Special Features
- Touchless hall technology
- Electrical range up to 360°
- 2 part design, mechanically decoupled
- High protection class IP67, IP68, IP69
- Resolution 12 bit
- Wear-free
- Temperature range -40 °C to +105 °C
- Optimized for use in industrial applications
- Other configurations see separate data sheets

Applications
- Manufacturing Engineering (textile machinery, packaging machinery, sheet metal and wire machinery)
- Automation technology
- Medical Engineering

The 2 part design consisting of sensor and magnetic position marker offers great flexibility when mounting. The absence of shaft and bearing makes the assembly much less sensitive to axial and radial application tolerances - separate couplings are obsolete. Measurements can be made transmissively through any non-ferromagnetic material. The sensor is perfectly suitable for use in harsh environmental conditions through the completely encapsulated electronics.

Description

<table>
<thead>
<tr>
<th>Material</th>
<th>Housing: high grade, temperature resistant plastic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting</td>
<td>With 2 pan head screws M4x20 (included in delivery)</td>
</tr>
<tr>
<td>Fastening torque of mounting</td>
<td>250 Ncm</td>
</tr>
<tr>
<td>Electrical connection</td>
<td>Connector M12x1, A-coded with cable L = 0.15 m / Cable 4x 0.5 mm² / AWG 20, TPE, shielded</td>
</tr>
</tbody>
</table>

Mechanical Data

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>See dimension drawing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical travel</td>
<td>continuous</td>
</tr>
<tr>
<td>Weight (w/o connection)</td>
<td>approx. 50 g</td>
</tr>
</tbody>
</table>
## Ordering Specifications

**Preferred types printed in bold**
- Delivery time up to 25 pcs. within 10 working days EXW
- Best low-volume pricing

### Accessories included in delivery
- 2x Pan head screws M4x20

### Supply voltage $U_b$
- 1: $U_b = 24 \text{ VDC}$
- 2: $4 \ldots 20 \text{ mA}$

### Output characteristic
- 1: Rising output characteristic cw
- 2: Rising output characteristic ccw
- Other output characteristics on request

### Electrical connection
- 201: Cable, 4-pole, shielded, $L = 0.5 \text{ m}$
- 202: Cable, 4-pole, shielded, $L = 1 \text{ m}$
- 206: Cable, 4-pole, shielded, $L = 3 \text{ m}$
- 210: Cable, 4-pole, shielded, $L = 5 \text{ m}$
- 220: Cable, 4-pole, shielded, $L = 10 \text{ m}$
- 501: Connector M12x1, 4-pin, with cable, shielded, $L = 0.15 \text{ m}$

Cable versions and assembled connectors on request

<table>
<thead>
<tr>
<th>R</th>
<th>F</th>
<th>C</th>
<th>4</th>
<th>8</th>
<th>5</th>
<th>1</th>
<th>6</th>
<th>3</th>
<th>6</th>
<th>1</th>
<th>2</th>
<th>1</th>
<th>2</th>
<th>0</th>
<th>2</th>
</tr>
</thead>
</table>

### Measuring range
- 03: Angle 0° ... 30° min.
- 06, 12, 18, 24, 36
- 36: Angle 0° ... 360° max.
- Other angles on request

### Number of channels
- 6: Single-channel version (1x supply voltage $U_b / 1x$ output)

### Mechanical version
- 4881: Elongated hole mounting for easy adjustment
- 4882: Round hole mounting
- 4883: Elongated hole mounting, without diagnostic function
- 4884: Round hole mounting, without diagnostic function
- Other configurations e.g. with internal shielding against magnetic fields on request
When the marking of the position marker is pointing towards the cable, the sensor output is near the electrical center position.
<table>
<thead>
<tr>
<th>Type</th>
<th>RFC-48- - _ - -12 - - _ - _</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output signal</td>
<td>4 ... 20 mA</td>
</tr>
<tr>
<td>Burden</td>
<td>≤ 500 Ω</td>
</tr>
<tr>
<td>Update rate</td>
<td>typ. 3.4 kHz</td>
</tr>
<tr>
<td>Measuring range</td>
<td>0 ... 30° up to 0 ... 360° in 10°-steps</td>
</tr>
<tr>
<td>Independent linearity</td>
<td>≤ ±0.5 %FS</td>
</tr>
<tr>
<td>Resolution</td>
<td>12 bits</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>typ. &lt; ±0.1°</td>
</tr>
<tr>
<td>Temperature error</td>
<td>Measuring range 30 ... 170°: typ. ±1.2 %FS, Measuring range ≥ 180°: typ. ±0.6 %FS</td>
</tr>
<tr>
<td>Supply voltage Ub</td>
<td>24 VDC (15 ... 30 VDC)</td>
</tr>
<tr>
<td>Current consumption w/o load</td>
<td>typ. 12 mA per channel</td>
</tr>
<tr>
<td>Polarity protection</td>
<td>yes (supply lines and outputs)</td>
</tr>
<tr>
<td>Short circuit protection</td>
<td>yes (vs. GND and supply voltage)</td>
</tr>
<tr>
<td>Insulation resistance (500 VDC)</td>
<td>≥ 10 MΩ</td>
</tr>
</tbody>
</table>

**Environmental Data**

- Max. operational speed: Mechanically unlimited
- Vibration: EC 60068-2-6
  - 20 g, 5 ... 2000 Hz, Amax = 0.75 mm
- Shock: EC 60068-2-27
  - 50 g, 6 ms
- Protection class DIN EN 60029
  - IP67 (connector M12), IP67 / IP68 / IP69
- Operating temperature
  - -25 ... +85°C (connector M12), -40 ... +105°C*
  - * The max. operating temperature depends on supply voltage Ub and load resp. burden (see temp. diagram)
- Life: Mechanically unlimited
- Functional safety: If you need assistance in using our products in safety-related systems, please contact us
- MTTF (IEC 60065): 798 years
- Traceability: Serial number on type labeling, production batch of the sensor assembly and relevant sensor components
- WEEE see https://www.novotechnik.de/en/downloads/certificates/eu-directive-weee/

**EMC Compatibility**

- EN 61000-4-2 ESD (contact/air discharge)
  - 4 kV, 8 kV
- EN 61000-4-3 Electromagnetic fields (RFI)
  - 10 V/m
- EN 61000-4-4 Fast transients (bursts)
  - 1 kV
- EN 61000-4-6 Conduct. disturbances (HF fields)
  - 10 V off
- EN 55016-2-3 Radiated disturbances
  - Industrial and residential area
- FS = Full scale: Signal span according to electrical measuring range

**Connection Assignment**

<table>
<thead>
<tr>
<th>Signal</th>
<th>Connector code 5 _ _</th>
<th>Cable code 2 _ _</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage Ub</td>
<td>Pin 1</td>
<td>GN</td>
</tr>
<tr>
<td>SN2</td>
<td>Pin 3</td>
<td>SN</td>
</tr>
<tr>
<td>Signal output</td>
<td>Pin 2</td>
<td>WH</td>
</tr>
<tr>
<td>Not assigned</td>
<td>Pin 4</td>
<td>YE</td>
</tr>
</tbody>
</table>

Connect cable shielding to GND
Technical Data
Output Characteristics

Temperature Diagram

Current output: max. operating temperature as a function of the supply voltage

101°C @ 24 V / 500 Ω
92°C @ 24 V / 250 Ω

Output characteristic

One-channel, rising cw

On request: different gradients

On request: parabolic output characteristic

Output characteristic

One-channel rising cw

On request: trapezoid output characteristic
Position Markers

Z-RFC-P02
Position marker for frontal fixation with 2 cylinder head screws M4x20 (with screw lock) or with locking pin (both included in delivery).
Material: PF
Max. permitted radial offset: ±3 mm
Operating temp.: -40 ... +125°C
P/N | Pack. unit [pcs]
---|---
400005661 | 1
400056080 | 25

Z-RFC-P08
Position marker for fixation with threaded pin M5 (included in delivery).
Material: PF
Max. permitted radial offset: ±3 mm
Operating temp.: -40 ... +125°C
P/N | Pack. unit [pcs]
---|---
400056070 | 1
400056064 | 25

Z-RFC-P41
Position marker for frontal fixation with 2 cylinder head screws M4x20 (with screw lock) or with locking pin (both included in delivery).
Material: PF
Max. permitted radial offset: ±3 mm
Operating temp.: -40 ... +125°C
P/N | Pack. unit [pcs]
---|---
400105037 | 1
400105038 | 25

Z-RFC-P47
Position marker for frontal fixation with 2 cylinder head screws M4x20 (with screw lock) or with threaded pin M5 (both included in delivery).
Material: PF
Max. permitted radial offset: ±3 mm
Operating temp.: -40 ... +125°C
P/N | Pack. unit [pcs]
---|---
400105039 | 1
400105040 | 25
Position Markers

Z-RFC-P23
Position marker for fixation with threaded pin M4 (included in delivery)
Caution: For orientation of the output characteristic please follow the user manual of the position marker!
Material: PA6-GF
Max. permitted radial offset: ±3 mm
Operating temp.: -40...+125°C
P/N | Pack. unit [pcs]
---|------------------
400056074 | 1
400056085 | 25

Z-RFC-P43
Position marker for fixation with threaded pin M4 (included in delivery)
Caution: For orientation of the output characteristic please follow the user manual of the position marker!
Material: PA6-GF
Max. permitted radial offset: ±3 mm
Operating temp.: -40...+125°C
P/N | Pack. unit [pcs]
---|------------------
300105041 | 1
400105042 | 25

Z-RFC-P30
Position marker for frontal fixation with 2 cylinder screws M3x8 (included in delivery).
Material: PBT-GF
Max. permitted radial offset: ±1.5 mm
Operating temp.: -40...+125°C
P/N | Pack. unit [pcs]
---|------------------
400056086 | 1
400056087 | 25

Z-RFC-P31
Position marker for frontal fixation with 2 cylinder screws M3x8 (included in delivery).
Material: PBT-GF
Max. permitted radial offset: ±3 mm
Operating temp.: -40...+125°C
P/N | Pack. unit [pcs]
---|------------------
400056088 | 1
400056089 | 25
Position Markers

Z-RFC-P22
Position marker for frontal fixation with 2 cylinder head screws M4x20 (with screw lock, included in delivery).
Attention: Closed side of position marker faces the active side of sensor.
Material: Aluminium, anodized
Max. permitted radial offset ≤ 4 mm
Operating temp.: -40...+125°C

<table>
<thead>
<tr>
<th>P/N</th>
<th>Pack. unit [pcs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>400106735</td>
<td>1</td>
</tr>
<tr>
<td>400106736</td>
<td>25</td>
</tr>
</tbody>
</table>

Z-RFC-P18
Screw position marker M10 x 25 mm, similar DIN 933, magnet potted
Material: Aluminium, anodized
Max. permitted radial offset ≤ 3 mm
Operating temp.: -40...+125°C

<table>
<thead>
<tr>
<th>P/N</th>
<th>Pack. unit [pcs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>400104756</td>
<td>1</td>
</tr>
<tr>
<td>400104757</td>
<td>25</td>
</tr>
</tbody>
</table>

Z-RFC-P28
Screw position marker M10x1 x 20 mm, similar DIN 933, magnet potted
Material: Aluminium, anodized
Max. permitted radial offset ≤ 3 mm
Operating temp.: -40...+125°C

<table>
<thead>
<tr>
<th>P/N</th>
<th>Pack. unit [pcs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>400108462</td>
<td>1</td>
</tr>
<tr>
<td>400108463</td>
<td>25</td>
</tr>
</tbody>
</table>

Z-RFC-P19
Screw position marker M8 x 25 mm, similar DIN 933/ISO 4017, magnet potted
Material: Aluminium, anodized
Max. permitted radial offset ≤ 1.5 mm
Operating temp.: -40...+125°C

<table>
<thead>
<tr>
<th>P/N</th>
<th>Pack. unit [pcs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>400104754</td>
<td>1</td>
</tr>
<tr>
<td>400104755</td>
<td>25</td>
</tr>
</tbody>
</table>
Position Markers

Z-RFC-P20
Screw position marker M10 x 25 mm, similar DIN 933
Material: Aluminium, anodized
Max. permitted radial offset: ± 3 mm
Operating temp.: -40 ... +125°C
P/N Pack. unit [pcs]
400104758 1
400104759 25

Z-RFC-P03
Magnet for direct application onto customer’s shaft (see user manual).
We recommend mounting on non-magnetizable materials, otherwise the specified working distances will vary (e.g. reduction of approx. 20% with axial mounting on a magnetizable shaft).
Max. permitted radial offset: ± 1.5 mm
Operating temp.: -40 ... +125°C
P/N Pack. unit [pcs]
300005658 1
400056081 50

Z-RFC-P04
Magnet for direct application onto customer’s shaft (see user manual).
We recommend mounting on non-magnetizable materials, otherwise the specified working distances will vary (e.g. reduction of approx. 20% with axial mounting on a magnetizable shaft).
Max. permitted radial offset: ± 3 mm
Operating temp.: -40 ... +125°C
P/N Pack. unit [pcs]
400005659 1
400056082 50

Z-RFC-S01/S02/S03
Shaft adapter for fixation at position marker Z-RFC-P02/P41 with locking pin
Material: SS 1.4305 / AISI 303
P/N Type ØB / A [mm]
400056206 Z-RFC-S01 6 / 4.5
400056207 Z-RFC-S02 8 / 6.5
400056208 Z-RFC-S03 10 / 8.5
Position Markers

Working Distances Position Markers [mm] - Single-channel Versions

<table>
<thead>
<tr>
<th></th>
<th>Z-RFC-P02 / P04 / P08</th>
<th>Z-RFC-P41 / P43 / P47</th>
<th>Z-RFC-P03 / P30</th>
<th>Z-RFC-P18 / P28</th>
<th>Z-RFC-P19</th>
<th>Z-RFC-P22</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFC-4851</td>
<td>2.3 ... 5</td>
<td>0 ... 2.7</td>
<td>0.7 ... 2.2</td>
<td>0 ... 4.5</td>
<td>0 ... 2.2</td>
<td>4.4 ... 9.2</td>
</tr>
<tr>
<td>RFC-4852</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RFC-4853</td>
<td>0 ... 4</td>
<td>0 ... 2.7</td>
<td>0 ... 1.5</td>
<td>0 ... 4.5</td>
<td>0 ... 2.2</td>
<td>4.4 ... 9.2</td>
</tr>
<tr>
<td>RFC-4854</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>w/o diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lateral Magnet Offset

Lateral magnet offset will cause additional linearity error. The angle error, which is caused by radial displacement of sensor and position marker depends on the used position marker or magnet.

Additional Linearity Error at Radial Displacement - Single-channel Versions

<table>
<thead>
<tr>
<th></th>
<th>Z-RFC-P02 / P04 / P08</th>
<th>Z-RFC-P41 / P43 / P47</th>
<th>Z-RFC-P03 / P30</th>
<th>Z-RFC-P18 / P28</th>
<th>Z-RFC-P19</th>
<th>Z-RFC-P22</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 mm: ±0.4°</td>
<td>0.5 mm: ±0.4°</td>
<td>0.5 mm: ±1.4°</td>
<td>0.5 mm: ±0.7°</td>
<td>0.5 mm: ±1.2°</td>
<td>1.0 mm: ±0.8°</td>
<td></td>
</tr>
<tr>
<td>1.0 mm: ±1.1°</td>
<td>1.0 mm: ±1.1°</td>
<td>1.0 mm: ±3.7°</td>
<td>1.0 mm: ±1.3°</td>
<td>1.0 mm: ±2.6°</td>
<td>2.0 mm: ±1.8°</td>
<td></td>
</tr>
<tr>
<td>2.0 mm: ±3.5°</td>
<td>2.0 mm: ±3.5°</td>
<td>2.0 mm: ±3.3°</td>
<td>2.0 mm: ±3.3°</td>
<td>2.0 mm: ±4.0°</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Connector System
M12

**EEM-33-32/62/97**
M12x1 Mating female connector, 4-pin, straight, A-coded, with molded cable, shielded, IP67, open ended

- **Plug housing**: PA
- **Cable sheath**: PUR, Ø = max. 6 mm,
  -25 ... +80°C (moved)
  -50 ... +80°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>400005600</td>
<td>EEM-33-32</td>
<td>2 m</td>
</tr>
<tr>
<td>400005609</td>
<td>EEM-33-62</td>
<td>5 m</td>
</tr>
<tr>
<td>400005650</td>
<td>EEM-33-97</td>
<td>10 m</td>
</tr>
</tbody>
</table>

**Protection class** IP67 DIN EN 60529

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

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

**UL - approved**

**Suitable for applications in dragchains**

**CAN-Bus**
MAP-4000
Multifunctional measuring device with digital display for direct connection of potentiometric and normalized signals.

- Supply voltage 10...30 VDC, 80...250 VDC or AC
- High accuracy up to 0.1%
- Adjustable supply voltage for sensors 5...24 V
- Temperature coefficient 100 ppm/K
- Optional RS 232, RS 485, analog output, limited switch
- Complete data see separate data sheet
**Connecting Options on request**

- **M12 connector**
  - Customized lengths
  - 3-, 4-, 5- and 6-pole versions
  - Protection class IP68
  - Ordering codes of standard versions see ordering specifications

- **Tyco AMP Super Seal**
  - Pin- and bushing housing
  - Customized lengths
  - 3-, 4- and 6-pole versions
  - Protection class IP67
  - On request

- **Deutsch DTM 04**
  - Pin- and bushing housing
  - Customized lengths
  - 3-, 4- and 6-pole versions
  - Protection class IP67
  - On request

- **ITT Cannon Sure Seal connector**
  - Customized lengths
  - 3-, 4- and 6-pole versions
  - Protection class IP67
  - On request

- **Molex Mini Fit jr.**
  - Customized length and lead wires
  - 3-, 4- and 6-pole versions
  - On request

- **Molex Mini Fit jr.**
  - Customized length and lead wires
  - 3-, 4- and 6-pole versions
  - On request
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.