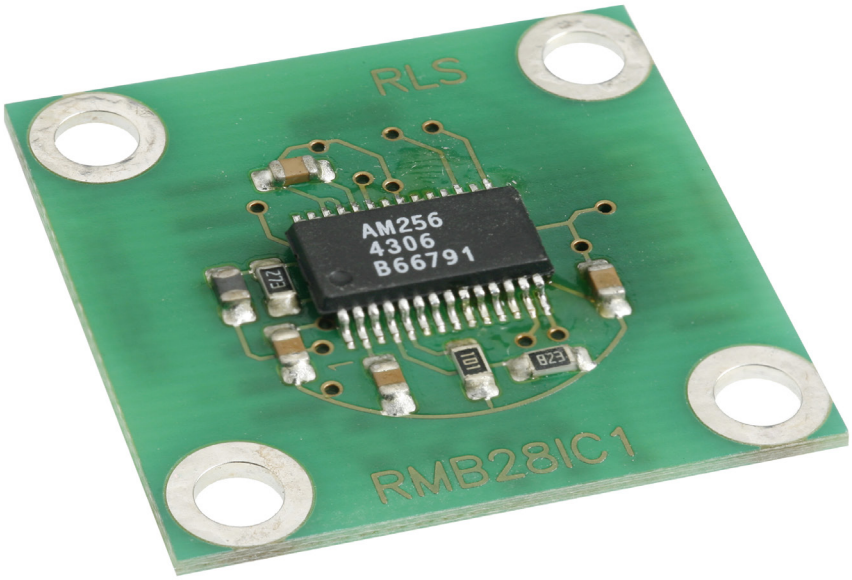
Data sheet
RMB28D01_07
Issue 7, 14th May 2014

RMB28 angular magnetic encoder module



The image does not represent all variants.

The RMB28 encoder module is designed for direct integration to high volume OEM applications. The low cost 28 mm square PCB can also be provided with a connector for easy installation.

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 RMB28 can be used in a wide range of OEM applications including motor control and industrial automation.

RMB28MD - Sine/Cosine + Absolute binary synchro-serial + Incremental, 5 V

RMB28IB - Incremental, Open Collector, 24 V

RMB28IE - Incremental, Open Collector, 5 V

RMB28IC - Incremental, RS422, 5 V

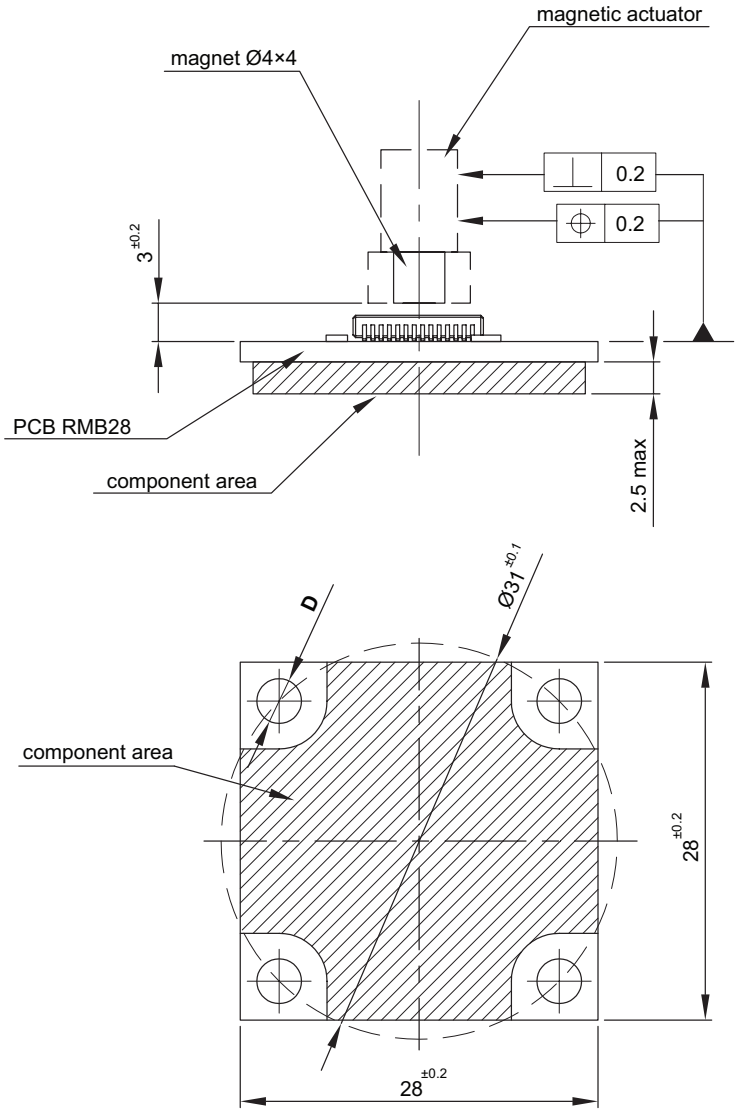
RMB28SC - Absolute binary synchro-serial, RS422, 5 V

RMB28SI - Absolute binary synchro-serial (SSI) + Incremental, RS422, 5 V

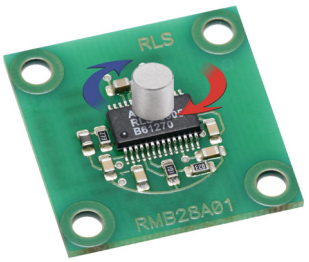
RMB28V - Linear voltage output, 5 V

- **28 mm square module**
- **Low cost for OEM integration**
- **24 V and 5 V power supply versions**
- **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 ±0.5°**
- **RoHS compliant (lead free)**

RMB28 installation drawing



Output type	Hole diameter (D)
RMB28MD	$3.5^{\pm 0.1}$
RMB28IB	$3.5^{\pm 0.1}$
RMB28IE	$3.5^{\pm 0.1}$
RMB28IC - 128, 256 cpr	$3.5^{\pm 0.1}$
RMB28IC - all other resolutions	$2.5^{\pm 0.1}$
RMB28SC - 8 bit	$3.5^{\pm 0.1}$
RMB28SC - all other resolutions	$2.5^{\pm 0.1}$
RMB28SI	$2.5^{\pm 0.1}$
RMB28V	$3.5^{\pm 0.1}$



Clockwise (CW) rotation of magnet

RMB28MD – Sine/Cosine + Absolute binary synchro-serial (SSI) + Incremental

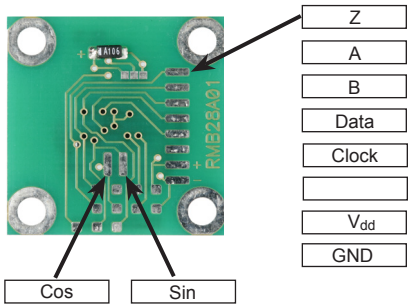
Complex feedback device for absolute position at start-up as well as during operation + incremental outputs

Power supply	V_{dd} = 5 V ± 5%	
Resolution	8 bit + 64 ppr (256 cpr) + one period per revolution	
Power consumption	13 mA – incremental and SSI (not loaded)	
SSI output code	Natural binary	
Data output	Serial data	
Data input	Clock	
Incremental outputs	A, B, Z	
Sin/Cos outputs	Signal amplitude Signal offset	2 ± 0.2 V_{pp} $V_{dd}/2$ ± 5 mV
Operating temperature	-40 °C to +125 °C	
Maximum speed	60,000 rpm	
Accuracy*	±0.7°	
Hysteresis	0.45°	

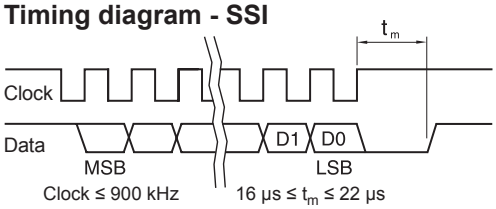
* Worst case within operational parameters including magnet position and temperature.

Connections

RMB28MD

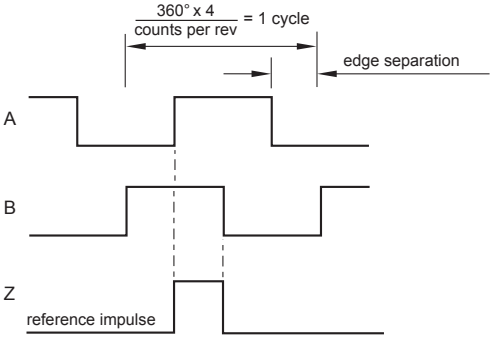


Timing diagram - SSI



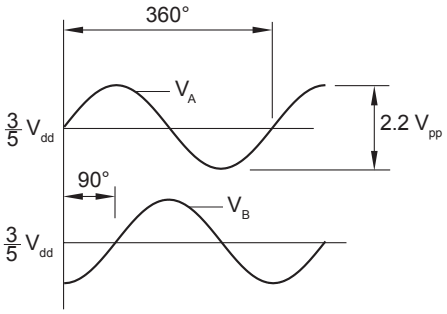
Position increases for clockwise rotation of magnet.

Timing diagram - Incremental



B leads A for clockwise rotation of magnet.

Timing diagram - Sine/Cosine



V_B leads V_A for clockwise rotation of magnet.

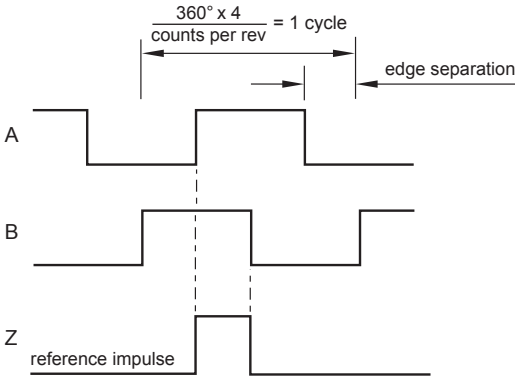
RMB28IB – Incremental, Open Collector, NPN, 24 V

Square wave output

Power supply	V_{dd} = 8 V to 26 V
Resolution	32, 64 ppr (128, 256 cpr)
Power consumption	13 mA (not loaded)
Maximum output load	20 mA
Output signals	A, B, Z
Operating temperature Ext. operat. temp.	0 °C to +70 °C -40 °C to +125 °C
Maximum speed	60,000 rpm
Accuracy*	±0.7°
Hysteresis	0.45°

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

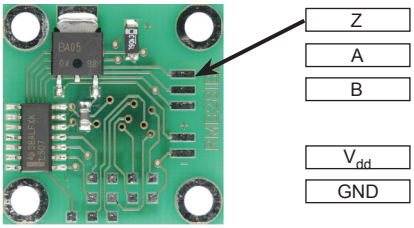
Timing diagram



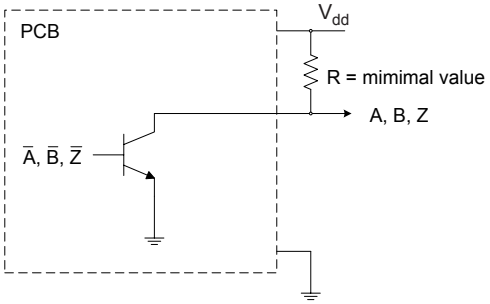
B leads A for clockwise rotation of magnet.

Connections

RMB28IB



Recommended signal termination



RMB28IE – Incremental, Open Collector, NPN, 5 V

Low cost alternative for ball bearing encoders

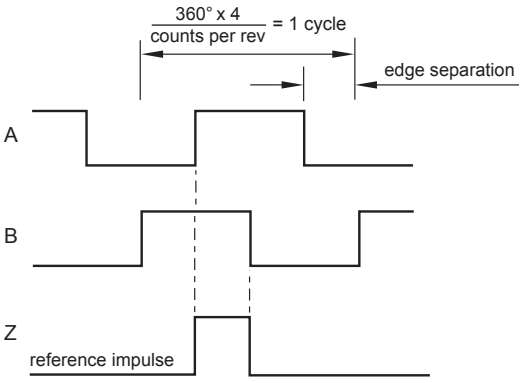
Power supply	V_{dd} = 5 V ± 5%
Power consumption	13 mA for 128, 256 cpr 35 mA for all other resolutions
Maximum output load	20 mA
Output signals	A, B, Z
Operating temperature Ext. operat. temp.	0 °C to +70 °C -40 °C to +125 °C

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

Resolution options (counts per revolution)	Maximum speed (rpm)	Accuracy*	Hysteresis
128, 256	60,000	±0.7°	0.45°
320, 400, 500, 512	30,000	±0.7°	0.18°
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°

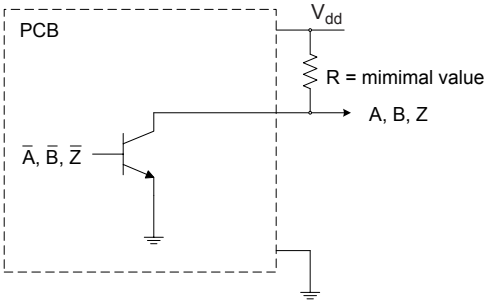
* Worst case within operational parameters including magnet position and temperature.

Timing diagram



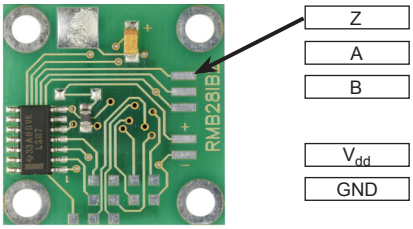
B leads A for clockwise rotation of magnet.

Recommended signal termination

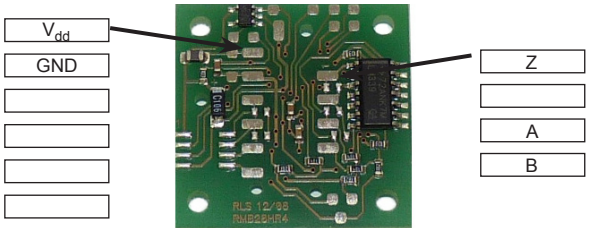


Connections

RMB28IE - 32, 64 pulses per revolution (128, 256 cpr)



RMB28IE - all other resolutions



Data sheet
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RMB28IC – Incremental, RS422, 5 V

Alternative for optical encoders

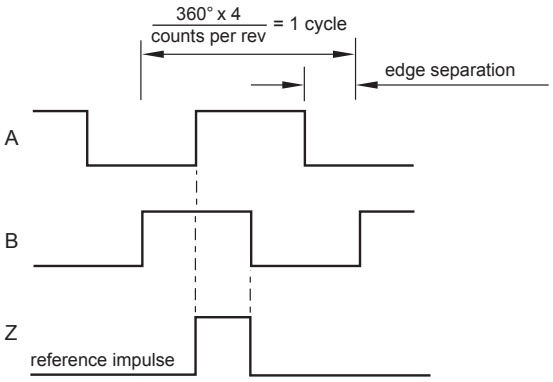
Power supply	V_{dd} = 5 V ± 5%
Power consumption	13 mA for 128, 256 cpr 35 mA for all other resolutions
Output signals	A, B, Z, A-, B-, Z- (RS422)
Operating temperature Ext. operat. temp.	-25 °C to +85 °C -40 °C to +125 °C
Edge separation	1 µs minimum

Resolution options (counts per revolution)	Maximum speed (rpm)	Accuracy*	Hysteresis
128, 256	60,000	±0.7°	0.45°
320, 400, 500, 512	30,000	±0.7°	0.18°
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.

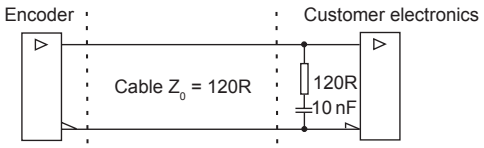
Timing diagram

Complementary signals not shown



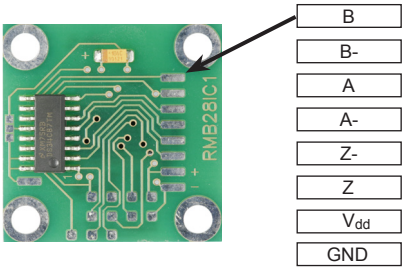
B leads A for clockwise rotation of magnet.

Recommended signal termination

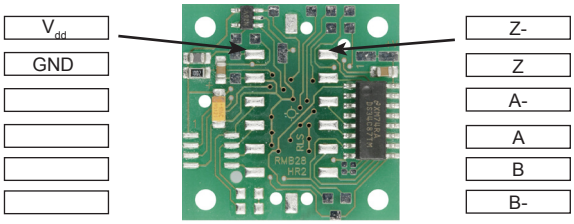


Connections

RMB28IC - 128, 256 counts per revolution



RMB28IC - all other resolutions



RMB28SC – Absolute binary synchro-serial (SSI), RS422, 5 V

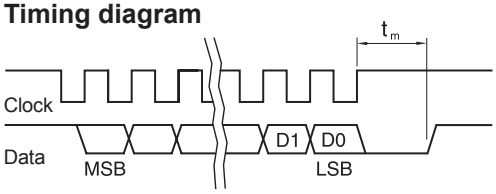
Alternative for optical encoders

Power supply	V_{dd} = 5 V ± 5%
Power consumption	13 mA for 8 bit resolution 35 mA for all other resolutions
SSI output code	Natural binary
Data output	Serial data (RS422)
Data input	Clock (RS422)
Operating temperature	-40 °C to +125 °C
Maximum speed	60,000 rpm

Resolution options (positions per rev)	Maximum speed (rpm)	Accuracy*	Hysteresis
256	60,000	±0.7	0.45°
320, 400, 500, 512	30,000	±0.7°	0.18°
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

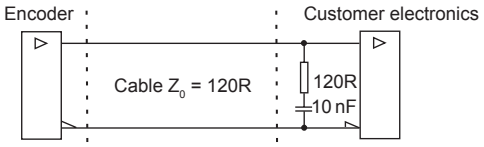


Clock ≤ 900 kHz 16 µs ≤ t_m ≤ 22 µs for 8 bit resolution
Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20 µs for all other resolutions

Position increases for clockwise rotation of magnet.

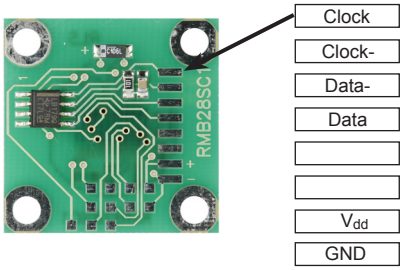
Recommended signal termination

For data output lines only

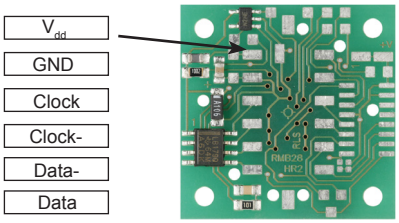


Connections

RMB28SC - 8 bit resolution



RMB28SC - all other resolutions



RMB28SI – Absolute binary synchro-serial (SSI) + Incremental, RS422, 5 V

Complex feedback device for absolute position at start up as well as during operation + incremental outputs.
Both the incremental and the SSI output always have the same fixed resolution.

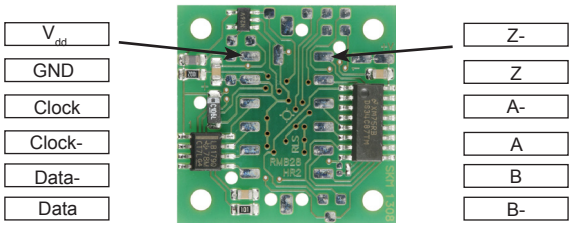
Power supply	V_{dd} = 5 V ± 5%
Power consumption	35 mA
SSI output code	Natural binary
Data output	Serial data (RS422)
Data input	Clock (RS422)
Incremental outputs	A, B, Z, A-, B-, Z- (RS422)
Operating temperature Ext. operat. temp.	-25 °C to +85 °C -40 °C to +125 °C

Resolution options (positions/counts per revolution)	Maximum speed (rpm)	Accuracy*	Hysteresis
320, 400, 500, 512	30,000	±0.7°	0.18°
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°

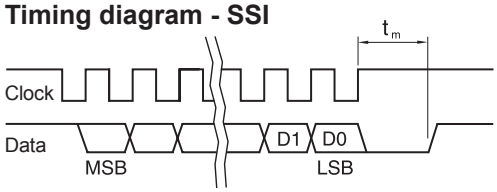
* Worst case within operational parameters including magnet position and temperature.

Connections

RMB28SI



Timing diagram - SSI

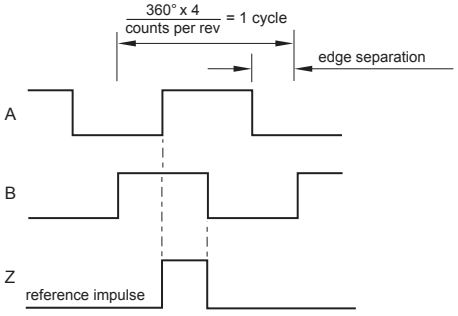


Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20.5 µs

Position increases for clockwise rotation of magnetic actuator.

Timing diagram - Incremental

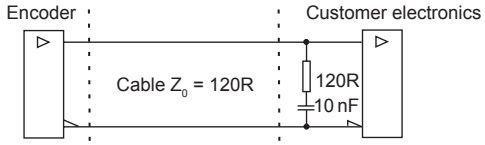
Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

Recommended signal termination

For incremental signals + SSI data output lines only



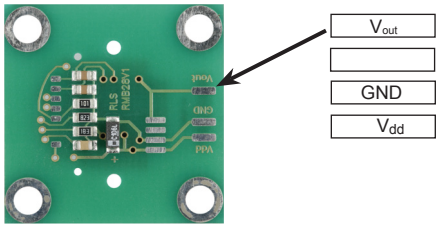
RMB28V – Linear voltage output

Alternative for potentiometers

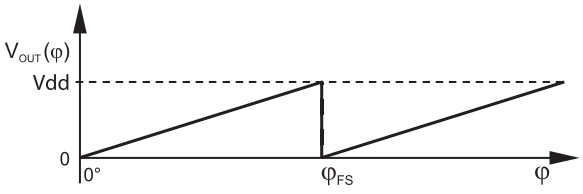
Power supply	V_{dd} = 5 V ± 5%
Power consumption	20 mA (not loaded)
Output voltage	0 V to V_{dd}
Output loading	Max. 10 mA
Nonlinearity	1 %
Operating temperature	-40 °C to +125 °C
Maximum speed	30,000 rpm

Connections

RMB28V



Electrical output



Output type and electrical variant

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

RMB28 ordering code

RMB28 IC 08B S 10

Series

Output type
MD - SSI + Incremental + Analogue sinusoidal, 5 V
IB - Incremental, open collector, NPN, 24 V
IC - Incremental, RS422, 5 V
IE - Incremental, open collector, NPN, 5 V
SC - Absolute binary synchro-serial (SSI), RS422, 5 V
SI - SSI + Incremental, RS422, 5 V
V_x - 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**

Resolution
For **MD**:
07B - 128 counts or positions per revolution
08B - 256 counts or positions per revolution
09B - 512 counts or positions per revolution (for output type **V_x** only)

Shape
S - Square

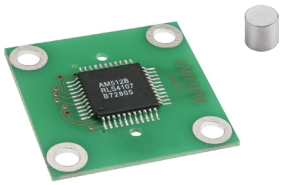
Special requirements
10 - No special requirements (standard)
11 - With Molex connector (for output types **IC**, **SC** and **SI**)
18 - Extended operating temperature (for output types **IB**, **IC**, **IE**, **SI**)

NOTE: Not all combinations are valid.

For output types **IC**, **IE**, **SC** and **SI**:

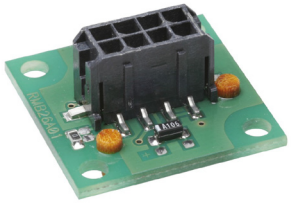
Decimal			Binary		
D32 - 320	**D80** - 800	**2D0** - 2000	**07B** - 128*	**10B** - 1024	**13B** - 8192
D40 - 400	**1D0** - 1000		**08B** - 256**	**11B** - 2048	
D50 - 500	**1D6** - 1600		**09B** - 512	**12B** - 4096	

* For **IC** and **IE** output types only.
** For output types **IC, IE** and **SC**.



NOTE: For sample quantities of RMB28 supplied with a magnet please add “KIT” to the end of the required RMB28 part number, eg. RMB28IC09BS10KIT

Connector options (for output types **IC**, **SC** and **SI** only)

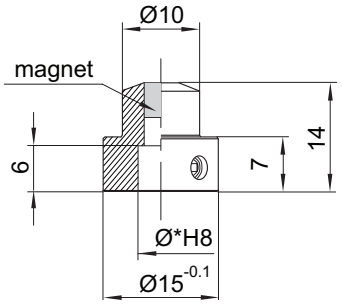


The layout of the pads on the board is suitable for the MOLEX 43045-1219 connector (mating part MOLEX 43025-1200 + crimp terminal 43030-xxxx).

Magnetic actuator and magnet ordering information

Actuator for integration onto shaft

Shaft = Ø*h7
Fixing: Grub screw provided

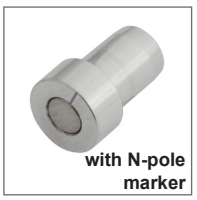


Part numbers:

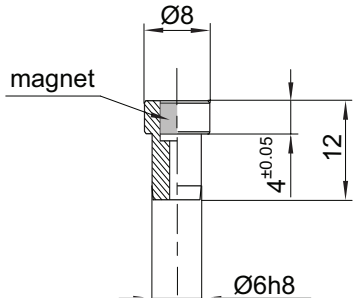
For resolutions up to 9 bit absolute (512 cpr incremental)
RMA04A2A00 – Ø4 mm shaft **RMA10A2A00** – Ø10 mm shaft
RMA05A2A00 – Ø5 mm shaft **RMA19A2A00** – Ø3/16" shaft
RMA06A2A00 – Ø6 mm shaft **RMA25A2A00** – Ø1/4" shaft
RMA08A2A00 – Ø8 mm shaft **RMA37A2A00** – Ø3/8" shaft

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



Hole = Ø6G7
Fixing: Glue (recommended – LOCTITE 648)



Part numbers:

For resolutions up to 9 bit absolute (512 cpr incremental)
RMH06A2A00

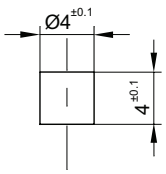
For resolutions from 10 bit absolute (800 cpr incremental) and above
RMH06A3A00

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

Magnet for direct recessing in non-ferrous shafts



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)

Fixing: Glue (recommended – LOCTITE 648)

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Document issues

Issue	Date	Page	Amendments done
01	5. 12. 2006	-	New document
02	1. 2. 2008	-	New layout with outputs IB and V_x, minor amendments
03	25. 11. 2008	2	Power consumption for IB output type changed to 13 mA
		-	New connection images with high resolution data added
04	14. 1. 2009	-	New layout
05	10. 2. 2010	2	Hole diameter table added
06	17.11.2010	-	Extended operating temperature range description changed
07	14. 5. 2014	5	RMB28IE high resolution version added

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