NOVOHALL
Rotary Sensor
Touchless
RFC-4800
4 ... 20 mA
Mobile Applications

Special Features
- Touchless hall technology
- Electrical range up to 360°
- 2 part design, mechanically decoupled
- High protection class IP67, IP68, IP69
- Resolution up to 12 bit
- Wear-free
- Temperature range -40 °C to +105 °C
- One and multi-channel versions
- Optimized for use in mobile applications with highest EMC requirements such as ISO pulses and high interferences to ISO 11452 and ECE-Standard
- Suitable for safety-related applications according to DIN EN ISO 13849
- Other configurations see separate data sheets

Applications
- Mobile working machines (industrial trucks, construction machinery, agricultural and forestry machinery)
- Marine applications

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. With its completely encapsulated electronics the sensor is perfectly suited for use in harsh environments. Single and dual-channel versions are available and suitable for use in safety-related applications.

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 M4 x 20 (included in delivery)</td>
</tr>
<tr>
<td>Fastening torque of mounting</td>
<td>250 Ncm</td>
</tr>
<tr>
<td>Electrical connection</td>
<td>Cable 4 x 0.5 mm² (AWG 20), TPE, un shielded / Connector M12x1 or AMP Superseal with cable L = 0.15 m / Lead wires 0.5 mm² (AWG 20), PVC</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 E/D/W
- Best low-volume pricing

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

### Supply voltage $U_b$
- 3: $U_b = 12/24$ VDC

### Output signal
- 2: 4 ... 20 mA

### Output characteristic
- 1: Rising characteristic cw
- 2: Rising characteristic ccw
- 3: Crossed outputs, channel 1 rising cw (partly redundant)
- 4: Crossed outputs, channel 1 rising cw (fully redundant)

### Other output characteristics on request

#### Electrical connection
- Single-channel / partly redundant version
- 251: Cable, 4-pole, unshielded, $L = 0.5$ m
- 252: Cable, 4-pole, unshielded, $L = 1$ m
- 256: Cable, 4-pole, unshielded, $L = 3$ m
- 260: Cable, 4-pole, unshielded, $L = 5$ m
- 270: Cable, 4-pole, unshielded, $L = 10$ m
- 401: Lead wires, 3x $L = 0.5$ m (single)
- 411: Lead wires, 4x $L = 0.5$ m (partly redundant)
- 551: Connector M12x1, 4-pin, with cable $L = 0.15$ m, unshielded
- 552: Connector AMP Superseal, 4-pin, with cable $L = 0.15$ m, unshielded
- Fully redundant version
- 421: Lead wires, 6x $L = 0.5$ m
- Cable versions and assembled connectors on request

### Measuring range
- 00: 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)
- 7: Partly redundant version (1x supply voltage $U_b$, 2x output)
- 8: Fully redundant version (2x supply voltage $U_b$, 2x output)

### Mechanical version
- 4851: Elongated hole mounting for easy adjustment
- 4852: Round hole mounting
- 4853: Elongated hole mounting, without diagnostic function
- 4854: 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_ - _ -32_-_ _ _</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog current</td>
<td></td>
</tr>
<tr>
<td>Output signal</td>
<td>4 ... 20 mA</td>
</tr>
<tr>
<td>Burden</td>
<td>@Ub &gt; 13 V: ≤ 500 Ω, @Ub ≤ 13 V: ≤ 250 Ω</td>
</tr>
<tr>
<td>Number of channels</td>
<td>1 / 2</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>activated (in case of error, output signal is outside of the plausible signal range)</td>
</tr>
<tr>
<td>Update rate</td>
<td>typ. 3.4 kHZ</td>
</tr>
<tr>
<td>Measuring range</td>
<td>0 ... 360° 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>Repeatability</td>
<td>typ. ≤ ±0.1°</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>typ. &lt; ±0.1°</td>
</tr>
<tr>
<td></td>
<td>Only measuring range 360°: typ. &lt; 0.25° (lower hysteresis on request)</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>12/24 VDC (8 ... 34 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 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 | PB7 / IP68 / IP69, IP67 (connector M12) |
| Operating temperature       | -40 ... +105°C               |
|                            | -25 ... + 85°C (connector M12) |
| Life                        | Mechanically unlimited       |
| Functional safety           | Suitable for safety-related applications according to ISO 13849 after customer validation. Further safety data (DCAw...), and support for functional safety are available on request. |
| Lifetime (IEC 60068-1)      | 1453 years (one-channel), 896 years (partly redundant, per channel) or 564 years (fully redundant, per channel) |
| MTTF (IEC 60068)            | 1453 years (one-channel), 896 years (partly redundant, per channel) or 564 years (fully redundant, per channel) |
| MTTF (EN ISO 13849-1 parts count method, w/o load) | 1453 years (one-channel), 896 years (partly redundant, per channel) or 564 years (fully redundant, per channel) |
| MTTF-1 certificate          | https://www.novotechnik.de/en/downloads/certificates/mttf-1-certificate/ |
| Traceability                | Serial number on type labeling; production batch of the sensor assembly and relevant sensor components |

**Conformity/Approval**

| WEEE see | https://www.novotechnik.de/en/downloads/certificates/eur directive-weee/ |

**EMC Compatibility**

| ISO 10055 ESD (Handling/Component) | 8 kV / 15 kV |
| ISO 11452-2 Radiated HF-fields   | 100 V/m |
| ISO 11452-3 Radiated HF-Fields, stripline | 250 V/m |
| CISPR 25 Radiated emission       | Level 5 |
| ISO 7637-2 Transient Emissions   | Level 3 |
| ISO 7637-2 Pulses on supply lines | Level 4 |
| ISO 7637-3 Pulses on output lines | Level 4 |
| EN 13309 Construction machinery | acc. to ECE: R10 |
| ISO 13766-1/2 Construction machinery | Any dual-channel version |

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

<table>
<thead>
<tr>
<th>Signal</th>
<th>Cable code 2_ _</th>
<th>Connector code 5_ _</th>
<th>Lead wires code 4_ _</th>
<th>Cable code 2_ _</th>
<th>Connector code 5_ _</th>
<th>Lead wires code 4_ _</th>
<th>Lead wires code 4_ _</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single-channel</td>
<td>Single-channel</td>
<td>Single-channel</td>
<td>Partially redundant</td>
<td>Partially redundant</td>
<td>Partially redundant</td>
<td>Fully redundant</td>
</tr>
<tr>
<td>Supply voltage Ub 1</td>
<td>GN</td>
<td>Pin 1</td>
<td>RD</td>
<td>GN</td>
<td>Pin 1</td>
<td>RD</td>
<td>RD</td>
</tr>
<tr>
<td>GND 1</td>
<td>BN</td>
<td>Pin 3</td>
<td>BK</td>
<td>BN</td>
<td>Pin 3</td>
<td>BK</td>
<td>BK</td>
</tr>
<tr>
<td>Signal output 1</td>
<td>WH</td>
<td>Pin 2</td>
<td>BU</td>
<td>WH</td>
<td>Pin 2</td>
<td>BLU</td>
<td>BLU</td>
</tr>
<tr>
<td>Signal output 2</td>
<td></td>
<td></td>
<td>YE</td>
<td></td>
<td></td>
<td>RD/WH</td>
<td>RD/WH</td>
</tr>
<tr>
<td>Supply voltage Ub 2</td>
<td>ME</td>
<td>Pin 4</td>
<td></td>
<td></td>
<td></td>
<td>RD/WH</td>
<td>RD/WH</td>
</tr>
<tr>
<td>Not assigned</td>
<td>YE</td>
<td>Pin 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Pin assignment M912](image)
Technical Data
Output Characteristics

Temperature Diagram

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

Supply voltage [V]

Output characteristic

One-channel, rising cw

Output characteristic

Crossed output characteristics, ch. 1 rising cw

Output characteristic

On request: output characteristics with offset

Output characteristic

On request: different gradients
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
400056084 | 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
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
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

| RFC-4851 | RFC-4852 with diagnosis | RFC-4853 | RFC-4854 with diagnosis |
| Z-RFC-P02 / P04 / P08 | Z-RFC-P20 / P23 / P31 | Z-RFC-P03 / P30 | Z-RFC-P03 / P30 |
| 2.3 … 5 | 0 ... 2.7 | 0.7 ... 2.2 | 0 ... 4.5 |
| Z-RFC-P18 / P28 | Z-RFC-P19 | Z-RFC-P22 |
| 0 ... 2.2 | 4.4 ... 9.2 |

Working Distances Position Markers [mm] - Redundant Versions

| RFC-4853 | RFC-4854 with diagnosis |
| Z-RFC-P02 / P04 / P08 | Z-RFC-P20 / P23 / P31 |
| Z-RFC-P03 / P30 | Z-RFC-P18 / P28 |
| Z-RFC-P19 | Z-RFC-P22 |
| 0 ... 4 | 0 ... 2.3 |
| 0 ... 4 | 0 ... 1.7 |
| 4 ... 8.8 |

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

| Z-RFC-P02 / P04 / P08 | Z-RFC-P02 / P04 / P08 |
| Z-RFC-P03 / P30 | Z-RFC-P03 / P30 |
| Z-RFC-P18 / P28 | Z-RFC-P19 | Z-RFC-P22 |
| 0.5 mm: ±0.4° | 0.5 mm: ±0.4° |
| 1.0 mm: ±1.1° | 1.0 mm: ±1.1° |
| 2.0 mm: ±3.5° | 2.0 mm: ±3.5° |
| 0.5 mm: ±0.7° | 0.5 mm: ±0.7° |
| 1.0 mm: ±1.3° | 1.0 mm: ±1.3° |
| 2.0 mm: ±3.3° | 2.0 mm: ±3.3° |
| 0 ... 2.7 | 0 ... 2.7 |
| 1.0 mm: ±2.6° | 1.0 mm: ±2.6° |
| 2.0 mm: ±4.6° | 2.0 mm: ±4.6° |
| 1.0 mm: ±1.1° | 1.0 mm: ±1.1° |
| 2.0 mm: ±2.4° | 2.0 mm: ±2.4° |
| 4.0 mm: ±6.7° | 4.0 mm: ±6.7° |

Additional Linearity Error at Radial Displacement - Redundant Versions

| Z-RFC-P02 / P04 / P08 | Z-RFC-P02 / P04 / P08 |
| Z-RFC-P03 / P30 | Z-RFC-P03 / P30 |
| Z-RFC-P18 / P28 | Z-RFC-P19 | Z-RFC-P22 |
| 0.5 mm: ±0.7° | 0.5 mm: ±0.7° |
| 1.0 mm: ±1.8° | 1.0 mm: ±1.8° |
| 2.0 mm: ±3.2° | 2.0 mm: ±3.2° |
| 0.5 mm: ±1.1° | 0.5 mm: ±1.1° |
| 1.0 mm: ±2.3° | 1.0 mm: ±2.3° |
| 2.0 mm: ±4.6° | 2.0 mm: ±4.6° |
| 1.0 mm: ±1.1° | 1.0 mm: ±1.1° |
| 2.0 mm: ±2.4° | 2.0 mm: ±2.4° |
| 4.0 mm: ±6.7° | 4.0 mm: ±6.7° |
Connector System
M12

EEM-33-35/36/37
M12x1 Mating female connector, 4-pin, straight, A-coded, with molded cable, not shielded, IP67, open ended
Plug housing: PA
Cable sheath: PUR, Ø = max. 6 mm,
-40...+85°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>400056135</td>
<td>EEM-33-35</td>
<td>2 m</td>
</tr>
<tr>
<td>400056136</td>
<td>EEM-33-36</td>
<td>5 m</td>
</tr>
<tr>
<td>400056137</td>
<td>EEM-33-37</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
Suit for applications in draughts
UL - approved
CAN-Bus

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Connecting Options
on request

M12 connector
- Customized lengths
- 3-, 4-, 6- and 8-pole versions
- Protection class IP66
- 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.