

## RM44/RM58 rotary magnetic encoder with AM4096



**The RM44/RM58 is an encoder for integration onto electric motors or other devices for measuring shaft position and rotational speed.**

**The solid metal housing provides highest IP protection classes, high EMC immunity, extended operating temperature range and best possible shock and vibration resistance.**

The output signals are provided in industry standard absolute, incremental, analogue sinusoidal and linear voltage formats. Available are resolutions of up to 12 bit absolute SSI and/ or 4,096 counts per revolution incremental for 5 V or 24 V power supply.

A system accuracy of  $\pm 0.5^\circ$  can be achieved with the supplied magnet. For easy integration onto or into the shaft, a range of magnetic actuators is also available.

### Product range

#### RM44/RM58AC

Analogue sinusoidal output with a single sine/cosine period per revolution.

#### RM44/RM58BC

Analogue complementary sinusoidal output with a single sine/cosine period per revolution.

#### RM44/RM58I

Incremental with 80 to 2,048 pulses per revolution (320 to 4,096 counts per revolution with x 4 evaluation) and/ or complementary analogue outputs with a single sine/cosine cycle per revolution.

#### RM44/RM58SC

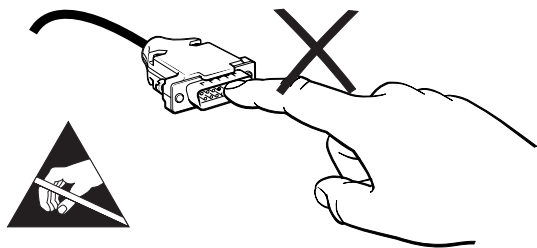
Synchro serial interface (SSI) with 320 to 4,096 positions per revolution.

#### RM44/RM58SI

Synchro serial interface (SSI) with 320 to 4,096 positions per revolution and incremental with 80 to 2,048 pulses per revolution (320 to 4,096 counts per revolution with x 4 evaluation).

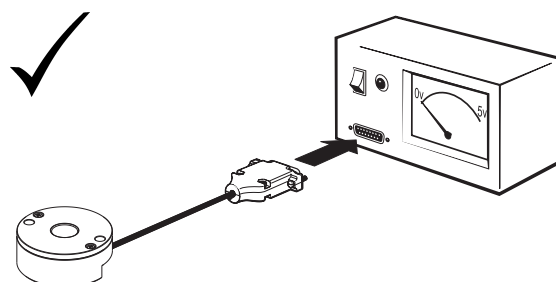
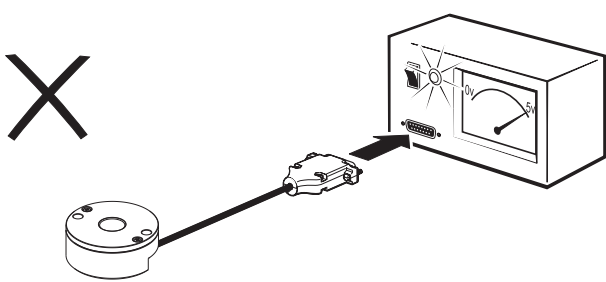
- Easy to install – with self locating design
- Low cost for OEM integration
- Fully sealed to IP68
- High reliability from proven non-contact sensing technology
- CE compliant, including RoHS - see Declaration of conformity

Storage and handling

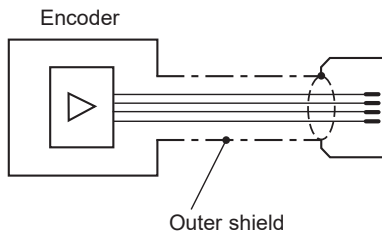


**IMPORTANT:** Power to RM44 encoders must be supplied from a DC SELV supply complying with the essential requirements of EN (IEC) 60950 or similar specification.

The RM44 series encoders have been designed to the relevant EMC standards, but must be correctly integrated to achieve EMC compliance. In particular, attention to shielding arrangements is critical.



Connections



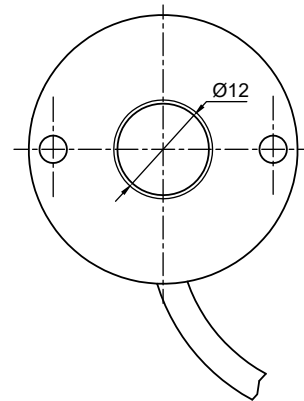
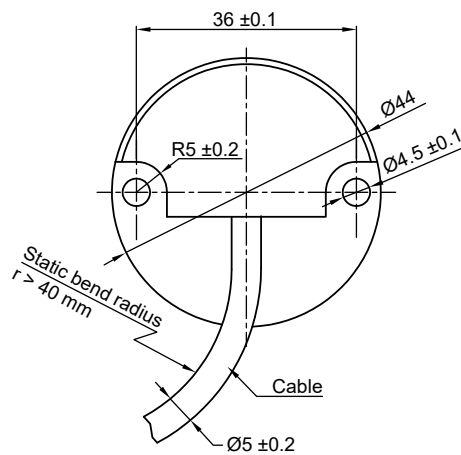
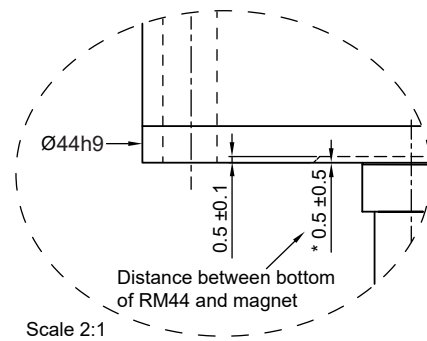
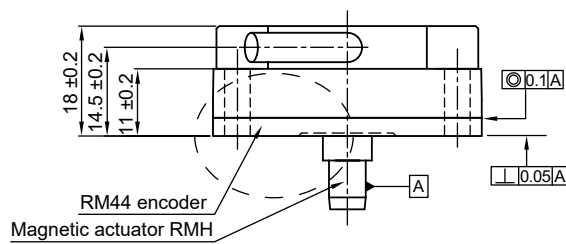
RM44/RM58AC		RM44/RM58BC		RM44/RM58IA		RM44/RM58IC		RM44/RM58IE		RM44/RM58SC		RM44/RM58SI	
Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour
Shield - see connection diagram				Shield - see connection diagram		Shield - see connection diagram		Shield - see connection diagram		Shield - see connection diagram			
$V_A$	Black	$V_{A+}$	Green	$V_{dd}$	Red	$V_{dd}$	Red	$V_{dd}$	Red	$V_{dd}$	Red	$V_{dd}$	Red
$V_B$	Brown	$V_{B+}$	Brown	GND	Blue	GND	Blue	GND	Blue	GND	Blue	GND	Blue
$V_{dd}$	Red	$V_{A-}$	Yellow	A	Grey	A	Grey	A	Grey	Clock+	White	A	Grey
GND	Orange	$V_{B-}$	White	B	Green	B	Green	B	Green	Data+	Green	B	Green
		$V_{dd}$	Red	Z	White	Z	White	Z	White	Clock-	Brown	Z	White
		GND	Blue	A-	Pink	A-	Pink			Data-	Yellow	A-	Pink
				B-	Yellow	B-	Yellow					B-	Yellow
				Z-	Brown	Z-	Brown					Z-	Brown
												Clock+	Black
												Data+	Grey/Pink
												Clock-	Violet
												Data-	Red/Blue

## Operating and electrical specifications

EMC compliance	EN 61326
Cable	Outside diameter 5 mm
Mass	Encoder unit 1 m cable (no connector) IP64 112 g, IP68 129 g. Magnetic actuator <2 g
Environmental sealing	IP64 (IP68 optional) EN 60529

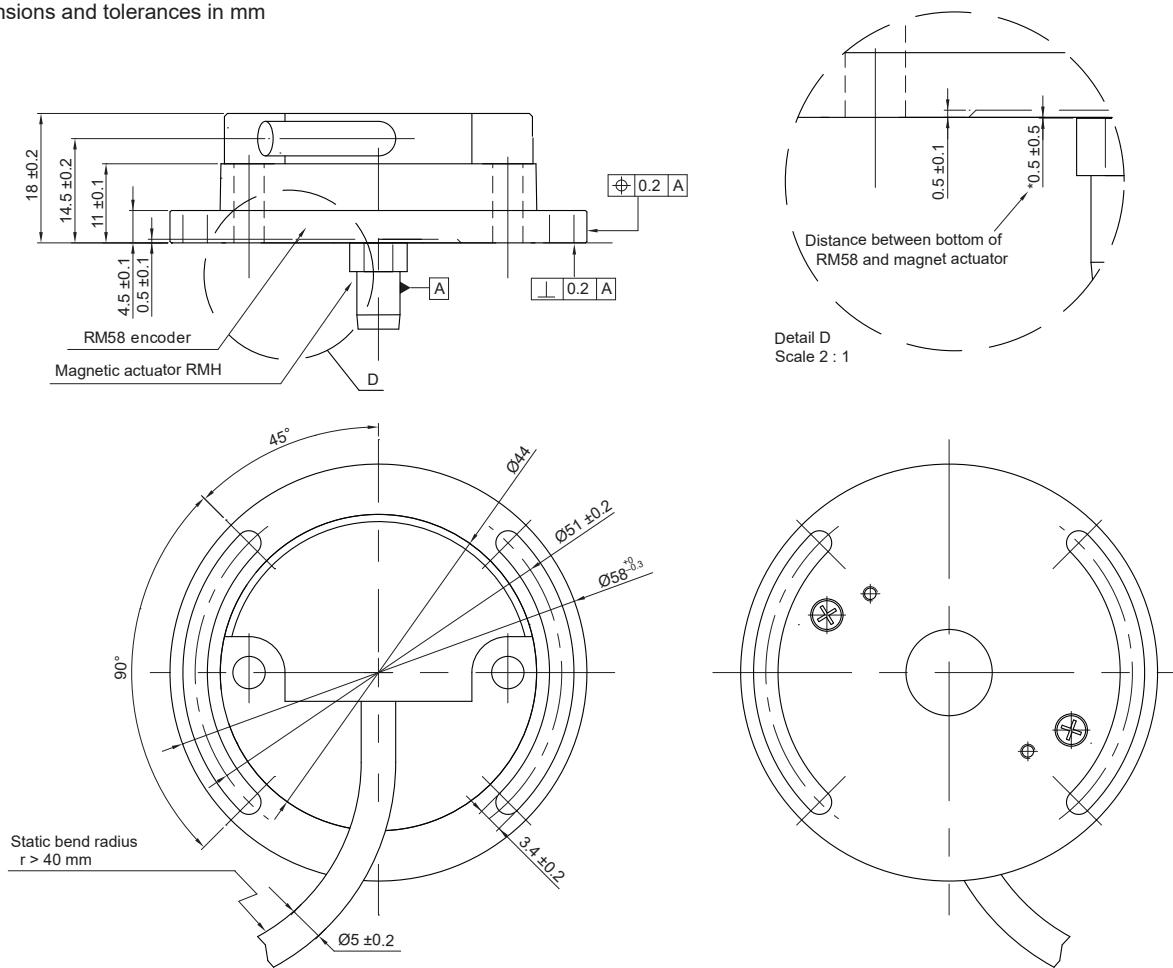
## RM44 dimensions

Dimensions and tolerances in mm



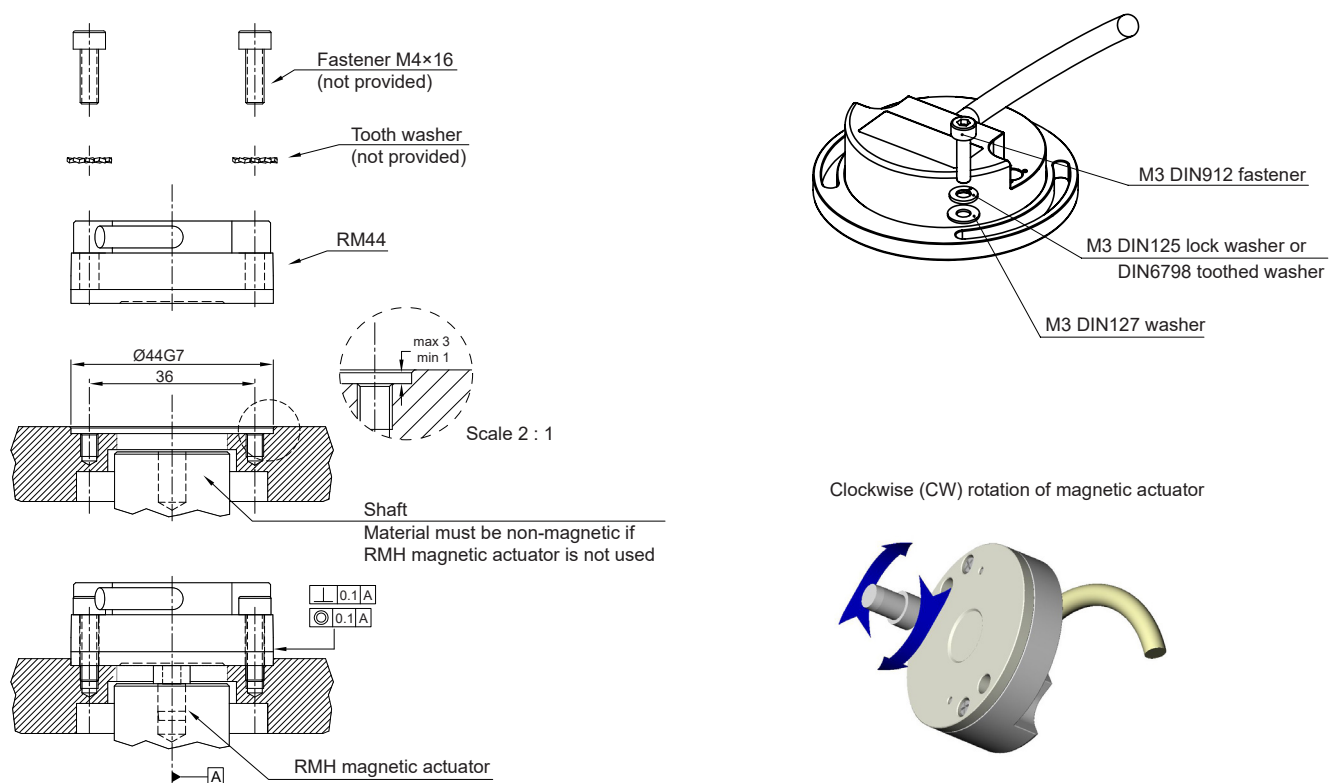
## RM58 dimensions

Dimensions and tolerances in mm



## RM44 / RM58 installation drawing

Dimensions and tolerances in mm

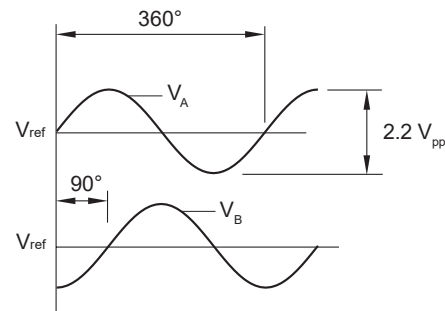


## RM44AC / RM58AC – Analogue sinusoidal outputs

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

<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	Max. 30 mA
<b>Outputs</b>	Single ended
<b>Internal serial impedance</b>	100 $\Omega$
<b>Signal amplitude</b>	$2.2 \pm 0.2\text{ V}_{pp}$
<b>Signal offset (<math>V_{ref}</math>)</b>	$2.5\text{ V} \pm 1\%$
<b>Maximum speed</b>	30,000 rpm
<b>Temperature</b>	$-30\text{ }^\circ\text{C}$ to $+80\text{ }^\circ\text{C}$
Operating and storage	

Timing diagram

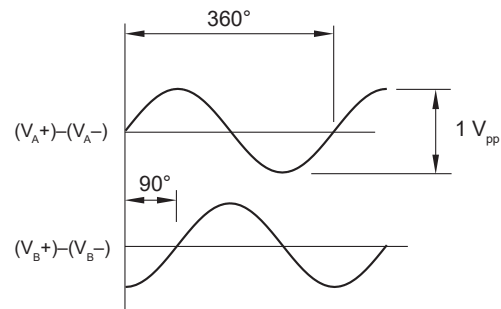


## RM44BC / RM58BC – Analogue sinusoidal outputs

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

<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	Max. 30 mA
<b>Outputs</b>	Differential
<b>Internal serial impedance</b>	10 $\Omega$
<b>Signal amplitude</b>	$0.5 \pm 0.1\text{ V}_{pp}$
<b>Signal offset (<math>V_{ref}</math>)</b>	$0 \pm 5\text{ mV}$
<b>Maximum speed</b>	30,000 rpm
<b>Temperature</b>	$-40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$
Operating and storage	

Timing diagram

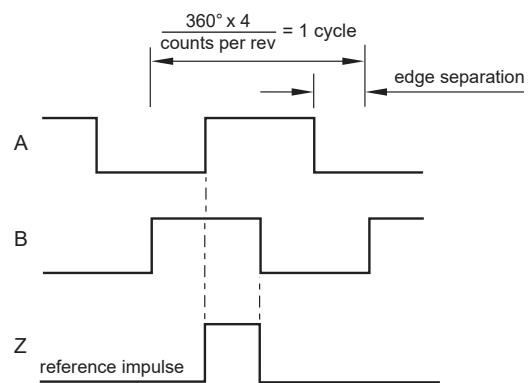


## RM44IA / RM58IA – Incremental, Push-pull

Square wave output

<b>Power supply</b>	$V_{dd} = 8\text{ V}$ to $26\text{ V}$
<b>Current consumption</b>	50 mA
<b>Output signals</b>	A, B, Z, A-, B-, Z- (RS422)
<b>Maximum output load</b>	30 mA
<b>Accuracy</b>	Typ. $\pm 0.5^\circ$
<b>Hysteresis</b>	$0.18^\circ$
<b>Resolution</b>	32, 64, 128, 256, 512, 1,024, 2,048, 4,096 cpr
<b>Maximum speed</b>	60,000 rpm for resolutions up to 1,024 cpr 30,000 rpm for 2,048 and 4,096 cpr
<b>Temperature</b>	$-40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$ (IP64)
Operating and storage	
$-40\text{ }^\circ\text{C}$ to $+85\text{ }^\circ\text{C}$ (IP68)	

Timing diagram



B leads A for clockwise rotation of magnet.

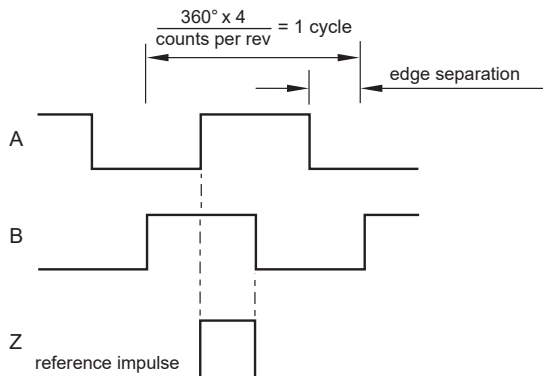
## RM44IC / RM58IC– Incremental, RS422

Square wave differential line driver to RS422

<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	Max. 35 mA
<b>Output signals</b>	A, B, Z, A–, B–, Z– (RS422)
<b>Accuracy</b>	$\pm 0.5^\circ$
<b>Hysteresis</b>	$0.18^\circ$
<b>Resolutions</b>	32, 64, 128, 256, 512, 1,024, 2,048, 4,096 cpr
<b>Maximum speed</b>	60,000 rpm for resolutions up to 1,024 cpr 30,000 rpm for 2,048 and 4,096 cpr
<b>Temperature</b>	$-40^\circ\text{C}$ to $+125^\circ\text{C}$ (IP64)
Operating and storage	$-40^\circ\text{C}$ to $+85^\circ\text{C}$ (IP68)

### Timing diagram

Complementary signals not shown



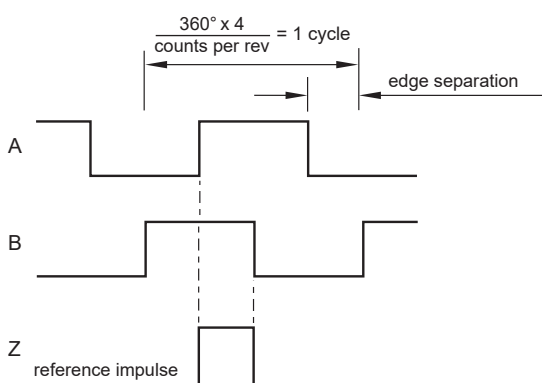
B leads A for clockwise rotation of magnet.

## RM44IE / RM58IE – Incremental, Open Collector, NPN

Low cost alternative for ball bearing encoders

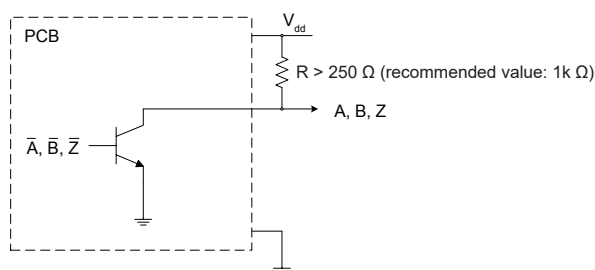
<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	35 mA (not loaded)
<b>Output signals</b>	A, B, Z
<b>Maximum output load</b>	20 mA
<b>Accuracy</b>	Typ. $\pm 0.5^\circ$
<b>Hysteresis</b>	$0.18^\circ$
<b>Resolutions</b>	32, 64, 128, 256, 512, 1,024, 2,048, 4,096 cpr
<b>Maximum speed</b>	60,000 rpm for resolutions up to 1,024 cpr 30,000 rpm for 2,048 and 4,096 cpr
<b>Temperature</b>	$-40^\circ\text{C}$ to $+125^\circ\text{C}$ (IP64)
Operating and storage	$-40^\circ\text{C}$ to $+85^\circ\text{C}$ (IP68)

### Timing diagram



B leads A for clockwise rotation of magnet.

### Recommended signal termination

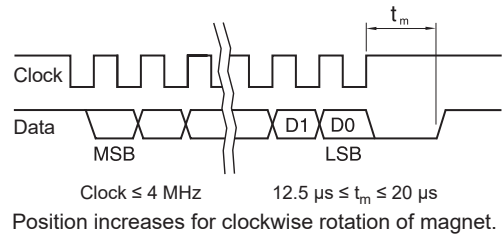


## RM44SC / RM58SC – Absolute binary synchro-serial (SSI), RS422

Serial encoded absolute position measurement

<b>Output code</b>	Natural binary
<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	Max. 35 mA
<b>Data output</b>	Serial data (RS422)
<b>Data input</b>	Clock (RS422)
<b>Accuracy</b>	Typ. $\pm 0.5^\circ$
<b>Hysteresis</b>	$0.18^\circ$
<b>Resolutions</b>	32, 64, 128, 256, 512, 1,024, 2,048, 4,096 cpr
<b>Maximum speed</b>	60,000 rpm for resolutions up to 1,024 cpr 30,000 rpm for 2,048 and 4,096 cpr
<b>Temperature</b>	$-40^\circ\text{C}$ to $+125^\circ\text{C}$ (IP64)
Operating and storage	$-40^\circ\text{C}$ to $+85^\circ\text{C}$ (IP68)

### Timing diagram

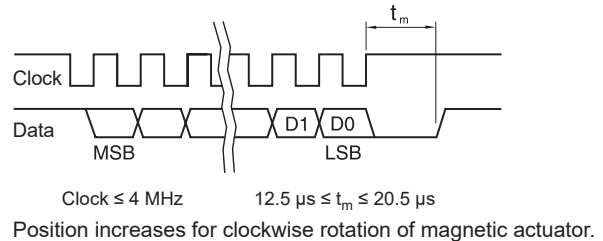


## RM44SI / RM58SI – Absolute binary synchro-serial (SSI) + Incremental, RS422

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.

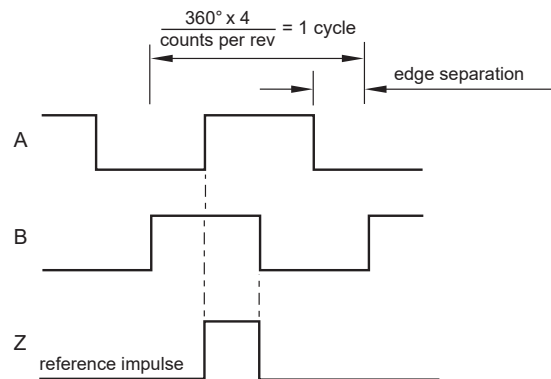
<b>Output code</b>	Natural binary
<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	Max. 35 mA
<b>Incremental outputs</b>	A, B, Z, A-, B-, Z- (RS422)
<b>Data output</b>	Serial data (RS422)
<b>Data input</b>	Clock (RS422)
<b>Accuracy</b>	Typ. $\pm 0.5^\circ$
<b>Hysteresis</b>	$0.18^\circ$
<b>Resolutions</b>	32, 64, 128, 256, 512, 1,024, 2,048, 4,096 cpr
<b>Maximum speed</b>	60,000 rpm for resolutions up to 1,024 cpr 30,000 rpm for 2,048 and 4,096 cpr
<b>Temperature</b>	$-40^\circ\text{C}$ to $+125^\circ\text{C}$ (IP64)
Operating and storage	$-40^\circ\text{C}$ to $+85^\circ\text{C}$ (IP68)

### Timing diagram - SSI



### Timing diagram - Incremental

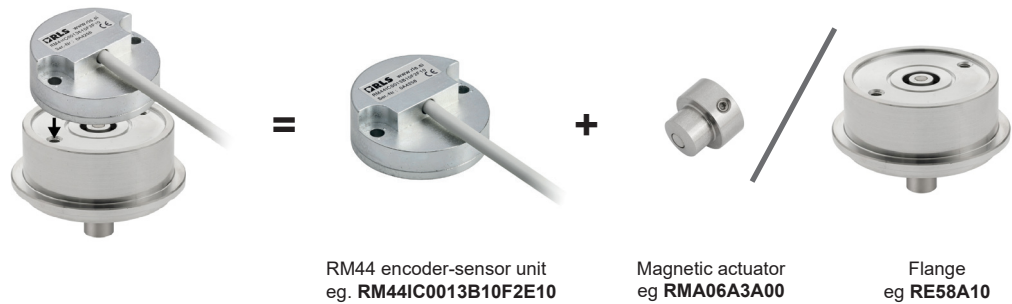
Complementary signals not shown



B leads A for clockwise rotation of magnet.

Part numbering

Encoder system = Encoder body + Magnetic actuator or flange



**Series**

**RM44** - Ø44 mm body  
**RM58** - Ø58 mm body

**Output type**

**AC** - Absolute analogue single ended, 5 V  
**BC** - Absolute analogue differential, 5 V  
**IA** - Incremental, Push-pull, 8 V to 26 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

**Shaft size**

**00** - n/a

**Resolution**

Counts/positions per revolution:

<b>05B</b> - 32	<b>08B</b> - 256	<b>11B</b> - 2048
<b>06B</b> - 64	<b>09B</b> - 512	<b>12B</b> - 4096
<b>07B</b> - 128	<b>10B</b> - 1024	

**RM44** **IC** **00** **12B** **10** **F** **2** **E** **96**

**Special requirements**  
**9M** - With AM4096 and cable length in meters  
**96** - With AM4096 - up to 12 bit

**Environment and material**  
**E** - IP64, die-cast body (Zinc alloy), standard EMC grade (standard)  
**F** - IP68, die-cast body (Zinc alloy), standard EMC grade

**Body style and cable exit**  
**2** - Cylindrical body, radial cable exit

**Connector options**  
**F** - Flying lead (no connector)

**Cable length**  
**10** - 1.0 meter (or 10 meters if **1M** special requirement is chosen)

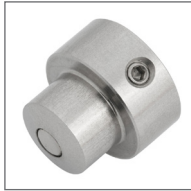
**NOTE:** Not all combinations are valid.

Series	Output type	Shaft	Resolution	Cable length	Connector options	Body style and cable exit	Environment and material	Special requirements
RM44 / RM58	AC	00	01S	10	F	2	E / F	9M / 96
	BC							
	IA		05B / 06B / 07B / 08B / 09B / 10B / 11B / 12B					
	IC							
	IE							
	SC							
	SI							

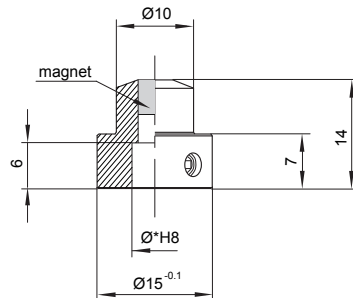


## Magnetic actuators and magnets ordering information

### Actuator for integration onto shaft



Shaft =  $\varnothing \times h7$   
Fixing: Grub screw provided



#### Part numbers:

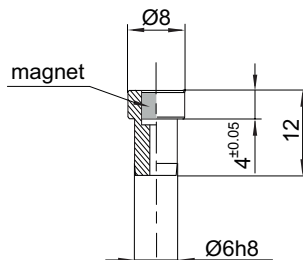
For resolutions up to 9 bit absolute (512 cpr incremental)

<b>RMA04A2A00</b> – Ø4 mm shaft	<b>RMA10A2A00</b> – Ø10 mm shaft
<b>RMA05A2A00</b> – Ø5 mm shaft	<b>RMA19A2A00</b> – Ø3/16" shaft
<b>RMA06A2A00</b> – Ø6 mm shaft	<b>RMA25A2A00</b> – Ø1/4" shaft
<b>RMA08A2A00</b> – Ø8 mm shaft	<b>RMA37A2A00</b> – Ø3/8" shaft

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

<b>RMA04A3A00</b> – Ø4 mm shaft	<b>RMA10A3A00</b> – Ø10 mm shaft
<b>RMA05A3A00</b> – Ø5 mm shaft	<b>RMA19A3A00</b> – Ø3/16" shaft
<b>RMA06A3A00</b> – Ø6 mm shaft	<b>RMA25A3A00</b> – Ø1/4" shaft
<b>RMA08A3A00</b> – Ø8 mm shaft	<b>RMA37A3A00</b> – Ø3/8" 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**

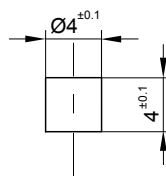
For resolutions from 10 bit absolute (800 cpr incremental) and above

**RMH06A3A02**

Hole =  $\varnothing 6G7$

Fixing: Glue (recommended – LOCTITE 648 or LOCTITE 2701)

### Magnet for direct recessing in non-ferrous shafts



Fixing: Glue (recommended – LOCTITE 648 or LOCTITE 2701)

#### 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** - Ø58 mm, 10 mm shaft

**RE58B06** - Ø58 mm, 6 mm shaft

**RE58C10** - Ø58 mm, 10 mm shaft

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

A **RENISHAW** associate company

## Head office

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## Document issues

Issue	Date	Page	Amendments done
1	19. 12. 2019	General	New document
2	22. 9. 2020	1, 2, 5, 8	RM44/RM58AC and RM44/RM58BC outputs added
		3, 4	Dimensions drawing amended
		5, 8	RM44/RM58IA description amended

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