BTL **K**

BTL **H**

General data,
Installation
instructions
series K

General data,
Installation
instructions
series H

Analog
interface

Digital pulse
interface

SSI interface

**Pressure rated to 600 bar, high repeatability, non-contact, rugged**

The BTL Micropulse transducer is the rugged position feedback system for use under extreme ambient conditions measuring between 25 and 5500 mm.

The actual waveguide is protected inside a high-pressure resistant stainless steel tube. The system is ideal for use in hydraulic cylinders for position feedback or as a level monitor with aggressive media in the food and chemical industries.

– stainless
– extremely short 34 mm
– IP 68 with cable
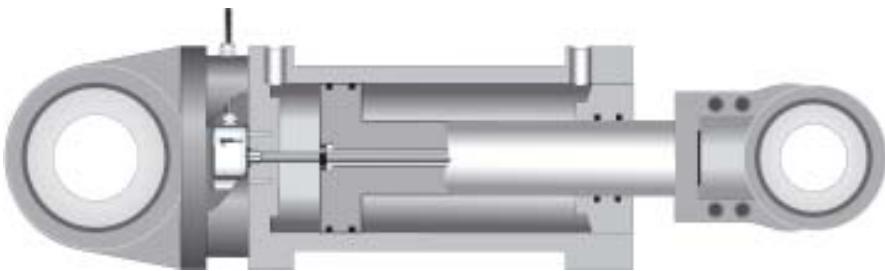
Compact Micropulse transducer installed in clevis mount cylinder

Installation BTL5 Compact rod K

non-magnetizable material

①-② for magnetizable material
④ for non-magnetizable material
a Spacer made of non-magnetizable material
b Magnet
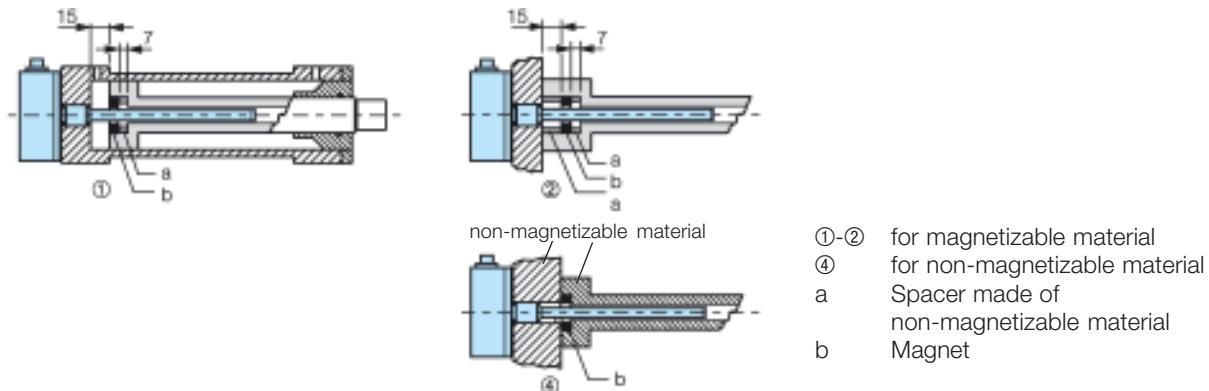
The Micropulse transducer has 6 mounting holes for cylinder head screws (ISO 4762 M6×18 A2-70). We recommend installing in non-magnetizable materials. If using magnetizable material, installation must be done as shown above. Sealing is at the flange mounting surface using a 15.4×2.1 mm O-ring included.

Ø 19.8 +0.1
R 0.1 +0.1
3.2
3.2
45°±5°
Ø 18 F7
15°±1°
2.4 +0.4

O-ring groove 15.4 × 2.1
25
thru-hole
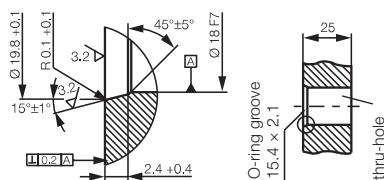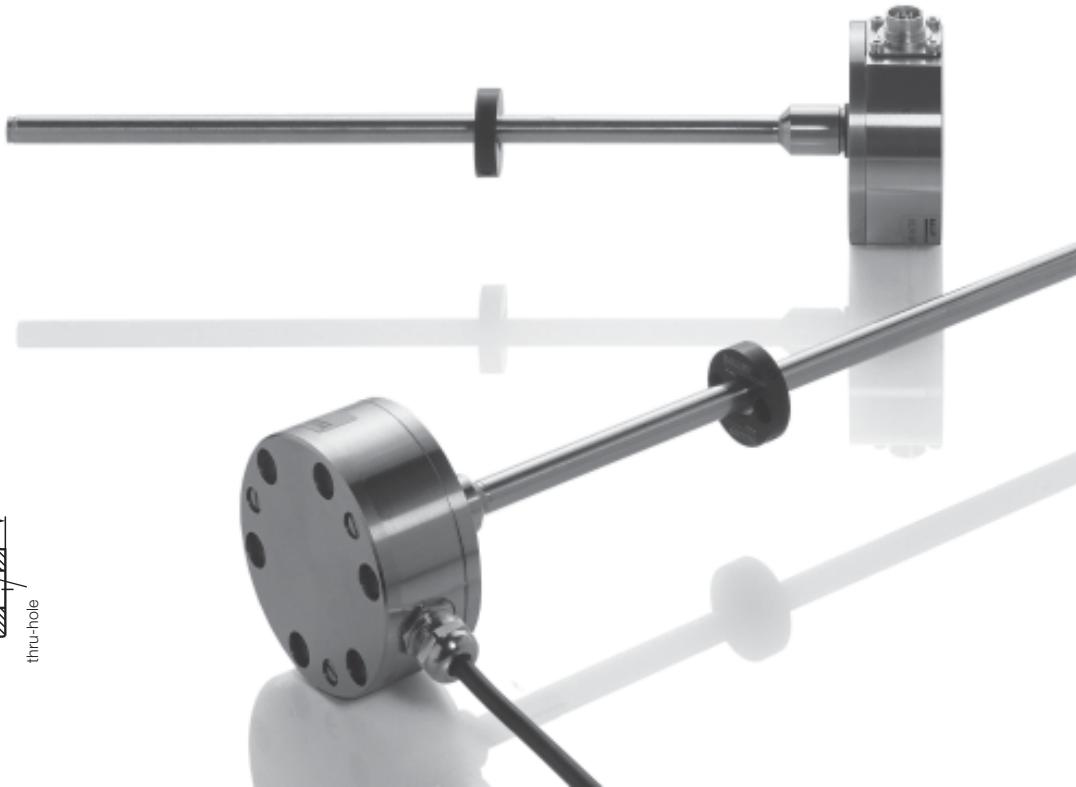
Series	**BTL5 Compact Rod K**

Housing K, BTL5-...-M_ _ _ _-K-SR32

**Flange Ø 18 mm
PCD Ø 64 mm
Plug connection
radial**

Nominal stroke = measuring area

Damping zone (non-usable area)

Magnet

M4×4/6 threaded blind hole, security disk Ø 9 DIN 6799

Mounting surface

BKS-S 33M

PL0022a
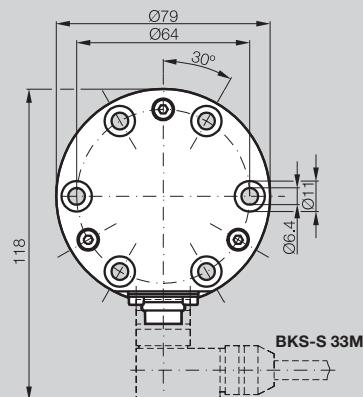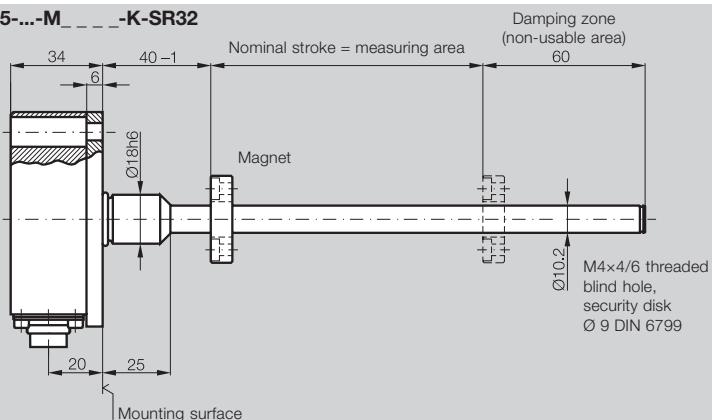
Housing K, BTL5-...-M_ _ _ _-K-K_ _

**Flange Ø 18 mm
PCD Ø 64 mm
Radial cable**

Nominal stroke = measuring area

Damping zone (non-usable area)

Magnet

M4×4/6 threaded blind hole, security disk Ø 9 DIN 6799

Mounting surface

PL0023a

Ordering code	BTL5-...-M_ _ _ _-K-_ _ _ _
Shock load	100 g/6 ms per IEC 60068-2-27 and 100 g/2 ms per IEC 60068-2-29
Vibration	12 g, 10...2000 Hz per IEC 60068-2-6
Polarity reversal protected	yes
Overvoltage protection	Transzorb protection diodes
Dielectric constant	500 V DC
Enclosure rating per IEC 60529	IP 67 (when screwed BKS-S connector is fitted); IP 68, 5 bar for cable version
Housing material	Stainless steel 1.4305
Flange and tube material	Tube stainless 1.4571, flange 1.4571 or 1.4429 or 1.4404
Housing attachment	flange with 6 mounting holes
Connection type	connector or integral cable
Recommended connector see p. **BKS.**3	BKS-S 32M/BKS-S 32M-C/BKS-S 33M
EMC testing:	
RF emission	EN 55011 Group 1, Class A
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 4
Line-borne noise, induced by high-frequency fields	IEC 61000-4-6 Severity Level 3
Standard nominal strokes [mm]	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500, 4750, 5000, 5250, 5500 or in 5 mm steps on request.

▶ Included:
– Transducer
(select your interface from page **K.H.**6)
– Short user's guide

Please order separately:
Magnets page **B.**16
Floats page **B.**17
Connectors starting page **BKS.**3

Pressure rated to 600 bar, high repeatability, non-contact, rugged

The BTL Micropulse transducer is the rugged position feedback system for use under extreme ambient conditions measuring between 25 and 5500 mm.

The actual waveguide is protected inside a high-pressure resistant stainless steel tube. The system is ideal for use in hydraulic cylinders for position feedback or as a level monitor with aggressive media in the food and chemical industries.

– stainless
– IP 68 with cable

O-ring groove, view A

Insertion hole M18×1.5 to ISO 6149, O-Ring 15.4×2.1

O-ring groove, view B
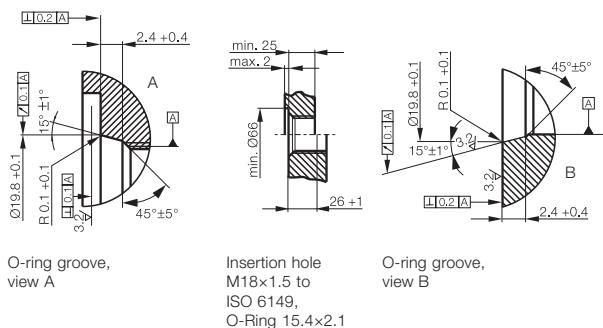
Installation
BTL 5 Compact rod H

The Micropulse transducer BTL has a mounting thread M18×1.5. We recommend that the mounting is of non-magnetizable material.

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 15.4×2.1 with the M18×1.5 thread.
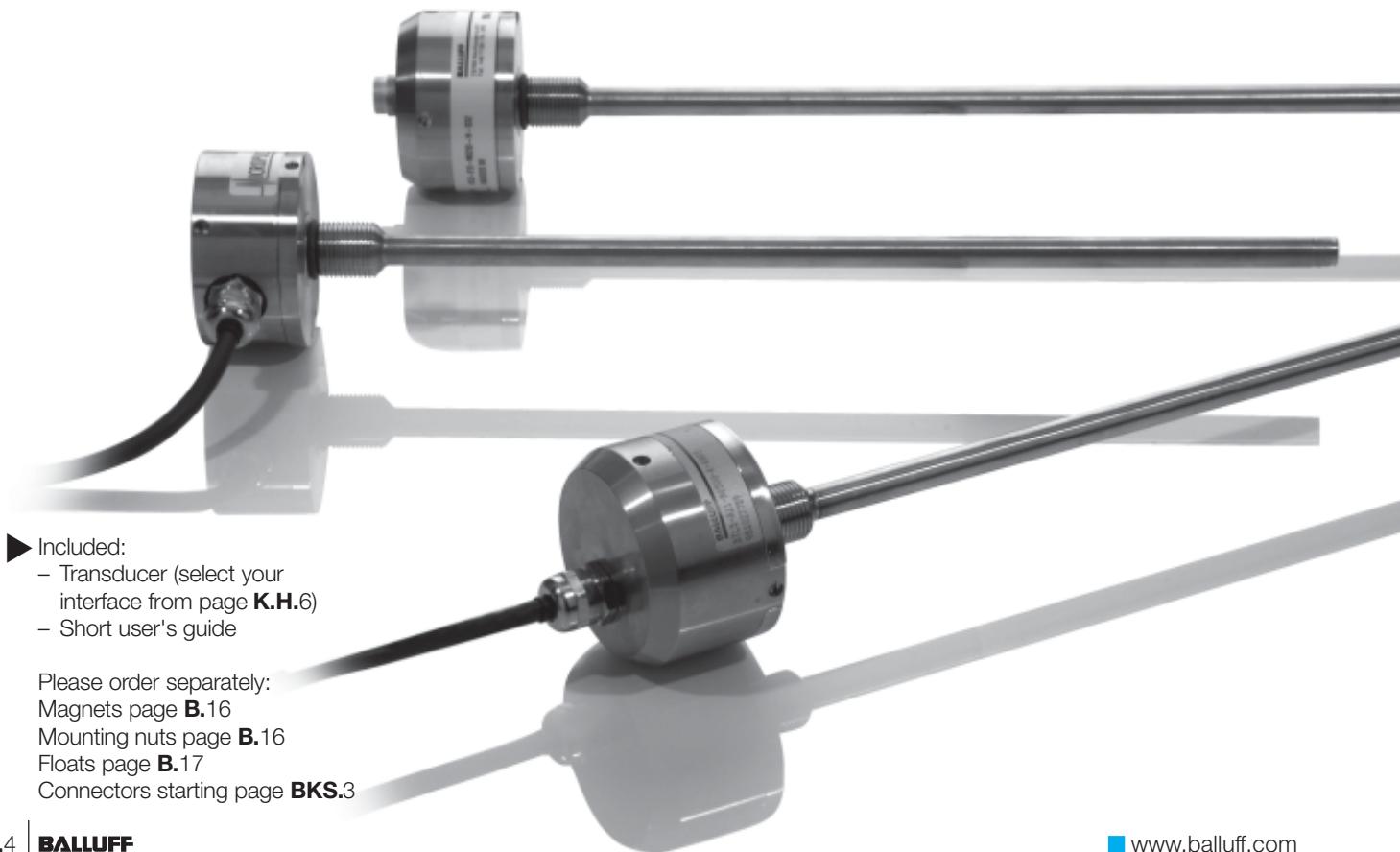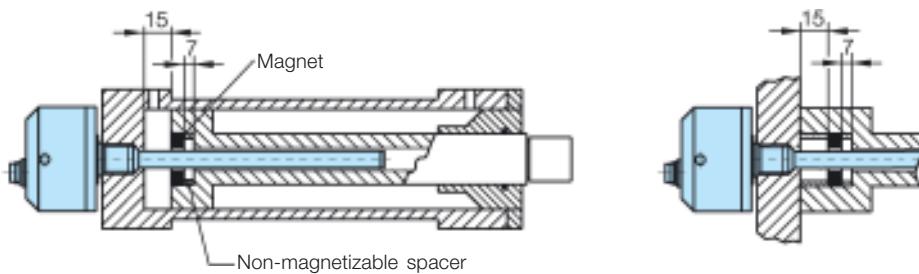
Magnet

Non-magnetizable spacer

▶ Included:
– Transducer (select your interface from page **K.H.**6)
– Short user's guide

Please order separately:
Magnets page **B.**16
Mounting nuts page **B.**16
Floats page **B.**17
Connectors starting page **BKS.**3

Series	**BTL5 Compact Rod H**

Housing H, BTL5-...-M_ _ _ _-H-K_ _

Mounting thread M18×1.5 Radial cable connection
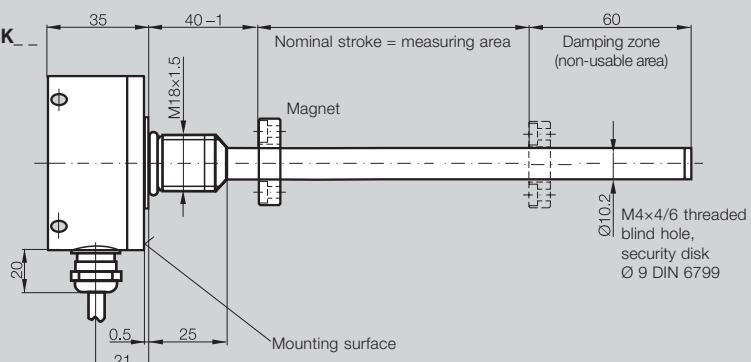
Housing H, BTL5-...-M_ _ _ _-H-KA _ _

Mounting thread M18×1.5 cable Axial
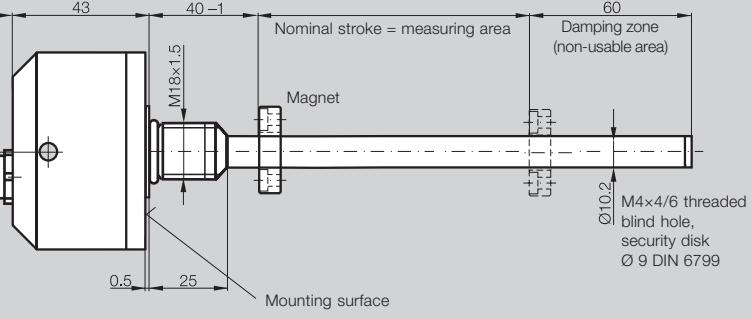
Housing H, BTL5-...-M_ _ _ _-H-S 32

Mounting thread M18×1.5 Plug connector Axial
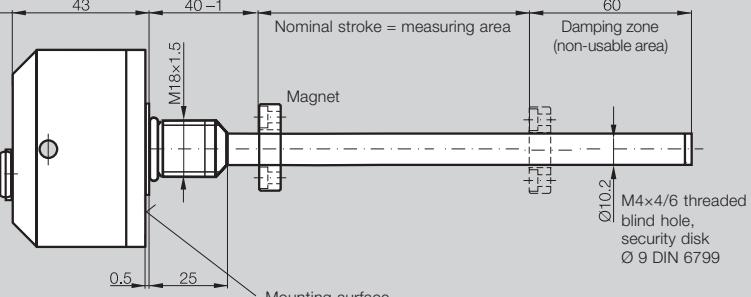
| Ordering code	**BTL5-...-M_ _ _ _ -H-_ _ _ _**
Shock load	100 g/6 ms per IEC 60068-2-27 and 100 g/2 ms per IEC 60068-2-29
Vibration	12 g, 10...2000 Hz per IEC 60068-2-6
Polarity reversal protected	yes
Overvoltage protection	Transzorb protection diodes
Dielectric constant	500 V (GND to housing)
Enclosure rating per IEC 60529	IP 67 (when BKS-S32/33 is installed); IP 68, 5 bar for cable version
Housing material	Stainless steel 1.4305
Flange and tube material	Tube stainless 1.4571, flange 1.4571 or 1.4429 or 1.4404
Housing attachment	flange with 6 mounting holes
Connection type	connector or integral cable
Recommended connector see p. **BKS.**3	BKS-S 32M/BKS-S 32M-C/BKS-S 33M
EMC testing:	
RF emission	EN 55011 Group 1, Class A
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 4
Line-borne noise, induced by high-frequency fields	IEC 61000-4-6 Severity Level 3
Standard nominal strokes [mm]	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500, 4750, 5000, 5250, 5500 or in 5 mm steps on request.

short and analog

Series	
Output signal	
Transducer interface	
Input interface	

CE

An integrator circuit provides resolution of better than 0.1 mV.

BTL transducers with analog outputs are available for 0...10 V, 4...20 mA, 0...20 mA and –10...10 V as rising or falling signals.

Outputs

U_A rising and U_A falling are both present

I_A rising or falling
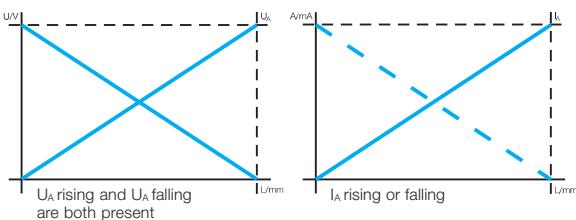
Compensating the output signal

BTL transducers with analog output have two potentiometers for adjusting the null and endpoint to the particular application.

The nullpoint can be shifted by max. 15 % of the nominal stroke in the direction of the rod end.

40 mm   60 mm

$\leq 15\,\% \,(L_{max})$

BTL factory setting

U_A 10V P_{END}

P_0

0V L_{max}

Null point
Factory set

End point
Factory set

BTL with compensated null and end point

$\leq 15\,\% \,(L_{max})$

U_A 10V P_{END}

8,5V

P_0

0V L_{max}

Null point
Factory set

desired 0-point

Pot "0"

Pot "E"

slot max. 1.5mm
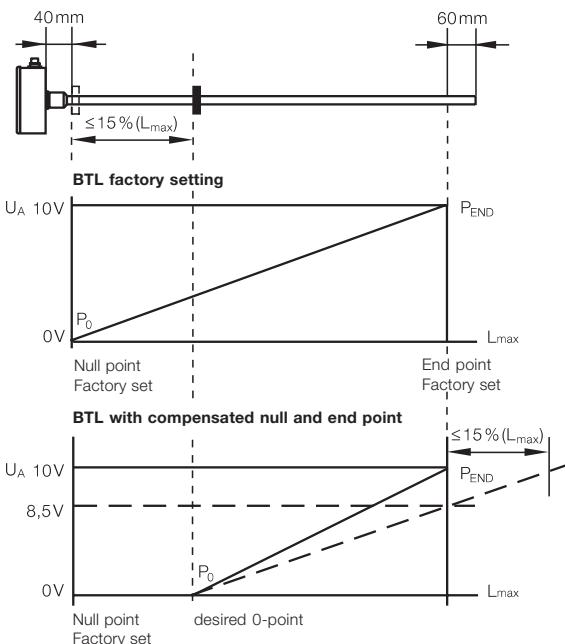
Location of trim pots with cover removed

Ordering code

Output voltage		
Output current		
Load current		
max. ripple		
Load resistance		
System resolution		
Hysteresis		
Repeatability		
Sampling rate		
max. non-linearity		
Temperature coefficient	Voltage output	
	Current output	
Supply voltage		
Current draw		
Polarity reversal protected		
Overvoltage protection		
Dielectric constant		
Operating temperature		
Storage temperature		

Pin assignments	Pin	Color
Output signals	1	YE
	2	GY
	3	PK
	5	GN
Supply voltage	6	BU
	7	BN
	8	WH

Connect shield to housing

▶ Please enter code for output signal, nominal stroke and connection type in ordering code!

▶ Included:
 – Transducer
 – Short user's guide

Please order separately:
Magnets page **B.**16
Mounting nuts page **B.**16
(for Compact rod H)
Floats page **B.**17 and **Ex.**6
Connectors starting page **BKS.**3

BTL5 Compact Rod	BTL5 Compact Rod	BTL5 Compact Rod	BTL5 Compact Rod
analog	analog	analog	analog
A	**E**	**C**	**G**
analog	analog	analog	analog
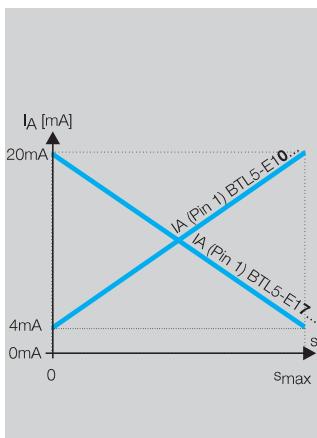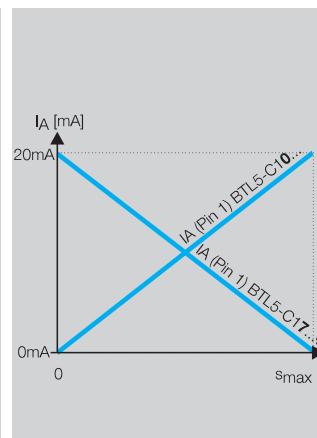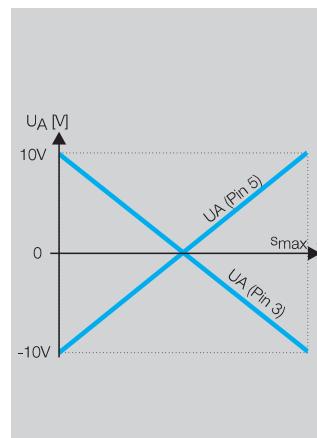
BTL5-**A**11-M_ _ _ _-_-_ _ _ _	BTL5-**E**1_-M_ _ _ _-_-_ _ _ _	BTL5-**C**1_-M_ _ _ _-_-_ _ _ _	BTL5-**G**11-M_ _ _ _-_-_ _ _ _
0...10 V and 10...0 V			**–10...10 V and 10...–10 V**
	4...20 mA or 20...4 mA	**0...20 mA or 20...0 mA**	
max. 5 mA			max. 5 mA
≤ 5 mV			≤ 5 mV
	≤ 500 Ohm	≤ 500 Ohm	
≤ 0.1 mV	≤ 0.2 µA	≤ 0.2 µA	≤ 0.1 mV
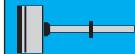
≤ 4 µm
System resolution/min. 2 µm
$f_{STANDARD}$ = 1 kHz
±100 µm up to 500 mm nominal stroke
±0.02 % 500...4500 mm nominal stroke
[150 µV/°C + (5 ppm/°C × P × U/L)] × ΔT
[0.6 µA/°C + (10 ppm/°C × P × I/L)] × ΔT
20...28 V DC
≤ 150 mA
yes
Transzorb protection diodes
500 V DC (ground to housing)
–40...+85 °C
–40...+100 °C

BTL5-**A**11...	BTL5-**E**10...	BTL5-**E**17...	BTL5-**C**10...	BTL5-**C**17...	BTL5-**G**11...
	4...20 mA	20...4 mA	0...20 mA	20...0 mA	
0 V Output	0 V Output		0 V Output		0 V Output
10...0 V	10...0 V		10...0 V		10...–10 V
0...10 V	0...10 V		0...10 V		–10 ... 10V
GND	GND		GND		GND
+24 V DC	+24 V DC		+24 V DC		+24 V DC

Ordering example:
BTL5-E1_-M_ _ _ _-_-_ _ _

Output signal		Standard nominal strokes [mm]	Series	Connection type			
1	rising and falling (for A and G)	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500 or in 5 mm steps on request.	K	Radial connection			
0	rising			K02	PUR cable	2 m	
7	falling (for C and E)			K05	PUR cable	5 m	
				K10	PUR cable	10 m	
				K15	PUR cable	15 m	
				SR32	connector		
			H	Radial connection			Axial connection
				K02	PUR cable 2 m		KA02 PUR cable 2 m
				K05	PUR cable 5 m		KA05 PUR cable 5 m
				K10	PUR cable 10 m		KA10 PUR cable 10 m
				K15	PUR cable 15 m		KA15 PUR cable 15 m
							S32 connector

■ www.balluff.com

BTL **K**

BTL **H**

General data, Installation instructions series K

General data, Installation instructions series H

Analog interface

Digital pulse interface

SSI interface

BKS

Page **BKS.**3

K.H.7

P Interface

Compatible with BTA processors and various OEM controls, e.g. Siemens, B & R, Phoenix Contact, Mitsubishi, Sigmatek, Parker, Esitron, WAGO etc.. Reliable signal transmission, even over cable lengths up to 500 m between BTA and BTL, is assured by the especially noise-immune RS485 differential drivers and receivers. Noise signals are effectively suppressed.

M Interface

The I and M interfaces are control-specific interface variations.

short and economical
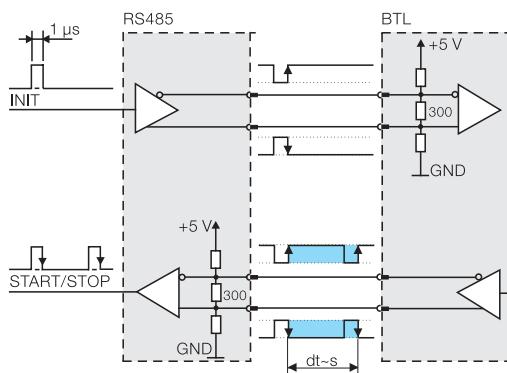
Block diagram of P-interface

Highly precise digitizing of the P-interface signal

Companies developing their own control and processing electronics can create a highly accurate P-interface cost effectively and with a minimum of effort using the Balluff digitizing chip. The digitizing chip was developed as a high-resolution, configurable ASIC for the Micropulse P-interface.

Digitizing chip 44QFP

Controller or
Processing electronics

Micropulse transducer
with 1 to 4 magnets

P pulse signal
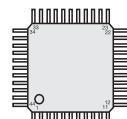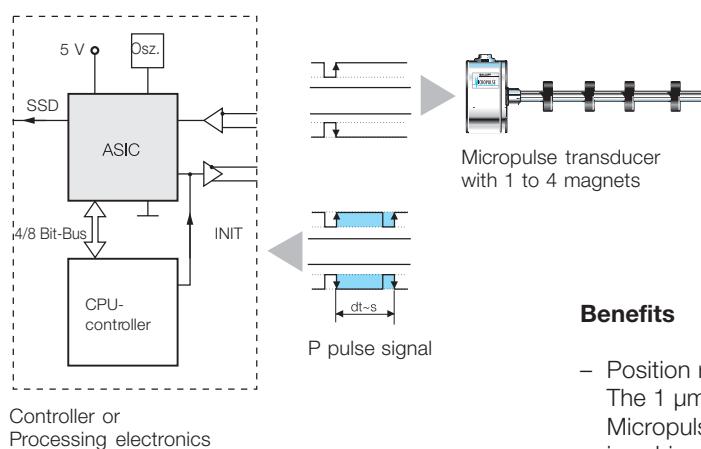
Benefits

– Position resolution 1 µm!
  The 1 µm resolution of the Micropulse positioning system is achieved by the high resolution of the digitizing chip (133 pS). (Clock frequency 2 or 20 MHz)
– Position data from 4 magnets can be processed simultaneously
– 4/8-bit processor interface

ASIC INFO:
+49 (0) 71 58/1 73-2 41

Compact Rod

Series	**BTL5 Compact Rod**
Transducer interface	Pulse **P**
Input interface	Pulse **P**

CE
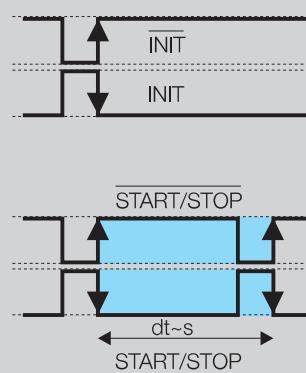
Ordering code	BTL5-**P**1-M_ _ _ _-_-_ _ _ _
System resolution	processing-dependent
Repeatability	2 µm or 1 digit depending on processing
Resolution	≤ 2 µm
Hysteresis	≤ 4 µm
Sampling rate	$f_{STANDARD}$ = 1 kHz = ≤ 1400 mm
max. non-linearity	±100 µm up to 500 mm nominal stroke
	±0.02 % 500...5500 mm nominal stroke
Temperature coefficient of overall system	(6 µm +5 ppm × L)/°C
Supply voltage	20...28 V DC
Current draw	≤ 100 mA
Operating temperature	–40...+85 °C
Storage temperature	–40...+100 °C

Pin assignments		Pin	Color	BTL5-**P**1-M...
Input/output signals	Input	1	YE	INIT
	Ouptut	2	GY	START/STOP
	Input	3	PK	$\overline{INIT}$
	Ouptut	5	GN	$\overline{START/STOP}$
Supply voltage		6	BU	GND
		7	BN	+24 V DC
		8	WH	

Connect shield to housing

▶ Please enter code for nominal stroke and connection type in ordering code!

▶ Included:
– Transducer
– Short user's guide

Please order separately:
Magnets page **B.**16
Mounting nuts page **B.**16
(für Compact rod H)
Floats page **B.**17 and **Ex.**6
Connectors starting page **BKS.**3

Ordering example:
BTL5-P1-M_ _ _ _-_-_ _ _ _

Standard nominal strokes [mm]	Series	**Connection type**
0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, 4000, 4250, 4500, 4750, 5000, 5250, 5500, or in 5 mm steps on request.	K H	Output radial K02 PUR cable 2 m K05 PUR cable 5 m K10 PUR cable 10 m K15 PUR cable 15 m SR32 connector Output radial K02 PUR cable 2 m K05 PUR cable 5 m K10 PUR cable 10 m K15 PUR cable 15 m Output axial KA02 PUR cable 2 m KA05 PUR cable 5 m KA10 PUR cable 10 m KA15 PUR cable 15 m S32 connector

BTL K

BTL H
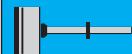
General data, Installation instructions series K

General data, Installation instructions series H

Analog interface

Digital pulse interface

SSI interface

BKS
Page **BKS.**3

BTA
Page **BTA.**2

Standard SSI interface

Synchronous serial data transmission for controls made by Siemens, Bosch-Rexroth, WAGO, B & R, Parker, Esitron, PEP etc. as well as for Balluff BDD-AM 10-1-SSD and BDD-CC 08-1-SSD display/controllers.

Reliable signal transmission, even over cable lengths of up to 400 m between control and BTL transducer is assured by especially noise-immune RS485/422 differential line drivers and receivers. Any noise signals are effectively suppressed.
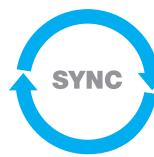
SYNC

**Synchronized
SSI interface**
BTL5-S1_ _**B**-M_ _ _ _-K/H-_ _ _ _*

Micropulse transducers with the synchronized SSI interface are suitable for dynamic control applications. The data acquisition in the transducer is synchronized to the external clock of the controller, permitting an optimum velocity calculation in the controller.
The pre-requirement for this synchronous mode of transducer operation is consistent clock signal timing.

The **maximum sampling frequency f_A**, at which a new current value is generated for each sample, can be derived from the following table:

BTL5-S1... with processor/controller, wiring example

mm	mm	Hz
nominal stroke ≤	120 :	2500
120 < nominal stroke ≤	475 :	2000
475 < nominal stroke ≤	750 :	1500
750 < nominal stroke ≤	1250 :	1000
1250 < nominal stroke ≤	2600 :	500
2600 < nominal stroke ≤	4000 :	333

*available from 2006

**Clock frequency is a
function of cable length**

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

Super-fast 2.5 kHz Sampling rate

▶ Please enter code for coding, system resolution, nominal stroke and connection type in ordering code!

▶ Included:
 – Transducer
 – Short user's guide

Please order separately:
Magnets page **B.**16
Mounting nuts page **B.**16
Floats page **B.**17
Connectors starting page **BKS.**3

Series	**BTL5 Rod**
Output signal	synchronous serial
Transducer interface	**S**
Input interface	synchronous serial

CE

Clock sequence
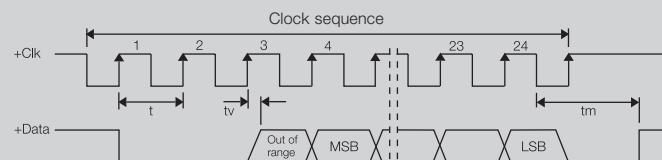
Ordering code	BTL5-**S**1_ _-M_ _ _ _-_-_ _ _ _
	BTL5-**S**1_ _B-M_ _ _ _-_-_ _ _ _

Repeatability	± 1 digit
System resolution depending on version (LSB)	1, 5, 10, 20 or 40 µm
Hysteresis	≤ 1 digit
Sampling rate	$f_{STANDARD}$ = 2 kHz
max. non-linearity	±30 µm at 1.5 and 10 µm resolution or ≤ ±2 LSB
Temperature coefficient of overall system	(6 µm +5 ppm × L) /°C
Supply voltage	20...28 V DC
Current draw	≤ 80 mA
Operating temperature	–40...+85 °C
Storage temperature	–40...+100 °C

Pin assignements	Pin	Color	
Control and	1	YE	+Clk
data signals	2	GY	+Data
	3	PK	–Clk
	5	GN	–Data
Supply	6	BU	GND
voltage (external)	7	BN	+24 V DC
	8	WH	must remain unconnected

Ordering example:

BTL5-S1_ _-M_ _ _ _-_-_ _ _ _

Coding		System resolution		Standard nominal strokes [mm]	Series	Connection type		
0	Binary code rising (24 bits)	1	1 µm	0025, 0050, 0075, 0100, 0125, 0150,	K	Output radial		
1	Gray code rising (24 bits)	2	5 µm	0175, 0200, 0225, 0250, 0275, 0300,		K02	PUR cable	2 m
6	Binary code rising (25 bits)	3	10 µm	0325, 0350, 0375, 0400, 0425, 0450,		K05	PUR cable	5 m
7	Gray code rising (25 bits)	4	20 µm	0475, 0500, 0550, 0600, 0650, 0700,		K10	PUR cable	10 m
		5	40 µm	0750, 0800, 0850, 0900, 0950, 1000,		K15	PUR cable	15 m
		6	100 µm	1100, 1200, 1300, 1400, 1500, 1600,		SR32	connector	
		7	2 µm	1700, 1800, 1900, 2000, 2250, 2500,				
				2750, 3000, 3250, 3500, 3750, 3850,	H	Output radial		
				4000 or in 5 mm increments on request		K02	PUR cable	2 m
						K05	PUR cable	5 m
						K10	PUR cable	10 m
						K15	PUR cable	15 m
						Output axial		
						KA02	PUR cable	2 m
						KA05	PUR cable	5 m
						KA10	PUR cable	10 m
						KA15	PUR cable	15 m
						S32	connector	

Ordering code for SSI interface with synchronization to clock
(dynamic control applications) insert the letter B!
BTL5-S1_ _**B**-M_ _ _ _-_-_ _ _ _