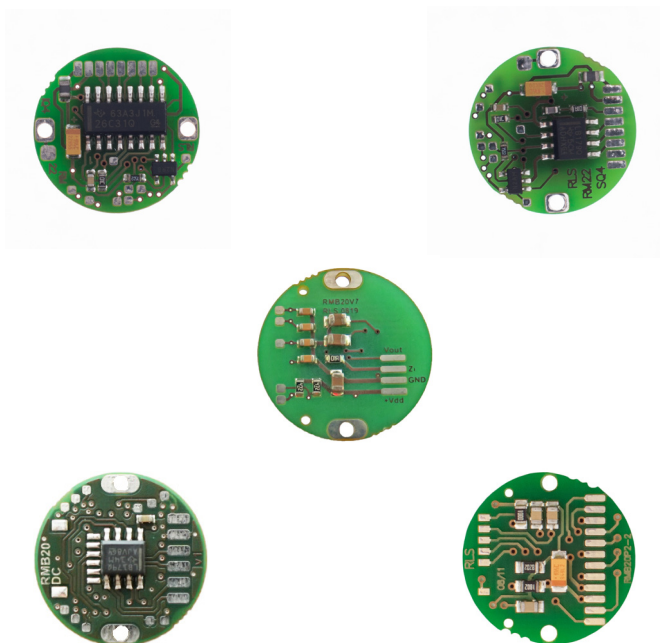


# RMB20 angular magnetic encoder module



**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 and optional revolution counter.

### 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

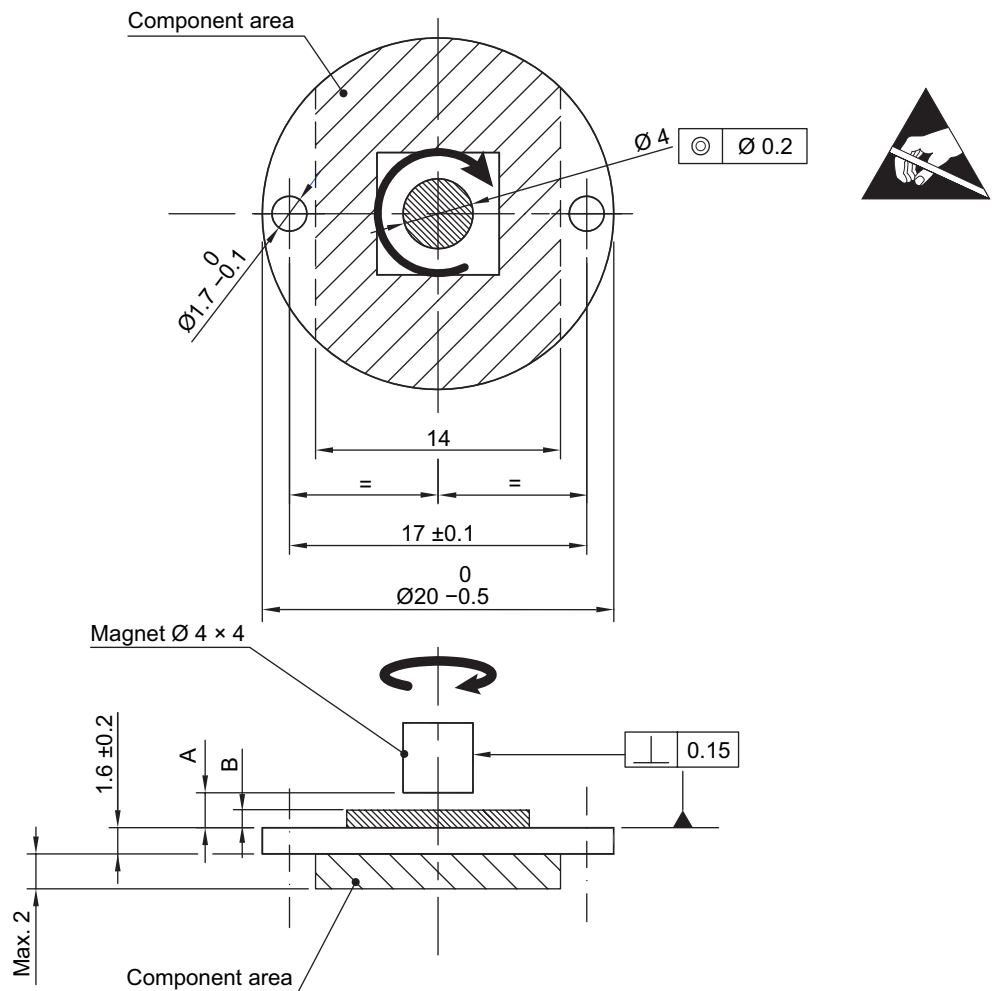
Synchro serial interface (SSI) with 320 to 8,192 positions per revolution.

### RMB20Vx

Linear voltage output in a range of variants.

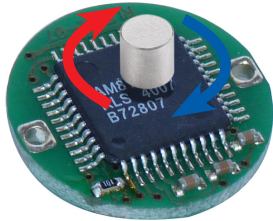
- 20 mm diameter circular module
- 5 V power supply
- High speed operation to 60,000 rpm
- Absolute - to 13 bit resolution (8,192 counts per revolution)
- Industry standard absolute, incremental, commutation and linear voltage output formats
- Accuracy to  $\pm 0.5^\circ$

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).



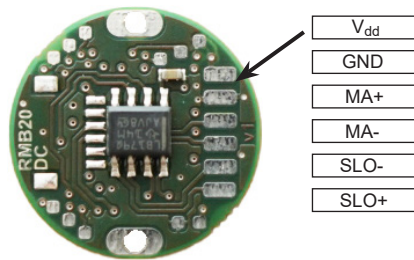
Clockwise (CW) rotation of magnet

## RMB20DC – Absolute natural binary BiSS C interface

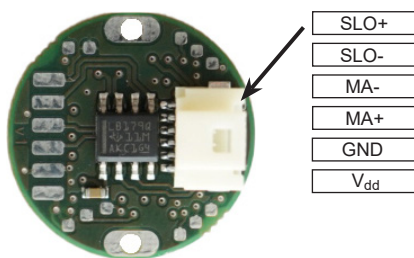
<b>Output code</b>	Natural binary
<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	Max. 50 mA
<b>Clock input</b>	MA (RS422)
<b>Data output</b>	SLO (RS422)
<b>Accuracy</b>	Typ. $\pm 0.5^\circ$
<b>Hysteresis</b>	$0.18^\circ$
<b>Resolution</b>	320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 positions per revolution
<b>Revolution counter</b>	12 bit (4096 revolutions)
<b>Maximum speed</b>	30,000 rpm
<b>Operating temperature</b>	$-40^\circ\text{C}$ to $+125^\circ\text{C}$ $-40^\circ\text{C}$ to $+105^\circ\text{C}$ (with connector)
<b>Max MA frequency</b>	8 MHz

### Connections

RMB20DC



RMB20DC with connector



#### Connector type

Molex 501568-0607

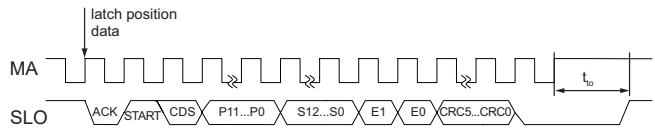
#### Mating connector

Molex 501330-0600 (not provided)

#### Crimp terminal

501334-0000 (not provided)

### Timing diagram – BiSS C



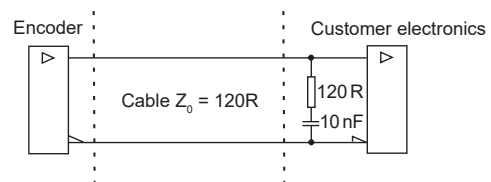
Data	Length	Description
P11 – P0	0 or 12 bit	Revolution counter value when enabled (see Part numbering/ resolution)
S12 – S0	7 to 13 bit	Position inside the revolution (length depends on the resolution)
E1 – E0	2 bit	Error data
CRC5 – CRC0	5 to 6 bit	Cyclic redundancy check data; polynomial 0x43; inverted 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.biiss-interface.com](http://www.biiss-interface.com).

### Recommended signal termination

For data output lines only



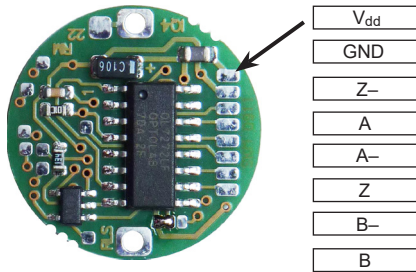
## RMB20IC – Incremental, RS422

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>	$-40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$
Operating and storage	

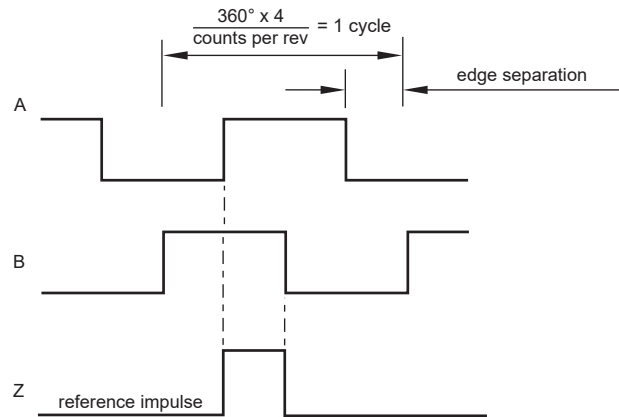
### Connections

RMB20IC

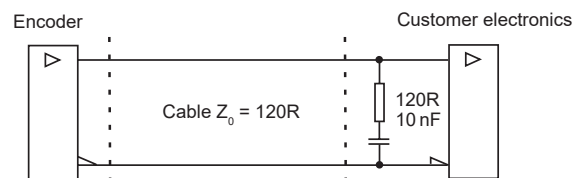


### Timing diagram

Complementary signals not shown



### Recommended signal termination

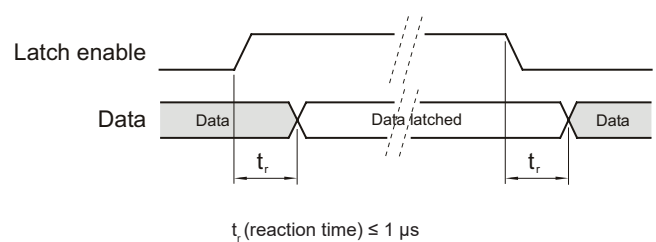


## RMB20PC – Absolute binary parallel interface

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 $-I_L \leq 3\text{ mA}$ $V_L \leq 1\text{ V}$ 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>	$-40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$
Operating and storage	

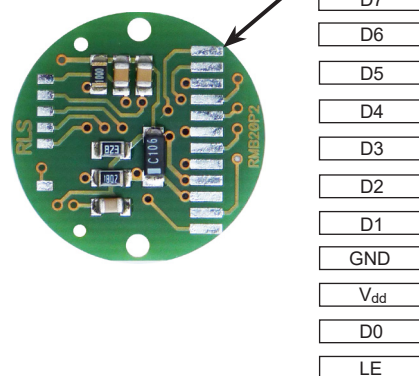
### Timing diagram



Position increases for clockwise rotation of magnet.

### Connections

RMB20PC

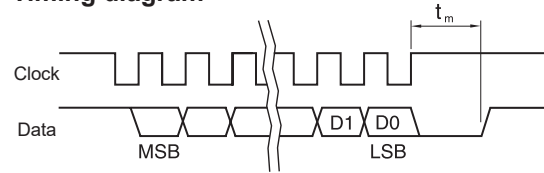


## RMB20SC – Absolute binary synchro-serial interface (SSI)

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> Operating and storage	$-40^\circ\text{C}$ to $+125^\circ\text{C}$

### Timing diagram

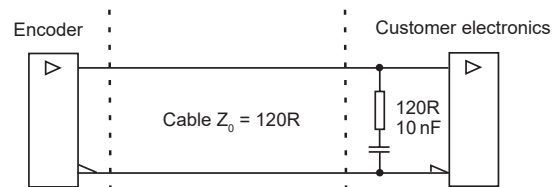


Clock  $\leq 4\text{ MHz}$        $12.5\text{ }\mu\text{s} \leq t_m \leq 20.5\text{ }\mu\text{s}$  (for all other resolutions)  
 Clock  $\leq 900\text{ kHz}$        $16\text{ }\mu\text{s} \leq t_m \leq 22\text{ }\mu\text{s}$  (for 9 bit resolution)

Position increases for clockwise rotation of magnet.

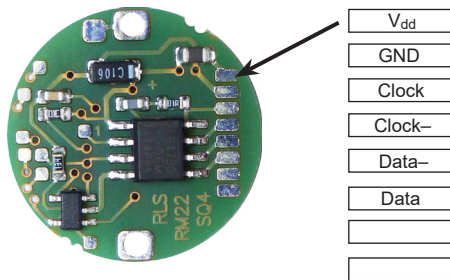
### Recommended signal termination

For data output lines only

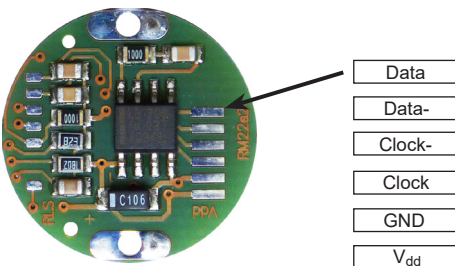


### Connections

RMB20SC - all other resolutions



RMB20SC - 9 bit resolution only

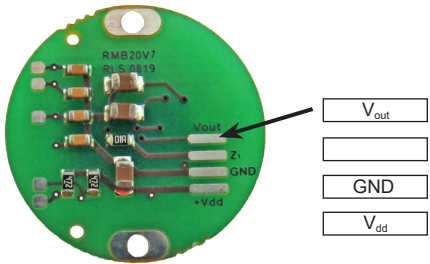


## RMB20Vx – Linear voltage output

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

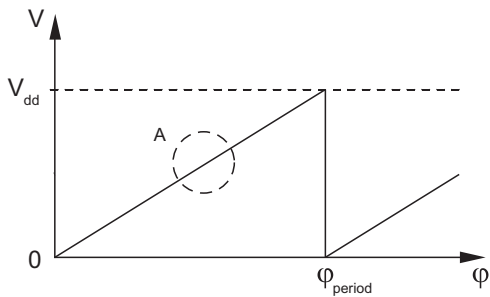
### Connections

RMB20V

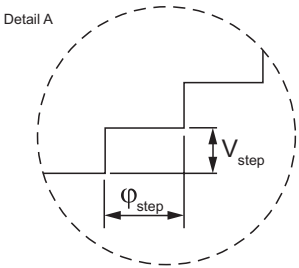


The digital relative angular position information is converted into linear voltage with a built-in 10 bit D/A converter. The linear output voltage swing ranges from 0 V and  $V_{dd}$  (5 V). The number of periods within one revolution ( $N_{\text{period}}$ ) can be 1, 2, 4 or 8, representing one full 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



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

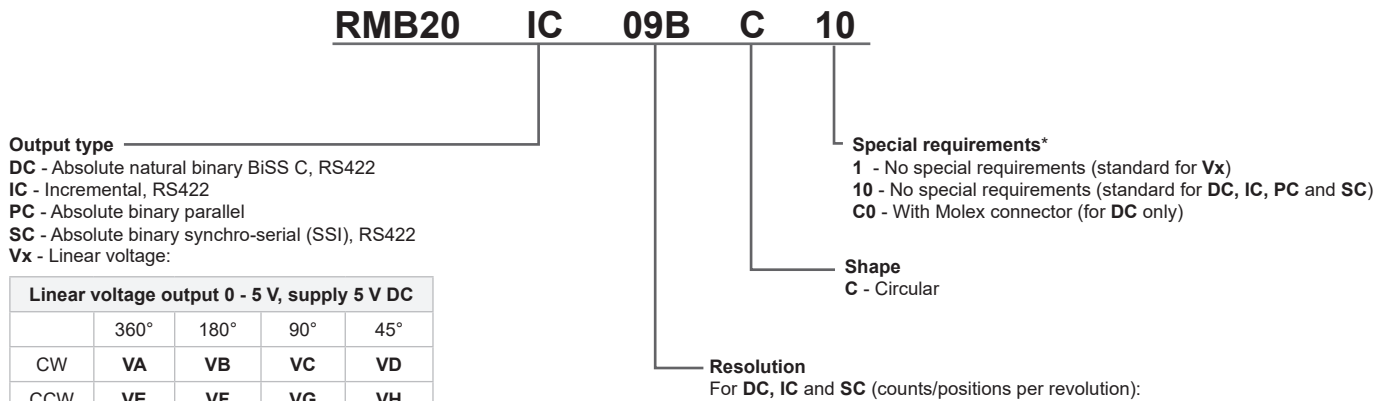
- $\phi_{\text{period}}$  = Angle covered in one period (one sawtooth)
- $V_{\text{period}}$  = Output voltage range for one period
- $\phi_{\text{step}}$  = Step angle (angular movement needed to register a change in the position)
- $V_{\text{step}}$  = Output voltage range for one step
- $N_{\text{period}}$  = 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°
Rotation				
Clockwise	VA	VB	VC	VD
Counterclockwise	VE	VF	VG	VH

## Part numbering



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

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 output types **DC** with enabled 12 bit revolution counter:

Decimal			Binary		
<b>M32</b> - 320	<b>M80</b> - 800	<b>2M0</b> - 2000	<b>07M</b> - 128	<b>10M</b> - 1024	<b>13M</b> - 8192
<b>M40</b> - 400	<b>1M0</b> - 1000		<b>08M</b> - 256	<b>11M</b> - 2048	
<b>M50</b> - 500	<b>1M6</b> - 1600		<b>09M</b> - 512	<b>12M</b> - 4096	

For **PC**:

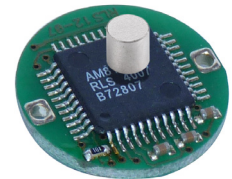
**08B** - 256 steps per revolution

For **Vx**:

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

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

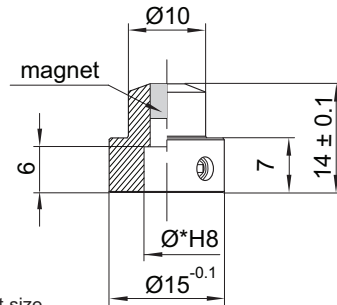
\* For sample quantities of RMB20 supplied with a magnet please add "KIT" to the end of the required RMB20 part number, eg. RMB20IC09BC10KIT.



Series	Output type	Resolution	Shape	Special requirements
RMB20	DC	09B / D50 / D40 / D32 / 10B / 1D0 / D80 / 11B / 2D0 / 1D6 / 12B / 13B 09M / M50 / M40 / M32 / 10M / 1M0 / M80 / 11M / 2M0 / 1M6 / 12M / 13M	C	10 / C0
	IC	2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 12B / 13B / 11B / 10B / 09B / 08B / 07B		10
	SC	2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 12B / 13B / 11B / 10B / 09B / 08B / 07B		
	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)

<b>RMA04A2A00</b> – Ø4 mm shaft	<b>RMA10A2A00</b> – Ø10 mm shaft
<b>RMA05A2A00</b> – Ø5 mm shaft	<b>RMA19A2A00</b> – Ø3/16" shaft
<b>RMA06A2A00</b> – Ø6 mm shaft	<b>RMA25A2A00</b> – Ø1/4" shaft
<b>RMA08A2A00</b> – Ø8 mm shaft	<b>RMA37A2A00</b> – Ø3/8" shaft

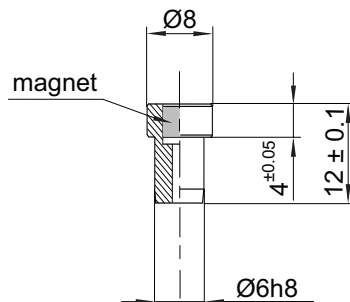
For resolutions from 10 bit absolute (800 cpr incremental) and above

<b>RMA04A3A00</b> – Ø4 mm shaft	<b>RMA10A3A00</b> – Ø10 mm shaft
<b>RMA05A3A00</b> – Ø5 mm shaft	<b>RMA19A3A00</b> – Ø3/16" shaft
<b>RMA06A3A00</b> – Ø6 mm shaft	<b>RMA25A3A00</b> – Ø1/4" shaft
<b>RMA08A3A00</b> – Ø8 mm shaft	<b>RMA37A3A00</b> – Ø3/8" shaft

### Actuator for integration into shaft



with N-pole  
marker



#### 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)

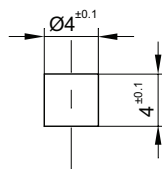
**RMH06A2A02**

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
18	20. 1. 2023	General	Revolution counter added

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