

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 or 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.

RMB20AC - Single ended analogue sinusoidal outputs with a single sine/cosine cycle per revolution

RMB20BC - Complementary analogue outputs with a single sine/cosine cycle per revolution

RMB20IC - Incremental with 80 to 2,048 pulses per revolution (320 to 8,192 counts per revolution with x 4 evaluation)

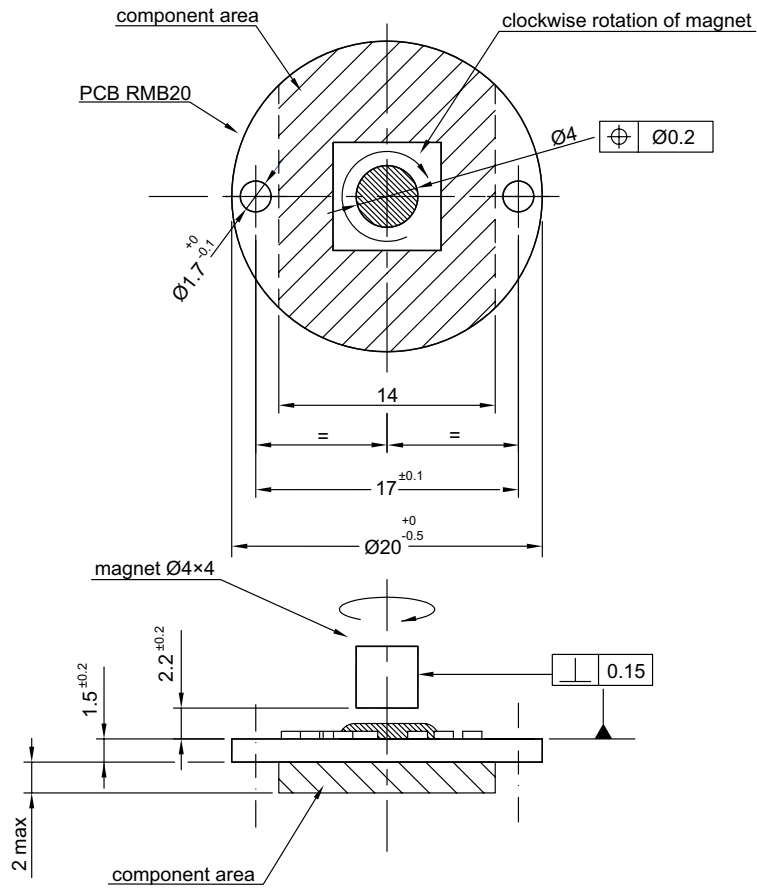
RMB20PC - Absolute parallel interface with 512 positions per revolution (9 bit)

RMB20SC - Synchro serial interface (SSI) with 320 to 8,192 positions per revolution

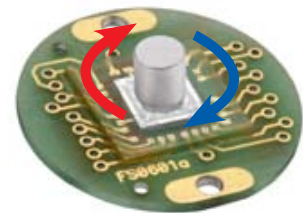
RMB20V - Linear voltage output in a range of variants

- 20 mm diameter circular module
- 5 V power supply
- High speed operation to 30,000 rpm
- Absolute - to 13 bit resolution (8,192 counts per revolution)
- Industry standard absolute, incremental, analogue and linear output formats
- Accuracy to $\pm 0.5^\circ$
- RoHS compliant (lead free)

RMB20 installation drawing



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).



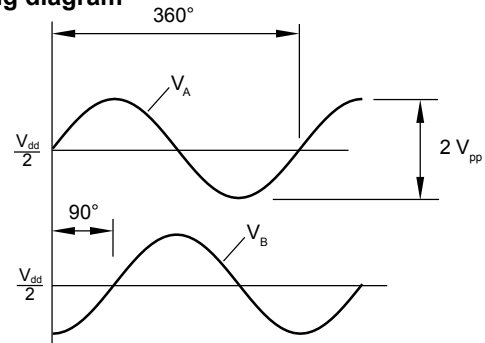
Clockwise (CW) rotation of magnet

RMB20AC – Analogue sinusoidal outputs

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

Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Power consumption	20 mA
Outputs	Signal amplitude $2 \pm 0.2 V_{pp}$ Signal offset $\frac{V_{dd}}{2} \pm 5\text{ mV}$
Max. output frequency	500 Hz
Temperature	Operating -25 °C to +125 °C Storage -25 °C to +125 °C
Maximum speed	30,000 rpm
Internal serial impedance	720 Ω

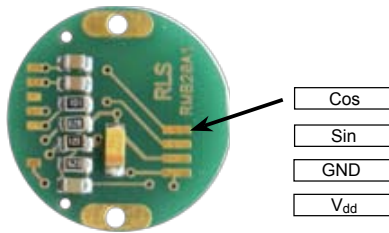
Timing diagram



V_A leads V_B for clockwise rotation of magnet

Connections

RMB20AC

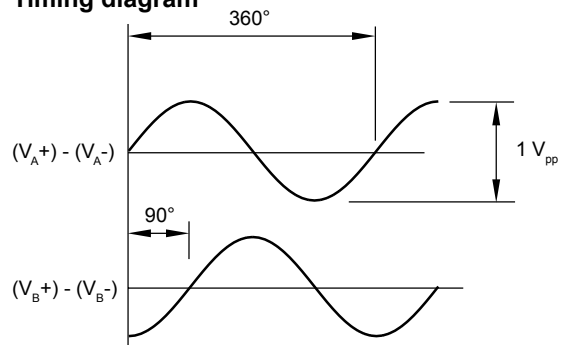


RMB20BC – Analogue complementary sinusoidal outputs

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

Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Power consumption	20 mA
Outputs	Signal amplitude $0.5 \pm 0.1 V_{pp}$ Signal offset $\frac{V_{dd}}{2} \pm 5\text{ mV}$
Max. output frequency	500 Hz
Temperature	Operating -25 °C to +85 °C Storage -25 °C to +85 °C
Maximum speed	30,000 rpm
Internal serial impedance	100 Ω

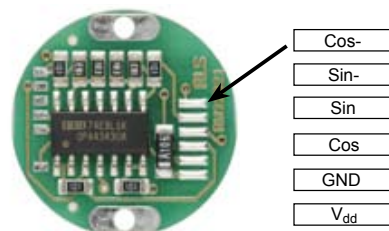
Timing diagram



V_A leads V_B for clockwise rotation of magnet

Connections

RMB20BC



RMB20IC – Incremental output

Square wave differential line driver to RS422A

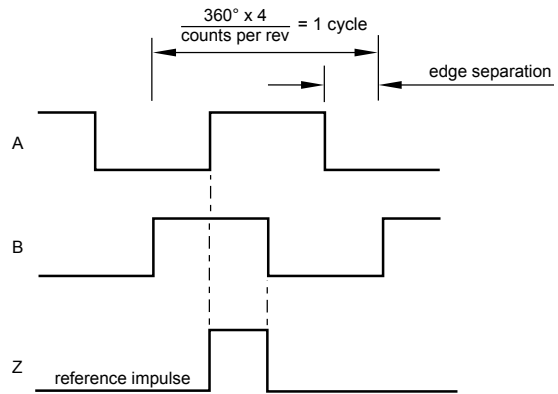
Power supply	$V_{dd} = 5 V \pm 5\%$
Power consumption	23 mA for 9 bit resolution 35 mA for all other resolutions
Output signals	A, B, Z, A-, B-, Z- (RS422A)
Temperature	Operating -25 °C to +85 °C -40 °C to +125 °C (option 1B) Storage -40 °C to +125 °C

Resolution options (counts per rev)	Maximum speed (rpm)	Accuracy*	Hysteresis
320, 400, 500	30,000	±0.7°	0.18°
512	30,000	±0.7°	0.45°
800, 1,000, 1,024	20,000	±0.5°	0.18°
1,600, 2,000, 2,048	10,000	±0.5°	0.18°
4,096	5,000	±0.5°	0.18°
8,192	2,500	±0.5°	0.18°

* Worst case within operational parameters including magnet position and temperature.

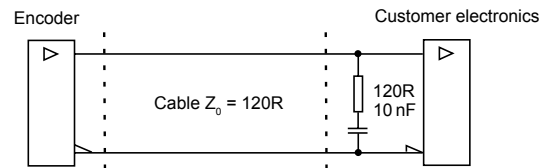
Timing diagram

Complementary signals not shown



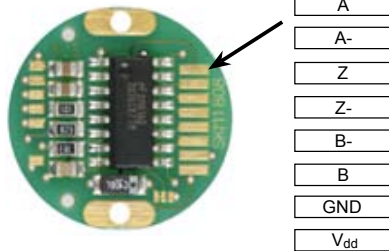
B leads A for clockwise rotation of magnet.

Recommended signal termination

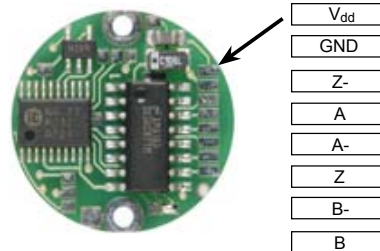


Connections

RMB20IC - 9 bit resolution only



RMB20IC - all other resolutions

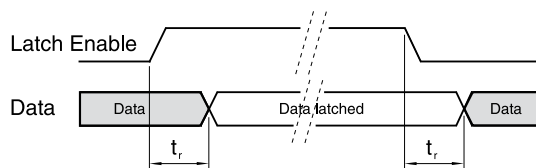


RMB20PC – Absolute binary parallel interface

Parallel absolute position measurement

Output code	Natural binary
Power supply	$V_{dd} = 5 V \pm 5\%$
Power consumption	20 mA without load
Output voltage	$V_H \geq 4 V$ at $-I_H \leq 3 mA$ $V_L \leq 1 V$ at $I_L \leq 3 mA$
Resolution	9 bit (512 positions per revolution)
Hysteresis	0.45°
Accuracy	±0.7°
Repeatability	≤ 0.07°
Data outputs	D0 (LSB) - D8 (MSB)
Data inputs	LE - latch enable input signal, active high Maximum sampling rate 500 kHz
Temperature	Operating -40 °C to +125 °C Storage -40 °C to +85 °C
Maximum speed	30,000 rpm

Timing diagram

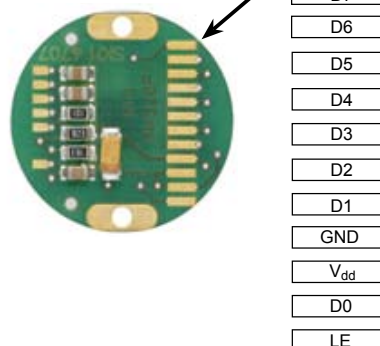


t_r (reaction time) ≤ 1 μs

Position increases for clockwise rotation of magnet.

Connections

RMB20PC



RMB20SC – Absolute binary synchro-serial interface (SSI)

Serial encoded absolute position measurement

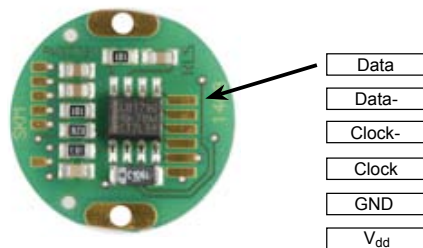
Output code	Natural binary
Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Power consumption	23 mA for 9 bit resolution 35 mA for all other resolutions
Repeatability	$\leq 0.07^\circ$
Data outputs	Serial data (RS422A)
Data inputs	Clock (RS422A)
Temperature	Operating $-40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$ Storage $-40\text{ }^\circ\text{C}$ to $+85\text{ }^\circ\text{C}$

Resolution options (positions per rev)	Maximum speed (rpm)	Accuracy*	Hysteresis
320, 400, 500	30,000	$\pm 0.7^\circ$	0.18°
512	30,000	$\pm 0.7^\circ$	0.45°
800, 1,000, 1,024	20,000	$\pm 0.5^\circ$	0.18°
1,600, 2,000, 2,048	10,000	$\pm 0.5^\circ$	0.18°
4,096	5,000	$\pm 0.5^\circ$	0.18°
8,192	2,500	$\pm 0.5^\circ$	0.18°

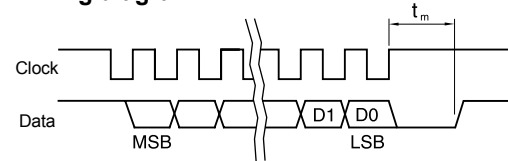
* Worst case within operational parameters including magnet position and temperature.

Connections

RMB20SC - 9 bit resolution only



Timing diagram

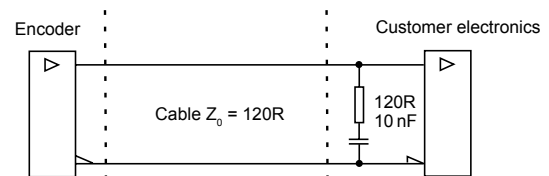


Clock $\leq 900\text{ kHz}$ $16\text{ }\mu\text{s} \leq t_m \leq 22\text{ }\mu\text{s}$ (for 9 bit resolution)
 Clock $\leq 4\text{ MHz}$ $12.5\text{ }\mu\text{s} \leq t_m \leq 20.5\text{ }\mu\text{s}$ (for all other resolutions)

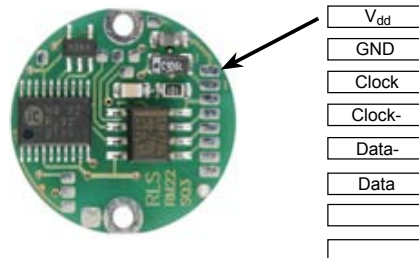
Position increases for clockwise rotation of magnet.

Recommended signal termination

For data output lines only



RMB20SC - all other resolutions

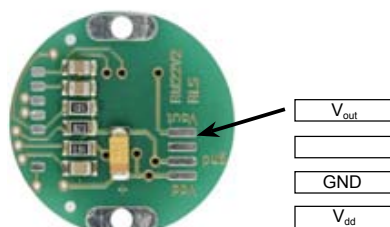


RMB20V – Linear voltage output

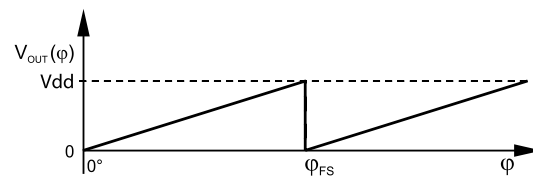
Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Power consumption	20 mA typical
Output voltage	0 V to V_{dd}
Output loading	Max. 10 mA
Nonlinearity	1 %
Temperature	Operating $-40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$ Storage $-40\text{ }^\circ\text{C}$ to $+85\text{ }^\circ\text{C}$
Maximum speed	30,000 rpm

Connections

RMB20V



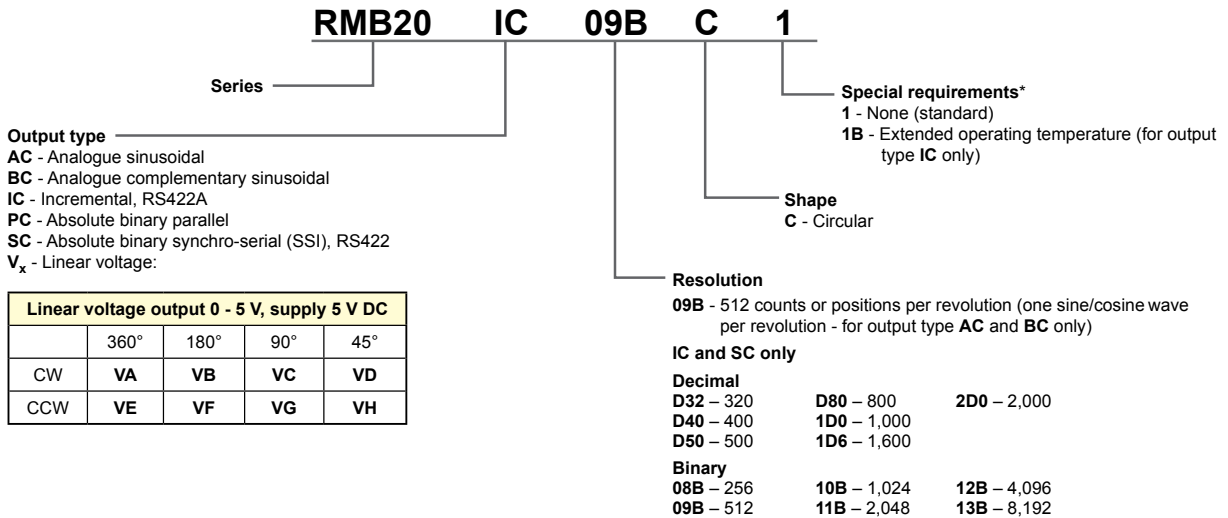
Electrical output/shaft position



Output type and electrical variant

ϕ_{FS}	360°	180°	90°	45°
CW	VA	VB	VC	VD
CCW	VE	VF	VG	VH

RMB20 ordering code



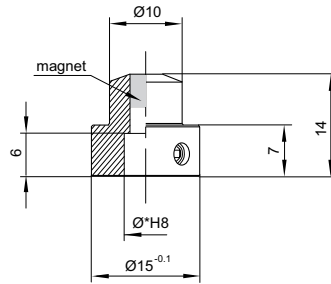
* For sample quantities of RMB20 supplied with a magnet please add "KIT" to the end of the required RMB20 part number, eg. **RMB20IC09BC1KIT**

Magnetic actuator and magnet ordering information

Actuator for integration onto shaft



Shaft = \varnothing^*h7
Fixing: Grub screw provided

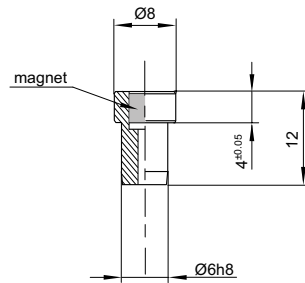


Part numbers:

For resolutions up to 9 bit absolute (512 cpr incremental)
RMA04A2A00 – $\varnothing 4$ mm shaft **RMA10A2A00** – $\varnothing 10$ mm shaft
RMA05A2A00 – $\varnothing 5$ mm shaft **RMA19A2A00** – $\varnothing 3/16''$ shaft
RMA06A2A00 – $\varnothing 6$ mm shaft **RMA25A2A00** – $\varnothing 1/4''$ shaft
RMA08A2A00 – $\varnothing 8$ mm shaft **RMA37A2A00** – $\varnothing 3/8''$ shaft

For resolutions from 10 bit absolute (800 cpr incremental) and above
RMA04A3A00 – $\varnothing 4$ mm shaft **RMA10A3A00** – $\varnothing 10$ mm shaft
RMA05A3A00 – $\varnothing 5$ mm shaft **RMA19A3A00** – $\varnothing 3/16''$ shaft
RMA06A3A00 – $\varnothing 6$ mm shaft **RMA25A3A00** – $\varnothing 1/4''$ shaft
RMA08A3A00 – $\varnothing 8$ mm shaft **RMA37A3A00** – $\varnothing 3/8''$ 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

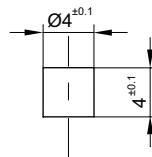
With N-pole marker scribed to a $\pm 5^\circ$ accuracy:

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

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

Hole = $\varnothing 6G7$
Fixing: Glue (recommended – LOCTITE 648)

Magnet for direct recessing in non-ferrous shafts



Fixing: Glue (recommended – LOCTITE 648)

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

RLS merilna tehnika d.o.o.
Cesta II. grupe odredov 25
SI-1261 Ljubljana - Dobrunje
Slovenia

T +386 1 5272100
F +386 1 5272129
E mail@rls.si
www.rls.si

Document issues

Issue	Date	Page	Amendments done
01	6. 5. 2005	-	New document
02	16. 11. 2005	2, 3	RMB20BC output and information on resolutions above 9 bit added
03	6. 12. 2005	1	New installation drawing
04	12. 1. 2006	3	Magnet information added and minor changes in ordering information done
05	10. 4. 2006	1	New installation drawing
06	2. 6. 2006	3	Pin out description changed
07	24. 11. 2008	-	New layout with new connection images
08	14. 1. 2009	-	New layout

RENISHAW  is our worldwide sales support partner for Magnetic Encoders.

Australia

T +61 3 9521 0922
E australia@renishaw.com

Austria

T +43 2236 379790
E austria@renishaw.com

Brazil

T +55 11 4195 2866
E brazil@renishaw.com

Canada

T +1 905 828 0104
E canada@renishaw.com

The People's Republic of China

T +86 10 8448 5306
E beijing@renishaw.com

Czech Republic

T +420 5 4821 6553
E czech@renishaw.com

France

T +33 1 64 61 84 84
E france@renishaw.com

Germany

T +49 7127 9810
E germany@renishaw.com

Hong Kong

T +852 2753 0638
E hongkong@renishaw.com

Hungary

T +36 23 502 183
E hungary@renishaw.com

India

T +91 20 6674 6751
E india@renishaw.com

Israel

T +972 4 953 6595
E israel@renishaw.com

Italy

T +39 011 966 10 52
E italy@renishaw.com

Japan

T +81 3 5366 5316
E japan@renishaw.com

The Netherlands

T +31 76 543 11 00
E benelux@renishaw.com

Poland

T +48 22 577 11 80
E poland@renishaw.com

Russia

T +7 495 231 1677
E russia@renishaw.com

Singapore

T +65 6897 5466
E singapore@renishaw.com

Slovenia

T +386 1 52 72 100
E mail@rls.si

South Korea

T +82 2 2108 2830
E southkorea@renishaw.com

Spain

T +34 93 663 34 20
E spain@renishaw.com

Sweden

T +46 8 584 90 880
E sweden@renishaw.com

Switzerland

T +41 55 415 50 60
E switzerland@renishaw.com

Taiwan

T +886 4 2473 3177
E taiwan@renishaw.com

UK

T +44 1453 524524
E uk@renishaw.com

USA

T +1 847 286 9953
E usa@renishaw.com

**For all other countries
Please contact RLS' head
office**

T +386 1 52 72 100
E mail@rls.si

RLS d.o.o. has made considerable effort to ensure the content of this document is correct at the date of publication but makes no warranties or representations regarding the content. RLS d.o.o. excludes liability, howsoever arising, for any inaccuracies in this document. © 2009 RLS d.o.o.