RM44 and RM58

Rotary Magnetic Encoders with AM4096

EASY INSTALLATION

IP68 DESIGN

WIDE INSTALLATION TOLERANCES

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.

Features and benefits

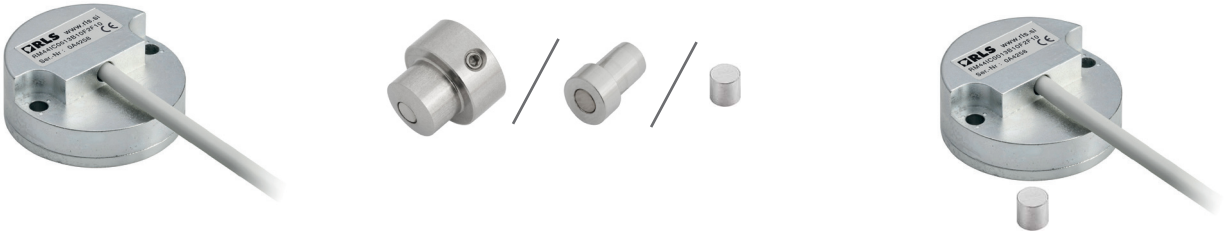
- Industry standard output formats
- Up to 12 bit resolution
- Up to 4,096 counts per revolution for 5 V or 24 V incremental power supply
- Accuracy up to ±0.5°
- Easy to install with self locating design
- Excellent price-performance ratio
- Fully sealed to IP68

MOTOR CONTROL | PRINTING | ASSEMBLY LINES | OFF-ROAD VEHICLES | INDUSTRIAL AUTOMATION

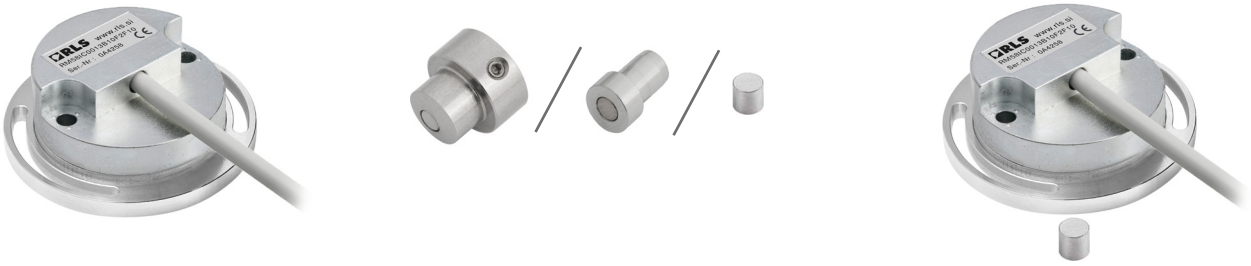
General information

The encoder system consists of a magnet/magnetic actuator* and a separate encoder body. The rotation of the magnetic actuator is read and processed by a custom encoder chip in the encoder body to obtain the required output format. A system accuracy of ±0.5° can be achieved with the supplied magnet. For easy integration onto or into the shaft, a range of magnetic actuators is also available. The output signals are provided in industry standard absolute, incremental, analogue sinusoidal and linear voltage formats. Available are resolutions of up to 12 bit absolute SSI and/or 4,096 counts per revolution incremental for 5 V or 24 V power supply.

RM44 + **Actuator or magnet** = **Encoder system**



RM58 + **Actuator or magnet** = **Encoder system**



* Magnetic actuator is magnet inside metal housing.
If you need a shaft encoder, please refer to the **RE58 data sheet**, which describes how RM44 can be converted into an RE58 by adding a flange.

Product range

RM44/RM58AC

Analogue with a single sine/cosine cycle per revolution.

RM44/RM58BC

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

RM44/RM58Ix

Incremental with 80 to 2,048 pulses per revolution (320 to 4,096 counts per revolution with x 4 evaluation).

RM44/RM58SC

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

RM44/RM58SI

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

Selection guide

		Power supply	
Product	**Available outputs**	**5 V**	**24 V**
RM44 / RM58	AC - Analogue sinusoidal outputs	✓	-
	BC – Analogue complementary sinusoidal outputs	✓	-
	IA - Incremental, push-pull	-	✓
	IC - Incremental, RS422	✓	-
	IE - Incremental, open collector NPN	✓	-
	SC - Absolute binary synchro-serial interface (SSI), RS422	✓	-
	SI - Absolute binary synchro-serial (SSI) + Incremental, RS422	✓	-

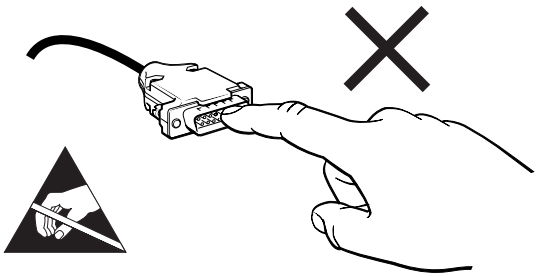
Storage and handling

Operating and storage temperature

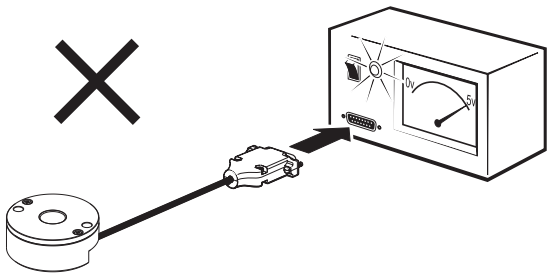
–40 °C to +125 °C (IP64)
–40 °C to +85 °C (IP68)
–30 °C to +80 °C (for AC output)

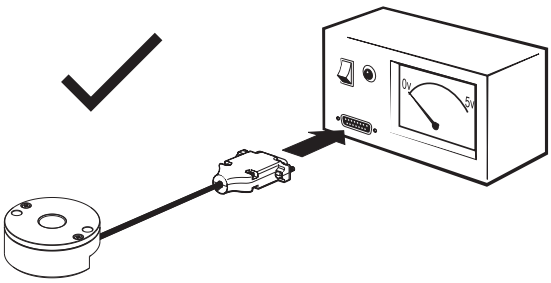
Humidity

Up to IP68



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.





Readhead is ESD sensitive - handle with care.
Do not touch electronic circuit, wires or sensor area without proper ESD protection or outside of ESD controlled environment.

Packaging

Each encoder is packed individually in an antistatic bag.

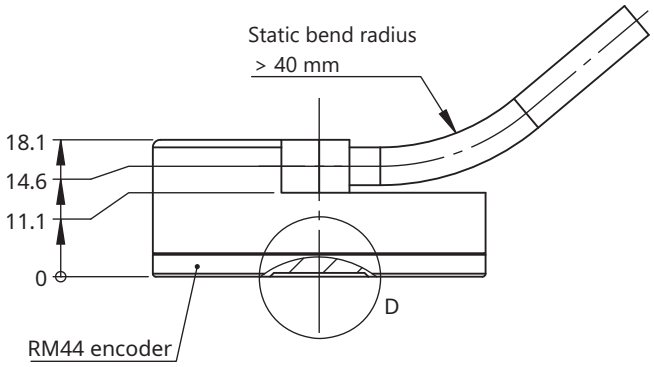
Magnet packaging:

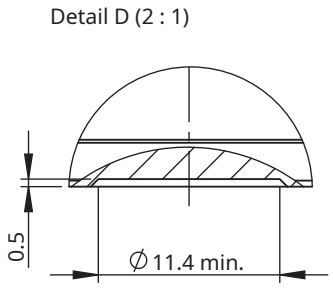
- RMM44A2A00 (individually packed) – for sample quantities only
- RMM44A2C00 (packed in tubes)
- RMM44A3A00 (individually packed) – for sample quantities only
- RMM44A3C00 (packed in tubes)

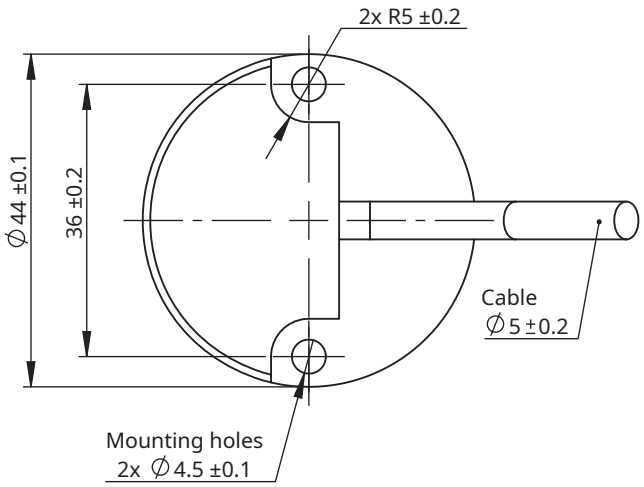
Dimension drawings

Dimensions and tolerances are in mm. Dimensions without tolerance values are in accordance with ISO 2768-m.

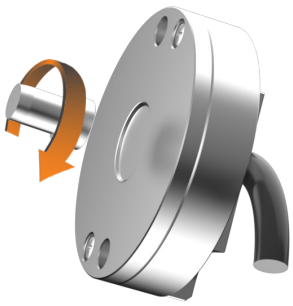
RM44



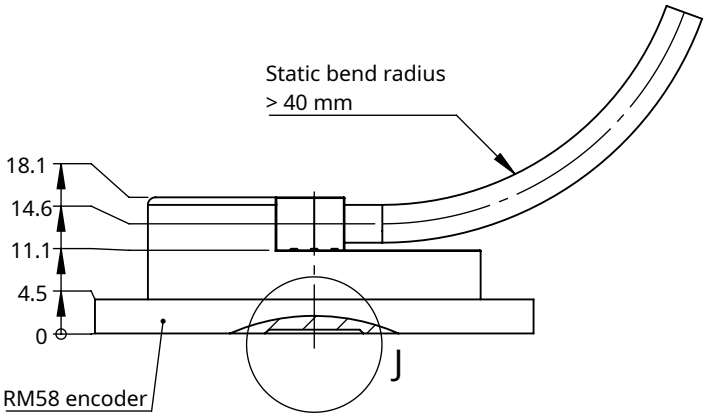


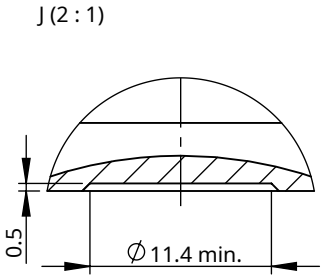


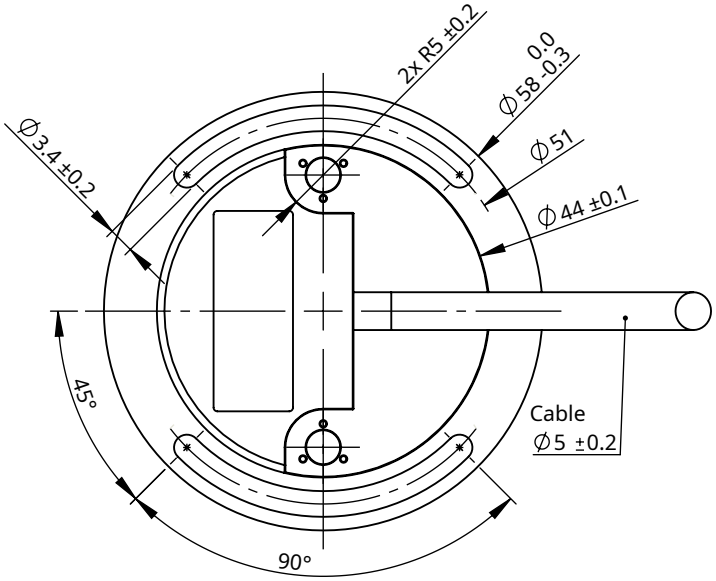
Clockwise (CW) rotation of magnetic actuator



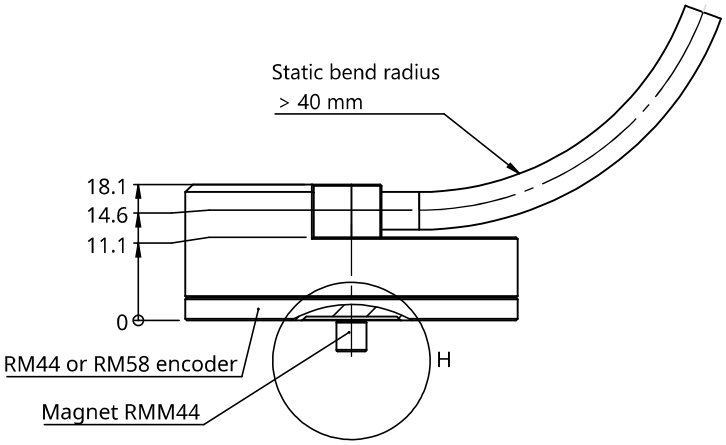
RM58

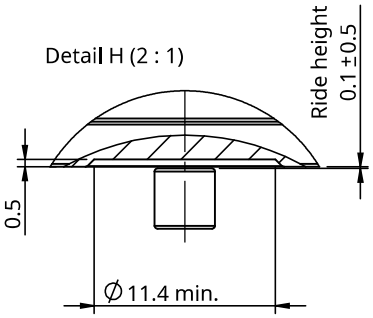

Static bend radius
> 40 mm
18.1
14.6
11.1
4.5
0
RM58 encoder
J

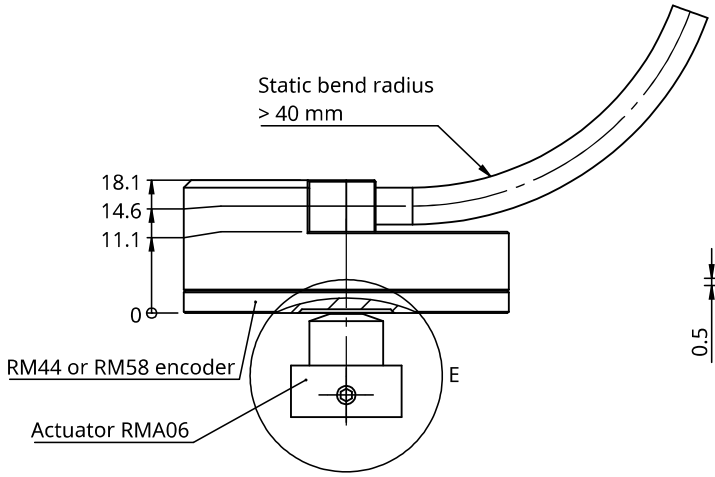

J (2 : 1)
0.5
∅11.4 min.

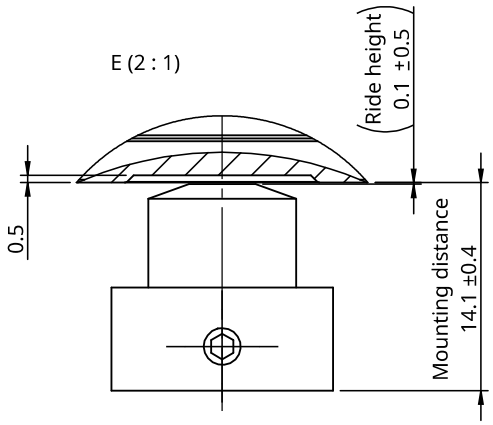

2x R5 ±0.2
∅58 0.0 -0.3
∅51
∅44 ±0.1
∅3.4±0.2
45°
90°
Cable
∅5 ±0.2

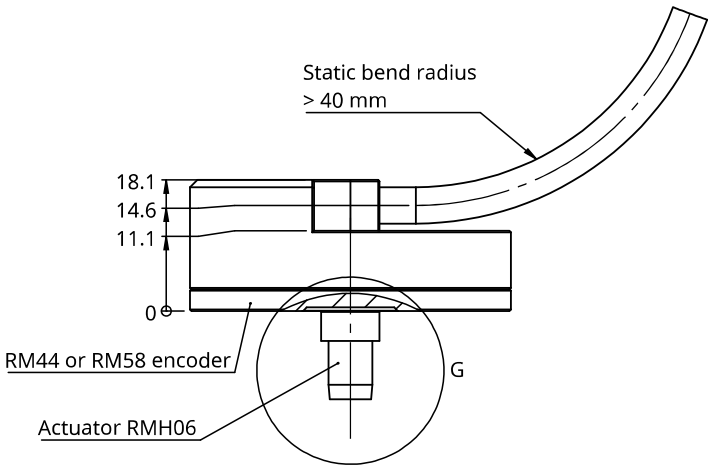
Installation drawing

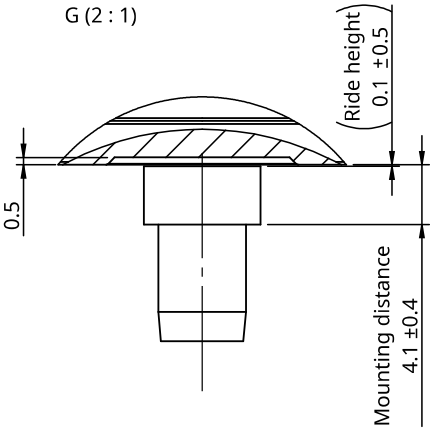








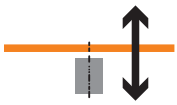
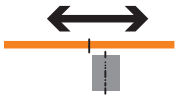
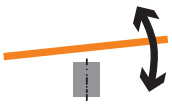




The magnet should not be in direct contact with ferrous material. When using the RMM44 magnet, the shaft must be non-ferrous.

Installation tolerances

Installation tolerances for RM44/RM58

Mounting distance	See installation drawings of encoder assemblies on **page 7.**	
Radial displacement (concentricity)	0.2 mm	
Perpendicularity	0.2°	

- Encoder - Magnet

Technical specifications

Mechanical data

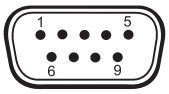
Housing material	Zamak
Cable	Outside diameter 5 mm
Mass	Encoder unit 1 m cable (no connector) IP64 112 g, IP68 129 g Magnetic actuator <2 g

Environmental data

Operating and storage temperature	–40 °C to +125 °C (IP64) –40 °C to +85 °C (IP68) –30 °C to +80 °C (for AC output)
Environmental sealing	IP64 (IP68 optional) EN 60529
EMC compliance	EN 61326
Shock	100 G (6 ms, standard EN 60068-2-27:2009)
Vibration	40 G (55 Hz–2000 Hz, standard EN 60068-2-6:2008)
Temperature drift error	0.004°/°C

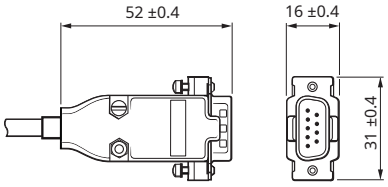
Electrical connections

9 pin D-type connector (male type)

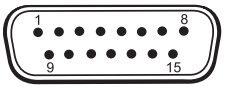


	AC		BC		IA, IC		IE		SC	
Pin Nr.	Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour
1	Shield - see connection diagram									
2	V_A	Black	V_A	Green	Z+	White	Z	White	Clock	White
3	V_B	Brown	V_B	Brown	B+	Green	B	Green	Clock–	Brown
4	NC	-	NC	-	A+	Grey	A	Grey	NC	-
5	V_{dd}	Red	V_{dd}	Red	V_{dd}	Red	V_{dd}	Red	V_{dd}	Red
6	NC	-	V_{A-}	Yellow	Z–	Brown	NC	-	Data	Green
7	NC	-	V_{B-}	White	B–	Yellow	NC	-	Data–	Yellow
8	NC	-	NC	-	A–	Pink	NC	-	NC	-
9	GND	Orange	GND	Blue	GND	Blue	GND	Blue	GND	Blue

9-way connector pin-out

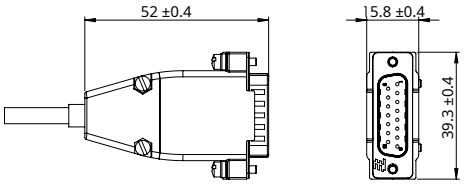


15 pin



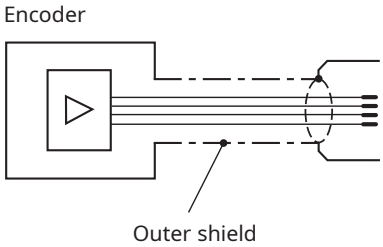
	SI	
Pin Nr.	Func-tion	Wire colour
1	Shield	
2	A+	Grey
3	A–	Pink
4	B+	Green
5	B–	Yellow
6	Z+	White
7	Z–	Brown
8	V_{dd}	Red
9	Clock+	Black
10	Clock–	Violet
11	NC	-
12	Data+	Grey/ Pink
13	Data–	Red/ Bue
14	NC	-
15	GND	Blue

15-pin connector pin-out



Shield connection

Figure below shows a recommended shield termination in order to ensure electromagnetic compatibility.



Housing of the encoder is galvanically connected with the housing of the connector via the cable outer shield. The encoder system must be correctly integrated to achieve EMC compliance. In particular, attention to shielding arrangements is essential.

Cable

Output type	IA, IC, IE, SC, BC	AC	SI
Cable specification	LI12YC12Y	LiYCY	LI12YC
Configuration	4 × 2 × 0.14 mm² (Twisted pairs)	4 x 0.20 mm²	12 x 0,14 mm²
Outer diameter		Approx. 5 mm	
Wires AWG	AWG 26	AWG 24	AWG 26
Rated Voltage	250 V	300 V	150 V
Mass	38 g/m	38 g/m	40 g/m

Output types

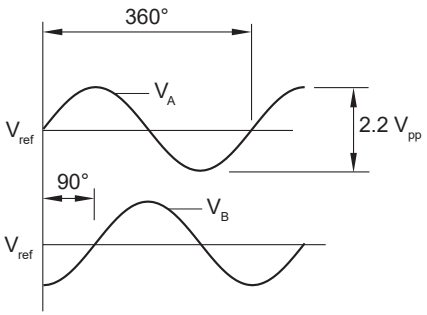
AC – Analogue sinusoidal outputs

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

Specifications

Power supply	V_{dd} = 5 V ±5 %
Current consumption	Max. 30 mA
Outputs	Single ended
Internal serial impedance	100 Ω
Signal amplitude	2.2 ±0.2 V_{pp}
Signal offset (V_{ref})	2.5 V ±1 %
Maximum speed	60,000 rpm
Operating temperature	–30 °C to +80 °C

Timing diagram



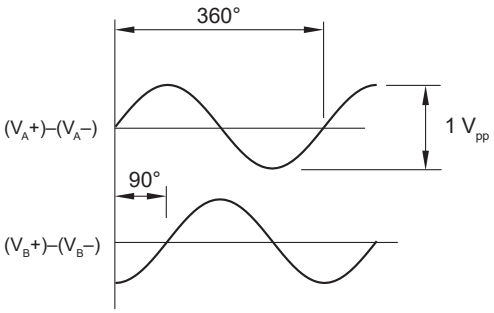
BC – Analogue complementary sinusoidal outputs

2 channels V_A and V_B differential sinusoids

Specifications

Power supply	V_{dd} = 5 V ±5 %
Current consumption	Max. 30 mA
Outputs	Differential
Internal serial impedance	10 Ω
Signal amplitude	0.5 ±0.1 V_{pp}
Signal offset (V_{ref})	0 ±5 mV
Maximum speed	30,000 rpm
Operating temperature	–40 °C to +125 °C (IP64) –40 °C to +85 °C (IP68)

Timing diagram



IA – Incremental, push-pull

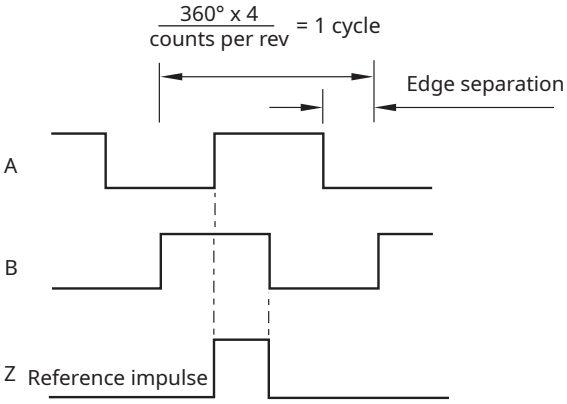
24 V supply
Square wave output

Specifications

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	8 to 1,024 pulses per revolution (32, 64, 128, 256, 512, 1024, 2048, 4096 counts per revolution)
Maximum speed	30,000 rpm
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.

IC – Incremental, RS422

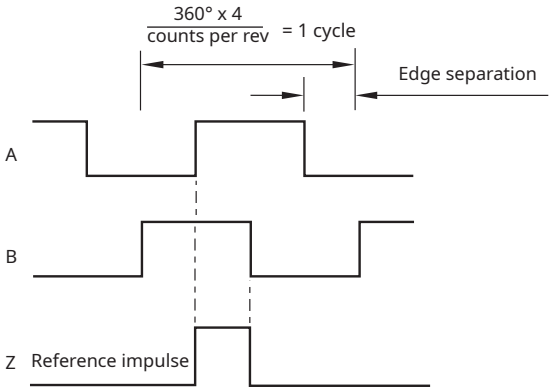
Square wave differential line driver to RS422

Specifications

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	8 to 1,024 pulses per revolution (32, 64, 128, 256, 512, 1024, 2048, 4096 counts per revolution)
Maximum speed	30,000 rpm
Operating temperature	–40 °C to +125 °C (IP64) –40 °C to +85 °C (IP68)

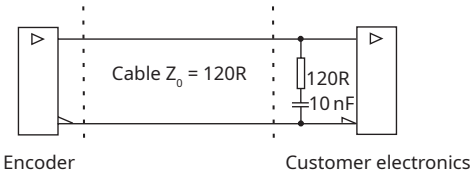
Timing diagram

Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

Recommended signal termination



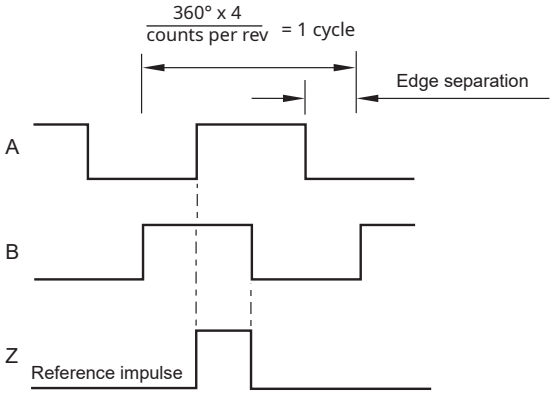
IE – Incremental, open collector, NPN

Low cost alternative for ball bearing encoders

Specifications

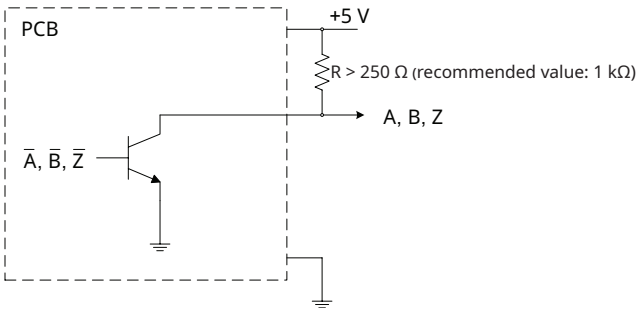
Power supply	V_{dd} = 5 V ±5 %
Current consumption	35 mA (not loaded)
Output signals	A, B, Z
Maximum output load	20 mA
Accuracy	Typ. ±0.5°
Hysteresis	0.18°
Resolution	8 to 1,024 pulses per revolution (32, 64, 128, 256, 512, 1024, 2048, 4096 counts per revolution)
Maximum speed	30,000 rpm
Operating temperature	–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



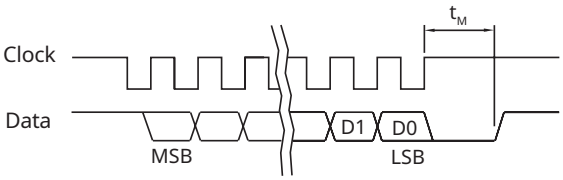
SC – Absolute binary synchro-serial interface (SSI), RS422

Serial encoded absolute position measurement

Specifications

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	32, 64, 128, 256, 512, 1024, 2048, 4096 positions per revolution
Maximum speed	30,000 rpm
Operating temperature	–40 °C to +125 °C (IP64) –40 °C to +85 °C (IP68)

Timing diagram

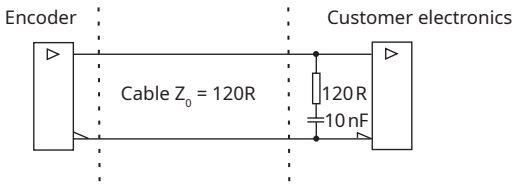


Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20.5 µs

Position increases for clockwise rotation of magnetic actuator.

Recommended signal termination

For data output lines only



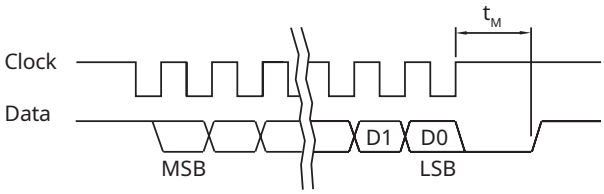
SI – Absolute binary synchro-serial (SSI) + Incremental, RS422

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.

Specifications

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	8 to 1,024 pulses per revolution (32, 64, 128, 256, 512, 1024, 2048, 4096 counts per revolution)
Maximum speed	30,000 rpm
Operating temperature	–40 °C to +125 °C (IP64) –40 °C to +85 °C (IP68)

Timing diagram - SSI

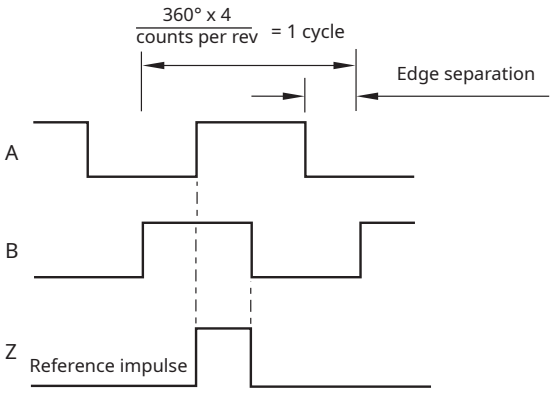


Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20.5 µs

Position increases for clockwise rotation of magnetic actuator.

Timing diagram - Incremental

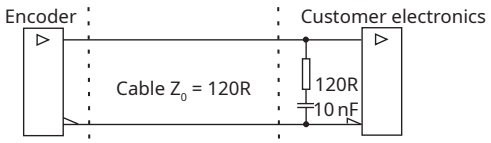
Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

Recommended signal termination

For incremental signals + SSI data output lines only



Part numbering

RM44 IC 00 12B 10 F 2 E 96

Series
RM44 - Ø44 mm body
RM58 - Ø58 mm body

Output type
AC - Absolute analogue single ended, 5 V
BC - Absolute analogue differential, 5 V
IA - Incremental, Push-pull, 8 V to 26 V
IC - Incremental, RS422, 5 V
IE - Incremental, Open Collector, NPN, 5 V
SC - Absolute binary synchro-serial (SSI), RS422, 5 V
SI - SSI + Incremental, RS422, 5 V

Shaft size
00 - N/A

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

For **Ix, Sx** output types (counts/positions per revolution):

Binary		
05B - 32	08B - 256	11B - 2048
06B - 64	09B - 512	12B - 4096
07B - 128	10B - 1024	

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

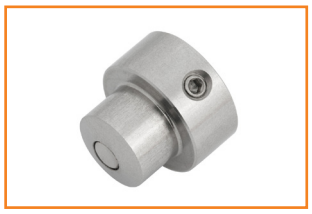
Not all part number combinations are valid. Please refer to the table of available combinations below.

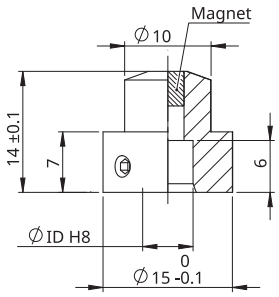
Table of available combinations

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

Magnetic actuator and magnet ordering information

Actuator for integration onto shaft





Shaft = Ø ID h7
Fixing: Grub screw provided

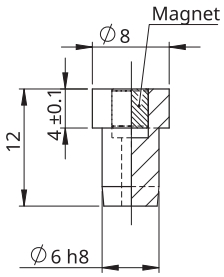
* Hole diameter for nominal shaft size.
See table on the right for more information on available shaft sizes.

Part numbers:

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

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

Actuator for integration into shaft



Part numbers:

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

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

with N-pole marker

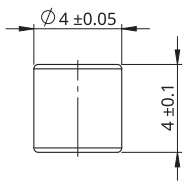
With N-pole marker scribed to a ±5° accuracy:

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: Adhesive (recommended – LOCTITE 648 or 2701)

Magnet for direct recessing in non-ferrous shafts



Fixing: Adhesive (recommended – LOCTITE 648 or 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)

If you need a shaft encoder, please refer to the **RE58 data sheet**, which describes how the RM44 can be converted into an RE58 by adding a flange.

Accessories

USB interface (for incremental encoders)
E201-9Q

USB interface (for SSI communication interface)
E201-9S

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Document issues

Issue	Date	Page	Description
1	6. 12. 2024	General	Redesign of RM44D06