BALLUFF

sensors worldwide

MICROPULSE® Generation 7 Analog Rod-Style Transducers

The global standard for analog position sensing

MICROPULSE® Generation 7
The global standard for analog position sensing

Trusted around the world
Balluff Micropulse® magnetostrictive linear position sensors have achieved a worldwide reputation for accuracy, stability, and rock-solid reliability. Around the globe, Micropulse transducers find applications in industries as diverse as renewable energy, plastic injection molding, tire manufacturing, packaging, steel production, forest products, medical devices, and metal forming. End users, machinery builders, cylinder manufacturers, and hydraulic systems integrators who serve these industries trust Micropulse to provide dependable position feedback signals.

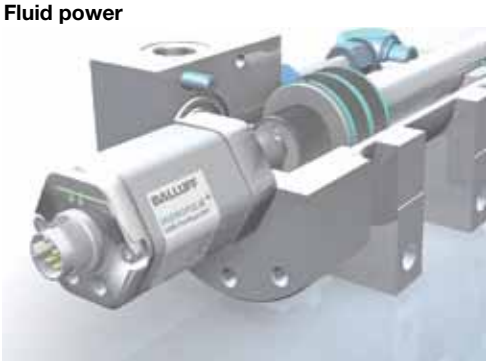
Taking performance to the next level
Competition in the manufacturing sector is tough and getting tougher. Standing still isn't an option as pressure builds to improve quality and productivity while cutting costs. Equipment has to run better and run longer, so machine components have to deliver more performance and higher value.

Recognizing these demands, Balluff set a goal to take the Micropulse transducer and make it even better. The result—Micropulse Generation 7.

- More Accurate
- More Rugged
- More Flexible
- More Capable

Balluff delivers
In today's lean-running business environment, multi-week lead times just aren't workable. Balluff's standard delivery time for made-to-order transducers is five business days after receipt of order. Same day or next day service is also available with an expediting adder.

Fluid power



Wind energy

MICROPULSE® and MICROPULSE+
Performance, compatibility, configurability

MICROPULSE® analog rod-style

Enhanced performance, full backward compatibility
The standard Micropulse analog-output rod-style transducer delivers industry-leading performance, and it offers 100% backward compatibility to previous Micropulse generations and magnets.

MICROPULSE+ analog rod-style

Enhanced performance, advanced configurability
The Micropulse+ analog-output rod-style transducer offers industry-leading performance, plus advanced features and USB configuration capability.

Key to system performance
Users and installers know that accurate and reliable position data is critical to getting maximum performance from a hydraulic positioning system. The proper operation of all other components – the hydraulic cylinder, the servo or proportional valve, and the computer motion controller – is dependent on the validity of the electrical signal coming from the linear position transducer. The Micropulse transducer probe, located inside the bore of the cylinder, detects the position of a magnetic target installed on the face of the piston, providing continuously updated absolute position feedback. Micropulse magnetostrictive technology is wear-free and provides the correct position reading on start-up, without any need to re-home the mechanism.

Micropulse+ configuration software

To be truly useful, transducer-based output configuration has to be simple and frustration-free. With Generation 7, Micropulse+ sets the standard for flexible yet painless output configuration. Communicating with the transducer over standard USB, Balluff's free PC-based software offers an intuitive graphical user interface that makes output configuration almost effortless.

Plastic injection molding

Sawmill equipment

Hydro power

GENERATION 7

The standard **MICROPULSE®** linear position transducer: Improved performance; 100% backward compatible

The same...

Order it, receive it, install it, run it. The standard Micropulse® Generation 7 linear transducer is a drop-in replacement for legacy Micropulse transducers and magnets.

Like all Micropulse Generation 7 transducers, the standard Micropulse transducer delivers significant performance improvements, while maintaining full backward compatibility with previous Micropulse generations and magnets.

Compatibility features include:

- **Identical standard connector and wire color code –** Standard 8-pin M16 connector and same wire color code eliminates the need to re-wire.
- **Uses the same position magnet –** Compatible with all previous Balluff position magnets. This is especially important in hydraulic cylinder applications where the magnet is embedded in the cylinder, and replacement would be costly and time-consuming.
- **Same (or smaller) mechanical envelope –** No worries about mechanical fit.
- **Same operating voltage –** +10…+30 Vdc power supply range means that it will operate with +24 Vdc, or +/-15 Vdc power supplies, right out of the box.
- **Same push-button setup procedure –** Pre-configured with a variety of standard analog voltage or analog current outputs. If calibration is ever required, the standard Micropulse is fully scalable over its mechanical stroke using the included removable push-button setup tool. The setup procedure is identical to previous Micropulse transducers.

...only better

While the standard Micropulse transducer is completely backward compatible, it offers performance and usability improvements that pay dividends in real-world linear positioning applications.

Performance improvements include:

- **Better ingress protection –** Integral cable versions offer IP68 ingress protection, meaning better performance and longer life in harsh applications.
- **Increased electromagnetic immunity –** Significantly improved protection against electromagnetic interference, ensuring trouble-free operation in electrically “noisy” environments.
- **Higher shock and vibration ratings –** Designed and tested to withstand the rigors of today’s demanding applications.
- **Longer available stroke lengths –** Available in stroke lengths from 25 mm to 7620 mm (1" to 300"), in 1 mm increments.
- **Bi-color LEDs for diagnostics and status monitoring –** Bright, easy-to-see bi-color LEDs provide instant verification of operation status, and provide visual feedback during the scaling and setup procedure.
- **Through-the-connector output scaling –** In addition to the familiar push-button scaling, the standard Micropulse Generation 7 transducer’s output can also be adjusted remotely, through two teach-in wires at the connector.
- **New connector options –** In addition to the standard 8-pin M16 connector, the standard Micropulse Generation 7 transducer is available with a smaller, industry-standard 8-pin M12 connector.

MICROPULSE®

Measured variable		Absolute linear displacement
Measuring length		25 mm to 7620 mm
Available electrical outputs:	Analog voltage	0 to 10 Vdc / 10 to 0 Vdc
	Analog voltage	-10 to +10 Vdc / +10 to -10 Vdc
	Analog current	0 to 20 mA / 20 to 0 mA
	Analog current	4 to 20 mA / 20 to 4 mA
Number of outputs	Voltage versions	2, rising and falling (not independently scalable)
	Current versions	1
Configurability		100% scalable stroke length using included push-button setup tool. Status LEDs for visual feedback.
Resolution:	Voltage output	≤ 0.33 mV
	Current output	≤ 0.66 µA
Non-linearity:	Stroke length ≤ 500 mm	+/- 50 µm
	Stroke length > 500 mm, ≤ 5500 mm	+/- 0.01% of full-scale
	Stroke length > 5500 mm	0.02% of full-scale
Supply voltage		+10 to +30 Vdc
Current draw		≤ 150 mA @ +24 Vdc
Environmental protection:	Connector versions	IP 67 (with connector attached)
	Integral cable versions	IP 68
Operating temperature		-40 to +85°C
Shock load		150g/6 ms per IEC 60068-2-27
Vibration		20g, 10 to 2000 Hz per EN 60068-2-6

For detailed technical specifications and installation guidelines, refer to the Technical User’s Guide, available at www.balluff.com/BTL7downloads

The MICROPULSE+ linear position transducer: Generation 7 performance, plus advanced configurability

All the performance…

The Micropulse+ offers all of the enhanced performance found in the standard Micropulse® Generation 7 analog rod-style transducers, plus advanced features and configurability that make the Micropulse+ the most versatile linear position transducer available.

Generation 7 performance improvements:

- **Better ingress protection**
- **Increased electromagnetic immunity**
- **Higher shock and vibration ratings**
- **Longer available stroke lengths**
- **Bi-color LEDs for diagnostics and status monitoring**
- **New connector options**

….plus, advanced functionality

The Micropulse+ utilizes innovative, easy-to-use PC-based configuration software and a standard USB interface to allow unprecedented configuration and setup options.

USB configuration features:

- **Stroke length scaling –** The factory default electrical stroke can be easily modified to suit application requirements. A variety of stroke scaling methods are available:
- **Teach-in procedure allows current magnet position to be read and stored as new START and END points**
- **Direct entry of new START and END point values**
- **Drag-and-drop new START and END points on output graph**
- **Output range adjustment –** Freely configurable output range allows the factory default 0-10V or 4-20 mA output to be changed to any value between -10 to +10V or 0-20 mA.
- **Select 1- or 2-magnet operation**
- **Select position, differential position, or velocity feedback**
- **Signal inversion –** Output signal slope can be instantly configured as either rising or falling.
- **Saving/Loading of configuration parameters –** Transducer configuration settings can be saved to a file and then re-loaded to replacement transducers or emailed to a remote location. For application troubleshooting, configuration files can be sent to a knowledge center for analysis.
- **Restore factory defaults**

In addition to the advanced configuration options available through the USB interface, the Micropulse+ transducer can be locally configured using the removable push-button programming tool. The streamlined Easy-Teach™ setup procedure provides the following functions:

- **Teach START and END points by moving magnet**
- **Invert signals from rising to falling**
- **Adjust signal level at current magnet position (can be done while transducer remains online/in-process)**
- **Reset transducer to factory defaults**
- **Teach-in push-buttons can be locked out via the USB configuration software to prevent tampering**

MICROPULSE+

Measured variable		Absolute linear displacement and/or velocity (with or without sign)
Measuring length		25 mm to 7620 mm
Available electrical outputs:	Analog voltage	0 to 10 Vdc / 10 to 0 Vdc (factory default)
	Analog voltage	-10 to +10 Vdc / +10 to -10 Vdc (user configurable)
	Analog current	0 to 20 mA / 20 to 0 mA (factory default) (user configurable)
	Analog current	4 to 20 mA / 20 to 4 mA (factory default)
Number of outputs		2, independently scalable and configurable for position or velocity feedback
Configurability		Configurable via PC USB interface. Configurable parameters include: – Stroke range – Output type (position, differential position, or velocity) – Output slope (rising or falling) – Output range – Error output values
Resolution:	Voltage output	≤ 0.33 mV
	Current output	≤ 0.66 µA
Non-linearity:	Stroke length ≤ 500 mm	+/- 50 µm
	Stroke length > 500 mm, ≤ 5500 mm	+/- 0.01% of full-scale
	Stroke length > 5500 mm	0.02% of full-scale
Supply voltage		+10 to +30 Vdc
Current draw		≤ 150 mA @ +24 Vdc
Environmental protection:	Connector versions	IP 67 (with connector attached)
	Integral cable versions	IP 68
Operating temperature		-40 to +85°C
Shock load		150g/6 ms per IEC 60068-2-27
Vibration		20g, 10 to 2000 Hz per EN 60068-2-6

For detailed technical specifications and installation guidelines, refer to the Technical User's Guide, available at www.balluff.com/BTL7downloads

GENERATION 7

B T L 7 - ☐☐☐☐ - M ☐☐☐☐ - ☐ - ☐☐☐☐

1 and 2 | 3 | 4 | 5

1. Choose version: **MICROPULSE**® or **MICROPULSE**+

Refer to the table comparing the features of the Micropulse and Micropulse+.

Feature	Micropulse	Micropulse+
Diagnostic/setup LEDs	■	■
Two position outputs (rising/falling) with one magnet	■	■
Second output configurable for independent position of second magnet, velocity, speed, or differential distance		■
Pushbutton setup:		
Teach zero/span	■	■
Adjust signal online/in-process	■	■
Reset to factory defaults		■
Reset to last good teach	■	
Invert outputs (rising/falling)		■
Legacy Balluff push-button procedure	■	
Easy-Teach™ push-button procedure		■
Setup via discrete lines through cable/connector	■	
USB-configurable with software		■

2. Choose output signal

Use the table below to choose the correct output signal.
Note the ordering code designation in bold.

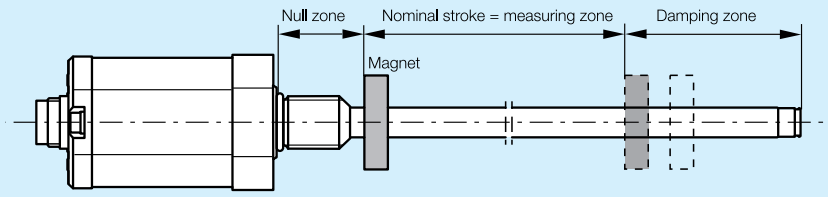
Output type	Ordering Code	
	Micropulse	Micropulse+
0...10V and 10...0V	BTL7 - **A510** - M _ _ _ _ - _ - _ _ _ _	BTL7 - **A501** - M _ _ _ _ - _ - _ _ _ _
-10...+10V and +10...-10V	BTL7 - **G510** - M _ _ _ _ - _ - _ _ _ _	BTL7 - **A501** - M _ _ _ _ - _ - _ _ _ _ (user configurable)
4...20 mA	BTL7 - **E510** - M _ _ _ _ - _ - _ _ _ _	BTL7 - **E501** - M _ _ _ _ - _ - _ _ _ _
20...4 mA	BTL7 - **E570** - M _ _ _ _ - _ - _ _ _ _	
0...20 mA	BTL7 - **C510** - M _ _ _ _ - _ - _ _ _ _	BTL7 - **E501** - M _ _ _ _ - _ - _ _ _ _ (user configurable)
20...4 mA	BTL7 - **C570** - M _ _ _ _ - _ - _ _ _ _	

3. Choose measuring range

The nominal stroke of the Micropulse transducer is expressed in millimeters, from 0025 mm up to 7620 mm.

Example:
BTL7 - _ _ _ _ - M**1524** - _ - _ _ _ _

The overall length of the rod includes the nominal stroke + the NULL zone + the DAMPING zone.



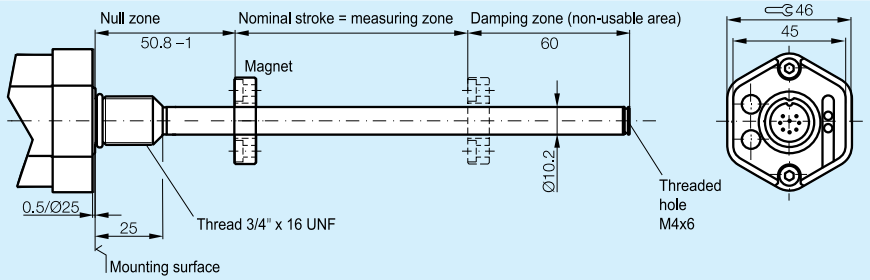
Note: To convert inches to millimeters, multiply by 25.4. Example: 60" x 25.4 = 1524 mm.

4. Choose mounting flange/thread type and rod diameter

Use the table below to choose the mounting flange/mounting thread combination. Note the ordering code designation in bold.

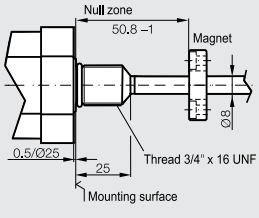
Flange configuration/Rod diameter:
3/4"-16 UNF threads,
raised-face mounting flange,
Ø10.2 mm rod

Ordering Code:
BTL7 - _ _ _ _ - M _ _ _ _ - **Z** - _ _ _
(Standard configuration)



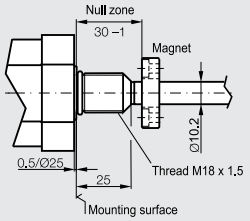
Flange configuration/ Rod diameter:
3/4"-16 UNF threads,
raised-face mounting flange,
Ø8 mm rod
(max stroke length = 1016 mm)

Ordering Code:
BTL7 - _ _ _ _ - M _ _ _ _ - **Z8** - _ _ _



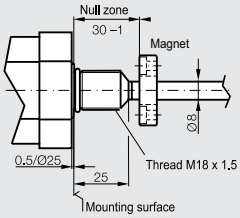
Flange configuration/ Rod diameter:
M18 x 1.5 threads,
raised-face mounting flange,
Ø10.2 mm rod

Ordering Code:
BTL7 - _ _ _ _ - M _ _ _ _ - **B** - _ _ _



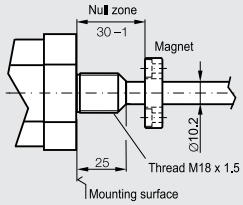
Flange configuration/ Rod diameter:
M18 x 1.5 threads,
raised-face mounting flange,
Ø8 mm rod
(max stroke length = 1016 mm)

Ordering Code:
BTL7 - _ _ _ _ - M _ _ _ _ - **B8** - _ _ _



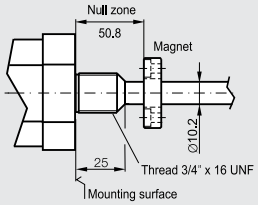
Flange configuration/ Rod diameter:
M18 x 1.5 threads,
flat-face mounting flange,
Ø10.2 mm rod

Ordering Code:
BTL7 - _ _ _ _ - M _ _ _ _ - **A** - _ _ _



Flange configuration/ Rod diameter:
3/4"-16 UNF threads,
raised-face mounting flange,
Ø10.2 mm rod

Ordering Code:
BTL7 - _ _ _ _ - M _ _ _ _ - **Y** - _ _ _



5. Choose connector type or integral cable

S115 = 8 pin M12 micro connector	**S32** = 8 pin M16 DIN connector	**KAxx** = Integral PUR cable (specify length **xx** in meters)

Full ordering codes

MICROPULSE®

Ordering example: **BTL7 - 5 0 - M - -**

Output signal
A 0...10V and 10...0V
G -10...+10V and +10...-10V
E 4...20 mA
C 0...20 mA

Output signal
1 for A and G rising and falling
0 for C and E rising
7 for C and E falling

Mounting threads
Z = Standard 3/4"-16 UNF

Nominal stroke in millimeters
0025 mm to **7620** mm
in 1 mm increments

Connection type
S115 8-pin M12 connector
S32 8-pin M16 connector
KA02 PUR cable 2 m
KA05 PUR cable 5 m
KA10 PUR cable 10 m
KA15 PUR cable 15 m

MICROPULSE+

Ordering example: **BTL7 - 501 - M - -**

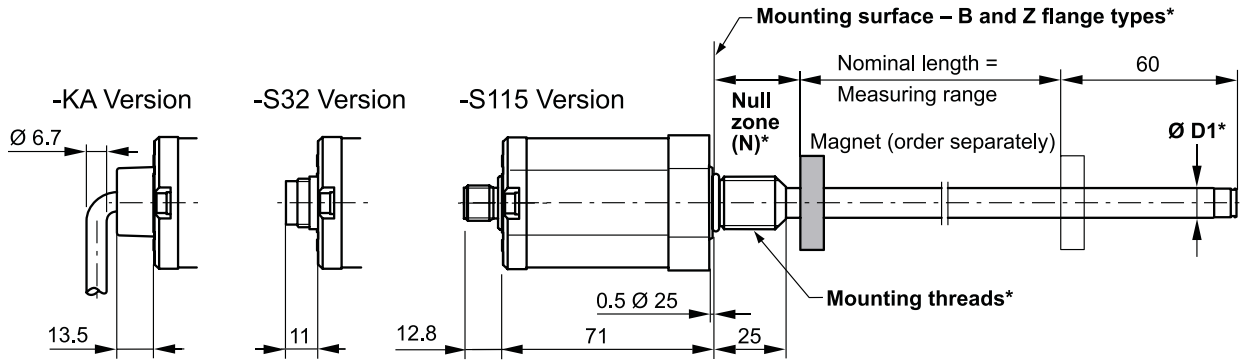
Output signal
A Voltage (user configurable)
E Current (user configurable)

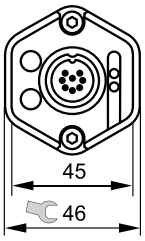
Mounting threads
Z = Standard 3/4"-16 UNF

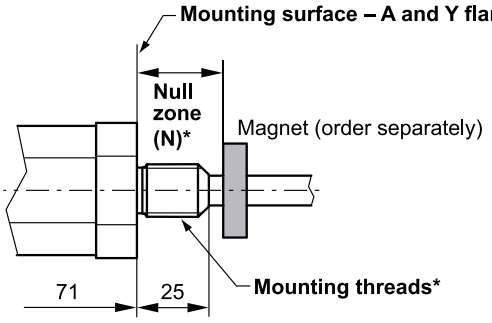
Nominal stroke in millimeters
0025 mm to **7620** mm
in 1 mm increments

Connection type
S115 8-pin M12 connector
S32 8-pin M16 connector
KA02 PUR cable 2 m
KA05 PUR cable 5 m
KA10 PUR cable 10 m
KA15 PUR cable 15 m

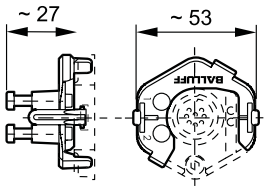
GENERATION 7







*see table below



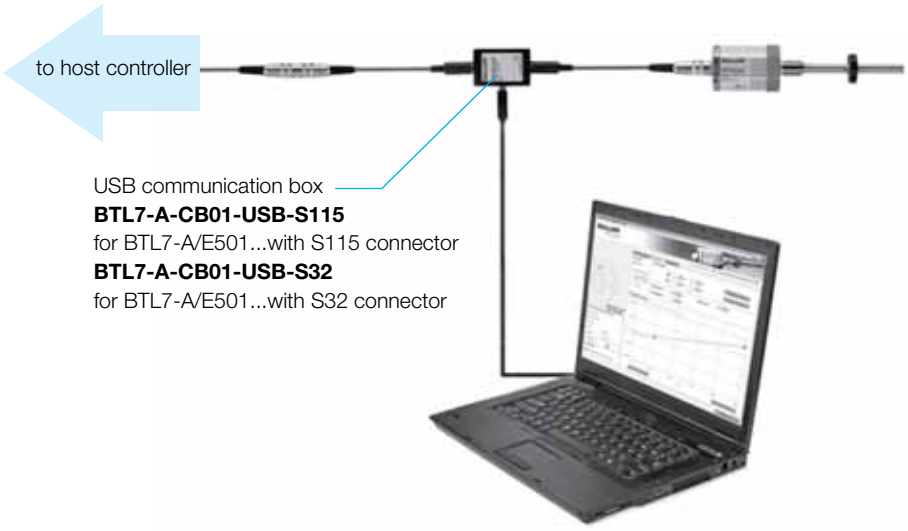
One calibration device included with each transducer. For replacement, order BTL7-A-EH01.

Version	Null zone (N)	Mounting threads	Mounting surface
BTL7- _ _ _ _-M_ _ _ _-**Z**-_ _ _ _	50.8 mm	¾"-16 UNF	raised-face (standard)
BTL7- _ _ _ _-M_ _ _ _-**Y**-_ _ _ _	50.8 mm	50.8 mm ¾"-16 UNF	flat-face
BTL7- _ _ _ _-M_ _ _ _-**B**-_ _ _ _	30 mm	M18 x 1.5 raised-face	raised-face
BTL7- _ _ _ _-M_ _ _ _-**A**-_ _ _ _	30 mm	M18 x 1.5 flat-face	flat-face

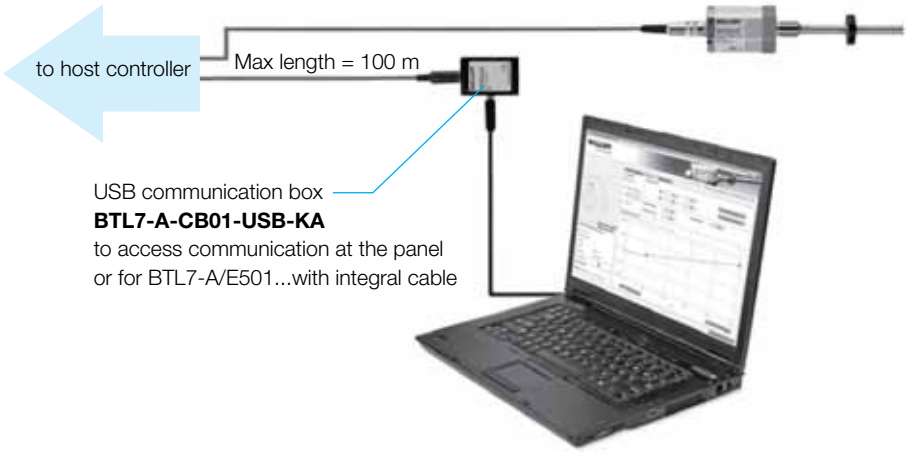
Version	Rod diameter (Ø D1)
BTL7- _ _ _ _-M_ _ _ _-**A**-_ _ _ _	10.2 mm with M4 x 6 threaded hole at end
BTL7- _ _ _ _-M_ _ _ _-**B**-_ _ _ _	
BTL7- _ _ _ _-M_ _ _ _-**Y**-_ _ _ _	
BTL7- _ _ _ _-M_ _ _ _-**Z**-_ _ _ _	
BTL7- _ _ _ _-M_ _ _ _-**A8**-_ _ _ _	8 mm (no threaded hole)
BTL7- _ _ _ _-M_ _ _ _-**B8**-_ _ _ _	
BTL7- _ _ _ _-M_ _ _ _-**Y8**-_ _ _ _	
BTL7- _ _ _ _-M_ _ _ _-**Z8**-_ _ _ _	

USB connection options – MICROPULSE+ version only

Connection at the transducer



Connection at the control panel



USB Interface kits

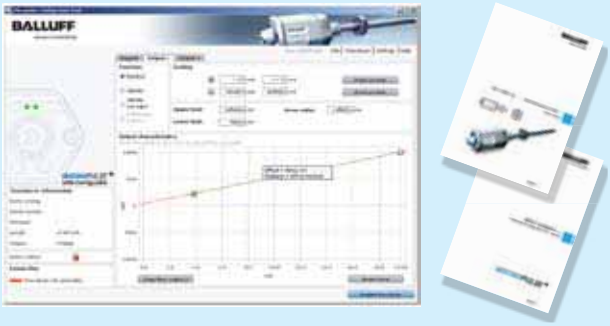
BTL-A-CB01-USB-S115

BTL-A-CB01-USB-S32

BTL-A-CB01-USB-KA

Online resources

PC software, software user's manual, and transducer user's manuals can be downloaded at **www.balluff.com/BTL7downloads**



Software tutorials and product information videos are available at **www.balluff.com/BTL7videos**

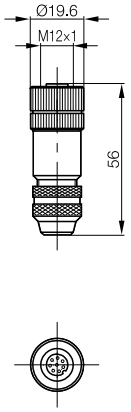
GENERATION 7

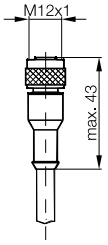
S115 Connectors and Cables

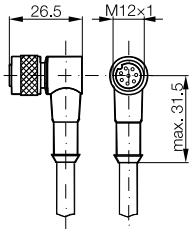
Description	Connector, female, straight, M12	Molded connector with cable, female, straight, M12	Molded connector with cable, female, right angle, M12
For version	Generation 7 Micropulse and Micropulse+ Rod-Style Transducers		
Part number	BKS-S115-00	BKS-S115-PU-_ _*	BKS-S116-PU-_ _*
Number of conductors	8	8	8
Conductor cross section	n/a	0.25 mm²	0.25 mm²
Contacts	Brass, gold-plated	Brass, gold-plated	Brass, gold-plated
Wire connection	Screw terminals	n/a	n/a
Cable jacket material	n/a	Molded-on PUR	Molded-on PUR
Cable jacket diameter	6...8 mm	6.6 +/-0.2 mm	6.6 +/-0.2 mm
Housing material	Nickel-plated brass	Nickel-plated brass and PUR	Nickel-plated brass and PUR
Min. bend radius	Cable dependent	Dynamic = 5 x Ø Static = 3 x Ø	Dynamic = 5 x Ø Static = 3 x Ø
Enclosure rating per IEC 60529	IP 67 (when attached)	IP 67 (when attached)	IP 67 (when attached)

* = Indicate cable length when ordering

00 = no cable, field-installable
(use shielded cable)
02 = 2 meters
03 = 3 meters
05 = 5 meters
10 = 10 meters
15 = 15 meters
20 = 20 meters
25 = 25 meters
Additional cable lengths available on request







S32 Connectors and Cables

Description	Connector, female, straight, M16	Connector, female, right angle, M16
For version	Generation 7 Micropulse and Micropulse+ Rod-Style Transducers	
Part number	BKS-S 32M-_ _*	BKS-S 33M-_ _*
Number of conductors	8	8
Conductor cross section	0.25 mm²	0.25 mm²
Contacts	Brass, gold-plated	Brass, gold-plated
Wire connection	Solder	Solder
Cable jacket material	PUR	PUR
Cable jacket diameter	7 mm	7 mm
Housing material	Nickel-plated brass	Nickel-plated brass
Min. bend radius	Dynamic = 5 x Ø Static = 3 x Ø	Dynamic = 5 x Ø Static = 3 x Ø
Enclosure rating per IEC 60529	IP 67 (when attached)	IP 67 (when attached)

* = Indicate cable length when ordering

00 = no cable, field-installable
(use shielded cable)
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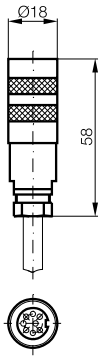
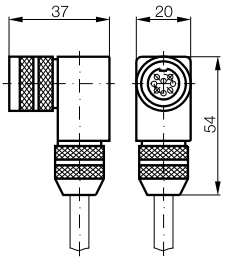
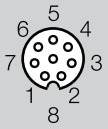
03 = 3 meters
05 = 5 meters
10 = 10 meters
15 = 15 meters
20 = 20 meters
25 = 25 meters
Additional cable lengths available on request





Wiring Table - S115 Connector



Wire-side view of female mating connector

		Function			
		Micropulse		Micropulse+	
Pin	Wire Color	Voltage output version	Current output version	Voltage output version	Current output version
1	YE (yellow)	signal common	signal common	signal common	signal common
2	GY (gray)	signal common	signal common	signal common	signal common
3	PK (pink)	output signal (falling)	not used	output signal (falling)[1]	output signal (falling)[1]
4	RD (red)	L_a (programming input)	L_a (programming input)	L_a (communication line)	L_a (communication line)
5	GN (green)	signal output (rising)	signal output	signal output (rising)[1]	signal output (rising)[1]
6	BU (blue)	supply GND	supply GND	supply GND	supply GND
7	BN (brown)	+10...30 Vdc input power	+10...30 Vdc input power	+10...30 Vdc input power	+10...30 Vdc input power
8	WH (white)	L_b (programming input)	L_b (programming input)	L_b (communication line)	L_b (communication line)

Notes: 1 = Indicates factory default setting. Rising/falling characteristic is configurable.

Wiring Table - S32 Connector or KAxx Integral Cable

Wire-side view of female mating connector

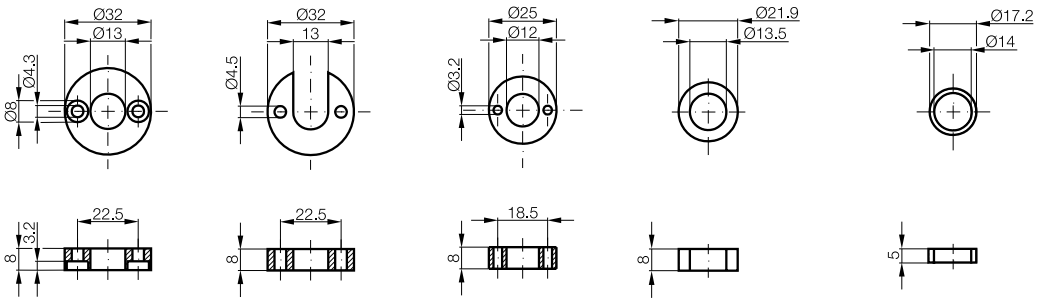
		Function			
		Micropulse		Micropulse+	
Pin	Wire Color	Voltage output version	Current output version	Voltage output version	Current output version
1	YE (yellow)	signal common	signal common	signal common	signal common
2	GY (gray)	signal common	signal common	signal common	signal common
3	PK (pink)	output signal (falling)	not used	output signal (falling)[1]	output signal (falling)[1]
4	RD (red)	L_a (programming input)	L_a (programming input)	L_a (communication line)	L_a (communication line)
5	GN (green)	signal output (rising)	signal output	signal output (rising)[1]	signal output (rising)[1]
6	BU (blue)	supply GND	supply GND	supply GND	supply GND
7	BN (brown)	+10...30 Vdc input power	+10...30 Vdc input power	+10...30 Vdc input power	+10...30 Vdc input power
8	WH (white)	L_b (programming input)	L_b (programming input)	L_b (communication line)	L_b (communication line)

Notes: 1 = Indicates factory default setting. Rising/falling characteristic is configurable.

Magnets

Description	Ring Magnet	Slotted Magnet	Ring Magnet	Ring Magnet	Ring Magnet
for version	Generation 7 Micropulse and Micropulse+ Rod-style Transducers				
Ordering code	**BAM013L***	**BAM013P***	**BAM013J***	**BAM013R**	**BAM013H**
Part number	BTL-P-1013-4R	BTL-P-1013-4S	BTL-P-1012-4R	BTL-P-1014-2R	BTL-P-0814-GR-PAF
Material	Aluminum	Aluminum	Aluminum	Aluminum	Ferrite, bound in polyamide
Weight	approx. 12 g	approx. 12 g	approx. 12 g	approx. 10 g	approx. 1.5 g
Operating/Storage temperature	-40...+100 °C	-40...+100 °C	-40...+100 °C	-40...+100 °C	-40...+100 °C

Stainless steel float magnets also available for liquid level applications. Refer to main Micropulse catalog.



*Includes spacers

Jam Nuts

Description	Jam nut, 3/4"-16 UNF	Jam nut, M18x1.5
For version	Generation 7 Micropulse and Micropulse+ Rod-Style Transducers	
Ordering code	**BAM0117**	**BAM0118**
Part number	BTL-A-FK01-E3/4"-16UNF	BTL-A-FK01-M18x1.5
Material	Stainless steel	Stainless steel

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