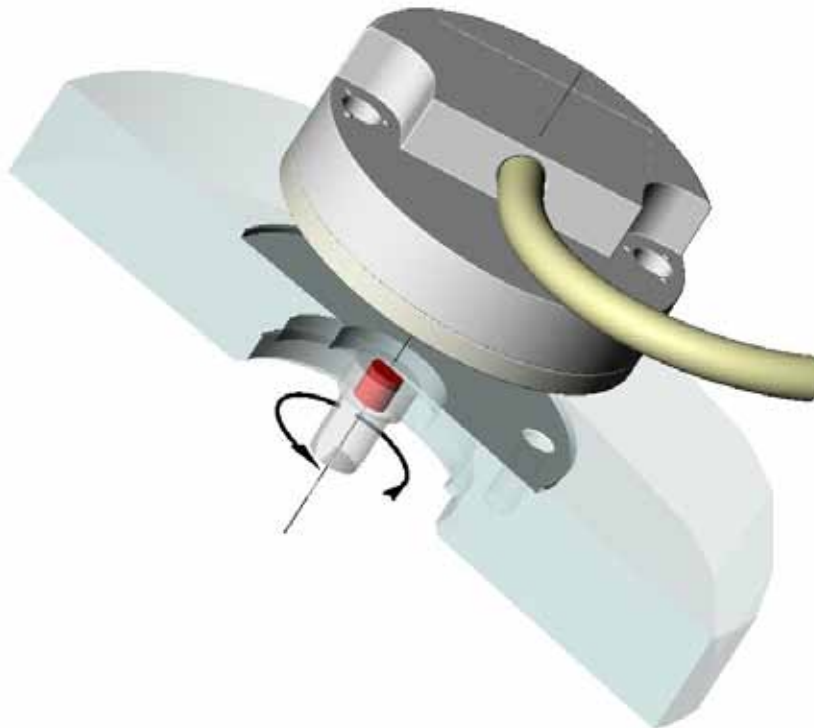


## RM44 magnetic encoder base unit



**The RM44 is an encoder designed for integration onto electric motors or other devices for shaft position and rotational speed measurement.**

The solid metal housing helps achieve the highest IP ratings, high EMC immunity, extended operating temperature range and the best possible shock and vibration resistance.

Output signals are provided in industry standard absolute, incremental, analogue sinusoidal and linear voltage formats.

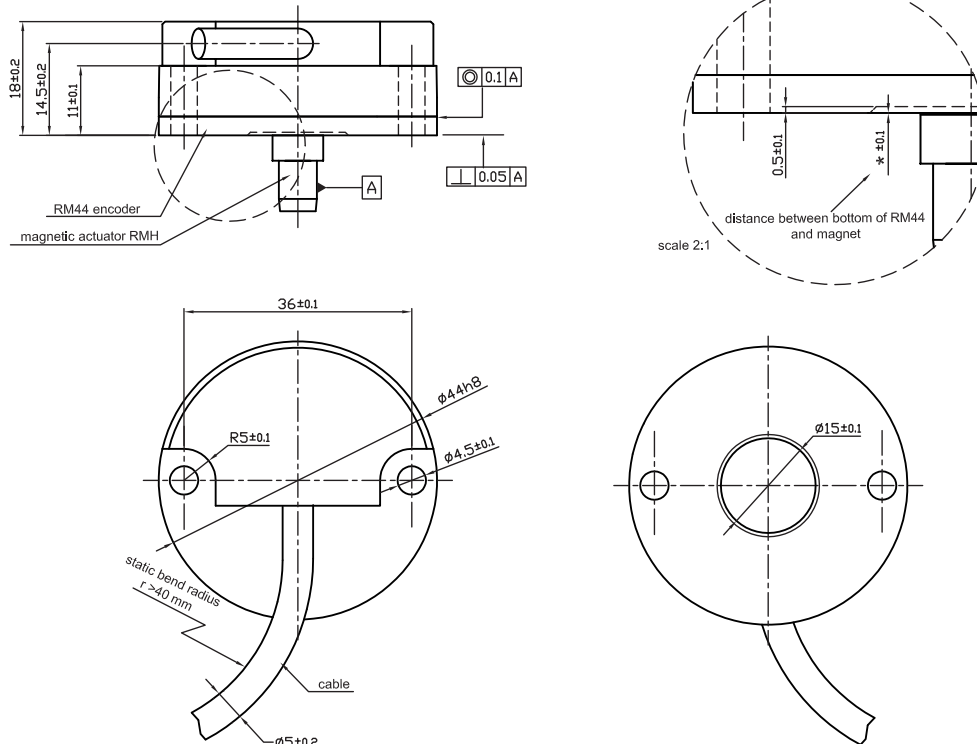
Available are resolutions of up to 13 bit absolute SSI and/or

8192 cpr incremental for 5 V or 24 V power supply.

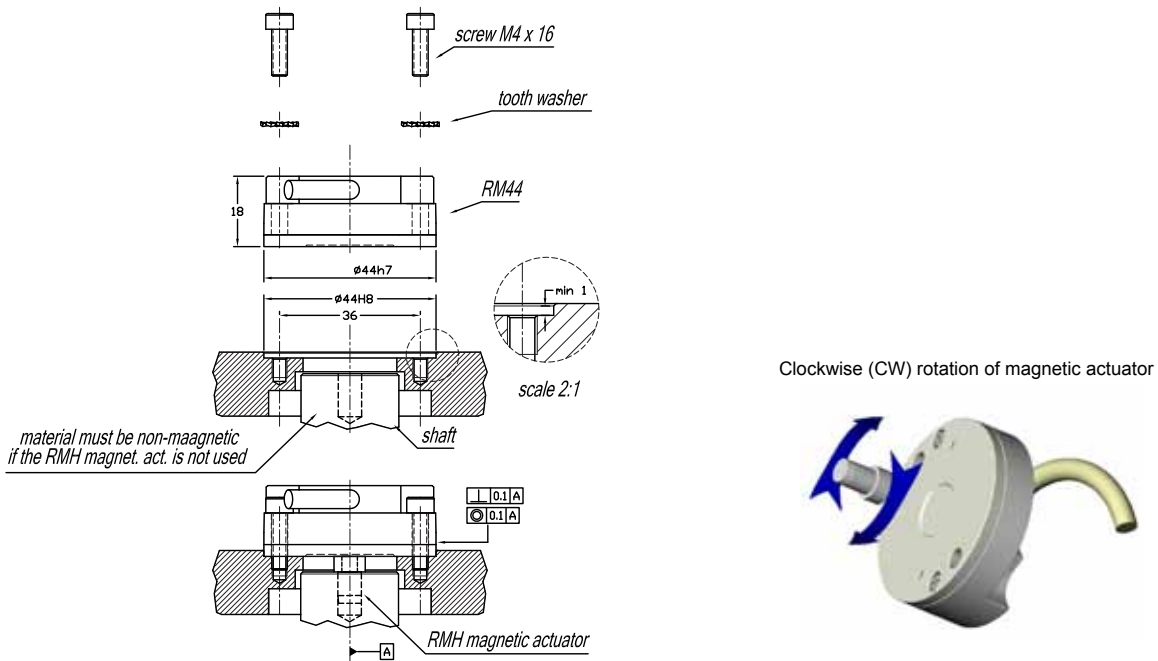
With the provided magnet a system accuracy of 0.2° is achievable. A range of magnetic actuators for easy integration onto or into the shaft is also offered for easy system integration.

- Easy to install – with self locating design
- Low cost for OEM integration
- Fully sealed to IP68
- High reliability from proven non-contact sensing technology
- RoHS compliant (lead free)

### RM44 dimensions



### RM44 installation drawing



### Operating and electrical specifications

<b>Humidity (for IP64 version)</b>	Storage 95% maximum relative humidity (non-condensing) (IEC 61010-1) Operating 80% maximum relative humidity (non-condensing) (IEC 61010-1)
<b>Acceleration</b>	Operating 500 m/s <sup>2</sup> BS EN 60068-2-7:1993 (IEC 68-2-7:1983)
<b>Shock (non-operating)</b>	1000 m/s <sup>2</sup> , 6 ms, 1/2 sine BS EN 60068-2-27:1993 (IEC 68-2-27:1987)
<b>Vibration (operating)</b>	100 m/s <sup>2</sup> max at 55 to 2000 Hz BS EN 60068-2-6:1996 (IEC 68-2-6:1995)
<b>EMV compliance</b>	BS EN 61326
<b>Cable</b>	Outside diameter 5 mm
<b>Mass</b>	Encoder unit 1 m cable (no connector) IP64 112 g, IP68 129 g. Magnetic actuator <2 g
<b>Environmental sealing</b>	IP64 (IP68 optional) BS EN 60529

## Output specifications - 5 V supply

### RM44AC – Analogue sinusoidal outputs, 5 V

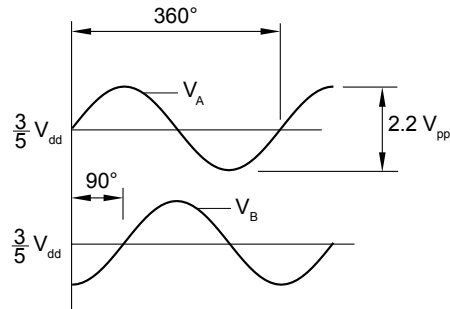
2 channels  $V_A$ ,  $V_B$  sinusoids (90° phase shifted, single ended)

<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Power consumption</b>	13 mA
<b>Outputs</b>	Signal amplitude $2 \pm 0.2 V_{pp}$ Signal offset $V_{dd}/2 \pm 5\text{ mV}$
<b>Max. output frequency</b>	1 kHz
<b>Max. cable length</b>	3 m
<b>Operating temperature</b>	-40 °C to +125 °C (IP64) -40 °C to +85 °C (IP68)
<b>Maximum speed</b>	60,000 rpm
<b>Internal serial impedance</b>	720 $\Omega$

#### Connections

Function	Wire colour
Shield	-
$V_{dd}$	Red
GND	Orange
$V_A$	Black
$V_B$	Brown

#### Timing diagram



$V_A$  leads  $V_B$  by 90° for clockwise rotation of magnetic actuator.

### RM44IE - Incremental, open collector, 5 V

Low cost alternative for ball bearing encoders

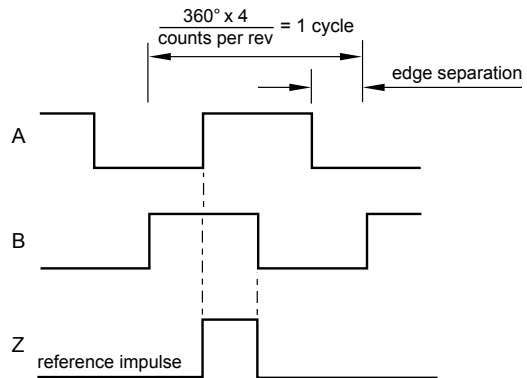
<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Resolution</b>	32, 64 ppr (128, 256 cpr)
<b>Power consumption</b>	13 mA (not loaded)
<b>Maximum output load</b>	20 mA
<b>Output signals</b>	A, B, Z
<b>Max. cable length</b>	20 m
<b>Operating temperature</b>	0 °C to +70 °C Extended operating temperature -40 °C to +125 °C (IP64) -40 °C to +85 °C (IP68)
<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

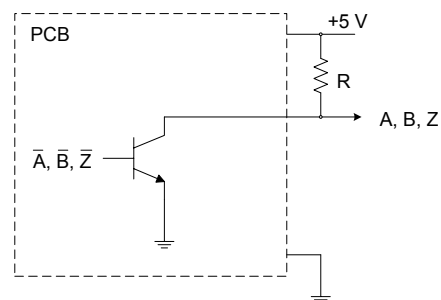
Function	Wire colour
Shield	-
$V_{dd}$	Red
GND	Blue
A	Grey
B	Green
Z	White

#### Timing diagram



B leads A for clockwise rotation of magnetic actuator.

#### Recommended signal termination



Data sheet  
RM44D01\_04

**RM44IC - Incremental, RS422A, 5 V**

Alternative for optical encoders

<b>Power supply</b>	$V_{dd} = 5 V \pm 5\%$
<b>Power consumption</b>	35 mA
<b>Output signals</b>	A, B, Z, A-, B-, Z- (RS422A)
<b>Max. cable length</b>	50 m
<b>Operating temperature</b>	-25 °C to +85 °C
Ext. operat. temp.	-40 °C to +125 °C (IP64)
<b>Edge separation</b>	1 $\mu$ s minimum

Resolution options (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°

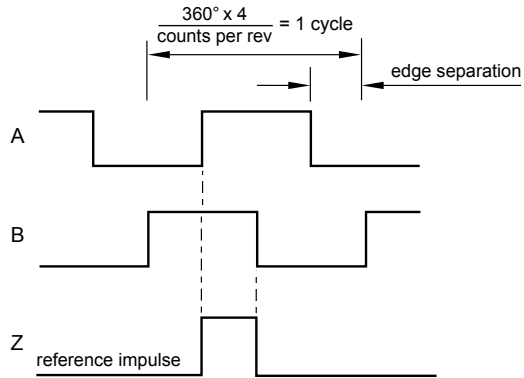
\* Worst case within operational parameters including magnet position and temperature.

**Connections**

Pin Nr.	Function	Wire colour
1	Shield	-
2	Z	White
3	B	Green
4	A	Grey
5	$V_{dd}$	Red
6	Z-	Brown
7	B-	Yellow
8	A-	Pink
9	GND	Blue

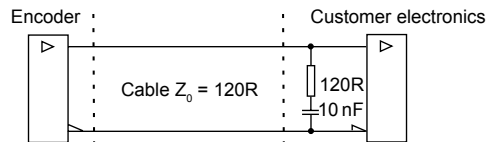
**Timing diagram**

(complementary signals not shown)



B leads A for clockwise rotation of magnetic actuator.

**Recommended signal termination**



**RM44SC - Absolute binary synchro-serial (SSI), RS422A, 5 V**

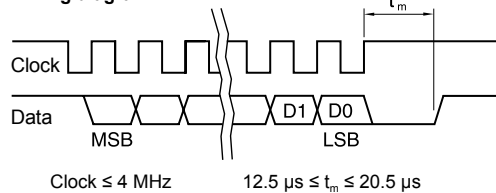
Alternative for optical encoders

<b>Power supply</b>	$V_{dd} = 5 V \pm 5\%$
<b>Power consumption</b>	35 mA
<b>SSI output code</b>	Natural binary
<b>Data outputs</b>	Serial data (RS422A)
<b>Data inputs</b>	Clock (RS422A)
<b>Repeatability</b>	$\leq 0.07^\circ$
<b>Max. cable length</b>	100 m (at 1 MHz)
<b>Operating temperature</b>	-40 °C to +125 °C (IP64)
	-40 °C to +85 °C (IP68)

Resolution options (positions 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.

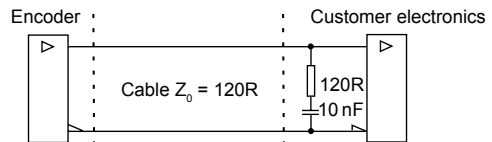
**Timing diagram**



Position increases for clockwise rotation of magnetic actuator.

**Recommended signal termination**

(For data output lines only)



**Connections**

Pin Nr.	Function	Wire colour
1	Shield	-
2	Clock	White
3	Clock-	Brown
4	NC	-
5	$V_{dd}$	Red
6	Data	Green
7	Data-	Yellow
8	NC	-
9	GND	Blue

## RM44SI - Absolute binary synchro-serial (SSI) + Incremental, RS422A, 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 outputs</b>	Serial data (RS422A)
<b>Data inputs</b>	Clock (RS422A)
<b>Incremental outputs</b>	A, B, Z, A-, B-, Z- (RS422A)
<b>Max. cable length</b>	50 m
<b>Operating temperature</b>	-25 °C to +85 °C Ext. operat. temp. -40 °C to +125 °C (IP64)

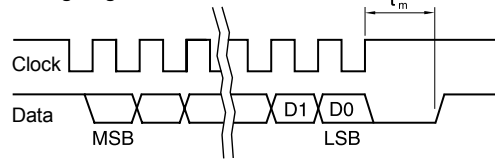
Resolution options (positions/counts per rev)	Maximum speed (rpm)	Accuracy*	Hysteresis
320, 400, 500, 512	30,000	$\pm 0.7^\circ$	0.18°
800, 1,000, 1,024	20,000	$\pm 0.5^\circ$	0.18°
1,600, 2,000, 2,048	10,000	$\pm 0.5^\circ$	0.18°
4,096	5,000	$\pm 0.5^\circ$	0.18°
8,192	2,500	$\pm 0.5^\circ$	0.18°

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

### Connections

	Function	Wire colour
Incremental	Shield	-
	$V_{dd}$	Red
	GND	Blue
	A	Grey
	A-	Pink
	B	Green
	B-	Yellow
	Z	White
SSI	Z-	Brown
	Clock	Black
	Clock-	Violet
	Data	Grey/Pink
Data-	Red/Blue	

### Timing diagram - SSI

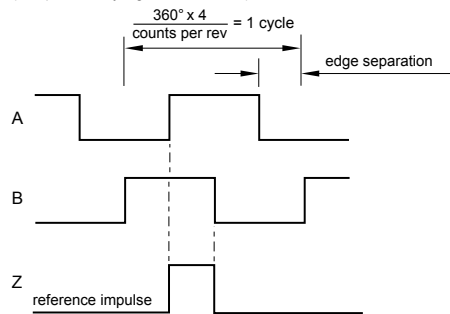


$$\text{Clock} \leq 4\text{ MHz} \quad 12.5\ \mu\text{s} \leq t_m \leq 20.5\ \mu\text{s}$$

Position increases for clockwise rotation of magnetic actuator.

### Timing diagram - Incremental

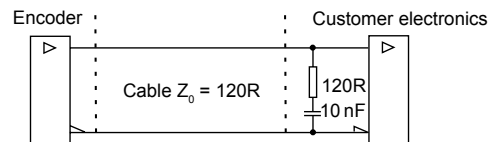
(complementary signals not shown)



B leads A for CW rotation of magnetic actuator.

### Recommended signal termination

(for incremental signals + SSI data output lines only)



## RM44V - Linear voltage output, 5 V

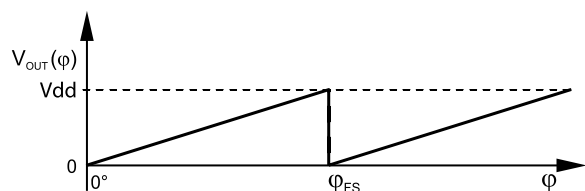
Alternative for potentiometers

<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>Max. cable length</b>	20 m
<b>Operating temperature</b>	-40 °C to +125 °C (IP64) -40 °C to +85 °C (IP68)
<b>Maximum speed*</b>	30,000 rpm

### Connections

Function	Wire colour
Shield	-
$V_{dd}$	Red
GND	Orange
$V_{OUT}$	Black

### Electrical output



### Output type and electrical variant

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

## Output specifications - 24 V supply

### RM44IA - Incremental, push-pull, 24 V

<b>Power supply</b>	$V_{dd} = 8\text{ V to }26\text{ V}$
<b>Power consumption</b>	50 mA – at 24 V
<b>Max. output load</b>	30 mA
<b>Output signals</b>	A, B, Z, A-, B-, Z- (RS422A)
<b>Max. cable length</b>	20 m
<b>Operating temperature</b>	-40 °C to +85 °C
<b>Edge separation</b>	min. 1 µs

Resolution options (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°

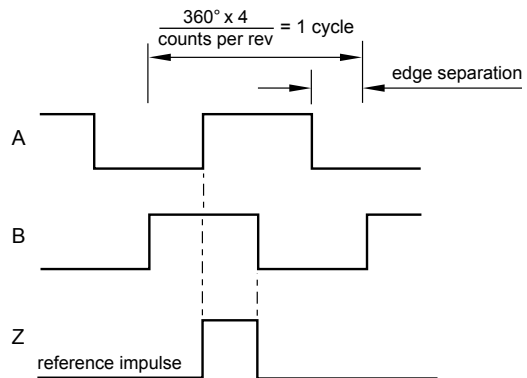
\* Worst case within operational parameters including magnet position and temperature.

#### Connections

Function	Wire colour
Shield	-
$V_{dd}$	Red
GND	Blue
A	Grey
A-	Pink
B	Green
B-	Yellow
Z	White
Z-	Brown

#### Timing diagram

(complementary signals not shown)



B leads A for clockwise rotation of magnetic actuator.

### RM44IB - Incremental, open collector NPN, 24 V

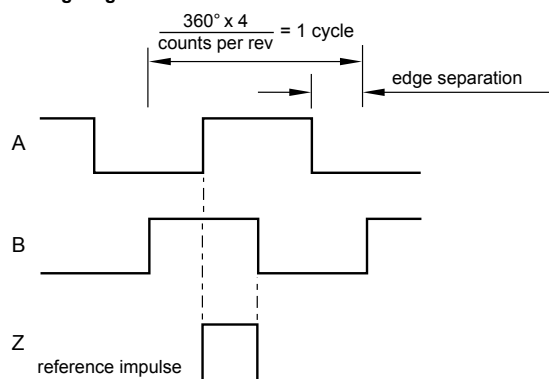
Square wave output

<b>Power supply</b>	$V_{dd} = 8\text{ V to }26\text{ V}$
<b>Power consumption</b>	25 mA
<b>Max. output load</b>	20 mA
<b>Output signals</b>	A, B, Z
<b>Resolution</b>	32, 64 ppr (128, 256 cpr)
<b>Max. cable length</b>	20 m
<b>Operating temperature</b>	0 °C to +70 °C
Ext. operat. temp.	-40 °C to +85 °C (IP68)

#### Connections

Function	Wire colour
Shield	-
$V_{dd}$	Red
GND	Blue
A	Grey
B	Green
Z	White

#### Timing diagram

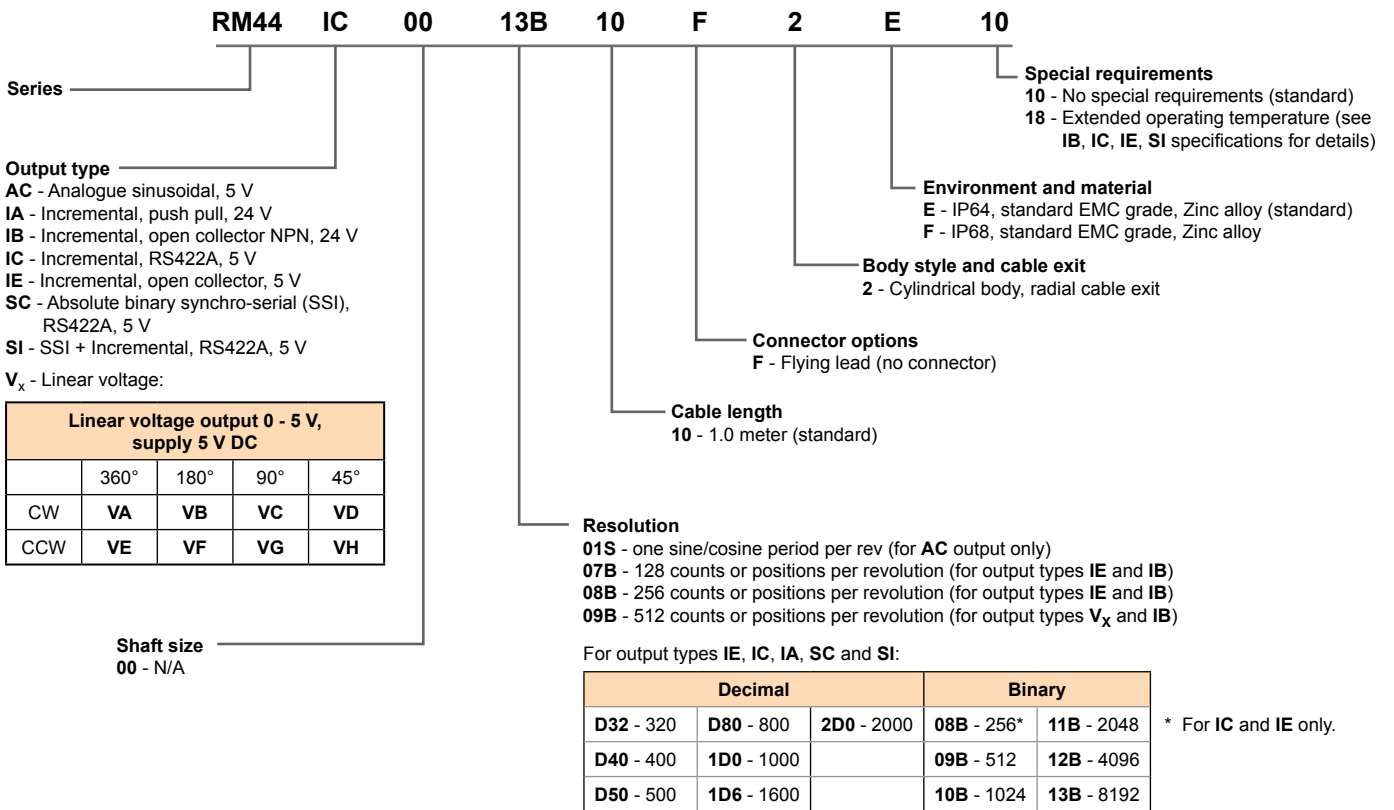


B leads A for CW rotation of magnetic actuator.

# RM44 ordering code



RM44 encoder-sensor unit  
eg. **RM44IC0013B10F2E10**



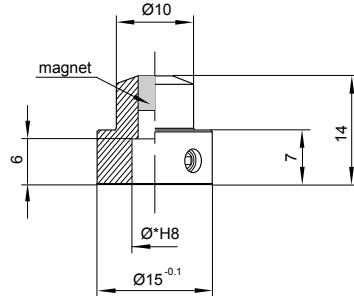
**NOTE:** Not all combinations are valid.

## Magnetic actuator and magnet ordering information

### Actuator for integration onto shaft



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



#### Part numbers:

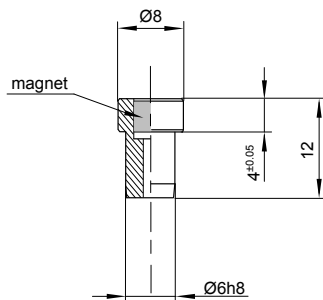
For resolutions up to 9 bit absolute (512 cpr incremental)  
**RMA04A2A00** –  $\varnothing 4$  mm shaft      **RMA10A2A00** –  $\varnothing 10$  mm shaft  
**RMA05A2A00** –  $\varnothing 5$  mm shaft      **RMA19A2A00** –  $\varnothing 3/16''$  shaft  
**RMA06A2A00** –  $\varnothing 6$  mm shaft   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



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

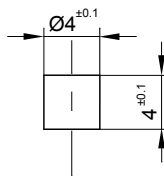


#### Part numbers:

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

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

### 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)

## RE58 flange part numbering

Refer to RE58 datasheet for further details.



#### Part numbers:

**RE58A10** -  $\varnothing 58$  mm    10 mm shaft

**RE58B06** -  $\varnothing 58$  mm    6 mm shaft

**RE58C10** -  $\varnothing 58$  mm    10 mm shaft

All RE58 flanges are supplied with required washer and M4 screws for RM44 encoder attachment.




## 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](mailto:mail@rls.si)  
[www.rls.si](http://www.rls.si)

## Document revision details

Issue	Date	Page	Amendments done
02	26. 2. 2008	-	New layout with new images, outputs <b>V</b> and <b>IB</b> , SSI clock, vibration shock test
03	14. 1. 2009	-	New layout
04	24. 11. 2010	-	New magnet dimensions and RE58 flange images, extended operating temperature range description and RM44AC timing diagram changed

**RENISHAW**  is our worldwide sales support partner for Magnetic Encoders.

**Australia**  
T +61 3 9521 0922  
E [australia@renishaw.com](mailto:australia@renishaw.com)

**Austria**  
T +43 2236 379790  
E [austria@renishaw.com](mailto:austria@renishaw.com)

**Brazil**  
T +55 11 4195 2866  
E [brazil@renishaw.com](mailto:brazil@renishaw.com)

**Canada**  
T +1 905 828 0104  
E [canada@renishaw.com](mailto:canada@renishaw.com)

**The People's Republic of China**  
T +86 10 8448 5306  
E [beijing@renishaw.com](mailto:beijing@renishaw.com)

**Czech Republic**  
T +420 5 4821 6553  
E [czech@renishaw.com](mailto:czech@renishaw.com)

**France**  
T +33 1 64 61 84 84  
E [france@renishaw.com](mailto:france@renishaw.com)

**Germany**  
T +49 7127 9810  
E [germany@renishaw.com](mailto:germany@renishaw.com)

**Hong Kong**  
T +852 2753 0638  
E [hongkong@renishaw.com](mailto:hongkong@renishaw.com)

**Hungary**  
T +36 23 502 183  
E [hungary@renishaw.com](mailto:hungary@renishaw.com)

**India**  
T +91 20 6674 6751  
E [india@renishaw.com](mailto:india@renishaw.com)

**Israel**  
T +972 4 953 6595  
E [israel@renishaw.com](mailto:israel@renishaw.com)

**Italy**  
T +39 011 966 10 52  
E [italy@renishaw.com](mailto:italy@renishaw.com)

**Japan**  
T +81 3 5366 5316  
E [japan@renishaw.com](mailto:japan@renishaw.com)

**The Netherlands**  
T +31 76 543 11 00  
E [benelux@renishaw.com](mailto:benelux@renishaw.com)

**Poland**  
T +48 22 577 11 80  
E [poland@renishaw.com](mailto:poland@renishaw.com)

**Russia**  
T +7 495 231 1677  
E [russia@renishaw.com](mailto:russia@renishaw.com)

**Singapore**  
T +65 6897 5466  
E [singapore@renishaw.com](mailto:singapore@renishaw.com)

**Slovenia (Head Office)**  
T +386 1 52 72 100  
E [mail@rls.si](mailto:mail@rls.si)

**South Korea**  
T +82 2 2108 2830  
E [southkorea@renishaw.com](mailto:southkorea@renishaw.com)

**Spain**  
T +34 93 663 34 20  
E [spain@renishaw.com](mailto:spain@renishaw.com)

**Sweden**  
T +46 8 584 90 880  
E [sweden@renishaw.com](mailto:sweden@renishaw.com)

**Switzerland**  
T +41 55 415 50 60  
E [switzerland@renishaw.com](mailto:switzerland@renishaw.com)

**Taiwan**  
T +886 4 2473 3177  
E [taiwan@renishaw.com](mailto:taiwan@renishaw.com)

**UK**  
T +44 1453 524524  
E [uk@renishaw.com](mailto:uk@renishaw.com)

**USA**  
T +1 847 286 9953  
E [usa@renishaw.com](mailto:usa@renishaw.com)

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

T +386 1 52 72 100  
E [mail@rls.si](mailto:mail@rls.si)