

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

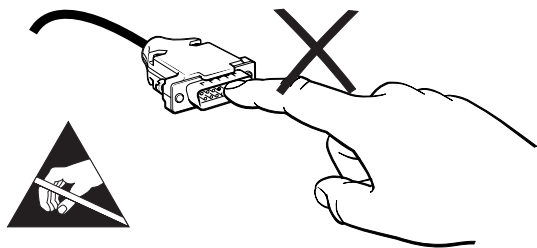
Synchro serial interface (SSI) with 320 to 8,192 positions per revolution and incremental with 80 to 2,048 pulses per revolution (320 to 8,192 counts per revolution with x 4 evaluation).

RM44/RM58Vx

Linear voltage output in a range of variants.

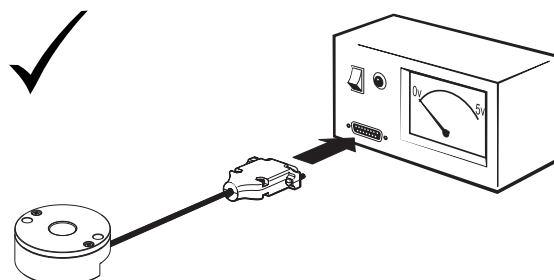
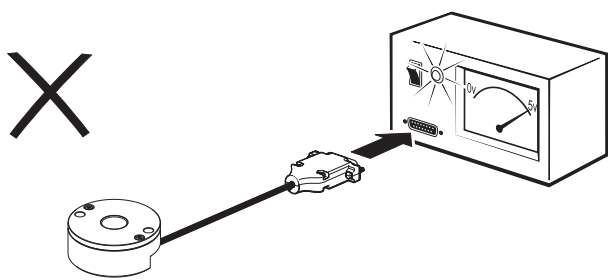
- Easy to install – with self locating design
- Inexpensive solution for OEM integration
- Fully sealed to IP68
- High reliability from proven non-contact sensing technology
- CE compliant, including RoHS - see Declaration of conformity

Storage and handling

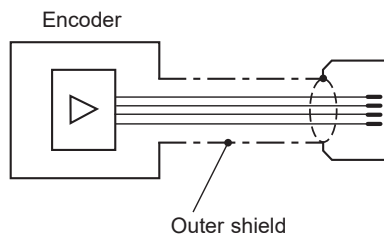


IMPORTANT: Power to RM44 encoders must be supplied from a DC SELV supply complying with the essential requirements of EN (IEC) 60950 or similar specification.

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



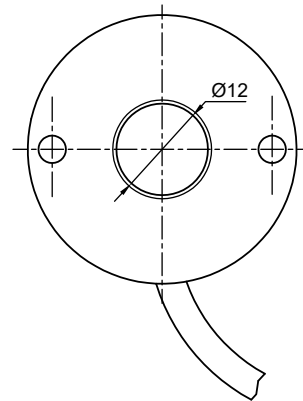
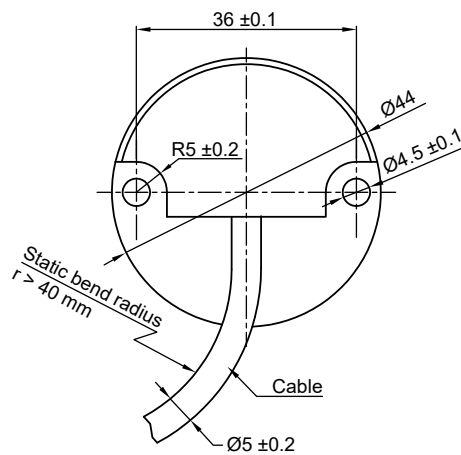
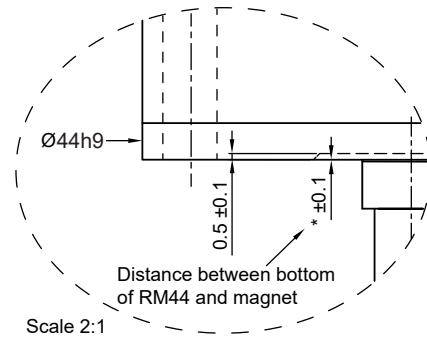
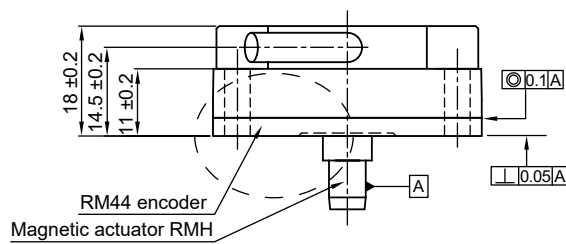
	RM44/RM58AC		RM44/RM58DC		RM44/RM58IA, IC, IG		RM44/RM58IB, IE		RM44/RM58SC		RM44/RM58SI		RM44/RM58Vx	
Pin Nr.	Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour
1	Shield - see connection diagram				Shield - see connection diagram				Shield - see connection diagram					
2	V_A	Black	MA	White	Z	White	Z	White	Clock	White	A+	Grey	NC	-
3	V_B	Brown	MA-	Brown	B	Green	B	Green	Clock-	Brown	A-	Pink	V_{out}	Black
4	NC	-	NC	-	A	Grey	A	Grey	NC	-	B+	Green	NC	-
5	V_{dd}	Red	V_{dd}	Red	V_{dd}	Red	V_{dd}	Red	V_{dd}	Red	B-	Yellow	V_{dd+}	Red
6	NC	-	SLO	Green	Z^{-1}	Brown	NC	-	Data	Green	Z+	White	NC	-
7	NC	-	SLO-	Yellow	B^{-1}	Yellow	NC	-	Data-	Yellow	Z-	Brown	NC	-
8	NC	-	NC	-	A^{-1}	Pink	NC	-	NC	-	V_{dd}	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/ Bue		
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

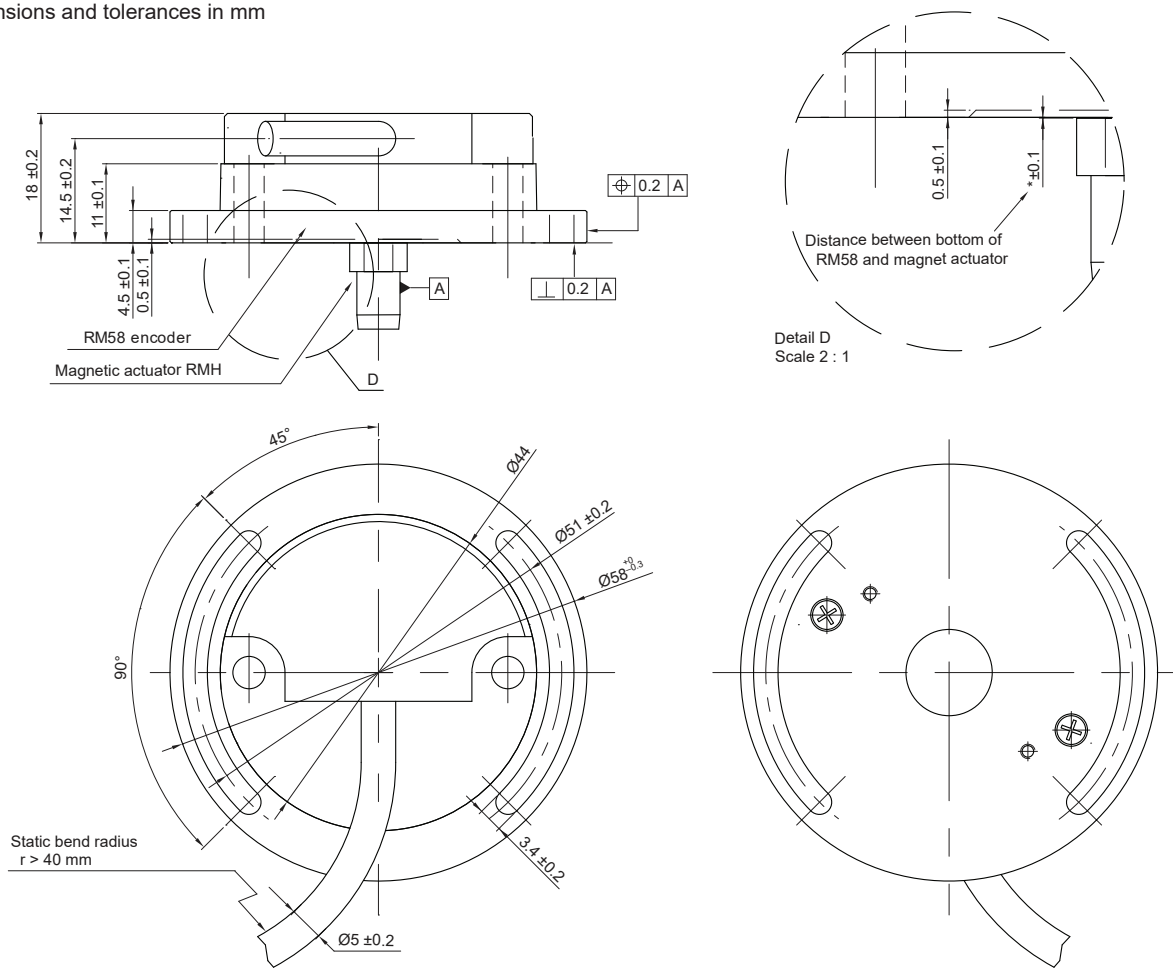
RM44 dimensions

Dimensions and tolerances in mm



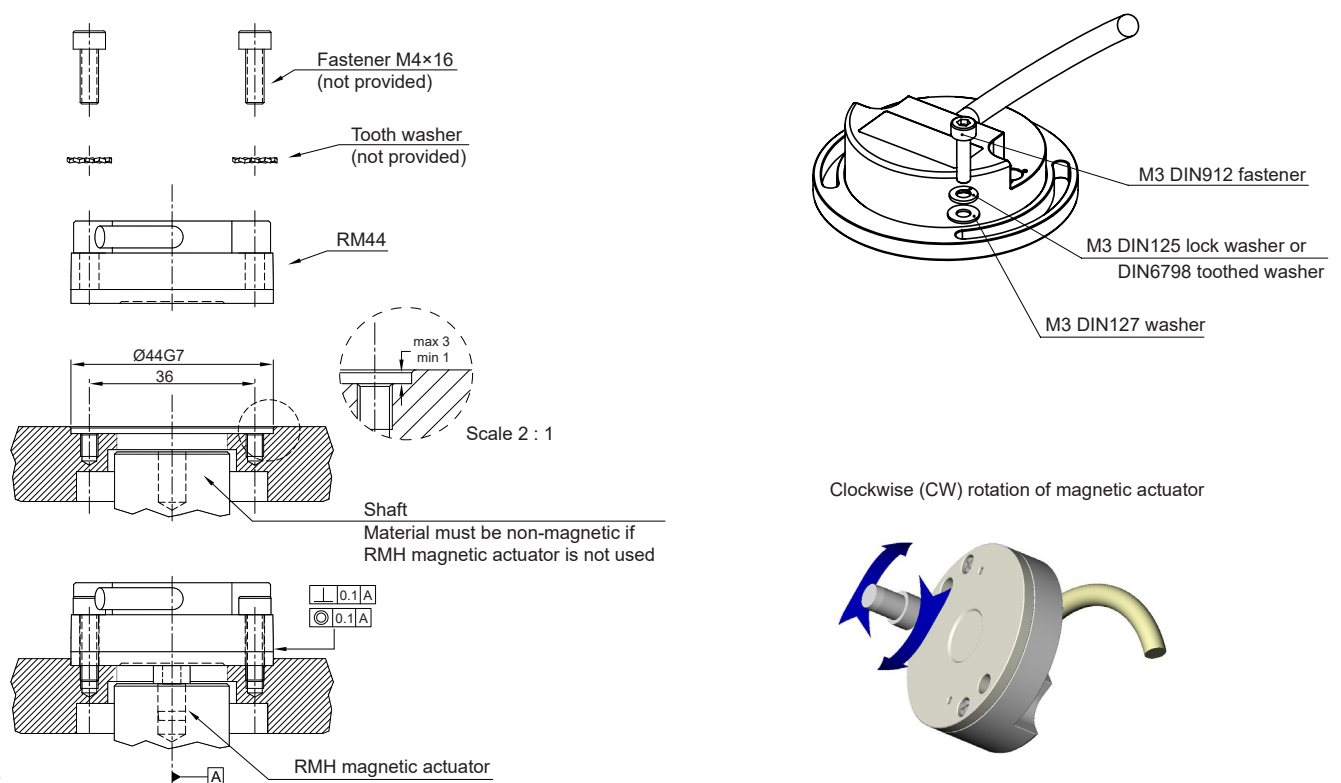
RM58 dimensions

Dimensions and tolerances in mm



RM44 installation drawing

Dimensions and tolerances in mm



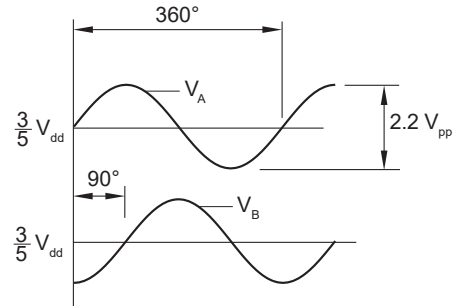
Output specifications – 5 V supply

RM44 / RM58AC – Analogue sinusoidal outputs

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

Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Current consumption	13 mA
Outputs	Signal amplitude $2.2 \pm 0.2\text{ V}_{pp}$ Signal offset $\frac{3}{5} V_{dd} \pm 5\text{ mV}$
Internal serial impedance	720 Ω
Maximum speed	60,000 rpm
Maximum cable length	3 m
Operating temperature	–40 °C to +125 °C (IP64) –40 °C to +85 °C (IP68)

Timing diagram

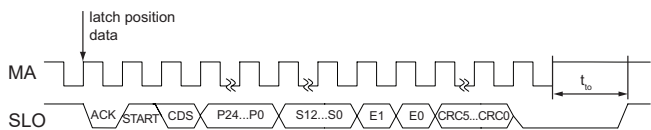


V_A leads V_B by 90° for clockwise rotation of magnetic actuator.

RM44 / RM58DC – Absolute natural binary BiSS-C interface

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

Timing diagram – BiSS-C

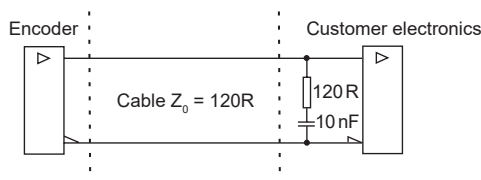


Data	Length	Description
P24 – P0	0 to 24 bit	Revolution counter value (length depends on the settings chosen)
S12 – S0	3 to 13 bit	Position inside the revolution (length depends on the resolution)
E1 – E0	2 bit	Error data
CRC5 – CRC0	5 to 6 bit	Cyclic redundancy check data; polynomial 0x43; inverted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

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

Recommended signal termination

For data output lines only



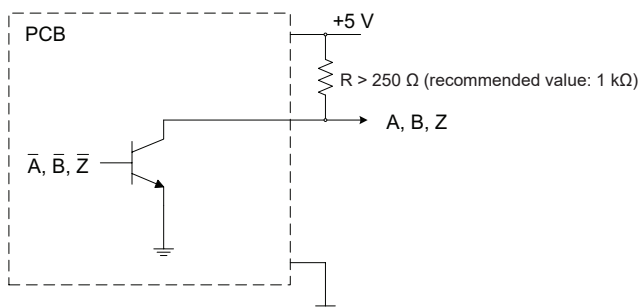
For more information on BiSS-C protocol please visit www.biss-interface.com.

RM44 / RM58IE – Incremental, open collector

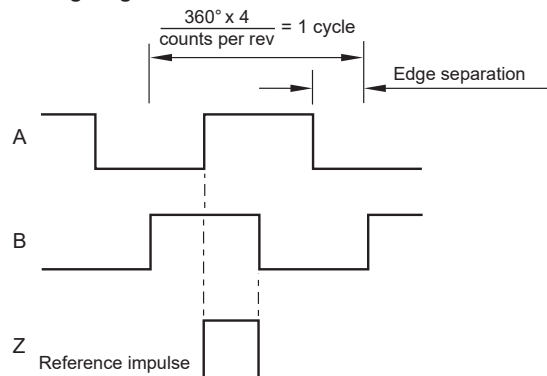
Low cost alternative for ball bearing encoders

Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Current consumption	35 mA (not loaded)
Output signals	A, B, Z
Maximum output load	20 mA
Accuracy	Typ. $\pm 0.5^\circ$
Hysteresis	0.18°
Resolution	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)
Maximum speed	30,000 rpm
Maximum cable length	20 m
Operating temperature	-40 °C to +125 °C (IP64) -40 °C to +85 °C (IP68)

Recommended signal termination



Timing diagram



B leads A for clockwise rotation of magnetic actuator.

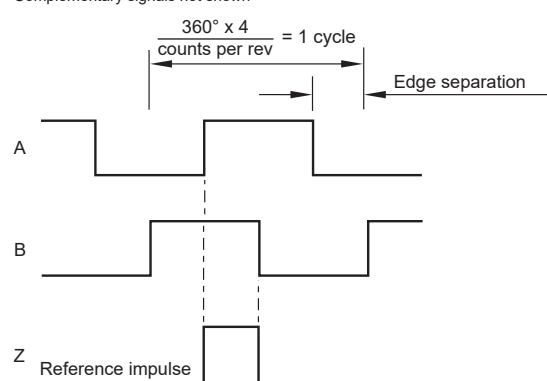
RM44 / RM58IC – Incremental, RS422

Square wave differential line driver to RS422

Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Current consumption	Max. 35 mA
Output signals	A, B, Z, A-, B-, Z- (RS422)
Accuracy	Typ. $\pm 0.5^\circ$
Hysteresis	0.18°
Resolution	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)
Maximum speed	30,000 rpm
Maximum cable length	50 m
Operating temperature	-40 °C to +125 °C (IP64) -40 °C to +85 °C (IP68)

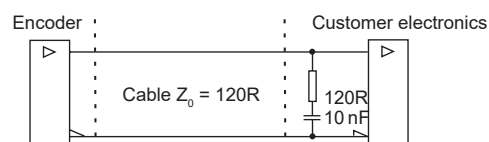
Timing diagram

Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

Recommended signal termination

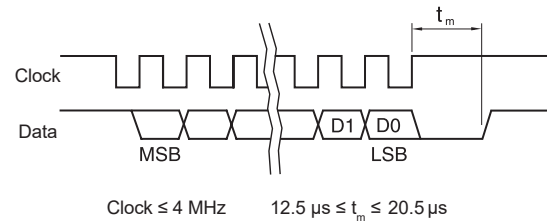


RM44 / RM58SC – Absolute binary synchro-serial interface (SSI)

Serial encoded absolute position measurement

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

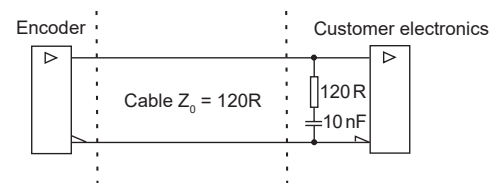
Timing diagram



Position increases for clockwise rotation of magnetic actuator.

Recommended signal termination

For data output lines only



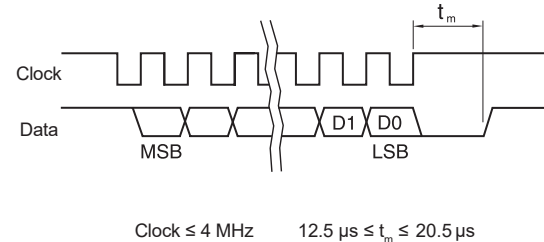
RM44 / RM58SI – Absolute binary synchro-serial (SSI) + Incremental, RS422

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.

Output code	Natural binary
Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Current consumption	Max. 35 mA
Incremental outputs	A, B, Z, A-, B-, Z- (RS422)
Data output	Serial data (RS422)
Data input	Clock (RS422)
Accuracy	Typ. $\pm 0.5^\circ$
Hysteresis	0.18°
Resolution	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)
Maximum speed	30,000 rpm
Maximum cable length	50 m
Operating temperature	-40°C to $+125^\circ\text{C}$ (IP64) -40°C to $+85^\circ\text{C}$ (IP68)

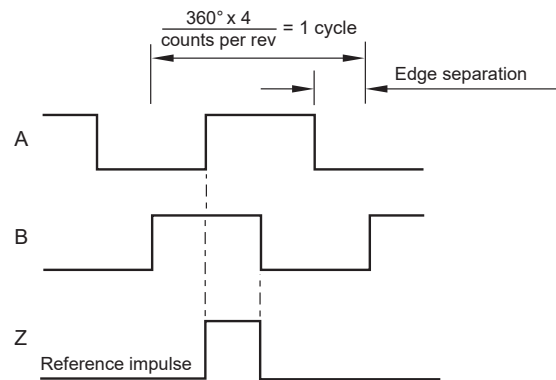
Timing diagram - SSI



Position increases for clockwise rotation of magnetic actuator.

Timing diagram - Incremental

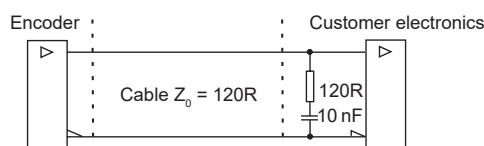
Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

Recommended signal termination

For incremental signals + SSI data output lines only



RM44 / RM58Vx – Linear voltage output

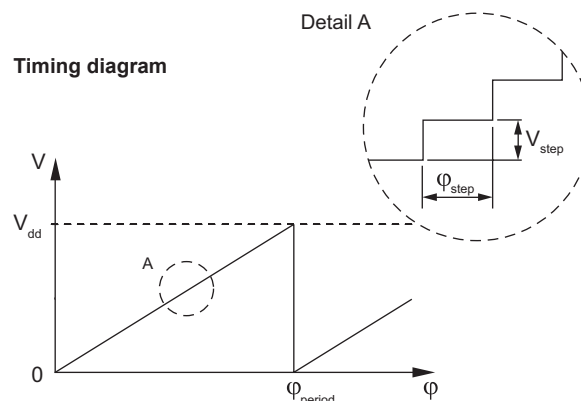
Alternative for potentiometers

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

Φ_{period}	N_{period}	N_{step}	Φ_{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 \ Φ_{period}	360°	180°	90°	45°
Clockwise	VA	VB	VC	VD
Counterclockwise	VE	VF	VG	VH



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

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

Output specifications - 24 V supply

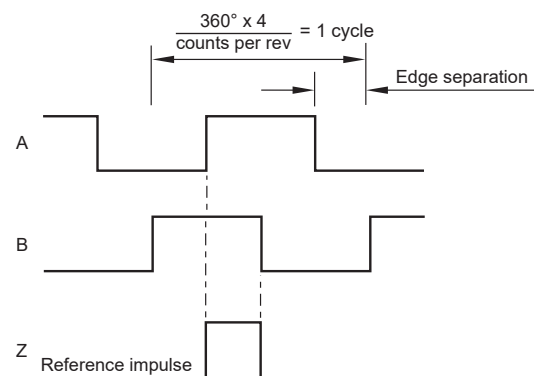
RM44 / RM58IA – Incremental, push-pull

Square wave output

Power supply	$V_{dd} = 8\text{ V to }26\text{ V}$
Current consumption	50 mA
Output signals	A, B, Z, A–, B–, Z– (RS422)
Maximum output load	30 mA
Accuracy	Typ. $\pm 0.5^\circ$
Hysteresis	0.18°
Resolution	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)
Maximum speed	30,000 rpm
Maximum cable length	20 m
Operating temperature	–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.

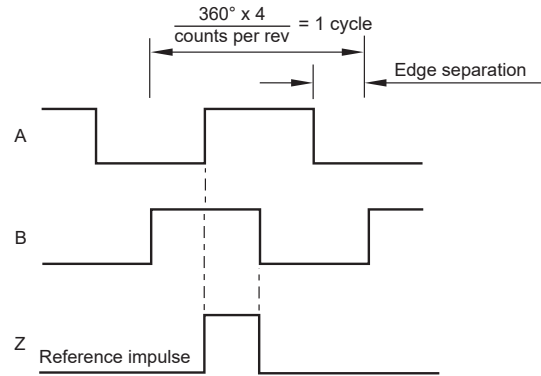
RM44 / RM58IG – Incremental, push-pull

Square wave output

Power supply	$V_{dd} = 8 \text{ V to } 26 \text{ V}$
Current consumption	50 mA
Output signals	A, B, Z, A–, B–, Z– (5 V RS422)
Maximum output load	30 mA
Accuracy	Typ. $\pm 0.5^\circ$
Hysteresis	0.18°
Resolution	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)
Maximum speed	30,000 rpm
Maximum cable length	20 m
Operating temperature	$-40^\circ \text{C to } +125^\circ \text{C}$ (IP64) $-40^\circ \text{C to } +85^\circ \text{C}$ (IP68)

Timing diagram

Complementary signals not shown



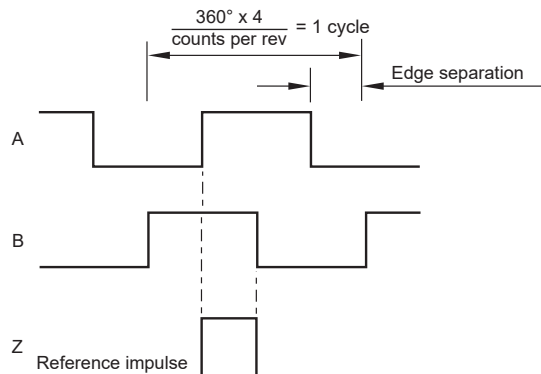
B leads A for clockwise rotation of magnetic actuator.

RM44 / RM58IB – Incremental, open collector NPN

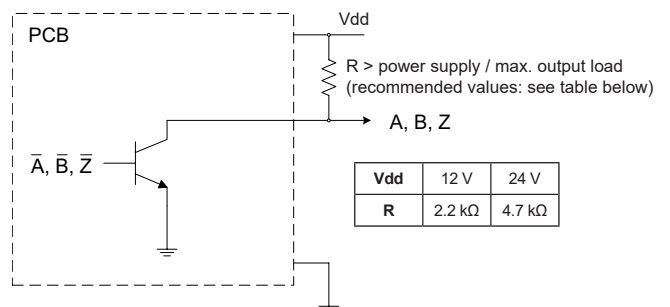
Square wave output

Power supply	$V_{dd} = 8 \text{ V to } 26 \text{ V}$
Current consumption	50 mA
Output signals	A, B, Z
Maximum output load	20 mA
Accuracy	Typ. $\pm 0.5^\circ$
Hysteresis	0.18°
Resolution	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)
Maximum speed	30,000 rpm
Maximum cable length	20 m
Operating temperature	$-40^\circ \text{C to } +125^\circ \text{C}$ (IP64) $-40^\circ \text{C to } +85^\circ \text{C}$ (IP68)

Timing diagram

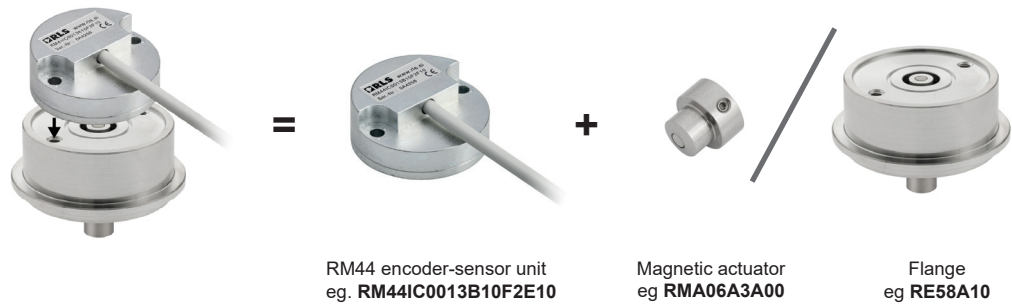


Recommended signal termination



Part numbering

Encoder system = Encoder body + Magnetic actuator or flange



RM44 **IC** **00** **13B** **10** **F** **2** **E** **10**

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	VA	VB	VC	VD
CCW	VE	VF	VG	VH

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		
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	

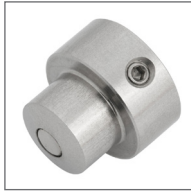
For Vx:
10B - 1024 counts/positions per revolution

NOTE: Not all combinations are valid.

Magnetic actuators and magnets ordering information

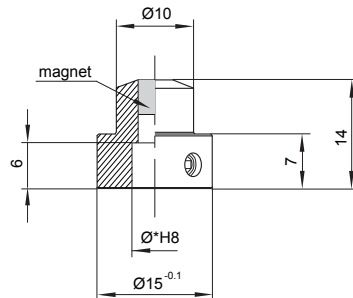
Dimensions and tolerances in mm

Actuator for integration onto shaft



Shaft = $\varnothing h7$

Fixing: Grub screw provided



Part numbers:

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

RMA04A2A00 – $\varnothing 4$ mm shaft

RMA05A2A00 – $\varnothing 5$ mm shaft

RMA06A2A00 – $\varnothing 6$ mm shaft

RMA08A2A00 – $\varnothing 8$ mm shaft

RMA10A2A00 – $\varnothing 10$ mm shaft

RMA19A2A00 – $\varnothing 3/16$ " shaft

RMA25A2A00 – $\varnothing 1/4$ " shaft

RMA37A2A00 – $\varnothing 3/8$ " shaft

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

RMA04A3A00 – $\varnothing 4$ mm shaft

RMA05A3A00 – $\varnothing 5$ mm shaft

RMA06A3A00 – $\varnothing 6$ mm shaft

RMA08A3A00 – $\varnothing 8$ mm shaft

RMA10A3A00 – $\varnothing 10$ mm shaft

RMA19A3A00 – $\varnothing 3/16$ " shaft

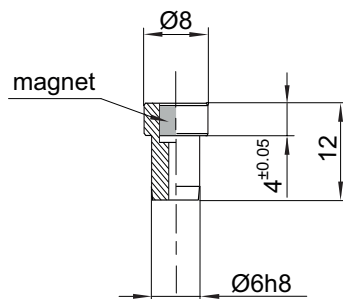
RMA25A3A00 – $\varnothing 1/4$ " shaft

RMA37A3A00 – $\varnothing 3/8$ " 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 $\pm 5^\circ$ accuracy:

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

RMH06A2A02

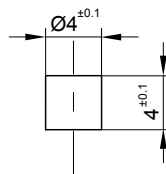
For resolutions from 10 bit absolute (800 cpr incremental) and above

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 - $\varnothing 58$ 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 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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