NOVOHALL
Rotary Sensor
Touchless
RFD-4000
Ratiometric

Special Features
• Fully touchless - no shaft or seals to wear
• Measure directly through any non-ferromagnetic material
• Electrical range up to 360°
• Linearity ±0.5%
• Simple mounting
• Lateral magnet offset up to ±3 mm
• Protection class IP67, IP68, IP69
• One and multi-channel versions
• Unlimited mechanical lifetime
• High resolution to 12 bit
• Excellent price/performance ratio
• Extremely flat 7 mm design

Applications
• Manufacturing Engineering (textile machinery, packaging machinery, sheet metal and wire machinery)
• Medical Engineering
• Mobile working machines (industrial trucks, construction machinery, agricultural and forestry machinery)
• Marine applications

The RFD-4000 utilizes a separate magnet or magnetic position marker, attached to the rotating shaft to be measured. The orientation of the magnetic field is measured and an analog voltage representing the angle is the output signal. The very compact physical dimensions allows installation in small spaces. The housing is made of high grade temperature-resistant plastic material. The sensor is sealed and is not sensitive to dust, dirt, or moisture. The two-part design, with the RFD sensor itself, and its 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. Measurements can be made transmissively through any nonferromagnetic material. Electrical connection is made via lead wires.

Description
| Material | Housing: high grade, temperature resistant plastic PBT GF with brass inserts |
| Mounting | With 2 pan head screws M4x14 (included in delivery) |
| Fastening torque of mounting | max. 150 Ncm |
| Electrical connection | Lead wires 0.5 mm² (AWG 20), PVC |

Mechanical Data
| Dimensions | See dimension drawing |
| Mechanical travel | continuous |
| Weight | approx. 10 g |
Ordering Specifications

Accessories included in delivery

- 2x Pan head screws M4x14
When the marking of the position marker is pointing towards the electrical outlet, the sensor output is near the electrical center position.
## Technical Data

### Type

<table>
<thead>
<tr>
<th>RFD-40_ <em>-</em> _ <em>-2</em> <em>-</em> _ _</th>
</tr>
</thead>
</table>

**Ratiometric**

### Output signal

- Ratiometric to supply voltage Ub
- 5 ... 95% (0.25 ... 4.75 V)
- 10 ... 90% (0.5 ... 4.5 V)

### Load

- ≥ 10 kΩ

### Number of channels

1 / 2

### Diagnosis

- Activated (in case of error, output signal is outside of the plausible signal range)

### Update rate

- Typ. 2.5 kHz

### Measuring range

- 0 ... 30° up to 0 ... 360° in 10°-steps
- ≤ ±0.5 %FS (at pull-down resistor 10 kΩ)

### Resolution

- 12 bits

### Repeatability

- Typ. ≤ ±0.1°

### Temperature error

- Measuring range 30 ... 170°: Typ. ±0.875 %FS, Measuring range ≥ 180°: Typ. ±0.6 %FS

### Supply voltage Ub

- 5 VDC (4.5 ... 5.5 VDC)

### Current consumption w/o load

- Typ. 13 mA per channel (typ. 8 mA on request)

### Polarity protection

- Yes (supply lines)

### Short circuit protection

- Yes (all outputs vs. GND and supply voltage)

### Insulation resistance (500 VDC)

- ≥ 10 MΩ

### Environmental Data

- Max. operational speed: Mechanically unlimited
- Vibration (IEC 60068-2-6)
  - 20 g, 5 ... 2000 Hz, Amax = 0.75 mm
- Shock (IEC 60068-2-27)
  - 50 g, 6 ms
- Protection class DIN EN 60529
  - IP67 / IP68 / IP69
- Operating temperature
  - -40 ... +125°C
- Life
  - Mechanically unlimited
- MTTF (IEC 60068)
  - 9526 years (one-channel), 4441 years (partly redundant, per channel) or 4512 years (fully redundant, per channel)
- Traceability
  - Serial number on type labeling; production batch of the sensor assembly and relevant sensor components

### Conformity/Approval

- CE, UKCA
- See https://www.novotechnik.de/en/downloads/certificates/declarations-of-conformity-eu/uk

### EMC Compatibility

- ISO 10605 ESD (Handling/Component)
  - 8 kV / 15 kV
- ISO 11452-2 Radiated HF-fields
  - 200 V/m
- ISO 11452-5 Radiated HF-fields, stripe line
  - 200 V/m
- EN 61000-4-2 Fast transients (burst)
  - 1 kV
- EN 61000-4-6 Cond. disturbances (HF fields)
  - 10 V eff.
- EN 61000-4-8 Magnetic fields
  - 30 A/m

### FS = Full scale: Signal span according to electrical measuring range

### Available on request: SPI or PWM interface

<table>
<thead>
<tr>
<th>Signal</th>
<th>Lead wires code 40_</th>
<th>Lead wires code 41_</th>
<th>Lead wires code 42_</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage Ub 1</td>
<td>GN</td>
<td>GN</td>
<td>GN</td>
</tr>
<tr>
<td>GND 1</td>
<td>BN</td>
<td>BN</td>
<td>BN</td>
</tr>
<tr>
<td>Signal output 1</td>
<td>WH</td>
<td>WH</td>
<td>WH</td>
</tr>
<tr>
<td>Signal output 2</td>
<td>YE</td>
<td>YE</td>
<td>YE</td>
</tr>
<tr>
<td>Supply voltage Ub 2</td>
<td>-</td>
<td>-</td>
<td>RD</td>
</tr>
<tr>
<td>GND 2</td>
<td>-</td>
<td>-</td>
<td>BK</td>
</tr>
</tbody>
</table>
Technical Data
Output Characteristics

Output characteristic

Output characteristic

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Position Markers

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 °C ... +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 °C ... +125 °C
P/N | Pack. unit [pcs]
---|---
400056088 | 1
400056089 | 25

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 °C ... +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 °C ... +125 °C
P/N | Pack. unit [pcs]
---|---
300105041 | 1
300105042 | 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
P/N Pack. unit [pcs]
400106735 1
400106736 25

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
P/N Pack. unit [pcs]
400104756 1
400104757 25

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
P/N Pack. unit [pcs]
400108462 1
400108463 25

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
P/N Pack. unit [pcs]
400104754 1
400104755 25
**Position Markers**

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

**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**:
  - 300005658: 1 pack.
  - 400056081: 50 packs.

**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**:
  - 400005659: 1 pack.
  - 400056082: 50 packs.
Position Markers

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

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1 ... 3</td>
<td>2.8 ... 6.2</td>
<td>0 ... 5</td>
<td>0 ... 2.8</td>
<td>2.8 ... 6.2</td>
<td>6.1 ... 10.9</td>
<td>2.8 ... 6.2</td>
<td>1.2 ... 2.7</td>
<td>2.8 ... 6.2</td>
<td>0.9 ... 3.4</td>
</tr>
</tbody>
</table>

Working Distances Position Markers [mm] - Redundant Versions

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>0.6 ... 2.6</td>
<td>2.8 ... 6.2</td>
<td>0 ... 4.5</td>
<td>0 ... 2.3</td>
<td>2.8 ... 6.2</td>
<td>5.6 ... 10.4</td>
<td>2.8 ... 6.2</td>
<td>0.7 ... 2.3</td>
<td>2.8 ... 6.2</td>
<td>0.5 ... 2.9</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>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: ±0.7°</td>
<td>0.5 mm: ±1.3°</td>
<td>1.0 mm: ±0.8°</td>
<td></td>
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<tr>
<td>1.0 mm: ±1.1°</td>
<td>1.0 mm: ±1.1°</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: ±4.0°</td>
<td>4.0 mm: ±5.4°</td>
<td></td>
</tr>
</tbody>
</table>

Additional Linearity Error at Radial Displacement - Redundant Versions

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<td>1.0 mm: ±2.0°</td>
<td>1.0 mm: ±4.5°</td>
<td>2.0 mm: ±2.4°</td>
</tr>
<tr>
<td>2.0 mm: ±5.2°</td>
<td>2.0 mm: ±5.2°</td>
<td>2.0 mm: ±4.6°</td>
<td>2.0 mm: ±4.0°</td>
<td>4.0 mm: ±6.7°</td>
<td></td>
</tr>
</tbody>
</table>
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-, 6- and 8-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
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.