BTL7-_-M_-J-DEXC-TA12

Micropulse Linear Position Sensor

Analog & Synchronous Serial Interface (SSI)
Explosion-Proof (Flame-Proof) Rod Style

Ex

MICROPULSE®
MICROPULSE+
USB-Configurable

Contents

CE *The CE Mark verifies that our products meet the requirements of EC Directive*

2004/108/EC (EMC Directive)

and the EMC Law. Testing in our EMC Laboratory, which is accredited by DATech for Testing Electromagnetic Compatibility, has confirmed that Balluff products meet the EMC requirements of the following Generic Standards:

- *EN 61000-6-4 (emission)*
- *EN 61000-6-2 (noise immunity)*

Emission tests:

RF Emission
EN 55011 Group 1, Class A

Noise immunity tests:

Static electricity (ESD)
EN 61000-4-2 Severity level 3

Electromagnetic fields (RFI)
EN 61000-4-3 Severity level 3

Fast transients (Burst)
EN 61000-4-4 Severity level 3 Surge
EN 61000-4-5 Severity level 2

Line-induced noise induced by high-frequency fields
EN 61000-4-6 Severity level 3

Magnetic fields
EN 61000-4-8 Severity level 4

i Preface - ATEX Directive Instructions

Instructions (European ATEX Directive 94/9/EC, Annex II, 1.0.6.)

The following instructions apply to equipment covered by certificate number SIRA 11ATEX1104X:

1. The equipment may be used with flammable gases and vapors with apparatus groups IIC and with temperature classes T6 and T5.

2. The equipment is certified for use in ambient temperatures in the range -50°C to +70°C (T6) or -50°C to +80°C (T5) and should not be used outside these ranges.

3. Installation shall be carried out by suitably trained personnel in accordance with the applicable code of practice, e.g. EN 60079-14: 2013.

4. Inspection and maintenance of this equipment shall be carried out by suitably trained personnel in accordance with the applicable code of practice, e.g. EN 60079-17: 2013.

5. Repair of this equipment shall be carried out by suitably trained personnel in accordance with the applicable code of practice, e.g. EN 60079-19: 2010.

6. Instructions for putting into service, use, and assembling this equipment are located in section 6 of this document.

7. Components to be incorporated into or used as replacement parts of the equipment shall be fitted by suitably trained personnel in accordance with the manufacturer's documentation.

8. The certification of this equipment relies upon the following materials used in its construction:
   - Flange – Stainless Steel, 316L
   - Cover – Stainless Steel, 316L (alternative: 304 Stainless Steel or Nitronics 60 or European equivalent 1.4404, 1.4571, 1.4305)
   - Viton (used for O-ring seals)

i Preface - ATEX Directive Instructions (Continued)

If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection provided by the equipment is not compromised.

Aggressive Substances:	e.g. acidic liquids or gases that may attack metals, or solvents that may affect polymeric materials.
Suitable Precautions:	e.g. regular checks as part of routine inspections or establishing from the material's data sheets that it is resistant to specific chemicals.

9. See the diagram of the product label in section 3 of this document for appropriate markings, ratings, and manufacture contact information.

10. The characteristics of the equipment are detailed in section 4 of this document.

1 Introduction

Read this manual before installing and operating the Micropulse linear position sensor.

1.1 Scope

This document provides installation instructions and technical data specific to the Micropulse EX linear position sensor. Detailed technical specifications for the electronics package can be found in the standard Micropulse linear position sensor User's Guides, corresponding to the relevant type of output signal.

1.2 Safety Advisory

Read this manual before installing the Micropulse EX linear position sensor. The Micropulse EX linear position sensor should be installed by qualified personnel and used in accordance with the conditions for which it was designed. Any unauthorized modification could result in equipment damage or personal injury, and is expressly forbidden.

1.3 Use and Inspection

The relevant safety regulations must be followed when using the linear position sensor system. In particular, steps must be taken to ensure that should the linear position sensor system become defective, no hazards to persons or property can result. This includes the installation of additional safety limit switches, emergency shutoff switches and maintaining the permissible ambient conditions.

Approvals:

C US
CSA15.2411253X

Class I Zone 1 AEx d IIC T* Ga/Gb T6 Ta -50° to 70°C, T5 Ta -50° to 80°C
Class I Zone 1 Ex d IIC T* Gb T6 Ta -50° to 70°C, T5 Ta -50° to 80°C
Class I, Division 1, Groups A,B,C,D
Class II, Division 1, Groups E,F,G;
Class III T6 Ta -50° to 70°C, T5 Ta -50° to 80°C Type 4X/6P; IP68
SIRA 11ATEX1104X
IECEx SIR 11.0048X

Ex II 1/2GD
Ex d IIC T* Ga/Gb Ta -50° to 70°C (T6) -50° to 80°C (T5)
Ex t IIIC T85/T100°C Da IP68 Ta -50° to 70°C (T85) -50° to 80°C (T100)
CE 0518 Ex (manufactured in the USA)
CE 0102 Ex (manufactured in Germany and Hungary)

2 General Information

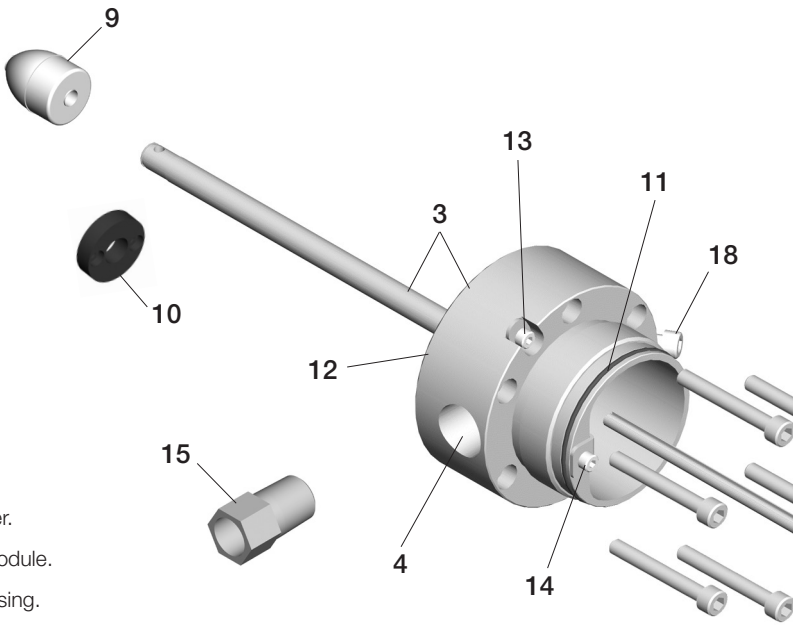
2.1 Functional Description

The Micropulse EX linear position sensor is designed to provide highly accurate position feedback in areas containing potentially explosive gases and dusts.

The Micropulse EX linear position sensor consists of:

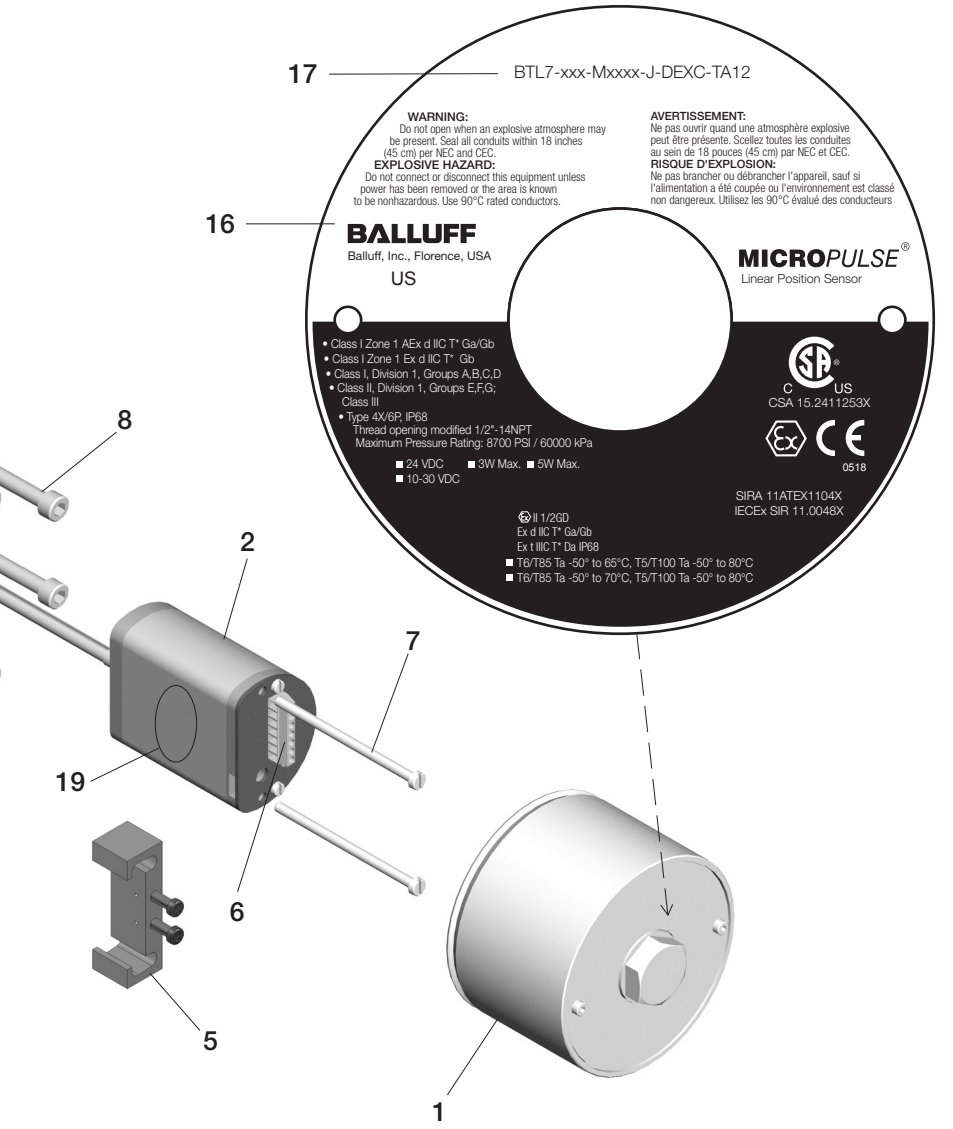
- A heavy-duty stainless steel housing with a Modified 1/2"-14 NPT threaded conduit opening for cable entry. Modified threading in accordance with FM Standard 3615, Chapter 3.3.3, Paragraph D, Section 1. Manufacturer does not supply conduit.
- An internal electronics module/sensing element that provides electrical position feedback signals in the form of an analog voltage, analog current, or synchronous serial signals. The internal electronics module/sensing element can be replaced while the external housing stays in place.

3 Component Overview



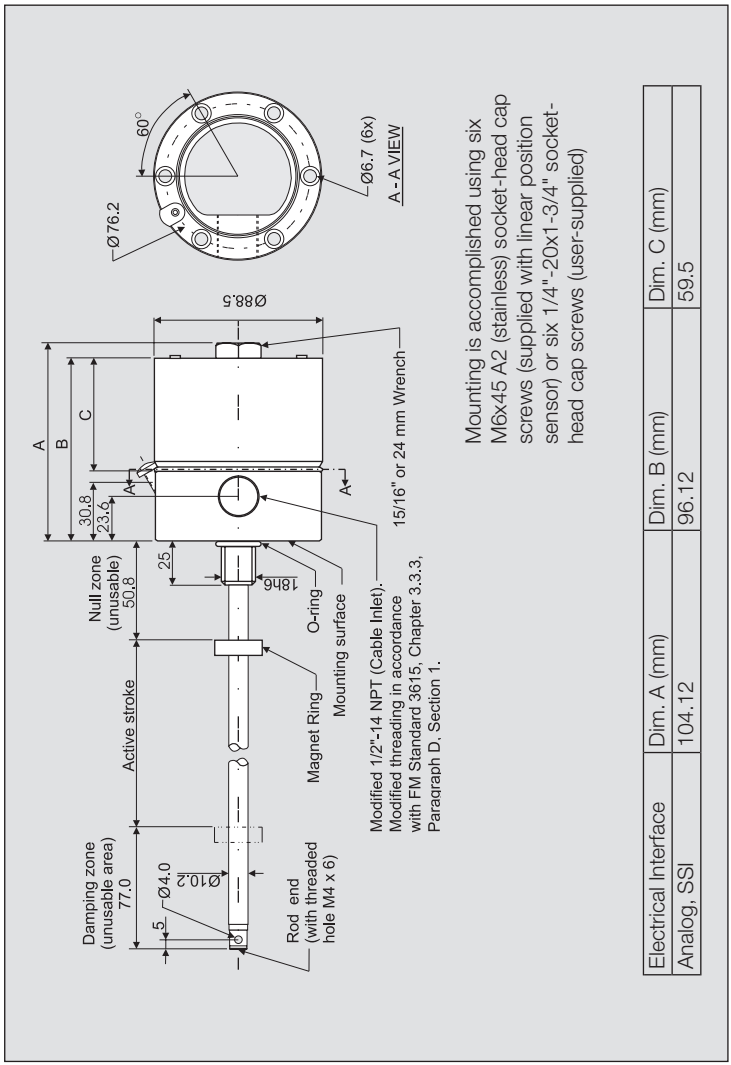
Key:

1. Housing Cover.
2. Electronics Module.
3. Pressure Housing.
4. Conduit Entry (Modified 1/2"-14 NPT per FM 3615, 3.3.3, D, 1)
5. Analog Programming Tool (optional). See section 6.5 for additional information.
6. Wiring Terminal Block. See section 6.4 for wiring information.
7. Electronics Module Retaining Screws.
8. Housing Screws. M6x45 A4-70 Socket-Head Cap Screws (6x–included).
   (Replacement Screw Kit: BTL7-A-FK01-E-J-DEX)
9. Float Magnet – For use in liquid-level applications. See section 5.3 for additional options.
10. Position Magnet. See section 5.1 for additional magnet sizes.
11. Housing Cover O-Ring.
12. Flange O-Ring (not visible).
13. External Housing GND.
14. Internal Housing GND.
15. 1/2”-14 NPT-to-M20 Adapter (optional). See section 5.2 for additional information.
16. Product Label (enlarged to show content).
17. Ordering code for complete linear position sensor assembly.
18. Cover secondary retaining screw.
19. Location of ordering code for replacement electronics module.


17
BTL7-xxx-Mxxxx-J-DEXC-TA12
WARNING:
Do not open when an explosive atmosphere may be present. Seal all conduits within 18 inches (45 cm) per NEC and CEC.
EXPLOSIVE HAZARD:
Do not connect or disconnect this equipment unless power has been removed or the area is known to be nonhazardous. Use 90°C rated conductors.
AVERTISSEMENT:
Ne pas ouvrir quand une atmosphère explosive peut être présente. Scellez toutes les conduites au sein de 18 pouces (45 cm) par NEC et CEC.
RISQUE D'EXPLOSION:
Ne pas brancher ou débrancher l'appareil, sauf si l'alimentation a été coupée ou l'environnement est classé non dangereux. Utilisez les 90°C évalué des conducteurs
16
BALLUFF
Balluff, Inc., Florence, USA
US
MICROPULSE®
Linear Position Sensor
• Class I Zone 1 AEx d IIC T* Ga/Gb
• Class I Zone 1 Ex d IIC T* Gb
• Class I, Division 1, Groups A,B,C,D
• Class II, Division 1, Groups E,F,G; Class III
• Type 4X/6P, IP68
Thread opening modified 1/2"-14NPT
Maximum Pressure Rating: 8700 PSI / 60000 kPa
24 VDC
3W Max.
5W Max.
10-30 VDC
C US
CSA 15.2411253X
0518
SIRA 11ATEX1104X
IECEx SIR 11.0048X
II 1/2GD
Ex d IIC T* Ga/Gb
Ex t IIIC T* Da IP68
T6/T85 Ta -50° to 65°C, T5/T100 Ta -50° to 80°C
T6/T85 Ta -50° to 70°C, T5/T100 Ta -50° to 80°C
8
2
7
19
6
5
1

4 Mechanical Data

4.1 Dimensions



Mounting is accomplished using six M6x45 A2 (stainless) socket-head cap screws (supplied with linear position sensor) or six 1/4"-20x1-3/4" socket-head cap screws (user-supplied)

Electrical Interface	Dim. A (mm)	Dim. B (mm)	Dim. C (mm)
Analog, SSI	104.12	96.12	59.5

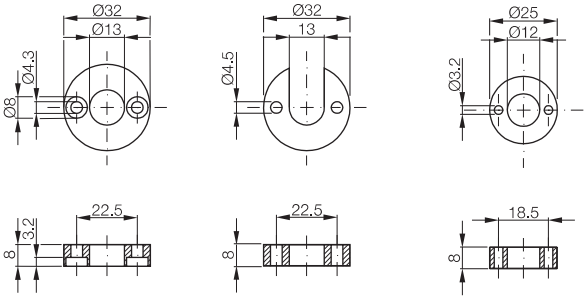
4.2 Specifications

Specifications	
Measurement Type	Linear Displacement
Measuring Range	51 mm (2 in.) to 7620 mm (300 in.)
Connection Means	Internal screw-type terminal block, Min. 26 AWG/Max. 14 AWG
Shock Rating	100 g/6 ms per IEC 68-2-27
Vibration Rating	12 g, 10 to 200 Hz per IEC 68-2-6
Environmental Protection	IP68* *To maintain the IP68 rating, ensure that the connection at the conduit opening also meets this standard. Thread sealant should be used on the conduit opening to ensure protection against moisture ingress. Take care to prevent the possibility of internal condensation in the conduit from entering the position sensor housing.
Housing/Rod Material	Stainless steel, 316L
Cover Material	Stainless steel, 316L (Standard version) Alternative: 304 Stainless Steel or Nitronics 60 or European equivalent (1.4404, 1.4571, 1.4305)
Cover O-Ring Material	Viton
Pressure Rating, Rod	8700 psi (600 bar)
Standard Operating Temperature Range	-40°C to +80°C (-40°F to +176°F) (Refer to Approvals on page 5 for application specific temperature constraints.)
Extended Low Temperature Operation to -50°C (-58°F): Specify SA418 Option (consult factory)	• Stroke length limited to 2680 mm • Only valid for transducers with analog interface • Transducer must remain constantly under power at temperatures below -40°C (-40°F) • Sampling rate half of standard
Storage Temperature Range	-50°C to +85°C (-58°F to +185°F) (Refer to Approvals on page 5 for application specific temperature constraints.)
Humidity	<90%, non-condensing
Electrical Performance Specifications	For complete electrical and performance specifications, refer to Micropulse BTL7 B/Z-housing User Guides for the appropriate output type.

5 Accessories (Order Separately)

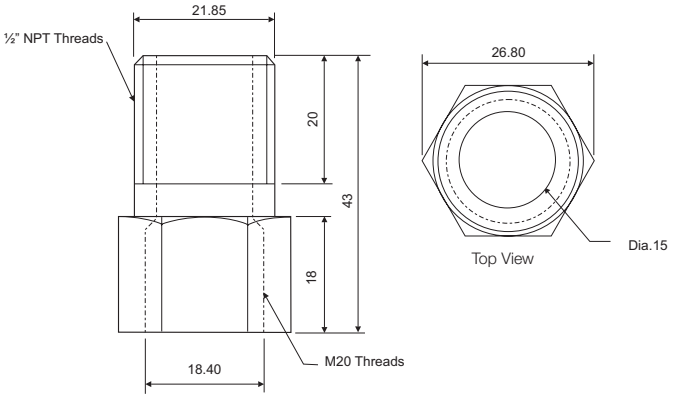
5.1 Magnets

Order code	BAM013L	BAM013P	BAM013J
Part number	BTL-P-1013-4R	BTL-P-1013-4S	BTL-P-1012-4R
Material	Aluminum	Aluminum	Aluminum
Weight	12 g	12 g	12 g



5.2 Conduit Adapter

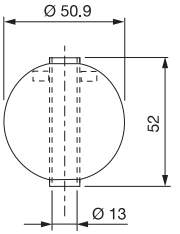
Order code	BAM011T	
Part number	BTL-A-AD09-M-00EX	
Material	Nickel-Plated Brass	
Approvals	SIRA00ATEX1094 EEx de I & IIC I M2, II 2 GD	AEx de Class 1, Zone 1, Groups I & IIC Class I Division 1 & 2, Groups A, B, C, D Class II & III, Groups E, F, G

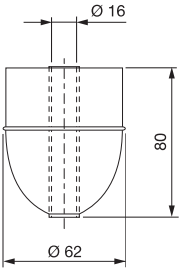


5.3 Floats

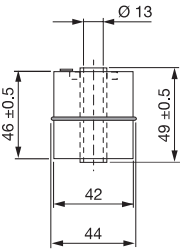
Order code	BAM014A	BAM014E
Part number	BTL2-S-5113-4K-EX	BTL2-6216-8P-EX
Material	Stainless 316	Stainless 316
Weight	26 g	41 g
Minimum fluid density	0.7 g/cm³	0.6 g/cm³
Immersion depth in 1 g/cm³(H_20)	26 mm	41 mm
Immersion depth in 0.7 g/cm³	40 mm	57 mm

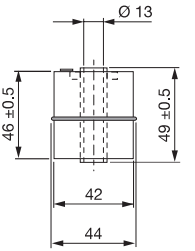
NOTE: The use of float magnets other than those shown on this page is not approved.





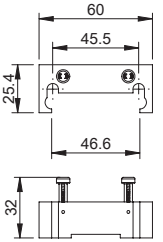
Order code	BAM0148	BAM0147
Part number	BTL2-S-4414-4Z01-EX	BTL2-S-4414-4Z-EX
Material	Stainless 316	Stainless 316
Weight	52 g	34 g
Minimum fluid density	0.85 g/cm³	0.7 g/cm³
Immersion depth in 1 g/cm³(H_20)	45 mm	30 mm
Immersion depth in 0.7 g/cm³	Sinks	39 mm





5.4 Tool Analog Programming Tool and USB Programming Hardware (PLUS Versions)

Order code	BAM02ME	BAE0040
Part number	BTL7-A-EH03	BTL7-A-CB01-USB-KA
Material	Acetal Plastic, Black	Box, ABS, Black; Cables, PVC, Gray
Weight	96 g	200 g



6 Installation Instructions

6.1 Installation Procedure

Warning! Do not open when an explosive atmosphere may be present.	Avertissement! Ne pas ouvrir si l'environnement est explosive.
Attention! Seal all conduits within 18 inches per NEC and CEC. Manufacturer does not supply conduit.	Attention! Scellez toutes les conduites au 18 pouces par NEC et CEC. Le fabricant ne fournit pas de conduit.

Step 1: Unscrew and remove housing cover.

Step 2: Install linear position sensor into position. Secure linear position sensor using six M6x45 A4-70, stainless steel, socket head cap screws (supplied with linear position sensor), or with
1/4"-20 x 1-3/4", stainless steel socket head cap screws. Tighten screws to 3.5 Nm (2.6 ft-lbs.) torque. (Fig. 1)

Use 90°C rated conductors.	Utilisez des conducteurs approuve 90° C

Step 3: Connect wiring as indicated in section 6.4. (Fig. 2)

Step 4: For analog output versions only—If necessary, scale the active stroke range per the instructions in section 6.5; otherwise, proceed to next step.

Step 5: Replace the housing cover and tighten to 25 ft-lbs. minimum, 30 ft-lbs. maximum. Tighten secondary retaining screw (ATEX).

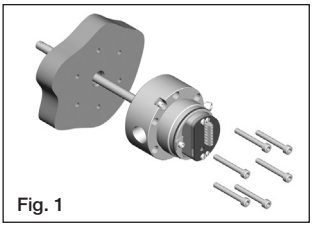


Fig. 1

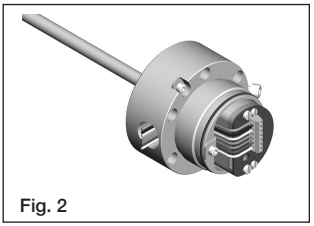
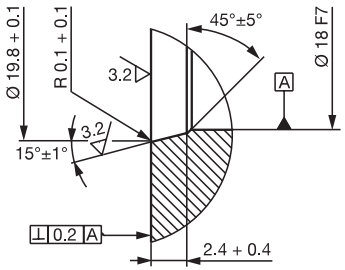
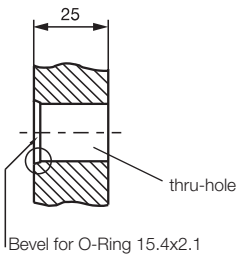


Fig. 2

6.2 Installation in Hydraulic/Pneumatic Cylinders

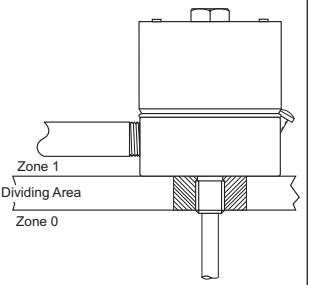
If the linear position sensor is to be installed in a cylinder, prepare the cylinder port in accordance with the diagram below.





6.3 Installing in Locations Classified as Zone 0 Under ATEX and IECEx Guidelines

Only the rod section of the linear position sensor may extend into Zone 0. To ensure safe isolation between Zone 0 and Zone 1, the relevant safety regulations detailed in IEC/EN60079-26 must be strictly adhered to. The linear position sensor must be installed in a manner that will result in a sufficiently tight joint (IP67) or flameproof joint (IEC/EN60079-1) between the less hazardous area and Zone 0.



When using a float magnet, it is necessary that a static discharge between the linear position sensor rod and the inner portion of the float be prevented. The floats listed in the accessory section (5.2) are designed so that, in normal operation, the float is tilted, thereby ensuring mechanical contact between the linear position sensor rod and the float wall. Do not use other types of floats or attempt to disable this design feature.

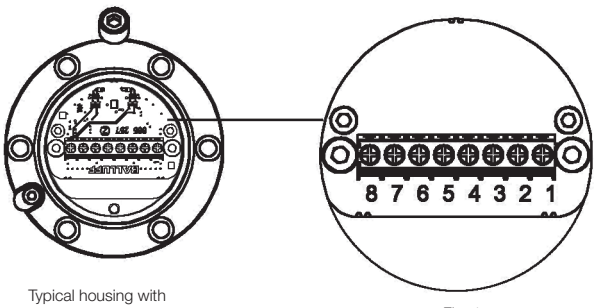
Note: The linear position sensor is not approved for use in locations classified as Zone 0 under North American guidelines.

6.4 Wiring

Type	TA12 ANA Voltage (A/G)	TA12 ANA Current (C/E)	TA12 SSI (S)
TA12 Pins			
1	not used	Signal Out 1	CLK+
2	Signal Common	Signal Common	DATA+
3	Signal Out 1	Signal Out 2*	CLK-
4	Supply GND	Supply GND	Supply GND
5	10…30 V Supply	10…30 V Supply	10…30 V Supply
6	Signal Out 2	not used	DATA-
7	La (programming input)	La (programming input)	La (programming input)**
8	Lb (programming input)	Lb (programming input)	Lb (programming input)**

*Only available on -E501 Version

**Only on -S501 Verision



Typical housing with terminal block assembly.

Fig. 1

6 Installation (Continued)

6.5 Using Analog Programming Tool
6.6 Using USB Programming Hardware (PLUS Versions)

Warning! Do not open when an explosive atmosphere may be present.	Avertissement! Ne pas ouvrir si l'environnement est explosive.

6.5 Versions of the Micropulse EX linear position sensor with an analog output, (ordering code A, B, C, E or G), have an electrical stroke that is 100% scalable. An optional analog programming tool is used to change the factory default stroke length.

Step 1: Unscrew and remove main housing cover. (Fig. 5)

Step 2: Slide programming tool into place as shown. (Fig. 3)

Step 3: Program the electrical stroke in accordance with the instructions in the standard Micropulse linear position sensor user's guide. (Fig. 4)

Step 4: Replace housing cover and tighten securely. Tighten secondary retaining screw (ATEX).

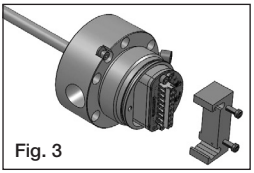


Fig. 3

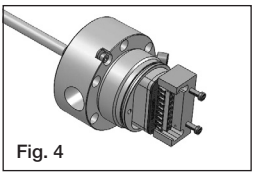


Fig. 4

Optional Analog Programming Tool BTL7-A-EH03

6.6 Step 1: Unscrew and remove main housing cover. (Fig. 5)

Step 2: Connect communication box as per instructions included with the kit.

Step 3: Program and configure as per instructions included with the kit.

Step 4: Replace the housing cover and tighten securely. Tighten secondary retaining screw (ATEX).

6.7 Replacing Electronics Module

Warning! Do not open when an explosive atmosphere may be present.	Avertissement! Ne pas ouvrir si l'environnement est explosive.
Attention! Replacement parts must be obtained from Balluff to ensure that the product certification is not invalidated.	**Attention!** Les pièces de rechange doivent proveni de Balluf pour s'assurer que la certification de produit n'est pas invalidée

Step 1: Disconnect power source.

Step 2: Unscrew and remove main housing cover. (Fig. 5)

Step 3: Disconnect wiring and note wire locations for re-assembly.

Step 4: Remove the 2 electronics module retaining screws.

Step 5: Carefully slide electronics module/waveguide assembly out of the pressure housing. Avoid bending the waveguide assembly. (Fig. 6)

Step 6: Carefully slide the new electronics module into the pressure housing. Avoid bending the waveguide assembly.

Step 7: Secure the electronics module using the 2 new screws provided with the replacement module.

Step 8: Connect wiring as per section 6.4.

Step 9: Remove and replace the housing O-ring with the new O-ring provided with the replacement module.

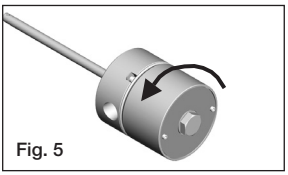


Fig. 5

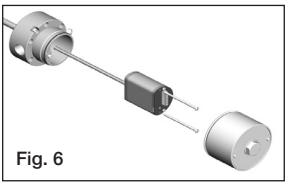


Fig. 6

Step 10: Replace housing cover. Tighten housing cover to 25 ft-lbs. minimum, 30 ft-lbs. maximum. Mating surfaces should make contact. Tighten secondary retaining screw (ATEX).

7 Ordering Code

BTL7 Analog Interface (Standard Version)

BTL7-_ _ _0-M_ _ _ _-J-M01-TA (replacement electronics module only, no pressure housing)
BTL7-_ _ _0-M_ _ _ _-J-DEXC-TA12 (complete linear position sensor)

Output signal
- A 0...10 V and 10...0 V
- G -10...10 V and 10...-10 V
- E 4...20 mA or 20...4 mA
- C 0...20 mA or 20...0 mA

Operating voltage
- 5 10...30 V

Signal characteristics
- 1 Rising and falling (output types A and G only).
- 0 Rising output only. Minimum output at connector end (output types C and E only).
- 7 Falling output only. Maximum output at connector end (output types C and E only).

Standard nominal stroke [mm]
0025...7620 mm in 1 mm increments

Connection
- TA12 Internal thread modified 1/2" 14 NPT

Programming tool for null point and end point **BTL7-A-EH03**

BTL7 Analog Interface (Plus Version, USB configurable)

BTL7-_501-M_ _ _ _-J-M01-TA (replacement electronics module only, no pressure housing)
BTL7-_501-M_ _ _ _-J-DEXC-TA12 (complete linear position sensor)

Output signal
- A 0...10 V and 10...0 V
- E 4...20 mA and 20...4 mA

Standard nominal stroke [mm]
0025...7620 mm in 1 mm increments

Connection
- TA12 Internal thread modified 1/2" 14 NPT

Programming tool for null point and end point **BTL7-A-EH03**

BTL7-S Synchronous Serial Interface (Standard Version)

BTL7-S5_ _ -M _ _ _ _-J-M01 -TA (replacement electronics module only, no pressure housing)
BTL7-S5_ _ -M _ _ _ _-J-DEXC-TA12 for asynchronous operation (complete linear position sensor)
BTL7-S5_ _B-M _ _ _ _-J-DEXC-TA12 for synchronous operation (complete linear position sensor)

Output format
- 0 Binary code rising (24 bit)
- 1 Gray code rising (24 bit)
- 6 Binary code rising (25 bit)
- 7 Gray code rising (25 bit)
- A Binary code rising (26 bit)
- B Gray code rising (26 bit)

Resolution
- 1 1 µm
- 2 5 µm
- 3 10 µm
- 4 20 µm
- 5 40 µm
- 6 100 µm
- 7 2 µm
- 8 50 µm

Standard nominal stroke [mm]
0025...7620 mm

Connection
- TA12 Internal thread modified 1/2" 14 NPT

BTL7-S Synchronous Serial Interface (Plus Version, USB configurable)

BTL7-S_ _ _ _-M _ _ _ _ -J-M01 -TA (replacement electronics module only, no pressure housing)
BTL7-S510 -M _ _ _ _ -J-DEXC-TA12 for asynchronous operation (complete linear position sensor)
BTL7-S510B -M _ _ _ _ -J-DEXC-TA12 for synchronous operation (complete linear position sensor)

Standard nominal stroke [mm]
0025...7620 mm in 1 mm increments on request

BALLUFF

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