Compact Rod and AR Rod

- Compact housing saves valuable space in and around the cylinder
- Rugged stainless steel housing
- Shock and vibration-secure with IP 67/68 degree of protection
- Pressure-resistant housing, for extreme applications offshore or under water
- Available with analog signals, digital and fieldbus interfaces
- Complete integration in hydraulic cylinders (AR)
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</tr>
<tr>
<td>Installation notices</td>
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</tbody>
</table>

MICROPULSE®
K BTL7 Compact Rod

**General data**

Pressure rated to 600 bar (8700 psi), high repeatability, non-contact, robust

The BTL Micropulse Transducer is a robust position feedback system for measuring ranges between 25 and 7620 mm under extreme ambient conditions.

The actual measurement section 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.

<table>
<thead>
<tr>
<th>Series</th>
<th>K BTL7 compact rod</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock load</td>
<td>150 g/6 ms as per EN 60068-2-27</td>
</tr>
<tr>
<td>Vibration</td>
<td>20 g, 10...2000 Hz per EN 60068-2-6</td>
</tr>
<tr>
<td>Polarity reversal protected</td>
<td>to 36 V</td>
</tr>
<tr>
<td>Overvoltage protection</td>
<td>to 36 V</td>
</tr>
<tr>
<td>Dielectric strength</td>
<td>500 V AC (GND to housing)</td>
</tr>
<tr>
<td>Degree of protection as per IEC 60529</td>
<td>IP 68 with cable outlet, IP 67 with screwed-on connector BKS-S...</td>
</tr>
<tr>
<td>Housing material</td>
<td>1.4571 stainless steel outer tube, 1.3952 stainless steel cast flange</td>
</tr>
<tr>
<td>Fasteners</td>
<td>Design K, 18h6 with 6 cylinder head screws</td>
</tr>
<tr>
<td>Pressure rating at 10.2 mm, protective tube</td>
<td>600 bar with installation in hydraulic cylinder</td>
</tr>
<tr>
<td>Pressure rating at 8 mm, protective tube</td>
<td>250 bar when installed in hydraulic cylinder</td>
</tr>
<tr>
<td>Connection</td>
<td>Connector or cable connection</td>
</tr>
<tr>
<td>EMC testing</td>
<td>EN 55016-2-3 (industrial and residential area)</td>
</tr>
<tr>
<td>Radio interference emission</td>
<td>EN 61000-4-2 Severity level 3</td>
</tr>
<tr>
<td>Static electricity (ESD)</td>
<td>EN 61000-4-3 Severity level 3</td>
</tr>
<tr>
<td>Electromagnetic fields (RFI)</td>
<td>EN 61000-4-4 Severity level 3</td>
</tr>
<tr>
<td>Fast transient interference pulses (BURST)</td>
<td>EN 61000-4-5 Severity level 2</td>
</tr>
<tr>
<td>Surge voltage</td>
<td>EN 61000-4-6 Severity level 3</td>
</tr>
<tr>
<td>Conducted interference induced by high-frequency fields</td>
<td>EN 61000-4-8 Severity level 4</td>
</tr>
<tr>
<td>Magnetic fields</td>
<td>EN 61000-4-8 Severity level 4</td>
</tr>
<tr>
<td>Standard nominal strokes [mm] with an 8 mm outer tube, the max. nominal stroke is 1016 mm</td>
<td>0025...7620 mm in 1 mm increments</td>
</tr>
</tbody>
</table>

**Rugged and compact**

- Bolt-in design
- Stainless steel

For more information, visit us online!

www.comoso.com
Pressure rated to 600 bar (8700 psi) bar, high repeatability, non-contact, robust

The BTL Micropulse Transducer is a robust position measuring system for measuring ranges between 25 and 7620 mm under extreme ambient conditions. The actual measurement section 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.

### BTL7 Compact H/W Rod

#### General data

- **Series:** BTL7 compact H/W Rod
- **Shock load:** 150 g/6 ms as per EN 60068-2-27
- **Vibration:** 20 g, 10...2000 Hz per EN 60068-2-6
- **Polarity reversal protected:** to 36 V
- **Overvoltage protection:** to 36 V
- **Dielectric strength:** 500 V AC (GND to housing)
- **Degree of protection as per IEC 60529:** IP 68 with cable outlet, IP 67 with screwed-on connector BKS-S...
- **Housing material:** Anodized aluminum/1.4571 stainless steel outer tube, 1.3952 stainless steel cast flange
- **Fasteners:** Design H M15×1.5 thread
- **Design W 3/4”-16UNF**
- **Pressure rating:**
  - at 10.2 mm, protective tube: 600 bar with installation in hydraulic cylinder
  - at 8 mm, protective tube: 250 bar when installed in hydraulic cylinder
- **Connection:** Connector or cable connection
- **EMC testing:**
  - Radio interference emission: EN 55016-2-3 (industrial and residential area)
  - Static electricity (ESD): EN 61000-4-2 Severity level 3
  - Electromagnetic fields (RFI): EN 61000-4-3 Severity level 3
  - Fast transient interference pulses (BURST): EN 61000-4-4 Severity level 3
  - Surge voltage: EN 61000-4-5 Severity level 2
  - Conducted interference induced by high-frequency fields: EN 61000-4-6 Severity level 3
  - Magnetic fields: EN 61000-4-8 Severity level 4
- **Standard nominal strokes [mm]**
  - with an 8 mm outer tube, the max. nominal stroke is 1016 mm
  - Stroke lengths up to 7620 mm

- **Thread-in design**
- **Stainless steel**
Rod Compact BTL7

General data

Features of Micropulse BTL7-A/C/E/G...H, K, W
- Non-contact detection of piston position
- Insensitive to contamination to IP 68
- Shock and vibration resistant 150 g/20 g
- Absolute output signal
- Measurement lengths 25 to 7620 mm in 1 mm increments
- Flexibly adjustable measuring range through button programming
- High measurement rate up to 4 kHz
- Temperature range -40 to +85°C

Micropulse Transducer BTL7 Compact with BTL-A-CB02 Calibration Box
With the BTL-A-CB02 Calibration Box, the slope (rising or falling) of the position measuring system can be easily and quickly adapted to the requirements of the hydraulic cylinder and the application. With simple plug & play, without PC, laptop or extensive software downloading, the measuring range as well as the slope of the output characteristic are set. The setting option saves storage and setup costs, since a Micropulse BTL7 Compact can fulfill different requirements where, in the past, several systems were required.

Series
Output signal
Transducer interface
Customer device interface

Part number
Output voltage
Output current
Load current
Load resistance
System resolution
Repeat accuracy
Measurement rate, length-dependent
Max. linearity deviation

Temperature coefficient
Supply voltage
Current consumption at 24 V DC
Polarity reversal protected
Overvoltage protection
Dielectric strength
Operating temperature

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

Scope of delivery
- Transducer
- Quick start instructions
- Stainless steel fastening screws “600 bar”

Please order separately:
Calibration box, page 178
Magnets/Floats, page 166
Mating cables/Connectors, page 236 and 244

Set the output characteristic with the calibration box.
Zero and end points, measuring range, rising and falling characteristic

Measurement rate to 4 kHz
Rod Compact BTL7

**General data**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Commonly specified stroke lengths:</th>
</tr>
</thead>
<tbody>
<tr>
<td>analog A</td>
<td>0...10 V and 10...0 V</td>
</tr>
<tr>
<td>analog BTL7</td>
<td>Max. 5 mA</td>
</tr>
<tr>
<td>analogG</td>
<td>≤ 0.33 mV</td>
</tr>
<tr>
<td>System resolution: 2 µm Max. 4 kHz</td>
<td>≤ 0.01% FS &gt; 5500 mm nominal stroke ≤ 0.2% FS &gt; 5500 mm nominal stroke ≤ 30 ppm/K</td>
</tr>
<tr>
<td>≤ 50 µm to ≤ 500 mm nominal stroke</td>
<td>10...30 V DC ≤ 150 mA to 36 V to 36 V 500 V AC (ground to housing) –40...+85 °C</td>
</tr>
<tr>
<td>≤ 0.01% FS &gt; 5500 mm nominal stroke</td>
<td>4...20 mA or 20...4 mA ≤ 0.66 µA System resolution: 2 µm Max. 4 kHz ≤ 0.2% FS &gt; 5500 mm nominal stroke ≤ 30 ppm/K 10...30 V DC ≤ 150 mA to 36 V to 36 V 500 V AC (ground to housing) –40...+85 °C</td>
</tr>
<tr>
<td>≤ 0.02% FS &gt; 5500 mm nominal stroke</td>
<td>≤ 0.66 µA System resolution: 2 µm Max. 4 kHz ≤ 30 ppm/K 10...30 V DC ≤ 150 mA to 36 V to 36 V 500 V AC (ground to housing) –40...+85 °C</td>
</tr>
<tr>
<td>≤ 30 ppm/K 10...30 V DC ≤ 150 mA to 36 V to 36 V 500 V AC (ground to housing) –40...+85 °C</td>
<td></td>
</tr>
</tbody>
</table>

**Ordering example:**

BTL7-50-M

<table>
<thead>
<tr>
<th>Output signal</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>analog A</td>
<td>0...10 V and 10...0 V</td>
</tr>
<tr>
<td>analog BTL7</td>
<td>Max. 5 mA</td>
</tr>
<tr>
<td>analogG</td>
<td>≤ 0.33 mV</td>
</tr>
<tr>
<td>System resolution: 2 µm Max. 4 kHz</td>
<td>≤ 0.01% FS &gt; 5500 mm nominal stroke ≤ 0.2% FS &gt; 5500 mm nominal stroke ≤ 30 ppm/K</td>
</tr>
<tr>
<td>≤ 50 µm to ≤ 500 mm nominal stroke</td>
<td>10...30 V DC ≤ 150 mA to 36 V to 36 V 500 V AC (ground to housing) –40...+85 °C</td>
</tr>
<tr>
<td>≤ 0.01% FS &gt; 5500 mm nominal stroke</td>
<td>4...20 mA or 20...4 mA ≤ 0.66 µA System resolution: 2 µm Max. 4 kHz ≤ 0.2% FS &gt; 5500 mm nominal stroke ≤ 30 ppm/K 10...30 V DC ≤ 150 mA to 36 V to 36 V 500 V AC (ground to housing) –40...+85 °C</td>
</tr>
<tr>
<td>≤ 0.02% FS &gt; 5500 mm nominal stroke</td>
<td>≤ 0.66 µA System resolution: 2 µm Max. 4 kHz ≤ 30 ppm/K 10...30 V DC ≤ 150 mA to 36 V to 36 V 500 V AC (ground to housing) –40...+85 °C</td>
</tr>
<tr>
<td>≤ 30 ppm/K 10...30 V DC ≤ 150 mA to 36 V to 36 V 500 V AC (ground to housing) –40...+85 °C</td>
<td></td>
</tr>
</tbody>
</table>

**Design**

K bolt-in design
10.2 mm Ø pressure tube 40 mm null point

K9 bolt-in design
8 mm Ø pressure tube 40 mm null point

K9 bolt-in design
8 mm Ø pressure tube 40 mm null point

W3/4*16 UNF thread-in design
10.2 mm Ø pressure tube 50.8 mm (2") null point

W8 3/4*16 UNF thread-in design
8 mm Ø diameter pressure tube 50.8 mm (2") null point

H M18 x 1.5 thread-in design
8 mm Ø diameter pressure tube 40 mm null point

H M18 x 1.5 thread-in design
8 mm Ø diameter pressure tube 8 mm null point

**Connection**

K-radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 10 m K15 PUR cable 15 m

H-W radial design
K02 PUR cable 2 m K05 PUR cable 5 m

K10 PUR cable 15 m K15 PUR cable 15 m

S32 Connector, 8-pole, M16

S115 Connector, 8-pole, M12
**Easy field set-up**

**Calibration box**

<table>
<thead>
<tr>
<th>Calibration boxes with cable sets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part number</strong></td>
</tr>
<tr>
<td>BTL7-A-CB02</td>
</tr>
<tr>
<td>BTL7-A-CB02-S115</td>
</tr>
<tr>
<td>BTL7-A-CB02-S32</td>
</tr>
</tbody>
</table>

**Micropulse Transducer BTL7 Rod Compact with “Calibration box” BTL-A-CB02**

Set the output characteristic with the calibration box.
Zero and end point, measuring range, rising or falling characteristic.

**Teach-in**

The factory-set zero and end points are replaced by new zero and end points. The zero and end points can be set independently of each other, and the characteristic slope changes.

**Inverting (only with BTL7-C/E)**

The slope of the current output can be inverted by activating the programming inputs. For example, the rising characteristic of the output becomes a falling characteristic.
The voltage outputs are not inverted.

**Adjusting**

Setting and adjusting the characteristic with stopped magnet. The factory-set zero and end points can be replaced by a new start and end points, and the associated output values can be adjusted. The start and end values can be adjusted as desired to the limits. Adjustment is possible from serial number 120615000xxxxxx xx.

**Reset**

Restoring the transducer to its factory default settings.
BTL Compact – the standard in power plant and process engineering

Balluff, as the first manufacturer of magnetostrictive position measuring systems, presented the BTL Compact, with a length of only 34 mm, as an innovation as early as the 1995 Hanover trade fair. The target applications were hydraulically actuated valve drives in power plant and process engineering. In the meantime, thousands of BTL Compacts all over the world reliably measure the current position of valves and guarantee safe, dependable and perfect control.

Balluff is once again achieving new benchmarks with the new generation, the Micropulse BTL7 Compact. The position measuring system, which is 100% backward-compatible with the existing BTL5 generation, impresses with its improvement in many types of performance data and a large number of extensions in application and function.

The BTL Compact integrated in the hydraulic cylinder of a hydraulically actuated servo drive guarantees safe, reliable control of the flow.
Rod Compact K BTL5

General data

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

The BTL Micropulse Transducer is a robust position measuring system for measuring ranges between 25 and 5500 mm as well as for use under extreme ambient conditions. The actual measurement section is protected in a high-pressure resistant stainless steel tube. The system is ideally suited for use in hydraulic cylinders for position feedback or as a level monitor with aggressive media in the food and chemical industries.

<table>
<thead>
<tr>
<th>Series</th>
<th>Rod Compact K BTL5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock load</td>
<td>100 g/6 ms according to EN 60068-2-27 and 100 g/2 ms</td>
</tr>
<tr>
<td></td>
<td>according to EN 60068-2-29</td>
</tr>
<tr>
<td>Vibration</td>
<td>12 g, 10...2000 Hz according to EN 60068-2-6</td>
</tr>
<tr>
<td>Polarity reversal protected</td>
<td>yes</td>
</tr>
<tr>
<td>Overvoltage protection</td>
<td>TransZorb protection diodes</td>
</tr>
<tr>
<td>Dielectric strength</td>
<td>500 V DC (GND to housing)</td>
</tr>
<tr>
<td>Degree of protection as per IEC 60529</td>
<td>IP 67 (with IP-67 connector BKS-S... attached); IP 68 (5 bar with cable)</td>
</tr>
<tr>
<td>Housing material</td>
<td>Stainless steel 1.4305</td>
</tr>
<tr>
<td>Flange and tube material</td>
<td>Tube stainless steel 1.4571, flange 1.4571 or 1.4429 or 1.4404</td>
</tr>
<tr>
<td>Housing attachment</td>
<td>Design K, 18h6 with 6 cylinder head screws</td>
</tr>
<tr>
<td>Connection</td>
<td>Connector or cable connection</td>
</tr>
<tr>
<td>Connector suggestion, see page 232/233</td>
<td>BKS-S 32M/BKS-S 32M-C/BKS-S 33M</td>
</tr>
<tr>
<td>EMC testing</td>
<td></td>
</tr>
<tr>
<td>Radio interference emission</td>
<td>EN 55016-2-3 (industrial and residential area)</td>
</tr>
<tr>
<td>Static electricity (ESD)</td>
<td>EN 61000-4-2 Severity level 3</td>
</tr>
<tr>
<td>Electromagnetic fields (RFI)</td>
<td>EN 61000-4-3 Severity level 3</td>
</tr>
<tr>
<td>Fast transient interference pulses (BURST)</td>
<td>EN 61000-4-4 Severity level 3</td>
</tr>
<tr>
<td>Conducted interference induced by high-frequency fields</td>
<td>EN 61000-4-6 Severity level 3</td>
</tr>
<tr>
<td>Standard nominal strokes [mm]</td>
<td>0025...5500 mm in 1 mm increments, depending on the interface</td>
</tr>
</tbody>
</table>

Note:
The information on pages 180 through 189 covers the Compact K housing and H/W housing transducer with digital, SSI and fieldbus outputs only.

For analog output versions see the BTL7 compact rod, starting on page 172.
Rod Compact K BTL5

General data

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

Design K, BTL5-...-M_ _ _ _-K-K_ _
**Rod Compact H/W BTL5**  
**General data**

<table>
<thead>
<tr>
<th>Property</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Series</strong></td>
<td>BTL5 Rod Compact H</td>
</tr>
<tr>
<td><strong>Shock load</strong></td>
<td>100 g/6 ms in accordance with EN 60068-2-27 and 100 g/2 ms in accordance with EN 60068-2-29</td>
</tr>
<tr>
<td><strong>Vibration</strong></td>
<td>12 g, 10...2000 Hz in accordance with EN 60068-2-6</td>
</tr>
<tr>
<td><strong>Polarity reversal protected</strong></td>
<td>yes</td>
</tr>
<tr>
<td><strong>Overvoltage protection</strong></td>
<td>TransZorb protection diodes</td>
</tr>
<tr>
<td><strong>Dielectric strength</strong></td>
<td>500 V DC (GND to housing)</td>
</tr>
<tr>
<td><strong>Degree of protection as per IEC 60529</strong></td>
<td>IP 67 (with IP-67 connector BKS-S... attached); IP 68 (5 bar with cable)</td>
</tr>
<tr>
<td><strong>Design material</strong></td>
<td>Stainless steel 1.4305</td>
</tr>
<tr>
<td><strong>Flange and tube material</strong></td>
<td>Tube stainless steel 1.4571, flange 1.4571 or 1.4429 or 1.4404</td>
</tr>
<tr>
<td><strong>Housing attachment</strong></td>
<td>Design H thread M18×1.5, design W 3/4&quot;-16UNF</td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td>Connector or cable connection</td>
</tr>
<tr>
<td><strong>Connector suggestion</strong></td>
<td>see page 232/233</td>
</tr>
<tr>
<td><strong>BKS-S 32M/BKS-S 32M-C/BKS-S 33M</strong></td>
<td></td>
</tr>
</tbody>
</table>

**EMC testing**

- Radio interference emission: EN 55016-2-3 (industrial and residential area)
- Static electricity (ESD): EN 61000-4-2 Severity level 3
- Electromagnetic fields (RFI): EN 61000-4-3 Severity level 3
- Fast transient interference pulses (BURST): EN 61000-4-4 Severity level 3
- Conducted interference induced by high-frequency fields: EN 61000-4-6 Severity level 3

**Pressure-resistant to 600 bar, high repeatability, non-contact, robust**

The BTL Micropulse Transducer is a robust position measuring system for measuring ranges between 25 and 5500 mm as well as for use under extreme ambient conditions. The actual measurement section is protected in 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.

**Standard nominal strokes [mm]**: 0025...5500 mm in 1 mm increments
**P Interface**
The P interface is compatible with BTA evaluation units as well as with controllers and modules from various manufacturers including Siemens, B & R, Phoenix Contact, Mitsubishi, Sigmatek, Parker, Esitron, WAGO and others. Reliable signal transmission, even with cable lengths of up to 500 m between the BTA evaluation unit and the BTL transducer. This is guaranteed by the especially interference-proof RS485 differential drivers and receivers. Interference signals are effectively suppressed.

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

**Benefits**
- Position resolution 1 μm!
- The 1 μm resolution of the Micropulse position measuring 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
**Compact Rod**

**Digital pulse interface**

<table>
<thead>
<tr>
<th>Series</th>
<th>BTL5 Compact rod</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transducer interface</td>
<td>Pulse P</td>
</tr>
<tr>
<td>Customer device interface</td>
<td>Pulse P</td>
</tr>
<tr>
<td>Part number</td>
<td>BTL5-P1-M_ _ _ <em>-</em>-_ _ _ _</td>
</tr>
</tbody>
</table>

| System resolution             | processing-dependent       |
| Repeat accuracy               | 2 μm or ±1 digit depending on electronic evaluation unit |
| Resolution                    | ≤ 2 μm                    |
| Hysteresis                    | ≤ 4 μm                    |
| Measurement rate              | f_{STANDARD} = 1 kHz = ≤ 1400 mm |
| Max. linearity deviation      | ±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 consumption           | ≤ 100 mA                  |
| Operating temperature         | –40...+85 °C               |
| Storage temperature           | –40...+100 °C              |

Please order separately:
- Magnet/float, page 166
- Mounting nut, page 167 (for Rod Compact H)
- Connector, page 236

**Ordering example:**

BTL5-P1-M_ _ _ _-_-_ _ _ _

**Commonly specified stroke lengths:**

<table>
<thead>
<tr>
<th>mm</th>
<th>inches</th>
<th>mm</th>
<th>inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>0051</td>
<td>2</td>
<td>1524</td>
<td>60</td>
</tr>
<tr>
<td>0102</td>
<td>4</td>
<td>1829</td>
<td>72</td>
</tr>
<tr>
<td>0152</td>
<td>6</td>
<td>2134</td>
<td>84</td>
</tr>
<tr>
<td>0203</td>
<td>8</td>
<td>2438</td>
<td>96</td>
</tr>
<tr>
<td>0254</td>
<td>10</td>
<td>2743</td>
<td>108</td>
</tr>
<tr>
<td>0305</td>
<td>12</td>
<td>3048</td>
<td>120</td>
</tr>
<tr>
<td>0407</td>
<td>16</td>
<td>3333</td>
<td>132</td>
</tr>
<tr>
<td>0508</td>
<td>20</td>
<td>3658</td>
<td>144</td>
</tr>
<tr>
<td>0610</td>
<td>24</td>
<td>3962</td>
<td>156</td>
</tr>
<tr>
<td>0762</td>
<td>30</td>
<td>4267</td>
<td>168</td>
</tr>
<tr>
<td>0914</td>
<td>36</td>
<td>4572</td>
<td>180</td>
</tr>
<tr>
<td>1067</td>
<td>42</td>
<td>4877</td>
<td>192</td>
</tr>
<tr>
<td>1220</td>
<td>48</td>
<td>5182</td>
<td>204</td>
</tr>
<tr>
<td>1372</td>
<td>54</td>
<td>5486</td>
<td>216</td>
</tr>
</tbody>
</table>

*Additional stroke lengths available*

Inch to millimeter conversion:

Inches × 25.4 = millimeters

**Design**

K bolt-in design
10.2 mm Ø pressure tube

K8 bolt-in design
8 mm Ø pressure tube

W 3/4"-16 UNF thread-in design
10.2 mm Ø pressure tube
50.8 mm (2") null point

W 8 3/4"-16 UNF thread-in design
8 mm Ø diameter pressure tube
50.8 mm (2") null point

H M18 x 1.5 thread-in design
10.2 mm Ø pressure tube
30 mm null point

**Connection**

Radial output
K02  PUR cable 2 m
K05  PUR cable 5 m
K10  PUR cable 10 m
K15  PUR cable 15 m
SR32  Connector

Axial output
KA02  PUR cable 2 m
KA05  PUR cable 5 m
KA10  PUR cable 10 m
KA15  PUR cable 15 m
S32  Connector

**Installation notices**

AR BTL6 rod
General data
Analog interface
Digital pulse interface
Installation notices

**Accessories**

Basic Information and Definitions
Standard SSI interface

The synchronous serial data transmission uses controllers from various manufacturers, such as Siemens, Bosch Rexroth, WAGO, B & R, Parker, Esitrorn, PEP and others and the Balluff BDD-AM 10-1-SSD and BDD-CC 08-1-SSID display and control units. Reliable signal transmission, even with cable lengths of up to 400 m between controller and BTL transducer. This is guaranteed by the especially interference-free RS485/422 differential drivers and receivers. Any interference signals are effectively suppressed.

Synchronized BTL5-S1_ _B-M_ _ _ _-_ _ _ _-_ SSI interface

Micropulse Transducers with synchronized SSI interface are well suited for dynamic control applications. Data acquisition in the transducer is synchronized using the controller’s external clock, allowing an optimum speed calculation to be performed in the controller.

A prerequisite for this synchronous method of transducer operation is time stability of the clock signal.

The maximum scan rate $f_s$ at which a new current value is generated for each scan, can be derived from the table:

The clock frequency depends on the cable length.

### Nominal stroke area

<table>
<thead>
<tr>
<th>Nominal stroke area</th>
<th>Scan rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 100 mm</td>
<td>1500 Hz</td>
</tr>
<tr>
<td>100 mm &lt; Nominal stroke ≤ 1000 mm</td>
<td>1000 Hz</td>
</tr>
<tr>
<td>1000 mm &lt; Nominal stroke ≤ 1400 mm</td>
<td>666 Hz</td>
</tr>
<tr>
<td>1400 mm &lt; Nominal stroke ≤ 2600 mm</td>
<td>500 Hz</td>
</tr>
<tr>
<td>≥ 2600 mm</td>
<td>333 Hz</td>
</tr>
</tbody>
</table>

### Cable length

<table>
<thead>
<tr>
<th>Cable length</th>
<th>Clock frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 25 m</td>
<td>1000 kHz</td>
</tr>
<tr>
<td>&lt; 50 m</td>
<td>500 kHz</td>
</tr>
<tr>
<td>&lt; 100 m</td>
<td>400 kHz</td>
</tr>
<tr>
<td>&lt; 200 m</td>
<td>200 kHz</td>
</tr>
<tr>
<td>&lt; 400 m</td>
<td>100 kHz</td>
</tr>
</tbody>
</table>

### Ordering example:

**BTL5-S1_ _-M_ _ _ _-_-_ _ _ _-_C** for asynchronous operation

**BTL5-S1_ _B-M_ _ _ _-_-_ _ _ _-_C** for synchronous operation

<table>
<thead>
<tr>
<th>Coding</th>
<th>System resolution</th>
<th>Commonly specified stroke lengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Binary code</td>
<td>1 μm 1220 48</td>
</tr>
<tr>
<td>1</td>
<td>Gray code</td>
<td>5 μm 1372 54</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>10 μm 1524 60</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>20 μm 1829 72</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>40 μm 2134 84</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>100 μm 2438 96</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>2 μm 2743 108</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>2 μm 3048 120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 μm 3658 144</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 μm 3962 156</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40 μm 4276 172</td>
</tr>
</tbody>
</table>

Additional stroke lengths available

Inch to millimeter conversion:

**www.comoso.com**
Compact and synchronous

Rod Compact SSI interface

Series | Rod Compact BTL5
---|---
Output signal | Synchronous-serial
Transducer interface | S
Customer device interface | Synchronous-serial
Part number | BTL5-S1__M__---
Part number synchronization | BTL5-S1__B-M__---
System resolution depending on model (LSB) | 1, 2, 5, 10, 20, 40 or 100 μm
Repeat accuracy | ±1 digit
Hysteresis | ≤ 1 digit
Measurement rate | f_{STANDARD} = 2 kHz
Max. linearity deviation | ±30 μm at ≤ 10 μm resolution or ±2 LSB
Temperature coefficient of overall system | (6 μm + 5 ppm × L)/°C
Supply voltage | 20...28 V DC
Current consumption | ≤ 80 mA
Operating temperature | –40...+85 °C
Storage temperature | –40...+100 °C

Clock sequence

Ordering example:

BTL5-S1__M__--- for asynchronous operation
BTL5-S1__B-M__--- for synchronous operation

Please enter code for coding, system resolution, nominal stroke, design and connection in the part number.

Scope of delivery
- Transducer
- Quick start instructions

Please order separately:
- Magnet/float, page 166
- Mounting nut, page 167
- Connector, page 236

Coding | System resolution | Commonly specified stroke lengths: |
---|---|---|
0 | Binary code rising (24-bit) | 0001 1 μm 1220 48
1 | 0102 2 μm 1372 54
2 | 0152 3 μm 1524 60
3 | 0203 4 μm 1829 72
4 | 0254 5 μm 2134 84
5 | 0305 10 μm 2438 96
6 | 0407 16 mm 2743 108
7 | 0508 20 mm 3048 120
8 | 0610 24 mm 3353 132
9 | 0712 30 mm 3658 144
A | 0814 36 mm 3962 156
B | 1067 42

Additional stroke lengths available

Inch to millimeter conversion:

<table>
<thead>
<tr>
<th>Inches</th>
<th>Millimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.051</td>
<td>1.27</td>
</tr>
<tr>
<td>0.1</td>
<td>2.54</td>
</tr>
<tr>
<td>0.152</td>
<td>3.81</td>
</tr>
<tr>
<td>0.203</td>
<td>5.11</td>
</tr>
<tr>
<td>0.254</td>
<td>6.41</td>
</tr>
<tr>
<td>0.305</td>
<td>7.72</td>
</tr>
<tr>
<td>0.407</td>
<td>10.31</td>
</tr>
<tr>
<td>0.508</td>
<td>12.95</td>
</tr>
<tr>
<td>0.610</td>
<td>15.49</td>
</tr>
<tr>
<td>0.712</td>
<td>18.09</td>
</tr>
<tr>
<td>0.814</td>
<td>20.66</td>
</tr>
</tbody>
</table>

Design
- K bolt-in design
  10.2 mm Ø pressure tube
  40 mm null point
- K8 bolt-in design
  8 mm Ø pressure tube
  40 mm null point
  (max. stroke length = 1016 mm)
- W 3/4"-16 UNF thread-in design
  10.2 mm Ø pressure tube
  50.8 mm (2") null point
- W8 3/4"-16 UNF thread-in design
  8 mm Ø diameter pressure tube
  50.8 mm (2") null point
  (max. stroke length = 1016 mm)
- H M18 x 1.5 thread-in design
  10.2 mm Ø pressure tube
  30 mm null point
- H8 M18 x 1.5 thread-in design
  8 mm Ø diameter pressure tube
  30 mm null point
  (max. stroke length = 1016 mm)

Connection
- Radial output
  K02 PUR cable 2 m
  K05 PUR cable 5 m
  K10 PUR cable 10 m
  K15 PUR cable 15 m
- Axial output
  KA02 PUR cable 2 m
  KA05 PUR cable 5 m
  KA10 PUR cable 10 m
  KA15 PUR cable 15 m
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, in contrast to most other field bus protocols, according to the producer-consumer principle. This eliminates target addressing of the process data. Each bus node decides for itself how the received data is processed. The CANopen interface of the Micropulse Transducer is compatible with CANopen according to CiA Standard DS301 Rev. 3.0 as well as with CAL and Layer 2 CAN networks.

EDS

CANopen offers a high level of flexibility in configuring 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)

Micropulse Transducers send their measured values optionally in one, two or four PDOs with 8 bytes of data each. The contents of the PDOs are freely configurable. The following information can be sent:

- The current position of the magnet, with a resolution in 5 μm increments
- The current speed of the magnet, with resolution selectable in 0.1mm/s increments
- The current status of four freely programmable cams per magnet

Synchronization Object (SYNC)

SYNC serves as a network-wide trigger for synchronizing all network nodes. When the SYNC object is received, all Micropulse Transducers connected to the CANopen bus store their current position and speed information, and then send it sequentially to the controller. This assures time-synchronous detection of the measured values.

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 measuring range, a valid value is output for the first two positions and a defined error value for positions 3 and 4.

Emergency Object

The emergency object is sent with the highest priority. It is used, for example, to report errors or can be used for high-priority transfer of changes in the status of the cam.

Service Data Object (SDO)

Service data objects transmit the parameters for the configuration to the transducer. The transducer may be configured on the bus by the controller or offline with a bus analyzer/CANopen tool. The configuration is stored in the transducer’s non-volatile memory.

Use of multiple magnets

The minimum distance between the magnets must be 65 mm.
Rod Compact
CANopen® interface

Series
Output signal
Transducer interface
Customer device interface
Part number
CANopen
H
CANopen
BTL5-H1_ _-M_ _ _ _-_-_ _ _ _

CANopen Version
Repeat accuracy
System resolution, configurable
Speed
Hysteresis
Measurement rate
Max. linearity deviation
Temperature coefficient of overall system
Supply voltage
Current consumption
Operating temperature
Storage temperature
Cable length [m] per CiA DS301
Baud rate [kbaud] per CiA DS301

Potential-free
± 1 digit
5 μm increments
0.1 mm/s increments
≤ 1 digit
f_{STANDARD} = 1 kHz
±30 μm at 5 μm resolution
(6 μm + 5 ppm × L)/°C
20...28 V DC
≤ 100 mA
−40...+85 °C
−40...+100 °C
< 25 < 50 < 250 < 500 < 1000 < 1250 < 2500
1000 800 500 250 125 100 50 20/10

Please enter code for software configuration, baud rate, nominal stroke and design in the part number. Cable on request.

Scope of delivery
■ Transducer
■ Quick start instructions

Please order separately:
Magnet/float, page 166
Mounting nut, page 167
Connector, page 236

Ordering example:
BTL5-H1_ _-M_ _ _ _-_-_ _ _ _

Software configuration  Baud rate  Commonly specified stroke lengths:  Design  Connection
1  1 x position and 1 x speed 0  1 Mbaud 0051  2  1220  48  K bolt-in design
1  800 kbaud 0102  4  1372  54
1  500 kbaud 0152  6  1524  60
2  2 x position and 2 x speed 2  250 kbaud 0203  8  1829  72
3  4 x position 3  125 kbaud 0234  10  2134  84
4  100 kbaud 0305  12  2438  96
5  50 kbaud 0438  16  3048  120
6  20 kbaud 0538  20  3353  132
7  10 kbaud 0610  24  3658  144
8  10 kbaud 0762  30  3962  156
1067  42

Additional stroke lengths available
Inch to millimeter conversion:
Inches x 25.4 = millimeters

Using the CANopen interface and a cable up to 2500 m in length, the signal is sent at a length-dependent baud rate to the controller. The high interference immunity of the connection is achieved using differential drivers and by the data monitoring implemented in the data protocol.

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www.balluff.com

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www.comoso.com
Micropulse ProCompact with cable protection system

Extreme ambient conditions, in which high reliability and accuracy are required, are typical application areas for Micropulse ProCompact transducers. The non-contact working principle of the systems ensures a complete absence of wear and nearly endless service life. The high-precision output signal is available as an absolute signal for the controller in a wide range of different interfaces.

Application areas:
- Locks and floodgates
- Water power plants
- Large, hydraulically powered valves
- Positioning the reflection channels for thermosolar power plants
- Dredger
- Railway track
- Logging machines
- Hydroelectric power stations
- Construction machinery
- Combine harvesters

The outdoor system
IP 69K, 40 bar

Accessories for the cable protection system

<table>
<thead>
<tr>
<th>Series</th>
<th>Adapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordering code</td>
<td>BAM01JW</td>
</tr>
<tr>
<td>Part number</td>
<td>BAM AD-XA-007-M18×1.5/D12-2</td>
</tr>
<tr>
<td>Housing material</td>
<td>Brass (not seawater-resistant)</td>
</tr>
<tr>
<td>Ordering code</td>
<td>BAM01JY</td>
</tr>
<tr>
<td>Part number</td>
<td>BAM AD-XA-007-M18×1.5/D12-4</td>
</tr>
<tr>
<td>Housing material</td>
<td>Stainless steel V2A (conditionally seawater-resistant)</td>
</tr>
<tr>
<td>Series</td>
<td>Protective hose</td>
</tr>
<tr>
<td>Part number</td>
<td>BAM PT-XA-001-005-0-000-000</td>
</tr>
<tr>
<td>Tube length</td>
<td>02, 05, 10, 15, 20, 30, 50 and 100 m</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP 68 (40 bar)</td>
</tr>
<tr>
<td></td>
<td>IP 67K (in installed and screwed-on state)</td>
</tr>
<tr>
<td>Housing material</td>
<td>PUR (resistant to seawater, weld spatter and UV radiation)</td>
</tr>
<tr>
<td>Outer diameter</td>
<td>16 mm</td>
</tr>
<tr>
<td>Inside diameter</td>
<td>9.5 mm</td>
</tr>
<tr>
<td>Temperature range</td>
<td>–40...+95 °C</td>
</tr>
<tr>
<td>Bending radius min. (static)</td>
<td>51 mm</td>
</tr>
</tbody>
</table>
Rod ProCompact HB/WB BTL5
General data

Series
Rod ProCompact HB/WB BTL5

Shock load
100 g/6 ms per EN 60068-2-27 and 100 g/2 ms per EN 60068-2-29

Vibration
12 g, 10...2000 Hz per EN 60068-2-6

Polarity reversal protected
yes

Overvoltage protection
TransZorb protection diodes

Dielectric strength
500 V DC (GND to housing)

Degree of protection as per IEC 60529
IP 68 (5 bar with cable); IP 69K, 40 bar (with cable protection system)

Housing material
Stainless steel 1.4404

Flange and tube material
Stainless steel tube 1.4571, flange 1.4404

Housing attachment
Flange with thread

Connection
Cable connection

EMC testing
Radio interference emission
EN 55016-2-3 (industrial and residential area)
Static electricity (ESD)
EN 61000-4-2 Severity level 3
Electromagnetic fields (RFI)
EN 61000-4-3 Severity level 3
Rapid, transient electrical pulses (burst)
EN 61000-4-4 Severity level 3
by high-frequency fields
EN 61000-4-6 Severity level 3

Standard nominal strokes [mm]
0025...5500 mm in 1 mm increments

HB/WB housing
BTL5-...-HB/WB-_ _ _ _-C
axial

HB: 30 mm
WB: 2"
Rated length = measuring range

Position encoder
Damping zone (unusable range)

M4×4/6 deep Internal thread

HB: M18×1.5
WB: 3/4"-16 UNF

HB/WB housing
BTL5-...-HB/WB-_ _ _ _-C
radial

HB: 30 mm
WB: 2"
Rated length = measuring range

Position encoder
Damping zone (unusable range)

M4×4/6 deep Internal thread

HB: M18×1.5
WB: 3/4"-16 UNF

Mounting surface
0.5/Ø 25

A (1:1)
Micropulse ProCompact with cable protection system

Extreme ambient conditions, in which high reliability and accuracy are required, are typical application areas for Micropulse ProCompact transducers. The non-contact working principle of the systems ensures a complete absence of wear and nearly endless service life. The high-precision output signal serves as an absolute signal for the controller in a wide range of different interfaces.

Application areas:
- Locks and floodgates
- Water power plants
- Large, hydraulically powered valves
- Positioning the reflection channels for thermosolar power plants
- Dredger
- Railway track
- Logging machines
- Hydroelectric power stations
- Construction machinery
- Combine harvesters

<table>
<thead>
<tr>
<th>Series</th>
<th>Output signal</th>
<th>Transducer interface</th>
<th>Customer device interface</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Part number</th>
<th>Output voltage</th>
<th>Output current</th>
<th>Load current</th>
<th>Max. residual ripple</th>
<th>Load resistance</th>
<th>System resolution</th>
<th>Hysteresis</th>
<th>Repeat accuracy</th>
<th>Measurement rate</th>
<th>Max. linearity deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Voltage output</td>
<td>Current output</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>Supply voltage</td>
<td>Current consumption</td>
<td>Polarity reversal protected</td>
<td>Overvoltage protection</td>
<td>Dielectric strength</td>
<td>Operating temperature</td>
<td>Storage temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Scope of delivery
- Transducer
- Quick start instructions

Please order separately:
- Magnet/float, on page 166
- Mounting nut, on page 167
Compact Rod
Analog interface

### BTL5 Compact rod
- **analog**
- **A**
- **E**
- **C**
- **G**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Commonly specified stroke lengths:</th>
<th>Design</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Rising and falling (output types A and G)</td>
<td>mm</td>
<td>inches</td>
<td>mm</td>
</tr>
<tr>
<td>42</td>
<td>16.5</td>
<td>4572</td>
<td>180</td>
</tr>
<tr>
<td>23</td>
<td>9</td>
<td>5080</td>
<td>200</td>
</tr>
<tr>
<td>7 Rising (output types C and E)</td>
<td>mm</td>
<td>inches</td>
<td>mm</td>
</tr>
<tr>
<td>58</td>
<td>2.28</td>
<td>4572</td>
<td>180</td>
</tr>
<tr>
<td>28</td>
<td>1.10</td>
<td>4572</td>
<td>180</td>
</tr>
<tr>
<td>610</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.05</td>
<td>0.02</td>
<td>128</td>
<td>5.04</td>
</tr>
<tr>
<td>0.10</td>
<td>0.04</td>
<td>241</td>
<td>9.52</td>
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<tr>
<td>0.15</td>
<td>0.06</td>
<td>355</td>
<td>13.94</td>
</tr>
<tr>
<td>0.20</td>
<td>0.08</td>
<td>468</td>
<td>18.42</td>
</tr>
<tr>
<td>Additional stroke lengths available</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connection notices</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR BTL6 rod</td>
</tr>
<tr>
<td>General data</td>
</tr>
<tr>
<td>Analog interface</td>
</tr>
<tr>
<td>Digital pulse interface</td>
</tr>
<tr>
<td>SSI interface</td>
</tr>
<tr>
<td>CANopen interface</td>
</tr>
<tr>
<td>HB/WB BTL5</td>
</tr>
<tr>
<td>Rod EX, T redundant and CD</td>
</tr>
</tbody>
</table>

### Ordering example:

**BTL5-E1-M-HB/WB-C**
SSI-SYNC – better control behavior and higher dynamics
The absolute position information from the Micropulse Transducer is transmitted synchronously to the axis control card. This synchronous data acquisition permits a precise calculation of the speed and acceleration.
The feedback of these status sizes (speed and acceleration) allows the damping and natural frequency of a hydraulic system to be increased. These measures permit greater control and, with it, better control behavior and higher dynamics.

Application with hydraulic cylinder in a control circuit

Micropulse Transducer BTL5 S1...

Control card with SSI interface for connecting Micropulse Transducers

www.comoso.com
Installation of BTL Rod Compact H

The Micropulse Transducer BTL has an M18×1.5 mounting thread. We recommend that the mounting is made of non-magnetizable material. If magnetizable materials are used, then the measures shown below have to be taken. Sealing is done at the flange mounting surface using the supplied 15.4×2.1 O-ring with M18×1.5 thread.

Installation of BTL5 Rod Compact W

The Micropulse Transducer BTL has a M18×1.5 mounting thread. We recommend that the mounting is made of non-magnetizable material. If magnetizable materials are used, then the measures shown below have to be taken. Sealing is at the flange mounting surface using the supplied 15.4×2.1 O-ring with M18×1.5 thread.

Installation BTL5 Rod Compact K

The Micropulse Transducer has 6 mounting holes for cylinder head screws (ISO 4762 M6×18 A2-70). We recommend that the holder is made of non-magnetizable material. If magnetizable materials are used, the measures described above have to be taken. Sealing is at the flange mounting surface using the supplied 15.4×2.1 mm O-ring.

Countsink for O-ring

Tapped hole 3/4” 16 UNF thread

Spacer made of non-magnetizable material

Magnet

A Spacer made of non-magnetizable material

B Magnet

1-2 with magnetizable material

3-4 with non-magnetizable material

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact K BTL5

H/W BTL5

BTL7

K BTL5

H/W BTL5

Digital pulse interface

SSI interface

CANopen interface

HB/WB BTL5

Analog interface

Installation notices

Rod AR BTL6

General data

Analog interface

Digital pulse interface

Installation notices

Rod EX,

T redundant and CD

SF Filling

Level Sensor

Accessories

Basic Information and Definitions
Position detection in mobile hydraulics
Sensors are being used more and more to extend the lifetime and increase safety in mobile working machines.

The new Micropulse AR Transducer senses the piston position in mobile hydraulic cylinders.

The sensor operates according to the proven Balluff magnetostrictive measuring principle. The compact size of the sensor makes it ideal for use in slender joint bearings and spherical eye end cylinders or large bore cylinders.

The electronic evaluation unit integrated in the sensor has been designed to meet the strict EMC Directives for industrial lift trucks, agricultural and forestry equipment and earthmoving machinery.

Compatibility testing according to EMC Directives
ISO 14982 Agricultural and Forestry Machinery
ISO 13766 Earthmoving Machinery
ISO 7637-1/2/3 Road Vehicles
EN 12895 Industrial Trucks
EN 50121-3-2 Railway Applications
ISO 11452-5 Electromagnetic HF field, 200 V/m

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Series | Rod AR BTL6
---|---
Shock load | 100 g/6 ms as per EN 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 V DC (GND to housing)
Degree of protection as per IEC 60529 | IP 67
Housing material | Stainless steel outer tube 1.4571, stainless steel flange 1.4404
Pressure rating |
- at 10.2 mm, with protective tube E2 | 350 bar installed in hydraulic cylinder
- at 8 mm, with protective tube E28 | 250 bar when installed in hydraulic cylinder
Connection | Cable connection or stranded wire

EMC testing
- Radio interference emission | EN 55016-2-3 (industrial and residential area)
- Static electricity (ESD) | EN 61000-4-2 Severity level 3
- Electromagnetic fields (RFI) | EN 61000-4-3 Severity level 3
- Fast transient interference pulses (BURST) | EN 61000-4-4 Severity level 3
- Surge voltage | EN 61000-4-5 Severity level 2
- Line-induced disturbances | EN 61000-4-6 Severity level 3
- Magnetic fields | EN 61000-4-8 Severity level 4

Standard nominal strokes [mm]
- with 8 mm outer tube (style E28), the max. nominal stroke is 1016 mm
- 0050...1524 mm in 1 mm increments
**Rod AR BTL6**

**General data**

**Design E2/E28**  
BTL6-...-E2/E28-_ _ _ _-KA

**Cable outlet**  
axial centric

---

**Design E2/E28**  
BTL6-...-E2/E28-_ _ _ _-LA

**Cable outlet**  
axial with stranded wire

---

<table>
<thead>
<tr>
<th>A</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>E2</td>
<td>10.2 Thread M4×4/6 deep</td>
</tr>
<tr>
<td>E28</td>
<td>8 without thread</td>
</tr>
</tbody>
</table>

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**Magnet**

**Nominal stroke = measuring range**

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**Damping zone (unusable range)**

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**Micropulse Transducers**

Profile P
Profile PF
Profile AT
Profile BIW
Rod
Rod Compact
K BTL7
H/W BTL7
BTL7
K BTL5
H/W BTL5
Digital pulse interface
SSI interface
CANopen interface
HB/WB BTL5
Analog interface
Installation notices

---

**Rod AR BTL6**

**General data**

**Analog interface**

**Digital pulse interface**

**Installation notices**

---

**SF Filling Level Sensor**

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**Accessories**

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**Basic Information and Definitions**

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**www.balluff.com**

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The position encoder’s position is determined from the runtime of an ultrasonic wave, triggered by magnetostriction. It is output as an analog value and has a rising characteristic. This is done with high precision and reproducibility within the measuring range designated as the rated length. If there is no position encoder within the measuring range, an error signal is output. There is a damping zone at the rod end. This zone may be traversed, but is not useful for metrology purposes. The electrical connection between the transducer, the controller and the power supply is established using a cable or stranded wire.

**Position encoder position**
- Within the measuring range (1)
- Position encoder not available (2)

---

**Ordering example:**

```
B T L 6 - _ 5 0 0 - M - - - - - - -
```

**Output signal**
- A 0...10 V
- B 0...5 V
- E 4...20 mA

**Standard nominal strokes [mm]**
- 0050...2000 mm in 1-mm increments

**Design**
- E2 Protective tube Ø 10.2 mm
- E28 Protective tube Ø 8 mm, max. rated length 1016 mm

**Commonly specified stroke lengths:**

<table>
<thead>
<tr>
<th>mm</th>
<th>inches</th>
<th>mm</th>
<th>inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>0051</td>
<td>2</td>
<td>0610</td>
<td>24</td>
</tr>
<tr>
<td>0102</td>
<td>4</td>
<td>0762</td>
<td>30</td>
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<td>0203</td>
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<td>1220</td>
<td>48</td>
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<tr>
<td>0305</td>
<td>12</td>
<td>1372</td>
<td>54</td>
</tr>
<tr>
<td>0407</td>
<td>16</td>
<td>1524</td>
<td>60</td>
</tr>
<tr>
<td>0508</td>
<td>20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Pigtail* connector systems “ZA” See page 249.

For more information, visit us online!

www.comoso.com
### Rod AR BTL6
**Analog interface**

<table>
<thead>
<tr>
<th>Rod AR BTL6</th>
<th>Rod AR BTL6</th>
<th>Rod AR BTL6</th>
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</thead>
<tbody>
<tr>
<td>analog</td>
<td>analog</td>
<td>analog</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>E</td>
</tr>
<tr>
<td>BTL6-A500-M</td>
<td>BTL6-B500-M</td>
<td>BTL6-E500-M</td>
</tr>
</tbody>
</table>

- **0...10 V**
  - Max. 2 mA
  - $\leq 5$ mV
  - $\pm 1.5$ mV
  - System resolution/min. 2 μm
  - $f_{\text{STANDARD}} = 1$ kHz
  - $\pm 200 \mu V$ to 500 mm nominal stroke
  - typ. $\pm 0.02\% \pm 500$ nominal stroke
  - $[150 \mu V/^\circ C + (5 \text{ ppm} /^\circ C \times P \times U/L) \times \Delta T]$
  - $[0.6 \mu A/^\circ C + (10 \text{ ppm} /^\circ C \times P \times I/L) \times \Delta T]$
  - 10...30 V DC
  - typ. $\leq 60$ mA
  - yes
  - yes
  - 500 V DC (ground to housing)
  - $-40...+85^\circ C$
  - $-40...+100^\circ C$

- **0...5 V**
  - Max. 2 mA
  - $\leq 2$ mV
  - $\pm 1.5$ mV
  - System resolution/min. 2 μm
  - $f_{\text{STANDARD}} = 1$ kHz
  - $\pm 200 \mu V$ to 500 mm nominal stroke
  - typ. $\pm 0.02\% \pm 500$ nominal stroke
  - $[150 \mu V/^\circ C + (5 \text{ ppm} /^\circ C \times P \times U/L) \times \Delta T]$
  - $[0.6 \mu A/^\circ C + (10 \text{ ppm} /^\circ C \times P \times I/L) \times \Delta T]$
  - 10...30 V DC
  - typ. $\leq 60$ mA
  - yes
  - yes
  - 500 V DC (ground to housing)
  - $-40...+85^\circ C$
  - $-40...+100^\circ C$

- **4...20 mA**
  - $\pm 500$ ohms
  - $\pm 7 \mu A$
  - System resolution/min. 2 μm
  - $f_{\text{STANDARD}} = 1$ kHz
  - $\pm 200 \mu V$ to 500 mm nominal stroke
  - typ. $\pm 0.02\% \pm 500$ nominal stroke
  - $[150 \mu V/^\circ C + (5 \text{ ppm} /^\circ C \times P \times U/L) \times \Delta T]$
  - $[0.6 \mu A/^\circ C + (10 \text{ ppm} /^\circ C \times P \times I/L) \times \Delta T]$
  - 10...30 V DC
  - typ. $\leq 60$ mA
  - yes
  - yes
  - 500 V DC (ground to housing)
  - $-40...+85^\circ C$
  - $-40...+100^\circ C$

---

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

**Scope of delivery**
- Transducer
- Quick start instructions

Please order separately:
- Magnet/float, page 166
P510 interface
The 510 interface is compatible with BTA evaluation units as well as with controllers and modules from various manufacturers including Siemens, B & R, Bosch, Phoenix Contact, Mitsubishi, Sigmatek, Parker, Esitron, WAGO and others. Reliable signal transmission, even with cable lengths of up to 500 m between the BTA evaluation unit and the transducer. This is guaranteed by the especially interference-proof RS485/differential drivers and receivers. Interference signals are effectively suppressed.

Universal P510 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 lies in how the edges are processed. The falling edges are processed in the P interface and the rising edges in the M interface. To reduce the number of different models to a minimum, the 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".

Extremely precise digitizing chip for P510 pulse interface
Companies developing their own electronic control and evaluation unit can create a highly accurate P interface cost effectively and with minimum effort using the Balluff digitizing chip. The digitizing chip was developed as a high-resolution, configurable ASIC for Micropulse Transducers with P interface.

Benefits
- High resolution: the actual 1 μm of the BTL position measuring system is supported completely by the 133 ps resolution of the chip (at low clock frequency 2 or 20 MHz).
- Position data from 4 magnets can be processed simultaneously
- 4/8-bit processor interface
Rod AR BTL6
Digital pulse interface

<table>
<thead>
<tr>
<th>Series</th>
<th>Rod AR BTL6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transducer interface</td>
<td>Pulse P510</td>
</tr>
<tr>
<td>Customer device interface</td>
<td>Pulse P510</td>
</tr>
<tr>
<td>Part number</td>
<td>BTL6-P510-M...</td>
</tr>
<tr>
<td>System resolution</td>
<td>processing-dependent</td>
</tr>
<tr>
<td>Repeat accuracy</td>
<td>≤ 10 μm</td>
</tr>
<tr>
<td>Repeatability</td>
<td>≤ 20 μm</td>
</tr>
<tr>
<td>Resolution</td>
<td>≤ 10 μm</td>
</tr>
<tr>
<td>Linearity deviation</td>
<td>±200 μm up to 500 mm nominal stroke</td>
</tr>
<tr>
<td></td>
<td>typ. ±0.02%, max. ±0.04% 500...1500 mm nominal stroke</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>10...30 V DC</td>
</tr>
<tr>
<td>Current consumption</td>
<td>≤ 60 mA (at 1kHz)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>−40...+85 °C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>−40...+100 °C</td>
</tr>
</tbody>
</table>

The rising and falling edges can be evaluated.

Please enter code for nominal stroke, design and connection in the part number.

**Scope of delivery**
- Transducer
- Quick start instructions

Please order separately:
Magnet/float, page 166

**Ordering example:**

BTL6-P510-M...-...-

- **Standard nominal strokes [mm]**
  - 0050...1524 mm in 1-mm increments
- **Design**
  - E2 Protective tube Ø 10.2 mm
  - E28 Protective tube Ø 8 mm, Max. rated length 1016 mm

- **Commonly specified stroke lengths:**

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<td></td>
</tr>
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- **Connection**
  - Axial output
    - KA02 PUR cable 2 m
    - KA05 PUR cable 5 m
    - KA10 PUR cable 10 m
    - KA15 PUR cable 15 m
    - KA20 PUR cable 20 m
  - Axial output
    - LA00,3 PUR stranded wire, 0.3 m
  - "Pigtail" connector systems "ZA"

  See page 249

Please order separately:
Magnet/float, page 166

www.comoso.com
Fixing the transducer using three M5 set screws at an angle of 120 °C

Set screw
DIN 914 M5×8

Installation examples

1. Installation on the piston, in magnetic piston material
2. Installation from rear, in magnetizable piston material
3. Installation on the piston
4. Installation on piston in a cylinder with articulated lug