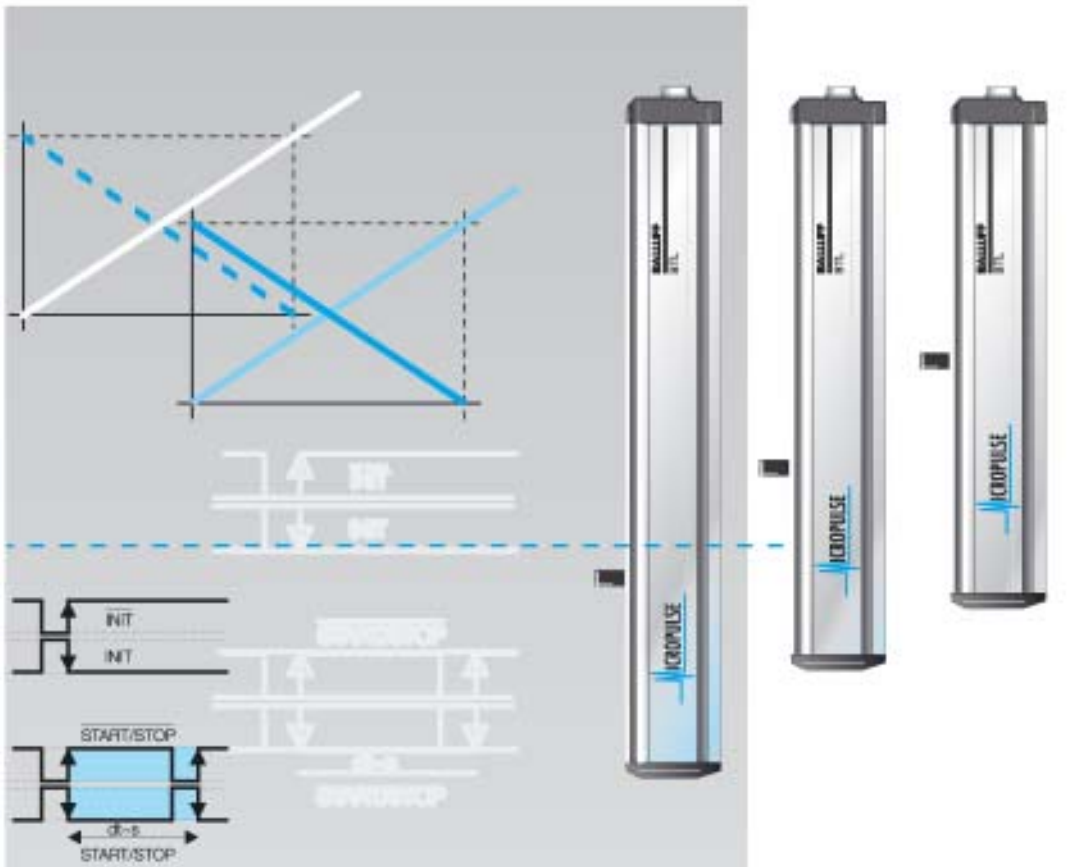
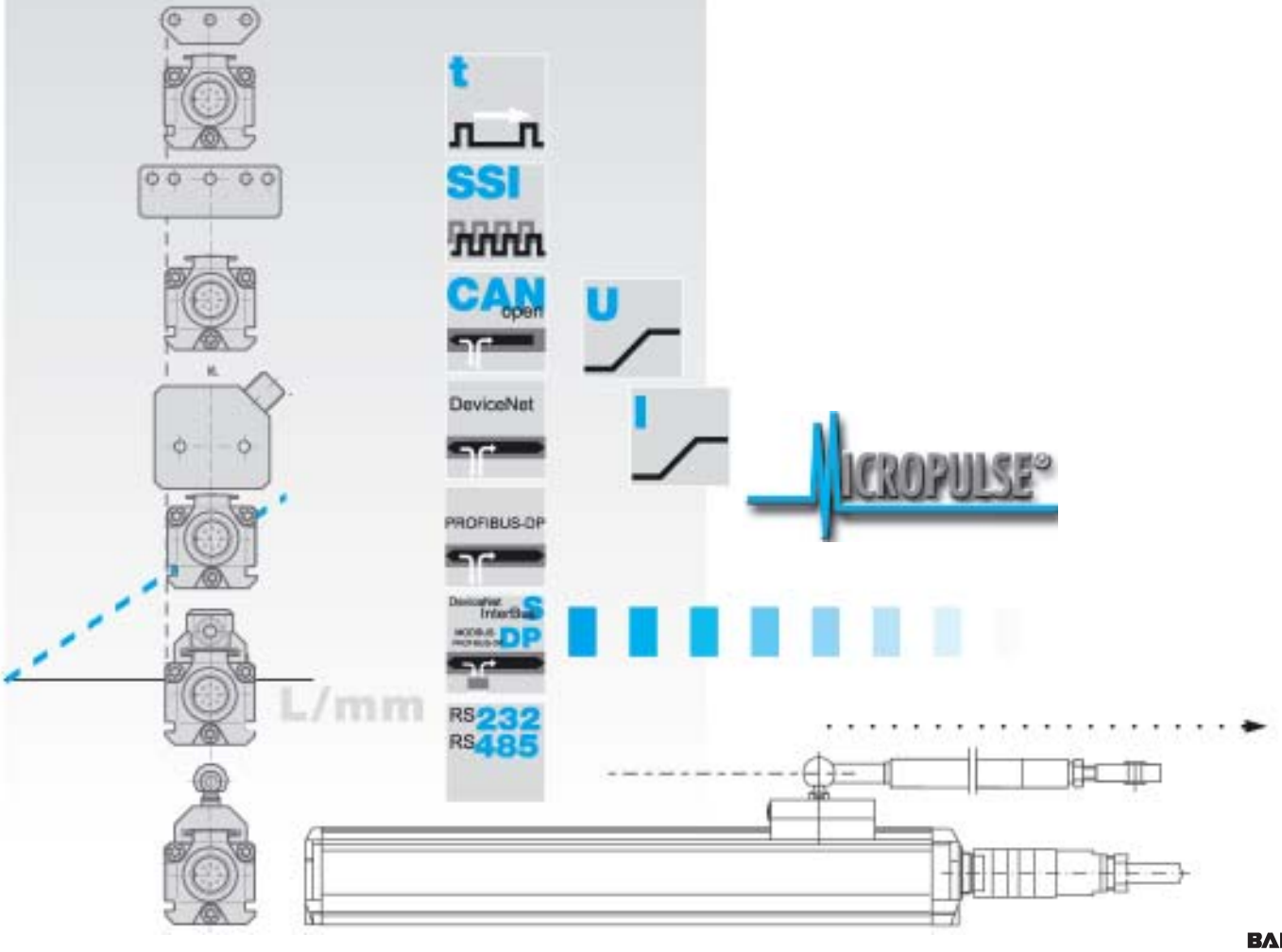




P.2 General data
P.4 Analog interface
P.6 Digital pulse interface
P.8 SSI interface
P.10 CANopen interface
P.12 DeviceNet interface
P.14 PROFIBUS-DP interface
P.16 Magnets floating
P.18 Magnets captive, control arm

BTL P

General data
Analog interface
Digital pulse interface
SSI interface
CANopen interface
DeviceNet interface
PROFIBUS-DP interface
Magnets floating
Magnets captive, control arm

Magnets floating or captive!

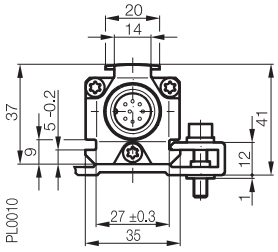
Balluff Micropulse transducers in the Profile housing, with their mechanical design, the high protection rating, and their ease of installation, are an alternative to linear transducers such as potentiometers, glass scales, and LVDTs. The linear sensing element is protected in an aluminum extrusion. The measuring point along the sensing element (waveguide) is indicated by a passive marker (magnet), which needs no power. Measuring stroke ranges between 50 and 5000 mm are available.

- non-contact detection of the actual position
- IP 67, insensitive to contamination
- wear-free
- insensitive to shock and vibration
- absolute output signal
- resolution up to 0.0004" (0.001 mm) (depending on processor used)
- direct signal processing or through processor cards for interfacing with any control system or stand-alone operation

Series	**BTL5 Profile**
Shock load	100 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	Transzorb protection diodes
Dielectric constant	500 V (GND to housing)
Enclosure rating per IEC 60529	IP 67 (with BKS-S... IP 67 connector attached)
Housing material	Anodized aluminum
Housing attachment	Compression clamps
Connection type	Connectors/cables
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]	0050, 0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750, 4000, (4250, 4500, 4750, 5000, 5250, 5500) increments on request

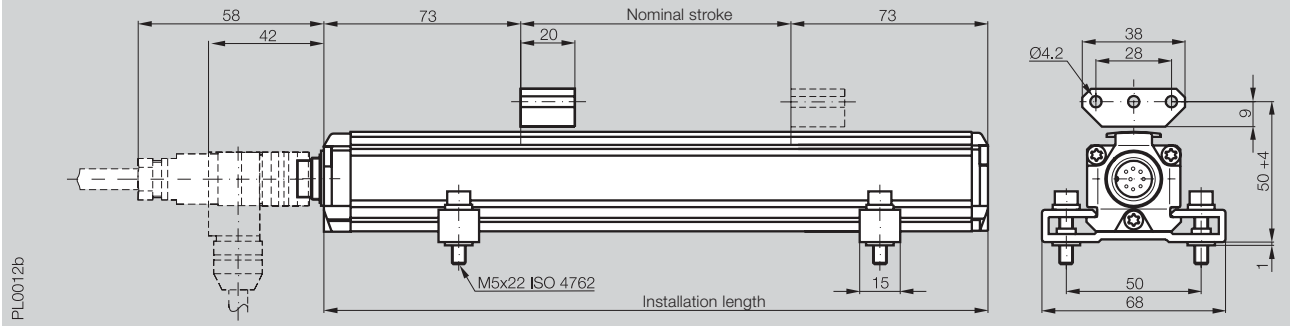
▶ Included:
- Transducer (select your interface starting page **P.**4)
- Short user's guide
- Mounting feet with isolation washers and screws

Please order separately:
Magnets starting page **P.**16
Connectors starting page **BKS.**3

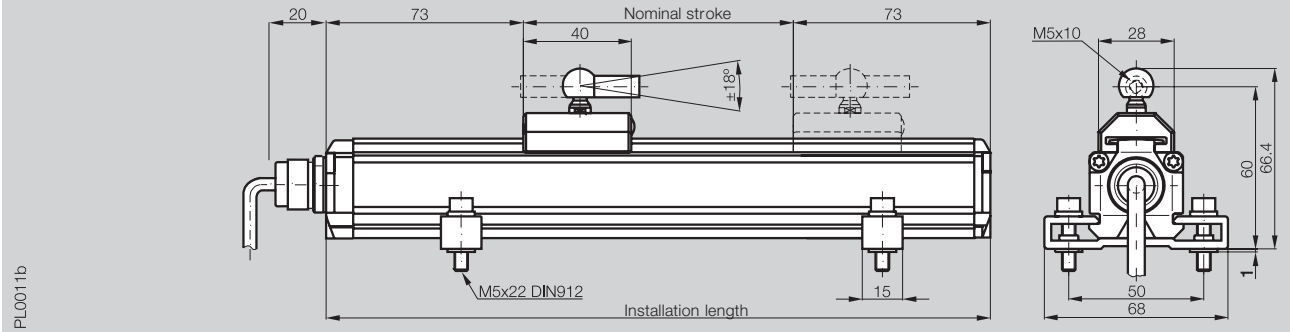


Series	**BTL5 Profile**
Magnets starting page **P.**16	floating or captive

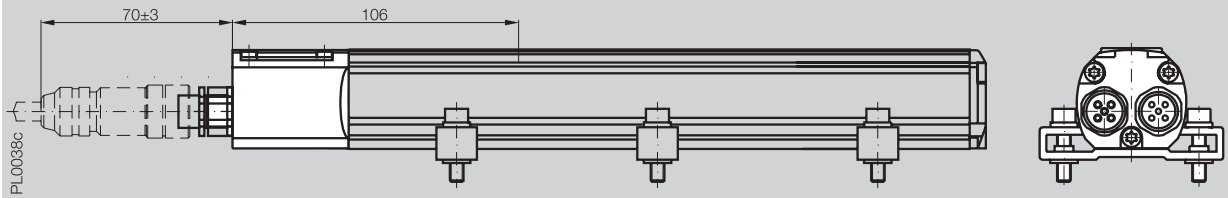
Transducer with floating magnet, S 32 connection with BKS-S 32M/BKS-S 32M-C/BKS-S 33M connector for transducers with analog interface, digital pulse interface and SSI interface Page P.4...**P.**9



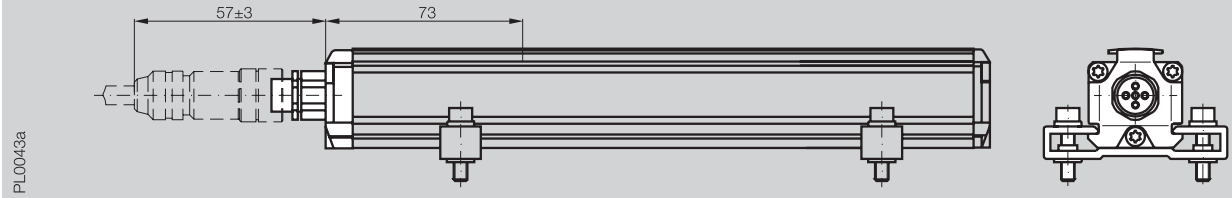
Transducer with captive magnets and cable connection for transducer with analog interface, digital pulse interface and SSI interface page P.4...**P.**9



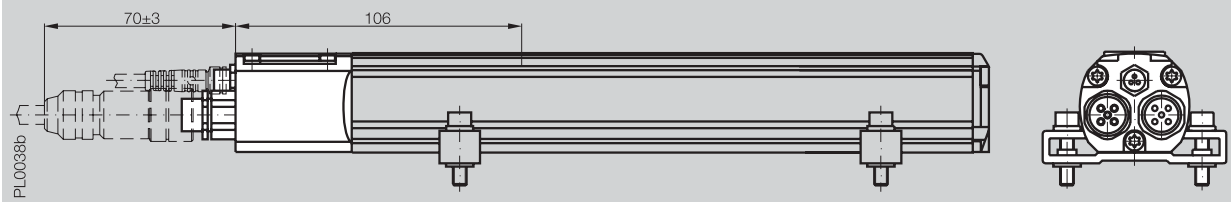
CANopen plug connector S 94 with connectors BKS-S 94-00 and BKS-S 92-00 for transducer with CANopen interface Page P.10



CANopen S 92 connection with BKS-S 92-00 connector for transducer with CANopen interface Page P.10



DeviceNet connection S93 with Connectors BKS-S 92-00, BKS-S 93-00 and BKS-S 48-15-CP-_ _ page P.12
PROFIBUS-DP plug connector S103 with connectors BKS-S 103-00, BKS-S 105-00 and BKS-S 48-15-CP-_ _ page P.14



BTL P
General data
Analog interface
Digital pulse interface
SSI interface
CANopen interface
DeviceNet interface
PROFIBUS-DP interface
Magnets floating
Magnets captive, control arm
BKS
Page **BKS.**3

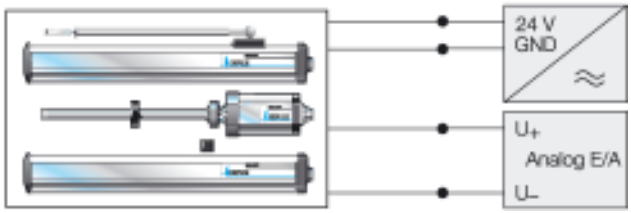
Series	
Output signal	
Transducer interface	
Input interface	

The analog outputs of the profile series are potential-free with respect to the input voltage. The isolation is galvanic using DC/DC converters.

Analog type BTL transducers are available in various output configurations: 0...10 V, 4...20 mA, 0...20 mA and –10...10 V, with rising and falling output slope.

Micropulse Transducers – a non-contact alternative to contacting feedback devices

Potentiometer connections, block diagram



Micropulse transducer connections, block diagram

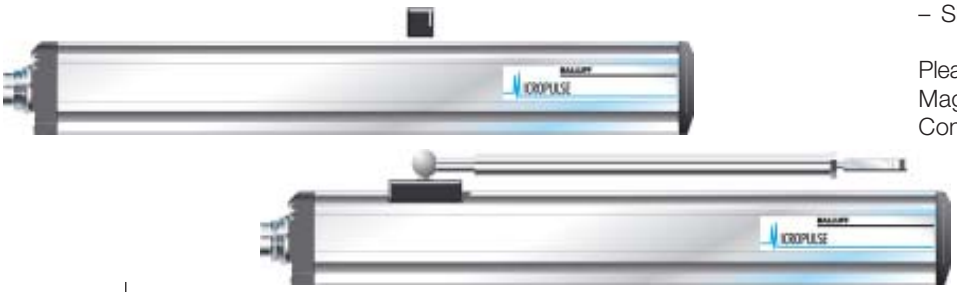
Ordering code		
Output		
Output voltage		
Output current		
Load current		
max. ripple		
Load resistance (recommended)		
System resolution		
Hysteresis		
Repeatability		
Sampling rate		
max. non-linearity		
Temperature coefficient	Voltage output	
	Current output	
Supply voltage		
Current draw		
Polarity 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

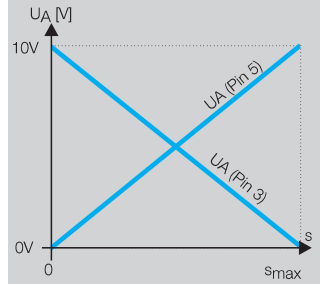
Connect shield to housing

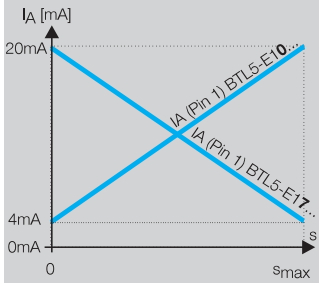
▶ Included:
- Transducer
- Mounting feet with isolation washers and screws
- Short user's guide

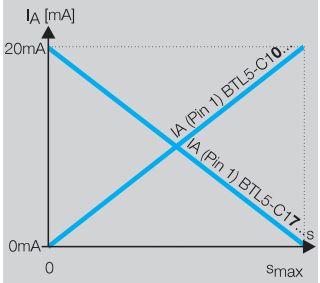
Please order separately:
Magnets starting page **P.**16
Connectors starting page **BKS.**3

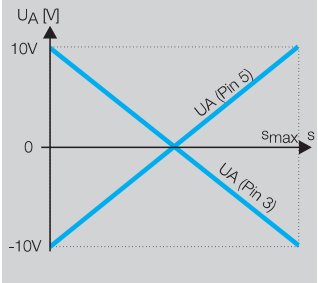


BTL5 Profile	BTL5 Profile	BTL5 Profile	BTL5 Profile
analog	analog	analog	analog
A	**E**	**C**	**G**
analog	analog	analog	analog









BTL5-**A**11-M_ _ _ _-P-_ _ _ _	BTL5-**E**1_-M_ _ _ _-P-_ _ _ _	BTL5-**C**1_-M_ _ _ _-P-_ _ _ _	BTL5-**G**11-M_ _ _ _-P-_ _ _ _
potential-free	potential-free	potential-free	potential-free
0...10 V and 10...0 V	**4...20 mA or 20...4 mA**	**0...20 mA or 20...0 mA**	**–10...10 V and 10...–10 V**
max. 5 mA			max. 5 mA
≤ 5 mV			≤ 5 mV
	≤ 500 Ohm (500 Ohm)	≤ 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... max. 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... 4...20 mA	BTL5-**E**17... 20...4 mA	BTL5-**C**10... 0...20 mA	BTL5-**C**17... 20...0 mA	BTL5-**G**11...
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
(GND)	(GND)		(GND)		(GND)

▶ Please enter code for output signal and nominal stroke length in ordering code.

▶ Preferred models interface A11 and E10
BTL5-A11-M_ _ _ _-P-S 32
BTL5-E10-M_ _ _ _-P-S 32
highlighted in blue are available from stock.

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

Output signal

1	rising and falling (for A and G)
0	rising
7	falling (for C and E)

Standard nominal strokes [mm]

0050, 0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750, 4000, 4250, 4500

Connection type

S 32	Connector
KA02	PUR cable 2 m
KA05	PUR cable 5 m
KA10	PUR cable 10 m
KA15	PUR cable 15 m

BTL P
General data
Analog interface
Digital pulse interface
SSI interface
CANopen interface
DeviceNet interface
PROFIBUS-DP interface
Magnets floating
Magnets captive, control arm
BKS
Page **BKS.**3

cost-effective

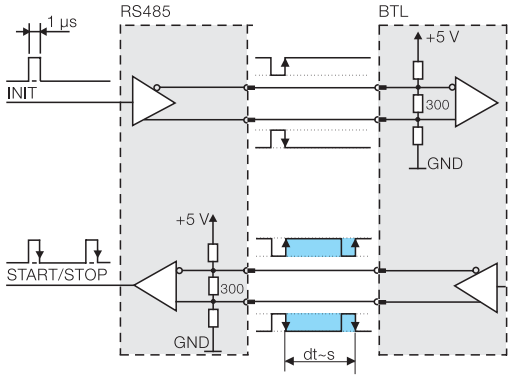
Series	
Transducer interface	
Input interface	

P Interface

Compatible with BTA/BTM 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

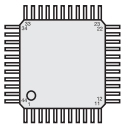
The I and M interfaces are control-specific interface variations.



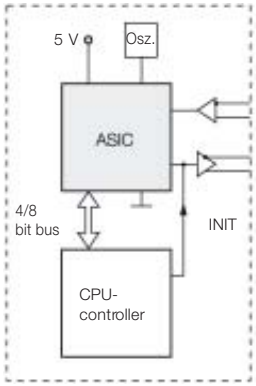
Block diagram of P-interface

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.

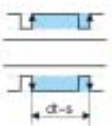


Digitizing chip 44QFP



Controller or Processing electronics

Micropulse transducer with 1 to 4 magnets



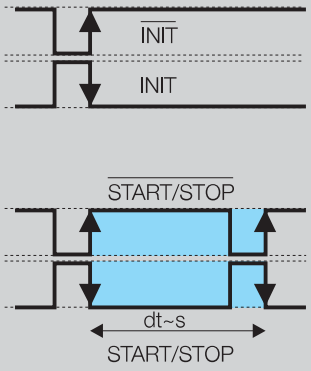
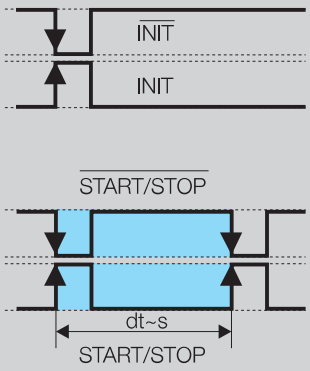
P pulse signal

Ordering code			
System resolution			
Repeatability			
Resolution			
Hysteresis			
Sampling rate			
max. non-linearity			
Temperature coefficient of overall system			
Supply voltage			
Current draw			
Operating temperature			
Storage temperature			
Pin assignments		Pin	Color
Input/output signals	Input	1	YE
	Ouptut	2	GY
	Input	3	PK
	Ouptut	5	GN
Supply voltage		6	BU
		7	BN
		8	WH
Connect shield to housing			

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

	BTL5 Profile	**BTL5 Profile**	
	Pulse **P**	Pulse **M**	
	Pulse **P**	Pulse **M**	
			
	BTL5-**P**1-M_ _ _ _-P-_ _ _ _	BTL5-**M**1-M_ _ _ _-P-_ _ _ _	
	processing-dependent		
	2 µm or ±1 digit depending on processing electronics		
	≤ 2 µm		
	≤ 4 µm		
	3 kHz...500 Hz depending on nominal stroke		
	±100 µm up to 500 mm nominal stroke		
	±0.02 % 500...5000 mm nominal stroke		
	(6 µm + 5 ppm × L) /°C		
	20...28 V DC		
	≤ 90 mA		
	–40...+85 °C		
	–40...+100 °C		

BTL5-**P**1-M...	BTL5-**M**1-M...
INIT	INIT
START/STOP	START/STOP
$\overline{\text{INIT}}$	$\overline{\text{INIT}}$
$\overline{\text{START/STOP}}$	$\overline{\text{START/STOP}}$
GND	GND
+24 V DC	+24 V DC
(GND)	(GND)

▶ Please enter code for nominal stroke in ordering code!

▶ Preferred models interface P
BTL5-P1-M_ _ _ _-P-S 32
highlighted in blue are available from stock.

▶ Included:
– Transducer
– Mounting feet with isolation washers and screws
– Short user's guide

Please order separately:
Magnets starting page **P.**16
Connectors starting page **BKS.**3

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

Standard nominal strokes [mm]

0050, 0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750, 4000, 4250, 4500, 5000, 5250, 5500

Connection type

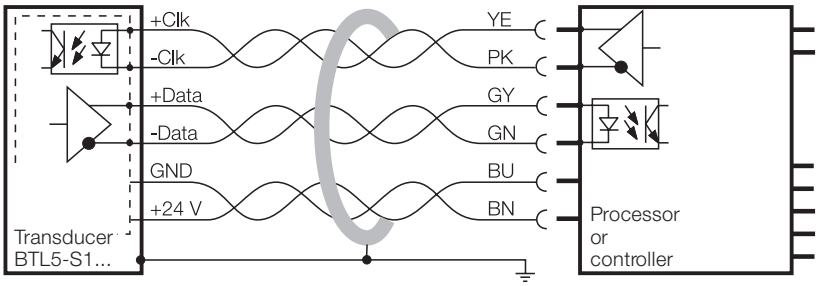
S 32	Connector
KA02	PUR cable 2 m
KA05	PUR cable 5 m
KA10	PUR cable 10 m
KA15	PUR cable 15 m

BTL P
General data
Analog interface
Digital pulse interface
SSI interface
CANopen interface
DeviceNet interface
PROFIBUS-DP interface
Magnets floating
Magnets captive, control arm
BKS
Page **BKS.**3
BTA
Page **BTA.**3

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.



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

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

Synchronized SSI interface
BTL5-S1_ _**B**-M_ _ _ _-P-_ _ _ _

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.

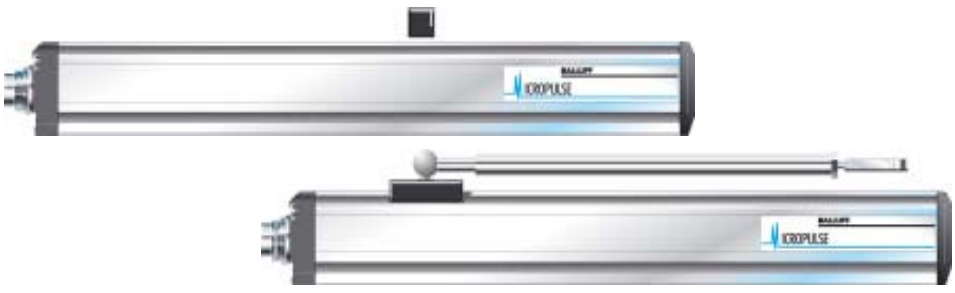
The **maximum sampling frequency f_A**, at which a new current value is generated for each sample, can be derived from the following table:

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

▶ Please enter code for coding, system resolution and nominal stroke length in ordering code.

▶ Preferred models interface S
BTL5-S112-M_ _ _ _-P-S 32 highlighted in blue are available from stock.

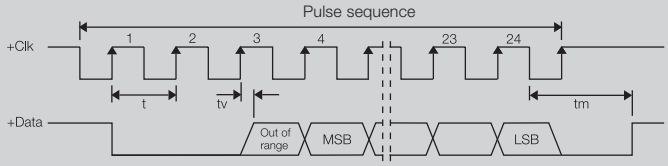
Super-fast 2.5 kHz Sampling rate



▶ Included:
- Transducer
- Mounting clamps with isolation washers and screws
- Short user's guide

Please order separately:
Magnets starting page **P.**16
Connectors starting page **BKS.**3

Series	**BTL5 Profile**
Output signal	synchronous serial
Transducer interface	**S**
Input interface	synchronous serial (SSI)



Ordering code	BTL5-**S**1_ _-M_ _ _ _-P-_ _ _ _ BTL5-**S**1_ _B-M_ _ _ _-P-_ _ _ _
Repeatability	± 5 µm
System resolution depending on version (LSB)	1, 5, 10, 20 or 40 µm
Hysteresis	≤ 5 µm or ≤ 1 digit
Sampling rate	$f_{STANDARD}$ = 2 kHz
max. non-linearity	±30 µm at 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 data signals	1	YE	+Clk
	2	GY	+Data
	3	PK	–Clk
	5	GN	–Data
Supply voltage (external)	6	BU	GND
	7	BN	+24 V DC
	8	WH	must remain unconnected

Ordering example:
BTL5-S1_ _-M_ _ _ _-P-_ _ _ _

Coding

0	Binary code rising (24 bits)
1	Gray code rising (24 bits)
6	Binary code rising (25 bits)
7	Gray code rising (25 bits)

System resolution

1	1 µm
2	5 µm
3	10 µm
4	20 µm
5	40 µm
6	100 µm
7	2 µm

Standard nominal strokes [mm]

0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750, 4000

Connection type

S 32	Connector
KA02	PUR cable 2 m
KA05	PUR cable 5 m
KA10	PUR cable 10 m
KA15	PUR cable 15 m

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

BTL P
General data
Analog interface
Digital pulse interface
SSI interface
CANopen interface
DeviceNet interface
PROFIBUS-DP interface
Magnets floating
Magnets captive, control arm
BKS
Page **BKS.**3

User-friendly hardware and software set-up

CANopen interface

Based on CAN (ISO/IEC 7498 and DIN ISO 11898), CANopen provides a Layer-7 implementation for industrial CAN networks. The serial data protocol of the CAN specification is defined according to the producer-consumer principle as opposed to most other fieldbus protocols. This eliminates target addressing of the process data. Each bus station decides for itself how the received data are processed.

The CANopen interface of the Micropulse transducer is compatible with CANopen conforming with CiA Standard DS301 Rev. 3.0, and with CAL and Layer 2 CAN networks.

CAN-BUS features

- Line topology, star structure also possible using repeaters
- Cost-effective 2-wire cabling
- Fast response times, high data integrity using CRC, hamming distance of 6
- 1 Mbps at cable lengths < 25 m
- Number of stations protocol-limited to 127
- Using multiple magnets: A minimum spacing of > 65 mm must be maintained.

CANopen offers a high level of flexibility with respect to functionality and data exchange. Using a standard data sheet in the form of an EDS file it is easy to link the Micropulse transducers to any CANopen system.

Process Data Object (PDO)

12 Micropulse transducers send their position information optionally in one or two PDOs with 8 bytes of data each. The contents of the PDOs is free configurable. The following information can be sent:

- Current magnet position with resolution in 5 µm steps
- Current velocity of the magnet with resolution selectable in 0.1mm/s steps
- Current status of the four freely programmable cams per magnet.

Synchronization Object (SYNC)

Serves as a net-wide trigger for synchronizing all network participants. When the SYNC object is received, all Micropulse transducers active on the bus store their current position and velocity information and then send it sequentially to the control. This assures time-synchronous capture of the measured values.

LED

Display of the CANopen status to DS303-3

FMM

The sensor can be operated as a 4-magnet type, whereby the sensor itself recognizes how many magnets are currently active. So if only two magnets are positioned in the measurement range, a valid value is output for the first two positions and a defined error value for positions 3 and 4.

Emergency Object

This object is sent with the highest priority. This is used for example for error messages when cam states change.

Service Data Object (SDO)

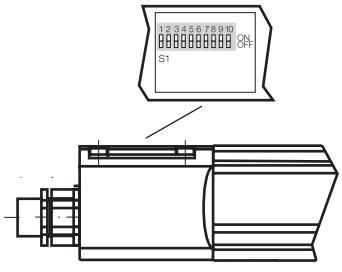
Service Data Objects transmit the parameters for the transducer configuration. The transducer configuration may be carried out on the bus by the controller, or offline using a PC with a configuration tool which runs under Windows. The configuration is stored in the transducer in a non-volatile memory.

CANopen certified

CiA 199911-301v30/11-009

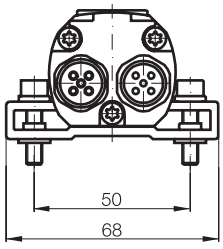
Use of multiple magnets

A minimum spacing of > 65 mm must be maintained.



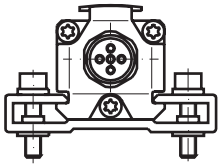
Position of the DIP switch S1, only on BTL-H1_ _ _ _-P-S 94

BTL5-H1_ _-M_ _ _ -P-S 94

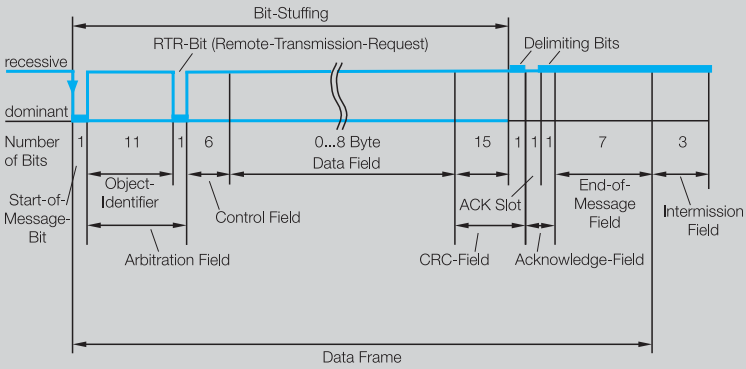


Node ID can be set by DIP switch.

BTL5-H1_ _-M_ _ _ -P-S 92



Series	**BTL5 Profile**
Output signal	CANopen
Transducer interface	**H**
Input interface	CANopen



Ordering code	BTL5-**H**1_ _-M_ _ _ _-P-S 92 BTL5-**H**1_ _-M_ _ _ _-P-S 94

CANopen Version		DS301, DS406
Repeatability		± 1 digit
System resolution	Position	5 µm increments configurable
configurable	Velocity	0.1 mm/s increments configurable
Hysteresis		≤ 1 digit
Sampling rate		$f_{STANDARD}$ = 1 kHz
max. non-linearity		±30 µm at5 µm resolution
Temperature coefficient of overall system		(6 µm + 5 ppm × L)/°C
Magnet traverse speed		any
Supply voltage		20...28 V DC
Current draw		≤ 100 mA
Operating temperature		–40...+85 °C
Storage temperature		–40...+100 °C

Cable length [m] per CiA DS301	< 25	< 50	< 100	< 250	< 500	< 1000	< 1250	< 2500
Baud rate [kBaud] per CiA DS301	1000	800	500	250	125	100	50	20/10

Pin assignements	Pin	Color	
Control and data signals	1	WH	CAN_GND
	4	GY	CAN_HIGH
	5	GN	CAN_LOW
Supply voltage (external)	2	BN	+24 V
	3	BU	0 V (GND)

Using the CANopen interface and cable lengths up to 2500 m, the signal is sent at a length-dependent baud rate to the control. The high noise immunity of the connection is achieved using differential drivers and by the data monitoring scheme.

▶ Included:
- Transducer
- Mounting feet with isolation washers and screws
- Short user's guide

Please order separately:
Magnets starting page **P.**16
Connectors starting page **BKS.**4

▶ Please enter code for software configuration, baud rate and nominal stroke length in order code.

Ordering example:
BTL5-H1_ _-M_ _ _ _-P-S 92
BTL5-H1_ _-M_ _ _ _-P-S 94

Software configuration

1	1 × Position and 1 × Velocity
2	2 × Position and 2 × Velocity

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

Standard nominal strokes [mm]

0050, 0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750, 4000

BTL P
General data
Analog interface
Digital pulse interface
SSI interface
CANopen interface
DeviceNet interface
PROFIBUS-DP interface
Magnets floating
Magnets captive, control arm
BKS
Page **BKS.**4

DeviceNet

DeviceNet is an open standard field bus, manufacturer-independent, in which automation technology for connecting programmable logic devices (PLCs) to intelligent devices such as sensors, pushbuttons, I/O modules, basic user interfaces and drives using a single cable. DeviceNet is an application protocol (OSI layer 7) based on the Controller Area Network (CAN) principle. It offers high reliability for demanding applications with a high number of I/O modules. The transmission speed depending on type and length of the cable is from 125 kBit/s to 500 kBit/s.

Master

DeviceNet is multi-master capable, i.e. several DeviceNet devices can simultaneously request the current position. The data transfer is controlled by the priority of the message. Messages on the DeviceNet carry an identifier.

The message that was sent can be received by all devices simultaneously (broadcast). Message filtering is performed by the device only for messages intended for it. The criterion for this decision is the identifier, with which each message is transmitted.

EDS

DeviceNet offers parameterization of functionality and data exchange. Using a standard data sheet in the form of an EDS file it is easy to link the Micropulse transducers to any DeviceNet system.

DeviceNet features

- Linear topology
- Cost-effective wiring with two-wire cable
- Fast response times,
- High data security due to CRC checking,
- Hamming distance of 6
- Potential-free data transmission (RS485)
- 125 Kb/s at cable length < 500 m
  250 Kb/s at cable length < 250 m
  500 Kb/s at cable length < 100 m
- Number of stations protocol-limited to 64

Position Sensor Object

The DeviceNet interface of the Micropulse transducer is compatible with the CIP Common Specification Object Library "Position Sensor Object" of the ODVA.

The Micropulse transducers transmit their measurement values in an entity of the Position Sensor Objects as a 32-bit value.

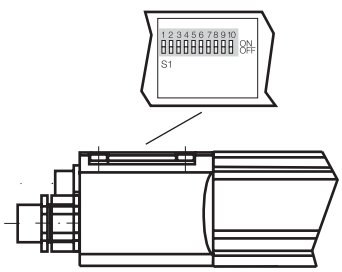
The following information can be sent:
- Current magnet position with resolution in 5000 µm steps
- Current magnet velocity in nm/s steps
- Current status of the four freely programmable cams.

Synchronization

Measurement can be triggered by the master I/O bit Strobe Command Message. Each network node is assigned a bit within this message. On receiving this bit the respective Micropulse transducer saves its instantaneous position and velocity information, which then be interrogated by the controller.

FMM

The sensor can be operated as a 4-magnet type, whereby the sensor itself recognizes how many magnets are currently active. So if only two magnets are positioned in the measurement range, a valid value is output for the first two positions and a defined error value for positions 3 and 4.



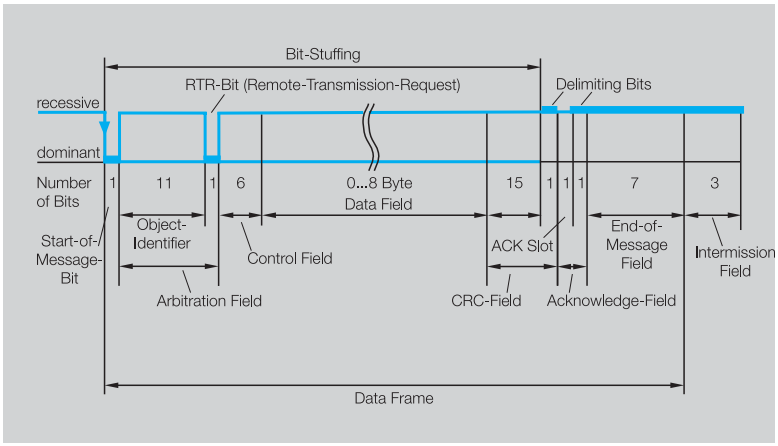
Position of the DIP switch S1,

Device address can be set by DIP switch

Use of multiple magnets

A minimum spacing of > 65 mm must be maintained.

Series	**BTL5 Profile**
Output signal	DeviceNet
Transducer interface	**D**
Input interface	DeviceNet



Ordering code Connector version S103	BTL5-**D**1_ _-M_ _ _ _-P-S 93

Profibus-Version		Encoder profile
Profibus-interface		potential-free
Repeatability		± 1 digit
System resolution configurable	Position	5 µm increments configurable
	Velocity	0.1 mm/s increments configurable
Hysteresis		≤ 1 digit
Sampling rate		$f_{STANDARD}$ = 1 kHz
max. non-linearity		±30 µm at5 µm resolution
Temperature coefficient of overall system		(6 µm + 5 ppm × L)/°C
Magnet traverse speed		any
Supply voltage		20...28 V DC
Current draw		≤ 100 mA
Operating temperature		–40...+85 °C
Storage temperature		–40...+100 °C

Address assignment	mechanical switches or DeviceNet			
Cable length [m]	100	250	500	
Baud rate [Kbps]	500	250	125	

Pin assignments		S 93 5-pin	S 93 3-pin
Control and data signals	CAN GND	1	
	n.c.	2	
	n.c.	3	
	CAN HIGH	4	
	CAN LOW	5	
Supply voltage and shield	+24 V		1
	GND		3
	Shield Supply		4

▶ Please enter code for software configuration and nominal stroke length in ordering code!

▶ Included:
- Transducer
- Mounting feet with isolation washers and screws
- Short user's guide

Please order separately:
Magnets starting page **P.**16
Connectors page **BKS.**4

Ordering example:
BTL5-D1_ _-M_ _ _ _-P-S93

Software configuration	**Baud rate**	**Standard nominal strokes [mm]**
1 Magnet FMM	2 500 kBaud 3 250 kBaud 4 125 kBaud	0050, 0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750, 4000

BTL P
General data
Analog interface
Digital pulse interface
SSI interface
CANopen interface
DeviceNet interface
PROFIBUS-DP interface
Magnets floating
Magnets captive, control arm
BKS
Page **BKS.**6

User-friendly hardware and software set-up

As the market leading standard for serial data transmission for process automation, PROFIBUS-DP is the ideal choice for implementing automation tasks with cycle times of > 5 ms.

Data transmission
A PROFIBUS telegram can contain up to 244 bytes of user data per telegram and station. The BTL5-T uses max. 32 bytes (max. 4 position values and max. 4 velocity values) for process data transmission. Up to 126 active stations (Address 0...125) can be connected on PROFIBUS-DP. User data cannot be sent with station address 126. This address is used as the default address for bus stations that have to be parameterized by a Class 2 master (for setting the device address if there are no mechanical switches available).
Each PROFIBUS station has the same priority. Prioritizing of individual stations is not intended, but can be done by the master since the bus transmission only makes up a fraction of the process cycle anyway.
At a transmission rate of 12 Mbps, the transmission time for an average data telegram is in the 100 µs range.

Master
There are two types of possible masters for PROFIBUS-DP. Master Class 1 carries out the user data interchange with the connected slaves. Master Class 2 is intended for startup and diagnostic purposes and may be used to briefly assume control of a slave.

GSD (Device Master Data)
The length of the data exchangeable with a slave is defined in the Device Master Data file (GSD) and is checked by the slave with the configuration telegram and confirmed for correctness.
In modular systems, various configurations are defined in the GSD file. Depending on the desired functionality, one of these configurations can be selected by the user when the system is configured. The BTL5-T is a modular device with the possibility of selecting the number of magnets (position values).

Slave
Once a PROFIBUS master has received the parameter set defined for the slave, it is able to exchange data. The parameter set consists of slave parameters and configuration data.
The parameter data contain the description of the slave settings (e.g. resolution of a position value). The configuration data describe the length and structure of the data telegram.

Process data
Under PROFIBUS-DP the default is for process data to be sent from the master to slaves acyclically and for the slave data to then be queried. To ensure synchronization of multiple devices, the master may use the SYNC and FREEZE services.

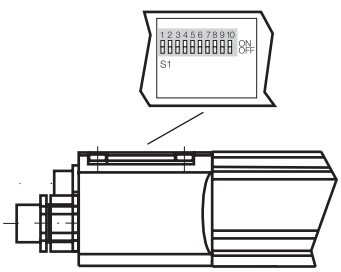
DP/V1 and DP/V2

Isochronic mode
Isochronic mode enables quick and deterministic data exchange by means of clock synchronicity on the bus system. A cyclic equidistant clock signal is sent by the master to all bus devices. This signal allows master and slaves to be synchronized irrespective of application – with an accuracy < 1 µs.

Cross traffic between slaves
Cross traffic permits two DP slaves to exchange data directly with each other: the master ensures that the slave publishes its data on the bus with a request for "Data-eXchange-Broadcast" (DXB-Request) and thus makes it available to other slaves. Since the process data is available in the process periphery without being diverted through the master application, cross-traffic permits very fast control system responses.

Acyclic services
The DP functions for prioritized communication permit acyclic read and write functions to be sent between master and slaves, independently of the cyclic user data traffic. The transfer of acyclic data is performed at a lower priority in parallel to the high speed cyclic data exchange – as if in the background. The background / foreground split means the ratio of cyclic to acyclic data can be adjusted if required.

FMM
The sensor can be operated as a 4-magnet type, whereby the sensor itself recognizes how many magnets are currently active. So if only two magnets are positioned in the measurement range, a valid value is output for the first two positions and a defined error value for positions 3 and 4.



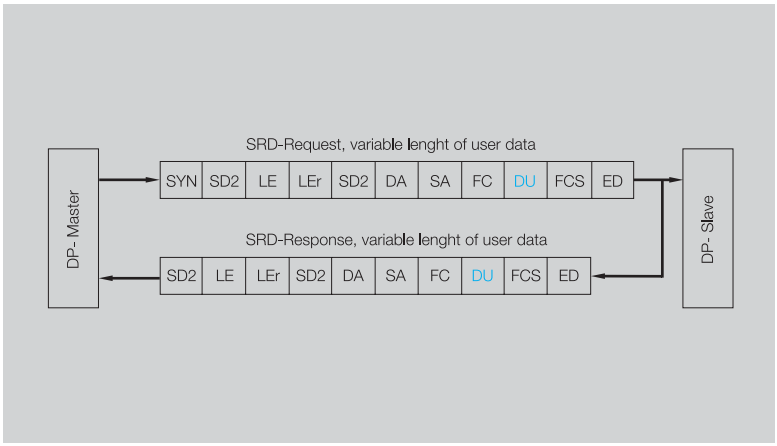
Position of the DIP switch S1,

Device address can be set by DIP switch

Use of multiple magnets

A minimum spacing of > 65 mm must be maintained.

Series	**BTL5 Profile**
Output signal	PROFIBUS-DP
Transducer interface	**T**
Input interface	PROFIBUS-DP



Ordering code Connector version S103		BTL5-T1_ 0-M_ _ _ _-P-S103				
Profibus-Version		DPV0/DPV2 EN 50170, encoder profile				
Profibus-interface		potential-free				
Repeatability		± 1 digit				
System resolution	Position	5 µm increments configurable				
configurable	Velocity	0.1 mm/s increments configurable				
Hysteresis		≤ 1 digit				
Sampling rate		$f_{STANDARD}$ = 1 kHz				
max. non-linearity		±30 µm at5 µm resolution				
Temperature coefficient of overall system		(6 µm + 5 ppm × L)/°C				
Magnet traverse speed		any				
Supply voltage		20...28 V DC				
Current draw		≤ 120 mA				
Operating temperature		–40...+85 °C				
Storage temperature		–40...+100 °C				
GSD file		BTL504B2.GSD				
Address assignment		mechanical switches and Master Class 2				
Cable length [m]		< 100	< 200	< 400	< 1000	< 1200
Baud rate [Kbps]		12000	1500	900	187.5	93.7/19.2/9.6

Pin assignments		S103 5-pin	S103 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

▶ Please enter code for software configuration and nominal stroke length in ordering code!

▶ Included:
- Transducer
- Mounting feet with isolation washers and screws
- Short user's guide

Please order separately:
Magnets starting page **P.**16
Connectors page **BKS.**6
GSD file BTL5TGSD 119399 (free of charge)

Ordering example:
BTL5-T1_ 0-M_ _ _ _-P-S103

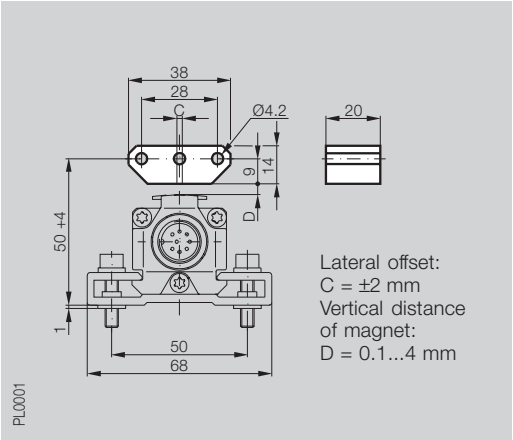
Software configuration		**Standard nominal strokes [mm]**
1	1 magnet	0050, 0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750, 4000
2	2 magnets	

BTL P
General data
Analog interface
Digital pulse interface
SSI interface
CANopen interface
DeviceNet interface
PROFIBUS-DP interface
Magnets floating
Magnets captive, control arm
BKS
Page **BKS.**6

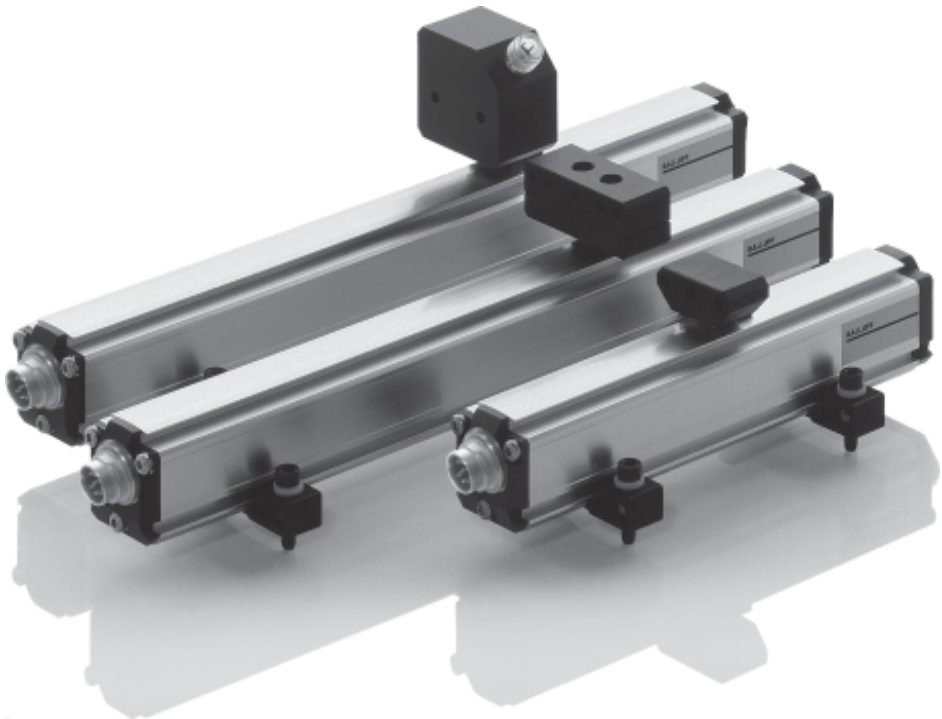
Balluff magnets are available in captive or floating styles. All BTL5 magnets shown here can be used on any Balluff Micropulse transducer. Maximum resolution and repeatability are achieved using captive magnets BTL5-F/M/N-2814-1S.

The BTL5-P-3800-2 magnet can be used with a vertical offset from the upper surface of the transducer body of 0.1...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 24V, 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	**Magnet**
for Series	BTL5 Profile
Type	floating



Ordering code	BTL5-P-**3800**-2
Housing material	Plastic
Weight	approx. 12 g
Magnet traverse speed	any
Supply voltage	
Current draw	
Operating temperature/Storage temperature	–40...+85 °C
Included	Magnet 2 mounting screws DIN 84 M4×35-A2 with washers and nuts
Accessories (please order separately)	

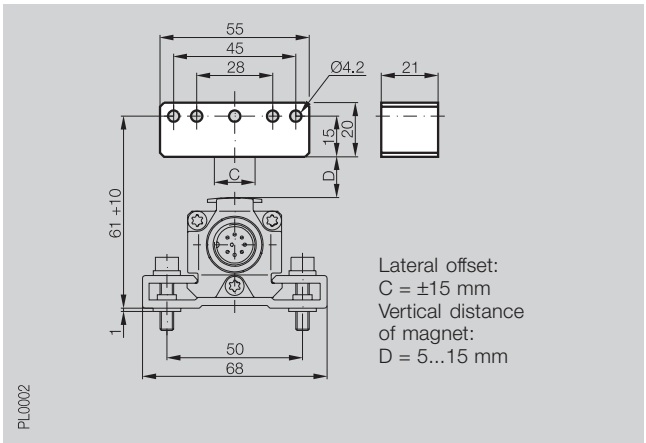


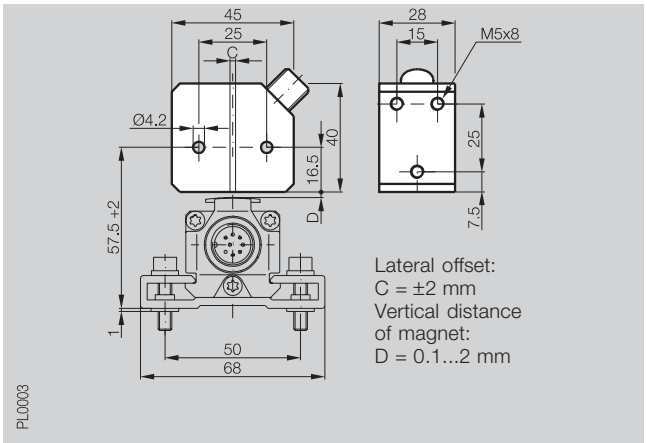
Mounting feet with isolation washers and screws included with transducer.

Replacement: 1 pair mounting feet and screws Type. No.: 110404

Length (stroke length)	Number of mounting feet
up to 250 mm	1
251 to 750 mm	2
751 to 1250 mm	3
1251 to 1750 mm	4
1751 to 2250 mm	5
2251 to 2750 mm	6
2751 to 3250 mm	7
from 3251 mm	8

Magnet	**Magnet**
BTL5 Profile	BTL5 Profile
floating	floating



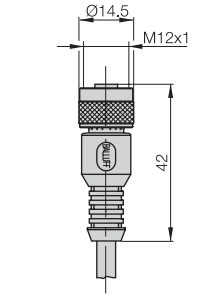


BTL5-P-**5500**-2	BTL5-P-**4500**-1
Plastic	Plastic
approx. 40 g	approx. 90 g
any	any
	24 V DC
	100 mA
–40...+85 °C	–40...+60 °C
Magnet	Magnet

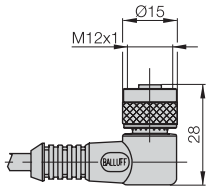
Straight connector	BKS-B 19-1-_ _
Right angle connector	BKS-B 20-1-_ _

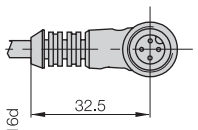
Please indicate cable length in ordering code!
03, 05, 10, 15
= PVC, 3 m, 5 m, 10 m or 15 m
PU-03, PU-05, PU-10, PU-15
= PUR, 3 m, 5 m, 10 m or 15 m

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

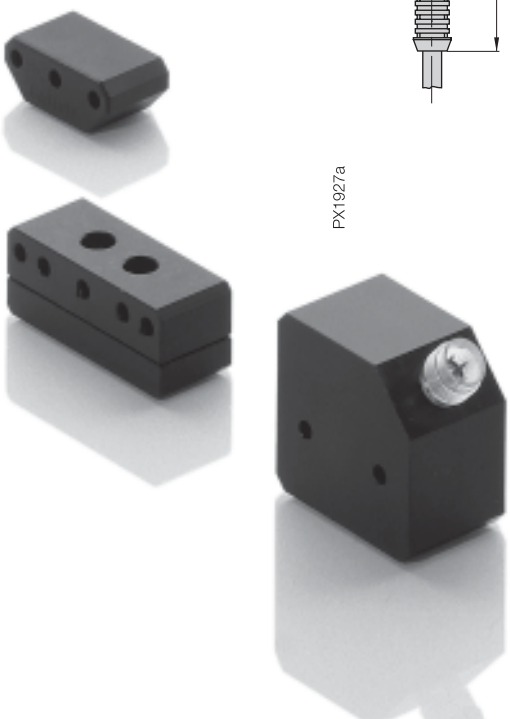


PX1927a



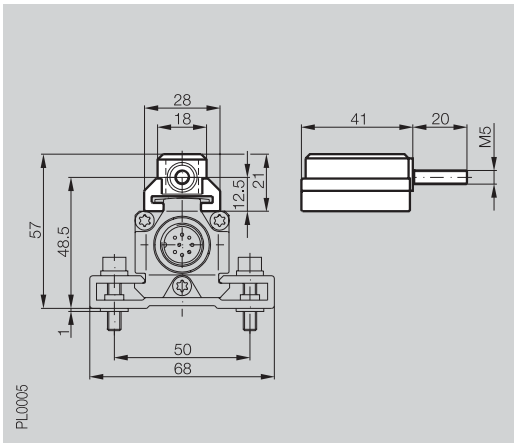


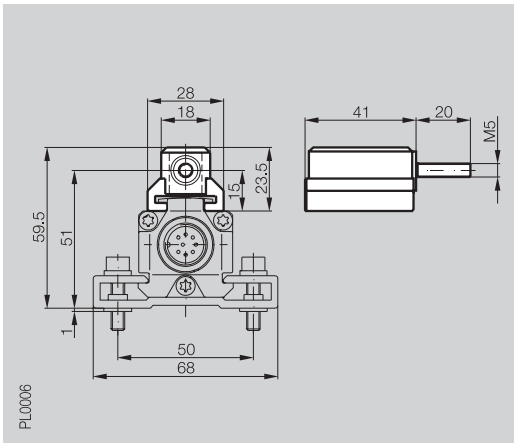
PX1416d



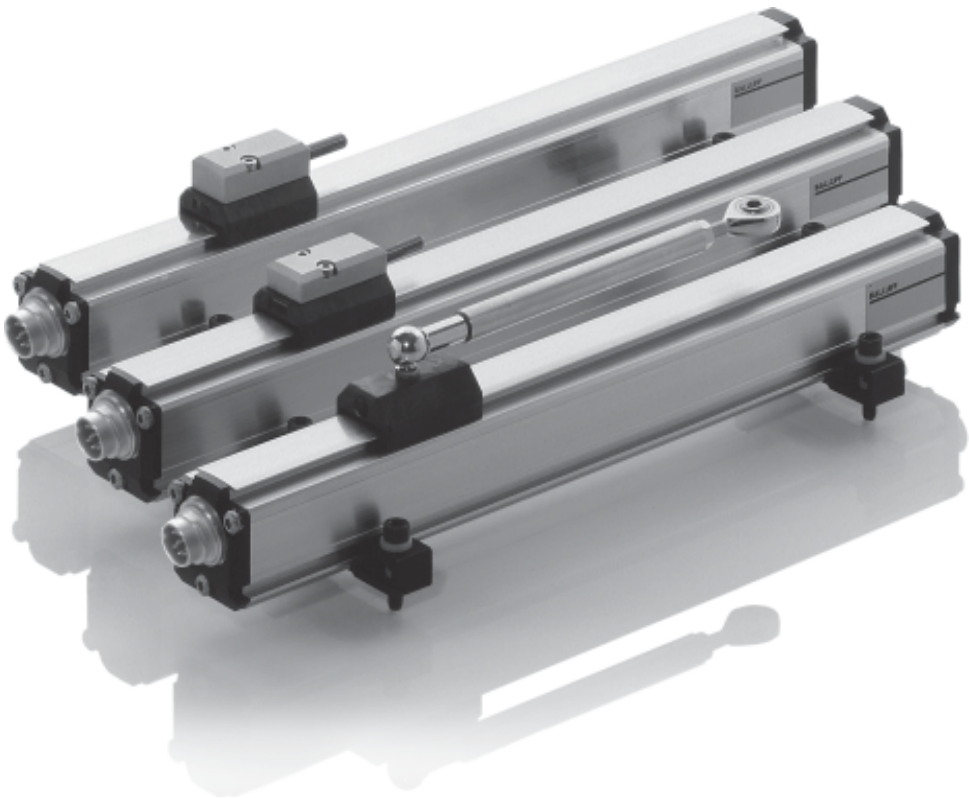
BTL P
General data
Analog interface
Digital pulse interface
SSI interface
CANopen interface
DeviceNet interface
PROFIBUS-DP interface
Magnets floating
Magnets captive, control arm

Description	**Magnet**	**Magnet**
for Series	BTL5 Profile	BTL5 Profile
Type	captive	captive





Ordering code		BTL5-**M-2814**-1S	BTL5-**N-2814**-1S
Material	Housing	Anodized aluminum	Anodized aluminum
	Slide surface	Plastic	Plastic
Weight		approx. 32 g	approx. 35 g
Magnet traverse speed		any	any
Operating temperature/Storage temperature		–40...+85 °C	–40...+85 °C

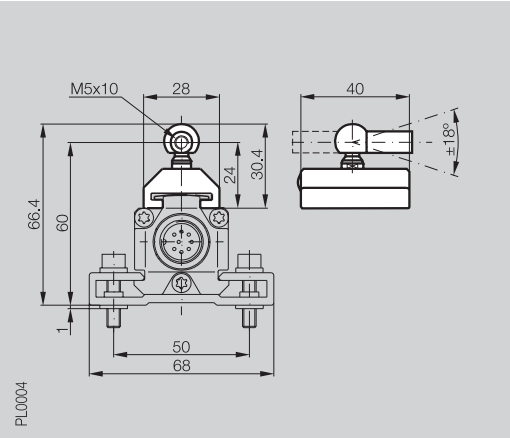


Mounting feet with isolation washers and screws included with transducer.

Replacement: 1 pair mounting feet and screws Type. No.: 110404

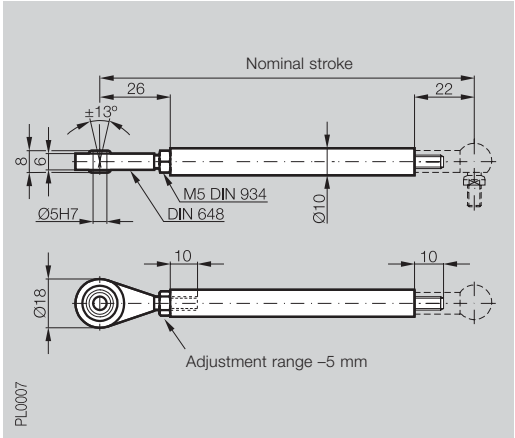
Length (stroke length)	Number of mounting feet
up to 250 mm	1
251 to 750 mm	2
751 to 1250 mm	3
1251 to 1750 mm	4
1751 to 2250 mm	5
2251 to 2750 mm	6
2751 to 3250 mm	7
from 3251 mm	8

	Magnet
	BTL5 Profile
	captive



	BTL5-**F-2814**-1S
	Plastic
	Plastic
	approx. 28 g
	any
	–40...+85 °C

Description for	**Control arm** (including swivel eye) Magnet BTL5-F-2814-1S



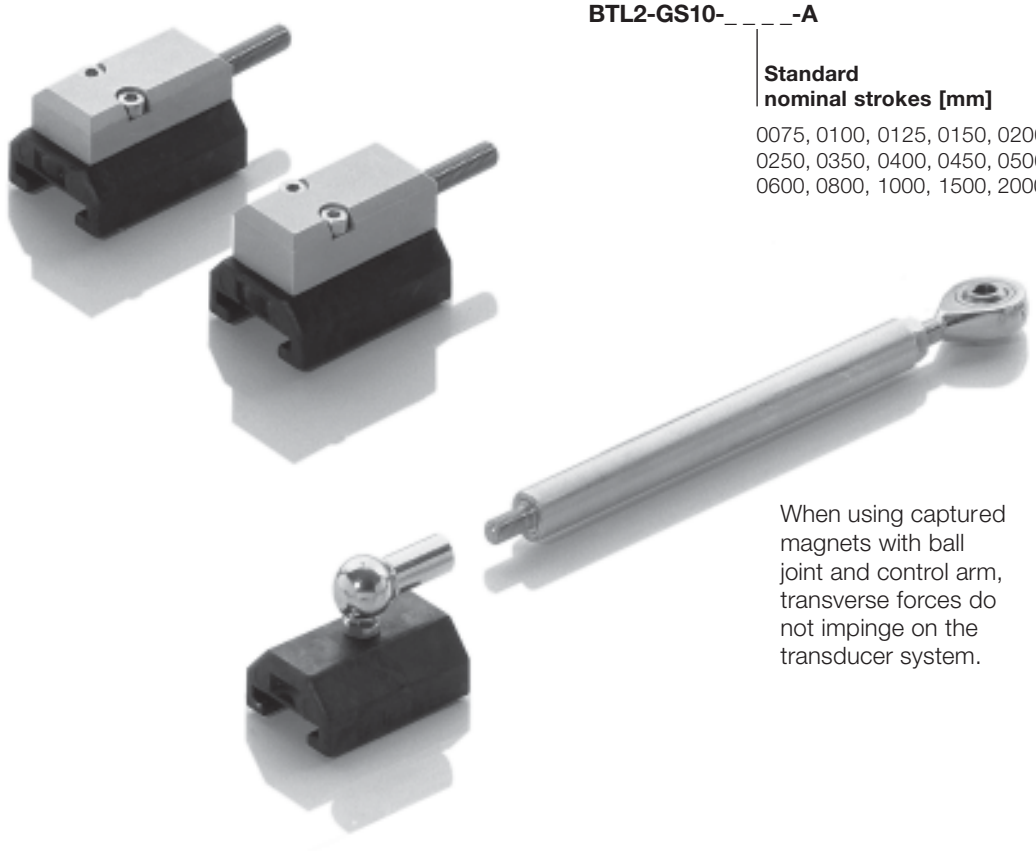
Ordering code	BTL2-**GS10-**_ _ _ _-A
Material	Al
Weight	approx. 150 g/m

▶ Please enter code for nominal stroke in ordering code!

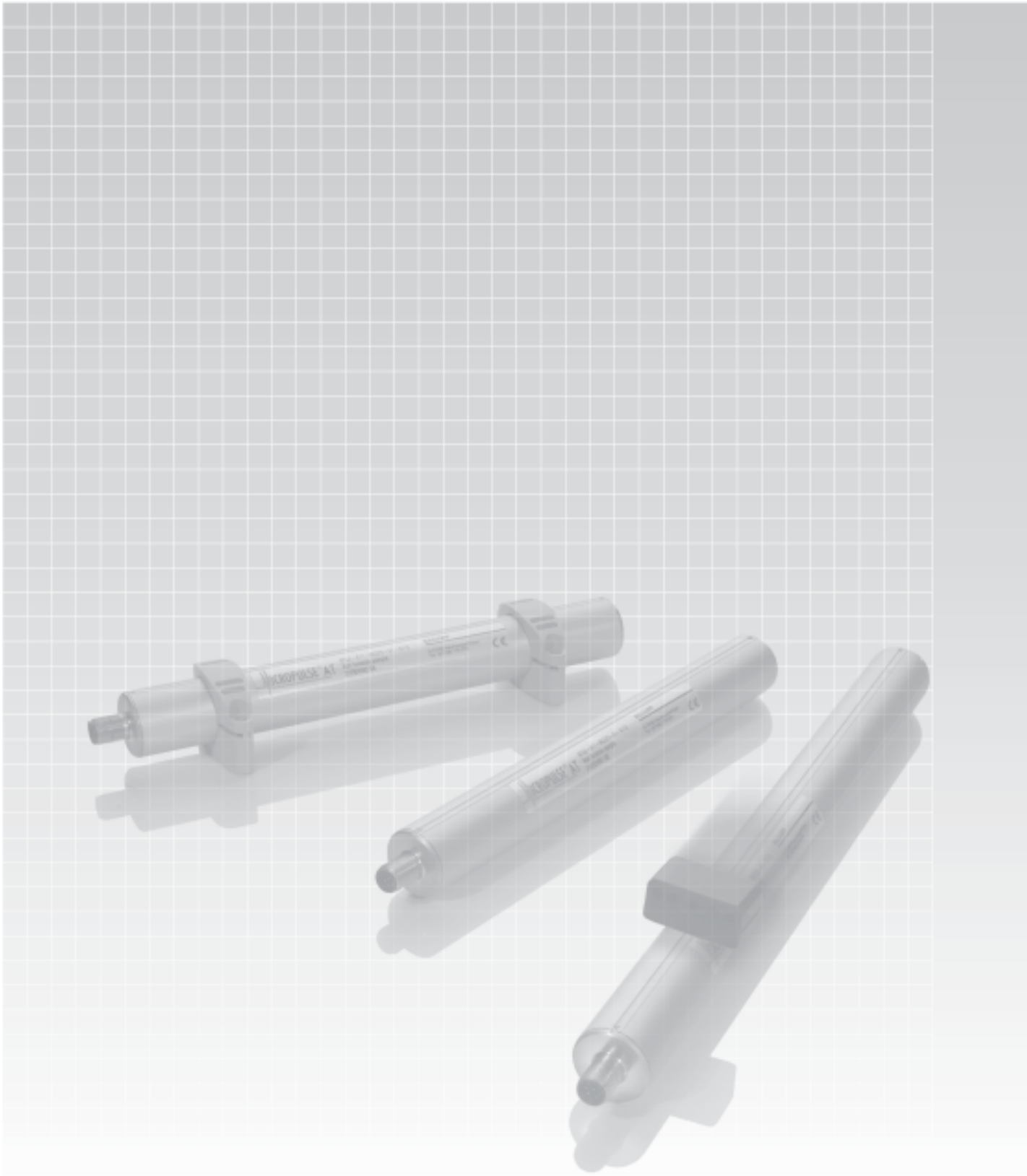
Ordering example:
BTL2-GS10-_ _ _ _**-A**

Standard nominal strokes [mm]

0075, 0100, 0125, 0150, 0200,
0250, 0350, 0400, 0450, 0500,
0600, 0800, 1000, 1500, 2000



Swivel eye
part no. 714619

When using captured magnets with ball joint and control arm, transverse forces do not impinge on the transducer system.

BTL P
General data
Analog interface
Digital pulse interface
SSI interface
CANopen interface
DeviceNet interface
PROFIBUS-DP interface
Magnets floating
Magnets captive, control arm