

RM36 series non-contact rotary encoders



The RM36 is a high-speed magnetic rotary encoder designed for use in harsh industrial 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 the required output.

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

The compact encoder body is 36 mm in diameter and provides dirt immunity up to IP68.

The RM36 can be used in a wide range of applications including marine, medical, print, converting, industrial automation, metal working, motor control and instrumentation.

5 V power supply version

RM36I-incremental with 80 to 2,048 pulses per revolution (320 to 8,192 counts per revolution with x 4 evaluation)

RM36S-synchro serial interface (SSI) with 320 to 8,192 positions per revolution

24 V power supply version

RM36P-absolute parallel interface with 512 positions per revolution

RM36I-incremental with 80 to 2,048 pulses per revolution (320 to 8,192 counts per revolution with x 4 evaluation)

RM36V-linear voltage output in a range of variants

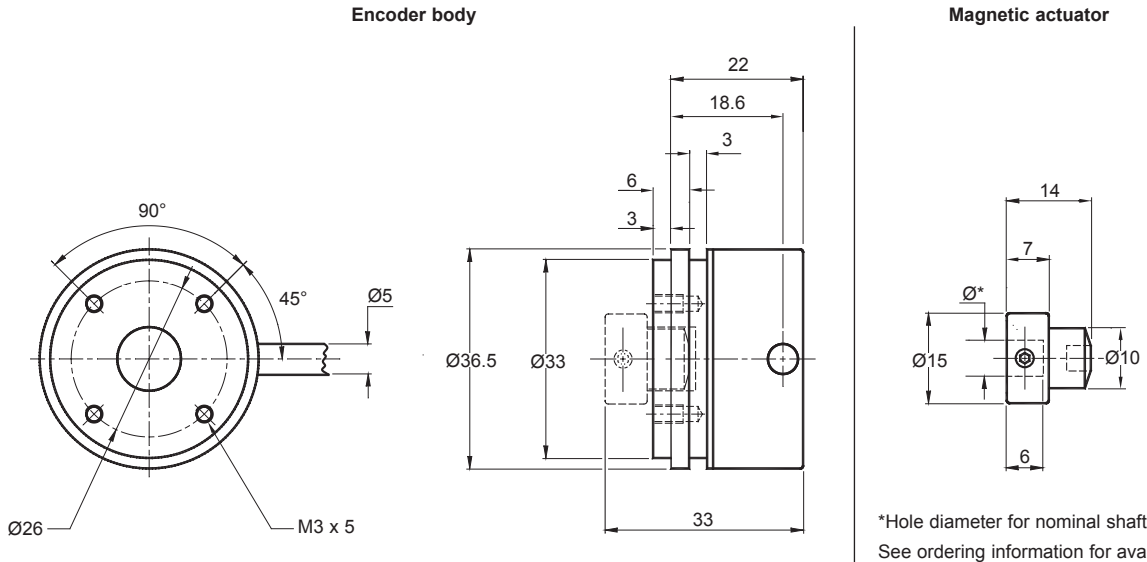
RM36C-linear current output in a range of variants

System features:

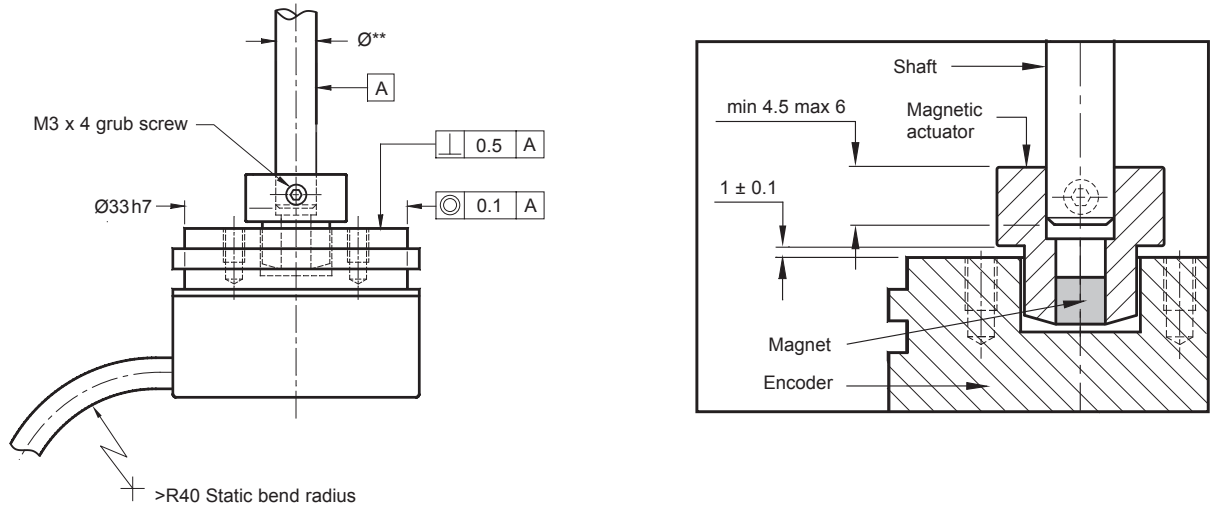
- Excellent immunity to IP68
- Non-contact, frictionless design
- High speed operation to 30,000 rpm
- 36 mm diameter body
- Industry standard absolute, incremental and linear output formats
- Binary and decimal resolution options
- Accuracy $\pm 0.5^\circ$
- Simple installation
- Low inertia
- Stainless steel body option

RM36 dimensions

Dimensions and tolerances in mm



RM36 installation drawing



**Nominal shaft size with tolerance h7.

Operating and electrical specifications

| | |
|------------------------------------|--|
| Humidity (for IP64 version) | Storage 95% maximum relative humidity (non-condensing) (IEC 61010-1) Operating 80% maximum relative humidity (non-condensing) (IEC 61010-1) |
| Acceleration | Operating 500 m/s ² BS EN 60068-2-7:1993 (IEC 68-2-7:1983) |
| Shock (non-operating) | 1000 m/s ² , 6 ms, 1/2 sine BS EN 60068-2-27:1993 (IEC 68-2-27:1987) |
| Vibration (operating) | 100 m/s ² max at 55 to 2000 Hz BS EN 60068-2-6:1996 (IEC 68-2-6:1995) |
| EMV compliance | BS EN 61326 |
| Cable | Outside diameter 5 mm |
| Mass | Encoder unit 1 m cable (no connector) 85 g. Stainless steel variant 160 g. Magnetic actuator 12 g |
| Environmental sealing | IP64 (IP68 optional) BS EN 60529 |

Output specifications - 5 V supply

RM36I – Incremental outputs

Square wave differential line driver to RS422A

| | |
|--------------------------|--|
| Power supply | $V_{dd} = 5\text{ V} \pm 5\%$ |
| Power consumption | 23 mA for 9 bit resolution 35 mA for all other resolutions |
| Output signals | A, B, Z, A-, B-, Z- (RS422A) |
| Max. cable length | 50 m |
| Connector options | 9 pin 'D' type plug (standard) Flying lead |
| Temperature | Operating $-25\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ $(-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ option 08)* Storage $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ |

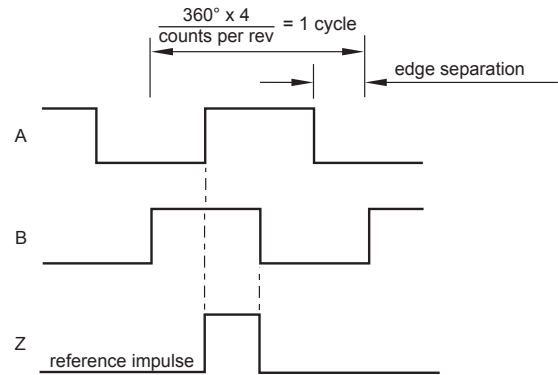
* Only available with IP64 sealing

| Resolution options (counts per revolution) | Maximum speed (rpm) | Accuracy* | Hysteresis |
|---|------------------------|-------------------|------------|
| 320, 400, 500 | 30,000 | $\pm 0.7^{\circ}$ | 0.18° |
| 512 | 30,000 | $\pm 0.7^{\circ}$ | 0.45° |
| 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° |

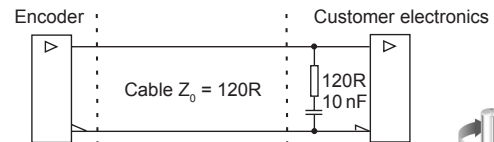
* Worst case within operational parameters including magnet position and temperature.

Timing diagram

(complementary signals not shown)



Recommended signal termination



B leads A for clockwise rotation of magnetic actuator



RM36S – Absolute binary synchro-serial interface (SSI)

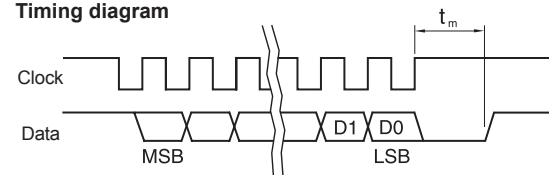
Serial encoded absolute position measurement

| | |
|--------------------------|---|
| Output code | Natural binary |
| Power supply | $V_{dd} = 5\text{ V} \pm 5\%$ |
| Power consumption | 35 mA |
| Repeatability | $\leq 0.07^{\circ}$ |
| Data outputs | Serial data (RS422A) |
| Data inputs | Clock (RS422A) |
| Max. cable length | 100 m (at 1 MHz) |
| Connector options | 9 pin 'D' type plug (standard) Flying lead |
| Temperature | Operating $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ (IP64) $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ (IP68) Storage $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ |

| Resolution options (positions per revolution) | Maximum speed (rpm) | Accuracy* | Hysteresis |
|--|------------------------|-------------------|------------|
| 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.

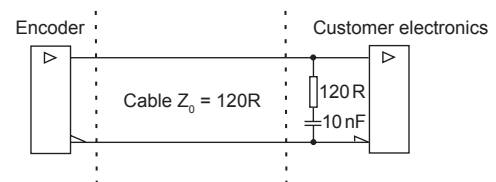
Timing diagram



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

Recommended signal termination

(For data output lines only)



Position increases for clockwise rotation of magnetic actuator



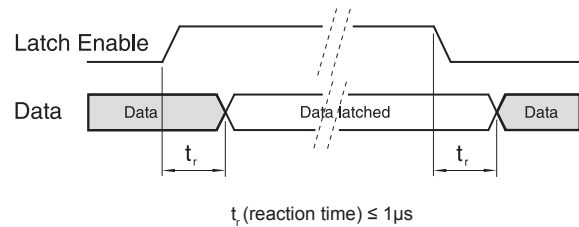
Output specifications - 24 V supply

RM36P – Absolute binary parallel interface

Parallel absolute position measurement

| | |
|--------------------------|--|
| Output code | Natural binary |
| Power supply | 8 V to 26 V = V_{supply} |
| Power consumption | (at 24 V) See table |
| Output voltage | $V_H \geq (V_{supply} - 1)$ at $-I_H \leq 10$ mA $V_L \leq 1$ V at $I_L \leq 10$ mA |
| Resolution | 9 bit (512 positions per revolution) |
| Hysteresis | 0.45° |
| Accuracy | ±0.7° |
| Repeatability | ≤ 0.07° |
| Data outputs | D0 (LSB) - D8 (MSB) |
| Data inputs | LE - latch enable input signal, active high Maximum sampling rate 500 kHz |
| Max. cable length | 10 m |
| Connector options | 15 pin 'D' type plug (standard) Flying lead |
| Temperature | Operating -25 °C to +125 °C (IP64) -25 °C to +85 °C (IP68) (0 °C to +70 °C variant PB) Storage -25 °C to +85 °C |
| Maximum speed | 30,000 rpm |

Timing diagram



Output type and electrical variant

| Variant | Type | Power consumption | Max. load |
|-----------|--------------------|-------------------|-----------|
| PA | Push-Pull | 40 mA | 30 mA |
| PB | Open Collector NPN | 25 mA | 20 mA |



Position increases for clockwise rotation of magnetic actuator

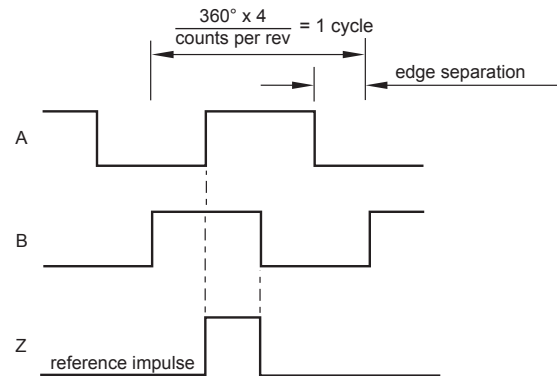
RM36I – Incremental outputs

Square wave output

| | |
|--------------------------|--|
| Power supply | 8 V to 26 V = V_{supply} |
| Power consumption | (at 24 V) See table |
| Output signals | Variant IA: A, B, Z, A-, B-, Z- (RS422A) Variant IB: A, B, Z |
| Resolution | Variant IB: 128 pulses per revolution (512 counts per revolution with 4x evaluation) Variant IA: 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) |
| Max. cable length | 20 m |
| Connector options | 9 pin 'D' type plug (standard) Flying lead |
| Temperature | Operating -25 °C to +70 °C (0 °C to +70 °C variant IB) Storage -25 °C to +85 °C |

Timing diagram

(complementary signals not shown)



Output type and electrical variant

| Variant | Type | Power consumption | Max. load |
|-----------|--------------------|--|-----------|
| IA | Push-Pull | 30 mA - 9-bit 50 mA - other resolutions | 30 mA |
| IB | Open Collector NPN | 25 mA | 20 mA |



B leads A for clockwise rotation of magnetic actuator

| Resolution options (counts per revolution) | Maximum speed (rpm) | Accuracy* | Hysteresis |
|--|---------------------|-----------|------------|
| 320, 400, 500 | 30,000 | ±0.7° | 0.18° |
| 512 | 30,000 | ±0.7° | 0.45° |
| 800, 1,000, 1,024 | 20,000 | ±0.5° | 0.18° |
| 1,600, 2,000, 2,048 | 10,000 | ±0.5° | 0.18° |
| 4,096 | 5,000 | ±0.5° | 0.18° |
| 8,192 | 2,500 | ±0.5° | 0.18° |

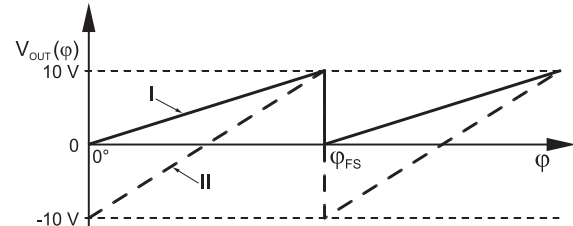
* Worst case within operational parameters including magnet position and temperature.

Output specifications - 24 V supply

RM36V – Linear voltage output

| | |
|--------------------------|---|
| Power supply | Type I: +20 V to +30 V DC Type II: ± 12 V to ± 16 V DC |
| Power consumption | 40 mA typical |
| Output voltage | Type I: 0 V to 10 V DC Type II: -10 V to +10 V DC |
| Output loading | Max. 10 mA |
| Nonlinearity | 1 % |
| Max. cable length | 20 m |
| Connector options | 9 pin 'D' type plug (standard) Flying lead |
| Temperature | Operating -25 °C to +70 °C Storage -25 °C to +125 °C |
| Maximum speed | 30,000 rpm |

Electrical output/shaft position



Output type and electrical variant

| ϕ_{FS} | Type I | | | | Type II | | | |
|-------------|--------|------|-----|-----|---------|------|-----|-----|
| | 360° | 180° | 90° | 45° | 360° | 180° | 90° | 45° |
| CW | VA | VB | VC | VD | VM | VN | VP | VQ |
| CCW | VE | VF | VG | VH | VR | VS | VT | VV |

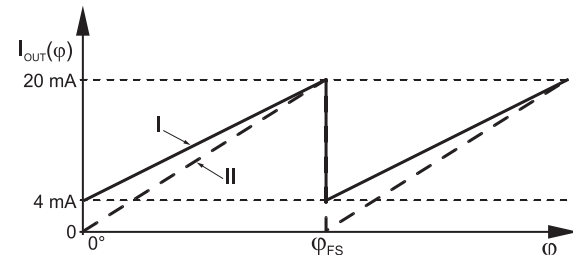


Image shows clockwise rotation of magnetic actuator

RM36C - Linear current output

| | |
|--------------------------|---|
| Power supply | $V_{dd} = +20$ V to +30 V DC |
| Power consumption | 50 mA plus output current |
| Output current | Type I: 4 mA to 20 mA Type II: 0 mA to 20 mA |
| Output loading | $R_L = 0$ to $\frac{V_{dd}}{I_{OUTmax}}$ |
| Nonlinearity | 1 % |
| Max. cable length | 20 m |
| Connector options | 9 pin 'D' type plug (standard) Flying lead |
| Temperature | Operating -25 °C to +70 °C Storage -25 °C to +125 °C |
| Maximum speed | 30,000 rpm |

Electrical output/shaft position



Output type and electrical variant

| ϕ_{FS} | Type I | | | | Type II | | | |
|-------------|--------|------|-----|-----|---------|------|-----|-----|
| | 360° | 180° | 90° | 45° | 360° | 180° | 90° | 45° |
| CW | CA | CB | CC | CD | CM | CN | CP | CQ |
| CCW | CE | CF | CG | CH | CR | CS | CT | CV |



Image shows clockwise rotation of magnetic actuator

RM36 ordering code

Encoder system = Encoder body + Magnetic actuator



Encoder part number
eg RM36SC0012B10A2B00

Magnetic actuator part number
eg RMA06A3A00

RM36 SC 00 12B 10 A 2 B 00

Output type and electrical variant

| | |
|--|-------------------|
| Incremental, push-pull, 24 V | IA |
| Incremental, open collector, 24 V | IB |
| Incremental, 5 V | IC |
| Absolute binary synchro-serial (SSI), 5 V | SC |
| Absolute parallel, push-pull, 24 V | PA |
| Absolute parallel, open collector, 24 V | PB |
| Linear voltage output 0 V to 10 V, supply +20 V to +30 V DC | |
| | 360° 180° 90° 45° |
| Clockwise | VA VB VC VD |
| Counter clockwise | VE VF VG VH |
| Linear voltage output ±10 V, supply ±12 V to ±16 V DC | |
| | 360° 180° 90° 45° |
| Clockwise | VM VN VP VQ |
| Counter clockwise | VR VS VT VV |
| Linear current output 4 mA to 20 mA, supply +20 V to +30 V DC | |
| | 360° 180° 90° 45° |
| Clockwise | CA CB CC CD |
| Counter clockwise | CE CF CG CH |
| Linear current output 0 mA to 20 mA, supply +20 V to +30 V DC | |
| | 360° 180° 90° 45° |
| Clockwise | CM CN CP CQ |
| Counter clockwise | CR CS CT CV |

Shaft size
00 - N/A

Special requirements

00 - None
08 - Extended operating temperature range
(for output type IC and IP64 only)

Environment and material

B - IP64, Aluminium body (standard)
C - IP68, Aluminium body
J - IP68, Stainless steel body

Body style and cable exit

2 - Cylindrical body, radial cable exit

Connector option

A - 'D' type connector - 9 way
B - 'D' type connector - 15 way (for output types PA and PB only)
F - Flying lead (no connector)

Cable length

10 - 1 metre

Resolution

All output types
09B - 512 counts or positions per revolution

Output types IA, IC, SC

Decimal

D32 - 320 D80 - 800 2D0 - 2,000
D40 - 400 1D0 - 1,000
D50 - 500 1D6 - 1,600

Binary

09B - 512 11B - 2,048 13B - 8,192
10B - 1,024 12B - 4,096

NOTE: Not all combinations are valid.

For output resolutions of 9-bit (512 count per rev), please select one of the following magnetic actuators:

RMA04A2A00 - 4 mm dia shaft RMA10A2A00 - 10 mm dia shaft
RMA05A2A00 - 5 mm dia shaft RMA19A2A00 - 3/16" dia shaft
RMA06A2A00 - 6 mm dia shaft RMA25A2A00 - 1/4" dia shaft
RMA08A2A00 - 8 mm dia shaft RMA37A2A00 - 3/8" dia shaft

For output resolutions of 10-bit (1024 count per rev) or higher, please select one of the following magnetic actuators:

RMA04A3A00 - 4 mm dia shaft RMA10A3A00 - 10 mm dia shaft
RMA05A3A00 - 5 mm dia shaft RMA19A3A00 - 3/16" dia shaft
RMA06A3A00 - 6 mm dia shaft RMA25A3A00 - 1/4" dia shaft
RMA08A3A00 - 8 mm dia shaft RMA37A3A00 - 3/8" dia shaft

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Document issues

| Issue | Date | Page | Corrections made |
|-------|-------------|------|------------------|
| 1 | 13. 1. 2009 | - | New layout |

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