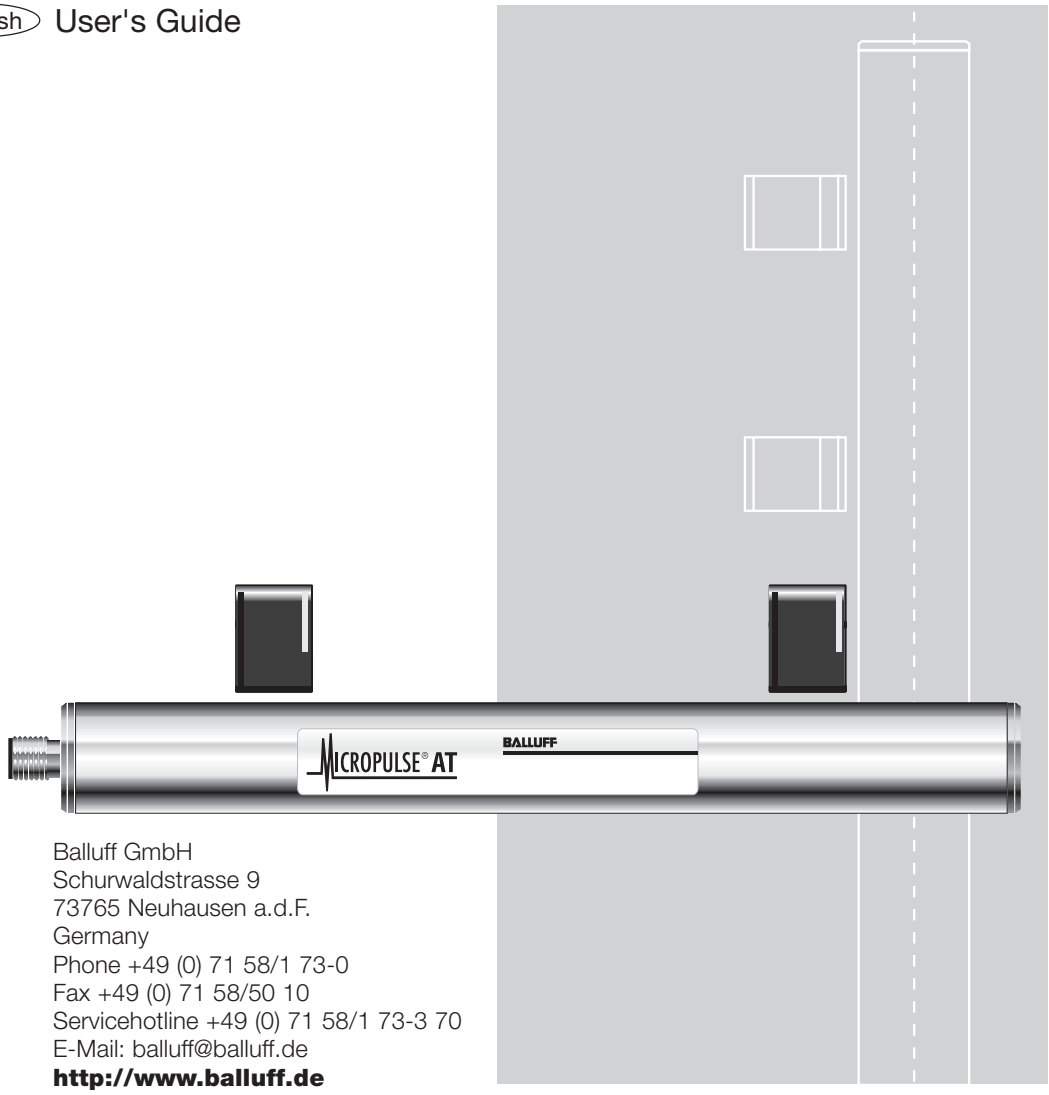
BALLUFF

BTL6-A/G301-M_ _ _ _-A1-S115

english User's Guide



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Contents

1 Safety Advisory

Read this manual before installing and operating the Micropulse Transducer.

1.1 Proper application

The BTL6 Micropulse transducer is intended to be installed in a machine or system. Together with a controller (PLC) 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.

1.4 Scope

This guide applies to the model BTL6-A/G301...A1-S115 Micropulse transducer.

An overview of the various models can be found in ➥ Section 7 Versions (indicated on part label) on page 11.

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

2 Function and Characteristics

2.1 Function

The Micropulse transducer contains a waveguide enclosed by an 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 current 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. This is output as a voltage value and may be rising (increasing voltage) or falling (decreasing voltage), ➥ Fig. 2-1. This process takes place with measuring high precision and repeatability within the stroke range defined as nominal stroke length.

When there is no magnet located in the nominal stroke range, a signal of approx. 10.5 V is output as an error indication.

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 controller and the power supply is via a cable with connectors.

Dimensions for installing the Micropulse transducer and for the magnets are found on ➥ Page 4

The unique feature of the BTL6-A/G301 transducers is that one transducers can be used to sense two motions at the same time and that you can select from between single-position measurement and differential measurement. All zero and span points can be separately programmed within the permissible stroke range using a teach-in procedure. An LED is provided as a programming aid.

The factory setting is for single-position sensing and programming of Output 1 and Output 2, see Fig. 2-2.

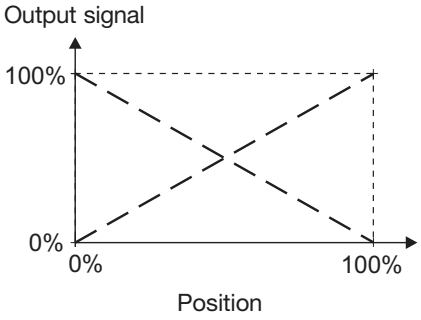

Fig. 2-1: Rising and falling output signal

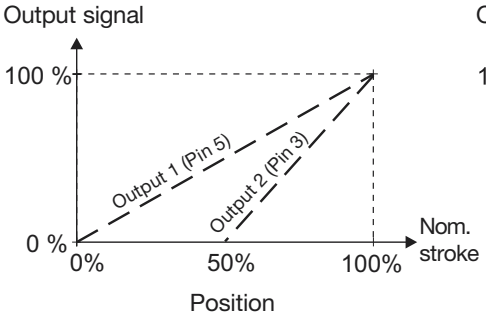

Fig. 2-2: Operating mode 1 Factory setting

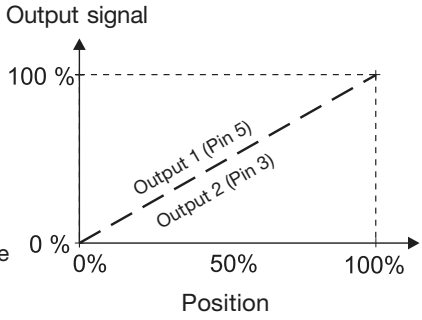

Fig. 2-3: Operating mode 3 until Serial-No. 0531xxxxx

3 Installation

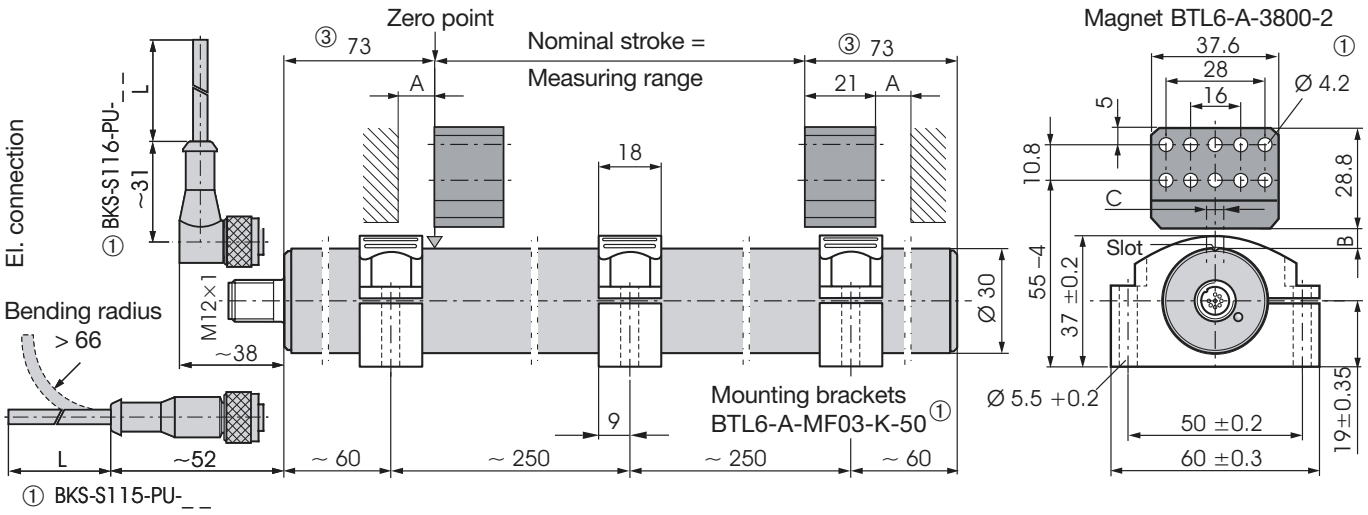

Fig. 3-1: Dimensional drawing (BTL6...A1-S115 transducer with floating magnet BTL6-A-3800-2 and mounting brackets BTL6-A-MF03-K-50)

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.
Mount the transducer on a level surface of the machine using the mounting brackets BTL6-A-MF03-K-50. Observe the recommended spacing of the mounting brackets, dimension.

1. Align transducer slot with magnet.
2. Tighten mounting screws to a maximum of 4 Nm.

① Not included

② Location of angle BKS on BTL.

③ Not usable area

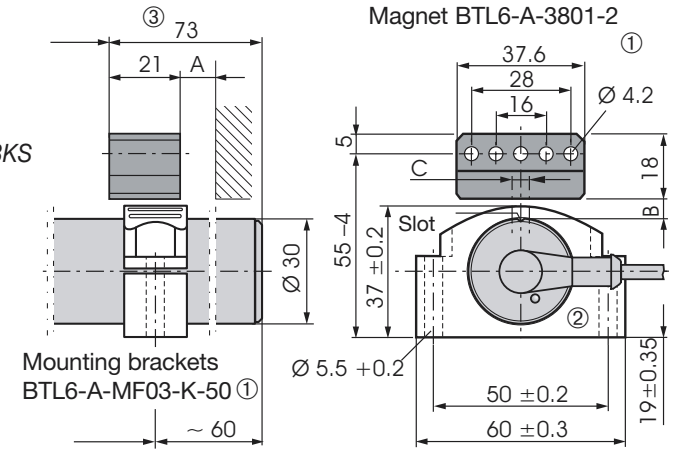

Fig. 3-2: Dimensional drawing (BTL6...A1-S115 transducer with floating magnet BTL6-A-3801-2, mounting brackets BTL6-A-MF03-K-50 and BKS-S116)

3.2 Magnet installation

To ensure the accuracy of the transducer system, the magnet is attached to the non-magnetizable moving member of the machine using non-magnetizable screws (stainless steel, brass, aluminum). The moving member must guide the magnet on a track parallel to the transducer.

Ensure that the distance " A " between parts made of magnetizable material and the magnet is at least 10 mm . Maintain the following values in [mm] for distance " B " and center offset " C " between the magnet and the transducer:

Magnet type	Distance " B "	Offset " C "
BTL6-A-3800-2	4 ... 8	± 5
BTL6-A-3801-2	4 ... 8	± 5

For optimum performance, a distance " B " of 6 ... 8 mm is recommended.

> ⚠ The spacing between the two magnets must not be closer than 65 mm.

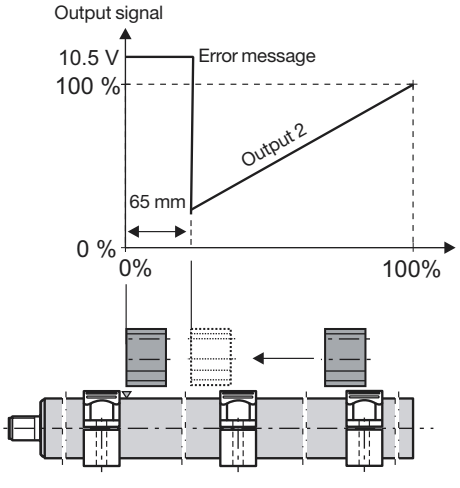

Fig. 3-3: Magnet spacing

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 controller must be connected using shielded cable.*
- *Shielding: Copper filament braided, 85 % coverage.*
- *The cable shield must be grounded on the control side, i.e., connected to the protection ground.*

Wiring assignments can be found in ➥ Table 4-1.

Pin	BTL6-A301...	BTL6-G301...	Cable BKS
Output signal:			
5	A1: 0...10 V ①	A1: -10...+10 V ①	GN green
3	A2: 0...10 V ①	A2: -10...+10 V ①	PK pink
2	0 $V_{(output)}$		GY gray
Supply voltage (external):			
6	GND		BU blue
7	+24 V		BN brown
Programming inputs:			
1	La ②		YE yellow
4	Lb ②		RD red

Reserved leads must remain unconnected.

8	reserved	WH white

① If there is no magnet within the measuring range, a voltage of approx. 10.5 V is output as an error indication.

If necessary the outputs can be reconfigured for a falling output (10...0V or +10...-10V) .

② After programming, the programming inputs should be tied to Pin 2 ($0V_{(output)}$).

Table 4-1: Wiring assignment

4 Wiring (cont.)

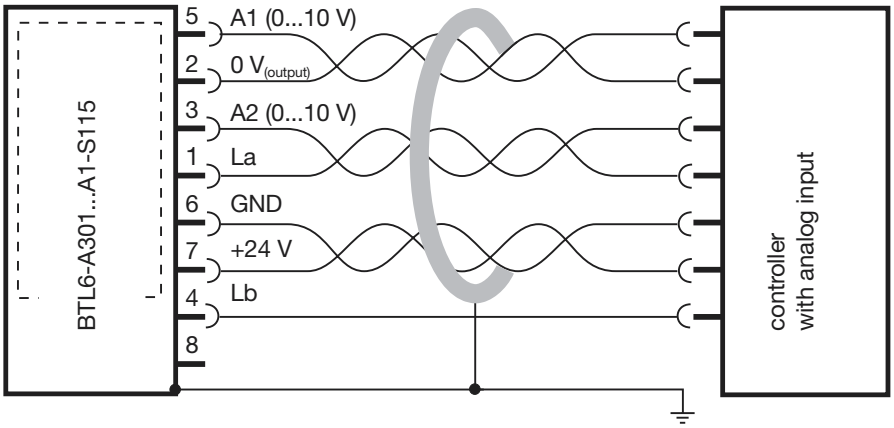

Fig. 4-1: Wiring example BTL6-A301...A1-S115 with controller

Pin numbering for connector, view of BTL side

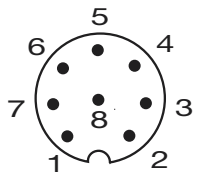

Fig. 4-2: Pin assignments S115, connector type BTL

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. Longer lengths may be used if construction, shielding and routing are such that external noise fields will have no effect on signal integrity.

5 Startup

5.1 Check connections

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 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.

5.3 Check output values

After replacing a transducer, it is advisable to verify the values for the start and end position of the magnet in manual mode. *

* Transducers are subject to modification or manufacturing tolerances.

5.4 Check functionality

The functionality of the transducer system and all its associated components 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 make sure the control cabinet and the system in which the BTL6 is contained are at the same ground potential.

6 Programming

6.1 Principle

The transducer should be connected to the controller. All settings are made with one or two magnets within the permissible measuring range.

In programming mode the outputs are used as feedback and status indicators. They should not be used for machine control.

Programming is accomplished using the programming inputs La and Lb. An LED next to the connector is provided for programming assistance.

> ⚠ The programming inputs may only be connected to Pin 2 (0 $V_{(output)}$), not Pin 6 (GND).

You can select from between two operating modes, "Single-Position" and "Differential". ➥ Section 6.4

The zero and span as well as the output slope can be programmed separately for each output. At least one magnet must be located within the stroke range for programming. To program Output 2 there must be 2 magnets within the stroke range.

Note: The magnet which is closer to the zero point mark is assigned to Output 1. If there is only one magnet within the permissible stroke range, it is automatically assigned to Output 1. This applies also if Magnet 1 leaves the permissible stroke range. Then Output 1 jumps to the value of Magnet 2 and Output 2 provides the error message.

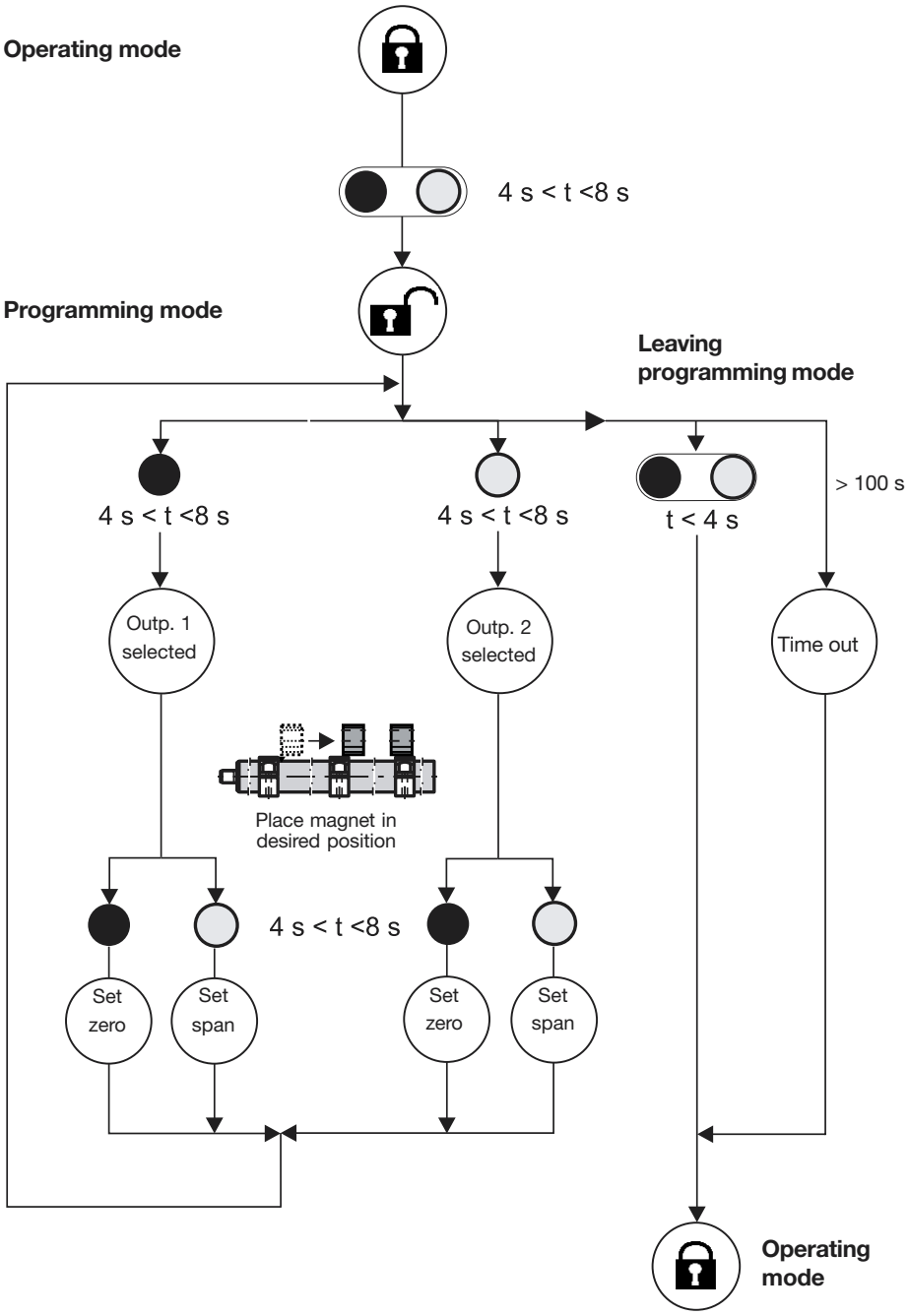

Fig. 6-1: Principles of programming

6 Programming (cont.)

6.2 Programming Output 1

BTL6-A/G301... with at least 1 magnet in the stroke range

Activate programming mode:

Programming input
La or Lb = "on" until LED comes on
(4 s < t < 8 s)

BTL is in programming mode:
"Error-Message" on both outputs
(10.5 V).

Select Output 1:
1) Programming input La = "on" until LED stays on (4 s < t < 8 s)
Output 1 selected, both outputs provide the current position value.

a) Set zero
1) Position magnet 1 at desired zero point.
2) Programming input La = "on" until LED stays on (4 s < t < 8 s)
Zero point for Output 1 programmed:
➔ see also: **Programming mode**

b) Set span
1) Position magnet 1 at desired end point.

2) Programming input Lb = "on" until LED stays on (4 s < t < 8 s)

Span for Output 1 programmed:
➔ see also: **Programming mode**

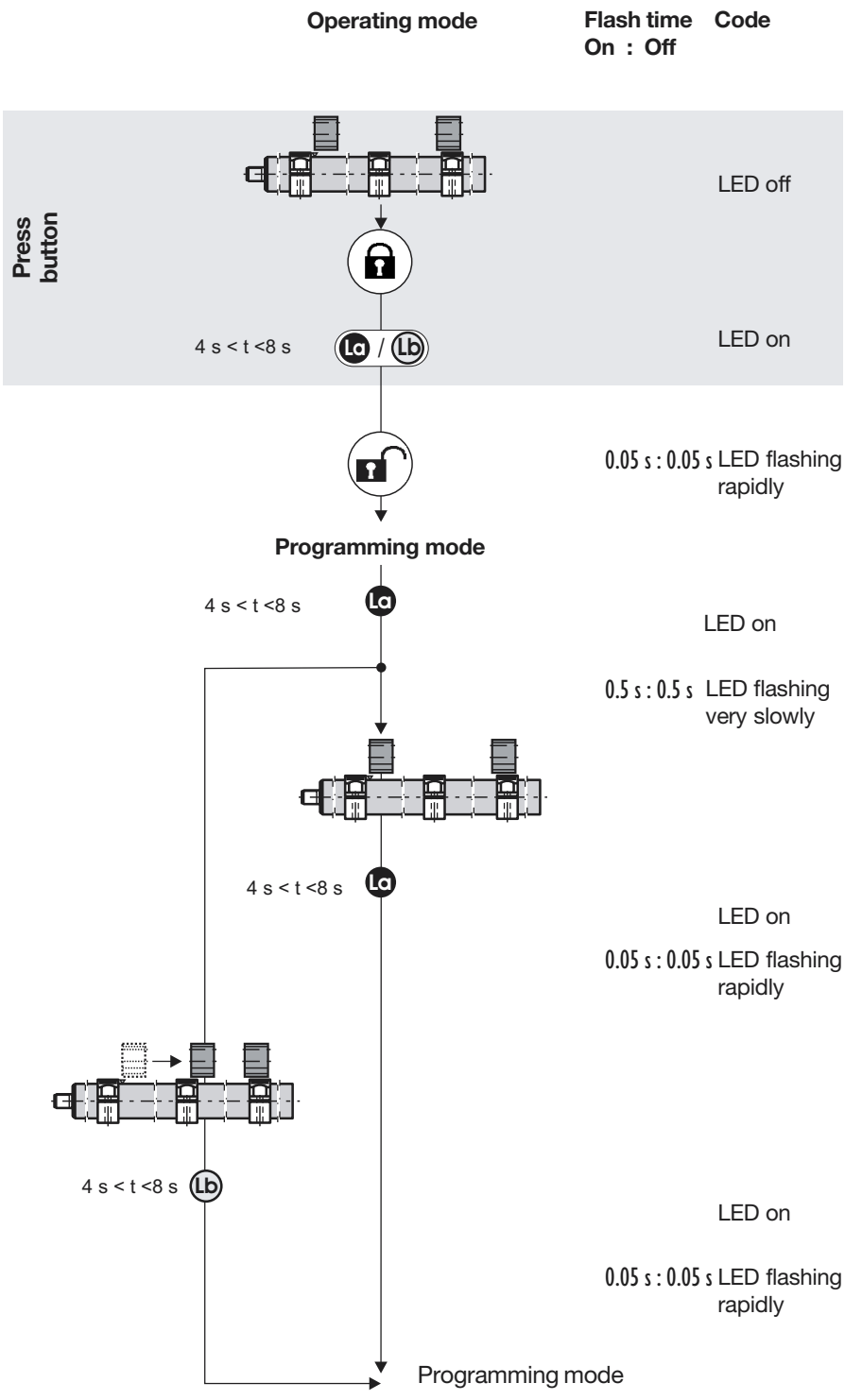

Fig. 6-2: Programming Output 1

La = on ➔ Programming input La to 0 $V_{(output)}$
Lb = on ➔ Programming input Lb to 0 $V_{(output)}$

> ⚠ If the value of the zero point is further from the zero point marking than the end point, the output slope is automatically set to falling.
> Zero = 100 % and
> Span = 0 % of output value.

6 Programming (cont.)

6.3 Programming Output 2

BTL6-A/G301... with 2 magnets in the stroke range

Activate Programming mode:

Programming input
La or Lb = "on" until LED comes on
(4 s < t < 8 s)

BTL is in Programming mode:
"Error message" on both outputs
(10.5 V).

Select Output 2:
1) Programming input Lb = "on" until LED constant on (4 s < t < 8 s)
Output 2 selected, both outputs provide the current position value.

a) Set zero
1) Place Magnet 2 at desired zero point.
2) Programming input La = "on" until LED stays on (4 s < t < 8 s)
Zero for Output 2 programmed:
➔ see also: **Programming mode**

b) Set span
1) Place Magnet 2 at desired end point.

2) Programming input Lb = "on" until LED stays on (4 s < t < 8 s)

Span for Output 2 programmed:
➔ see also: **Programming mode**

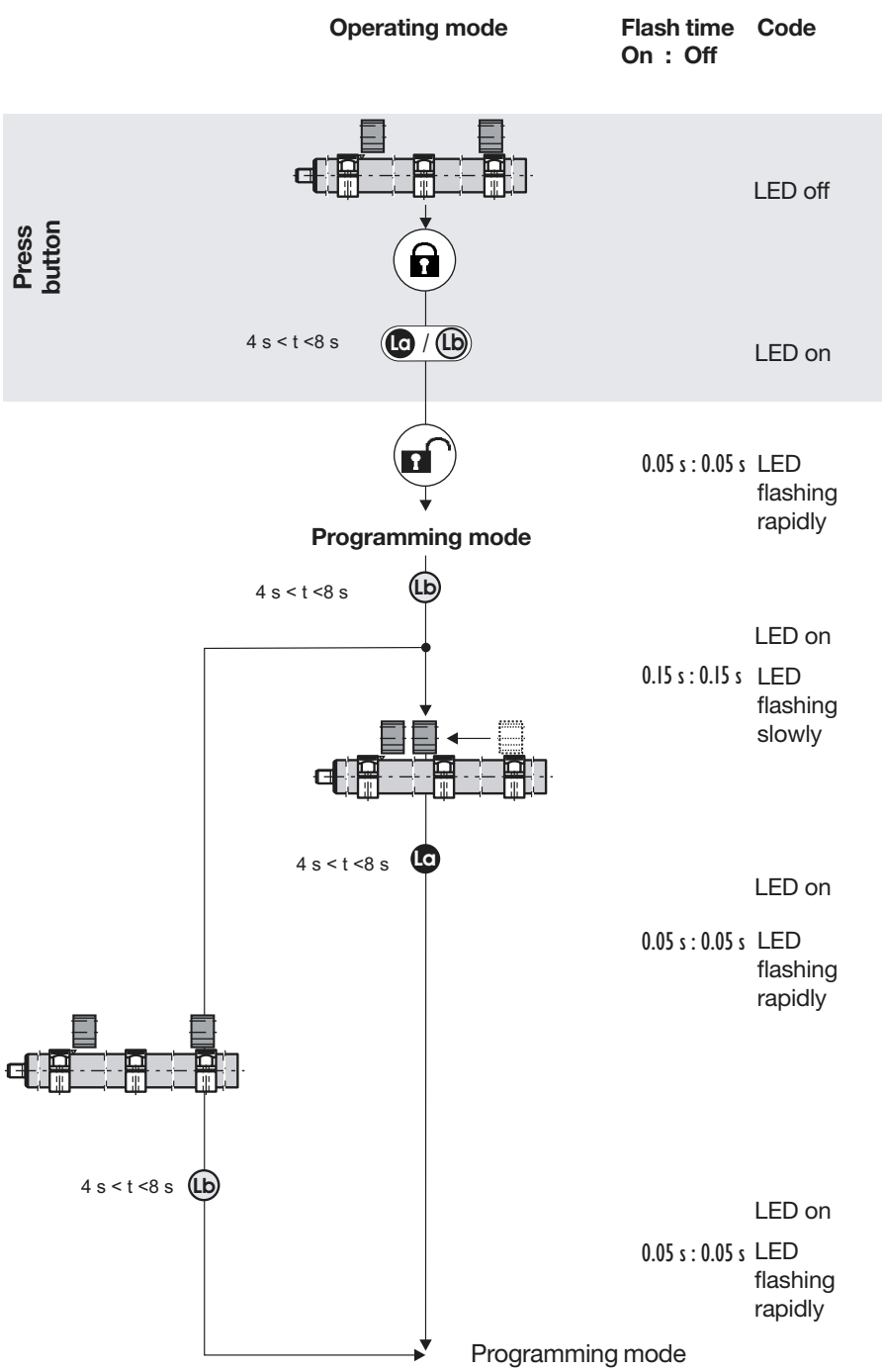

Fig. 6-3: Programming Output 2

If the value of the zero point is further from the zero point marking than the end point, the output slope is automatically set to falling.
Zero = 100 % and
Span = 0 % of output value.

La = on ➔ Programming input La to 0 $V_{(output)}$
Lb = on ➔ Programming input Lb to 0 $V_{(output)}$

6 Programming (cont.)

6.4 Changing the operating mode

Starting from the factory setting ➥ Section 6.5 you can select the other operating modes, beginning with Mode 2 and then Mode 3. (back to Operating Mode 1 ➥ Section 6.5 Factory Setting)

Operating mode 1 ➔ Single position measurement: Factory setting Fig. 2-2	Output 1 = Position value for Magnet 1 Output 2 = Position value for Magnet 2
Operating mode 2 ➔ Differential measurement:	Output 1 = Position value for Magnet 1 Output 2 = Differential value between Magnet 1 and Magnet 2
Operating mode 3 ➔ Single position measurement: Fig. 2-3 until Serial-No. 0531xxxxx	Output 1 = Position value for Magnet 1 Output 2 = Position value for Magnet 2

Use this programming sequence to change the operating mode.

	Flash time On : Off	Code
1) Turn off power to the BTL6		
2) Programming input Lb = "on"		
3) Turn on power supply		LED off
4) Wait until LED comes (4 s < t < 8 s) and then Lb = "off"		LED on 0.05 s : 0.05 s LED flashing rapidly
5) Wait until LED is constant on (4 s < t < 8 s) and then Lb = "on"		LED on 0.5 s : 0.5 s LED flashing very slowly
6) Wait until LED is constant on (4 s < t < 8 s) and then Lb = "off"		LED on LED off
7) Turn power off and on. ➔ new operating mode is active		
8) Check programming of the outputs and reprogram if necessary ➥ Section 6.3		

The Micropulse transducer is now ready to use.

Lb = on ➔ Programming input Lb to 0 $V_{(output)}$
Lb = off ➔ Programming input Lb open

6.5 Factory setting

The BTL is reset to factory defaults,
see Fig. 2-2
➥ page 3

	Flash time On : Off	Code
1) Turn off power to BTL6		
2) Programming input La = "on"		
3) Turn on power		LED off
4) Wait until LED comes on (4 s < t < 8 s) and then La = "off"		LED on 0.05 s : 0.05 s LED flashing rapidly
5) Wait until LED is constant on (4 s < t < 8 s) and then La = "on"		LED on 0.5 s : 0.5 s LED flashing very slowly
6) Wait until LED is constant on (4 s < t < 8 s) and then La = "off"		LED on LED off
7) Turn power off and on. BTL is now ready to use.		

La = on ➔ Programming input La to 0 $V_{(output)}$
La = off ➔ Programming input La open

7 Versions (indicated on part label)

Supply voltage 3 = DC 24 V potential-free

Electr. connection: with connector S115

BTL6-A301-M0450-A1-S115

Micropulse Linear Transducer

Profile style (round), Ø 30 mm

Nom. length (4 digits), M = metric in mm

Interface: A = 0...+10 V
G = -10...+10 V
01 = 2 outputs, each for 1 magnet
freely programmable:
Mode, 2 separate positions or 1 position and 1 differential
Measuring range
Output characteristics, rising or falling

7.1 Included in shipment

Transducer with condensed guide

7.2 Available stroke lengths

To provide for optimum fit in any application, a wide range of standard stroke lengths are available:

stroke lengths			increments	
150	...	1500	25	mm

Additional stroke lengths on request.

Stroke lengths < 200 mm are suitable for single-magnet operation only.

8 Accessories (order separately)

8.1 Magnet

BTL6-A-3800-2 ➥ Fig. 3-1
Weight approx. 30 g
BTL6-A-3801-2 ➥ Fig. 3-2
Weight approx. 25 g
Housing plastic
Spacing, offset and installation ➥ Page 4
Operating temp. –40 °C to +85 °C

8.2 Mounting brackets

BTL6-A-MF03-K-50 ➥ Fig. 3-1

BTL6-A-MF01-A-50 ➥ Fig. 8-1

BTL6-A-MF01-A-43 ➥ Fig. 8-2

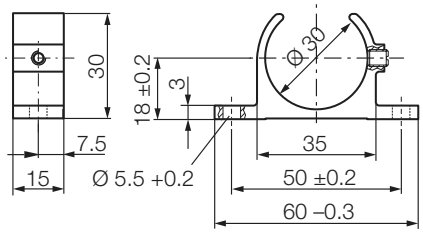

Fig. 8-1: Mounting bracket BTL6-A-MF01-A-50

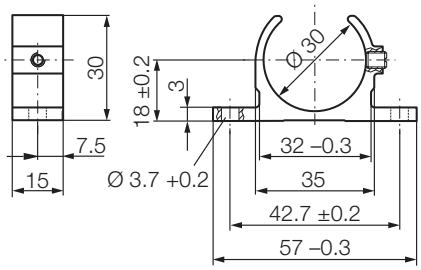

Fig. 8-2: Mounting bracket BTL6-A-MF01-A-43

8.3 Connection cables, connectors

Shielded cable with connector on one end ➥ Fig. 8-4
straight: BKS-S115-PU-_ _
right-angle: BKS-S116-PU-_ _
_ _ = Length L, 02, 05, 10, 15, 20, 25
05 means L = 5 m
Wiring assignments ➥ Table 4-1

Connector for shielded cable ➥ Fig. 8-3
straight: BKS-S115-00
Wiring assignments ➥ Table 4-1

straight
BKS-S115-00

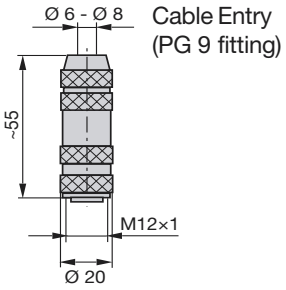

Fig. 8-3: Connector (female)

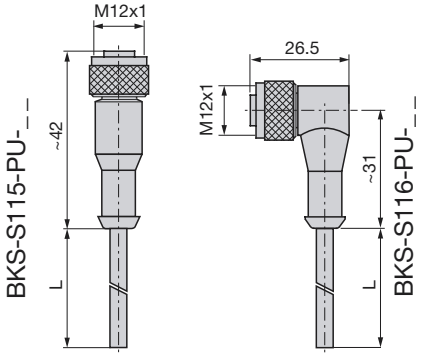

Fig. 8-4: Connection cable BKS-S...

9 Technical Data

The following are typical values for an BTL6 with nominal stroke length 500 at DC 24 V and room temperature. Fully operational after power-up, with full accuracy after warm-up. Values are with BTL6-A-3800-2 or BTL6-A-3801-2 at a constant offset from the transducer:

Resolution	
BTL6-A301	≤ ±1 mV
BTL6-G301	≤ ±2 mV
Repeat accuracy	≤ ±2 mV
Temperature coefficient typical	< 30 ppm/K
Max. sampling rate	1kHz stroke-dependent

Non-linearity:

NL	≤ 500 mm	≤ ±200 µm
NL	> 500 mm	≤ ±0.04 % FS typ.±0.02 % FS

At relatively slow movement of the magnets, discrepancies of approx. 2 mV may result.

9.1 Dimensions, weights, ambient conditions

Nominal length ≤ 1500 mm

Dimensions	➥ Page 4
Weight	approx. 1.0 kg/m
Housing	anodized aluminum
Operating temp.	0 °C to +70 °C
Humidity	< 90 %, non-condensing
Protection class	pe IEC 60529 IP 67 when closed up
Shock loading per IEC 60068-2-27 [1]	50 g/6 ms
Continuous shock per IEC 60068-2-29 [1]	50 g/2 ms
Vibration per IEC 60068-2-6 [1]	12 g, 10 to 2000 Hz

[1] Individual specifications as per Balluff factory standard

9.2 Supply voltage (external)

Regulated supply voltage	DC 18 ... 30 V
Ripple	≤ 0.5 V_{ss}
Current draw	100 mA typical
Polarity reverse protection	1.5 * U_B

9.3 Output signal, potential-free

Output voltage	
BTL6-A301	0...+10 V
BTL6-G301	-10...+10 V
Load current	≤ 5 mA short circuit protected

9.4 Overvoltage protection

Dielectric strength 500 V to housing

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 61000-6-4 (emission)

EN 61000-6-2 (noise immunity)

Emission tests:
RF Emission
EN 55011 Group 1, Class A+B
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

UL authorization
File No.
E227256

No. 834 707 - 726 E • 01.105612 • Edition 0601; Specifications subject to change. • Replaces edition 0408.