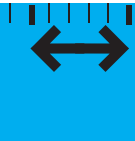


Transducer Catalog

Linear Position Transducers



MICROPULSE®

Find the latest product information and application solutions at www.balluff.com



■ Product Selector

Select and compare sensors to best fit your application.



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See real world examples of sensor applications.



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Enter Balluff Part #
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BES M08MH1-PSC30B-S04G

Property Name	Value
Housing Size	M 8
Housing material	CuZn, chrome plated
Sensing face material	PST
Housing	quasi flush mountable
Number of Wires	3-wire
Switching output	NPN
Switching element function	NO
Special Duty	Extended Sensing Range
Rated operating distance (m)	3 mm
Assured operating distance	5...2.4 mm
Rated operational voltage (V _{DC})	24 DC V
Supply voltage max. (V _{DC})	30 V
Supply voltage min. (V _{DC})	18 V
Voltage drop max. static	3 V
Load current capacity (I _L)	200 mA
Short circuit protected	yes
Protected against polarity reversal	yes
Output indication	yes
Ambient temperature min.	-25 °C
Ambient temperature max.	+70 °C
Operating frequency (f)	1000 Hz
Degree of protection IP	IP67
Connection	connector
Approval	CE
Off-state current max. (I _r)	100 µA
Repeat accuracy max. (K)	± 5 %
Brand	SuperG

Quicklinks
 ▶ Pictures
 ▶ Diagrams
 ▶ CAD
 ▶ Datasheet (pdf)

Download datasheets, manuals, and CAD drawings

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Balluff North America



Florence, Kentucky USA

Enjoying one of the highest growth rates in the automation industry, Balluff's Florence, Kentucky United States headquarters is located just south of Cincinnati, Ohio. Our customers are in industries such as automotive, machine tool, robotics, injection molding, packaging, material handling, and more.

In addition to sales, marketing, and logistic functions, this facility manufactures regionally focused inductive proximity sensors and Micropulse® magnetostrictive linear position sensors.

The Balluff Global Network

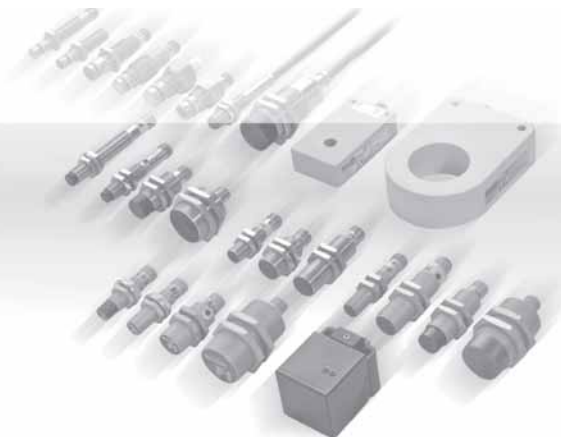


**Balluff spans the globe
with representation in
49 countries.**



Argentina
Australia
Austria
Belarus
Belgium
Brazil

Bulgaria
Canada
China
Columbia
Croatia
Czech Republic



Germany

World Headquarters

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73765 Neuhausen a.d.f.
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For a complete global listing visit www.balluff.com/global



Denmark	Hungary	Japan	Pakistan	Singapore	Switzerland
Finland	India	Korea	Philippines	Slovakia	Thailand
France	Indonesia	Malaysia	Poland	Slovenia	Taiwan
Great Britain	Iran	Mexico	Portugal	South Africa	Turkey
Greece	Israel	Netherlands	Romania	Spain	USA
Hong Kong	Italy	Norway	Russia	Sweden	Venezuela

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Balluff de Mexico S.A. de C.V.
Prol. Av. Luis M. Vega #109
Col. Ampliacion Cimataro
Queretaro, QRO 76030
Phone: (+52 442) 212-4882,
224-3583, 224-3171
Fax: (+52 442) 214-0536
E-Mail: balluff.mexico@balluff.com

Applications

Balluff control solutions are found wherever products are being produced, controlling key functions in virtually every type of production cycle. Balluff provides thousands of different sensors, but it also provides something else—a unique understanding of how best to apply them for maximum positive impact.

Balluff Application Expertise Can:

**Prevent Unplanned Downtime
Reduce Planned Downtime
Decrease Life Cycle Costs**

**Increase Sensor Life
Increase Process Efficiency
Increase Product Quality
Increase Profitability**

Service

- **24 hour on-call service.**
- **Same-day shipping—in by 2 PM, out the same day.**
- **Complete in-house technical support.**
- **Comprehensive product selection, cross reference, and application assistance.**
- **Fast, friendly experienced service – guaranteed!**

The best customer service team in the industry is ready to solve your automation challenges. We'll make finding the right sensor easier and faster.

1-800-543-8390
Give us a call.

Balluff's enthusiastic and knowledgeable staff help us stand out from the competition. When you call, you'll be instantly connected with experienced customer service, technical support, and application engineers. We know your industry, and we know how to make your job easier, and we'll go out of our way to make sure you are satisfied with our products and services.

Warranty

Balluff products are guaranteed to be free from defects in material and workmanship as follows:

Standard lifetime warranty for inductive sensors and magnetically operated sensors sold to the original user.

Standard 2-year warranty from the date of shipment for photoelectric, capacitive sensors, read-write ID systems, magnetostrictive transducers*, connectors and cables, electromechanical limit and rotary switches, and all products with electromechanical relays sold to the original user.

Balluff will repair or replace at our discretion, without charge, any unit which fails because of defective workmanship or material, during this guarantee period and which is returned to Balluff transportation prepaid. This guarantee will not apply if, in the judgement of Balluff, damage or failure has resulted from accident, alteration, misuse, abuse, or operation on an incorrect power supply. This guarantee expressly does not include any other costs such as the cost of removal of the defective part, installation, labor or consequential

damages of any kind. Balluff assumes no responsibility for selection and installation of its products. The foregoing is in lieu of all other guarantees expressed, implied or statutory and Balluff neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with said products.



WARNING



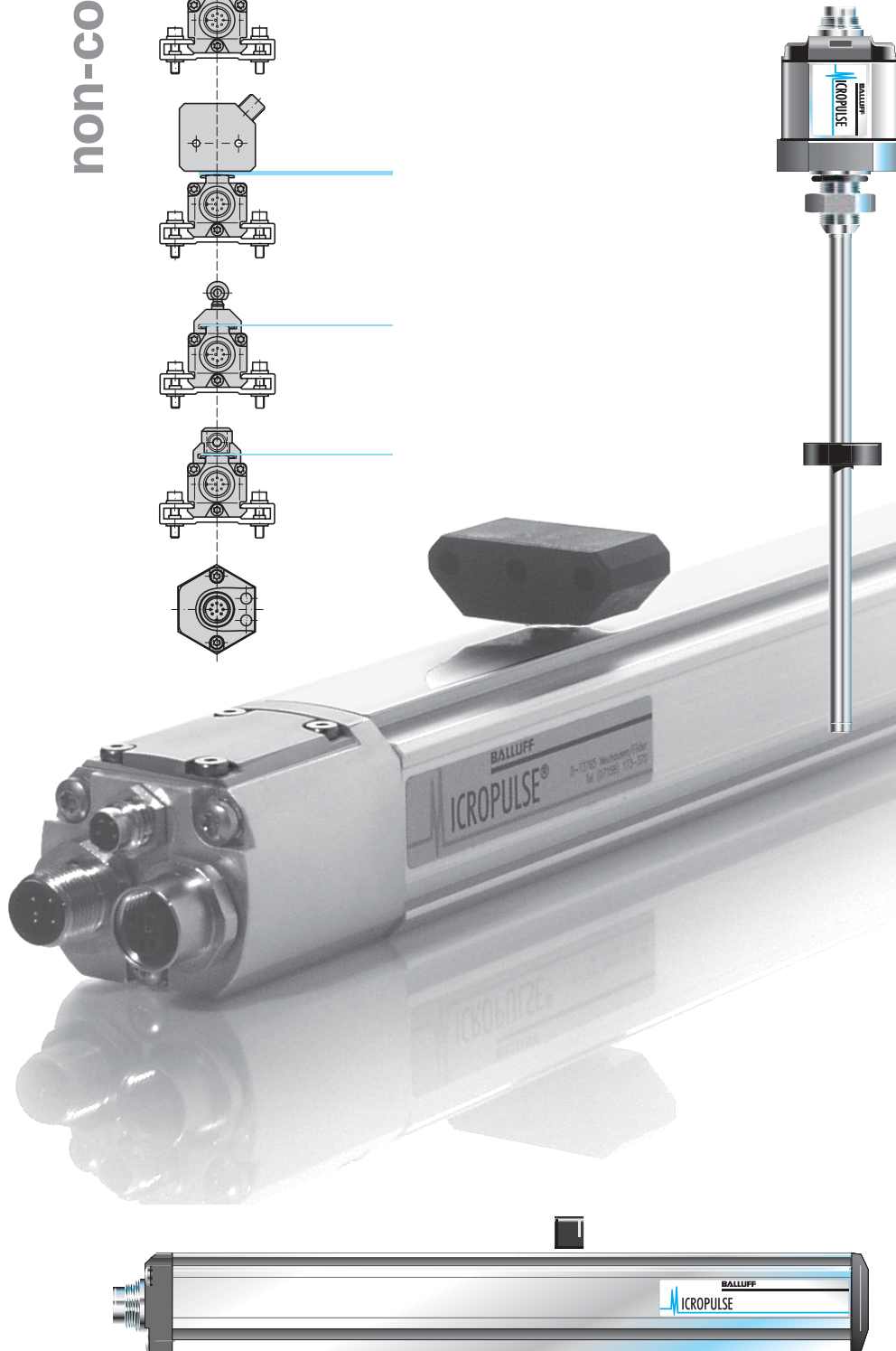
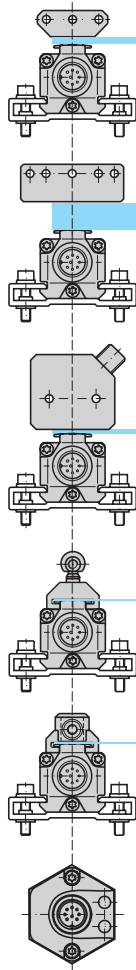
These sensors are NOT approved for use in personnel safety applications. A sensor failure or malfunction can result in either an energized or de-energized output state. Never use these sensors for personnel safety. Doing so may result in serious bodily injury or death.

Only products specifically designated as safety products are designed to meet OSHA and ANSI standards for point-of-operation devices.

MICROPULSE®

CE

non-contact



Product Introduction & Applications	INTRO
Pages 2-14	i
Standard Rod Style	BTLZ
Pages 15-28	
Compact, Rugged Rod Style Thread-in	BTLW
Pages 29-38	
Compact, Rugged Rod Style Bolt-in	BTLK
Pages 39-46	
Embeddable Rod Style	BTLAR
Pages 47-54	
Explosion Proof Rod Style	BTLEx
Pages 55-64	
Profile Series	BTLP
Pages 65-80	
Low Profile Series	BTLR
Pages 81-90	
Advanced Tube Profile Series	BTLAT
Pages 91-102	
Plunger Style Linear Potentiometer Replacement	BIW
Pages 103-106	
Connector & Options	BKS
Pages 107-114	
Processors, Positioning module, Digital displays, BTA module	BDD
Pages 115-122	BTM
Terminology & Testing	T
Pages 123-128	

MICROPULSE®



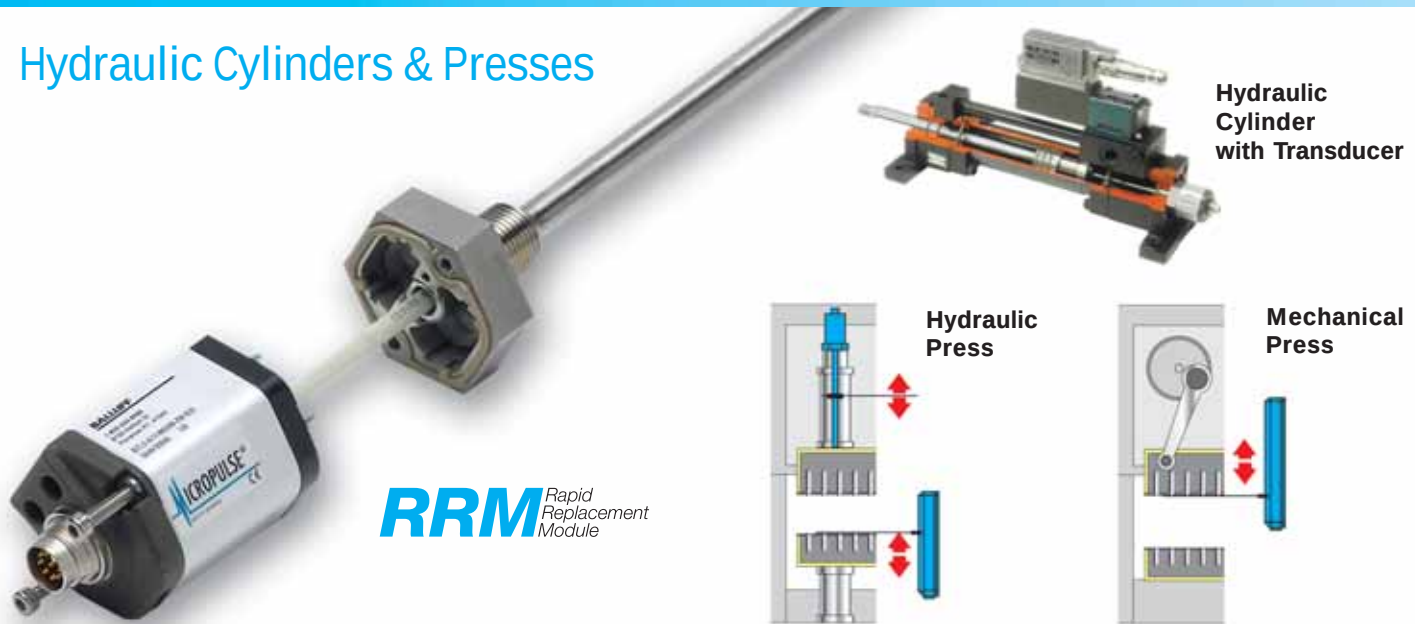
Series	Rod Style Z	Rugged Style W&K	Rod Style AR	Explosion-Proof Rod Style EX	
Analog					
Sin/Cos, 1Vpk-pk					
0...10 V and 10...0 V	■	■	■ (only 0-10)	■	
-5...+5 V and +5...-5 V	■	■	■ (only 0-5)	■	
-10...+10 V and +10...-10 V	■	■		■	
4...20 mA or 20...4 mA	■	■	■ (only 4...20 mA)	■	
0...20 mA or 20...0 mA	■	■		■	
Digital					
Start/Stop, RS422	■	■	■	■	
Start/Stop, RS422, DPI/IP					
Pulse-Width Modulated, RS422	■	■		■	
PWM (w/recirculations), RS422	■	■		■	
Specialized					
Synchronous Serial Interface (SSI)	■	■		■	
CANopen	■			■	
Profibus DP	■			■	
Quadrature	■			■	
Dual-Magnet Analog w/Programmable Stroke					
Resolution					
0.1 mV (analog)		■	± 1.5 mV		
0.2 µA (analog)		■	± 7 µA		
16 bit (analog)	■			■	
Controller-dependent (Start/Stop & PWM)	■	■		■	
1,2,3,5,10 µm selectable (Quadrature output)	■			■	
5,10,20,40 µm selectable (SSI output)	■	■		■	
5 µm increments selectable (CANopen & Profibus)	■			■	
10 µm (analog)					
5 µm (analog)					
1...2000 µm					
Stroke Length					
Active measurement area*	1"-200"	1"-200"	1"-59"	1"-200"	
Wiring Options					
Quick disconnect	■	■			
Cable-out	■	■	■	1/2" NPT	
Operating Voltage					
24 Vdc (±20%)	■	■		■	
±15 Vdc (±2%)	■	■		■	
10...30 Vdc	■	■	■	■	
5 Vdc					
Features	- 3/4"-16-UNF threads or M18 threads - Pressure-rated to 8700 psi for use in hydraulic cylinders - Optional Rapid Replacement Module - Analog signal adjustable in field - Industry standard configuration	- Rugged, all-stainless steel housing - Eliminates the need for protective covers - 3/4"-16-UNF threads (W) - Bolt-in design (K) - Pressure-rated to 8700 psi	- Rugged, compact housing - All stainless steel construction - For use in hydraulic cylinders - Embeddable design can be used in welded cylinders	- Factory Mutual, and ATEX approved - Explosion proof - Flame proof - Bolt-in design - Standard Rapid Replacement Module	
* Depending on output type					
Page	15-28	29-46	47-54	55-64	

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Micropulse Transducers at Work:

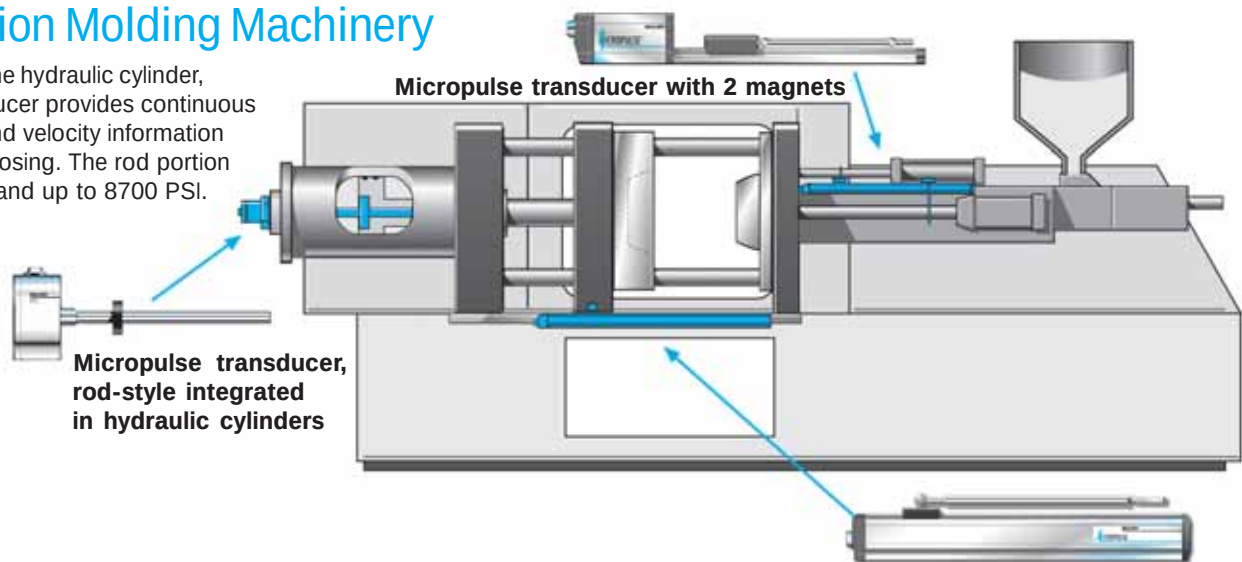
Balluff transducers are the rugged choice for use under extreme ambient conditions up to 85°C and over measuring distances between 25 mm (1") and 5080 mm (200").

Hydraulic Cylinders & Presses

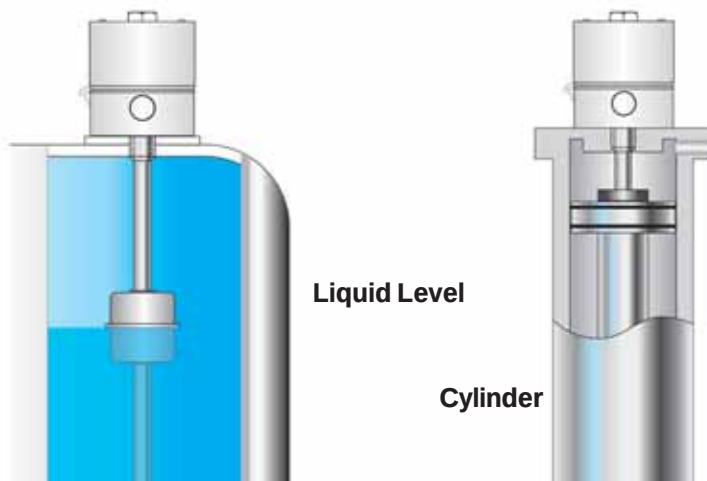


Injection Molding Machinery

Built into the hydraulic cylinder, the transducer provides continuous position and velocity information for mold closing. The rod portion can withstand up to 8700 PSI.



Hazardous Locations



- Tooling & tool handling
- Presses
- Casting & rolling mills
- Foundries
- Injection molding
- Leveling machines
- Transport systems
- Lift controls
- Level monitoring
- Woodworking machinery
- Conveying
- Packaging machines
- Windmills
- Elevators

The rugged choice for extreme conditions

Enhanced Magnetostrictive Technology

The waveguide consists of a special nickel-iron alloy with 0.7 mm O.D. and 0.5 mm I.D.

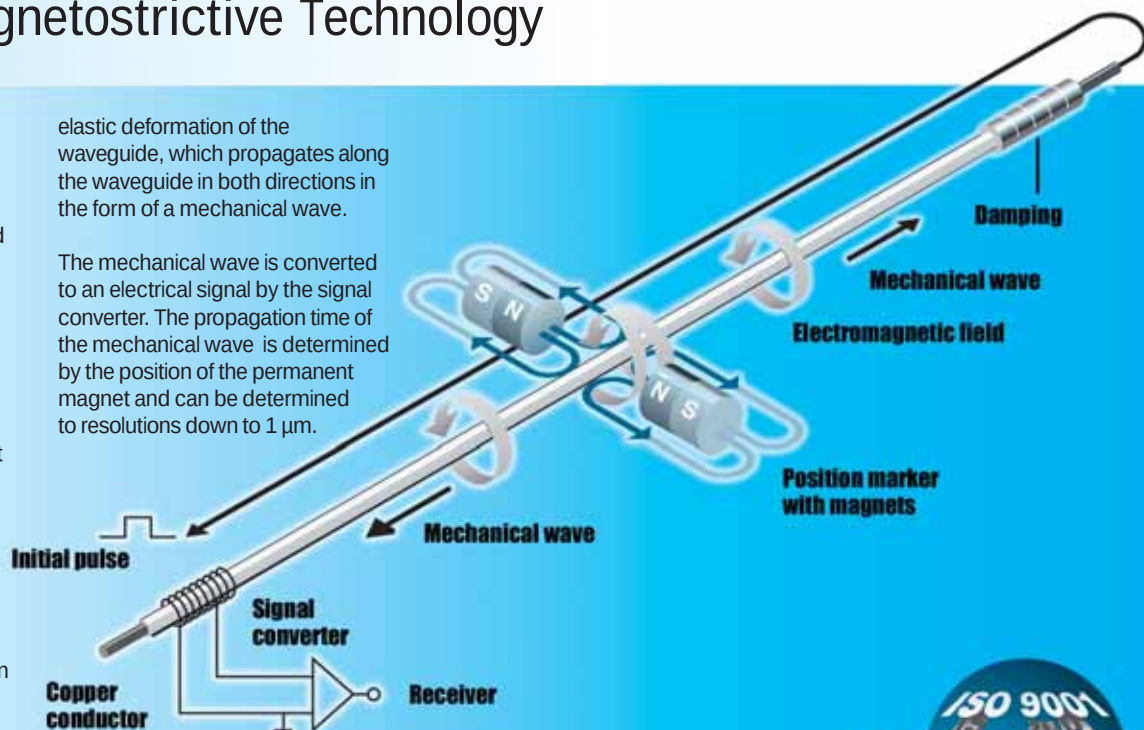
A copper conductor is introduced through the length of this tube. The start of measurement is initiated by a short current pulse. This current generates a circular magnetic field which rotates around the waveguide.

A permanent magnet at the point of measurement is used as the marker element, whose lines of field run at right angles to the electromagnetic field.

In the area on the waveguide where the two fields intersect, a magnetostrictive effect causes an

elastic deformation of the waveguide, which propagates along the waveguide in both directions in the form of a mechanical wave.

The mechanical wave is converted to an electrical signal by the signal converter. The propagation time of the mechanical wave is determined by the position of the permanent magnet and can be determined to resolutions down to 1 μm .



MICROPULSE®



Accessories

Floats

Non-contact floats with integrated permanent magnet measure liquid level.



Non - contact!

Setup is a snap with Balluff accessories!

Magnets



BTM Module

Provides up to 4 channels of analog position and/or velocity feedback!



Connectors

Connect with Balluff and decrease your setup and down time!



MICROPULSE® Withstands the rigors of



Oil & Gas Industry

- Globally certified by FM Approvals for use in US, Canada and ATEX applications
- Non-wearing, non-contact position feedback for long MTBF
- Rapid Replacement Module for quick and easy field replacement of electronics package
- Compact, rugged, stainless steel housing for harsh applications
- 100% scalable analog outputs for quick and easy setup: zero, span, and stroke length
- Wide range of outputs to match a variety of controller interfaces



Plastic Injection and Blow Molding Industry

- Captive (guided control rod) or floating magnet for versatile installation options (P & R profile styles)
- Low-profile housing provides mechanical upgrade path from linear potentiometers (R profile style)
- Wide range of outputs to match a variety of controller interfaces (P profile style)
- No-compromise non-contact performance in cost-sensitive applications (AT tubular style)
- 100% scalable analog outputs for quick and easy setup: zero, span, stroke length (AT tubular style)
- Dual-magnet, dual-analog outputs with differential mode (AT tubular style)



harsh, real-world applications!



Tire Manufacturing Industry



- 100% scalable analog outputs for quick and easy setup: zero, span, and stroke length (Z rod style)
- Rapid Replacement Module for quick change out without breaking cylinder seal (Z rod style)
- Legacy connectors and patented magnet Autotuning for trouble-free retrofits (Z rod style)
- ProSet4 with four programmable setpoint outputs eliminates discrete switches (Z rod style)
- Captive (guided control rod) or floating magnet for versatile installation options (P profile style)
- Wide range of standard outputs to match a variety of controller interfaces (P profile style)

Lumber Industry

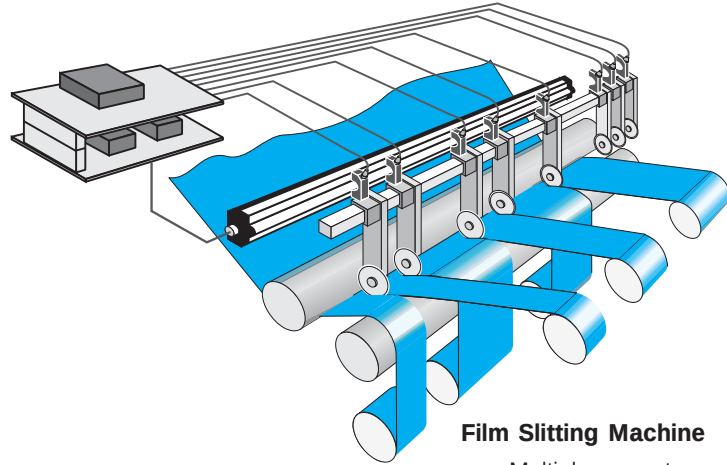


- High linearity to ± 0.001 " for precise cuts to increase yield (SSI interface)
- Synchronized position data for smoother high- and low-speed motion (SSI interface)
- Rapid Replacement Module for quick change out without breaking cylinder seal
- Legacy connectors and patented magnet Autotuning for trouble-free retrofits
- Simple DIP-switch setup of PWM recircs without special hardware or software

Applications:

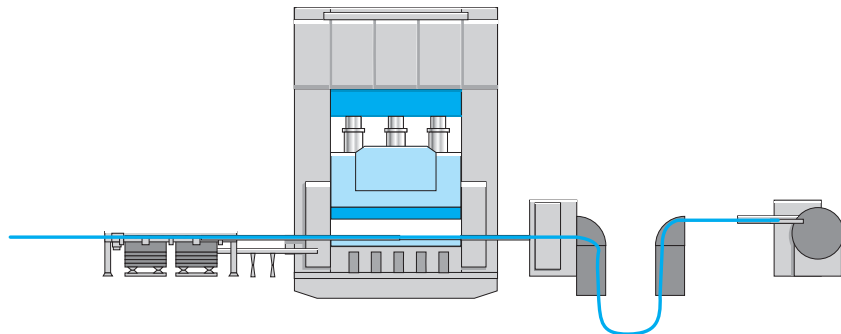
Balluff transducers offer features which assure reliable operation in many areas of automation and process technology under extreme conditions:

- Hydraulic cylinders
- Laminating presses
- Rolling mills
- Foundries
- Injection molding machines
- Liquid level monitoring
- Tunnel boring equipment
- Die casting machinery
- Woodworking machinery
- Flight simulators
- Cutting/slitting machinery
- Conveying
- Packaging machines
- Wire and cable
- Wind turbine pitch control
- Elevators
- Food processing
- Lumber
- Semiconductor
- Tire machinery
- Web processes
- Mobile equipment
- Dispensing equipment
- Dosing equipment
- Measurement



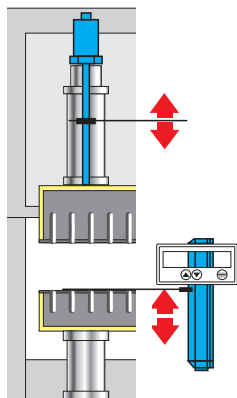
Film Slitting Machine

- Multiple magnets

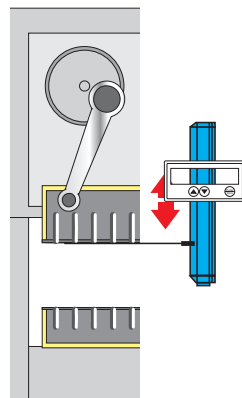


Hydraulic Press

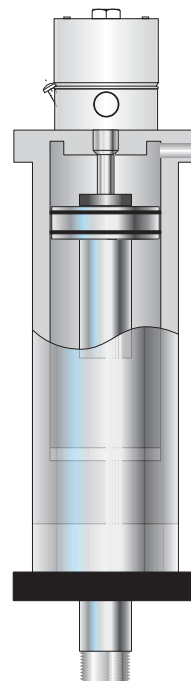
- Hydraulic cylinder
- Injection molding machine
- Tire press
- Veneer press or knife



Hydraulic Press



**Mechanical
Eccentric Press**



Cylinder



Balluff transducers are the rugged choice for use under extreme ambient conditions and over measuring distances between 25 mm (1") and 5080 mm (200").

Various output signal formats are available for integration into your specific control system.

In addition, digital-to-analog processor modules are available with a variety of programming functions, for flexible interfacing to your control system.

Features:

- Auto Tuning
- Non-contact
- Wear free
- IP 67 & IP 68
- Analog, Digital, SSI, Pulse, CANopen, Profibus, Quadrature, and DeviceNet

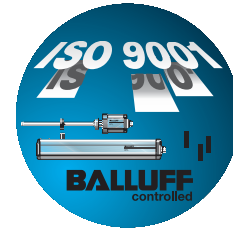
Obtaining accurate position feedback is a critical part of many automation processes. Without accurate, reliable measurement feedback, quality and production suffer. The Micropulse® line of linear transducers has been providing a high level of linear measurement for years.

Micropulse® transducers incorporate some of the most advanced features found in any magnetostrictive linear transducer.

Advantages:

Compared with traditional position feedback systems, Balluff transducers offer the following advantages:

- Insensitive to shock, vibration, temperature swings, contamination, ambient moisture and electrical noise
- Wear and maintenance free, thanks to non-contact principle of operation
- Absolute output signal, even after voltage interruption; no re-homing of the machine necessary
- High resolution repeatability and linearity
- Simple installation, marker element (magnet) needs no power
- IP 67 per DIN 40 050
- Pressure-rated to 8700 PSI, for internal hydraulic cylinder installation



The CE-Marking confirms that our products meet the requirements of the EC Directive 89/336/EEG (EMC Directive) and the EMC Law. Testing done in our EMC Laboratory, which is accredited by the DATech for Electromagnetic Compatibility Testing, Balluff products have been shown to meet the EMC requirements of the Generic Standard EN 50 081-2 (Emission) and EN 50 082-2 (Noise Immunity). See the corresponding user's manual for detailed information.

MICROPULSE®



Z Standard Rod Style

The Z style product line is one of the most versatile lines in the Micropulse® family. With a variety of electrical options, interfacing to your control system will never be a problem.

Built into the hydraulic cylinder, or mounted externally, the transducer provides continuous, absolute position feedback.

The Z housing offers a variety of outputs, replaceable electronics and the ability to adjust the analog signal in the field.

Applications:

Balluff transducers offer features which assure reliable operation in many areas of automation and process technology, even under extreme ambient conditions:

- Hydraulic cylinders
- Laminating presses
- Rolling mills
- Foundries
- Injection molding
- Liquid level monitoring
- Tunnel boring equipment
- Die casting machinery
- Woodworking machinery
- Flight simulators
- Cutting/slitting machinery
- Conveying
- Packaging machines
- Wire and cable machines
- Wind turbine pitch control
- Elevators
- Tire machinery
- Extruders



Features:

- Absolute, non-contact position feedback
- Highly accurate, super reliable, maintenance-free
- Heavy duty stainless steel pressure tube
- Rated to 8700 psi
- Optional Rapid Replacement Module
 - Plug and play field repair
 - Fluid circuit remains intact
 - Reduced downtime
- Wide variety of available outputs
 - Analog voltage or current
 - Digital START/STOP
 - Digital Pulse-Width-Modulated (PWM)
 - Synchronous Serial Interface (SSI)
 - CANopen
 - Profibus-DP
 - Quadrature

Wide selection of standard, legacy, and military style connectors available!

Drop-In Replacement of Competitor's Legacy Transducers

- Micropulse® transducers are available with a wide variety of special connector options, allowing drop-in replacement of competitors' products.
- Balluff patented autotuning electronics allows use of new and legacy Balluff magnets as well as many competitive magnets.
- Available Rapid Replacement Module allows quick repair without removing pressure tube from cylinder – so no oil spillage and no need to bleed air from hydraulic system after replacement.
- User-adjustable stroke on analog models for quick calibration.
- Easy DIP-switch setup for recirculations on PWM models – no programming hardware or software required.

RRM Rapid Replacement Module

(See page 22)

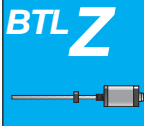


- 100% scalable output signal (analog versions)
- User-scalable using supplied programming tool
- Programming tool is removable to guard against tampering
- Three programming modes to suit any application requirement:

Teach-In – Used to set the “zero” and “end” values anywhere within the nominal factory stroke range

Adjust – Used to perform manual adjustment of output signal values

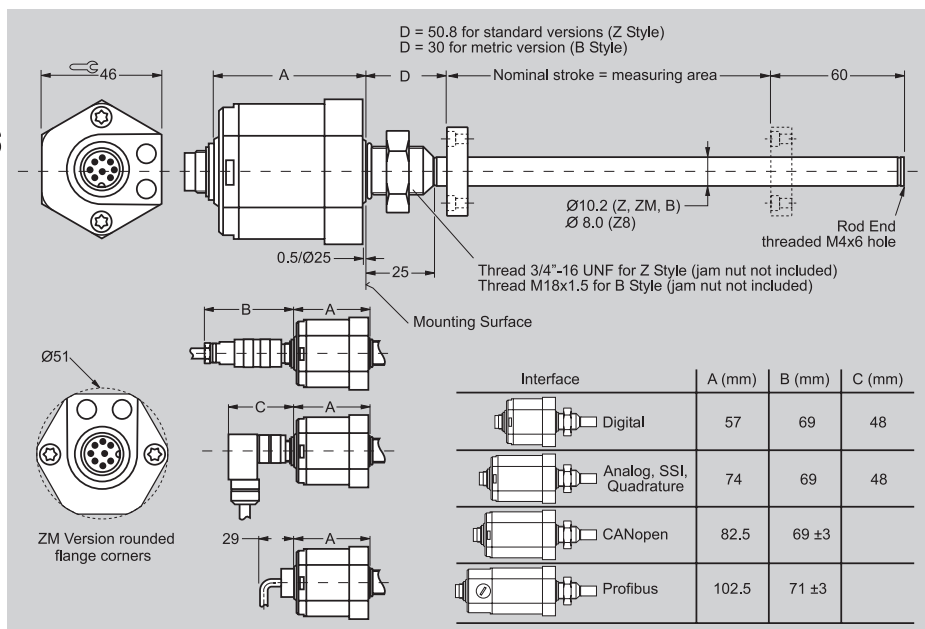
Online Adjust – Used to perform real-time adjustment of output signal without disrupting the control-loop



General Specifications	pg 16
Electrical Options	pgs 17-21
Rapid Replacement Module	pg 22
Accessories	pgs 23-24
Installation Guidelines	pg 25
Wiring Diagrams	pg 26
How to Order	pg 27

Series
Available Lengths
Output Signals

Z Style
25 mm (1 in) to 5080 mm (200 in)
Analog, Digital Pulse, SSI, CANopen, Profibus, Quadrature



Ordering Code

BTL5- -M- -Z- (See ordering code on page 27)

Measurement Type
Measurement Range
Shock Rating
Vibration Rating
Environmental Protection
Housing Material
Pressure Rating (rod)
Operating Temperature
Storage Temperature
Humidity
Connection Type
Noise Immunity
Approvals

Linear displacement
25 mm (1 in) to 5080 mm (200 in)
100 g/6 ms (100 g/2 ms continuous) per IEC 68 2-27
12 g, 10 to 2000 Hz per IEC 68-2-6
IP 67- with connector attached
Anodized aluminum body, stainless investment cast flange (DIN 1.3952), 316 stainless steel tube
600 bar (8700 PSI) max (10.2 mm Ø rod)
250 bar (3600 PSI) max (8 mm Ø rod)
-40 to + 185° F
-40 to + 212° F
< 90% non-condensing
connector or integral cable
ESD, RFI and BURST per IEC 1000-4-2/3/4/6, severity level 3
CE

Warning:

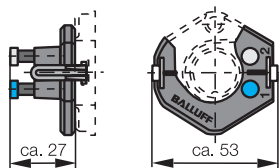
These products are not rated for personnel safety applications.

Accessories:

Magnets and Floats pg 23
Connectors pg 24
Jam nuts pg 24

For additional connectors, see pages 107-114

Calibration device BTL5 A-EH01



Supplied with analog versions

Autotuning Circuitry

Patented Autotuning circuitry in Balluff Micropulse® transducers automatically compensates for changes in the strength of the magnetostrictive return signal.

- Allows Micropulse rod-style transducers to be used in hydraulic cylinders that have both new and legacy Balluff magnets. Autotuning allows use of many legacy competitor's magnets as well.
- Automatically compensates for changes in temperature, providing a more stable signal over a wide temperature range.

Analog Stroke Adjustment

- Removeable magnetic push button tool
- No delicate trim pots
- Housing remains sealed



Micropulse Z Style

Electrical Options

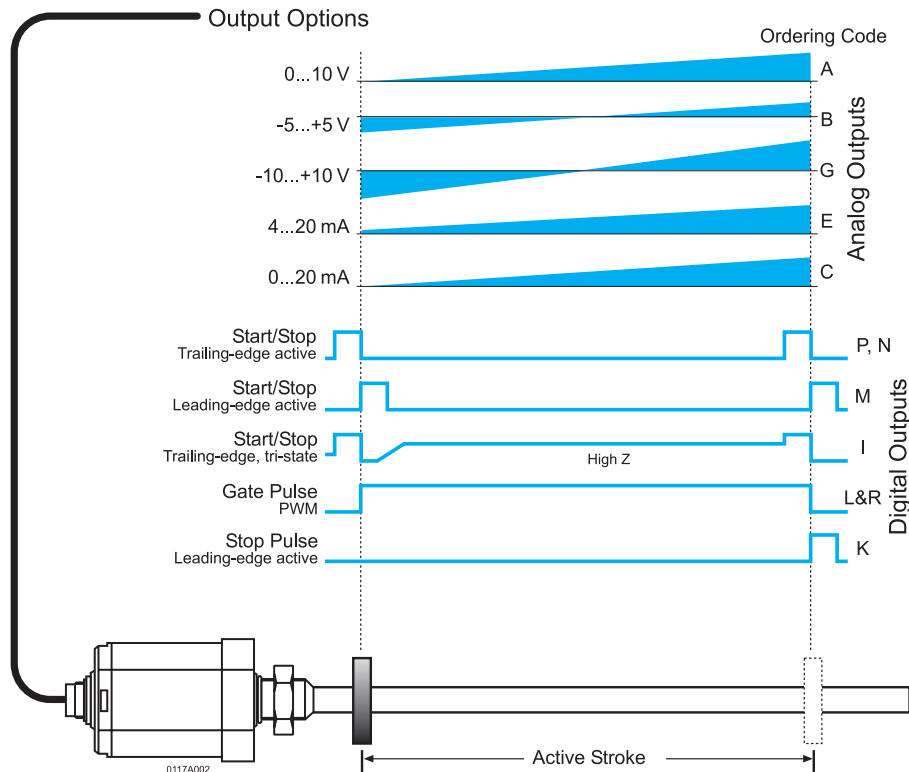
Electrical Interface	Analog	Analog	Digital
Electrical Type	Voltage	Current	Start/Stop PWM
Part No. Code (See pg. 27)	A, B, G	E, C	P, M, N, I, L, R, K
Output	0...+10 V, -5...+5 V, -10...+10 V	4...20 mA, 0...20 mA	Start/Stop or Pulse-width-modulated (RS422/RS485) per spec
Output Load	> 2K Ω (5 mA max)	$\leq 500 \Omega$	Controller dependent
Resolution	≤ 0.33 mV	$\leq 0.66 \mu\text{A}$	Controller dependent
Non-linearity	$\pm 100 \mu\text{m}$ to 500 mm stroke, ± 0.02 % over 500 mm stroke	$\pm 100 \mu\text{m}$ to 500 mm stroke, ± 0.02 % over 500 mm stroke	$\pm 100 \mu\text{m}$ to 500 mm stroke, ± 0.02 % over 500 mm stroke
Repeatability	Resolution/ min 2 μm	Resolution/ min 2 μm	Resolution/ min 2 μm
Hysteresis	$\leq 5 \mu\text{m}$	$\leq 5 \mu\text{m}$	$\leq 5 \mu\text{m}$
Sampling Rate	2 kHz	2 kHz	500 Hz stroke > 2000 mm 1 kHz stroke < 2000 mm
Temperature Coefficient*	$[150 \mu\text{V}/^\circ\text{C} + (5 \text{ ppm}/^\circ\text{C} \cdot \text{P} \cdot \text{V}/\text{NL})] \cdot \Delta\text{T}$	$[0.6 \mu\text{A}/^\circ\text{C} + (10 \text{ ppm}/^\circ\text{C} \cdot \text{P} \cdot \text{V}/\text{NL})] \cdot \Delta\text{T}$	$(6 \mu\text{m} + 5 \text{ ppm} \cdot \text{NL}) / ^\circ\text{C}$
Operating Voltage	24 Vdc $\pm 20\%$, 10...30 Vdc or 15 Vdc $\pm 2\%$	24 Vdc $\pm 20\%$, 10...30 Vdc or 15 Vdc $\pm 2\%$	24 Vdc $\pm 20\%$, 10...30 Vdc or 15 Vdc $\pm 2\%$
Operating Current	< 150 mA Nominal, @ 24 Vdc	< 150 mA Nominal, @ 24 Vdc	< 100 mA (at 1 kHz sampling rate)

Notes:

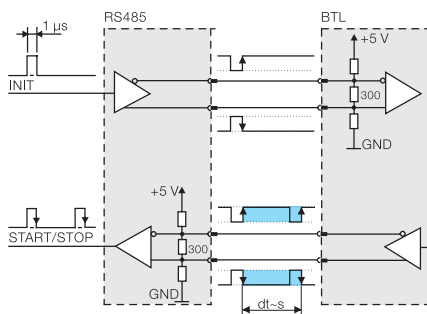
Analog voltage output versions incorporate both rising and falling outputs. Analog current version must be ordered as rising or falling outputs.

*Temperature coefficient variables:

V = output range in V
I = output range in [mA]
 ΔT = temperature change
P = magnet position
NL = stroke length



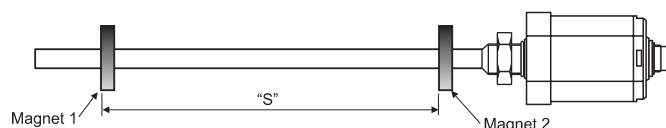
Analog and Digital Output Options for the Micropulse Z Style



RS-485 signal transmission with digital outputs

Two-Magnet Differential Mode

- Available on Analog and PWM
- Output proportional to distance "S"
- Add "-D" suffix to ordering code



CANopen

This interface provides an efficient connection to machines using CANopen. Features include:

- Process data objects incorporating position, velocity and set-point information
- Emergency object for set-points
- Service data objects for configuring transducer modes
- Synchronization objects for network wide activities

Profibus

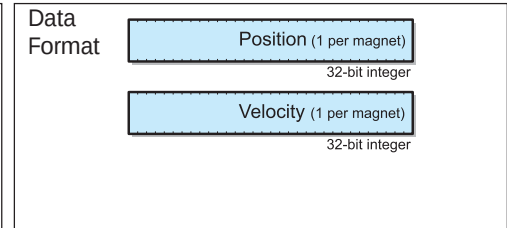
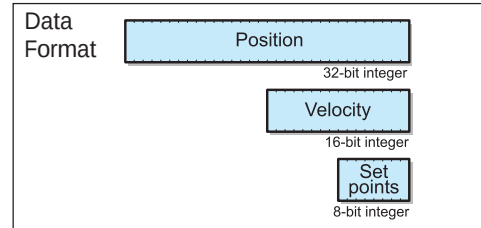
This interface provides an efficient connection to machines using Profibus. Features of this interface include:

- Single telegram message for fast updates even with 4 magnets
- Operates at 12 Mbps
- GSD file provided to configure telegram message
- Sync and Freeze functions available for coordination between other devices

Ordering Code	H	T
Resolution	Position 5 µm, Velocity 0.1 mm/s increments (selectable)	Position 5 µm (configurable) Velocity 0.1 mm/s increments (configurable)
Non-linearity	±30 µm at 5 µm resolution	±30 µm at 5 µm resolution
Repeatability (resolution + hysteresis)	±1 digit	±1 digit
Hysteresis	≤ 1 digit	≤ 1 digit
Sampling Rate	1 kHz	1 kHz
Temperature Coefficient	(6 µm + 5 ppm x L)/°C	(6 µm + 5 ppm x L)/°C
Operating Voltage	24 Vdc ±20%	24 Vdc ±20%
Operating Current	≤ 100 mA	≤ 100 mA
Network Isolation	yes	yes
Network Speed	10, 20, 50, 100, 125, 250, 500, 800, 1000 kBaud	9.6, 19.2, 93.7, 187.5, 900, 1500, 12000 kBaud
Network Compatibility	CiA Standard DS301, DS406 (Encoder Profile)	EN 50170 (Encoder Profile)
Address Selection	Software/DIP switch	DIP switch
Communication Types	Producer/Consumer	Master/Slave
Configuration Software	none required	GSD file
Number of Magnets Supported	1, 2 or 4	1, 2 or 4

Notes:

For more technical information, see pages 123-128



BTL5-H1 _ -Mxxxx-Z-S94

Process Data

- 1 = 1 x position & 1 x velocity
- 2 = 2 x position & 2 x velocity
- 3 = 4 x position

Baud Rate

- 0 = 1 MBaud
- 1 = 800 kBaud
- 2 = 500 kBaud
- 3 = 250 kBaud
- 4 = 125 kBaud
- 5 = 100 kBaud
- 6 = 50 kBaud
- 7 = 20 kBaud
- 8 = 10 kBaud

Stroke Length

xxxx = length in mm (see chart on page 27)
Max = 156" (3962 mm)

Connection Type¹

- S92 = one 5-pin (optional)
- S94 = two 5-pin M12 (standard)
 - Bus in: 5-pin male, M12
 - Mating connector: BKS-S92-00 (female)
 - Bus out: 5-pin female, M12
 - Mating connector: BKS-S94-00 (male)

BTL5-T1_0 -Mxxxx-Z-S103

No. of Magnets

- 1 = 1 magnet
- 2 = 2 magnets
- 3 = 4 magnets

Stroke Length

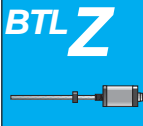
xxxx = length in mm
Max = 156" (3962 mm)
(see chart on page 27)

Connection Type²

- S103 = 3 connectors (standard):
 - Power: 3-pin male, M8
 - Mating connector: BKS-S48-15-CP-xx (female)
 - Bus in: 5-pin male, M12
 - Mating connector: BKS-S105-00 (female)
 - Bus out: 5-pin female, M12
 - Mating connector: BKS-S103-00 (male)

¹See pages 107-114 for mating cables/connectors.

²See pages 107-114 for mating cables/connectors.



SSI

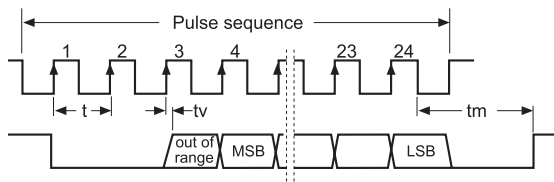
The SSI (synchronous serial interface) output interfaces with popular control systems from manufacturers such as Allen-Bradley, Delta Computer, Siemens, Parker, Bosch-Rexroth and many others. Cable spans can be up to 400 m with noise-free operation. Individual, EEPROM linearization of this interface makes it ideal for applications requiring the best accuracy available.

Ordering Code	S	S ___ B*
Resolution	5, 10, 20 or 40 μ m (see ordering code below)	5, 10, 20 or 40 μ m (see ordering code below)
Non-linearity – Non-synchronized	$\pm 30 \mu$ m or ± 2 LSBs, whichever is greater	$\pm 30 \mu$ m or ± 2 LSBs, whichever is greater
Repeatability (resolution + hysteresis)	± 1 digit	± 1 digit
Hysteresis	≤ 1 digit	≤ 1 digit
Sampling Rate	2 kHz	2 kHz
Temperature Coefficient	$(6 \mu\text{m} + 5 \text{ ppm} \times L)/^{\circ}\text{C}$	$(6 \mu\text{m} + 5 \text{ ppm} \times L)/^{\circ}\text{C}$
Communication Speeds	100, 200, 400, 500, 1000 kHz	100, 200, 400, 500, 1000 kHz
Output Modes	24 or 25 bits (binary or gray code)	24 or 25 bits (binary or gray code)
Operating Voltage	24 Vdc $\pm 20\%$ or 10...30 Vdc	24 Vdc $\pm 20\%$ or 10...30 Vdc
Operating Current	≤ 80 mA	≤ 80 mA
Output	Standard RS-485/422 levels	Standard RS-485/422 levels

Notes:

SSI Maximum cable lengths

Cable length	Clock Freq.
< 25 m	< 1000 kHz
< 50 m	< 500 kHz
< 100 m	< 400 kHz
< 200 m	< 200 kHz
< 400 m	< 100 kHz



*S ___ B Versions

The internal interrogation of the S ___ B version is synchronized to the externally supplied clock pulses. This configuration results in a more uniform, predictable data update rate, and is better-suited for highly dynamic closed-loop servo applications. Like the standard version, the S ___ B version is EEPROM linearized at the factory.

BTL5-S ___ -Mxxxx-Z- ___

Supply Voltage

- 1 = +24 V
- 5 = 10...30 V

Data Format

- 0 = Binary, increasing, 24 bit
- 1 = Gray code, increasing, 24 bit
- 2 = Binary, falling, 24 bit
- 3 = Gray code, falling, 24 bit
- 6 = Binary, increasing, 25 bit
- 7 = Gray code, increasing, 25 bit
- 8 = Binary, falling, 25 bit
- 9 = Gray code, falling, 25 bit

System Resolution

- 2 = 5 μ m
- 3 = 10 μ m
- 4 = 20 μ m
- 5 = 40 μ m
- 6 = 100 μ m
- 8 = 50 μ m

Synchronized Data

- B = synchronized*
- Blank = non-synchronized

Stroke Length

- xxxx = length in mm
- Max = 156" (3962 mm)
- (see chart on page 27)

Connection Type

- S 32 = 8-pin connector (standard)¹
- S140 = MS connector (optional)²
- KA02 = 2 m PUR cable
- KA05 = 5 m PUR cable
- KA10 = 10 m PUR cable
- KA15 = 15 m PUR cable

¹See page 24 for mating cables/connectors.

²See pages 107-114 for mating cables/connectors.

Quadrature

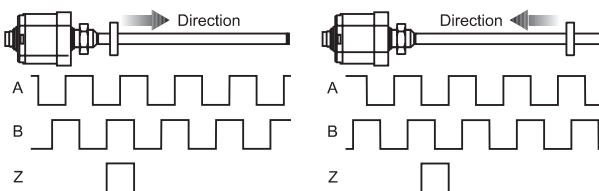
The quadrature output interfaces directly to standard encoder inputs (90° out of phase, A & B). This configuration gives you more interface options for connecting to motion based systems. In addition, the Micropulse quadrature output transducer has the ability to provide **absolute** position information through use of its innovative BURST function.

Ordering Code	Q
Resolution	1, 2, 5 10, 50 μ m, 0.001", 0.0001", 0.0005" (switch selectable)
Non-linearity	$\pm 100 \mu$ m to 500 mm stroke, $\pm 0.02\%$ over 500 mm stroke
Repeatability (resolution + hysteresis)	resolution + ($\pm 2 \times$ resolution or 5 μ m, whichever is greater)
Hysteresis	$\pm 2 \times$ resolution or 5 μ m, whichever is greater
Sampling Rate	Free-running: 1 ms, 2 ms, 4 ms; Synchronous: 500 μ s to 10 ms
Temperature Coefficient	(6 μ m + 5 ppm $\times$ L)/°C
Communication Speeds	10, 200, 400, 800 kHz
Output Modes	Free-running or Synchronous (switch selectable)
Operating Voltage	24 Vdc $\pm 20\%$, ± 15 Vdc $\pm 2\%$, 10...30 Vdc
Operating Current	≤ 80 mA
Output	Standard A & B (RS-422 level)

Notes:

SSI Maximum cable lengths

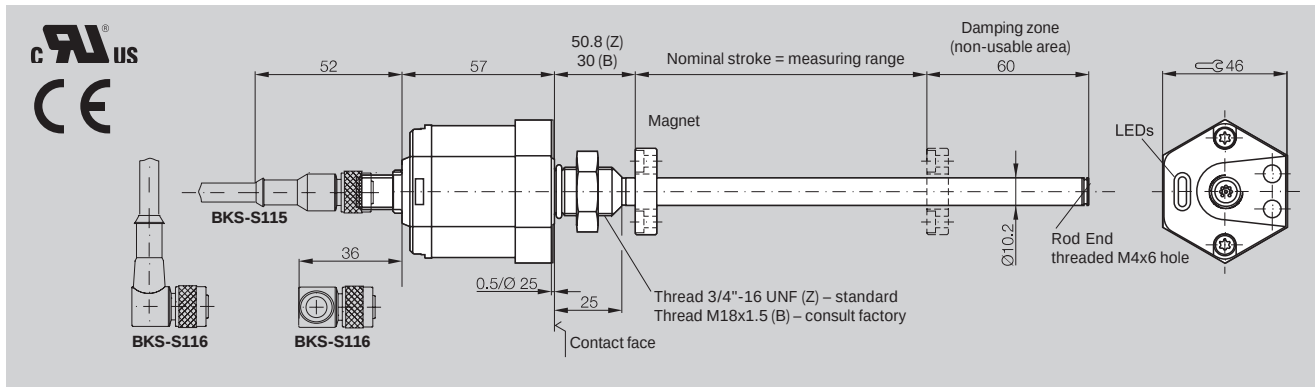
Cable length	Clock Freq.
< 25 m	< 1000 kHz
< 50 m	< 500 kHz
< 100 m	< 400 kHz
< 200 m	< 200 kHz
< 400 m	< 100 kHz

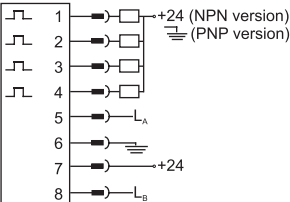


BTL5-Q	-Mxxxx-Z-S140
Supply Voltage	
1 = +24 V	
2 = ± 15 V	
5 = 10...30 V	
Quadrature Frequency	
0 = 833 kHz	
1 = 416 kHz	
2 = 208 kHz	
6 = 10 kHz	
System Resolution	
0 = 1 μ m	
1 = 2 μ m	
2 = 5 μ m	
3 = 10 μ m	
5 = 50 μ m	
6 = 0.0001"	
7 = 0.001"	
8 = 0.0005"	
Mode/Update Rate	
0 = Synchronous (initiated by controller— consult factory)	
1 = free-running, 1 ms update — ≤ 1250 mm stroke only	
2 = free-running, 2 ms update — 1251 mm to 2500 mm	
4 = free-running, 4 ms update — ≥ 2501 mm	
Stroke Length	
xxxx = length in mm	
(see chart on page 27)	
Connection Type	
S140 = MS connector ¹	
KA__ = Integral PVC cable (specify length in meters - 05 standard)	

¹See pages 107-114 for mating cables/connectors.

Series	Z Style
Transducer Interface Code	F
Input Interface	digital, programmable discrete setpoints



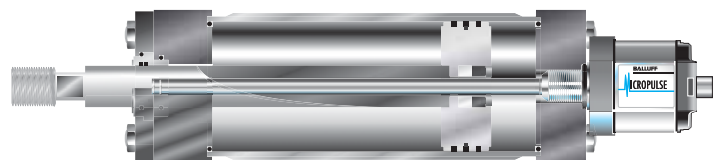
Ordering Code	NPN	BTL5 F100-M_ _ _ *-Z-S115																
	PNP	BTL5 F110-M_ _ _ *-Z-S115																
Output Signals		4 switching outputs																
Max. Current Load Per Output		100 mA																
Repeatability		±0.1 mm / ±0.004 inch																
Internal Sampling Frequency		f _{STANDARD} = 1 kHz = ≤ 1400 mm																
Operating Voltage		24 Vdc ±20 %																
No-load Current		≤ 100 mA																
Operating Temperature		-40 to +185 °F																
Storage Temperature		-40 to +212 °F																
Pin Assignments		<table><tr><td>Pin 1</td><td>switching output (open collector)</td></tr><tr><td>Pin 2</td><td>switching output (open collector)</td></tr><tr><td>Pin 3</td><td>switching output (open collector)</td></tr><tr><td>Pin 4</td><td>switching output (open collector)</td></tr><tr><td>Pin 5</td><td>L_A; programming input (low-active)</td></tr><tr><td>Pin 6</td><td>GND</td></tr><tr><td>Pin 7</td><td>+24 Vdc (10...30 V not available)</td></tr><tr><td>Pin 8</td><td>L_B; programming input (low-active)</td></tr></table>	Pin 1	switching output (open collector)	Pin 2	switching output (open collector)	Pin 3	switching output (open collector)	Pin 4	switching output (open collector)	Pin 5	L _A ; programming input (low-active)	Pin 6	GND	Pin 7	+24 Vdc (10...30 V not available)	Pin 8	L _B ; programming input (low-active)
Pin 1	switching output (open collector)																	
Pin 2	switching output (open collector)																	
Pin 3	switching output (open collector)																	
Pin 4	switching output (open collector)																	
Pin 5	L _A ; programming input (low-active)																	
Pin 6	GND																	
Pin 7	+24 Vdc (10...30 V not available)																	
Pin 8	L _B ; programming input (low-active)																	
Shock		100 g/6 ms per IEC 60068-2-27																
Vibration		12 g, 10...2000 Hz per IEC 60068-2-6																
Dielectric Strength		500 V (GND to housing)																
Enclosure Rating per IEC 60529		IP 67 (with IP 67 BKS-S... connector attached)																
Housing Material		Anodized Al/ 1.4571 (316) stainless steel rod, 1.3952 stainless investment cast flange																
Mounting		Thread 3/4"-16 UNF (Z) or M18×1.5 (B)																
Pressure Rating		600 bar (8700 psi) when installed in cylinder																
Connection Type		S115 8-pole M12 DC Micro connector																
Stroke Lengths		2" (51 mm)...200" (5080 mm)																

* See page 27 for standard lengths.

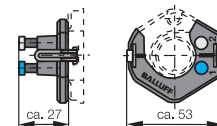
Advantages

- Four setpoints detect cylinder end-of-stroke or anywhere in between
- Interfaces to discrete I/O instead of more costly analog inputs
- Upgrade from end-of-stroke sensors
- Eliminate multiple external proximity sensors, brackets, targets, cables, and connection blocks
- Eliminate motion controller: run speed/position ramping profiles with direct-input proportional valve
- Installs just like a traditional MDT in probe-ready steel-walled cylinders
- Auto-Tuning™ circuitry allows use of Balluff or competitors' magnets
- Two easy programming options: local, with handy programming tool; or remote, using teach-in connections

4 Switching Outputs x 4 Switching Modes



**Programming Tool
BTL5-A-EH02
for teaching setpoints
(included)**



Rapid Replacement Module Option

Balluff's new Rapid Replacement Module (RRM) option allows quick field replacement without removing the pressure tube from the cylinder, making change-outs easy and cutting equipment downtime.

Advantages of the RRM include:

- No hydraulic oil spillage and no need for environmental containment
- No danger from hot oil spilling onto repair personnel
- No need to bleed air from hydraulic system after replacement
- No danger of dirt entering open hydraulic port
- 100% exchange of sensor package eliminates guesswork
- Dimensionally identical to standard Balluff Z style for equivalent output type
- Backward-compatible with existing standard Balluff Z style pressure tubes*
- Available for all output types except Profibus, CANopen, and ProSet4

The RRM can be installed in your maintenance program in a variety of ways:

- For new installations, you can order optional ZM construction, which includes a Balluff pressure tube along with a RRM pre-installed. To change out this type, you simply remove two housing screws, replace the RRM, re-tighten the two housing screws – and you're done.
- For new installations, you can also order standard Z construction, which includes a complete standard transducer. You can still do field swaps on this type by removing the standard electronics head and internal waveguide element as two separate components, then replacing both with a single RRM unit.
- If you already have an installed base of standard Balluff Z transducers, you can also change them out quickly with the RRM as described above. The RRM easily retrofits into existing Balluff pressure tubes once the old electronics and waveguide element have been removed.*
- Keep spare RRM units on hand to maintain any Balluff ZM or Z construction transducer.

* Synchronized SSI RRM is not backward-compatible to standard pressure tubes used on non-synchronized SSI units. Synchronized SSI RRM only fits pressure tube supplied with complete synchronized SSI units.

Ordering Example – Complete Transducer Unit with RRM + Pressure Tube

BTL5-xxx-Mxxxx-ZM-xxx

Add "M" after "Z" _____

Ordering Example – Rapid Replacement Module Only

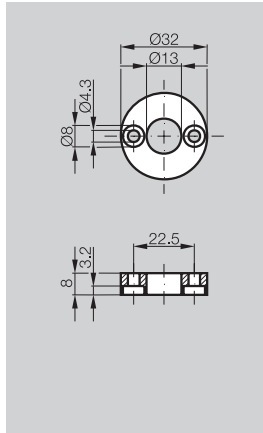
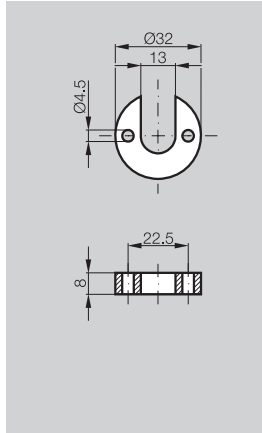
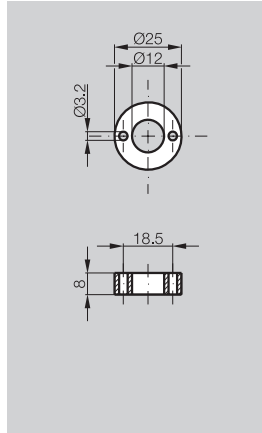
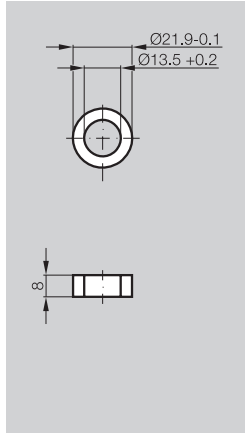
BTL5-xxx-Mxxxx-ZM-xxx/RU

Add "M" after "Z" _____

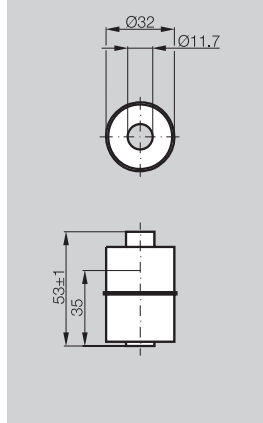
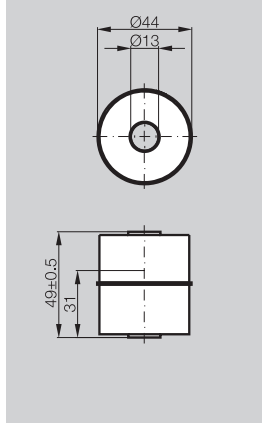
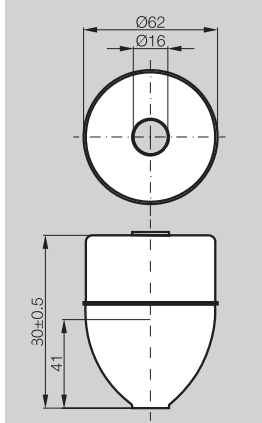
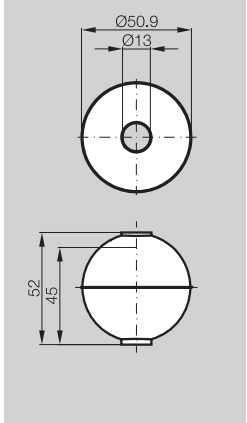
Add "/RU" at end of ordering code _____

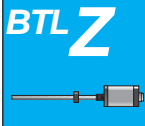
See page 27 for complete ordering code.

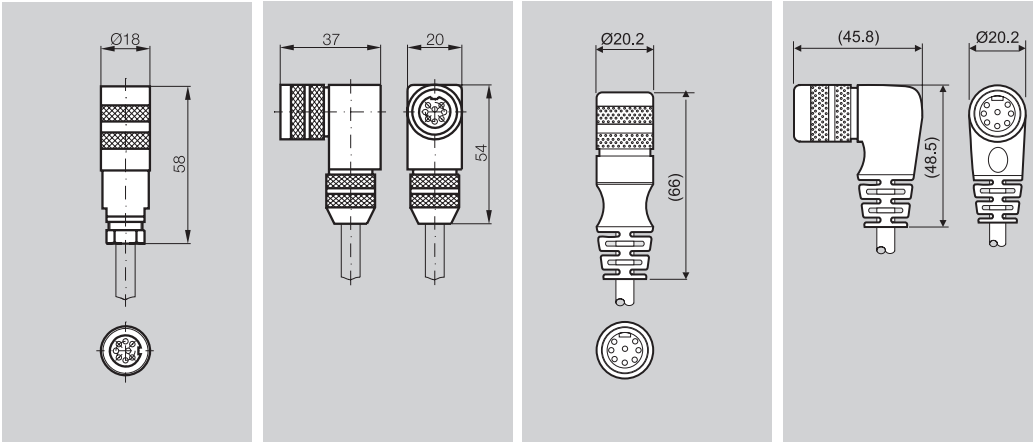


Product Type	Magnet, Spacer Ø32 ring	Magnet, Spacer Ø32 open ring	Magnet, Spacer Ø25 ring	Magnet Ø22 ring
				
	Ordering Code - Magnet	Ordering Code - Magnet	Ordering Code - Magnet	Ordering Code - Magnet
	Ordering Code - Spacer	Ordering Code - Spacer	Ordering Code - Spacer	Ordering Code - Spacer
	Material	Material	Material	Material
	Weight	Weight	Weight	Weight
	Magnet Speed	Magnet Speed	Magnet Speed	Magnet Speed
	Operating/Storage Temperature	Operating/Storage Temperature	Operating/Storage Temperature	Operating/Storage Temperature
	BTL-P-1013-4R*	BTL-P-1013-4S*	BTL-P-1012-4R*	BTL-P-1014-2R
	BTL Z-P-1013-4R-SPACER	SPACER BTL-P-1013-DS	BTL Z-2-1012-4R-SPACER	N/A
	AL	AL	AL	AL
	12 g	12 g	12 g	10 g
	any	any	any	any
	-40...+100°C	-40...+100°C	-40...+100°C	-40...+100°C

*Spacer is included with these magnets

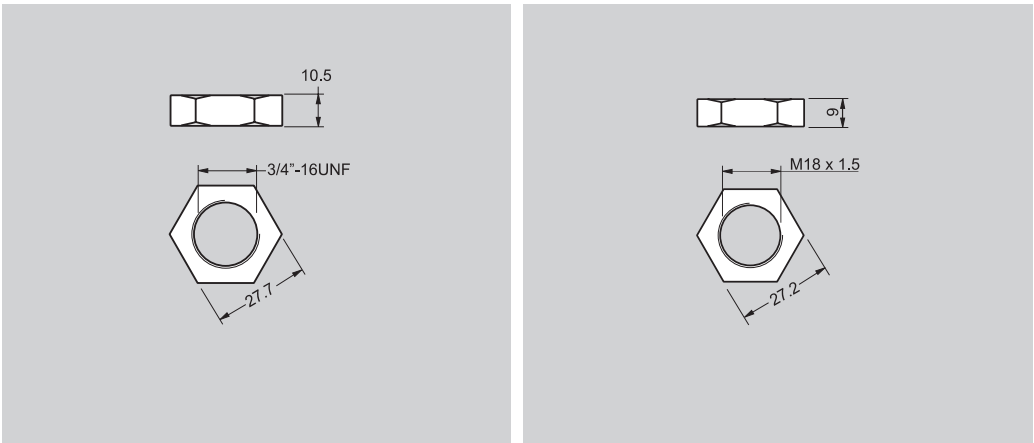
Product Type	Magnet Barrel float	Magnet Barrel float	Magnet Bullet float	Magnet Sphere float
				
	Ordering Code	Ordering Code	Ordering Code	Ordering Code
	Material	Material	Material	Material
	Weight	Weight	Weight	Weight
	Operating/Storage Temperature	Operating/Storage Temperature	Operating/Storage Temperature	Operating/Storage Temperature
	Water Displacement	Water Displacement	Water Displacement	Water Displacement
	Pressure (static)	Pressure (static)	Pressure (static)	Pressure (static)
	BTL2-S-3212-4Z	BTL2-S-4414-4Z	BTL2-S-6216-8P	BTL2-S-5113-4K
	Stainless 316	Stainless 316	Stainless 316	Stainless 316
	20 g	35 g	66 g	34 g
	-40...+120°C	-40...+120°C	-40...+120°C	-40...+120°C
	35 mm	30 mm	41 mm	26 mm
	24 bar (348 psi)	20 bar (290 psi)	15 bar (217 psi)	40 bar (580 psi)



Product				
Type	Straight Connector 8-pin female	Right-angle Connector 8-pin female	Molded Straight Connector 8-pin female	Molded Right-angle Connector 8-pin female
				
	Ordering Code	BKS-S 32M-_*	BKS-S 33M-_*	BKS-S 232-PU-_*
	Material	CuZn, nickel plated	CuZn, nickel plated	CuZn, nickel plated
	Contact Surface	0.8 µm Au	0.8 µm Au	0.8 µm Au
	Solder Connection	00 option only	00 option only	N/A
	Cable	7 x 0.25 mm ² /AWG 24	7 x 0.25 mm ² /AWG 24	7 x 0.25 mm ² /AWG 24
	Cable Diameter	6.35 mm ± 0.35 mm	6.35 mm ± 0.35 mm	6.35 mm ± 0.35 mm
	Allowable Cable Diameter	6...8 mm	6...8 mm	N/A
	Cable Material	PUR	PUR	PUR
	Environmental Rating	IP 67 (when installed)	IP 67 (when installed)	IP 67 (when installed)

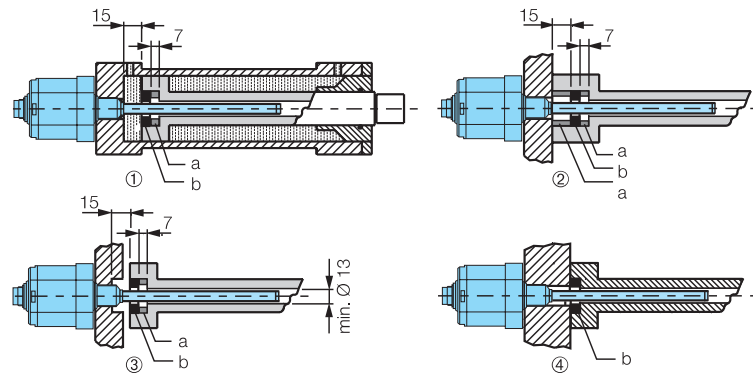
For additional connectors,
see pages 107-114

* Indicate cable length in ordering code in meters
(consult factory for longer lengths)
00 = connector only (only available for BKS-S 32M and BKS-S 33M)
02 = 2 meter cable
05 = 5 meter cable

Product		
Type	Jam nut 3/4"-16 UNF	Jam nut M18 x 1.5
Note: Jam nut not needed for in-cylinder applications		
	Ordering Code	BTL-5-JAM-NUT
Application	Z housing	B/H housing
Material	Stainless steel	Stainless steel

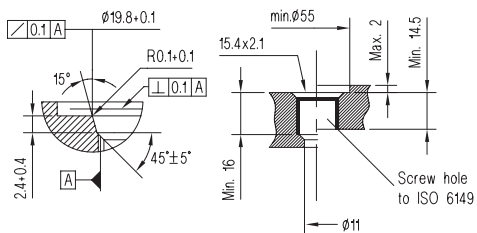
Installation

The BTL Micropulse transducer is provided with a 3/4" x 16-UNF (optional M18 x 1.5) mounting thread. We recommend mounting into non-magnetizable materials. If magnetizable materials are used, the installation must be carried out as shown in the drawing below. Sealing is at the flange mounting surface, using the supplied O-ring.

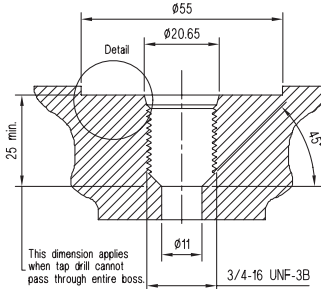
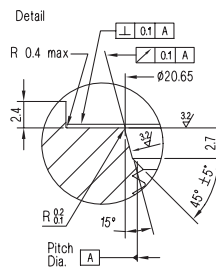


- ①②③ For magnetizable material
④ For non-magnetizable material
a Spacer made of non-magnetizable material
b Magnet

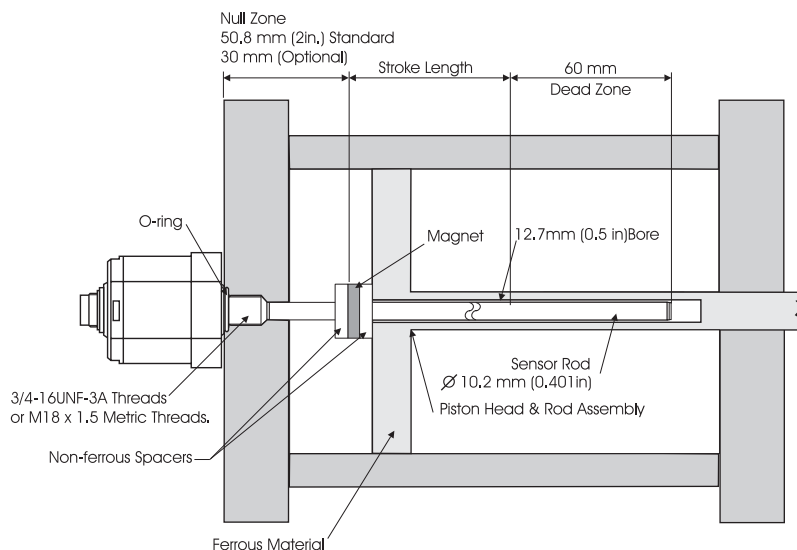
B Style Housing



Z, Z8, ZM Style Housing

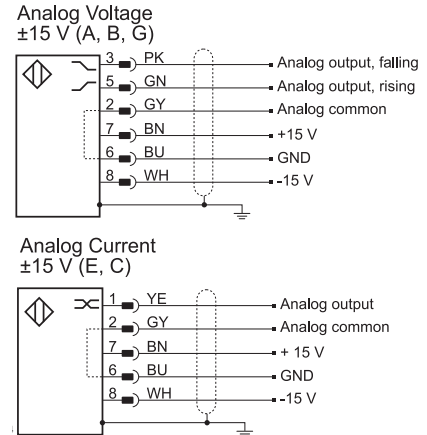
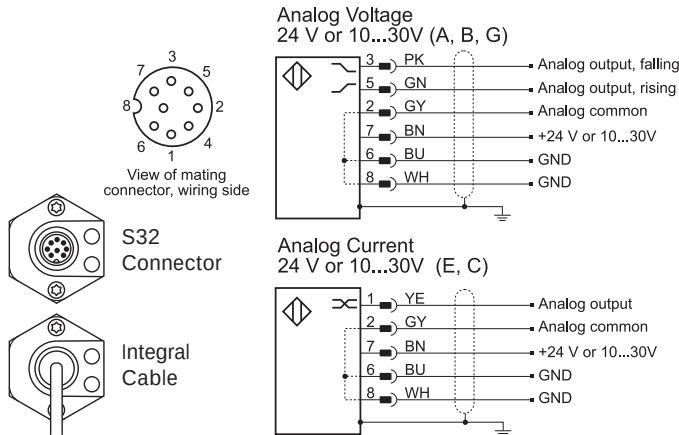


- Notes:
1 Threads machined per ANSI/ASME B1.1
2 The threads should be machined to meet the strength requirements of the material.
3 The port is similar to SAE J1926/1 port hole #8 with dimensional changes.

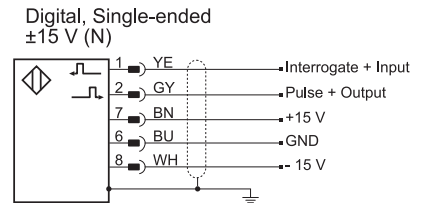
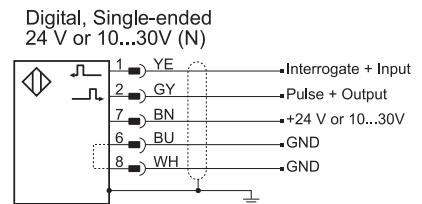
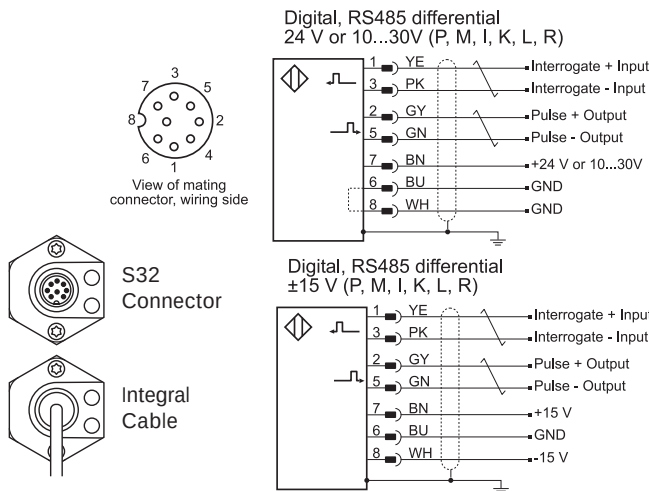


Typical Installation in Hydraulic Cylinder

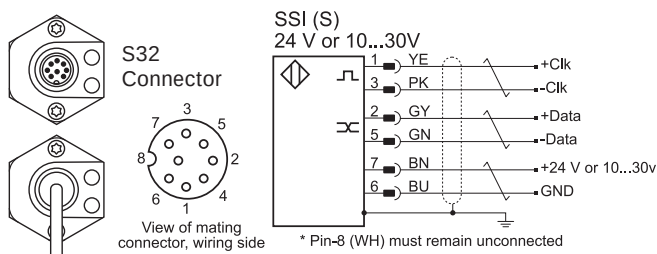
Analog Wiring Diagrams



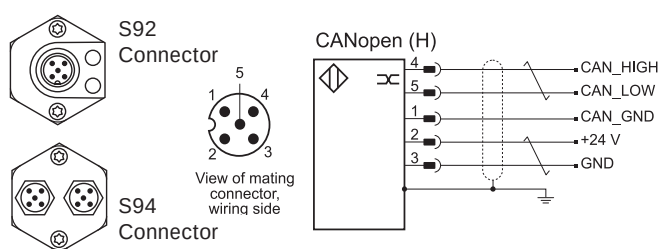
Digital Wiring Diagrams



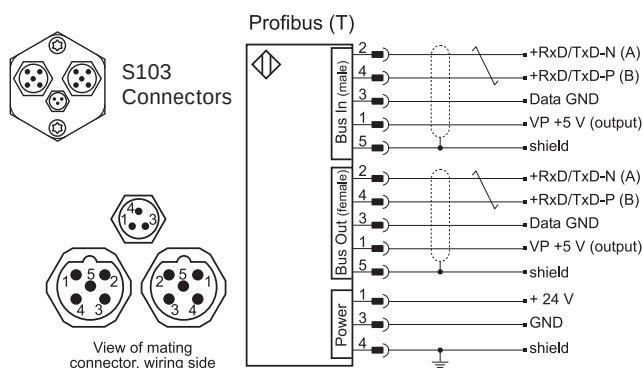
SSI Wiring Diagram



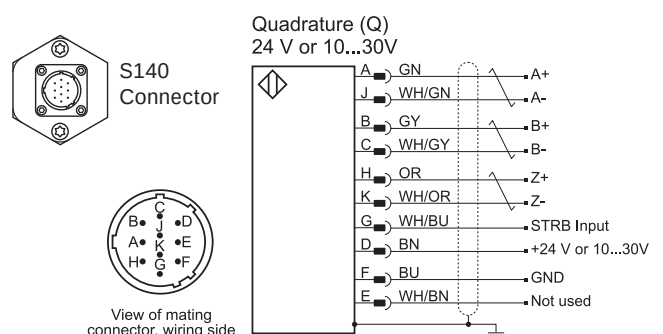
CANopen Wiring Diagram



Profibus Wiring Diagram



Quadrature Wiring Diagram



Note: ↗ = twisted-pair



B T L 5 - A 1 1 - M 0 3 0 5 - Z - S 3 2 - E 4 / U S

K A 0 5

Balluff

Linear Transducer

Generation 5

Output Type

A = 0 to 10 Vdc Q = Quadrature*
B = -5 to +5 Vdc I = Differential start/stop with tri-state
C = 0 to 20 mA K = Differential stop - leading edge active
E = 4 to 20 mA L = Differential pulse - width modulated
F = Setpoint* M = Differential start/stop - leading edge active
G = -10 to +10 Vdc N = Single ended start/stop - leading edge (add/US)
S = SSI* P = Differential start/stop - trailing edge active
T = Profibus* R = Differential pulse-width - recirculated
H = CANopen*

Supply Voltage

1 = 24 Vdc ±20%
2 = ±15 Vdc ±2% (Not available for S, T, H or F output types)
5 = 10...30 Vdc (Not available for T & H output types; not available for SSI "B")

**Analog Output Operation
(blank for digital)**

Voltage output (Output type A, B & G)
1 = User selectable rising or falling

Current output (Output type C & E)
0 = Minimum output at connector end (rising towards opposite end)
7 = Maximum output at connector end (falling towards opposite end)

Stroke Length

0 3 0 5 = active stroke length (in mm)

Housing Type

Z = Standard Rod Style (3/4"x16-UNF mounting threads and 50.8 mm null zone) 10.2 mm dia. pressure tube
Z8 = Z Rod 8.0 mm dia. pressure tube (1016 mm max. length, 3600 psi max. pressure)
ZM = Rapid Replacement Module version of standard Z rod style. Rounded flange corners for clearance in hydraulic cylinder protective caps.
B = Metric Rod Style (M18x1.5 mounting threads and 30 mm null zone) 10.2 mm dia. pressure tube
B8 = Metric B Rod Style 8.0 mm dia. pressure tube (1016 mm max. length, 3600 psi max. pressure)
BM = Rapid Replacement Module version of B metric rod style. Includes rounded flange corners.

Connection Type

S 3 2 = 8-pin quick disconnect metal (standard) connector (see page 24 for mating cable)
K A 0 5 = Cable out (5 m standard; specify length in meters)
S 1 4 0 = MS connector (optional) (see pages 107-114 for mating cable)
(For additional connector options, refer to pages 107-114 in the connector options section)

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

I = Internal interrogation, E = External interrogation

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

1=1 circulation, 2 = 2 circulations, 3 = 3 circulations, 4 = 4 circulations, 6 = 6 circulations,
8 = 8 circulations, 10 = 10 circulations, 16 = 16 circulations

N output only

/US = TTL - single ended Start/Stop - leading edge (US Standard)

Blank = TTL - single ended Start only - leading edge (European Standard)

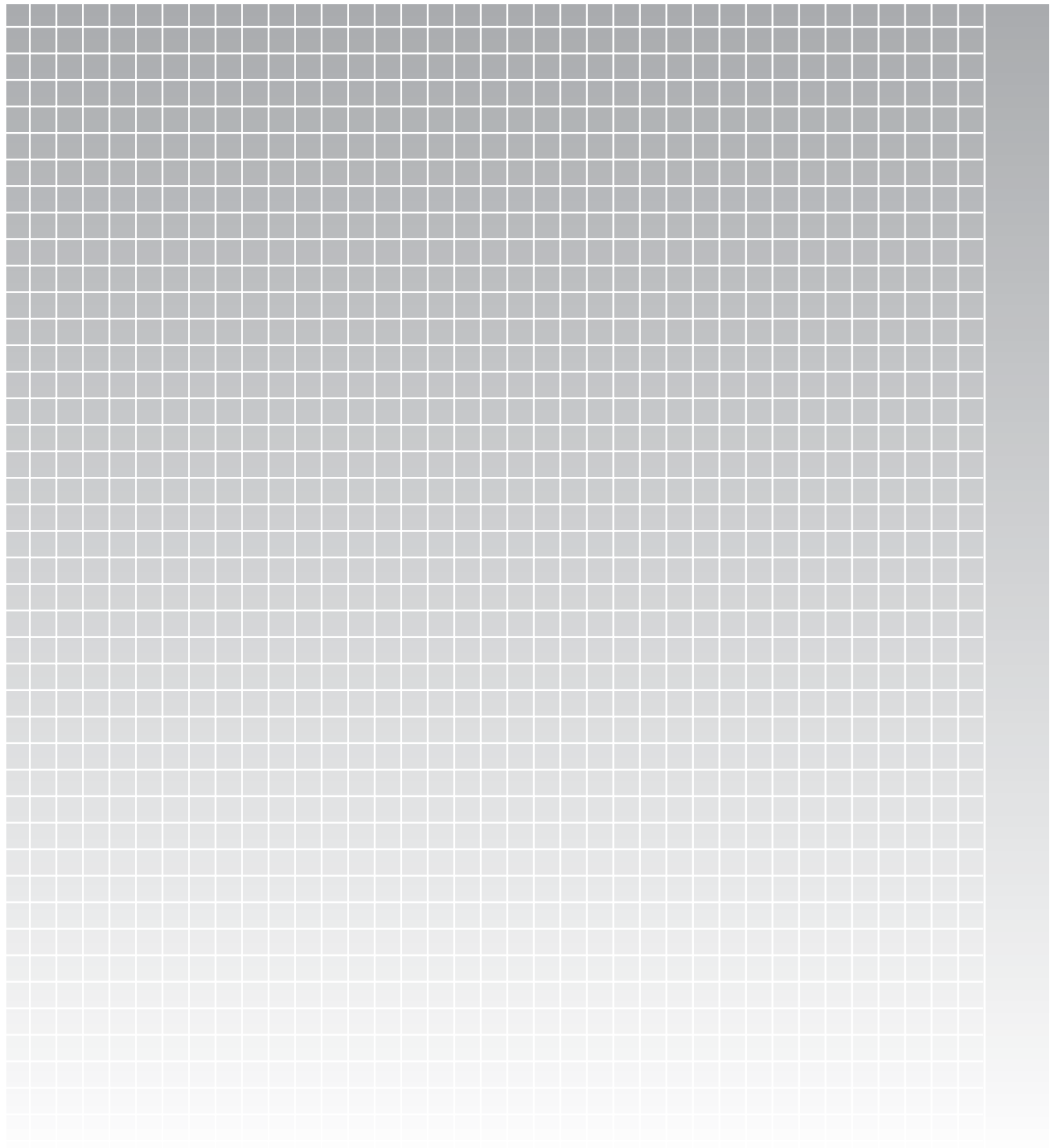
*See additional ordering information on pages 18-21.

Standard Stroke Lengths, Inches (mm) (consult factory for additional lengths)

1 (0025)	9 (0230)	22 (0560)	48 (1220)	89 (2261)	156 ^A (3962)	192 (4877)
2 (0051)	10 (0254)	24 (0610)	50 (1270)	98 (2490)	160 (4064)	196 (4978)
3 (0076)	11 (0280)	26 (0661)	54 (1372)	108 (2743)	164 (4166)	200 (5080)
3.5 (0090)	12 (0305)	28 (0711)	60 (1524)	118 (2997)	168 (4267)	
4 (0102)	13 (0330)	30 (0762)	66 (1676)	126 (3200)	172 (4369)	
5 (0127)	15 (0381)	32 (0813)	69 (1753)	140 (3556)	176 (4470)	
6 (0152)	16 (0407)	36 (0914)	72 (1829)	144 (3658)	180 ^B (4572)	
7 (0178)	18 (0457)	40 (1016)	78 (1981)	148 (3759)	184 (4674)	
8 (0203)	20 (0508)	42 (1067)	84 (2134)	152 (3861)	188 (4775)	

^A Maximum length for SSI, Profibus, CANopen = 156 inches.

^B Maximum length for analog outputs = 180 inches.



Compact Rugged Rod Style Thread-In

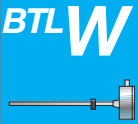
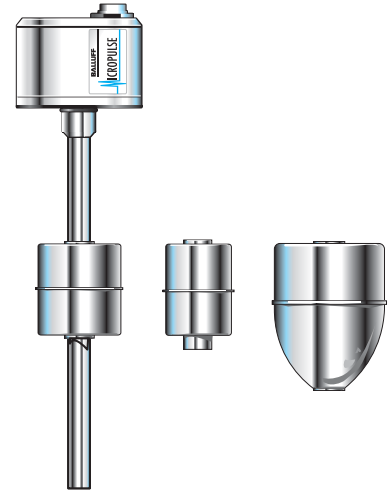
Compact, rugged, and built to last, the all stainless steel "W" housing can withstand the rigors of harsh, real-world applications. With its compact size and "built like a tank" ruggedness, the "W" housing is the logical choice for demanding applications.

Applications:

- Hydraulic cylinder
- Primary wood (lumber)
- Valve control
- Food processing
- Waste water plants
- Pulp and paper
- Gate position
- Hydro/Civil engineering

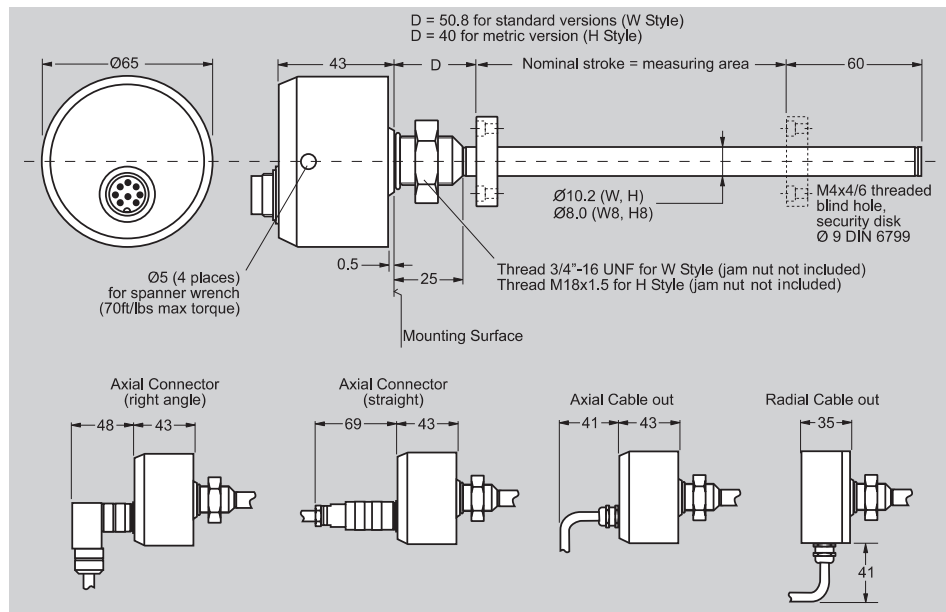
Features:

- Rugged all stainless steel housing
- Designed for demanding applications
- Eliminates need for protective covers
- Pressure rated 8700 psi
- 3/4"x16- UNF threads (W housing)
- Metric M18 thread version available (H housing)
- Outputs
 - Analog (voltage or current)
 - Digital start/stop
 - Pulse width Modulation (PWM)
 - PWM with recirculations
 - SSI
- Stroke length – 1" to 200"
- Quick disconnect or integral cable



General Specifications	pg 30
Electrical Options	pgs 31-32
Accessories	pgs 33-34
Installation Guidelines	pg 35
Wiring Diagrams	pg 36
How to Order	pg 37

Series	W Style
Available Lengths	25 mm (1 in) to 5080 mm (200 in)
Output Signals	Analog, Digital Pulse, SSI



Ordering Code	BTL 5- -M- -W- - - - (See ordering code on page 37)
Measurement Type	Linear displacement
Measurement Range	25 mm (1 in) to 5080 mm (200 in)
Shock Rating	100 g/6 ms (100 g/2 ms continuous) per IEC 68 2-27
Vibration Rating	12 g, 10 to 2000 Hz per IEC 68-2-6
Environmental Protection	Connector versions: IP 67 Integral cable versions: IP 68
Housing Material	316 stainless steel
Rod & Flange Material	Tube: 316T stainless, flange: 316L
Pressure Rating (rod)	600 bar (8700 PSI) max (10.2 mm Ø Pressure Tube) 250 (3600 PSI) max (8 mm Ø Pressure Tube)
Operating Temperature	-40 to + 185° F
Storage Temperature	-40 to + 212° F
Humidity	< 90% non-condensing
Connection Type	connector or integral cable
Noise Immunity	ESD, RFI and BURST per IEC 1000-4-2/3/4/6, severity level 3
Approvals	CE

Warning:

These products are not rated for personnel safety applications.

Accessories:

Magnets and Floats pg 33
Connectors pg 34

For additional connectors,
see pages 107-114

Autotuning Circuitry

Patented Autotuning circuitry in Balluff Micropulse® transducers automatically compensates for changes in the strength of the magnetostrictive return signal.

- Allows Micropulse rod-style transducers to be used in hydraulic cylinders that have both new and legacy Balluff magnets. Autotuning allows use of many legacy competitor's magnets as well.
- Automatically compensates for changes in temperature, providing a more stable signal over a wide temperature range.

Electrical Interface	Analog	Analog	Digital
Electrical Type	Voltage	Current	Start/Stop, PWM
Part No. Code (See Pg. 37)	A, B, G	E, C	P, M, N, I, L, R, K
Output	0...+10 V, -5...+5 V, -10...+10 V	4...20 mA, 0...20 mA	Start/Stop or Pulse-width-modulated (RS422/RS485)
Output Load	> 2K Ω (5 mA max)	$\leq 500 \Omega$	per spec
Resolution	≤ 0.1 mV	$\leq 0.2 \mu\text{A}$	Controller dependent
Non-linearity	$\pm 100 \mu\text{m}$ to 500 mm stroke, ± 0.02 % over 500 mm stroke	$\pm 100 \mu\text{m}$ to 500 mm stroke, ± 0.02 % over 500 mm stroke	$\pm 100 \mu\text{m}$ to 500 mm stroke, ± 0.02 % over 500 mm stroke
Repeatability	Resolution/ min 2 μm	Resolution/ min 2 μm	Resolution/ min 2 μm
Hysteresis	4 μm	4 μm	4 μm
Sampling Rate	500 Hz stroke > 2000 mm 1 kHz stroke < 2000 mm	500 Hz stroke > 2000 mm 1 kHz stroke < 2000 mm	500 Hz stroke > 2000 mm 1 kHz stroke < 2000 mm
Temperature Coefficient*	$[150 \mu\text{V}/^\circ\text{C} + (5 \text{ ppm}/^\circ\text{C} \cdot \text{P} \cdot \text{V}/\text{NL})] \cdot \Delta\text{T}$	$[0.6 \mu\text{A}/^\circ\text{C} + (10 \text{ ppm}/^\circ\text{C} \cdot \text{P} \cdot \text{V}/\text{NL})] \cdot \Delta\text{T}$	$(6 \mu\text{m} + 5 \text{ ppm} \cdot \text{NL}) / ^\circ\text{C}$
Operating Voltage	24 Vdc $\pm 20\%$ or 10...30 Vdc	24 Vdc $\pm 20\%$ or 10...30 Vdc	24 Vdc $\pm 20\%$ or 10...30 Vdc
Operating Current	< 150 mA Nominal, @ 24 Vdc	< 150 mA Nominal, @ 24 Vdc	< 150 mA Nominal, @ 24 Vdc

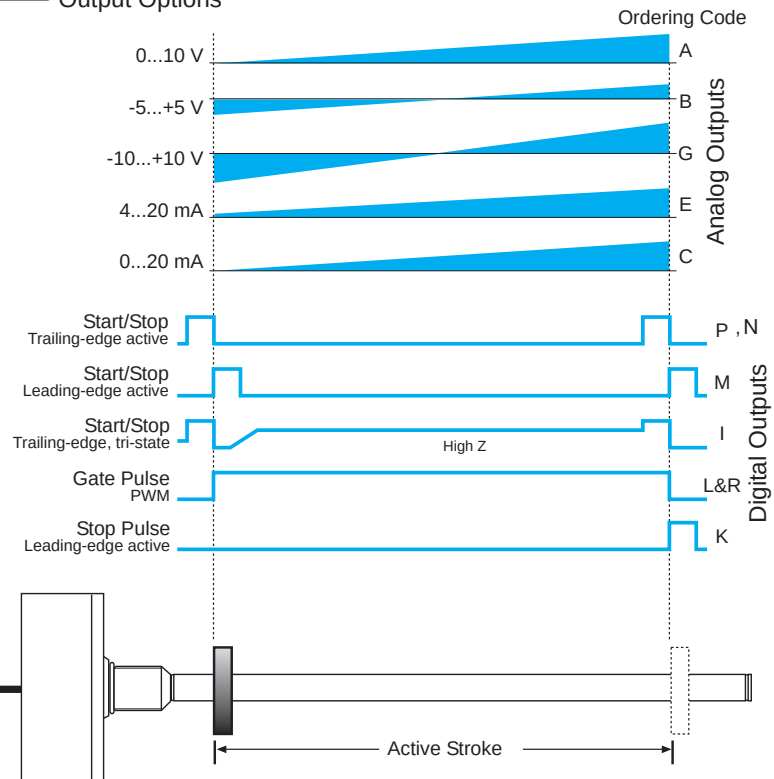
Notes:

Analog voltage output versions incorporate both rising and falling outputs.
Analog current version must be ordered as rising or falling outputs.

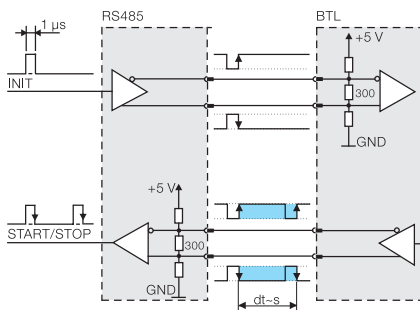
*Temperature coefficient variables:

V = output range in V
I = output range in [mA]
 ΔT = temperature change
P = magnet position
NL = stroke length

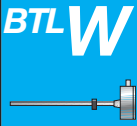
Output Options



Analog and Digital Output Options for the Micropulse W Style



RS-485 signal transmission with digital outputs





SSI

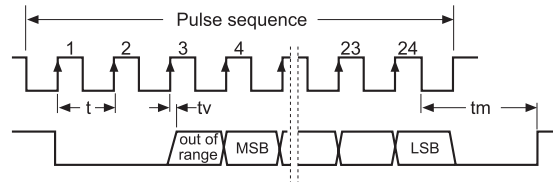
The SSI (synchronous serial interface) output interfaces with popular control systems from manufacturers such as Allen-Bradley, Siemens, Parker and many others. Cable spans can be up to 400 m with noise free operation. Individual EEPROM linearization of this interface makes it ideal for applications requiring the best accuracy available.

Ordering Code	S
Resolution	5, 10, 20 or 40 μm
Non-linearity	$\pm 30 \mu\text{m}$ or $\pm 2\text{LSBs}$, whichever is greater
Repeatability (resolution + hysteresis)	± 1 digit
Hysteresis	≤ 1 digit
Sampling Rate	500 μs
Temperature Coefficient	$(6 \mu\text{m} + 5 \text{ ppm} \times \text{L})/^{\circ}\text{C}$
Communication Speeds	100, 200, 400, 500, 1000 kHz
Output Modes	24 or 25 bits, binary or gray code
Operating Voltage	24 Vdc $\pm 20\%$
Operating Current	$\leq 80 \text{ mA}$
Output	Standard RS-485/422 levels

Notes:

SSI Maximum cable lengths

Cable length	Clock Freq.
< 25 m	< 1000 kHz
< 50 m	< 500 kHz
< 100 m	< 400 kHz
< 200 m	< 200 kHz
< 400 m	< 100 kHz



BTL5-S1 -Mxxxx-W-

Data Format

- 0 = Binary, increasing, 24 bit
- 1 = Gray code, increasing, 24 bit
- 2 = Binary, falling, 24 bit
- 3 = Gray code, falling, 24 bit
- 6 = Binary, increasing, 25 bit
- 7 = Gray code, increasing, 25 bit
- 8 = Binary, falling, 25 bit
- 9 = Gray code, falling, 25 bit

System Resolution

- 2 = 5 μm
- 3 = 10 μm
- 4 = 20 μm
- 5 = 40 μm
- 6 = 100 μm
- 8 = 50 μm

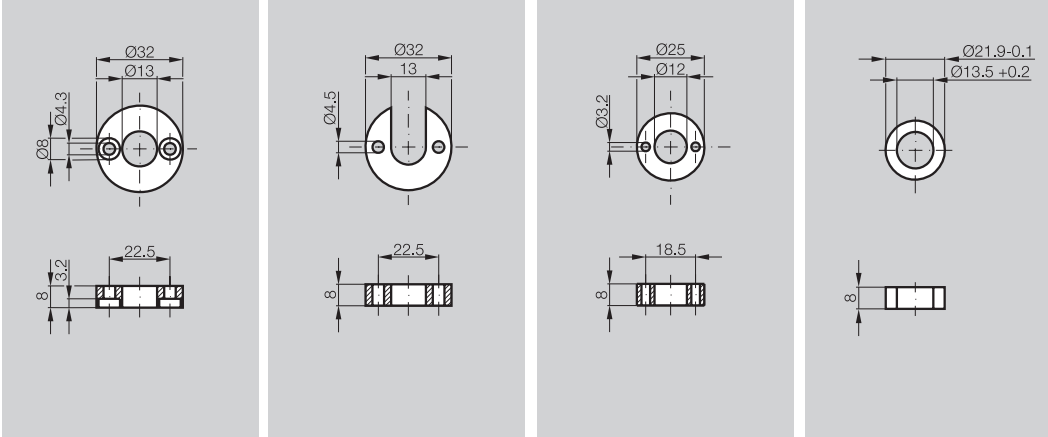
Stroke Length

xxxx = length in mm
(see chart on page 37)
Max = 156" (3962 mm)

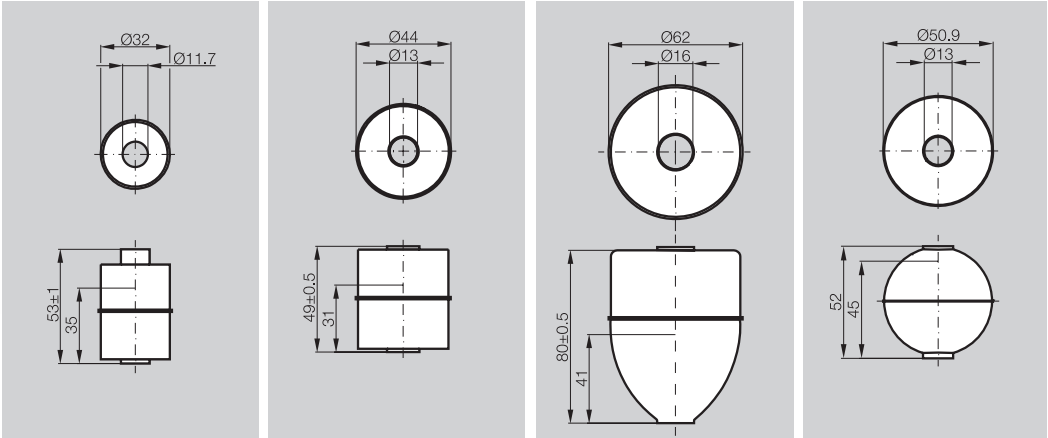
Connection Type

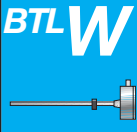
- S 32 = 8-pin connector (standard)¹
- KA02 = 2m PUR cable
- KA05 = 5m PUR cable
- KA10 = 10m PUR cable
- KA15 = 15m PUR cable

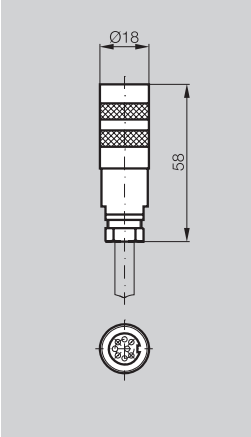
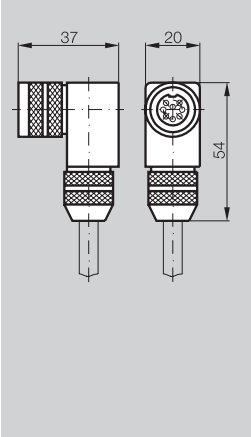
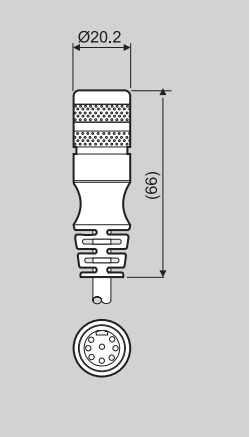
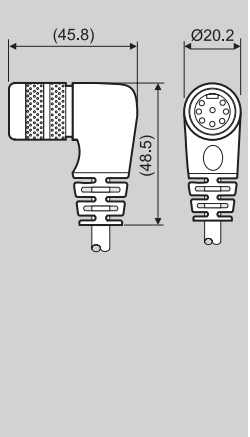
¹See page 34 for mating cables/connectors.

Product	Magnet, Spacer	Magnet, Spacer	Magnet, Spacer	Magnet, Spacer
Type	Ø32 ring	Ø32 open ring	Ø25 ring	Ø22 ring
				
				
Ordering Code - Magnet	BTL-P-1013-4R*	BTL-P-1013-4S*	BTL-P-1012-4R*	BTL-P-1014-2R
Ordering Code - Spacer	BTL Z-P-1013-4R-SPACER	SPACER BTL-P-1013-DS	BTL Z-2-1012-4R-SPACER	N/A
Material	AL	AL	AL	AL
Weight	12 g	12 g	12 g	10 g
Magnet Speed	any	any	any	any
Operating/Storage Temperature	-40...+100°C	-40...+100°C	-40...+100°C	-40...+100°C

*Spacer is included with these magnets

Product	Magnet	Magnet	Magnet	Magnet
Type	Barrel float	Barrel float	Bullet float	Sphere float
				
				
Ordering Code	BTL2-S-3212-4Z	BTL2-S-4414-4Z	BTL2-S-6216-8P	BTL2-S-5113-4K
Material	Stainless 316	Stainless 316	Stainless 316	Stainless 316
Weight	20 g	35 g	66 g	34 g
Operating/Storage Temperature	-40...+120°C	-40...+120°C	-40...+120°C	-40...+120°C
Water Displacement	35 mm	30 mm	41 mm	26 mm
Pressure (static)	24 bar (348 psi)	20 bar (290 psi)	15 bar (217 psi)	40 bar (580 psi)



Product	Straight Connector		Molded	
Type	8-pin female		8-pin female	
				
				

Ordering Code	BKS-S 32M-_*	BKS-S 33M-_*	BKS-S 232-PU-_*	BKS-S 233-PU-_*
Material	CuZn, nickel plated	CuZn, nickel plated	CuZn, nickel plated	CuZn, nickel plated
Contact Surface	0.8 µm Au	0.8 µm Au	0.8 µm Au	0.8 µm Au
Solder Connection	00 option only	00 option only	N/A	N/A
Cable	7 x 0.25 mm ² /AWG 24	7 x 0.25 mm ² /AWG 24	7 x 0.25 mm ² /AWG 24	7 x 0.25 mm ² /AWG 24
Cable Diameter	6.35 mm ± 0.35 mm	6.35 mm ± 0.35 mm	6.35 mm ± 0.35 mm	6.35 mm ± 0.35 mm
Allowable Cable Diameter	6...8 mm	6...8 mm	N/A	N/A
Cable Material	PUR	PUR	PUR	PUR
Environmental Rating	IP 67 (when installed)	IP 67 (when installed)	IP 67 (when installed)	IP 67 (when installed)

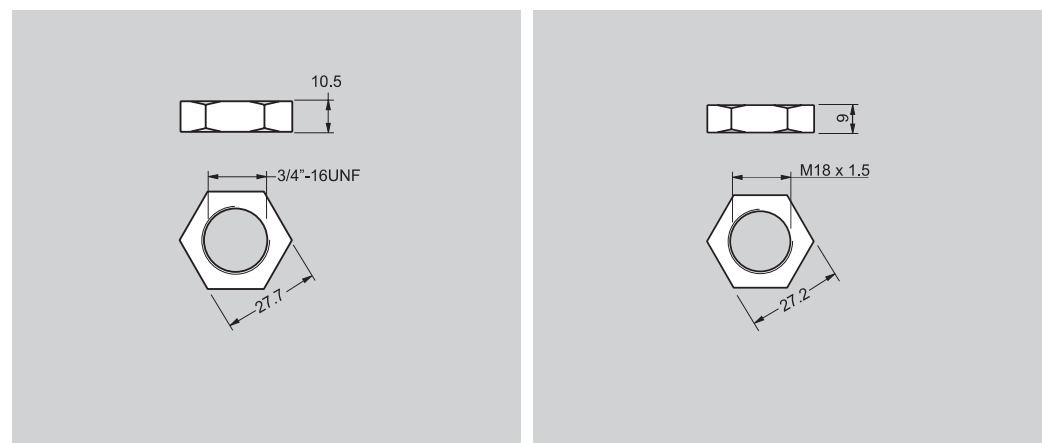
For additional connectors, see pages 107-114

* Indicate cable length in ordering code in meters (consult factory for longer lengths)
00 = connector only (only available for BKS-S 32M and BKS-S 33M)
02 = 2 meter cable
05 = 5 meter cable

Product	Jam nut	Jam nut
Type	3/4"-16 UNF	M18 x 1.5

Note:

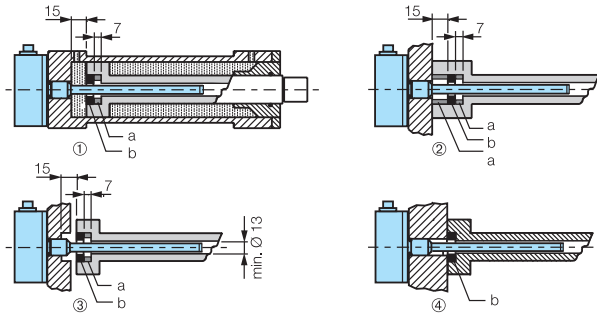
Jam nut not needed for in-cylinder applications



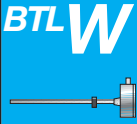
Ordering Code	BTL-5-JAM-NUT	BTL-A-FK01-E-M18x1.5
Application	W housing	H housing
Material	Stainless steel	Stainless steel

Installation

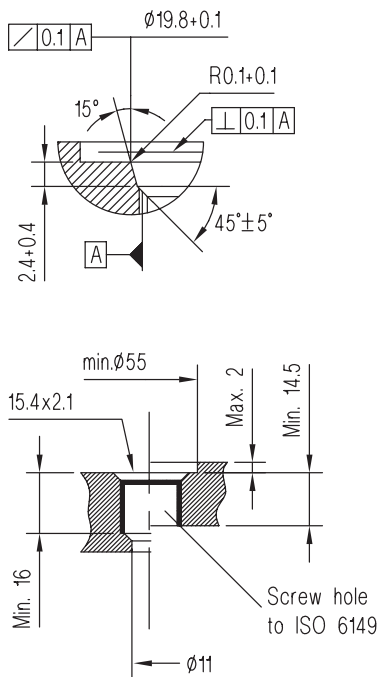
The BTL Micropulse transducer is provided with a $\frac{3}{4}$ " x 16-UNF (optional M18 x 1.5) mounting thread. We recommend mounting into non-magnetizable materials. If magnetizable materials are used, the installation must be carried out as shown in the drawings at right. Sealing is at the flange mounting surface, using the supplied O-ring.



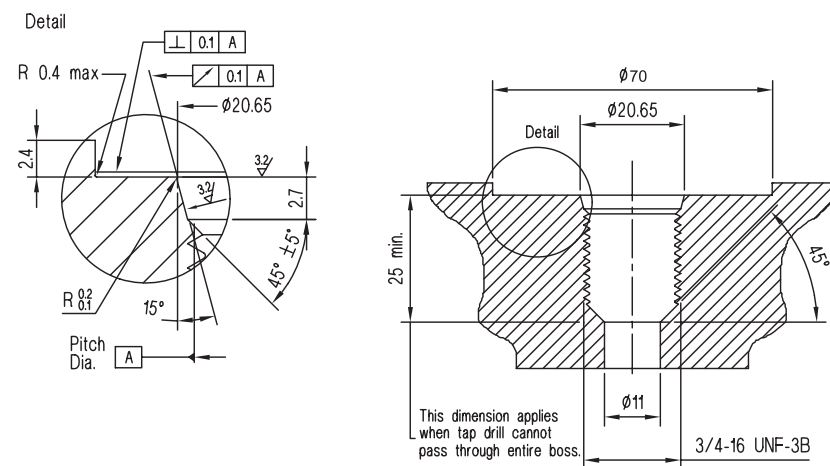
- ①②③ For magnetizable material
- ④ For non-magnetizable material
- a Spacer made of non-magnetizable material
- b Magnet



H Style Metric Thread Housing

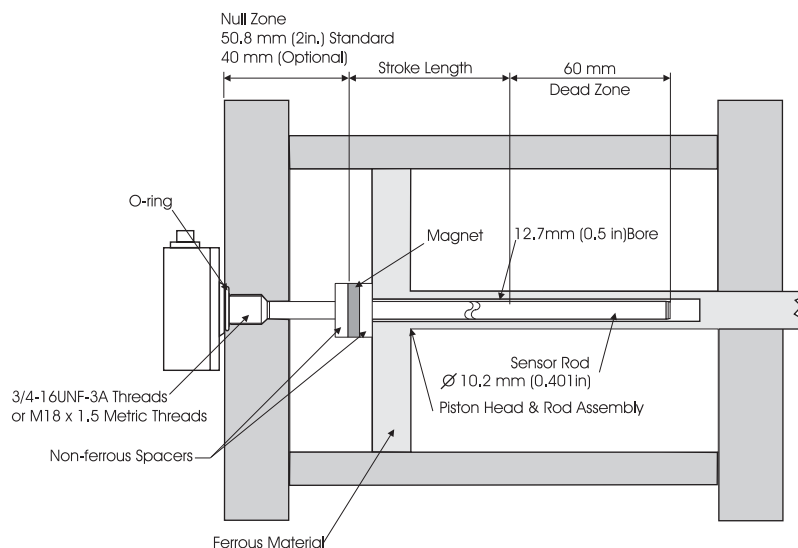


W Style Inch Thread Housing



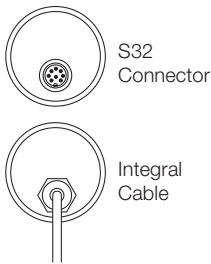
Notes:

- 1 Threads machined per ANSI/ASME B1.1.
- 2 The threads should be machined to meet the strength requirements of the material.
- 3 The port is similar to SAE J1926/1 port hole #8 with dimensional changes.

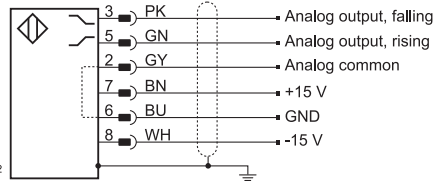


Typical Installation in Hydraulic Cylinder

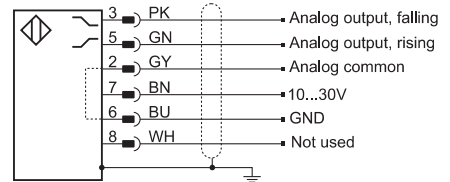
Analog Wiring Diagrams



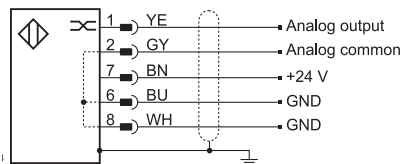
Analog Voltage
±15 V (A, B, G)



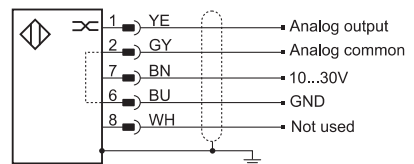
Analog Voltage
10...30V (A, B, G)



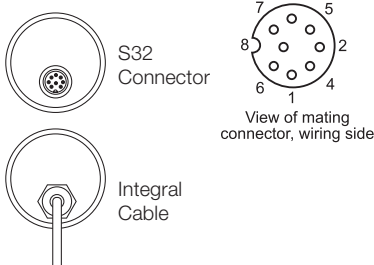
Analog Current
24 V (E, C)



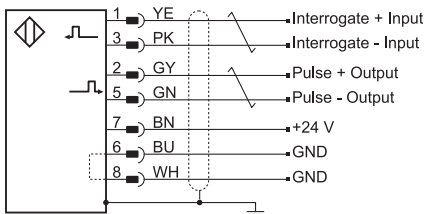
Analog Current
10...30V (E, C)



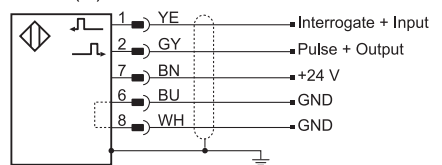
Digital Wiring Diagrams



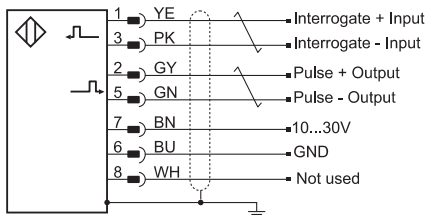
Digital, RS485 differential
24 V (P, M, I, K, L, R)



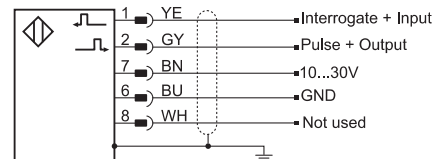
Digital, Single-ended
24 V (N)



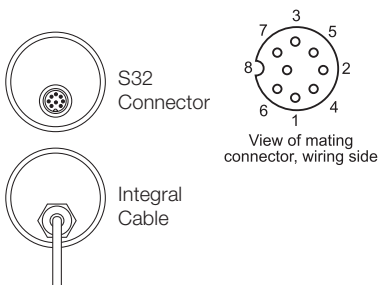
Digital, RS485 differential
10...30V (P, M, I, K, L, R)



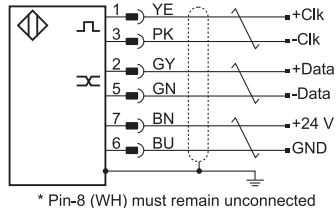
Digital, Single-ended
10...30V (N)



SSI Wiring Diagram



SSI (S)



Note: = twisted-pair

B T L 5 - A 1 1 - M 0 3 0 5 - W - S 3 2 - E 4 / U S
K A 0 5

**Balluff
Linear Transducer**

Generation 5

Output Type

A = 0 to 10 Vdc
B = -5 to +5 Vdc
C = 0 to 20 mA
E = 4 to 20 mA
G = -10 to +10 Vdc
S = SSI*
I = Differential start/stop with tri-state
K = Differential stop - leading edge active
L = Differential pulse - width modulated
M = Differential start/stop - leading edge active
N = Single ended start/stop - leading edge (add/US)
P = Differential start/stop - trailing edge active
R = Differential pulse-width - recirculated

Supply Voltage

1 = 24 Vdc ±20%
5 = 10...30 Vdc

**Analog Output Operation
(Leave Blank for Digital Versions)**

Voltage output (Output type A, B & G)

1 = User selectable rising or falling

Current output (Output type C & E)

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

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

Stroke Length

0 3 0 5 = 305 mm active stroke length

Housing Type

W...10.2 mm...Compact, threaded rod style, 3/4"-16 UNF threads, 2 inch null point

W8 = 8.0 mm dia. pressure tube (1016 mm max length, 250 bar max pressure)

H...10.2 mm...Compact, threaded rod style, M18x1.5 threads, 40 mm null point

H8 = 8.0 mm dia. pressure tube (1016 mm max length, 250 bar max pressure)

Connection Type

S 3 2 = 8-pin quick disconnect metal connector (see page 34 for mating cable)

K A 0 5 = Axial cable out (5 m standard; specify length in meters)

K 0 5 = Radial cable out (5 m standard; specify length in meters)

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

I = Internal interrogation, E = External interrogation

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

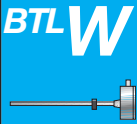
1=1 circulation, 2 = 2 circulations, 3 = 3 circulations, 4 = 4 circulations, 6 = 6 circulations,

8 = 8 circulations, 10 = 10 circulations, 16 = 16 circulations

N output only

/US = TTL - single ended Start/Stop - leading edge (US Standard)

Blank = TTL - single ended Start only - leading edge (European Standard)



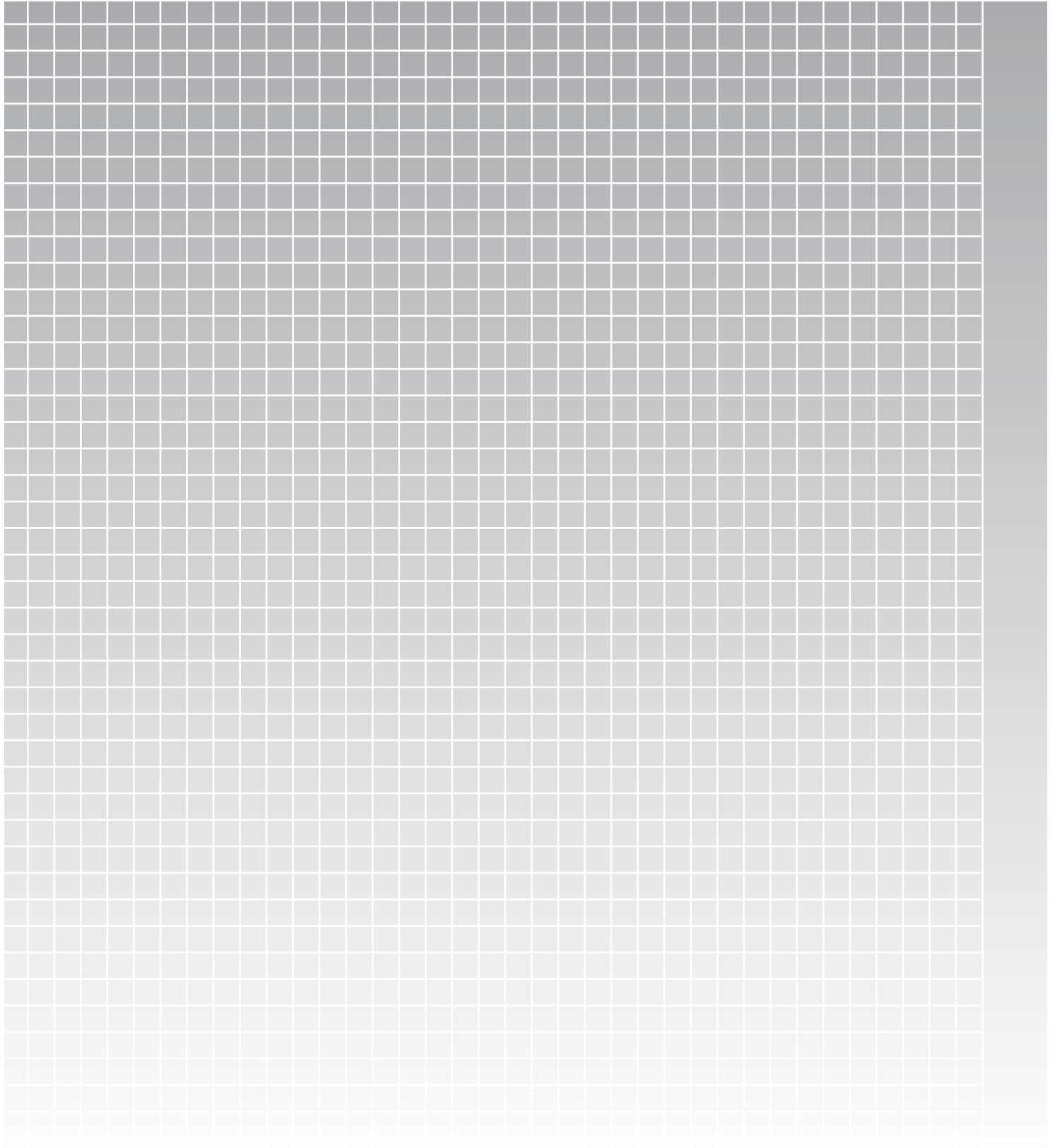
* See additional ordering information on page 32.

Standard Stroke Lengths, Inches (mm) (consult factory for additional lengths)

1 (0025)	9 (0230)	22 (0560)	48 (1220)	89 (2261)	156 ^A (3962)	192 (4877)
2 (0051)	10 (0254)	24 (0610)	50 (1270)	98 (2490)	160 (4064)	196 (4978)
3 (0076)	11 (0280)	26 (0661)	54 (1372)	108 (2743)	164 (4166)	200 (5080)
3.5 (0090)	12 (0305)	28 (0711)	60 (1524)	118 (2997)	168 (4267)	
4 (0102)	13 (0330)	30 (0762)	66 (1676)	126 (3200)	172 (4369)	
5 (0127)	15 (0381)	32 (0813)	69 (1753)	140 (3556)	176 (4470)	
6 (0152)	16 (0407)	36 (0914)	72 (1829)	144 (3658)	180 ^B (4572)	
7 (0178)	18 (0457)	40 (1016)	78 (1981)	148 (3759)	184 (4674)	
8 (0203)	20 (0508)	42 (1067)	84 (2134)	152 (3861)	188 (4775)	

^A Maximum length for SSI = 156 inches.

^B Maximum length for analog outputs = 180 inches.



Compact Rugged Rod Style Bolt-In

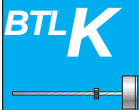
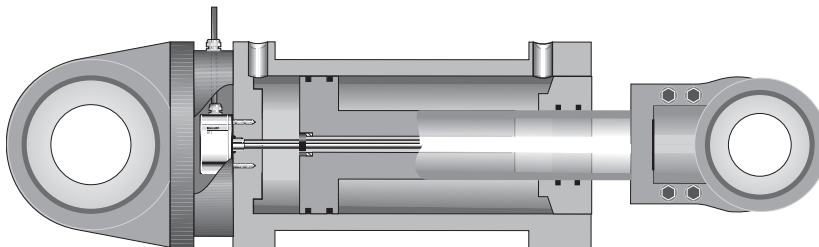
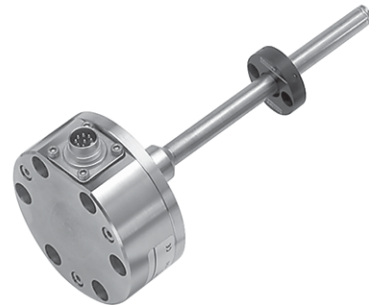
The rugged and tough stainless steel "K" housing, with its bolt-in mounting design feature, actually becomes an extension of the cylinder. Its compact size is ideal for space-restricted applications.

Applications:

- Hydraulic cylinder
- Primary wood (lumber)
- Valve control
- Food processing
- Waste water plants
- Pulp and paper
- Gate position
- Hydro/Civil engineering

Features:

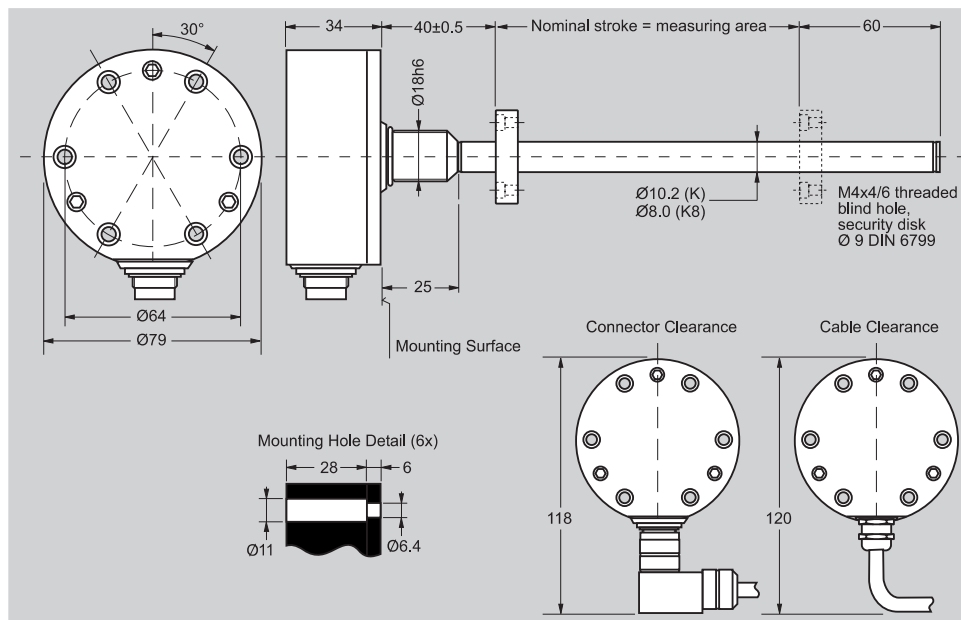
- Bolt-in design
- Rugged all stainless steel housing
- Designed for demanding applications
- Eliminates need for protective covers
- Pressure rated 8700 psi
- Outputs
 - Analog (voltage or current)
 - Digital start/stop
 - Pulse with modulates (PWM)
 - PWM with recirculations
 - SSI
- Stroke length – 1" to 200"
- Quick disconnect and integral cable



General Specifications	pg 40
Electrical Options	pgs 41-42
Accessories	pgs 43-44
Installation Guidelines	pg 44
Wiring Diagrams	pg 45
How to Order	pg 46

Series
Available Lengths
Output Signals

K Style
25 mm (1 in) to 3962 mm (156 in)
Analog, Digital Pulse, SSI



Ordering Code

BTL-5- -M- -K- - (See ordering code on page 46)

Measurement Type
Measurement Range
Shock Rating
Vibration Rating
Environmental Protection
Housing Material
Rod & Flange Material
Pressure Rating (rod)
Operating Temperature
Storage Temperature
Humidity
Connection Type
Noise Immunity
Approvals

Linear displacement
25 mm (1 in) to 3962 mm (156 in)
100 g/6 ms (100 g/2 ms continuous) per IEC 68 2-27
12g, 10 to 2000 Hz per IEC 68-2-6
Connector versions: IP 67 Integral cable versions: IP 68
316 stainless steel
Tube: 316T stainless, flange: 316L
600 bar (8700 PSI) max (10.2 mm Ø Pressure Tube)
250 (3600 PSI) max (8 mm Ø Pressure Tube)
-40 to + 185° F
-40 to + 212° F
< 90% non-condensing
connector or integral cable
ESD, RFI and BURST per IEC 1000-4-2/3/4/6, severity level 3
CE

Warning:

These products are not rated for personnel safety applications.

Accessories:

Magnets and Floats pg 43
Connectors pg 44

For additional connectors,
see pages 107-114

Autotuning Circuitry

Patented Autotuning circuitry in Balluff Micropulse® transducers automatically compensates for changes in the strength of the magnetostrictive return signal.

- Allows Micropulse rod-style transducers to be used in hydraulic cylinders that have both new and legacy Balluff magnets. Autotuning allows use of many legacy competitor's magnets as well.
- Automatically compensates for changes in temperature, providing a more stable signal over a wide temperature range.

Electrical Interface	Analog	Analog	Digital
Electrical Type	Voltage	Current	Start/Stop, PWM
Part No. Code (See pg. 46)	A, B, G	E, C	P, M, N, I, L, R, K
Output	0...+10 V, -5...+5 V, -10...+10 V	4...20 mA, 0...20 mA	Start/Stop or Pulse-width-modulated (RS422/RS485)
Output Load	> 2 K Ω (5 mA max)	$\leq$ 500 Ω	per spec
Resolution	$\leq$ 0.1 mV	$\leq$ 0.2 μ A	Controller dependent
Non-linearity	$\pm$ 100 μ m to 500 mm stroke, $\pm$ 0.02 % over 500 mm stroke	$\pm$ 100 μ m to 500 mm stroke, $\pm$ 0.02 % over 50 mm stroke	$\pm$ 100 μ m to 500 mm stroke, $\pm$ 0.02 % over 500 mm stroke
Repeatability	Resolution/ min 2 μ m	Resolution/ min 2 μ m	Resolution/ min 2 μ m
Hysteresis	4 μ m	4 μ m	4 μ m
Sampling Rate	500 Hz stroke > 2000 mm 1 kHz stroke < 2000 mm	500 Hz stroke > 2000 mm 1 kHz stroke < 2000 mm	500 Hz stroke > 2000 mm 1 kHz stroke < 2000 mm
Temperature Coefficient*	[150 μ V/ $^{\circ}$ C + (5 ppm/ $^{\circ}$ C*P*V/NL)] * Δ T	[0.6 μ A/ $^{\circ}$ C + (10 ppm/ $^{\circ}$ C*P*V/NL)] * Δ T	(6 μ m + 5 ppm*NL) / $^{\circ}$ C
Operating Voltage	24 Vdc $\pm$ 20% or 10...30 Vdc	24 Vdc $\pm$ 20% or 10...30 Vdc	24 Vdc $\pm$ 20% or 10...30 Vdc
Operating Current	< 150 mA Nominal, @ 24 Vdc	< 150 mA Nominal, @ 24 Vdc	<150 mA Nominal, @ 24 Vdc

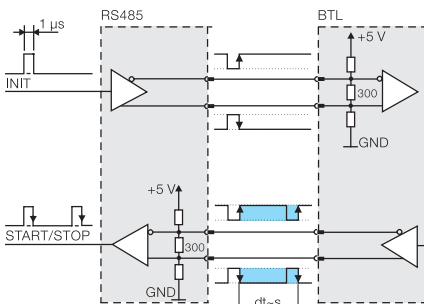
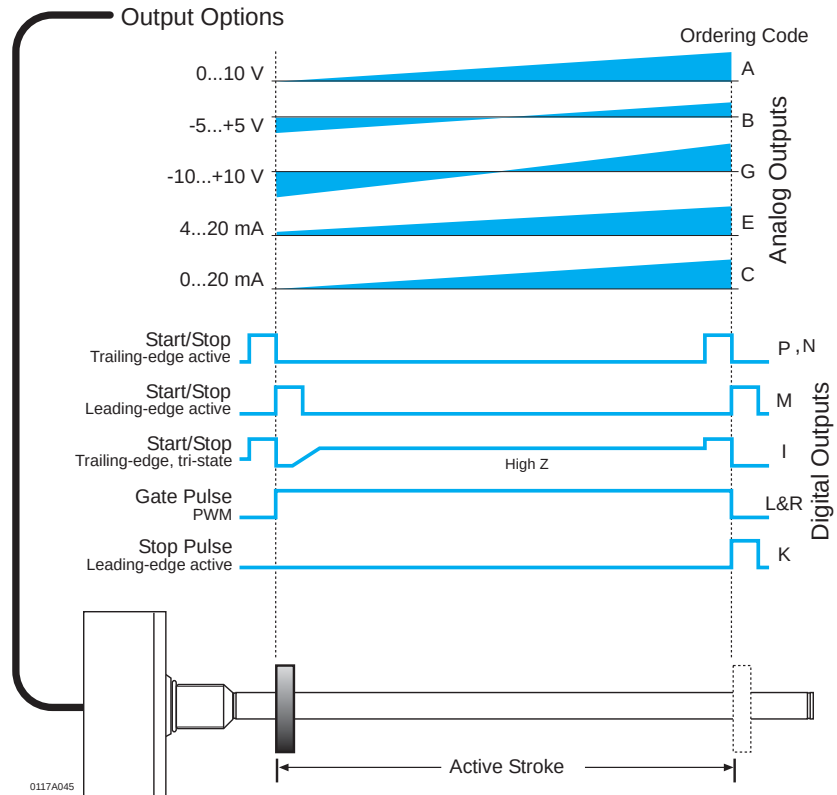
Notes:

Analog voltage output versions incorporate both rising and falling outputs. Analog current version must be ordered as rising or falling outputs.

*Temperature coefficient variables:

- V** = output range in V
- I** = output range in [mA]
- Δ T** = temperature change
- P** = magnet position
- NL** = stroke length

Output Options



RS 485 Signal transmission with digital outputs

Analog and Digital Output Options for the Micropulse K Style



SSI

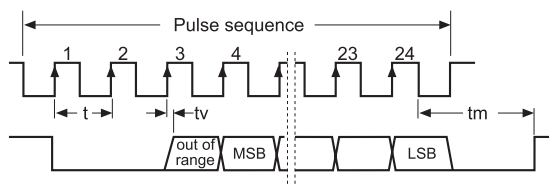
The SSI (synchronous serial interface) output interfaces with popular control systems from manufacturers such as Allen-Bradley, Delta Computer, Siemens, Parker and many others. Cable spans can be up to 400 m with noise free operation. Individual, EEPROM linearization of this interface makes it ideal for applications requiring the best accuracy available.

Ordering Code	S
Resolution	5, 10, 20 or 40 μm
Non-linearity	$\pm 30 \mu\text{m}$ or $\pm 2\text{LSBs}$, whichever is greater
Repeatability (resolution + hysteresis)	± 1 digit
Hysteresis	≤ 1 digit
Sampling Rate	500 μs
Temperature Coefficient	$(6 \mu\text{m} + 5\text{ppm} \times L)/^\circ\text{C}$
Communication Speeds	100, 200, 400, 500, 1000 kHz
Output Modes	24 or 25 bits
Operating Voltage	24 Vdc $\pm 20\%$
Operating Current	$\leq 80 \text{ mA}$
Output	Standard RS-485/422 levels

Notes:

SSI Maximum cable lengths

Cable length	Clock Freq.
< 25 m	< 1000 kHz
< 50 m	< 500 kHz
< 100 m	< 400 kHz
< 200 m	< 200 kHz
< 400 m	< 100 kHz



BTL5-S1 -Mxxxx-K-

Data Format

- 0 = Binary, increasing, 24 bit
- 1 = Gray code, increasing, 24 bit
- 2 = Binary, falling, 24 bit
- 3 = Gray code, falling, 24 bit
- 6 = Binary, increasing, 25 bit
- 7 = Gray code, increasing, 25 bit
- 8 = Binary, falling, 25 bit
- 9 = Gray code, falling, 25 bit

System Resolution

- 2 = 5 μm
- 3 = 10 μm
- 4 = 20 μm
- 5 = 40 μm
- 6 = 100 μm
- 8 = 50 μm

Stroke Length

xxxx = length in mm
(see chart on page 46)
Max = 156" (3962 mm)

Connection Type

- S 32 = 8-pin connector (standard)¹
- KA02 = 2 m PUR cable
- KA05 = 5 m PUR cable
- KA10 = 10 m PUR cable
- KA15 = 15 m PUR cable

¹See page 44 for mating cables/connectors.

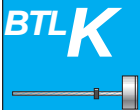


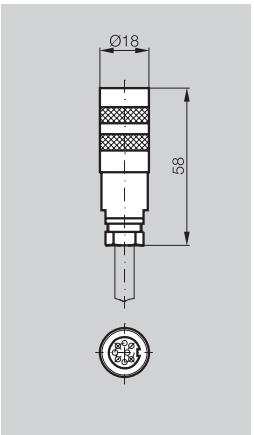
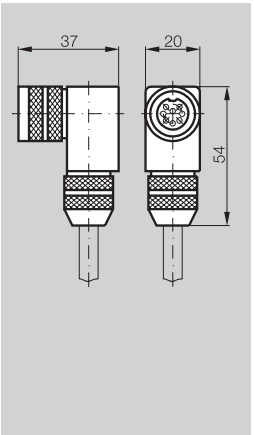
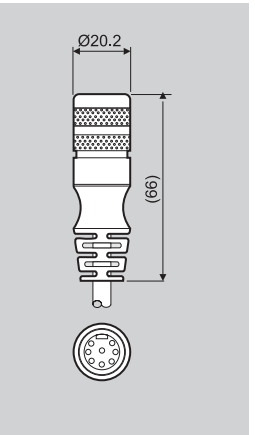
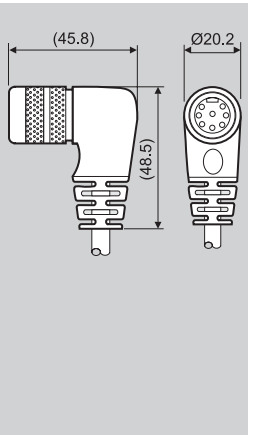
Product Type	Magnet, Spacer Ø32 ring	Magnet, Spacer Ø32 open ring	Magnet, Spacer Ø25 ring	Magnet, Spacer Ø22 ring
Ordering Code - Magnet	BTL-P-1013-4R*	BTL-P-1013-4S*	BTL-P-1012-4R*	BTL-P-1014-2R
Ordering Code - Spacer	BTL Z-P-1013-4R-SPACER	SPACER BTL -P-1013-0S	BTL Z-2-1012-4R-SPACER	N/A
Material	AL	AL	AL	AL
Weight	12 g	12 g	12 g	10 g
Magnet Speed	any	any	any	any
Operating/Storage Temperature	-40...+100°C	-40...+100°C	-40...+100°C	-40...+100°C

*Spacer is included with these magnets



Product Type	Magnet Barrel float	Magnet Barrel float	Magnet Bullet float	Magnet Sphere float
Ordering Code	BTL2-S-3212-4Z	BTL2-S-4414-4Z	BTL2-S-6216-8P	BTL2-S-5113-4K
Material	Stainless 316	Stainless 316	Stainless 316	Stainless 316
Weight	20 g	35 g	66 g	34 g
Operating/Storage Temperature	-40...+120°C	-40...+120°C	-40...+120°C	-40...+120°C
Water Displacement	35 mm	30 mm	41 mm	26 mm
Pressure (static)	24 bar (348 psi)	20 bar (290 psi)	15 bar (217 psi)	40 bar (580 psi)



Product	Straight Connector	Right-angle Connector	Molded Straight Connector	Molded Right-angle Connector
Type	8-pin female	8-pin female	8-pin female	8-pin female
				

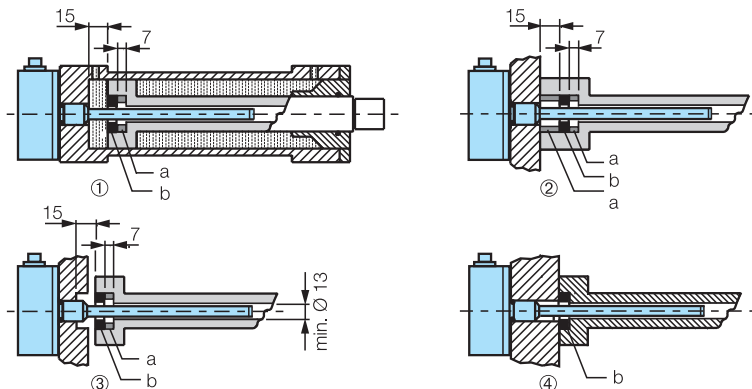
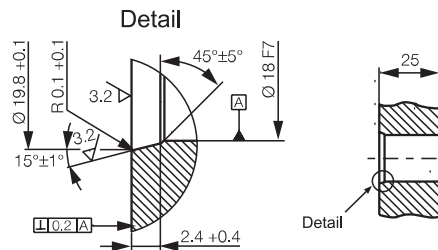
Ordering Code	BKS-S 32M-_*	BKS-S 33M-_*	BKS-S 232-PU-_*	BKS-S 233-PU-_*
Material	CuZn, nickel plated	CuZn, nickel plated	CuZn, nickel plated	CuZn, nickel plated
Contact Surface	0.8 µm Au	0.8 µm Au	0.8 µm Au	0.8 µm Au
Solder Connection	00 option only	00 option only	N/A	N/A
Cable	7 x 0.25 mm²/AWG 24	7 x 0.25 mm²/AWG 24	7 x 0.25 mm²/AWG 24	7 x 0.25 mm²/AWG 24
Cable Diameter	6.35 mm ± 0.35 mm	6.35 mm ± 0.35 mm	6.35 mm ± 0.35 mm	6.35 mm ± 0.35 mm
Allowable Cable Diameter	6...8 mm	6...8 mm	N/A	N/A
Cable Material	PUR	PUR	PUR	PUR
Environmental Rating	IP 67 (when installed)	IP 67 (when installed)	IP 67 (when installed)	IP 67 (when installed)

For additional connectors, see pages 107-114

* Indicate cable length in ordering code in meters (consult factory for longer lengths)
 00 = connector only (only available for BKS-S 32M and BKS-S 33M)
 02 = 2 meter cable
 05 = 5 meter cable

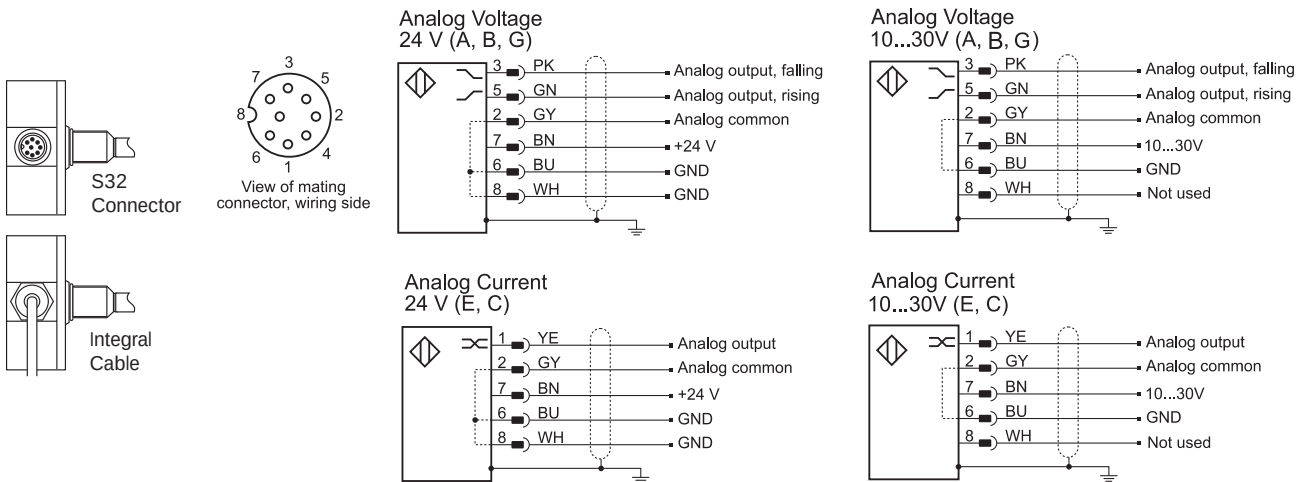
Installation

The Micropulse K transducer has 6 mounting holes for cylinder head screws (ISO 4762 M6×18 A2-70). We recommend installing in non-magnetizable materials. If using magnetizable material, installation must be done as shown below. Sealing is at the flange mounting surface using a supplied 15.4 × 2.1 O-ring.

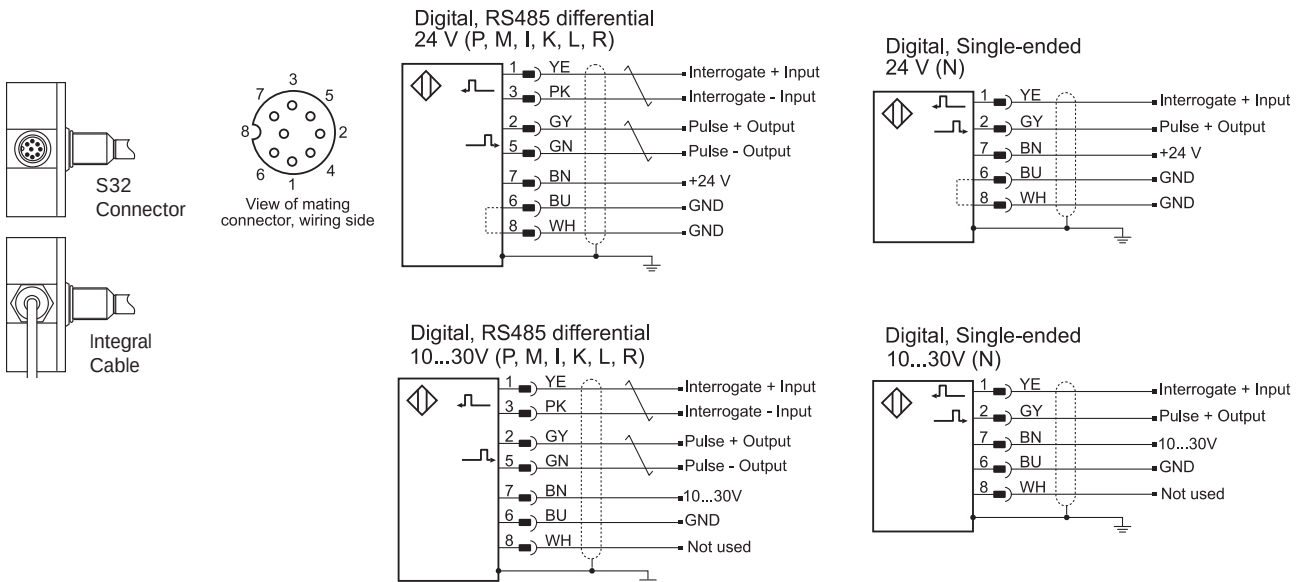


- ①②③ For magnetizable material
- ④ For non-magnetizable material
- a Spacer made of non-magnetizable material
- b Magnet

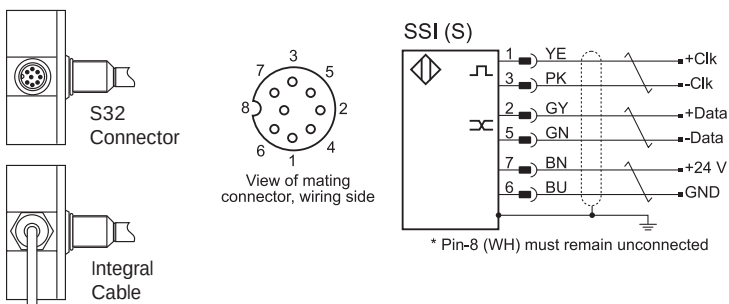
Analog Wiring Diagrams



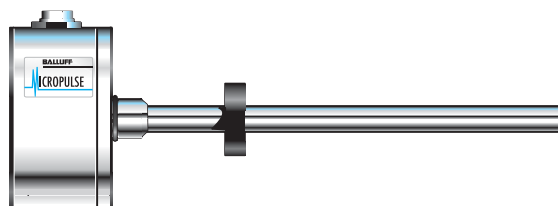
Digital Wiring Diagrams



SSI Wiring Diagram



Note: = twisted-pair



B T L 5 - A 1 1 - M 0 3 0 5 - K - S R 3 2 - E 4 / U S
K 0 5

**Balluff
Linear Transducer**

Generation 5

Output Type

A = 0 to 10 Vdc
B = -5 to +5 Vdc
C = 0 to 20 mA
E = 4 to 20 mA
G = -10 to +10 Vdc
S = SSI*
I = Differential start/stop with tri-state
K = Differential stop - leading edge active
L = Differential pulse - width modulated
M = Differential start/stop - leading edge active
N = Single ended start/stop - leading edge (add/US)
P = Differential start/stop - trailing edge active
R = Differential pulse-width - recirculated

Supply Voltage

1 = 24 Vdc ±20%
5 = 10...30 Vdc (Not available for S output)

**Analog Output Operation
(Leave Blank for Digital Versions)**

Voltage output (Output type A, B & G)

1 = User selectable rising or falling

Current output (Output type C & E)

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

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

Stroke Length

0 3 0 5 = 305 mm active stroke length (in mA)

Housing Type

K = Compact, bolt-in rod style, 10.2 mm Pressure Tube (standard)
K8 = Compact, bolt-in rod style, 8 mm Pressure Tube
(1016 mm max length, 250 bar max pressure)

Connection Type

S R 3 2 = 8-pin quick disconnect metal connector (see page 44 for mating cable)

K 0 5 = Cable out (5 m standard; specify length in meters)

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

I = Internal interrogation, E = External interrogation

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

1=1 circulation, 2 = 2 circulations, 3 = 3 circulations, 4 = 4 circulations, 6 = 6 circulations,
8 = 8 circulations, 10 = 10 circulations, 16 = 16 circulations

N output only

/US = TTL - single ended
Start/Stop - leading edge
(US Standard)

Blank = TTL - single ended
Start only - leading edge
(European Standard)

* See additional ordering
information on page 42.

Standard Stroke Lengths, Inches (mm) (consult factory for additional lengths)

1 (0025)	9 (0230)	22 (0560)	48 (1220)	89 (2261)	156 ^A (3962)	192 (4877)
2 (0051)	10 (0254)	24 (0610)	50 (1270)	98 (2490)	160 (4064)	196 (4978)
3 (0076)	11 (0280)	26 (0661)	54 (1372)	108 (2743)	164 (4166)	200 (5080)
3.5 (0090)	12 (0305)	28 (0711)	60 (1524)	118 (2997)	168 (4267)	
4 (0102)	13 (0330)	30 (0762)	66 (1676)	126 (3200)	172 (4369)	
5 (0127)	15 (0381)	32 (0813)	69 (1753)	140 (3556)	176 (4470)	
6 (0152)	16 (0407)	36 (0914)	72 (1829)	144 (3658)	180 ^B (4572)	
7 (0178)	18 (0457)	40 (1016)	78 (1981)	148 (3759)	184 (4674)	
8 (0203)	20 (0508)	42 (1067)	84 (2134)	152 (3861)	188 (4775)	

^A Maximum length for
SSI = 156 inches.

^B Maximum length for
analog outputs = 180 inches.

Micropulse AR Embeddable Rod Style

Rugged and Reliable Compact Housing

The Micropulse AR is a rugged, compact rod-style linear position transducer designed and built to meet the needs of demanding mobile hydraulic applications.

The Micropulse AR's stainless steel housing and compact size allow it to be completely embedded into a hydraulic cylinder for maximum protection against harsh environments.



Features:

- Compact design for embedded cylinder applications
- Non-contact sensing technology
- No external electronics
- Analog outputs:
 - 0-10 Vdc
 - 0-5 Vdc
 - 4-20 mA
- Digital output:
 - RS422 Start/Stop

Applications:

Micropulse AR transducers are designed and tested to withstand the rigors of demanding mobile hydraulic applications, such as:

- Agricultural machinery
- Forestry machinery
- Earth moving equipment
- Construction machinery



General Specifications pg 48
Electrical Options pgs 49-52
Magnets pg 53
Installation Guidelines pg 54

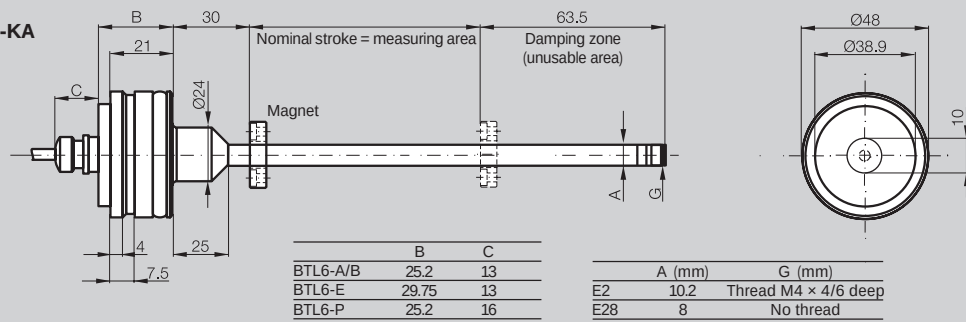
Series

AR Rod Style

**Housing E2/E28,
BTL6-...-E2/E28-...-KA**

**Cable out
axial centric**

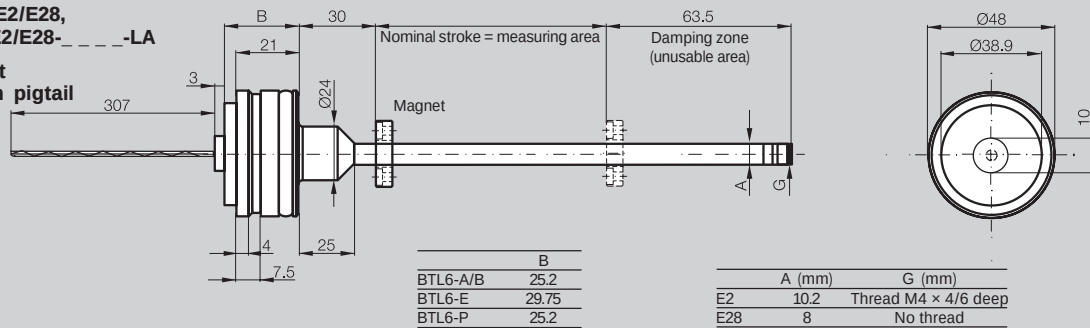
PL0082a



**Housing E2/E28,
BTL6-...-E2/E28-...-LA**

**Cable out
axial with pigtail**

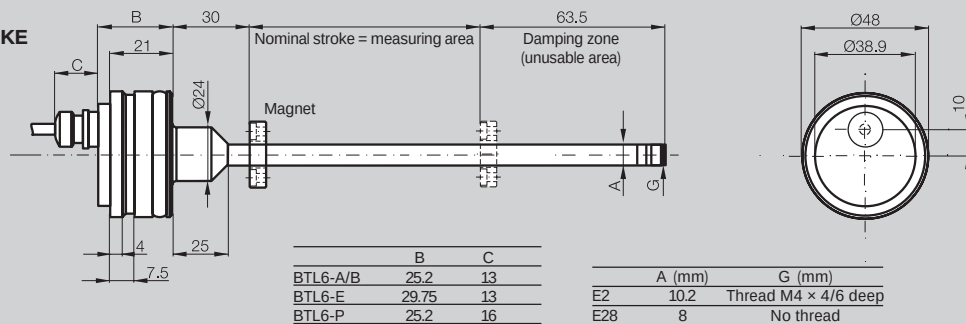
PL0083a



**Housing E2/E28,
BTL6-...-E2/E28-...-KE**

**Cable out
axial eccentric**

PL0084a



Ordering Code

BTL6-...-M _ _ _ -E2/E28- _ _ _

Shock Load	100 g/6 ms per IEC 60068-2-27
Continuous Shock	50 g/2 ms
Vibration	12 g, 10...2000 Hz per EN 60068-2-6
Polarity Reversal Protected	yes
Dielectric Strength	500 Vdc (GND to housing)
Protection per IEC 60529	IP 67
Housing Material	Outer tube 1.4571 stainless, flange 1.4404 stainless
Pressure Rating with 10.2 mm Outer Tube (E2)	350 bar when installed in hydraulic cylinder
Pressure Rating with 8 mm Outer Tube (E28)	250 bar when installed in hydraulic cylinder
Connection Type	Cable connection or pigtail
EMC Tests:	
RF Emission	EN 55011 Group 1, Class A/B
Static Electricity (ESD)	IEC 61000-4-2 Severity Level 3
Electromagnetic Fields (RFI)	IEC 61000-4-3 Severity Level 3
Rapid Transients (BURST)	IEC 61000-4-4 Severity Level 3
Surge Voltage	IEC 61000-4-5 Severity Level 2
Line-induced Disturbances	IEC 61000-4-6 Severity Level 3
Magnetic Fields	IEC 61000-4-8 Severity Level 4
Standard nominal stroke lengths [mm]	0025, 0051, 0076, 0090, 0102, 0127, 0152, 0178, 0203, 0230, 0254, 0280, 0305, 0330, 0381, 0407, 0457, 0508, 0560, 0610, 0661, 0711, 0762, 0813, 0914, 1016, 1067, 1220, 1270, 1372, 1524
Max. stroke length for 8 mm outer rod (Style E28) = 1016 mm	

The propagation time of an ultrasonic wave, induced by magnetostriction, is used to determine the position of the magnet.

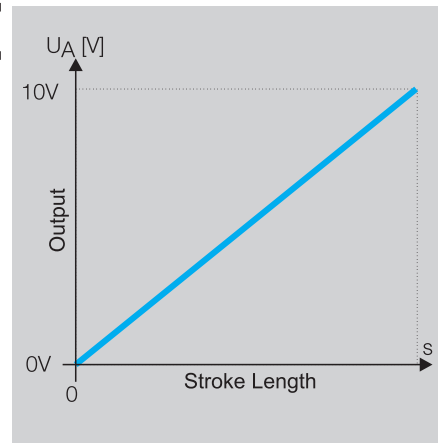
The position is output as an analog value which rises. This is done with high precision and repeatability within the measuring area designated as the nominal stroke length. If there is no magnet within the measuring area, an error signal is output. At the rod end is a damping zone. When a magnet is in this zone the output is spurious. The electrical connection between the transducer, the controller and the power supply is accomplished using a cable or pigtail.

Dimensions and mechanical data
page 48

Please order separately:
Magnets see page 53

Series
Output Signal
Part No. Code (see page 50)

BTL6 Rod AR
analog voltage
A



Ordering Code

BTL6-A500-M

Output Voltage

0...10 Vdc

Output Current

Load Current

max. 2 mA

Ripple Max.

≤ 5 mV

Load Resistance

System Resolution

± 1.5 mV

Hysteresis

≤ 4 μ m

Repeat Accuracy

System resolution/min. 2 μ m

Sampling Rate

$f_{\text{STANDARD}} = 1$ kHz

Max. Non-linearity

± 200 μ m up to 500 mm nominal stroke
typ. ± 0.02 % ≥ 500 nominal stroke

Temperature

Voltage Output

Coefficient

Current Output

$[150 \mu\text{V}/^\circ\text{C} + (5 \text{ ppm}/^\circ\text{C} \times P \times U/L)] \times DT$
 $[0.6 \mu\text{A}/^\circ\text{C} + (10 \text{ ppm}/^\circ\text{C} \times P \times I/L)] \times DT$

Supply Voltage

10...30 Vdc

Current Draw

typ. ≤ 60 mA

Polarity Reversal Protected

yes

Overvoltage Protected

yes

Dielectric Strength

500 Vdc (GND to housing)

Operating Temperature

-40 to $+185$ $^\circ\text{F}$

Storage Temperature

-40 ... $+212$ $^\circ\text{F}$

Pin Assignments

Color

BTL6-A500...

Output Signals

GY

0 V output

GN

0...10 Vdc

Operating Voltage

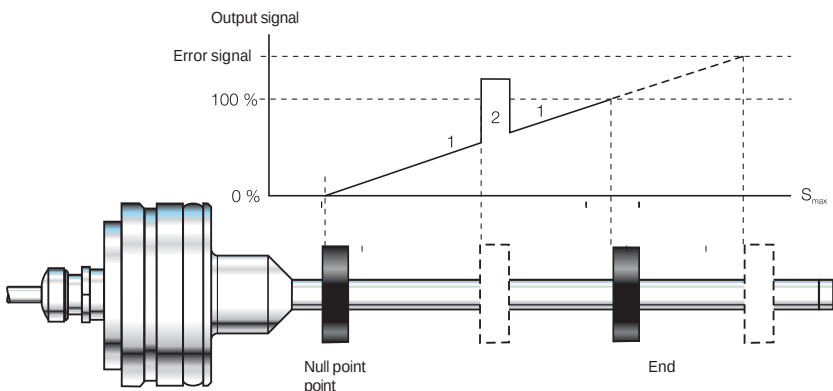
BU

GND

BN

10...30 Vdc

Shield connected to housing

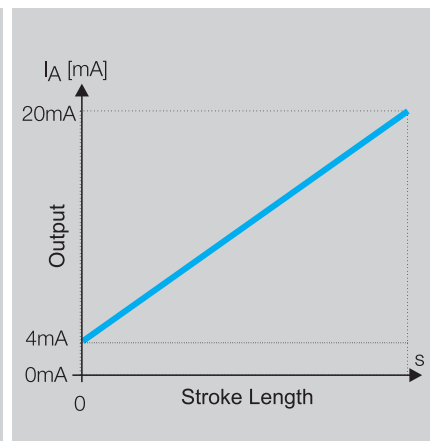
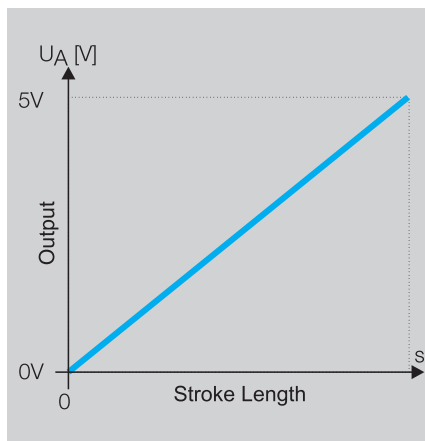


Output signal rising

Magnet position

- 1 Within the measuring area
- 2 Magnet not present

Series	BTL6 Rod AR	BTL6 Rod AR
Output Signal	analog voltage	analog current
Part No. Code (see below)	B	E



Ordering Code		BTL6-B500-M - - -	BTL6-E500-M - - -
Output Voltage		0...5 Vdc	
Output Current			4...20 mA
Load Current		max. 2 mA	
Ripple Max.		≤ 2 mV	
Load Resistance			≤ 500 Ohms
System Resolution		±1.5 mV	±7 µA
Hysteresis			≤ 4 µm
Repeat Accuracy			System resolution/min. 2 µm
Sampling Rate			f _{STANDARD} = 1 kHz
Max. Non-linearity			±200 µm up to 500 mm nominal stroke typ. ±0.02 % ≥ 500 nominal stroke
Temperature Coefficient	Voltage Output	$[150 \mu\text{V}/^\circ\text{C} + (5 \text{ ppm}/^\circ\text{C} \times P \times U/L)] \times \text{DT}$	
	Current Output	$[0.6 \mu\text{A}/^\circ\text{C} + (10 \text{ ppm}/^\circ\text{C} \times P \times I/L)] \times \text{DT}$	
Supply Voltage		10...30 Vdc	
Current Draw		typ. ≤ 60 mA	
Polarity Reversal Protected		yes	
Overvoltage Protected		yes	
Dielectric Strength		500 Vdc (GND to housing)	
Operating Temperature		-40 to +185 °F	
Storage Temperature		-40 to +212 °F	
Pin Assignments	Color	BTL6-B500...	BTL6-E500...
Output Signals	GY	0 V output	0 V output
	GN	0...5 Vdc	4...20 mA
Operating Voltage	BU	GND	GND
	BN	10...30 Vdc	10...30 Vdc

Shield connected to housing

Ordering example:

BTL6- 500-M - - -

Output signal

A	0...10 V
B	0...5 V
E	4...20 mA

Standard nominal stroke [mm]

0025, 0051, 0076, 0090, 0102, 0127, 0152, 0178, 0203, 0230, 0254, 0280, 0305, 0330, 0381, 0407, 0457, 0508, 0560, 0610, 0661, 0711, 0762, 0813, 0914, 1016, 1067, 1220, 1270, 1372, 1524
Consult factory for special lengths

Housing

E2	outer tube Ø 10.2 mm
E28	outer tube Ø 8 mm, max. nominal stroke 1016 mm

Connection type

Axial out	
KA02	PUR cable 2 m
Axial eccentric out	
KE02	PUR cable 2 m
Axial out	
LA00,3	PUR pigtail 0.3 m

P510 interface

Compatible with Balluff BTA processors, controllers, and modules from various manufacturers, including Siemens, B & R, Bosch, Phoenix Contact, Mitsubishi, Sigmatek, Parker, Esitron, WAGO, AB and others.

Reliable signal transmission even over cable lengths of up to 500m between the BTA processor and the transducer is assured by the especially noise-immune RS485 differential drivers and receivers. Noise signals are effectively suppressed.

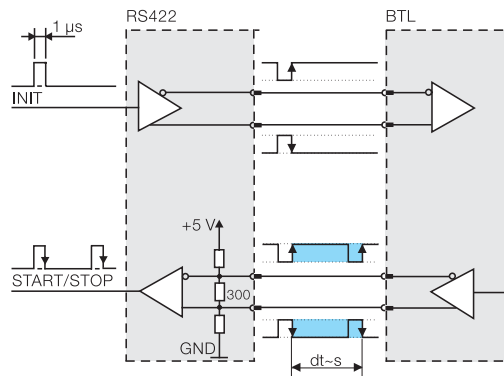
P510 universal for rising and falling edge evaluation

As a consequence of different control philosophies, digital pulse interfaces are available in two different types depending on the controller.

The difference is in which edge is used for processing. In the "P-interface" the falling edges are used for timing and in the "M-interface" the rising edges.

To reduce the number of different models to a minimum, the "P510-interface" was created as a universal pulse interface which combines both functions.

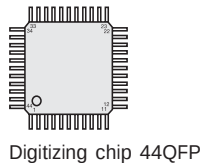
The reference point for the propagation time measurement is the "Start" pulse.



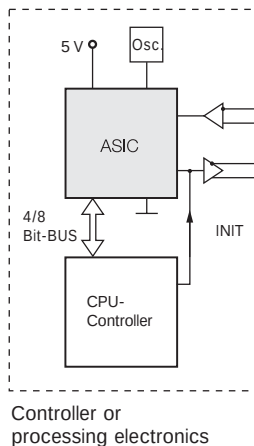
Block diagram of the P-interface

High-accuracy digitizing chip for P510 pulse interface

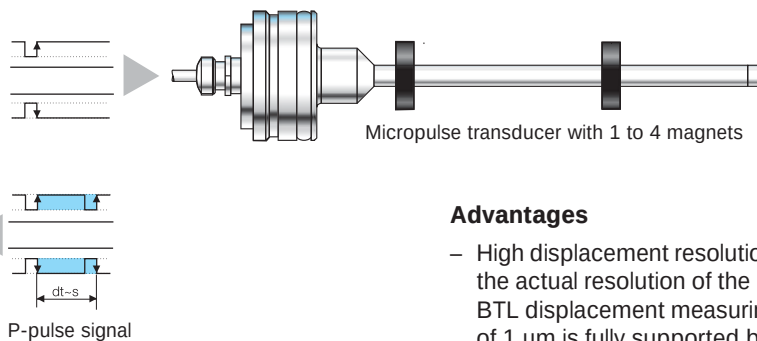
Companies who develop their own control and processing electronics can use the Balluff digitizing chip to implement a highly accurate P-type interface at low cost and without great effort. The digitizing chip was developed as a high-resolution, parameterizable ASIC for Micropulse transducers having a P-type pulse interface.



Digitizing chip 44QFP



Controller or processing electronics

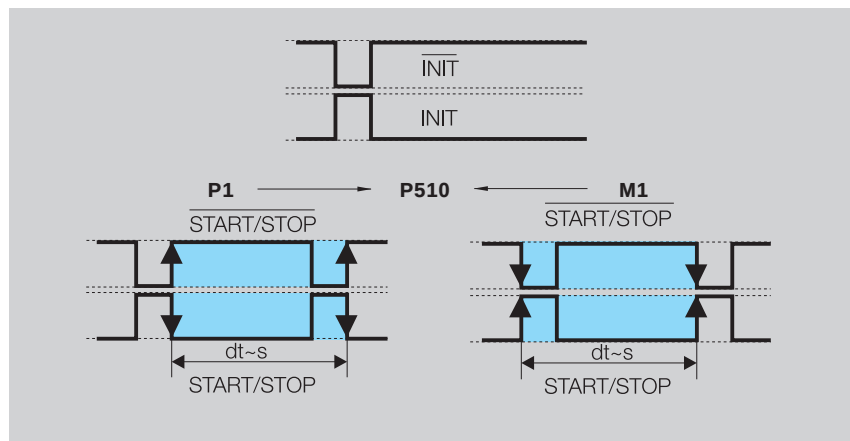


Advantages

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

Series
Part No. Code (see below)
Transducer Interface

BTL6 Rod AR
P
Digital ST/SP Pulse



Ordering Code			BTL6-P510-M - - -
System Resolution			processor-dependent
Repeat Accuracy			≤ 10 µm
Repeatability			≤ 20 µm
Resolution			≤ 10 µm
Non-linearity			±200 µm up to 500 mm nominal stroke typ. ±0.02 %, max. ±0.04 % 500...1500 mm nom. stroke length
Supply Voltage			10...30 Vdc
Current Draw			≤ 60 mA (at 1kHz)
Operating Temperature			-40 to +185 °F
Storage Temperature			-40 to +212 °F
Pin Assignments			BTL6-P510-M...
In-/Output Signals	Input	YE	INIT
	Output	GY	START/STOP
	Input	PK	INIT
	Output	GN	START/STOP
Operating Voltage		BU	GND
		BN	+24 Vdc

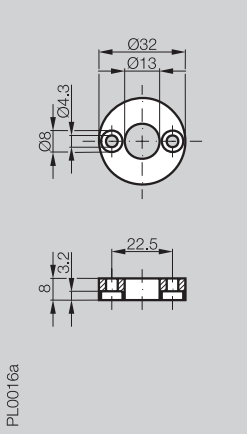
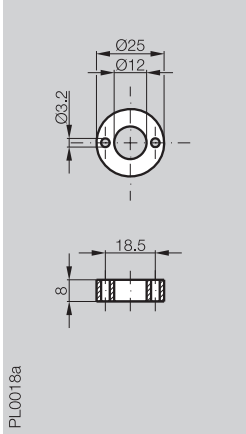
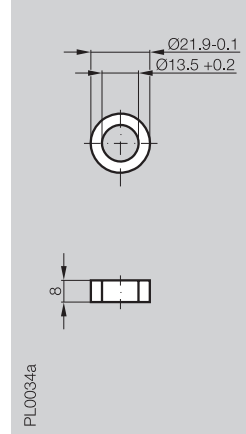
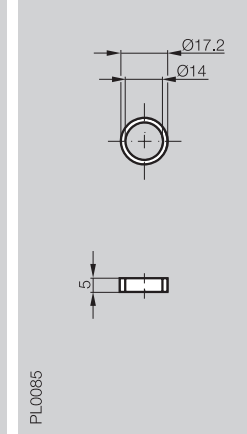
Shield connected to housing

Dimensions and mechanical data
page 48

Please order separately:
Magnets see page 53

Ordering example:

BTL6-P510-M - - -			
Standard nominal stroke [mm]	Housing	Connection type	
0025, 0051, 0076, 0090, 0102, 0127, 0152, 0178, 0203, 0230, 0254, 0280, 0305, 0330, 0381, 0407, 0457, 0508, 0560, 0610, 0661, 0711, 0762, 0813, 0914, 1016, 1067, 1220, 1270, 1372, 1524	E2 outer tube Ø 10.2 mm	Axial out KA02	PUR cable 2 m
	E28 outer tube Ø 8 mm, max. nominal stroke 1016 mm	Axial eccentric out KE02	PUR cable 2 m
		Axial out LA00,3	PUR pigtail 0.3 m

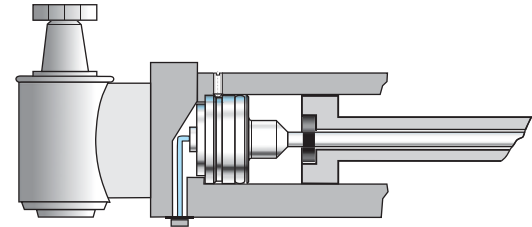
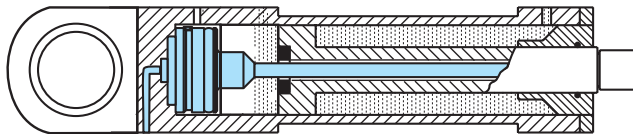
Description for Series	Magnet BTL6 rod	Magnet BTL6 rod	Magnet BTL6 rod	Magnet BTL6 rod
				
Ordering Code - Magnet	BTL-P-1013-4R*	BTL-P-1012-4R*	BTL-P-1014-2R	BTL-P-0814-GR-PAF
Ordering Code - Spacer	BTL Z-P-1013-4R-SPACER	BTL Z-2-1012-4R-SPACER	N/A	N/A
Material	Al	Al	Al	Ferrite PA 6
Weight	approx. 12 g	approx. 12 g	approx. 10 g	approx. 1.5 g
Magnet Traverse Speed	any	any	any	any
Operating Temperature/ Storage Temperature	-40...+100 °C	-40...+100 °C	-40...+100 °C	-40...+100 °C
Ordering Code PA 60 Fiberglass Reinforced	BTL-P-1013-4R-PA*	BTL-P-1012-4R-PA*		
Ordering Code - Spacer	SPACER BTL-P-1013-DR	SPACER BTL-P-1012-DR		
Material	PA 60 fiberglass reinforced	PA 60 fiberglass reinforced		
Weight	approx. 10 g	approx. 10 g		
Magnet Traverse Speed	any	any		
Operating Temperature/ Storage Temperature	-40...+100 °C	-40...+100 °C		

*Spacer is included with these magnets



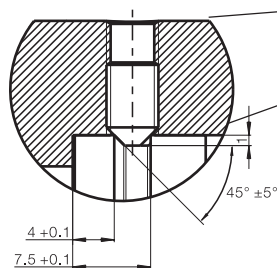
Micropulse AR style transducers are designed for integration in hydraulic cylinders. The transducer is mechanically supported at the housing. Three M5 set screws spaced at 120 °C hold the transducer, which fits into a Ø48 H8 hole.

Sealing is accomplished using the supplied O-ring and support ring. The magnet ring, which is integrated into the piston, marks the actual position of the piston as it moves without contact.

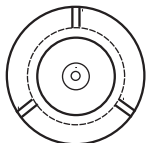


The metal surrounding the cylinder replaces the needed cable shield when the BTL AR...LA, cable out pigtail version is installed in the cylinder. The pigtail version cannot be used without additional EMC protection (shield).

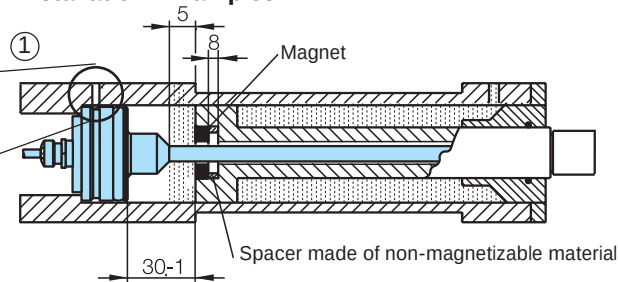
Set screw DIN 914 M5x8



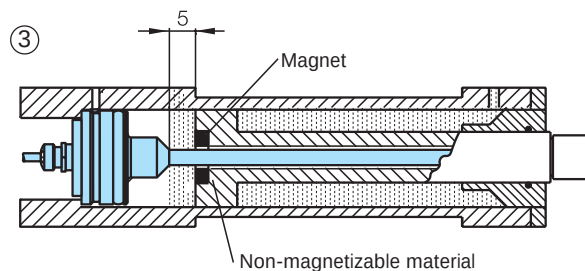
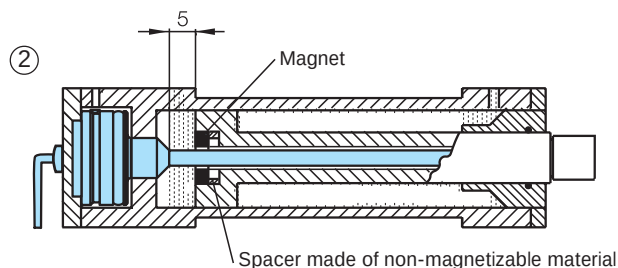
**Fixing the transducer
using three M5 set
screws spaced 120 °C**



Installation Examples



- ① Installation on piston side
- ② Installation from rear
- ③ Installation on piston side, in magnetic piston material



Note: Before construction, installation, and startup please familiarize yourself with the user's guide found at www.balluff.com.

Explosion Proof Flame Proof

In the petrochemical and process industries, reliability and uptime are critical. Component failure must be a rare event, but when it does occur, replacements should be fast and easy. Micropulse non-contact magnetostrictive technology offers superior long-term reliability over competing contact sensors such as linear or rotary potentiometers.

Balluff's cutting-edge explosion proof housing design incorporates a Rapid Replacement Module to get you up and running quickly in the unlikely event replacement is ever necessary. There is no need to break the hydraulic seal to remove the entire unit, because the internal electronics and sensing element can be replaced as an assembly in just a matter of minutes. Held in by two retaining screws, the Rapid Replacement Module is simple to remove and re-install, giving you confidence and peace of mind.

In today's global economy and world-wide scope of industrial operations, universal hazardous location approvals are indispensable for maintaining the flexibility to ship equipment throughout the world. The Balluff Micropulse® TA12 series offers the widest range of global application certifications for any magnetostrictive linear position feedback device on the market.

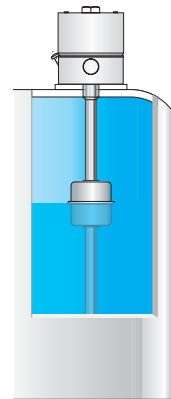


Features:

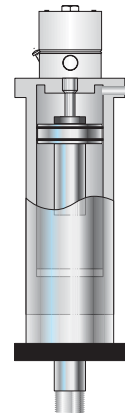
- Globally certified by FM Approvals for use in US, Canada and ATEX applications
- Rapid Replacement Module standard
- Eliminates the need for IS barriers
- Completely self-contained unit
- Solid stainless steel housing sealed to IP 68 standards
- Operates from 24 Vdc or 10...30 Vdc
- Wide range of output options to interface with virtually any control system
- Standard resolution to $<2 \mu\text{m}$ and linearity of $\pm 0.02\%$
- Provides consistent, stable accuracy over a temperature range of -40 to 176°F
- Enhanced wave guide construction provides a high level of resistance to shock and vibration.

Applications:

- Valve control
- Liquid level measurement
- Turbine applications
- Grain elevators
- Petroleum applications
- Paint manufacturing



Liquid Level



Cylinder


RRM Rapid Replacement Module

Enhanced Features

Balluff TA12 Ex-Proof transducers offer innovative features that enhance usability and increase performance.

Autotuning

- Patented Autotuning circuitry automatically compensates for changes in the strength of the magnetostrictive return signal.
- Autotuning compensates for changes in temperature, providing a more stable signal over a wide temperature range, and reducing maintenance and repair costs.
- Patented auto-tuning electronics help reduce maintenance and repair costs.

Rapid Replacement Module

- The Rapid Replacement Module allows quick replacement without having to remove the pressure tube from the cylinder – no need to de-pressurize the system.
- Decreases downtime – get up and running in minutes, not hours.

Configurable

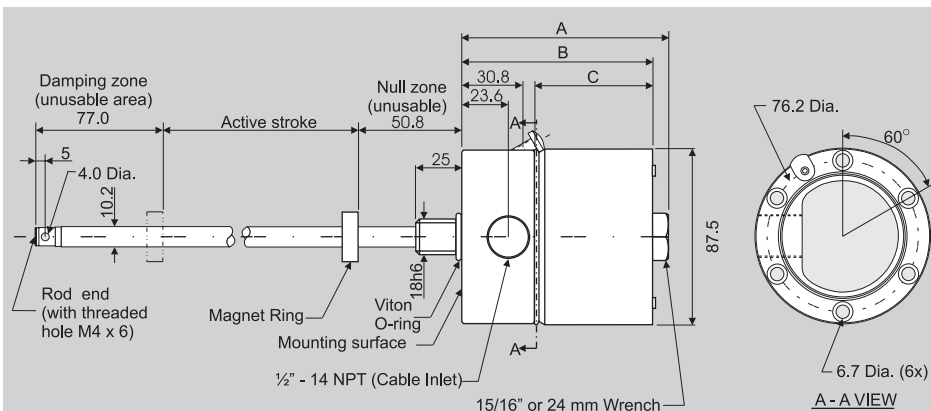
- Analog-output versions offer 100% scalable stroke range.
- PWM versions feature easy DIP-switch configuration for recirculation count and interrogation method.

General Specifications pg 56
Electrical Options pgs 57-60
Accessories pg 61
Installation Guidelines pg 62
Wiring Diagrams pg 62
How to Order pg 63

Series
Approvals
Output Signals

Explosion Proof, Flame Proof

FM Approvals, ATEX
Analog, Digital Pulse, SSI, CANopen, Profibus, Quadrature



Mounting is accomplished using six M6x45 A2 (stainless) socket-head cap screws (supplied with transducer) or six 1/4"-20x1-3/4" socket-head cap screws (user-supplied)

• Metric conduit adapter available. See page 61.

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

Ordering Code

BTL 5 _ _ _ _ -J-DEXC-TA12 (See ordering code on page 63)

Measurement Type
Measurement Range
Shock Rating
Vibration Rating
Environmental Protection
Housing Material
Pressure Rating (rod)
Operating Temperature
Storage Temperature
Humidity
Connection Type
Compatible Magnets
Approvals

Linear displacement
25 mm (1 in) to 5080 mm (200 in)
100 g/6 ms (100 g/2 ms continuous) per IEC 68 2-27
12 g, 10 to 2000 Hz per IEC 68-2-6
IP 68
316 stainless steel; cover Nitronics 60 stainless steel
600 bar (8700 PSI) max
-40 to + 176° F
-40 to + 212° F
< 90% non-condensing
Terminal block via rigid conduit (see accessories for approved conduit adapter)
See accessories



Class I, Division I, Groups A, B, C, and D
Class II/III, Division I, Groups E, F, and G
T6 Ta=65°C, T5 Ta=80°C Type 4X/6P
Class I Zone 1 AEx d IIC T6 Ta=65°C, T5 Ta=80°C
FM08ATEX0037

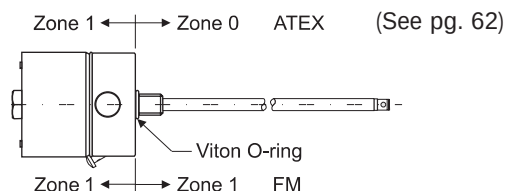


II 1/2 G Ex d IIC T6 Ta=65°C, T5 Ta=80°C IP68
II 1/2 D Ex tD A20 IP68 T85°C Ta=65°C, T100°C Ta=80°C
CE 0518 Ex

Metric conduit adapter (if required) must be ordered separately. See page 61.

Warning:

Proper installation of the Micropulse Ex is essential. Follow all installation instructions and precautions are outlined in the Micropulse Ex manual, provided with every unit. These products are not rated for personnel safety applications.



Electrical Interface	Analog	Analog	Digital
Electrical Type	Voltage	Current	Start/Stop PWM
Part No. Code (See pg. 63)	A, B, G	E, C	P, M, N, I, L, R, K
Output	0...+10 V, -5...+5 V, -10...+10 V	4...20 mA, 0...20 mA	Start/Stop or Pulse-width-modulated (RS422/RS485)
Output Load	> 2 K Ω (5 mA max)	$\leq 500 \Omega$	per spec
Resolution	≤ 0.33 mV	$\leq 0.66 \mu\text{A}$	Controller dependent
Non-linearity	$\pm 100 \mu\text{m}$ to 500 mm stroke, ± 0.02 % over 500 mm stroke	$\pm 100 \mu\text{m}$ to 500 mm stroke, ± 0.02 % over 500 mm stroke	$\pm 100 \mu\text{m}$ to 500 mm stroke, ± 0.02 % over 500 mm stroke
Repeatability	Resolution/ min 2 μm	Resolution/ min 2 μm	Resolution/ min 2 μm
Hysteresis	$\leq 5 \mu\text{m}$	$\leq 5 \mu\text{m}$	$\leq 5 \mu\text{m}$
Sampling Rate	2 kHz	2 kHz	500 Hz stroke > 2000 mm 1 kHz stroke < 2000 mm
Temperature Coefficient*	$[150 \mu\text{V}/^\circ\text{C} + (5 \text{ ppm}/^\circ\text{C} \cdot \text{P} \cdot \text{V}/\text{NL})] \cdot \Delta\text{T}$	$[0.6 \mu\text{A}/^\circ\text{C} + (10 \text{ ppm}/^\circ\text{C} \cdot \text{P} \cdot \text{V}/\text{NL})] \cdot \Delta\text{T}$	$(6 \mu\text{m} + 5 \text{ ppm} \cdot \text{NL}) / ^\circ\text{C}$
Operating Voltage	24 Vdc $\pm 20\%$, 10...30 Vdc	24 Vdc $\pm 20\%$, 10...30 Vdc	24 Vdc $\pm 20\%$, 10...30 Vdc
Operating Current	<150 mA Nominal, @ 24 Vdc	<150 mA Nominal, @ 24 Vdc	<100 mA (at 1 kHz sampling rate)

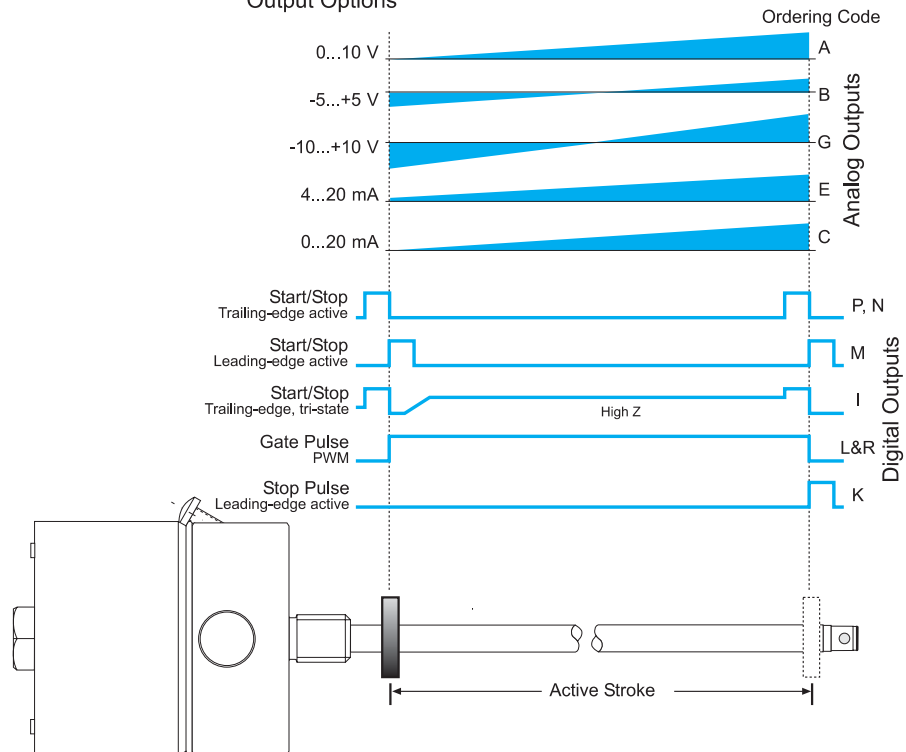
Notes:

Analog voltage output versions incorporate both rising and falling outputs.
Analog current version must be ordered as rising or falling outputs.

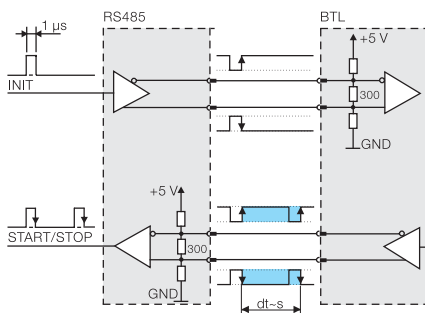
*Temperature coefficient variables:

- V** = output range in V
- I** = output range in [mA]
- ΔT = temperature change
- P** = magnet position
- NL** = stroke length

Output Options



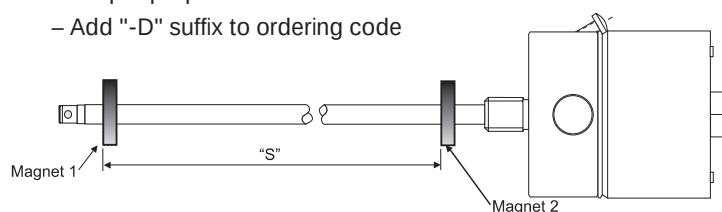
Analogue and Digital Output Options for the Micropulse Ex Style



RS-485 signal transmission with digital outputs

Two-Magnet Differential Mode

- Available on Analog & PWM
- Output proportional to distance "S"
- Add "-D" suffix to ordering code



CANopen

This interface provides an efficient connection to machines using CANopen. Features include:

- Process data objects incorporating position, velocity and set-point information
- Emergency object for set-points
- Service data objects for configuring transducer modes
- Synchronization objects for network wide activities

Profibus

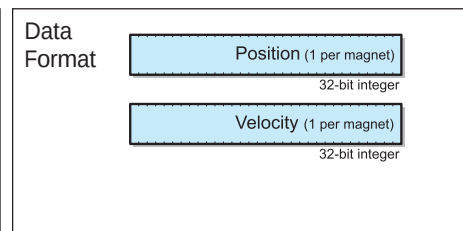
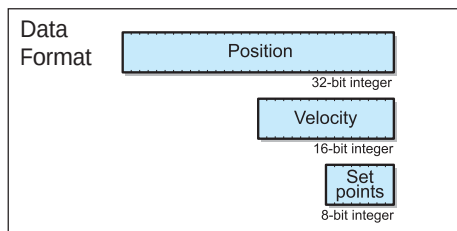
This interface provides an efficient connection to machines using Profibus. Features of this interface include:

- Single telegram message for fast updates even with 4 magnets
- Operates at 12 Mbps
- GSD file provided to configure telegram message
- Sync and Freeze functions available for coordination between other devices

Ordering Code	H	T
Resolution	Position 5 μ m, Velocity 0.1 mm/s increments (selectable)	Position 5 μ m (configurable) Velocity 0.1 mm/s increments (configurable)
Non-linearity	$\pm 30 \mu$ m at 5 μ m resolution	$\pm 30 \mu$ m at 5 μ m resolution
Repeatability (resolution + hysteresis)	± 1 digit	± 1 digit
Hysteresis	≤ 1 digit	≤ 1 digit
Sampling Rate	1 kHz	1 kHz
Temperature Coefficient	(6 μ m + 5 ppm x L)/ $^{\circ}$ C	(6 μ m + 5 ppm x L)/ $^{\circ}$ C
Operating Voltage	24 Vdc $\pm 20\%$	24 Vdc $\pm 20\%$
Operating Current	≤ 100 mA	≤ 120 mA
Network Isolation	yes	yes
Network Speed	10, 20, 50, 100, 125, 250, 500, 800, 1000 kBaud	9.6, 19.2, 93.7, 187.5, 900, 1500, 12000 kBaud
Network Compatibility	CiA Standard DS301 DS406 (Encoder Profile)	EN 50170 (Encoder Profile)
Address Selection	Software	DIP switch
Communication Types	Producer/Consumer	Master/Slave
Configuration Software	none required	GSD file
Number of Magnets Supported	1, 2 or 4	1, 2 or 4

Notes:

For more technical information, see pages 123-128



BTL5-H1 _ -Mxxxx-J-DEXC-TA12

Process Data

- 1 = 1 x position & 1 x velocity
- 2 = 2 x position & 2 x velocity
- 3 = 4 x position

Baud Rate

- 0 = 1MBaud
- 1 = 800 kBaud
- 2 = 500 kBaud
- 3 = 250 kBaud
- 4 = 125 kBaud
- 5 = 100 kBaud
- 6 = 50 kBaud
- 7 = 20 kBaud
- 8 = 10 kBaud

Stroke Length

xxxx = length in mm (see chart on page 63)
Max=156" (3962 mm)

BTL5-T1 0 -Mxxxx-J-DEXC-TA12

No. of Magnets

- 1 = 1 magnet
- 2 = 2 magnets
- 3 = 4 magnets

Stroke Length

xxxx = length in mm (see chart on page 63)
Max=156" (3962 mm)



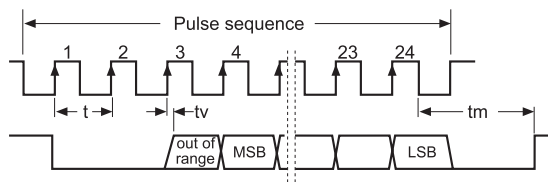
SSI

The SSI (synchronous serial interface) output interfaces with popular control systems from manufacturers such as Allen-Bradley, Delta Computer, Siemens, Parker, Bosch-Rexroth and many others. Cable spans can be up to 400 m with noise-free operation. Individual, EEPROM linearization of this interface makes it ideal for applications requiring the best accuracy available.

Ordering Code	S
Resolution	5, 10, 20 or 40 μm (see ordering code below)
Non-linearity–Non-synchronized	$\pm 30 \mu\text{m}$ or $\pm 2\text{LSBs}$, whichever is greater
"B" Synchronized	same as start/stop digital
Repeatability (resolution + hysteresis)	± 1 digit
Hysteresis	≤ 1 digit
Sampling Rate	2 kHz
Temperature Coefficient	$(6 \mu\text{m} + 5 \text{ ppm} \times L)/^\circ\text{C}$
Communication Speeds	100, 200, 400, 500, 1000 kHz
Output Modes	24 or 25 bits (binary or gray code)
Operating Voltage	24 Vdc $\pm 20\%$
Operating Current	$\leq 80 \text{ mA}$
Output	Standard RS-485/422 levels

Notes:

SSI Maximum cable lengths	
Cable length	Clock Freq.
< 25 m	< 1000 kHz
< 50 m	< 500 kHz
< 100 m	< 400 kHz
< 200 m	< 200 kHz
< 400 m	< 100 kHz



BTL5-S1 -Mxxxx-J-DEXC-TA12

Supply Voltage

1 = +24 V

Data Format

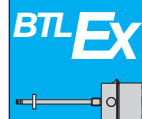
- 0 = Binary, increasing, 24 bit
- 1 = Gray code, increasing, 24 bit
- 2 = Binary, falling, 24 bit
- 3 = Gray code, falling, 24 bit
- 6 = Binary, increasing, 25 bit
- 7 = Gray code, increasing, 25 bit
- 8 = Binary, falling, 25 bit
- 9 = Gray code, falling, 25 bit

System Resolution

- 2 = 5 μm
- 3 = 10 μm
- 4 = 20 μm
- 5 = 40 μm
- 6 = 100 μm
- 8 = 50 μm

Stroke Length

xxxx = length in mm (see chart on page 63)
Max = 156" (3962 mm)





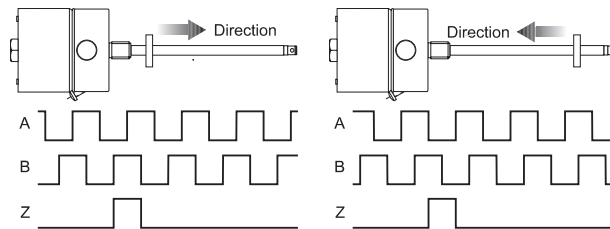
Quadrature

The quadrature output interfaces directly to standard encoder inputs (90° out of phase, A & B). This configuration gives you more interface options for connecting to motion based systems. In addition, the Micropulse quadrature output transducer has the ability to provide **absolute** position information through use of its innovative BURST function.

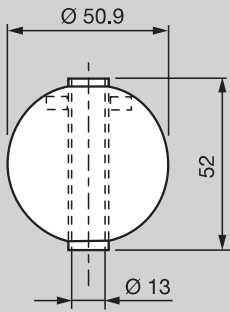
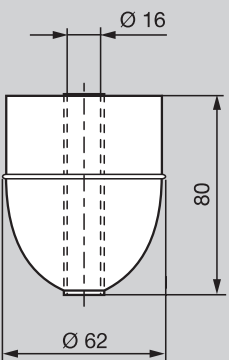
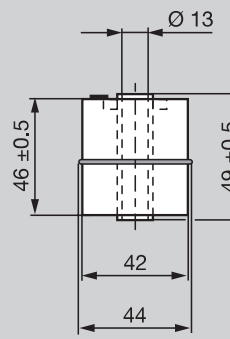
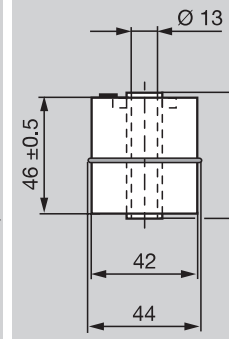
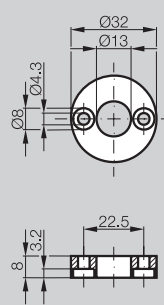
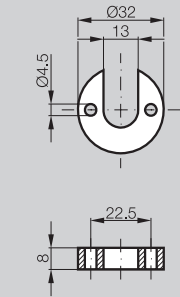
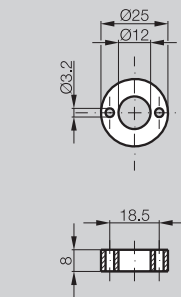
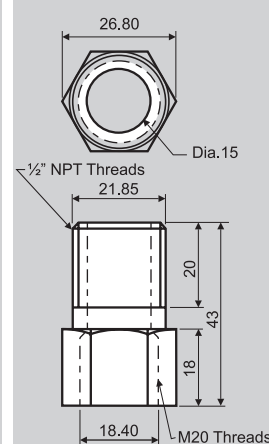
Ordering Code	Q
Resolution	1, 2, 5 10, 50 μm , 0.001", 0.0001", 0.0005" (switch selectable)
Non-linearity	± 100 mm to 500 mm stroke, $\pm 0.02\%$ over 500 mm stroke
Repeatability (resolution + hysteresis)	resolution + ($\pm 2 \times$ resolution or 5 μm , whichever is greater)
Hysteresis	$\pm 2 \times$ resolution or 5 μm , whichever is greater
Sampling Rate	Free-running: 1 ms, 2 ms, 4 ms; Synchronous: 500 μs to 10 ms
Temperature Coefficient	(6 μm + 5 ppm $\times$ L)/°C
Communication Speeds	10, 200, 400, 800 kHz
Output Modes	Free-running or Synchronous (switch selectable)
Operating Voltage	24 Vdc $\pm 20\%$, 10...30 Vdc
Operating Current	≤ 80 mA
Output	Standard A & B (RS-422 level)

Notes:

SSI Cable length	Maximum cable lengths Clock Freq.
< 25 m	< 1000 kHz
< 50 m	< 500 kHz
< 100 m	< 400 kHz
< 200 m	< 200 kHz
< 400 m	< 100 kHz



BTL5-Q -Mxxxx-J-DEXC-TA12	
Supply Voltage	1 = +24 V 5 = 10...30 V
Quadrature Frequency	0 = 833 kHz 1 = 416 kHz 2 = 208 kHz 6 = 10 kHz
System Resolution	0 = 1 μm 1 = 2 μm 2 = 5 μm 3 = 10 μm 5 = 50 μm 6 = 0.0001" 7 = 0.001" 8 = 0.0005"
Mode/Update Rate	0 = Synchronous (initiated by controller) 1 = free-running, 1 ms update – ≤ 1250 mm stroke only 2 = free-running, 2 ms update – 1251 mm to 2500 mm 4 = free-running, 4 ms update – ≥ 2501 mm
Stroke Length	xxxx = length in mm (see chart on page 63)

Product Type	Ex Rated Float Magnet Sphere	Ex rated Float Magnet Bullet	Ex Rated Float Magnet Barrel	Ex Rated Float Magnet Barrel
				
Ordering Code	BTL2-S-5113-4K-EX	BTL2-S-6216-8P-EX	BTL2-S-4414-4Z01-EX	BTL2-S-4414-4Z-EX
Minimum Density	0.7 g/cm ₃	0.6 g/cm ₃	0.85 g/cm ₃	0.7 g/cm ₃
Immersion Depth in 1 g/cm ₃ (H ₂ O)	26	41	45	30
Immersion Depth in 0.7 g/cm ₃	40	57	sinks	39
Material	Stainless 316	Stainless 316	Stainless 316	Stainless 316
Product Type	Magnet, Spacer Ø32 Ring	Magnet Ø32 Open Ring	Magnet Ø25 Ring	Adapter Rigid Conduit Adapter
				
Ordering Code	BTL-P-1013-4R*	BTL-P-1013-4S*	BTL-P-1012-4R*	BTL-A-AD09-M-00EX
Ordering Code - Spacer	BTL Z-P-1013-4R-Spacer	Spacer BTL-P-1013-DS	BTL Z-2-1012-4R-Spacer	
Material	Aluminum	Aluminum	Aluminum	Nickel Plated Brass

*Spacer is included with these magnets

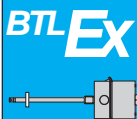
Approvals for BTL-A-AD09-M-00EX:



ATEX
SIRA 00A TEX1094
Ex de I & IIC
I M2, II 2 GD



CSA/AEx
AEx de Class I, Zone I, Groups I & IIC
Class I, Division 1 & 2, Groups A, B, C, D
Class II & III, Groups E, F, G

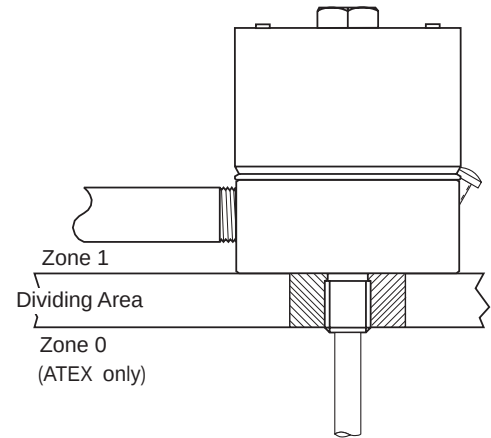


Installing in Locations Classified as Zone 0 Under ATEX Guidelines

Only the rod section of the transducer may extend into Zone 0. To ensure safe isolation between Zone 0 and Zone 1, the relevant safety regulations for potentially explosive atmospheres must be strictly adhered to.

When using a float magnet, it is necessary that a static discharge between the transducer rod and the inner portion of the float be prevented. The floats on page 61 are designed so that, in normal operation, the float is tilted, thereby ensuring mechanical contact between the transducer rod and the float wall. Do not use other types of floats or attempt to disable this design feature.

Note: The transducer is not approved for locations classified as Zone 0 under FM Approval guidelines.



Output Type (Ordering Code) Fig. 1

Pin	Analog Voltage (A/B/G)	Analog Current (C/E)	Digital START/STOP (I/K/M/N/P)	DIGITAL PWM (L/R)	SSI (S)
1	not used	Signal Out	Interrogate (+) (input)	Interrogate (+) (input)	CLK (+) (input)
2	signal GND	Signal GND	START/STOP (+) (output)	GATE (+) (output)	DATA (+) (output)
3	Signal Out (falling)	not used	Interrogate (-) ¹ (input)	Interrogate (-) (input)	CLK (-) (input)
4	Pwr Supply GND	Pwr Supply GND	Pwr Supply GND	Pwr Supply GND	Pwr Supply GND
5	Pwr Supply (+10 to +30 Vdc)	Pwr Supply (+10 to +30 Vdc)	Pwr Supply (+10 to +30 Vdc)	Pwr Supply (+10 to +30 Vdc)	Pwr Supply (+10 to +30 Vdc)
6	Signal Out (rising)	not used	START/STOP (-) ¹ (output)	GATE (-) (output)	DATA (-) (output)
7	not used	not used	not used	not used	not used

Note 1: Ordering code version "N" is a single-ended, TTL compatible START/STOP version. This version does not use **Interrogate (-)** or **START/STOP (-)**. Pins 3 and 6 should be left unconnected for "N"-type transducers.

Output Type (Ordering Code) Fig. 2

Pin	Profibus (T)
1	RxD/TxD-N
2	RxD/TxD-P
3	Data GND
4	Pwr Supply GND
5	Pwr Supply (+)
6	VP (+5 V Output)
7	Not used
8	Not used

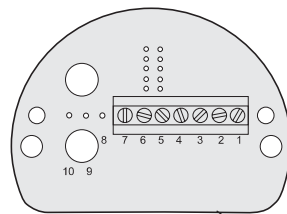


Fig. 1

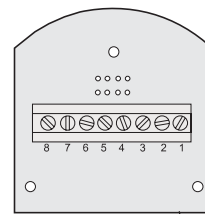


Fig. 2

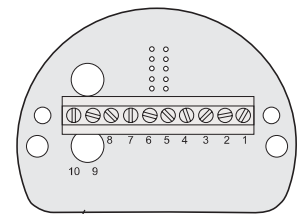
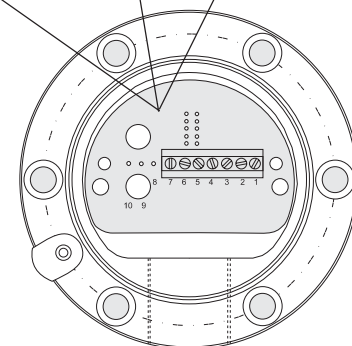


Fig. 3

Output Type (Ordering Code) Fig. 3

Pin	Quadrature (Q)	CANbus (H)
1	Output Channel A (+)	CAN GND
2	Output Channel B (+)	CAN Low
3	Output Channel A (-)	CAN High
4	Pwr Supply GND	Pwr Supply GND
5	Pwr Supply (+10 to +30 Vdc)	Pwr Supply (+24V)
6	Output Channel B (-)	CAN GND
7	Output Channel Z (+)	CAN Low
8	Output Channel Z (-)	CAN High
9	Strobe Input	Not used
10	Not used	Not used



Typical housing with terminal block assembly.

Replacement Module Only **B T L 5 - A 11 - M 0 3 0 5 - J - M 0 1 - T A**
 Complete Transducer **B T L 5 - A 11 - M 0 3 0 5 - J - D E X C - T A 1 2 - E 4 / U S**

**Balluff
Linear Transducer**

Generation 5

Output Type

A = 0 to 10 Vdc
 B = -5 to +5 Vdc
 C = 0 to 20 mA
 E = 4 to 20 mA
 G = -10 to +10 Vdc
 S = SSI*
 T = Profibus*
 H = CANopen*
 Q = Quadrature*
 I = Differential start/stop with tri-state
 K = Differential stop – leading edge active
 L = Differential pulse – width modulated
 M = Differential start/stop – leading edge active
 N = Single ended start/stop – leading edge (add /US)
 P = Differential start/stop – trailing edge active
 R = Differential pulse-width – recirculated

Supply Voltage

1 = 24 Vdc ±20%
 5 = 10...30 Vdc (Not available for T & H output types; not available for SSI "B")

Analog Output Operation

(blank for digital)

Voltage output (Output type A, B & G)

1 = User selectable rising or falling

Current output (Output type C & E)

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

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

Stroke Length

0 3 0 5 = active stroke length

Housing Style

J = Rod Style, Smooth Flange, O-ring seal
 Supplied with (6) M6 x 45 stainless steel mounting screws

Rating Code

D E X = Explosion-Proof, **C** = Universal end plug

Electrical Connection Style

T A 1 2 = Terminal block connection, 1/2"-14 NPT conduit entry (see M20 adapter on page 61)

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

I = Internal interrogation, E = External interrogation

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

1=1 circulation, 2 = 2 circulations, 3 = 3 circulations, 4 = 4 circulations, 6 = 6 circulations,
 8 = 8 circulations, 10 = 10 circulations, 16 = 16 circulations

*See additional ordering information on pages 58-60.

Notes:

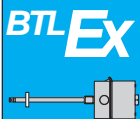
- Conduit adapter 1/2" - 14 NPT to M20 metric **BTL-A-AD09-M-00EX**
- Replacement metric mounting screw kit: **BTL5-A-FK01-E-J-DEX**
- Analog Programming Tool: **BTL5-A-EH03**
- Replacement electronics and waveguide module: Substitute "J-M01-TA" for "J-DEXC-TA12" in part number of complete unit

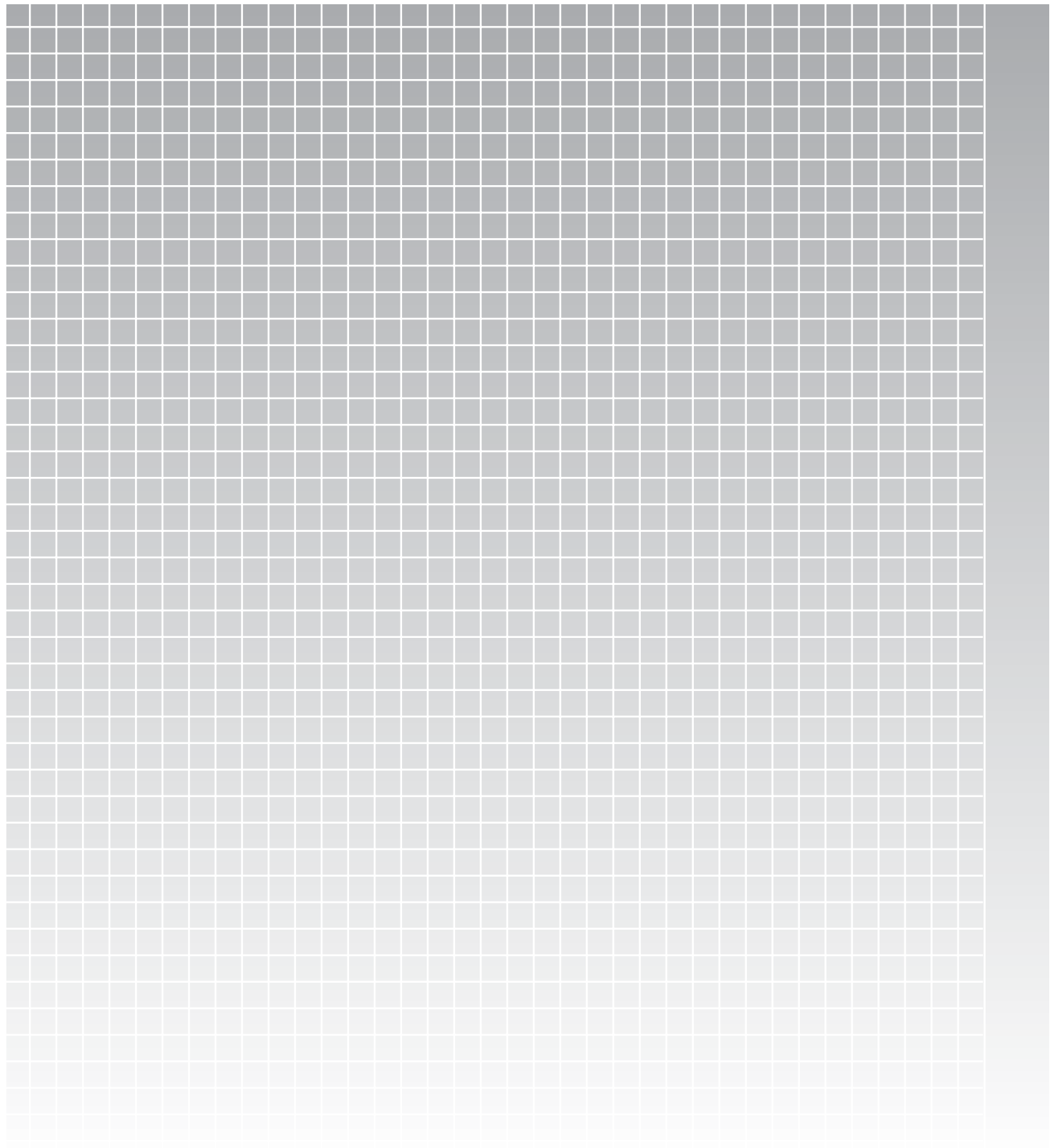
Standard Stroke Lengths, Inches (mm) (consult factory for additional lengths)

1 (0025)	9 (0230)	22 (0560)	48 (1220)	89 (2261)	156 ^A (3962)	192 (4877)
2 (0051)	10 (0254)	24 (0610)	50 (1270)	98 (2490)	160 (4064)	196 (4978)
3 (0076)	11 (0280)	26 (0661)	54 (1372)	108 (2743)	164 (4166)	200 (5080)
3.5 (0090)	12 (0305)	28 (0711)	60 (1524)	118 (2997)	168 (4267)	
4 (0102)	13 (0330)	30 (0762)	66 (1676)	126 (3200)	172 (4369)	
5 (0127)	15 (0381)	32 (0813)	69 (1753)	140 (3556)	176 (4470)	
6 (0152)	16 (0407)	36 (0914)	72 (1829)	144 (3658)	180 ^B (4572)	
7 (0178)	18 (0457)	40 (1016)	78 (1981)	148 (3759)	184 (4674)	
8 (0203)	20 (0508)	42 (1067)	84 (2134)	152 (3861)	188 (4775)	

^A Maximum length for SSI, Profibus, CANopen = 156 inches.

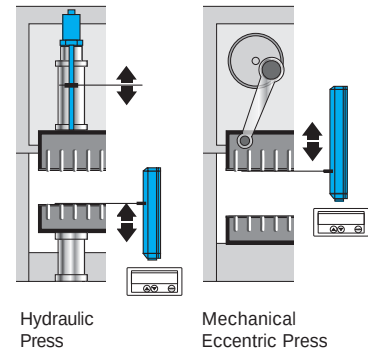
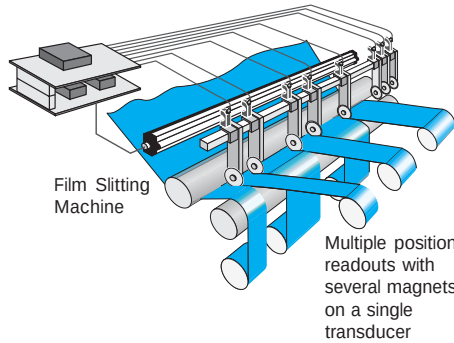
^B Maximum length for analog outputs = 180 inches.





Profile Style

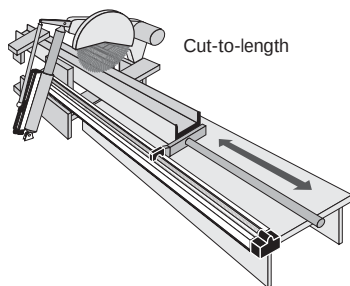
Balluff Micropulse® linear position transducers in the Profile-style housing are a rugged, wear-free alternative to other linear feedback devices such as wear-prone potentiometers, expensive and fragile glass scales, and limited-stroke LVDT's. Environmentally sealed to IP 67, and utilizing either a sliding captive magnet or a free-floating magnet, the Profile housing Micropulse transducer provides highly accurate linear position feedback in demanding, harsh industrial applications.



Speed up die changes with digital display of shut height and parallelism

Features/Advantages:

- Non-contact absolute position feedback
- IP 67, highly resistant to contamination
- Wear free
- High immunity to shock and vibration
- Direct replacement of lower grade linear feed back devices
- Captive or floating magnet



Outputs:

- Analog
- Digital Pulse
- SSI
- CANopen
- Profibus
- DeviceNet

Applications:

Balluff transducers offer features which assure reliable operation in many areas of automation and process technology, even under extreme ambient conditions:

- Hydraulic cylinders
- Tooling and tool handling
- Presses
- Casting and rolling mills
- Foundries
- Injection molding
- Leveling machines
- Transport systems
- Lift controls
- Level monitoring
- Tunnel boring equipment
- Die casting machinery
- Portal robots
- Woodworking machinery
- Flight simulators
- Cutting/slitting machinery
- Conveying
- Packaging machines
- Windmills
- Elevators
- Forestry



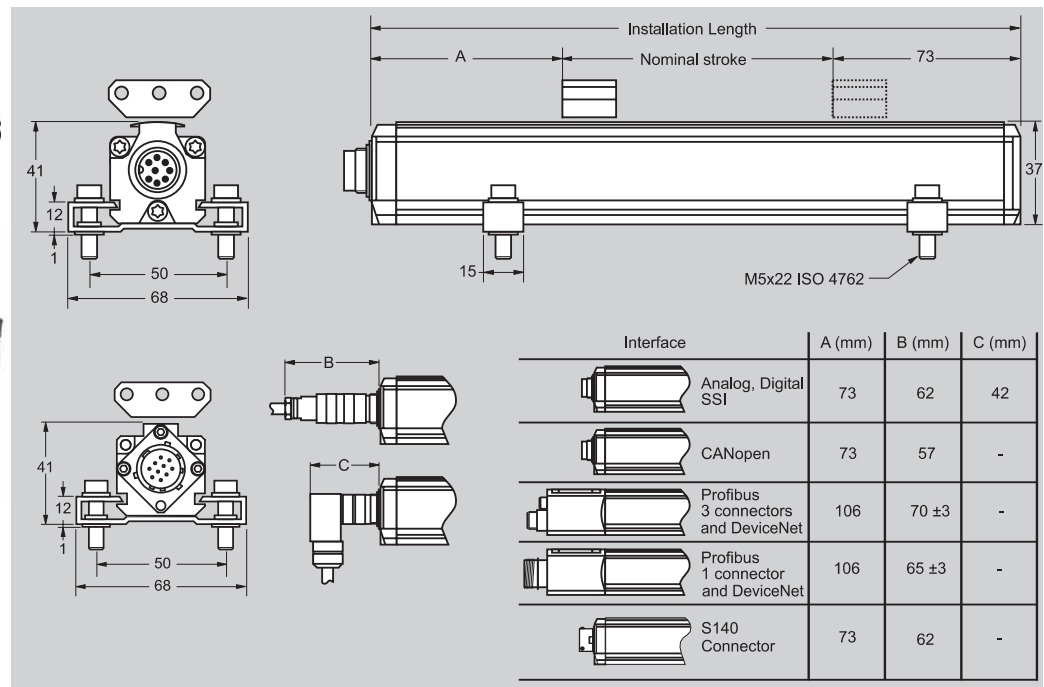
BTL^P



General Specifications pg 66
Electrical Options pgs 67-70
Magnets pgs 71-73
Accessories pg 74
Wiring Diagrams pg 75
How to Order pg 76

Series
Available Lengths
Output Signals

P Style
51 mm (2 in) to 5080 mm (200 in)
Analog, Digital Pulse, SSI, CANopen, Profibus, DeviceNet, Quadrature



Ordering Code

BTL5- -M- -P- - (See ordering code on page 76)

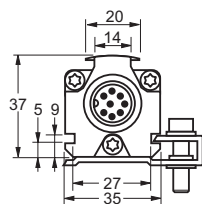
Measurement Type	Linear displacement
Measurement Range	51 mm (2 in) to 5080 mm (200 in)
Shock Rating	100 g/6 ms (100 g/2 ms continuous) per IEC 68 2-27
Vibration Rating	12 g, 10 to 2000 Hz per IEC 68-2-6
Environmental Protection	IP 67 (when BKS-S32/33 is installed)
Housing Material	anodized aluminum
Operating Temperature	-40 to + 185° F
Storage Temperature	-40 to + 212° F
Humidity	< 90% non-condensing
Connection Type	connector or integral cable
Noise Immunity	ESD, RFI and BURST per IEC 1000-4-2/3/4/6, severity level 3
Approvals	CE

Warning:

These products are not rated for personnel safety applications.

Accessories:

Magnets pg 71-73
Connectors pg 74



Additional mounting dimensions

Autotuning Circuitry

Patented Autotuning circuitry in Balluff Micropulse® transducers automatically compensates for changes in the strength of the magnetostrictive return signal.

- Automatically compensates for changes in temperature, providing a more stable signal over a wide temperature range.
- For Micropulse profile-style transducers using a floating magnet configuration, Autotuning ensures that the return signal remains stable, even if the distance from magnet to transducer varies.

Micropulse P Style

Electrical Options

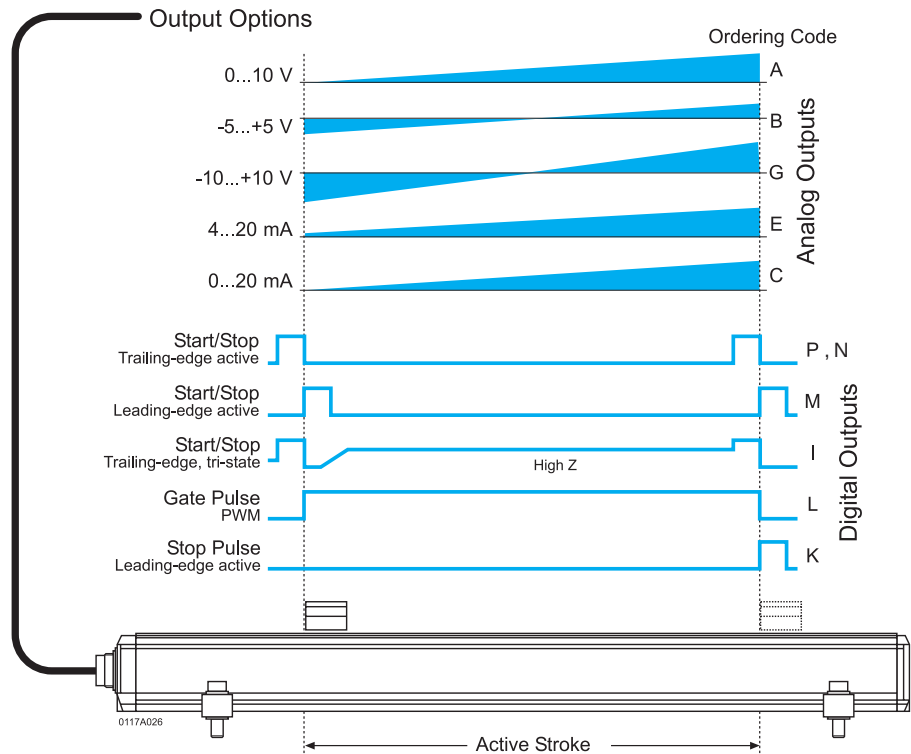
Electrical Interface	Analog	Analog	Digital
Electrical Type	Voltage	Current	Start/Stop & PWM
Part No. Code (See Pg. 76)	A, B, G	E, C	P, M, N, I, L, K
Output	0...+10 V, -5...+5 V, -10...+10 V	4...20 mA, 0...20 mA	Start/Stop or Pulse-width-modulated (RS422/RS485)
Output Load	> 2 K Ω (5 mA max)	$\leq 500 \Omega$	per spec
Resolution	< 0.1 mV	< 0.2 μ A	Controller dependent
Non-linearity	$\pm 100 \mu$ m to 500 mm stroke, ± 0.02 % over 500 mm stroke	$\pm 100 \mu$ m to 500 mm stroke, ± 0.02 % over 500 mm stroke	$\pm 100 \mu$ m to 500 mm stroke, ± 0.02 % over 500 mm stroke
Repeatability	Resolution/ min 2 μ m	Resolution/ min 2 μ m	Resolution/ min 2 μ m
Hysteresis	4 μ m	4 μ m	4 μ m
Sampling Rate	500 Hz stroke > 2000 mm 1 kHz stroke < 2000 mm	500 Hz stroke > 2000 mm 1 kHz stroke < 2000 mm	500 Hz stroke > 2000 mm 1 kHz stroke < 2000 mm
Temperature Coefficient*	[150 μ V/ $^{\circ}$ C + (5 ppm/ $^{\circ}$ C*P*V/NL)] * Δ T	[0.6 μ A/ $^{\circ}$ C + (10 ppm/ $^{\circ}$ C*P*V/NL)] * Δ T	(6 μ m + 5 ppm*NL) / $^{\circ}$ C
Operating Voltage	24 Vdc $\pm 20\%$ or 15 Vdc $\pm 2\%$	24 Vdc $\pm 20\%$ or 15 Vdc $\pm 2\%$	24 Vdc $\pm 20\%$ or 15 Vdc $\pm 2\%$
Operating Current	< 150 mA (at 1 kHz sampling rate)	< 150 mA (at 1 kHz sampling rate)	< 150 mA (at 1 kHz sampling rate)

Notes:

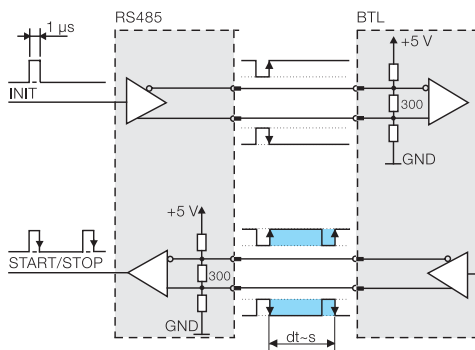
Analog voltage output versions incorporate both rising and falling outputs. Analog current version must be ordered as rising or falling outputs.

*Temperature coefficient variables:

V = output range in V
I = output range in [mA]
 Δ T = temperature change
P = magnet position
NL = stroke length



Analog and Digital Output Options for the Micropulse P Style



RS485 signal transmission with digital outputs

BTL P



Micropulse P Style



Electrical Options

CANopen

This interface provides an efficient connection to machines using CANopen. Features include:

- Process data objects incorporating position, velocity and set-point information
- Emergency object for set-points
- Service data objects for configuring transducer modes
- Synchronization objects for network wide activities

DeviceNet

This interface provides an efficient connection to machines using DeviceNet. Features include:

- Process data objects incorporating position, velocity and set-point information
- EDS file provided for configuration and set up
- Bi-color LED provides limited device and communication status
- High data security: output data is checked for validity and plausibility in the controller

Network Options

Profibus

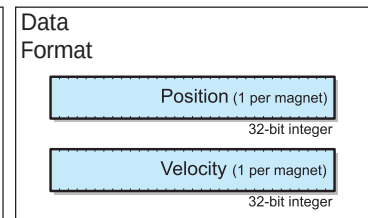
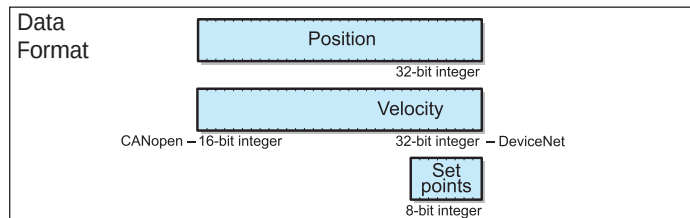
This interface provides an efficient connection to machines using Profibus. Features of this interface include:

- Single telegram message for fast updates even with 4 magnets
- Operates at 12 Mbps
- GSD file provided to configure telegram message
- Sync and Freeze functions available for coordination between other devices

Ordering Code	H	D	T
Resolution	5 μ m	5 μ m (configurable)	5 μ m (configurable)
Position Velocity	0.1 mm/s increments (selectable)	0.1 mm/s increments (configurable)	0.1mm/s increments (configurable)
Non-linearity	$\pm 30 \mu$ m at 5 μ m resolution	$\pm 30 \mu$ m at 5 μ m resolution	$\pm 30 \mu$ m at 5 μ m resolution
Repeatability (resolution + hysteresis)	± 1 digit	± 1 digit	± 1 digit
Hysteresis	≤ 1 digit	≤ 1 digit	≤ 1 digit
Sampling Rate	1 kHz	1 kHz	1 kHz
Temperature Coefficient	(6 μ m + 5 ppm x L)/°C	(6 μ m + 5 ppm x L)/°C	(6 μ m + 5 ppm x L)/°C
Operating Voltage	24 Vdc $\pm 20\%$	20...28 Vdc	24 Vdc $\pm 20\%$
Operating Current	≤ 100 mA	≤ 100 mA	≤ 120 mA
Network Isolation	yes	yes	yes
Network Speed	10, 20, 50, 100, 125, 250, 500, 800, 1000 kBaud	125, 250, 500 kBaud	9.6, 19.2, 93.7, 187.5, 900, 1500, 1200 kBaud
Network Compatibility	CiA Standard DS301, DS406 (Encoder Profile)	CIP 2.1 (Resolver Device)	EN 50170 (Encoder Profile)
Address Selection	Software	DIP switch or Software	DIP switch
Communication Types	Producer/Consumer	Producer/Consume	Master/Slave
Configuration Software	none required	EDS file	GSD file
Number of Magnets Supported	1, 2 or 4	1, 2 or 4	1, 2 or 4

Notes:

For more technical information, see pages 123-128



BTL5-H1_ -Mxxxx-P-S94

BTL5-D1_ -Mxxxx-P-S93

BTL5-T1_0 -Mxxxx-P-S103

Process Data

- 1 = 1 x position & 1 x velocity
- 2 = 2 x position & 2 x velocity (CANopen only)
- 3 = 4 x position (CANopen only)

Baud Rate

- 0 = 1 MBaud (CANopen only)
- 1 = 800 kBaud (CANopen only)
- 2 = 500 kBaud
- 3 = 250 kBaud
- 4 = 125 kBaud
- 5 = 100 kBaud (CANopen only)
- 6 = 50 kBaud (CANopen only)
- 7 = 20 kBaud (CANopen only)
- 8 = 10 kBaud (CANopen only)

Stroke Length

xxxx = length in mm (see chart on page 76)

Connection Type¹

S94 = two 5-pin M12 (standard-CANopen only)

- Bus in: 5-pin male, M12
- Mating connector: BKS-S92-00 (female)
- Bus out: 5-pin female, M12
- Mating connector: BKS-S94-00 (male)

S92 = one 5-pin (optional-CANopen only)

S93 = three connectors (standard-DeviceNet only)

- Bus in: 5-pin male, M12
- Mating connector: BKS-S92-00 (female)
- Bus out: 5-pin female, M12
- Mating connector: BKS-S94-00 (male)
- Power: 3-pin male, M8
- Mating connector: BKS-S48-15-CP-xx (female)

No. of Magnets

- 1 = 1 magnet
- 2 = 2 magnets
- 3 = 4 magnets

Stroke Length

xxxx = length in mm (see chart on page 76)

Connection Type

S103 = 3 connectors (standard):

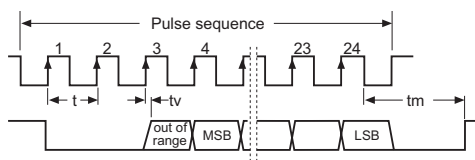
- Power: 3-pin male, M8
- Mating connector: BKS-S48-15-CP-xx (female)
- Bus in: 5-pin male, M12
- Mating connector: BKS-S105-00 (female)
- Bus out: 5-pin female, M12
- Mating connector: BKS-S103-00 (male)



SSI

The SSI (synchronous serial interface) output interfaces with popular control systems from manufacturers such as Allen-Bradley, Siemens, Parker and many others. Cable spans can be up to 400m with noise free operation. Individual EEPROM linearization of this interface makes it ideal for applications requiring the best accuracy available.

Ordering Code	S
Resolution	5, 10, 20 or 40 μm
Non-linearity	$\pm 30 \mu\text{m}$ or $\pm 2\text{LSBs}$, whichever is greater
Repeatability (resolution + hysteresis)	± 1 digit
Hysteresis	≤ 1 digit
Sampling Rate	500 μs
Temperature Coefficient	$(6 \mu\text{m} + 5\text{ppm} \times L)/^\circ\text{C}$
Communication Speeds	100, 200, 400, 500, 1000 kHz
Output Modes	24 or 25 bits
Operating Voltage	24 Vdc $\pm 20\%$
Operating Current	$\leq 80 \text{ mA}$
Output	Standard RS-485/422 levels
Output Load	$> 2 \text{ K}\Omega$ (5 mA max)



Notes:

Cable length	Clock Freq.
< 25 m	< 1000 kHz
< 50 m	< 500 kHz
< 100 m	< 400 kHz
< 200 m	< 200 kHz
< 400 m	< 100 kHz

BTLS-S1 -Mxxxx-P-

Coding

- 0 = Binary, increasing, 24 bit
- 1 = Gray code, increasing, 24 bit
- 2 = Binary, falling, 24 bit
- 3 = Gray code, falling, 24 bit
- 6 = Binary, increasing, 25 bit
- 7 = Gray code, increasing, 25 bit
- 8 = Binary, falling, 25 bit
- 9 = Gray code, falling, 25 bit

System Resolution

- 2 = 5 μm
- 3 = 10 μm
- 4 = 20 μm
- 5 = 40 μm
- 6 = 100 μm
- 8 = 50 μm

Stroke Length

xxxx = length in mm
(see chart on page 76)
Maximum stroke length = 156" (3962 mm)

Connection Type

- S 32 = Connector (see page 74 for mating cables)
- KA02 = 2 m PUR cable
- KA05 = 5 m PUR cable
- KA10 = 10 m PUR cable
- KA15 = 15 m PUR cable

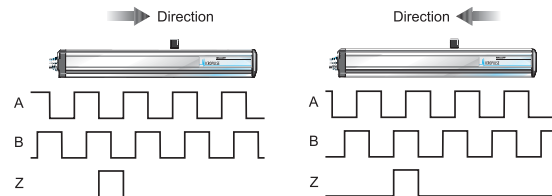
Quadrature

The quadrature output interfaces directly to standard encoder inputs (90° out of phase, A & B). This configuration gives you more interface options for connecting to motion based systems. Operating modes can be either free-running or synchronous (switch selectable) depending on the control system's requirements.

- Remotely triggered Burst Mode rapidly delivers accumulated pulse string for absolute information upon demand, eliminating the need to re-home after a power loss or other cycle interruption.
- Operates in either synchronous or free-running modes
- Selectable position resolution (1, 2, 5, 10, 50 μm or 0.001", 0.0005", 0.0001")
- Selectable pulse frequencies (10, 208, 416, 833 kHz)

Ordering Code

Resolution	1, 2, 5, 10, 50 μm or 0.001", 0.0005", 0.0001" (switch selectable)
Non-linearity	$\pm 100 \mu\text{m}$ to 500 mm stroke, $\pm 0.02\%$ over 500 mm stroke
Repeatability (resolution + hysteresis)	resolution + ($\pm 2 \times$ resolution or 5 μm , whichever is greater)
Hysteresis	$\pm 2 \times$ resolution or 5 μm , whichever is greater
Sampling Rate	Free-running: 1 ms, 2 ms, 4 ms Synchronous: 500 μs to 10 ms
Temperature Coefficient	(6 μm + 5 ppm $\times$ L)/°C
Pulse Frequency	10, 208, 416, 833 kHz
Output Modes	Free-running or Synchronous (switch selectable)
Operating Voltage	10...30 Vdc
Operating Current	$\leq 75 \text{ mA @ } 24 \text{ V}, \leq 100 \text{ mA @ } 15 \text{ V}, \leq 150 \text{ mA @ } 10 \text{ V}$
Output	Standard A & B (RS-422 level)



BTL5-Q5 -Mxxxx-P-xxxx

Supply Voltage

5 = 10...30 Vdc

Quadrature Frequency

0 = 833 kHz

1 = 416 kHz

2 = 208 kHz

6 = 10 kHz

System Resolution

0 = 1 μm

1 = 2 μm

2 = 5 μm

3 = 10 μm

5 = 50 μm

6 = 0.0001"

7 = 0.001"

8 = 0.0005"

Mode/Update Rate

0 = Synchronous (initiated by controller — consult factory)

1 = free-running, 1 ms update — $\leq 1250 \text{ mm}$ stroke only

2 = free-running, 2 ms update — 1251 mm to 2500 mm

4 = free-running, 4 ms update — $\geq 2501 \text{ mm}$

Stroke Length

xxxx = Length in mm (see chart page 76)

Connection Type

S140 = MS style connector (see page 107-114 for mating cables)

KA02 = 2 meter PVC cable

KA05 = 5 meter PVC cable

KA10 = 10 meter PVC cable

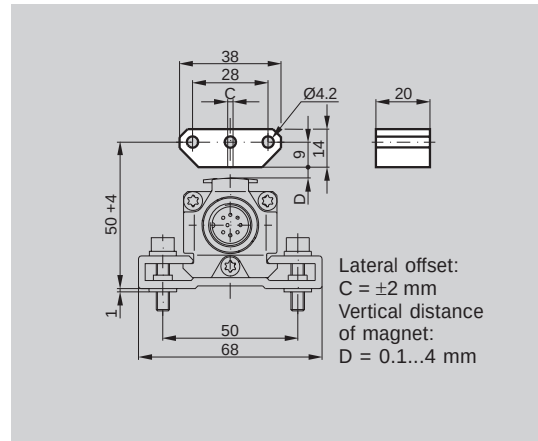
KA15 = 15 meter PVC cable

Balluff magnets are available in captive or floating styles. All BTL5 magnets shown here can be used on any Balluff Micropulse transducer.

The BTL5-P-3800-2 magnet can be used with a vertical offset from the upper surface of the transducer body of 0...4 mm, and the BTL5-P-5500-2 permits a distance of 5...15 mm. The BTL5-P-4500-1 is an electromagnet and requires a supply voltage of 24 V, which can be turned on and off for selective activation. This allows multiplex operation with multiple magnets on a single transducer, since only one magnet is active at a time.

Description
for Series
Type

Magnet
BTL Profile
Floating



Ordering Code
Housing Material
Weight
Magnet Traverse Speed
Supply Voltage
Current Draw
Operating Temperature/Storage Temperature
Included

BTL5-P-3800-2
Plastic
approx. 12 g
any
-40...+85 °C
Magnet
2 mounting screws DIN 84 M4×35-A2 with washers and nuts



Each mounting foot includes 4 isolation washers and 2 mounting screws ordered separately.
Order part number:
BTL P-M5-VZ (sold in pairs)

Number of Mounting Feet (Recommended)

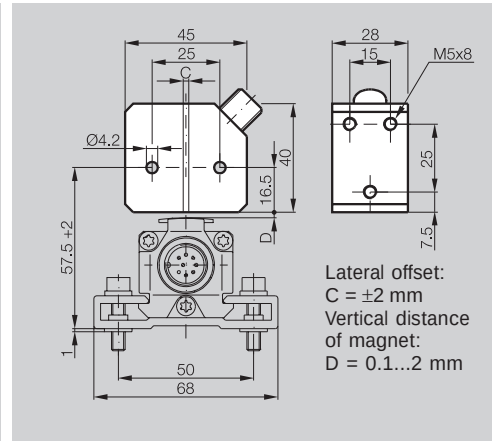
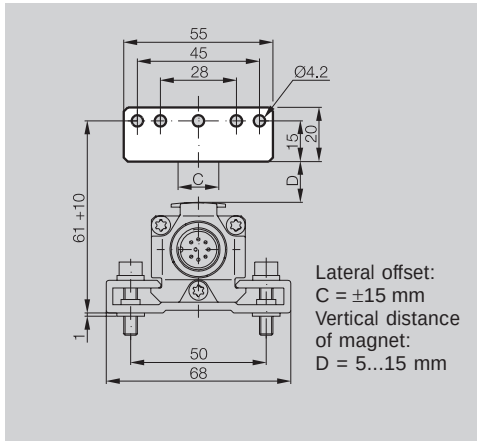
Transducer Stroke Length (mm)	Recommended Number of Feet
0051-0457	2
0508-0711	3
0762-0914	4
1016-1220	5
1270	6
1524	7
1778	8
2032	9
2286	10
2540	11
2794	12
3048	13
3302	14
3606	15
3962	16
4267	17
4572	18
4877	19
5080	20



Description
for Series
Type

Magnet
BTL Profile
Extended range, Floating

Magnet
BTL Profile
Electromagnet, Floating



Ordering Code

BTL5-P-5500-2

BTL5-P-4500-1

Housing Material
Weight
Magnet Traverse Speed
Supply Voltage
Current Draw
Operating/Storage Temperature
Included
Accessories
(please order separately)

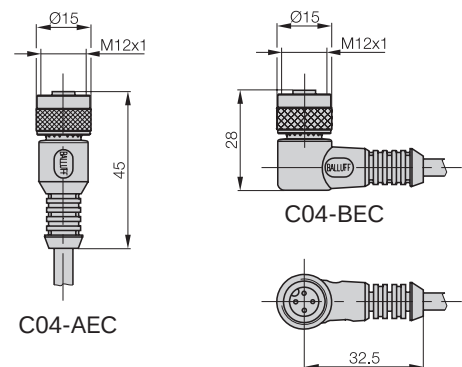
Plastic
approx. 40 g
any
-40...+85 °C
Magnet

Plastic
approx. 90 g
any
24 Vdc
100 mA
-40...+60 °C
Magnet
Straight connector C04-AEC-00-VY-050M
Right-angle connector C04-BEC-00-VY-050M

Non-contact!
Vertical offset
0.1...4 mm or
5...15 mm

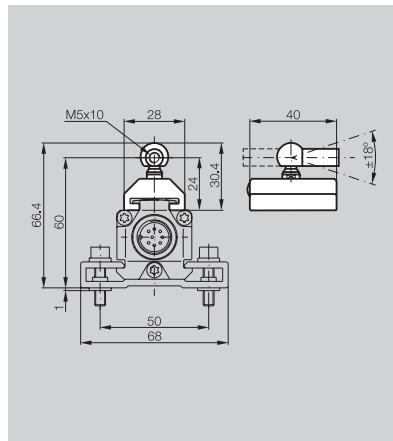


Please indicate cable length in ordering code:
03, 05, 10, 15
e.g. 050M = 5M



Connector for Electromagnet

Description	Magnet
for Series	BTL Profile
Type	Standard Captive



Ordering Code		BTL5-F-2814-1S
Material	Housing	Plastic
	Slide Surface	Plastic
Weight	approx. 28 g	
Magnet Traverse Speed	any	
Operating/Storage Temperature	-40...+85 °C	

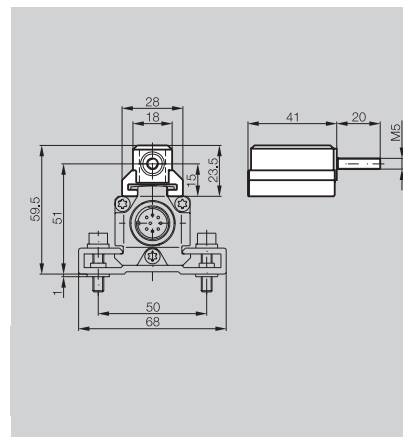
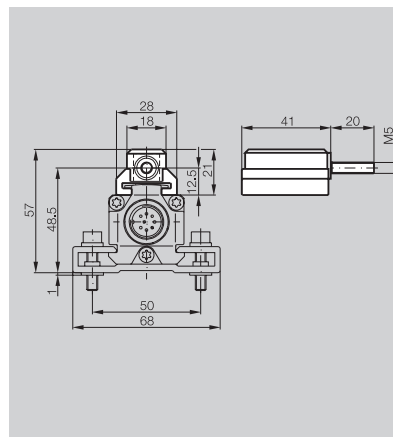


Each mounting foot includes 4 isolation washers and 2 mounting screws ordered separately.
Order part number:
BTL P-M5-VZ (sold in pairs)

BTL P



Description	Magnet
for Series	BTL Profile
Type	Special Purpose Captive



Ordering Code		BTL5-M-2814-1S
Material	Housing	Anodized aluminum
	Slide Surface	Plastic
Weight	approx. 32 g	
Magnet Traverse Speed	any	
Operating/Storage Temperature	-40...+85 °C	

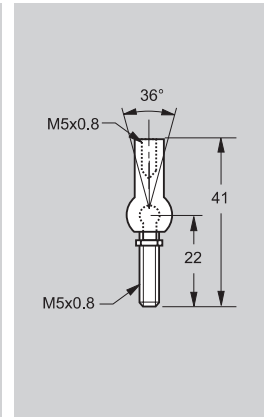
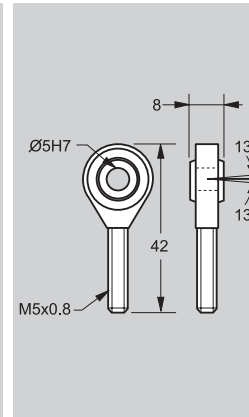
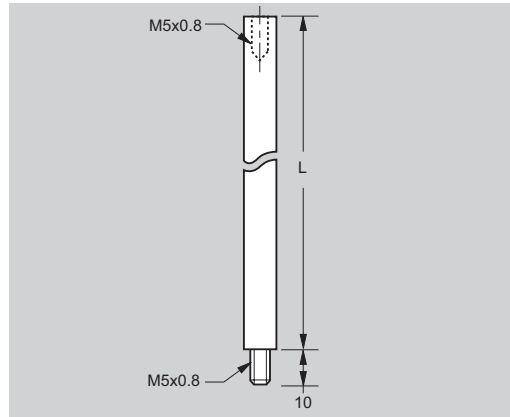
Ordering Code		BTL5-N-2814-1S
Material	Housing	Anodized aluminum
	Slide Surface	Plastic
Weight	approx. 35 g	
Magnet Traverse Speed	any	
Operating/Storage Temperature	-40...+85 °C	

Product
Compatibility

Control Arm
BTL5-F-2814-1S and BTL5-R-2814-1S

Swivel Eye
BTL5-GS08-

Ball Joint
BTL5-GS08-



Ordering Code

BTL Z-5-GS08-_*_-A

BTL5-SWIVEL-EYE

BTL5-A-BJ01

Material

Aluminum

Aluminum/Steel

Aluminum/Steel

Weight

150 g/m

14 g

11 g

*Specify control arm length in mm e.g. BTL-5-GS08-0305-A

Product

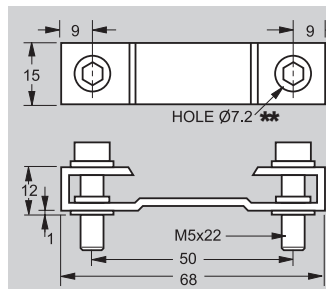
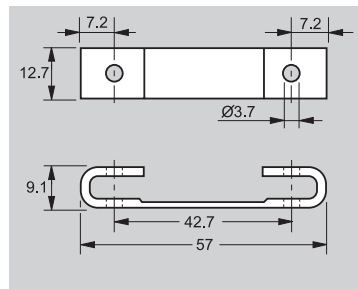
Mounting feet

Mounting feet

Type

Narrow (optional)

Standard



**Each BTL P-M5-VZ Mounting Foot is supplied with 4 plastic isolation washers with an inner diameter of 5.1 mm. If the cable shield is connected at the electrical panel, these washers should be used to isolate the transducer body from the machine frame, thereby avoiding potential ground loops.

Ordering Code

BTL5-FEET-NR (one foot)

BTL P-M5-VZ (sold in pairs)

Material

Aluminum

Black Anodized Aluminum

Weight

6 g

12 g

Product

Straight Connector
8-pin female

Right-angle Connector
8-pin female

Molded
Straight Connector
8-pin female

Molded
Right-angle Connector
8-pin female



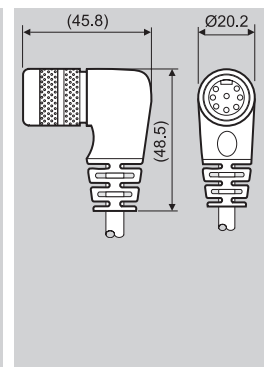
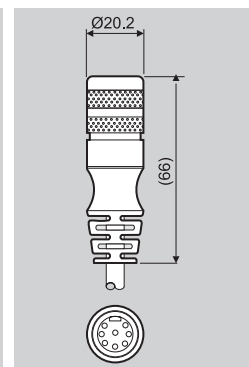
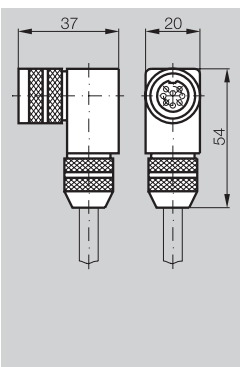
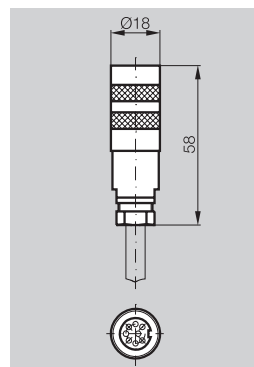
For additional connectors, see page 107-114

* Indicate cable length in ordering code (consult factory for longer lengths)

00 = connector only (only S32 and S33)

02 = 2 meter cable

05 = 5 meter cable



Ordering Code

BKS-S 32M-_*

BKS-S 33M-_*

BKS-S 232-PU-_*

BKS-S 233-PU-_*

Material

CuZn, nickel plated

CuZn, nickel plated

CuZn, nickel plated

CuZn, nickel plated

Contact Surface

0.8 µm Au

0.8 µm Au

0.8 µm Au

0.8 µm Au

Solder Connection

00 option only

00 option only

N/A

N/A

Cable

7 x 0.25 mm²/AWG 24

7 x 0.25 mm²/AWG 24

7 x 0.25 mm²/AWG 24

7 x 0.25 mm²/AWG 24

Cable Diameter

6.35 mm ± 0.35 mm

6.35 mm ± 0.35 mm

6.35 mm ± 0.35 mm

6.35 mm ± 0.35 mm

Allowable Cable Diameter

6...8 mm

6...8 mm

N/A

N/A

Cable Material

PUR

PUR

PUR

PUR

Environmental Rating

IP 67 (when installed)

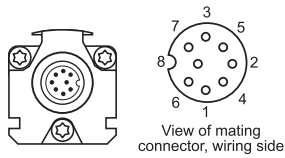
IP 67 (when installed)

IP 67 (when installed)

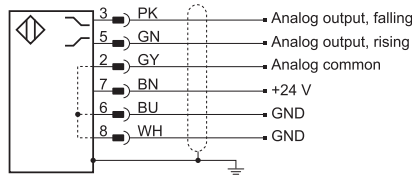
IP 67 (when installed)

Analog Wiring Diagrams

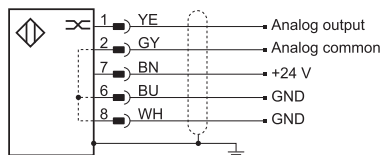
S32 Connector



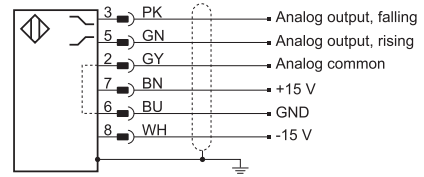
Analog Voltage 24 V (A, B, G)



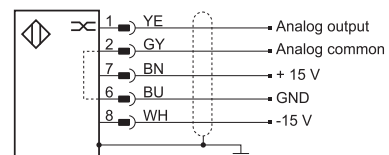
Analog Current 24 V (E, C)



Analog Voltage ±15 V (A, B, G)

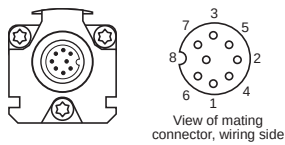


Analog Current ±15 V (E, C)

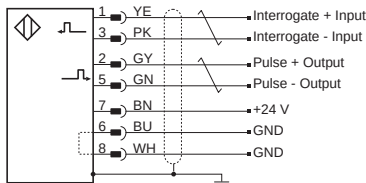


Digital Wiring Diagrams

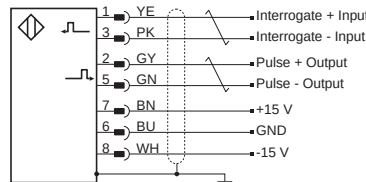
S32 Connector



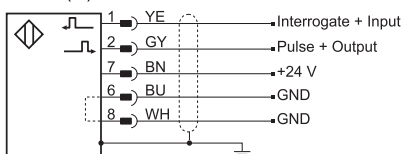
Digital, RS485 differential 24 V (P, M, I, K, L)



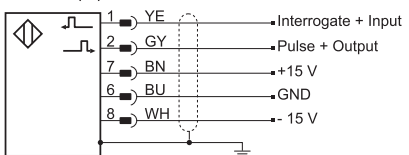
Digital, RS485 differential ±15 V (P, M, I, K, L)



Digital, Single-ended 24 V (N)

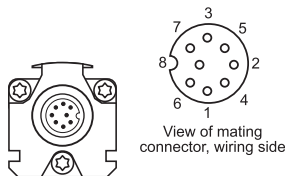


Digital, Single-ended ±15 V (N)

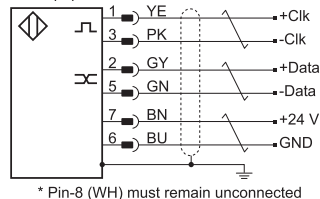


SSI Wiring Diagram

S32 Connector

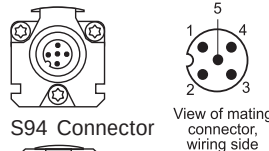


SSI (S)

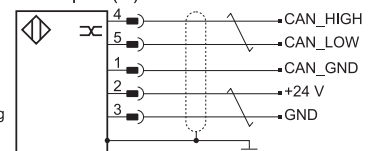


CANopen/DeviceNet Wiring Diagram

S92 Connector



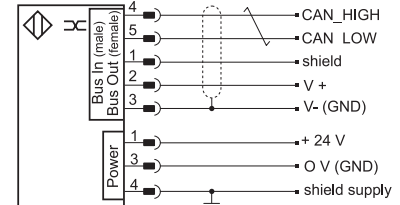
CANopen (H)



S94 Connector



DeviceNet (D)

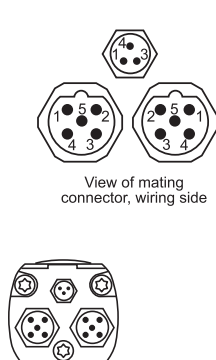


S93 Connector

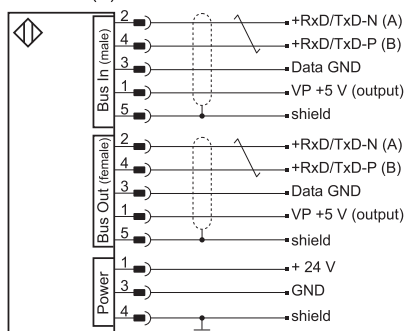


Profibus Wiring Diagram

S103 Connector



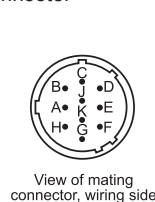
Profibus (T)



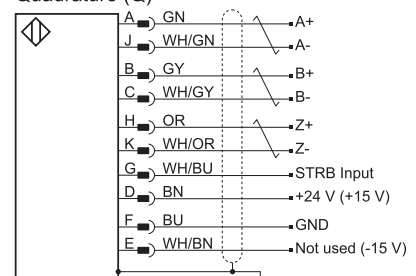
Note: \ = twisted-pair

Quadrature Wiring Diagram

S140 Connector



Quadrature (Q)



B T L 5 - A 1 1 - M 0 3 0 5 - P - S 3 2 / U S
K A 0 5

Balluff - Linear Transducer

Generation 5

Output Type

A = 0 to 10 Vdc (add /US)

B = -5 to +5Vdc (add /US)

C = 0 to 20 mA (add /US)

E = 4 to 20 mA (add /US)

G = -10 to +10 Vdc (add /US)

Q = Quadrature*

S = SSI*

T = Profibus*

H = CANopen*

D = DeviceNet*

I = Differential start/stop with tri-state

K = Differential stop – leading edge active

L = Differential pulse – width modulated

M = Differential start/stop – leading edge active

N = Single ended start/stop – leading edge active (add /US)

P = Differential start/stop – trailing edge active

Analog and N output only

Analog/US =
Non-potential-free

Analog blank =
Potential free

N output/US =
TTL single-ended start/stop

N output blank =
TTL single-ended stop only

Supply Voltage

1 = 24 Vdc ±20%

2 = ±15 Vdc ±2% (Not available for Q, S, T, H, or D outputs)

5 = 10...30 Vdc (Q output only)

Analog Output Operation (blank for digital)

Voltage output (Output type A, B & G)

1 = User selectable rising or falling

Current output (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 = 305 mm active stroke

Housing Type

P = Standard Profile Housing

Connection Type

S 3 2 = 8-pin quick disconnect metal connector (standard) (see page 74 for mating cables)

K A 0 5 = Cable out (5 m standard; specify length in meters)

S 1 4 0 = M5 - style quick disconnect for Quadrature output (see page 107-114 for mating cables)

* See additional
ordering information
on pages 68-70.

Standard Stroke Lengths, Inches (mm) (consult factory for additional lengths)

1 (0025)	9 (0230)	22 (0560)	48 (1220)	89 (2261)	156 ^A (3962)	192 (4877)
2 (0051)	10 (0254)	24 (0610)	50 (1270)	98 (2490)	160 (4064)	196 (4978)
3 (0076)	11 (0280)	26 (0661)	54 (1372)	108 (2743)	164 (4166)	200 (5080)
3.5 (0090)	12 (0305)	28 (0711)	60 (1524)	118 (2997)	168 (4267)	
4 (0102)	13 (0330)	30 (0762)	66 (1676)	126 (3200)	172 (4369)	
5 (0127)	15 (0381)	32 (0813)	69 (1753)	140 (3556)	176 (4470)	
6 (0152)	16 (0407)	36 (0914)	72 (1829)	144 (3658)	180 ^B (4572)	
7 (0178)	18 (0457)	40 (1016)	78 (1981)	148 (3759)	184 (4674)	
8 (0203)	20 (0508)	42 (1067)	84 (2134)	152 (3861)	188 (4775)	

^A Maximum length for SSI,
Profibus, CANopen = 156
inches.

^B Maximum length for analog
outputs = 180 inches.

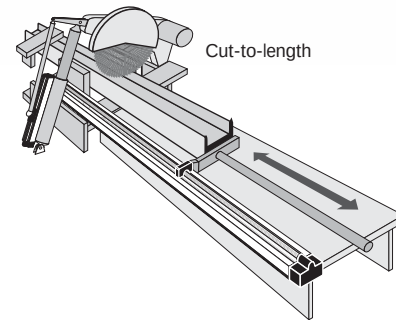
SLT Economical Profile Style

Accurate, Rugged, Reliable Unmatched Value

The Micropulse® SLT offers a lower-cost alternative to traditional profile-style linear position transducers.

The Micropulse SLT use the same field-proven magnetostrictive technology that has made Balluff a world leader in linear position sensing.

The economical SLT is made possible by utilizing streamlined manufacturing techniques and standardized configurations. The result is a high-performance linear position sensor offering unmatched value.



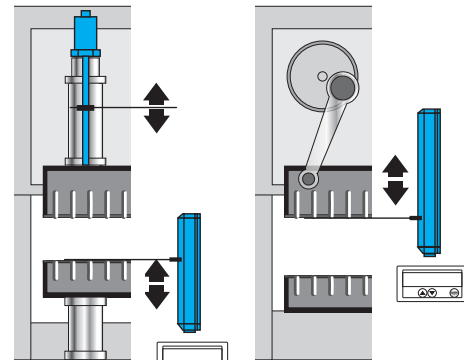
Features:

- 0-10 V or 4-20 mA Output
- Floating or Captive Magnet
- Measuring Lengths from 2" to 110"

Applications:

Balluff transducers offer features which assure reliable operation in many areas of automation and process technology, even under extreme ambient conditions:

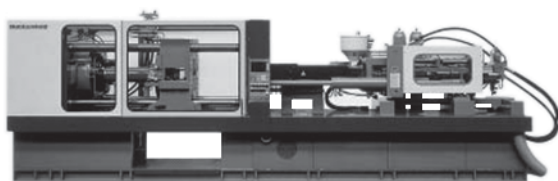
- Plastic injection molding machinery
- Tire manufacturing machinery
- Presses
- Die casting machinery
- Casting and rolling mills
- Level monitoring
- Cutoff saws
- Packaging and conveying machinery
- Tooling and handling
- Woodworking machinery
- Cutting/slitting machinery



Hydraulic Press

Mechanical Eccentric Press

Speed up die changes with digital display of shut height and parallelism



General Specifications	pg 78
Accessories	pg 79
Wiring Diagrams	pg 80
How to Order	pg 80



SLT

The SLT “A110” voltage output model offers both rising (0-10 Vdc) and falling (10-0 Vdc) outputs. Current output models must be ordered as rising (E100, 4-20 mA) or falling (E170, 20-4 mA). Mounting feet are included with the “SLT”. The PK3 and PK4 packages offer a magnet and mounting feet included with the transducer. See page 80 for ordering instructions of magnet packages.

Ordering Code (See page 80)	BTL6-A110-M____-P-S115 BTL6-E1_0-M____-P-S115
Output	0-10 Vdc and 10-0 Vdc (A110) or 4-20 mA (E100) / 20-4 mA (E170)
Resolution	≤ 10 μm
Repeat Accuracy	≤ 10 μm
Non-linearity	Stroke length ≤ 500 mm ± 100 μm Stroke length > 500 mm ± 0.02% of full scale
Update Rate	1 ms
Operating Voltage	+ 24 Vdc ± 20%
Current Draw	≤ 150 mA
Reverse Polarity Protected	Yes
Overvoltage Protected	Yes
Operating Temperature	-40 to +176 °F
Storage Temperature	-40 to +212 °F
Protection Class	IP 67
Vibration Rating	12 g, 10 to 2000 Hz per IEC 68-2-6
Shock Rating	100 g, 6 ms per IEC 68-2-27
Housing Material	Anodized aluminum
Approvals	CE

Analog Output Options

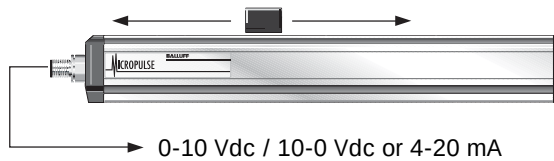
The following versions are available:

0-10 V and 10-0 V (BTL6-A110-...)

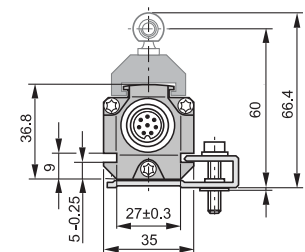
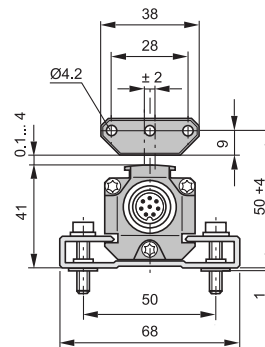
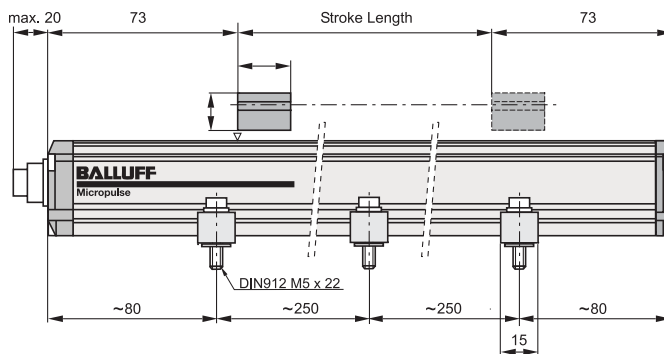
4-20 mA (BTL6-E100-...)

20-4 mA (BTL6-E170-...)

Position magnet attached to moving part of machine



Installation



Mounting Instructions

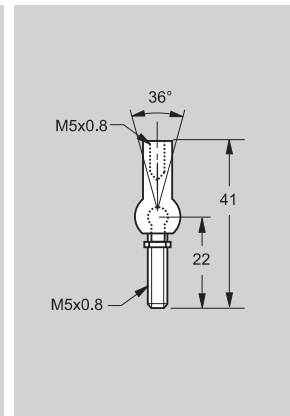
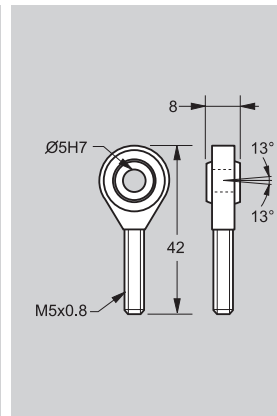
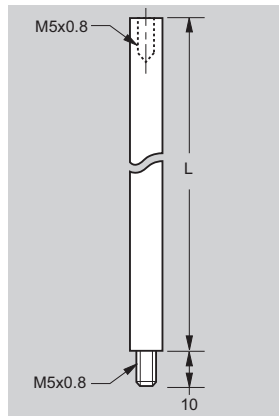
Mounting feet, along with M5 x 22 socket-head screws and plastic isolation washers are supplied with transducer.

Additional mounting feet must be purchased separately.

Stroke Length (in.)	Number of Mounting Feet Supplied
2-18	2
20-36	4
40-60	6
70-110	8

Product	Control Arm	Swivel Eye	Ball Joint
Compatibility	BTL5-F-2814-1S BTL5-R-2814-1S	BTL5-GS08-	BTL5-GS08-

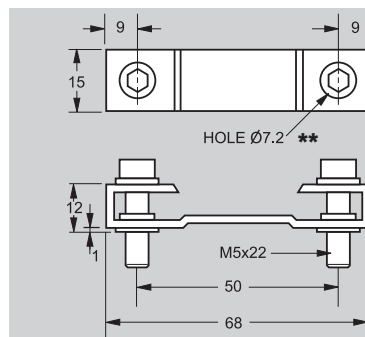
Note: Mounting feet and magnet are included. Other accessories must be ordered separately.



Ordering Code	BTL Z-5-GS08- * _ -A	BTL5-SWIVEL-EYE	BTL5-A-BJ01
Material	Aluminum	Aluminum/Steel	Aluminum/Steel
Weight	150 g/m	14 g	11 g

*Specify control arm length in mm e.g. BTL-5-GS08-0305-A

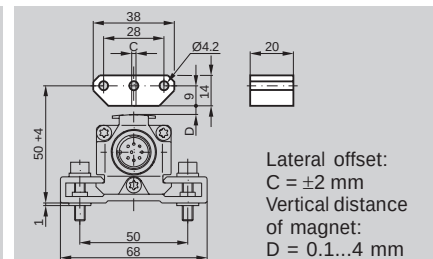
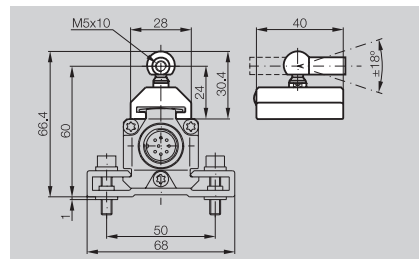
Product	Mounting feet (included with package)
Type	Standard



**Each BTL P-M5-VZ Mounting Foot is supplied with 4 plastic isolation washers with an inner diameter of 5.1 mm. If the cable shield is connected at the electrical panel, these washers should be used to isolate the transducer body from the machine frame, thereby avoiding potential ground loops.

Ordering Code	BTL P-M5-VZ (sold in pairs)
Material	Black Anodized Aluminum
Weight	12 g

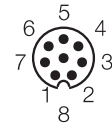
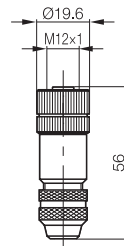
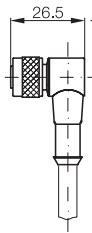
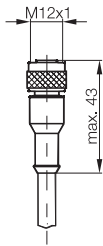
Description	Magnet	Magnet
For Series	BTL Profile	BTL Profile
Type	Standard Captive	Floating



Ordering Code	BTL5-F-2814-1S	BTL5-P-3800-2
Housing Material/Slide Surface	Plastic/Plastic	Plastic/--
Weight	approx. 28 g	approx. 12 g
Magnet Traverse Speed	any	any
Operating/Storage Temperature	-40...+85 °C	-40...+85 °C

Included: Magnet, 2 mounting screws DIN 84 M4x35-A2 with washers and nuts

Wiring Instructions/Connector Drawing/ Wiring Diagram



BKS-S115-PU-__*

BKS-S116-PU-__*

BKS-S115-PU-00

Pin numbering for
connector, male pin view

* Specify cable length in meters: 02, 05, 10, 15, 20, 25

Pin	Analog Voltage Output BTL6-A1__ -	Analog Current Output BTL6-E1__ -	Wire Color
1	Signal Common (GND)	Signal Common (GND)	Yellow
2	Signal Common (GND)	Signal Common (GND)	Grey
3	Output Signal 10...0 V	Not used	Pink
4	Not used	Not used	Red
5	Output Signal 0...10 V	Signal Output 4...20 mA (BTL6-E100-...) Signal Output 20...4 mA (BTL6-E170-...)	Green
6	Supply GND	Supply GND	Blue
7	Supply Voltage +24 Vdc	Supply Voltage +24 Vdc	Brown
8	Not used	Not used	White

How to Order

BTL6-xxxx-Mxxxx-P-S115/PKx

Output Type/Operating Voltage

A110 = 0-10 V and 10-0 V output, +24 V ±20% Supply Voltage

E100 = 4-20 mA output, +24 V ±20% Supply Voltage

E170 = 20-4 mA output, +24 V ±20% Supply Voltage

Stroke Length, inches (mm)

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

Connector

S115 = 8-pin M12 Micro Connector (BKS-S115-PU-xx)

Magnet Type

PK3 = **BTL5-F-2814-1S** Captive Sliding Magnet included, **BTL-P-M5-VZ** Mounting Feet included

PK4 = **BTL5-P-3800-2** Floating Magnet included, **BTL-P-M5-VZ** Mounting Feet included

R Low-Profile Style

Ultra-low Profile

The low-profile “R” housing is designed to be mechanically compatible with legacy linear potentiometers. The centerline at the control rod is the same vertical location as the rod on many popular “pots.” However, the R style provides long-life, non-contact magnetostrictive technology that will outlast any wear-prone linear potentiometer.



Features:

- Low profile for space critical applications
- Compatible with plunger type linear potentiometers
- Cable out or quick disconnect
- Stroke Length 2” – 142”
- Floating or captive magnet
- Outputs – Digital start/stop, Pulse Width Modulated PWM, Analog Voltage or Current
- IP 67
- Can sense floating magnet on top or bottom side

Applications:

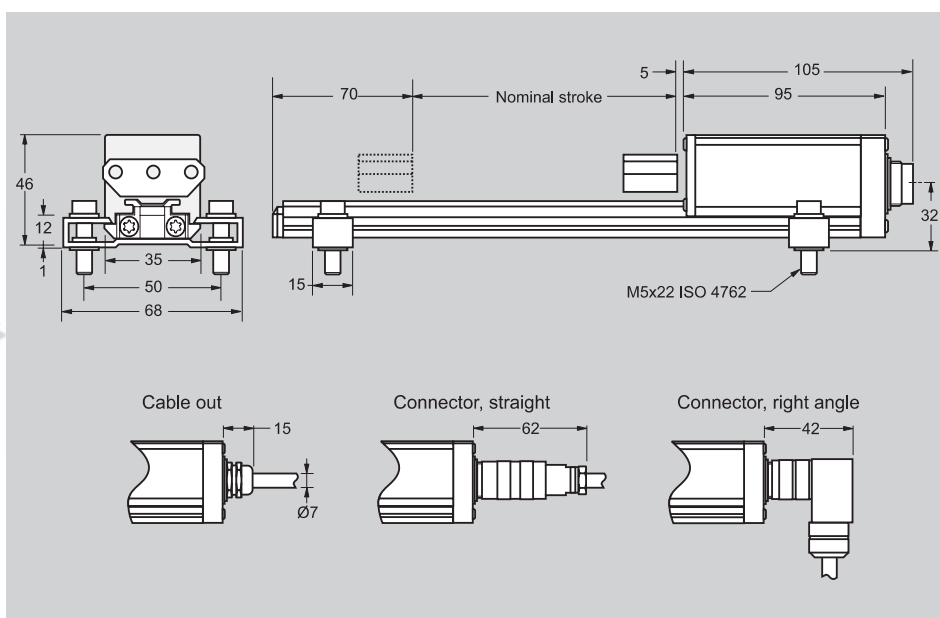
- Pneumatic slides
- Plastic injection molding
- Stamping presses
- Transport systems
- Die casting
- Entertainment motion platforms
- Flight simulators
- Tool handling
- Packaging
- Conveying
- Measurement
- Semiconductor fabrication
- Test cells



General Specifications	pg 82
Electrical Options	pg 83
Magnets	pgs 84-87
Accessories	pg 88
Wiring Diagrams	pg 89
How to order	pg 90

Series
Available Lengths
Output Signals

R Style
51 mm (2 in) to 3734 mm (147 in)
Analog & Digital Pulse



Ordering Code	BTL-5-_-M-_-R-_- (See ordering code on page 90)
Measurement Type	Linear displacement
Measurement Range	51 mm (2 in) to 3734 mm (147 in)
Shock Rating	100 g/6 ms (100 g /2m s continuous) per IEC 68 2-27
Vibration Rating	12 g, 10 to 2000 Hz per IEC 68-2-6
Environmental Protection	IP 67 (with connector attached)
Housing Material	anodized aluminum
Operating Temperature	-40 to + 185° F
Storage Temperature	-40 to + 212° F
Humidity	< 90% non-condensing
Connection Type	connector or integral cable
Noise Immunity	ESD, RFI and BURST per IEC 1000-4-2/3/4/6, severity level 3 (4 for BURST)
Approvals	CE

Warning:

These products are not rated for personnel safety applications.

Accessories:

Magnets pg 84-87
Connectors pg 88

Autotuning Circuitry

Patented Autotuning circuitry in Balluff Micropulse® transducers automatically compensates for changes in the strength of the magnetostrictive return signal.

- Automatically compensates for changes in temperature, providing a more stable signal over a wide temperature range.
- For Micropulse profile-style transducers using a floating magnet configuration, Autotuning ensures that the return signal remains stable, even if the distance from magnet to transducer varies.

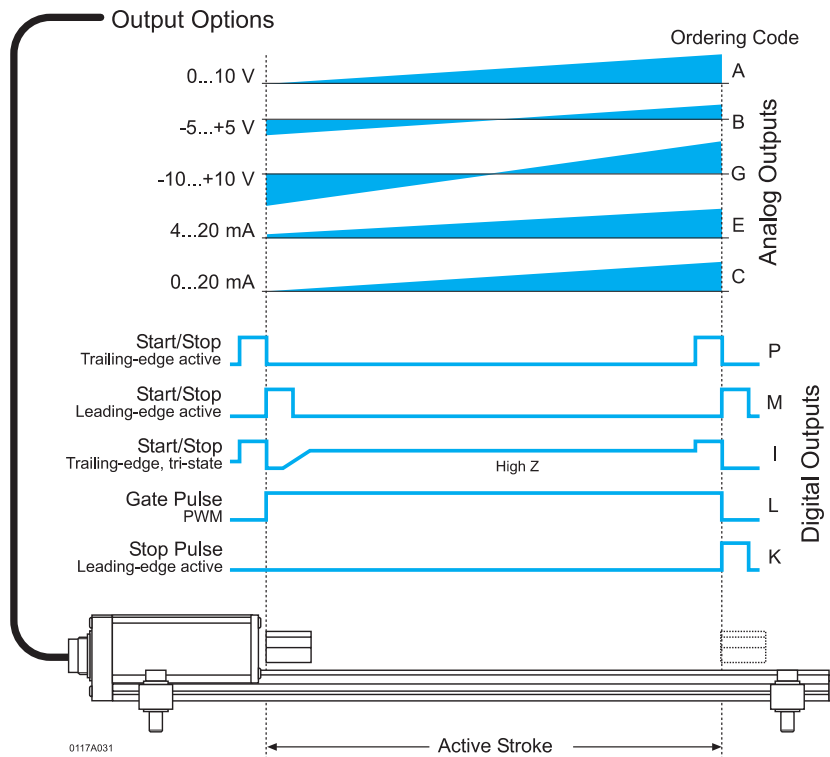
Electrical Interface	Analog	Analog	Digital
Electrical Type	Voltage	Current	Start/Stop & PWM
Part No. Code (See pg. 90)	A, B, G	E, C	P, M, I, L, K
Output	0...+10 V, -5...+5 V, -10...+10 V	4...20 mA, 0...20 mA	Start/Stop or Pulse-width-modulated (RS422/RS485)
Output Load	> 2 K Ω (5 mA max)	$\leq 500 \Omega$	per spec
Resolution	≤ 0.1 mV	$\leq 0.2 \mu\text{A}$	Controller dependent
Non-linearity	$\pm 100 \mu\text{m}$ to 500 mm stroke, ± 0.02 % over 500 mm stroke	$\pm 100 \mu\text{m}$ to 500 mm stroke, ± 0.02 % over 500 mm stroke	$\pm 100 \mu\text{m}$ to 500 mm stroke, ± 0.02 % over 500 mm stroke
Repeatability	Resolution/ min 2 μm	Resolution/ min 2 μm	Resolution/ min 2 μm
Hysteresis	5 μm	5 μm	5 μm
Sampling Rate	1 kHz	1 kHz	1 kHz
Temperature Coefficient*	$[150 \mu\text{V}/^\circ\text{C} + (5 \text{ ppm}/^\circ\text{C} \cdot \text{P} \cdot \text{V}/\text{NL})] \cdot \Delta\text{T}$	$[0.6 \mu\text{A}/^\circ\text{C} + (10 \text{ ppm}/^\circ\text{C} \cdot \text{P} \cdot \text{V}/\text{NL})] \cdot \Delta\text{T}$	$(6 \mu\text{m} + 5 \text{ ppm} \cdot \text{NL}) / ^\circ\text{C}$
Operating Voltage	24 Vdc $\pm 20\%$	24 Vdc $\pm 20\%$	24 Vdc $\pm 20\%$
Operating Current	≤ 150 mA	≤ 150 mA	≤ 150 mA

Notes:

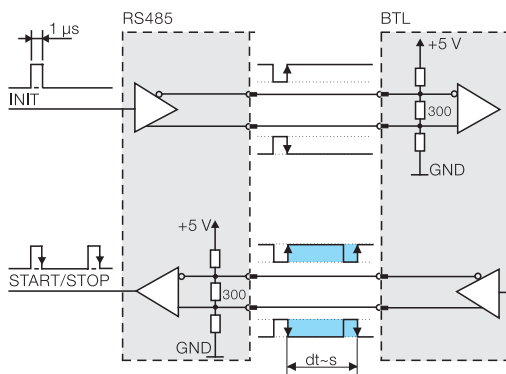
Analog voltage output versions incorporate both rising and falling outputs. Analog current version must be ordered as rising or falling outputs.

*Temperature coefficient variables:

- V** = output range in V
- I** = output range in [mA]
- ΔT** = temperature change
- P** = magnet position
- NL** = stroke length



Analog and Digital Output Options for the Micropulse R Style



RS485 Transmission of digital signals

Micropulse R Style

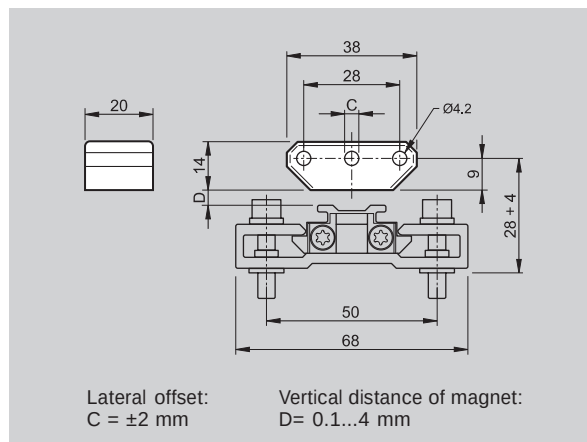
Floating Magnets Profile Series

Balluff magnets are available in captive or floating styles. All BTL5 magnets shown here can be used on any Balluff Micropulse transducer. Maximum resolution and repeatability are achieved using BTL5-F/M/N-2814-1S captive magnets on page 86-87.

The BTL5-P-3800-2 magnet can be used with a vertical offset from the upper surface of the transducer body of 0...4 mm, and the BTL5-P-5500-2 permits a distance of 5...15 mm. The BTL5-P-4500-1 is an electromagnet and requires a supply voltage of 24 V, which can be turned on and off for selective activation. This allows multiplex operation with multiple magnets on a single transducer, since only one magnet is active at a time.

Description
for Series
Type

Magnet
BTL Profile
Standard, floating



Ordering Code
Housing Material
Weight
Magnet Traverse Speed
Supply Voltage
Current Draw
Operating Temperature/Storage Temperature
Included

BTL5-P-3800-2
Plastic
approx. 12 g
any
-40...+85 °C
Magnet
2 mounting screws DIN 84 M4×35-A2 with washers and nuts

Accessories (please order separately)
--

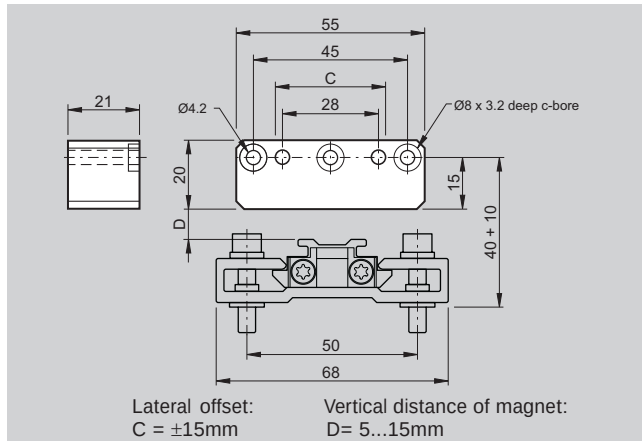


Each mounting foot includes 4 isolation washers and 2 mounting screws ordered separately. Order part number: **BTL P-M5-VZ** (sold in pairs)

Number of Mounting Feet (Recommended)

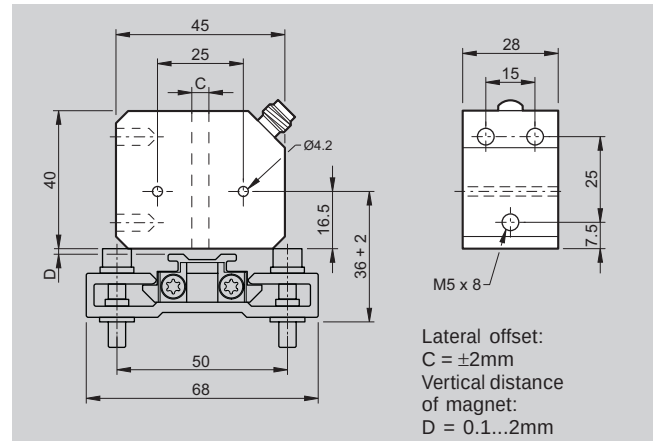
Transducer Stroke Length (mm)	Recommended Number of Feet
0051-0457	2
0508-0711	3
0762-0914	4
1016-1220	5
1270	6
1524	7
1778	8
2032	9
2286	10
2540	11
2794	12
3048	13
3302	14
3606	15
3734	16

Magnet
BTL Profile
Extended range, floating



BTL5-P-5500-2
Plastic
approx. 40 g
any
-40...+85 °C
Magnet

Magnet
BTL Profile
Electro-magnet, floating

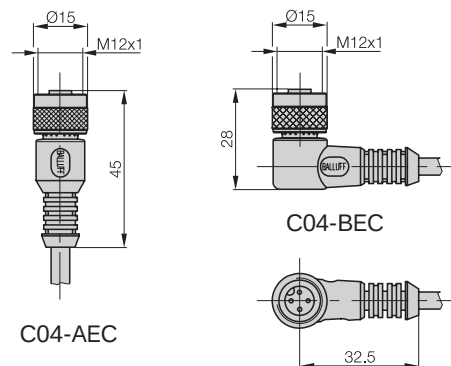


BTL5-P-4500-1
Plastic
approx. 90 g
any
24 Vdc
100 mA
-40...+60 °C
Magnet
Straight connector C04-AEC-00-VY-050M
Right-angle connector C04-BEC-00-VY-050M

Non-contact!
Vertical offset
0.1...4 mm or
5...15 mm



Please indicate cable length in ordering code:
03, 05, 10, 15 e.g. 050M = 5M

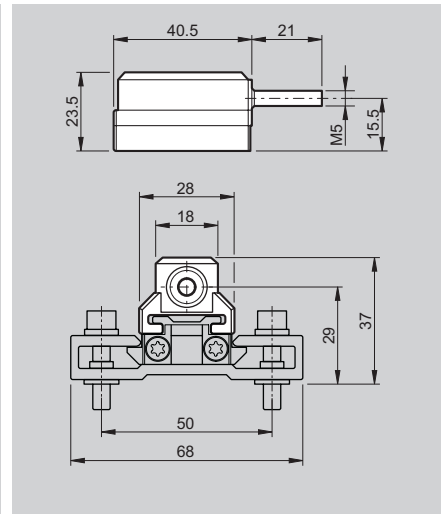
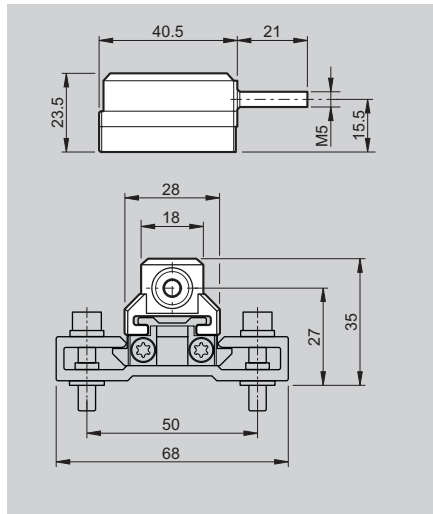


Mating connector for electromagnet

Description
for Series
Type

Magnet
BTL Profile
Captive

Magnet
BTL Profile
Captive



Ordering Code

BTL5-M-2814-1S

BTL5-N-2814-1S

Material Housing
Slide Surface

Anodized aluminum
Plastic

Anodized aluminum
Plastic

Weight
Magnet Traverse Speed

approx. 32 g
any

approx. 35 g
any

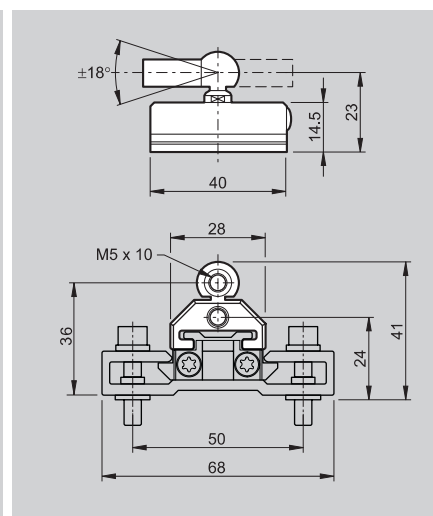
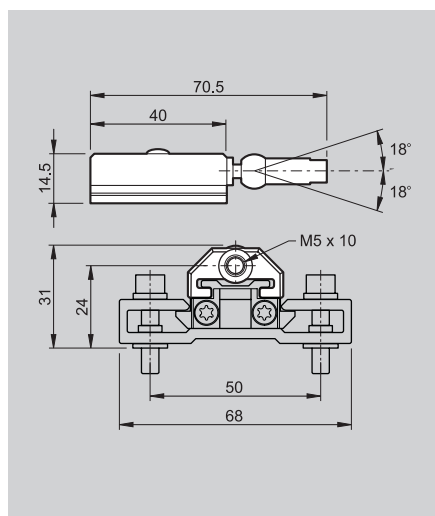
Operating Temperature/Storage
Temperature

-40...+85 °C

-40...+85 °C



Description	Magnet	Magnet
for Series	R-style only	BTL Profile
Type	Captive	Captive



Ordering Code	BTL5-R-2814-1S	BTL5-F-2814-1S
----------------------	-----------------------	-----------------------

Material	Housing	Plastic	Plastic
	Slide Surface	Plastic	Plastic
Weight		approx. 28 g/m	approx. 28 g
Magnet Traverse Speed		any	any
Operating Temperature/Storage Temperature		-40...+85 °C	-40...+85 °C

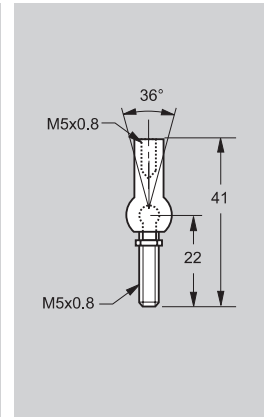
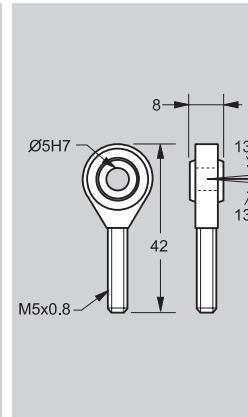
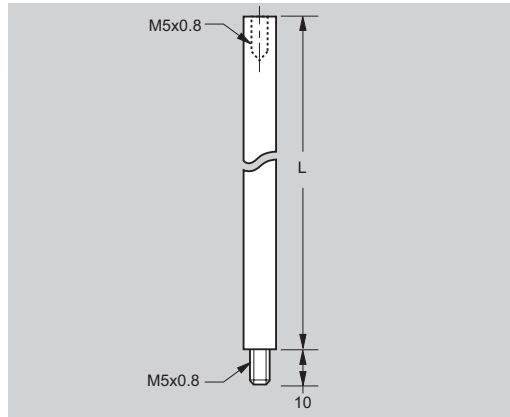


Product
Compatibility

Control Arm
BTL5-F-2814-1S and BTL5-R-2814-1S

Swivel Eye
BTL5-GS08-

Ball Joint
BTL5-GS08-



Ordering Code

BTL Z-5-GS08-_*_-A

BTL5-SWIVEL-EYE

BTL5-A-BJ01

Material

Aluminum

Aluminum/steel

Aluminum/steel

Weight

150 g/m

14 g

11 g

*Specify control arm length in mm e.g. BTL-5-GS08-0305-A

Product

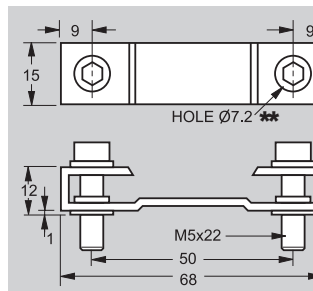
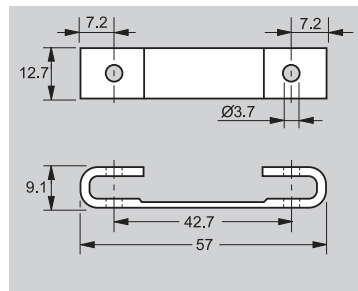
Mounting feet

Mounting feet

Type

Narrow (optional)

Standard



**Each BTL P-M5-VZ Mounting Foot is supplied with 4 plastic isolation washers with an inner diameter of 5.1 mm. If the cable shield is connected at the electrical panel, these washers should be used to isolate the transducer body from the machine frame, thereby avoiding potential ground loops.

Ordering Code

BTL5-FEET-NR (one foot)

BTL P-M5-VZ (sold in pairs)

Material

Aluminum

Black Anodized Aluminum

Weight

6 g

12 g

Product

Straight Connector
8-pin female

Right-angle Connector
8-pin female

Molded
Straight Connector
8-pin female

Molded
Right-angle Connector
8-pin female



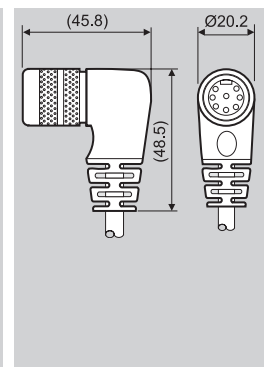
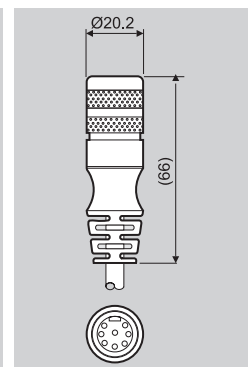
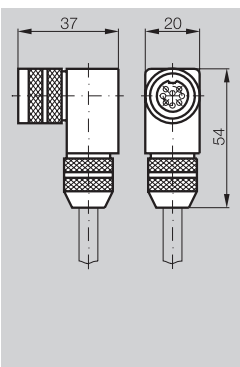
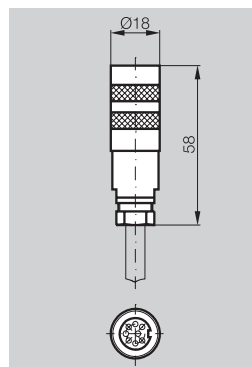
For additional connectors, see page 107-114

* Indicate cable length in ordering code (consult factory for longer lengths)

00 = connector only (only S32 and S33)

02 = 2 meter cable

05 = 5 meter cable



Ordering Code

BKS-S 32M-_*_-

BKS-S 33M-_*_-

BKS-S 232-PU-_*_-

BKS-S 233-PU-_*_-

Material

CuZn, nickel plated

CuZn, nickel plated

CuZn, nickel plated

CuZn, nickel plated

Contact Surface

0.8 µm Au

0.8 µm Au

0.8 µm Au

0.8 µm Au

Solder Connection

00 option only

00 option only

N/A

N/A

Cable

7 x 0.25 mm²/AWG 24

7 x 0.25 mm²/AWG 24

7 x 0.25 mm²/AWG 24

7 x 0.25 mm²/AWG 24

Cable Diameter

6.35 mm ± 0.35 mm

6.35 mm ± 0.35 mm

6.35 mm ± 0.35 mm

6.35 mm ± 0.35 mm

Allowable Cable Diameter

6...8 mm

6...8 mm

N/A

N/A

Cable Material

PUR

PUR

PUR

PUR

Environmental Rating

IP 67 (when installed)

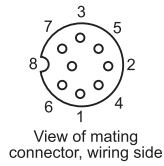
IP 67 (when installed)

IP 67 (when installed)

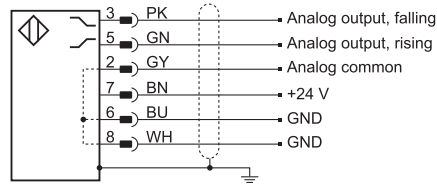
IP 67 (when installed)

Analog Wiring Diagrams

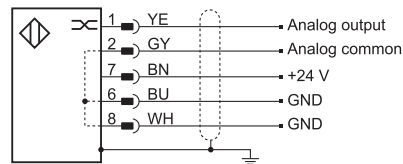
S32 Connector



Analog Voltage 24 V (A, B, G)

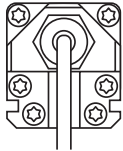
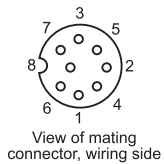


Analog Current 24 V (E, C)

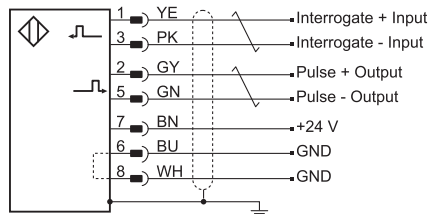


Digital Wiring Diagram

S32 Connector



Digital, RS485 differential 24 V (P, M, I, K, L, R)



Note:  = twisted-pair

Micropulse R Style

Ordering Code

**B T L 5 - A 1 1 - M 0 3 0 5 - R - S 3 2
K A 0 5**

Balluff - Linear Transducer

Generation 5

Output Type

A = 0 to 10 Vdc

B = -5 to +5 Vdc

C = 0 to 20 mA

E = 4 to 20 mA

G = 10 to +10 Vdc

I = Differential start/stop with tri-state

K = Differential stop - leading edge active

L = Differential pulse-width modulated

M = Differential start/stop - leading edge active

P = Differential start/stop - trailing edge active

Supply Voltage

1 = 24 Vdc ±20%

Analog Output Operation (blank for digital)

Voltage output (Output type A, B & G)

1 = User selectable rising or falling

Current output (Output type C & E)

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

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

Nominal Stroke Length

0 3 0 5 = 305 mm active stroke

Housing Type

R = Low Profile Housing

Connection Type

S 3 2 = 8-pin quick disconnect metal connector (see page 88 for mating cables)

K A 0 5 = Cable out (5 m standard; specify length in meters)

Standard Stroke Lengths, Inches (mm) (consult factory for additional lengths)

2 (0051)	12 (0305)	30 (0762)	90 (2286)
3 (0077)	13 (0330)	32 (0813)	100 (2540)
4 (0102)	15 (0381)	36 (0914)	110 (2794)
5 (0127)	16 (0407)	40 (1016)	120 (3048)
6 (0152)	18 (0457)	42 (1067)	130 (3302)
7 (0178)	20 (0508)	48 (1220)	142 (3606)
8 (0203)	22 (0560)	50 (1270)	147 (3734)
9 (0230)	24 (0610)	60 (1524)	
10 (0254)	26 (0661)	70 (1778)	
11 (0280)	28 (0711)	80 (2032)	

Micropulse AT

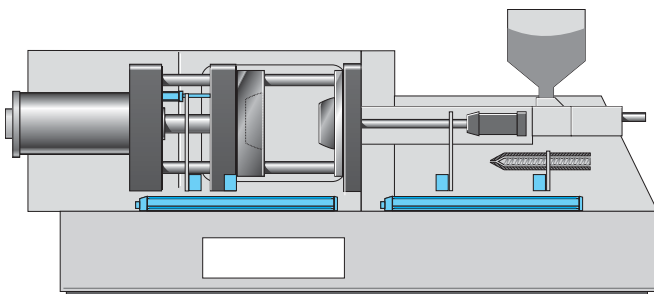
Magnetostrictive Technology at a Potentiometer Price

Accurate Linear Position Measurement

The Micropulse® AT is a superior alternative to traditional low-cost linear feedback devices such as linear potentiometers (pots). Balluff designed the Micropulse AT in a modular fashion to simplify manufacturing and reduce component costs to be competitive with these devices.

The main advantage of the Micropulse AT is the non-contact, wear-free magnetostrictive sensing principle. Linear potentiometers, by contrast, are electro-mechanical devices that utilize a moving wiper contact riding along a resistive element. Both the wiper contact and the resistive element are subject to wear from repeated operation and continuous machine vibration. Abrasive contaminants are able to enter the potentiometer housing through the mechanical seals, further accelerating wear – leading to erratic position signals.

With no moving parts, the Micropulse AT is impervious to environmental contamination such as dust and grit. It is also shock and vibration rated for use in demanding industrial applications. The convenient M12 connector assures easy installation and quick replacement without the need to remove and reinstall hardwired cabling.



Micropulse AT – ideal for use in injection molding machines

Wear-Free

Inexpensive

Easy to Order

Easy to Hook Up

The round housing of the Micropulse AT allows the unit to be rotated to sense the position magnet in multiple directions, enhancing installation flexibility. The position magnet is a floating design, meaning no mechanical linkage is required, saving cost and reducing installation complexity. Linkage is eliminated as a source of backlash error. No mechanical linkage also eliminates over-stroking as a potential source of sensor breakage and production downtime.

Advantages

- Non-contact, wear-free, unlimited cycles
- No mechanical linkage required; saves space
- Correct position reading on power-up without re-homing
- Precise position indication
- Universal controller compatibility
- High noise immunity



Features

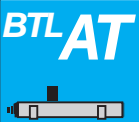
- Magnetostrictive sensing principle
- Floating target magnet
- Absolute position output
- Resolution 10 microns
- 0-10 V analog output
- Start/stop digital output

ATvantage

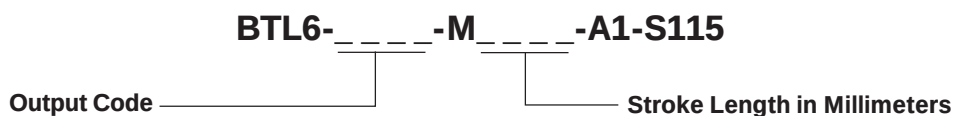
Micropulse ATvantage offers two-magnet operation with two analog outputs that are user-programmable for stroke length and rising 0-10 V or falling 10-0 V signals. The second output can also be user-configured for differential mode to output a 0-10 V signal that is proportional to the difference in position between Magnet A and Magnet B.



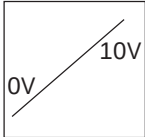
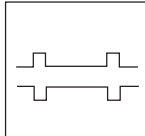
How to Order	pg 92
General	
Specifications	pgs 93-96
ATvantage	pgs 97-99
Accessories	pg 100
Connectors	pg 101



Micropulse AT Ordering Code - Quick Reference



Micropulse AT Output Types - Refer to following pages for detailed specifications

Diagram	Output	Signal	Features	Resolution	Stroke*	Output Code
	Analog	0...10 V, 10...0 V	- Rising & falling signals included	< 10 µm	51...1524 mm (2...60")	A110
	Adjustable Analog 	0...10 V, 10...0 V	- Adjustable stroke - Two independent outputs - Use with one or two magnets - Rising & falling signals included - 2nd magnet differential mode - Setup LED	< 10 µm	50...1500 mm	A301
	Digital	Start/Stop Pulse	- Leading & trailing edge active	< 10 µm	51...2540 mm (2...100")	P110
	Smart Digital DPI/IP	Start/Stop Pulse	- DPI/IP Data Exchange protocol (allows "plug and play")† - Leading & trailing edge active	< 10 µm	51...2540 mm (2...100")	P111

* see following pages for standard stroke lengths

† with compatible controller, e.g. Sigmatek

Position Magnets

BTL6-A-3801-2

BTL6-A-3800-2

Standard magnet

Optional magnet for legacy applications



Pg. 100

Mounting Feet

BTL6-A-MF03-K-50

BTL6-A-MF01-A-50

BTL6-A-MF01-A-43

Standard plastic mounting foot

Aluminum mounting foot, 50 mm bolt spacing

Aluminum mounting foot, 43 mm bolt spacing



Pg. 100

Connector Cables

BKS-S115-PU-02

BKS-S116-PU-02

BKS-S115-PU-____

BKS-S116-PU-____

Standard connector cable, 2-meter, straight

Standard connector cable, 2-meter, right angle

Connector cable, straight, available lengths 05, 10, 20, 25 meters

Connector cable, right angle, available lengths 05, 10, 15, 20, 25 meters



Pg. 101

Economical Digital Displays

BDD UM-3023

BDD 100

BDD 640

Analog voltage input

Digital start/stop pulse input

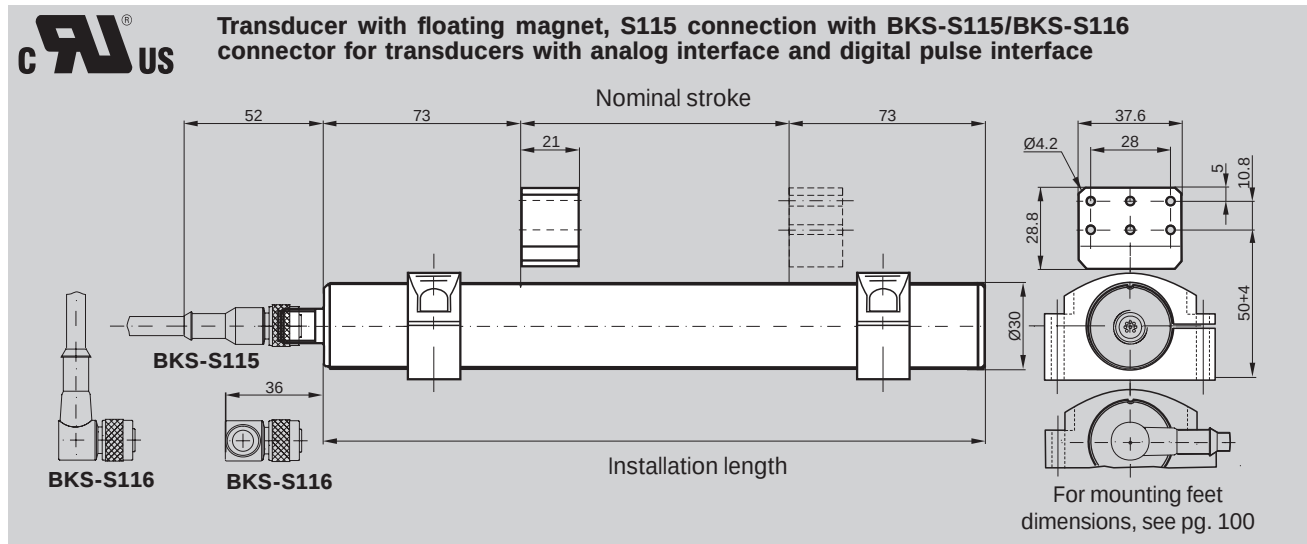
Analog voltage/current input



Pg. 118-119

Series

BTL6 Profile A1



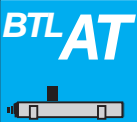
Ordering Code	BTL6- -M- -A1-S115
Shock Load	50 g/6 ms per IEC 60068-2-27
Vibration	12 g, 10...2000 Hz per IEC 60068-2-6
Polarity Reversal Protected	yes
Overvoltage Protection	yes
Enclosure Rating per IEC 60529	IP 67 (with BKS-S... IP 67 connector attached)
Housing Material	Anodized aluminum
Housing Attachment	Mounting clamps
Connection Type	Connector M12, 8-pin standard
EMC Testing:	
RF Emission	EN 55011 Group 1, Class A+B
Static Electricity (ESD)	IEC 61000-4-2 Severity Level 3
Electromagnetic Fields (RFI)	IEC 61000-4-3 Severity Level 3
Fast Transients (BURST)	IEC 61000-4-4 Severity Level 3
Line-carried Noise,	IEC 61000-4-6 Severity Level 3
Induced by High-frequency Fields	IEC 61000-4-8 Severity Level 4

Included:

- Transducer
- User's guide

Please order separately:

- Magnets pg 100
- Mounting clamps/cuff ... pg 100
- Connectors pg 101



P110-Interface

Compatible with various OEM controls, e.g., Siemens, Schleicher, B & R, Bosch, Mitsubishi, Schiele, Parker, Esitron, WAGO, etc.

Reliable signal transmission, even over cable lengths up to 500 m between BTL and controller, is assured by the especially noise-immune RS422 differential drivers and receivers. Noise signals are effectively suppressed.

P110 Rising/Falling in a Single Interface

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.

In the "P" interface the falling edges and in the "M" interface the rising edges are processed.

To reduce the amount of part numbers, the "P110 interface" has been developed which combines both functions.

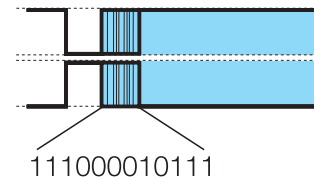
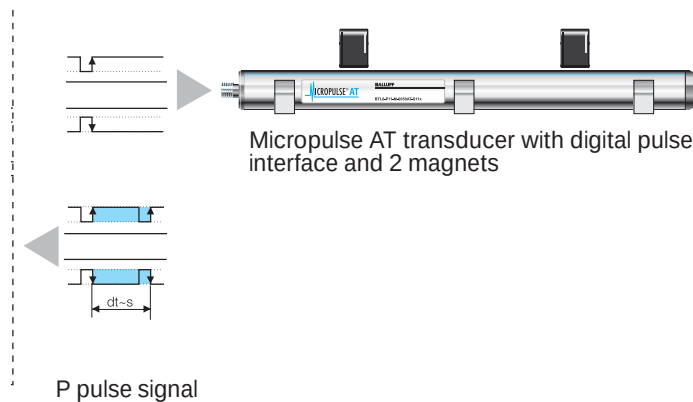
The reference point for the propagation time measurement is the "Start" pulse.

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, stroke length and waveguide gradient. This allows start-up or replacement of a transducer without having to make manual changes in the controller parameters.

With the P110 start/stop digital output, both the rising and the falling edges of the signal are precisely controlled, allowing the flexibility to match the controller interface requirements with a single part number.

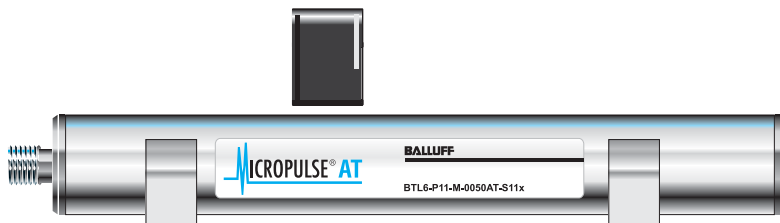


Features

- Bi-directional communication
- Transducer controlled using INIT and START/STOP signals
- Integrated diagnostic functions
- Plug and Play
- Automatic parameterizing reduces downtimes
- Sending of sensor model, stroke length, specific parameters

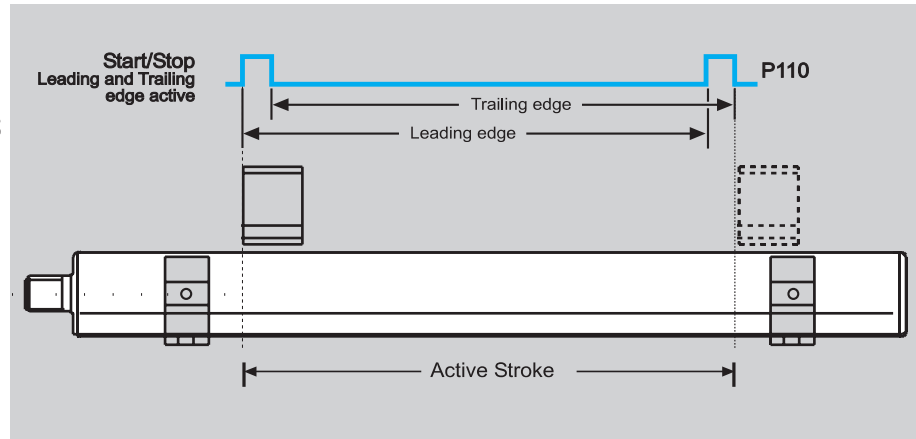
Benefits

- High resolution
- Position data from 2 magnets can be processed simultaneously
- 4/8-bit processor interface



Series
Part No. Code (see below)
Transducer Interface

BTL6 Profile A1
P
Digital ST/SP Pulse



Ordering Code			BTL6-P110-M _ _ _ -A1-S115
System Resolution			processing-dependent
Repeatability			$\leq 10 \mu\text{m}$
Repeat Accuracy			$\leq 20 \mu\text{m}$
Resolution			$\leq 10 \mu\text{m}$
Non-linearity			$\leq \pm 200 \mu\text{m}$ up to 500 mm nominal stroke typ. $\pm 0.02 \%$, max. $\pm 0.04 \%$ 508...2540 mm nominal stroke
Supply Voltage			20...28 Vdc
Current Draw			$\leq 60 \text{ mA}$ (at 1 kHz)
Operating Temperature			0 to +158 °F
Storage Temperature			-40 to +212 °F
Pin Assignments	Pin	Color	BTL6-P11 _ -M...
In-/Output Signals	Input	1 YE	INIT
	Output	2 GY	START/STOP
	Input	3 PK	INIT
		4 RD	Not used—No connection
	Output	5 GN	START/STOP
Supply Voltage		6 BU	GND
		7 BN	+24 Vdc
		8 WH	Not used—No connection

Connect shield to housing,
pins 4 and 8 must remain unconnected.

Please enter length for nominal
stroke in ordering code.

Included:

- Transducer
- User's guide

Please order separately:

Magnets pg 100
Mounting clamps/cuff pg 100
Connectors pg 101

Ordering example:

BTL6-P11 -M _ _ _ -A1-S115

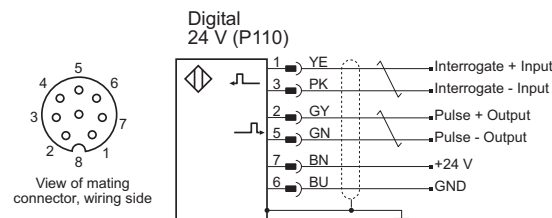
Data Protocol

- 0 without DPI/IP
(Standard)
- 1 with DPI/IP

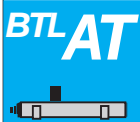
**Standard
nominal strokes [mm]**

0051, 0077, 0102, 0127,
0152, 0178, 0203, 0230,
0254, 0280, 0305, 0330,
0381, 0407, 0457, 0508,
0533, 0560, 0610, 0661,
0711, 0762, 0813, 0914,
1016, 1067, 1220, 1270,
1372, 1524, 1778, 2032,
2286, 2540

Metric to Inch Conversion:
inches = mm/25.4

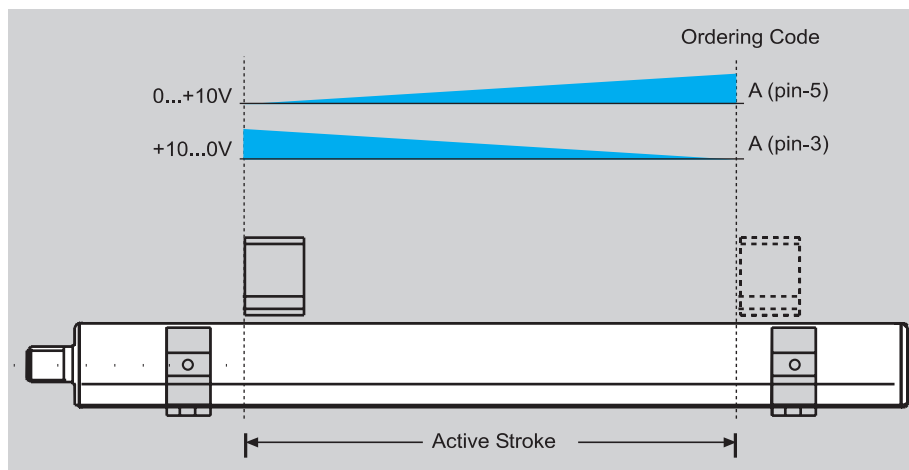


Pins 4 and 8 must remain unconnected



Series
Output Signal
Transducer Interface

BTL6 Profile A1
Analog Voltage
A



Ordering Code

BTL6-A110-M _ _ _ -A1-S115

Output Voltage	0...10 V and 10...0 V
Load Current	max. 5 mA
max. Ripple	≤ 5 mV
System Resolution	≤ 10 μm
Repeatability	≤ 10 μm
Repeat Accuracy	≤ 20 μm
Sampling Rate	STANDARD = 1 kHz
Non-linearity	≤ ±200 μm to 500 mm nominal stroke typ. ±0.02 %, max. ±0.04 % 508...1524 mm nominal stroke
Supply Voltage	20...28 Vdc
Current Draw	≤ 70 mA
Polarity Reversal Protected	yes
Operating Temperature	0 to +158 °F
Storage Temperature	-40 to +212 °F

Pin Assignments	Pin	Color	BTL6-A110...
Output Signals	1	YE	Analog common (falling)
	2	GY	Analog common (rising)
	3	PK	10...0 V output
	4	RD	Not used—No connection
	5	GN	0...10 V output
Supply Voltage	6	BU	GND
	7	BN	+24 Vdc
	8	WH	Not used—No connection

Connect shield to housing,
pins 4 and 8 must remain unconnected.

Please enter length for nominal
stroke in ordering code.

Included:
– Transducer
– User's guide

Please order separately:

Magnets pg 100
Mounting clamps/cuff pg 100
Connectors pg 101

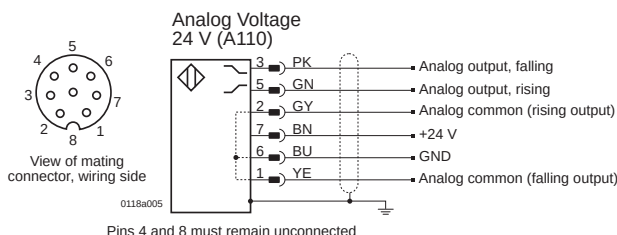
Ordering example:

BTL6-A110-M _ _ _ -A1-S115

Metric to Inch Conversion:
inches = mm/25.4

**Standard
nominal strokes [mm]**

0102, 0127, 0152, 0178,
0203, 0230, 0254, 0280,
0305, 0330, 0381, 0407,
0457, 0508, 0533, 0560,
0610, 0661, 0711, 0762,
0813, 0914, 1016, 1067,
1220, 1270, 1372, 1524



Advanced, multi-function tracking capability in one transducer

The Balluff Micropulse® ATvantage starts with all the advantages of the Micropulse AT, and adds two-magnet operation to detect two independent machine motions or speeds at the same time in the same installation. The added ability to track single stroke/dual motion machine functions (such as clamp/eject on a plastic injection molding machine) allows a single transducer to perform the same function as two separate transducers.

- 100% adjustable analog signal
- LED indicator for programming assistance
- Separate teach-in for all zero and span points
- Selectable dual position or single position plus differential measurement modes

ATvantage

Senses two motions at the same time!

100% Field-Scalable

Track two motions with one system

- The ATvantage senses two motions at the same time
- Two magnets provide two user programmable analog outputs for stroke length and rising 0-10 V or falling 10-0 V signals – set your zero and span points anywhere between
- Significant cost reduction with one transducer taking the place of two

Higher performance, longer life, lower cost

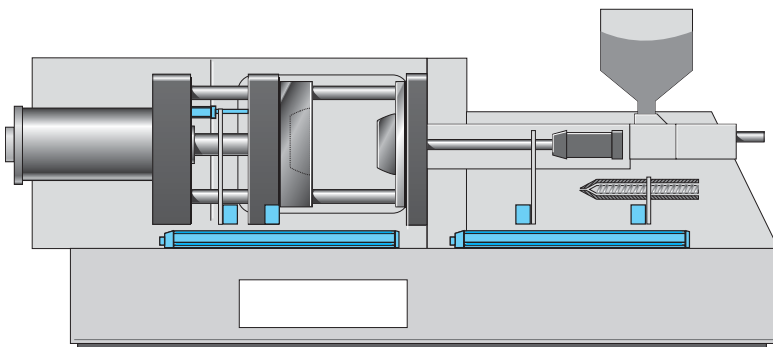
- With no moving parts, the Micropulse AT's non-contact magnetostrictive sensing technology is far superior to wear prone electro-mechanical contact designs such as potentiometers
- Impervious to dust, grit, shock, and vibration and rated for use in a wide variety of industrial applications

From optional to standard: an industry example

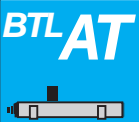
Micropulse transducers have long been standard in the plastics machinery industry on high-precision machines and offered on standard machines as a non-contact option to potentiometric systems.

The Micropulse AT and ATvantage have been designed in cooperation with development engineers from the plastics machinery industry. The AT family is competitively priced and meets all the technical demands of the industry.

With the introduction of Micropulse AT transducers, downtimes can be reduced to a minimum – not just on high-end specialty machines, but on standard production models as well.



Micropulse AT and ATvantage – ideal for use in injection molding machines



Using the ATvantage

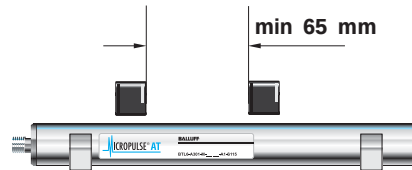
Two moving members on a machine often travel in the same direction. Each axis normally requires a separate feedback sensor.

With the Micropulse AT you can now sense both movements at the same time with just one transducer having two analog outputs.

The position of the respective null and end points can be set individually using two programmable inputs.

The two ranges may be adjacent, may overlap, and can be programmed for a rising or falling output signal. The transducer can be operated using one or two magnets.

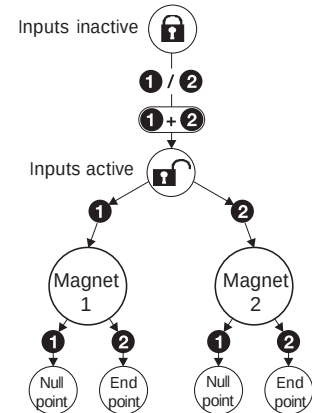
If one magnet leaves the programmed range or if only one is present, the position is indicated on Output 1. Output 2 then indicates an error value.



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

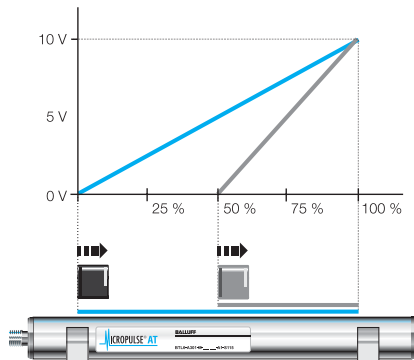
Teach-in

Used for changing the factory set null and end point with a new null and end point. First the magnet must be brought to the new null point and then to the new end position, and the respective values stored by pressing the button.

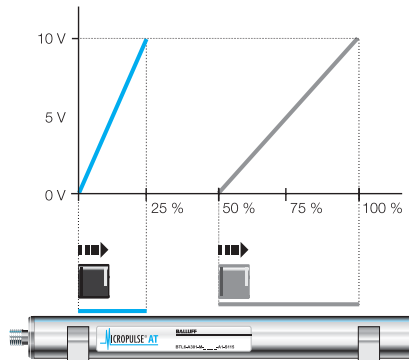


Example: Programming steps for setting the measurement range

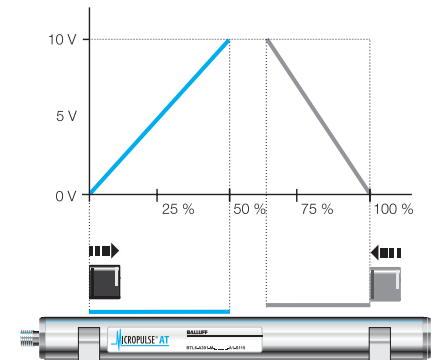
Mode for individual feedback from 2 positions



Basic default setting

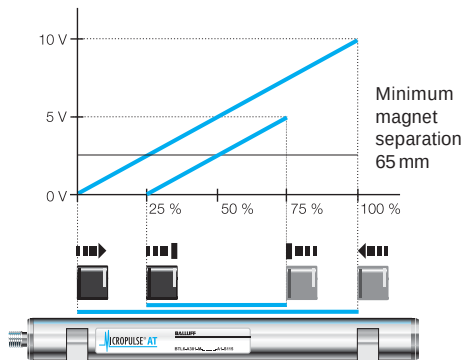


Programming example:
Output 1: 25 % nominal stroke, signal rising
Output 2: 50 % nominal stroke, signal rising

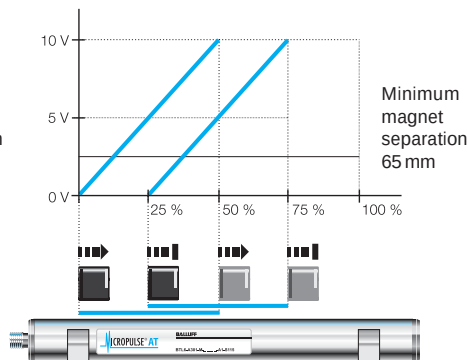


Programming example:
Output 1: 50 % nominal stroke, signal rising
Output 2: 37.5 % nominal stroke, signal falling

Mode for differential measurement between 2 magnets



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



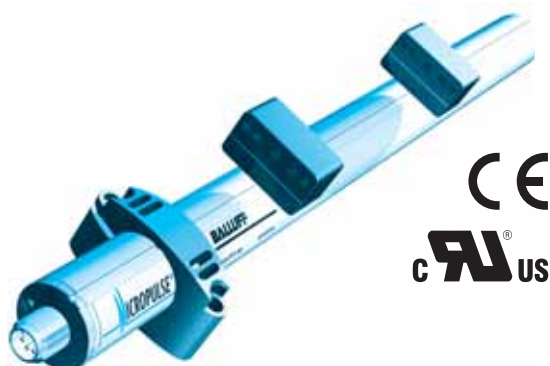
Programming example:
Differential travel 50 % nominal stroke = 10 V differential signal

Mode selection

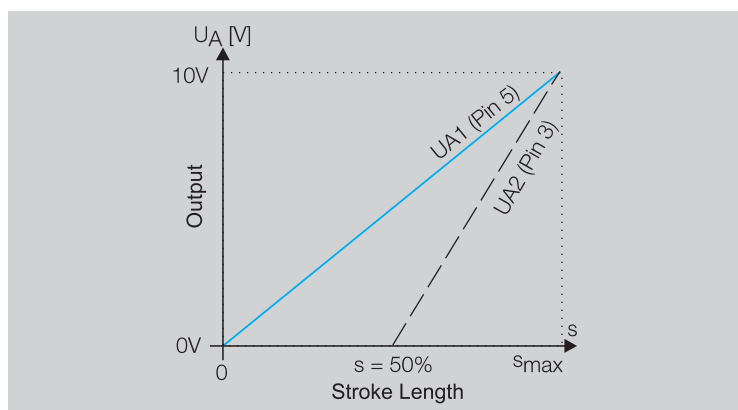
The standard function is separate measurement of two positions.

The programming inputs are used to switch over to differential mode.

Series
Output Signal
Transducer Interface



BTL6 Profile A1
Analog Voltage, Programmable
A



Ordering Code

BTL6-A301-M -A1-S115

Output Voltage (U_A)

0...10 V programmable

Load Current

max. 5 mA

Max. Ripple

≤ 5 mV

System Resolution

≤ 10 μ m

Repeatability

≤ 10 μ m

Repeat Accuracy

≤ 20 μ m

Sampling Rate

fSTANDARD = 1 kHz (< 850 mm)

Non-linearity

$\leq \pm 200$ μ m to 500 mm nominal stroke
typ. ± 0.02 %, max. ± 0.04 % 500...1500 mm nominal stroke

Supply Voltage

18...30 Vdc

Current Draw

≤ 100 mA

Polarity Reversal Protected

yes

Operating Temperature

0 to +158 °F

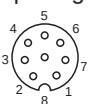
Storage Temperature

-40 to +212 °F

Pin Assignments

Pin Color*

Output Signals



1	YE
2	GY
3	PK
4	RD
5	GN
6	BU
7	BN
8	WH

Supply Voltage

BTL6-A301...

Programming input (a)

Analogue common

Output 2, 0-10 V programmable

Programming input (b)

Output 1, 0-10 V programmable

Supply GND

+24 Vdc supply

Not used — Do not connect

Connect shield to housing,
Pin 8 (WH) must remain unconnected.
*Connector BKS-S115/BKS-S116

Ordering example:

BTL6-A301-M -A1-S115

Please enter code for nominal
stroke in ordering code

Included:

- Transducer
- User's guide

Please order separately:

Magnets pg 100
Mounting clamps/cuff pg 100
Connectors pg 101

Output signal

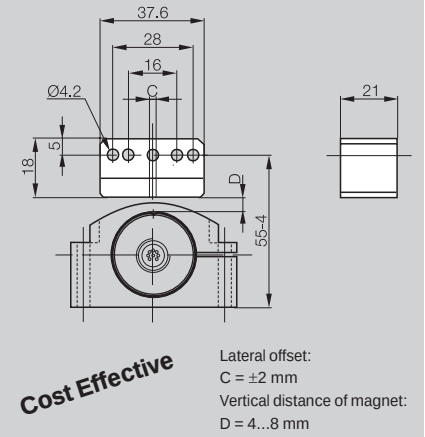
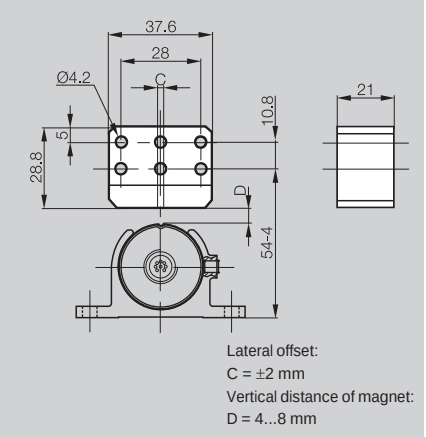
2 analog outputs
Single or differential-
measurement, rising,
falling, zero and end
point programmable

Standard nominal strokes [mm]

0050, 0100, 0130, 0150, 0175, 0200,
0225, 0250, 0300, 0350, 0360, 0400,
0450, 0500, 0550, 0600, 0650, 0700,
0750, 0800, 0900, 0950, 1000, 1100,
1200, 1250, 1300, 1400, 1500, on
request in 25 mm increments for high
quantities only

BTLAT



Description	Magnet	Magnet
Series	BTL6 Profile A1	BTL6 Profile A1
		
Ordering Code	BTL6-A-3801-2	BTL6-A-3800-2
Housing Material	Plastic	Plastic
Weight	ca. 25 g	ca. 30 g
Magnet Traverse Speed	any	any
Operating Temperature/Storage Temperature	-40...+85 °C	-40...+85 °C
Included	Magnet	Magnet

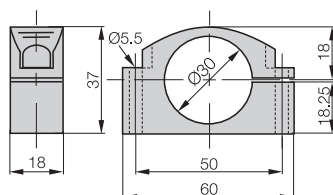
The BTL6-A-3800-2 magnet can be operated at a distance of 4...8 mm from the top surface of the profile housing.

This means that both families of transducers can be interchanged without making any mechanical modifications.

Together with mounting clamps BTL6-A-MF01-A-50 or mounting cuff BTL6-A-MF03-K-50 the mechanical installation is compatible to series BTL5-...-P-S 32 with magnets BTL5-P-3800-2 or BTL5-P-5500-2 on page 71-72.

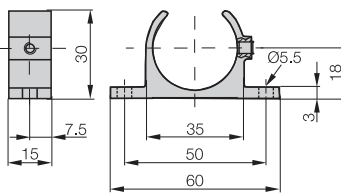


Mounting clamps/cuff

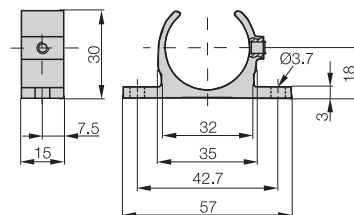


Cost Effective

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



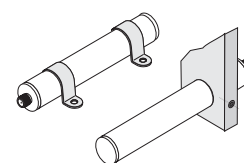
Mounting clamp
Ordering code: **BTL6-A-MF01-A-50**
Includes: 1 clamp



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

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

Length (stroke length)	No. of mounting clamps/cuffs
up to 250 mm	2
251 to 500 mm	3
501 to 750 mm	4
751 to 1000 mm	5
1001 to 1250 mm	6
1251 to 1500 mm	7

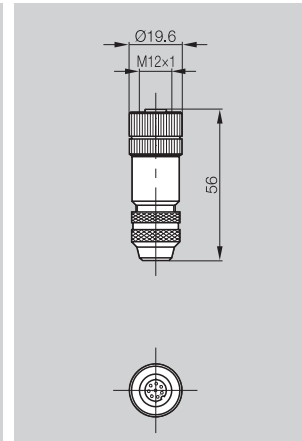
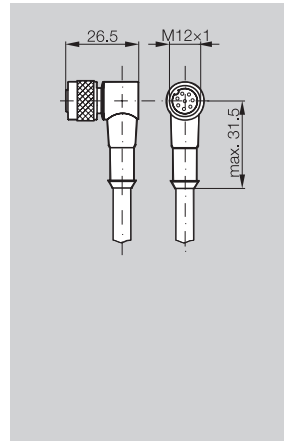
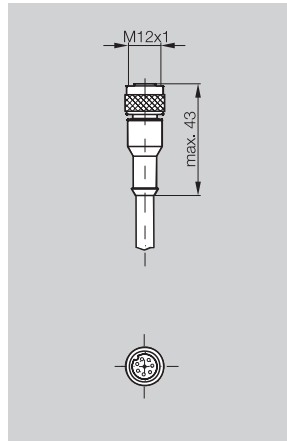


Custom mounting options

Micropulse AT Style

Connectors Profile Series A1

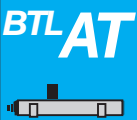
Connectors for Series	BKS-S115-PU-__ BTL6-__-S115	BKS-S116-PU-__ BTL6-__-S115	BKS-S115-00 BTL6-__-S115
Type	8-pin, Straight, female	8-pin, Right angle, female	8-pin, female

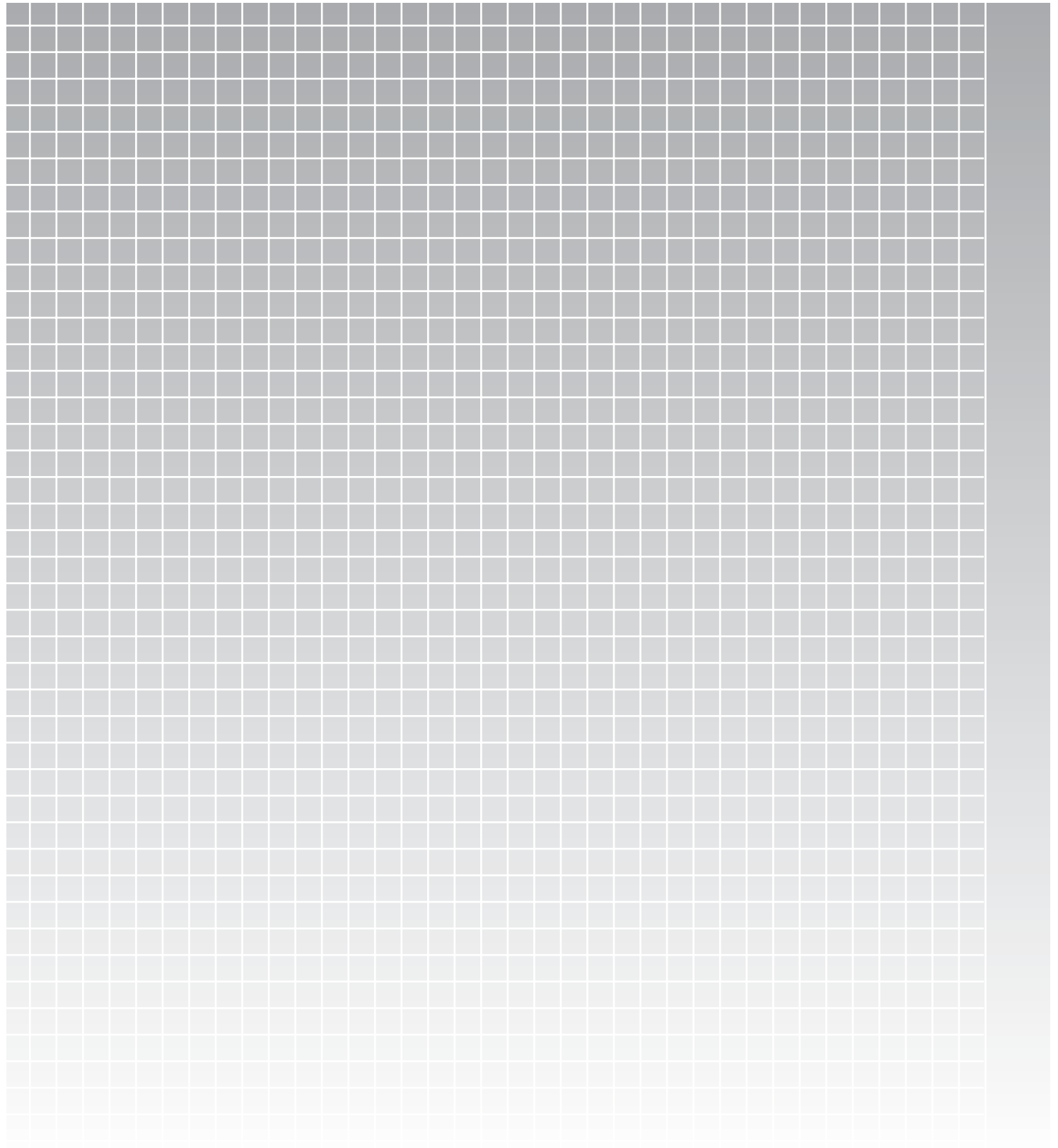


Ordering Code	BKS-S115-PU-__	BKS-S116-PU-__	BKS-S115-00
Screw Terminal			max. 0.75 mm ²
Housing Material	PUR	PUR	CuZn nickel plated
Contacts	CuZn	CuZn	CuZn
Contact Finish	0.8 µm Au	0.8 µm Au	
Cable Strain Relief			PG 9
Accepts Cable Diameter			6...8 mm
Enclosure Rating per IEC 60529	IP 67	IP 67	IP 67 (when attached)
Knurled Coupling Ring	CuZn	CuZn	
Finish	2.5 µm Ni	2.5 µm Ni	
O-ring	Viton	Viton	Viton
Cable	Molded-on PUR		
No. of Wires × Conductor Cross Section	8 × 0.25 mm ² + braided shield		
Type	LIYY-CF11Y		
Conductor Configuration	14 × 0,15 mm		
Outer Diameter	6,6 ±0,2 mm		
Min. Bending Radius	dynamic 4 × D, static 3 × D		

Please indicate cable length
in ordering code
02 = Length 2 m; 05 = Length 5 m;
10 = Length 10 m; 15 = Length 15 m;
20 = Length 20 m; 25 = Length 25 m

Pin assignments	Pin	Color
	1	YE
	2	GY
	3	PK
	4	RD
	5	GN
	6	BU
	7	BN
	8	WH
View of female		





Micropulse BIW

Non-Contact Performance, Standard Form Factor, Linear Potentiometer Price

The Micropulse BIW uses patented pulsed-inductive measurement technology to provide 0-10 Vdc or 4-20 mA position feedback in a form factor identical to many wear-prone resistive linear potentiometers. Unlike linear potentiometers, the BIW's non-contact technology assures years of trouble free operation.



Features:

- Plunger-style form factor provides for drop-in replacement of linear potentiometers
- Non-Contact Sensing Technology
- No External Electronics
- Analog Outputs:
 - 0-10 Vdc / 10-0 Vdc
 - 4-20mA / 20-4 mA

Applications:

The Micropulse BIW is ideal for applications such as:

- Plastic injection molding machinery
- Packaging machinery
- Hydraulic and pneumatic motion bases / flight simulators

Principle of Operation

The BIW inductive linear position transducer is based on a new, patented principle of operation which detects the measured position without contact.

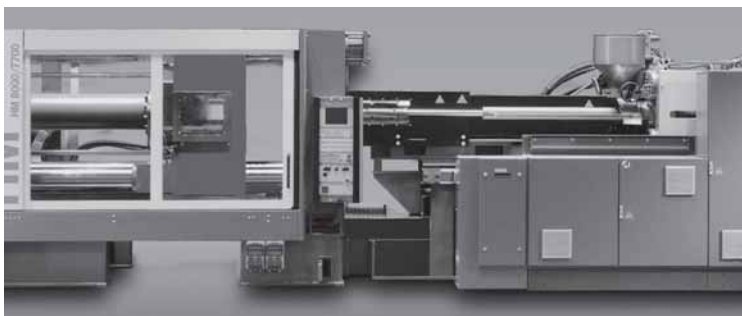
The BIW transducer contains a sender/ receiver element and an oscillator protected by an extruded aluminum housing.

The oscillator is attached to a sliding rod which is in turn attached to the moving member of the machine or equipment. The oscillator is excited by the sender component at a sampling rate of 32 kHz and couples the current position signal into the receiver element. The position is immediately available on the output as an absolute analog value.

The direction of the output signal – rising or falling – can be determined by how the output slope connections are made.

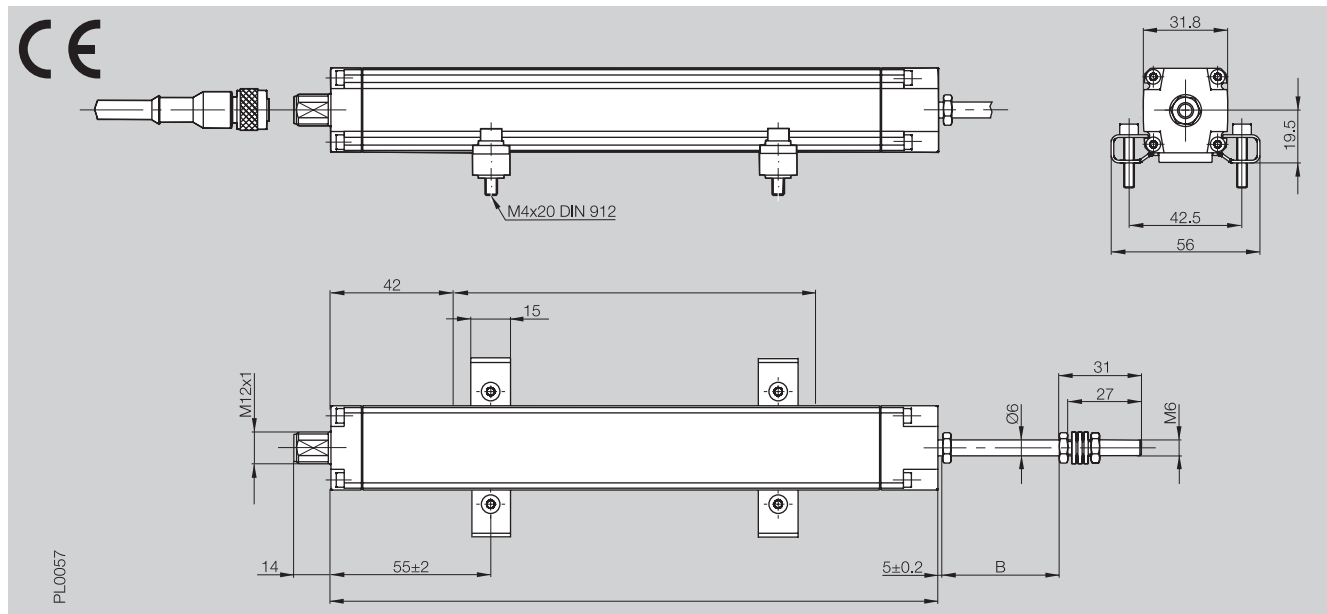


BIW



General Specifications .. pg 104
Accessories pg 105

Series	BIW	BIW
Output Signal	Analog Voltage	Analog Current
Transducer Interface	A/G	C/E



Ordering Code			BIW1-A/G310-M _ _ _ -P1-S115	BIW1-C/E310-M _ _ _ -P1-S115
Output			0...+10 V (order code A) -10...+10 V (order code G)	0...20 mA (order code C) 4...20 mA (order code E)
Output Load			6 mA	≤ 500 Ω
System Resolution				5 μm
Repeatability				10 μm
Non-linearity			≤ ±200 μm up to 500 mm nominal stroke typ. ±0.02 %, max. ±0.04 % 508...2540 mm nominal stroke	
Sampling Rate			typ. 32 kHz	
Supply Voltage			18...30 Vdc	
No-load Current			≤ 60 mA	
Operating Temperature			-4 to +185 °F	
Storage Temperature			-40 to +212 °F	
Pin Assignments	Pin	Color		
	1	YE	Slope selector	
	2	GY	0 V (signal common)	
	3	PK	not used	
	4	RD	Slope selector	
	5	GN	Output signal	
	6	BU	GND	
	7	BN	+24 Vdc	
	8	WH	not used	
Shock Load			100 g/2 ms	
Vibration			12 g, 10...2000 Hz	
Dielectric Strength			500 V (GND to housing)	
Enclosure Rating per IEC 60529			IP 54	
Housing Material			Anodized aluminum	
Mounting			Mounting clamps	
Connection Type			Connector M12, 8-pin standard	
Housing Length A			Nominal stroke + 100 mm	
Mechanical Stroke B			Nominal stroke + 10 mm	

Included:

- Transducer
- User's guide
- 2 Mounting clamps

Ordering example:

BIW1_310-M _ _ _ -P1-S115

Data Protocol

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

Standard nominal strokes [mm]

0075, 0100, 0130, 0150, 0175, 0225, 0300, 0360, 0375, 0400, 0450, 0500, 0600, 0650, 0750

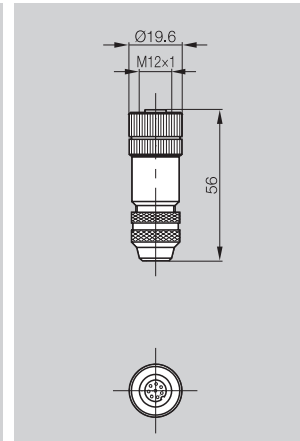
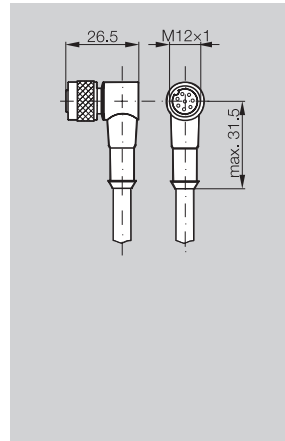
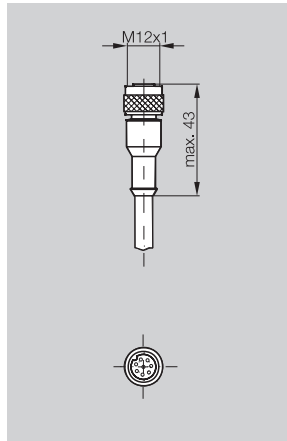
Metric to Inch Conversion: inches = mm/25.4

Connectors/Accessories
for Series
Type

BKS-S115-PU-__
BIW-__-S115
8-pin, Straight, female

BKS-S116-PU-__
BIW-__-S115
8-pin, Right angle, female

BKS-S115-00
BIW-__-S115
8-pin, female



Ordering Code	BKS-S115-PU-__	BKS-S116-PU-__	BKS-S115-00
Screw Terminal			max. 0.75 mm ²
Housing Material	PUR	PUR	CuZn nickel plated
Contacts	CuZn	CuZn	CuZn
Contact Finish	0.8 µm Au	0.8 µm Au	
Cable Strain Relief			PG 9
Cable Diameter			6...8 mm
Enclosure Rating per IEC 60529	IP 67	IP 67	IP 67 (when attached)
Knurled Coupling Ring	CuZn	CuZn	
Finish	2.5 µm Ni	2.5 µm Ni	
O-ring	Viton	Viton	Viton
Cable	Molded-on PUR		
No. of Wires × Conductor Cross Section	8 × 0.25 mm ²		
Type	LIYY-CF11Y		
Conductor Configuration	14 × 0,15 mm		
Outer Diameter	6,6 ±0,2 mm		
Min. Bending Radius	dynamic 4 × D, static 3 × D		

Please indicate cable length
in ordering code
02 = Length 2 m; 05 = Length 5 m;
10 = Length 10 m; 15 = Length 15 m;
20 = Length 20 m; 25 = Length 25 m

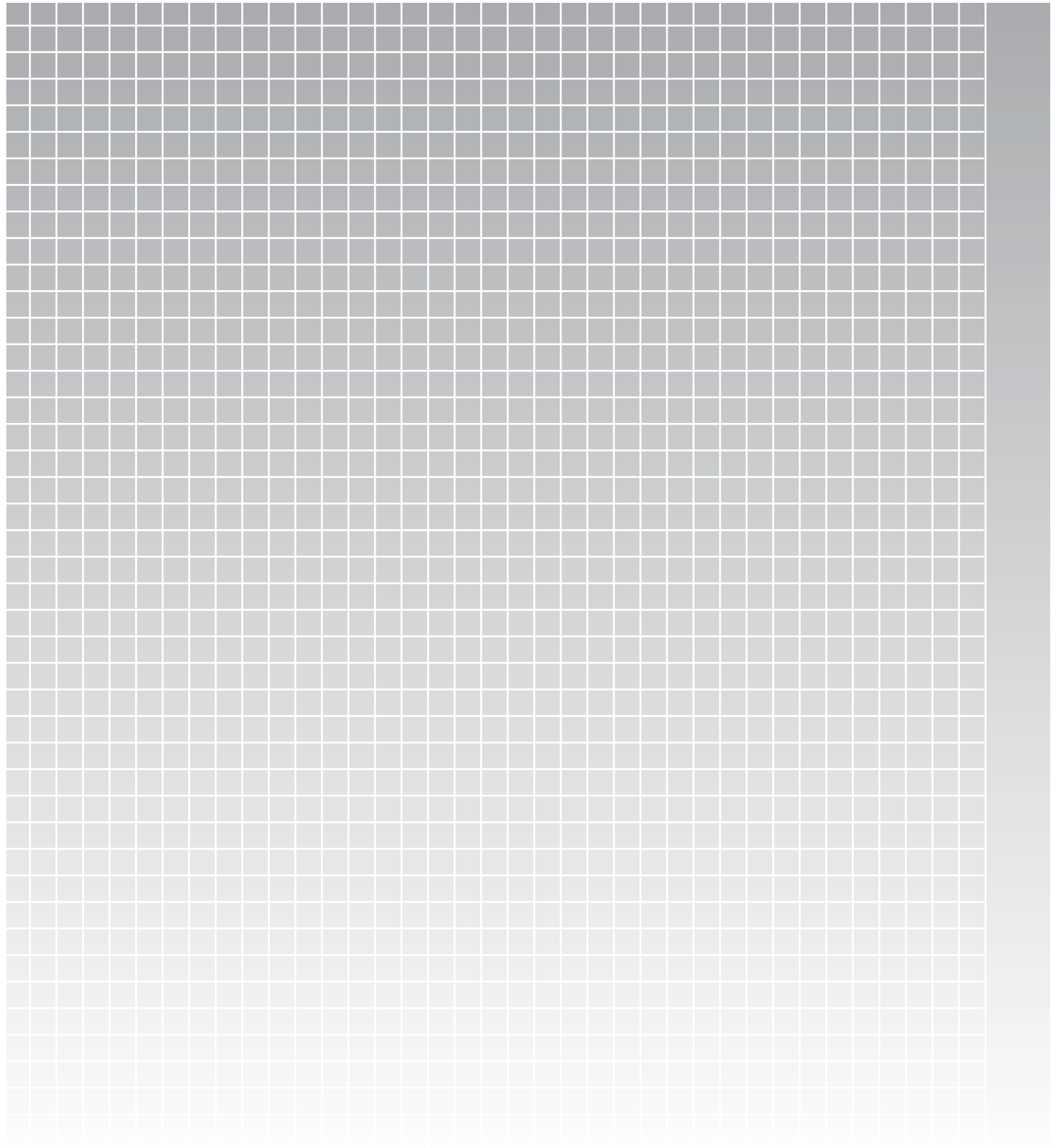
Pin assignments	Pin	Color
	1	YE
	2	GY
	3	PK
	4	RD
	5	GN
	6	BU
View of female	8	WH

Adapter BKS-S15 to BKS-S32
Ordering code: BKS-S115/GS32-PU-00.2



BIW





Connectors and Accessories

In addition to the standard connector options, Micropulse® transducers offer many additional connector configurations to suit various application requirements.

Compatibility – Micropulse transducers are available with connectors designed to offer plug-and-play replacement of competitive products.

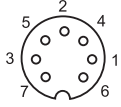
Rugged Connectors – For demanding applications in harsh environments, rugged MS-style connectors offer rugged construction and a quick, positive-locking bayonet-style connection mechanism.

Fieldbus Connectors – Special connectors for CANbus and Profibus allow Micropulse transducers to be quickly and easily connected to fieldbus systems. A choice of molded cable assemblies or field-installable connectors provides maximum versatility.



Connector Overview	pg. 108
Rugged MS-Style Connector	pg. 109
6 & 7-Pin DIN-Style Connector ..	pg. 110
Connectors & Accessories for CANopen/DeviceNet	pgs. 111-112
Connectors & Accessories for PROFIBUS-DP	pgs. 113-114



Connector Type	Housing Styles	Transducer Ordering Code	Mating Connector(s)	Catalog Page
7-pin DIN Style 	Z Rod P Profile 	BTL5-... S147	BKS- S147 -xx (straight)	110
10-pin MS Connector 	Z Rod P Profile 	BTL5-...- S140	BKS- S140 -xx (straight) BKS- S140 -23-xx (straight shielded)	109
6-pin DIN Style (D6) 	Z Rod P Profile R Low-Profile 	BTL5-...- S135	BKS- S135 -xx (straight) BKS- S136 -xx (right angle)	110
CANopen/DeviceNet Connectors 	Z Rod P Profile 	BTL5-...- S92 BTL5-...- S94 BTL5-...- S93	BKS- S92 -00 (straight female) BKS- S94 -00 (straight male) BKS- S93 -00 (right angle female) BKS- S95 -00 (right angle male) BKS- S48 -15-CP-xx (power for S93)	111-112
Profibus Connectors 	Z Rod P Profile 	BTL5-...- S103	BKS- S103 -00 (field-installable female) BKS- S105 -00 (field-installable male) BKS- S103 -CP-xx (molded cordset female) BKS- S105 -CP-xx (molded cordset male) BKS- S48 -15-CP-xx (power for S103)	113-114

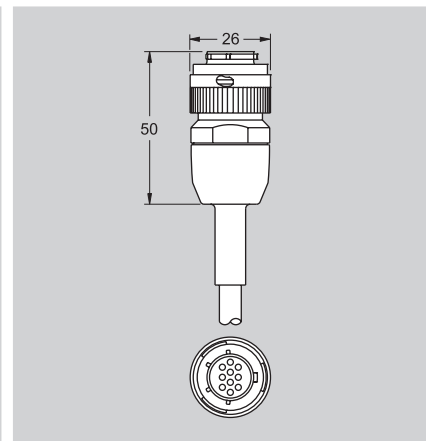
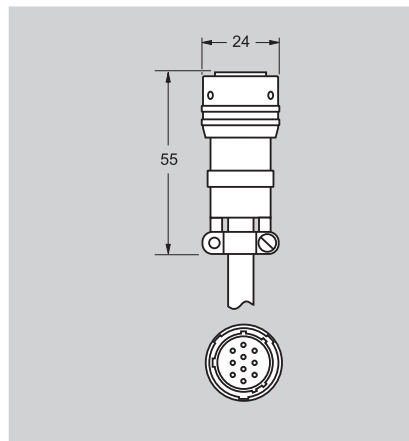
Connector Options

The table above summarizes the special connector options available for Micropulse® transducers. For detailed information, refer to the pages referenced in the table. For configurations not listed, please consult factory.

Connector Series
Connector Description
For Transducer Series
Transducer Ordering Code

S140
10-pin MS, Bayonet connector
Rod Style Z, Profile Style P
BTL5-...- S140

S140
10-pin MS, Bayonet connector - shielded
Rod Style Z, Profile Style P
BTL5-...- S140



Ordering Code

BKS-S140-00 (field-installable, straight)
BKS-S140-xx (cable assembly, straight,
specify cable length "xx" in meters)

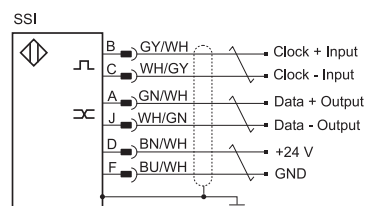
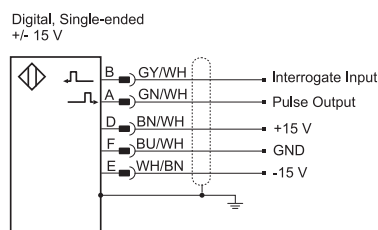
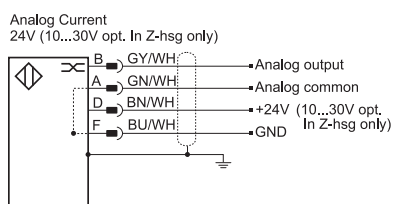
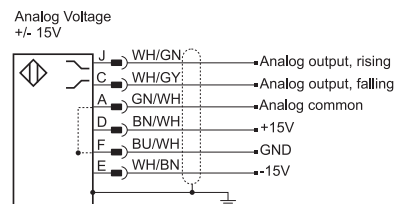
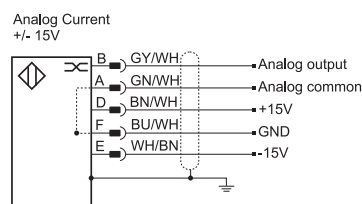
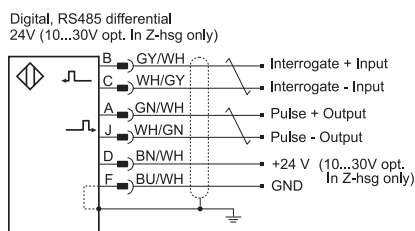
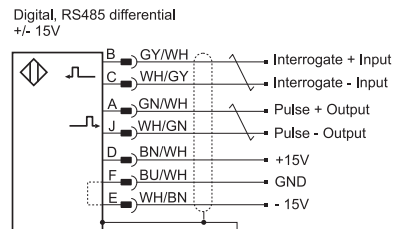
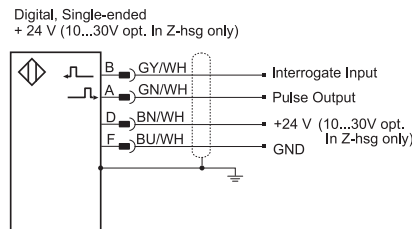
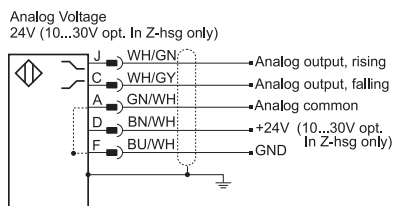
BKS-S140-23-00 (shielded)
BKS-S140-23-xx (shielded,
specify cable length "xx" in meters)

Connector Specifications:
Housing Material
No. of Contacts/Material
Cable Diameter Range (field-installable)
Cable Assembly Specifications:
Wire Gauge
Number of Conductors
Overall Diameter
Jacket Material
Environmental Rating

Anodized aluminum
10/Gold-plated nickel
6...9 mm
24 AWG
10 + braided shield
8 mm
PVC
IP 65 (when connected)

Anodized aluminum
10/Gold-plated nickel
6...9 mm
24 AWG
10 + braided shield
8 mm
PVC
IP 65 (when connected)

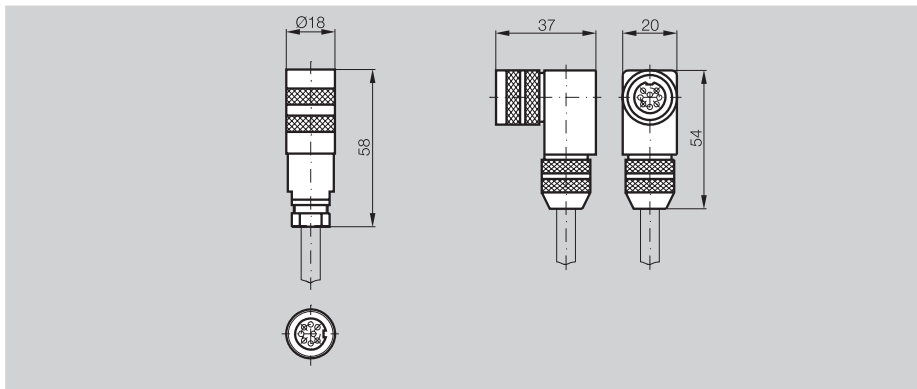
Wiring Diagrams



Connector Series
Connector Description
For Transducer Series
Transducer Ordering Code

S135
6-pin DIN
Rod Style Z, Profile Style P, Low-profile Style R
BTL5-...- S135

S147
7-pin DIN
Rod Style Z, Profile Style P
BTL5-...- S147



Ordering Code

BKS-S135-00 (Field-installable, straight)
BKS-S136-00 (Field-installable, right angle)
BKS-S135-xx (cable assembly, straight, specify cable length "xx" in meters)
BKS-S136-xx (cable assembly, right angle, specify cable length "xx" in meters)

BKS-S147M-00 (Field-installable, straight)
BKS-S147M-xx (cable assembly, straight, specify cable length "xx" in meters)

Connector Specifications:

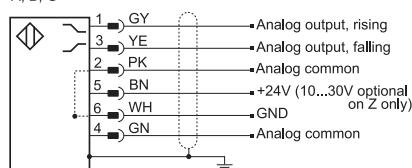
Housing Material
No. of Contacts/Material
Cable Diameter Range (field-installable)
Cable Assembly Specifications:
Wire Gauge
Number of Conductors
Overall Diameter
Jacket Material
Environmental Rating

Nickel-plated Brass
6/Gold-plated nickel
6...8 mm
24 AWG
6 + braided shield
6 mm
PUR
IP 67 (when connected)

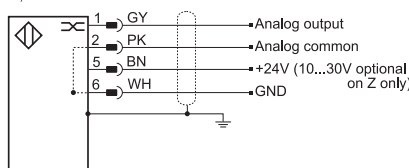
Nickel-plated Brass
7/Gold-plated nickel
6...8 mm
24 AWG
7 + braided shield
6 mm
PUR
IP 67 (when connected)

Wiring Diagrams

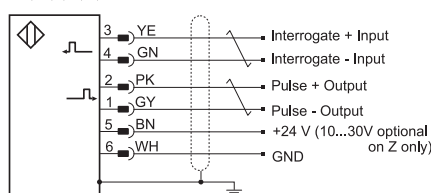
Analog Voltage
A, B, G



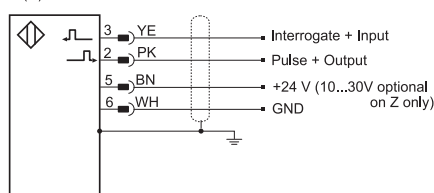
Analog Current
E, C



Digital, RS485 differential
P, M, I, K, L, R

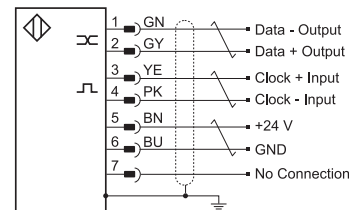


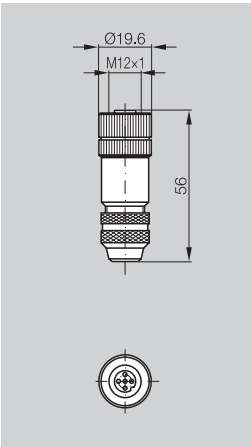
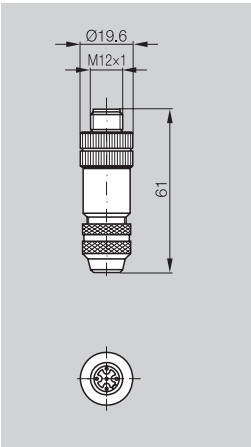
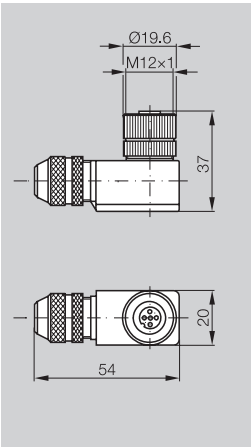
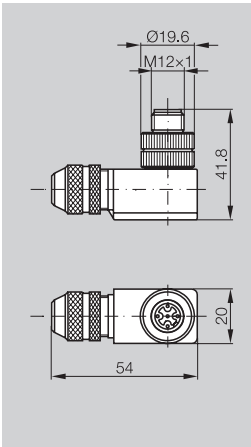
Digital, Single-ended
(N)



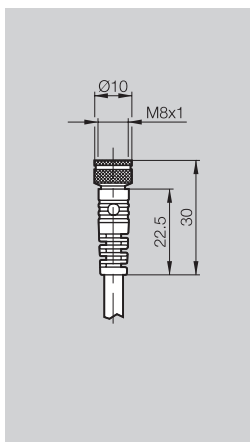
S147 Only

SSI



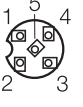
Connectors/Accessories for Series Type	BKS-S 92-00 CANopen/DeviceNet Straight, female	BKS-S 94-00 CANopen/DeviceNet Straight, male	BKS-S 93-00 CANopen/DeviceNet Right angle, female	BKS-S 95-00 CANopen/DeviceNet Right angle, male
				
Ordering Code	BKS-S 92-00	BKS-S 94-00	BKS-S 93-00	BKS-S 95-00
Screw Terminal	max. 0.75 mm ² /AWG 18	max. 0.75 mm ² /AWG 18	max. 0.75 mm ²	max. 0.75 mm ²
Housing Material	Nickel plated brass	Nickel plated brass	Nickel plated brass	Nickel plated brass
Contacts	Brass	Brass	Brass	Brass
Contact Finish	0.8 µm gold plated	0.8 µm gold plated	0.8 µm gold plated	0.8 µm gold plated
Cable Strain Relief	PG 9	PG 9	PG 9	PG 9
Cable Diameter	6...8 mm	6...8 mm	6...8 mm	6...8 mm
Enclosure Rating Per IEC 60529	IP 67 (when attached)	IP 67 (when attached)	IP 67 (when attached)	IP 67 (when attached)

Connectors/Accessories for Series	BKS-S 48-15-CP- BTL5-D1...-S93
Type	Supply voltage 3-pin, female



Ordering Code	BKS-S 48-15-CP-_*
Housing Material	PUR
Contacts	Brass
Contact Finish	
No. of Wires × Conductor Cross Section	2 × 0.25 mm ² /AWG 24
Enclosure Rating Per IEC 60529	IP 67 (when attached)

CANopen Wiring

Pin Assignments	BKS-S 92-00/-S 93-00/-S 94-00/-S 95-00	BKS-S 92-R01/-S 94-R01
	Pin Signal	Pin Signal
1	CAN_GND	1 -
2	+24 V	2 -
3	GND (0 V)	3 -
4	CAN_HIGH	4 121 Ohms
5	CAN_LOW	5

DeviceNet Wiring

Pin Assignments	BKS-S 92-00/-S 93-00/-S 94-00/-S 95-00
	Pin Signal
1	Shield
2	V +
3	V- (GND)
4	CAN_HIGH
5	CAN_LOW

External supply voltage and shield

S 48 3-pin

1	+24 V
3	0 V (GND)
4	Shield Supply

* Indicate cable length in meters.

02 = Length 2 m

05 = Length 5 m

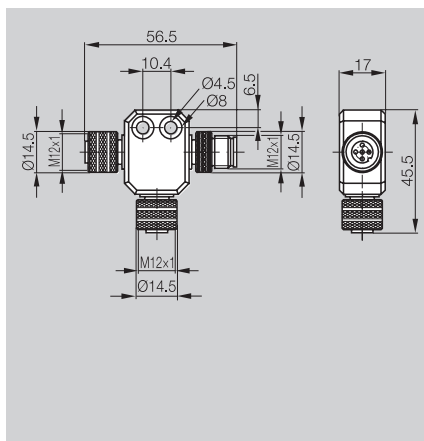
10 = Length 10 m



Connectors/Accessories
for Series
Type

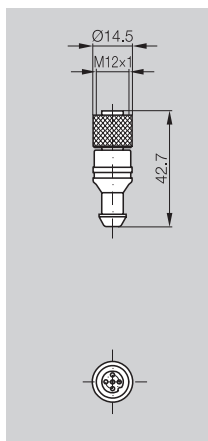
BKS-S 92-TA1

CANopen/DeviceNet
T-splitter, 2 x F, 1 x M



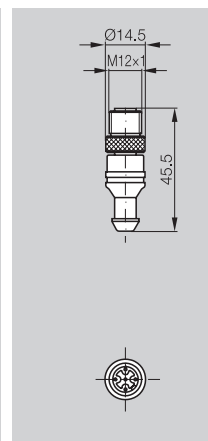
BKS-S 92-R01

CANopen/DeviceNet
Termination resistor,
female



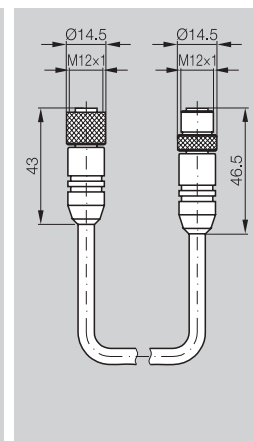
BKS-S 94-R01

CANopen/DeviceNet
Termination resistor,
male



BKS-S 92-16/GS92-_-

CANopen/DeviceNet
Male/female extension



Ordering Code

BKS-S 92-TA1

BKS-S 92-R01

BKS-S 94-R01

BKS-S 92-16/GS92-_*

Housing Material

PA

TPU

TPU

PUR

Contacts

Brass

Brass

Brass

Brass

Contact Finish

Ni

0.8 µm gold plated

0.8 µm gold plated

0.8 µm gold plated

No. of Wires × Conductor
Cross Section

5 × 0.34 mm²/AWG 22

Enclosure Rating Per
IEC 60529

IP 67

IP 68

IP 68

IP 67

Knurled Coupling Ring

Brass

Brass

Brass

Brass

Finish

2.5 µm Ni

2.5 µm Ni

2.5 µm Ni

2.5 µm Ni

O-ring

HBR

Viton

Viton

Viton

Resistor

121 Ohms

121 Ohms

* Indicate cable length
in meters.

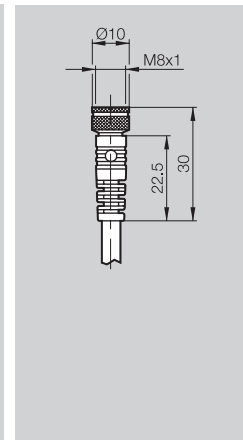
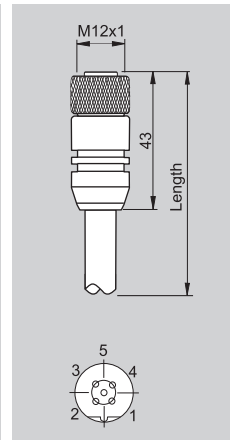
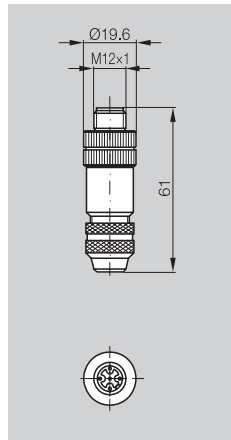
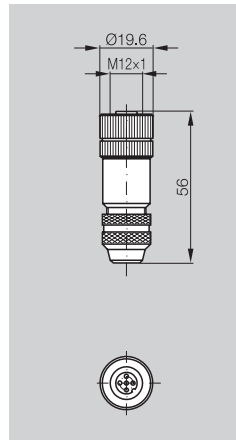
02 = Length 2 m

05 = Length 5 m

10 = Length 10 m



Connectors/Accessories for Series	BKS-S 103-00 BTL5-T1...-S103	BKS-S 105-00 BTL5-T1...-S103	BKS-S103-CP-xx BTL5-T1...-S103	BKS-S 48-15-CP- BTL5-T1...-S103 Supply voltage
Type	5-pin, female	5-pin, male	5-pin, female, molded cordset	3-pin, female



Ordering Code	BKS-S 103-00	BKS-S 105-00	BKS-S103-CP- *	BKS-S 48-15-CP- *
Screw Connection	max. 0.75 mm ² / AWG 18	max. 0.75 mm ² / AWG 18		
Housing Material	Nickel plated brass	Nickel plated brass	PUR	PUR
Contacts	Brass	Brass	Brass	Brass
Cable Strain Relief	PG 9	PG 9		
Cable Diameter	6...8 mm	6...8mm		
No. of Wires × Conductor Cross Section			2 x 0.64 mm ² / AWG 18	2 x 0.25 mm ² / AWG 24
Enclosure Rating Per IEC 60529	IP 67 (when attached)	IP 67 (when attached)	IP 67 (when attached)	IP 67 (when attached)
Knurled Coupling Ring			Nickel plated brass	
O-ring			Viton	

* Indicate cable length
in meters.

003= Length 0.3 m

02 = Length 2 m

05 = Length 5 m

10 = Length 10 m

Pin Assignments		S 103/S 105 5-pin	S 48 3-pin
Control and data signals	Data GND	3	
	RxD/TxD-N (A)	2	
	RxD/TxD-P (B)	4	
	VP +5 V	1	
Supply voltage and shield	+24 V		1
	0 V (GND)		3
	Ground PROFIBUS-DP	5	
	Shield Supply		4



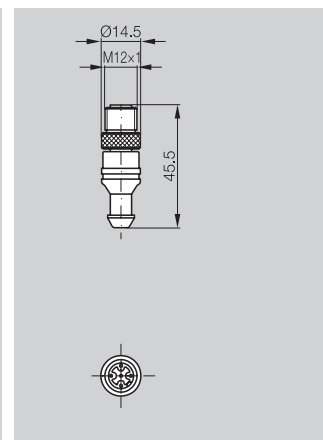
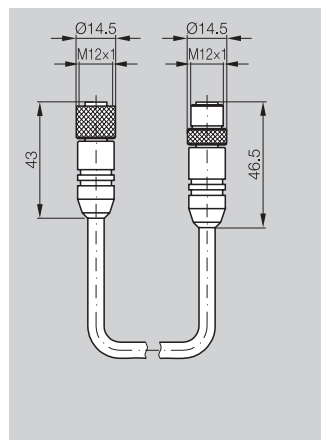
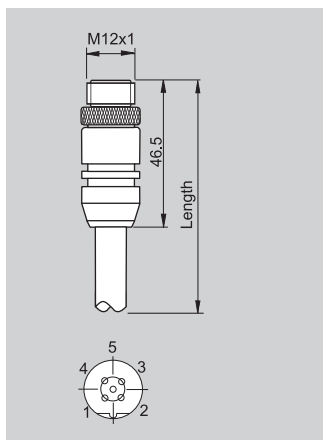
Profibus Profile Style



Profibus Rod Style



Connectors/Accessories for Series	BKS-S105-CP-xx BTL5-T1...-S103	BKS-S103/GS103-CP- BTL5-T1...-S103	BKS-S 105-R01 BTL5-T1...-S103
Type	5-pin, male, molded cordset	Male/female extension	Termination resistor, male



Ordering Code	BKS-S105-CP- *_	BKS-S103/GS103-CP- *_	BKS-S 105-R01
Screw Connection			
Housing Material	PUR	PUR	PUR
Contacts	Brass	Brass	Brass
Cable Strain Relief			
Cable Diameter			
No. of Wires × Conductor	2 × 0.64 mm ² /	2 × 0.64 mm ² /	
Cross Section	AWG 18	AWG 18	
Enclosure Rating Per IEC 60529	IP 67 (when attached)	IP 67 (when attached)	IP 67 (when attached)
Knurled Coupling Ring	Nickel plated brass	Nickel plated brass	Nickel plated brass
O-ring	Viton	Viton	Viton

* Indicate cable length
in meters.
02 = Length 2 m
05 = Length 5 m
10 = Length 10 m



Analog Interface Modules and Digital Displays

This section contains digital displays and analog interface modules to be used with Micropulse transducers.

Analog Interface Module

The versatile BTM module converts a START/STOP digital pulse signal from a Micropulse transducer into user-scalable analog position and/or velocity information. In addition, the BTM module can be used to provide a position signal from up to 4 magnets on a single Micropulse transducer. Since the conversion from digital signal into analog signal takes place in the close proximity to the analog input device, a high degree of signal noise immunity can be achieved.

Digital Interface Module

The BTM-H1 module converts a START/STOP digital pulse signal from a Micropulse transducer into parallel digital outputs (up to 23-bits, depending on transducer length). The output data format is user-selectable binary, BCD, or Gray code. The BTM-H module also provides a 24-bit Synchronous Serial Interface (SSI) signal. User-selectable resolutions, and a super-fast update rate make the BTM-H1 a high-performance interface solution.

Digital Displays

Ranging from simple, low cost displays to allow visual position monitoring up to full-featured displays with programmable setpoints and serial communication capabilities, Balluff offers a display product to meet any application requirement.



BDD
BTM

BTM Analog Interface Module pg. 116
BTM-H Digital Interface Module .. pg. 117
Digital Displays pg. 118-121



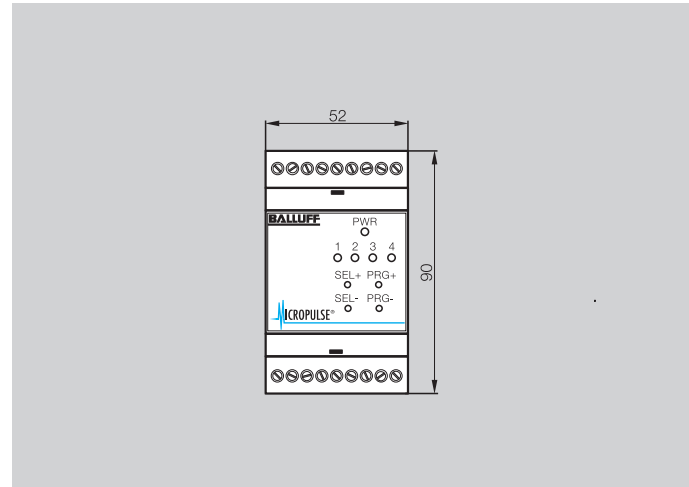
Description:

Used in conjunction with the Balluff P1... START/STOP linear transducer, the Balluff BTM module is used to provide up to 4 channels of analog position and/or velocity feedback. In multi-magnet mode, the BTM can be used to provide independent position information on up to 4 magnets on the Balluff transducer.

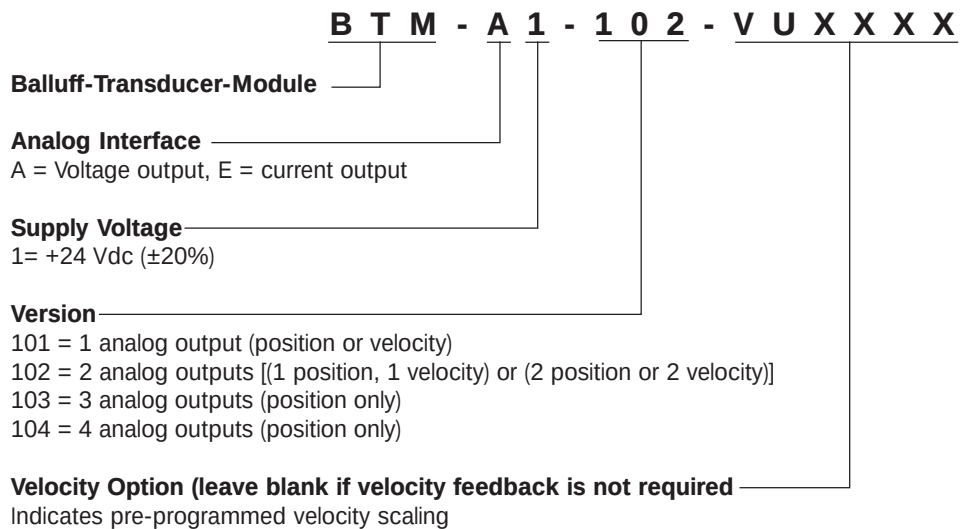
Features:

- User-scalable outputs:
-10 to +10, -5 to +5, 0 to 5, 0 to 10 Vdc, 4-20 mA
- Standard DIN-rail mounting
- Fast 0.5 ms update rate
- Noise-immune RS-422 interface allows for cable lengths of up to 1,600 feet between transducer and BTM-A
- Outputs short-circuit and reverse-polarity protected

Type	BTM-A1/E1 Analog Output Processor
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Ordering Code	See below
Input	Balluff BTL5 or BTL6 P1... START/STOP linear transducer
Outputs	Analog position and/or analog velocity
Operating Voltage	+24 Vdc $\pm$ 20%
Current Draw	125 mA max (excluding transducer)
Operating Temperature	0 to 70° C
Number of Outputs	1 to 4 (see ordering code)
Position Output	0 to 10 Vdc, -10 to +10 Vdc, -5 to +5 Vdc, user programmable
Velocity Output	-10 to +10 Vdc
Velocity Range	2 to 400 inches/sec.
Output Resolution	16-bit
Update Rate	0.5ms / 2 ms for velocity



If "M" in position 13 specify velocity in millimeters/second
If "U" in position 13, specify velocity in inches and tenths of inches/second

e.g.
VU0300 = velocity scaling of 30.0 in/second
VM0762 = velocity scaling of 762 mm/second

Description:

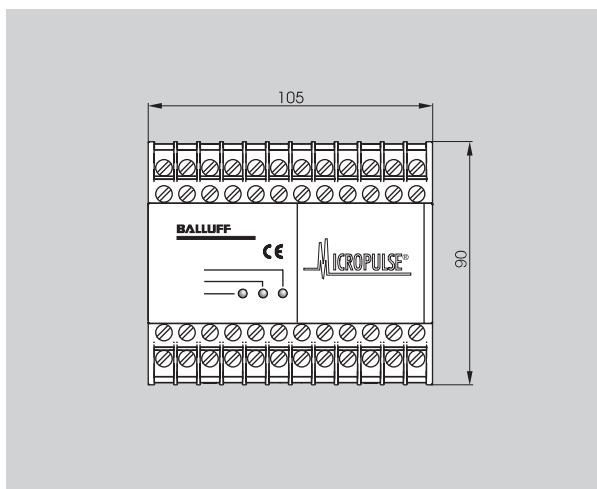
Used in conjunction with the Balluff BTL5 or BTL6 P1... START/STOP linear transducer, the BTM-H1 Module provides 23-bits of parallel data in binary, BCD or Gray Code. The BTM-H1 also provides a 24-bit SSI output in Gray Code. The BTM-H1 can be used to interface to discrete inputs on PLC's and other controllers.

Features:

- User selectable resolution (10, 25, 100, or 1000 μ m)
- Fast 0.5 ms position update
- DATA READY, SIGN, and ERROR, UP-DOWN and Parity outputs
- DATA HOLD and ENABLE inputs
- Available with short-circuit protected 10-30 V Source Driver I/O (BTM-H1-240) or TTL-level I/O (BTM-H1-340)
- Standard DIN-rail mounting

Type**BTM-H1-240/340**

Digital Parallel Interface Processor

**Ordering Code**

BTM-H1-240 (10-30 V Source Driver Outputs)
BTM-H1-340 (TTL Level Outputs)

Input**Outputs****Parallel Output Loading****Resolution****Repeatability****Update Rate****Operating Voltage****Current Draw****Operating Temperature****Humidity**

Balluff BTL5 or BTL6 P1... START/STOP linear transducer
 Parallel: 23-bit binary, BCD or Gray Code (user selectable)
 SSI: 24-bit Gray Code

20 mA max

10, 25, 100, 1000 μ m, user selectable

1 digit

0.5 ms

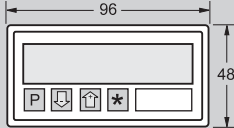
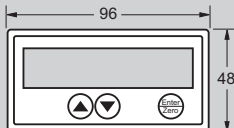
24 Vdc +/- 10%

max 500 mA (module + transducer)

0 to 60° C

≤ 90%, non-condensing



Name	BDD-UM 3023	BDD-100
Series	Analog - input digital display	Digital display for Micropulse transducers with ST/SP (P) interface
	 Housing depth 55mm Analog Input	 Housing depth 70mm START/STOP Input
Ordering Code	BDD-UM 3023	BDD-100
Features	– 4-digit (14 mm, red LED) – Analog Input (0-10 V or 4-20 mA) – 10-bit resolution – 5 measurements/sec – Scalable – Programmable Decimal Point – 24 Vdc input power	– 6-digit, 0.57" high, seven-segment LED display – 0.002" resolution – Fixed 5 ms update rate – Programmable decimal point, Units, and Gradient – Remote Zero – RS-232 serial interface for programming and data transfer – Removable Phoenix-type connectors – Front panel lock-out – 24 Vdc input power



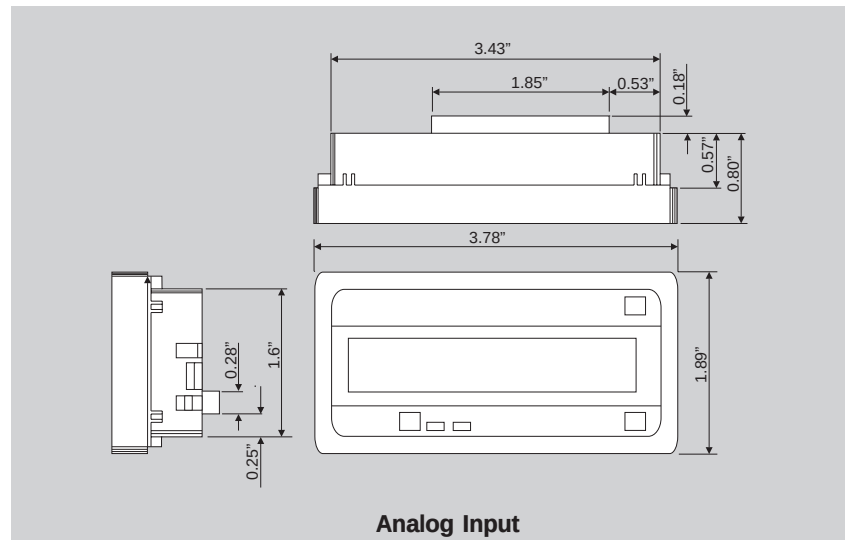
BDD 640

The BDD 640 series panel meters offer high performance and advanced functionality in a compact package. The BDD 640 series is a high resolution display designed for use with continuous output analog position sensors. The universal 16-bit analog input allows the BDD 640 series to be used with either 0-10 Vdc or 4-20 mA analog inputs. Available options include a scaleable 16-bit output and up to 4 programmable PNP set-points.

Features:

- Ultra thin design consumes minimal panel space
- 100% adjustable zero and span
- 16-bit input resolution for superior accuracy
- Fast update rate provides superior display readout response
- Available with up to 4 programmable setpoint outputs
- Scaleable 16-bit analog output available

Name	BDD 640
Series	Analog - input digital display



Versions

BDD 640-R3A-0-00-E-00	16-bit analog input, display only
BDD 644-R3A-0-54-E-00	16-bit analog input, four programmable PNP outputs
BDD 645-R3A-5-53-E-00	16-bit analog input, two programmable PNP outputs, 16-bit 0-10 Vdc or 4-20 mA analog output, 100% adjustable

Technical Specifications

Input Signal	0-10 Vdc or 4-20 mA
Display	6-digit (5-digit usable for analog models), 0.56" digits, 6 ms refresh rate
Supply Voltage	24 Vdc $\pm$ 20%
Temperature Range	0 to 70°C
Update Rate	67 ms
Resolution	16-bit A/D
Digital Outputs	PNP, 100 mA per output
Analog Output	16-bit analog, 0-10 Vdc or 4-20 mA, 100% adjustable
Housing Information	Plastic, 1/8 DIN housing, panel mountable

Accessories (optional)

BDD Z-001	Clear Nema 4X IP65 display cover
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BDD 652

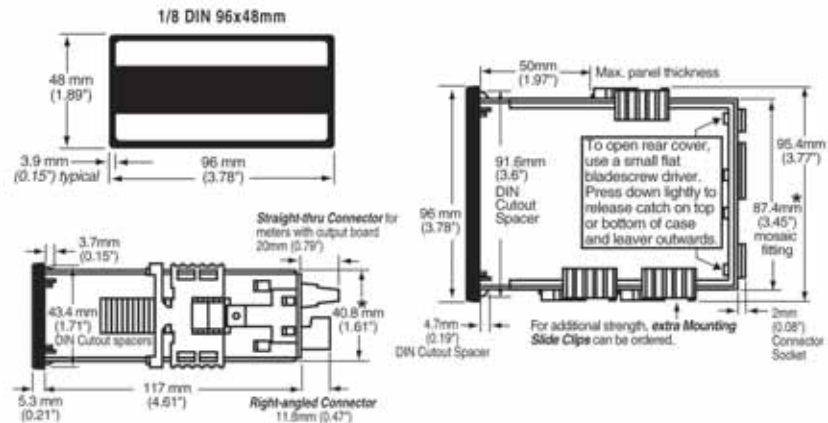
Magnetostriuctive Start/Stop Display and Controller

The BDD 652 is a full-featured digital display that is compatible with Micropulse® magnetostriuctive linear position transducers with a START/STOP interface. The BDD 652 features a 6-digit alphanumeric display with scrolling menu prompts for easy programming and setup. The modular construction of the BDD 652 allows for a variety of relay, analog and serial output options using factory installed plug-in output cards.

Features:

- High resolution – down to 0.0001"
- Multiple position magnets: up to 4 magnets can be used on a single Transducer
- Display position or velocity
- Easy programming with scrolling alphanumeric display
- Front panel zero button including "reset-to-preset" capability
- 120 Vac operation with built-in +24 Vdc supply
- Up to 4 programmable setpoints with 5-amp form A relays
- Optional 16-bit auxiliary analog output
- Optional RS232 serial interface

Name	Magnetostriuctive START/STOP Display and Controller
Series	BDD 652

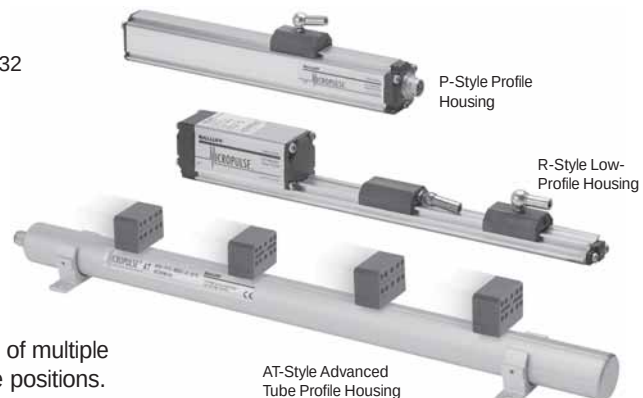


Ordering Code	BDD 652-R ¹ P- ² - ³ -E- ⁴ (See ordering options below)
Transducer Interface	Micropulse Start/Stop transducer, leading edge ("M1") or trailing edge ("P1")
Display	6-digit, alphanumeric, 0.56" digits
Resolution	Inches: 0.01", 0.001", or 0.0001" Millimeters: 0.1, 0.01, 0.001 mm
Display Range	0.00001 to 99999.9
Displayed Value	Position or velocity for 1 to 4 position magnets
Update Rate	10 samples/sec.
Max. Sensor Length	165" (4000 mm)
Programmable Setpoints	Up to 4 programmable setpoints utilizing 5-amp form A relays
Analog Output	Optional 16-bit analog output (0 to 10 Vdc, 4 to 20 mA, or 0 to 20 mA)
Serial Communications	Optional RS232 ASCII interface
Operating Voltage	85-265 Vac / 95-370 Vdc or 15-48 Vac / 10-72 Vdc
Power Supply	Built-in +24 Vdc, 150 mA power supply
Operating Temperature	0 to 50° C (32 to 122° F)
Storage Temperature	-20 to +70° C (-4 to +158° F)
Case Dimensions	1/8 DIN, 96 x 48 mm (3.78" x 1.89")
Case Material	94 V-0 UL rated self-extinguishing polycarbonate (metal case optional)
Approvals	CE approval per EN-61000-3/4/6 and EN-61010-1

Ordering Options:

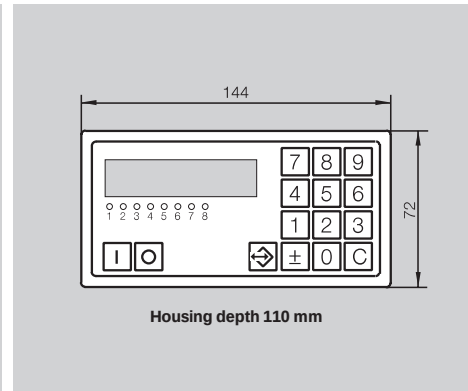
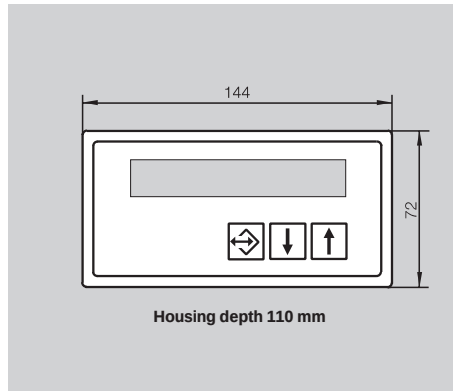
- ¹ = Power Supply
1 = High Range 85-265 Vac/90-370 Vdc
2 = Low Range 15-48 Vac/10-72 Vdc
- ² = Analog Output
0 = None
1 = Isolated 16-bit voltage output, 0-10 Vdc
4 = Isolated 16-bit current output, 0-20 or 4-20 mA
- ³ = Relay Outputs
00 = None
34 = Four 5A form A relays, isolated
- ⁴ = Options
00 = None
S2 = Isolated ASCII code RS232 serial interface

The BDD 652 is compatible with Micropulse® transducers with a START/STOP interface.



The BDD 652 supports the use of multiple magnets for monitoring multiple positions.

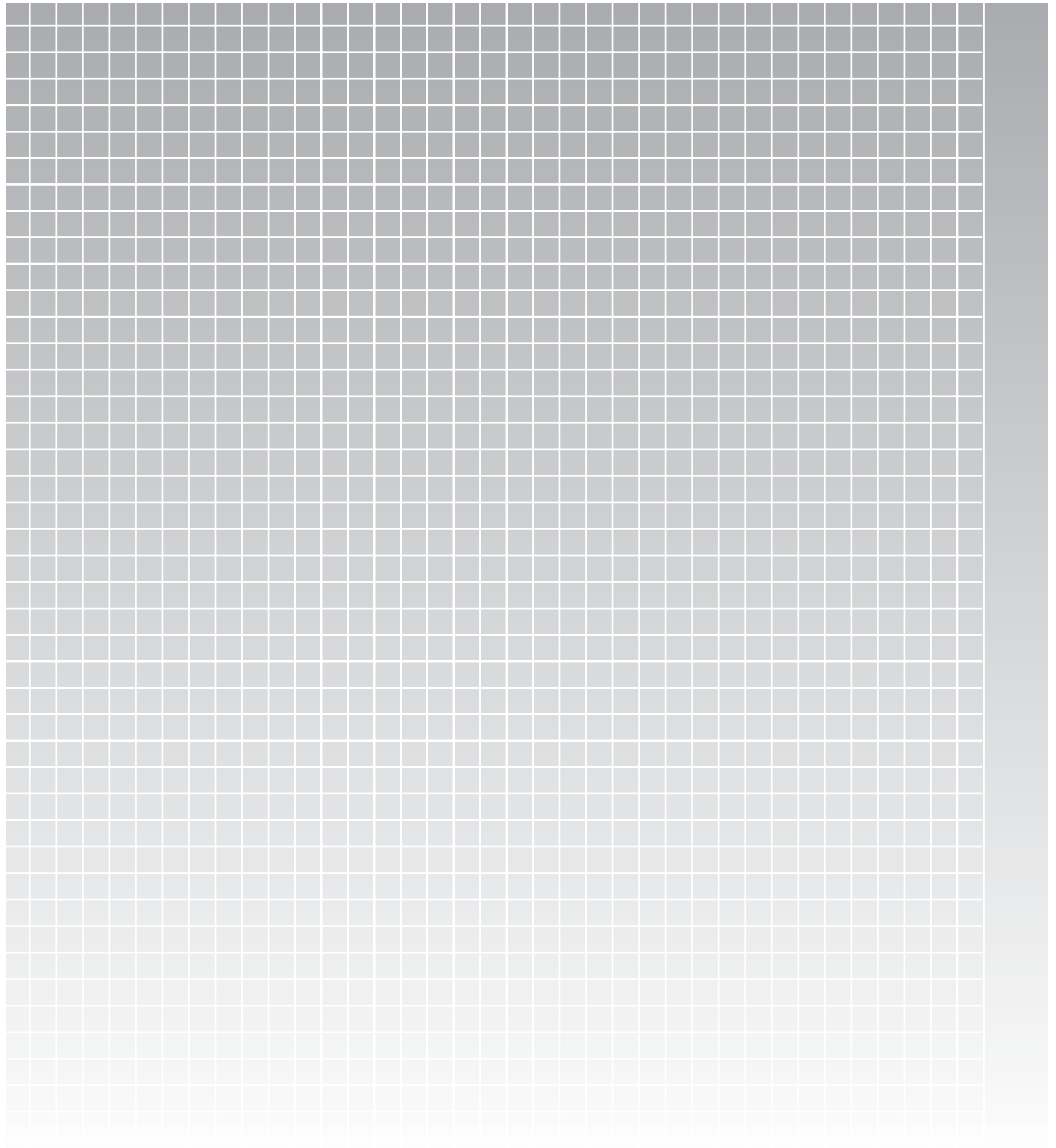
Name	BDD-AM 10-1-P	BDD-AM 10-1-SSD	BDD-CC 08-1-P	BDD-CC 08-1-SSD
Series	Digital display for Micropulse transducers with ST/SP (P) interface	Digital display for Micropulse transducers with SSI interface	Cam controller for Micropulse transducers with ST/SP (P) interface	Cam controller for Micropulse transducers with SSI interface



Ordering Code	BDD-AM 10-1-P	BDD-AM 10-1-SSD	BDD-CC 08-1-P	BDD-CC 08 1-SSD
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Features	– 7 1/2-digit display with sign – LED display 14 mm high red 7-segment – 0.002" resolution (BDD-AM 10-1-P) – 0.0002" resolution (BDD-AM10-1-SSD) – scalable units – variable decimal point setting – adjustable null point – operating voltage 10...32 V – 2 programmable relay outputs, defined as – limit switch/comparator – dwell – 2-position (on if below, off if above set value) – 2 configurable inputs – external null set – latch display value – isolated DIN housing for panel mount (mounting hardware included) – 24 Vdc input power		– 8 programmable outputs – 8 directional switchpoints possible – LED display, 14 mm high red 7-segment, 6-position – 0.002" resolution (BDD-CC08-1-P) – 0.0002" resolution (BDD-AM10-1-SSD) – LED switchpoint status on front panel – 300 switchpoints can be distributed over up to 15 programs – adjustable nullpoint shift – static and dynamic setpoints with deadtime compensation – multiple BDD-CC 08 can be wired in parallel – built-in transducer supply voltage 300 mA, 24 V – isolated DIN housing for panel mount (mounting hardware included) – 18...32 Vdc input power	
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Terminology and Testing

Resolution

The smallest increment of position change that can be detected by the transducer. The resolution of Micropulse transducers depends on the output type chosen.

Digital Pulse Output (all housings)

For digital pulse-output systems (i.e. Start/Stop or PWM) resolution is determined by the clock frequency of the customer interface which measures the time interval between the Start pulse and the Stop pulse (or the rising and falling edges of the PWM signal). Resolution can be determined as follows:

$$\text{Resolution (in inches)} = 1 \div (\text{Gradient} \times \text{Clock Frequency})$$

The gradient value is printed on the label of each transducer and is expressed in microseconds per inch (µsec/inch).

The Clock Frequency is the frequency of the counter in the customer supplied interface and is usually expressed in megahertz (MHz).

Example - assuming a gradient value of 9.000 µs/inch and a clock frequency of 56 MHz

$$\begin{aligned} \text{Resolution (in inches)} &= 1 \div (9 \times 56) \\ &= 1 \div 504 \\ &= 0.00198" \end{aligned}$$

Digital Serial Systems (SSI, Canbus, etc.)

Resolution is a defined value, stated in inches.

Digitally-Derived Analog (Z housing, rod-style only)

Output resolution is expressed as 16-bits. The digital position information is converted into an analog signal internally through a digital-to-analog converter.

True Analog (all other housing styles)

The analog output is derived without using a digital-to-analog converter. Resolution for this type of system is virtually infinite. Attainable resolution is determined primarily by electrical noise inherent to the application, and input resolution of the control system.

Temperature Coefficient

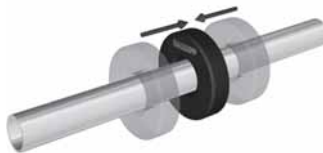
Expressed as ppm/°C or °F, TC is the degree to which the output signal (and therefore the indicated position) is affected by ambient temperature changes.

Non-Linearity

The degree to which the output value from the Micropulse transducer system is not perfectly proportional to travel distance. Standard transducers show a non-linearity of max. ±0.02% full scale. Example: a 24-inch stroke BTL5 with analog output may output a position value which is 0.0048" greater or less than the true, absolute position. This value is repeatable, however, to within 0.0002" (see "resolution" and "repeatability"). For higher accuracy requirements, Micropulse transducers with Synchronous Serial Interface (SSI) can be used.

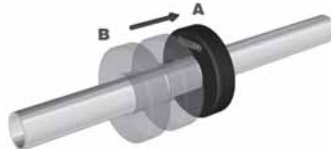
Hysteresis

The difference in indicated position when the same point is reached from two different directions. Repeatability refers to travel from one direction only, hysteresis from two directions.



Repeatability

The degree to which the indicated position point B as represented by the output value is reproduced when moving in one direction from point A and back to point B. In the case of a BTL5 system, position repeat accuracy is always the same as the stated resolution + hysteresis.



Dead Zone

The end of the Micropulse transducer rod, from end of stroke to the end of the rod. This is usually the last 2.3 inches of the rod. If the magnet enters the dead zone the output will be unpredictable.

Null Space

The distance from the head of the transducer to the start of the electrical stroke.

Null Position

The position of the magnet on the transducer rod which reads a zero or minimum output.

Stroke

The active electrical portion or the sensing portion of the Micropulse transducer.

Analog

The output of the transducer is an analog voltage (0 to 10 Vdc, -10 to +10 Vdc, or -5 to 5 Vdc) or an analog current (0 to 20 mA, 4-20 mA) and is proportional to the position of the magnet.

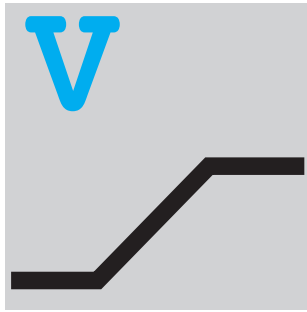
Digital Pulse Output

The output of the transducer is a digital Start/Stop pulse or a Pulse Width Modulated (PWM) signal. Magnet position is directly proportional to the time interval between the Start pulse and the Stop pulse (or the rising and falling edges of the PWM signal). An external counter is required to measure this time interval.

A wide variety of processor cards, PLC plug-in cards, and stand-alone controllers designed around this interface are available.

Digital Serial Output

The output of the transducer is in the form of a serial data word or string in SSI (binary or Gray code) or CANbus format.



Analog voltage output

The output voltage is directly proportional to the position of the magnet along the waveguide.

The most important parameter for analog outputs is the refresh rate and the ripple of the output signal. Many transducers on the market attain the specified values for output ripple only by means of low-pass filtering. This always carries with it an undesirable time delay of the output signal.

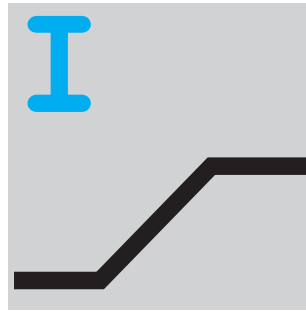
Micropulse transducers attain the specified signal quality without extensive low-pass filters, instead using improved circuit design. This means fast update times with low levels of ripple and noise on the output signal. Micropulse transducers with voltage output have 2 outputs, one increasing and one decreasing.

Available versions include:

0...10 V (10...0 V)

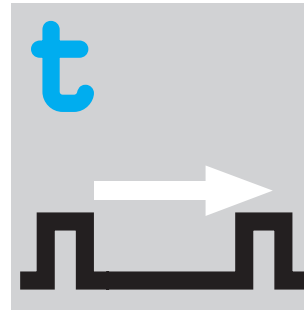
-10...10 V (10...-10 V) and

-5...5 V (5 V...-5 V)



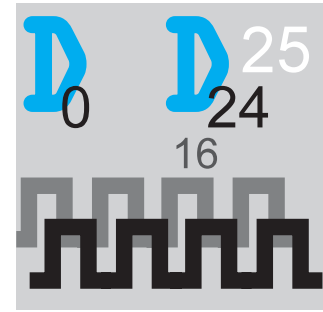
Analog current output

The output signal is directly proportional to the magnet position along the waveguide. Analog current interfaces of 0...20 mA and 4...20 mA are standard in numerous applications and in many industries. Current interfaces are significantly less sensitive to induced noise than are analog voltage interfaces. A 500 Ohm resistor can be used to easily convert the 0...20 mA signal into a voltage of 0...10 V. The 4...20 mA signal provides a simple form of cable break monitoring, since even at the nullpoint of the stroke a current of 4 mA must flow. Micropulse transducers with current output are available with increasing or decreasing signals.



Pulse interface

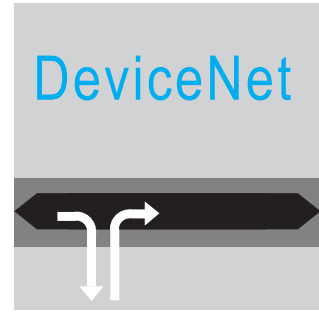
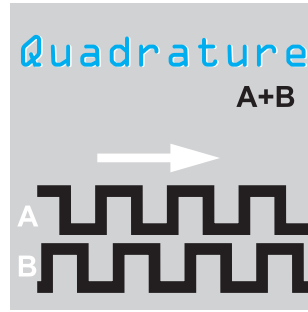
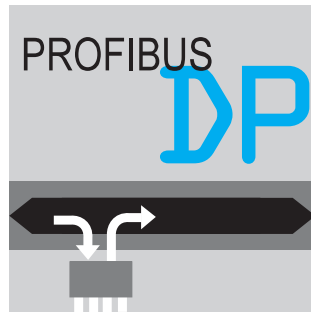
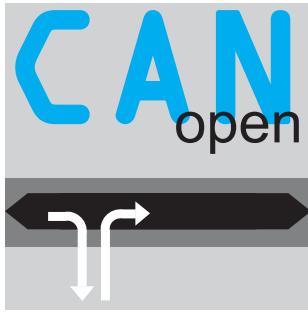
The time between an interrogation and the reply signal is directly proportional to the position of the magnet along the waveguide. These pulses are transmitted using RS485/422 differential line drivers, guaranteeing noise-free signal transmission over distances of up to 500 m (1640 ft.). The great advantage of these interfaces is the noise-immune signal transmission with a simple and economical interface. Interfaces with tristate outputs allow multiplexing of several Micropulse transducers. Appropriate control cards are available.



SSI synchronous serial interface

The position of the magnet along the waveguide is sent to the control serially in the form of a data word.

Micropulse transducers with SSI interface can be connected directly to controls or closed-loop control cards with SSI interfaces designed for absolute encoders. The data transmission from the sensor to the control is synchronized by means of a clock pulse from the control. Depending on the required resolution, transducers with 24 or 25-bit data words are available. The maximum non-linearity of the SSI Micropulse transducer of $\pm 30 \mu\text{m}$ over the entire stroke, the update frequency of 2 kHz and a resolution of $5 \mu\text{m}$ make the SSI Micropulse transducers an ideal feedback sensor, even in the most demanding applications.



CANopen

The position of the magnet along the waveguide is sent over the CAN-Bus to the control in so-called Process Data Objects, PDOs. Micropulse transducers work with standard *CANopen* protocols per CiA DS 301 and with the standard device profile per DS 406. *CANopen* offers greater flexibility because of the large number of configuration options for the transducer. For example, the resolution is programmable for 5, 10, 20 or 100 μm , depending on your application. Or you can select whether only position or also velocity information shall be sent to your control; cyclically, or on-demand. And there's more: Up to 4 so-called software cams can be defined in the active stroke range. Each time the status of one of these cams changes, high-priority Emergency messages are sent to the control (check factory for availability).

- Consult factory for technical data

PROFIBUS

This interface provides an efficient connection to machines using Profibus. Features of this interface include:

- Single telegram message for fast updates even with 4 magnets
- Operates at 12 Mbps
- GSD file provided to configure telegram message
- Sync and Freeze functions available for coordination between other devices

Quadrature

The quadrature output interfaces directly to standard encoder inputs (90° out of phase, A & B). This configuration gives you more interface options for connecting to motion based systems. Operating modes can be either free-running or synchronous (switch selectable) depending on the control system's requirements.

DeviceNet™

DeviceNet is a manufacturer-independent, open standard fieldbus used to interconnect control devices and sensors for data exchange. It uses **Controller Area Network (CAN)** as the backbone technology.

The Micropulse® linear position transducer with DeviceNet interface is compatible with the CIP Common Specification Object Library "Position Sensor Object".

Micropulse DeviceNet transducers feature:

- Selectable position resolution to 5 μm
- Selectable velocity resolution to 0.1 mm/s
- MAC-ID and baud rate can be preset using DIP switches, and can also be changed via software
- On-board status LED shows network/device status

HALT – High Accelerated Lifetime Test – Highest function security over years

The result is linear displacement systems and sensors of the highest quality and reliability which will continue to perform with the same safety and precision for years to come. Their use increases equipment up time, prevents service and repair costs and achieves significantly greater efficiency.

Rapid temperature cycles from $-100\text{ }^{\circ}\text{C}$ to $+200\text{ }^{\circ}\text{C}$ and vibration loads between 10 and 50 g can simulate aging of a sensor. Using this procedure the products are tested for their specifications to determine the reliability, load capacity and life expectancy of the sensor.

The sample is intentionally destroyed so that we can immediately improve the first component to fail. In the HALT system both sensors and transducers can be tested.

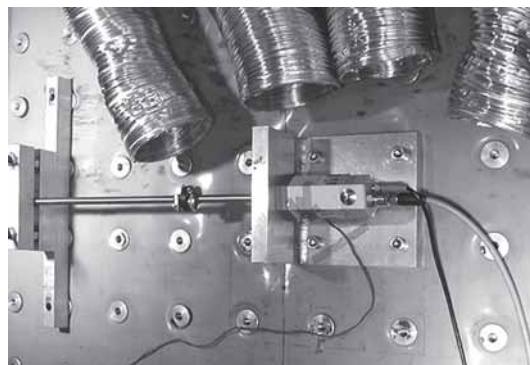
Technical Data

HALT System

Manufacturer	Thermotron Industries USA
Frequency Spectrum	2...10000 Hz
Acceleration	up to 50 g
Excitation	9 pneumatic cylinders, noise spectrum, 3-axis, 3 linear and 3 rotary degrees of freedom
Temperature Range	$-100\text{ }^{\circ}\text{C}$... $+200\text{ }^{\circ}\text{C}$
Temperature Gradient	70 K/min
Electrical Power	96 kW
Procedure	Electric heater, liquid nitrogen for cooling



Nitrogen tank for the cooling system



"Stress on the sample"

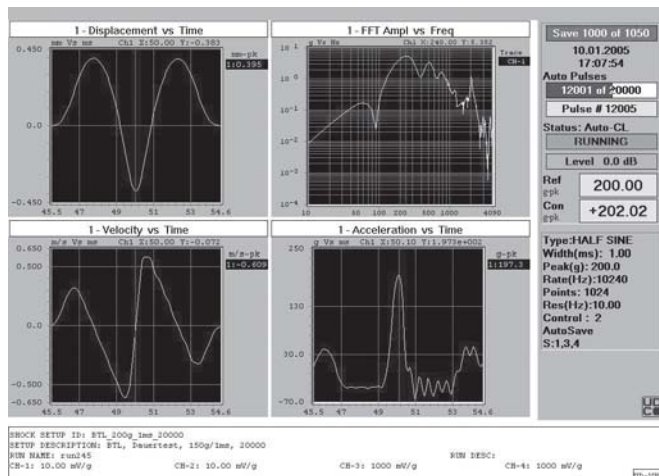


Multifunctional climate chamber

Reliability doesn't happen by chance

Tests and checks during the development process improve the product and give protection against “surprises” in service.

Objective: Simulate the mechanical loads on a product over its working life. Balluff products are often fitted in machines when mechanical vibrations and impacts occur. For reliable operation they must be designed to be immune to vibration and shock. In the Balluff test laboratory all products are therefore tested before series release for their mechanical stability.



The features of the vibration test equipment at Balluff are as follows:

Manufactured by	Unholtz-Dickie Corporation	
Model	SA 15-S092-BP	SAI60-H560B-24-LP
sinusoidal force vector	4.4 kN	35.6 kN
random force vector	4.4 kN	35.6 kN
shock force vector	8.8 kN	73 kN
max. sinusoidal acceleration	100 g	89 g
max. random acceleration	100 g	74 g
max. shock acceleration	200 g	210 g
max. sinusoidal velocity	2.0 m/s	1.9 m/s
max. shock velocity	5.1 m/s	3.5 m/s
max. amplitude	51 mmp-p	51 mmp-p
Frequency range up to	3.5 kHz	up to 2.7 kHz



The following tests can be performed on this equipment:

- Sinusoidal testing
- Noise testing
- Shocks

In addition one equipment if fitted with an FFT analyzer.

Tests can be performed to the following standards:

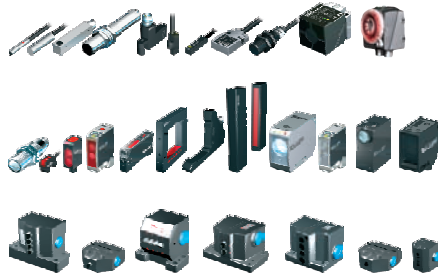
- MIL STD 202
- EN 60068-2-6
- EN 60068-2-27
- EN 60068-2-29
- EN 60068-2-64
- DIN EN 50155
- IEC / EN 61373
- GL 2001

Test equipment in the test laboratory

	Tests	Test equipment
1. Electro-magnetic compatibility (EMC)	Immunity from discharge of static electricity (EN 61000-4-2)	ESD generator ESD 30C, EM test with IEC finger and relay discharge module
	Immunity from electro-magnetic fields (EN 61000-4-3)	GTEM cell 1500, MEB Signal generator SML, Rohde & Schwarz HF amplifier model 100W1000M1, AR HF amplifier model CBA9429, SCHAFFNER HF circuit network RFSN, SCHAFFNER Wattmeter NRVS, Rohde & Schwarz Wattmeter head NRV-Z 51, Rohde & Schwarz Directional coupler RK 100, MEB Directional coupler C6187, VERLATONE Field strength measurement system HI-6005, Holaday Software MEB IMM, SCHAFFNER
	Immunity from rapid transient interference (bursts) (EN 61000-4-4)	Burst generator EFT 503, EM-Test Capacitive coupler HFK, EM-Test
	Immunity from abrupt voltage surges (EN 61000-4-5)	Hybrid generator CE-SURGE, Hilo-Test Coupling / decoupling network CDN 104 Coupling / decoupling network CDN 202
	Immunity from mains-borne high-frequency interference (EN 61000-4-6)	Signal generator SMH, Rohde & Schwarz HF amplifier model 150A100A, AR Coupling / decoupling network M2, MS3, S4, S9, AF2, AF4, RJ45/5 EM injection clamp F-203I-23mm, FCC Software MEB IMM, Schaffner MEB
	Immunity from magnetic fields with power transmission frequencies (EN 61000-4-8)	Self-built test equipment, Balluff GmbH
	Immunity from voltage dips, short breaks in power supply and voltage fluctuations (EN 61000-4-11)	Self-built test equipment, Balluff GmbH
	Radiated emissions (EN 55011)	GTEM cell 1500, MEB Measurement logger SM41, MEB Software, MEB
	Mains-borne emissions (EN 55011)	Measurement logger ESHS 30, Rohde & Schwarz Network simulator ESH3-Z5, Rohde & Schwarz Shield Cubicle
	Emissions, HF magnetic field (DIN EN 300 330-1)	Frame antenna HLA6120, SCHAFFNER Measurement logger ESHS 30, Rohde & Schwarz Shield Cubicle
2. Product-specific tests	Making capacity / breaking capacity (EN 60947-5-2)	Self-built test equipment, Balluff GmbH
	Testing cable anchoring of devices with integral connection cables (EN 60947-5-2)	Self-built test equipment, Balluff GmbH
	Short circuit testing (EN 60947-5-2)	Self-built test equipment, Balluff GmbH
3. Shock, sinusoidal and noise tests	Shock, sinusoidal and noise testing (EN 60068-2-6) (EN 60068-2-27; EN 60068-2-29) (EN 60068-2-64)	Shock and vibration equipment, model SA15-S092-PB and model SAIGO H560B-24LP, Unholtz-Dickie with software modules for: Sinusoidal vibrations Shocks Noise tests Signal analysis
4. Other	X-ray analysis	X-ray inspection equipment RTX 113, HEEB-INOTEC

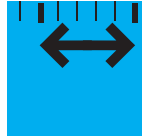


Object Detection



Inductive Proximity Sensors
Photoelectric Sensors
Machine Vision - Sharpshooter®
Capacitive Sensors
Magnetic Field Sensors
Mechanical Sensors
Sensors for Cylinders

Linear Position and Measurement



Linear Position Transducers
Inductive Distance Sensors
Photoelectric Distance Sensors
Magneto-Inductive Linear Position Sensors
Magnetic Linear Encoder System

Industrial Identification



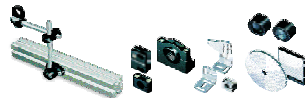
Industrial RFID
Machine Vision - Sharpshooter®

Networking and Connectivity



Remote Systems
Passive Connectivity
DeviceNet Connectivity

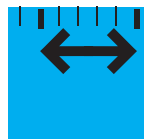
Accessories



Accessories for Inductive Proximity Sensors
Accessories for Photoelectric Sensors
Accessories for Capacitive Sensors
Accessories for Magneto-Inductive Sensors
Accessories for Linear Position Transducers
Accessories for Mechanical Sensors



Object Detection



Linear Position and Measurement



Industrial Identification



Networking and Connectivity



Accessories



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