

# 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.**

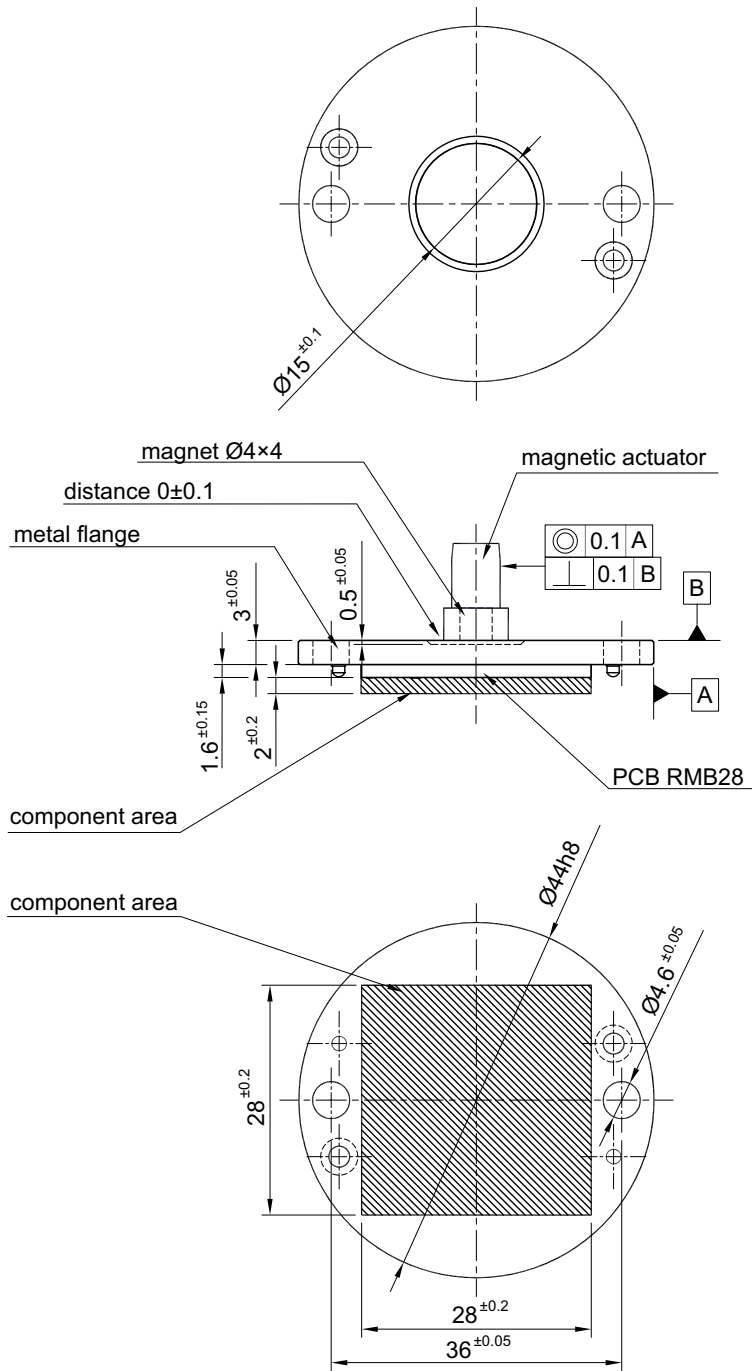
The encoder module consists of a magnetic actuator and a separate sensor board. Rotation of the magnetic actuator is sensed by a custom encoder chip mounted on the sensor board, and processed to give the required output format. Output signals are provided in industry standard absolute, incremental, analogue 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, 24 V  
**RMF44IE** - Incremental, Open Collector, 5 V  
**RMF44IC** - Incremental, RS422, 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  $\pm 0.5^\circ$
- RoHS compliant (lead free)

### RMF44 installation drawing



Clockwise (CW) rotation of magnet

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

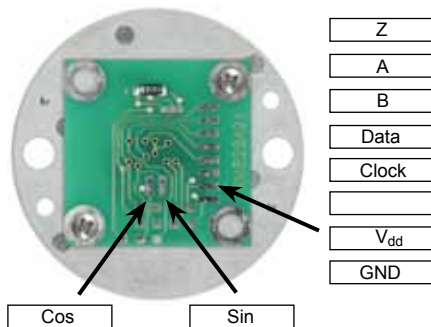
Complex feedback device for absolute position at start-up as well as during operation + incremental outputs

<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Resolution</b>	8 bit + 64 ppr (256 cpr) + one period per revolution
<b>Power consumption</b>	13 mA – incremental and SSI (not loaded)
<b>SSI output code</b>	Natural binary
<b>Data output</b>	Serial data
<b>Data input</b>	Clock
<b>Incremental outputs</b>	A, B, Z
<b>Sin/Cos outputs</b>	Signal amplitude: $1.1 \pm 0.2\text{ V}$
<b>Operating temperature</b>	$-40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$
<b>Maximum speed</b>	60,000 rpm
<b>Accuracy*</b>	$\pm 0.7^\circ$
<b>Hysteresis</b>	$0.45^\circ$

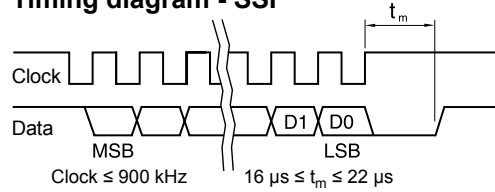
\* Worst case within operational parameters including magnet position and temperature.

### Connections

#### RMF44MD

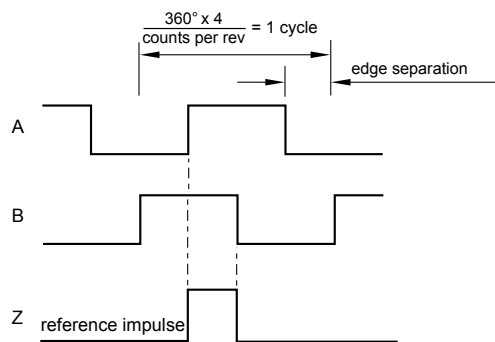


### Timing diagram - SSI



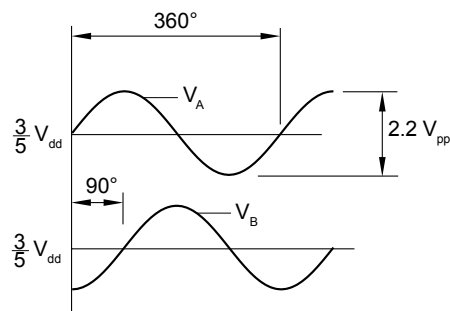
Position increases for clockwise rotation of magnet.

### 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.

**RMF44IB – Incremental, Open Collector NPN, 24 V**

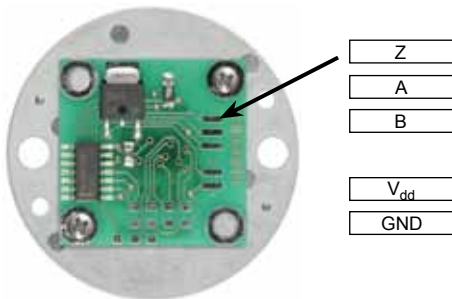
Square wave output

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

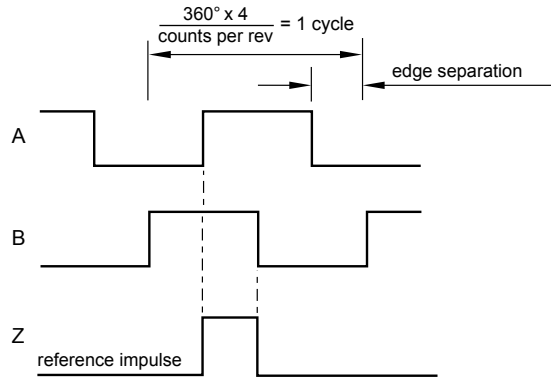
\* Worst case within operational parameters including magnet position and temperature.

**Connections**

RMF44IB

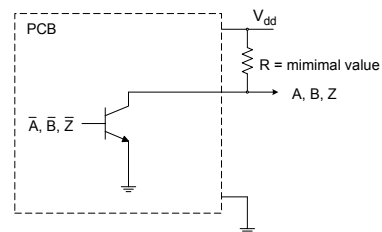


**Timing diagram**



B leads A for clockwise rotation of magnetic actuator.

**Recommended signal termination**



**RMF44IE – Incremental, Open Collector NPN, 5 V**

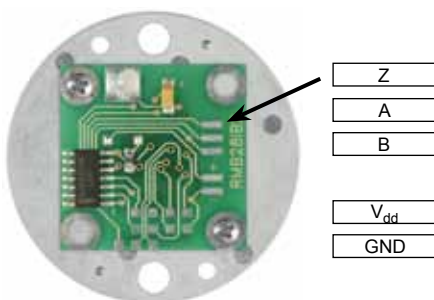
Low cost alternative for ball bearing encoders

<b>Power supply</b>	$V_{dd} = 5 \text{ V} \pm 5\%$
<b>Resolution</b>	32, 64 ppr (128, 256 cpr)
<b>Power consumption</b>	13 mA (not loaded)
<b>Maximum output load</b>	20 mA
<b>Output signals</b>	A, B, Z
<b>Operating temperature</b>	0 °C to +70 °C
Ext. operat. temp.	-40 °C to +125 °C
<b>Maximum speed</b>	60,000 rpm
<b>Accuracy*</b>	$\pm 0.7^\circ$
<b>Hysteresis</b>	0.45°

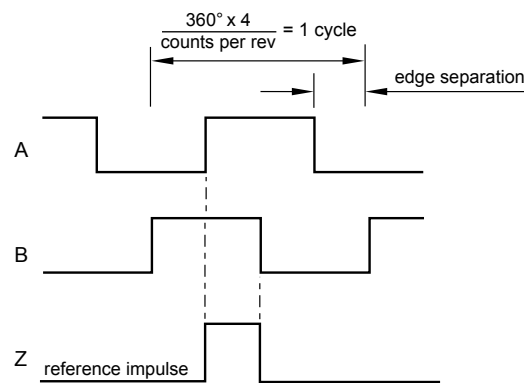
\* Worst case within operational parameters including magnet position and temperature.

**Connections**

RMF44IE

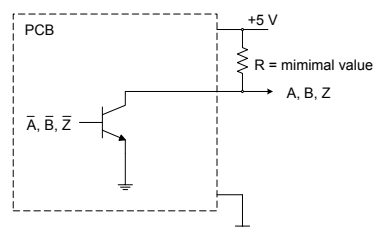


**Timing diagram**



B leads A for clockwise rotation of magnetic actuator.

**Recommended signal termination**



## RMF441C – Incremental, RS422, 5 V

Alternative for optical encoders

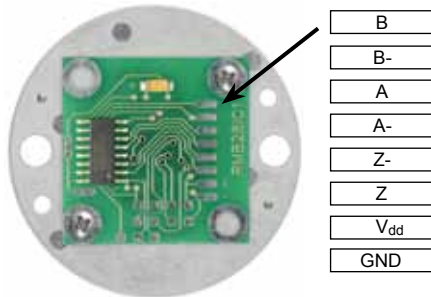
<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Power consumption</b>	13 mA for 7, 8 bit resolutions 35 mA for all other resolutions
<b>Output signals</b>	A, B, Z, A-, B-, Z- (RS422)
<b>Operating temperature</b>	-25 °C to +85 °C
<b>Ext. operat. temp.</b>	-40 °C to +125 °C
<b>Edge separation</b>	1 $\mu\text{s}$ minimum

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

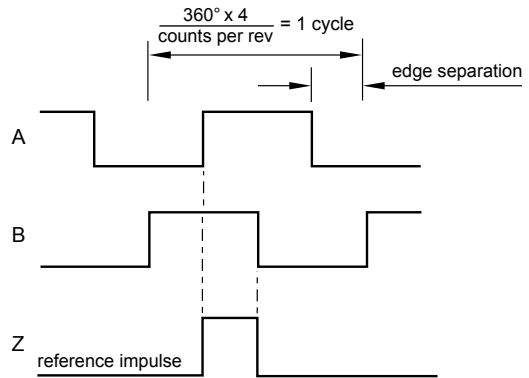
## Connections

RMF441C - 7, 8 bit resolutions only



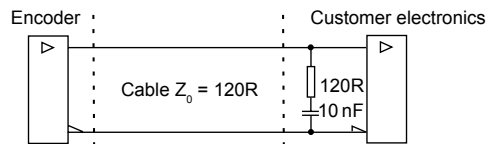
## Timing diagram

Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

## Recommended signal termination



RMF441C - all other resolutions

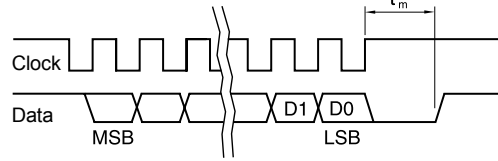


**RMF44SC – Absolute binary synchro-serial (SSI), RS422, 5 V**

Alternative for optical encoders

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

**Timing diagram**



Clock  $\leq 900\text{ kHz}$        $16\ \mu\text{s} \leq t_m \leq 22\ \mu\text{s}$       for 8 bit resolution  
 Clock  $\leq 4\text{ MHz}$        $12.5\ \mu\text{s} \leq t_m \leq 20\ \mu\text{s}$       for all other resolutions

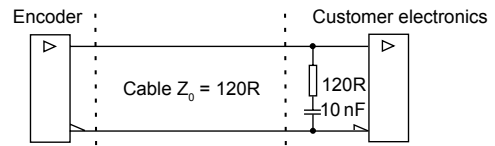
Position increases for clockwise rotation of magnetic actuator.

Resolution options (positions per rev)	Maximum speed (rpm)	Accuracy*	Hysteresis
256	60,000	$\pm 0.7$	$0.45^\circ$
320, 400, 500, 512	30,000	$\pm 0.7^\circ$	$0.18^\circ$
800, 1,000, 1,024	20,000	$\pm 0.5^\circ$	$0.18^\circ$
1,600, 2,000, 2,048	10,000	$\pm 0.5^\circ$	$0.18^\circ$
4,096	5,000	$\pm 0.5^\circ$	$0.18^\circ$
8,192	2,500	$\pm 0.5^\circ$	$0.18^\circ$

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

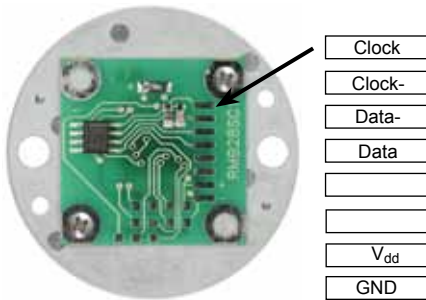
**Recommended signal termination**

For data output lines only

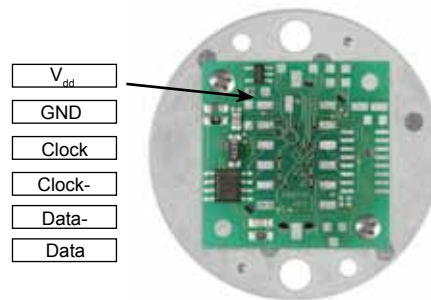


**Connections**

**RMF44SC - 8 bit resolution only**



**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.

<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Power consumption</b>	35 mA
<b>SSI output code</b>	Natural binary
<b>Data output</b>	Serial data (RS422)
<b>Data input</b>	Clock (RS422)
<b>Incremental outputs</b>	A, B, Z, A-, B-, Z- (RS422)
<b>Operating temperature</b>	-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	$\pm 0.7^\circ$	0.18°
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°

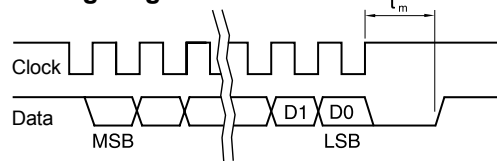
\* Worst case within operational parameters including magnet position and temperature.

### Connections

#### RMF44SI



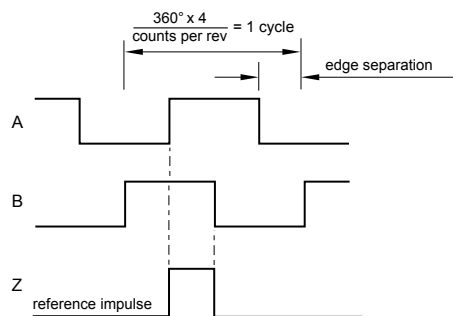
### Timing diagram - SSI



Clock  $\leq 4\text{ MHz}$        $12.5\ \mu\text{s} \leq t_m \leq 20.5\ \mu\text{s}$   
Position increases for clockwise rotation of magnetic actuator.

### Timing diagram - Incremental

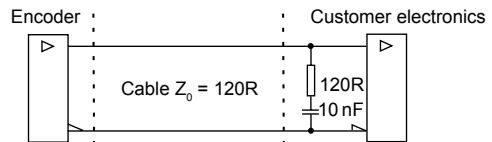
Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

### Recommended signal termination

For incremental signals + SSI data output lines only



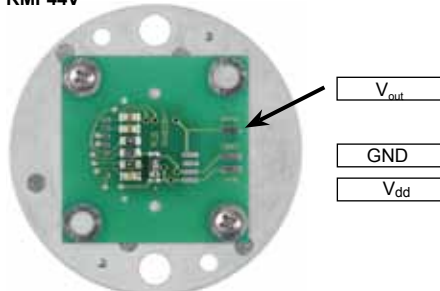
## RMF44V – Linear voltage output

Alternative for potentiometers

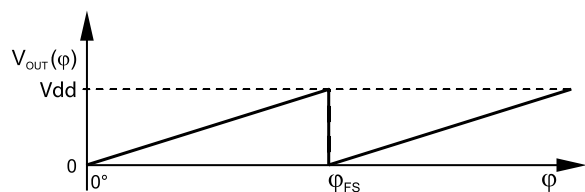
<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Power consumption</b>	20 mA (not loaded)
<b>Output voltage</b>	0 V to $V_{dd}$
<b>Output loading</b>	Max. 10 mA
<b>Nonlinearity</b>	1 %
<b>Operating temperature</b>	-40 °C to +125 °C
<b>Maximum speed*</b>	30,000 rpm

### Connections

#### RMF44V



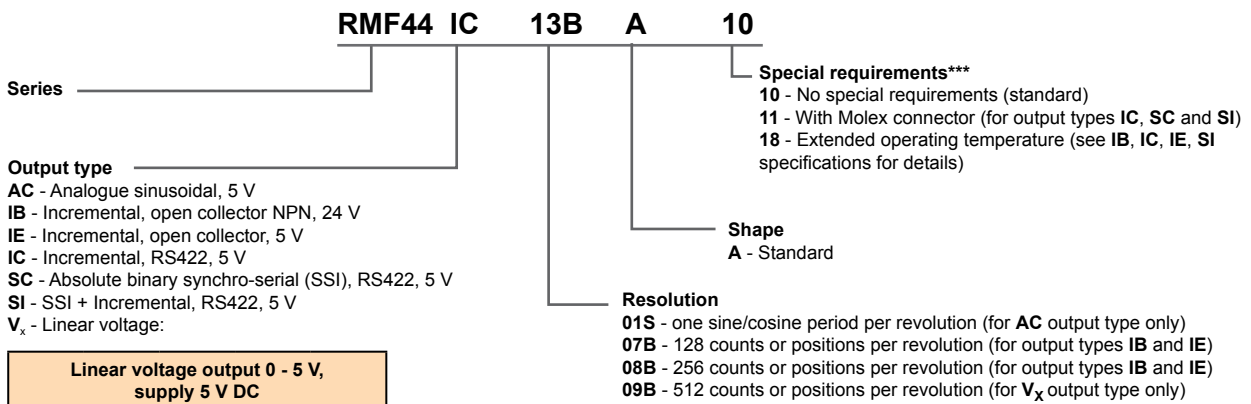
### Electrical output



### Output type and electrical variant

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

**RMF44 ordering code**



Linear voltage output 0 - 5 V, supply 5 V DC				
	360°	180°	90°	45°
CW	<b>VA</b>	<b>VB</b>	<b>VC</b>	<b>VD</b>
CCW	<b>VE</b>	<b>VF</b>	<b>VG</b>	<b>VH</b>

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

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

**NOTE:** Not all combinations are valid.

\* For **IC** output type only.

\*\* For output types **IC** and **SC**.



\*\*\* For sample quantities of RMF44 supplied with a magnet please add "KIT" to the end of the required RMF44 part number, eg. **RMF44IC13BA10KIT**

**Connector options**

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).

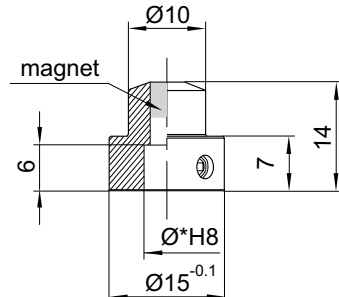


## Magnetic actuator and magnet ordering information

### Actuator for integration onto shaft



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

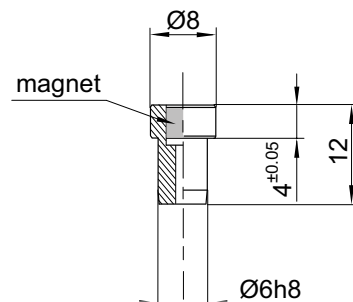


#### Part numbers:

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:

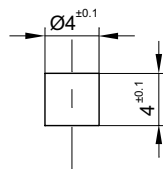
For resolutions up to 9 bit absolute (512 cpr incremental)  
**RMH06A2A02**

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



#### 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)


## Head office

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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

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