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></th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>Flange: SS 1.4307 / AISI 304L</td>
</tr>
<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>
<tr>
<td>Mounting</td>
<td>Plugged into cylinders, secured in position with set screw M5 ISO 4026</td>
</tr>
<tr>
<td>Electrical connection</td>
<td>Connector M12x1, A-coded / Connector system M12x1, A-coded with lead wires</td>
</tr>
</tbody>
</table>

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

**Preferred types printed in bold**

### Interface

- **J: CAN SAE J1939**

#### Interface parameters

- 1: 1x position, 1x speed
- 3: 500 kbaud
- 4: 250 kbaud

### Electrical connection

- 106: Connector M12x1, 5-pin
- 466: Plug system M12x1, 5-pin, with lead wires 80 mm
- 472: Plug system M12x1, 5-pin, with lead wires 120 mm
- 476: Plug system M12x1, 5-pin, with lead wires 160 mm
- 480: Plug system M12x1, 5-pin, with lead wires 200 mm
- 484: Plug system M12x1, 5-pin, with lead wires 240 mm

### Series

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

### Mechanical version

- 305: Plug-in flange Ø 40 mm
- 307: Plug-in flange Ø 40 mm with internal thread M4 x 6 at rod end, additional length 7.5 mm
### Technical Data

<table>
<thead>
<tr>
<th>Type</th>
<th>TM1-<em><strong>-305-J-</strong></em></th>
</tr>
</thead>
<tbody>
<tr>
<td>CAN SAE J1939</td>
<td></td>
</tr>
</tbody>
</table>

**Measuring variables**
- Position, speed and temperature

**Electrical measuring range (dim. L)**
- 0 ... 50 mm up to 0 ... 2000 mm

**Measuring range speed**
- 25 ... 1000 mm/s

**Protocol**
- CAN SAE J1939

**Programmable parameters**
- Offset position, averaging, baud rate, transmit mode, transmit cycle, source address

**Node ID**
- 128 ... 247 (dynamic address claiming)

**Baud rate**
- 250, 500 kbaud

**Update rate (output)**
- 1 kHz (internal measuring rate 0.5 kHz)

**Resolution position**
- ±0.1 mm

**Resolution speed**
- 2 mm/s

**Absolute linearity**
- ±0.04 %FS (min. 300 µm)

**Tolerance of electric zero point**
- ±1 mm

**Repeatability**
- ±0.1 mm

**Hysteresis**
- ±0.1 mm

**Temperature error**
- ±15 ppm/K (min. 0.01 mm/K)

**Supply voltage Ub**
- 12/24 VDC (8 ... 34 VDC)

**Power drain w/o load**
- < 1.5 W

**Overvoltage protection**
- yes (supply lines and outputs)

**Short circuit protection**
- yes (all outputs vs. GND and supply voltage)

**Insulation resistance (500 VDC)**
- ≥ 10 MΩ

**Bus termination internal**
- w/o (internal load resistance 120 Ω on request)

### 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, -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 60068)**
- 391 years

**Traceability**
- Serial number on type labeling; production batch of the sensor assembly and relevant sensor components

### EMC Compatibility

**ISO 10605 ESD (Handling/Component)**
- 6 kV / 15 kV

**ISO 11452-2 Radiated HF-fields**
- 100 V/m

**ISO 11452-4 BCI (Bulk current injection)**
- 200 mA

**IEC 61000-4-8 Radiated emission**
- Level 4

**ISO 7837-2 Transient Emissions**
- Level 1/2

**ISO 7837-2 Pulses on supply lines**
- (1, 2a, 2b, 3a, 3b) Level 4

**ISO 7837-3 Pulses on output lines**
- (3a, 3b) Fast Level 2

**ISO 15750 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 Agricult./forestry machines

**Emission/Immunity**
- Exceeds E1 requirements

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FS = Full scale: Signal span according to electrical measuring range
<table>
<thead>
<tr>
<th>Signal</th>
<th>Connector code 106</th>
<th>Plug system code 4_ _</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage Ub</td>
<td>Pin 2</td>
<td>Pin 2</td>
</tr>
<tr>
<td>GND</td>
<td>Pin 3</td>
<td>Pin 3</td>
</tr>
<tr>
<td>CAN_H</td>
<td>Pin 4</td>
<td>Pin 4</td>
</tr>
<tr>
<td>CAN_L</td>
<td>Pin 5</td>
<td>Pin 5</td>
</tr>
<tr>
<td>Not assigned</td>
<td>Pin 1</td>
<td>Pin 1</td>
</tr>
</tbody>
</table>
### 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:** max. 100 Ncm

<table>
<thead>
<tr>
<th>P/N</th>
<th>Pack. unit [pcs]</th>
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<tr>
<td>400005697</td>
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</table>

### Z-TH1-P19
Z-TH1-P19 With spacer
- **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

<table>
<thead>
<tr>
<th>P/N (Spacer)</th>
<th>Pack. unit [pcs]</th>
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<tbody>
<tr>
<td>400005698</td>
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<tr>
<td>400107117</td>
<td>incl. 1</td>
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</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>P/N</th>
<th>Pack. unit [pcs]</th>
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<tr>
<td>400106139</td>
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</table>

### 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:** max. 100 Ncm

<table>
<thead>
<tr>
<th>P/N</th>
<th>Pack. unit [pcs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>400105076</td>
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</table>
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).
Connector System M12

M12x1 Mating female connector, 5-pin, straight, A-coded, with molded cable, IP67, shielded (shield on knurl), open ended.

- **Plug housing**: TPU
- **Cable sheath**: PUR, Ø = 6.7 mm,
- **Lead wires**: PE, 2x0.25 mm²+2x0.34 mm²

<table>
<thead>
<tr>
<th>P/N</th>
<th>Type</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>400106368</td>
<td>EEM-33-49</td>
<td>2 m</td>
</tr>
<tr>
<td>400106371</td>
<td>EEM-33-50</td>
<td>5 m</td>
</tr>
<tr>
<td>400106372</td>
<td>EEM-33-51</td>
<td>10 m</td>
</tr>
</tbody>
</table>

M12x1 Mating female/male connector, 5-pin, straight, A-coded, with molded cable, IP67, shielded (shield on knurl), CAN-Bus.

- **Plug housing**: PUR
- **Cable sheath**: PUR, Ø = 6.7 mm,
- **Lead wires**: PE, 2x0.25 mm²+2x0.34 mm²

<table>
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<tr>
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<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>400106373</td>
<td>EEM-33-52</td>
<td>5 m</td>
</tr>
</tbody>
</table>

M12x1 Splitter / T-connector, 5-pin, A-coded, IP68, 1:1 connection, female - male - female, CAN-Bus.

- **Plug housing**: PUR

<table>
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<tr>
<th>P/N</th>
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</tr>
</thead>
<tbody>
<tr>
<td>400056145</td>
<td>EEM-33-45</td>
</tr>
</tbody>
</table>

M12x1 Terminating resistor, 5-pin, A-coded, IP67, 120 Ω resistance, CAN-Bus.

- **Plug housing**: PUR, -25 ... +85°C

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>400056147</td>
<td>EEM-33-47</td>
</tr>
</tbody>
</table>

Protection class IP67 DIN EN 60529
Protection class IP68 DIN EN 60529
Very good Electromagnetic Compatibility (EMC) and shield systems.
Very good resistance to oils, coolants and lubricants.

Siuited for applications in dragchains
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.