Data sheet
RMF44D01_05
Issue 5, 16th May 2014

RMF44 Magnetic encoder module

The image does not represent all variants.

The RMF44 is a compact encoder module is designed for easy installation with a self aligning metal mounting flange. The low cost module can be provided with an integrated connector.

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 RMF44 can be used in a wide range of applications including motor control and industrial automation.

RMF44MD - Sine/Cosine + Absolute binary synchro-serial + Incremental, 5 V

RMF44IB - Incremental, Open Collector, NPN, 24 V

RMF44IC - Incremental, RS422, 5 V

RMF44IE - Incremental, Open Collector, NPN, 5 V

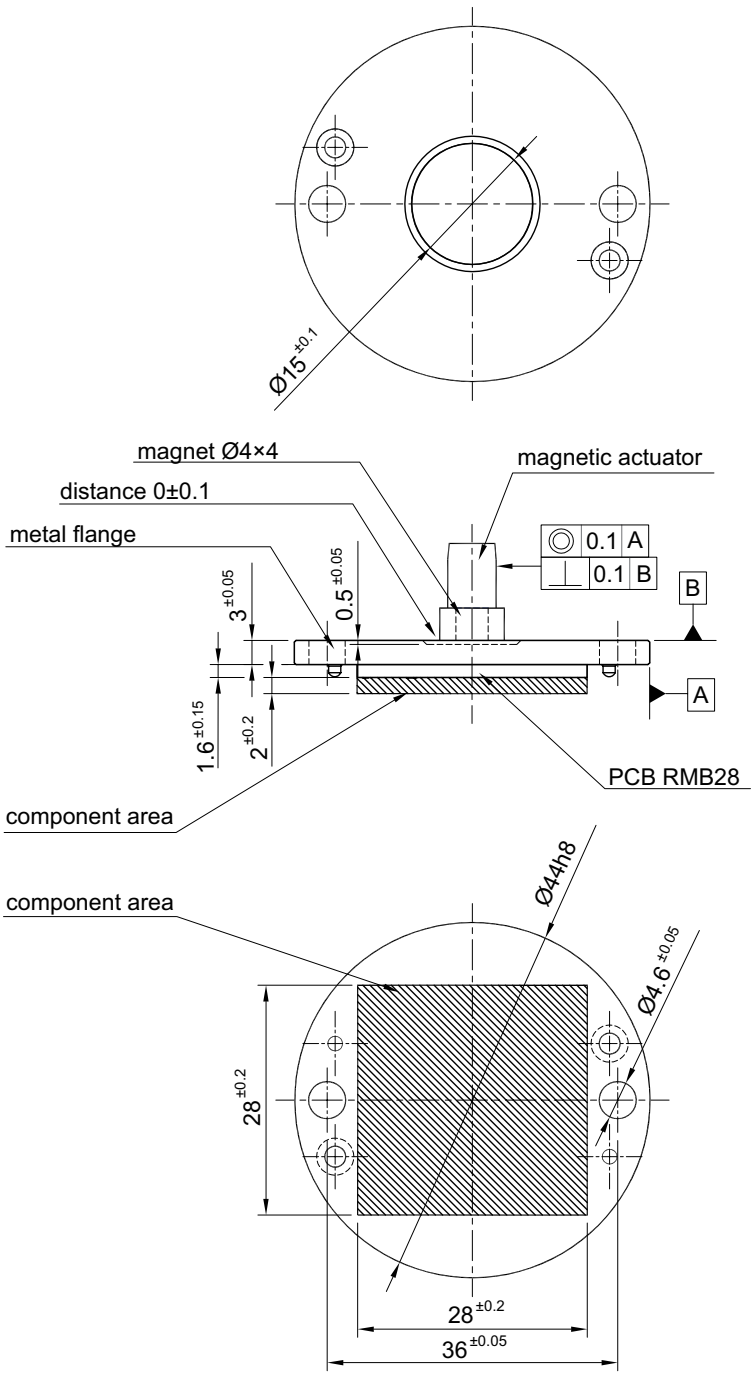
RMF44SC - Absolute binary synchro-serial, RS422, 5 V

RMF44SI - Absolute binary synchro-serial (SSI) + Incremental, RS422, 5 V

RMF44V - Linear voltage output, 5 V

- **Easy to install – with self locating design**
- **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)**

RMF44 installation drawing



Clockwise (CW) rotation of magnet

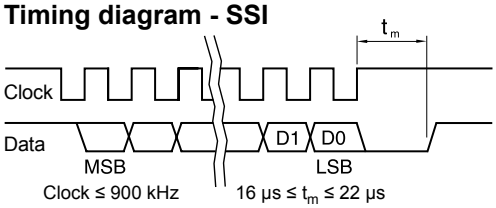
RMF44MD – Sine/Cosine + Absolute binary synchro-serial (SSI) + Incremental

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: 1.1 V ± 0.2 V
Operating temperature	-40 °C to +125 °C
Maximum speed	60,000 rpm
Accuracy*	±0.7°
Hysteresis	0.45°

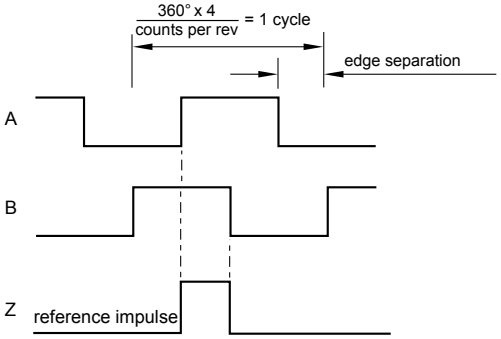
* Worst case within operational parameters including magnet position and temperature.

Timing diagram - SSI



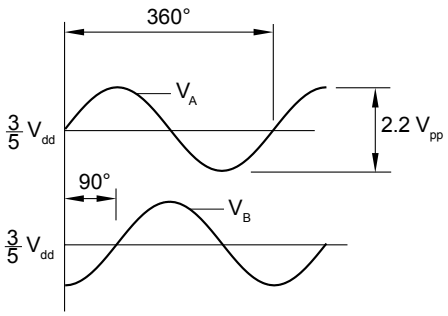
Position increases for clockwise rotation of magnet.

Timing diagram - Incremental



B leads A for clockwise rotation of magnet.

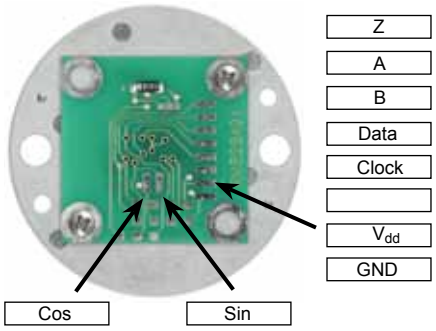
Timing diagram - Sine/Cosine



V_B leads V_A for clockwise rotation of magnet.

Connections

RMF44MD



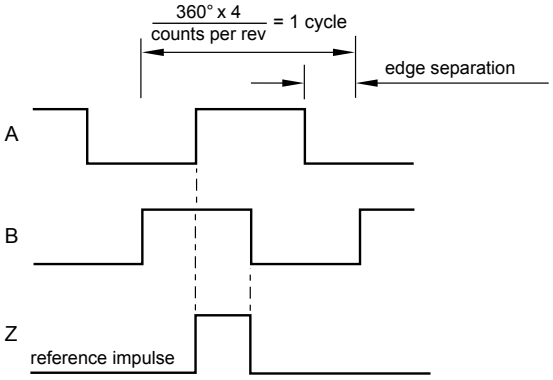
RMF44IB – Incremental, Open Collector, NPN, 24 V

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.

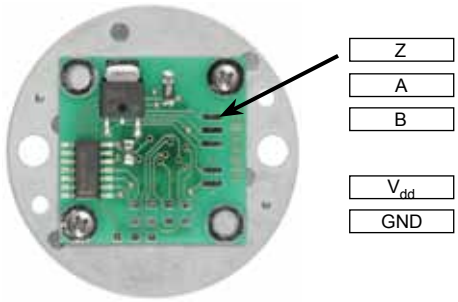
Timing diagram



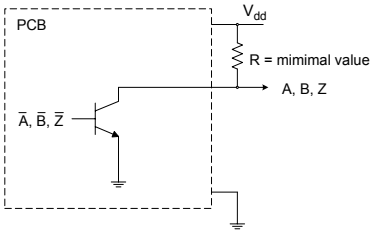
B leads A for clockwise rotation of magnetic actuator.

Connections

RMF44IB



Recommended signal termination



RMF44IE – Incremental, Open Collector, NPN, 5 V

Low cost alternative for ball bearing encoders

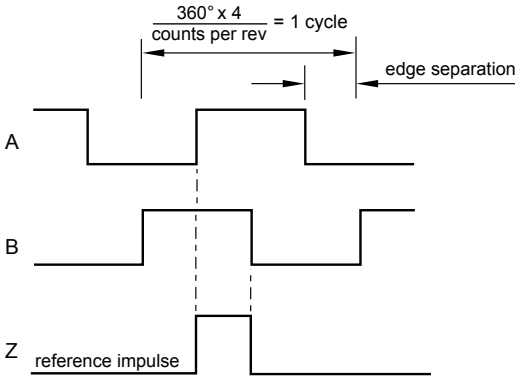
Power supply	V_{dd} = 5 V ± 5%
Power consumption	13 mA for 128, 256 cpr 35 mA for all other resolutions
Maximum output load	20 mA
Output signals	A, B, Z
Operating temperature Ext. operat. temp.	0 °C to +70 °C -40 °C to +125 °C

* 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°

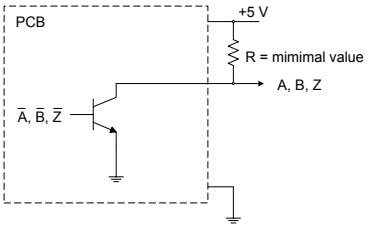
* Worst case within operational parameters including magnet position and temperature.

Timing diagram



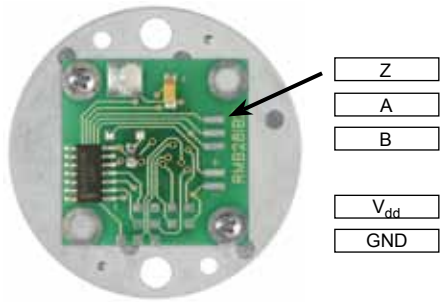
B leads A for clockwise rotation of magnetic actuator.

Recommended signal termination



Connections

RMF44IE - 128, 256 cpr



RMF44IE - all other resolutions

RMF44IC – Incremental, RS422, 5 V

Alternative for optical encoders

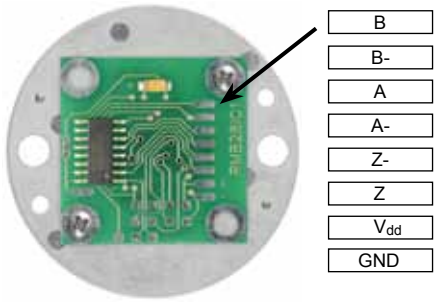
Power supply	V_{dd} = 5 V ± 5%
Power consumption	13 mA for 128, 256 cpr 35 mA for all other resolutions
Output signals	A, B, Z, A-, B-, Z- (RS422)
Operating temperature Ext. operat. temp.	-25 °C to +85 °C -40 °C to +125 °C
Edge separation	1 µs minimum

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.

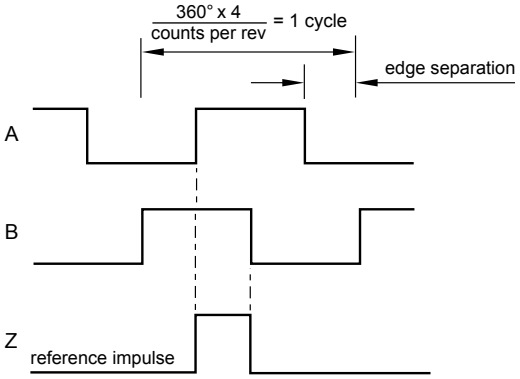
Connections

RMF44IC - 128, 256 cpr



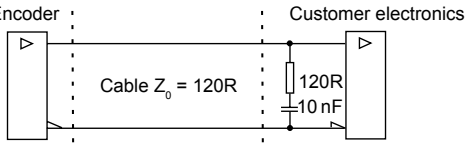
Timing diagram

Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

Recommended signal termination



RMF44IC - all other resolutions

RMF44SC – Absolute binary synchro-serial (SSI), RS422, 5 V

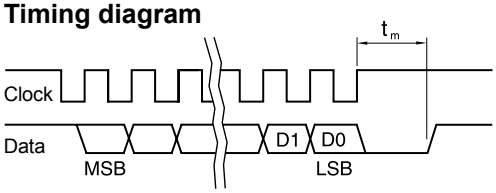
Alternative for optical encoders

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

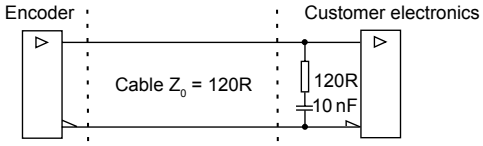


Clock ≤ 900 kHz 16 µs ≤ t_m ≤ 22 µs for 8 bit resolution
Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20 µs for all other resolutions

Position increases for clockwise rotation of magnetic actuator.

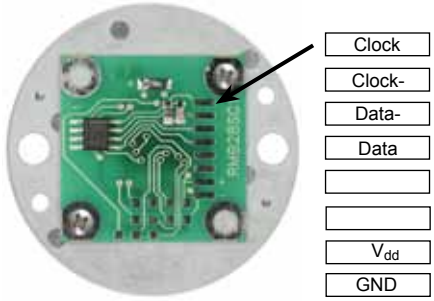
Recommended signal termination

For data output lines only

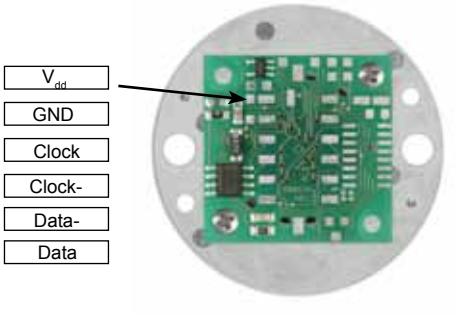


Connections

RMF44SC - 8 bit resolution



RMF44SC - all other resolutions



RMF44SI – 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	-25 °C to +85 °C
Ext. operat. temp.	-40 °C to +125 °C

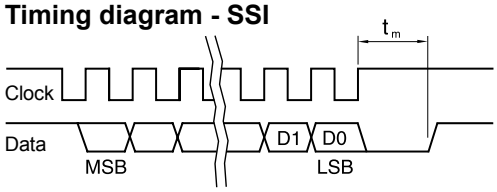
Resolution options (positions/counts per rev)	Maximum speed (rpm)	Accuracy*	Hysteresis
320, 400, 500, 512	30,000	±0.7°	0.18°
800, 1,000, 1,024	20,000	±0.5°	0.18°
1,600, 2,000, 2,048	10,000	±0.5°	0.18°
4,096	5,000	±0.5°	0.18°
8,192	2,500	±0.5°	0.18°

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

Connections

RMF44SI

Timing diagram - SSI

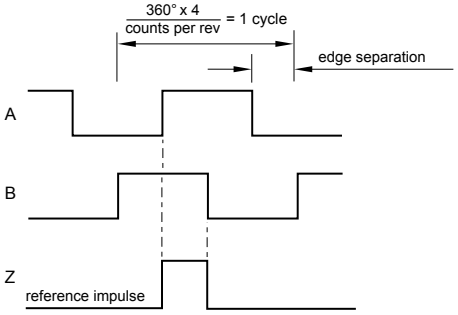


Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20.5 µs

Position increases for clockwise rotation of magnetic actuator.

Timing diagram - Incremental

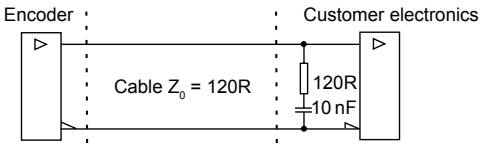
Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

Recommended signal termination

For incremental signals + SSI data output lines only



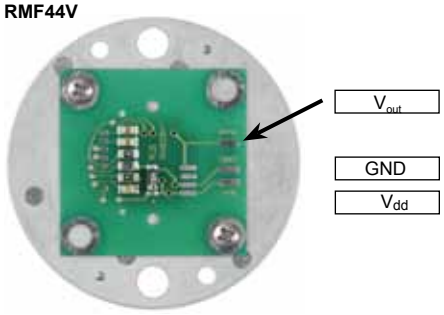
RMF44V – Linear voltage output

Alternative for potentiometers

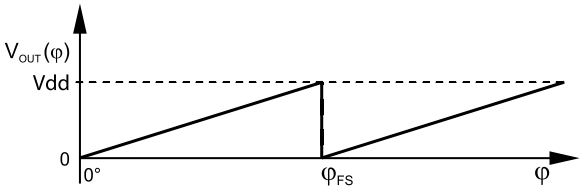
Power supply	V_{dd} = 5 V ± 5%
Power consumption	20 mA (not loaded)
Output voltage	0 V to V_{dd}
Output loading	Max. 10 mA
Nonlinearity	1 %
Operating temperature	-40 °C to +125 °C
Maximum speed*	30,000 rpm

Connections

RMF44V



Electrical output



Output type and electrical variant

φFS	360°	180°	90°	45°
CW	**VA**	**VB**	**VC**	**VD**
CCW	**VE**	**VF**	**VG**	**VH**

RMF44 ordering code

RMF44 IC 13B A 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**

NOTE: Not all combinations are valid.

Shape
A - Standard

Resolution
For **MD** **08B** - 256 counts or positions per revolution
For **IB** **07B** - 128 counts per revolution
08B - 256 counts per revolution
For **V_X** **09B** - 512 positions per revolution
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**.

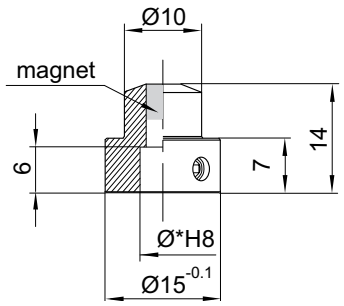
Special requirements
10 - No special requirements (standard)
11 - With Molex connector (for output types **IC**, **SC** and **SI** above 9 bit)
18 - Extended operating temperature (for output types **IB**, **IC**, **IE**, **SI**)

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

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



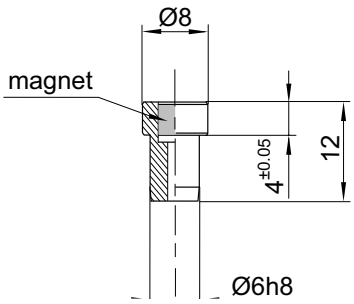
Shaft = Ø*h7
Fixing: Grub screw provided

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

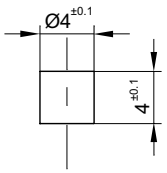
For resolutions from 10 bit absolute (800 cpr incremental) and above
RMH06A3A00

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



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)

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Document issues

Issue	Date	Page	Amendments done
1	25. 11. 2008	-	New document
2	14. 1. 2009	-	New layout
3	2. 3. 2010	5, 7	Connections diagram corrected
4	19.11.2010	-	Extended operating temperature range description changed
5	16. 5. 2014	5	RMF44IE high resolution version added

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