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
Material
Flange: SS 1.4307 / AISI 304L
Flange cover: AlSiMgBi
Rod: SS 1.4571 / AISI 316Ti
Sealing: O-ring NBR 90 SH A

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

Electrical connection
Connector M12x1, A-coded

Mechanical Data
Dimensions
See dimension drawing
Ordering Specifications

Preferred types printed in bold

T | M | 1 | 0 | 5 | 0 | 0 | 3 | 0 | 6 | 6 | 1 | 4 | 1 | 0 | 6

Mechanical version
306: Screw flange M16x1.5
308: Screw flange M16x1.5 with internal thread M4x0.7 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

Interface
6: CANopen

Interface parameters
1: 1x position, 1x speed

Baud rate
1: 1000 kBaud
2: 800 kBaud
3: 500 kBaud
4: 250 kBaud
5: 125 kBaud
7: 50 kBaud

Electrical connection
106: Connector M12x1, 5-pin
**Type**

<table>
<thead>
<tr>
<th>Measured variables</th>
<th>Position, speed and temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical measuring range</td>
<td>0 ... 50 mm up to 0 ... 2000 mm</td>
</tr>
<tr>
<td>Measuring range speed</td>
<td>25 ... 1000 mm/s</td>
</tr>
<tr>
<td>Protocol</td>
<td>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</td>
</tr>
<tr>
<td>Programmable parameters</td>
<td>Position, speed, cams, working areas, temperature, node ID, baud rate</td>
</tr>
<tr>
<td>Node ID</td>
<td>1 ... 127 (default 127)</td>
</tr>
<tr>
<td>Baud rate</td>
<td>50 ... 1000 kbit/s</td>
</tr>
<tr>
<td>Update rate (output)</td>
<td>1 kHz (internal measuring rate 0.5 kHz)</td>
</tr>
<tr>
<td>Resolution position</td>
<td>±0.1 mm</td>
</tr>
<tr>
<td>Resolution speed</td>
<td>2 mm/s</td>
</tr>
<tr>
<td>Absolute linearity</td>
<td>±0.04 % FS (min. 300 µm)</td>
</tr>
<tr>
<td>Tolerance of electr. zero point</td>
<td>±1 mm</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.1 mm</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>±0.1 mm</td>
</tr>
<tr>
<td>Temperature error</td>
<td>±15 ppm/K (min. 0.01 mm/K)</td>
</tr>
<tr>
<td>Supply voltage Ub</td>
<td>12/24 VDC (8 ... 34 VDC)</td>
</tr>
<tr>
<td>Power drain w/o load</td>
<td>&lt; 1.0 W</td>
</tr>
<tr>
<td>Overvoltage protection</td>
<td>40 VDC ±5%</td>
</tr>
<tr>
<td>Polarity protection</td>
<td>yes (supply lines and outputs)</td>
</tr>
<tr>
<td>Short circuit protection</td>
<td>yes (all outputs vs. GND and supply voltage)</td>
</tr>
<tr>
<td>Insulation resistance (500 VDC)</td>
<td>≥ 10 MΩ</td>
</tr>
<tr>
<td>Bus termination internal</td>
<td>w/o (internal load resistance 120 Ω on request)</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 60052     | PBT                              |
| 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)               | 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 (burst current injection) | 200 mA |
| IEC/IEC 61000-4-2 Radiated emission | Level 4 |
| ISO 7637-2 Transient Emissions   | Level 1/2    |
| ISO 7637-2 Pulses on supply lines| 1a, 2a, 3a, 3b, Level 4          |
| ISO 7637-3 Pulses on output lines| 1a, 3b, 3c, Level 2               |
| ISO 10755 ESD (Handling/Component) | 12 V / 24 V, Load dump A ≤200 V |
| EN 13309 Construction machinery  | E1 requirements |
| ISO 14982 Agricult./forestry machines | 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>Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage Ub</td>
<td>2</td>
</tr>
<tr>
<td>GND</td>
<td>3</td>
</tr>
<tr>
<td>CAN_H</td>
<td>4</td>
</tr>
<tr>
<td>CAN_L</td>
<td>5</td>
</tr>
<tr>
<td>Not assigned</td>
<td>1</td>
</tr>
</tbody>
</table>

*Connector code 106*
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 | Pack. unit [pcs]
--- | ---
400005697 | 1

Z-TH1-P19
Z-TH1-PD19 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

P/N | P/N | Pack. unit [pcs]
--- | --- | ---
400005698 | 400107117 | 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 | 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 of mounting: 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: 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).

Z-TH1-M01
Lock nut ISO 8675, M18x1.5-A2
P/N: 400056090
Pack. unit [pcs]: 1
**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
- Temperature range: -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>
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<tbody>
<tr>
<td>4000106368</td>
<td>EEM-33-49</td>
<td>2 m</td>
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<tr>
<td>4000106371</td>
<td>EEM-33-50</td>
<td>5 m</td>
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<tr>
<td>4000106372</td>
<td>EEM-33-51</td>
<td>10 m</td>
</tr>
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</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
- Temperature range: -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>
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<tbody>
<tr>
<td>4000106373</td>
<td>EEM-33-52</td>
<td>5 m</td>
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</tbody>
</table>

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

- Plug housing: PUR, -25 ... +85°C

<table>
<thead>
<tr>
<th>P/N</th>
<th>Type</th>
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<tbody>
<tr>
<td>4000056145</td>
<td>EEM-33-45</td>
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</table>

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

- Plug housing: PUR, -25 ... +85°C

<table>
<thead>
<tr>
<th>P/N</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>4000056147</td>
<td>EEM-33-47</td>
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</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**

**Suitable for applications in dry hanes**

**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.