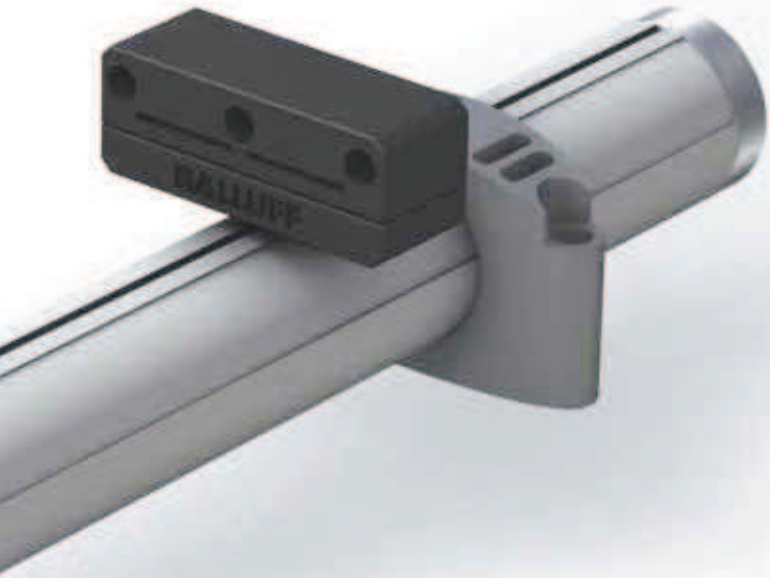
Micropulse Transducers

Profile AT

- In a robust 30-mm pipe housing for universal fastening
- The cost-effective, contactless position measuring solution
- Multiple paths – one system, which measures position in many paths
- With analog output signal and Real-Time Ethernet

Contents

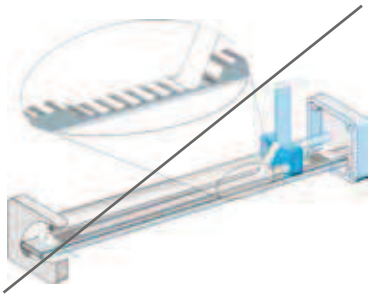
MICROPULSE®



Micropulse Transducers – a contactless alternative to contacting transducers

The structural design, high degree of protection and simple installation of non-contact Balluff Micropulse AT transducers in a profiled housing makes them an excellent alternative to contacting potentiometers. The linear sensing element is protected inside an extruded aluminum profile.

A passive magnet with no power supply marks the measuring point on the measuring path without making contact. Measuring ranges between 50 and 1,500 mm are possible.



- Non-contact detection of the measurement position
- IP 67, insensitive to contamination
- Wear-free
- Insensitive to shock and vibration
- Absolute output signal
- Direct signal evaluation or in conjunction with evaluation units for all control and closed-loop systems

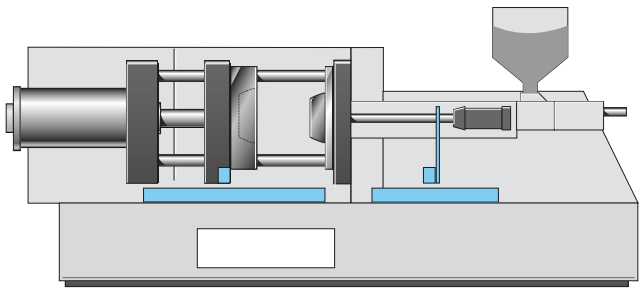
This product is certified according to File No. E227256.

From optional to standard

Micropulse Transducers have long been standard in the plastics machinery industry on high-precision machines and offered on standard machines as a non-contact option for potentiometric systems. The only thing that has stood in the way of more widespread use has been the comparatively high price.

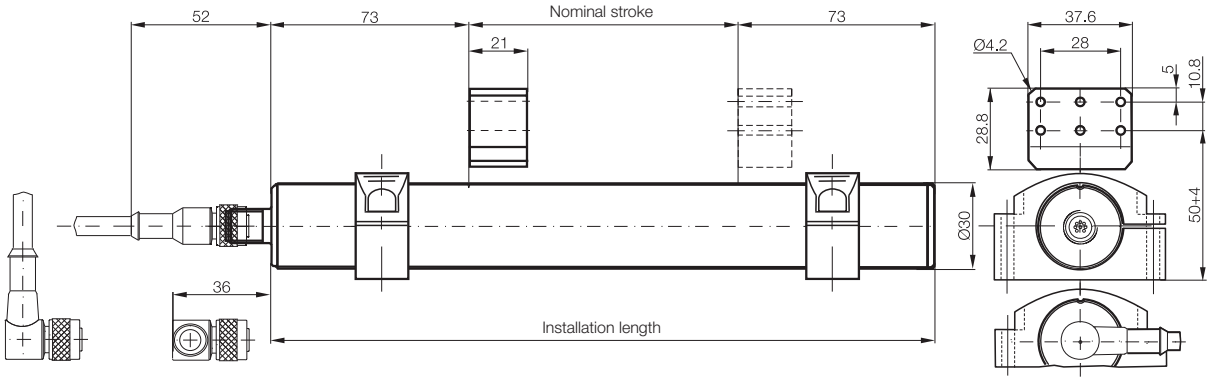
The Micropulse AT has been designed in cooperation with development engineers from the plastics machinery industry and represents a system that is competitively priced and meets all the technical demands of the industry.

With the Micropulse AT position feedback system, now even standard machines can feature the benefit of minimum downtime provided by non-contact transducer systems.



Series	**BTL6 Profile A1**
Part number	BTL6-_ _ _-M_ _ _ _-A1-S115
Part number	BTL6-**A**301-M_ _ _ _-A1-S115
Shock load	50 g/6 ms as per IEC 60068-2-27
Vibration	12 g, 10...2,000 Hz per EN 60068-2-6
Polarity reversal protected	yes
Overvoltage protected	yes
Degree of protection as per IEC 60529	IP 67 (with IP-67 connector BKS-S... attached)
Housing material	Anodized aluminum
Housing attachment	Mounting clamps
Connection	Connector M12, 8-pin standard
EMC testing	
Radio interference emission	EN 55016-2-3 (industry and residential area)
Static electricity (ESD)	EN 61000-4-2 Severity level 3
Electromagnetic fields (RFI)	EN 61000-4-3 Severity level 3
Rapid, transient electrical pulses (burst)	IEC 61000-4-4 Severity level 3
Conducted interference	EN 61000-4-6 Severity level 3
induced by high-frequency fields	EN 61000-4-8 Severity level 4

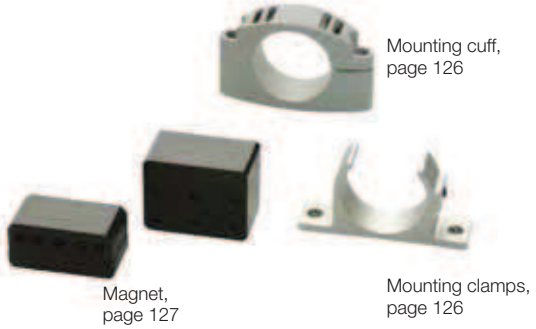
Transducers with floating magnet and connection S115 with plug connector BKS-S115/BKS-S116
for transducer with analog interface, digital pulse interface and VARAN Bus interface on page 118



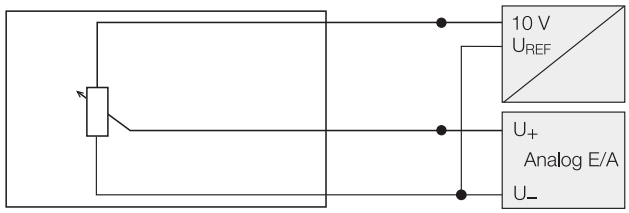
Caution!
Please read the instructions in the user's guide before designing, installing, and commissioning! www.balluff.de

Scope of delivery
- Transducer (select your interface from page 118)
- Quick start instructions

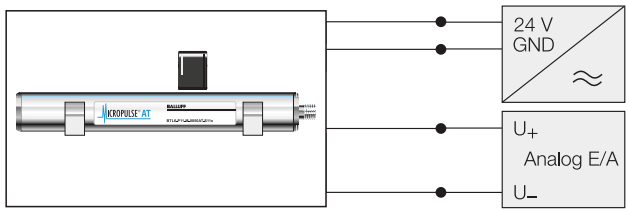
Please order separately:
Magnet, page 127
Mounting clamps/cuff, page 126
Plug connectors, page 232



The analog outputs of the standard series BTL6-A110 are non-floating.
BTL6 transducers exist in the variants 0...10 V and –10...10 V with rising and falling characteristics. The version –10...10 V generally has floating output signals.



Potentiometer connections, block diagram



Micropulse Transducer connections, block diagram

Please enter code for output signal and nominal stroke in the part number.

Preferred models
BTL6-A110-M_ _ _ _-A1-S115
are available from stock in the nominal strokes highlighted in blue.

Scope of delivery
- Transducer
- Quick start instructions

Please order separately:
Magnet, page 127
Mounting clamps/cuff, page 126
Plug connectors, page 232

Ordering example:

BTL6-_ _ 10-M_ _ _ _-A1-S115

Output signal

A	0...10 V
	10...0 V
G	–10...10 V
	–10...10 V

Characteristic

1	Non-floating*
3	Floating

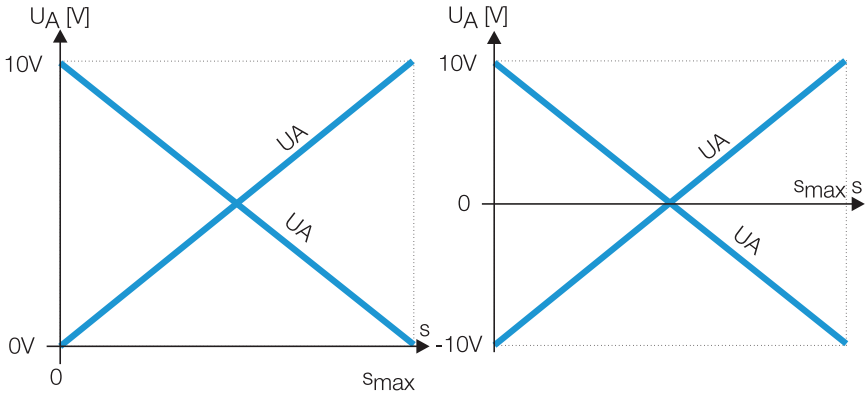
Standard nominal stroke [mm]

0100	0130	0150	0160	0175	0200	0225
0250	0275	0300	0325	0350	0360	0375
0400	0425	0450	0475	0500	0550	0600
0650	0700	0750	0800	0850	0900	0950
1000	1100	1200	1250	1300	1400	1500

in 25 mm increments on request

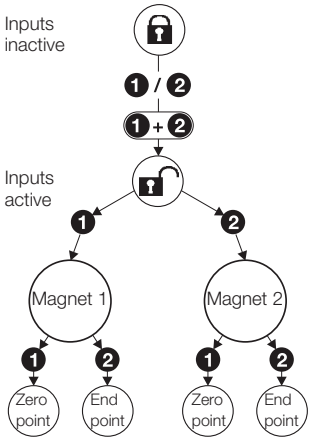
*only for BTL6-A110-M_ _ _ _-A1-S115

Series	**Profile A1 BTL6**	**Profile A1 BTL6**
Output signal	Analog	Analog
Transducer interface	**A**	**G**
Customer device interface	Analog	Analog
Part number	BTL6-A110-M_ _ _ _-A1-S115	BTL6-G310-M_ _ _ _-A1-S115
Output voltage	**0...10 V and 10...0 V**	**–10...10 V and 10...–10 V**
Load current	Max. 5 mA	Max. 5 mA
Max. residual ripple	≤ 5 mV	≤ 5 mV
System resolution	≤ 10 µm	≤ 10 µm
Repeat accuracy	≤ 10 µm	≤ 10 µm
Reproducibility	≤ 20 µm	≤ 20 µm
Sampling rate	$f_{STANDARD}$ = 1 kHz	$f_{STANDARD}$ = 1 kHz
Linearity deviation	≤ ±200 µm up to 500 mm nominal stroke typ. ±0.02%, max. ±0.04% 500...1500 mm nominal stroke	≤ ±200 µm up to 500 mm nominal stroke typ. ±0.02%, max. ±0.04% 500...1500 mm nominal stroke
Supply voltage	20...28 V DC	20...28 V DC
Current consumption	≤ 70 mA	≤ 70 mA
Polarity reversal protected	yes	yes
Operating temperature	0...+70 °C	0...+70 °C
Storage temperature	–40...+100 °C	–40...+100 °C



BTL6-A301-... Two become one

Two moving members on a machine often travel in the same direction. Each axis normally requires a separate feedback sensor.
With the Micropulse AT, it is now possible to detect two movements at the same time using just one transducer with two analog outputs. The position of the respective zero and end points can be set individually using programming inputs.
The two measuring ranges can be adjacent, can partially overlap, and can be programmed for a rising or falling characteristic. The transducer can be operated using one or two magnets. If one magnet leaves the measuring range or if only one is present, the position is indicated on Output 1. Output 2 then indicates an error value.



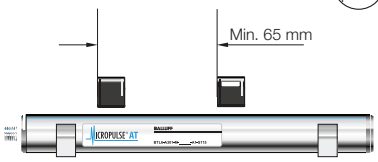
Teach-in

The zero and end points set at the factory are to be replaced by the new zero and end points. First, the magnet must be brought to the new zero point and then to the new end position, and the respective values stored by pressing the button.

Example: Programming steps for setting the measuring range

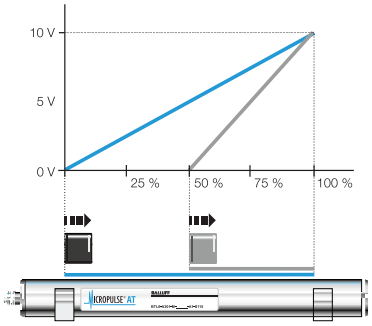
Mode selection

The standard function is the separate measurement of two positions. The programming inputs are used to switch the mode.

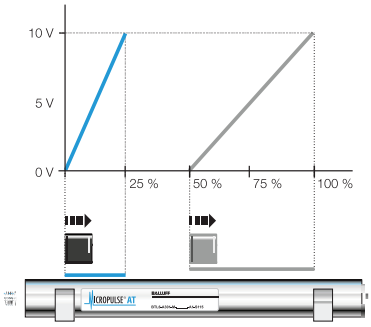


The separation between two magnets should not generally be less than 65 mm.

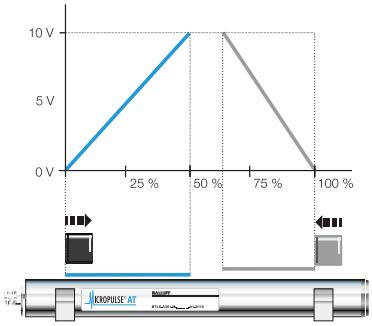
Mode 1: Single measurement of 2 positions (single measurement default setting 100%/50%)



Basic default setting

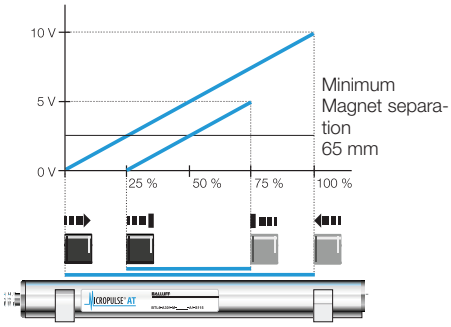


Programming example:
Output 1: 25% nominal stroke, signal rising
Output 2: 50% nominal stroke, signal rising

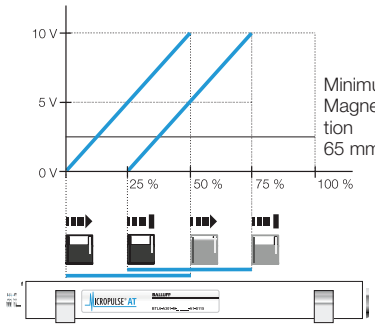


Programming example:
Output 1: 50% nominal stroke, signal rising
Output 2: 37.5% nominal stroke, signal falling

Mode 2: Differential measurement between 2 magnets

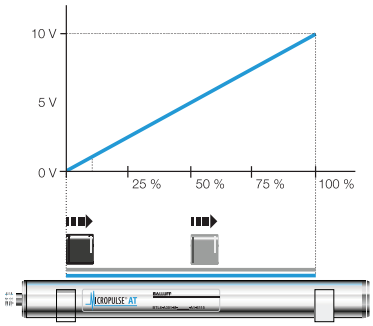


Default setting: Differential measurement
Output 1: Standard displacement signal (not shown)
Output 2: Differential signal 100% nominal stroke = 10 V
Programming example:
Differential displacement 50% nominal stroke = 5 V differential signal



Programming example: Differential displacement 50% nominal stroke = 10 V differential signal

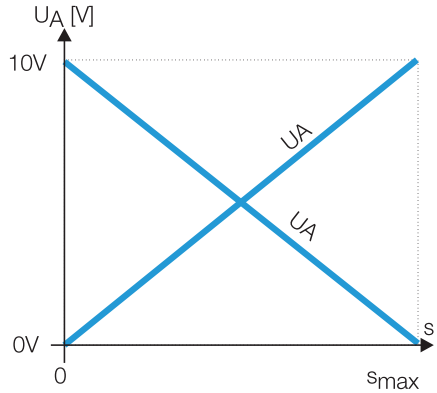
Mode 3: Single measurement (both magnets 0...100%)



Features of Micropulse BTL6-A
- 100% setting range of the analog signals
- Error signal value, no magnet in the measuring range, transducer in setting mode
- LED display for programming support
- Separate teach-in of all zero and end points
- Freely selectable single position or differential measurement

Measure two motions with one system
- One transducer measures two movements simultaneously.
- Substantial cost reduction, because installation costs are halved.
- Two 0...10 V Analog output

Series	**Profile A1 BTL6**
Output signal	Analog
Transducer interface	**A**
Customer device interface	Analog
Part number	BTL6-**A**301-M_ _ _ _-A1-S115
Output	Potential-free
Output voltage	**0...10 V programmable**
Load current	Max. 5 mA
Max. residual ripple	≤ 5 mV
System resolution	≤ 10 µm
Repeat accuracy	≤ 10 µm
Reproducibility	≤ 20 µm
Sampling rate	$f_{STANDARD}$ = 1 kHz (< 850 mm)
Linearity deviation	≤ ±200 µm up to 500 mm nominal stroke typ. ±0.02%, max. ±0.04% 500...1500 mm nominal stroke
Supply voltage	18...30 V DC
Current consumption	≤ 100 mA
Polarity reversal protected	yes
Operating temperature	0...+70 °C
Storage temperature	–40...+100 °C



Please enter the code for the nominal stroke in the part number.

Preferred models interface A301
BTL6-A301-M_ _ _ _-A1-S115
are available from stock in the nominal lengths highlighted in blue.

Scope of delivery
- Transducer
- Quick start instructions

Please order separately:
Magnet, page 127
Mounting clamps/cuff, page 126

Ordering example:

BTL6-A301-M_ _ _ _-A1-S115

Characteristic

Floating
2 analog outputs
Single or differential measurement, rising, falling, zero and end point programmable

Standard nominal stroke [mm]

0160 0175 0200 0225 0250 0275 0300
0325 0350 0360 0375 0400 0425 0450
0475 0500 0550 0600 0650 0700 0750
0800 0850 0900 0950 1000 1100 1200
1250 1300 1400 1500
in 25 mm increments on request

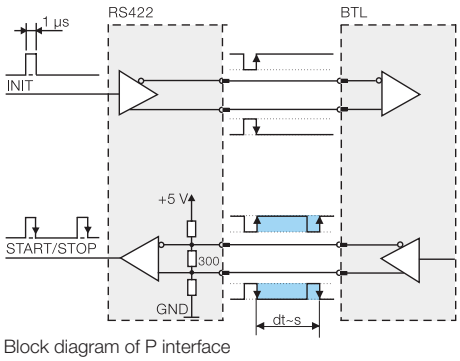
Standard nominal stroke (mm)
0050, 0100, 0130, 0150 for single magnet only

P110 interface
The P110 interface works with Balluff BTA evaluation units and controllers and modules from various manufacturers, e.g. Siemens, B & R, Bosch, Phoenix Contact, Mitsubishi, Sigmatek, Esitron, WAGO and others.
Reliable signal transmission, even over cable lengths up to 500 m, between the BTA evaluation unit and the transducer is guaranteed by the particularly interference-free RS485 differential drivers and receivers. Interference signals are effectively suppressed.

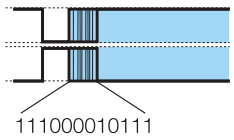
P110 replaces P1 and M1
Based on differing philosophies, two controller-specific interfaces have been established for the digital pulse versions.
The difference lies in how the edges are processed. The falling edges are processed in the P interface and the rising edges in the M interface. To reduce the number of different models to a minimum, the P110 interface was created as a universal pulse interface which combines both functions. The reference point for the propagation time measurement is the start pulse.

P111 interface – Cost savings using DPI/IP for start-up and installation
DPI/IP is a protocol for direct data interchange between a controller and transducer. The signal lines are used to send additional information such as manufacturer, measuring length and waveguide gradient. This allows start-up or replacement of a transducer without having to make manual changes to the controller parameters.

Features
- Bi-directional communication
- Position measuring system controller using Init and start/stop signals
- Integrated diagnostic functions
- Plug and Play
- Automatic configuration reduces downtimes.
- Transmission of sensor type, measuring length, specific parameters
- Measurement length up to 3,250 mm

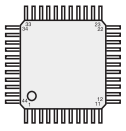


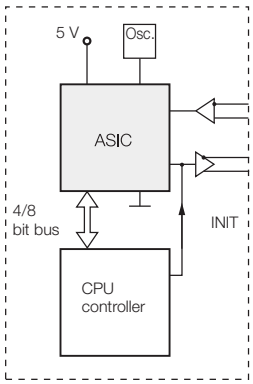
Block diagram of P interface



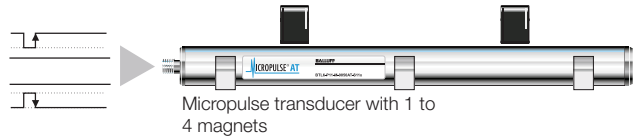
Extremely precise digitizing chip for P110 pulse interface
Companies developing their own electronic control and evaluation unit can create a highly accurate P interface cost-effectively and with minimum effort using the Balluff digitizing chip. The digitizing chip was developed as a high-resolution, configurable ASIC for Micropulse Transducers with P interface.

Advantages:
- High resolution: the actual 1 µm of the BTL position measuring system is fully supported by the 133 ps resolution of the chip (at low clock frequency 2 or 20 MHz).
- Position data from 4 magnets can be processed simultaneously
- 4/8-bit processor interface


Digitizing chip 44QFP



Controller or electronic evaluation unit

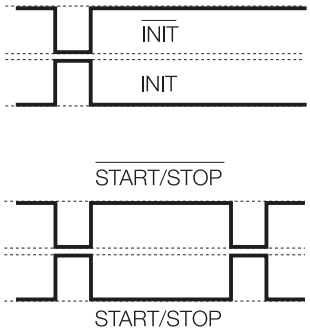


Micropulse transducer with 1 to 4 magnets
P pulse signal

ASIC INFO:
+49 7158 173-370

Series	**Profile A1 BTL6**
Transducer interface	Pulse **P11**_
Customer device interface	Pulse **P11**_
Part number	BTL6-**P11**_-M_ _ _ _-A1-S115
System resolution	processing-dependent
Repeat accuracy	≤ 10 µm
Reproducibility	≤ 20 µm
Resolution	≤ 10 µm
Linearity deviation	≤ ±200 µm up to 500 mm nominal stroke typ. ±0.02%, max. ±0.04%, 500...1500 mm nominal stroke
Supply voltage	20...28 V DC
Current consumption	≤ 60 mA (at 1 kHz)
Operating temperature	0...+70 °C
Storage temperature	–40...+100 °C

The rising and falling edges can be evaluated.



Please enter code for data protocol and nominal stroke in the Part number.

Preferred models interface P11_
BTL6-P11_-M_ _ _ _-A1-S115 are available from stock in the nominal strokes highlighted in blue.

Scope of delivery
- Transducer
- Quick start instructions

Please order separately:
Magnet, page 127
Mounting clamps/cuff, page 126
Plug connectors, page 232

Ordering example:

BTL6-P11_-M_ _ _ _-A1-S115

Data protocol

0 without DPI/IP* (standard)
1 with DPI/IP

Standard nominal stroke [mm]

0050	0075	0100	0130	0150	0160	0175
0200	0225	0250	0300	0350	0360	0400
0450	0500	0550	0600	0650	0700	0750
0800	0850	0900	0950	1000	1100	1200
1250	1300	1400	1500	1700	2000	2100
2500	2800	3000	3250			

in 25 mm increments on request

*the version without DPI/IP is only available up to a nominal stroke of 1,500

Real-time Ethernet cost-effective

Micropulse position measuring system BTL6-V11_ Profile AT with real-time Industrial Ethernet

Precision measurement of the travel path of primary and secondary axes!
Micropulse position measuring systems in a profile housing are non-contact, absolute measuring systems for accurately measuring one or more measurement paths. The position measuring systems are characterized by a stable structure, high degree of protection, simple installation and wear-free measuring principle with a high degree of accuracy. One significant advantage is an economical single plug solution. which in terms of system costs incurred for materials and installation, scores well compared to expensive three-plug models.

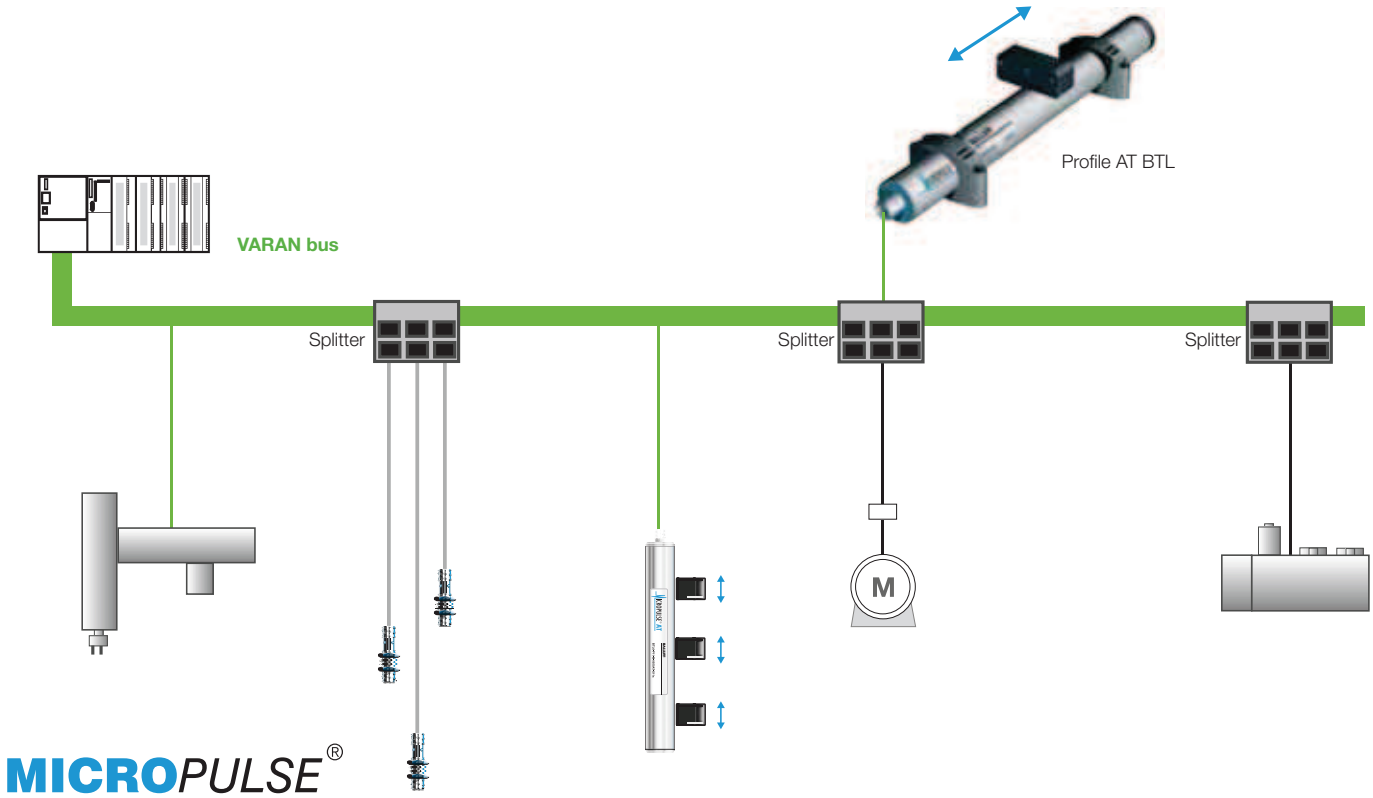
Up to four axes with one position measuring system
Up to four passive magnets with no power supply "mark" the measuring positions on the measuring path without making contact, with measuring ranges from 50 to 4000 mm. The particular attraction of this is that as a result of the system, up to four different paths can be measured simultaneously with one transducer. The position measuring systems tolerate a lateral offset as well as a height offset of up to 15 mm.

Features
- Non-contact detection of the measurement position
- IP 67, insensitive to contamination
- Insensitive to shock and vibration
- Absolute output signal
- Stroke lengths up to 4000 mm
- Up to 4 measurement paths per system
- Fast, simple mounting
- Single-plug solution saves system costs.
- Secure data transmission

Additional information
For VARAN, see www.varan-bus.net
or for EtherCAT, see www.ethercat.org

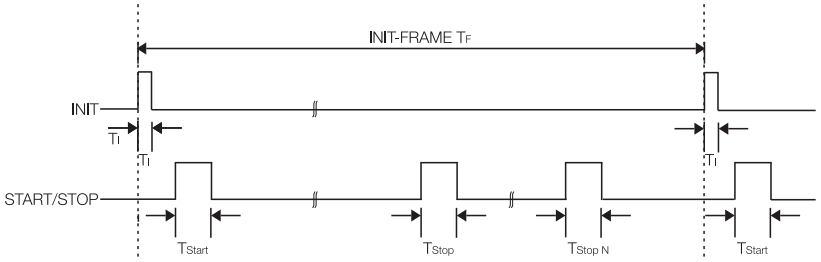
EtherCAT®

VARAN



MICROPULSE®

Series	**Profile A1 BTL6**	**Profile A1 BTL6**
Output signal	VARAN	EtherCAT
Transducer interface	**V11V**	**V11E**
Customer device interface	VARAN	EtherCAT
Part number	BTL6-**V**11V-M_ _ _ _-A1-S115	BTL6-**V**11E-M_ _ _ _-A1-S115
System resolution	≤ 15 µm	≤ 15 µm
Repeat accuracy	≤ 20 µm	≤ 30 µm
Reproducibility	≤ 30 µm	≤ 30 µm
Sampling rate	$f_{STANDARD}$ = 1 kHz (< 850 mm)	$f_{STANDARD}$ = 1 kHz (< 850 mm)
Linearity deviation	≤ ±200 µm up to 500 mm nominal stroke ±0.04% 500...1500 mm nominal stroke	≤ ±200 µm up to 500 mm nominal stroke ±0.04% 500...1500 mm nominal stroke
Supply voltage	20...28 V DC	20...28 V DC
Current consumption	≤ 75 mA	≤ 100 mA
Polarity reversal protected	yes	yes
Operating temperature	0...+70 °C	0...+70 °C
Storage temperature	–40...+100 °C	–40...+100 °C



Please enter the code for the nominal stroke in the part number.

Scope of delivery
- Transducer
- Quick start instructions

Please order separately:
Magnet, page 127
Mounting clamps/cuff, page 126

Ordering example:

BTL6-V11_-M_ _ _ _-A1-S115

Interface

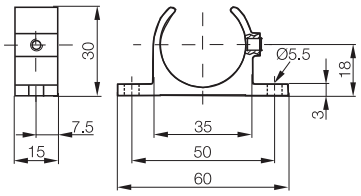
V VARAN
E EtherCAT

Standard
Nominal stroke [mm]

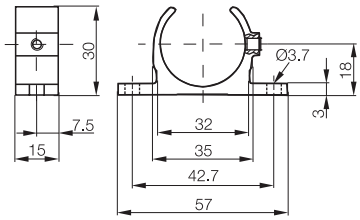
0160 0175 0200 0225 0250 0275 0300
0325 0350 0360 0375 0400 0425 0450
0475 0500 0550 0600 0650 0700 0750
0800 0850 0900 0950 1000 1100 1200
1250 1300 1400 1500
in 25 mm increments on request

The BTL6-A-3800-2 Magnet can be operated at a distance of 4...8 mm from the profile surface.
In conjunction with mounting clamp BTL6-A-MF01-A-50 and mounting cuff BTL6-A-MF03-K-50, the mechanical installation is compatible with series BTL5-...-P-S32 with magnet BTL5-P-3800-2 or BTL5-P-5500-2.
As a result, large measurement lengths or transducers with a bus connection, for example, can be implemented optionally without requiring mechanical modifications.

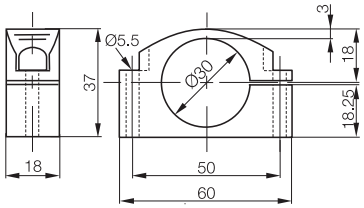
Mounting clamps/cuff



Mounting clamp
Ordering code: **BTL6-A-MF01-A-50**
Includes: 1 clamp



Mounting clamp
Ordering code: **BTL6-A-MF01-A-43**
Includes: 1 clamp



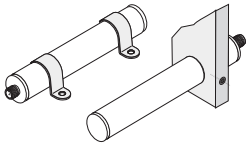
Mounting cuff
Ordering code: **BTL6-A-MF03-A-50**
Includes: 1 cuff

When extreme shock and vibration loads are present, we recommend spacing mounting clamps every 250 mm.

Length			Number of mounting clamp pairs
	to	250 mm	1
251	to	750 mm	2
751	to	1250 mm	3
1251	to	1750 mm	4
1751	to	2250 mm	5
2251	to	2750 mm	6
2751	to	3250 mm	7
	more than	3251 mm	8

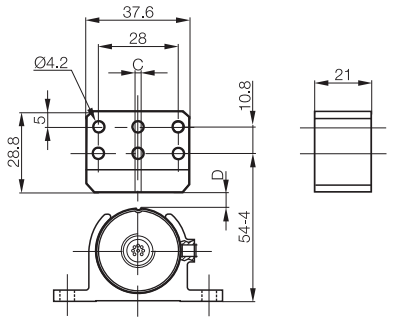
Caution!
Please read the instructions in the user's guide before designing, installing, and commissioning! www.balluff.de

Customer-specific mounting options

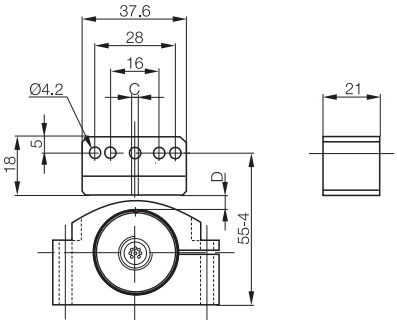


For connector accessories, see page 232

Description	**Magnet**	**Magnet**
for Series	BTL profile A1	Profile A1 BTL
Ordering code	**BAM014W**	**BAM014Z**
Part number	BTL6-A-3800-2	BTL6-A-3801-2
Housing material	Plastic	Plastic
Weight	Approx. 30 g	Approx. 25 g
Magnet travel speed	any	any
Operating temperature/Storage temperature range	–40...+85 °C	–40...+85 °C
Scope of delivery	Magnet	Magnet



Lateral offset: C = ±5 mm
Distance of magnet:
D = 4...8 mm



Lateral offset: C = ±5 mm
Distance of magnet:
D = 4...8 mm