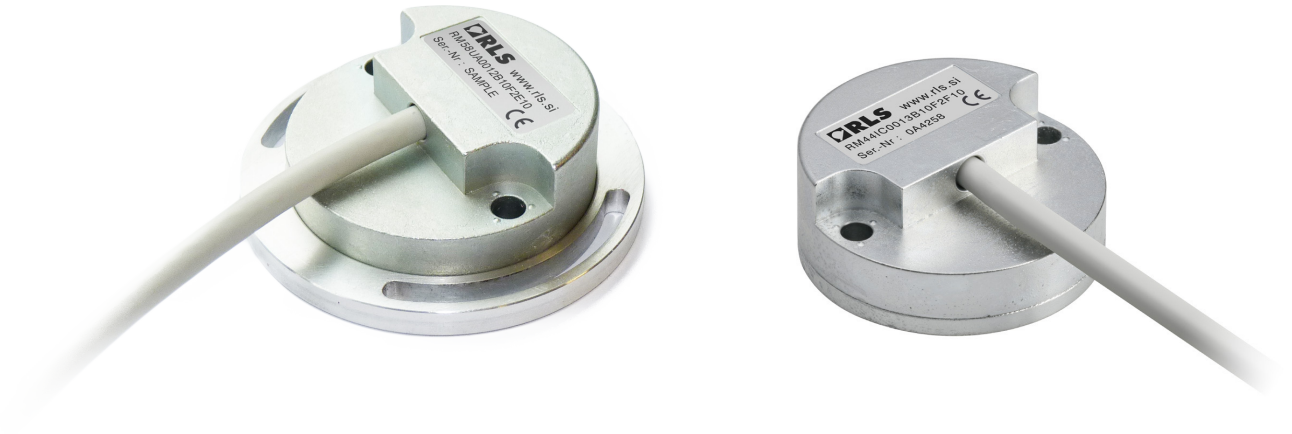
Data sheet
RM44D01_11
Issue 11, 15th October 2018

RM44 and RM58 rotary magnetic encoders



The RM44/RM58 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 8,192 counts per revolution incremental for 5 V or 24 V power supply.

With the provided magnet a system accuracy of ±0.5° is achievable. A range of magnetic actuators for easy integration onto or into the shaft is also offered for easy system integration.

Product range

RM44/RM58AC
Analogue with a single sine/cosine cycle 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.

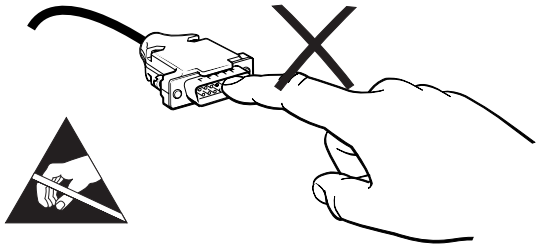
RM44/RM58SC
Synchro serial interface (SSI) with 320 to 8,192 positions per revolution.

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.

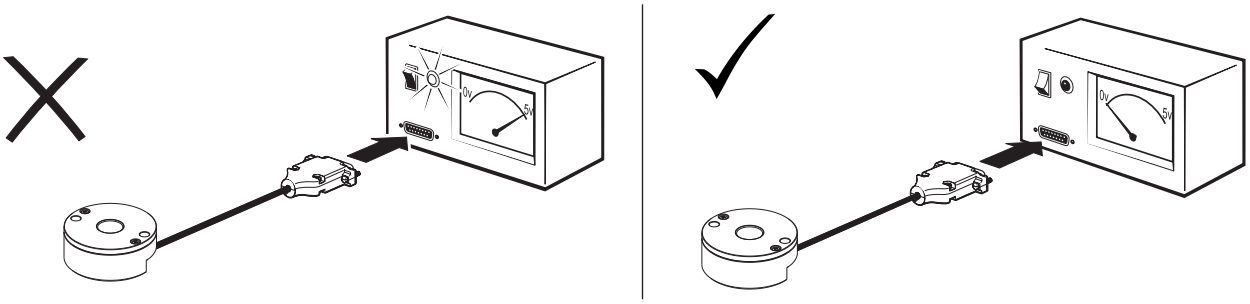
- **Easy to install – with self locating design**
- **Low cost for OEM integration**
- **Fully sealed to IP68**
- **High reliability from proven non-contact sensing technology**
- **CE compliant, including RoHS - see Declaration of conformity**

Storage and handling

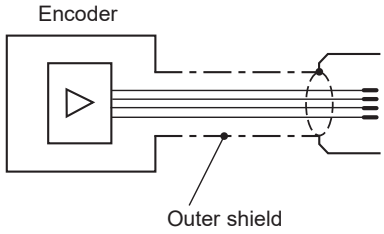


IMPORTANT: Power to RM44 encoders must be supplied from a DC SELV supply complying with the essential requirements of EN (IEC) 60950 or similar specification.

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



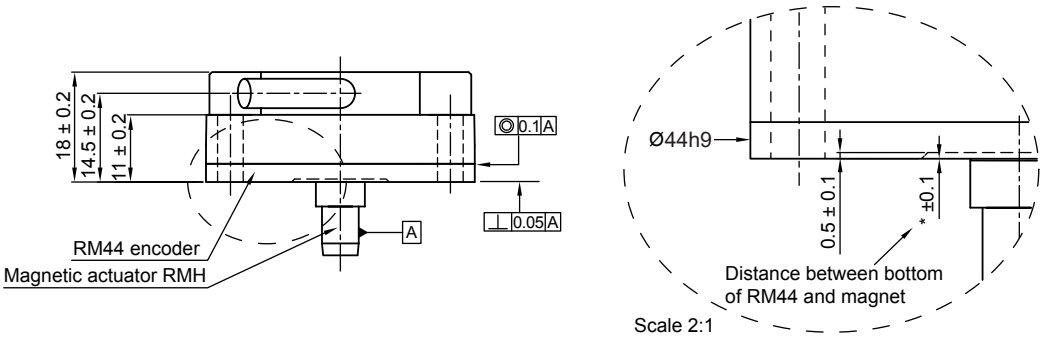
RM44/RM58AC		RM44/RM58I		RM44/RM58SC		RM44/RM58SI		RM44/RM58Vx	
Function	**Wire colour**	**Function**	**Wire colour**	**Function**	**Wire colour**	**Function**	**Wire colour**	**Function**	**Wire colour**
Shield - see connection diagram		Shield - see connection diagram		Shield - see connection diagram					
V_{dd}	Red	V_{dd}	Red	V_{dd}	Red	V_{dd}	Red	V_{dd}	Red
GND	Orange	GND	Blue	GND	Blue	GND	Blue	GND	Orange
V_A	Black	A+	Grey	Clock+	White	A+	Grey	V_{out}	Black
V_B	Brown	B+	Green	Data+	Green	B+	Green		
		Z+	White	Clock–	Brown	Z+	White		
		A–	Pink	Data–	Yellow	A–	Pink		
		B–	Yellow			B–	Yellow		
		Z–	Brown			Z–	Brown		
						Clock+	Black		
						Data+	Grey/Pink		
						Clock–	Violet		
						Data–	Red/Blue		

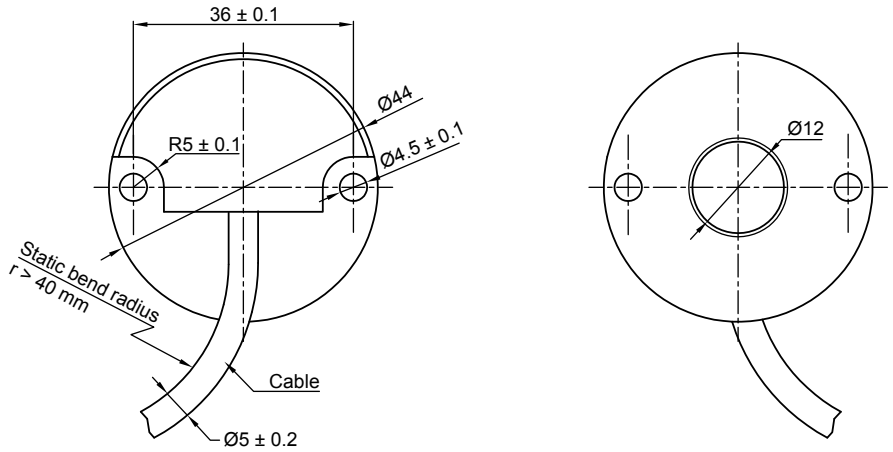
Operating and electrical specifications

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

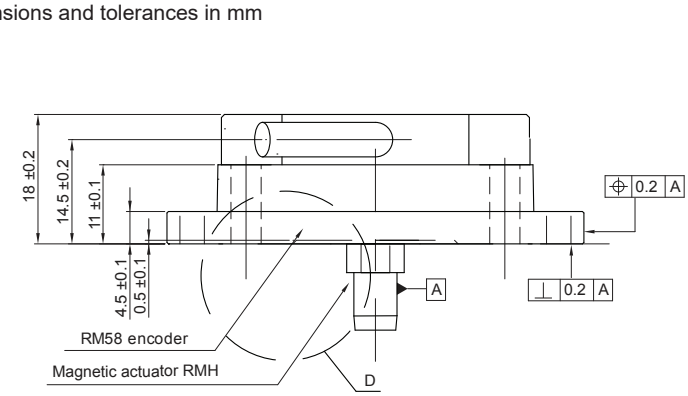
Dimensions and tolerances in mm

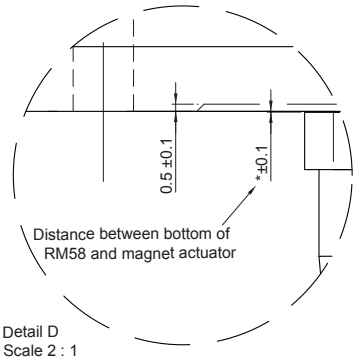


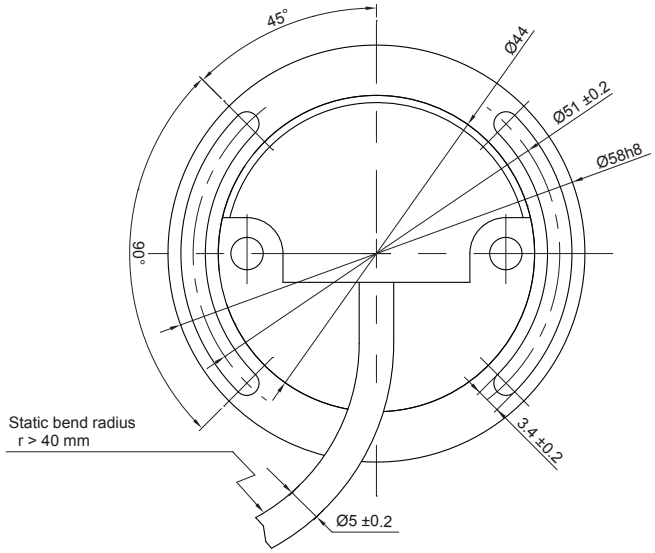


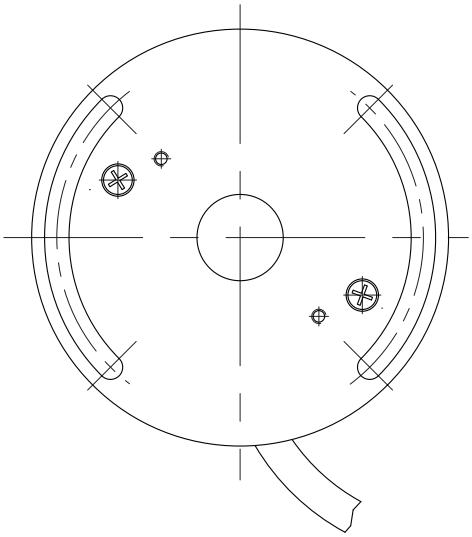
RM58 dimensions

Dimensions and tolerances in mm



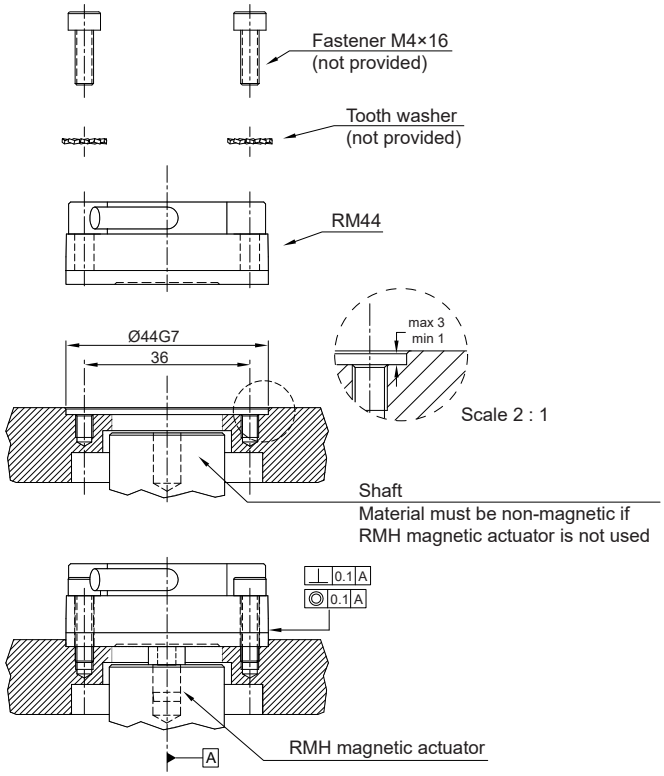


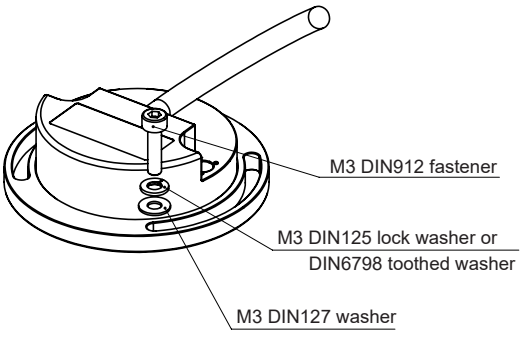




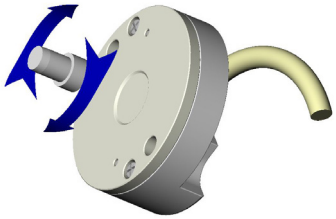
RM44 / RM58 installation drawing

Dimensions and tolerances in mm





Clockwise (CW) rotation of magnetic actuator



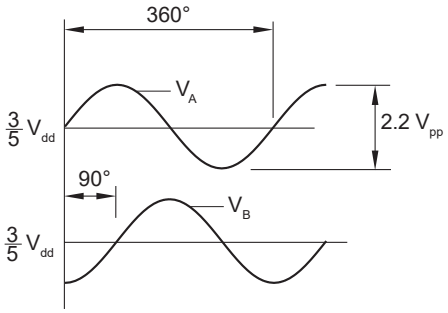
Output specifications – 5 V supply

RM44 / RM58AC – Analogue sinusoidal outputs

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

Power supply	V_{dd} = 5 V ±5 %	
Power consumption	13 mA	
Outputs	Signal amplitude Signal offset	1.1 ±0.2 V_{pp} $\frac{3}{5}$ V_{dd} ±5 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



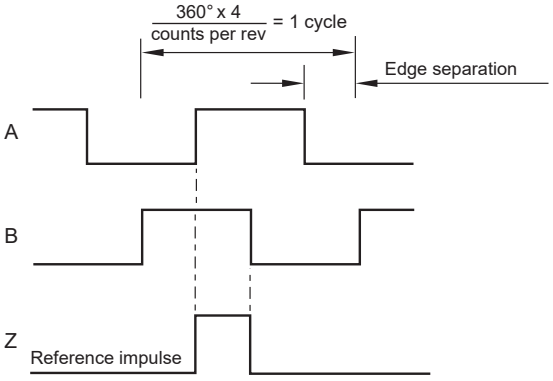
V_A leads V_B by 90° for clockwise rotation of magnetic actuator.

RM44 / RM58IE – Incremental, open collector

Low cost alternative for ball bearing encoders

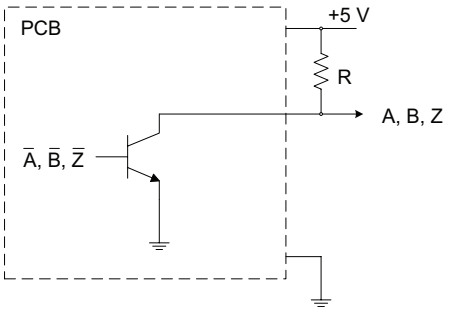
Power supply	V_{dd} = 5 V ±5 %
Power consumption	35 mA (not loaded)
Output signals	A, B, Z
Maximum output load	20 mA
Accuracy	Typ. ±0.5°
Hysteresis	0.18°
Resolution	80 to 2,048 pulses per revolution (320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 counts per revolution)
Maximum 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



B leads A for clockwise rotation of magnetic actuator.

Recommended signal termination



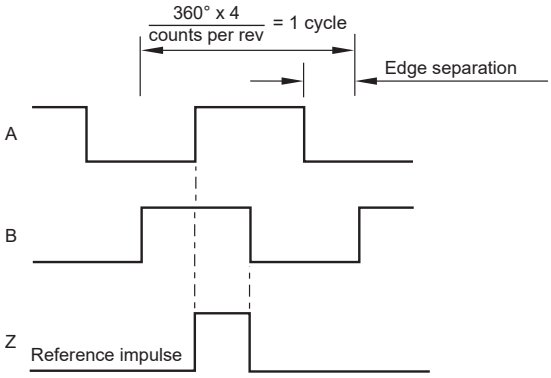
RM44 / RM58IC – Incremental, RS422

Square wave differential line driver to RS422

Power supply	V_{dd} = 5 V ±5 %
Power consumption	Max. 35 mA
Output signals	A, B, Z, A–, B–, Z– (RS422)
Accuracy	Typ. ±0.5°
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)

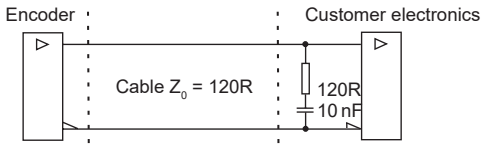
Timing diagram

Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

Recommended signal termination

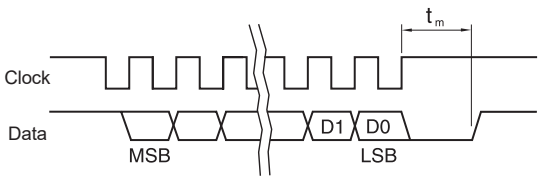


RM44 / RM58SC – Absolute binary synchro-serial interface (SSI)

Serial encoded absolute position measurement

Output code	Natural binary
Power supply	V_{dd} = 5 V ±5 %
Power consumption	Max. 35 mA
Data output	Serial data (RS422)
Data input	Clock (RS422)
Accuracy	Typ. ±0.5°
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 °C (IP64) –40 °C to +85 °C (IP68)

Timing diagram

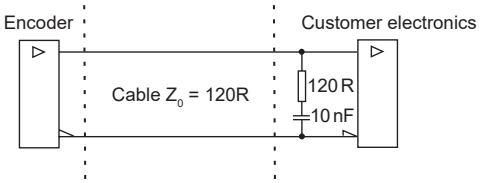


Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20.5 µs

Position increases for clockwise rotation of magnetic actuator.

Recommended signal termination

For data output lines only



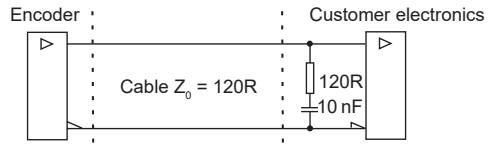
RM44 / RM58SI – Absolute binary synchro-serial (SSI) + Incremental, RS422

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.

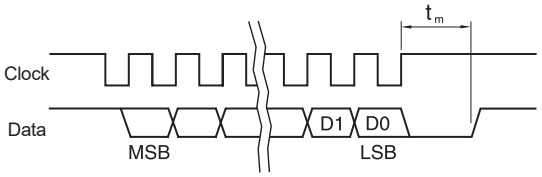
Output code	Natural binary
Power supply	V_{dd} = 5 V ±5 %
Power consumption	Max. 35 mA
Incremental outputs	A, B, Z, A–, B–, Z– (RS422)
Data output	Serial data (RS422)
Data input	Clock (RS422)
Accuracy	Typ. ±0.5°
Hysteresis	0.18°
Resolution	80 to 2,048 pulses per revolution (320, 400, 500, 512, 800, 1,000, 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)

Recommended signal termination

For incremental signals + SSI data output lines only



Timing diagram - SSI

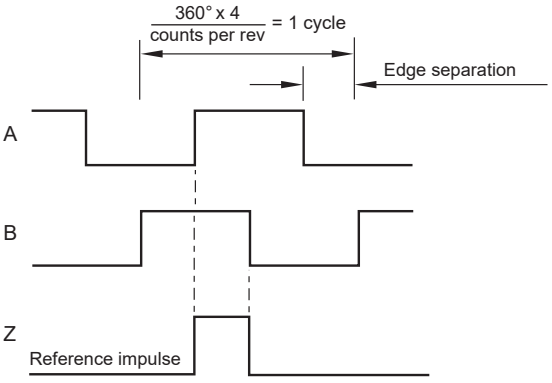


Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20.5 µs

Position increases for clockwise rotation of magnetic actuator.

Timing diagram - Incremental

Complementary signals not shown



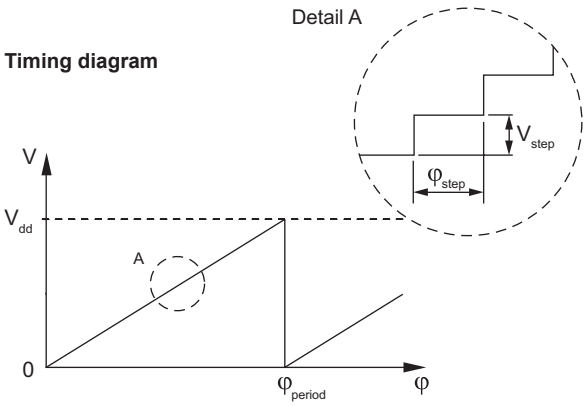
B leads A for clockwise rotation of magnetic actuator.

RM44 / RM58Vx – Linear voltage output

Alternative for potentiometers

Power supply	V_{dd} = 5 V ± 5 %
Power 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)

Timing diagram



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°

$$\varphi_{step} = \frac{\varphi_{period}}{N_{step}} \qquad V_{step} = \frac{V_{dd}}{N_{step}}$$

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 type and electrical variant

Rotation \ φ_{period}	**360°**	**180°**	**90°**	**45°**
Clockwise	VA	VB	VC	VD
Counterclockwise	VE	VF	VG	VH

Output specifications - 24 V supply

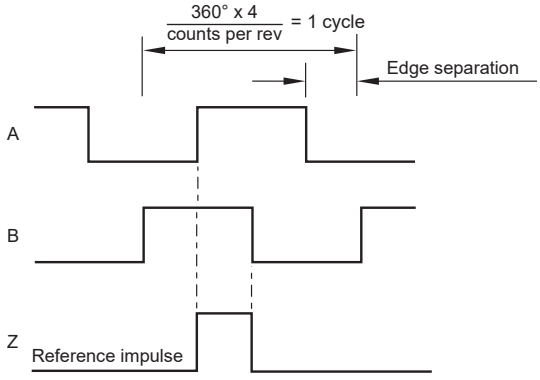
RM44 / RM58IA – Incremental, push-pull

Square wave output

Power supply	V_{dd} = 8 V to 26 V
Power consumption	50 mA
Output signals	A, B, Z, A–, B–, Z– (RS422)
Maximum output load	30 mA
Accuracy	Typ. ±0.5°
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.

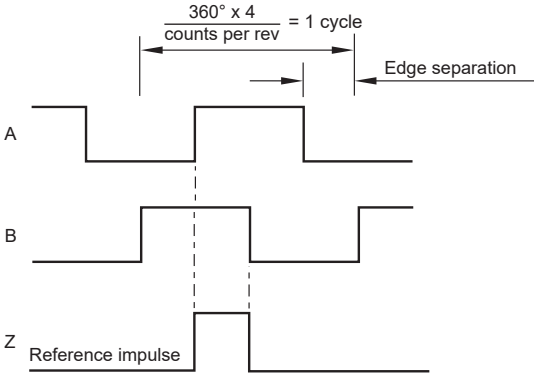
RM44 / RM58IG – Incremental, push-pull

Square wave output

Power supply	V_{dd} = 8 V to 26 V
Power consumption	50 mA
Output signals	A, B, Z, A–, B–, Z– (5 V RS422)
Maximum output load	30 mA
Accuracy	Typ. ±0.5°
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



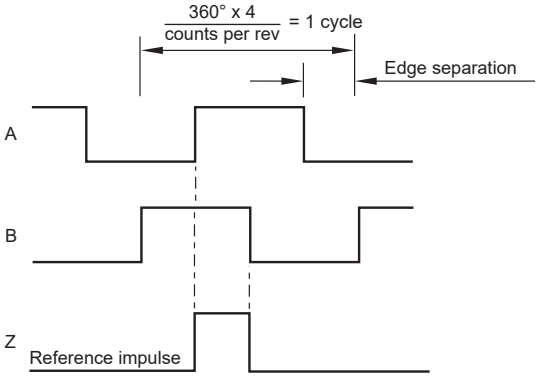
B leads A for clockwise rotation of magnetic actuator.

RM44 / RM58IB – Incremental, open collector NPN

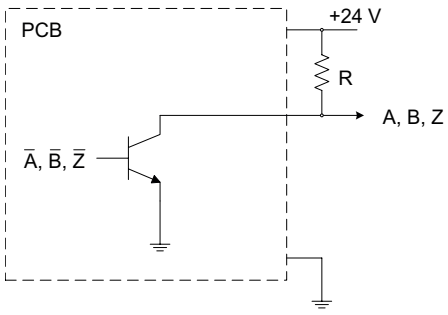
Square wave output

Power supply	V_{dd} = 8 V to 26 V
Power consumption	50 mA
Output signals	A, B, Z
Maximum output load	20 mA
Accuracy	Typ. ±0.5°
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



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**

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
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

Resolution
For **AC:**
01S - One sine/cosine period per revolution
For **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

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

Connector options
F - Flying lead (no connector)

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

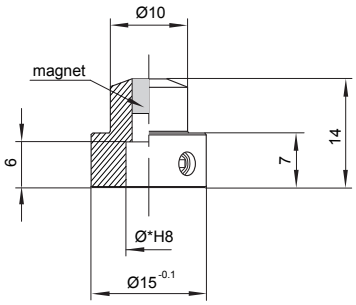
Environment and material
E - IP64, die-cast body (Zinc alloy), standard EMC grade (standard)
F - IP68, die-cast body (Zinc alloy), standard EMC grade

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

NOTE: Not all combinations are valid.

Magnetic actuators and magnets ordering information

Actuator for integration onto shaft



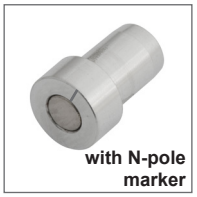
Shaft = Ø*h7
Fixing: Grub screw provided

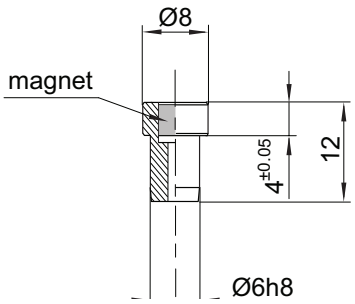
Part numbers:

For resolutions up to 9 bit absolute (512 cpr incremental)
RMA04A2A00 – Ø4 mm shaft **RMA10A2A00** – Ø10 mm shaft
RMA05A2A00 – Ø5 mm shaft **RMA19A2A00** – Ø3/16" shaft
RMA06A2A00 – Ø6 mm shaft **RMA25A2A00** – Ø1/4" shaft
RMA08A2A00 – Ø8 mm shaft **RMA37A2A00** – Ø3/8" shaft

For resolutions from 10 bit absolute (800 cpr incremental) and above
RMA04A3A00 – Ø4 mm shaft **RMA10A3A00** – Ø10 mm shaft
RMA05A3A00 – Ø5 mm shaft **RMA19A3A00** – Ø3/16" shaft
RMA06A3A00 – Ø6 mm shaft **RMA25A3A00** – Ø1/4" shaft
RMA08A3A00 – Ø8 mm shaft **RMA37A3A00** – Ø3/8" shaft

Actuator for integration into shaft





Hole = Ø6G7
Fixing: Glue (recommended – LOCTITE 648 or LOCTITE 2701)

Part numbers:

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

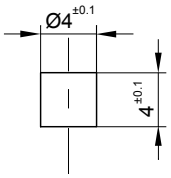
For resolutions from 10 bit absolute (800 cpr incremental) and above
RMH06A3A00

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

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.

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Document issues

Issue	Date	Page	Amendments done
5	14. 8. 2015	2	Storage and handling added
		3	Installation drawing tolerance amended
		4–9	New resolution options added to outputs **IB** and **IE**, **IG** output added, option **18** removed
		10	Loctite information updated
6	2. 11. 2015	3	Dimension picture updated
7	20. 1. 2016	2	Descriptions for RM44SC and RM44SI corrected
		5	Power consumpiton for IC and SC /7 and 8 bit) deleted
		9	Environment and material E and F description updated
8	23. 3. 2016	2, 7, 10	Ux output added
9	1. 12. 2016	4, 5, 6, 9, 10	Maximum speed amended
10	5. 7. 2018	General	RM58 added
		4 - 6, 8, 9	Resolution amended
11	15. 10. 2018	3, 4	RM58 installation drawing added, RM44 dimensions amended