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
- 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.

Description
<table>
<thead>
<tr>
<th>Material</th>
<th>Flange: SS 1.4307 / AISI 304L</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range cover: AlSiMgBi</td>
</tr>
<tr>
<td></td>
<td>Rod: SS 1.4571 / AISI 316Ti</td>
</tr>
<tr>
<td></td>
<td>Sealing: O-ring FKM 80, Supporting ring: PTFE</td>
</tr>
</tbody>
</table>

Mounting
- Plugged into cylinders, secured in position with set screw M5 ISO 4026

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

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

**Preferred types printed in bold**

**Supply voltage** $U_b$

8: $U_b = 12/24$ VDC

**Output signal**

2: 4 ... 20 mA

**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
- 498: Plug system M12x1, 4-pin, with lead wires 80 mm
- 442: Plug system M12x1, 4-pin, with lead wires 120 mm
- 446: Plug system M12x1, 4-pin, with lead wires 160 mm
- 450: Plug system M12x1, 4-pin, with lead wires 200 mm
- 454: Plug system M12x1, 4-pin, with lead wires 240 mm

**Series**

Electronic measuring range

- Standard lengths 0000 up to 2000 mm in 25 mm-steps
- Other lengths on request

| T | M | 1 | 0 | 5 | 0 | 0 | 3 | 0 | 5 | 8 | 2 | 1 | 4 | 4 | 2 |

**Mechanical version**

- 305: Plug-in flange Ø 48 mm
- 307: Plug-in flange Ø 48 mm with internal thread M4x6 at rod end, additional length 7.5 mm
Drawing

CAD data see www.novotechnik.de/en/download/cad-data/
Technical Data

**Type**

<table>
<thead>
<tr>
<th>Type</th>
<th>TM1- _ _ _-305-82- _ _ _</th>
</tr>
</thead>
</table>

**Output signal**

4 … 20 mA

**Burden**

@Ub 24 V: ≤ 500 Ω, @Ub 12 V: ≤ 250 Ω

**Sampling rate / Update rate**

0.5 kHz

**Electrical measuring range (dim. L)**

0 … 50 mm up to 0 … 2000 mm

**Absolute linearity**

≤ ±0.04 %FS (min. 300 µm)

**Tolerance of electrical zero point**

≤ ±1 mm

**Resolution**

≤ 0.1 mm

**Repeatability**

≤ ±0.1 mm

**Hysteresis**

≤ ±0.1 mm

**Temperature error**

typ. 50 ppm/K (min. 0.01 mm/K)

**Supply voltage Ub**

12/24 VDC (8 … 32 VDC)

**Supply voltage ripple**

≤ 10% Ub

**Power drain w/o load**

< 1 W

**Overvoltage protection**

36 VDC (permanent)

**Polarity protection**

yes (36 VDC)

**Short circuit protection**

yes (output vs GND and supply voltage up to 36 VDC)

**Insulation resistance (500 VDC)**

≥ 10 MΩ

**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 (Connector system M12, fastened, when correctly fitted in cylinder: IP69)

**Operating temperature**

-40 … +105°C (connector M12 / Kabel), -40 … +85°C (connector system M12)

**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 60050)

355 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

EN 50121-2-25 Transient Emissions

Level 1/2

ISO 7637-2 Pulses on supply lines

1, 2a, 2b, 3a, 3b Level 4

ISO 7637-3 Pulses on output lines

3a, 3b Fast Level 2

ISO 11451-5 Pulses on supply lines

Starting profile Level 4 @12 V / Level 3 @24 V, Load dump A +200 V

EN 13309 Construction machinery

ISO 14982 Agricultural / forestry machines

Exceeds E1 requirements

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

**Connection Assignment**

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

**FS** = Full scale: Signal span according to electrical measuring range.
### 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 With spacer**  
Z-TH1-PD19  
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  
  - **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 ... +105°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 36.7 mm in water
P/N 400105703 Pack. unit [pcs] 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 approx. 26.6 mm in water
P/N 400056044 Pack. unit [pcs] 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).
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>
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.