

RM22 rotary magnetic encoder



The RM22 is a compact, high-speed rotary magnetic encoder designed for use in harsh environments. The non-contact two part design removes the need for seals or bearings ensuring long-term reliability and simple installation.

The encoder comprises a magnetic actuator and a separate encoder body. Rotation of the magnetic actuator is sensed by a custom encoder chip within the body, and processed to give the required output format.

The encoder chip processes the signals received to provide resolutions to 13 bit (8,192 positions per revolution) with high operational speeds. Output signals are provided in industry standard absolute, incremental, analogue or linear formats.

The compact encoder body is just 22 mm in diameter and provides dirt immunity up to IP68.

The RM22 can be used in a wide range of applications including marine, medical, print, converting, industrial automation, metal working, motor control and instrumentation.

Product range

RM22AC

Analogue with a single sine/cosine cycle per revolution

RM22BC

Complementary analogue outputs with a single sine/cosine cycle per revolution

RM22IC

Incremental with 80 to 2,048 pulses per revolution (320 to 8,192 counts per revolution with x 4 evaluation)

RM22SC

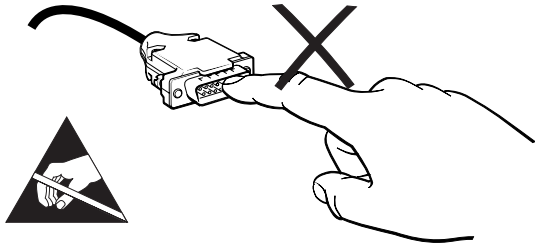
Synchro serial interface (SSI) with 320 to 8,192 positions per revolution

RM22Vx

Linear voltage output in a range of variants

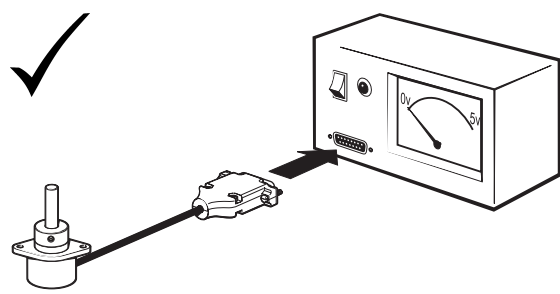
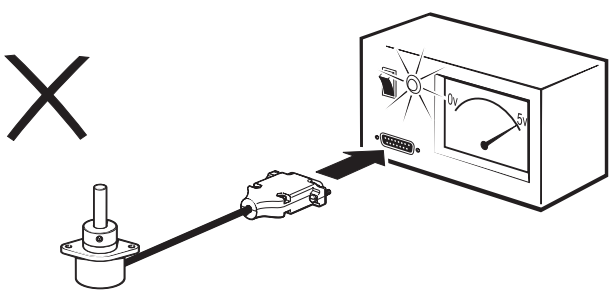
- Excellent immunity to IP68
- Non-contact, frictionless design
- High speed operation to 30,000 rpm
- Compact - 22 mm diameter body
- Absolute - to 13 bit (8,192 positions per revolution)
- Industry standard absolute, incremental, analogue and linear output formats
- Accuracy to $\pm 0.5^\circ$
- Simple installation
- RoHS compliant (lead free) - see Declaration of conformity

Storage and handling

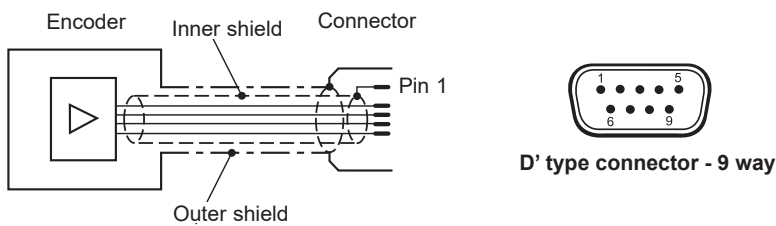


IMPORTANT: Power to RM22 encoders must be supplied from a DC SELV supply complying with the essential requirements of EN (IEC) 60950 or similar specification.

The RM22 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



Pin nr.	RM22AC		RM22BC		RM22IC		RM22SC		RM22V	
	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		Shield - see connection diagram			
2	V _A	Green	V _{A+}	Green	Z	White	Clock	White	NC	–
3	V _B	Brown	V _{B+}	Brown	B	Green	Clock–	Brown	V _{out}	Green
4	NC	–	NC	–	A	Grey	NC	–	NC	–
5	V _{dd}	Red	V _{dd}	Red	V _{dd}	Red	V _{dd}	Red	V _{dd}	Red
6	NC	–	V _{A-}	Yellow	Z–	Brown	Data	Green	NC	–
7	NC	–	V _{B-}	White	B–	Yellow	Data–	Yellow	NC	–
8	NC	–	NC	–	A–	Pink	NC	–	NC	–
9	GND	Blue	GND	Blue	GND	Blue	GND	Blue	GND	Blue

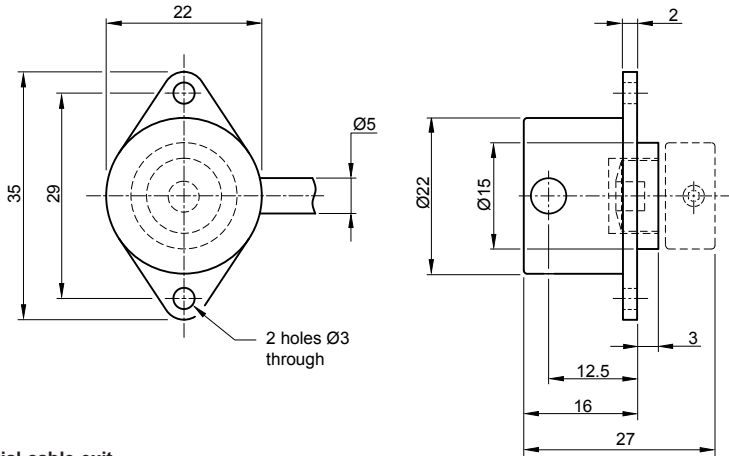
Operating and electrical specifications

EMC compliance	EN 61326
Cable	Outside diameter 5 mm
Connector options	'D' type connector - 9 way Flying lead
Mass	Encoder unit 1 m cable (no connector): 48 g; magnetic actuator: 12 g
Environmental sealing	IP64 (IP68 optional) EN 60529

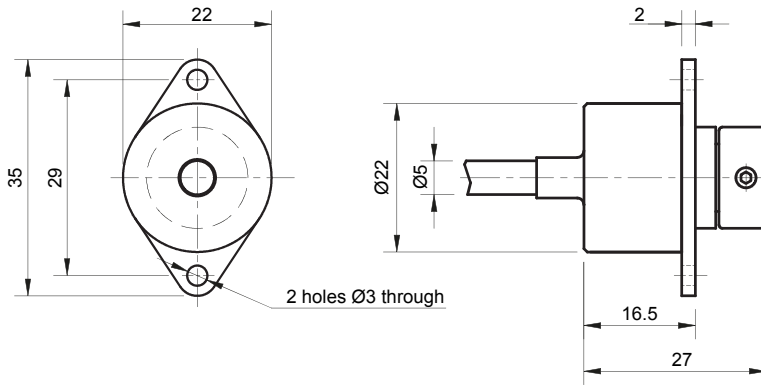
Dimensions

Dimensions and tolerances in mm

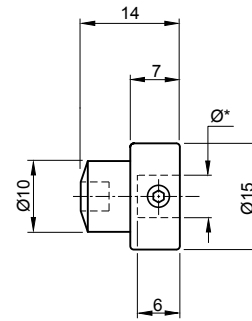
Radial cable exit



Axial cable exit



Magnetic actuator

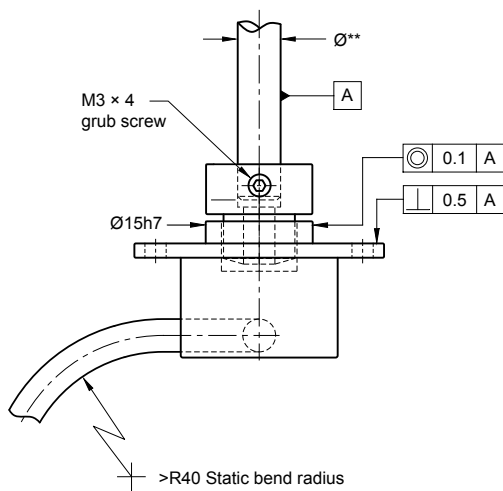


* Hole diameter for nominal shaft size.

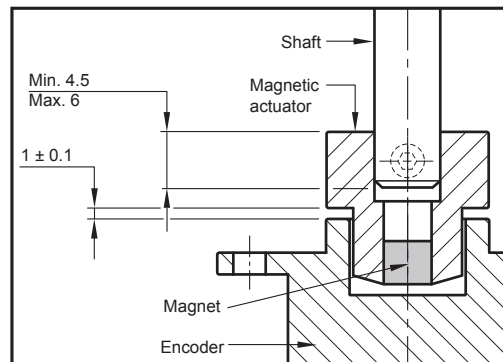


Clockwise (CW) rotation of magnetic actuator.

Installation drawing



** Nominal shaft size with tolerance h7.

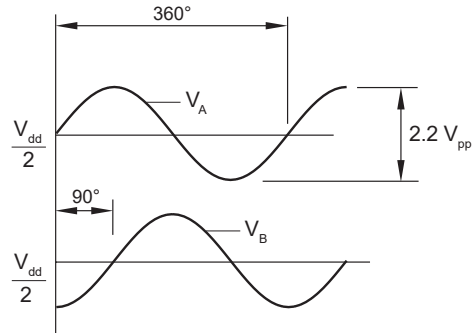


RM22AC – Analogue sinusoidal outputs

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

Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Power consumption	20 mA
Outputs	Signal amplitude $1.1 \pm 0.2 V_{pp}$ Signal offset $\frac{V_{dd}}{2} \pm 5\text{ mV}$
Internal serial impedance	720 Ω
Maximum speed	30,000 rpm
Maximum cable length	3 m
Operating temperature	-40 °C to +125 °C (IP64) -40 °C to +85 °C (IP68)

Timing diagram



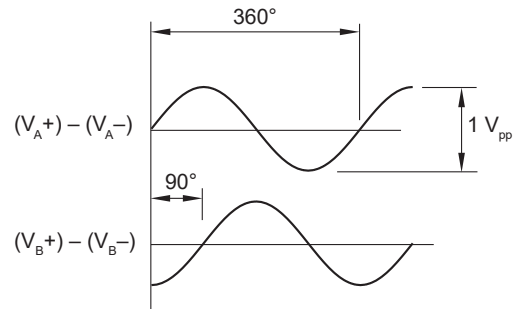
V_A leads V_B by 90° for clockwise rotation of magnetic actuator.

RM22BC – Analogue complementary sinusoidal outputs

2 channels V_A and V_B differential sinusoids in quadrature (90° phase shifted)

Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Power consumption	20 mA
Outputs	Signal amplitude $0.5 \pm 0.1 V_{pp}$ Signal offset $\frac{V_{dd}}{2} \pm 5\text{ mV}$
Internal serial impedance	100 Ω
Maximum speed	30,000 rpm
Maximum cable length	20 m
Operating temperature	-40 °C to +85 °C

Timing diagram



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

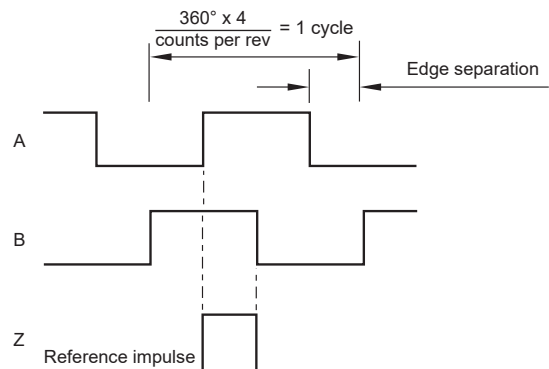
RM22IC – Incremental, RS422

Square wave differential line driver to RS422

Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Power 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)

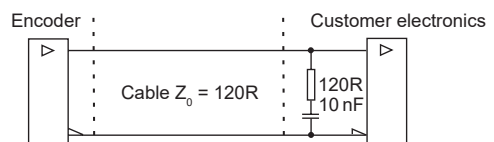
Timing diagram

Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

Recommended signal termination

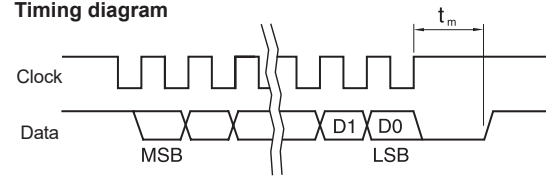


RM22SC – Absolute binary synchro-serial interface (SSI)

Serial encoded absolute position measurement

Output code	Natural binary
Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
Power 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	$-40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$ (IP64) $-40\text{ }^\circ\text{C}$ to $+85\text{ }^\circ\text{C}$ (IP68)

Timing diagram

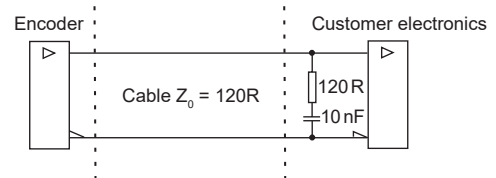


Clock $\leq 4\text{ MHz}$ $12.5\ \mu\text{s} \leq t_m \leq 20.5\ \mu\text{s}$

Position increases for clockwise rotation of magnetic actuator.

Recommended signal termination

For data output lines only



RM22Vx – Linear voltage output

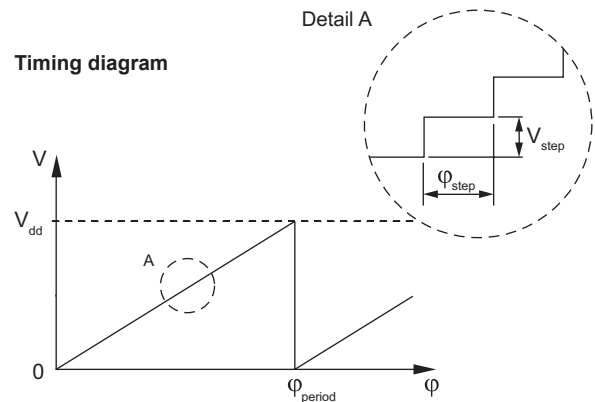
Alternative for potentiometers

Power supply	$V_{dd} = 5\text{ V} \pm 5\%$
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)

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

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



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

- 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

The digital relative angular position information is converted into linear voltage with a built-in 10 bit D/A converter. The linear output voltage swing ranges from 0 V and V_{dd} (5 V). The number of periods within one revolution (N_{period}) can be 1, 2, 4 or 8, representing one full swing over an angle (Φ_{period}) of 360°, 180°, 90° or 45° respectively. The signal is made up of steps which represent the angular movement needed to register a change in the position (Φ_{step}) and the resulting change in the output voltage (V_{step}). The number of steps in one period (N_{step}) is given in the table below.

For clockwise rotation of the magnetic actuator, the output voltage increases. For counterclockwise rotation, the output voltage decreases.

Part numbering

Encoder system = Encoder body + Magnetic actuator



Encoder body part number
eg **RM22SC0009B10A1B00**

Magnetic actuator
eg **RMA06A2A00**

RM22 SC 00 09B 10 A 1 B 00

Output type

AC - Analogue sinusoidal 2 V_{pp}
BC - Analogue complementary sinusoidal
IC - Incremental, RS422
SC - Absolute binary synchro - serial (SSI), RS422
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** and **BC**:

01S - One sine/cosine wave per revolution

For **IC** and **SC** (counts/positions per revolution):

Decimal			Binary	
D32 - 320	D80 - 800	2D0 - 2000	09B - 512	12B - 4096
D40 - 400	1D0 - 1000		10B - 1024	13B - 8192
D50 - 500	1D6 - 1600		11B - 2048	

For **Vx**:

10B - 1,024 counts/positions per revolution

Special requirements

00 - No special requirements (standard)
0M - Cable length in meters

Environment and material

B - IP64, Aluminium body (standard)
C - IP68, Aluminium body
J - IP68, Stainless steel body (for Body style 1 only)

Body style and cable exit

1 - Flanged body, radial cable exit
4 - Flanged body, axial cable exit

Connector option

A - 'D' type connector - 9 way
F - Flying lead (no connector)

Cable length

10 - 1 meter (or 10 meters if **0M** special requirement is chosen)

NOTE: Not all combinations are valid.

Magnetic actuator ordering information

Actuator for integration onto shaft



Shaft = \varnothing *h7

Fixing: Grub screw provided

* Hole diameter for nominal shaft size.

Part numbers:

For resolutions of 9 bit absolute (512 cpr incremental)

RMA04A2A00 - 4 mm dia shaft
RMA05A2A00 - 5 mm dia shaft
RMA06A2A00 - 6 mm dia shaft
RMA08A2A00 - 8 mm dia shaft

RMA10A2A00 - 10 mm dia shaft
RMA19A2A00 - 3/16" dia shaft
RMA25A2A00 - 1/4" dia shaft
RMA37A2A00 - 3/8" dia shaft

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

RMA04A3A00 - 4 mm dia shaft
RMA05A3A00 - 5 mm dia shaft
RMA06A3A00 - 6 mm dia shaft
RMA08A3A00 - 8 mm dia shaft

RMA10A3A00 - 10 mm dia shaft
RMA19A3A00 - 3/16" dia shaft
RMA25A3A00 - 1/4" dia shaft
RMA37A3A00 - 3/8" dia shaft

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Document issues

Issue	Date	Page	Corrections made
1	13. 1. 2009	-	New layout
2	14. 2. 2017	2	Storage and handling, connections added
		3	Axial cable exit drawing added
		6	Linear voltage power consumption updated, Parallel output removed
		7	Parallel output and extended operating temperature range removed, magnetic actuator ordering info and special option 0M added
		General	Data sheet design updated
3	4. 7. 2018	4, 5	Resolution amended

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