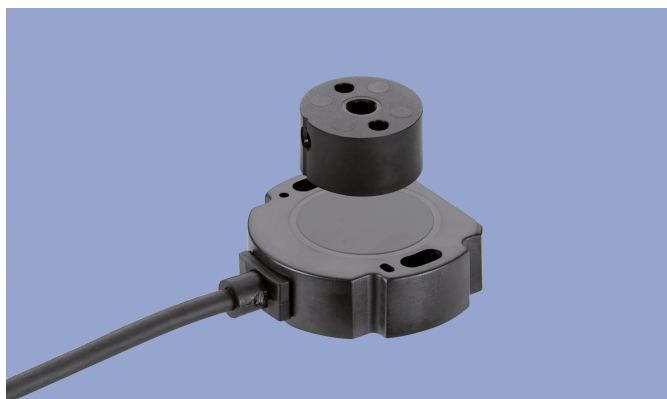
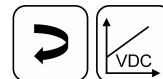


**NOVOHALL
Rotary Sensor
Touchless**

**RFC-4800
Ratiometric
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

| | |
|------------------------------|--|
| Material | Housing: high grade, temperature resistant plastic |
| Mounting | With 2 pan head screws M4x20 (included in delivery) |
| Fastening torque of mounting | 250 Ncm |
| Electrical connection | Cable 4x 0.5 mm ² (AWG 20), TPE, unshielded / Connector M12x1 or AMP Superseal with cable L = 0.15 m / Lead wires 0.5 mm ² (AWG 20), PVC |

Mechanical Data

| | |
|-------------------------|-----------------------|
| Dimensions | See dimension drawing |
| Mechanical travel | continuous |
| Weight (w/o connection) | approx. 50 g |

Ordering Specifications

Ordering Specifications

Preferred types printed in bold

- Delivery time up to 25 pcs. within 10 working days EXW
- Best low-volume pricing

Supply voltage Ub

2: Ub = 5 VDC

Output signal

1: 5 ... 95% ratiometric to supply voltage Ub (0.25 ... 4.75 VDC)

2: 10 ... 90% ratiometric to supply voltage Ub (0.5 ... 4.5 VDC)

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

R F C - 4 8 5 1 - 6 3 6 - 2 1 1 - 4 0 1

Series

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

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 Ub, 1x output)

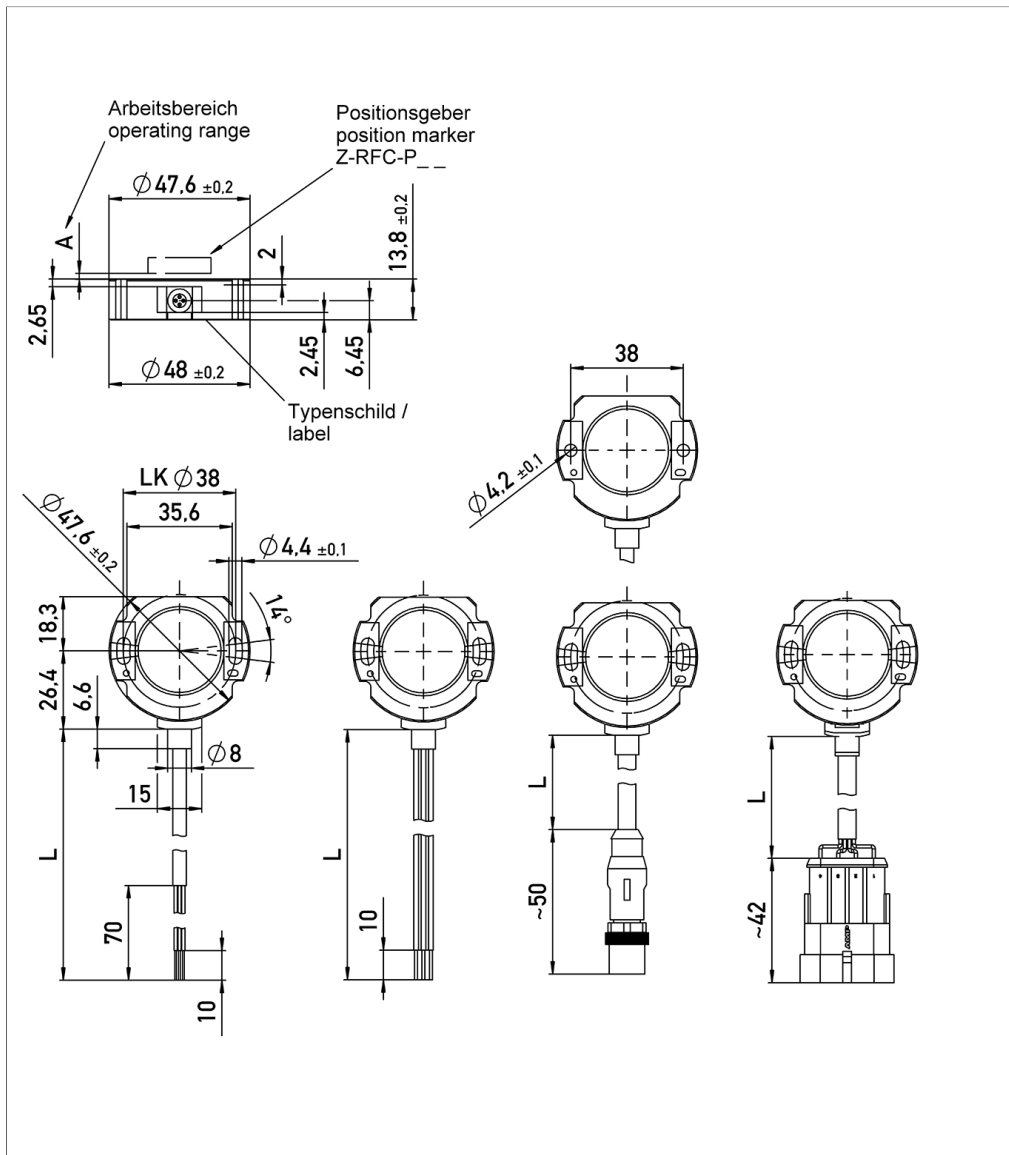
7: Partly redundant version (1x supply voltage Ub, 2x output)

8: Fully redundant version (2x supply voltage Ub, 2x output)

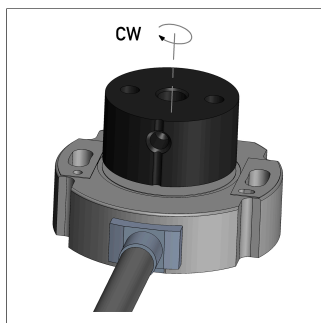
Accessories included in delivery

- 2x Pan head screws M4x20

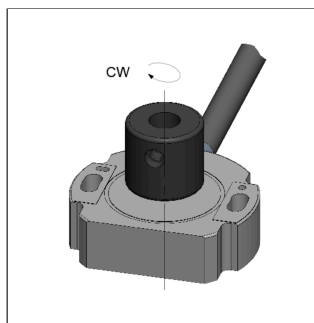
Drawing



CAD data see
www.novotechnik.de/en/download/cad-data/



When the marking of the position marker is pointing towards the cable, the sensor output is near the electrical center position (index position).



Only Z-RFC-P23/P43:
When the marking of the position marker is pointing away from the cable, the sensor output is near the electrical center position (index position).

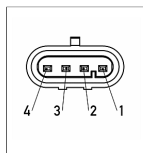
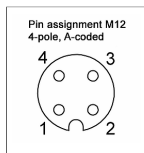
Technical Data

| Type | RFC-48 _ _ _ _ -2 _ _ _ _ Ratiometric |
|---|--|
| Output signal | ratiometric to supply voltage U_b 5 ... 95% (0.25 ... 4.75 V) 10 ... 90% (0.5 ... 4.5 V) |
| Load | $\geq 5 \text{ k}\Omega$ |
| Number of channels | 1 / 2 |
| Diagnosis | activated (in case of error, output signal is outside of the plausible signal range) |
| Update rate | typ. 3.4 kHz |
| Measuring range | 0 ... 30° up to 0 ... 360° in 10°-steps |
| Independent linearity | $\leq \pm 0.5 \text{ \%FS}$ |
| Resolution | 12 bits |
| Repeatability | typ. $\leq \pm 0.1^\circ$ |
| Hysteresis | typ. $< \pm 0.1^\circ$ Only measuring range 360°: typ. $< 0.25^\circ$ (lower hysteresis on request) |
| Temperature error | Measuring range 30 ... 170°: typ. $\pm 0.7 \text{ \%FS}$, Measuring range $\geq 180^\circ$: typ. $\pm 0.35 \text{ \%FS}$ |
| Supply voltage U_b | 5 VDC (4.5 ... 5.5 VDC) |
| Current consumption w/o load | typ. 12 mA per channel |
| Polarity protection | yes (supply lines and outputs) |
| Short circuit protection | yes (vs. GND and supply voltage) |
| Insulation resistance (500 VDC) | $\geq 10 \text{ M}\Omega$ |
| Environmental Data | |
| Max. operational speed | Mechanically unlimited |
| Vibration IEC 60068-2-6 | 20 g, 5 ... 2000 Hz, $A_{max} = 0.75 \text{ mm}$ |
| Shock IEC 60068-2-27 | 50 g, 6 ms |
| Protection class DIN EN 60529 | IP67 / IP68 / IP69, IP67 (connector M12) |
| Operating temperature | -40 ... +105°C, -40 ... +85°C (connector M12) |
| Life | Mechanically unlimited |
| Functional safety | Suitable for safety-related applications according to ISO 13849 after customer validation. Further safety data (DCavg...) and support for functional safety are available on request. |
| MTTF (IEC 60050) | 1652 years (one-channel), 824 years (partly redundant, per channel) or 826 years (fully redundant, per channel) |
| MTTFd (EN ISO 13849-1 parts count method, w/o load) | 3304 years (one-channel), 1648 years (partly redundant, per channel) or 1653 years (fully redundant, per channel) |
| MTTFd Declaration of Conformity | https://www.novotechnik.de/en/downloads/certificates/mttf-d-certificate |
| Traceability | Serial number on type labeling: production batch of the sensor assembly and relevant sensor components |
| Conformity/Approval | CE, UKCA, E1 see https://www.novotechnik.de/en/downloads/certificates/declarations-of-conformity-eu/uk WEEE see https://www.novotechnik.de/en/downloads/certificates/eu-directive-weee/ |
| EMC Compatibility | |
| ISO 10605 ESD (Handling/Component) | 8 kV / 15 kV |
| ISO 11452-2 Radiated HF-fields | 100 V/m |
| ISO 11452-5 Radiated HF-Fields, stripline | 200 V/m |
| CISPR 25 Radiated emission | Level 5 |
| EN 13309 Construction machinery | |
| Emission/Immunity E1 | acc. to ECE-R10 |
| ISO 13766-1/-2 Construction machinery | On request |

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

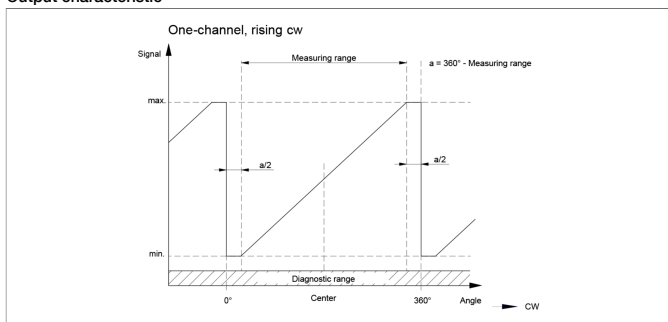
Connection Assignment

| Signal | Cable code 2__ | Connector code 5__ | Lead wires code 4__ | Cable code 2__ | Connector code 5__ | Lead wires code 4__ | Lead wires code 4__ |
|---------------------|-------------------|-----------------------|------------------------|-------------------|-----------------------|------------------------|------------------------|
| | Single-channel | Single-channel | Single-channel | Partly redundant | Partly redundant | Partly redundant | Fully redundant |
| Supply voltage Ub 1 | GN | Pin 1 | RD | GN | Pin 1 | RD | RD |
| GND 1 | BN | Pin 3 | BK | BN | Pin 3 | BK | BK |
| Signal output | WH | Pin 2 | BU | WH | Pin 2 | BU | BU |
| Signal output 2 | - | - | - | YE | Pin 4 | BU/WH | BU/WH |
| Supply voltage Ub 2 | - | - | - | - | - | - | RD/WH |
| GND 2 | - | - | - | - | - | - | BK/WH |
| Not assigned | YE | Pin 4 | - | - | - | - | - |

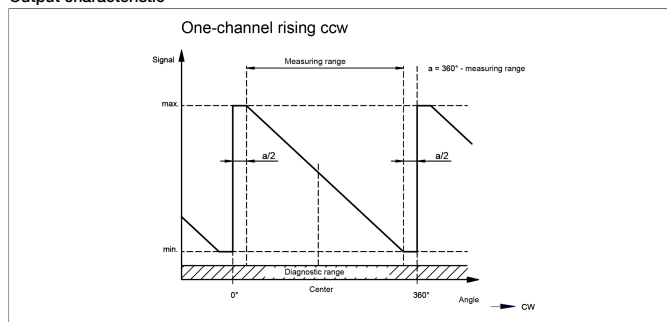


**Technical Data
Output
Characteristics**

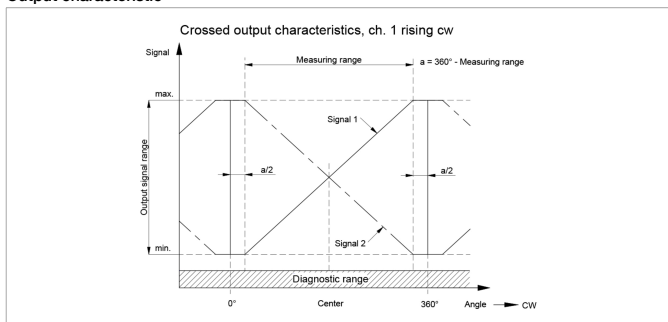
Output characteristic



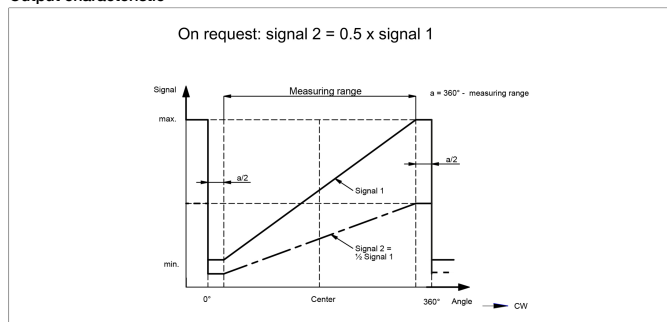
Output characteristic



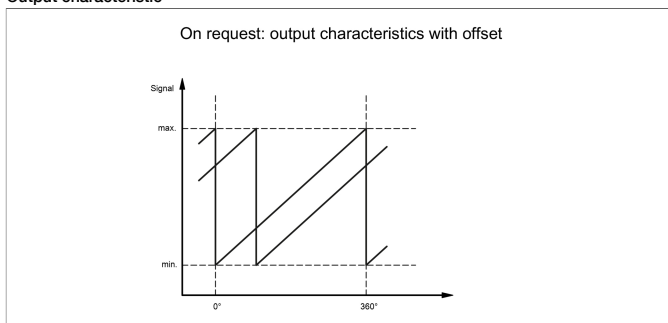
Output characteristic



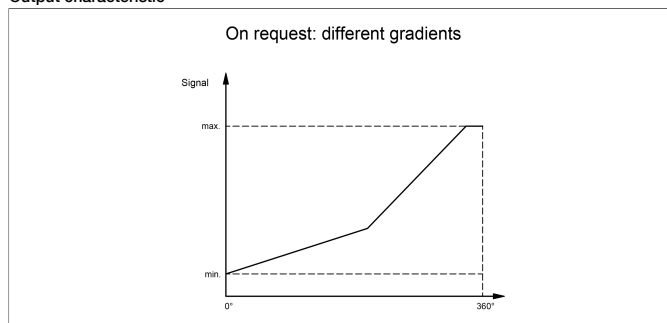
Output characteristic



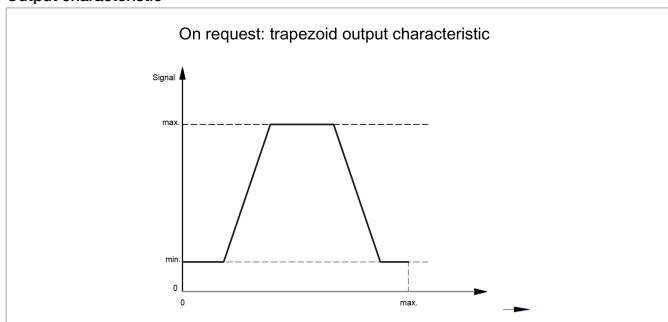
Output characteristic



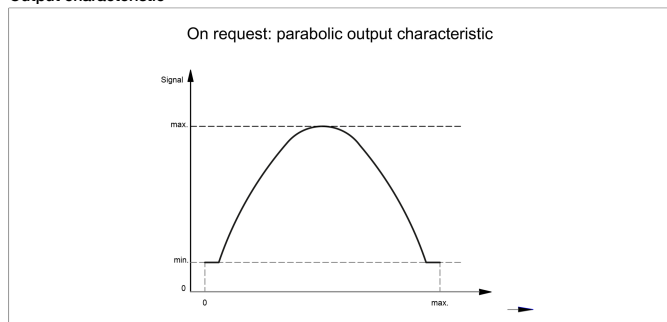
Output characteristic



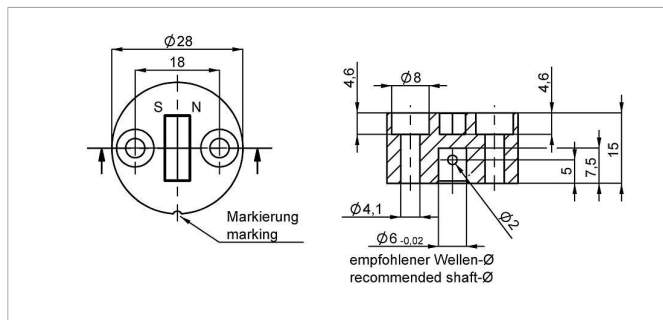
Output characteristic



Output characteristic



Position Markers

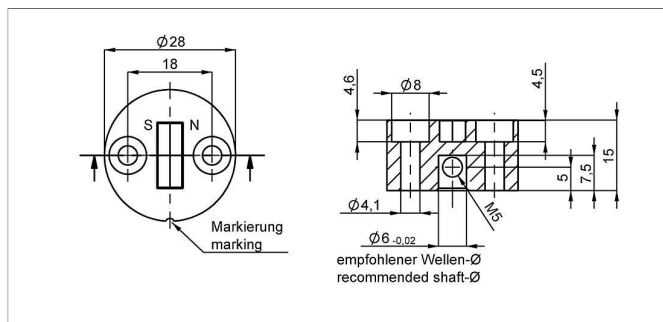


Z-RFC-P02

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 ± 3 mm
radial offset
Operating temp. $-40 \dots +125^{\circ}\text{C}$

| P/N | Pack. unit [pcs] |
|-----------|------------------|
| 40005661 | 1 |
| 400056080 | 25 |

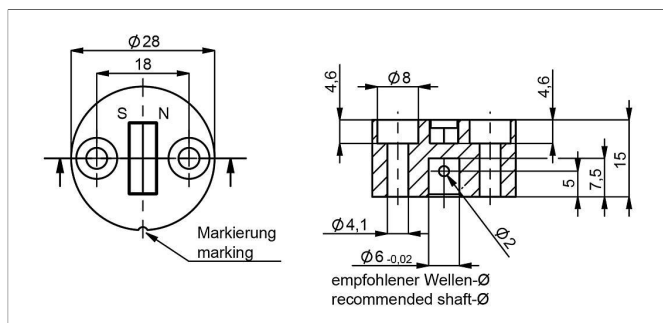


Z-RFC-P08

Position marker for fixation with threaded pin M5 (included in delivery).

Material PF
Max. permitted ± 3 mm
radial offset
Operating temp. $-40 \dots +125^{\circ}\text{C}$

| P/N | Pack. unit [pcs] |
|-----------|------------------|
| 400056070 | 1 |
| 400056084 | 25 |

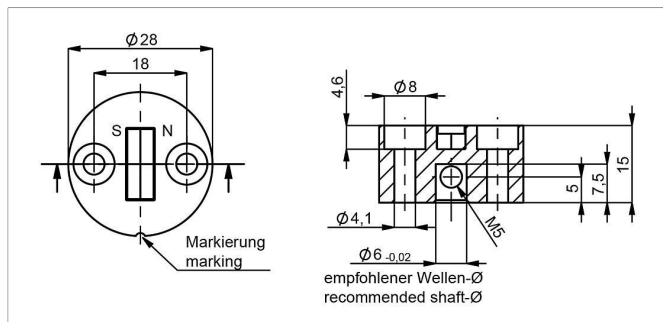


Z-RFC-P41

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 ± 3 mm
radial offset
Operating temp. $-40 \dots +125^{\circ}\text{C}$

| P/N | Pack. unit [pcs] |
|-----------|------------------|
| 400105037 | 1 |
| 400105038 | 25 |



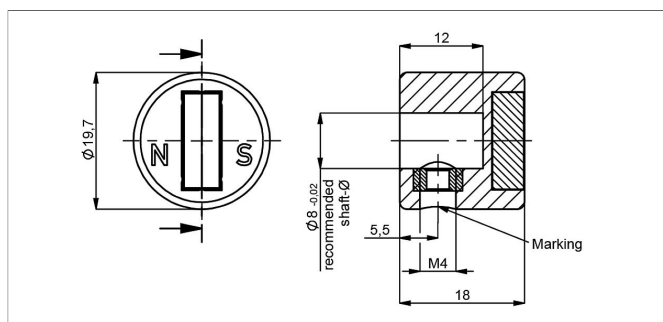
Z-RFC-P47

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 ± 3 mm
radial offset
Operating temp. $-40 \dots +125^{\circ}\text{C}$

| 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!

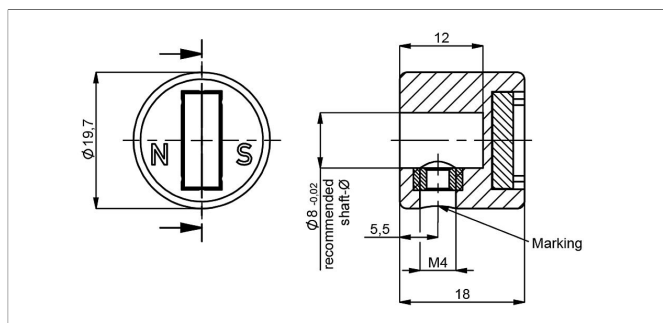
Material PA6-GF

Max. permitted ± 3 mm

radial offset

Operating temp. $-40 \dots +125^\circ\text{C}$

| 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!

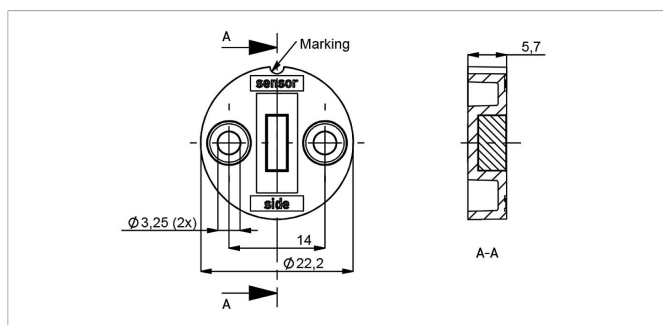
Material PA6-GF

Max. permitted ± 3 mm

radial offset

Operating temp. $-40 \dots +125^\circ\text{C}$

| P/N | Pack. unit [pcs] |
|-----------|------------------|
| 400105041 | 1 |
| 400105042 | 25 |



Z-RFC-P30

Position marker for frontal fixation with 2 cylinder screws M3x8 (included in delivery).

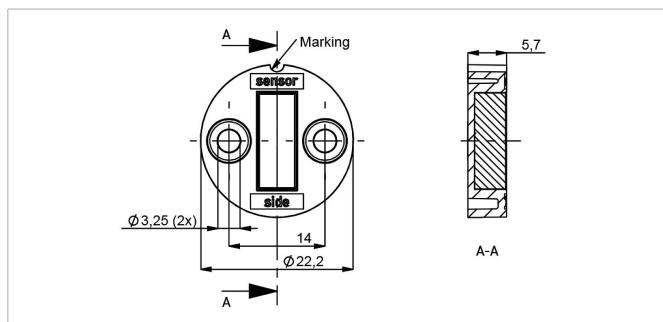
Material PBT-GF

Max. permitted ± 1.5 mm

radial offset

Operating temp. $-40 \dots +125^\circ\text{C}$

| 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

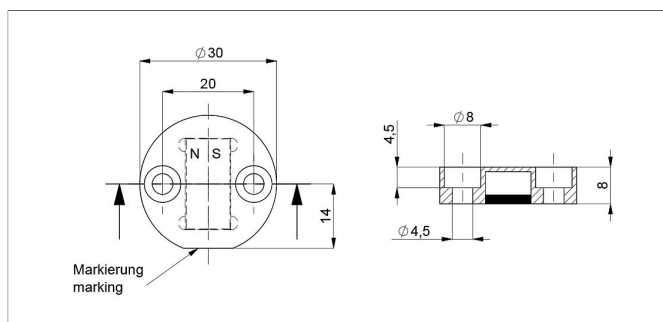
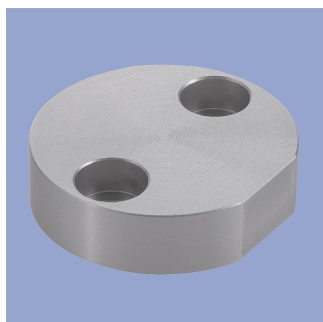
Max. permitted ± 3 mm

radial offset

Operating temp. $-40 \dots +125^\circ\text{C}$

| P/N | Pack. unit [pcs] |
|-----------|------------------|
| 400056088 | 1 |
| 400056089 | 25 |

Position Markers



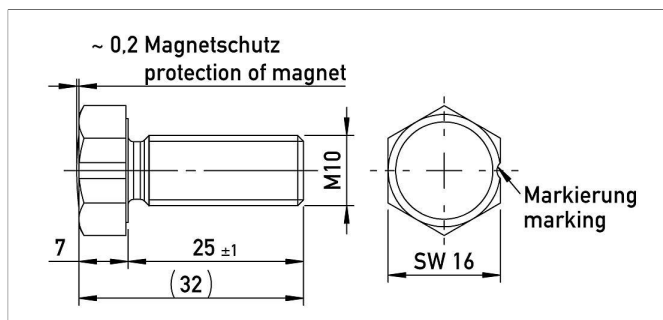
Z-RFC-P22

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. $-40 \dots +125^\circ\text{C}$

| P/N | Pack. unit [pcs] |
|-----------|------------------|
| 400106735 | 1 |
| 400106736 | 25 |

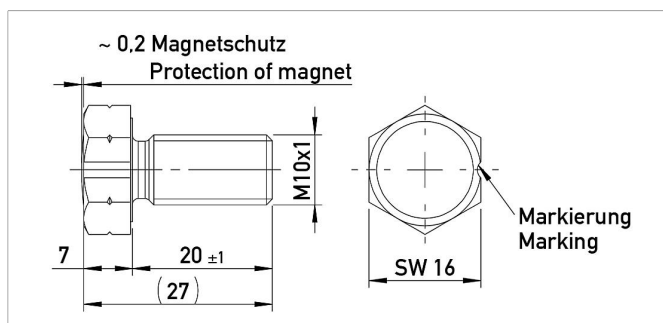


Z-RFC-P18

Screw position marker M10 x 25 mm, similar DIN 933, magnet potted

Material Aluminium, anodized
Max. permitted radial offset ± 3 mm
Operating temp. $-40 \dots +125^\circ\text{C}$

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

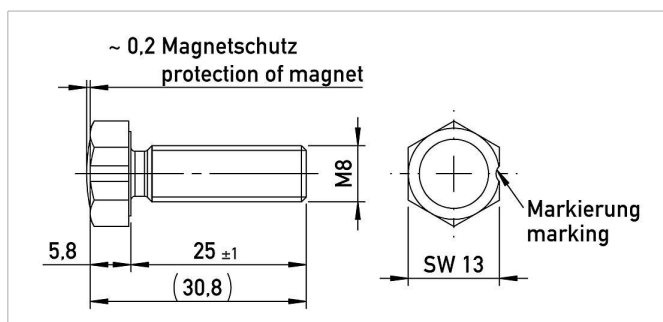


Z-RFC-P28

Screw position marker M10x1 x 20 mm, similar DIN 933, magnet potted

Material Aluminium, anodized
Max. permitted radial offset ± 3 mm
Operating temp. $-40 \dots +125^\circ\text{C}$

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



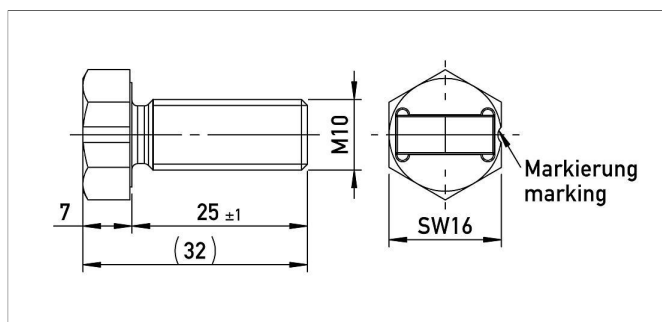
Z-RFC-P19

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. $-40 \dots +125^\circ\text{C}$

| P/N | Pack. unit [pcs] |
|-----------|------------------|
| 400104754 | 1 |
| 400104755 | 25 |

Position Markers



Z-RFC-P20

Screw position marker M10 x 25 mm, similar DIN 933

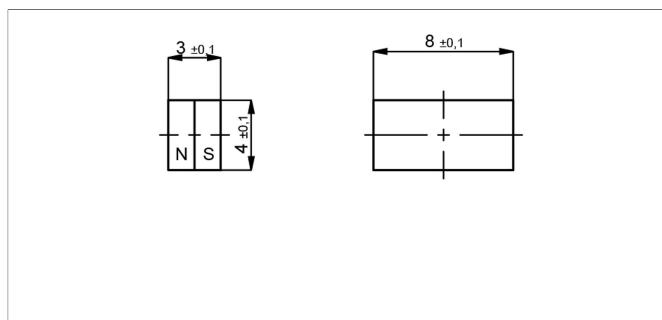
Material Aluminium, anodized

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).

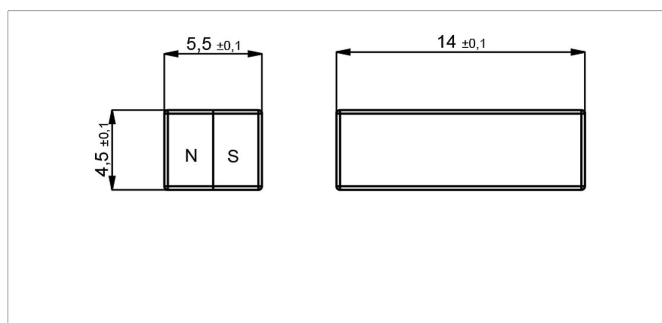
We recommend mounting on non-magnetizable materials, otherwise the specified working distances will vary (e.g. reduction of approx. 20% with axial mounting on a magnetizable shaft).

Max. permitted radial offset ± 1.5 mm

Operating temp. -40 ... +125°C

P/N Pack. unit [pcs]

| | |
|-----------|----|
| 400005658 | 1 |
| 400056081 | 50 |



Z-RFC-P04

Magnet for direct application onto customer's shaft (see user manual).

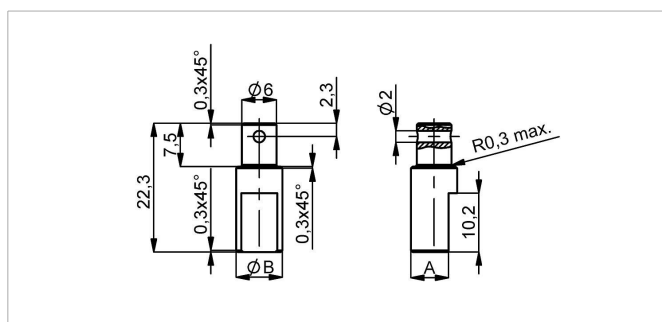
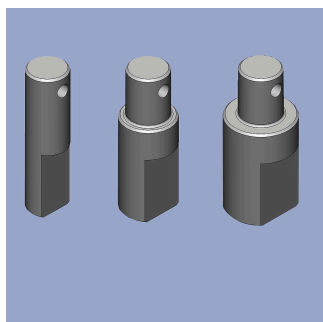
We recommend mounting on non-magnetizable materials, otherwise the specified working distances will vary (e.g. reduction of approx. 20% with axial mounting on a magnetizable shaft).

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

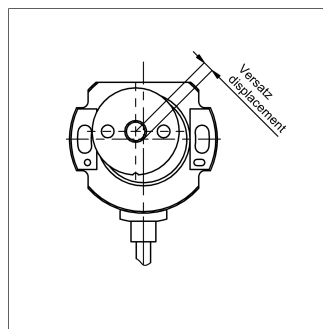
Working Distances Position Markers [mm] - Single-channel Versions

| | Z-RFC-P02 / P04 / P08 Z-RFC-P20 / P23 / P31 | Z-RFC-P41 / P43 / P47 | Z-RFC-P03 / P30 | Z-RFC-P18 / P28 | Z-RFC-P19 | Z-RFC-P22 |
|----------------------------|--|-----------------------|-----------------|-----------------|-----------|-------------|
| RFC-4851 | 2.3 ... 5 | 0 ... 2.7 | 0.7 ... 2.2 | 0 ... 4.5 | 0 ... 2.2 | 4.4 ... 9.2 |
| RFC-4852 with diagnosis | | | | | | |
| RFC-4853 | 0 ... 4 | 0 ... 2.7 | 0 ... 1.5 | 0 ... 4.5 | 0 ... 2.2 | 4.4 ... 9.2 |
| RFC-4854 w/o diagnosis | | | | | | |

Working Distances Position Markers [mm] - Redundant Versions

| | Z-RFC-P02 / P04 / P08 Z-RFC-P20 / P23 / P31 | Z-RFC-P41 / P43 / P47 | Z-RFC-P03 / P30 | Z-RFC-P18 / P28 | Z-RFC-P19 | Z-RFC-P22 |
|----------------------------|--|-----------------------|-----------------|-----------------|-----------|-----------|
| RFC-4851 | 1.9 ... 4.5 | 0 ... 2.3 | 0.3... 1.8 | 0 ... 4 | 0 ... 1.7 | 4 ... 8.8 |
| RFC-4852 with diagnosis | | | | | | |
| RFC-4853 | 0 ... 4 | 0 ... 2.3 | 0... 1.5 | 0 ... 4 | 0 ... 1.7 | 4 ... 8.8 |
| RFC-4854 w/o diagnosis | | | | | | |

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.

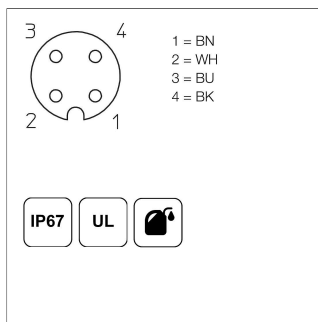
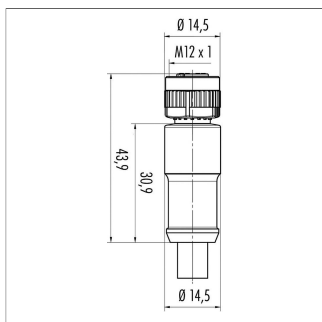
Additional Linearity Error at Radial Displacement - Single-channel Versions

| Z-RFC-P02 / P04 / P08 Z-RFC-P20 / P23 / P31 | Z-RFC-P41 / P43 / P47 | Z-RFC-P03 / P30 | Z-RFC-P18 / P28 | Z-RFC-P19 | Z-RFC-P22 |
|--|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 0.5 mm: $\pm 0.4^\circ$ | 0.5 mm: $\pm 0.4^\circ$ | 0.5 mm: $\pm 1.4^\circ$ | 0.5 mm: $\pm 0.7^\circ$ | 0.5 mm: $\pm 1.3^\circ$ | 1.0 mm: $\pm 0.8^\circ$ |
| 1.0 mm: $\pm 1.1^\circ$ | 1.0 mm: $\pm 1.1^\circ$ | 1.0 mm: $\pm 3.7^\circ$ | 1.0 mm: $\pm 1.3^\circ$ | 1.0 mm: $\pm 2.6^\circ$ | 2.0 mm: $\pm 1.8^\circ$ |
| 2.0 mm: $\pm 3.5^\circ$ | 2.0 mm: $\pm 3.5^\circ$ | 2.0 mm: - | 2.0 mm: $\pm 3.3^\circ$ | 2.0 mm: - | 4.0 mm: $\pm 5.4^\circ$ |

Additional Linearity Error at Radial Displacement - Redundant Versions

| Z-RFC-P02 / P04 / P08 Z-RFC-P20 / P23 / P31 | Z-RFC-P41 / P43 / P47 | Z-RFC-P03 / P30 | Z-RFC-P18 / P28 | Z-RFC-P19 | Z-RFC-P22 |
|--|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 0.5 mm: $\pm 0.7^\circ$ | 0.5 mm: $\pm 0.7^\circ$ | 0.5 mm: $\pm 2.5^\circ$ | 0.5 mm: $\pm 1.1^\circ$ | 0.5 mm: $\pm 2.3^\circ$ | 1.0 mm: $\pm 1.1^\circ$ |
| 1.0 mm: $\pm 1.8^\circ$ | 1.0 mm: $\pm 1.8^\circ$ | 1.0 mm: $\pm 6.4^\circ$ | 1.0 mm: $\pm 2^\circ$ | 1.0 mm: $\pm 4.5^\circ$ | 2.0 mm: $\pm 2.4^\circ$ |
| 2.0 mm: $\pm 5.2^\circ$ | 2.0 mm: $\pm 5.2^\circ$ | 2.0 mm: - | 2.0 mm: $\pm 4.6^\circ$ | 2.0 mm: - | 4.0 mm: $\pm 6.7^\circ$ |

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

| P/N | Type | Length |
|-----------|-----------|--------|
| 400056135 | EEM-33-35 | 2 m |
| 400056136 | EEM-33-36 | 5 m |
| 400056137 | EEM-33-37 | 10 m |

IP67 Protection class IP67 DIN EN 60529

IP68 Protection class IP68 DIN EN 60529

Very good Electromagnetic Compatibility (EMC) and shield systems

Very good resistance to oils, coolants and lubricants

C Suited for applications in dragchains

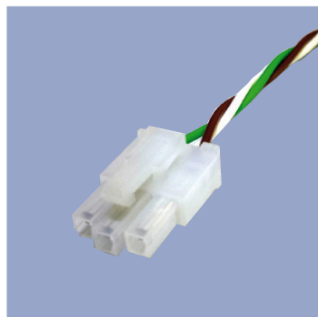
UL UL - approved

CAN-Bus

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



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



- Tyco AMP Super Seal**
- Pin- and bushing housing
 - 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



- 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

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