**⊂RLS**®

# Commutation and Incremental
## Magnetic Encoder Solutions

**EASY INSTALLATION**

**HIGH RESOLUTION**

**NON-CONTACT**

**OnAxis™ commutation magnetic rotary encoder range is designed for use in BLDC motor feedback applications requiring both A, B, Z incremental and U, V, W commutation signals.** To simplify alignment to the motor rotor, the encoder allows setting of the zerro position. Robust non-contact OnAxis sensor technology provides ultimate long term reliability and performance.
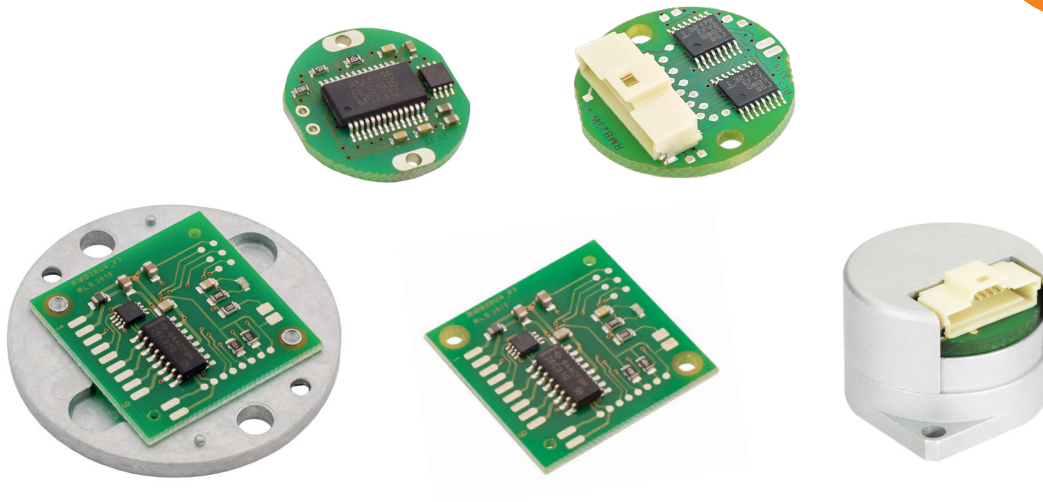
## Features and benefits

- ▶ Robust non-contact OnAxis encoders
- ▶ Resolutions from 256 to 16.384 counts per revolution
- ▶ U, V, W commutation signals up to 64 poles
- ▶ Encoder module sizes from 20 mm diameter to 58 mm diameter
- ▶ Operate in tough environments

MOTOR CONTROL  |  PRINTING  |  MARINE  |  MEDICAL  |  INDUSTRIAL AUTOMATION

# General information

Installation is simplified with a range of magnetic actuators and mounting options for the encoder. Resolutions are available from 64 to 4,096 pulses per revolution (256 to 16,384 counts per revolution with ×4 evaluation). U,V,W commutation signals are simultaneously output with 1 to 32 pole pairs (2 to 64 poles). Commutation encoders are available in different design variants and sizes, from 20 mm diameter encoder module RMB20 to 58 mm diameter encoder module on a metal flange RMF58 or as RMC22 and RMC35 on a metal flange with a removable metal cap to allow easy installation and zeroing.

## Product range

| Product | Type | Dimensions | Available outputs | Commutation outputs | Incremental outputs | Power supply | Maximum speed |
|---|---|---|---|---|---|---|---|
| **RMB29** | Board | 29 mm × 29 mm | Ex | U, V, W | - | 5 V ±10 % | 30,000 rpm |
| **RMB20** | | Ø20 mm | Ux | | A, B, Z, A–, B–, Z– (RS422) | | |
| **RMB23** | | Ø23 mm | Wx | U, V, W and U+, U–, V+, V–, W+ W– | | | |
| **RMB28** | | 28 mm × 28 mm | Ux, Wx | | | | |
| **RMF44** | Module on metal flange | Ø44 mm | | | | | |
| **RMF58** | | Ø58 mm | | | | | |
| **RM44** | Enclosed encoder | Ø44 mm | | | | | |
| **RM58** | | Ø58 mm | | | | | |
| **RMC22** | Module on metal flange with a removable metal cap | Ø22 mm | Ux | U, V, W | | | |
| **RMC35** | | Ø35 mm | | | | | |

# Storage and handling
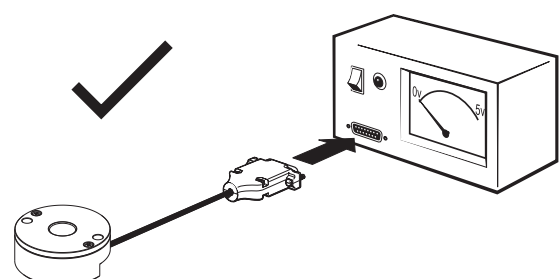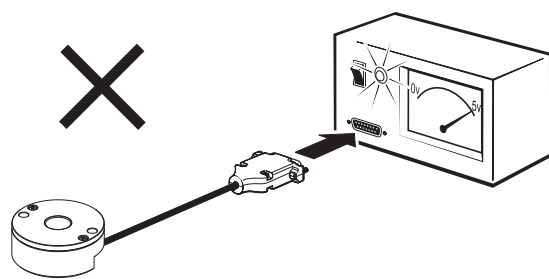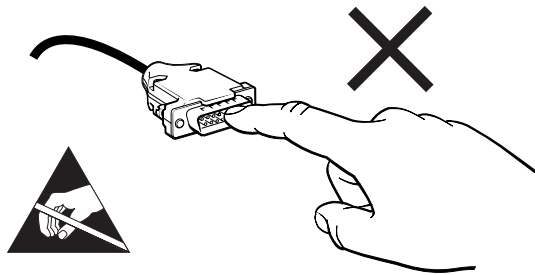
## Operating and storage temperature

RMB, RMF, RMC: –40 °C to +105 °C (with connector)
RMB, RMF, RMC: –40 °C to +125 °C (without connector)
RM: –40 °C to 85 °C (IP68)
RM: –40 °C to +125 °C (IP64)

## Humidity

RMB and RMF: Up to 70 % non-condensing
RMC: Up to IP40
RM: Up to IP68

**Readhead is ESD sensitive - handle with care.**
Do not touch electronic circuit, wires or sensor area without proper ESD protection or outside of ESD controlled environment.

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# Output types

## Incremental outputs

There are three signals for the incremental output: A, B and Z. Signals A and B are quadrature signals, shifted by 90°, and signal Z is a reference mark. The reference mark signal is produced once per revolution. The width of the Z pulse is 1/4 of the quadrature signal period and it is synchronized with the A and B signals.

The chart below shows the timing diagram of A, B and Z signals with clockwise (CW) rotation of the magnet and positive counting direction. B leads A for CW rotation.

### Timing diagram - Incremental
Complementary signals not shown

$$\frac{360° \times 4}{\text{counts per rev}} = 1 \text{ cycle}$$

Edge separation

A

B

Z

Reference impulse
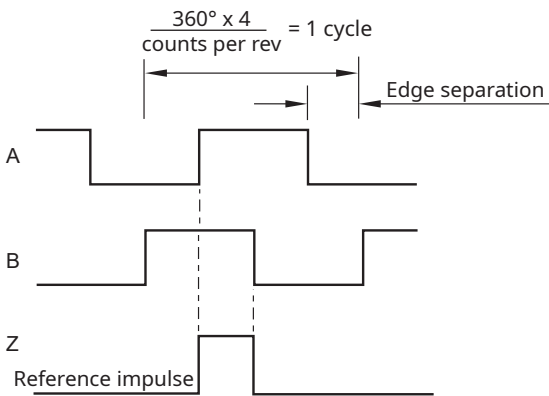
B leads A for clockwise rotation of magnetic actuator.
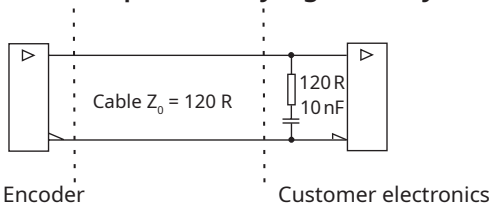
## Commutation outputs

UVW outputs can be output as digital signals. The number of signal periods (P) equals number of pole pairs. The timing diagram shows the signals when the position data is increasing. The U signal always starts at zero position regardless the signal period length (not valid for board B).

### Timing diagram - Commutation
Complementary signals not shown

Zero

U

V

W

A A A A A A
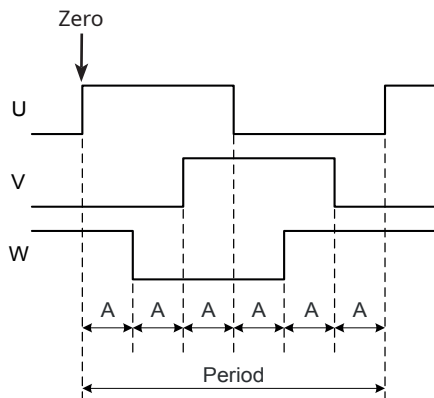
Period

### Recommended signal termination
### - for complementary signals only

Cable $Z_0$ = 120 R

120 R
10 nF

Encoder          Customer electronics

### UVW outputs

| Board | Pole | A | Period | Pole pairs* |
|-------|------|--------|---------|-------------|
|  | 2 | 60° | 360° | 1 |
|  | 4 | 30° | 180° | 2 |
|  | 6 | 20° | 120° | 3 |
|  | 8 | 15° | 90° | 4 |
| A | 10 | 12° | 72° | 5 |
|  | 12 | 10° | 60° | 6 |
|  | 14 | 8.57° | 51.42° | 7 |
|  | 16 | 7.50° | 45° | 8 |
|  | 18 | 6.67° | 40° | 9 |
|  | 20 | 6° | 36° | 10 |
|  | 22 | 5.45° | 32.73° | 11 |
|  | 24 | 5° | 30° | 12 |
| B | 26 | 4.62° | 27.7° | 13 |
|  | ⋮ |  |  |  |
|  | 64 | 1.875° | 11.25° | 32 |

* Number of pole pairs equals number of periods per revolution.

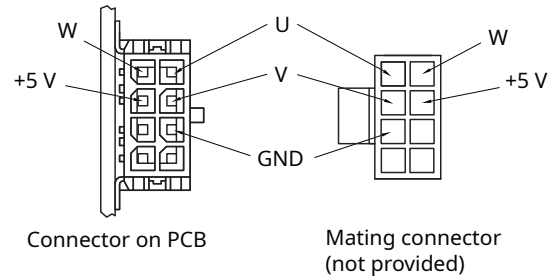# RMB29Ex

## Connections



→ Zeroing pads
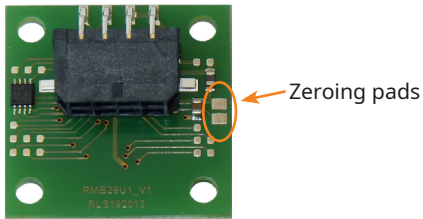
**Connector on board**
Molex 43045-0810
**Mating connector** (Not provided)
**Shell:** Molex 43025-0800
**8 pin crimp:** Molex 43030-0010

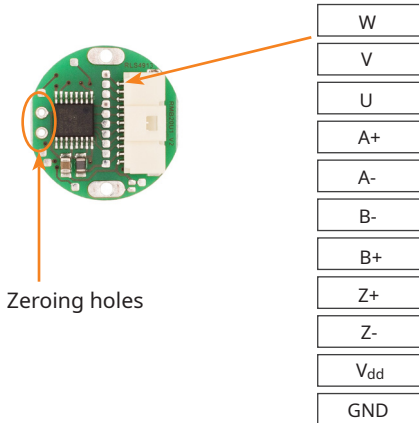> Product without connector is not conformal coated (polyurethane).

**With pads or with Molex connector:**



Connector on PCB | Mating connector (not provided)

## Specifications

| | |
|---|---|
| **Power supply** | $V_{dd}$ = 5 V ±10 % |
| **Current consumption** | 30 mA (not loaded) |
| **Maximum speed** | 30,000 rpm |
| **Accuracy** | Typ. ±0.5° |
| **Commutation outputs** | U, V, W |
| **Number of poles for commutation outputs** | 2, 4, 6, 8, 10, 12, 14, 16 |
| **Temperature** Operating and storage | –40 °C to +105 °C with connector –40 °C to +125 °C without connector |

For dimensions and installation tolerances please refer to document RMB29D01 in **RLS Media center.**

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# RMB20Ux

## Connections



| W |
|---|
| V |
| U |
| A+ |
| A- |
| B- |
| B+ |
| Z+ |
| Z- |
| V$_{dd}$ |
| GND |

Zeroing holes

**Connector on board**
Molex 501568-1107
**Mating connector** (Not provided)
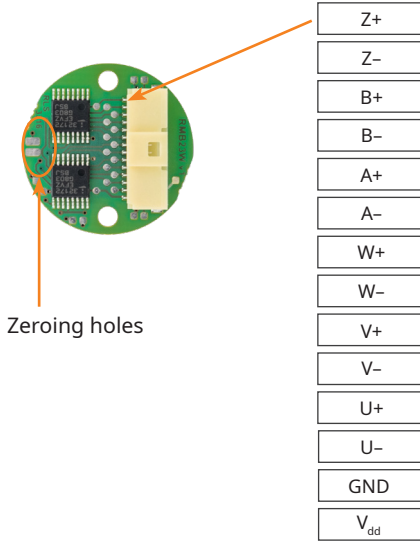**Shell:** Molex 501330-1100
**Crimp terminal:** Molex 501334-xxxx

## Specifications

| | |
|---|---|
| **Power supply** | V$_{dd}$ = 5 V ±10 % |
| **Current consumption** | 30 mA (not loaded) |
| **Maximum speed** | 30,000 rpm |
| **Accuracy** | Typ. ±0.5° |
| **Incremental outputs** | A, B, Z, A–, B–, Z– (RS422) |
| **Incremental resolutions** | 256, 512, 1024, 2048, 4096 counts per revolution |
| **Commutation outputs** | U, V, W |
| **Number of poles for commutation outputs** | 2, 4, 6, 8, 10, 12, 14, 16 |
| **Temperature** Operating and storage | –40 °C to +125 °C −40 °C to +105 °C for option 10 (with connector) |

For dimensions and installation tolerances please refer to documents RMB20 in **RLS Media center.**

# RMB23Wx

## Connections

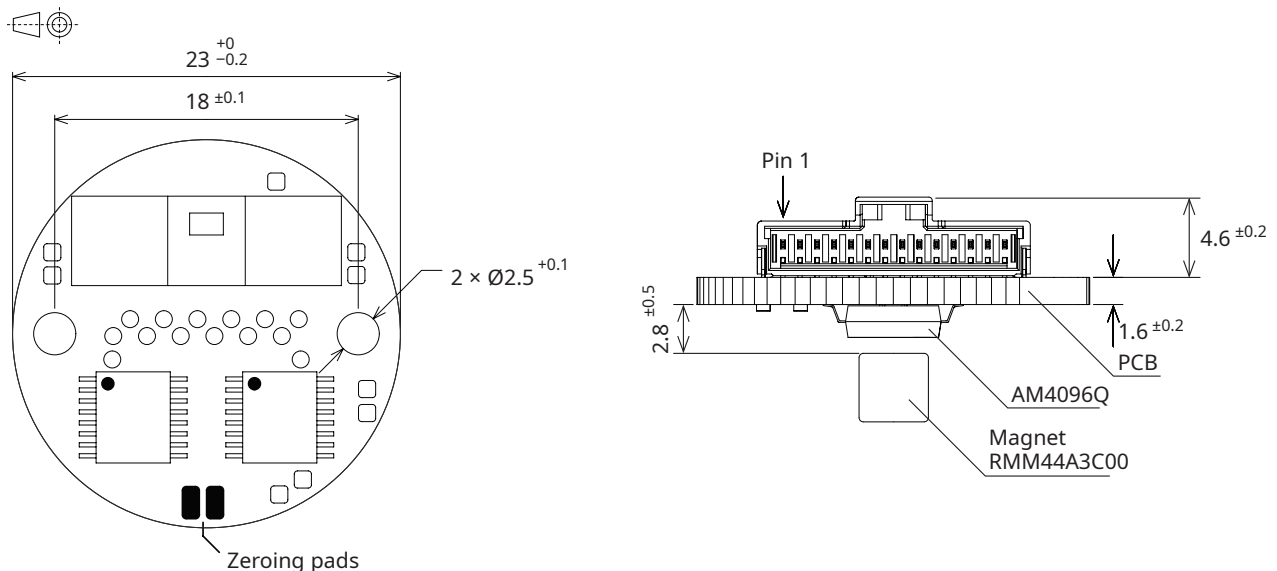| Z+ |
|---|
| Z− |
| B+ |
| B− |
| A+ |
| A− |
| W+ |
| W− |
| V+ |
| V− |
| U+ |
| U− |
| GND |
| $V_{dd}$ |

Zeroing holes

**Connector on board**
Molex 501568- 1407
**Mating connector** (Not provided)
**Shell:** Molex 501330-1400
**Crimp terminal:** Molex 501334-xxxx

## Specifications

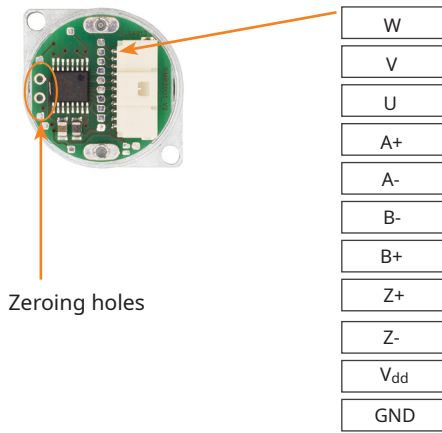| | |
|---|---|
| **Power supply** | $V_{dd}$ = 5 V ±10 % |
| **Current consumption** | 30 mA (not loaded) |
| **Maximum speed** | 30,000 rpm |
| **Accuracy** | Typ. ±0.5° |
| **Incremental outputs** | A, B, Z, A−, B−, Z− (RS422) |
| **Incremental resolutions** | 256, 512, 1024, 2048, 4096 counts per revolution |
| **Commutation outputs** | U, V, W, U−, V−, W− (RS422) |
| **Number of poles for commutation outputs** | 2, 4, 6, 8, 10, 12, 14, 16 |
| **Temperature** Operating and storage | −40 °C to +105 °C (Limited by connector. All other components used are specified for operation from −40 °C to +125 °C) |

## Dimensions and installation tolerance

Dimensions and tolerances are in mm. Dimensions without tolerance values are in accordance with ISO 2768-m.

$23 \, ^{+0}_{-0.2}$

$18 \, ^{±0.1}$

$2 \times \varnothing 2.5 \, ^{+0.1}$

Zeroing pads

Pin 1

$4.6 \, ^{±0.2}$

$2.8 \, ^{±0.5}$

$1.6 \, ^{±0.2}$

PCB

AM4096Q

Magnet
RMM44A3C00

## RMC22Ux

### Connections

| |
|---|
| W |
| V |
| U |
| A+ |
| A- |
| B- |
| B+ |
| Z+ |
| Z- |
| $V_{dd}$ |
| GND |

Zeroing holes

**Connector on board**
Molex 501568-1107
**Mating connector** (Not provided)
**Shell:** Molex 501330-1100
**Crimp terminal:** Molex 501334-xxxx
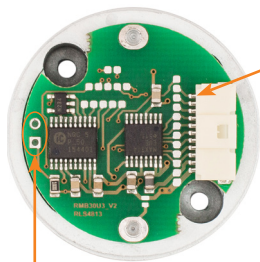
### Specifications

| | |
|---|---|
| **Power supply** | $V_{dd}$ = 5 V ±10 % |
| **Current consumption** | 30 mA (not loaded) |
| **Maximum speed** | 30,000 rpm |
| **Accuracy** | Typ. ±0.5° |
| **Hysteresis** | 0.17° |
| **Incremental outputs** | A, B, Z, A–, B–, Z– (RS422) |
| **Incremental resolutions** | 256, 512, 1024, 2048, 4096 cpr |
| **Commutation outputs** | U, V, W (±24 mA output drive) |
| **Number of poles for commutation outputs** | 2, 4, 6, 8, 10, 12, 14, 16 |
| **Temperature** <br> Operating and storage | –40 °C to +105 °C <br> (Limited by connector. All other components used are specified for operation from –40 °C to +125 °C) |
| **Mass** | 22 g |

For dimensions and installation tolerances please refer to document RMC22D01 in **RLS Media center.**

## Connections

| | |
|---|---|
| W | |
| V | |
| U | |
| A+ | |
| A- | |
| B- | |
| B+ | |
| Z+ | |
| Z- | |
| V$_{dd}$ | |
| GND | |

Zeroing holes

**Connector on board**
Molex 501568-1107
**Mating connector** (Not provided)
**Shell:** Molex 501330-1100
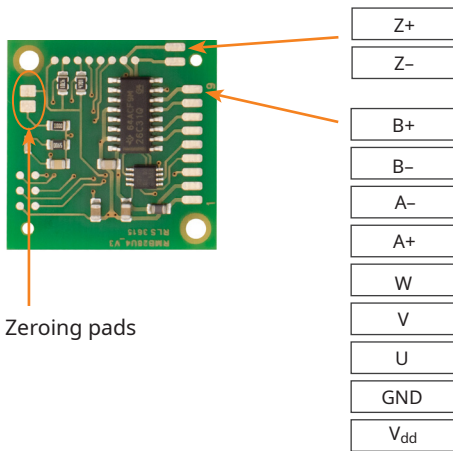**Crimp terminal:** Molex 501334-xxxx

## Specifications

| | |
|---|---|
| **Power supply** | V$_{dd}$ = 5 V ±10 % |
| **Current consumption** | 40 mA (not loaded) |
| **Maximum speed** | Typ. ±0.5° |
| **Accuracy** | 0.18° |
| **Hysteresis** | 30,000 rpm |
| **Incremental outputs** | A, B, Z, A-, B-, Z- (RS422) |
| **Incremental resolutions** | 256, 320, 400, 500, 512, 800, 1000, 1024, 1600, 2000, 2048, 4096, 8192 cpr |
| **Commutation outputs** | U, V, W (±24 mA output drive) |
| **Number of poles for commutation outputs** | 2, 4, 6, 8, 10, 12, 14, 16 |
| **Temperature** Operating and storage | –40 °C to +105 °C (Limited by connector. All other components used are specified for operation from –40 °C to +125 °C) |
| **Mass** | 45 g |

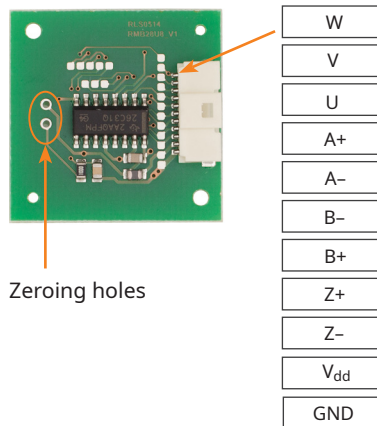For dimensions and installation tolerances please refer to document RMC35D01 in **RLS Media center.**

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## RMB28Ux / RMF44Ux / RMF58Ux

### Connections

**Board A, with pads:**

| Z+ |
| Z– |

| B+ |
| B– |
| A– |
| A+ |
| W |
| V |
| U |
| GND |
| $V_{dd}$ |

Zeroing pads

**Board A, with Molex connector:**
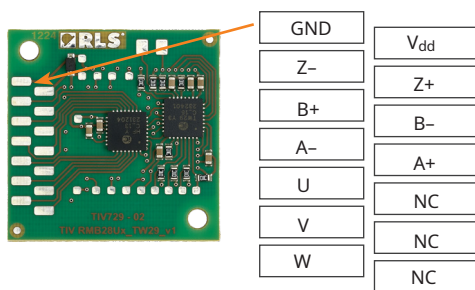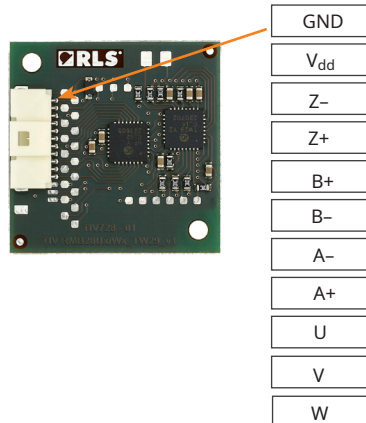
| W |
| V |
| U |
| A+ |
| A– |
| B– |
| B+ |
| Z+ |
| Z– |
| $V_{dd}$ |
| GND |

Zeroing holes

**Board B, with pads:**

| GND | $V_{dd}$ |
| Z– | Z+ |
| B+ | B– |
| A– | A+ |
| U | NC |
| V | NC |
| W | NC |

**Board B, with Molex connector:**

| GND |
| $V_{dd}$ |
| Z– |
| Z+ |
| B+ |
| B– |
| A– |
| A+ |
| U |
| V |
| W |

**Connector on board**
Molex 501568-1107
**Mating connector** (Not provided)
**Shell:** Molex 501330-1100
**Crimp terminal:** Molex 501334-xxxx

> Image may not represent actual product as components can vary based on chosen resolution.

### Specifications

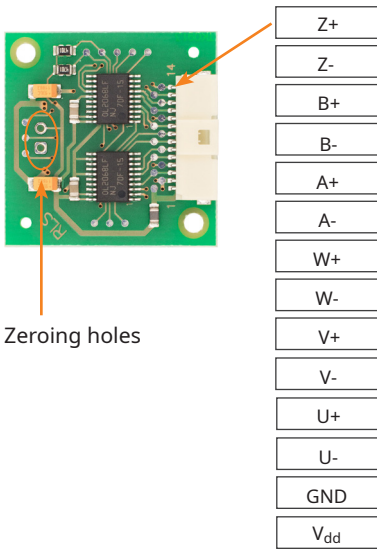| | |
|---|---|
| **Power supply** | $V_{dd}$ = 5 V ±10 % |
| **Current consumption** | **Board A:** 35 mA (not loaded)<br>**Board B:** 65 mA  (not loaded) |
| **Maximum speed** | 30,000 rpm |
| **Accuracy** | Typ. ±0.5° |
| **Incremental outputs** | A, B, Z, A–, B–, Z– (RS422) |
| **Incremental resolutions** | **Board A:** 320, 400, 500, 512, 800, 1000, 1024, 1600, 2000, 2048, 4096 counts per revolution<br>**Board B:** 360, 3600, 4000, 8000, 8192, 10000, 16000, 16384 counts per revolution* |
| **Commutation outputs** | U, V, W (±24 mA output drive) |
| **Number of poles for commutation outputs** | **Board A:** 2, 4, 6, 8, 10, 12, 14, 16<br>**Board B:** 18, 20, 22, ... 64 |
| **Temperature**<br>Operating and storage | –40 °C to +125 °C<br>–40 °C to +105 °C for option 12 (with connector) |

For dimensions and installation tolerances please refer to document RMBD01 in **RLS Media center.**

* For other resolutions **contact RLS.**

## Connections

**Board A, with pads or with Molex connector:**



Zeroing holes

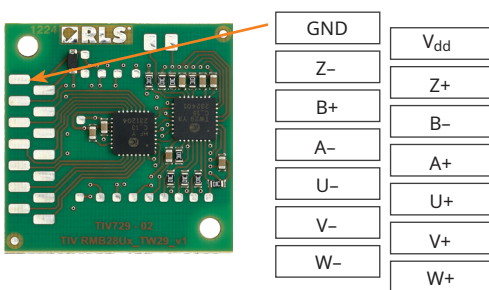| |
|---|
| Z+ |
| Z- |
| B+ |
| B- |
| A+ |
| A- |
| W+ |
| W- |
| V+ |
| V- |
| U+ |
| U- |
| GND |
| $V_{dd}$ |

**Connector on board**
Molex 501568-1407
**Mating connector** (Not provided)
**Shell:** Molex 501330-1400
**Crimp terminal:** Molex 501334-xxxx

**Board B, with pads:**



| | |
|---|---|
| GND | $V_{dd}$ |
| Z– | Z+ |
| B+ | B– |
| A– | A+ |
| U– | U+ |
| V– | V+ |
| W– | W+ |

**Board B, with Molex connector:**



| |
|---|
| GND |
| $V_{dd}$ |
| Z– |
| Z+ |
| B+ |
| B– |
| A– |
| A+ |
| U+ |
| V+ |
| W+ |
| U– |
| V– |
| W– |

## Specifications

| | |
|---|---|
| **Power supply** | $V_{dd}$ = 5 V ±10 % |
| **Current consumption** | **Board A:** 35 mA (not loaded)<br>**Board B:** 65 mA  (not loaded) |
| **Maximum speed** | 30,000 rpm |
| **Accuracy** | Typ. ±0.5° |
| **Incremental outputs** | A, B, Z, A–, B–, Z– (RS422) |
| **Incremental resolutions** | **Board A:** 256, 512, 1024, 2048, 4096<br>**Board B:** 8192, 16384 counts per revolution* |
| **Commutation outputs** | U, V, W, U–, V–, W– (RS422) |
| **Number of poles for commutation outputs** | **Board A:** 2, 4, 6, 8, 10, 12, 14, 16<br>**Board B:** 18, 20, 22, ... 64 |
| **Temperature**<br>Operating and storage | –40 °C to +125 °C<br>–40 °C to +105 °C for option 12 (with connector) |

For dimensions and installation tolerances please refer to document RMBD01 in **RLS Media center.**

* For other resolutions **contact RLS.**

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## RM44Ux / Wx and RM58Ux / Wx

### Connections

**RM44**

**RM58**



| RM44/58Ux | | RM44/58Wx | |
|---|---|---|---|
| **Function** | **Wire colour** | **Function** | **Wire colour** |
| $V_{dd}$ | Red | $V_{dd}$ | Red |
| GND | Blue | GND | Blue |
| A | Grey | U– | Green/Black |
| A– | Pink | U+ | Black |
| B | Green | V– | Brown/Black |
| B– | Yellow | V+ | Violet |
| Z | White | W– | White/Black |
| Z– | Brown | W+ | Yellow/Black |
| U | Black | A– | Pink |
| V | Violet | A+ | Grey |
| W | Grey/Violet | B– | Yellow |
| - | - | B+ | Green |
| - | - | Z– | Brown |
| - | - | Z+ | White |

Encoder

Outer shield
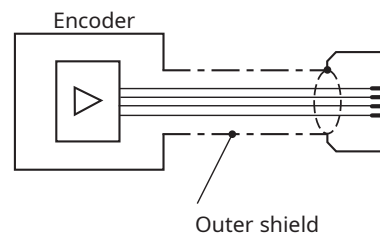
### Specifications

| | |
|---|---|
| **Power supply** | $V_{dd}$ = 5 V ±10 % |
| **Current consumption** | max. 65 mA (not loaded) |
| **Accuracy** | Typ. ±0.5° |
| **Hysteresis** | 0.18° |
| **Maximum speed** | 30,000 rpm |
| **Incremental outputs** | A, B, Z, A–, B–, Z– (RS422) |
| **Incremental resolutions** | 256, 320, 360, 400, 500, 512, 800, 1000, 1024, 1600, 2000, 2048, 3600, 4000, 4096, 8000, 8192, 10000, 16384 counts per revolution* |
| **Commutation outputs (for Ux)** | U, V, W (±24 mA output drive) |
| **Commutation outputs (for Wx)** | U, V, W, U–, V–, W– (RS422) |
| **Number of poles for commutation outputs** | 2, 4, 6, 8, 10, 12, 14, 16, ... 64 |
| **Temperature** Operating and storage | –40 °C to +125 °C (IP64) –40 °C to +85 °C (IP68) |
| **Mass** | 45 g |

* RM44 with external zeroing is available with binary resolutions only.

For dimensions and installation tolerances please refer to document RM4458D01 in **RLS Media center.**

# Zero position setting procedure
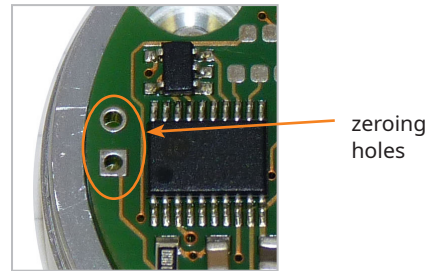
## Zeroing with zeroing pads and zeroing holes

Setting the zero position is possible for boards with marked zero pads or holes. It can be easily set by shortening the zeroing pads or holes on the board. After locking the motor at the mechanical zero position short together the two zeroing pads.
 The output angle position data can be zeroed at any angle with resolution of 0.0879°.
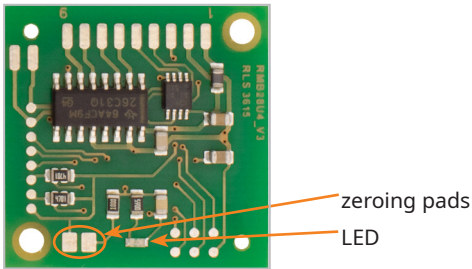


*RMB28U zeroing example*



*RMC35U zeroing example*

The zeroing pads can be shorted to set the zero position of the encoder. If the zeroing is successful, the LED flashes red. Boards that don't have zeroing pads marked don't support zeroing.

> Boards without marked zero pads do not allow zeroing.

The zeroing holes can be shorted to set the zero position of the encoder.

## External zeroing

The RM44/58 with external zeroing is designed for setting the encoder zero position by using zero pen. It is designed for power supply voltage of 5 V only. For electrical characteristics and dimensional drawings please refer to document RM4458D01 in **RLS Media center.**
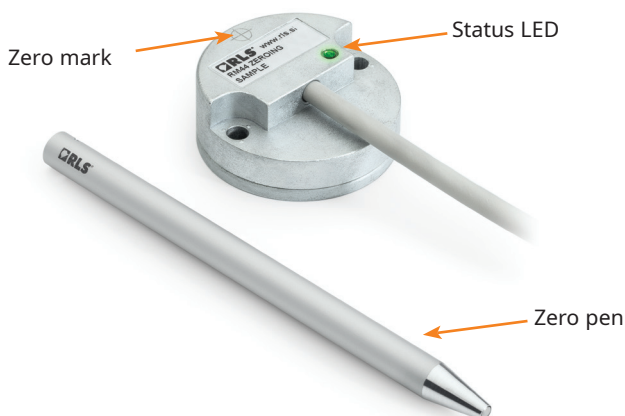


### Status indicator LED

| LED | Status |
| --- | --- |
| Green | Normal operation |
| Red | Zero position |
| No light | Presence of Zero pen |

1. Install the magnetic actuator and RM44/58 encoder.

    For more information please refer to document RM4458 in **RLS Media center.**
2. Set the mechanical zero position.
3. Use the zero pen to set the encoder zero position (see image):
    3.1 Touch the Zero mark with the apex of the Zero pen - the status LED goes off.
    3.2 Hold the Zero pen for 3 seconds.
    3.3 The new Zero position is set when status LED goes RED.

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# Part numbering

## RMB29Ex commutation

|  |  |  |  |  |
|---|---|---|---|---|
| **RMB29** | **Ex** | **12B** | **S** | **66** |

**Ex - UVW + incremental (no line drivers), 5 V**

**EA** - One period per revolution (2 poles)
**EB** - Two periods per revolution (4 poles)
**EC** - Three periods per revolution (6 poles)
**ED** - Four periods per revolution (8 poles)
**EE** - Five periods per revolution (10 poles)
**EF** - Six periods per revolution (12 poles)
**EG** - Seven periods per revolution (14 poles)
**EH** - Eight periods per revolution (16 poles)

**Resolution**

**12B** - 4,096 counts per revolution

**Shape**

**S** - Square

**Special requirements**

**66** - Push pull UVW, no incremental (with Molex connector and conformal coating)
**6A** - Push pull UVW, no incremental (without connector and conformal coating)

## Table of available combinations

| Series | Output type | Resolution | Shape | Special requirements |
|---|---|---|---|---|
| **RMB29** | EA / EB / EC / ED / EE / EF / EG / EH | 12B | S | 66 / 6A |

**RMB20    UA    09B    C    10**

**Ux - Commutation single ended + incremental with line driver output type**

**UA** - One period per revolution (2 poles)
**UB** - Two periods per revolution (4 poles)
**UC** - Three periods per revolution (6 poles)
**UD** - Four periods per revolution (8 poles)
**UE** - Five periods per revolution (10 poles)
**UF** - Six periods per revolution (12 poles)
**UG** - Seven periods per revolution (14 poles)
**UH** - Eight periods per revolution (16 poles)

**Resolution**

**08B** - 256 counts per revolution
**09B** - 512 counts per revolution
**10B** - 1,024 counts per revolution
**11B** - 2,048 counts per revolution
**12B** - 4,096 counts per revolution

**Shape**

**C** - Circular

**Special requirements**

**00** - Without connector
**10** - Molex connector type 501568-1107*

\* Mating connector not provided.

## Table of available combinations

| Series | Output type | Resolution | Shape | Special requirements |
|---|---|---|---|---|
| **RMB20** | UA / UB / UC / UD / UE / UF / UG / UH | 12B / 11B / 10B / 09B / 08B | C | 00 / 10 |

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## RMB23Wx (commutation complementary and incremental complementary)

**RMB23    WA    09B    C    12**

**Wx - Commutation with line driver + incremental with line driver**

**WA**  -  One period per revolution (2 poles)
**WB**  -  Two periods per revolution (4 poles)
**WC**  -  Three periods per revolution (6 poles)
**WD**  -  Four periods per revolution (8 poles)
**WE**  -  Five periods per revolution (10 poles)
**WF**  -  Six periods per revolution (12 poles)
**WG**  -  Seven periods per revolution (14 poles)
**WH**  -  Eight periods per revolution (16 poles)

**Resolution**

**08B**  -  256 counts per revolution
**09B**  -  512 counts per revolution
**10B**  -  1,024 counts per revolution
**11B**  -  2,048 counts per revolution
**12B**  -  4,096 counts per revolution

**Shape**

**C**  -  Circular

**Special requirements**

**12**  -  Molex connector type 501568-1407*

* Mating connector not provided.

## Table of available combinations

| Series | Output type | Resolution | Shape | Special requirements |
|--------|-------------|------------|-------|----------------------|
| **RMB23** | WA / WB / WC / WD / WE / WF / WG / WH | 12B / 11B / 10B / 09B / 08B | C | 12 |

## RMB28Ux / RMF44Ux / RMF58Ux and RMB28Wx / RMF44Wx / RMF58Wx (commutation, commutation complementary and incremental complementary)

**RMB28   W   A   09B   S   10**

### Series

**RMB28** - Rotary magnetic board with 28 mm side
**RMF44** - Rotary magnetic board on flange with 44 mm diameter aluminium flange
**RMF58** - Rotary magnetic board on flange with 58 mm diameter aluminium flange

### Output type

**U** - Commutation single ended + incremental with line driver
**W** - Commutation with line driver + incremental with line driver

### UVW output configuration

| | |
|---|---|
| **A** - 1 period per revolution (2 poles) | **S** - 17 periods per revolution (34 poles) |
| **B** - 2 periods per revolution (4 poles) | **T** - 18 periods per revolution (36 poles) |
| **C** - 3 periods per revolution (6 poles) | **U** - 19 periods per revolution (38 poles) |
| **D** - 4 periods per revolution (8 poles) | **V** - 20 periods per revolution (40 poles) |
| **E** - 5 periods per revolution (10 poles) | **W** - 21 periods per revolution (42 poles) |
| **F** - 6 periods per revolution (12 poles) | **Y** - 22 periods per revolution (44 poles) |
| **G** - 7 periods per revolution (14 poles) | **Z** - 23 periods per revolution (46 poles) |
| **H** - 8 periods per revolution (16 poles) | **1** - 24 periods per revolution (48 poles) |
| **I** - 9 periods per revolution (18 poles) | **2** - 25 periods per revolution (50 poles) |
| **J** - 10 periods per revolution (20 poles) | **3** - 26 periods per revolution (52 poles) |
| **K** - 11 periods per revolution (22 poles) | **4** - 27 periods per revolution (54 poles) |
| **L** - 12 periods per revolution (24 poles) | **5** - 28 periods per revolution 56 poles) |
| **M** - 13 periods per revolution (26 poles) | **6** - 29 periods per revolution (58 poles) |
| **N** - 14 periods per revolution (28 poles) | **7** - 30 periods per revolution (60 poles) |
| **P** - 15 periods per revolution (30 poles) | **8** - 31 periods per revolution (62 poles) |
| **R** - 16 periods per revolution (32 poles) | **9** - 32 periods per revolution (64 poles) |

### Resolution

**08B** - 256 counts per revolution
**09B** - 512 counts per revolution
**10B** - 1,024 counts per revolution
**11B** - 2,048 counts per revolution
**12B** - 4,096 counts per revolution
**13B** - 8,192 counts per revolution
**14B** - 16,384 counts per revolution

For **Ux** (counts per revolution):

| Decimal | | | Binary | |
|---|---|---|---|---|
| **D32** - 320 | **1D0** - 1000 | **8D0** - 8000 | **08B** - 256 | **13B** - 8192 |
| **D36** - 360 | **1D6** - 1600 | **10D** - 10000 | **09B** - 512 | **14B** - 16384 |
| **D40** - 400 | **2D0** - 2000 | **16D** - 16000 | **10B** - 1024 | |
| **D50** - 500 | **3D6** - 3600 | | **11B** - 2048 | |
| **D80** - 800 | **4D0** - 4000 | | **12B** - 4096 | |

### Shape

**S** - Square (for **RMB28** only)
**A** - Standard 44 mm diameter aluminium flange (for **RMF44** only)

### Special requirements

**10** - None (standard)
**12** - Molex connector type 501568-1407*

\* Mating connector not provided.

## Table of available combinations

| Series | Output type | Resolution | Shape | Special requirements |
|---|---|---|---|---|
| RMB28 | UA / UB / UC / UD / UE / UF / UG / UH / UI / UJ / UK / UL / UM / UN / UP / UR / US / UT / UU / UV / UW / UY / UZ / U1 / U2 / U3 / U4 / U5 / U6 / U7 / U8 / U9 | 2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 13B / 12B / 11B / 10B / 09B / 08B / D36 / 3D6 / 4D0 / 8D0 / 10D / 16D / 14B | S | 10 / 12 |
|  | WA / WB / WC / WD / WE / WF / WG / WH / WI / WJ / WK / WL / WM / WN / WP / WR / WS / WT / WU / WV / WW / WY / WZ / W1 / W2 / W3 / W4 / W5 / W6 / W7 / W8 / W9 | 14B / 13B / 12B / 11B / 10B / 09B / 08B |  |  |

| Series | Output type | Resolution | Shape | Special requirements |
|---|---|---|---|---|
| RMF44/ RMF58 | UA / UB / UC / UD / UE / UF / UG / UH / UI / UJ / UK / UL / UM / UN / UP / UR / US / UT / UU / UV / UW / UY / UZ / U1 / U2 / U3 / U4 / U5 / U6 / U7 / U8 / U9 | 2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 13B / 12B / 11B / 10B / 09B / 08B D36 / 3D6 / 4D0 / 8D0 / 10D / 16D / 14B | A | 10 / 12 |
|  | WA / WB / WC / WD / WE / WF / WG / WH / WI / WJ / WK / WL / WM / WN / WP / WR / WS / WT / WU / WV / WW / WY / WZ / W1 / W2 / W3 / W4 / W5 / W6 / W7 / W8 / W9 | 14B / 13B / 12B / 11B / 10B / 09B / 08B |  |  |

## RMC22Ux and RMC35Ux (commutation and incremental complementary)

RMC22   U   A   09B   AA   10

**Series**

**RMC22** - Rotary magnetic compact encoder with 22 mm body
**RMC35** - Rotary magnetic compact encoder with 35 mm body

**Output type**

**U** - Commutation single ended + incremental with line driver

**UVW output configuration**

**A** - One period per revolution (2 poles)
**B** - Two periods per revolution (4 poles)
**C** - Three periods per revolution (6 poles)
**D** - Four periods per revolution (8 poles)
**E** - Five periods per revolution (10 poles)
**F** - Six periods per revolution (12 poles)
**G** - Seven periods per revolution (14 poles)
**H** - Eight periods per revolution (16 poles)

**Resolution**

For **RMC22Ux:**

**08B** - 256 counts per revolution
**09B** - 512 counts per revolution
**10B** - 1,024 counts per revolution
**11B** - 2,048 counts per revolution
**12B** - 4,096 counts per revolution

For **RMC35Ux** (counts per revolution):

| Decimal | | | Binary | |
|---|---|---|---|---|
| **D32** - 320 | **D80** - 800 | **2D0** - 2000 | **08B** - 256 | **11B** - 2048 |
| **D40** - 400 | **1D0** - 1000 | | **09B** - 512 | **12B** - 4096 |
| **D50** - 500 | **1D6** - 1600 | | **10B** - 1024 | **13B** - 8192 |

**Shape**

**AA** - Molex 501568-1107

**Special requirements**

**10** - None (standard)

## Table of available combinations

| Series | Output type | Resolution | Shape | Special requirements |
|---|---|---|---|---|
| **RMC22** | UA / UB / UC / UD / UE / UF / UG / UH | 12B / 11B / 10B / 09B / 08B | AA | 10 |
| **RMC35** | | 2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 13B / 12B / 11B / 10B / 09B / 08B | | |

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## RM44Ux / Wx and RM58Ux / Wx (commutation and incremental complementary)

|RM44|U|A|00|12B|10|F|2|E|10|

### Series

**RM44** - Ø44 mm body
**RM58** - Ø58 mm body

### Output type

**U** - Commutation single ended + incremental with line driver
**W** - Commutation with line driver + incremental with line driver

### UVW output configuration

| | |
|---|---|
| **A** - 1 period per revolution (2 poles) | **S** - 17 periods per revolution (34 poles) |
| **B** - 2 periods per revolution (4 poles) | **T** - 18 periods per revolution (36 poles) |
| **C** - 3 periods per revolution (6 poles) | **U** - 19 periods per revolution (38 poles) |
| **D** - 4 periods per revolution (8 poles) | **V** - 20 periods per revolution (40 poles) |
| **E** - 5 periods per revolution (10 poles) | **W** - 21 periods per revolution (42 poles) |
| **F** - 6 periods per revolution (12 poles) | **Y** - 22 periods per revolution (44 poles) |
| **G** - 7 periods per revolution (14 poles) | **Z** - 23 periods per revolution (46 poles) |
| **H** - 8 periods per revolution (16 poles) | **1** - 24 periods per revolution (48 poles) |
| **I** - 9 periods per revolution (18 poles) | **2** - 25 periods per revolution (50 poles) |
| **J** - 10 periods per revolution (20 poles) | **3** - 26 periods per revolution (52 poles) |
| **K** - 11 periods per revolution (22 poles) | **4** - 27 periods per revolution (54 poles) |
| **L** - 12 periods per revolution (24 poles) | **5** - 28 periods per revolution 56 poles) |
| **M** - 13 periods per revolution (26 poles) | **6** - 29 periods per revolution (58 poles) |
| **N** - 14 periods per revolution (28 poles) | **7** - 30 periods per revolution (60 poles) |
| **P** - 15 periods per revolution (30 poles) | **8** - 31 periods per revolution (62 poles) |
| **R** - 16 periods per revolution (32 poles) | **9** - 32 periods per revolution (64 poles) |

### Shaft size

**00** - N/A

### Resolution

For **Wx:**

**08B** - 256 counts per revolution
**09B** - 512 counts per revolution
**10B** - 1,024 counts per revolution
**11B** - 2,048 counts per revolution
**12B** - 4,096 counts per revolution
**13B** - 8,192 counts per revolution
**14B** - 16,384 counts per revolution

For **Ux** (counts per revolution):

| Decimal | | | Binary | |
|---|---|---|---|---|
| **D32** - 320 | **1D0** - 1000 | **8D0** - 8000 | **08B** - 256 | **13B** - 8192 |
| **D36** - 360 | **1D6** - 1600 | **10D** - 10000 | **09B** - 512 | **14B** - 16384 |
| **D40** - 400 | **2D0** - 2000 | **16D** - 16000 | **10B** - 1024 | |
| **D50** - 500 | **3D6** - 3600 | | **11B** - 2048 | |
| **D80** - 800 | **4D0** - 4000 | | **12B** - 4096 | |

For **RM44 with external zeroing** (counts per revolution):

| | | |
|---|---|---|
| **05Z** - 32 | **08Z** - 256 | **2D0** - 2000 |
| **06Z** - 64 | **09Z** - 512 | |
| **07Z** - 128 | **10Z** - 1024 | |

### Cable length

**10** - 1.0 meter (or 10 meters if **1M** special requirement is chosen)

### Connector options

**F** - Flying lead (no connector)

### Body style and cable exit

**2** - Cylindrical body, radial cable exit

### Environment and material

**E** - IP64, die-cast body (Zinc alloy), standard EMC grade (standard)
**F** - IP68, die-cast body (Zinc alloy), standard EMC grade

### Special requirements

**10** - None (standard)
**1M** - Cable length in meters

## Table of available combinations

| Series | Output type | Shaft size | Resolution | Cable length | Connector type | Body style | Environment and material | Special requirements |
|---|---|---|---|---|---|---|---|---|
| **RM44/ RM58** | UA / UB / UC / UD / UE / UF / UG / UH / UI / UJ / UK / UL / UM / UN /UP / UR / US / UT / UU / UV / UW / UY / UZ / U1 / U2 / U3 / U4 / U5 / U6 / U7 / U8 / U9 | 00 | 2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D36 / D32 / 3D6 / 4D0 / 8D0 / 16D / 10D / 14B / 13B / 12B / 11B / 10B / 09B / 08B | 10 | F | 2 | E / F | 10 / 1M |
| | WA / WB / WC / WD / WE / WF / WG / WH / WI / WJ / WK / WL / WM / WN / WP / WR / WS / WT / WU / WV / WW / WY / WZ / W1 / W2 / W3 / W4 / W5 / W6 / W7 / W8 / W9 | | 14B / 13B / 12B / 11B / 10B / 09B / 08B | | | | | |
| **RM44Ux with external zeroing** | UA / UB / UC / UD / UE / UF / UG / UH | | 12Z / 11Z / 10Z / 09Z / 08Z / 07Z / 06Z / 05Z | | | | | |

# Magnetic actuator and magnet ordering information

## Actuator for integration onto shaft
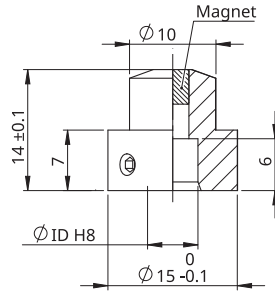


**Shaft** = Ø ID h7
**Fixing**: Grub screw provided

\* Hole diameter for nominal shaft size.
  See table on the right for more information on available shaft sizes.

**Part numbers:**

For resolutions up to 9 bit absolute (512 cpr incremental)
| | |
|---|---|
| **RMA04A2A00** – ID = Ø4 mm | **RMA10A2A00** – ID = Ø10 mm |
| **RMA05A2A00** – ID = Ø5 mm | **RMA19A2A00** – ID = Ø3/16″ mm |
| **RMA06A2A00** – ID = Ø6 mm | **RMA25A2A00** – ID = Ø1/4″ mm |
| **RMA08A2A00** – ID = Ø8 mm | **RMA37A2A00** – ID = Ø3/8″ mm |

For resolutions from 10 bit absolute (800 cpr incremental) and above
| | |
|---|---|
| **RMA04A3A00** – ID = Ø4 mm | **RMA10A3A00** – ID = Ø10 mm |
| **RMA05A3A00** – ID = Ø5 mm | **RMA19A3A00** – ID = Ø3/16″ mm |
| **RMA06A3A00** – ID = Ø6 mm | **RMA25A3A00** – ID = Ø1/4″ mm |
| **RMA08A3A00** – ID = Ø8 mm | **RMA37A3A00** – ID = Ø3/8″ mm |

## Actuator for integration into shaft
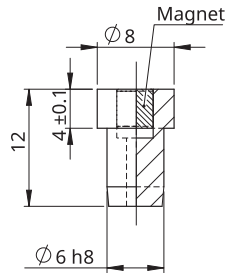


**with N-pole marker**



**Hole** = Ø6G7
**Fixing**: Adhesive (recommended – LOCTITE 648 or 2701)

**Part numbers:**

For resolutions up to 9 bit absolute (512 cpr incremental)
**RMH06A2A00**

For resolutions from 10 bit absolute (800 cpr incremental) and above
**RMH06A3A00**

**With N-pole marker scribed to a ±5° accuracy:**

For resolutions up to 9 bit absolute (512 cpr incremental)
**RMH06A2A02**

For resolutions from 10 bit absolute (800 cpr incremental) and above
**RMH06A3A02**

## Magnet for direct recessing in non-ferrous shafts
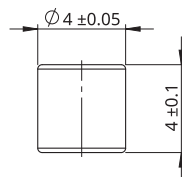


**Fixing**: Adhesive (recommended – LOCTITE 648 or 2701)

**Part numbers:**

For resolutions up to 9 bit absolute (512 cpr incremental)
**RMM44A2A00** (individually packed) – for sample quantities only
**RMM44A2C00** (packed in tubes)

For resolutions from 10 bit absolute (800 cpr incremental) and above
**RMM44A3A00** (individually packed) – for sample quantities only
**RMM44A3C00** (packed in tubes)

If you need a shaft encoder, please refer to the **RE58 data sheet**, which describes how the RM44 can be converted into an RE58 by adding a flange.

# Accessories

Zeroing pen
**ZEROPEN00**

**For Ux output**

Cable assembly, 12 core
**ACC001** cable assembly 0.3 m
**ACC002** cable assembly 0.5 m
**ACC003** cable assembly 1 m

Cable assembly, 14 core
**ACC020** cable assembly 30 cm

# Cable assemblies

## Cable specifications for connection of Molex 501330-1100, 12 core

| | |
|---|---|
| **Part numbers** | ACC001 (cable length: 30 cm)<br>ACC002 (cable length: 50 cm)<br>ACC003 (cable length: 100 cm)<br>ACC026 (cable length: 3 m) |
| **Connector** | Molex 501330-1100, 11 pins |
| **Wire diameter** | AWG26 (0.14 mm$^2$) |
| **Sheath color** | Grey (RAL7032) |
| **Rated voltage** | 250 V |
| **Operating temperature** | From –30 °C to +125 °C |
| **Environmental conformation** | RoHS conform<br>73/23/EWG-Guideline CE conform<br>Halogen free |

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## Dimensions

Dimensions and tolerances in mm.
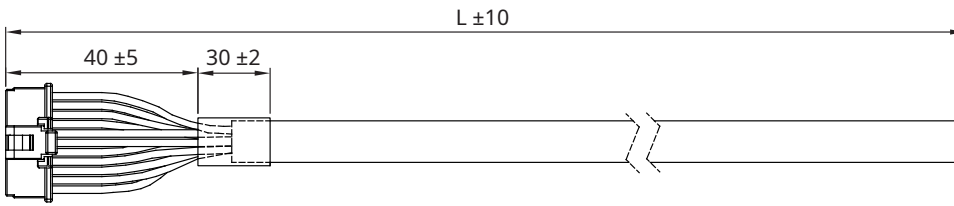


| Pin | Wire color |
|-----|------------|
| 1 | Blue |
| 2 | Red |
| 3 | Brown |
| 4 | White |
| 5 | Green |
| 6 | Yellow |
| 7 | Grey |
| 8 | Pink |
| 9 | Black |
| 10 | Violet |
| 11 | Grey/Pink |

## Cable specifications for connection of Molex 501568-1407, 14 core

| Part numbers | ACC020 (cable length: 30 cm) |
|---|---|
| Connector | Molex 501568-1407, 14 pin |
| Wire diameter | AWG28 |
| Rated voltage | 300 V |
| Operating temperature | From –40 °C to +125 °C |

### Dimensions

Dimensions and tolerances in mm.
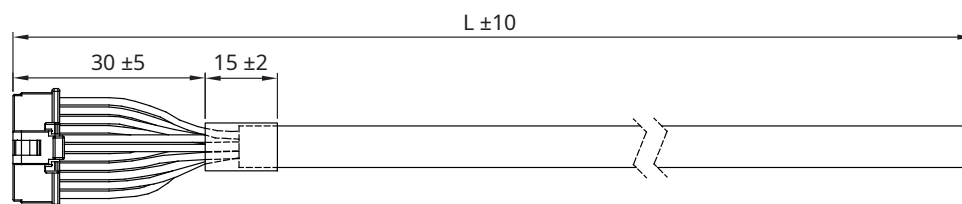


| Pin | Wire color |
|-----|------------|
| 1 | Red |
| 2 | Blue |
| 3 | Green/Black |
| 4 | Black |
| 5 | Brown/Black |
| 6 | Violet |
| 7 | White/Black |
| 8 | Yellow/Black |
| 9 | Pink |
| 10 | Grey |
| 11 | Yellow |
| 12 | Green |
| 13 | Brown |
| 14 | White |

## Global support

Visit our **website** to contact your nearest sales representative.

## Document issues

| Issue | Date | Page | Description |
|---|---|---|---|
| 5 | 27. 9. 2021 | 10 | RM44 dimensions amended |
| 6 | 12. 2. 2024 | 2, 11, 12, 20 | RM58 option added |
| | | 2, 9, 18 | RMF58 option added |
| 7 | 28. 11. 2024 | General | New design |
| 8 | 23. 5. 2025 | 7 | Molex connector amended |

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