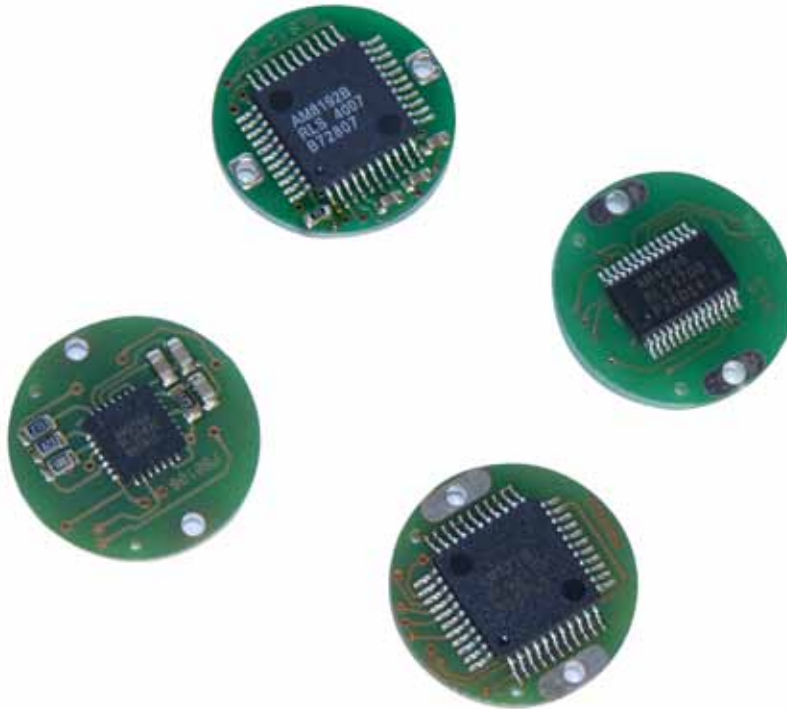


RMB20 OnAxis™ magnetic encoder module



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.

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 x4 evaluation)

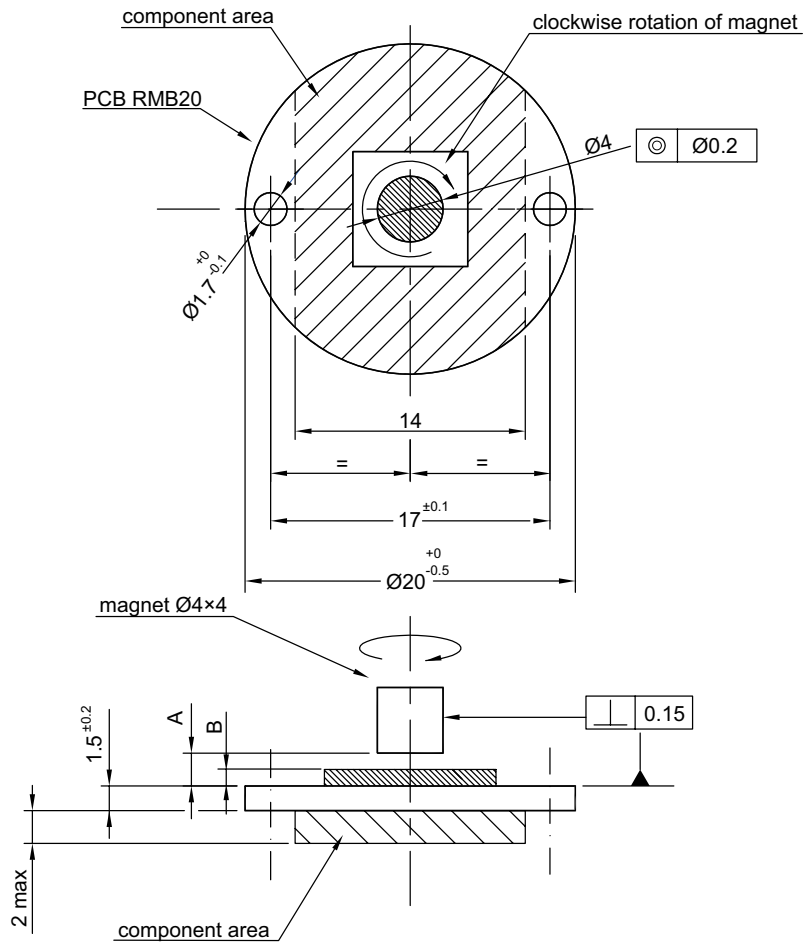
RMB20PC - Absolute parallel interface with 512 positions per revolution (9 bit)

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

RMB20V - 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 and linear output formats
- Accuracy to $\pm 0.5^\circ$
- RoHS compliant (lead free)

RMB20 installation drawing



Module	A (mm)	B (mm)
RMB20 AC	$2.35^{+0.2}$	1.00 max.
RMB20 BC	$2.35^{+0.2}$	1.00 max.
RMB20 IC	$3.50^{+0.2}$	1.60 max.
RMB20 PC	$3.50^{+0.2}$	1.60 max.
RMB20 SC	$3.50^{+0.2}$	1.60 max.
RMB20 Vx	$2.80^{+0.5}$	2.00 max.

A – PCB surface to magnet distance
B - Chip height



Clockwise (CW) rotation of magnet

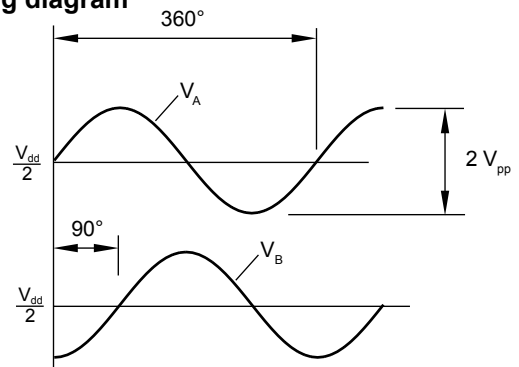
NOTE: For the accuracy specified the center line of the magnet needs to be square to the chip within 2° and aligned within the center of the board ± 0.1 mm (mid point between the 2 mounting holes).

RMB20AC – Analogue sinusoidal outputs

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

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

Timing diagram



V_A leads V_B for clockwise rotation of magnet

Connections

RMB20AC



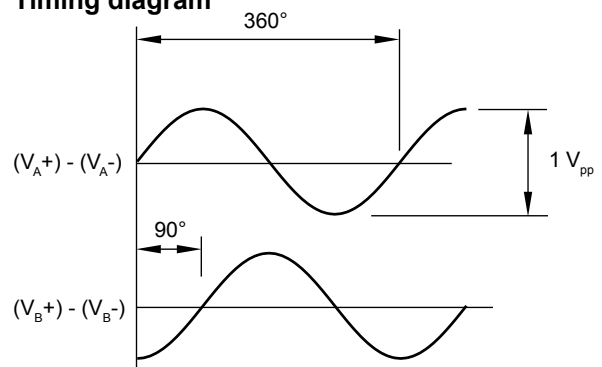
- Cos
- Sin
- GND
- V_{dd}

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 $\frac{V_{dd}}{2} \pm 5\text{ mV}$
Maximum speed	60,000 rpm
Temperature	-40 °C to +85 °C
Operating and storage	
Internal serial impedance	100 Ω

Timing diagram



V_A leads V_B for clockwise rotation of magnet

Connections

RMB20BC



- Cos-
- Sin-
- Sin
- Cos
- GND
- V_{dd}

RMB20IC – Incremental output

Square wave differential line driver to RS422

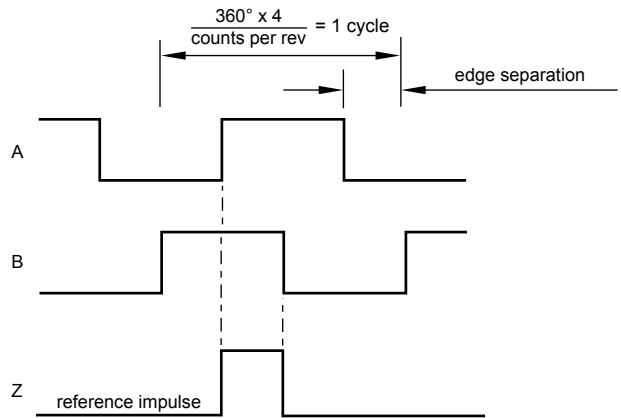
Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Power consumption	23 mA for 9 bit resolution 35 mA for all other resolutions
Output signals	A, B, Z, A-, B-, Z- (RS422)
Operating temperature	-25 °C to +85 °C
Ext. operat. temp.	-40 °C to +125 °C
Storage temperature	-40 °C to +125 °C

Resolution options (counts per rev)	Maximum speed (rpm)	Accuracy*	Hysteresis
256, 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.
† 0.18° for extended temperature range variant (option 18)

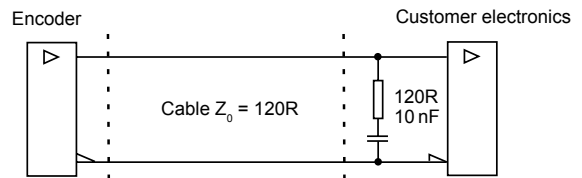
Timing diagram

Complementary signals not shown



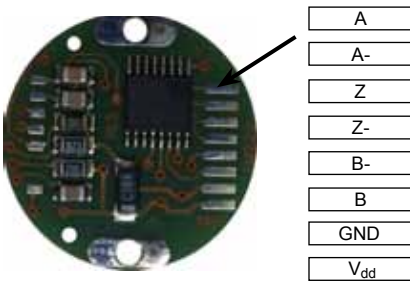
B leads A for clockwise rotation of magnet.

Recommended signal termination

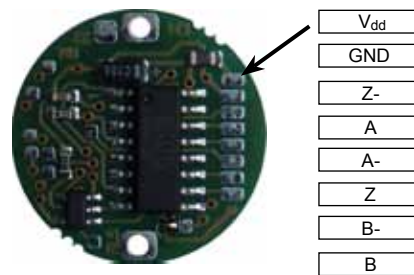


Connections

RMB20IC - 9 bit resolution (standard temperature range) only



RMB20IC - all other resolutions and 9-bit extended temperature range variant (option 18)

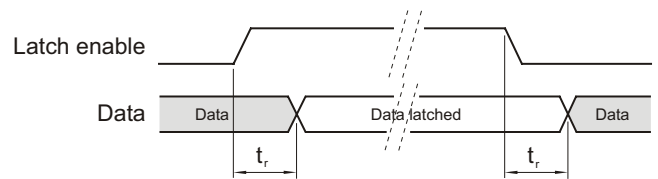


RMB20PC – Absolute binary parallel interface

Parallel absolute position measurement

Output code	Natural binary
Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Power consumption	20 mA without load
Output voltage	$V_H \geq 4\text{ V}$ at $-I_H \leq 3\text{ mA}$ $V_L \leq 1\text{ V}$ at $I_L \leq 3\text{ mA}$
Resolution	9 bit (512 positions per revolution)
Hysteresis	0.45°
Accuracy	$\pm 0.7^\circ$
Repeatability	$\leq 0.07^\circ$
Data outputs	D0 (LSB) - D8 (MSB)
Data input	LE - latch enable input signal, active high Maximum sampling rate 500 kHz
Temperature	-40 °C to +125 °C
Operating and storage	
Maximum speed	60,000 rpm

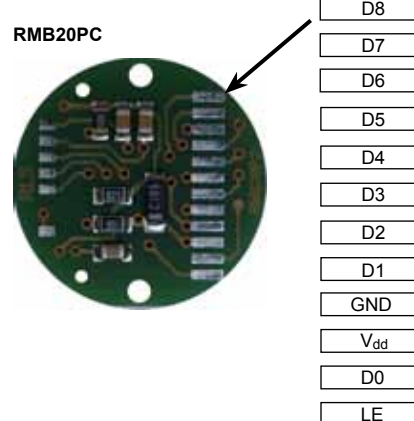
Timing diagram



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

Position increases for clockwise rotation of magnet.

Connections



RMB20SC – Absolute binary synchro-serial interface (SSI)

Serial encoded absolute position measurement

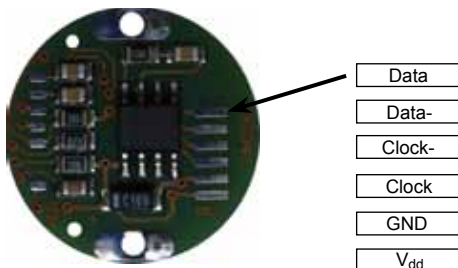
Output code	Natural binary
Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Power consumption	23 mA for 9 bit resolution 35 mA for all other resolutions
Repeatability	$\leq 0.07^\circ$
Data output	Serial data (RS422)
Data input	Clock (RS422)
Temperature	-40 °C to +125 °C
Operating and storage	

Resolution options (positions per rev)	Maximum speed (rpm)	Accuracy*	Hysteresis
256, 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°

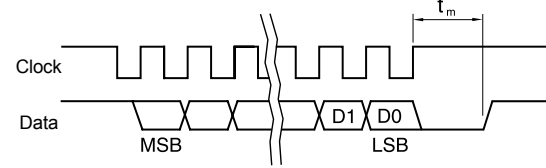
* Worst case within operational parameters including magnet position and temperature.

Connections

RMB20SC - 9 bit resolution only



Timing diagram

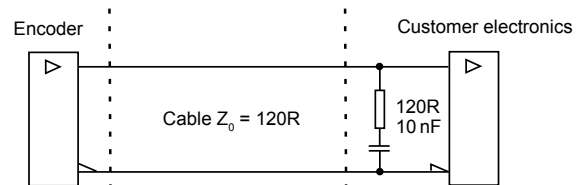


Clock $\leq 900\text{ kHz}$ $16\ \mu\text{s} \leq t_m \leq 22\ \mu\text{s}$ (for 9 bit resolution)
 Clock $\leq 4\text{ MHz}$ $12.5\ \mu\text{s} \leq t_m \leq 20.5\ \mu\text{s}$ (for all other resolutions)

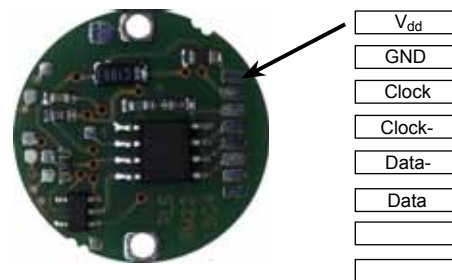
Position increases for clockwise rotation of magnet.

Recommended signal termination

For data output lines only



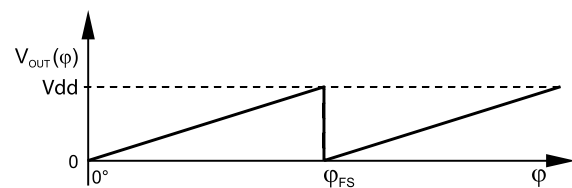
RMB20SC - all other resolutions



RMB20V – Linear voltage output

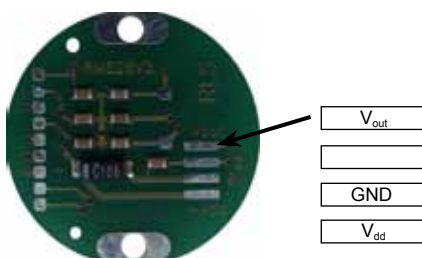
Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Power consumption	26 mA typical
Output voltage	0 V to V_{dd}
Nonlinearity	1 %
Temperature	-40 °C to +125 °C
Operating and storage	
Maximum speed	30,000 rpm

Electrical output/shaft position



Connections

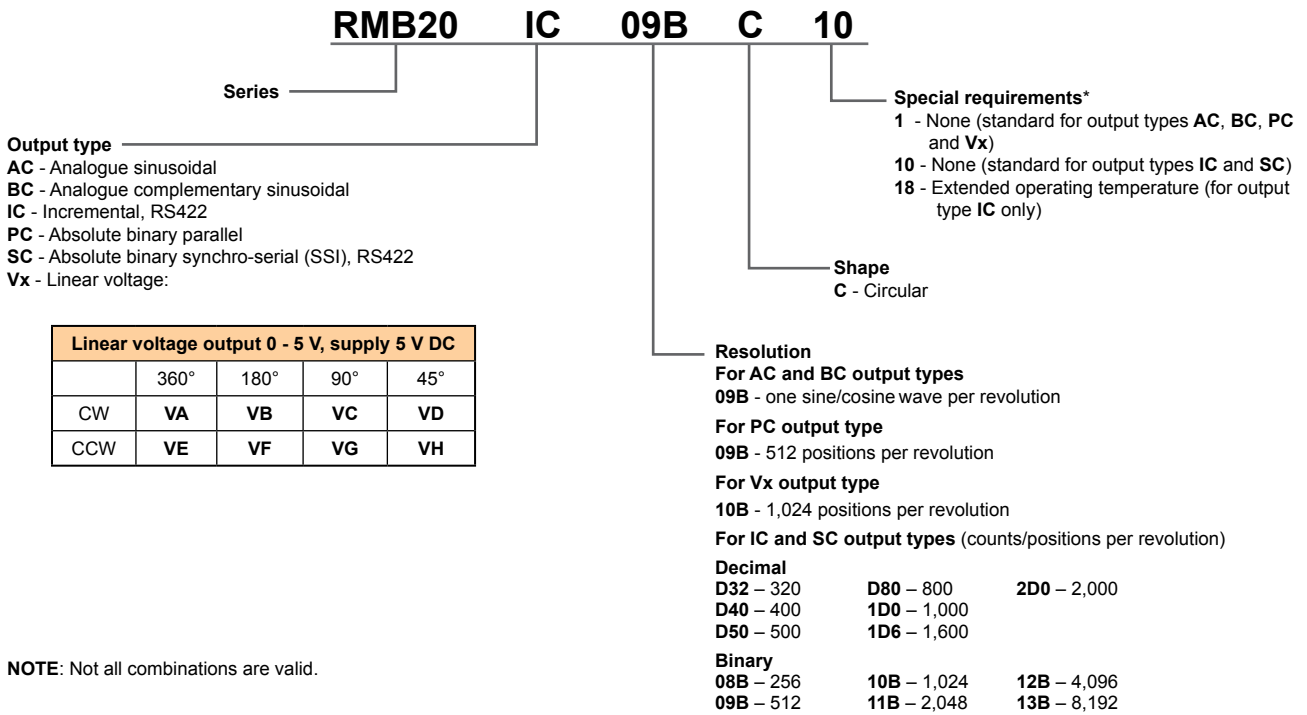
RMB20V



Output type and electrical variant

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

RMB20 ordering code



NOTE: Not all combinations are valid.

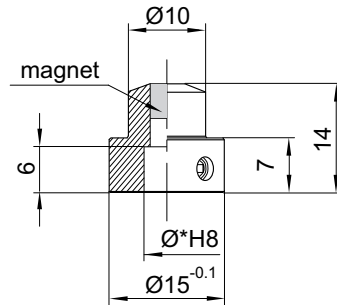
* For sample quantities of RMB20 supplied with a magnet please add "KIT" to the end of the required RMB20 part number, eg. **RMB20IC09BC10KIT**

Magnetic actuator and magnet ordering information

Actuator for integration onto shaft



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

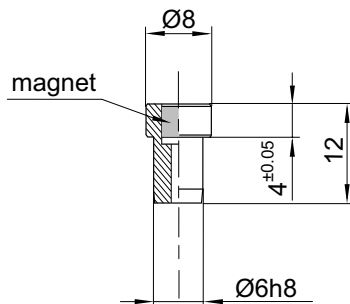


Part numbers:

For resolutions up to 9 bit absolute (512 cpr incremental)
RMA04A2A00 – $\varnothing4$ mm shaft **RMA10A2A00** – $\varnothing10$ mm shaft
RMA05A2A00 – $\varnothing5$ mm shaft **RMA19A2A00** – $\varnothing3/16''$ shaft
RMA06A2A00 – $\varnothing6$ mm shaft **RMA25A2A00** – $\varnothing1/4''$ shaft
RMA08A2A00 – $\varnothing8$ mm shaft **RMA37A2A00** – $\varnothing3/8''$ shaft

For resolutions from 10 bit absolute (800 cpr incremental) and above
RMA04A3A00 – $\varnothing4$ mm shaft **RMA10A3A00** – $\varnothing10$ mm shaft
RMA05A3A00 – $\varnothing5$ mm shaft **RMA19A3A00** – $\varnothing3/16''$ shaft
RMA06A3A00 – $\varnothing6$ mm shaft **RMA25A3A00** – $\varnothing1/4''$ shaft
RMA08A3A00 – $\varnothing8$ mm shaft **RMA37A3A00** – $\varnothing3/8''$ 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:

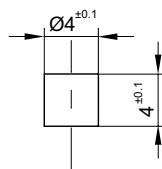
For resolutions up to 9 bit absolute (512 cpr incremental)
RMH06A2A02

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

Hole = $\varnothing6G7$

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)

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
09	27. 5. 2011	2	PCB surface to magnet distance and chip height table added
		-	Redesign of all RMB20 boards with incremental (IC) and absolute binary SSI (SC) outputs
		-	New linear voltage output module added

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