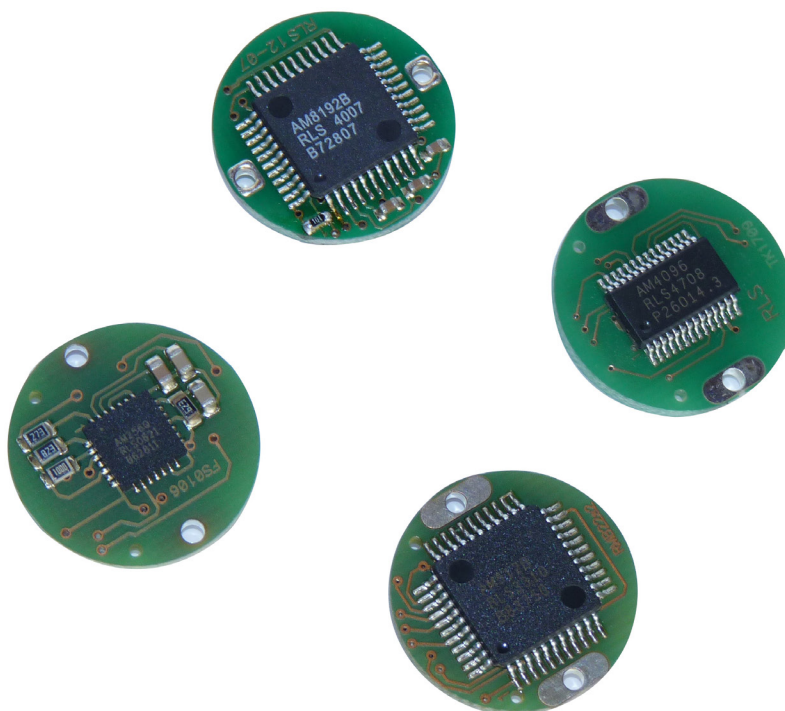


RMB20 angular magnetic encoder module



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

RMB20AC/BC

Analogue sinusoidal outputs with a single sine/cosine period 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

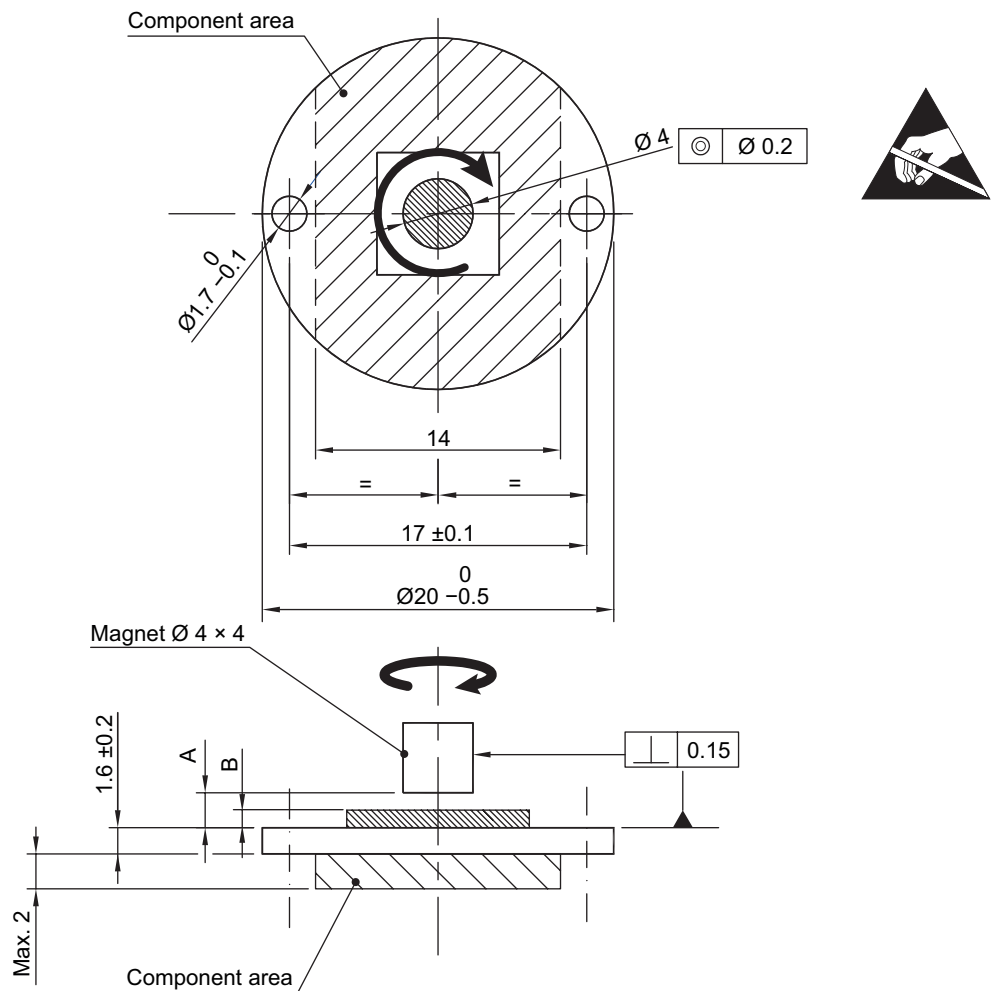
Synchro serial interface (SSI) with 320 to 8,192 positions per revolution.

RMB20Vx

Linear voltage output in a range of variants.

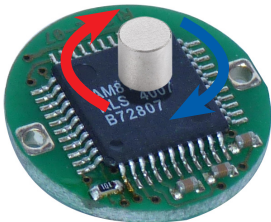
- 20 mm diameter circular module
- 5 V power supply
- High speed operation to 60,000 rpm
- Absolute - to 13 bit resolution (8,192 counts per revolution)
- Industry standard absolute, incremental, analogue, commutation and linear output formats
- Accuracy to $\pm 0.5^\circ$
- RoHS compliant (lead free)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

Installation drawing



Module	A PCB surface to magnet distance [mm]	B Chip height [mm]
RMB20 AC	2.35 ± 0.2	Max. 1.00
RMB20 BC		
RMB20 IC	3.50 ± 0.2	Max. 1.60
RMB20 PC		
RMB20 SC		
RMB20Vx	2.80 ± 0.2	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).



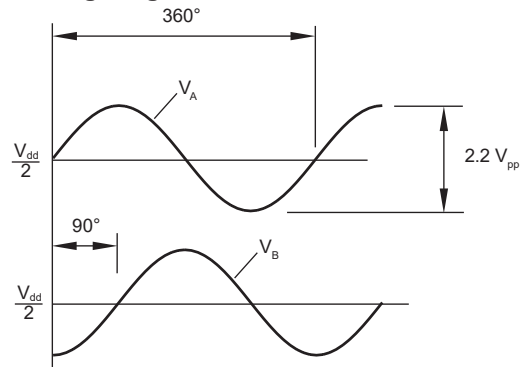
Clockwise (CW) rotation of magnet

RMB20AC – Analogue sinusoidal outputs

2 channels V_A and V_B sinusoids (90° phase shifted, single ended)

Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Current consumption	20 mA
Outputs	Signal amplitude $\frac{1}{2} \pm 0.2 V_{pp}$ Signal offset $\frac{V_{dd}}{2} \pm 5\text{ mV}$
Internal serial impedance	720 Ω
Maximum speed	60,000 rpm
Temperature Operating and storage	-40 °C to +125 °C

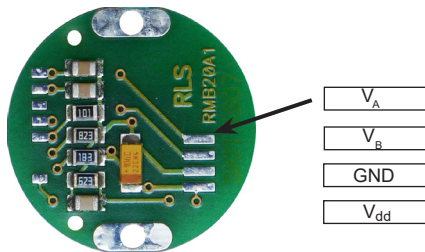
Timing diagram



V_A leads V_B for clockwise rotation of magnet

Connections

RMB20AC

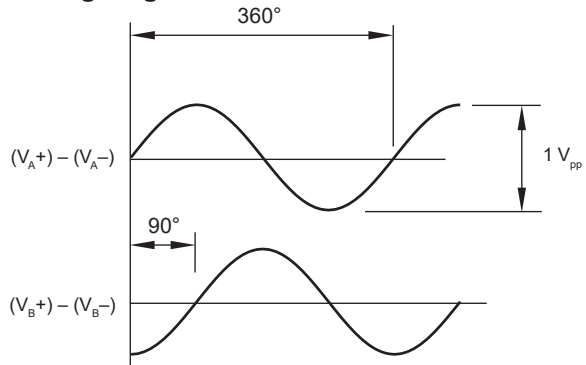


RMB20BC – Analogue complementary sinusoidal outputs

2 channels V_A and V_B differential sinusoids in quadrature (90° phase shifted)

Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Current consumption	20 mA
Outputs	Signal amplitude $0.5 \pm 0.1 V_{pp}$ Signal offset $\frac{V_{dd}}{2} \pm 5\text{ mV}$
Internal serial impedance	100 Ω (option 72: 10 Ω)
Maximum speed	60,000 rpm
Temperature Operating and storage	-40 °C to +85 °C

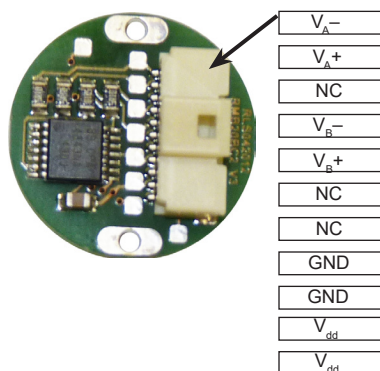
Timing diagram



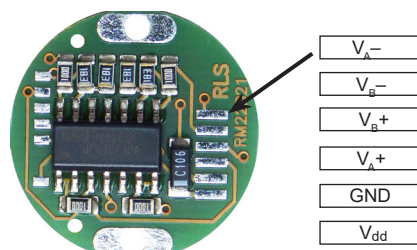
V_A leads V_B for clockwise rotation of magnet

Connections

RMB20BC with connector



RMB20BC



Connector type

Molex 501568-1107

Mating connector*

Molex 501330-1100

Crimp terminal 501334-xxxx

*Not provided

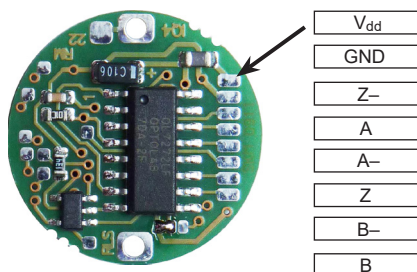
RMB20IC – Incremental, RS422

Square wave differential line driver to RS422

Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Current consumption	Max. 35 mA
Output signals	A, B, Z, A–, B–, Z– (RS422)
Accuracy	Typ. $\pm 0.5^\circ$
Hysteresis	0.18°
Resolution	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)
Maximum speed	30,000 rpm
Temperature	$-40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$
Operating and storage	

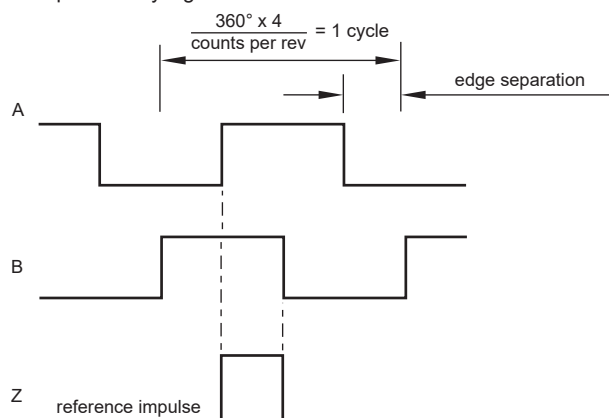
Connections

RMB20IC



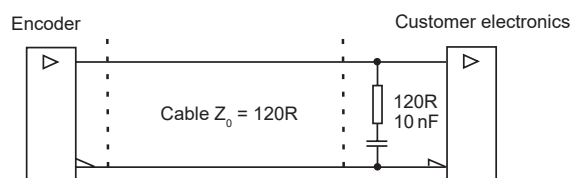
Timing diagram

Complementary signals not shown



B leads A for clockwise rotation of magnet.

Recommended signal termination

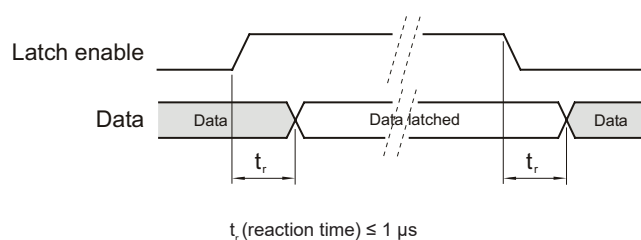


RMB20PC – Absolute binary parallel interface

Parallel absolute position measurement

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

Timing diagram

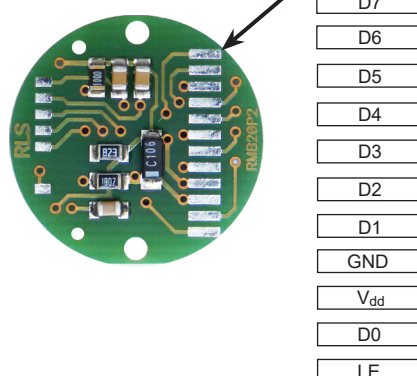


t_r (reaction time) $\leq 1\text{ }\mu\text{s}$

Position increases for clockwise rotation of magnet.

Connections

RMB20PC

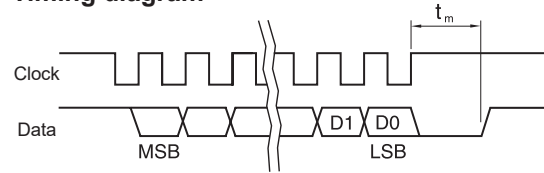


RMB20SC – Absolute binary synchro-serial interface (SSI)

Serial encoded absolute position measurement

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

Timing diagram

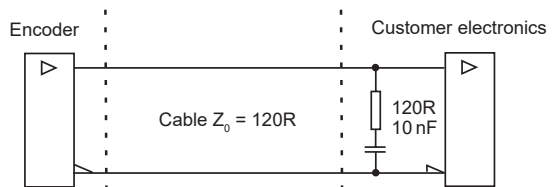


Clock $\leq 4\text{ MHz}$ $12.5\text{ }\mu\text{s} \leq t_m \leq 20.5\text{ }\mu\text{s}$ (for all other resolutions)
 Clock $\leq 900\text{ kHz}$ $16\text{ }\mu\text{s} \leq t_m \leq 22\text{ }\mu\text{s}$ (for 9 bit resolution)

Position increases for clockwise rotation of magnet.

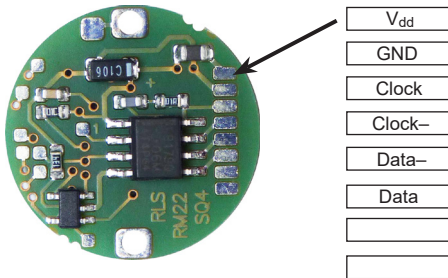
Recommended signal termination

For data output lines only

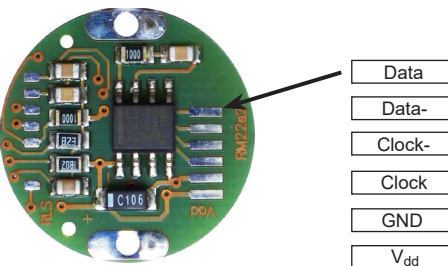


Connections

RMB20SC - all other resolutions



RMB20SC - 9 bit resolution only

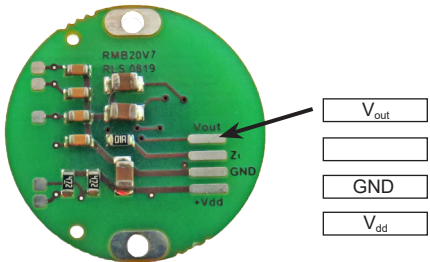


RMB20Vx – Linear voltage output

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 $+125\text{ }^{\circ}\text{C}$

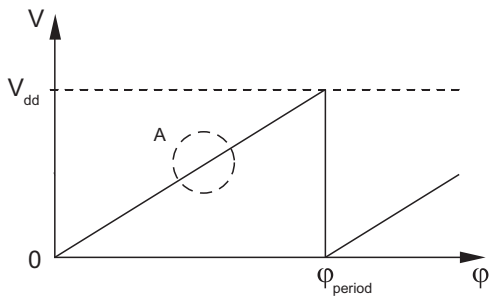
Connections

RMB20V

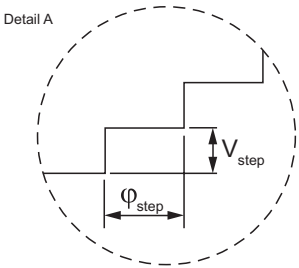


The digital relative angular position information is converted into linear voltage with a built-in 10 bit D/A converter. The linear output voltage swing ranges from 0 V and V_{dd} (5 V). The number of periods within one revolution (N_{period}) can be 1, 2, 4 or 8, representing one full swing over an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



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

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

ϕ_{period}	N_{period}	N_{step}	ϕ_{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

ϕ_{period}	360°	180°	90°	45°
Rotation				
Clockwise	VA	VB	VC	VD
Counterclockwise	VE	VF	VG	VH

Part numbering

RMB20 IC 09B C 10

Output type

AC - Analogue sinusoidal
BC - Analogue complementary sinusoidal
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	VA	VB	VC	VD
CCW	VE	VF	VG	VH

Special requirements*

1 - No special requirements
 (standard for **AC**, **BC**, **PC** and **Vx**)
10 - No special requirements (standard for **IC** and **SC**)
12 - With Molex connector (for **BC** only)
72 - With 10 Ω serial resistors (for **BC** only)

Shape

C - Circular

Resolution

For **AC** and **BC**:

01S - one sine/cosine wave per revolution

For **PC**:

09B - 512 positions per revolution

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

Decimal		
D32 - 320	D80 - 800	2D0 - 2000
D40 - 400	1D0 - 1000	
D50 - 500	1D6 - 1600	

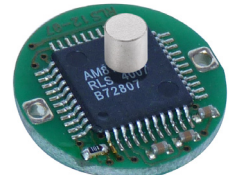
Binary		
07B - 128	10B - 1024	13B - 8192
08B - 256	11B - 2048	
09B - 512	12B - 4096	

For **Vx**:

10B - 1,024 steps per revolution

NOTE: Not all combinations are valid.

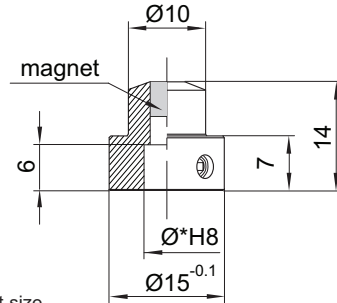
* For sample quantities of RMB20 supplied with a magnet please add "KIT" to the end of the required RMB20 part number, eg. RMB20IC09BC10KIT.



Series	Output type	Resolution	Shape	Special requirements
RMB20	AC	01S	C	1
	PC	09B		1 / 12 / 72
	BC	01S		10
	IC	2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 13B / 12B / 11B / 10B / 09B / 08B / 07B		1
	SC	2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 13B / 12B / 11B / 10B / 09B / 08B / 07B		
	Vx	10B		

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:

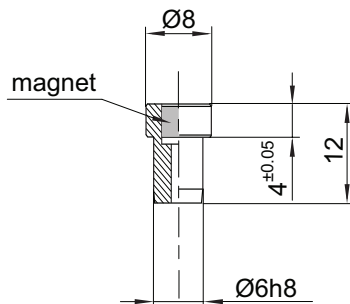
For resolutions up to 9 bit absolute (512 cpr incremental)

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

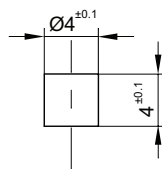
For resolutions from 10 bit absolute (800 cpr incremental) and above

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)

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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

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