

Technical Description / User's Guide

BTL5-_-M_-J-DEXC-TA12

Micropulse Linear Position Sensor

Analog & Digital-Pulse Outputs

Explosion-Proof (Flame-Proof) Rod Style



MICROPULSE[®]

Contents

i	Preface - ATEX Directive Instructions.....	3-4
1	Introduction.....	4
1.1	Scope.....	4
1.2	Safety Advisory.....	4
1.3	Approvals.....	5
2	General Information.....	5
2.1	Functional Description.....	5
3	Component Overview.....	6-7
4	Mechanical Data.....	8
4.1	Dimensions.....	8
4.2	Specifications.....	9
5	Accessories.....	10
5.1	Magnets.....	10
5.2	Conduit Adapter.....	10
5.3	Floats.....	11
6	Installation Instructions.....	12
6.1	Installation Procedure (mounting bolt specifications, tightening torque, etc.).....	12
6.2	Installation in Hydraulic/Pneumatic Cylinders.....	12
6.3	Installing in Zone 0 Locations.....	13
6.4	Wiring.....	13
6.5	Using Analog Programming Tool.....	14
6.6	Replacing Electronics Module.....	14
7	Order Code.....	15



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

In our accredited EMC Laboratory, proof has been documented that these Balluff products meet the EMC requirements of the following product standard:

*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

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

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 +65°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.
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.
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.
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)

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

i Preface - ATEX Directive Instructions (cont.)

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:



Class I Zone 1 AEx db IIC T* Ga/Gb T6 Ta -50° to 65°C, T5 Ta -50° to 80°C
Class I Zone 1 Ex db IIC T* Gb T6 Ta -50° to 65°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 65°C, T5 Ta -50° to 80°C Type 4X/6P; IP68
SIRA 11ATEX1104X
IECEX SIR 11.0048X



Ex II 1/2GD
Ex db IIC T* Ga/Gb Ta -50° to 65°C (T6) -50° to 80°C (T5)
Ex t IIIC T85/T100°C Da IP68 Ta -50° to 65°C (T85) -50° to 80°C (T100)
CE 2813 Ex (manufactured in the USA)
CE 0102 Ex (manufactured in Hungary)

2 General Information

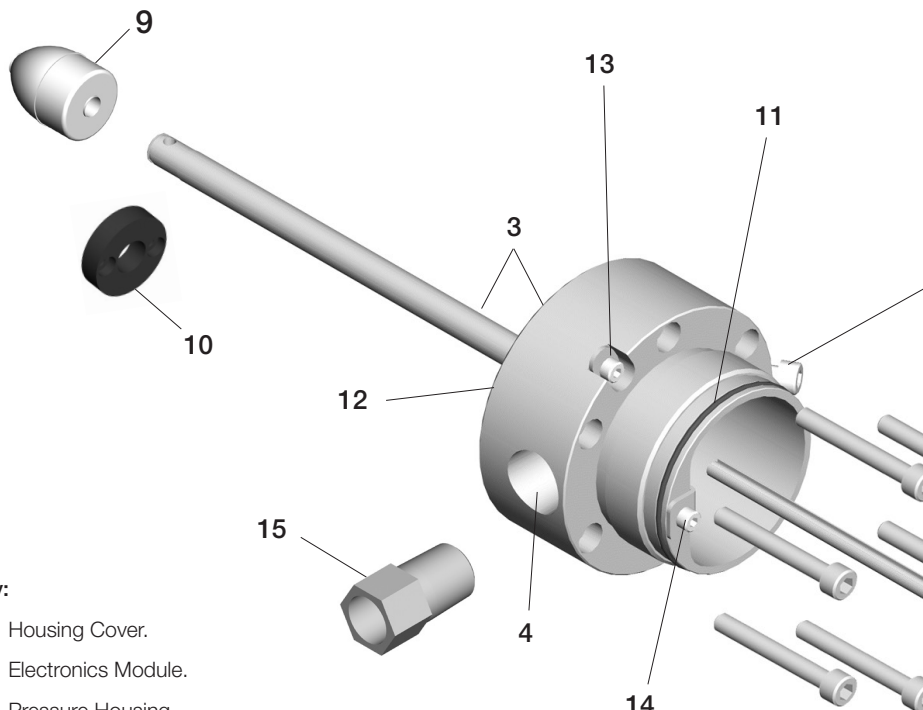
2.1 Functional Description

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 digital pulse signals. The internal electronics module/sensing element can be replaced while the external housing stays in place.

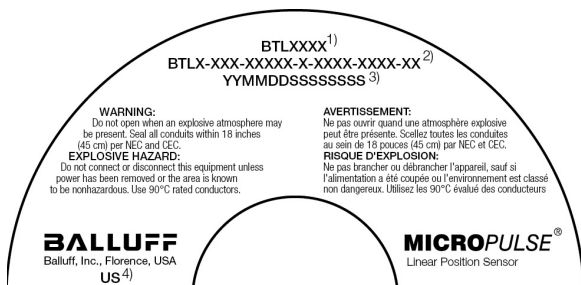
3 Component Overview



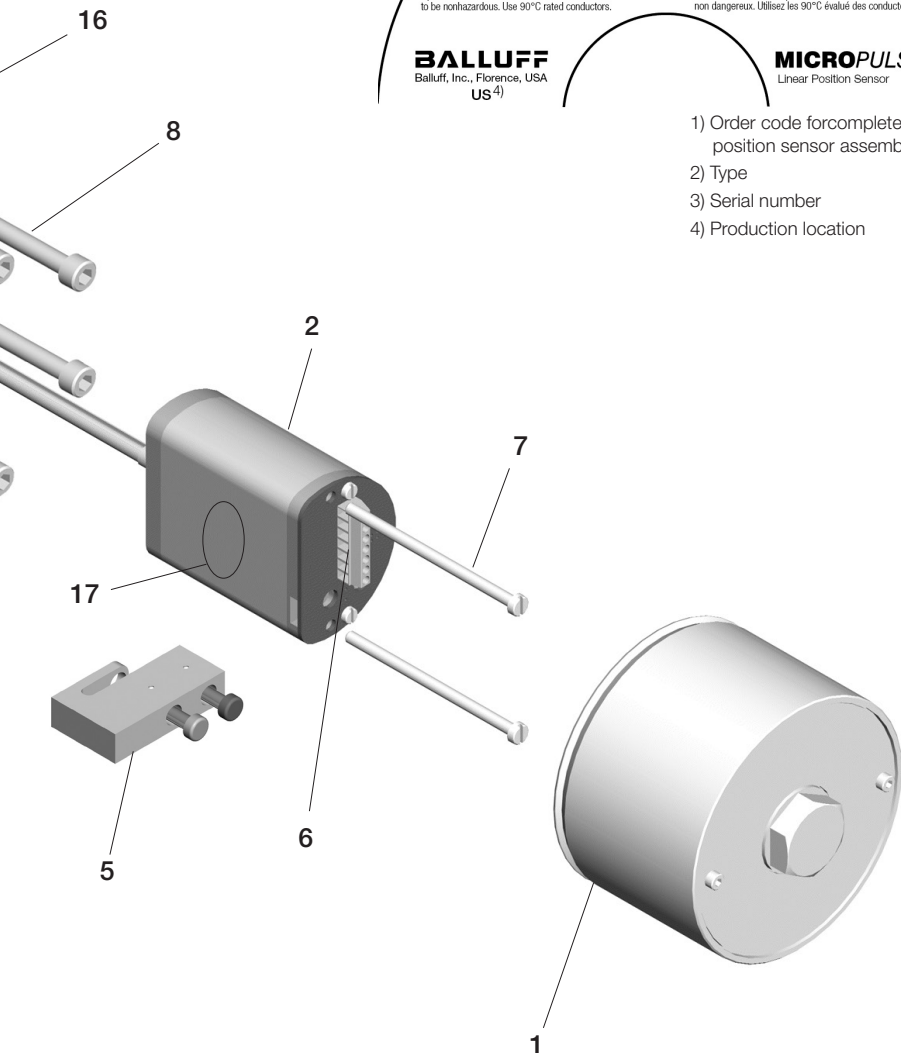
Key:

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. Cover secondary retaining screw.
17. Location of order code for replacement electronics module.

Product Label (detail, example)

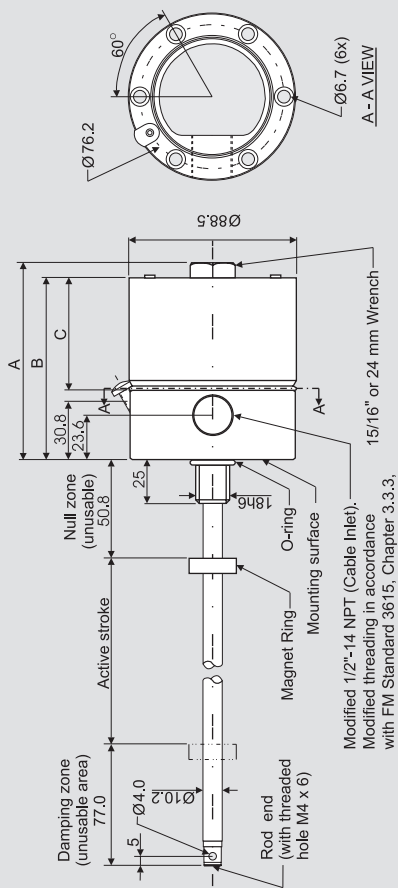


- 1) Order code for complete linear position sensor assembly
- 2) Type
- 3) Serial number
- 4) Production location



4 Mechanical Data

4.1 Dimensions



Mounting is accomplished using six M6x45 A4 (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, Digital, SSI, Quadrature	104.12	96.12	59.5
Profibus, CANbus	135.62	127.62	91

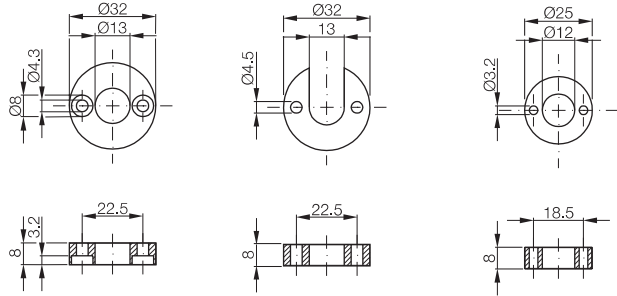
4.2 Specifications

Specifications	
Measurement Type	Linear Displacement
Measuring Range	51 mm (2 in.) to 4445 mm (175 in.)
Connection Means	Internal screw-type terminal block, Min. 26 AWG/Max. 16 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.)
Low Temperature Operation < -40°C (-40°F)	Protection method rated to -50°C (-58°F). Sensor functionality not assured.
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 BTL5 B/Z-housing User Guides for the appropriate output type.

5 Accessories (Order Separately)

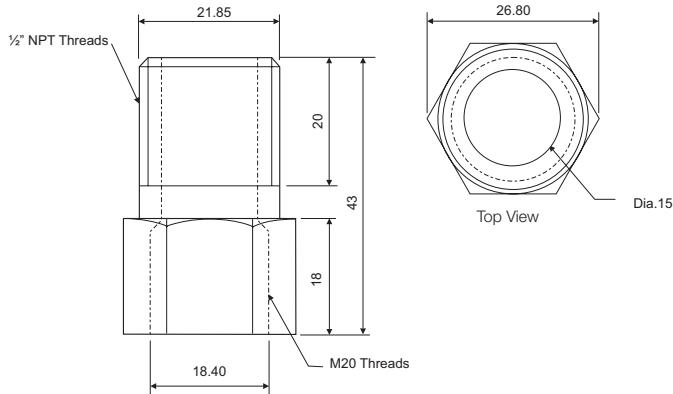
5.1 Magnets

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



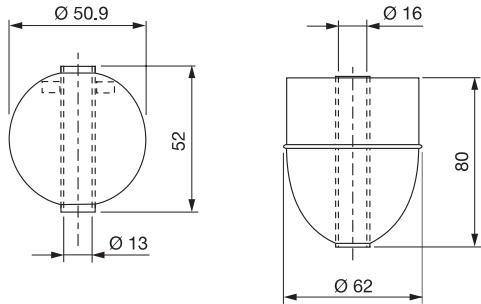
5.2 Conduit Adapter

Order code	BAM011T	
Part number	BTL-A-AD09-M-00-EX	
Material	Nickel-Plated Brass	
Approvals	 SIRAA00ATEX1094 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



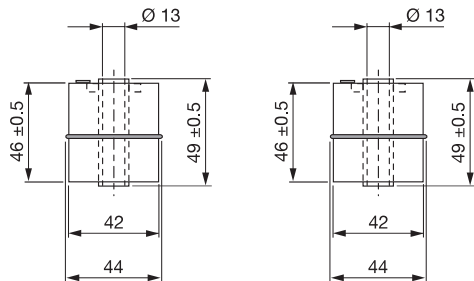
5.3 Floats

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/cm ³	0.6 g/cm ³
Immersion depth in 1 g/cm ³ (H ₂ O)	26 mm	41 mm
Immersion depth in 0.7 g/cm ³	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/cm ³	0.7 g/cm ³
Immersion depth in 1 g/cm ³ (H ₂ O)	45 mm	30 mm
Immersion depth in 0.7 g/cm ³	Sinks	39 mm



6 Installation

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)

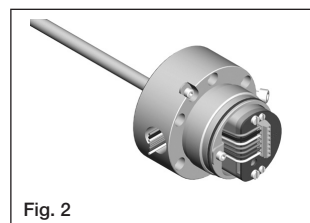
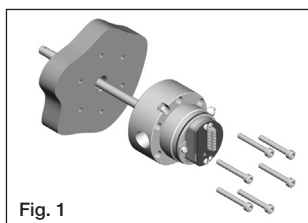
Step 3: Connect wiring as indicated in section 6.4. (Fig. 2)

Use 90°C rated conductors.

Utilisez des conducteurs approuvé 90° C

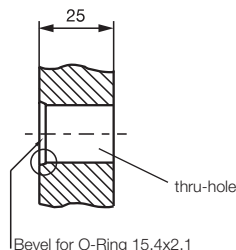
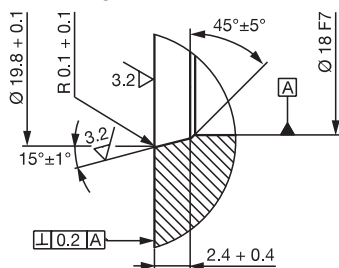
Step 4: For analog output versions only—If necessary, scale the active stroke range per the instructions in section 6.5; otherwise, proceed to next step.

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



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.

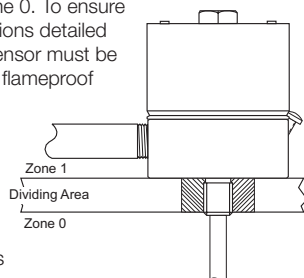


6.3 Installing in Locations Classified as Zone 0 Under ATEX and IECEx Guidelines

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

Pin	Output Type (Order Code) Fig. 1				
	Analog Voltage (A/B/G)	Analog Current (C/E)	Digital START/STOP (I/K/M/N/P)	Digital PWM (L/R)	SSI (S)
1	not used	Signal Out	Interrogate (+) (input)	Interrogate (+) (input)	CLK (+) (input)
2	signal GND	Signal GND	START/STOP (+) (output)	GATE (+) (output)	DATA (+) (output)
3	Signal Out (failing)	not used	Interrogate (-)' (input)	Interrogate (-) (input)	CLK (-) (input)
4	Pwr Supply GND	Pwr Supply GND	Pwr Supply GND	Pwr Supply GND	Pwr Supply GND
5	Pwr Supply (+10 to +30 vdc)	Pwr Supply (+10 to +30 vdc)	Pwr Supply (+10 to +30 vdc)	Pwr Supply (+10 to +30 vdc)	Pwr Supply
6	Signal Out (rising)	not used	START/STOP (-)' (output)	GATE (-) (output)	DATA (-) (output)
7	not used	not used	not used	not used	not used

Note 1: Order code version "N" is a single-ended, TTL compatible START/STOP version. This version does not use Interrogate (-) or START/STOP (-). Pins 3 and 6 should be left unconnected for "N" type linear position sensors.

Output Type (Order Code) Fig. 2	
Pin	Profibus (T)
1	RxD/TxD-N
2	RxD/TxD-P
3	Data GND
4	Pwr Supply GND
5	Pwr Supply (+)
6	VP (+5V Output)
7	Not used
8	Not used

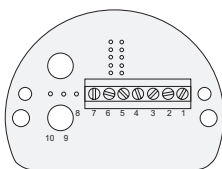


Fig. 1

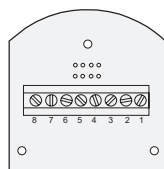


Fig. 2

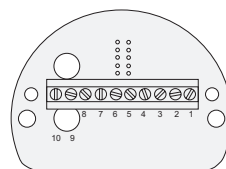
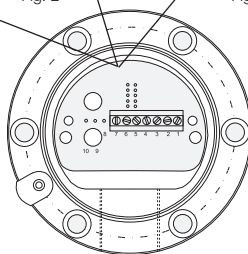


Fig. 3

Output Type (Order Code) Fig. 3		
Pin	Quadrature (Q)	CANbus (H)
1	Output Channel A (+)	CAN GND
2	Output Channel B (+)	CAN Low
3	Output Channel A (-)	CAN High
4	Pwr Supply GND	Pwr Supply GND
5	Pwr Supply (+10 to +30 Vdc)	Pwr Supply (+24V)
6	Output Channel B (-)	CAN GND
7	Output Channel Z (+)	CAN Low
8	Output Channel Z (-)	CAN High
9	Strobe Input	Not used
10	Not used	Not used



Typical housing with terminal block assembly.

6 Installation (cont.)

6.5 Using Analog Programming Tool

Warning!
Do not open when an explosive atmosphere may be present.

Avertissement!
Ne pas ouvrir si l'environnement est explosive.

Versions of the Micropulse EX linear position sensor with an analog output, (orde 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).

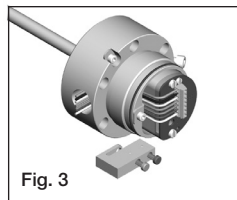


Fig. 3

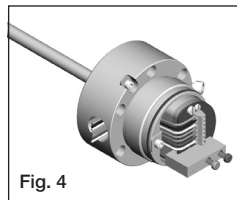


Fig. 4

Optional Analog Programming Tool BTL5-A-EH03

6.6 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 Balluff 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.
- 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).

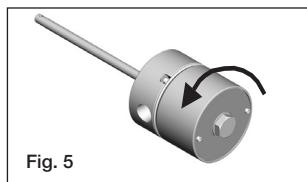


Fig. 5

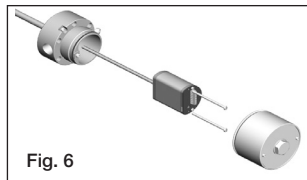


Fig. 6

7 Order Code

BTL5 Analog Interface

BTL5-_-_-M_-_-_-J-M01-TA (replacement electronics module only, no pressure housing)

BTL5-_-_-M_-_-_-J-DEXC-TA12 (complete linear position sensor)

Output signal	Standard nominal stroke [mm]	Connection
A51 0...10 V and 10...0 V Rising and falling	0025...4445 mm in 1 mm increments	TA12 Internal thread modified 1/2" 14 NPT
E50 4...20 mA, rising		
E57 20...4 mA, falling		
C50 0...20 mA, rising		
C57 20...0 mA, falling		
G51 -10...10 V and 10...-10 V rising and falling		

Programming tool for null point and end point **BTL5-A-EH03**

BTL5 SSI Interface

BTL5-S1_-_-M_-_-_-J-M01-TA (replacement electronics module only, no pressure housing)

BTL5-S1_-_-M_-_-_-J-DEXC-TA12 for asynchronous operation (complete linear position sensor)

BTL5-S1_-_-B-M_-_-_-J-DEXC-TA12 for synchronous operation (complete linear position sensor)

Output format	Resolution	Standard nominal stroke [mm]	Connection
0 Binary code, rising (24-bit)	1 1 µm	0025...3962 mm	TA12 Internal thread modified 1/2" 14 NPT
1 Gray code, rising (24-bit)	2 5 µm		
6 Binary code, rising (25-bit)	3 10 µm		
7 Gray code, rising (25-bit)	4 20 µm		
	5 40 µm		

BTL5 CANopen Interface

BTL5-H1_-_-M_-_-_-J-M01-TA (replacement electronics module only, no pressure housing)

BTL5-H1_-_-M_-_-_-J-DEXC-TA12 (complete linear position sensor)

Software configuration	Baud rate	Standard nominal stroke [mm]	Connection
1 1 × position and 1 × velocity	0 1 Mbaud 1 800 kbaud	0025...3962 mm	TA12 Internal thread modified 1/2" 14 NPT
2 2 × position and 2 × velocity	2 500 kbaud 3 250 kbaud 4 125 kbaud 5 100 kbaud 6 50 kbaud 7 20 kbaud 8 10 kbaud		

BTL5 PROFIBUS DP Interface

BTL5-T1_0-M_-_-_-J-M01-TA (replacement electronics module only, no pressure housing)

BTL5-T1_0-M_-_-_-J-DEXC-TA12 (complete linear position sensor)

Software configuration	Standard nominal stroke [mm]	Connection
1 1 × position and 1 × velocity	0025...3962 mm	TA12 Internal thread modified 1/2" 14 NPT
2 2 × position and 2 × velocity		

Germany

Global Headquarters

Balluff GmbH

Schurwaldstraße 9

73765 Neuhausen a.d.F.

Telefon: +49 (0)71 58/1 73-0

Telefax: +49 (0)71 58/50 10

Hotline: +49 (0)71 58/1 73-370

Web: www.balluff.de

E-mail: balluff@balluff.de

USA

North American Headquarters

Balluff Inc.

8125 Holton Drive

Florence, KY 41042

Phone: (859) 727-2200

Toll-free: 1-800-543-8390

Fax: (859) 727-4823

Web: www.balluff.us

E-Mail: balluff@balluff.com

Canada

Balluff Canada, Inc.

2840 Argentia Road, Unit #1

Mississauga, Ontario L5N 8G4

Phone: (905) 816-1494

Toll-free: 1-800-927-9654

Fax: (905) 816-1411

Web: www.balluff.ca

E-mail: balluff.canada@balluff.ca

Mexico

Balluff de Mexico SA de CV

Anillo Vial II Fray Junipero Serra No. 4416

Colonia La Vista Residencial

Queretaro, QRO CP76146

Phone: (+52 442) 212-4882

Fax: (+52 442) 214-0536

Web: www.balluff.mx

E-mail: balluff.mexico@balluff.com