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.

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>

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

Mechanical Data

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>See dimension drawing</th>
</tr>
</thead>
</table>
# Ordering Specifications

**Preferred types printed in bold**

<table>
<thead>
<tr>
<th>Interface</th>
<th>CANopen</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interface parameters</strong></td>
<td></td>
</tr>
<tr>
<td>1: 1x position, 1x speed</td>
<td></td>
</tr>
</tbody>
</table>

- Baud rate
  - 1: 1000 kBit/s
  - 2: 800 kBit/s
  - 3: 500 kBit/s
  - 4: 250 kBit/s
  - 5: 125 kBit/s
  - 7: 9.6 kBit/s

**Electrical connection**
- 106: Connector M12x1, 5-pin
- 468: 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 100 mm
- 480: Plug system M12x1, 5-pin, with lead wires 200 mm
- 484: Plug system M12x1, 5-pin, with lead wires 240 mm

**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

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

**Type**
- TM1-...-305-6...

**CANopen**

**Measured 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**
- CANopen protocol to CiA DS-301 V4.2.0, Device profile DS-406 V3.2 Encoder Class C2, LSS services to CiA DS-305 V1.1.2

**Programmable parameters**
- Position, speed, cams, working areas, temperature, node ID, baud rate

**Node ID**
- 1 ... 127 (default 127)

**Baud rate**
- 50 ... 1000 kbaud

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

**Resolution position**
- ±0.1 mm

**Resolution speed**
- ±0.1 mm

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

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

**Supply voltage ripple**
- ≤ 10% Ub

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

**Burst pressure**
- > 700 bar

**Life**
- Mechanically unlimited

**Functionality**
- If you need assistance in using our products in safety-related systems, please contact us

**MTTF (IEC 60050)**
- 391 years

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

### 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

**Supply pressure**
- > 700 bar

**Functional safety**
- If you need assistance in using our products in safety-related systems, please contact us

**EMC Compatibility**

- 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 106</th>
<th>Plug system code 4_ _</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage U_b</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>

![Pin assignment diagram](image)
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: max. 100 Ncm

P/N: Pack. unit [pcs]
400005697: 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 Pack. unit [pcs]
400005698: 1
400107117: incl. 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: Pack. unit [pcs]
400106139: 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: max. 100 Ncm

P/N: Pack. unit [pcs]
400105076: 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: 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 in water: approx. 26.6 mm
P/N: 900056044
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

**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,
  -25 ... +90°C (socket)
  -20 ... +80°C (cable)

**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,
  -25 ... +90°C (plug/socket)
  -20 ... +80°C (cable)

**Lead wires**
- PE, 2x0.25 mm² + 2x0.34 mm²

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

**M12x1 terminating resistor, 5-pin, A-coded, IP67, 120 Ω resistance, CAN-Bus**

**Plug housing**
- PUR

<table>
<thead>
<tr>
<th>P/N</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>400056147</td>
<td>EEM-33-47</td>
</tr>
</tbody>
</table>
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