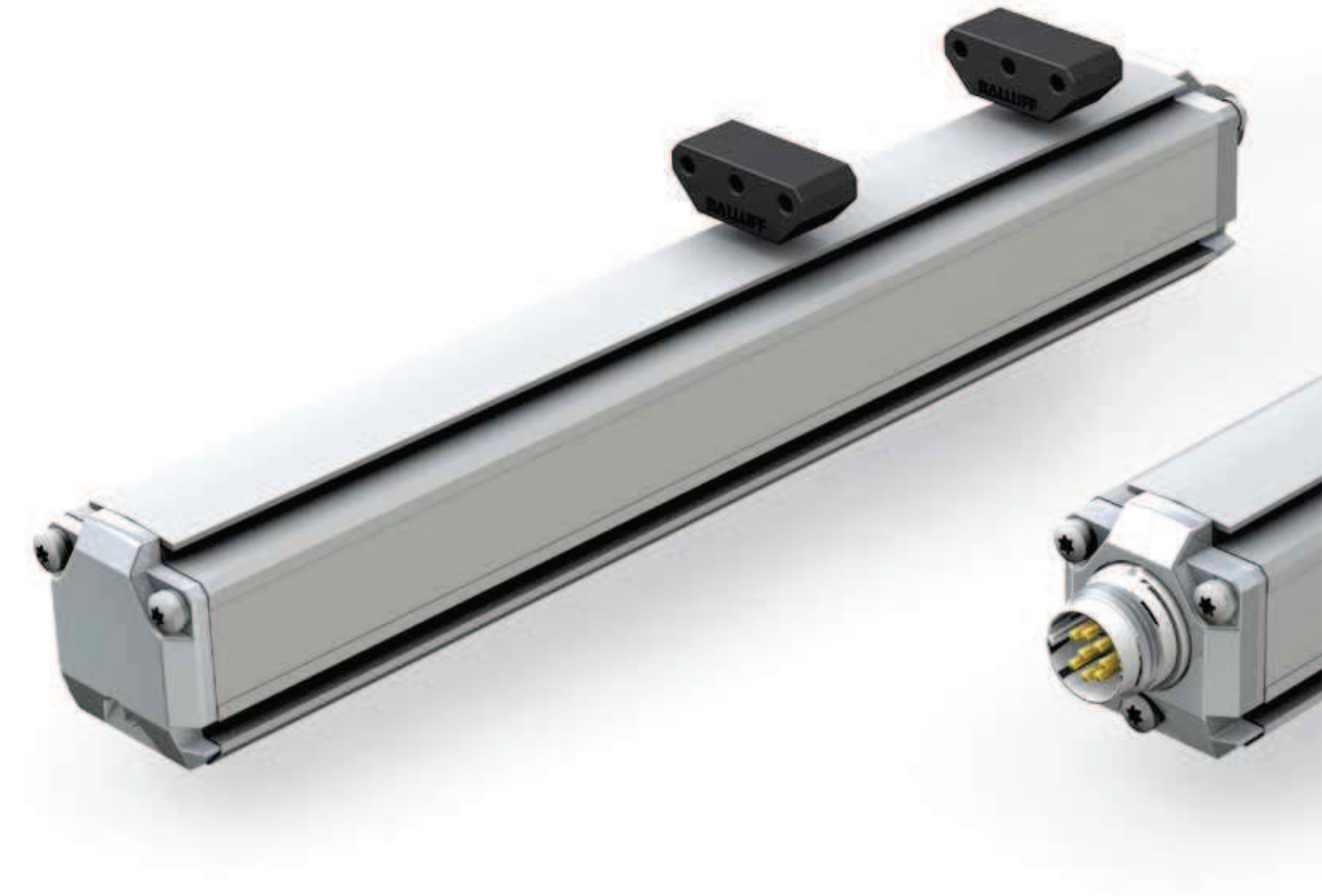
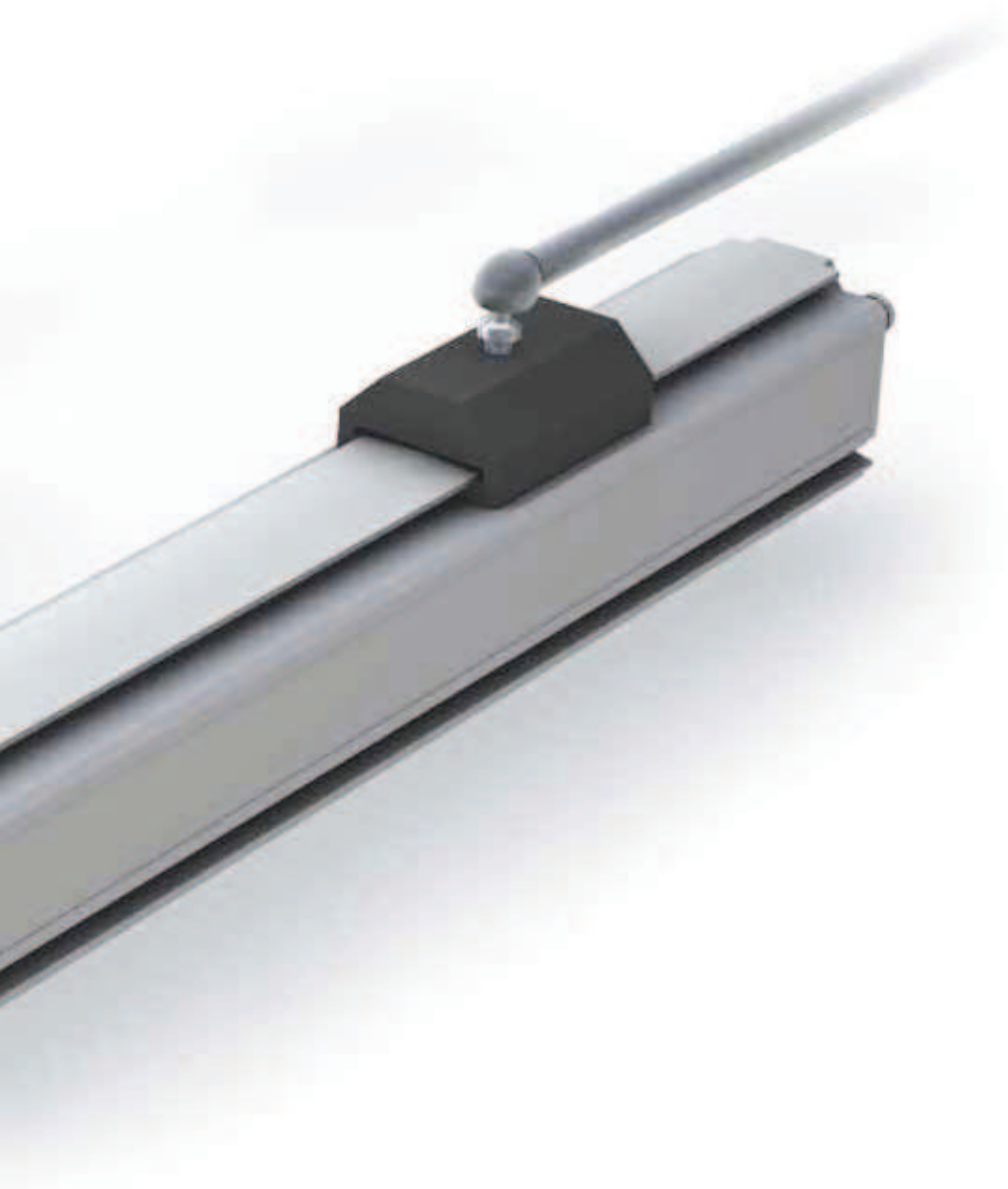
Micropulse Transducers

Profile P

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



MICROPULSE®



Series	**Profile P BTL7**
Shock load	150 g/6 ms as per IEC 60068-2-27
Continuous shock	150 g/2 ms as per IEC 60068-2-29
Vibration	20 g, 10...2000 Hz per EN 60068-2-6
Polarity reversal protected	to 36 V
Overvoltage protected	to 36 V
Dielectric strength	500 V AC (GND to housing)
Degree of protection as per IEC 60529	IP 68 with cable outlet, IP 67 with screwed-on plug connector BKS-S...
Housing material	Anodized aluminum
Housing attachment	Mounting clamps
Connection	Connectors/cables
EMC testing	
Radio interference emission	EN 55016-2-3 (industrial and residential area)
Static electricity (ESD)	EN 61000-4-2 Severity level 3
Electromagnetic fields (RFI)	EN 61000-4-3 Severity level 3
Rapid, transient electrical pulses (burst)	IEC 61000-4-4 Severity level 3
Surge voltage	EN 61000-4-5 Severity level 2
Conducted interference induced by high-frequency fields	EN 61000-4-6 Severity level 3
Magnetic fields	EN 61000-4-8 Severity level 4
Standard nominal strokes [mm]	0050...7620 mm in 5 mm increments

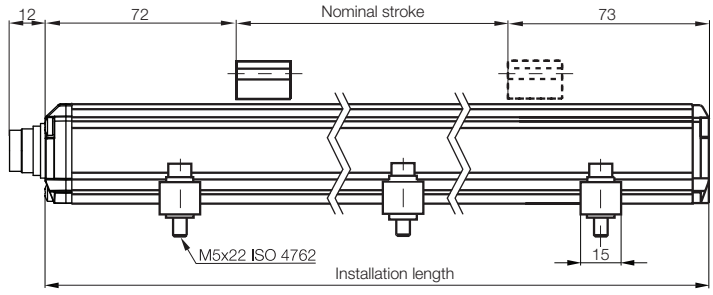
- Non-contact detection of the actual position
- IP 67, insensitive to contamination
- Wear-free
- Insensitive to shock and vibration
- Absolute output signal
- Measurement length up to 7,620 mm
- Two measurement paths per system
- Error and status LED

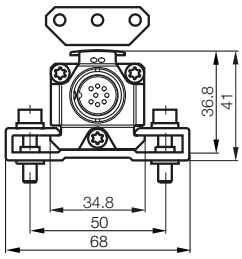
Caution!
Please read the instructions in the user's guide before designing, installing and commissioning! www.balluff.de

Scope of delivery
- Transducer (select your interface from page 80)
- Quick start instructions
- Mounting clamps with insulating sleeves and screws

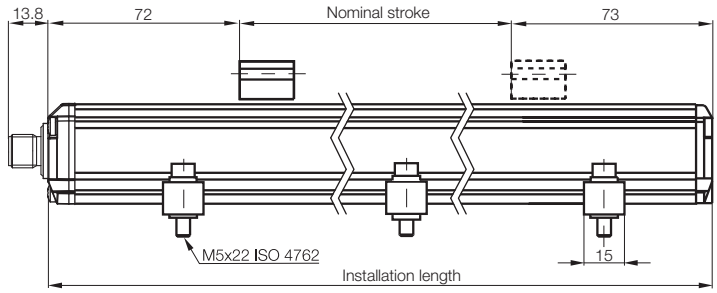
Please order separately:
USB communication box, page 82
Magnet, page 98
Plug connectors, page 232

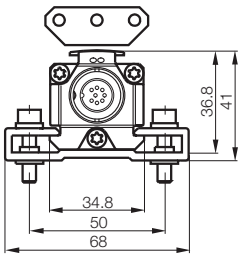
Transducer with floating magnet and S32 connection



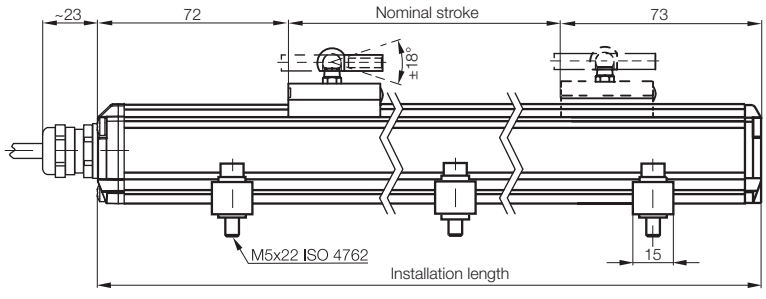


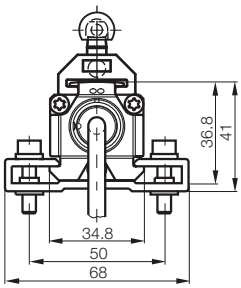
Transducer with floating magnet and S115 connection





Transducer with captive magnet and KA cable outlet





Micropulse+ USB-Configurable BTL7-A/E501

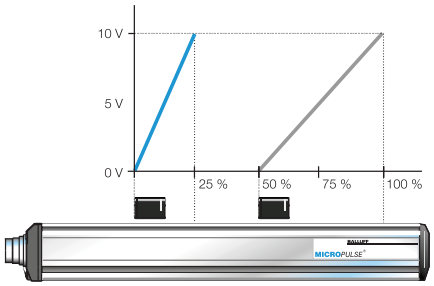
- Simple configuration and adjustment of the start and end point via the USB interface, fast startup
- "Easy Setup" for manual adjustment on-site
- Configurable dual output functions, position and speed
- Increased operating reliability with status LEDs for indicating the operating status and diagnostic information

Position and velocity

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

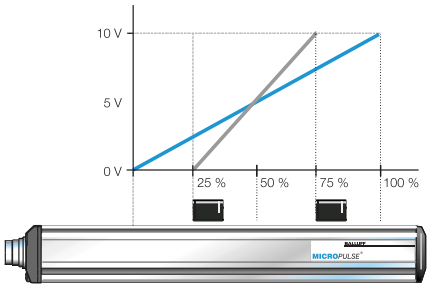
Series	
Output signal	
Transducer interface	
Position signal interface, customer device	
Part number	
Output signal factory setting	
Output signal can be adjusted via Configurable USB	
Load current	
Load resistance	
System resolution	
Current consumption at 24 V DC	
Hysteresis	
Repeat accuracy	
Sampling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

Operating mode: Double position indicator



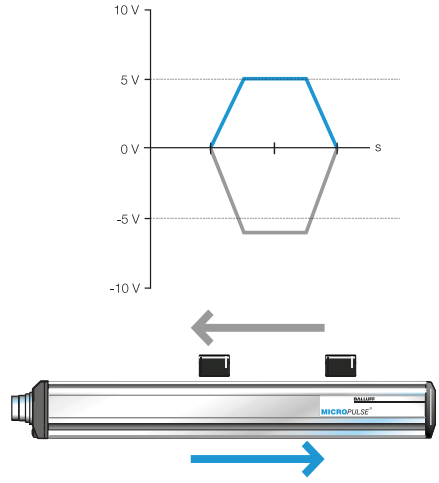
2 magnets, 2 movements, 2 output signals

Operating mode: Differential



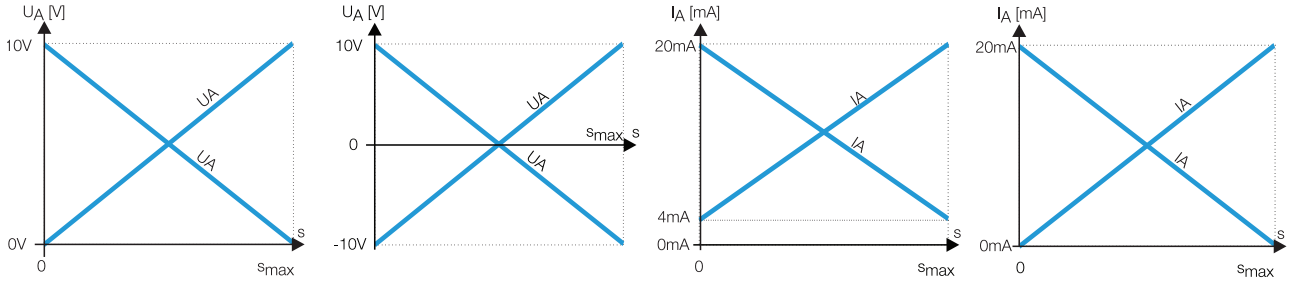
Differential signal between
2 magnets, position and difference possible.

Operating mode: Speed



Velocity output

	Profile P BTL7	**Profile P BTL7**
	analog	analog
	A	**E**
	analog	analog
	BTL7-**A501**-M_ _ _ _-P-_ _ _ _	BTL7-**E501**-M_ _ _ _-P-_ _ _ _
	0...10 V and 10...0 V	4...20 mA and 20...4 mA
	–10...10 V and 10...–10 V	0...20 mA and 20...0 mA
	Max. 5 mA	
		≤ 500 ohms
	≤ 0.33 mV	≤ 0.66 µA
	≤ 150 mA	≤ 180 mA
	≤ 10 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
	to 36 V	to 36 V
	to 36 V	to 36 V
	500 V AC (ground to housing)	500 V AC (ground to housing)
	–40...+85 °C	–40...+85 °C



Please enter code for output signal, nominal stroke and connection in the Part number.

Ordering example:

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

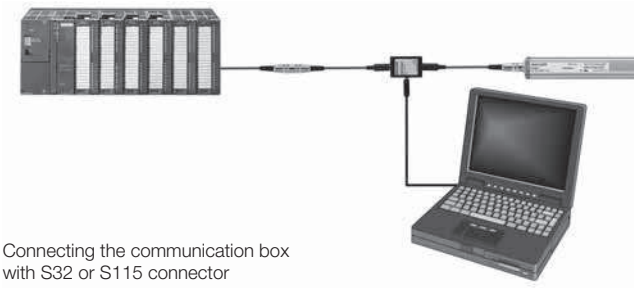
Output signal	**Standard Nominal stroke [mm]**	**Connection**
A 0...10 V and 10...0 V	0050...7620 mm in 5 mm increments	S32 Connectors
E 4...20 mA and 20...4 mA		S115 Connectors
		KA02 PUR cable 2 m
		KA05 PUR cable 5 m
		KA10 PUR cable 10 m
		KA15 PUR cable 15 m

USB configuration

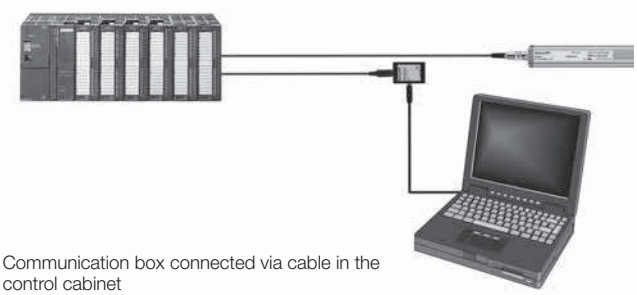
System requirements
- Standard PC
- Operating system: Windows 2000/XP/Vista/7
- Screen resolution at least 1024 × 768 pixels
- 10 MB available hard disk space
- Install Java Runtime Environment (JRE) Version 1.4.2 or higher
  http://java.com/getjava
- USB port

Start, end value setting and configuration via USB
The Micropulse Configuration Tool software allows the quick and easy configuration of Balluff transducers of type BTL7-A/E501... on a PC.
The most important features include:
- Online display of the current position of the magnet
- Graphic support for setting the functions and characteristics
- Display of information about the connected transducers
- Selectable number formats and units for display
- Reset to factory settings possible
- Demo mode without having a transducer connected

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



Connecting the communication box with S32 or S115 connector



Communication box connected via cable in the control cabinet

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 Connector S115

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

Scope of delivery
- USB communication box
- Cable set
- Quick start instructions

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

Caution!
Please read the instructions in the user's guide before designing, installing, and commissioning! www.balluff.de

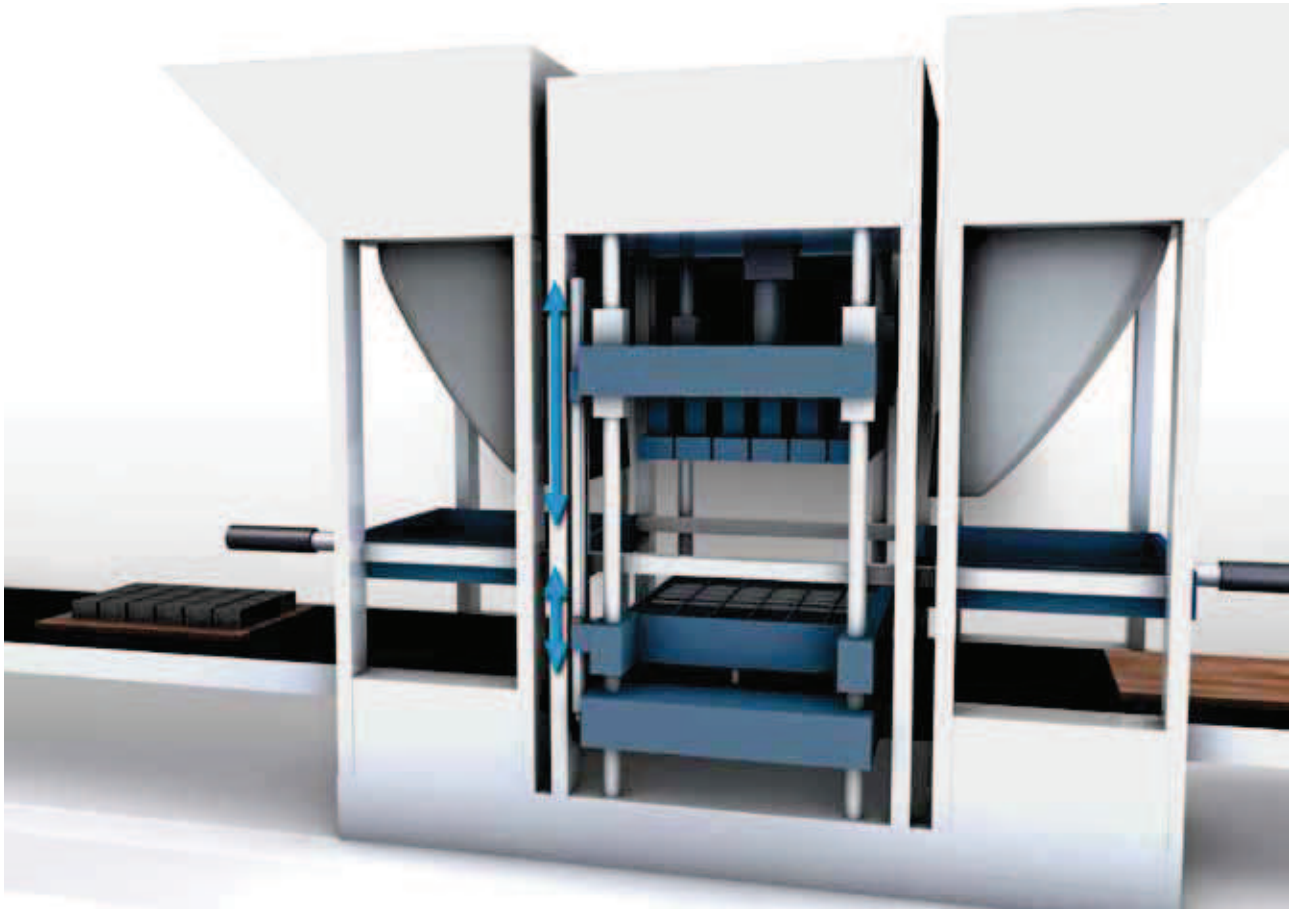
Profile P BTL7 Micropulse+

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

Features

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

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



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 on the measuring path without making contact. Measuring ranges between 50 and 5,000 mm are possible.

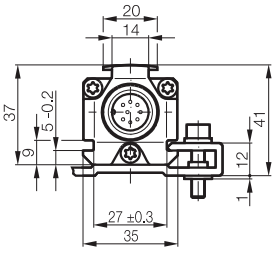
- Non-contact detection of the measurement position
- IP 67, insensitive to contamination
- Wear-free
- Insensitive to shock and vibration
- Absolute output signal
- Max. resolution of 0.001 mm (depending on the electronic evaluation unit)
- Direct signal evaluation or in conjunction with evaluation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

Series	**Profile P BTL5**
Shock load	100 g/6 ms as per IEC 60068-2-27
Vibration	12 g, 10...2000 Hz per EN 60068-2-6
Polarity reversal protected	yes
Overvoltage protected	TransZorb protection diodes
Dielectric strength	500 V (GND to housing)
Degree of protection as per IEC 60529	IP 67 (with IP-67 connector BKS-S... attached)
Housing material	Anodized aluminum
Housing attachment	Compression clamps
Connection	Connectors/cables
EMC testing	
Radio interference emission	EN 55016-2-3 (industrial and residential area)
Static electricity (ESD)	EN 61000-4-2 Severity level 3
Electromagnetic fields (RFI)	EN 61000-4-3 Severity level 3
Rapid, transient electrical pulses (burst)	IEC 61000-4-4 Severity level 4
Conducted interference induced by high-frequency fields	EN 61000-4-6 Severity level 3
Standard nominal strokes [mm]	0050...5500 mm in 5 mm increments, depending on the interface

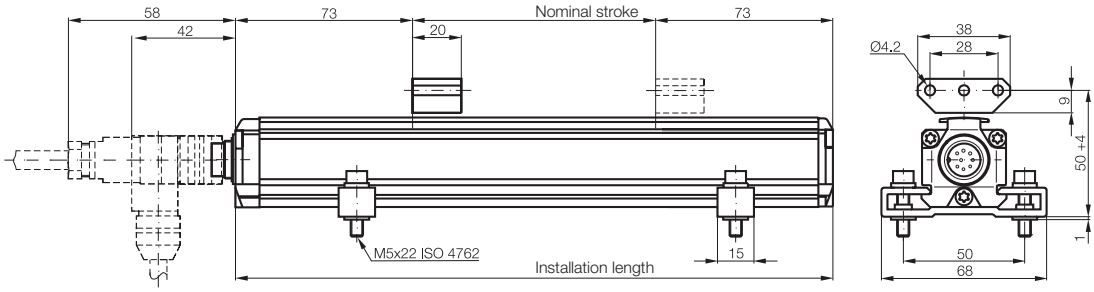
Scope of delivery
- Transducer (select your interface from page 86)
- Quick start instructions
- Mounting clamps with insulating sleeves and screws

Please order separately:
Magnets, on page 98
Plug connectors, page 232

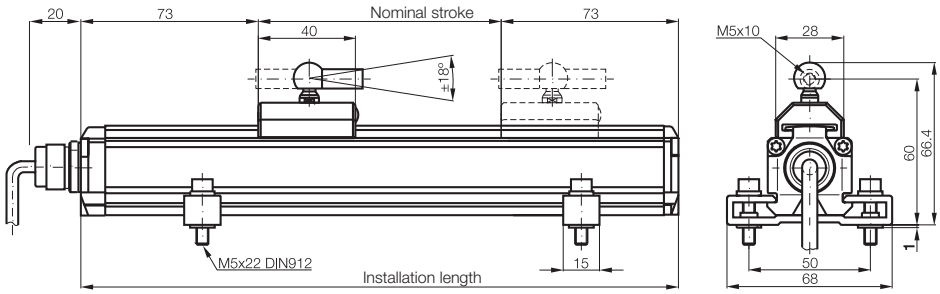
Caution!
Please read the instructions in the user's guide before designing, installing, and commissioning! www.balluff.de



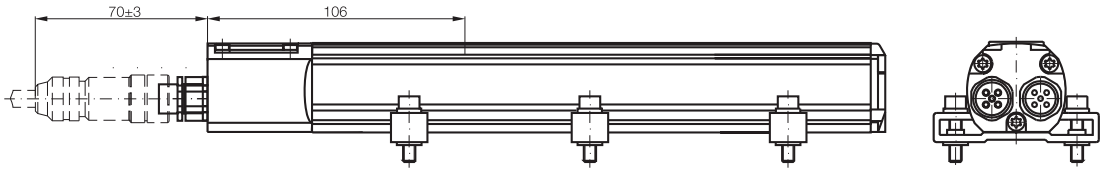
**Transducer with floating magnet, S 32 connection with BKS-S 32M/BKS-S 32M-C/
BKS-S 32M connector for transducers with analog interface, digital pulse interface and SSI interface, from page 232**



Transducers with captive magnets and cable outlet for transducers with analog interface, digital pulse interface and SSI interface, from page 232

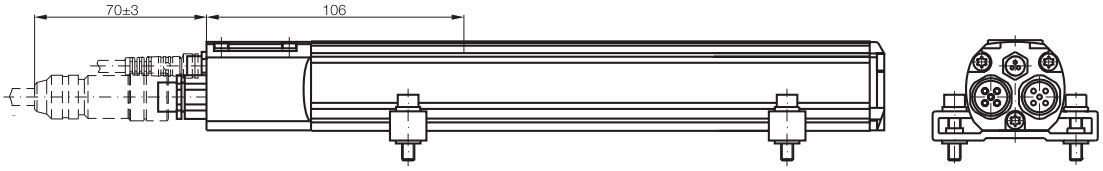


CANopen connection S 94 with connectors BKS-S 94-00 and BKS-S 92-00 for transducers with CANopen interface, page 234



CANopen connection S 92 with connector BKS-S 92-00 for transducers with CANopen interface, page 234

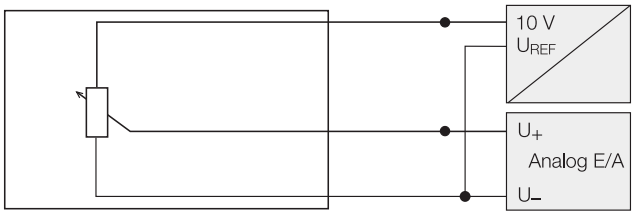
DeviceNet connection S 93 with connectors BKS-S 92-00, BKS-S 93-00 and BKS-S -48-15-CP-_ _, page 234
Profibus DP connection S103 with plug connector BCC0715 and BCC0714, page 237 and BKS-S-48-15-CP-_ _ page 234



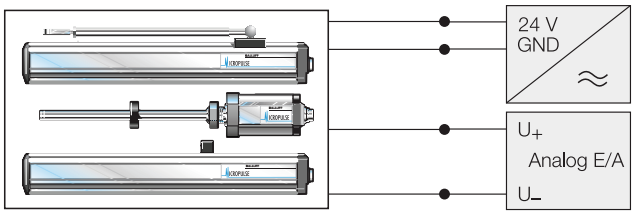
The analog outputs of the profile series are potential-free with respect to the input voltage. The isolation is galvanic using DC/DC converters.
BTL transducers with analog outputs are available in the variants 0...0 V, 4...20 mA, 0...20 mA and –10...10 V, with rising and falling characteristics.

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

Micropulse Transducers – a non-contact alternative to contacting transducers



Connection scheme potentiometer, block diagram

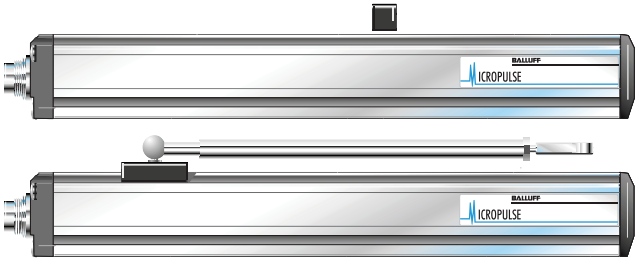


Micropulse Transducer connections, block diagram

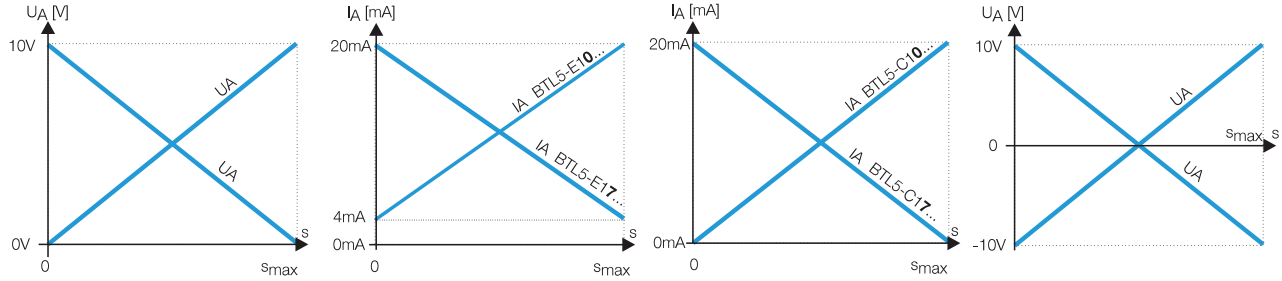
Please enter code for output signal and nominal stroke in the part number.

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

Please order separately:
Magnets, on page 98
Plug connectors, page 232



	Profile P BTL5	**Profile P BTL5**	**Profile P BTL5**	**Profile P BTL5**
	analog	analog	analog	analog
	A	**E**	**C**	**G**
	analog	analog	analog	analog
	BTL5-**A11**-M_ _ _ _-P-_ _ _ _	BTL5-**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 to max. nominal stroke	±0.02% 500 to max. nominal stroke	±0.02% 500 to max. nominal stroke	±0.02% 500 to 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



Ordering example:

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

Output signal

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

Standard Nominal stroke [mm]

0050...4500 mm in 5 mm increments

Connection

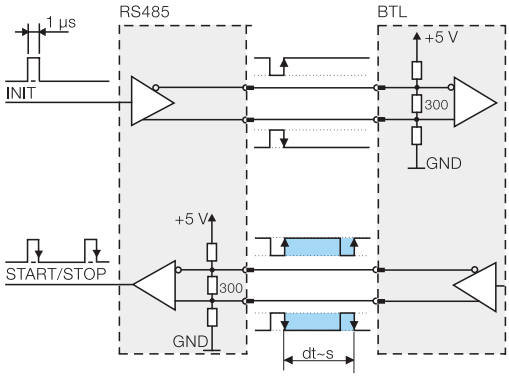
S32	Connectors
KA02	PUR cable 2 m
KA05	PUR cable 5 m
KA10	PUR cable 10 m
KA15	PUR cable 15 m

P Interface

The P-interface fits Balluff BTA/BTM evaluation units and controllers and modules of various manufacturers, e.g. Siemens, B & R, Phoenix Contact, Mitsubishi, Sigmatek, Esitron, and WAGO, among others. Secure signal transfer even with cable lengths of 500 m between the BTA evaluation unit and the BTL transducer guarantee the particularly interference-free RS485 differential driver and receiver. Noise signals are effectively suppressed.

M interface

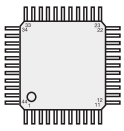
The I and M interfaces are control-specific interface variations.



Block diagram of P interface

Highly precise digitizing of the P pulse signal

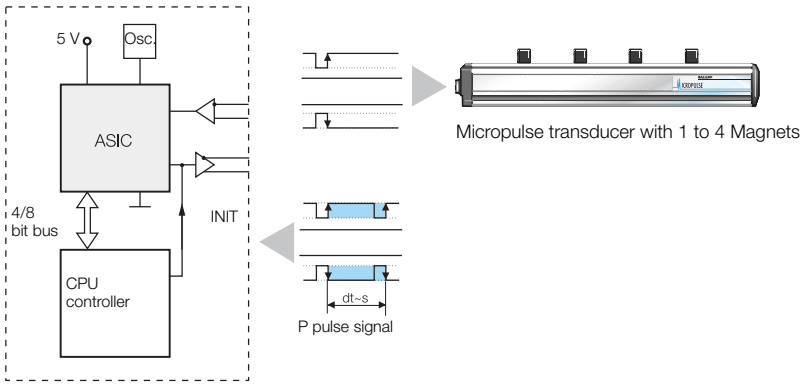
Companies developing their own electronic control and evaluation unit can create a highly accurate P interface cost-effectively and with minimum effort using the Balluff digitizing chip. The digitizing chip was developed as a high-resolution, configurable ASIC for Micropulse Transducers with P pulse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



Digitizing chip 44QFP

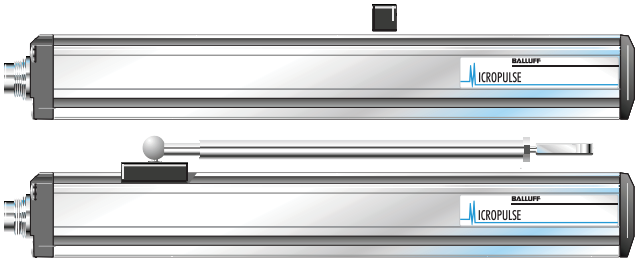
Benefits

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



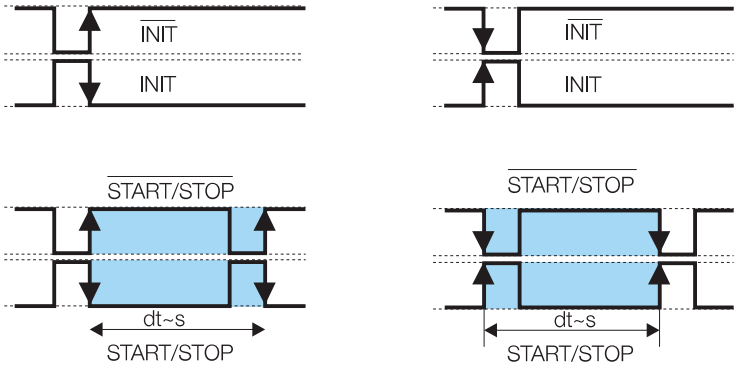
Controller or
electronic evaluation unit

Micropulse transducer with 1 to 4 Magnets



ASIC INFO:
+49 7158 173-370

Series	**Profile P BTL5**	**Profile P BTL5**
Transducer interface	Pulse **P**	Pulse **M**
Customer device interface	Pulse **P**	Pulse **M**
Part number	BTL5-**P**1-M_ _ _ _-P-_ _ _ _	BTL5-**M**1-M_ _ _ _-P-_ _ _ _
System resolution	processing-dependent	processing-dependent
Repeat accuracy	2 µm or ±1 digit depending on electronic evaluation unit	2 µm or ±1 digit depending on electronic evaluation unit
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. linearity deviation	±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
Supply voltage	20...28 V DC	20...28 V DC
Current consumption	≤ 90 mA	≤ 90 mA
Operating temperature	–40...+85 °C	–40...+85 °C
Storage temperature	–40...+100 °C	–40...+100 °C



Please enter the code for
the nominal stroke in the part number.

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

Please order separately:
Magnets, on page 98
Plug connector, on page 232

Ordering example:

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

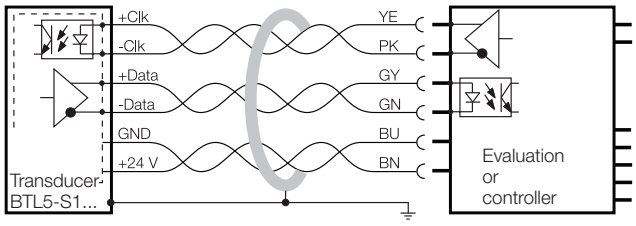
Standard
Nominal stroke [mm]

0050...5500 mm in 5 mm increments

Connection

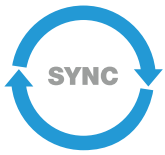
S32	Plug connector
KA02	PUR cable 2 m
KA05	PUR cable 5 m
KA10	PUR cable 10 m
KA15	PUR cable 15 m

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



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

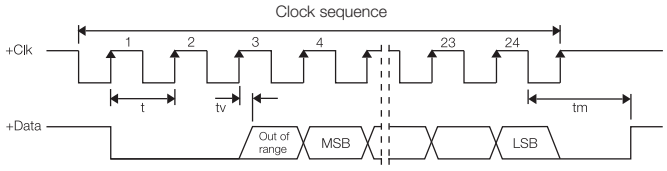
Synchronized SSI interface BTL5-S1_ _B-M_ _ _ _-P-_ _ _ _
Micropulse Transducers with synchronized SSI interface are well suited for dynamic control applications. Data acquisition in the transducer is synchronized using the external clock of the controller, allowing an optimum speed calculation to be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



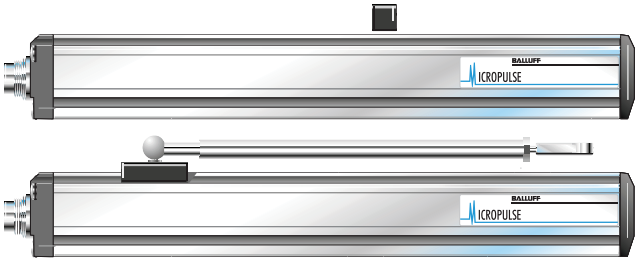
Nominal length area				Scan rate
< Nominal stroke	≤	100 mm	:	1500 Hz
100 mm < Nominal stroke	≤	1,000 mm	:	1,000 Hz
1,000 mm < Nominal stroke	≤	1,400 mm	:	666 Hz
1,400 mm < Nominal stroke	≤	2,600 mm	:	500 Hz
2,600 mm < Nominal stroke	≤	4,000 mm	:	333 Hz

The clock frequency depends on the cable length.

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



Super-fast 2.5 kHz sampling rate



Series	**Profile P BTL5**
Output signal	synchronous-serial
Transducer interface	**S**
Customer device interface	synchronous serial (SSI)
Part number	BTL5-**S**1_ _-M_ _ _ _-P-_ _ _ _
Part number synchronization	BTL5-**S**1_ _B-M_ _ _ _-P-_ _ _ _
System resolution depending on model (LSB)	1, 2, 5, 10, 20, 40 or 100 µm
Repeat accuracy	±5 µm
Hysteresis	≤ 4 µm or ≤ 1 digit
Sampling rate	$f_{STANDARD}$ = 2 kHz
Max. linearity deviation	±30 µm at ≤ 10 µm resolution or ≤ ±2 LSB at > 10 µm resolution
Temperature coefficient of overall system	(6 µm + 5 ppm × L)/°C
Supply voltage	20...28 V DC
Current consumption	≤ 80 mA
Operating temperature	–40...+85 °C
Storage temperature	–40...+100 °C

Please enter code for coding, system resolution and nominal stroke in the part number.

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

Please order separately:
Magnets, on page 98
Plug connectors, page 232

Ordering example:

BTL5-S1_ _-M_ _ _ _-P-_ _ _ _ for asynchronous operation
BTL5-S1_ _-B-M_ _ _ _-P-_ _ _ _ for synchronous operation

Coding

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

System resolution

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

Standard nominal stroke [mm]

0100...4000 mm in 5 mm increments

Connection

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

CANopen interface
Based on CAN (ISO/IEC 7498 and DIN ISO 11898), CANopen provides a Layer-7 implementation for industrial CAN networks. The serial data protocol of the CAN specification is defined according to the producer-consumer principle as opposed to most other fieldbus protocols. This eliminates target addressing of the process data. Each bus 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.

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

Process Data Object (PDO)
Micropulse Transducers send their measured values 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:
- The current magnet with a resolution in 5 µm increments
- Current speed of the magnet, with resolution selectable in 0.1mm/s increments
- The current status of the four freely programmable cams per magnet

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

LED
Display of the CANopen status according to DS303-3

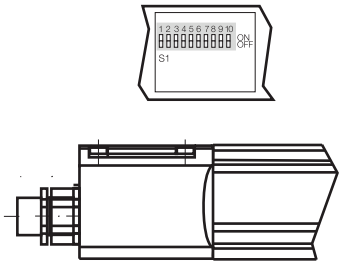
FMM
The sensor can be operated as a 4-magnet type, whereby the sensor itself recognizes how many magnets are currently active.
So if only two magnets are positioned in the measuring area, a valid value is output for the first two positions and a defined error value for positions 3 and 4.

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 with a bus analyzer/CANopen tool. The configuration is stored in the non-volatile memory of the transducer.

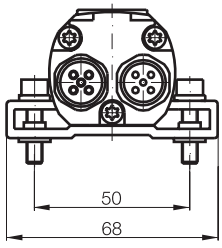
CiA 199911-301v30/11-009

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



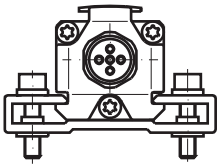
Position of the DIP switch S1, only on BTL-H1_ _ _ _-P-S94

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



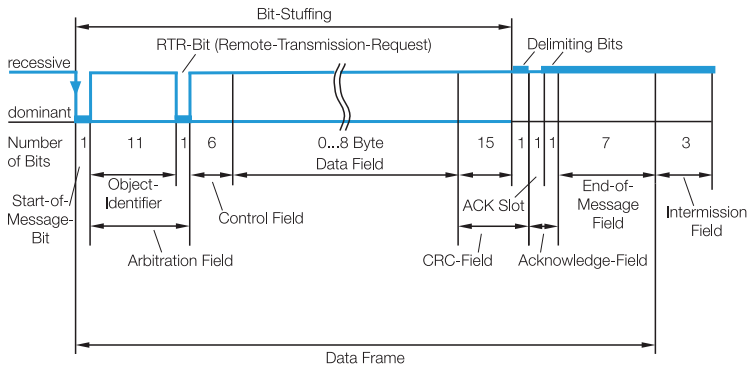
Node ID can be set by DIP switch.

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



Series		**Profile P BTL5**						
Output signal		CANopen						
Transducer interface		**H**						
Customer device interface		CANopen						
Part number		BTL5-**H**1_ _-M_ _ _ _-P-S92						
Part number		BTL5-**H**1_ _-M_ _ _ _-P-S94						
CANopen Version		DS301, DS406						
Repeat accuracy		±1 digit						
System resolution	Position	5 µm increments configurable						
Configurable	Speed	0.1 mm/s increments configurable						
Hysteresis		≤ 1 digit						
Sampling rate		$f_{STANDARD}$ = 1 kHz						
Max. linearity deviation		±30 µm at 5 µm resolution						
Temperature coefficient of overall system		(6 µm + 5 ppm × L)/°C						
Magnet travel speed		any						
Supply voltage		20...28 V DC						
Current consumption		≤ 100 mA						
Operating temperature		–40...+85 °C						
Storage temperature		–40...+100 °C						
Cable length [m] per CiA DS301		< 25	< 50	< 100	< 250	< 500	< 1,000	< 1,250	< 2,500
Baud rate [kbaud] per CiA DS301		1,000	800	500	250	125	100	50	20/10

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



Please enter code for software configuration, baud rate and nominal stroke in the part number.

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

Please order separately:
Magnets, on page 98
Plug connectors, page 232

Ordering example:

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

Software configuration

1	1 × Position and 1 × speed
2	2 × Position and 2 × speed

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...4000 in 5 mm increments

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

EDS
DeviceNet offers configuration of functionality and data exchange. Through a standard datasheet in the form of an EDS-file, a problem-free connection of the Micropulse Transducer to any DeviceNet systems is possible.

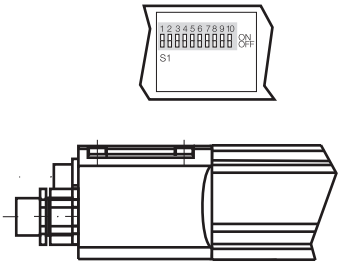
DeviceNet features:
- Linear topology
- Low-cost wiring with two-wire cable
- Fast response times
- High data security due to CRC checking
- Hamming distance of 6
- Potential-free data transmission (RS485)
- 125 Kb/s at cable length < 500 m
  250 Kb/s at cable length < 250 m
  500 Kb/s at cable length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

Position Sensor Object
The DeviceNet interface of the Micropulse Transducer is compatible with the CIP Common Specification Object Library "Position Sensor Object" of the ODVA.
The Micropulse Transducers transmit their measured values to an instance of the position sensor object as a 32-bit value.

The following information can be sent:
- Current magnet position with resolution in 5 µm increments
- Current magnet speed in increments of 0.1 mm/s
- The 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.

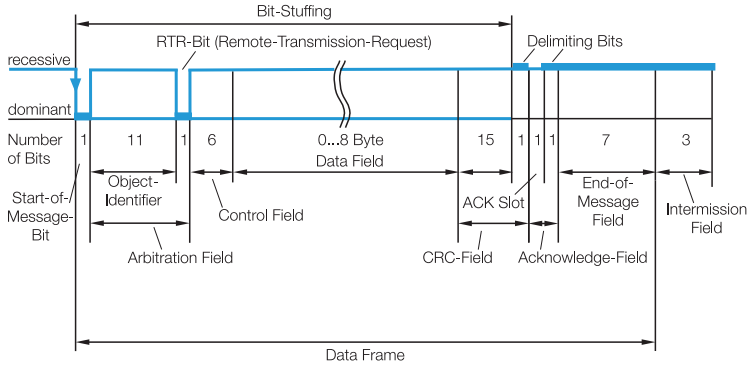


Position of the DIP switch S1,

Device address can be set by DIP switch

Use of multiple magnets
The minimum distance between the Magnets must be 65 mm.

Series	**Profile P BTL5**		
Output signal	DeviceNet		
Transducer interface	**D**		
Customer device 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	Configurable in increments of 5 µm		
Configurable Speed	0.1 mm/s increments configurable		
Hysteresis	≤ 1 digit		
Sampling rate	$f_{STANDARD}$ = 1 kHz		
Max. linearity deviation	±30 µm at 5 µm resolution		
Temperature coefficient of overall system	(6 µm + 5 ppm × L)/°C		
Magnet travel speed	any		
Supply voltage	20...28 V DC		
Current consumption	≤ 100 mA		
Operating temperature	–40...+85 °C		
Storage temperature	–40...+100 °C		
Address assignment	Mechanical switches or DeviceNet		
Cable length [m]	100	250	500
Baud rate [kbps]	500	250	100



Please enter code for software configuration, baud rate and nominal stroke in the Part number.

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

Please order separately:
Magnets, on page 98
Plug connectors, page 232

Ordering example:

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

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

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

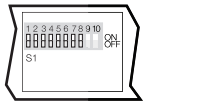
Data transmission
A Profibus telegram can contain up to 244 bytes of user data per telegram and node. The BTL5-T uses max. 32 bytes (max. 4 position values and max. 4 velocity values) for process data transmission.
Up to 126 active stations (addresses 0...125) can be connected on Profibus DP. User data cannot be sent with node address 126. This address is used as the default address for bus nodes that have to be configured by a Class 2 master (for setting the device address if there are no mechanical switches available). Each Profibus 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 Mbaud, the transmission time for an average data telegram is in the 100 µs range.

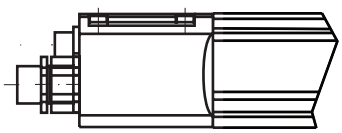
GSD (device master data)
The length of the data exchangeable with a slave is defined in the Device Master Data file (GSD) and is checked by the slave with the configuration telegram and confirmed for correctness.
In modular systems, various configurations are defined in the GSD file. Depending on the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

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

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

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



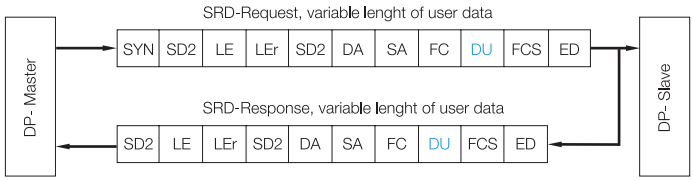


Position of the DIP switch S1

Device address can be set by DIP switch

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

Series		**Profile P BTL5**				
Output signal		Profibus DP				
Transducer interface		**T**				
Customer device 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	Position	5 µm increments configurable				
Configurable	Speed	0.1 mm/s increments configurable				
Hysteresis		≤ 1 digit				
Sampling rate		$f_{STANDARD}$ = 1 kHz				
Max. linearity deviation		±30 µm at 5 µm resolution				
Temperature coefficient of overall system		(6 µm + 5 ppm × L)/°C				
Magnet travel speed		any				
Supply voltage		20...28 V DC				
Current consumption		≤ 120 mA				
Operating temperature		–40...+85 °C				
Storage temperature		–40...+100 °C				
GSD file		BTL504B2.GSD				
Address assignment		Mechanical switches and Master Class 2				
Cable length [m]		< 100	< 200	< 400	< 1,000	< 1,200
Baud rate [kbps]		12000	1500	900	187.5	93.7/19.2/9.6



Please enter code for software configuration and nominal stroke in the Part number.

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

Please order separately:
Magnets, on page 98
Plug connector, on page 232

Ordering example:

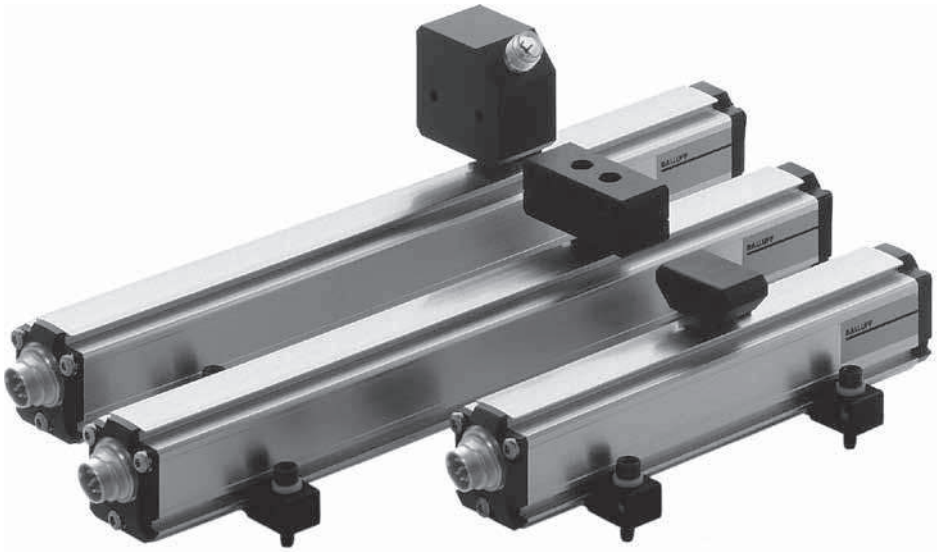
BTL5-T1_ 0-M_ _ _ _-P-S103

Software configuration		**Standard nominal stroke [mm]**
1	1 × Magnet 1 × Position 1 × Speed	0050...4000 in 5 mm increments
2	2 × Position 2 × Speed	

Non-contact!
Distance up to 15 mm

Balluff magnets are available in captive or floating designs. Transducers with captive magnets guarantee the highest resolution and reproducibility.
The BTL5-P-4500-1 magnet is an electromagnet and requires an operating voltage of 24 V, which can be turned on and off for selective activation. This allows multiplex operation with multiple magnets on a single transducer.

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



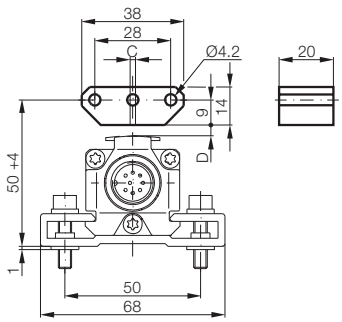
Caution!
Please read the instructions in the user's guide before designing, installing, and commissioning! www.balluff.de

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

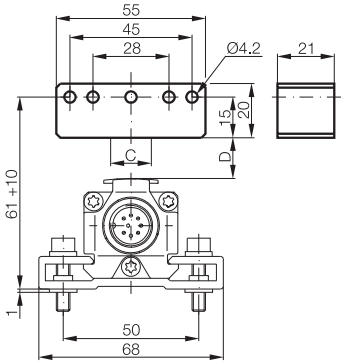
Mounting clamps with insulating sleeves and screws included in the scope of delivery of the transducer.

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

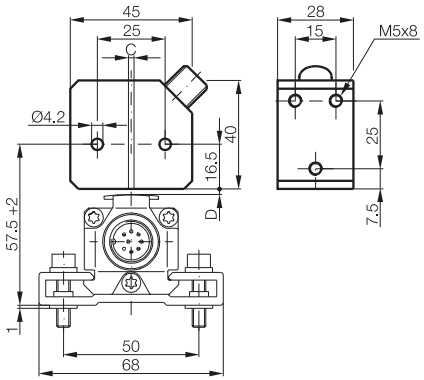
	Magnet	**Magnet**	**Magnet**
	Profile P BTL	Profile P BTL	Profile P BTL
	Floating	Floating	Floating
	BAM014M	**BAM014T**	**BAM014P**
	BTL5-P-3800-2	BTL5-P-5500-2	BTL5-P-4500-1
	Plastic	Plastic	Plastic
	approx. 12 g	Approx. 40 g	Approx. 90 g
	any	any	any
			24 V DC
			100 mA
	–40...+85 °C	–40...+85 °C	–40...+60 °C
	Magnet 2 fastening screws DIN 84 M4×35-A2 with washers and nuts	Magnet	Magnet
			Connector, straight* BCC M415-0000-1A-014-PS0434 Connector, angle* BCC M425-0000-1A-014-PS0434



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

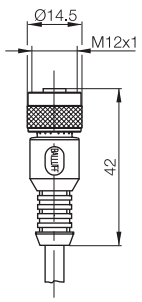


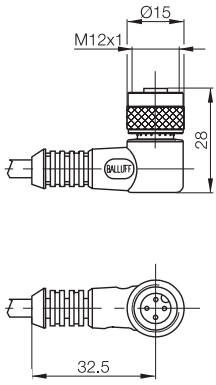
Lateral offset:
C = ±15 mm
Distance of Magnet:
D = 5...15 mm



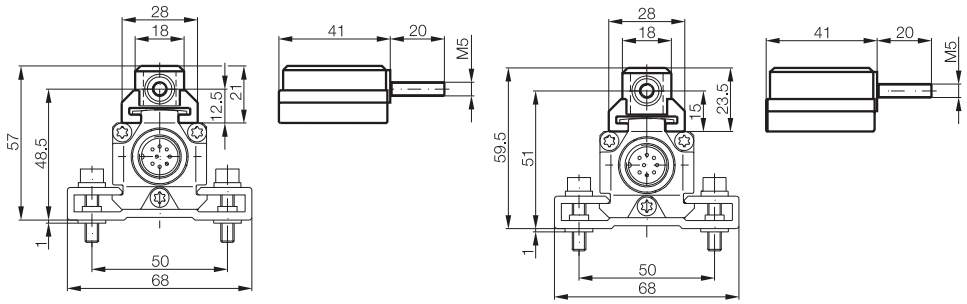
Lateral offset:
C = ±2 mm
Distance of Magnet:
D = 0.1...2 mm

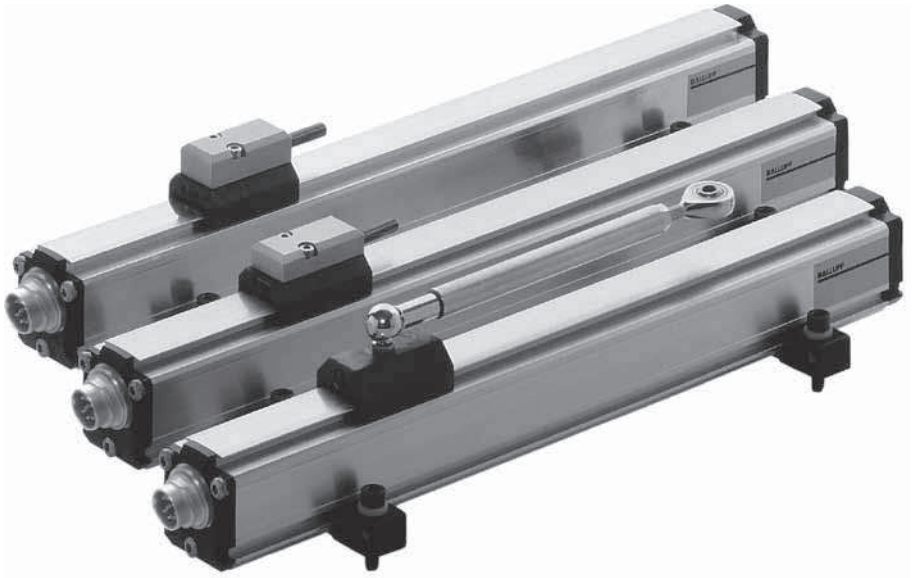
* Please include the cable length code in the part number.
010 = 2 m, 050 = 5 m, 100 = 10 m





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





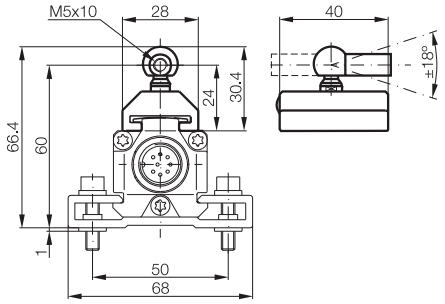
Caution!
Please read the instructions in the user's guide before designing, installing, and commissioning! www.balluff.de

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

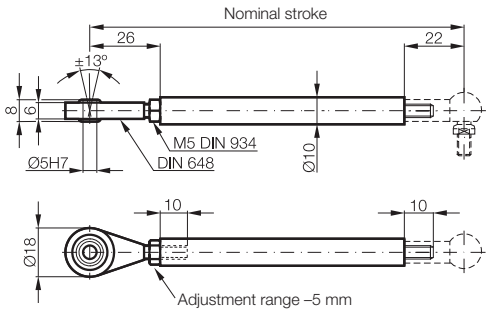
Mounting clamps with insulating sleeves and screws included in the scope of delivery of the transducer.

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

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



Description	**Control arm**
for Series	Profile P
Version	Captive
Part number	BTL2-GS10-_ _ _ _-A
Material	Aluminum
Weight	approx. 150 g/m



Please enter the code for the nominal stroke in the part number.

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.