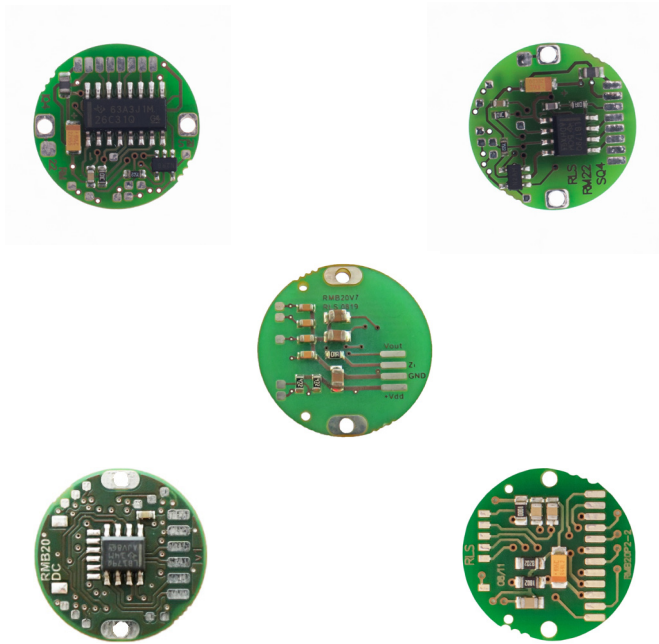


# RMB20 angular magnetic encoder module



**The RMB20 encoder module provides the functionality of the RM22 encoder in a compact component format for simple customer integration. With a PCB diameter of only 20 mm the module fits into miniature designs.**

**The encoder module consists of a magnetic actuator and a separate sensor board. Rotation of the magnetic actuator is sensed by a custom encoder chip mounted on the sensor board, and processed to give the required output format. Output signals are provided in industry standard absolute, incremental, analogue, commutation and linear formats.**

The RMB20 can be designed into equipment used in a wide range of applications including marine, medical, print, converting, industrial automation, motor control and instrumentation.

## Product range

### RMB20DC

BiSS C interface with up to 8,192 counts per revolution.

### RMB20IC

Incremental with 80 to 2,048 pulses per revolution (320 to 8,192 counts per revolution with x4 evaluation).

### RMB20PC

Absolute parallel interface with 512 positions per revolution (9 bit).

### RMB20SC

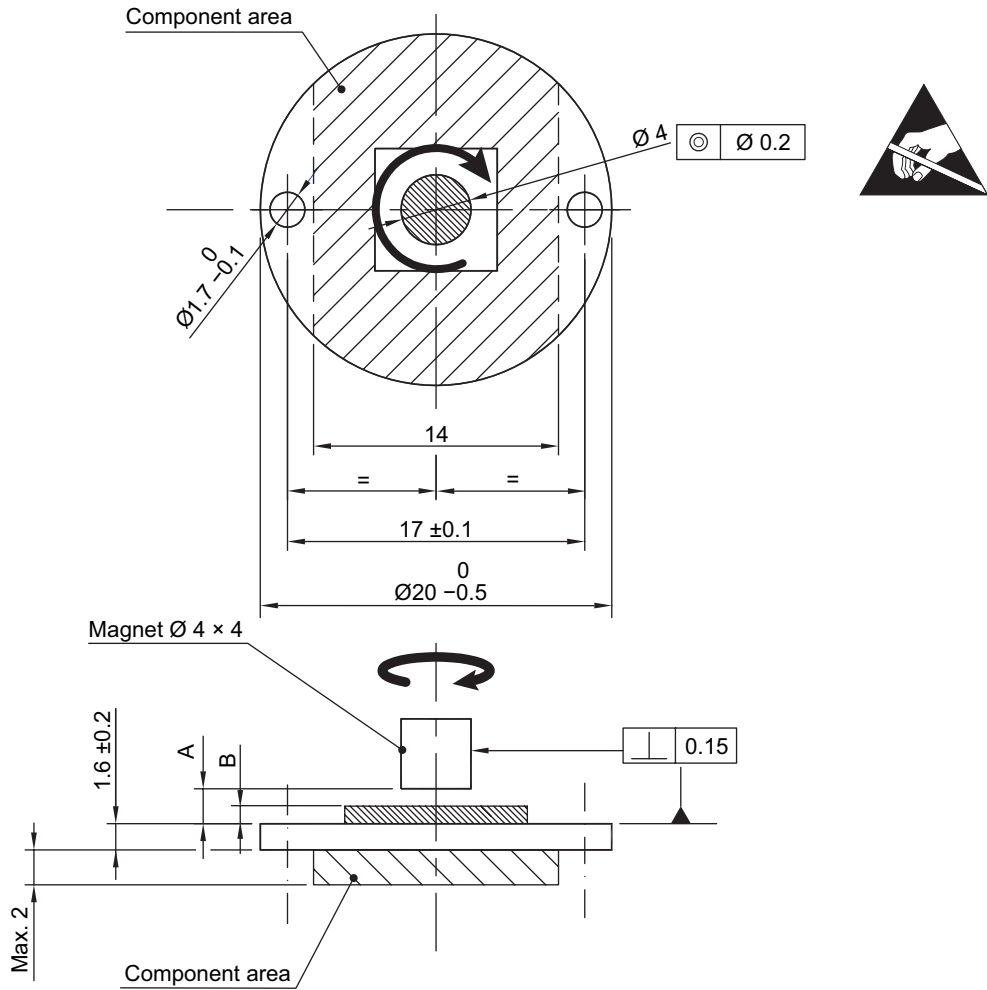
Synchro serial interface (SSI) with 320 to 8,192 positions per revolution.

### RMB20Vx

Linear voltage output in a range of variants.

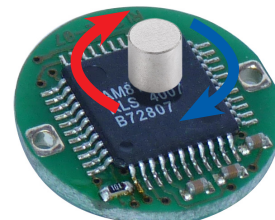
- 20 mm diameter circular module
- 5 V power supply
- High speed operation to 60,000 rpm
- Absolute - to 13 bit resolution (8,192 counts per revolution)
- Industry standard absolute, incremental, commutation and linear voltage output formats
- Accuracy to  $\pm 0.5^\circ$

Installation drawing



Module	A PCB surface to magnet distance [mm]	B Chip height [mm]
RMB20 DC	2.50 ± 0.2	Max. 1.00
RMB20 IC	3.50 ± 0.2	Max. 1.60
RMB20 PC		
RMB20 SC		
RMB20 Vx	2.80 ± 0.5	Max. 2

**NOTE:** For the accuracy specified the center line of the magnet needs to be square to the chip within 2° and aligned within the center of the board ±0.1 mm (mid point between the 2 mounting holes).



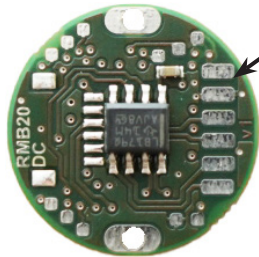
Clockwise (CW) rotation of magnet

## RMB20DC – Absolute natural binary BiSS C interface

Output code	Natural binary
Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Current consumption	Max. 50 mA
Clock input	MA (RS422)
Data output	SLO (RS422)
Accuracy	Typ. $\pm 0.5^\circ$
Hysteresis	$0.18^\circ$
Resolution	320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 positions per revolution
Maximum speed	30,000 rpm
Operating temperature	$-40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$ $-40\text{ }^\circ\text{C}$ to $+105\text{ }^\circ\text{C}$ (with connector)
Max MA frequency	8 MHz

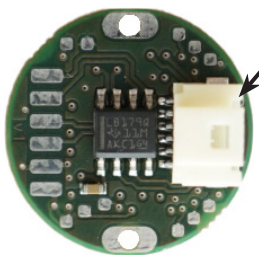
### Connections

#### RMB20DC



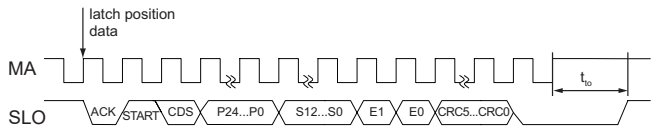
V <sub>dd</sub>
GND
MA+
MA-
SLO-
SLO+

#### RMB20DC with connector



SLO+
SLO-
MA-
MA+
GND
V <sub>dd</sub>

### Timing diagram – BiSS C



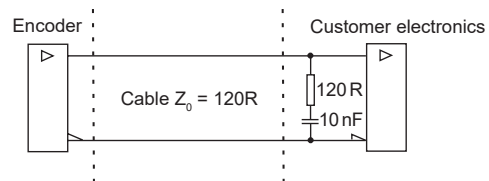
Data	Length	Description
P24 – P0	0 to 24 bit	Revolution counter value (length depends on the settings chosen)
S12 – S0	3 to 13 bit	Position inside the revolution (length depends on the resolution)
E1 – E0	2 bit	Error data
CRC5 – CRC0	5 to 6 bit	Cyclic redundancy check data; polynomial 0x43; inverted bit output

Error	E0	E1
No error	1	1
Amplitude error	0	1
Too high velocity	1	0
Undervoltage; Configuration; System error	0	0

For more information on BiSS C protocol please visit [www.biss-interface.com](http://www.biss-interface.com).

### Recommended signal termination

For data output lines only



#### Connector type

Molex 501568-0607

#### Mating connector

Molex 501330-0600 (not provided)

#### Crimp terminal

501334-0000 (not provided)

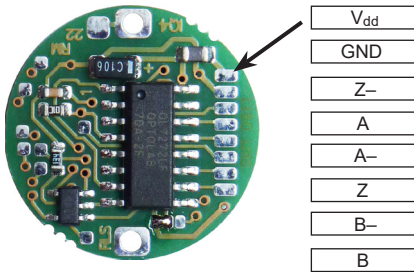
## RMB20IC – Incremental, RS422

Square wave differential line driver to RS422

<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	Max. 35 mA
<b>Output signals</b>	A, B, Z, A-, B-, Z- (RS422)
<b>Accuracy</b>	Typ. $\pm 0.5^\circ$
<b>Hysteresis</b>	0.18°
<b>Resolution</b>	80 to 2,048 pulses per revolution (320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 counts per revolution)
<b>Maximum speed</b>	30,000 rpm
<b>Temperature</b> Operating and storage	-40 °C to +125 °C

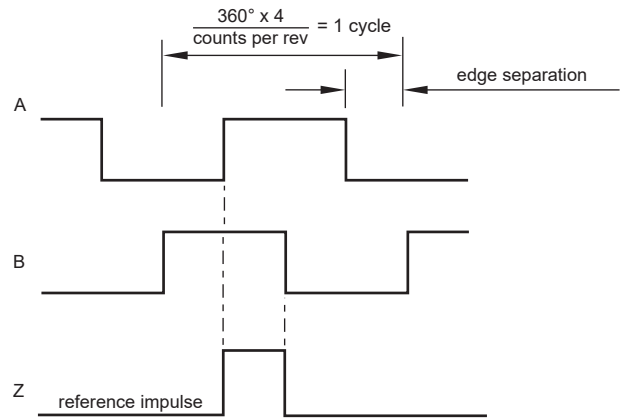
### Connections

RMB20IC



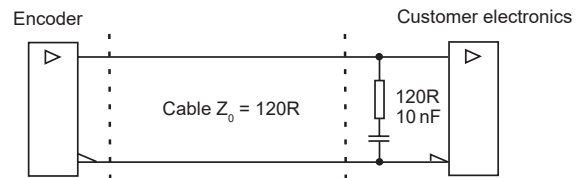
### Timing diagram

Complementary signals not shown



B leads A for clockwise rotation of magnet.

### Recommended signal termination

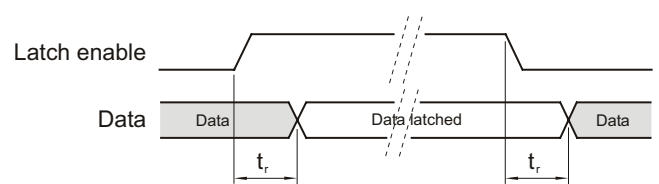


## RMB20PC – Absolute binary parallel interface

Parallel absolute position measurement

<b>Output code</b>	Natural binary
<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	20 mA without load
<b>Data outputs</b>	D0 (LSB) - D8 (MSB)
<b>Data input</b>	LE - latch enable input signal, active high Maximum sampling rate 500 kHz
<b>Output voltage</b>	$V_H \geq 4\text{ V}$ at $-I_H \leq 3\text{ mA}$ $V_L \leq 1\text{ V}$ at $I_L \leq 3\text{ mA}$
<b>Accuracy</b>	$\pm 0.7^\circ$
<b>Hysteresis</b>	0.45°
<b>Resolution</b>	9 bit (512 positions per revolution)
<b>Maximum speed</b>	60,000 rpm
<b>Temperature</b> Operating and storage	-40 °C to +125 °C

### Timing diagram

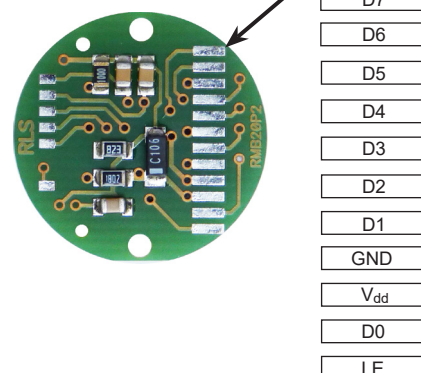


$t_r$  (reaction time)  $\leq 1\ \mu\text{s}$

Position increases for clockwise rotation of magnet.

### Connections

RMB20PC

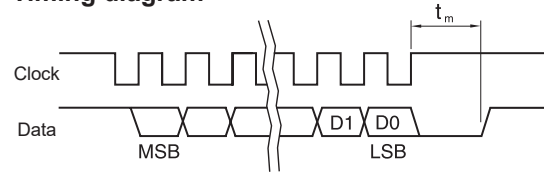


## RMB20SC – Absolute binary synchro-serial interface (SSI)

Serial encoded absolute position measurement

<b>Output code</b>	Natural binary
<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	23 mA for 9 bit resolution 35 mA for all other resolutions
<b>Data output</b>	Serial data (RS422)
<b>Data input</b>	Clock (RS422)
<b>Accuracy</b>	Typ. $\pm 0.5^\circ$
<b>Hysteresis</b>	$0.18^\circ$
<b>Resolution</b>	320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 positions per revolution
<b>Repeatability</b>	$\leq 0.07^\circ$
<b>Maximum speed</b>	30,000 rpm
<b>Temperature</b>	$-40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$
Operating and storage	

### Timing diagram

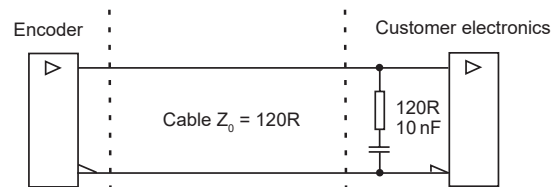


Clock  $\leq 4\text{ MHz}$      $12.5\text{ }\mu\text{s} \leq t_m \leq 20.5\text{ }\mu\text{s}$  (for all other resolutions)  
 Clock  $\leq 900\text{ kHz}$      $16\text{ }\mu\text{s} \leq t_m \leq 22\text{ }\mu\text{s}$  (for 9 bit resolution)

Position increases for clockwise rotation of magnet.

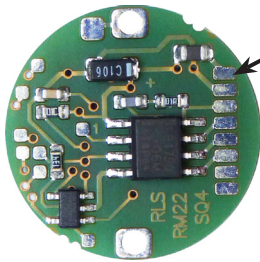
### Recommended signal termination

For data output lines only



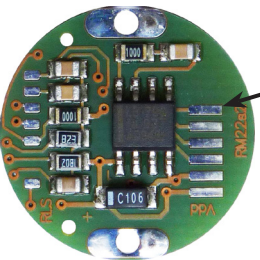
### Connections

RMB20SC - all other resolutions



- V<sub>dd</sub>
- GND
- Clock
- Clock-
- Data-
- Data
- 
- 

RMB20SC - 9 bit resolution only



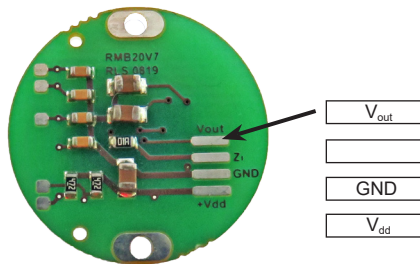
- Data
- Data-
- Clock-
- Clock
- GND
- V<sub>dd</sub>

### RMB20Vx – Linear voltage output

<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	Typ. 26 mA
<b>Output voltage</b>	0 V to $V_{dd}$
<b>Output load</b>	Max. 2 mA
<b>Nonlinearity</b>	1 %
<b>Maximum speed</b>	30,000 rpm
<b>Temperature</b>	-40 °C to +125 °C
Operating and storage	

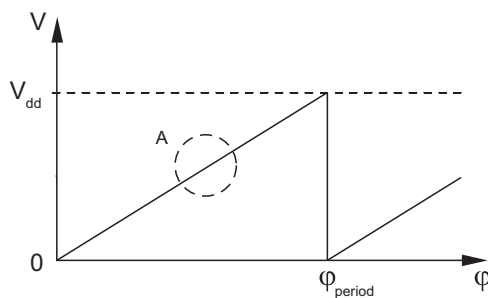
### Connections

RMB20V

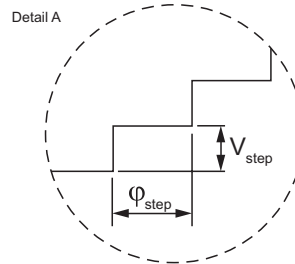


The digital relative angular position information is converted into linear voltage with a built-in 10 bit D/A converter. The linear output voltage swing ranges from 0 V and  $V_{dd}$  (5 V). The number of periods within one revolution ( $N_{\text{period}}$ ) can be 1, 2, 4 or 8, representing one full swing over an angle ( $\phi_{\text{period}}$ ) of 360°, 180°, 90° or 45° respectively. The signal is made up of steps which represent the angular movement needed to register a change in the position ( $\phi_{\text{step}}$ ) and the resulting change in the output voltage ( $V_{\text{step}}$ ). The number of steps in one period ( $N_{\text{step}}$ ) is given in the table below.

For clockwise rotation of the magnetic actuator, the output voltage increases. For counterclockwise rotation, the output voltage decreases.



Timing diagram for linear voltage output



$$\phi_{\text{step}} = \frac{\phi_{\text{period}}}{N_{\text{step}}} \quad V_{\text{step}} = \frac{V_{\text{dd}}}{N_{\text{step}}}$$

- $\phi_{\text{period}}$  = Angle covered in one period (one sawtooth)
- $V_{\text{period}}$  = Output voltage range for one period
- $\phi_{\text{step}}$  = Step angle (angular movement needed to register a change in the position)
- $V_{\text{step}}$  = Output voltage range for one step
- $N_{\text{period}}$  = Number of periods in one revolution
- $N_{\text{step}}$  = Number of steps in one period

$\phi_{\text{period}}$	$N_{\text{period}}$	$N_{\text{step}}$	$\phi_{\text{step}}$
360°	1	1024	0.35°
180°	2	1024	0.18°
90°	4	1024	0.09°
45°	8	512	0.09°

### Output type and electrical variant

$\phi_{\text{period}}$	360°	180°	90°	45°
<b>Rotation</b>				
<b>Clockwise</b>	VA	VB	VC	VD
<b>Counterclockwise</b>	VE	VF	VG	VH

## Part numbering

**RMB20 IC 09B C 10**

### Output type

**DC** - Absolute natural binary BiSS C, RS422  
**IC** - Incremental, RS422  
**PC** - Absolute binary parallel  
**SC** - Absolute binary synchro-serial (SSI), RS422  
**Vx** - Linear voltage:

Linear voltage output 0 - 5 V, supply 5 V DC				
	360°	180°	90°	45°
CW	<b>VA</b>	<b>VB</b>	<b>VC</b>	<b>VD</b>
CCW	<b>VE</b>	<b>VF</b>	<b>VG</b>	<b>VH</b>

### Special requirements\*

**1** - No special requirements (standard for **Vx**)  
**10** - No special requirements (standard for **DC**, **IC**, **PC** and **SC**)  
**C0** - With Molex connector (for **DC** only)

### Shape

**C** - Circular

### Resolution

For **DC**, **IC** and **SC** (counts/positions per revolution):

Decimal			Binary		
<b>D32</b> - 320	<b>D80</b> - 800	<b>2D0</b> - 2000	<b>07B</b> - 128	<b>10B</b> - 1024	<b>13B</b> - 8192
<b>D40</b> - 400	<b>1D0</b> - 1000		<b>08B</b> - 256	<b>11B</b> - 2048	
<b>D50</b> - 500	<b>1D6</b> - 1600		<b>09B</b> - 512	<b>12B</b> - 4096	

For **PC**:

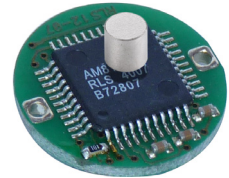
**08B** - 256 steps per revolution

For **Vx**:

**10B** - 1,024 steps per revolution

\* For sample quantities of RMB20 supplied with a magnet please add "KIT" to the end of the required RMB20 part number, eg. RMB20IC09BC10KIT.

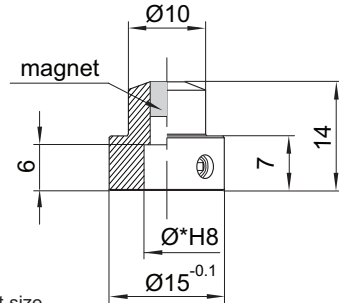
**NOTE:** Not all combinations are valid.



Series	Output type	Resolution	Shape	Special requirements
<b>RMB20</b>	DC	2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 13B / 12B / 11B / 10B / 09B / 08B / 07B	C	10 / C0
	IC			
	SC	2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 13B / 12B / 11B / 10B / 09B / 08B / 07B		10
	Vx	10B		1

## Magnetic actuator and magnet ordering information

### Actuator for integration onto shaft



Shaft = Ø\*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** – Ø4 mm shaft      **RMA10A2A00** – Ø10 mm shaft

**RMA05A2A00** – Ø5 mm shaft      **RMA19A2A00** – Ø3/16" shaft

**RMA06A2A00** – Ø6 mm shaft      **RMA25A2A00** – Ø1/4" shaft

**RMA08A2A00** – Ø8 mm shaft      **RMA37A2A00** – Ø3/8" shaft

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

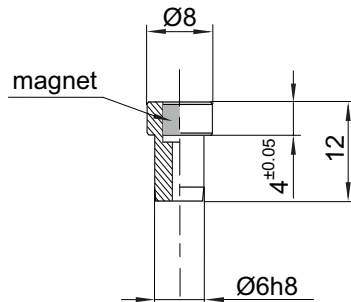
**RMA04A3A00** – Ø4 mm shaft      **RMA10A3A00** – Ø10 mm shaft

**RMA05A3A00** – Ø5 mm shaft      **RMA19A3A00** – Ø3/16" shaft

**RMA06A3A00** – Ø6 mm shaft      **RMA25A3A00** – Ø1/4" shaft

**RMA08A3A00** – Ø8 mm shaft      **RMA37A3A00** – Ø3/8" shaft

### Actuator for integration into shaft



#### 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**

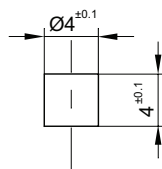
For resolutions from 10 bit absolute (800 cpr incremental) and above

**RMH06A3A02**

Hole = Ø6G7

Fixing: Glue (recommended – LOCTITE 648 or 2701)

### Magnet for direct recessing in non-ferrous shafts



Fixing: Glue (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)



## Head office

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## Document issues

Issue	Date	Page	Amendments done
10	8. 4. 2016	4, 5	RMB20IC and RMB20SC Connections 9-bit resolution deleted
		6	RMB20Vx description amended
		7	Ordering code amended
11	3. 6. 2016	2, 3	RMB20IC and RMB20SC Connections 9 bit resolution added
12	6. 10. 2016	3	RMB20BC timing diagram and pinout order amended
		4	IC output temperature and Current consumption amended, connections 9 bit resolution deleted
		7	Special requirements option 12 added, resolution binary table amended, ordering table added
13	5. 7. 2018	4, 5	Resolutions amended
14	8. 8. 2019	6	New version of RMB20Vx added
15	30. 8. 2019	2	Dimensions image change
16	27. 9. 2021	2	Dimensions image change
17	2. 2. 2022	General	AC, BC output removed, DC added

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