Data sheet
RM44D01_15
Issue 15, 14th February 2022

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 ±0.5° 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.

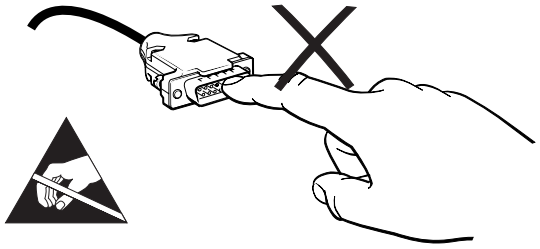
RM44/RM58SC
Synchro serial interface (SSI) with 320 to 8,192 positions per revolution.

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.

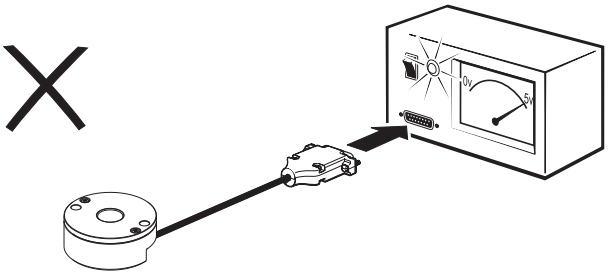
- **Easy to install – with self locating design**
- **Inexpensive solution for OEM integration**
- **Fully sealed to IP68**
- **High reliability from proven non-contact sensing technology**
- **CE compliant, including RoHS - see Declaration of conformity**

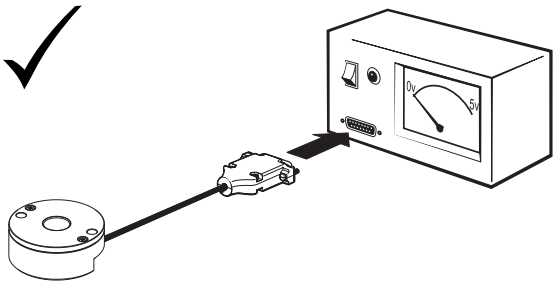
Storage and handling



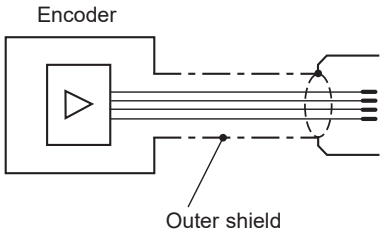
IMPORTANT: Power to RM44 encoders must be supplied from a DC SELV supply complying with the essential requirements of EN (IEC) 60950 or similar specification.

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



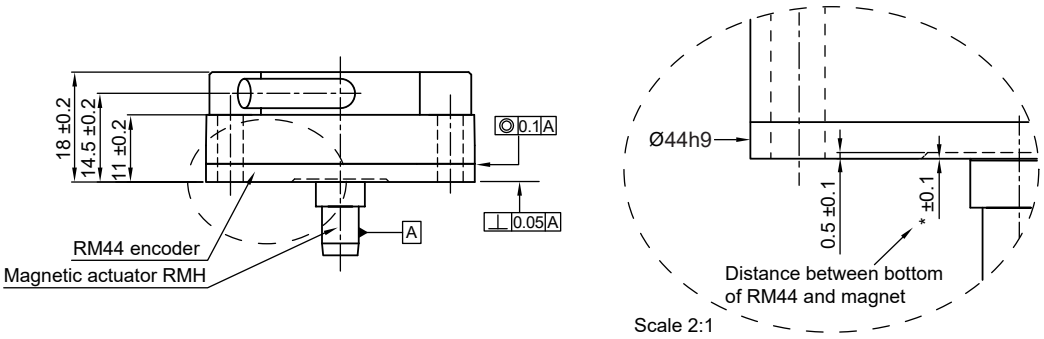
	RM44/RM58AC		RM44/RM58DC		RM44/RM58IA, IC, IG		RM44/RM58IB, IE		RM44/RM58SC		RM44/RM58SI		RM44/RM58Vx	
Pin Nr.	**Function**	**Wire colour**	**Function**	**Wire colour**	**Function**	**Wire colour**	**Function**	**Wire colour**	**Function**	**Wire colour**	**Function**	**Wire colour**	**Function**	**Wire 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		

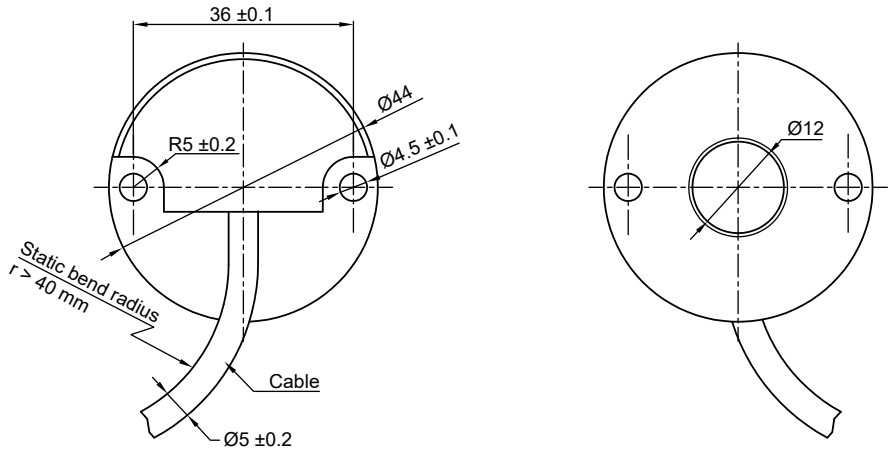
Operating and electrical specifications

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

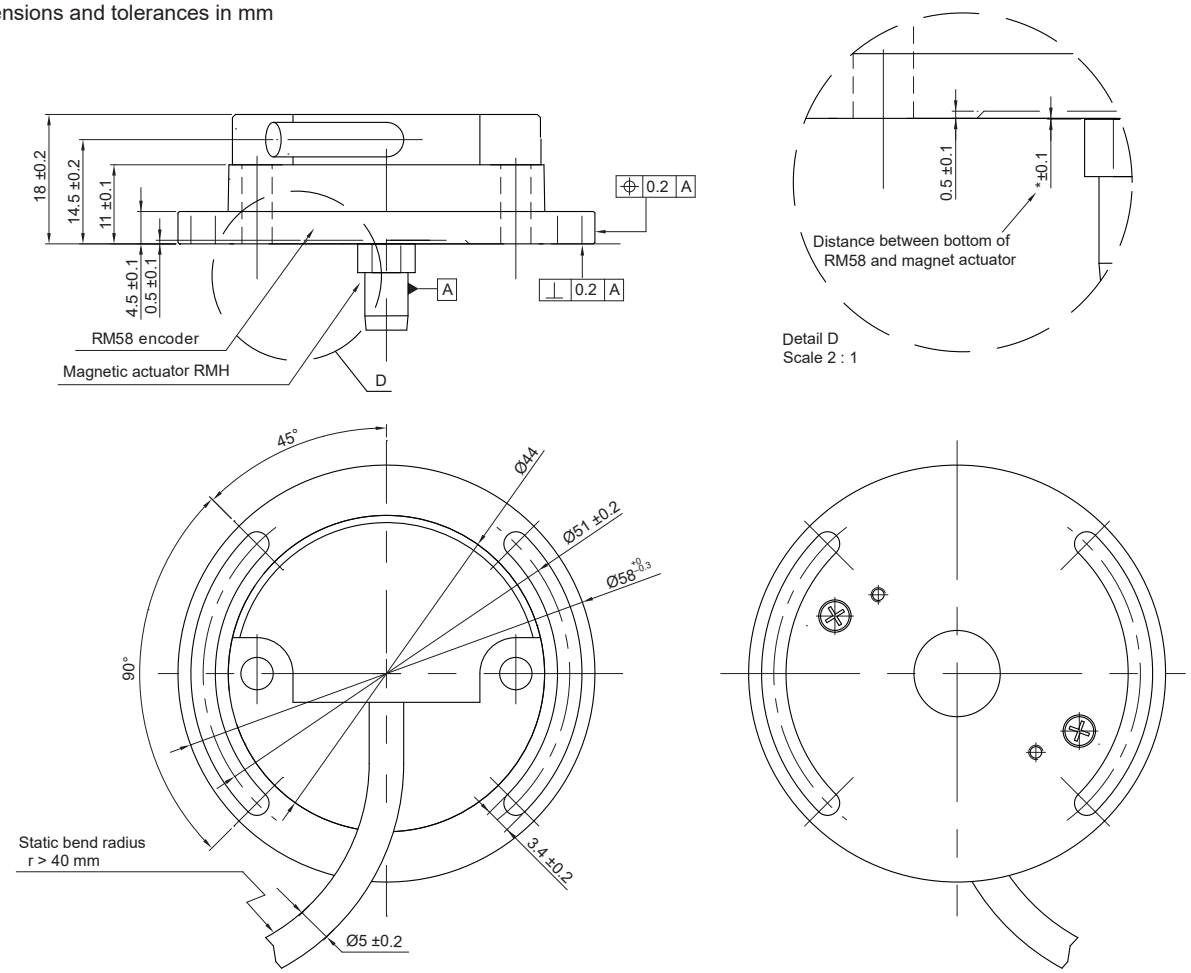
Dimensions and tolerances in mm





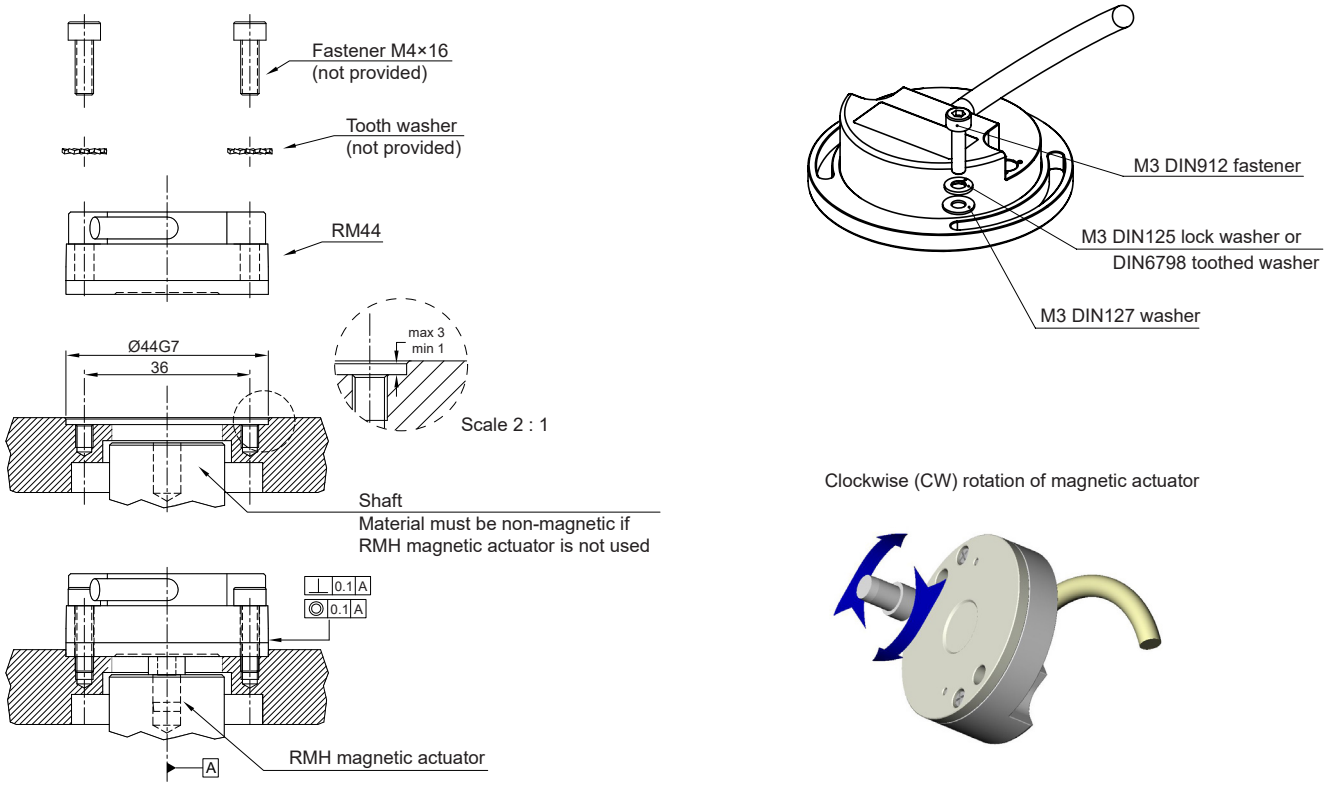
RM58 dimensions

Dimensions and tolerances in mm



RM44 installation drawing

Dimensions and tolerances in mm



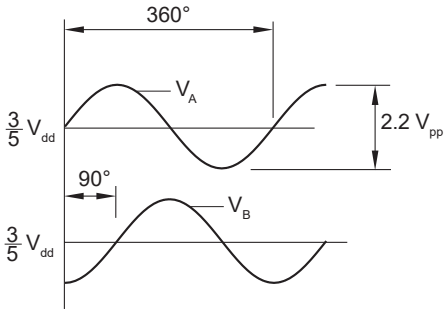
Output specifications – 5 V supply

RM44 / RM58AC – Analogue sinusoidal outputs

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

Power supply	V_{dd} = 5 V ±5 %
Current consumption	13 mA
Outputs	Signal amplitude 2.2 ±0.2 V_{pp} Signal offset $\frac{3}{5} V_{dd}$ ±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



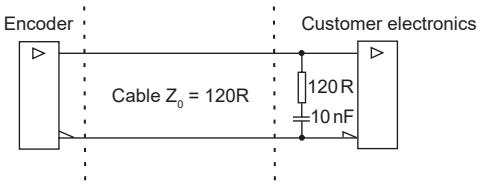
V_A leads V_B by 90° for clockwise rotation of magnetic actuator.

RM44 / RM58DC – Absolute natural binary BiSS-C interface

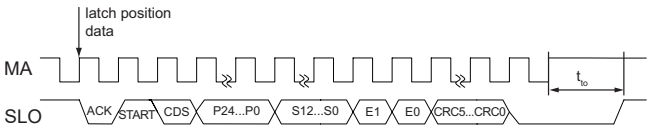
Output code	Natural binary
Power supply	V_{dd} = 5 V ±5 %
Current consumption	Max. 50 mA
Clock input	MA (RS422)
Data output	SLO (RS422)
Accuracy	Typ. ±0.5°
Hysteresis	0.18°
Resolution	320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 positions per revolution
Maximum speed	30,000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

Recommended signal termination

For data output lines only



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

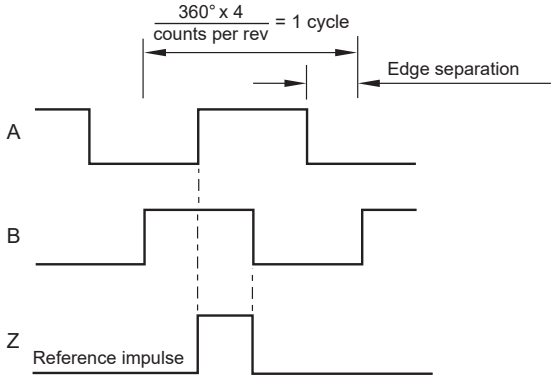
For more information on BiSS-C protocol please visit www.biss-interface.com.

RM44 / RM58IE – Incremental, open collector

Low cost alternative for ball bearing encoders

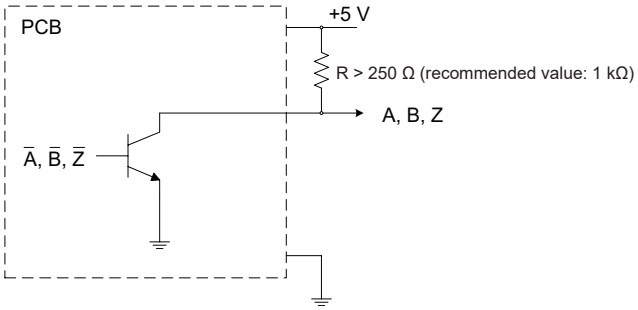
Power supply	V_{dd} = 5 V ±5 %
Current consumption	35 mA (not loaded)
Output signals	A, B, Z
Maximum output load	20 mA
Accuracy	Typ. ±0.5°
Hysteresis	0.18°
Resolution	80 to 2,048 pulses per revolution (320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 counts per revolution)
Maximum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



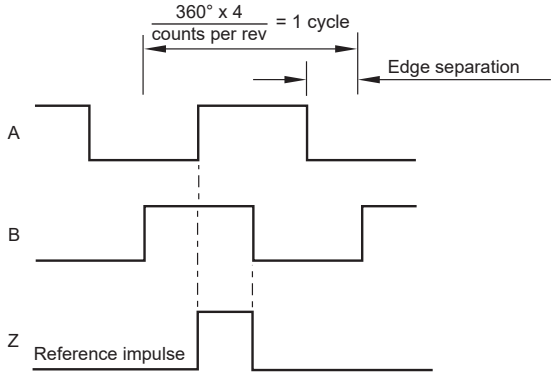
RM44 / RM58IC – Incremental, RS422

Square wave differential line driver to RS422

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

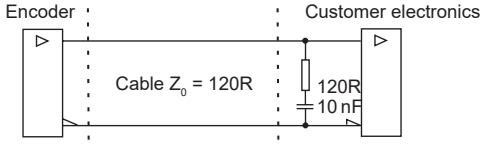
Timing diagram

Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

Recommended signal termination

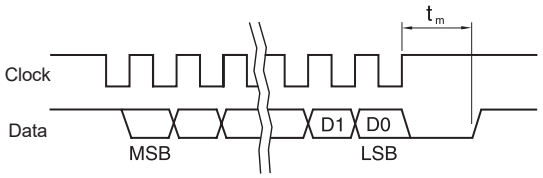


RM44 / RM58SC – Absolute binary synchro-serial interface (SSI)

Serial encoded absolute position measurement

Output code	Natural binary
Power supply	V_{dd} = 5 V ±5 %
Current 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

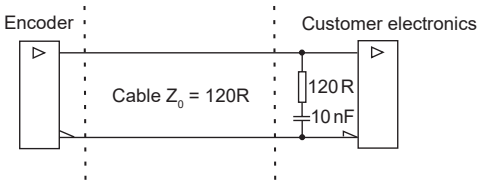


Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20.5 µs

Position increases for clockwise rotation of magnetic actuator.

Recommended signal termination

For data output lines only



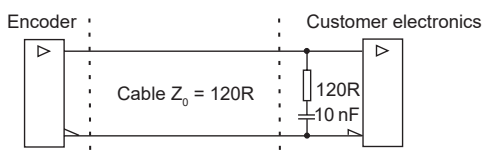
RM44 / RM58SI – Absolute binary synchro-serial (SSI) + Incremental, RS422

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.

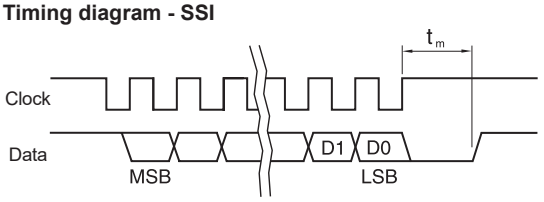
Output code	Natural binary
Power supply	V_{dd} = 5 V ±5 %
Current consumption	Max. 35 mA
Incremental outputs	A, B, Z, A–, B–, Z– (RS422)
Data output	Serial data (RS422)
Data input	Clock (RS422)
Accuracy	Typ. ±0.5°
Hysteresis	0.18°
Resolution	80 to 2,048 pulses per revolution (320, 400, 500, 512, 800,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

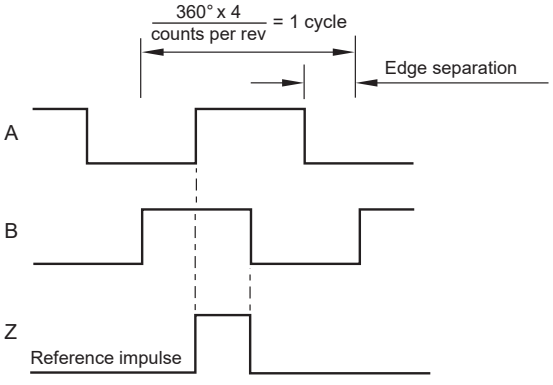


Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20.5 µs

Position increases for clockwise rotation of magnetic actuator.

Timing diagram - Incremental

Complementary signals not shown



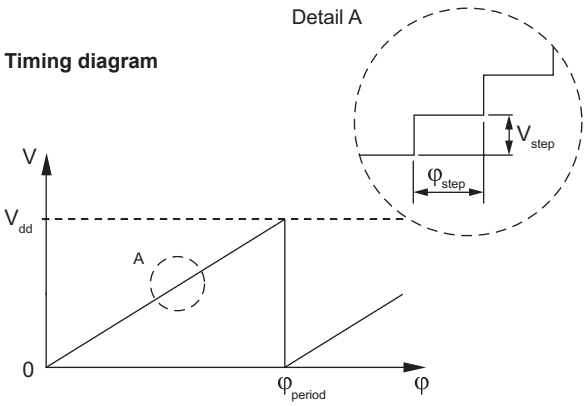
B leads A for clockwise rotation of magnetic actuator.

RM44 / RM58Vx – Linear voltage output

Alternative for potentiometers

Power supply	V_{dd} = 5 V ± 5 %
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)

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

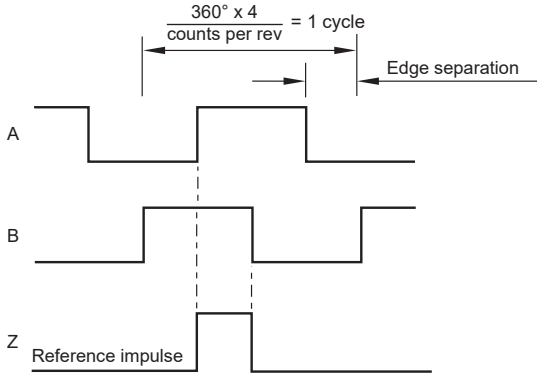
RM44 / RM58IA – Incremental, push-pull

Square wave output

Power supply	V_{dd} = 8 V to 26 V
Current 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.

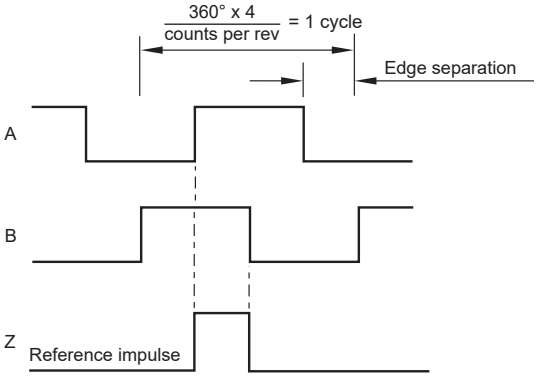
RM44 / RM58IG – Incremental, push-pull

Square wave output

Power supply	V_{dd} = 8 V to 26 V
Current 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



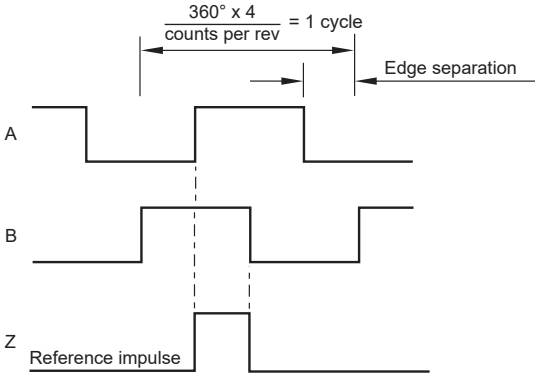
B leads A for clockwise rotation of magnetic actuator.

RM44 / RM58IB – Incremental, open collector NPN

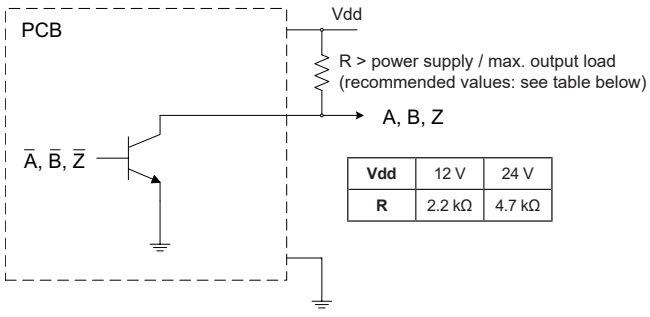
Square wave output

Power supply	V_{dd} = 8 V to 26 V
Current 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



Vdd	12 V	24 V
R	2.2 kΩ	4.7 kΩ

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
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

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

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

Connector options
A - 'D' type connector - 9 way
B - 'D' type connector - 15 way (for output type SI only)
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

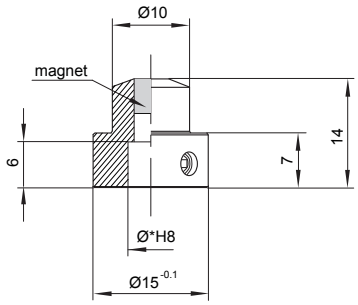
Special requirements
10 - No special requirements (standard)
1M - Cable length in meters

NOTE: Not all combinations are valid.

Magnetic actuators and magnets ordering information

Dimensions and tolerances in mm

Actuator for integration onto shaft



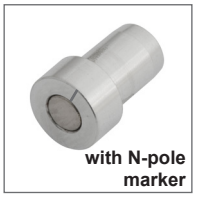
Shaft = Ø*h7
Fixing: Grub screw provided

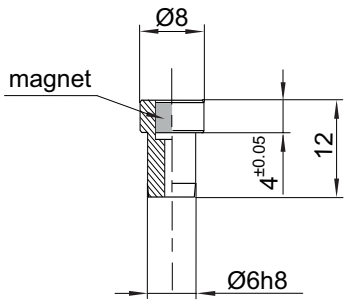
Part numbers:

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

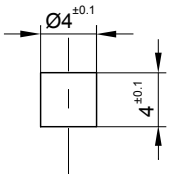
For resolutions from 10 bit absolute (800 cpr incremental) and above
RMH06A3A00

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.

Head office

RLS merilna tehnika d.o.o.
Poslovna cona Žeje pri Komendi
Pod vrbami 2
SI-1218 Komenda
Slovenia

T +386 1 5272100
F +386 1 5272129
E mail@rls.si
www.rls.si

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