



RM22



RM22 & RM36

RM22 ABSOLUTE & INCREMENTAL 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

ELECTRICAL & OPERATING 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



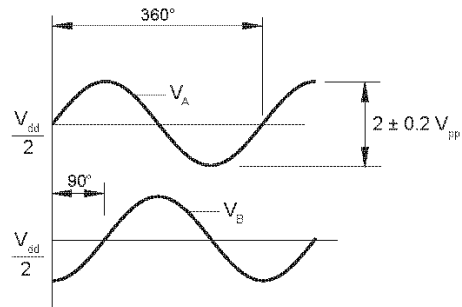
ELAP VIA VITTORIO VENETO, 4-I-20094 CORSICO (MI) • TEL. +39.02.4519561
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RM22AC – Analogue sinusoidal outputs

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

Power supply	$V_{dd} = 5 V \pm 5 \%$
Power consumption	20 mA
Outputs	Signal amplitude $2 \pm 0.2 V_{pp}$ Signal offset $\frac{V_{dd}}{2} \pm 5 mV$
Maximum output frequency	500 Hz
Maximum cable length	3 m
Operating temperature	-40 °C to +125 °C (IP64) -40 °C to +85 °C (IP68)
Maximum speed	30,000 rpm
Internal serial impedance	720 Ω

Timing diagram



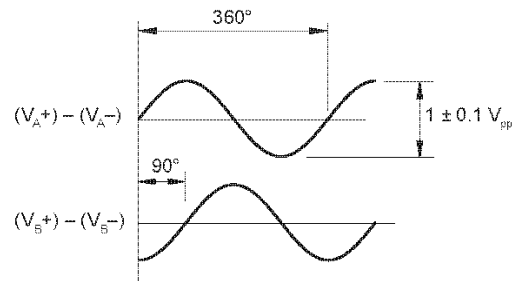
V_A leads V_B by 90° for clockwise rotation of magnetic actuator.

RM22BC – Analogue complementary sinusoidal outputs

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

Power supply	$V_{dd} = 5 V \pm 5 \%$
Power consumption	20 mA
Outputs	Signal amplitude $0.5 \pm 0.1 V_{pp}$ Signal offset $\frac{V_{dd}}{2} \pm 5 mV$
Maximum output frequency	500 Hz
Maximum cable length	20 m
Operating temperature	-25 °C to +85 °C
Maximum speed	30,000 rpm
Internal serial impedance	100 Ω

Timing diagram



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

RM22IC – Incremental, RS422, 5 V

Square wave differential line driver to RS422

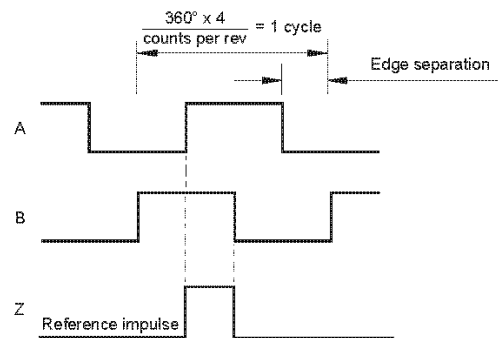
Power supply	$V_{dd} = 5 V \pm 5 \%$
Power consumption	Max. 35 mA
Output signals	A, B, Z, A-, B-, Z- (RS422)
Maximum cable length	50 m
Operating temperature	-40 °C to +125 °C (IP64) -40 °C to +85 °C (IP68)
Edge separation	Min. 1 μs

Resolution options (counts per revolution)	Maximum speed (rpm)	Accuracy ¹	Hysteresis
128, 256	60,000	$\pm 0.7^\circ$	0.45°
320, 400, 500, 512	30,000	$\pm 0.7^\circ$	0.18°
800, 1,000, 1,024	20,000	$\pm 0.5^\circ$	0.18°
1,600, 2,000, 2,048	10,000	$\pm 0.5^\circ$	0.18°
4,096	5,000	$\pm 0.5^\circ$	0.18°
8,192	2,500	$\pm 0.5^\circ$	0.18°

¹ Worst case within operational parameters including magnet position and temperature.

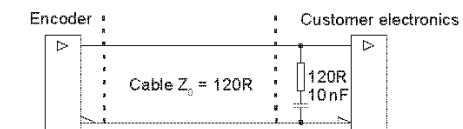
Timing diagram

Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

Recommended signal termination

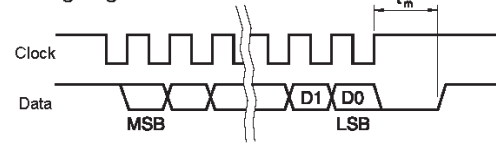


RM22SC – Absolute binary synchro-serial interface (SSI)

Serial encoded absolute position measurement

Output code	Natural binary
Power supply	$V_{dd} = 5 V \pm 5 \%$
Power consumption	Max. 35 mA
Repeatability	$\leq 0.07^\circ$
Data output	Serial data (RS422)
Data input	Clock (RS422)
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 ≤ 900 kHz $16 \mu s \leq t_m \leq 22 \mu s$ (for 9 bit resolution)
 Clock ≤ 4 MHz $12.5 \mu s \leq t_m \leq 20.5 \mu s$ (for all other resolutions)

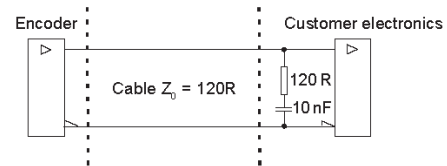
Position increases for clockwise rotation of magnetic actuator.

Resolution options (counts per revolution)	Maximum speed (rpm)	Accuracy*	Hysteresis
128, 256	60,000	$\pm 0.7^\circ$	0.45°
320, 400, 500, 512	30,000	$\pm 0.7^\circ$	0.18°
800, 1,000, 1,024	20,000	$\pm 0.5^\circ$	0.18°
1,600, 2,000, 2,048	10,000	$\pm 0.5^\circ$	0.18°
4,096	5,000	$\pm 0.5^\circ$	0.18°
8,192	2,500	$\pm 0.5^\circ$	0.18°

* Worst case within operational parameters including magnet position and temperature.

Recommended signal termination

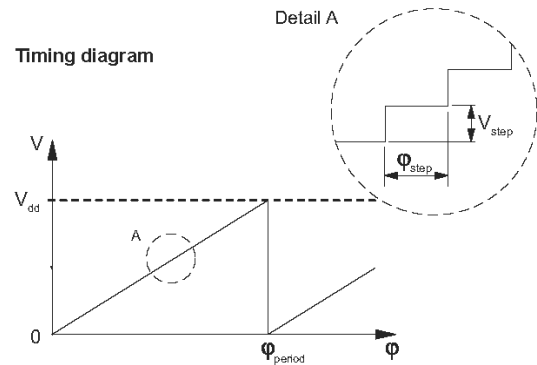
For data output lines only



RM22Vx – Linear voltage output

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

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°

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

Output type and electrical variant

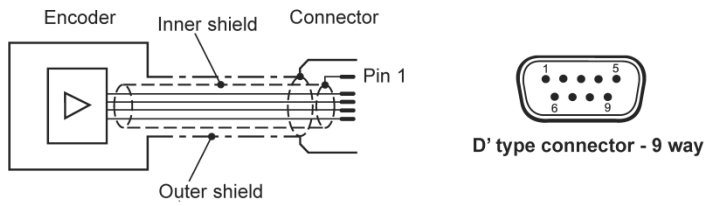
Rotation \ Φ_{period}	360°	180°	90°	45°
Clockwise	VA	VB	VC	VD
Counterclockwise	VE	VF	VG	VH

- 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.

CONNECTIONS

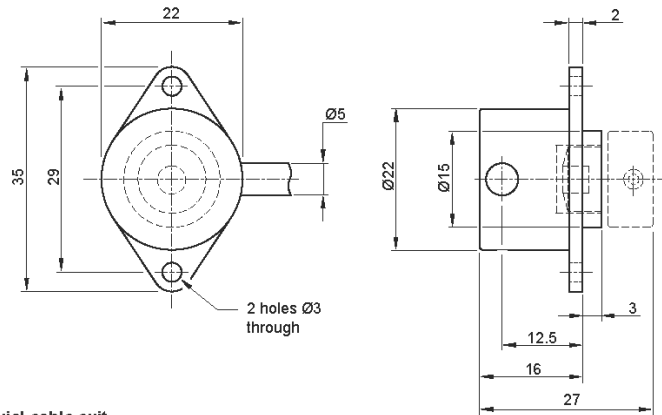


Pin nr.	RM22AC		RM22BC		RM22IC		RM22SC		RM22V	
	Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour	Function	Wire colour
1	Shield - see connection diagram		Shield - see connection diagram		Shield - see connection diagram		Shield - see connection diagram		Shield - see connection 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

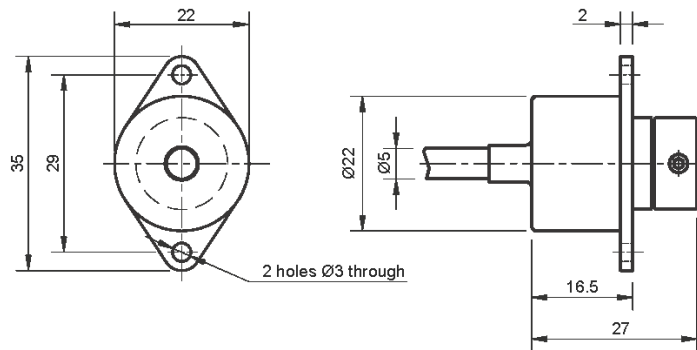
DIMENSIONS

Dimensions and tolerances in mm

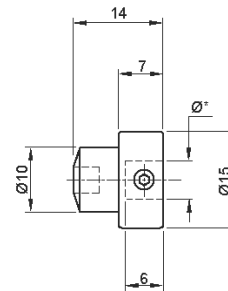
Radial cable exit



Axial cable exit



Magnetic actuator



* Hole diameter for nominal shaft size.



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