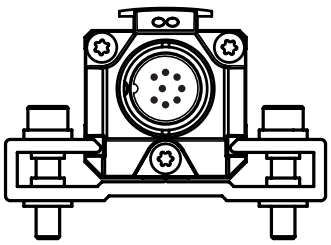
BALLUFF

sensors worldwide

BTL7-P511-M_ _ _ _-P-S32/S115/KA_ _

User's Guide



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1 Notes to the user

1.1 Validity

This guide describes the construction, function and setup options for the BTL7 Micropulse Transducer with digital (P) interface. It applies to types
BTL7-P511-M_ _ _ _-P-S32/S115/KA_ _
(see Type code breakdown from page 22).

The guide is intended for qualified technical personnel. Read this guide before installing and operating the transducer.

1.2 Symbols and conventions

Individual **instructions** are indicated by a preceding triangle.

► Instruction 1

Action sequences are numbered consecutively:

1. Instruction 1
2. Instruction 2

Note, tip
This symbol indicates general notes.

1.3 Scope of delivery

– BTL7 transducer
– Mounting clamps with insulating sleeves and screws
– Condensed guide

The magnets are available in various models and must be ordered separately.

1.4 Approvals and markings

c UL us LISTED

UL approval
File no.
E227256

US Patent 5 923 164
The US patent was awarded in connection with this product.

CE

The CE Mark verifies that our products meet the requirements of the current EMC Directive.

The transducer meets the requirements of the following product standards:

– EN 61326-2-3 (noise immunity and emission)

Emission tests:

– RF emission EN 55011

Noise immunity tests:

– Static electricity (ESD)
  EN 61000-4-2 Severity level 3
– Electromagnetic fields (RFI)
  EN 61000-4-3 Severity level 3
– Electrical fast transients (burst)
  EN 61000-4-4 Severity level 3
– Surge
  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

More detailed information on the guidelines, approvals, and standards is included in the declaration of conformity.

2 Safety

2.1 Intended use

The BTL7 Micropulse Transducer, together with a machine controller (e. g. PLC), comprises a position measuring system. It is intended to be installed into a machine or system. Flawless function in accordance with the specifications in the technical data is ensured only when using original BALLUFF accessories. Use of any other components will void the warranty.

Opening the transducer or non-approved use are not permitted and will result in the loss of warranty and liability claims against the manufacturer.

2.2 General safety notes for the position measuring system

Installation and **startup** may only be performed by trained specialists with basic electrical knowledge.
Qualified personnel are those who can recognize possible hazards and institute the appropriate safety measures due to their professional training, knowledge, and experience as well as their understanding of the relevant regulations pertaining to the work to be done.

The **operator** is responsible for ensuring that local safety regulations are observed.
In particular, the operator must take steps to ensure that a defect in the position measuring system will not result in hazards to persons or equipment.
If defects and unresolvable faults occur in the transducer, it should be taken out of service and secured against unauthorized use.

2.3 Explanation of the warnings

Always observe the warnings in these instructions and the measures described to avoid hazards.

The warnings used here contain various signal words and are structured as follows:

SIGNAL WORD
Hazard type and source Consequences if not complied with ► Measures to avoid hazards

The individual signal words mean:

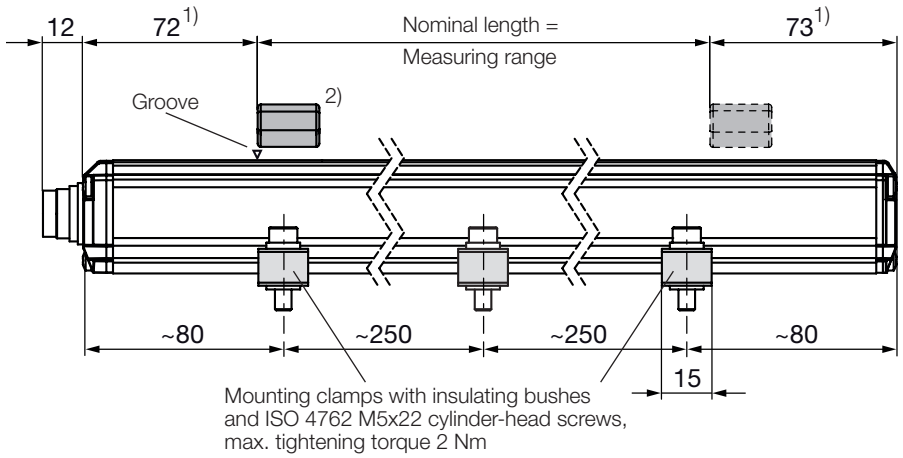
NOTICE
Identifies a hazard that could **damage or destroy the product**.
⚠ DANGER
The general warning symbol in conjunction with the signal word DANGER identifies a hazard which, if not avoided, **will certainly result in death or serious injury**.

2.4 Disposal

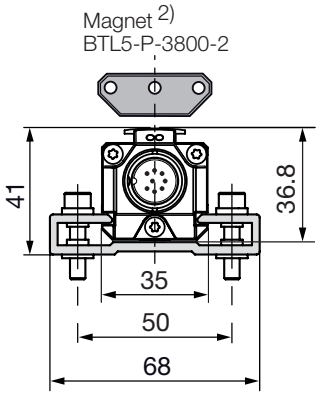
► Observe the national regulations for disposal.

3 Construction and function

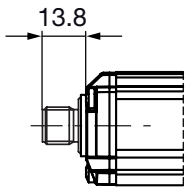
BTL7…-S32



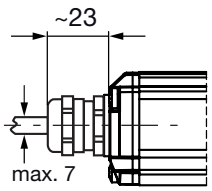
View from above on BTL7…-S32



BTL7…-S115



BTL7… cable



1) Unusable area

2) Not included in scope of delivery

Fig. 3-1: BTL7… transducer, construction

3.1 Construction

Electrical connection: The electrical connection is made via a cable or a connector (see Type code breakdown from page 22).

Housing: Aluminum housing containing the waveguide and processing electronics.

Magnet: Defines the position to be measured on the waveguide. Magnets are available in various models and must be ordered separately (see Accessories starting on page 18).

Nominal length: To optimally adapt the transducer to the application, nominal lengths from 50 mm to 7620 mm are available.

3 Construction and function (continued)

3.2 Function

The BTL7 transducer contains the waveguide which is protected by an aluminum housing. A magnet is moved along the waveguide. This magnet is connected to the system part whose position is to be determined. The magnet defines the position to be measured on the waveguide.

An externally generated INIT pulse interacts with the magnetic field of the magnet to generate a torsional wave in the waveguide which propagates at ultrasonic velocity.

The component of the torsional wave which arrives at the end of the waveguide is absorbed in the damping zone to prevent reflection. The component of the torsional wave which arrives at the beginning of the waveguide is converted by a coil into an electrical signal. The travel time of the wave is used to calculate the position. The position value corresponds to the travel time of the torsional wave and is output as digital time information between the start and stop pulses.

The evaluation may relate to the rising or falling edge. This is done with a high level of precision and reproducibility within the measuring range indicated as the nominal length.

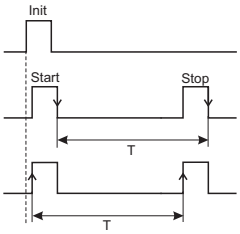


Fig. 3-2: Time/distance measuring principle

3.3 Number of magnets

Up to 16 magnets can be used. The distance (L) between the magnets must be at least 65 mm.

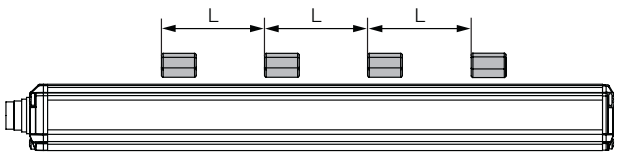


Fig. 3-3: Distance between the magnets

3.4 LED display

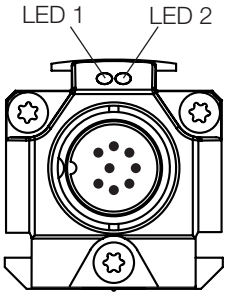


Fig. 3-4: BTL7 LED displays

LED 1	
Green	**Normal function** Magnet is within the limits.
Red	**Error** No magnet or magnet outside the limits.

LED 2	
Off	**Normal function** Valid Init signal.
Flashing red	**Init error** Missing or invalid Init signal and LED 1 is off.

4 Installation and connection

4.1 Installing the transducer

NOTICE

Improper installation

Improper installation can compromise the function of the transducer and result in damage.

- ▶ For this reason, ensure that no strong electrical or magnetic fields are present in the immediate vicinity of the transducer.
- ▶ The recommended spacing for the installation must be strictly observed.

Any orientation is permitted. Mount the transducer on a level surface of the machine using the provided mounting clamps and cylinder-head screws. A sufficient number of mounting clamps is supplied.

In order to avoid the development of resonant frequencies from vibration loads, we recommend arranging the mounting clamps at irregular intervals.

The transducer is electrically isolated from the machine with the supplied insulating bushes (see Fig. 3-1).

1. Guide the transducer into the mounting clamps.
2. Attach transducer to the base using mounting screws (tighten screws in the clamps with max. 2 Nm).
3. Insert magnet (accessories).

The micropulse transducer in profile housing is suitable both for floating, i.e. non-contacting magnets (see Fig. 4-4 to Fig. 4-8), and for captive magnets (see Fig. 4-1 to Fig. 4-3).

4.2 Captive magnets

The following must be observed when installing the magnet:

- Avoid lateral forces.
- Connect the magnet to the machine member with a joint rod (see Accessories on page 18).

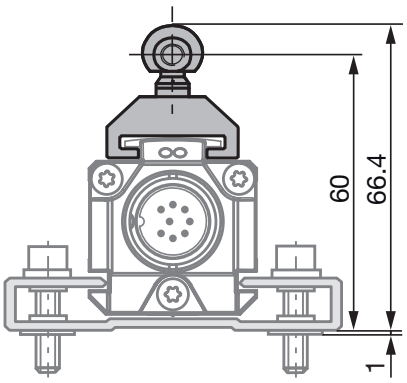


Fig. 4-1: Dimensions and distances with BTL5-F-2814-1S magnet

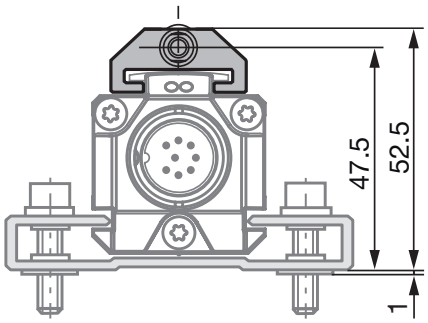


Fig. 4-2: Dimensions and distances with BTL5-T-2814-1S magnet

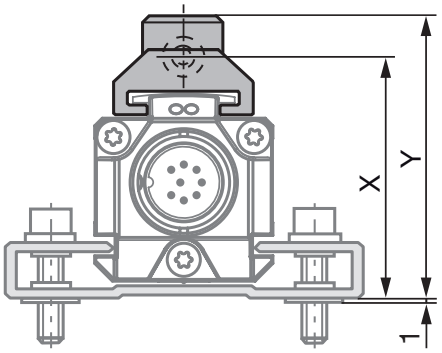


Fig. 4-3: Dimensions and distances with BTL5-M/N-2814-1S magnet

	BTL5-M-2814-1S	BTL5-N-2814-1S
Distance X	48.5 mm	57 mm
Distance Y	51 mm	59.5 mm

Tab. 4-1: Distances with BTL5-M/N-2814-1S magnet

4 Installation and connection (continued)

4.3 Floating magnets

The following must be observed when installing the magnet:

- To ensure the accuracy of the position measuring system, the magnet is attached to the moving member of the machine using non-magnetizable screws (stainless steel, brass, aluminum).
- The moving member must guide the magnet on a track parallel to the transducer.
- Ensure that the distance A between the magnet and parts made of magnetizable material is at least 10 mm (see Fig. 4-4 to Fig. 4-8).
- Maintain the following values for distance B between the magnet and transducer and for center offset C (see Fig. 4-4 to Fig. 4-8):

Type of magnet	Distance B[1)]	Offset C
BTL5-P-3800-2	0.1…4 mm	± 2 mm
BTL5-P-5500-2	5…15 mm	± 15 mm
BTL5-P-4500-1	0.1…2 mm	± 2 mm
BTL6-A-3800-2	4…8 mm[2)]	± 5 mm
BTL6-A-3801-2	4…8 mm[2)]	± 5 mm

[1)] The selected distance must stay constant over the entire measuring length.

[2)] For optimum measurement results, a distance B of 6 to 8 mm is recommended.

Tab. 4-2: Distance and offset for floating magnets

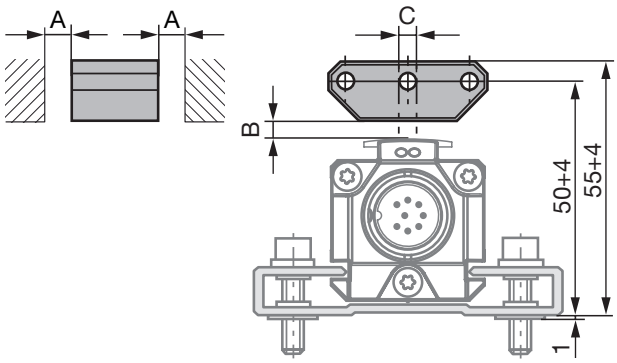


Fig. 4-4: Dimensions and distances with BTL5-P-3800-2 magnet

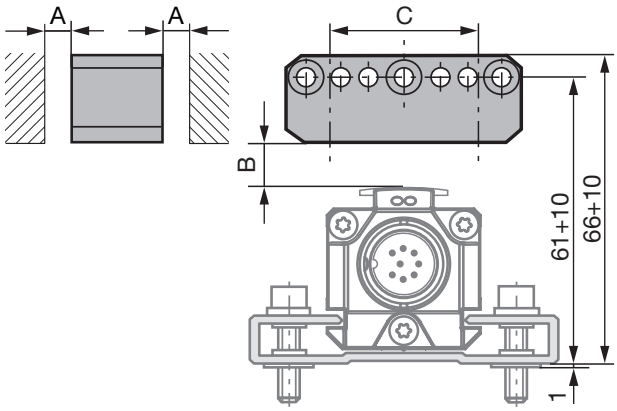


Fig. 4-5: Dimensions and distances with BTL5-P-5500-2 magnet

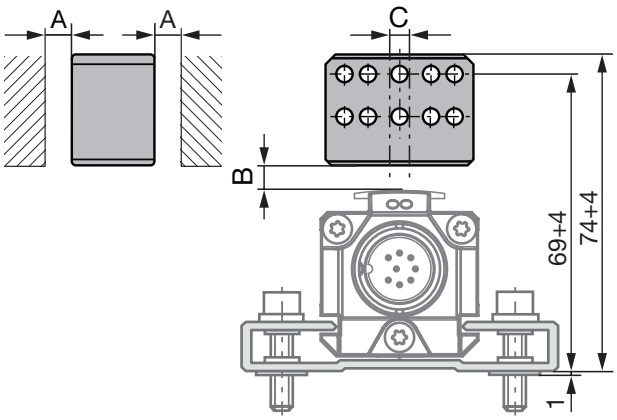


Fig. 4-6: Dimensions and distances with BTL6-A-3800-2 magnet

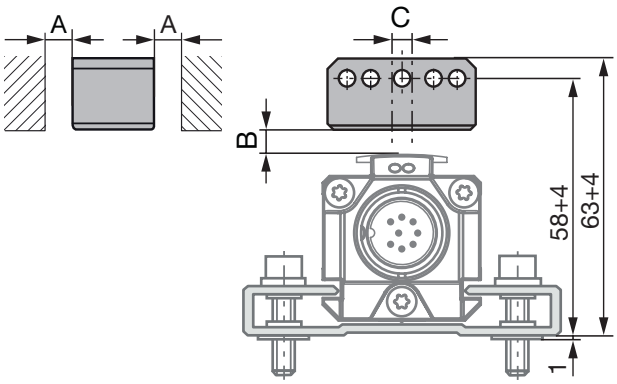


Fig. 4-7: Dimensions and distances with BTL6-A-3801-2 magnet

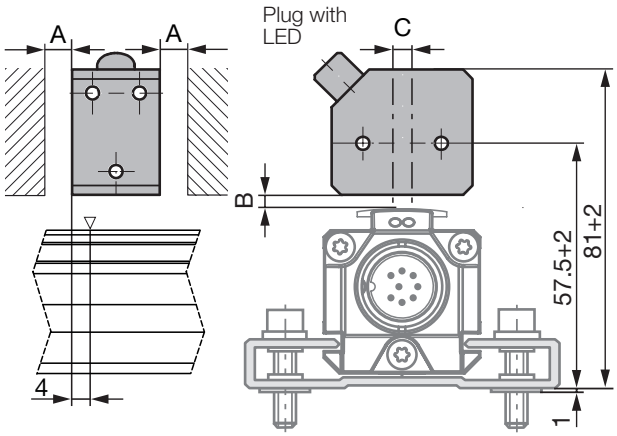


Fig. 4-8: Dimensions and distances with BTL5-P-4500-1 electromagnet (24 V/100 mA)

The measuring range is offset by 4 mm towards the transducer plug (see Fig. 4-8).

4 Installation and connection (continued)

4.4 Electrical connection

Depending on the model, the electrical connection is made using a cable or a connector.
The connection or pin assignments for the respective version can be found in Tab. 4-3 to Tab. 4-4.

> Note the information on shielding and cable routing on page 12.

4.4.1 Connector S32/cable

Pin	Cable color	Interface BTL7-P511…-S32
1	YE yellow	+Init
2	GY gray	+Start/stop
3	PK pink	–Init
4	RD red	Not used[1)]
5	GN green	–Start/Stop
6	BU blue	GND
7	BN brown	10…30 V
8	WH white	Not used[1)]

[1)] Unassigned leads can be connected to the GND on the controller side but not to the shield.

Tab. 4-3: Connection assignments

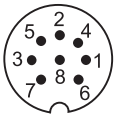


Fig. 4-9: Pin assignment of S32 (view from above on transducer), 8-pin M16 circular plug

4.4.2 Connector S115

Pin	Interface BTL7-P511…-S115
1	+Init
2	+Start/stop
3	–Init
4	Not used[1)]
5	–Start/Stop
6	GND
7	10…30 V
8	Not used[1)]

[1)] Unassigned leads can be connected to the GND on the controller side but not to the shield.

Tab. 4-4: Connection assignments

Fig. 4-10: Pin assignment of S115 (view from above on transducer), 8-pin M12 circular plug

4 Installation and connection (continued)

4.5 Shielding and cable routing

Defined ground!
The transducer and the control cabinet must be at the same ground potential.

Shielding

To ensure electromagnetic compatibility (EMC), observe the following:

– Connect transducer and controller using a shielded cable.
  Shielding: Braided copper shield with minimum 85% coverage.
– Connector version: Shield is internally connected to connector housing.
– Cable version: On the transducer side, the cable shielding is connected to the housing.

Magnetic fields

The position measuring system is a magnetostrictive system. It is important to maintain adequate distance between the transducer and strong, external magnetic fields.

Cable routing

Do not route the cable between the transducer, controller, and power supply near high voltage cables (inductive stray noise is possible).
The cable must be routed tension-free.

Bending radius for fixed cable

The bending radius for a fixed cable must be at least five times the cable diameter.

Cable length

BTL7-P…	Max. 500 m[1)]

[1)] Prerequisite: Construction, shielding and routing preclude the effect of any external noise fields. Required cable cross-section ≥ 0.6 mm² or ≤ AWG19

Tab. 4-5: Cable length BTL7-P…

Noise elimination

To avoid equipotential bonding – a current flow – through the cable shield, please note the following:

– Use insulating bushes
– Put the control cabinet and the system in which the transducer is located to the same ground potential.

5 Startup

5.1 Starting up the system

⚠ DANGER

Uncontrolled system movement

When starting up, if the position measuring system is part of a closed loop system whose parameters have not yet been set, the system may perform uncontrolled movements. This could result in personal injury and equipment damage.

- ▶ Persons must keep away from the system's hazardous zones.
- ▶ Startup must be performed only by trained technical personnel.
- ▶ Observe the safety instructions of the equipment or system manufacturer.

1. Check connections for tightness and correct polarity. Replace damaged connections.
2. Turn on the system.
3. Check measured values and readjust the transducer, if necessary.

i Check for the correct values, especially after replacing the transducer or after repair by the manufacturer.

5.2 Operating notes

- Check the function of the position measuring system and all associated components on a regular basis.
- Take the position measuring system out of operation whenever there is a malfunction.
- Secure the system against unauthorized use.

6 P interface

6.1 Principle

The P interface is a universal impulse interface and unifies the functions of the falling and rising edges. The position measuring system control is done via Init and start/stop signals. Here, the “start pulse” is the reference point for the travel time measurement.

Reliable signal transmission, even with cable lengths of up to 500 m between the evaluation unit and transducer is ensured by the particularly fail-safe RS485 differential driver and receiver. Interfering signals are effectively suppressed.

DPI/IP is a protocol for direct data exchange between the controller and transducer. Here, the signal lines transmit additional information, such as manufacturer, sensor type, measuring length, and waveguide velocity. This makes it possible to start up or exchange a transducer without needing to manually change the control parameters.

The interface enables bi-directional communication and includes integrated diagnostic functions. Downtimes are reduced thanks to Plug & Play and automatic parameterization.

6.2 DPI/IP method

6.2.1 Function and characteristics

The DPI/IP method includes two operating modes, DPI measuring operation and operation with the IP data protocol.

DPI = digital pulse interface

IP = integrated protocol

DPI measuring operation

The Init pulse is sent to the transducer via the Init line at regular intervals, its rising edge triggers a measurement.

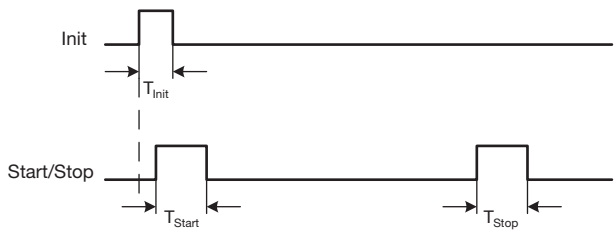
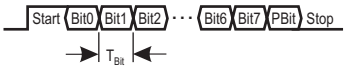


Fig. 6-1: Principle of data transfer in DPI measuring operation

T_{Init}	1 µs to 5 µs
T_{Start}	3 µs to 5 µs (typ. 4 µs)
T_{Stop}	3 µs to 5 µs (typ. 4 µs)

Operation with IP data protocol

If the length of the Init pulse T_{IP} is extended to 10 µs to 50 µs, the transducer switches from DPI measuring mode to operation with the IP data protocol (see Fig. 6-2). Here, a character string (command) is transferred to the transducer after the Init pulse. While the start pulse is still sent by the transducer as a response on the start/stop line, a character string (response) is transferred to the controller instead of the stop pulses, which contains the requested response dependent on the command. Each character in the transfer protocol has the following bit structure:



Start bit	Start-of-frame bit
Bit 0 to bit 7	8 data bits
PBit	Parity bit (even parity)
Stop	Stop-of-frame bit
T_{Bit}	4 µs (bit length at a data rate of 250 kbit/s)

Data security during transfer of the string is achieved with the parity and CRC16 checks with polynomial X16+X12+X5+1 (corresponds to 0x1021). If there is a transfer or protocol error, the transducer sends an appropriate error message as the response.

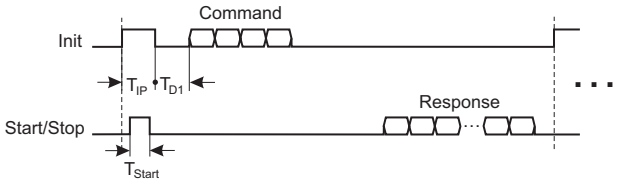


Fig. 6-2: Principle of data transfer with the IP data protocol

T_{IP}	10 µs to 50 µs Operation with IP data protocol
Command	Command to request transducer data (information that is stored in the transducer)
T_{Start}	3 µs to 5 µs (typ. 4 µs)
T_{D1}	> 50 µs
Response	Response in line with the request Alternative: error message

6 P interface (continued)

6.2.2 Protocol parameters

Read out parameter	CI LEN CRC CRC Inquiry		CR LEN D0 ··· Dn CRC CRC Response			
	CI	LEN	CR	LEN	D0…Dn	n
Manufacturer ID	01h	00h	01h	07h	Vendor name ASCII coded 'B' 'A' 'L' 'L' 'U' 'F' 'F'	6
or	06h	00h	06h	04h	Vendor code Hex coded 0x00000001 for BALLUFF	3
Ordering code	02h	00h	02h	28h	Type key ASCII coded Example: 'BTL7-P511-M0500-P-S32'	39
Serial number	03h	00h	03h	11h	Serial number ASCII coded Example: '15011400012345 DE'	16
or	07h	00h	07h	08h	Serial number Hex coded Example: 0x0005554764881E45 = 15011400012345 DE	7
Ultrasonic velocity	04h	00h	04h	03h	Ultrasonic velocity BCD coded v_{us} = 2850.00 m/s = 28h 50h 00h	2
or	08h	00h	08h	04h	Ultrasonic velocity Hex coded 0x00045948 = 2850.00 m/s	3
Null point offset	09h	00h	09h	04h	Zero point offset [µm] Example: 0x000124F8 = 75000 µm	3
Measuring length	0Ah	00h	0Ah	04h	Stroke length [mm] Example: 0x000001F4 = 500 mm	3
Error message			FFh	02h	Error code 01h = unknown command 02h = transmission error 03h = EEPROM access error	1

Tab. 6-1: List of request/response parameters

CI	Command ID
CR	Command response
LEN	Length of data D0…Dn
D0…Dn	Data frame
CRC	CRC16 from CI/CR to Dn

7 Technical data

7.1 Accuracy

The specifications are typical values for BTL7-P… at 24 V DC and room temperature, with a nominal length of 500 mm in conjunction with the BTL5-P-3800-2, BTL5-P-4500-1, BTL5-P-5500-2[1], BTL6-A-3800-2[1], BTL6-A-3801-2[1], BTL5-F-2814-1S, BTL5-T-2814-1S, BTL5-M-2814-1S or BTL5-N-2814-1S.
The transducer is fully operational immediately, with full accuracy after warm-up.

> For special versions, other technical data may apply.
> Special versions are indicated by the suffix -SA on the part label.

Non-linearity at	
Nominal length ≤ 500 mm	±50 µm
Nominal length > 500 to ≤ 5500 mm	±0.01% FS
Nominal length > 5500 mm	±0.02% FS
Hysteresis	≤ ±10 µm
Repeat accuracy	≤ ±5 µm (typ. ±2.5 µm)
Temperature coefficient[2]	≤ 15 ppm/K
Ultrasonic velocity (standardized)	2850 m/s
Gradient (standardized)	8.9122807 µs/inch
Max. detectable velocity	10 m/s

7.2 Ambient conditions[3]

Operating temperature	–40°C…+85°C
Operating temperature for UL (only BTL7-…-KA…)	Max. +80°C
Storage temperature	–40°C…+100°C
Humidity	< 90%, non-condensing
Shock rating Continuous shock per EN 60068-2-27[4]	150 g/6 ms 150 g/2 ms
Vibration per EN 60068-2-6[4]	20 g, 10…2000 Hz
Degree of protection per IEC 60529	
Connector S32/S115 (when attached)	IP67
Cable	IP68[4]

7.3 Supply voltage

Voltage, stabilized[5]	10…30 V DC
Ripple	≤ 0.5 V_{ss}
Current draw (at 24 V DC)	≤ 100 mA
Inrush current	≤ 500 mA/10 ms
Reverse polarity protection	Up to 36 V (supply to GND)
Overvoltage protection	Up to 36 V
Dielectric strength (GND to housing)	500 V AC

7.4 Output

Start/stop difference	
Max. number of magnets	16[6]
Short-circuit protection	Signal lines to +36 V or GND

[1] In the position range 0…20 mm, the specified linearity limit can be exceeded by ±100 µm.
[2] Nominal length 500 mm, magnet in the middle of the measuring range
[3] For c UL us LISTED: Use in enclosed spaces and up to a height of 2000 m above sea level.
[4] Individual specifications as per Balluff factory standard, resonances excluded
[5] For c UL us LISTED: The transducer must be externally connected via a limited-energy circuit as defined in UL 61010-1, a low-power source as defined in UL 60950-1, or a class 2 power supply as defined in UL 1310 or UL 1585.
[6] Number dependent on nominal length (see section 3.3)

7 Technical data (continued)

7.5 Dimensions, weights

Housing height	36.8 mm
Nominal length	50…7620 mm
Weight (depends on length)	Approx. 1.4 kg/m
Housing material	Aluminum

BTL7-…-KA_ _

Cable material	PUR cULus 20549 80°C, 300 V, internal wiring
Cable temperature	–40°C…+90°C
Cable diameter	Max. 7 mm
Permissible bending radius	
Fixed routing	≥ 35 mm
Movable	≥ 105 mm

7.6 Connection to the evaluation unit

The maximum sampling frequency $f_{A,max}$, at which a new current value is available with each sampling, can be found in the following graphic:

The minimum sampling frequency $f_{A,min}$ is 62,5 Hz.

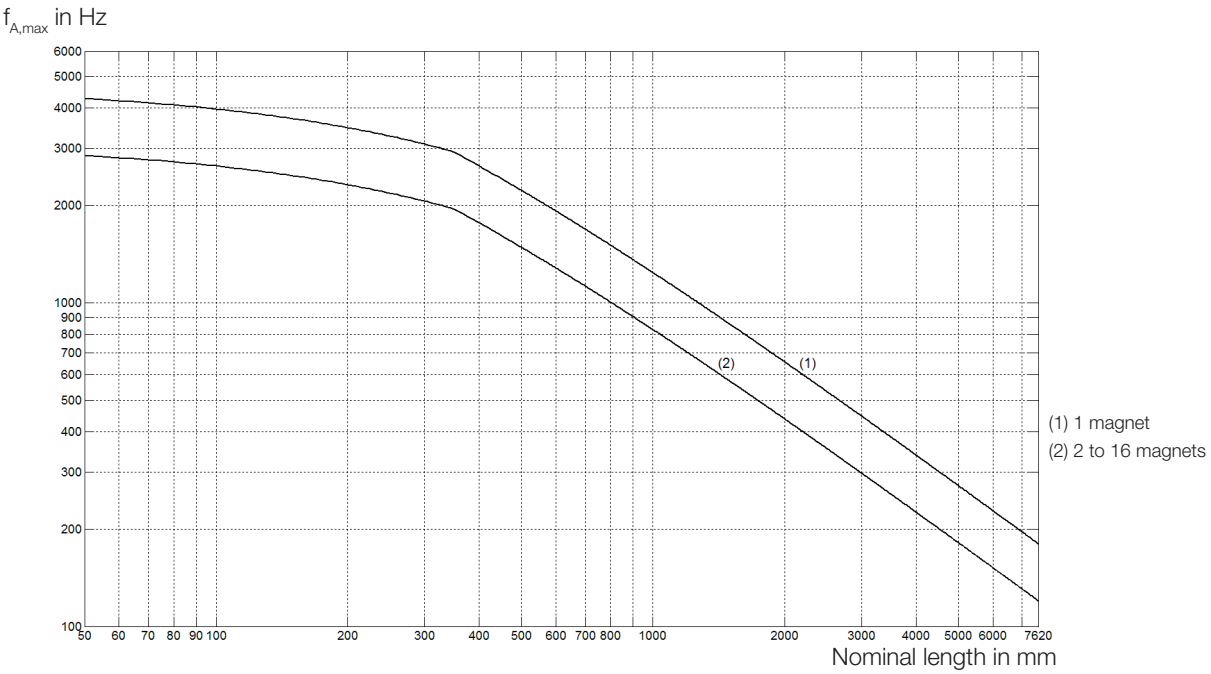


Fig. 7-1: Maximum sampling rate depending on the nominal length

8 Accessories

8.1 Captive magnets

BTL5-M/N-2814-1S

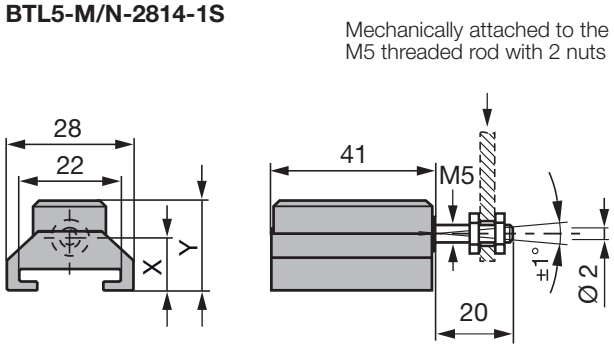


Fig. 8-1: Installation dimensions of BTL5-M/N-2814-1S magnet

	BTL5-M-2814-1S	BTL5-N-2814-1S
Distance X	12.5 mm	15 mm
Distance Y	21 mm	23.5 mm
Weight:	Approx. 32 g	Approx. 35 g
Housing:	Aluminum	Aluminum
Slide surface:	Plastic	Plastic

BTL5-F-2814-1S

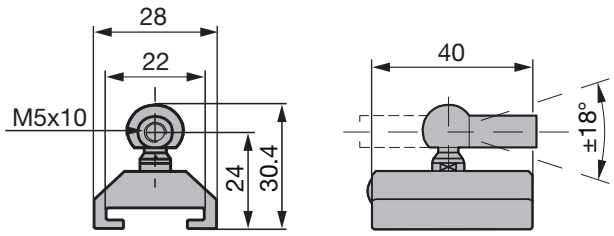


Fig. 8-2: Installation dimensions of BTL5-F-2814-1S magnet

Weight:	Approx. 28 g
Housing:	Aluminum
Slide surface:	Plastic

BTL5-T-2814-1S

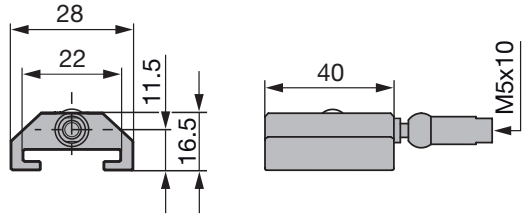


Fig. 8-3: Installation dimensions of BTL5-T-2814-1S magnet

Weight:	Approx. 28 g
Housing:	Aluminum
Slide surface:	Plastic

8.2 BTL2-GS10-_ _ _ _-A joint rod

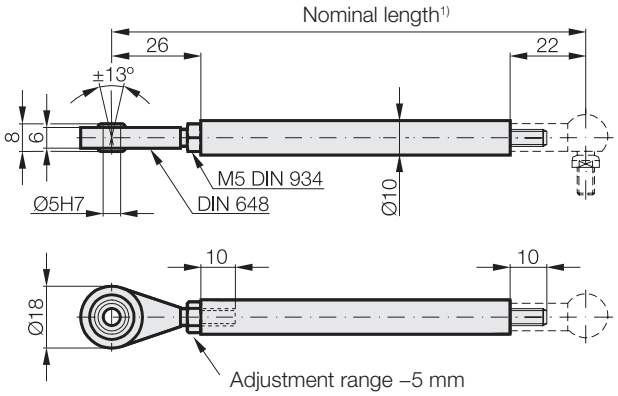


Fig. 8-4: BTL2-GS10-_ _ _ _-A joint rod

Weight:	Approx. 150 g/m
Material:	Aluminum

1) State the nominal length when ordering

Example: BTL2-GS10-**0100**-A (nominal length = 100 mm)

8 Accessories (continued)

8.3 Floating magnets

BTL5-P-3800-2

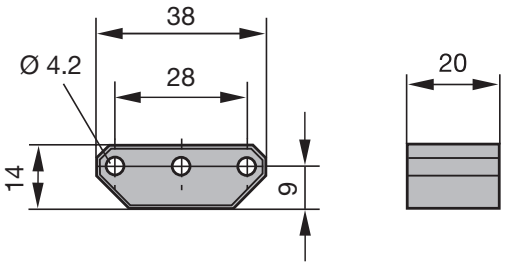


Fig. 8-5: Installation dimensions of BTL5-P-3800-2 magnet

Weight:	Approx. 12 g
Housing:	Plastic

BTL5-P-5500-2

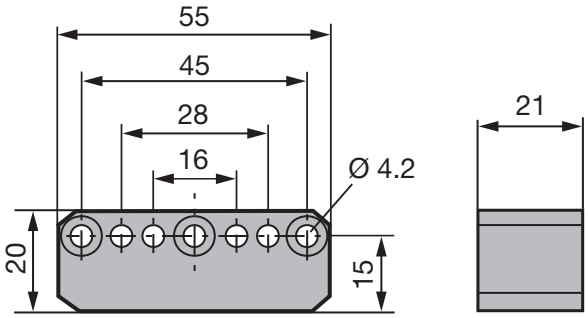


Fig. 8-6: Installation dimensions of BTL5-P-5500-2 magnet

Weight:	Approx. 40 g
Housing:	Plastic

BTL6-A-3800-2

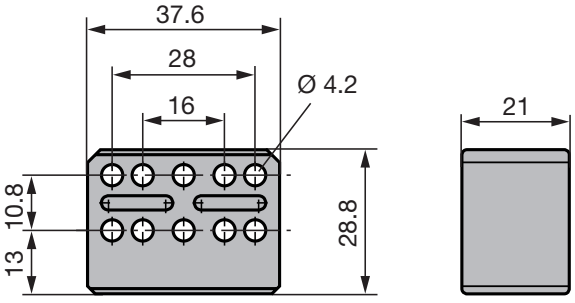


Fig. 8-7: Installation dimensions of BTL6-A-3800-2 magnet

Weight:	Approx. 30 g
Housing:	Plastic

BTL6-A-3801-2

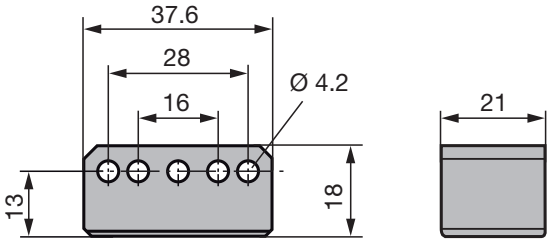


Fig. 8-8: Installation dimensions of BTL6-A-3801-2 magnet

Weight:	Approx. 25 g
Housing:	Plastic

BTL5-P-4500-1

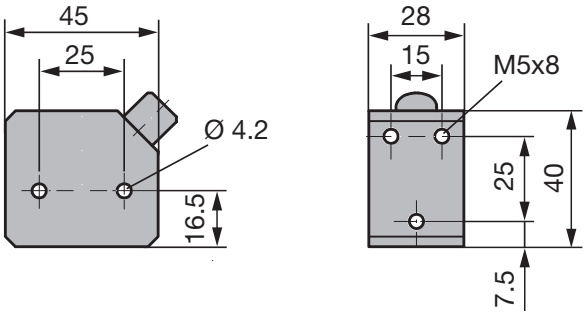


Fig. 8-9: Installation dimensions of BTL5-P-4500-1 magnet

Weight:	Approx. 90 g
Housing:	Plastic
Operating temperature:	–40°C…+60°C

Special advantage of the BTL5-P-4500-1 magnet: Several magnets on the same transducer can be separately switched on and off electrically (actuation with a PLC signal).

8 Accessories (continued)

8.4 Connectors and cables

8.4.1 BKS-S32/S33M-00, freely configurable

BKS-S32M-00

Straight connector, freely configurable
M16 per IEC 130-9, 8-pin

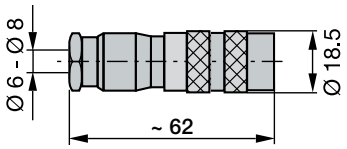


Fig. 8-10: Connector BKS-S32M-00

BKS-S33M-00

Angled connector, freely configurable
M16 per IEC 130-9, 8-pin

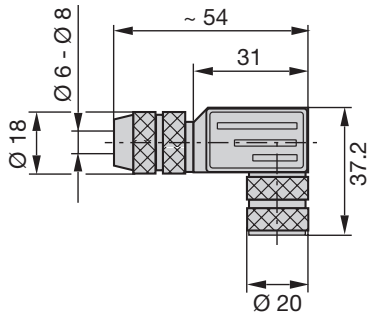


Fig. 8-11: Connector BKS-S33M-00

8.4.2 BKS-S232/S233-PU-_ _, preassembled

BKS-S232-PU-_ _

Straight connector, molded, preassembled
M16, 8-pin
Various cable lengths can be ordered,
e. g. BKS-S232-PU-05: Cable length 5 m

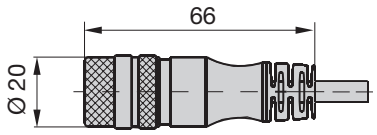


Fig. 8-12: Connector BKS-S232-PU-_ _

BKS-S233-PU-_ _

Angled connector, molded, preassembled
M16, 8-pin
Various cable lengths can be ordered,
e. g. BKS-S233-PU-05: Cable length 5 m

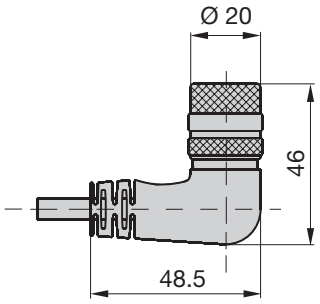


Fig. 8-13: Connector BKS-S233-PU-_ _

The outlet direction and the pin assignment for the BKS-S233-PU-_ _ is the same as that for BKS-S116-PU-_ _ (see Fig. 8-16 or Tab. 8-1).

8 Accessories (continued)

8.4.3 BKS-S115/S116-PU-_ _, preassembled

BKS-S115-PU-_ _

Straight connector, molded-on cable, preassembled
M12, 8-pin
Various cable lengths can be ordered,
e. g. BKS-S115-PU-05: Cable length 5 m

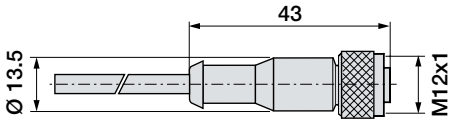


Fig. 8-14: Connector type BKS-S115-PU-_ _

BKS-S116-PU-_ _

Angled connector, molded-on cable, preassembled
M12, 8-pin
Various cable lengths can be ordered,
e. g. BKS-S116-PU-05: Cable length 5 m

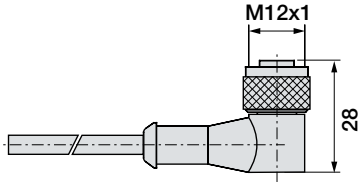


Fig. 8-15: Connector BKS-S116-PU_ _

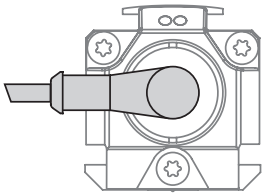


Fig. 8-16: Connector BKS-S116-PU_ _, outlet

Pin	Color
1	YE yellow
2	GY gray
3	PK pink
4	RD red
5	GN green
6	BU blue
7	BN brown
8	WH white

Tab. 8-1: BKS-S115/116-PU-_ _ pin assignment

Type code breakdown

BTL7 - P 5 1 1 - M0500 - P - S32

Micropulse transducer

P interface (DPI/IP)

Supply voltage:
5 = 10…30 V DC

Data protocol:
11 = with DPI/IP

Nominal length (4-digit):
M0500 = Metric specification in mm, nominal length 500 mm (M0050…M7620)

Construction:
P = profile housing

Electrical connection:
S32 = 8-pin, M16 plug per IEC 130-9
S115 = 8-pin, M12 plug
KA05 = Cable, 5 m (PUR)

10 Appendix

10.1 Converting units of length

1 mm = 0.0393700787 inch

mm	inch
1	0.03937008
2	0.07874016
3	0.11811024
4	0.15748031
5	0.19685039
6	0.23622047
7	0.27559055
8	0.31496063
9	0.35433071
10	0.393700787

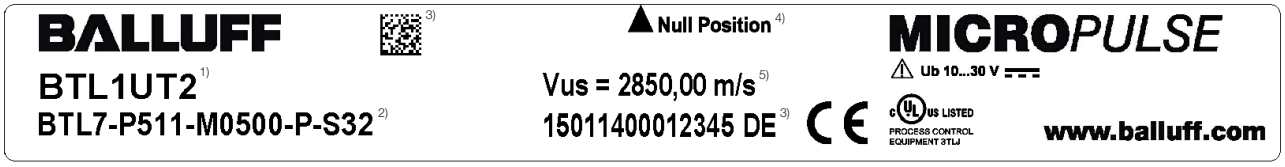
Tab. 10-1: Conversion table mm to inches

1 inch = 25.4 mm

inch	mm
1	25.4
2	50.8
3	76.2
4	101.6
5	127
6	152.4
7	177.8
8	203.2
9	228.6
10	254

Tab. 10-2: Conversion table inches to mm

10.2 Part label



1) Ordering code
2) Type
3) Serial number
4) Null mark
5) US velocity

Fig. 10-1: BTL7 part label

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