Special Features

- Touchless hall technology
- Electrical range 360°
- 2 part design, mechanically decoupled
- High protection class IP67, IP68, IP69K
- Resolution 14 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, exceeds E1 requirements
- 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. The sensor is perfectly suitable for use in harsh environmental conditions through the completely encapsulated electronics.

<table>
<thead>
<tr>
<th>Description</th>
<th>Material</th>
<th>Housing: high grade, temperature resistant plastic PBT GF30 with SS inserts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting</td>
<td>With 2 pan head screws M4x18 (included in delivery)</td>
<td></td>
</tr>
<tr>
<td>Fastening torque of mounting</td>
<td>max. 200Nm</td>
<td></td>
</tr>
<tr>
<td>Electrical connection</td>
<td>6-pin MQS-connector, code A, tinned contact according to drawing AMP-114-18063-126, Index A1 (Connector: AMP P/N 1-967616-1)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mechanical Data</th>
<th>Dimensions</th>
<th>See dimension drawing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical travel</td>
<td>continuous</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>approx. 50 g</td>
<td></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 M4x18

Interface
J: CAN SAE J1939

Interface parameters
Single-channel version
1: 1x position, 1x speed, 1x revolution counter
6: 1x position, 1x speed, 1x revolution counter with bus termination 120 Ohm
Dual-channel version
2: 2x position, 2x speed
3: 2x position, 1x revolution counter
6: 2x position, 2x speed with bus termination 120 Ohm
7: 2x position, 1x revolution counter with bus termination 120 Ohm

Baud rate
3: 500 kbit/s
4: 250 kbit/s

Electrical connection
521: Connector AMP M05 6-pin, male

Resolution
14: 14 bits

Interface
2: Digital Interface

Series
Mechanical version
3201: Standard design
When the marking of the position marker points towards the connector, the sensor is near the electrical center position.
## Technical Data

### Type

**RFE-32_ _-214-J_ _-_ _ _**

**CAN SAE J1939**

### Measured variables

- Position, speed, revolution counter

### Measuring range

- 360°

### Measuring range speed

- 0 ... 750 rpm

### Number of channels

- 1 / 2

### Protocol

- CAN SAE J1939

### Diagnostic parameters

- Offset position, counting direction, averaging, baud rate, transmit mode, transmit cycle, source address, resolution position, resolution speed

### Diagnosis

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

### Node ID

- 128 ... 247 (dynamic address claiming)

### Baud rate

- 250, 500 kBaud

### Update rate (output)

- 1 kHz

### Resolution

- 14 bits

### Resolution speed

- 0.055°/s ... 2.2°/s

### Linearity

- ±0.5 %FS

### Hysteresis

- ±0.1 %FS

### Temperature error

- ±0.2 %FS

### Supply voltage Ub

- 12/24 VDC (8 ... 34 VDC)

### Power consumption at Power-on

- ≤ 50 mA

### Overvoltage protection

- 45 VDC (permanent)

### Polarity protection

- Yes (supply lines)

### Short circuit protection

- Yes (all outputs vs. GND and supply voltage up to 40 VDC)

### Insulation resistance (500 VDC)

- ≥ 10 MΩ

### Bus termination internal

- 120 Ω (optionally)

### 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 ISO 20653

- IP65 / IP68 / IP69K

#### Operating temperature

- -40 ... +105°C

### Life

- Mechanically unlimited

### Functional safety

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

### MTTF (IEC 60050)

- 843 years (one-channel) or 819 years (two-channel, per channel)

### Traceability

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

### Conformity/Approval


### ISO 10605 ESD (Handling/Component)

- II KV

### ISO 11452-2 Radiated HF-fields

- 100 V/m

### ISO 11452-4 BCI (Bulk current injection)

- 200 mA

### CISPR 25 Radiated emission

- Level 3

### ISO 7637-2 Transient Emissions

- Level 4

### ISO 7637-2 Pulses on supply lines

- [1, 2a, 2b, 3a, 3b, 4, 5] Level 4

### ISO 7637-3 Pulses on output lines

- [3a, 3b] Fast Level 2, Slow Level 4

### ISO 16750 Pulses on supply lines

- Starting profile Level 4 @12 V / Level 3 @24 V

### Emission/Immunity

- Exceeds IEC requirements

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

<table>
<thead>
<tr>
<th>Signal</th>
<th>Connector code</th>
<th>Pin 1</th>
<th>Pin 2</th>
<th>Pin 3, pin 6</th>
<th>Pin 4, pin 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage Ub</td>
<td>code 5_ _</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAN_H</td>
<td>Pin 3, pin 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAN_L</td>
<td>Pin 4, pin 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>P/N</th>
<th>Pack. unit [pcs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>400056074</td>
<td>1</td>
</tr>
<tr>
<td>400056085</td>
<td>25</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>P/N</th>
<th>Pack. unit [pcs]</th>
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</thead>
<tbody>
<tr>
<td>400105041</td>
<td>1</td>
</tr>
<tr>
<td>400105042</td>
<td>25</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>P/N</th>
<th>Pack. unit [pcs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>400056086</td>
<td>1</td>
</tr>
<tr>
<td>400056087</td>
<td>25</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>P/N</th>
<th>Pack. unit [pcs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>400056088</td>
<td>1</td>
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<tr>
<td>400056089</td>
<td>25</td>
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</tbody>
</table>
Position Markers

<table>
<thead>
<tr>
<th>Position Marker</th>
<th>Material</th>
<th>Max. permitted radial offset</th>
<th>Operating temp.</th>
<th>P/N</th>
<th>Pack. unit [pcs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-RFC-P22</td>
<td>Aluminium, anodized</td>
<td>± 4 mm</td>
<td>-40 ... +125°C</td>
<td>400106735</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>400106736</td>
<td>25</td>
</tr>
<tr>
<td>Z-RFC-P18</td>
<td>Aluminium, anodized</td>
<td>± 3 mm</td>
<td>-40 ... +125°C</td>
<td>400104756</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>400104757</td>
<td>25</td>
</tr>
<tr>
<td>Z-RFC-P28</td>
<td>Aluminium, anodized</td>
<td>± 3 mm</td>
<td>-40 ... +125°C</td>
<td>400108462</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>400108463</td>
<td>25</td>
</tr>
<tr>
<td>Z-RFC-P19</td>
<td>Aluminium, anodized</td>
<td>± 1.5 mm</td>
<td>-40 ... +125°C</td>
<td>400104754</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<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]
---|---
300056558 | 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]
---|---
400056559 | 1
400056082 | 50
Position Markers

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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4 ... 1.9</td>
<td>2 ... 4.7</td>
<td>0 ... 4</td>
<td>0 ... 1.8</td>
<td>2 ... 4.7</td>
<td>4.1 ... 8.9</td>
<td>2 ... 4.7</td>
<td>0.4 ... 1.9</td>
<td>2 ... 4.7</td>
<td>0 ... 2.4</td>
</tr>
</tbody>
</table>

### Working Distances Position Markers [mm] - Redundant Versions

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 1.5</td>
<td>1.6 ... 4.2</td>
<td>0 ... 3.5</td>
<td>0 ... 1.3</td>
<td>1.6 ... 4.2</td>
<td>2.6 ... 8.4</td>
<td>1.6 ... 4.2</td>
<td>0 ... 1.5</td>
<td>1.6 ... 4.2</td>
<td>0 ... 2</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: ±1.4°</td>
<td>0.5 mm: ±0.7°</td>
<td>0.5 mm: ±1.3°</td>
<td>1.0 mm: ±0.8°</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>
</tr>
<tr>
<td>2.0 mm: ±3.5°</td>
<td>2.0 mm: ±3.5°</td>
<td>2.0 mm: -</td>
<td>2.0 mm: ±3.3°</td>
<td>2.0 mm: -</td>
<td>4.0 mm: ±5.4°</td>
</tr>
</tbody>
</table>

### Additional Linearity Error at Radial Displacement - Redundant 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: ±0.7°</td>
<td>0.5 mm: ±0.7°</td>
<td>0.5 mm: ±2.5°</td>
<td>0.5 mm: ±1.1°</td>
<td>0.5 mm: ±2.3°</td>
<td>1.0 mm: ±1.1°</td>
</tr>
<tr>
<td>1.0 mm: ±1.8°</td>
<td>1.0 mm: ±1.8°</td>
<td>1.0 mm: ±6.4°</td>
<td>1.0 mm: ±2°</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: -</td>
<td>2.0 mm: ±4.6°</td>
<td>2.0 mm: -</td>
<td>4.0 mm: ±6.7°</td>
</tr>
</tbody>
</table>
Connector System
MQS

EEM-33-34
Connector kit MQS System including
• 1 plug socket (female), PBT GF15, AMP P/N 1-967616-1
• 6 tinned contacts for cable cross-section area 0.25 ... 0.35 mm² (AWG 22), AMP-P/N 963727-1 or 5-962885-1
• 6 single conductor sealings AMP P/N 967287-2
Operating temp. -40 ... +120°C

<table>
<thead>
<tr>
<th>P/N</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>400005666</td>
<td>EEM-33-34</td>
</tr>
</tbody>
</table>

EEM-33-24
Connector MQS AMP P/N 1-967616-1, 6-pin, PBT GF15, with lead wires 0.5 mm², PVC, 1 m, open ended
Operating temp. -40 ... +120°C
Lead wires PVC, 6x0.5 mm²

<table>
<thead>
<tr>
<th>P/N</th>
<th>Type</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>300106229</td>
<td>EEM-33-24</td>
<td>1 m</td>
</tr>
</tbody>
</table>
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.