BALLUFF

sensors worldwide

Technical Description / User's Guide

BTL5-_-M_-J-DEXC-TA12

Micropulse Linear Position Transducer

Analog & Digital-Pulse Outputs
Explosion-Proof (Flame-Proof) Rod Style

MICROPULSE®

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 vapours with apparatus groups IIC and with temperature classes T6 and T5.

2. The equipment is only certified for use in ambient temperatures in the range -20°C to +65°C (T6) or -20°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: 2003.

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: 2007.

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: 2007.

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:

   – Stainless Steel, 316
   – Stainless Steel, 304
   – Viton (used for O-ring seals)

i Preface - ATEX Directive Instructions (cont.)

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 Transducer.

1.1 Scope

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

1.2 Safety Advisory

Read this manual before installing the Micropulse EX transducer. The Micropulse EX transducer 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 transducer system. In particular, steps must be taken to ensure that should the transducer 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
11-2411253X

Class I, Division 1, Groups A, B, C, and D
Class II, Division 1, Groups E, F, and G; Class III
T6 Ta=65°C, T5 Ta=80°C Type 4X/6P; IP68
Class I, Zone 1 AEx d IIC T6 Ta=65°C, T5 Ta=80°C
Class I, Zone 1 Ex d IIC T6 Ta=65°C, T5 Ta=80°C
SIRA 11ATEX1104X
IECEx SIR 11.0048X

Ex II 1/2GD
Ex d IIC T6/T5 Ga/Gb Ta +65°C (T6) +80°C (T5)
Ex t IIIC T85/T100°C Da IP68 Ta +65°C (T85) +80°C (T100)

CE 0518 Ex

2 General Information

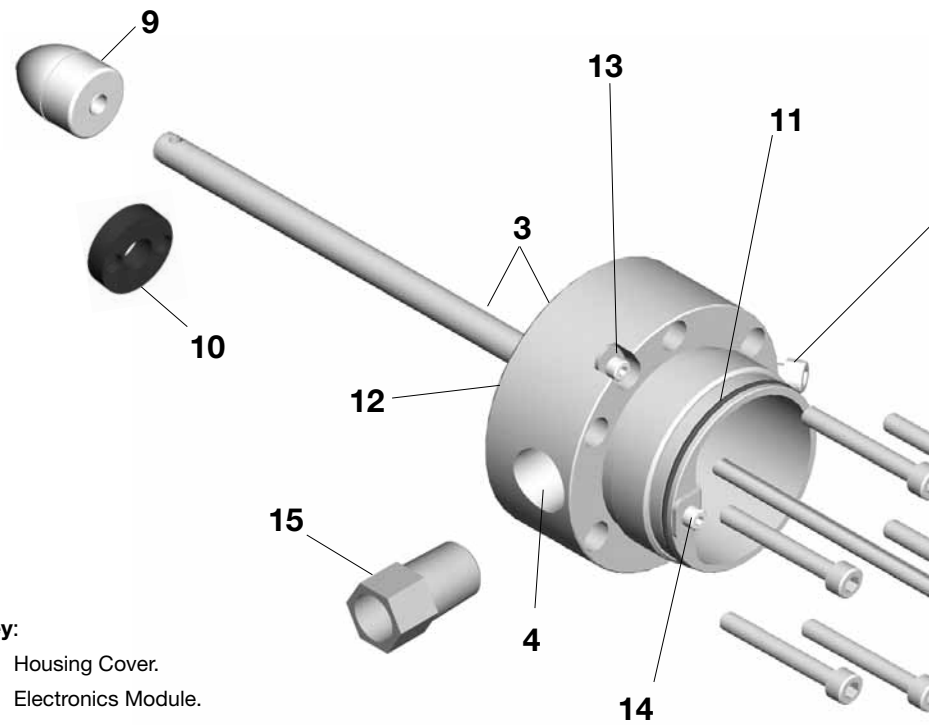
2.1 Functional Description

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

The Micropulse EX Linear Position Transducer consists of:

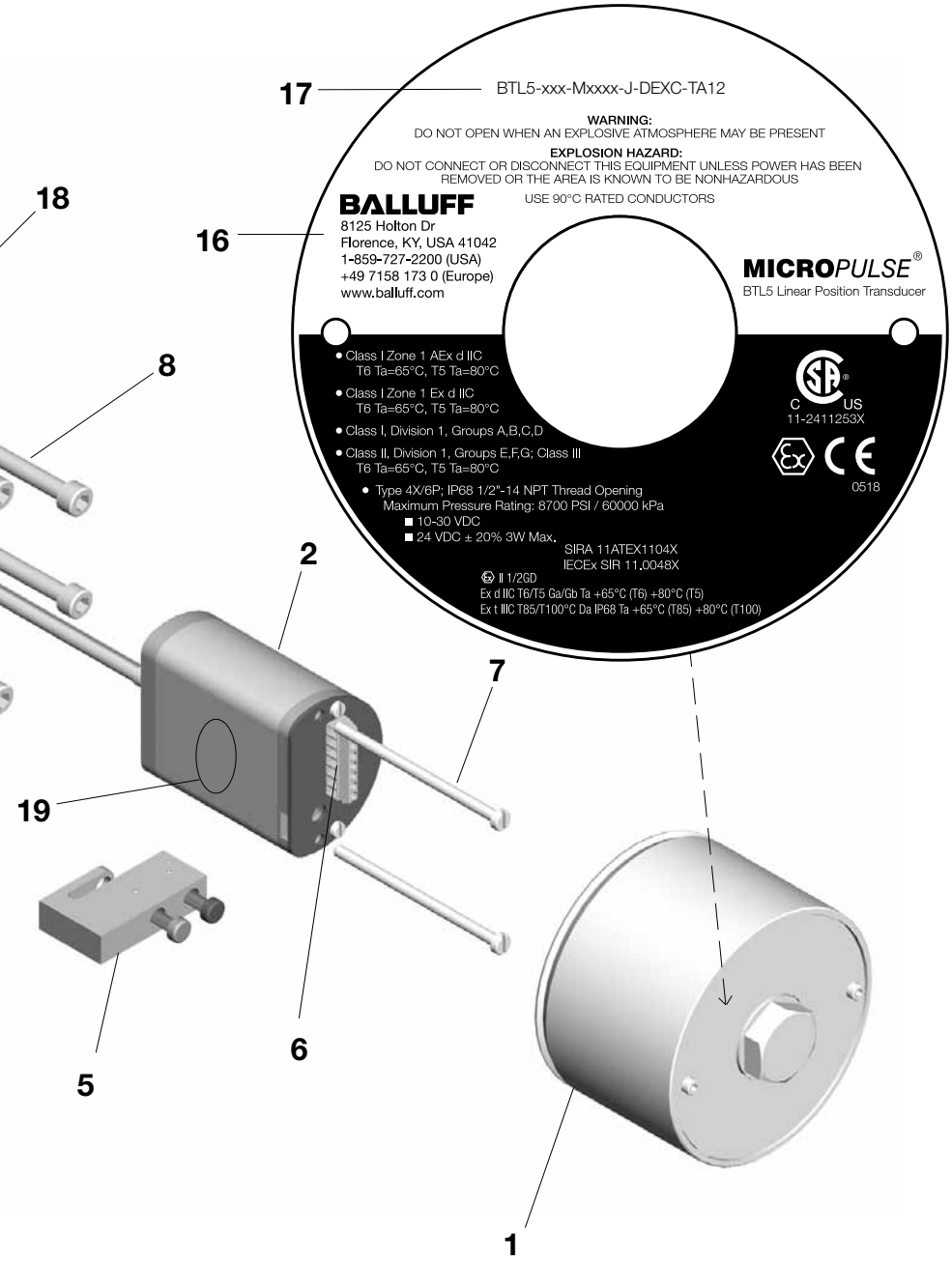
- A heavy-duty stainless steel housing with a ½"-14 NPT threaded conduit opening for cable entry.
- An internal electronics module/sensing element that provides electrical position feedback signals in the form of an analog voltage, analog current, or digital pulse signals. The internal electronics module/sensing element can be replaced while the external housing stays in place.

3 Component Overview



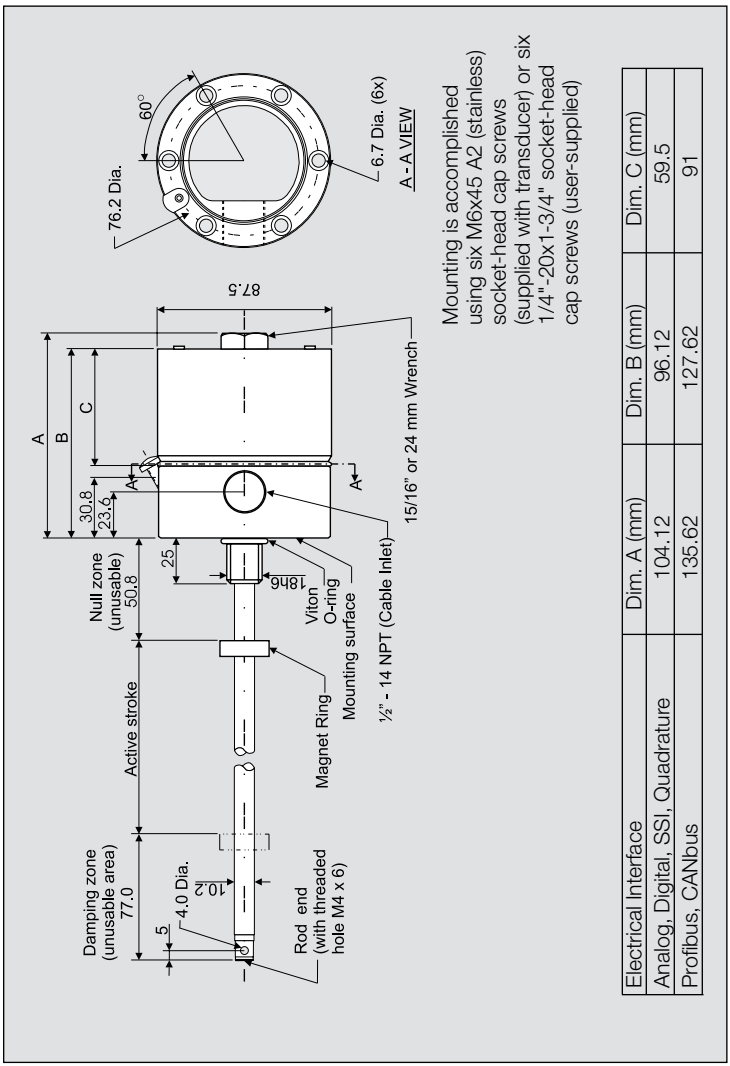
Key:

1. Housing Cover.
2. Electronics Module.
3. Pressure Housing.
4. Conduit Entry (1/2”-14 NPT).
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 A2 Socket-Head Cap Screws (6x–included). (Replacement Screw Kit: BTL5-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 transducer assembly.
18. Cover secondary retaining screw.
19. Location of ordering code for replacement electronics module.


17
BTL5-xxx-Mxxxx-J-DEXC-TA12
WARNING:
DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT
EXPLOSION 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
18
BALLUFF
16
8125 Holton Dr
Florence, KY, USA 41042
1-859-727-2200 (USA)
+49 7158 173 0 (Europe)
www.balluff.com
MICROPULSE®
BTL5 Linear Position Transducer
8
• Class I Zone 1 AEx d IIC T6 Ta=65°C, T5 Ta=80°C
• Class I Zone 1 Ex d IIC T6 Ta=65°C, T5 Ta=80°C
• Class I, Division 1, Groups A,B,C,D
• Class II, Division 1, Groups E,F,G; Class III T6 Ta=65°C, T5 Ta=80°C
• Type 4X/6P; IP68 1/2"-14 NPT Thread Opening
Maximum Pressure Rating: 8700 PSI / 60000 kPa
■ 10-30 VDC
■ 24 VDC ± 20% 3W Max.
C US
11-2411253X
0518
SIRA 11ATEX1104X
IECEx SIR 11.0048X
II 1/2GD
Ex d IIC T6/T5 Ga/Gb Ta +65°C (T6) +80°C (T5)
Ex t IIIC T85/T100°C Da IP68 Ta +65°C (T85) +80°C (T100)
2
7
19
6
5
1

4 Mechanical Data

4.1 Dimensions



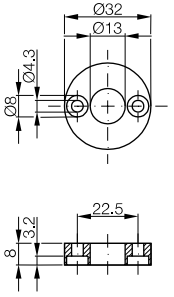
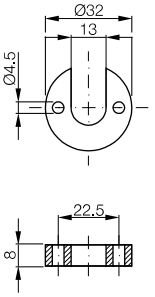
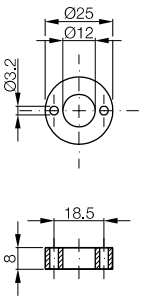
Electrical Interface	Dim. A (mm)	Dim. B (mm)	Dim. C (mm)
Analog, Digital, SSI, Quadrature	104.12	96.12	59.5
Profibus, CANbus	135.62	127.62	91

4.2 Specifications

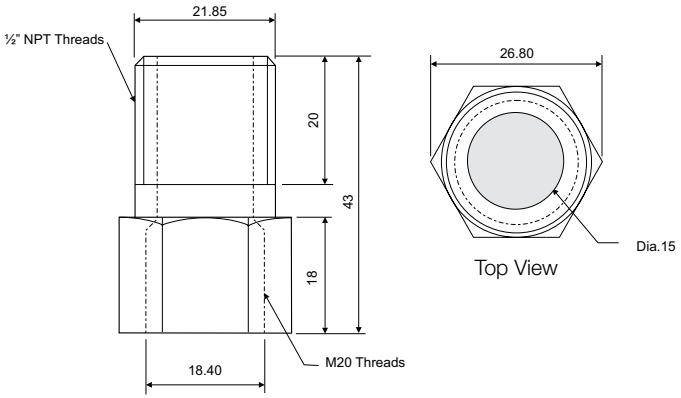
Specifications	
Measurement Type	Linear Displacement
Measuring Range	51 mm (2 in.) to 5080 mm (200 in.)
Connection Means	Internal screw-type terminal block
Shock Rating	100 g/6 ms per IEC 68-2-27
Vibration Rating	12 g, 10 to 200 Hz per IEC 68-2-6
Environmental Protection	IP68* *To maintain the IP68 rating, ensure that the connection at the conduit opening also meets this standard. Thread sealant should be used to ensure protection against moisture ingress. Take care to prevent the possibility of condensation in the conduit from entering the transducer housing.
Housing/Rod Material	Stainless steel, 316
Cover Material	Stainless steel, 304
Cover O-Ring Material	Viton
Pressure Rating, Rod	8700 psi
Operating Temperature	-40°C to +80°C (-40°F to +176°F) -20°C to +80°C (ATEX Applications)
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Humidity	<90%, non-condensing
Electrical Performance Specifications	For complete electrical and performance specifications, refer to Micropulse B/Z-housing User Guides for the appropriate output type

5 Accessories (Order Separately)

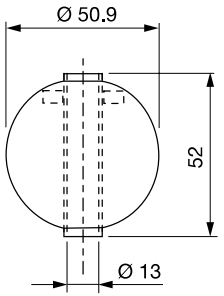
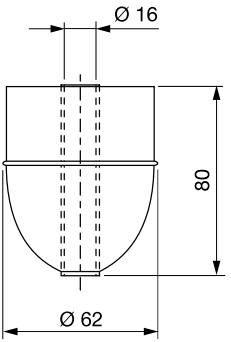
5.1 Magnets

Description	Ring Magnet	Slotted Magnet	Small Ring Magnet
Ordering Code	**BTL-P-1013-4R**	**BTL-P-1013-4R**	**BTL-P-1012-4R**
Material	AL	AL	AL
Weight	12 g	12 g	12 g
			

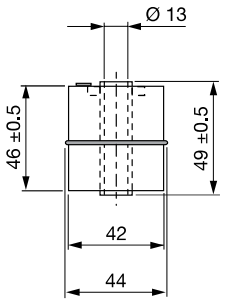
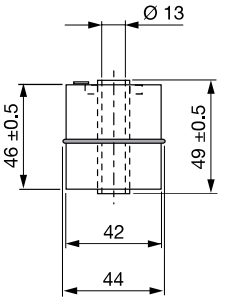
5.2 Conduit Adapter

Description	1/2" – 14 NPT to M20 Adapter	
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

Description	Spherical Float	Bullet Float
Ordering Code	**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.

Description	Barrel Float, Liquid Interface	Barrel Float, Liquid Level
Ordering Code	**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
		

6 Installation

6.1 Installation Procedure

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

Attention!
Only approved conduit systems are to be used.

Step 1: Unscrew and remove housing cover.

Step 2: Install transducer into position. Secure transducer using six M6x45 A2, stainless steel, socket head cap screws (supplied with transducer), 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.

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).

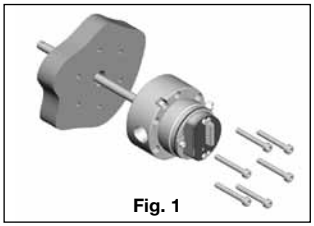


Fig. 1

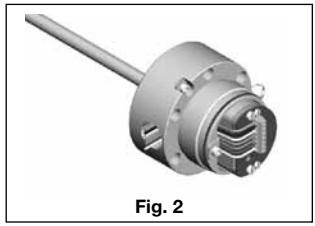
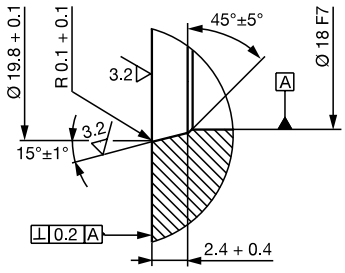
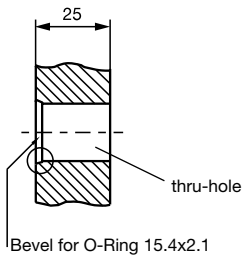


Fig. 2

6.2 Installation in Hydraulic/Pneumatic Cylinders

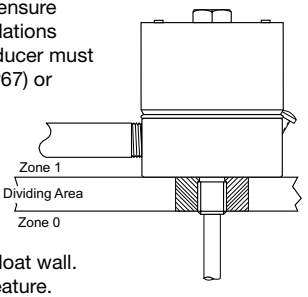
If the transducer is to be installed in a cylinder, prepare the cylinder port in accordance with the diagram below.





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

Only the rod section of the transducer 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 transducer 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 transducer 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 transducer rod and the float wall. Do not use other types of floats or attempt to disable this design feature.

Note: The transducer is not approved for use in location classified as Zone 0 under North American guidelines.

6.4 Wiring

	Output Type (Ordering Code) Fig. 1				
Pin	**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 (-)[1] (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 (-)[1] (output)	GATE (-) (output)	DATA (-) (output)
7	not used	not used	not used	not used	not used

Note 1: Ordering 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 transducers.

Output Type (Ordering 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

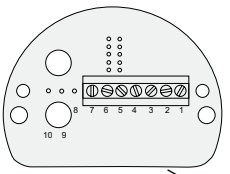


Fig. 1

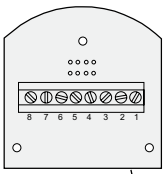


Fig. 2

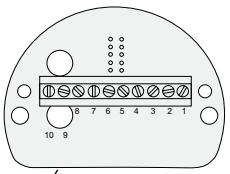
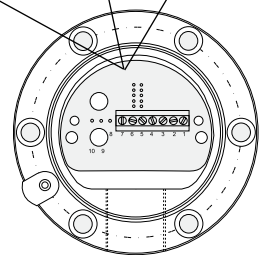


Fig. 3

Output Type (Ordering Code) Fig. 3		
Pin	**Quadrature (Q)**	**CANbus (H)**
1	Output Channel A (+)	CAN GND
2	Output Channel B (+)	CAN Low
3	Outpur 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.

6.5 Using Analog Programming Tool

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

Versions of the Micropulse EX transducer 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 transducer user's guide. (Fig. 4)

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

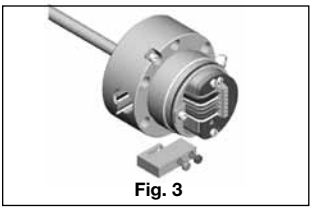


Fig. 3

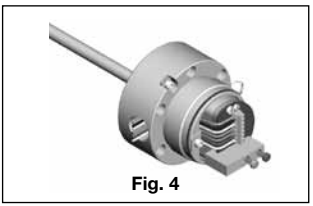


Fig. 4

Optional Analog Programming Tool **BTL5-A-EH03**

6.6 Replacing Electronics Module

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

Attention!
Replacement parts must be obtained from Balluff to ensure that the product certification is not invalidated.

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

Step 2: Disconnect wiring and note wire locations for re-assembly.

Step 3: Remove the 2 electronics module retaining screws.

Step 4: Carefully slide electronics module/waveguide assembly out of the pressure housing. Avoid bending the waveguide assembly. (Fig. 6)

Step 5: Carefully slide the new electronics module into the pressure housing. Avoid bending the waveguide assembly.

Step 6: Secure the electronics module using the 2 new screws provided with the replacement module.

Step 7: Connect wiring as per section 6.4.

Step 8: Remove and replace the housing O-ring with the new O-ring provided with the replacement module.

Step 9: 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).

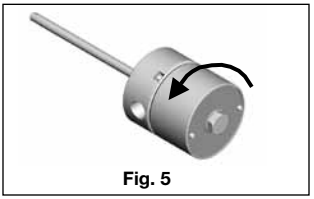


Fig. 5

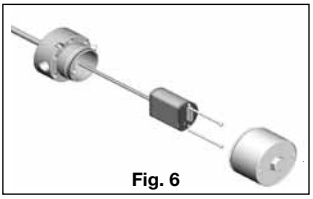


Fig. 6

7 Ordering Code

Replacement Module Only **B T L 5 - A 1 1 - M 0 3 0 5 - J - M 0 1 - T A**

Complete Transducer **B T L 5 - A 1 1 - M 0 3 0 5 - J - D E X C - T A 1 2 - E 4**

Balluff - Transducer - Linear

Generation 5

Output

A = 0 to 10Vdc
B = -5 to +5Vdc
C = 0 to 20 mA
E = 4 to 20 mA
G = -10 to +10 Vdc
S = SSI
T = Profibus
H = CANopen
Q = Quadrature

I = Differential start/stop with tri-state
K = Differential stop - leading edge active
L = Differential pulse-width modulated
M = Differential start/stop - leading edge active
N = Single ended start/stop - leading edge active
P = Differential start/stop - trailing edge active
R = Differential pulse-width - recirculated

Supply Voltage

1 = +24 Vdc ± 20% (H, T and S output versions only)
5 = +10... + 30 Vdc (all other output types)

Analog Output Operation

Voltage Output (type A, B, or G)
1 = User selectable rising or falling
Current Output (type C & E)
0 = Minimum output at connector end (rising toward opposite end)
7 = Maximum output at connector end (falling towards opposite end)

Nominal Stroke Length

0 3 0 5 = 305 mm active stroke

Housing Type

J = Rod-style, smooth flange, o-ring seal

Protection Method/Rod Termination

DEX = Flameproof, **C** = Universal end plug

Connection Type

T A 1 2 = Terminal block connection, 1/2"-14 NPT conduit entry

Interrogation (only vaild if output type=R, otherwise leave blank)

I = Internal interrogation, E = External interrogation

Recirculation (only valid if output type = R, otherwise leave blank)

1 = 1 circulation, 2 = 2 circulations, 4 = 4 circulations, 8 = 8 circulations, 16 = 16 circulations

Standard Stroke Lengths, Inches (mm)

2	(0051)	11	(0280)	28	(0711)	66	(1676)	140	(3556)	180	(4572**)
3	(0076)	12	(0305)	30	(0762)	69	(1753)	144	(3658)	184	(4674)
3.5	(0090)	13	(0330)	32	(0813)	72	(1829)	148	(3759)	188	(4674)
4	(0102)	15	(0381)	36	(0914)	78	(1981)	152	(3861)	192	(4877)
5	(0127)	16	(0407)	40	(1016)	84	(2134)	156	(3962*)	196	(4978)
6	(0152)	18	(0457)	42	(1067)	89	(2261)	160	(4064)	200	(5080)
7	(0178)	20	(0508)	48	(1220)	98	(2490)	164	(4166)		
8	(0203)	22	(0560)	50	(1270)	108	(2743)	168	(4267)		
9	(0230)	24	(0610)	54	(1372)	118	(2997)	172	(4369)		
10	(0254)	26	(0661)	60	(1524)	126	(3200)	176	(4470)		

* Max Length for CANopen, Profibus, and SSI
** Max Length for Analog

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