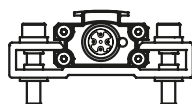


BTL6-V55V-M _ _ _ _ -PF-S115

User's Guide



www.balluff.com

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1

Notes to the user

1.1 Validity

This guide describes the construction, function and setup options for the BTL6 Micropulse Transducer with VARAN interface. It applies to types

BTL6-V55V-M _ _ _ _ -PF-S115 (see Type code breakdown on page 14).

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

- BTL6 transducer
- Mounting clamps with insulating sleeves and screws
- Condensed guide



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

1.4 Downloading further instructions

The VARAN bus is an industrial real-time bus system based on the IEEE 802.3 100TX Standard Ethernet technology. You can find more detailed information on configuration in the configuration guide.



You can find a detailed configuration guide online at: www.balluff.com/downloads-btl6.

1.5 Approvals and markings



UL approval
File no.
E227256

US Patent 5 923 164

The US patent was awarded in connection with this product.



The CE Mark verifies that our products meet the requirements of EU Directive 2004/108/EC (EMC Directive).

The transducer meets the requirements of the following generic standards:

- EN 61000-6-1 (noise immunity)
- EN 61000-6-2 (noise immunity)
- EN 61000-6-3 (emission)
- EN 61000-6-4 (emission)

and the following product standard:

- EN 61326-2-3

Emission tests:

- RF emission
EN 55016-2-3 (industrial and residential areas)

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.

1.6 Abbreviations

DO	Data object
VARAN	Versatile Automation Random Access Network, a bus system based on Ethernet technology
VNO	VARAN-BUS user organization, www.varan-bus.net

2

Safety

2.1 Intended use

The Micropulse Transducer, together with a machine control (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 transducer 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

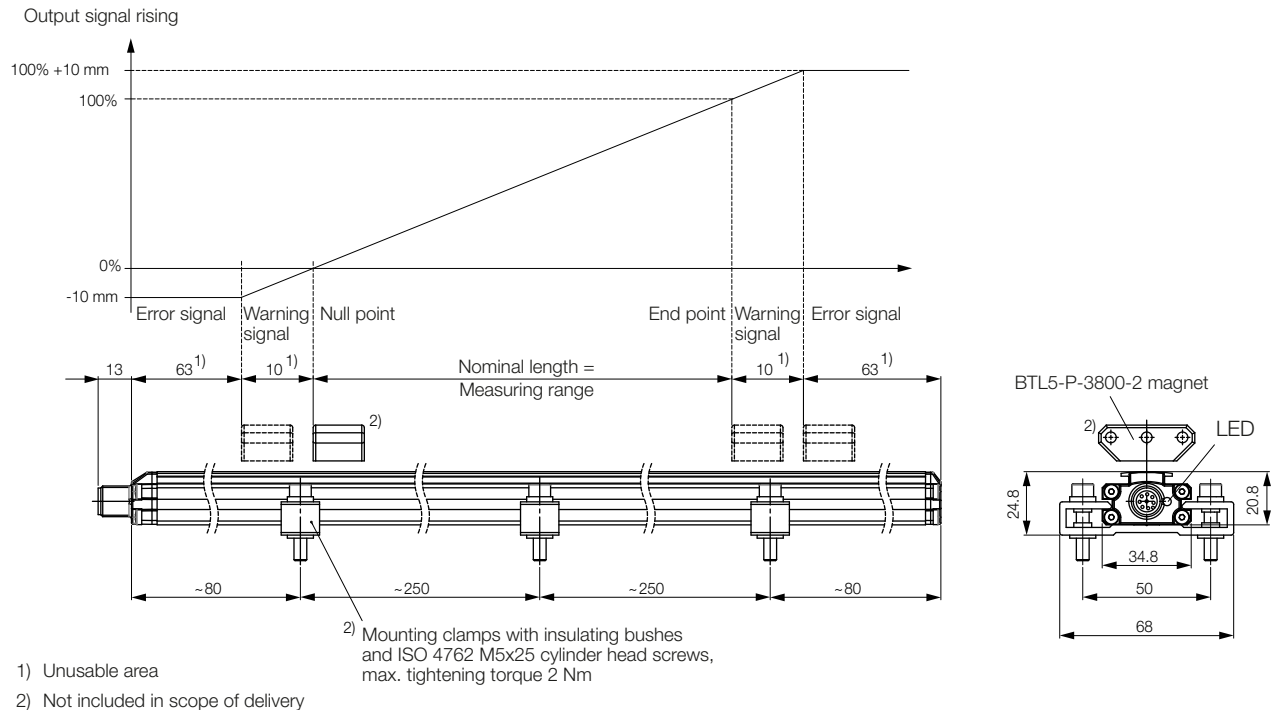


Fig. 3-1: BTL6... transducer, construction

3.1 Construction

Electrical connection: The electrical connection is made via a connector (see Type code breakdown on page 14).

BTL 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 12).

Nominal length: To optimally adapt the transducer to the application, the following nominal lengths are available:

Nominal length	Grading
50...4572	25 mm

3.2 Function

The BTL6 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 internally generated INIT pulse interacts with the magnetic field of the magnet to generate a torsional wave in the waveguide which propagates at ultrasonic speed.

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.

This information is transferred via the VARAN interface. VARAN is an industrial bus system based on the physical layer of the Ethernet (see www.varan-bus.net).

3.3 LED display



In normal operation the LED indicates the operating states of the VARAN bus.

LED	Operating state
Green	Ethernet Connection available
Orange	Data is being transmitted via the VARAN bus.

Tab. 3-1: LED display

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.

- i** 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 on page 6).

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).

- i** 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. 4-2 and Fig. 4-3).

4.2 Multiple magnets

If multiple magnets are used, the distance between the magnets must be at least 65 mm (see Fig. 4-1).

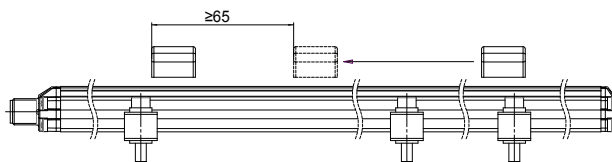


Fig. 4-1: Distance between the magnets

4.3 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 13).

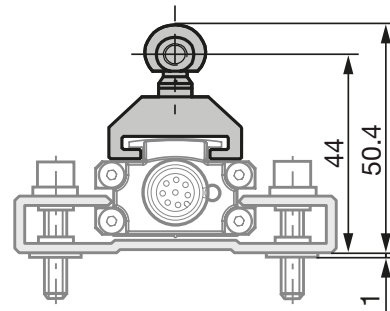


Fig. 4-2: Dimensions and distances with BTL5-F-2814-1S magnet

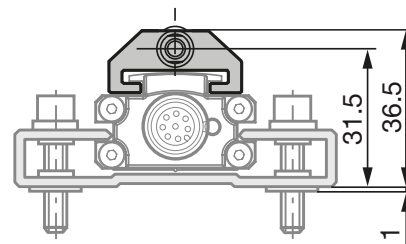


Fig. 4-3: Dimensions and distances with BTL5-T-2814-1S magnet

4 Installation and connection (continued)

4.4 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 magnets 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 to 4 mm	± 2 mm
BTL5-P-5500-2	5 to 15 mm	± 15 mm
BTL5-P-4500-1	0.1 to 2 mm	± 2 mm
BTL6-A-3800-2	4 to 8 mm ²⁾	± 2 mm
BTL6-A-3801-2	4 to 8 mm ²⁾	± 2 mm

¹⁾ The selected distance should stay constant over the entire measuring length.

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

Tab. 4-1: Distance and offset for magnets (see Fig. 4-4 to Fig. 4-8)

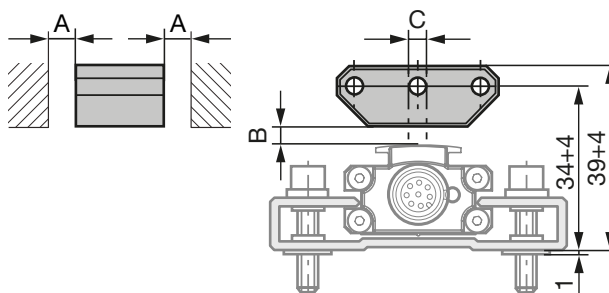


Fig. 4-4: Dimensions and distances with BTL5-P-3800-2 magnet

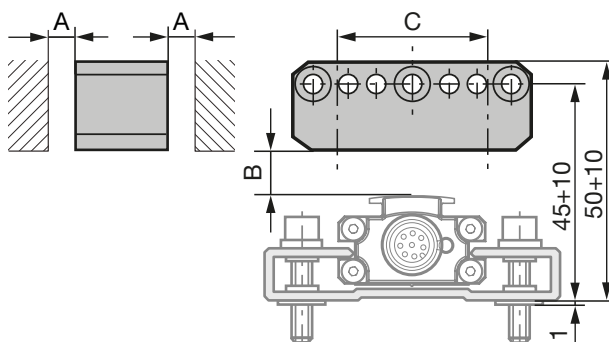


Fig. 4-5: Dimensions and distances with BTL5-P-5500-2 magnet

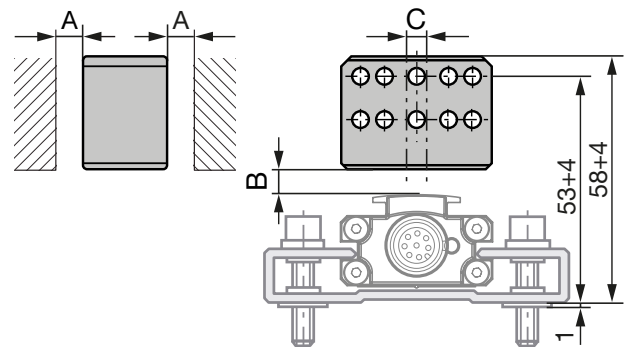


Fig. 4-6: Dimensions and distances with BTL6-A-3800-2 magnet

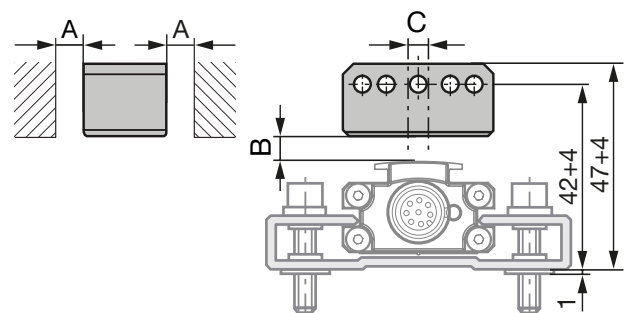


Fig. 4-7: Dimensions and distances with BTL6-A-3801-2 magnet

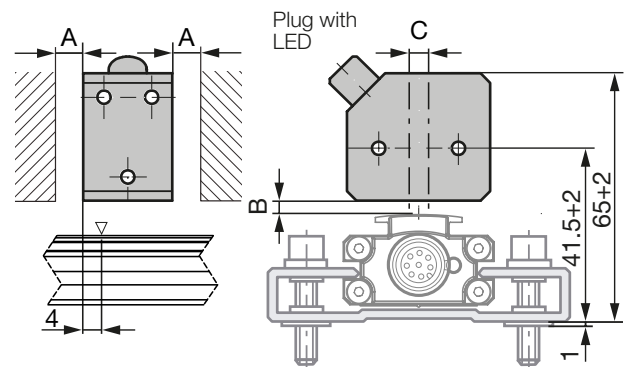


Fig. 4-8: Dimensions and distances with BTL5-P-4500-1 electromagnet (24 V/100 mA)



BTL5-P-4500-1:

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

4

Installation and connection (continued)

4.5 Electrical connection

The BTL is connected via an S115 connector (see Accessories on page 13).

PIN	Color		BTL6-V55V-... interface
1	—	—	Not used ¹⁾
2	OG/WH	Orange/white	TX+
3	OG	Orange	TX–
4	—	—	Not used ¹⁾
5	GN/WH	Green/white	RX+
6	BU	Blue	GND ²⁾
7	BN	Brown	10 to 30 V
8	GN	Green	RX–

¹⁾ Unassigned leads that are not used can be connected to the GND on the controller side but not to the shield.

²⁾ Reference potential for supply voltage and EMC-GND.

Tab. 4-2: Pin assignment of S115 connector

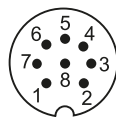


Fig. 4-9: Pin assignment of S115 connector (view from above on transducer)

4.6 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%.
- Shield is internally connected to connector 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).

Cable length

The maximum cable length when using CAT5e cables is 100 m.

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 BTL6 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 adjustable parameters (especially after replacing the transducer).

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

Technical data

6.1 Accuracy

The specifications are typical values 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, BTL6-A-3800-2, BTL6-A-3801-2, BTL5-F-2814-1S or BTL5-T-2814-1S magnet. The BTL 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.

Resolution	< 10 µm
Repeat accuracy, typical	< 20 µm
Sampling rate	
Dependent on nominal length	250 µs to 4 ms
At nominal length = 500 mm	≥ 428 µs
Non-linearity at	
Nominal length ≤ 500 mm	±150 µm
Nominal length > 500 mm	±0.03 % FS
Temperature coefficient ¹⁾	≤ 20 ppm/K

6.2 Ambient conditions²⁾

Operating temperature	0 to +85°C
Storage temperature	–40 to +100°C
Humidity	< 90%, non-condensing
Shock rating per EN 60068-2-27 ³⁾	50 g/6 ms
Continuous shock per EN 60068-2-29 ³⁾	50 g/2 ms
Vibration per EN 60068-2-6 ³⁾	12 g, 10 to 2000 Hz
Degree of protection per IEC 60529 with screwed-on connector	IP 67

6.3 Supply voltage

Voltage, stabilized ⁴⁾	10 to 30 V DC
Ripple	≤ 2.5 V _{ss}
Current draw (at 24 V DC)	≤ 80 mA
Inrush current	≤ 4 A/0.5 ms
Reverse polarity protection	Up to 36 V
Overvoltage protection	Up to 36 V (supply cables only!)
Dielectric strength of GND to housing	500 V DC


6.4 Inputs/outputs

Short circuit resistance	Signal cable to GND
--------------------------	---------------------


6.5 Dimensions, weights

Housing height	20.8 mm
Nominal length	50 to 4572 mm
Weight (depends on length)	Approx. 1 kg/m
Housing material	Aluminum, anodized

¹⁾ Nominal length = 500 mm, magnet in the middle of the measuring range

²⁾ For : Use in enclosed spaces and up to a height of 2000 m above sea level.

³⁾ Individual specifications as per Balluff factory standard

⁴⁾ For : 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.

7

Accessories

Accessories are not included in the scope of delivery and must be ordered separately.

7.1 Floating magnets

BTL5-P-3800-2

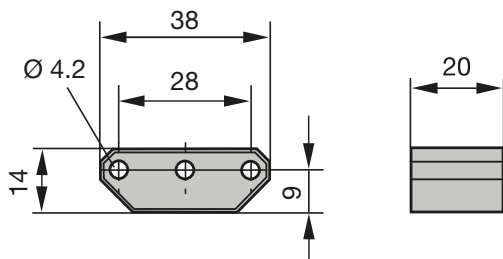


Fig. 7-1: Installation dimensions of BTL5-P-3800-2 magnet

Weight: Approx. 12 g

Housing: Plastic

BTL5-P-5500-2

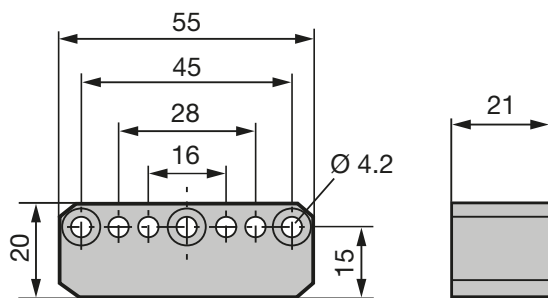


Fig. 7-2: Installation dimensions of BTL5-P-5500-2 magnet

Weight: Approx. 40 g

Housing: Plastic

BTL6-A-3800-2

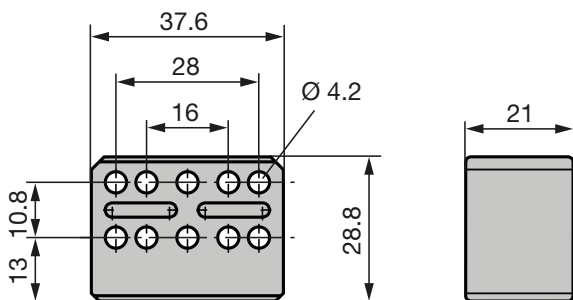


Fig. 7-3: Installation dimensions of BTL6-A-3800-2 magnet

Weight: Approx. 30 g

Housing: Plastic

BTL6-A-3801-2

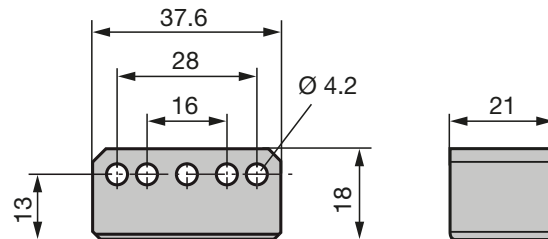


Fig. 7-4: Installation dimensions of BTL6-A-3801-2 magnet

Weight: Approx. 25 g

Housing: Plastic

BTL5-P-4500-1

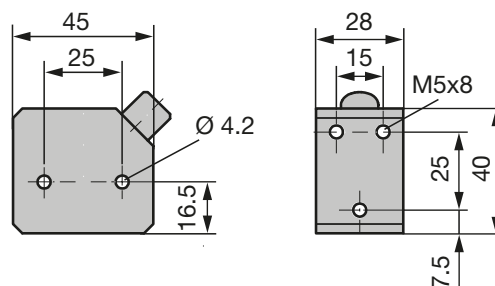


Fig. 7-5: Installation dimensions of BTL5-P-4500-1 magnet

Weight: Approx. 90 g

Housing: Plastic

Operating temperature: -40°C to +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).

7

Accessories (continued)

7.2 Captive magnets

BTL5-F-2814-1S

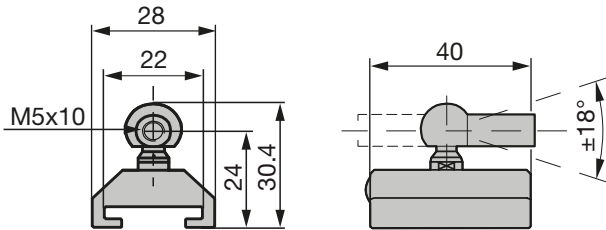


Fig. 7-6: Installation dimensions of BTL5-F-2814-1S magnet

Weight: Approx. 28 g
Housing: Anodized aluminum
Slide surface: Plastic

BTL5-T-2814-1S

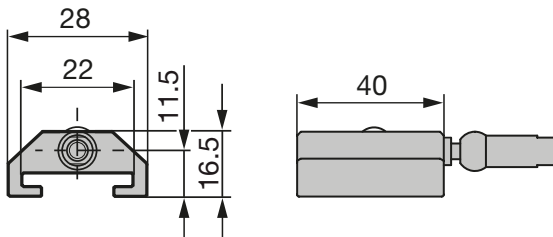


Fig. 7-7: Installation dimensions of BTL5-T-2814-1S magnet

Weight: Approx. 28 g
Housing: Anodized aluminum
Slide surface: Plastic

7.3 BTL2-GS10- -A joint rod

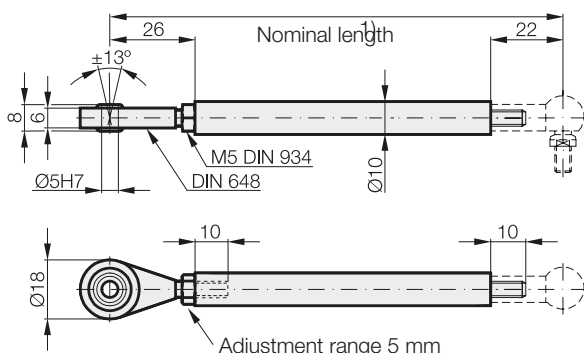


Fig. 7-8: BTL2-GS10- -A joint rod

Weight: Approx. 150 g/m
Material: Aluminum

1) State the nominal length when ordering

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

7.4 Connectors



For information on pin assignment, see Tab. 4-2 on page 9.

BCC M488-0000-1A-000-43x834-000

- Ordering code: BCC04ME
- Angled connector, freely configurable
- M12, 8-pin

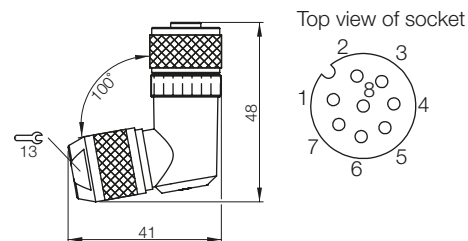


Fig. 7-9: Connector BCC M488-0000-1A-000-43x834-000

BCC M478-0000-1A-000-43x834-000

- Ordering code: BCC04MC
- Straight connector, freely configurable
- M12, 8-pin

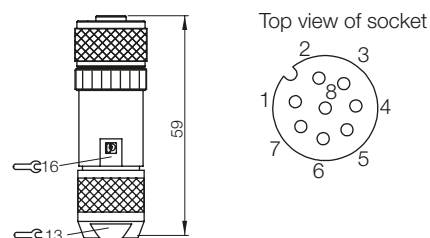


Fig. 7-10: Connector BCC M478-0000-1A-000-43x834-000

8

Type code breakdown

BTL6 - V 5 5 V - M0500 - PF - S115

Micropulse transducer

Ethernet interface

Supply voltage

5 = 10 to 30 V DC

Device profile

5 = EUROMAP 75

Ethernet interface type

V = VARAN

Nominal length (4-digit)

M0500 = Metric specification in mm, nominal length 500 mm (M0050 to M4572)

Construction

PF = Flat profile housing

Electrical connection

S115 = S115 connector, M12, 8-pin

9

Appendix

9.1 Converting units of length

1 mm = 0.03937008 inches

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. 9-1: 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. 9-2: Conversion table inches to mm

9.2 Part label



¹⁾ Ordering code

²⁾ Type

³⁾ Null mark

⁴⁾ Serial number

Fig. 9-1: BTL6 part label



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