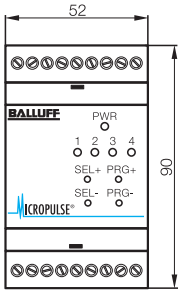
Output driver

240 Source driver (PNP with SCP, 10...30 V) and 24-bit synchronous serial data transmission (SSI)
340 TTL outputs tri-state and 24-bit synchronous serial data transmission (SSI)

	BTA-G	BTM-H1	BTM-_1
	analog	digital	analog
	analog		analog
	P	**P**	**P**
	BTA-G1_-_ _ _ _	**BTM-H1_-_ _ _**	**BTM-_1_-_ _ _**
	Resolution 0.1 mV/0.2 µA, LED function indicator, End point adjust 15 %, Span adjust 15 %, Velocity output, Error output (relay)	Resolution 0.01 mm, 0.025 mm, 0.1 mm, 1 mm, BCD, binary, gray code, null point adjustment, direction signal, DATA READY, min./max. programming, ENABLE, DATA HOLD, bus-compatible, ERROR output. Replaces processors: BTA-D, BTA-H, BTA-P	Resolution 16 bits Up to 4 magnets on a single transducer can be processed individually. Analog velocity output. 100 % programmable measuring range, ERROR output
	50...5500 mm	50...5500 mm	25...4000 mm
	Edge connector, 32-pin, DIN 41612 F, 19" plug-in card	Plastic housing for mounting on standard top-hat rail EN 50022-35	Plastic housing for mounting on standard top-hat rail EN 50022-35
	130 mA at 24 V DC	max. 500 mA	max. 300 mA
	0...60 °C	0...60 °C	0...70 °C
	1 kHz	2 kHz	2 kHz
	analog voltage	digital 22 bit parallel BCD, binary, gray code, 24 bit synchronous serial (SSI) gray code	analogue, voltage or current see ordering code
	analog –10...+10 V and +10...–10 V	Digital TTL 5 V DC (BTM-H1-340) PNP source driver, 24 V DC (BTM-H1-240)	Analog, voltage or current see ordering code
	analog ±10 V at ±2.5 m/s		analog ±10 V programmed to 1000 mm/s, adjustable over the range 50 mm/s...10 m/s
	Card holder 48-pin Form F/627164		







Connectors
Processors
Profibus module P111
BUS interface modules
Digital display CAM controller

Micropulse analog module

■ Please enter the code for the output signal and version in the ordering code!

Ordering examples:

BTM-_1-_ _ _

Output signal | **Versions**

A	0...10 V, 10...0 V –10...10 V, 10...–10 V	101	1 analog output, 1 magnet
		102	2 analog outputs, 2 magnets
E	4...20 mA, 20...4 mA 0...20 mA, 20...0 mA	103	3 analog outputs, 3 magnets
		104	4 analog outputs, 4 magnets

BTM-_1-102-VM1000

Output signal | **Versions** | **Velocity**

A E	2 analog outputs, 1 magnet with velocity	±10 V at a velocity of 1000 mm/s

Accessories
Profibus modules P111 for BTL

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

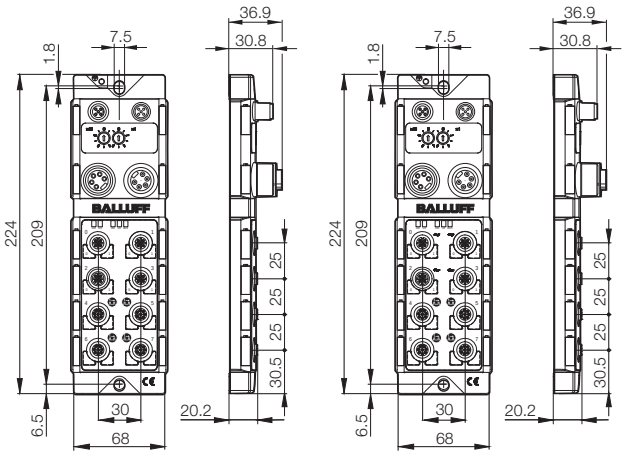
The modules have a robust metal housing that was designed for use in harsh industrial environments and is capable of withstanding powerful mechanical loads. These modules are fitted with four interdependent ports for Micropulse transducers BTL with P111 or M1 pulse interfaces. A maximum of 16 magnets can be used per BTL port. The maximum nominal stroke 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.

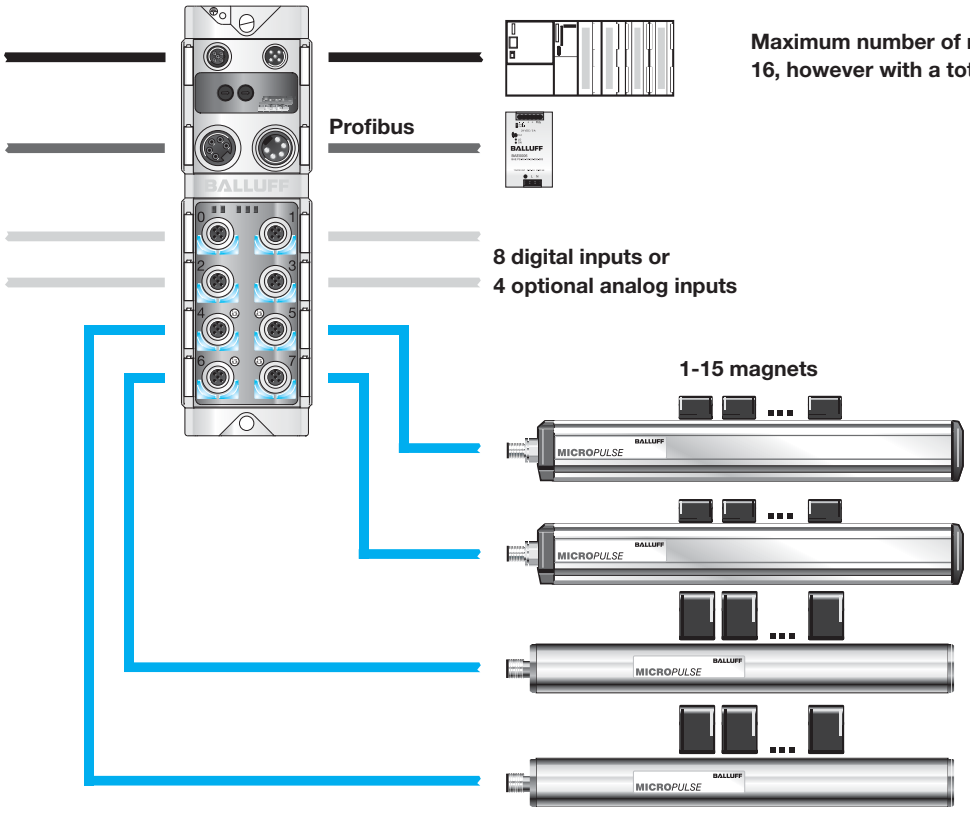
digital Inputs

analog Inputs

Fieldbus	Profibus	Profibus
Version	4× P111 or M1	4× P111 or M1
Ordering code	**BNI001A**	**BNI002H**
Part number	BNI-PBS-551-000-Z001	BNI-PBS-552-000-Z001
Operating voltage U_B	18...30 V DC	18...30 V DC
Function indicator	BUS RUN	BUS RUN
Fault function indicator	Red LED	
Power indicator	U_A, U_S, undervoltage	U_A, U_S, undervoltage
Connection: Fieldbus	M12, B-coded	M12, B-coded
Connection: Operating voltage	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 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 attached)	IP 67 (when attached)
Operating temperature T_a	0...+55 °C	0...+55 °C
Weight	approx. 735 g	approx. 735 g
Mounting	2 mounting holes	2 mounting holes
Dimensions (L×W×H)	224×68×36.9	224×68×36.9
Housing material	Nickel-plated GD-Zn, matt finish	Nickel-plated GD-Zn, matt finish



All modules include 4 screw plugs and 1 label set.



Maximum number of magnets per BTL is 16, however with a total of only 60 per module

1562
Connectors
Processors
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BUS interface modules
Digital display CAM controller

WAGO digital pulse interface 750-635 for BTL5-P1-_ _ or BTL6-P1_ _-

The digital pulse interface was developed for connecting Micropulse transducers (BTL5-P1-...). Die RS422 interface assures quick and noise-immune transmission of signals with a resolution down to 1µm. The absolute position of the Micropulse transducer is sent to the supervisory controller as a 24-bit value.
The controller can perform a null point offset and configure the number of magnets.
The bus terminal with digital pulse interface can be operated by all bus drivers of the WAGO-I/O-SYSTEM 750, except the Economy variants.

Interfaces:
- InterBus
- PROFIBUS-DP
- CANopen
- DeviceNet
- Ethernet TCP/IP
- MODBUS
- CC Link

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

Further technical details and orders from:

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

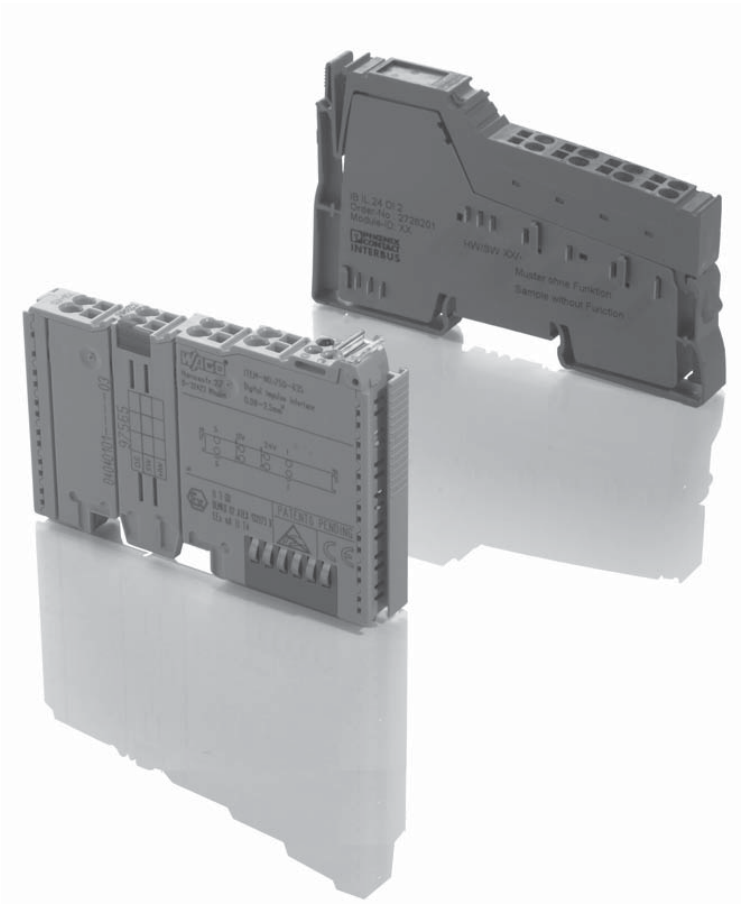
Phoenix Contact IMPULSE-IN terminal for BTL5-P1-_ _ or BTL6-P1_ _-

The IB IL IMPULSE-IN is a terminal from the Inline product family by Phoenix Contact and processes the Micropulse transducer with pulse interface.
The IMPULSE-IN terminal enables particularly cost-effective solutions because it senses the positions using the 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.

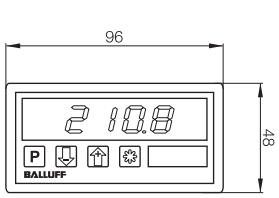
Interfaces:
- InterBus
- PROFIBUS-DP
- CANopen
- DeviceNet
- Ethernet

Further technical details and orders from:

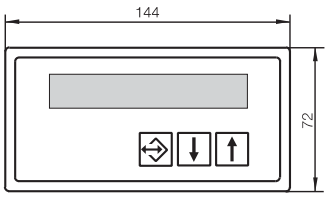
Phoenix Contact
GmbH & Co. KG
Flachsmarktstraße 8
32823 Blomberg
Phone +49 5235-300
Fax +49 5235-341200
E-mail: info@phoenixcontact.com
www.phoenixcontact.com



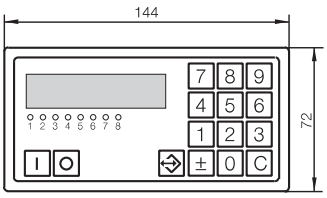
Series	BDD-UM 3023	BDD-AM 10-1-P	BDD-AM 10-1-SSD	BDD-CC 08-1-P	BDD-CC 08-1-SSD
	Digital display for analog input signals Current/voltage	Digital display for BTL5-P with P Interface	Digital display for BTL5-S with SSD interface	CAM controller for BTL5-P with P Interface	CAM controller for BTL5-S with SSD interface
Part number	**BDD-UM 3023**	**BDD-AM 10-1-P**	**BDD-AM 10-1-SSD**	**BDD-CC 08-1-P**	**BDD-CC 08-1-SSD**
Features	– 4-digit display with prefix – LED display 14 mm high red 7-segment – Programmable decimal point setting – 12-bit AC/DC converter – Measuring range selection – Voltage input 0-10V – Current input 0/4-20 mA – Scalable display range	– Seven 1/2-digit display with prefix – LED display 14 mm high red 7-segment – Scalable units – Variable decimal point setting – Adjustable null point – Operating voltage 10...32 V – 2 programmable relay outputs, defined as – Limit switch/comparator – Dwell – 2-position controller – 1 configurable input – External null set – Latch display value – Isolated DIN housing for mounting in front panel (mounting hardware included)		– 8 programmable outputs – 8 directional switching points possible – LED display, 14 mm high red 7-segment, 6-digit – LEDs for switching point status on front panel – 300 switching points can be distributed over up to 15 programs – Adjustable null point offset – Dynamic deadtime compensation for each individual switching point – Multiple BDD-CC 08 can be wired in parallel – Integrated transducer supply voltage 300 mA, 24 V – Isolated DIN housing for mounting in front panel (mounting hardware included)	



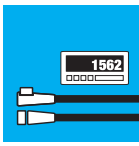
Housing depth 55.5 mm



Housing depth 110 mm



Housing depth 110 mm



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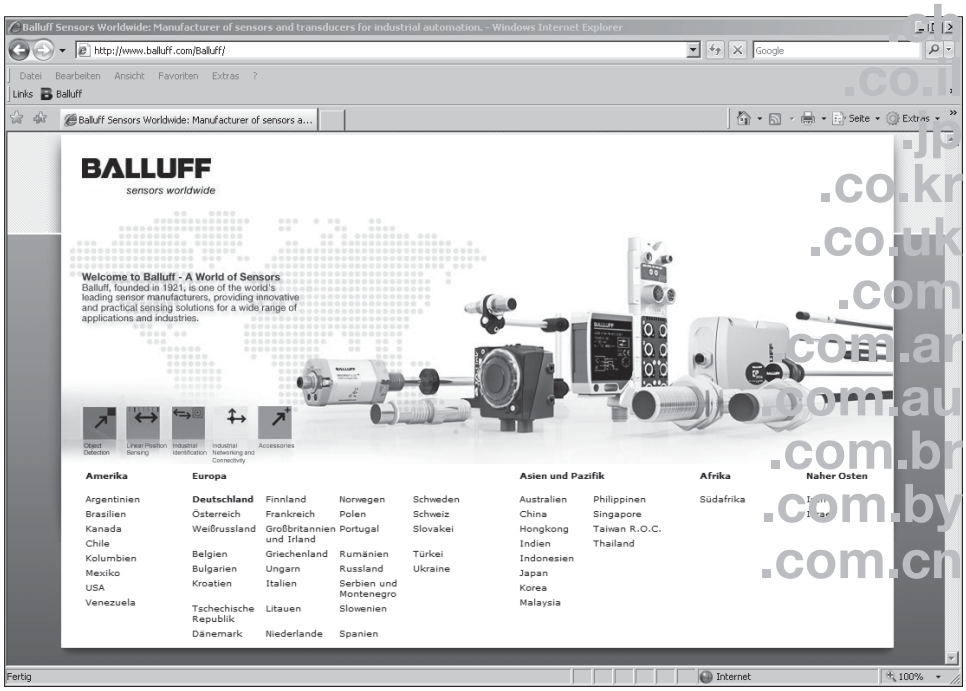

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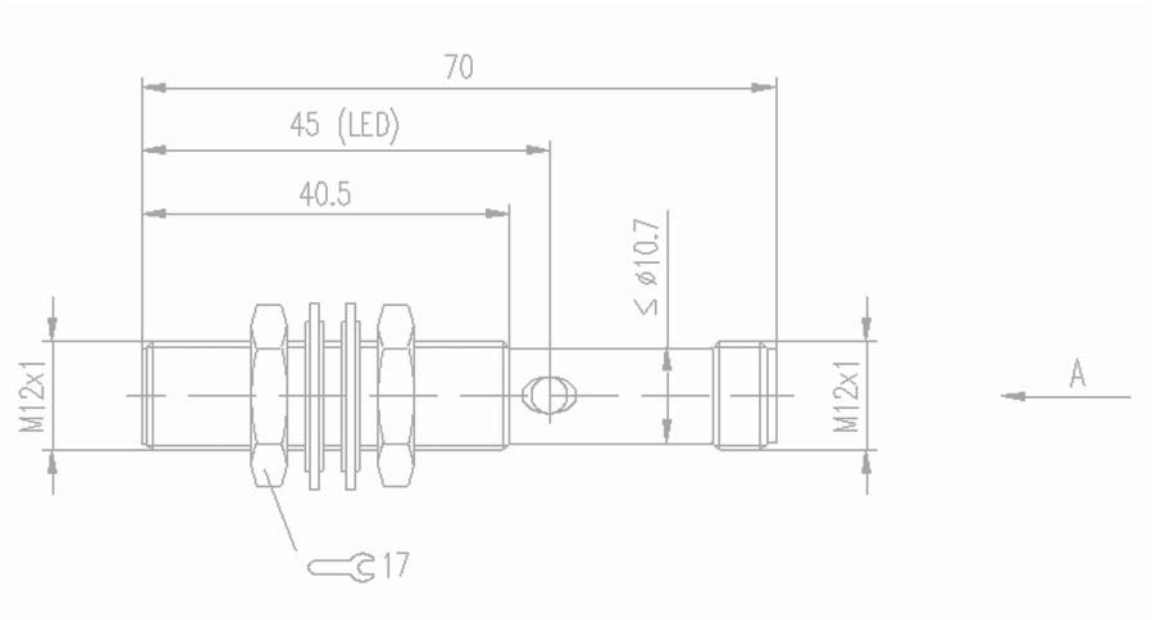

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Sales and Logistics Services

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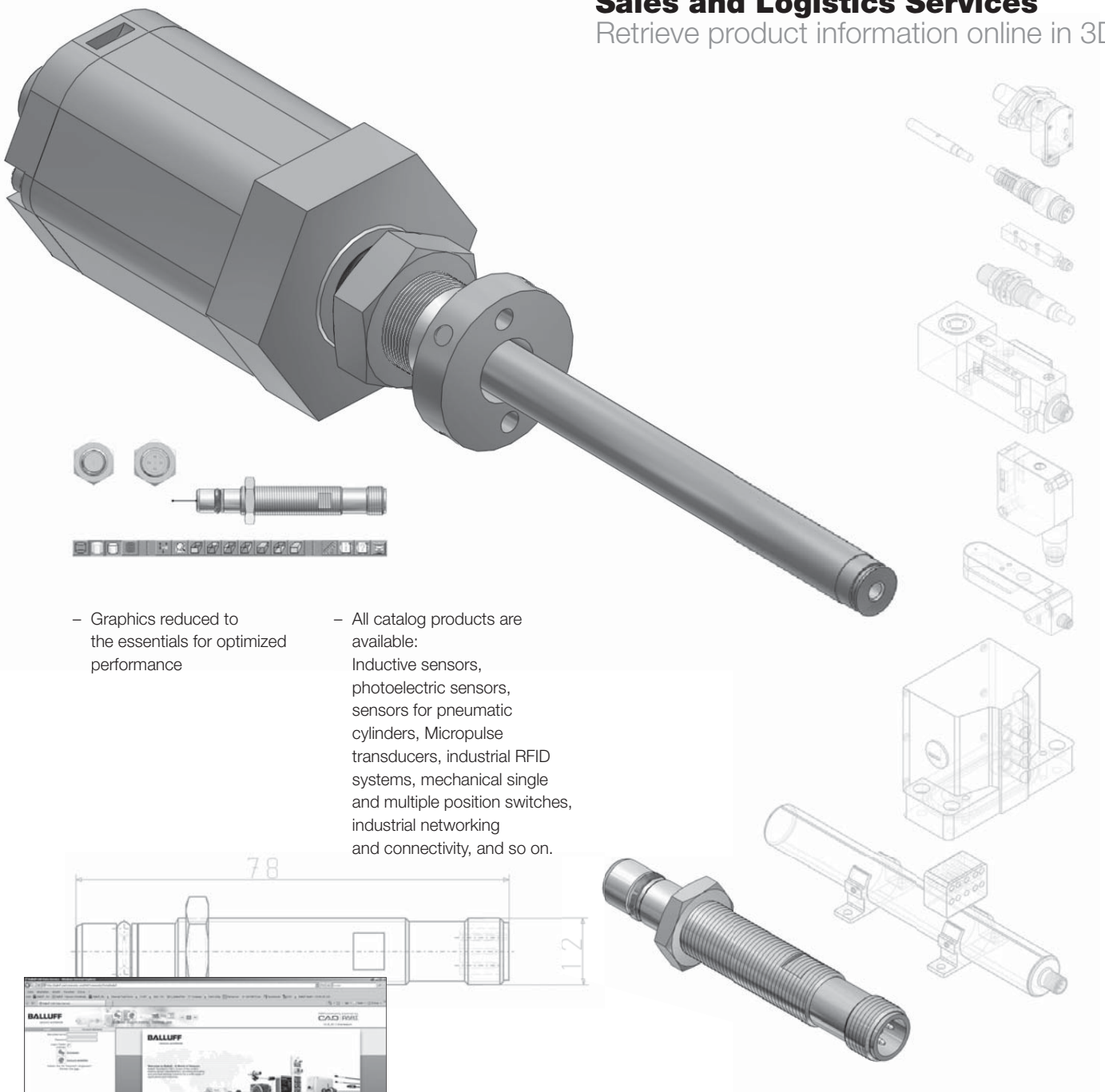
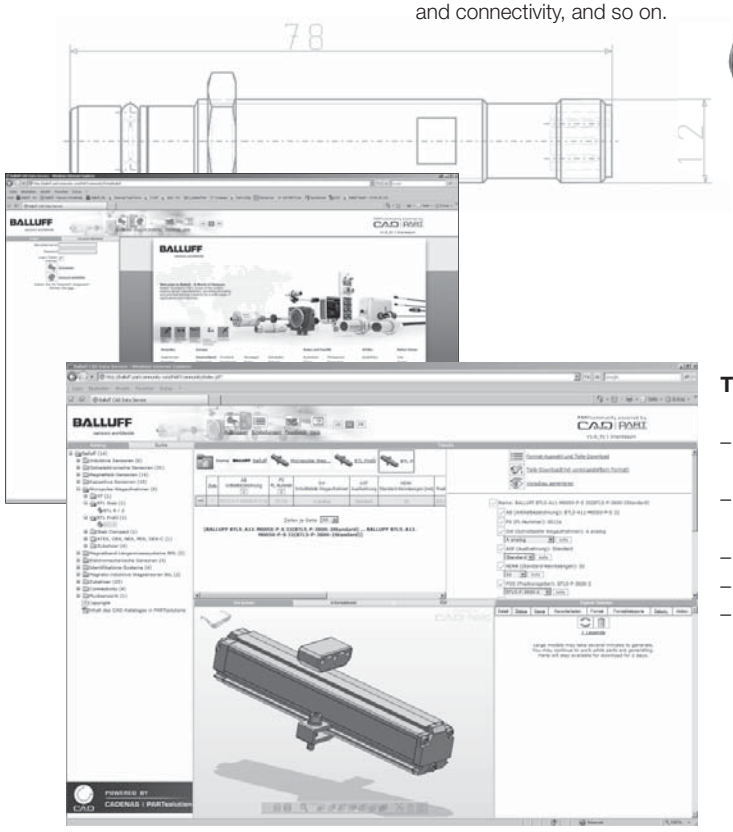


– Graphics reduced to the essentials for optimized performance

– All catalog products are available:
Inductive sensors, photoelectric sensors, sensors for pneumatic cylinders, Micropulse transducers, industrial RFID systems, mechanical single and multiple position switches, industrial networking and connectivity, and so on.



The benefits to you

– Faster and more efficient designing
– Free availability of all Balluff catalog products
– All common CAD formats
– Convenient preview in 3D
– Configurable products

And here's how it works

– At **www.balluff.com**, go to 3D data in the respective product area
– You are automatically redirected to the Cadenas PARTserver
– Select a sensor and perform an optional check via 3D preview
– Add to shopping basket
– Once you have entered your details, the CAD files of your choice are sent to you by e-mail

CAD formats on the Cadenas PARTserver

autodesk inventor, SolidWorks, I-deas, CATIA, inspace designer, Solid Edge, MegaCAD, UGS PLM Solutions, HiCAD neXt, CADdy, DXF, STEP, IGES, Mastercam, PTC

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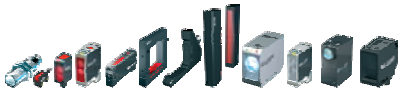
Object Detection

Sensor Product Line
Inductive sensors BES DC 3-/4-wire
Inductive sensors BES DC 2-wire
Inductive sensors BES AC/DC
Inductive sensors BES with special properties
Sensors for pneumatic cylinders BMF
Magnetic field sensors BMF
Capacitive sensors BCS
Ultrasonic sensors BUS
Pressure sensors BSP



Photoelectric Product Line
Diffuse energetic BOS with fore- and background suppression
Retro-reflective sensors BOS
Through-beam sensors BOS (emitter/receiver)
Fiber optic devices BFB
Through-beam fork sensors BGL
Dynamic optical windows BOWA
Light grids BLG
Contrast sensors BKT
Luminescence sensors BLT
Color sensors BFS
Photoelectric distance sensors BOD

Mechanical Product Line
Mechanical single and multiple position switches
Mechanical single and multiple position switches to DIN EN 60204-1/VDE 0113
Mechanical single and multiple position switches with forced opening
Mechanical single and multiple position switches with quick-change plunger unit
Inductive single and multiple position switches
Inductive single and multiple position switches with extended switching distance
Mechanical wireless position switches
Mixed assembly multiple position switches

Linear Position Sensing

Linear Displacement Product Line
Micropulse® transducer BTL Profile series
Micropulse® transducer BTL AT series
Micropulse® transducer BTL Rod series
Micropulse® transducer BTL Compact Rod series
Micropulse® processors, BUS interfaces
Magnetic linear encoder system BML
Incremental and absolute encoders BDG/BRG
Inductive linear position sensor BIW
Inductive distance sensors BAW
Magneto-inductive position sensors BIL
Photoelectric distance sensors BOD
Ultrasonic sensors BUS

Industrial Identification

Industrial Identification
Industrial RFID systems BIS C
Industrial RFID Systems BIS L
Industrial RFID systems BIS M
Industrial RFID systems BIS S
Vision sensor BVS

Industrial Networking and Connectivity

Industrial Networking and Connectivity
Connectors and cables BCC
Passive splitter boxes BPI
Active splitter boxes BNI
IO-Link
Remote inductive transmission systems
Inductive couplers BIC
BUS systems
Wireless
Electrical devices

Mechanical Accessories

Mechanical Accessories
Holders and fastening systems
Mounting system BMS

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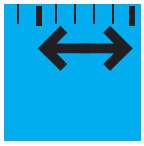
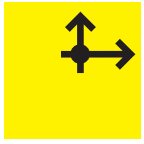
Object Detection



Linear Position Sensing

Industrial Identification



Industrial Networking and Connectivity

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