

## RM44 and RM58 rotary magnetic encoders



**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 13 bit absolute SSI and/or 8,192 counts per revolution incremental for 5 V or 24 V power supply.

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

### Product range

#### RM44/RM58AC

Analogue with a single sine/cosine cycle per revolution.

#### RM44/RM58DC

BiSS-C interface with up to 8,192 counts per revolution.

#### RM44/RM58I

Incremental with 80 to 2,048 pulses per revolution (320 to 8,192 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 8,192 positions per revolution.

#### RM44/RM58SI

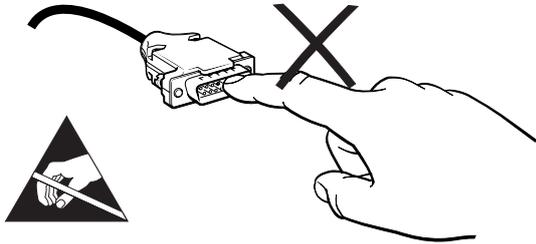
Synchro serial interface (SSI) with 320 to 8,192 positions per revolution and incremental with 80 to 2,048 pulses per revolution (320 to 8,192 counts per revolution with x 4 evaluation).

#### RM44/RM58Vx

Linear voltage output in a range of variants.

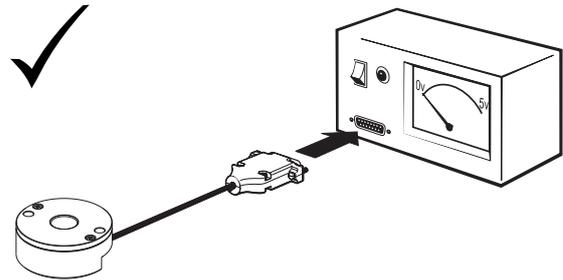
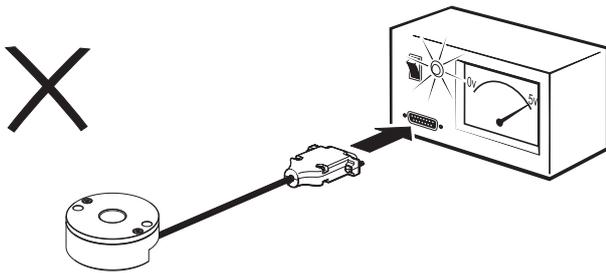
- Easy to install – with self locating design
- Inexpensive solution for OEM integration
- Fully sealed to IP68
- High reliability from proven non-contact sensing technology
- CE compliant, including RoHS - see Declaration of conformity

## Storage and handling

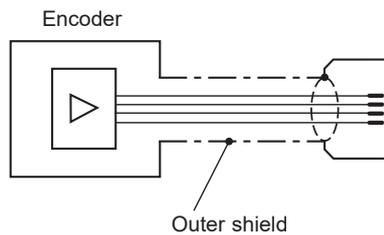


**IMPORTANT:** Power to RM44 encoders must be supplied from a DC SELV supply complying with the essential requirements of EN (IEC) 60950 or similar specification.

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



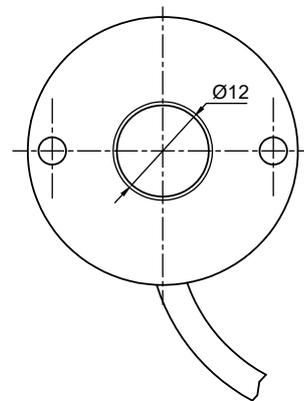
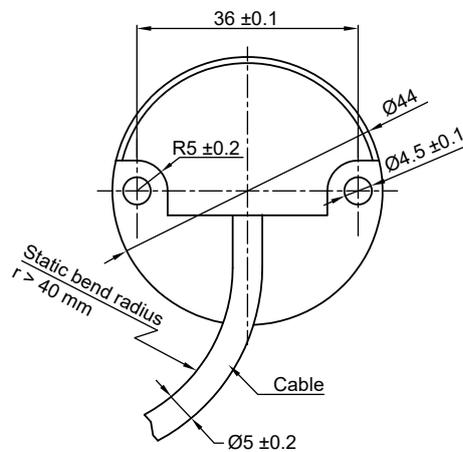
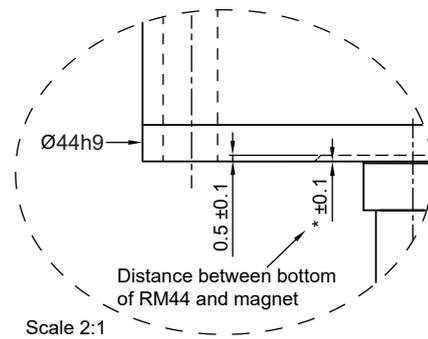
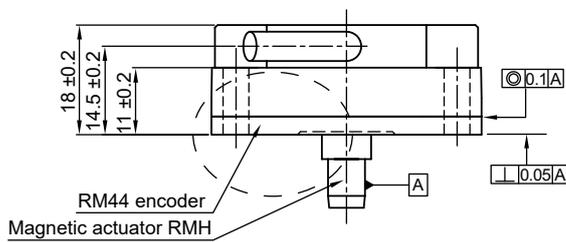
	RM44/RM58AC		RM44/RM58DC		RM44/RM58IA, IC, IG		RM44/RM58IB, IE		RM44/RM58SC		RM44/RM58SI		RM44/RM58Vx	
Pin Nr.	Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour
1	Shield - see connection diagram				Shield - see connection diagram				Shield - see connection diagram					
2	V <sub>A</sub>	Black	MA	White	Z	White	Z	White	Clock	White	A+	Grey	NC	-
3	V <sub>B</sub>	Brown	MA-	Brown	B	Green	B	Green	Clock-	Brown	A-	Pink	V <sub>out</sub>	Black
4	NC	-	NC	-	A	Grey	A	Grey	NC	-	B+	Green	NC	-
5	V <sub>dd</sub>	Red	V <sub>dd</sub>	Red	V <sub>dd</sub>	Red	V <sub>dd</sub>	Red	V <sub>dd</sub>	Red	B-	Yellow	V <sub>dd+</sub>	Red
6	NC	-	SLO	Green	Z <sup>-1</sup>	Brown	NC	-	Data	Green	Z+	White	NC	-
7	NC	-	SLO-	Yellow	B <sup>-1</sup>	Yellow	NC	-	Data-	Yellow	Z-	Brown	NC	-
8	NC	-	NC	-	A <sup>-1</sup>	Pink	NC	-	NC	-	V <sub>dd</sub>	Red	NC	-
9	GND	Orange	GND	Blue	GND	Blue	GND	Blue	GND	Blue	Clock+	Black	GND	Orange
10											Clock-	Violet		
11											NC	-		
12											Data+	Grey/ Pink		
13											Data-	Red/ Blue		
14											NC	-		
15											GND	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
Temperature drift error	0.004°/°C

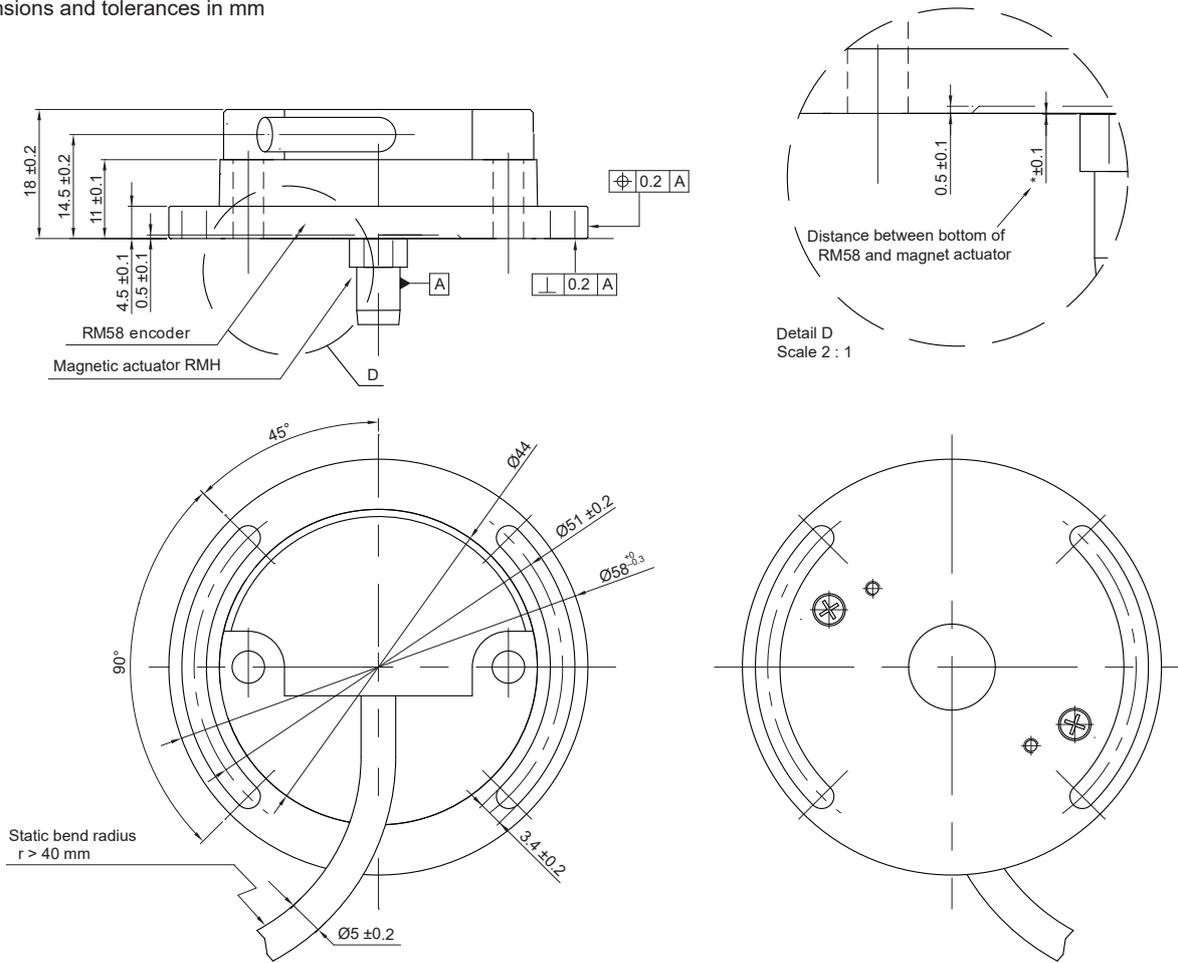
## RM44 dimensions

Dimensions and tolerances in mm



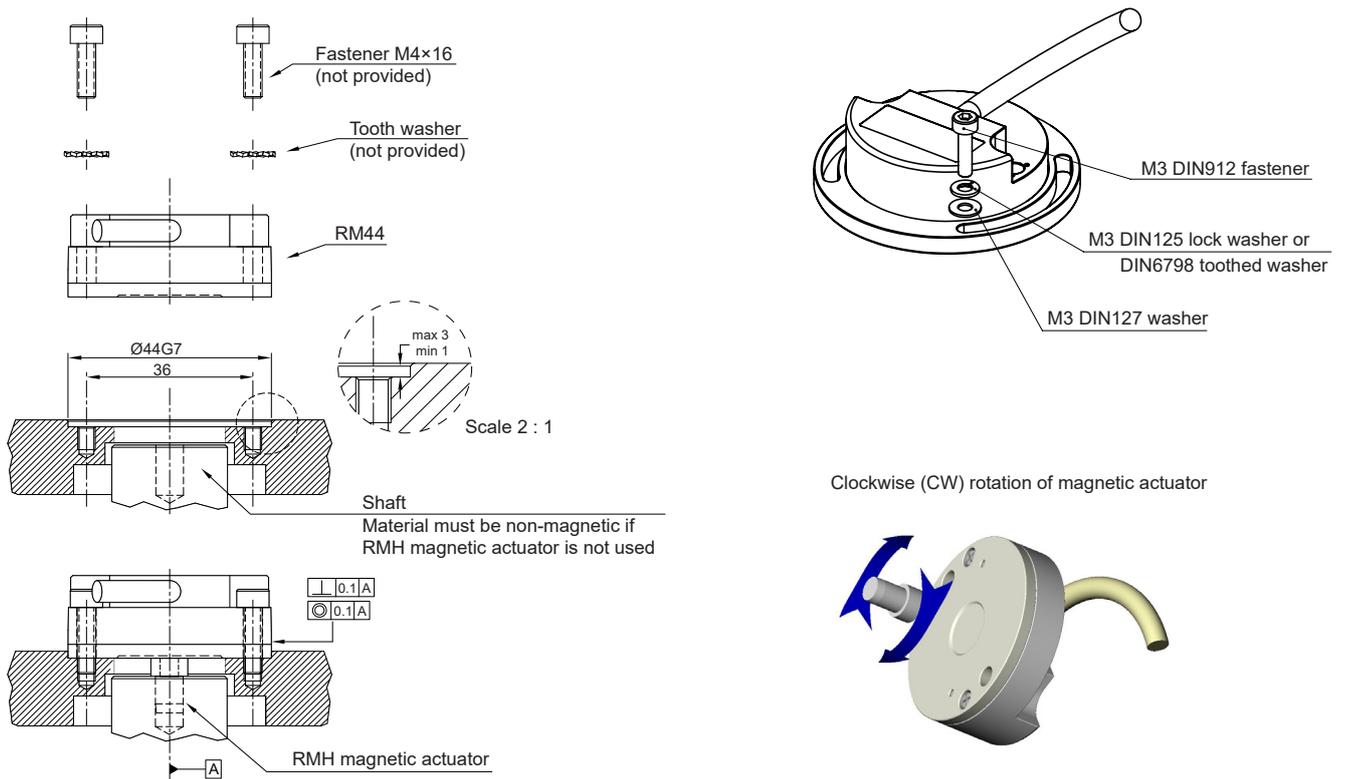
**RM58 dimensions**

Dimensions and tolerances in mm



**RM44 installation drawing**

Dimensions and tolerances in mm



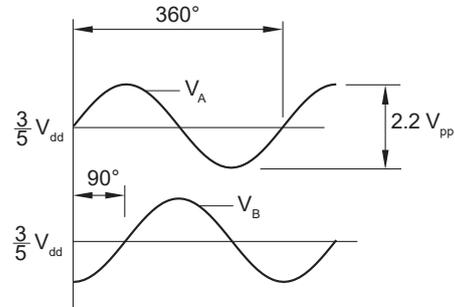
## Output specifications – 5 V supply

### RM44 / 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>	13 mA
<b>Outputs</b>	Signal amplitude $2.2 \pm 0.2 V_{pp}$ Signal offset $\frac{3}{5} V_{dd} \pm 5\text{ mV}$
<b>Internal serial impedance</b>	720 $\Omega$
<b>Maximum speed</b>	60,000 rpm
<b>Maximum cable length</b>	3 m
<b>Operating temperature</b>	-40 °C to +125 °C (IP64) -40 °C to +85 °C (IP68)

### Timing diagram

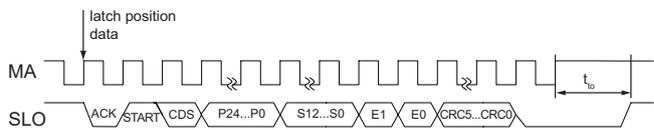


$V_A$  leads  $V_B$  by 90° for clockwise rotation of magnetic actuator.

### RM44 / RM58DC – Absolute natural binary BiSS-C interface

<b>Output code</b>	Natural binary
<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	Max. 50 mA
<b>Clock input</b>	MA (RS422)
<b>Data output</b>	SLO (RS422)
<b>Accuracy</b>	Typ. $\pm 0.5^\circ$
<b>Hysteresis</b>	0.18°
<b>Resolution</b>	320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 positions per revolution
<b>Maximum speed</b>	30,000 rpm
<b>Operating temperature</b>	-40 °C to +125 °C (IP64) -40 °C to +85 °C (IP68)
<b>Max MA frequency</b>	8 MHz

### Timing diagram – BiSS-C



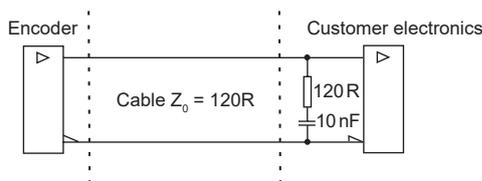
Data	Length	Description
P24 – P0	0 to 24 bit	Revolution counter value (length depends on the settings chosen)
S12 – S0	3 to 13 bit	Position inside the revolution (length depends on the resolution)
E1 – E0	2 bit	Error data
CRC5 – CRC0	5 to 6 bit	Cyclic redundancy check data; polynomial 0x43; inverted bit output

Error	E0	E1
No error	1	1
Amplitude error	0	1
Too high velocity	1	0
Undervoltage; Configuration; System error	0	0

For more information on BiSS-C protocol please visit [www.biss-interface.com](http://www.biss-interface.com).

### Recommended signal termination

For data output lines only

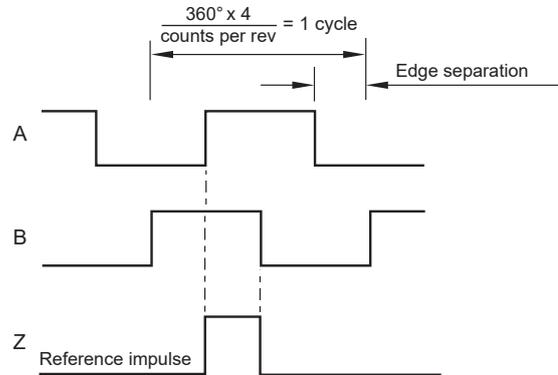


**RM44 / RM581E – Incremental, open collector**

Low cost alternative for ball bearing encoders

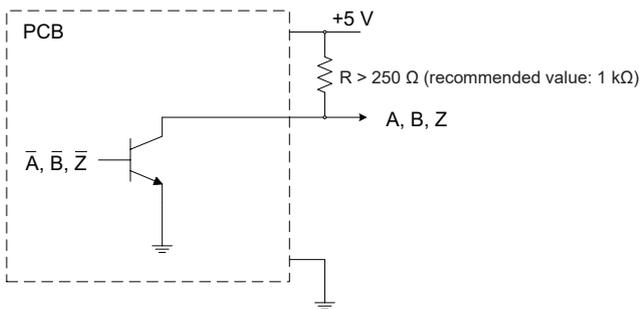
<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	35 mA (not loaded)
<b>Output signals</b>	A, B, Z
<b>Maximum output load</b>	20 mA
<b>Accuracy</b>	Typ. $\pm 0.5^\circ$
<b>Hysteresis</b>	0.18°
<b>Resolution</b>	80 to 2,048 pulses per revolution (320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 counts per revolution)
<b>Maximum speed</b>	30,000 rpm
<b>Maximum cable length</b>	20 m
<b>Operating temperature</b>	-40 °C to +125 °C (IP64) -40 °C to +85 °C (IP68)

**Timing diagram**



B leads A for clockwise rotation of magnetic actuator.

**Recommended signal termination**



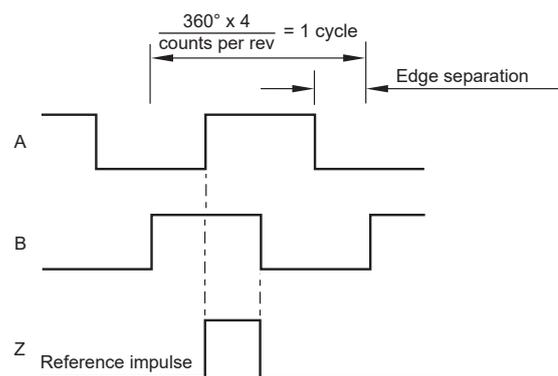
**RM44 / RM581C – Incremental, RS422**

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>	Typ. $\pm 0.5^\circ$
<b>Hysteresis</b>	0.18°
<b>Resolution</b>	80 to 2,048 pulses per revolution (320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 counts per revolution)
<b>Maximum speed</b>	30,000 rpm
<b>Maximum cable length</b>	50 m
<b>Operating temperature</b>	-40 °C to +125 °C (IP64) -40 °C to +85 °C (IP68)

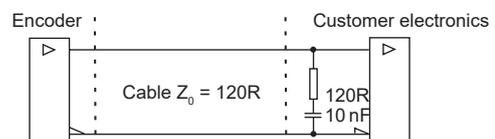
**Timing diagram**

Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

**Recommended signal termination**

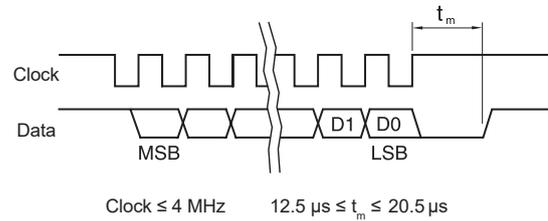


## RM44 / RM58SC – Absolute binary synchro-serial interface (SSI)

Serial encoded absolute position measurement

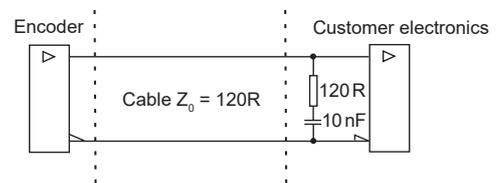
<b>Output code</b>	Natural binary
<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	Max. 35 mA
<b>Data output</b>	Serial data (RS422)
<b>Data input</b>	Clock (RS422)
<b>Accuracy</b>	Typ. $\pm 0.5^\circ$
<b>Hysteresis</b>	$0.18^\circ$
<b>Resolution</b>	320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 positions per revolution
<b>Maximum speed</b>	30,000 rpm
<b>Maximum cable length</b>	100 m (at 1 MHz)
<b>Operating temperature</b>	$-40^\circ\text{C}$ to $+125^\circ\text{C}$ (IP64) $-40^\circ\text{C}$ to $+85^\circ\text{C}$ (IP68)

### Timing diagram



### Recommended signal termination

For data output lines only



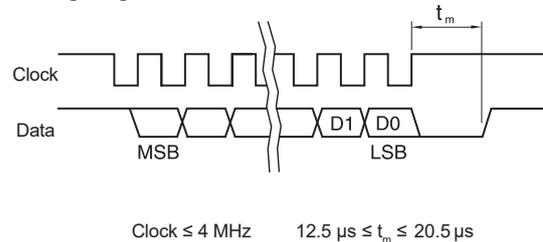
## RM44 / RM58SI – Absolute binary synchro-serial (SSI) + Incremental, RS422

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.

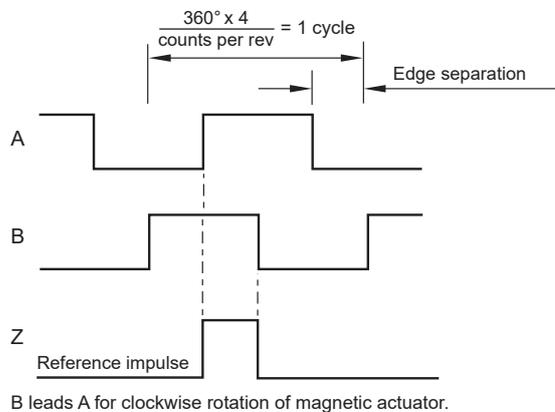
<b>Output code</b>	Natural binary
<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	Max. 35 mA
<b>Incremental outputs</b>	A, B, Z, A-, B-, Z- (RS422)
<b>Data output</b>	Serial data (RS422)
<b>Data input</b>	Clock (RS422)
<b>Accuracy</b>	Typ. $\pm 0.5^\circ$
<b>Hysteresis</b>	$0.18^\circ$
<b>Resolution</b>	80 to 2,048 pulses per revolution (320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 counts per revolution)
<b>Maximum speed</b>	30,000 rpm
<b>Maximum cable length</b>	50 m
<b>Operating temperature</b>	$-40^\circ\text{C}$ to $+125^\circ\text{C}$ (IP64) $-40^\circ\text{C}$ to $+85^\circ\text{C}$ (IP68)

### Timing diagram - SSI



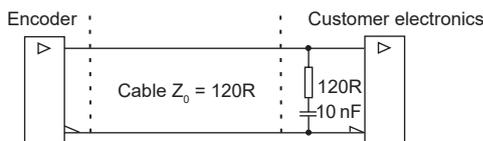
### Timing diagram - Incremental

Complementary signals not shown



### Recommended signal termination

For incremental signals + SSI data output lines only



**RM44 / RM58Vx – Linear voltage output**

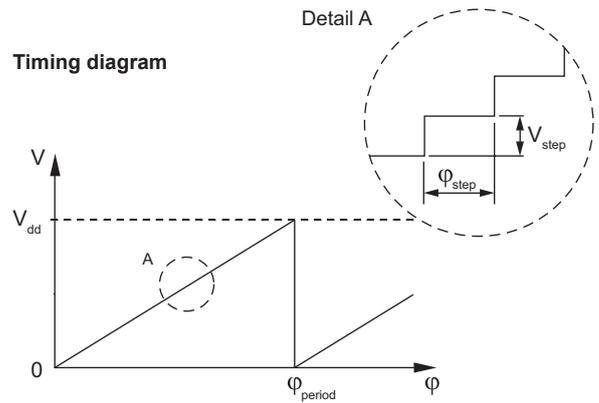
Alternative for potentiometers

<b>Power supply</b>	$V_{dd} = 5\text{ V} \pm 5\%$
<b>Current consumption</b>	Typ. 26 mA
<b>Output voltage</b>	0 V to $V_{dd}$
<b>Output loading</b>	Max. 10 mA
<b>Nonlinearity</b>	1 %
<b>Maximum speed</b>	30,000 rpm
<b>Maximum cable length</b>	20 m
<b>Operating temperature</b>	-40 °C to +125 °C (IP64) -40 °C to +85 °C (IP68)

$\Phi_{\text{period}}$	$N_{\text{period}}$	$N_{\text{step}}$	$\Phi_{\text{step}}$
360°	1	1,024	0.35°
180°	2	1,024	0.18°
90°	4	1,024	0.09°
45°	8	512	0.09°

**Output type and electrical variant**

Rotation \ $\Phi_{\text{period}}$	360°	180°	90°	45°
<b>Clockwise</b>	VA	VB	VC	VD
<b>Counterclockwise</b>	VE	VF	VG	VH



$$\Phi_{\text{step}} = \frac{\Phi_{\text{period}}}{N_{\text{step}}} \quad V_{\text{step}} = \frac{V_{dd}}{N_{\text{step}}}$$

- $\Phi_{\text{period}}$  = Angle covered in one period (one sawtooth)
- $V_{\text{period}}$  = Output voltage range for one period
- $\Phi_{\text{step}}$  = Step angle (angular movement needed to register a change in the position)
- $V_{\text{step}}$  = Output voltage range for one step
- $N_{\text{period}}$  = Number of periods in one revolution
- $N_{\text{step}}$  = Number of steps in one period

**Output specifications - 24 V supply**

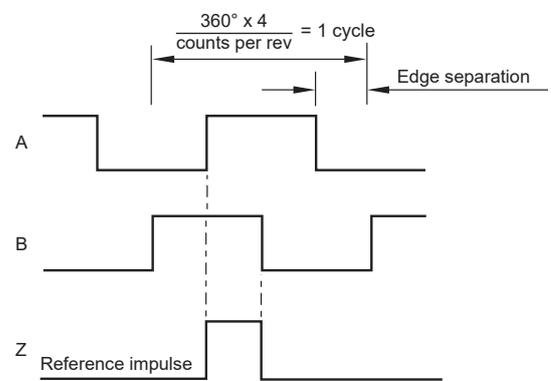
**RM44 / RM58IA – Incremental, push-pull**

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°
<b>Resolution</b>	80 to 2,048 pulses per revolution (320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 counts per revolution)
<b>Maximum speed</b>	30,000 rpm
<b>Maximum cable length</b>	20 m
<b>Operating temperature</b>	-40 °C to +125 °C (IP64) -40 °C to +85 °C (IP68)

**Timing diagram**

Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

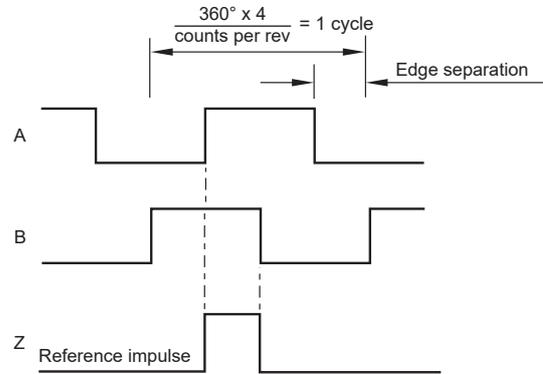
### RM44 / RM581G – Incremental, push-pull

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- (5 V 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>	80 to 2,048 pulses per revolution (320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 counts per revolution)
<b>Maximum speed</b>	30,000 rpm
<b>Maximum cable length</b>	20 m
<b>Operating temperature</b>	$-40\text{ }^\circ\text{C to }+125\text{ }^\circ\text{C}$ (IP64) $-40\text{ }^\circ\text{C to }+85\text{ }^\circ\text{C}$ (IP68)

#### Timing diagram

Complementary signals not shown



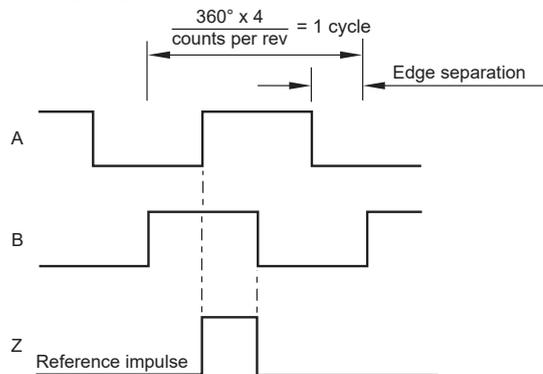
B leads A for clockwise rotation of magnetic actuator.

### RM44 / RM581B – Incremental, open collector NPN

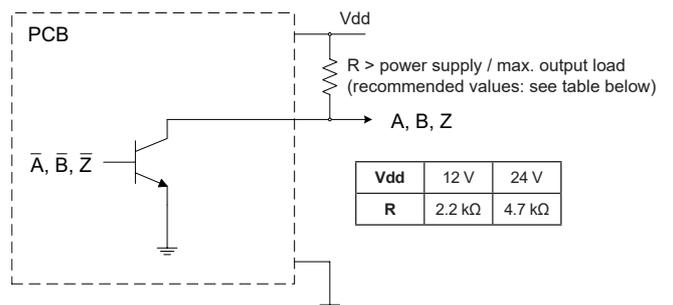
Square wave output

<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
<b>Maximum output load</b>	20 mA
<b>Accuracy</b>	Typ. $\pm 0.5^\circ$
<b>Hysteresis</b>	$0.18^\circ$
<b>Resolution</b>	80 to 2,048 pulses per revolution (320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 counts per revolution)
<b>Maximum speed</b>	30,000 rpm
<b>Maximum cable length</b>	20 m
<b>Operating temperature</b>	$-40\text{ }^\circ\text{C to }+125\text{ }^\circ\text{C}$ (IP64) $-40\text{ }^\circ\text{C to }+85\text{ }^\circ\text{C}$ (IP68)

#### Timing diagram



#### Recommended signal termination



## Part numbering

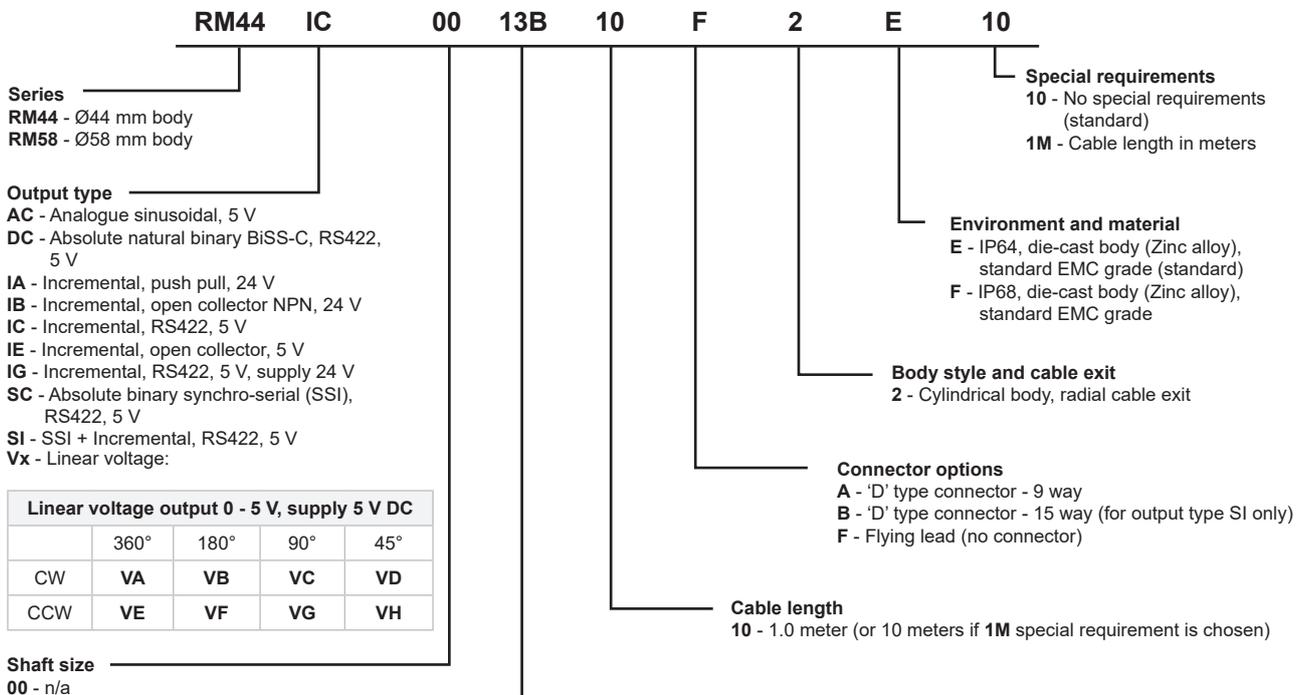
Encoder system = Encoder body + Magnetic actuator or flange



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

Magnetic actuator  
 eg **RMA06A3A00**

Flange  
 eg **RE58A10**



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

**Output type**  
**AC** - Analogue sinusoidal, 5 V  
**DC** - Absolute natural binary BiSS-C, RS422, 5 V  
**IA** - Incremental, push pull, 24 V  
**IB** - Incremental, open collector NPN, 24 V  
**IC** - Incremental, RS422, 5 V  
**IE** - Incremental, open collector, 5 V  
**IG** - Incremental, RS422, 5 V, supply 24 V  
**SC** - Absolute binary synchro-serial (SSI), RS422, 5 V  
**SI** - SSI + Incremental, RS422, 5 V  
**Vx** - Linear voltage:

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>

**Shaft size**  
**00** - n/a

**Special requirements**  
**10** - No special requirements (standard)  
**1M** - Cable length in meters

**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**  
**A** - 'D' type connector - 9 way  
**B** - 'D' type connector - 15 way (for output type SI only)  
**F** - Flying lead (no connector)

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

**Resolution**  
 For **AC**:  
**01S** - One sine/cosine period per revolution  
 For **DC, IA, IB, IC, IE, IG, SC** and **SI** (counts/positions per revolution):

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	

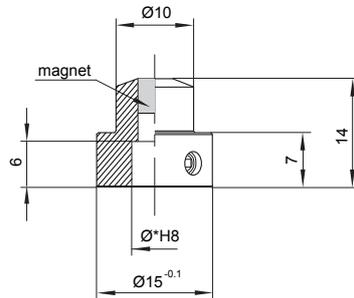
For **Vx**:  
**10B** - 1024 counts/positions per revolution

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

## Magnetic actuators and magnets ordering information

Dimensions and tolerances in mm

### Actuator for integration onto shaft



Shaft = Ø\*h7

Fixing: Grub screw provided

#### Part numbers:

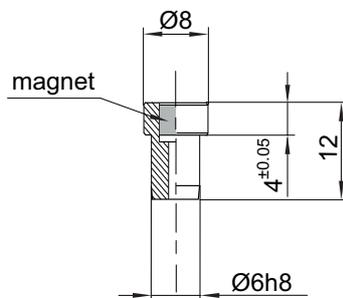
For resolutions up to 9 bit absolute (512 cpr incremental)

<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



with N-pole marker

#### 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**

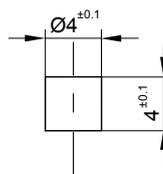
For resolutions from 10 bit absolute (800 cpr incremental) and above

**RMH06A3A02**

Hole = Ø6G7

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.

## Head office

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## Document issues

Issue	Date	Page	Amendments done
11	15. 10. 2018	3, 4	RM58 installation drawing added, RM44 dimensions amended
12	19. 12. 2019	2	Connections amended
		5, 9	Signal termination amended
13	3. 2. 2020	4	RM58 dimension tolerance amended
14	22. 9. 2020	1, 2, 5, 10	RM44/58DC interface added
		3	RM44 dimensions drawing amended, Temperature drift error added
15	14. 2. 2022	2, 10	Connections table amended and connector added

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