Special Features
- For integration in pneumatic and hydraulic cylinders
- Touchless magnetostrictive measurement technology
- Operating pressure up to 350 bar, peaks up to 450 bar
- Ring-shaped position marker does not contact sensor
- Unlimited mechanical life
- No velocity limit for position marker
- Absolute output
- Outstanding accuracy performance up to 0.04 %
- Wide range of supply voltage
- Optimized for use in mobile applications with highest EMC requirements such as ISO pulses and high interferences to ISO 11452, exceeds E1 requirements
- Other configurations see separate data sheets

Applications
Hydraulic or pneumatic cylinders in
- Agricultural and forestry machinery
- Construction machines
- Vehicles with loading and unloading devices
- Vehicles with extension arms

The absolute position transducer can be used directly in-cylinder and thus enables a compact and cost-effective position measurement. The sensor consists of a stainless steel flange welded to a pressure tight rod and can therefore be used in harsh environments.

The magnetostrictive measuring technology offers excellent accuracy for measuring lengths up to 2000 mm.

The passive ring-shaped position marker allows a mechanically decoupled measurement.

<table>
<thead>
<tr>
<th>Description</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flange: SS 1.4307 / AISI 304L</td>
<td>Flange cover: AlSiMgBi</td>
</tr>
<tr>
<td>Rod: SS 1.4571 / AISI 316Ti</td>
<td>Sealing: O-ring NBR 90 SH A</td>
</tr>
</tbody>
</table>

| Mounting | Screwed into cylinder via bushing M18x1.5 for screw plug hole per ISO 6149 |

| Electrical connection | Connector M12x1, A-coded / Cable 3x 0.5 mm² (AWG 20), PUR, unshielded |

| Mechanical Data | Dimensions | See dimension drawing |
## Ordering Specifications

<table>
<thead>
<tr>
<th>T</th>
<th>M1</th>
<th>0</th>
<th>5</th>
<th>0</th>
<th>0</th>
<th>3</th>
<th>0</th>
<th>6</th>
<th>8</th>
<th>5</th>
<th>1</th>
<th>1</th>
<th>0</th>
<th>4</th>
</tr>
</thead>
</table>

**Preferred types printed in bold**

**Supply voltage** $U_b$

8: $U_b = 12/24$ VDC, 24 VDC

**Output signal**

1: 0.1 ... 10 VDC
4: 0.5 ... 4.5 VDC
5: 0.25 ... 4.75 VDC

**Output characteristic**

1: Rising output characteristic, seen from flange
2: Falling output characteristic, seen from flange

**Electrical connection**

104: Connector M12x1, 4-pin
251: Cable, 3-pole, unshielded, $A = 1$ m
253: Cable, 3-pole, unshielded, $A = 3$ m
255: Cable, 3-pole, unshielded, $A = 5$ m

**Series**

Mechanical version

306: Screw flange M18x1.5
308: Screw flange M18x1.5 with internal thread M4x6 at rod end, additional length 7.5 mm

**Electrical measuring range**

Standard lengths 0000 up to 2000 mm in 25 mm-steps

Other lengths on request
Technical Data

<table>
<thead>
<tr>
<th>Type</th>
<th>TM1-<strong>-306-84-</strong>-__</th>
<th>TM1-<strong>-306-85-</strong>-__</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output signal</td>
<td>0.25 ... 4.75 V</td>
<td>0.1 ... 10 V</td>
</tr>
<tr>
<td></td>
<td>0.5 ... 4.0 V</td>
<td></td>
</tr>
<tr>
<td>Load</td>
<td>≥ 10 kΩ</td>
<td></td>
</tr>
<tr>
<td>Sampling rate / Update rate</td>
<td>0.5 kHz</td>
<td></td>
</tr>
<tr>
<td>Electrical measuring range (dim. L)</td>
<td>0 ... 50 mm up to 0 ... 2000 mm</td>
<td></td>
</tr>
<tr>
<td>Absolute linearity</td>
<td>±0.04 %FS (min. 300 µm)</td>
<td></td>
</tr>
<tr>
<td>Tolerance of elect. zero point</td>
<td>±1 mm</td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>±0.1 mm</td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.1 mm</td>
<td></td>
</tr>
<tr>
<td>Hysteresis</td>
<td>±0.1 mm</td>
<td></td>
</tr>
<tr>
<td>Temperature error</td>
<td>typ. 50 ppm/K (min. 0.01 mm/K)</td>
<td></td>
</tr>
<tr>
<td>Supply voltage Ub</td>
<td>12/24 VDC (16 ... 32 VDC)</td>
<td>24 VDC (16 ... 34 VDC)</td>
</tr>
<tr>
<td>Supply voltage ripple</td>
<td>≤ 10% Ub</td>
<td></td>
</tr>
<tr>
<td>Power drain w/o load</td>
<td>≤ 3 W</td>
<td></td>
</tr>
<tr>
<td>Overvoltage protection</td>
<td>36 VDC (permanent)</td>
<td></td>
</tr>
<tr>
<td>Polarity protection</td>
<td>yes (-36 VDC)</td>
<td></td>
</tr>
<tr>
<td>Short circuit protection</td>
<td>yes (output vs GND and supply voltage up to 36 VDC)</td>
<td></td>
</tr>
<tr>
<td>Insulation resistance (500 VDC)</td>
<td>≥ 10 MΩ</td>
<td></td>
</tr>
</tbody>
</table>

Environmental Data

Max. operational speed | Mechanically unlimited |
Vibration IEC 60068-2-6 | 20 g, 10 ... 2000 Hz, Amax = 0.75 mm |
Shock IEC 60068-2-27 | 100 g, 11 ms (single hit) |
Protection class DIN EN 60529 | IP67 |
Operating temperature | -40 ... +105°C |
Operating humidity | 0 ... 95 % R.H. (no condensation) |
Working pressure | ≤ 350 bar |
Pressure peaks | ≤ 450 bar |
Burst pressure | > 700 bar |
Life | Mechanically unlimited |
Functional safety | If you need assistance in using our products in safety-related systems, please contact us |
MTTF (IEC 60065) | 346 years |

EMC Compatibility

ISO 10605 ESD (Handling/Component) | 8 kV / 15 kV |
ISO 11452-2 Radiated HF-fields | 100 V/m |
ISO 11452-4 BCI (Bulk current injection) | 200 mA |
CISPR 25 Radiated emission | Level 4 |
EN 954-3 Transient emissions | Level 1/2 |
EN 55011-2 Pulses on supply lines | [1, 2a, 2b, 3a, 3b] Level 4 |
EN 55011-3 Pulses on output lines | [3a, 3b] Fast Level 2 |
EN 61850-11 Pulses on supply lines | Starting profile Level 4 @12 V / Level 3 @24 V, Load dump A +200 V |
EN 13309 Construction machinery |
ISO 15982 Agriculture/forestry machines | Exceeds E1 requirements |

The EMC measurements are conducted in a reference cylinder. The EMC properties can deviate when using different cylinders.

FS = Full scale: Signal span according to electrical measuring range
**Connection Assignment**

<table>
<thead>
<tr>
<th>Signal</th>
<th>Connector code 1</th>
<th>Cable code 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage U_b</td>
<td>Pin 1</td>
<td>BN</td>
</tr>
<tr>
<td>GND</td>
<td>Pin 3</td>
<td>WH</td>
</tr>
<tr>
<td>Signal output</td>
<td>Pin 2</td>
<td>GN</td>
</tr>
<tr>
<td>Do not connect</td>
<td>Pin 4</td>
<td>-</td>
</tr>
</tbody>
</table>

![Pin assignment WI12](image-url)
Technical Data
Output Characteristics

Output characteristic

Output characteristic
Position Markers

Z-TH1-P18
Ring position marker for fixation with screws M3
Material: PA6-GF
Weight: approx. 12 g
Operating temp.: -40 ... +100°C
Surface pressure: max. 40 N/mm²
Fastening torque of mounting: max. 100 Ncm
P/N: 400005697
Pack. unit [pcs]: 1

Z-TH1-P19
Ring position marker for fixation with screws M4, optionally with or without spacer
Material: PA6-GF, Spacer: POM-GF
Weight: approx. 14 g
Operating temp.: -40 ... +100°C
Surface pressure: max. 40 N/mm²
Fastening torque: max. 100 Ncm
P/N: Spacer: 400005698, Pack. unit [pcs]: 1
P/N: incl.: 400107117, Pack. unit [pcs]: 1

Z-TH1-P30
Ring position marker for mounting via lock washer and retaining ring
Material: NdFeB bonded (EP)
Weight: approx. 5 g
Operating temp.: -40 ... +100°C
Surface pressure: max. 10 N/mm²
P/N: 400106139
Pack. unit [pcs]: 1

Z-TH1-P25
U-shaped position marker for fixation with M4 screws
Caution: for dimension of electrical zero point please follow the user manual!
Material: PA6-GF
Operating temp.: -40 ... +105°C
Surface pressure: max. 40 N/mm²
Fastening torque of mounting: max. 100 Ncm
P/N: 400105076
Pack. unit [pcs]: 1
Position Markers

Z-TH1-P32
Ball-type floating position marker
Material SS 1.4571 / AISI 316Ti
Weight approx. 42 g
Operating temp. -40 ... +100°C
Compression strength ≤ 40 bar
Density 720 kg/m³
Immersion depth in water 36.7 mm
P/N Pack. unit [pcs]
400105703 1

Z-TH1-P21
Cylinder floating position marker
Material SS 1.4404 / AISI 316L
Weight approx. 20 g
Operating temp. -40 ... +100°C
Compression strength ≤ 8 bar
Density 740 kg/m³
Immersion depth in water approx. 26.6 mm
P/N Pack. unit [pcs]
400056044 1

Floating Position Marker - Installation
Recommendation
When using floating position markers, we recommend to secure the marker against loss with a washer at the rod end.
For this purpose, a sensor version with inner thread at the rod end is required (s. ordering code).

Z-TH1-M01
Lock nut ISO 8675, M18x1.5-A2
P/N Pack. unit [pcs]
400056090 1
**Connector System M12**

**EEM-33-35/36/37**
M12x1 Mating female connector, 4-pin, straight, A-coded, with molded cable, not shielded, IP67, open ended

- Plug housing: PA
- Cable sheath: PUR, Ø = max. 6 mm, -40...+85°C (fixed)
- Lead wires: PP, 0.34 mm²

<table>
<thead>
<tr>
<th>P/N</th>
<th>Type</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>400056135</td>
<td>EEM-33-35</td>
<td>2 m</td>
</tr>
<tr>
<td>400056136</td>
<td>EEM-33-36</td>
<td>5 m</td>
</tr>
<tr>
<td>400056137</td>
<td>EEM-33-37</td>
<td>10 m</td>
</tr>
</tbody>
</table>

**EEM-33-38/39/40**
M12x1 Mating female connector, 4-pin, angled, A-coded, with molded cable, not shielded, IP67, open ended

- Plug housing: PA
- Cable sheath: PUR, Ø = max. 6 mm, -40...+85°C (fixed)
- Lead wires: PP, 0.34 mm²

<table>
<thead>
<tr>
<th>P/N</th>
<th>Type</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>400056138</td>
<td>EEM-33-38</td>
<td>2 m</td>
</tr>
<tr>
<td>400056139</td>
<td>EEM-33-39</td>
<td>5 m</td>
</tr>
<tr>
<td>400056140</td>
<td>EEM-33-40</td>
<td>10 m</td>
</tr>
</tbody>
</table>

**EEM-33-89**
M12x1 Mating female connector, 4-pin, angled, A-coded, with coupling nut, screw termination, IP67, not shieldable

- Operating temp.: -25...+90°C
- Plug housing: PBT
- For wire gauge: 6...8 mm, max. 0.75 mm²

<table>
<thead>
<tr>
<th>P/N</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>400005634</td>
<td>EEM-33-89</td>
</tr>
</tbody>
</table>

**Very good Electromagnetic Compatibility (EMC) and shield systems**

**Very good resistance to oils, coolants and lubricants**

**Suitable for applications in dangerous areas**

**UL - approved**

**CAN-Bus**
The specifications contained in our datasheets are intended solely for informational purposes. The documented specification values are based on ideal operational and environmental conditions and can vary significantly depending on the actual customer application. Using our products at or close to one or more of the specified performance ranges can lead to limitations regarding other performance parameters. It is therefore necessary that the end user verifies relevant performance parameters in the intended application. We reserve the right to change product specifications without notice.