

**BTL7-A/C/E/G50 -M \_ \_ \_ -TB2/3-S32/S135/KA \_ \_ /FA \_ \_**  
**BTL7-A/C/E/G50 -M \_ \_ \_ -TZ2/3-S32/S135/KA \_ \_ /FA \_ \_**  
**BTL7-A/C/E/G50 -M \_ \_ \_ -TT2/3-S32/KA \_ \_ /FA \_ \_**



User's Guide



**[www.balluff.com](http://www.balluff.com)**

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# BTL7-A/C/E/G50\_-M\_ \_ \_ \_ -T\_2/3-S32/S135/KA\_ \_/FA\_ \_ Magnetostrictive Linear Position Sensor – Rod Style

## 1

### Notes to the user

#### 1.1 Validity

This guide describes the construction, function and setup options for the BTL magnetostrictive linear position sensor with analog interface. It applies to types

**BTL7-A/C/E/G50\_-M\_ \_ \_ \_ -T\_2/3-S32/S135/KA\_ \_/FA\_ \_** (see Type code on page 21).

The BTL7...-TB... is used in the illustrations in this user's guide by way of example.

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

#### 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

- BTL
- Condensed guide



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

#### 1.4 Approvals and markings



Not for BTL7-...-FA\_ \_

#### 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 BTL 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.



By using the DNV GL symbol, we confirm that the marked products were type tested according to the guidelines of DNV GL.

The type approval is authenticated with a certificate ([www.balluff.com](http://www.balluff.com)).

Therefore, the marked products can be used according to the specifications of the certificate on ocean-going and inland vessels and on offshore operations in systems subject to mandatory type-testing.

Maximum length:

- BTL7-...-TB.../ BTL7-...-TZ...: 300 mm (500 mm when supported at the end of the rod using slide bush  
BAM PC-TL-001-D10,4-4 in bore with a diameter of max. 13 mm)
- BTL7-...-TT...: 240 mm

## 2

### Safety

#### 2.1 Intended use

This BTL contains 2 or 3 independent measuring units, depending on the version. Because of this redundancy, this type is especially suitable for applications in which safety is relevant.

The BTL magnetostrictive linear position sensor, together with a machine controller (e.g. PLC), comprises a position measuring system. It is intended to be installed into a machine or system and used in the industrial sector. 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 BTL or non-approved use are not permitted and will result in the loss of warranty and liability claims against the manufacturer.

#### 2.2 Reasonably foreseeable misuse

The products are not intended for the following applications and areas and may not be used there:

- in safety related applications where personal safety depends on functioning of the device
- in explosion hazard areas
- in the food sector

#### 2.3 General safety notes

**Installation** and **startup** may only be performed by qualified personnel 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 BTL will not result in hazards to persons or equipment.

If defects and unresolvable faults occur in the BTL, take it out of service and secure against unauthorized use.


#### 2.4 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
<b>Hazard type and source</b> Consequences if not complied with ▶ Measures to avoid hazards

The individual signal words mean:

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

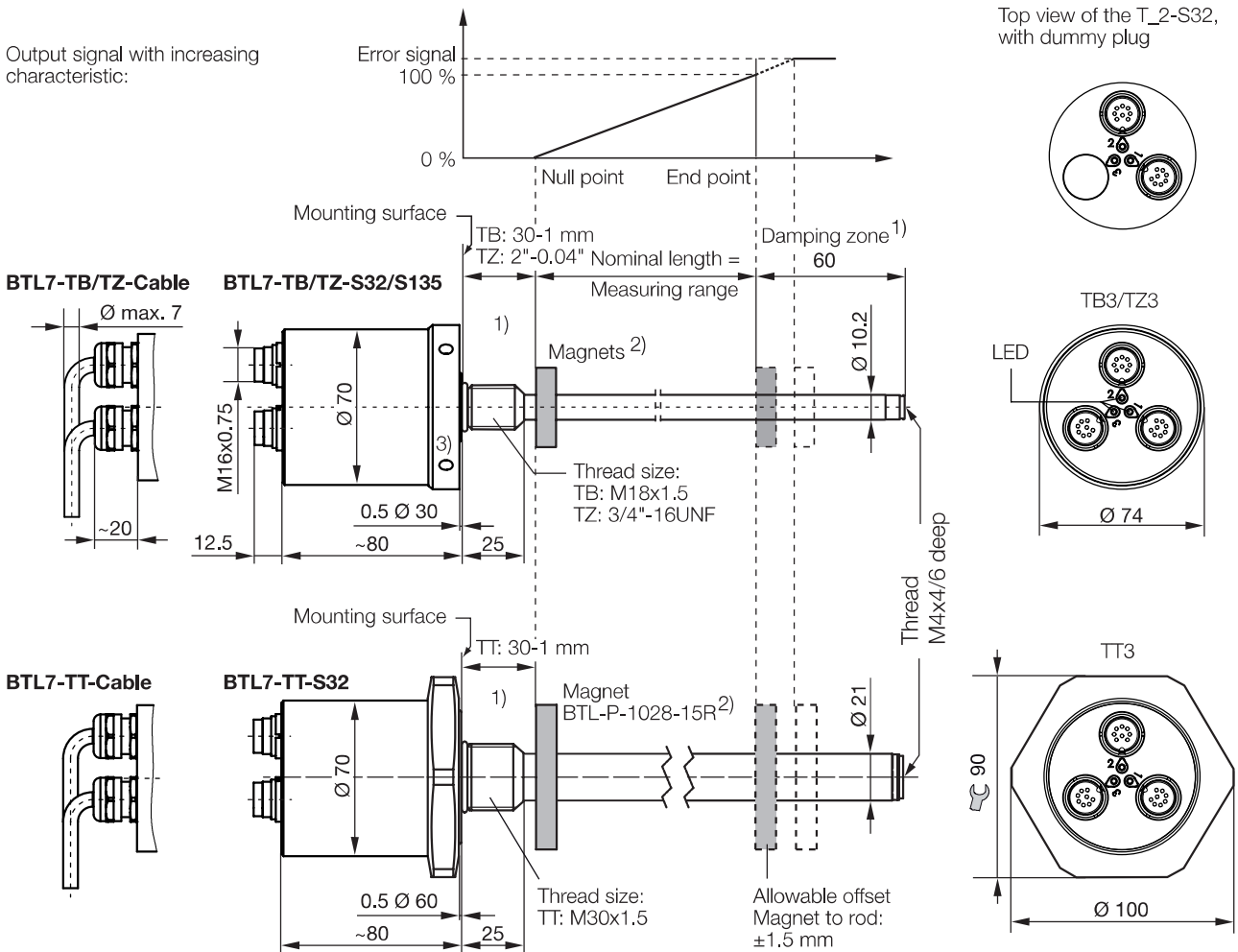
#### 2.5 Disposal

- ▶ Observe the national regulations for disposal.

# BTL7-A/C/E/G50\_-M\_-\_-\_-T\_2/3-S32/S135/KA\_/FA\_-\_- Magnetostrictive Linear Position Sensor – Rod Style

## 3

### Construction and function



- 1) Unusable area
- 2) Not included in scope of delivery
- 3) Ø 6.1 for hook spanner Ø 74

Fig. 3-1: BTL7..., construction and function

### 3.1 Construction

**Electrical connection:** The electrical connection is made via a cable or a connector (see Type code on page 21).

**Housing:** Aluminum housing containing the processing electronics.

**Mounting thread:** We recommend assembling the following BTLs on the mounting thread:

- BTL7-...-TB: M18x1.5
- BTL7-...-TZ: 3/4"-16UNF
- BTL7-...-TT: M30x1.5

The BTL has an additional thread at the end of the rod to support larger nominal lengths.

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

**Nominal length:** Defines the available measuring range. Rods with various nominal lengths from 25 mm to 7620 mm are available depending on the version of the BTL:

- Ø 10.2 mm: Nominal length from 25 mm to 7620 mm
- Ø 21 mm: Nominal length from 25 mm to 3250 mm

**Damping zone:** Area at the end of the rod that cannot be used for measurements, but which may be passed over.

**3**

**Construction and function (continued)**

**3.2 Function**

The BTL contains the waveguide which is protected by an outer stainless steel tube (rod). 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 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. Depending on the version, this information is made available as a voltage or current output with a rising or falling gradient. Depending on the version, this output signal is therefore redundantly present at 2 or 3 independent measuring units.

One output is available per measuring unit. The following functions can be selected for the output values:

- Position
- Velocity (with or without leading sign)

**i** The entire function scope can only be configured with the PC software BTL7 Configuration Tool. To do this, the USB communication box must be connected (see Accessories on page 20).

**3.3 LED display**

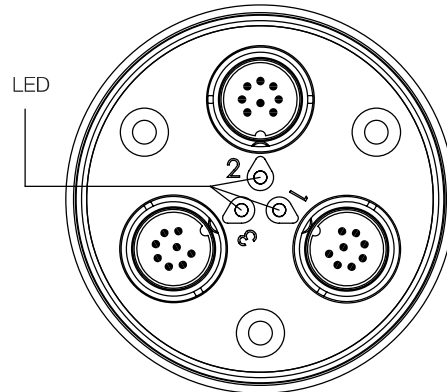


Fig. 3-2: Position of the BTL7 LED displays

**i** In normal operation, the LEDs indicate the operating states of the measuring units.

LED	Operating state
Green	<b>Normal function</b> Magnet is within the limits.
Red	<b>Error</b> No magnet or magnet outside the limits.

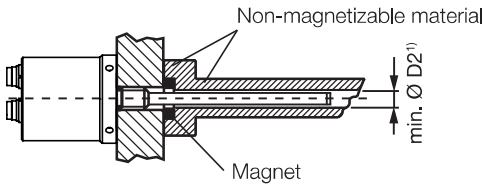
Tab. 3-1: LED displays in normal operation



**4 Installation and connection**

**4.1 Installation guidelines**

**Non-magnetizable material**

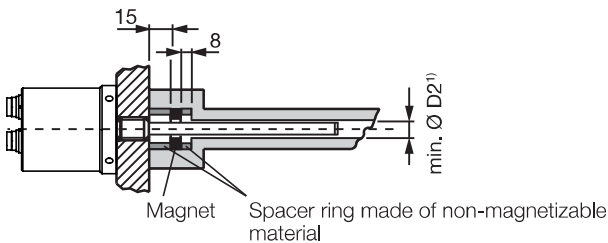
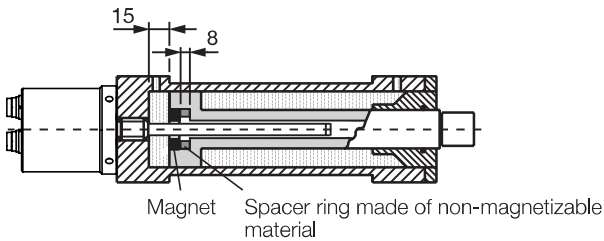


¹) Min. Ø D2 = Minimum diameter of the bore (see Tab. 4-1)

Fig. 4-1: Installation variant in non-magnetizable material

**Magnetizable material**

If using magnetizable material, the BTL must be protected against magnetic interference through suitable measures (e.g. spacer ring made of non-magnetizable material, a suitable distance from strong external magnetic fields).



¹) Min. Ø D2 = Minimum diameter of the bore (see Tab. 4-1)

Fig. 4-2: Installation in magnetizable material

Rod diameter	Bore diameter D2
10.2 mm	At least 13 mm
21 mm	At least 27 mm

Tab. 4-1: Bore diameter if installed in a hydraulic cylinder

**4.2 Preparing for installation**

**Installation note:** We recommend using non-magnetizable material to mount the BTL and magnet.

**Horizontal assembly:** For horizontal assembly with nominal lengths > 500 mm, support the rod and tighten it at the end if necessary.

**Hydraulic cylinder:** If installed in a hydraulic cylinder, ensure that the minimum value for the bore diameter of the support piston is complied with (see Tab. 4-1).

**Mounting hole:** BTL threads are M18x1.5 (ISO), M30x1.5 (ISO) or 3/4"-16UNF (SAE). Depending on the version, a mounting hole must be made before assembly.

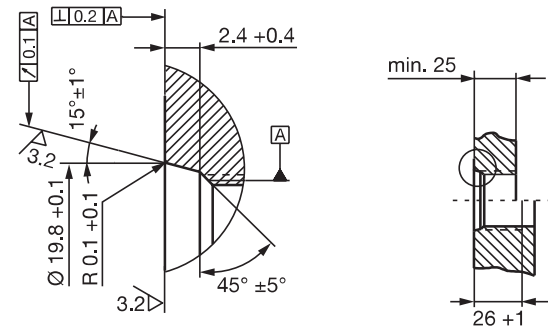


Fig. 4-3: Mounting hole M18x1.5 per ISO 6149 O-ring 15.4x2.1

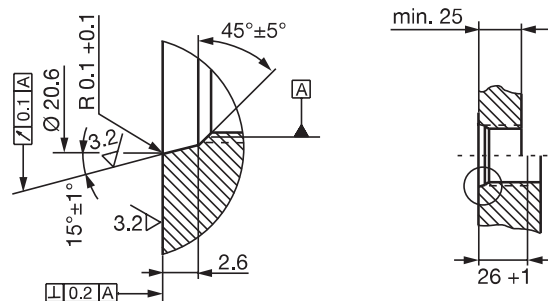


Fig. 4-4: Mounting hole 3/4"-16UNF per SAE J475 O-ring 15.3x2.4

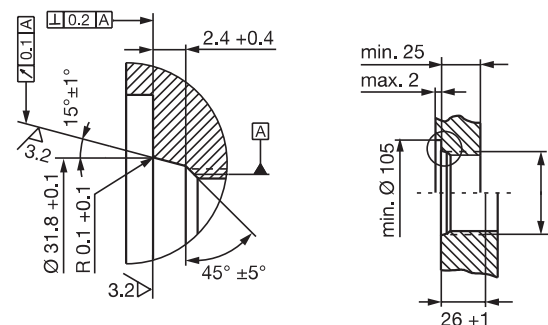


Fig. 4-5: Mounting hole M30x1.5 per ISO 6149 O-ring 27x2.5

**Magnet:** Various magnets are available for the BTL (see Accessories on page 18).

## 4 Installation and connection (continued)

### 4.3 Installing the BTL

#### NOTICE!

##### Interference in function

Improper installation can compromise the function of the BTL and result in increased wear.

- ▶ The mounting surface of the BTL must make full contact with the supporting surface.
- ▶ The bore must be perfectly sealed (O-ring/flat seal).

- ▶ Make a mounting hole with thread (possibly with countersink for the O-ring) acc. to Fig. 4-3, Fig. 4-4 or Fig. 4-5.
- ▶ Screw the BTL thread into the mounting hole (max. torque 100 Nm for M18x1.5 and 3/4"-16UNF; max. 150 Nm for M30x1.5).
- ▶ Install the magnet (accessories).
- ▶ From 500 mm nominal length: support the rod and tighten it at the end if necessary.

**i** Suitable nuts for the mounting thread (for the BTL7...-TZ/TB...) are available as accessories (see page 18).

#### 4.3.1 Installation recommendation for hydraulic cylinders

If you seal the bore with a flat seal, the max. operating pressure will be reduced in accordance with the larger pressurized surface.

If installing horizontally in a hydraulic cylinder (nominal lengths > 500 mm), we recommend affixing a slide element to protect the rod end from wear.

**i** Dimensioning of the detailed solutions is the responsibility of the cylinder manufacturer.

The slide element material must be suitable for the appropriate load case, medium used, and application temperatures. E.g. Torton, Teflon or bronze are all possible materials.

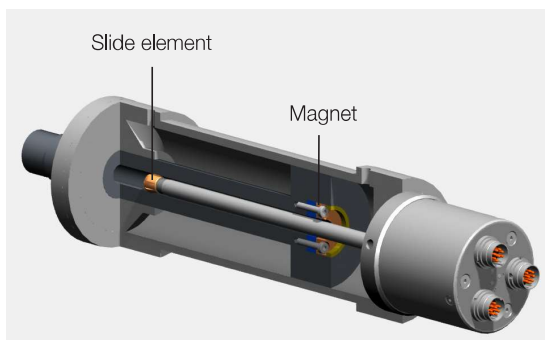


Fig. 4-6: Example 1, BTL installed with slide element

The slide element can be screwed on or bonded.

- ▶ Secure the screws so they cannot be loosened or lost.
- ▶ Select a suitable adhesive.

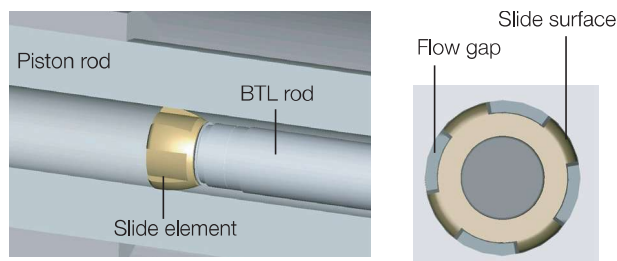


Fig. 4-7: Detailed view and top view of slide element

There must be a gap between the slide element and piston bore that is sufficiently large for the hydraulic oil to flow through.

Options for fixing the magnet:

- Screws
- Threaded ring
- Press fitting
- Notches (center punching)

**i** If installed in a hydraulic cylinder, the magnet should not make contact with the rod.

The hole in the spacer ring must ensure optimum guidance of the rod by the slide element.

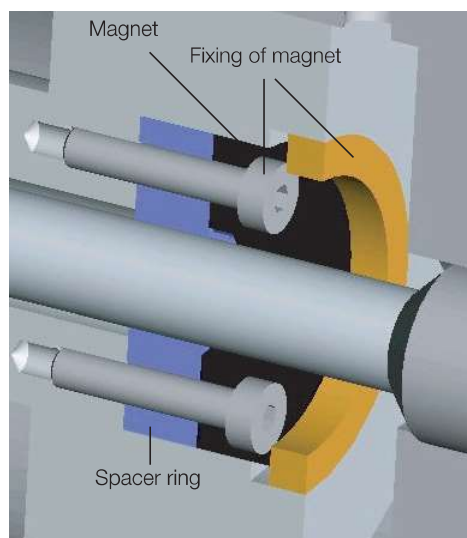


Fig. 4-8: Fixing of magnet

An example of how to install the BTL with a supporting rod is shown in Fig. 4-9 on page 11.

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## 4 Installation and connection (continued)

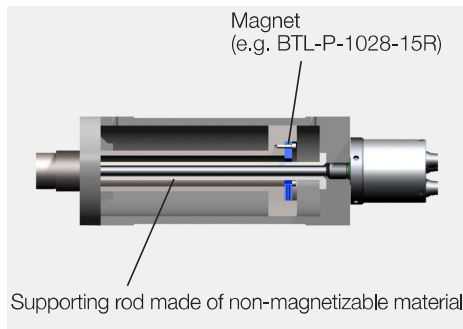


Fig. 4-9: Example 2, BTL installed with supporting rod (only for BTL7...-TB/TZ...)

### 4.4 Electrical connection

Depending on the model, the electrical connection is made using a cable or a connector (BTL7...-S32, BTL7...-S135). The connection or pin assignments for the respective version can be found in Tables 4-2 to 4-5.

**i** Note the information on shielding and cable routing on page 12.

#### 4.4.1 Connector S32/cable connection

S32 Pin	Wire color	BTL7-... interface			
		-A504	-G504	-C504	-E504
1	YE yellow	Not used <sup>1)</sup>		0...20 mA <sup>2)</sup>	4...20 mA <sup>2)</sup>
2	GY gray	0 V			
3	PK pink	Not used <sup>1)</sup>			
4	RD red	La (communication line)			
5	GN green	0...10 V <sup>2)</sup>	-10...10 V <sup>2)</sup>	Not used <sup>1)</sup>	
6	BU blue	GND <sup>3)</sup>			
7	BN brown	10...30 V			
8	WH white	Lb (communication line)			

Tab. 4-2: Connection assignment BTL7-A/C/E/G504-...-S32/cable

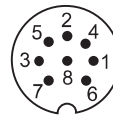


Fig. 4-10: Pin assignment of S32 connector (view from above on BTL), 8-pin M16 circular plug

S32 Pin	Wire color	BTL7-... interface			
		-A505	-G505	-C505	-E505
1	YE yellow	Not used <sup>1)</sup>		20...0 mA <sup>2)</sup>	20...4 mA <sup>2)</sup>
2	GY gray	0 V			
3	PK pink	Not used <sup>1)</sup>			
4	RD red	La (communication line)			
5	GN green	10...0 V <sup>2)</sup>	10...-10 V <sup>2)</sup>	Not used <sup>1)</sup>	
6	BU blue	GND <sup>3)</sup>			
7	BN brown	10...30 V			
8	WH white	Lb (communication line)			

Tab. 4-3: Connection assignment BTL7-A/C/E/G505-...-S32/cable

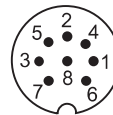


Fig. 4-11: Pin assignment of S32 connector (view from above on BTL), 8-pin M16 circular plug

<sup>1)</sup> Unassigned leads can be connected to the GND on the controller side but not to the shield.

<sup>2)</sup> Factory setting, can be freely configured with the PC software.

<sup>3)</sup> Reference potential for supply voltage and EMC-GND.

## 4 Installation and connection (continued)

### 4.4.2 Connector S135

S135 Pin	BTL7-... interface			
	-A504	-G504	-C504	-E504
1	0...10 V <sup>1)</sup>	-10...10 V <sup>1)</sup>	0...20 mA <sup>1)</sup>	4...20 mA <sup>1)</sup>
2	0 V			
3	La (communication line)			
4	Lb (communication line)			
5	10...30 V			
6	GND <sup>2)</sup>			

Tab. 4-4: Connection assignment BTL7-A/C/E/G504-...-S135

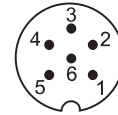


Fig. 4-12: Pin assignment of S135 connector (view from above on BTL), 6-pin M16 circular plug

S135 Pin	BTL7-... interface			
	-A505	-G505	-C505	-E505
1	10...0 V <sup>1)</sup>	10...-10 V <sup>1)</sup>	20...0 mA <sup>1)</sup>	20...4 mA <sup>1)</sup>
2	0 V			
3	La (communication line)			
4	Lb (communication line)			
5	10...30 V			
6	GND <sup>2)</sup>			

Tab. 4-5: Connection assignment BTL7-A/C/E/G505-...-S135

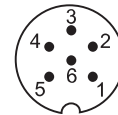


Fig. 4-13: Pin assignment of S135 connector (view from above on BTL), 6-pin M16 circular plug

<sup>1)</sup> Factory setting, can be freely configured with the PC software.

<sup>2)</sup> Reference potential for supply voltage and EMC-GND.

## 4.5 Shielding and cable routing



### Defined ground!

The BTL and the control cabinet must be at the same ground potential.

### Shielding

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

- Connect BTL and controller using a shielded cable. Shield: Braided copper shield with minimum 85% coverage.
- Connector version: Shield is internally connected to connector housing.
- Cable version: On the BTL side, the cable shielding is connected to the housing. Ground the cable shielding on the controller side (connect with the protective earth conductor).

### Magnetic fields

The position measuring system is a magnetostrictive system. Ensure that there is sufficient distance between the BTL, holding cylinder and strong, external magnetic fields.

### Cable routing

Do not route the cable between the BTL, 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-A/G	Max. 20 m <sup>1)</sup>
BTL7-C/E	Max. 50 m <sup>1)</sup>

Tab. 4-6: Cable lengths BTL7

<sup>1)</sup> Prerequisite: Construction, shielding and routing preclude the effect of any external noise fields.

## 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 and readjust the BTL if necessary.

---

 Check for the correct values at the null point and end point, especially after replacing the BTL or after repair by the manufacturer.

---

#### 5.2 Operating notes

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

**6**

**Configuration with the BTL7 Configuration Tool**

**6.1 BTL7 Configuration Tool**

<b>NOTICE!</b>
<b>Interference in function</b>
Configuration with the BTL7 Configuration Tool while the system is running may result in malfunctions.
▶ Stop the system before configuration.

The BTL can be quickly and easily configured on the PC using the PC software BTL7 Configuration Tool.

The most important features include:

- Online display of the current position of the magnet
- Graphical support for setting the functions and curve
- Display of information on the connected measuring unit
- Selectable number formats and units for display
- Resetting to factory settings is possible
- Demo mode without a connected BTL
- The 3 measuring units are treated like 3 independent BTLs

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**i** The PC software and associated manual can be found in the Internet under [www.balluff.com/downloads-btl7](http://www.balluff.com/downloads-btl7).

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**6.2 Connecting the USB communication box**

For a BTL with connector the communication box must be inserted between the BTL and the controller. The communication box is connected to the PC via a USB cable.

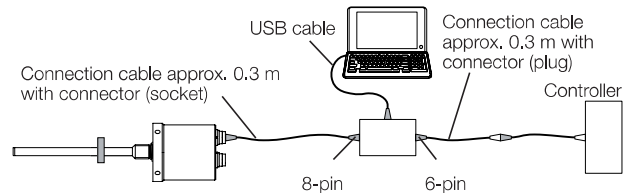


Fig. 6-1: Connecting the communication box with a connector

For a BTL with cable connection the communication lines La, Lb and GND are connected to the USB communication box.

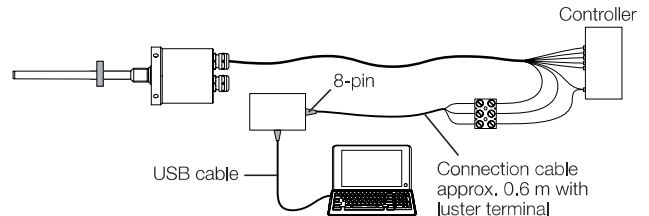


Fig. 6-2: Connecting the communication box with a cable connection

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**i** When reading or writing data via the Configuration Tool, the LED flashes green.

---

**6**

**Configuration with the BTL7 Configuration Tool (continued)**

**6.3 Configuration options**

**Prerequisites**

- USB communication box connected to the BTL and PC.
- Software correctly installed.
- BTL connected to the power supply.
- Magnet on BTL.

**Output functions**

- **Position:** Position in the measuring range.
- **Velocity:** velocity of the magnet. The sign indicates the direction of movement. Movement from the null point to the end point is output with a positive sign. Movement from the end point to the null point is output with a negative sign. Max. detectable velocity range of -10 to +10 m/s.
- **Velocity (no sign):** velocity of the magnet. The direction of movement cannot be read. Max. detectable velocity range of 0 to 10 m/s.

**Freely configurable curve**

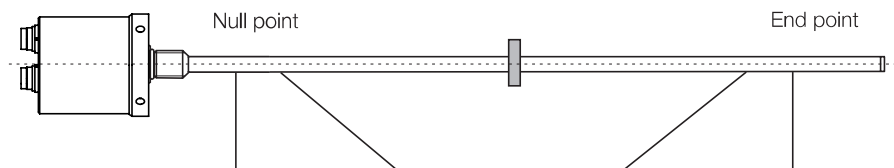
- Null and end point can be read (teach-in) or specified with the mouse.
- For position, the distance between the null point and end point must be at least 4 mm (0.15 inch) and 100 mm/s (4 inch/s) for velocity.
- The characteristic curve can be inverted.
- The limits can be adjusted to the measuring range.
- The error value can be set in accordance with the limits.

**⚠ 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.

- ▶ The system must be taken out of operation before configuration.
- ▶ The BTLs may only be connected to the communication box for configuration.
- ▶ The communication box must be removed after configuration.



Output gradient	BTL	Unit	Min. value	Null value	End value	Max. value	Error value
Rising	BTL7-A...	V	-0.5	0	+10	+10.5	+10.5
	BTL7-G...	V	-10.5	-10	+10	+10.5	+10.5
	BTL7-C...	mA	0	0	20	20.4	20.4
	BTL7-E...	mA	3.6	4	20	20.4	3.6
Falling	BTL7-A...	V	+10.5	+10	0	-0.5	-0.5
	BTL7-G...	V	+10.5	+10	-10	-10.5	-10.5
	BTL7-C...	mA	20.4	20	0	0	20.4
	BTL7-E...	mA	20.4	20	4	3.6	3.6

Tab. 6-1: Factory settings value table

## 7

### Technical data

#### 7.1 Accuracy

The specifications are typical values for the BTL7-A/C/E/G... at 24 V DC and room temperature, with a nominal length of 500 mm in conjunction with the BTL-P-1013-4R, BTL-P-1013-4S, BTL-P-1012-4R or BTL-P-1014-2R magnet.

The BTL is fully operational immediately, with full accuracy after warm-up.

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

Repeat accuracy	
Voltage, typical	±10 µm
Current, typical	±5 µm
Sampling rate	
Dependent on the nominal length	
At nominal lengths of 25...1200 mm	2 ms
At nominal lengths of 1201...5000 mm	4 ms
At nominal lengths of 5001...7620 mm	5,7 ms
Non-linearity at	
Nominal length ≤ 500 mm	±200 µm
Nominal lengths of 501...7620 mm	±0.04% FS
Temperature coefficient <sup>1)</sup>	
Voltage	≤ 40 ppm/K
Current	≤ 20 ppm/K
Max. detectable velocity	10 m/s

#### 7.2 Ambient conditions<sup>2)</sup>

Ambient temperature	-40...+85°C
Ambient temperature for UL (only BTL7-...-KA...)	≤ +80°C
Storage temperature	-40...+100°C
Relative humidity	< 90%, non-condensing
Rod pressure rating (when installed in hydraulic cylinders)	
For Ø 10.2 mm	
– ≤ 2000 mm	≤ 600 bar
– ≥ 2001 mm	≤ 300 bar
For Ø 21 mm	≤ 250 bar
Shock rating	100 g/6 ms
Continuous shock per EN 60068-2-27 <sup>3), 4)</sup>	100 g/2 ms
Vibration <sup>5)</sup> per EN 60068-2-6 <sup>3), 4)</sup>	12 g, 10...2000 Hz
Degree of protection per IEC 60529	
Connector S32/S135 (when attached)	IP67
Cable	IP67

#### 7.3 Supply voltage (external)

Voltage, stabilized <sup>6)</sup>	10...30 V DC
Ripple	≤ 0.5 V <sub>ss</sub>
Current draw (at 24 V DC)	≤ 150 mA per unit
Inrush current	≤ 500 mA per unit
Reverse polarity protection <sup>7)</sup>	Up to 36 V
Overvoltage protection	Up to 36 V
Dielectric strength (GND to housing)	500 V AC

<sup>1)</sup> Nominal length = 500 mm, magnet in the center of the measuring range  
<sup>2)</sup> For UL: Use in enclosed spaces and up to a height of 2000 m above sea level.  
<sup>3)</sup> Individual specifications as per Balluff factory standard  
<sup>4)</sup> Resonant frequencies excluded  
<sup>5)</sup> Nominal length > 2000 mm: use only under static conditions  
<sup>6)</sup> For UL: The BTL 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.  
<sup>7)</sup> A prerequisite is that no current can flow between GND and 0 V in the event of polarity reversal.



# BTL7-A/C/E/G50\_-M\_ \_ \_ \_ -T\_2/3-S32/S135/KA\_ \_/FA\_ \_

## Magnetostrictive Linear Position Sensor – Rod Style

### 7

#### Technical data (continued)

#### 7.4 Output

BTL7-A...	
Output voltage	
Max. configuration <sup>1)</sup>	–10...10 V or 10...–10 V
Factory setting ...-A504-...	0...10 V
Factory setting ...-A505-...	10...0 V
Load current	≤ 5 mA
BTL7-C...	
Output current	
Max. configuration <sup>1)</sup>	0...20 mA or 20...0 mA
Factory setting ...-C504-...	0...20 mA
Factory setting ...-C505-...	20...0 mA
Load resistance	≤ 500 ohms
BTL7-E...	
Output current	
Max. configuration <sup>1)</sup>	0...20 mA or 20...0 mA
Factory setting ...-E504-...	4...20 mA
Factory setting ...-E505-...	20...4 mA
Load resistance	≤ 500 ohms
BTL7-G...	
Output voltage	
Max. configuration <sup>1)</sup>	–10...10 V or 10...–10 V
Factory setting ...-G504-...	–10...10 V
Factory setting ...-G505-...	10...–10 V
Load current	≤ 5 mA
Short circuit resistance	Signal cable to 36 V Signal cable to GND

<sup>1)</sup> Only with PC software (Configuration Tool)

#### 7.5 Communication lines La, Lb

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

#### 7.6 Dimensions, weights

Rod diameter	
...TB/TZ...	10.2 mm
...TT...	21 mm
Nominal length	
For Ø 10.2 mm	25...7620 mm
For Ø 21 mm	25...3250 mm
Weight (depends on length)	Approx. 2 kg/m
Housing material	Aluminum
Flange material	Stainless steel
Rod material	Stainless steel
Rod wall thickness	
For Ø 10.2 mm	
– ≤ 2000 mm	2 mm
– ≥ 2001 mm	1,8 mm
For Ø 21 mm	2 mm
Housing mounting via threads	
For Ø 10.2 mm	M18×1.5 or 3/4"-16UNF
For Ø 21 mm	M30×1.5
Tightening torque	
...TB/TZ...	Max. 100 Nm
...TT...	Max. 150 Nm

#### BTL7-...-KA\_ \_

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

#### BTL7-...-FA\_ \_

Cable material	PTFE No UL approval available
Cable temperature	–55...+200°C
Cable diameter	Max. 7 mm
Permissible bending radius	
Fixed routing	≥ 35 mm
Movable	No permissible bending radius

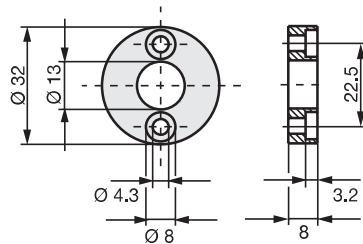
## 8

### Accessories

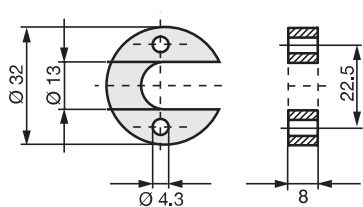
Accessories are not included in the scope of delivery and must be ordered separately.

#### 8.1 Magnets for TB/TZ

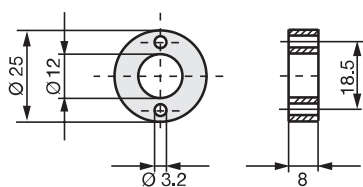
##### BTL-P-1013-4R



##### BTL-P-1013-4S



##### BTL-P-1012-4R



##### BTL-P-1014-2R

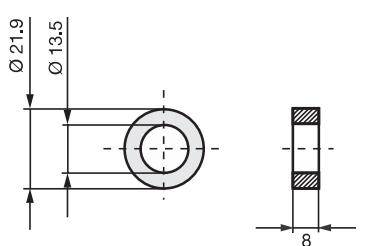


Fig. 8-1: Magnet installation dimensions

#### **BTL-P-1013-4R, BTL-P-1013-4S, BTL-P-1012-4R, BTL-P-1014-2R:**

Weight: < 15 g  
 Housing: Aluminum

#### **Included in the scope of delivery for the BTL-P-1013-4R, BTL-P-1013-4S, BTL-P-1012-4R:**

Spacer: 8 mm, material: polyoxymethylene (POM)

#### **BTL5-P-4500-1 magnet (solenoid):**

Weight: Approx. 90 g  
 Housing: Plastic  
 Ambient temperature: -40...+60 °C

#### 8.2 BTL-P-1028-15R

Weight: Approx. 68 g  
 Housing: Aluminum

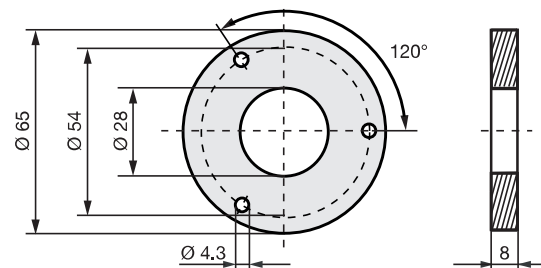


Fig. 8-2: BTL-P-1028-15R

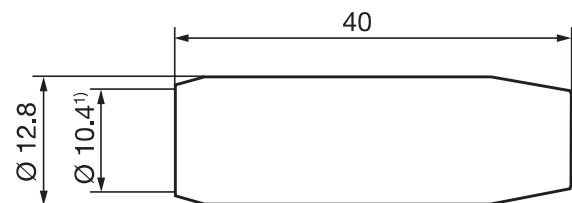
#### 8.3 Mounting nut

- M18×1.5 mounting nut:  
 BTL-A-FK01-E-M18×1.5
- Mounting nut 3/4"-16UNF:  
 BTL-A-FK01-E-3/4"-16UNF

#### 8.4 Slide bush

##### **BAM PC-TL-001-D10,4-4**

Suitable for BTL rod diameters of 10.2 mm (BTL7-...-TB.../BTL7-...-TZ...).



<sup>1)</sup> 25 mm deep

Fig. 8-3: Slide bush BAM PC-TL-001-D10,4-4

**8**

**Accessories (continued)**

**8.5 Connector type S32**

**8.5.1 Freely configurable**

**BKS-S 32M-00**

Order code: BCC00TT  
 Straight connector, M16 per IEC 130-9, 8-pin

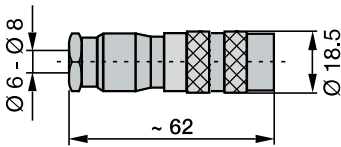


Fig. 8-4: Connector BKS-S32 M-00

**BKS-S 33M-00**

Order code: BCC00UP  
 Angled connector, M16 per IEC 130-9, 8-pin

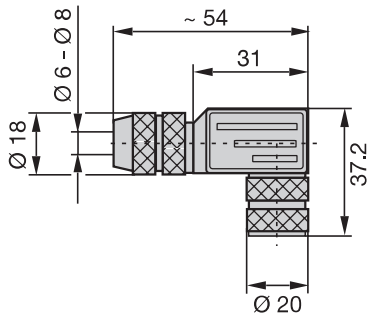


Fig. 8-5: Connector BKS S 33M-00

**8.5.2 Preassembled**

Straight connector, molded, M16, 8-pin  
 Various cable lengths can be ordered, e.g.  
 BCC S518-0000-1Y-133-PS0825-050  
 (Order code: BCC0L21): Cable length 5 m

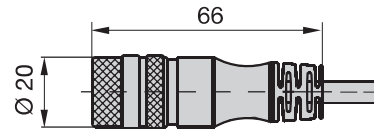


Fig. 8-6: Connector type S32 (preassembled)

Angled connector, molded, M16, 8-pin  
 Various cable lengths can be ordered, e.g.  
 BCC S528-0000-1Y-133-PS0825-050  
 (Order code: BCC0L2A): Cable length 5 m

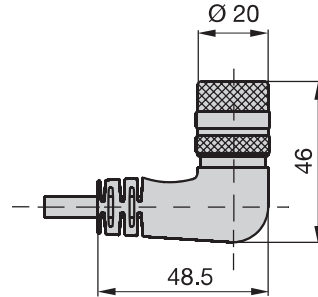


Fig. 8-7: Connector type S32 (preassembled)

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: S32 (preassembled) pin assignment

**8**

**Accessories (continued)**

**8.5.3 Connector type S135, freely configurable**

**BKS-S135M-00**

Order code: BCC00Z6  
 Straight connector, freely configurable  
 M16 per IEC 130-9, 6-pin

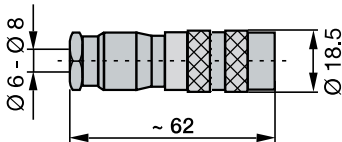


Fig. 8-8: Connector BKS-S135M-00

**BKS-S136M-00**

Order code: BCC0117  
 Angled connector, freely configurable  
 M16 per IEC 130-9, 6-pin

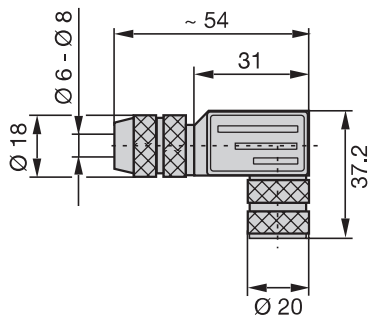


Fig. 8-9: Connector BKS-S136M-00

**8.6 USB communication box**

**BTL7-A-CB01-USB-S32**

For BTL7-... USB-Configurable with S32 connector.  
 Scope of delivery: USB communication box, USB cable,  
 2 adapter cables each approx. 0.3 m, condensed guide.

**BTL7-A-CB01-USB-S135**

For BTL7-... USB-Configurable with S135 connector.  
 Scope of delivery: USB communication box, USB cable,  
 2 adapter cables each approx. 0.3 m, condensed guide.

**BTL7-A-CB01-USB-KA**

For BTL7-... USB-Configurable with cable connection.  
 Scope of delivery: USB communication box, USB cable,  
 1 adapter cable approx. 0.6 m, condensed guide.

# BTL7-A/C/E/G50\_-M\_-\_-\_-T\_2/3-S32/S135/KA\_/FA\_-\_- Magnetostrictive Linear Position Sensor – Rod Style

9

## Type code

**BTL7 - A 5 0 4 - M0500 - TB2 - S32**

Analog interface: \_\_\_\_\_

- A = Voltage output 0...10 V or 10...0 V (factory setting)
- C = Current output 0...20 mA or 20...0 mA (factory setting)
- E = Current output 4...20 mA or 20...4 mA (factory setting)
- G = Voltage output -10...10 V or 10...-10 V (factory setting)

Supply voltage: \_\_\_\_\_

5 = 10...30 V DC

Output gradient: \_\_\_\_\_

- 04 = 1 output rising, configurable
- 05 = 1 output falling, configurable

Nominal length (4-digit): \_\_\_\_\_

- M0500 = Metric specification in mm, nominal length 500 mm
- BTL7-...-TB.../BTL7-...-TZ...: M0025...M7620
- BTL7-...-TT...: M0025...M3250

Rod version, fastening: \_\_\_\_\_

- TB2 = Metric mounting thread M18×1.5, O-ring, rod diameter 10.2 mm, dual redundant
- TZ2 = 3/4"-16UNF thread, O-ring, rod diameter 10.2 mm, dual redundant
- TT2 = Metric mounting thread M30×1.5, O-ring, rod diameter 21 mm, dual redundant  
(Replacement for BTL5-...-T-2)
- TB3 = Metric mounting thread M18×1.5, O-ring, rod diameter 10.2 mm, triple redundant
- TZ3 = 3/4"-16UNF thread, O-ring, rod diameter 10.2 mm, triple redundant
- TT3 = Metric mounting thread M30×1.5, O-ring, rod diameter 21 mm, triple redundant  
(Replacement for BTL5-...-T-3)

Electrical connection: \_\_\_\_\_

- S32 = 8-pin, M16 plug per IEC 130-9
- S135 = 6-pin, M16 plug per IEC 130-9 (only for BTL7-...-TB.../ BTL7-...-TZ...)
- KA05 = Cable, 5 m, PUR
- FA05 = Cable, 5 m, PTFE

## 10 Appendix

### 10.1 Converting units of length

1 mm = 0.0393700787 inch

mm	inches
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

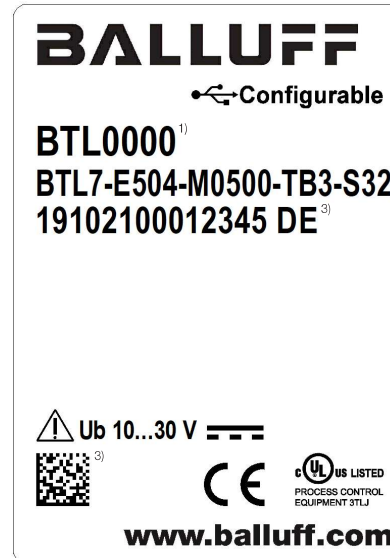
Tab. 10-1: Conversion table mm to inches

1 inch = 25.4 mm

inches	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



<sup>1)</sup> Order code

<sup>2)</sup> Type

<sup>3)</sup> Serial number

Fig. 10-1: BTL7 part label (example)

**BTL7-A/C/E/G50 -M\_ \_ \_ -TB2/3-S32/S135/KA\_ \_ /FA\_ \_**  
**BTL7-A/C/E/G50 -M\_ \_ \_ -TZ2/3-S32/S135/KA\_ \_ /FA\_ \_**  
**BTL7-A/C/E/G50 -M\_ \_ \_ -TT2/3-S32/KA\_ \_ /FA\_ \_**



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