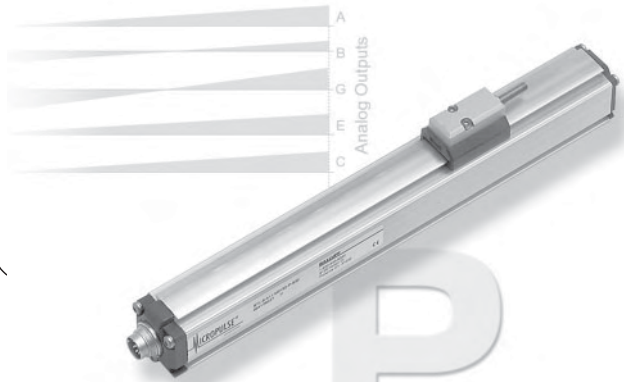
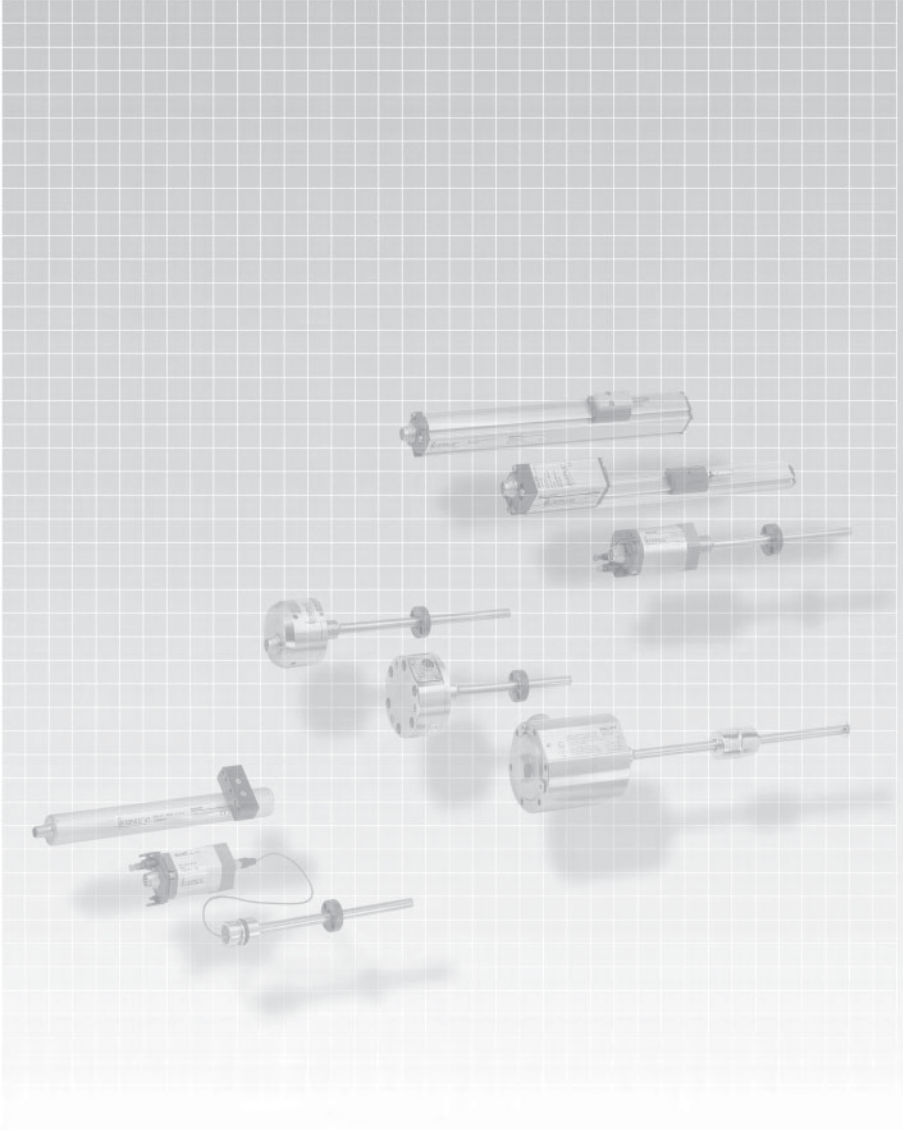


BTL5-A/C/E/G_-M____-P-S32/KA_
Micropulse Linear Transducer
Analog Output/Profile Housing



BTL5-A/C/E/G _-M/U _ _-P-S 32/KA _ _
Micropulse Linear Position Transducer
Analog Profile Style





BTL5-A/C/E/G_ _-M/U_ _ _-P-S 32/KA_ _

Micropulse Linear Position Transducer

Analog Profile Style

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
B	T	L	-	5	-	A	1	1	-	M	0	3	0	5	-	P	-	S	3	2	
																		K	A	0	5

Balluff - Linear Transducer

Generation 5

Output Type

- A = 0 to 10Vdc
- B = -5 to +5Vdc
- C = 0 to 20 mA
- E = 4 to 20 mA
- G = -10 to +10 Vdc

Supply Voltage

- 1 = 24 Vdc ±20%
- 2 = ±15 Vdc ±2% (Not available for S, T or H outputs)

Analog Output Operation

Voltage type (Output type A, B & G)

1 = User selectable rising or falling

Current type (Output type C & E)

0 = Minimum output at connector end (rising towards opposite end)

7 = Maximum output at connector end (falling towards opposite end)

Normal Stroke Length

0	3	0	5
---	---	---	---

 = 305mm active stroke

Housing Type

P = Standard Profile Housing

Connection Type

S	3	2
---	---	---

 = 8-pin quick disconnect metal connector

K	A	0	5
---	---	---	---

 = Cable out (5m standard; specify length in meters)

Standard Stroke Lengths (consult factory for additional lengths)

Electrical Stroke

inches	mm	inches	mm	inches	mm	inches	mm
2	0051	15	0381	42	1067	148	3759
3	0077	16	0407	48	1220	156	3962
4	0102	18	0457	50	1270		
5	0127	20	0508	60	1524		
6	0152	22	0560	70	1778		
7	0178	24	0610	80	2032		
8	0203	26	0661	90	2286		
9	0230	28	0711	100	2540		
10	0254	30	0762	110	2794		
11	0280	32	0813	120	3048		
12	0305	36	0914	130	3302		
13	0330	40	1016	142	3606		

BTL5-A/C/E/G _-M/U _ _ _-P-S 32/KA _ _
Micropulse Linear Position Transducer
Analog Output/Profile Housing



Contents	
1	Safety Advisory 2
1.1	Proper application 2
1.2	Qualified personnel 2
1.3	Use and inspection 2
1.4	Scope 2
2	Function and Characteristics 3
2.1	Characteristics 3
2.2	Function 3
2.3	Available stroke lengths and magnets 3
3	Installation 3
3.1	Transducer installation 3
3.2	Floating magnets 4
3.3	Captive magnets 5
4	Wiring 6
5	Startup 7
5.1	Check connections 7
5.2	Turning on the system 7
5.3	Check output values 7
5.4	Check functionality 7
5.5	Fault conditions 7
5.6	Noise elimination 7
6	Versions (indicated on part label) 7
7	Technical Data 8
7.1	Dimensions, weights, ambient conditions 8
7.2	Supply voltage (external) .. 8
7.3	Outputs 8
7.4	Connection to processor . 8
7.5	Included in shipment 8
7.6	Magnets (order separately) 8
7.7	Accessories (optional) 8

1 Safety Advisory

Read this manual before installing and operating the Micropulse Transducer.

1.1 Proper application

The BTL5 Micropulse transducer is intended to be installed in a machine or system. Together with a controller (PLC) or a processor (BTA) it comprises a position measuring system and may only be used for this purpose.

Unauthorized modifications and non-permitted usage will result in the loss of warranty and liability claims.

1.2 Qualified personnel

This guide is intended for specialized personnel who will perform the installation and setup of the system.

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.

1.4 Scope

This guide applies to the model BTL5-A/C/E/G...P... Micropulse transducer.

An overview of the various models can be found in section 6 Versions (indicated on part label) on page 7.

Note: For special versions, which are indicated by an -SU _ _ _ designation in the part number, other technical data may apply (affecting calibration, wiring, dimensions etc.).

The following patents have been granted in connection with this product:
US Patent 5 923 164
Apparatus and Method for Automatically Tuning the Gain of an Amplifier



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

89/336/EEC (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 50081-2 (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

2 Function and Characteristics

2.1 Characteristics

Micropulse transducers feature:

- Very high resolution, repeatability and linearity
- Immunity to shock, vibration, contamination and electrical noise
- An absolute output signal
- IP 67 per IEC 529

2.2 Function

The Micropulse transducer contains a tubular waveguide enclosed by an extruded aluminum housing. A magnet attached to the moving member of the machine is moved across the top of the housing and its position constantly updated.

The magnet defines the measured position on the waveguide. An internally generated INIT pulse interacts with the magnetic field of the magnet to generate a magnetostrictive torsional wave in the waveguide which propagates at ultrasonic speed.

The torsional wave arriving at the end of the waveguide is absorbed in the damping zone. The wave arriving at the beginning of the waveguide creates an electrical signal in the coil surrounding the waveguide. The propagation time of the wave is used to derive the position. Depending on the version the corresponding value is output as a voltage or a current either with rising or falling characteristic. This process takes place with high precision and repeatability within the stroke range defined as nominal stroke length.

On both ends of the nominal stroke length is an area which provides an unreliable signal, but which may be entered.

The electrical connection between the transducer, the processor/controller and the power supply is via a cable, which depending on the version is either fixed or connected using a female connector.

Dimensions for installing the Micropulse transducer and for the magnets and control arm are found on pages 4 and 5.

2.3 Available stroke lengths and magnets

To provide for optimum fit in any application, a wide range of stroke lengths, magnets and mounting hardware is available. Magnets, control arms and mounting brackets must be ordered separately.

See inside front cover for available stroke lengths.

3 Installation

3.1 Transducer installation

Ensure that no strong electrical or magnetic fields are present in the immediate vicinity of the transducer.

Any orientation is permitted. The mounting brackets and cylinder head screws allow the transducer to be mounted on a flat machine surface. These should be evenly spaced (Figs. 3-1 and 3-5).

The recommended spacing for long transducers and extreme conditions (e.g. strong shock or vibration): A = 80 mm; spacing between the individual brackets B = 250 mm.

The isolation bushings are used to electrically insulate the transducer from the machine (Fig. 3-1 and 3-5 and chapter 5.6 Noise elimination).

The Micropulse transducer in profile housing is suitable both for floating, i.e. non-contacting magnets (Page 4) and for captive magnets (Page 5).

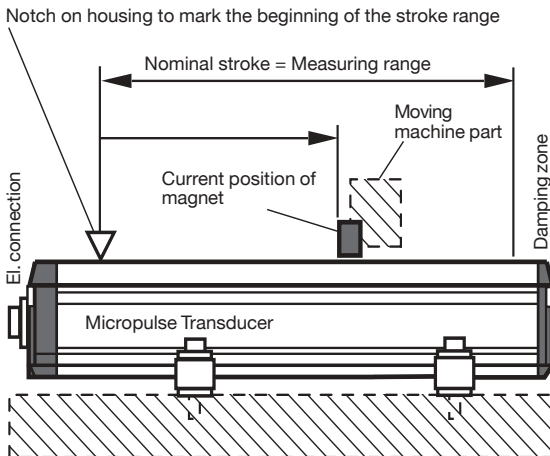


Fig. 2-1: Basic arrangement

BTL5-A/C/E/G _-M/U _ _-P-S 32/KA _ _
Micropulse Linear Position Transducer
Analog Output/Profile Housing



3 Installation (cont.)

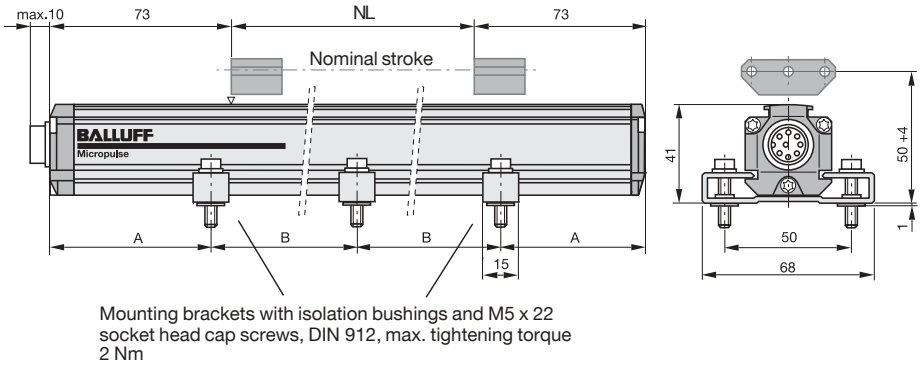


Fig. 3-1: Dimensional drawing (BTL5...P-S 32 transducer with floating magnet BTL5-P-3800-2)

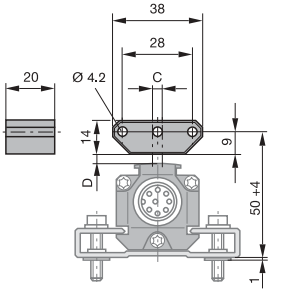


Fig. 3-2: BTL5-P-3800-2 magnet

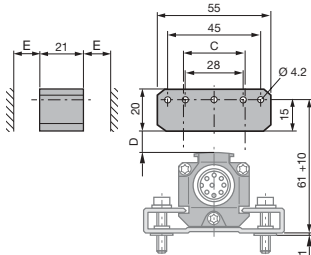


Fig. 3-3: BTL5-P-5500-2 magnet

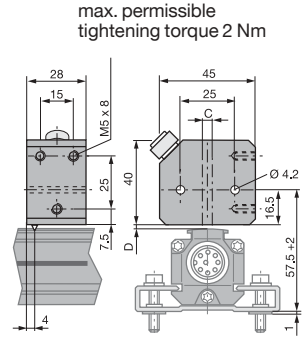


Fig. 3-4: BTL5-P-4500-1 electromagnet (24 V/100 mA)

3.2 Floating magnets

The floating magnet (Figs. 3-2 to 3-4) is attached to the moving member of the machine using non-magnetizable screws (brass, aluminum). To ensure the accuracy of the transducer system, the moving member must carry the magnet on a track parallel to the transducer.

The following table provides figures in [mm] for the spacing which must be maintained between magnet and transducer and for the permissible center offset:

Magnet type	Distance "D"	Offset "C"
BTL5-P-3800-2	0.1 ... 4	± 2
BTL5-P-5500-2	5 ... 15	± 15
BTL5-P-4500-1	0.1 ... 2	± 2

BTL5-P-4500-1 magnet, special features: Multiple magnets on the same transducer can be turned on and off individually (PLC control signal).



Ensure that the distance E between parts made of magnetizable material and the BTL5-P-5500-2 magnet is at least 12 mm (Fig. 3-3).

The stroke range is offset 4 mm towards the BTL connector/cable (Fig. 3-4).

3 Installation (cont.)

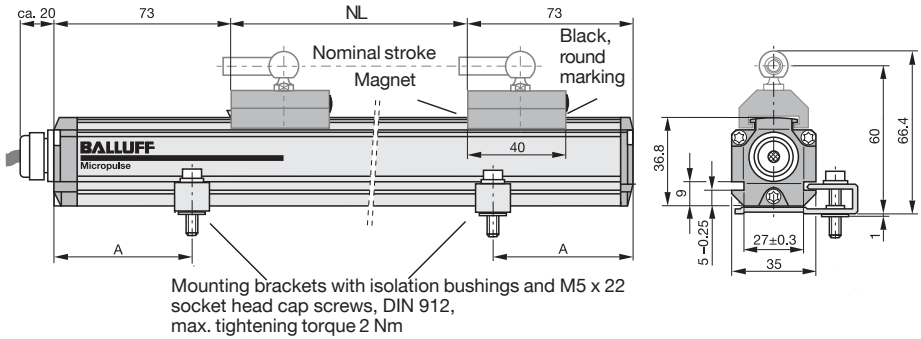


Fig. 3-5: Dimensional drawing (BTL5...P-KA transducer with captive magnet BTL5-F-2814-1S)

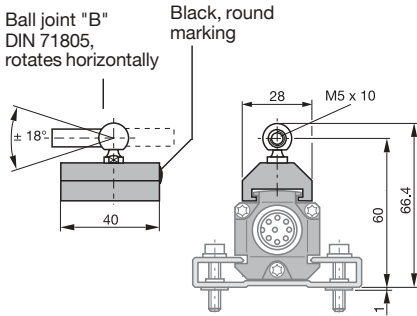


Fig. 3-6: BTL5-F-2814-1S magnet

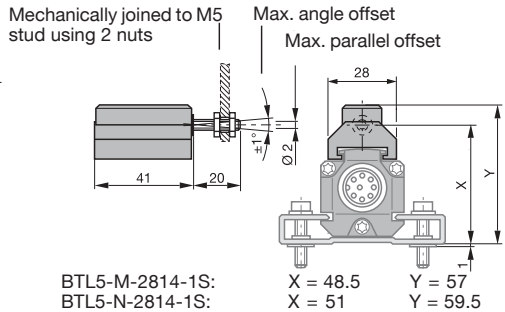


Fig. 3-7: BTL5-M/N-2814-1S magnet

3.3 Captive magnets

Lateral forces are to be avoided when using captive magnets (Figs. 3-6 and 3-7). Connections are required here which permit the corresponding degree of freedom with respect to the direction of movement of the magnet along the stroke range. It is assumed that the BTL5-F-2814-1S magnet is connected to the machine member using a connecting rod. The BTL2-GS08...A connecting rod (Fig. 3-8) is available as an accessory (please indicate length LS when ordering).

Ball joint "B" DIN 71805, rotates horizontally (part of BTL5-F-2814-1S magnet)

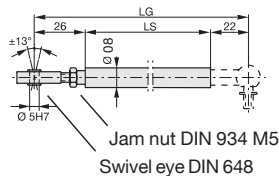
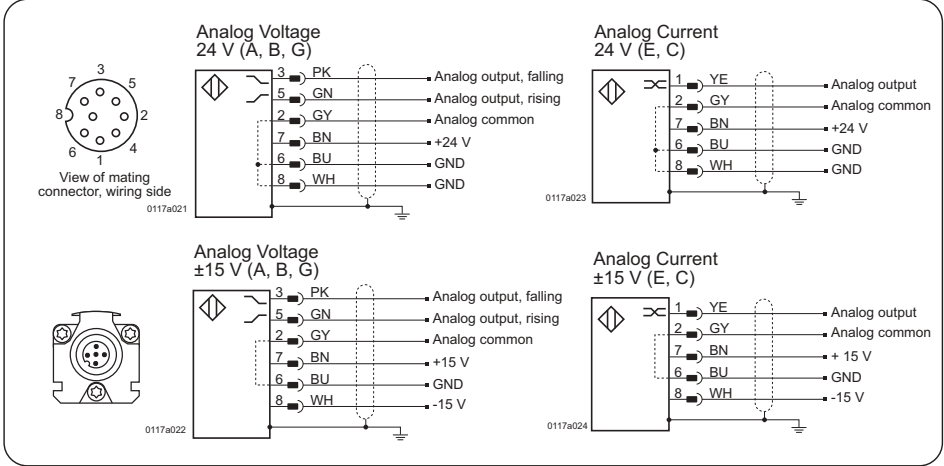


Fig. 3-8: BTL2-GS08-...-A connecting rod

BTL5-A/C/E/G _-M/U _- -P-S 32/KA _- Micropulse Linear Position Transducer Analog Output/Profile Housing



4 Wiring



Note the following when making electrical connections:

System and control cabinet must be at the same ground potential.



To ensure electromagnetic compatibility (EMC), which Balluff verifies by the CE Marking, the following points must be strictly observed.

BTL transducer and the processor/control must be connected using shielded cable.

Shielding: Copper filament braided, 80% coverage.

The shield must be tied to the connector housing in the BKS connector (Fig. 4-1); see instructions accompanying the connector.

In the cable version the cable shield is connected to the housing in the PG fitting.

The cable shield must be grounded on the control side, i.e., connected to the protection ground.

Pin assignments can be found in the illustration above. Connections on the controller side may vary according to the controller and configuration used.

When routing the cable between the transducer, controller and power supply, avoid proximity to high voltage lines to prevent noise coupling. Especially critical is inductive noise caused by AC harmonics (e.g. from phase-control devices), against which the cable shield provides only limited protection.

Cable length max. 20 m; Ø 6 to 8 mm. Longer lengths may be used if construction, shielding and routing are such that external noise fields will have no effect on signal integrity.

straight BKS-S 32M-00 right-angle BKS-S 33M-00

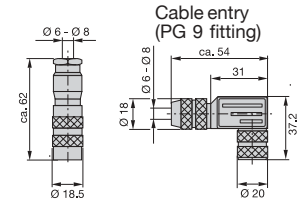


Fig. 4-1: Connector (optional)

BKS connector, view towards solder side of female BKS-S 32M-00 or BKS-S 33M-00



Fig. 4-2: Pin assignments BKS, connector type BTL

4 Wiring (cont.)

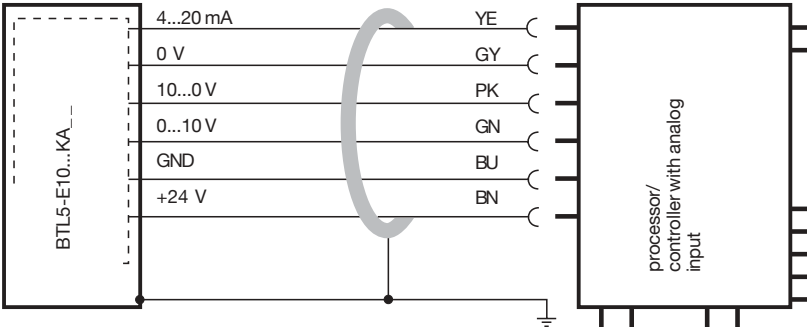


Fig. 4-3: BTL5-E10...KA__ with processor card/controller, wiring example

5 Startup

5.1 Check connections

Although the connections are polarity reversal protected, components can be damaged by improper connections and overvoltage. Before you apply power, check the connections carefully.

5.2 Turning on the system

Note that the system may execute uncontrolled movements when first turned on or when the transducer is part of a closed-loop system whose parameters have not yet been set. Therefore make sure that no hazards could result from these situations.

If there is no magnet in the stroke range, the integrated function monitor provides the following defined output signals:

Voltage output 10 V
 increasing $V_A > 10\text{ V}$ decreasing $< 0\text{ V}$

Current output 20 mA
 increasing $I_A \geq 20\text{ mA}$ decreasing 0 mA for BTL5-C...
 $I_A \geq 20\text{ mA}$ $\leq 4\text{ mA}$ for BTL5E...

5.3 Check output values

After replacing or repairing a transducer, it is advisable to verify the values for the start and end position of the magnet in manual mode. If values other* than those present before the replacement or repair are found, a correction should be made.

* Transducers are subject to modification or manufacturing tolerances.

5.4 Check functionality

The functionality of the transducer system and all its associated com

ponents should be regularly checked and recorded.

5.5 Fault conditions

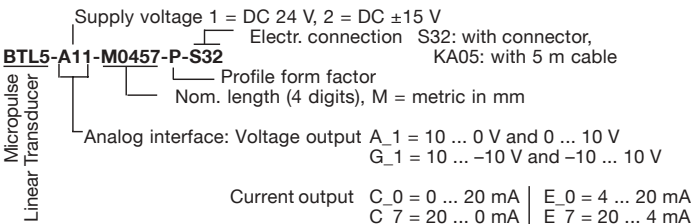
When there is evidence that the transducer system is not operating properly, it should be taken out of service and guarded against unauthorized use.

5.6 Noise elimination

Any difference in potential - current flow - through the cable shield should be avoided. Therefore:

- Use the isolation bushings, and
- Make sure the control cabinet and the system in which the BTL is contained are at the same ground potential.

6 Versions (indicated on part label)



BTL5-A/C/E/G_ _-M/U_ _ _-P-S 32/KA_ _

Micropulse Linear Position Transducer

Analog Output/Profile Housing



7 Technical Data

The following are typical values at DC 24 V and 25 °C. Fully operational after power-up, with full accuracy after warm-up. Values are with BTL5-P-3800-2, BTL5-P-4500-1 or BTL5-P-5500-2 magnet held at a constant offset from the transducer or with captive magnet BTL5-F/M/N-2814-1S (see magnet section for exceptions):

Resolution	≤ ±2 μm
+ Hysteresis	≤ ±4 μm
= Repeatability	≤ ±6 μm
△ Voltage	≤ ±0.1 mV
△ Current	≤ ±0.16 μA

Sampling rate f_{Standard} = 1 kHz

Non-linearity:	
Nom. length ≤ 500mm	>500mm
±100 μm	±0.02%FS

Temperature coefficient

Voltage output:

[150 μV/K + (5 ppm/K * P * V/NL)] * ΔT

Current output:

[0.6 μA/K + (10 ppm/K * P * I/NL)] * ΔT

V = output voltage range in [V]

I = output current range in [mA]

NL = nominal length in [mm]

ΔT = temperature difference in [K]

P = magnet position in [mm]

Shock loading:

100 g/6 ms per IEC 68-2-27¹

Continuous shock:

100 g/2 ms per IEC 68-2-29¹

Vibration:

12 g, 10 to 2000 Hz

per IEC 68-2-6¹

¹ Individual specifications as per Balluff factory standard

7.1 Dimensions, weights, ambient conditions

- Nominal length ≤ 4000 mm
- Dimensions pages 4 and 5
- Weight approx. 1.4 kg/m
- Housing anodized aluminum
- Housing attachment:
Mounting clamps with isolation bushings and screws
- Operating temp. -40 °C to +85 °C
- Humidity < 90%, non-condensing
- Protection class per IEC 529
IP 67 (with connector attached).

7.2 Supply voltage (external)

Regulated supply voltage
BTL5_1... DC 20 to 28 V
Ripple ≤ 0.5 V_{pp}
BTL5_2... DC ±14.7 to ±15.3 V
Current draw ≤ 150 mA
Inrush ≤ 3 A/0.5 ms
Polarity reversal protection built-in
Overvoltage protection
Transzorb diodes
Dielectric strength
GND to housing 500 V

7.3 Outputs

BTL5-A...

Output voltage 0...10/10...0 V
Load current ≤ 5 mA
Ripple ≤ 5 mV

BTL5-G...

Output voltage 10...10/10...-10 V
Load current ≤ 5 mA
Ripple ≤ 5 mV

BTL5-C...

Output current 0...20/20...0 mA
Load resistance ≤ 500 Ohm

BTL5-E...

Output current 4...20/20...4 mA
Load resistance ≤ 500 Ohm

7.4 Connection to processor

Analog interface:
With S32 connector for shielded cable (max. length, see "Wiring"), diameter 6 to 8 mm, or with integral cable KA05 (5 m long)

7.5 Included in shipment

Transducer Fig. 3-1
or Fig. 3-5
Users Guide
(Mounting brackets and magnets must be ordered separately).

7.6 Magnets (order separately)

Spacing, offset and installation pages 4 and 5
Operating temp. -40 °C to +85 °C

BTL5-P-3800-2 Fig. 3-2
Weight approx. 12 g
Housing plastic

BTL5-P-5500-2 Fig. 3-3
Weight approx. 40 g
Housing plastic

Non-linearity:
Nom. length ≤ 500 mm | > 500 mm
±150 μm | ±0.03 % FS

BTL5-P-4500-1 Fig. 3-4
Weight approx. 90 g
Housing plastic
Operating temp. -40 °C to +60 °C

BTL5-F-2814-1S Fig. 3-6
Weight approx. 28 g
Housing plastic

BTL5-M-2814-1S Fig. 3-7
Weight approx. 32 g
Housing anodized aluminum

Contact surface plastic

BTL5-N-2814-1S Fig. 3-7
Weight approx. 35 g
Housing anodized aluminum

Contact surface plastic

Control arm (optional)

BTL2-GS08- _ _ _ _ -A
Aluminum, dimensions Fig. 3-8
Various standard lengths LS available (please specify when ordering)

7.7 Accessories (optional)

Connectors Fig. 4-1

Complete Product Range



*Inductive
Sensors*



*Photoelectric
Sensors*



*Micropulse™
Transducers*

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.com
E-Mail: balluff@balluff.com

Canada

Balluff Canada, Inc.
2840 Argentia Road, Unit #2
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 S.A. de C.V
Fray Pedro de Gante 25 P.B.
Col. Cimatarío
Queretaro, QRO 76030
Phone: (+52 442) 212-4882,
224-3583, 224-3171
Fax: (+52 442) 214-0536
E-mail: balluff.mexico@balluff.com



*Capacitive
Sensors*



*Magnetic Field
Sensors*



*Electromechanical
Sensors*



*Identification
Systems*



*Connectors &
Accessories*