RMB28 / RMF44 / RMF58
Rotary Magnetic Encoders

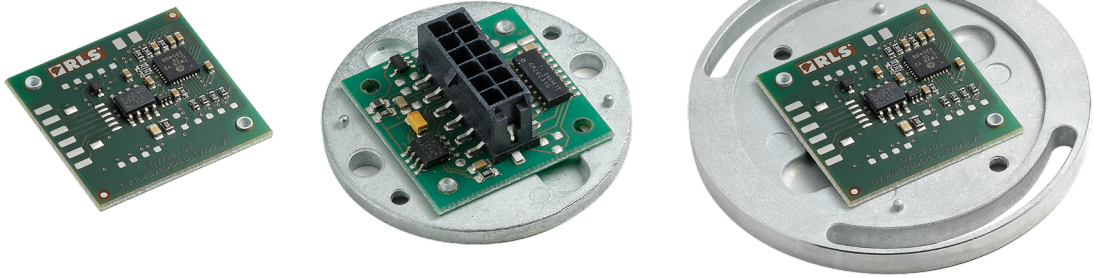
14 BIT

EASY MOUNTING

NUMEROUS OUTPUT OPTIONS

The RMB28 encoder module is designed for direct integration into high volume OEM applications.

The inexpensive 28 mm square PCB can also be supplied with a connector or as RMF44/RMF58 on a metal flange with 44 mm or 58 mm diameters for easy mounting. The RMB28/RMF44/RMF58 encoder modules can be used in a wide range of OEM applications, including motor control and industrial automation.



Features and benefits

- 5 V and 24 V power supply versions
- High speed operation to 60,000 rpm
- Absolute - to 14 bit resolution (16,384 counts per revolution)
- Accuracy up to ±0.5°
- Inexpensive solution for OEM integration
- Industry standard absolute, incremental, analogue, commutation and linear voltage output formats

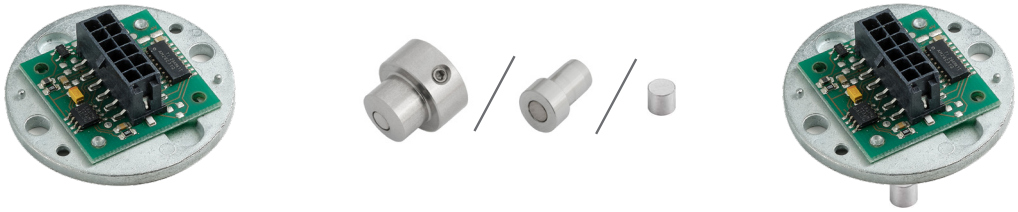
MOTOR CONTROL | PRINTING | MARINE | MEDICAL | INDUSTRIAL AUTOMATION

General information

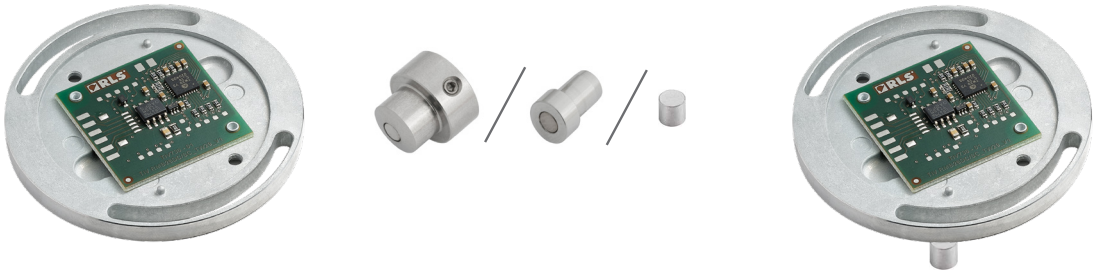
The encoder module consists of a magnetic actuator and a separate sensor board. The rotation of the magnetic actuator is detected and processed by a custom encoder chip mounted on the sensor board to obtain the desired output format. The output signals are provided in industry standard absolute, incremental, analog or linear voltage output formats.

RMB28 + **Actuator or magnet** = **Encoder system**

RMF44 + **Actuator or magnet** = **Encoder system**



RMF58 + **Actuator or magnet** = **Encoder system**



For commutation outputs please refer to **Commutation and incremental magnetic encoder solutions.**

Product range

AC

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

DC

BiSS-C interface with up to 16,384 positions per revolution and optional revolution counter.

I

Incremental with up to 4,096 pulses per revolution (320 to 16,384 counts per revolution with 4× evaluation).

SC

Synchro serial interface (SSI) with up to 16,384 positions per revolution.

SI

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).

Vx

Linear voltage output in a range of variants.

Selection guide

		Power supply	
Product	**Available outputs**	**5 V**	**24 V**
RMB28 / RMF44 / RMF58	AC - Analogue sinusoidal outputs	✓	-
	DC - Absolute natural binary BiSS-C interface, RS422	✓	-
	IB - Incremental, open collector NPN	-	✓
	IC - Incremental, RS422	✓	-
	IE - Incremental, open collector	✓	-
	SC - Absolute binary synchro-serial interface (SSI), RS422	✓	-
	SI - Absolute binary synchro-serial (SSI) + Incremental, RS422	✓	-
	Vx - Linear voltage output	✓	-

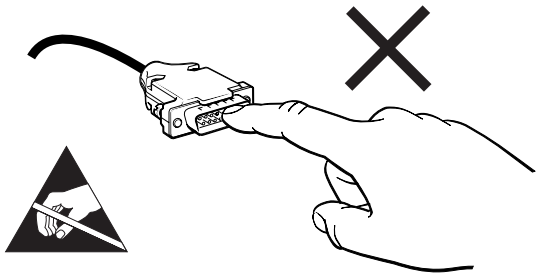
Storage and handling

Operating and storage temperature

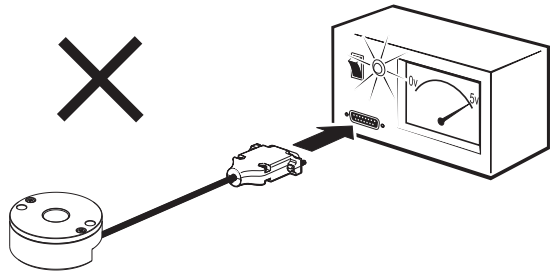
–40 °C to +125 °C
–40 °C to +105 °C (with connector)

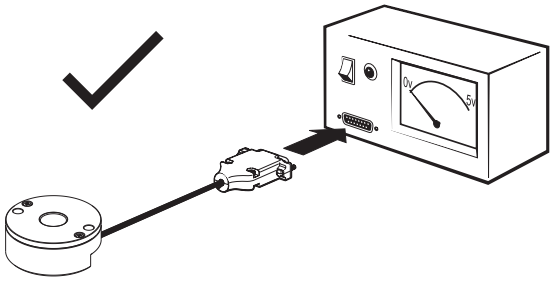
Humidity

Up to 70 % non-condensing



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

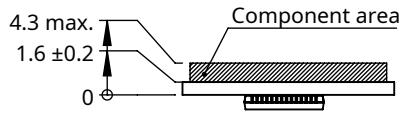
Less than 20 products are packed individually in an antistatic box. If the order quantity is 20 systems and larger, the parts are packed in antistatic plastic trays. Magnets and readheads are packed separately.

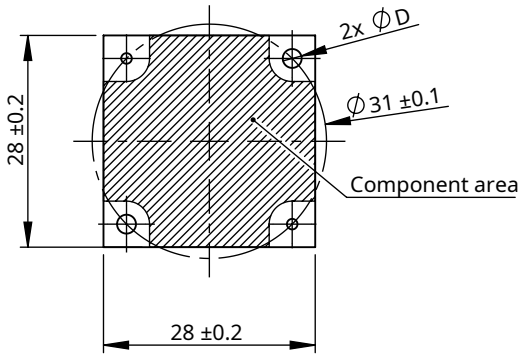
Dimensions and installation drawings

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

RMB28

Dimensions

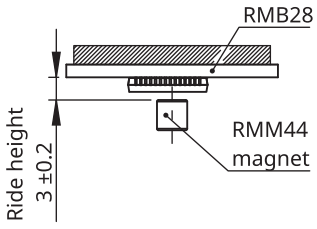


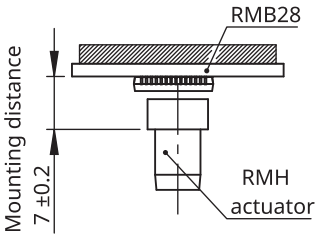


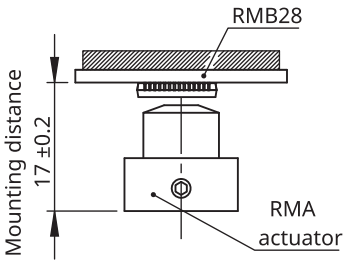
Output type	Hole diameter (D)
AC	$2.5^{\pm 0.1}$
DC	$2.5^{\pm 0.1}$
IC	$2.5^{\pm 0.1}$
IB	$3.5^{\pm 0.1}$
IE	$3.5^{\pm 0.1}$
SC	$2.5^{\pm 0.1}$
SI	$2.5^{\pm 0.1}$
Vx	$3.5^{\pm 0.1}$

Clockwise (CW) rotation of magnet

Installation drawing

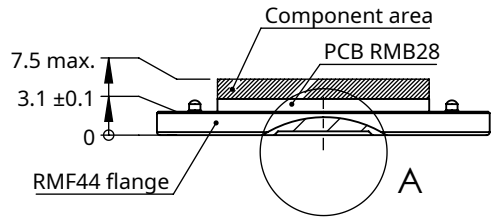


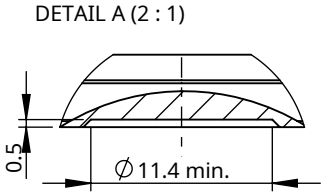


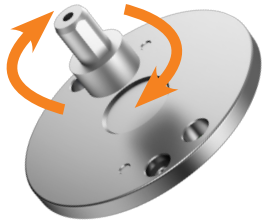


RMF44

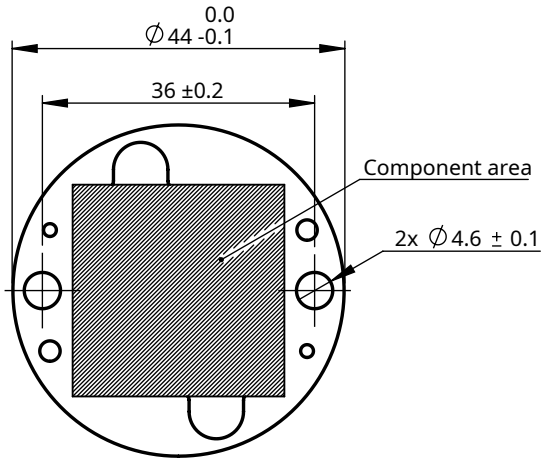
Dimensions



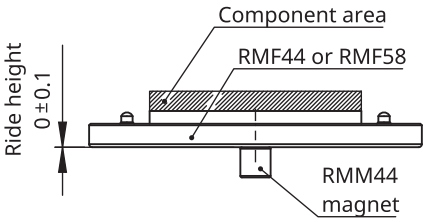


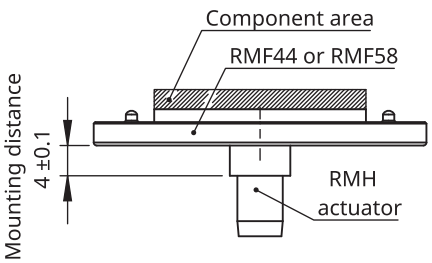


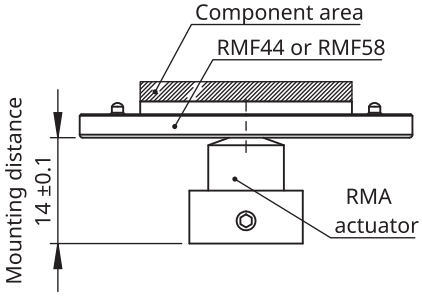
Clockwise (CW) rotation of magnet



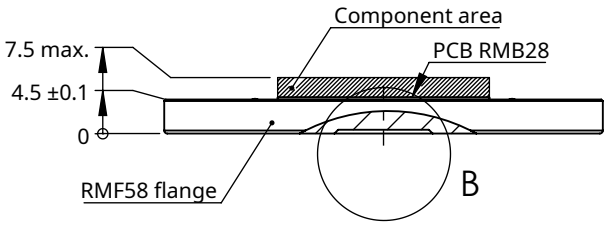
Installation drawing

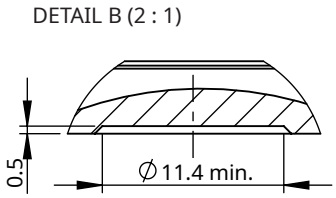




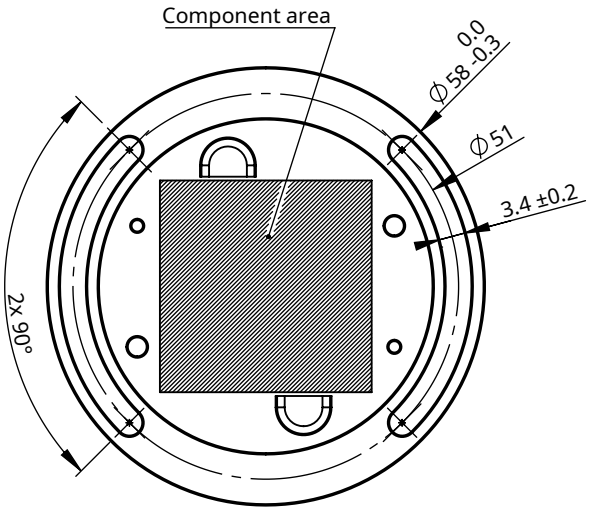


Dimensions



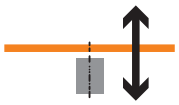
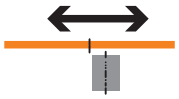
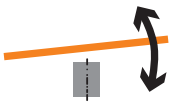


Clockwise (CW) rotation of magnet



Installation tolerances

Installation tolerances for RMB28 / RMF44 / RMF58

Mounting distance	See installation drawings of encoder assemblies on **page 5 and 6.**	
Radial displacement (concentricity)	0.2 mm	
Perpendicularity	0.2°	

- Encoder - Magnet

Technical specifications

Mechanical data

Mass	Encoder unit <20 g Magnetic actuator <2 g
Magnet material	Sm2Co17 with Ni-Cu-Ni protective layer
Actuator material	RMH: Aluminium RMA: Stainless steel

Environmental data

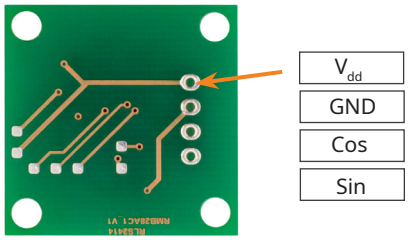
EMC compliance	EN 61326
Shock	100 G (6 ms, standard EN 60068-2-27:2009)
Vibration	40 G (55 Hz–2000 Hz, standard EN 60068-2-6:2008)
Temperature drift error	0.004°/°C

Output types

AC – Analogue sinusoidal outputs

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

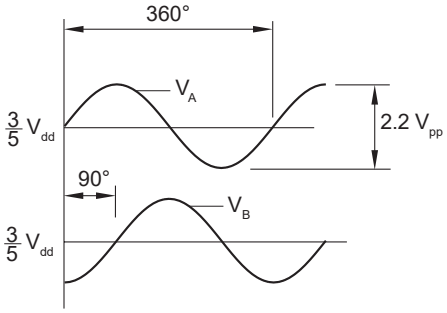
Connections



Specifications

Power supply	V_{dd} = 5 V ±5 %
Resolution	One sine/cosine wave per revolution
Current consumption	13 mA
Sin/Cos outputs	Signal amplitude: 1.1 V ±0.2 V Signal offset: $\frac{3}{5} V_{dd}$ ±5 mV
Maximum speed	60,000 rpm
Operating temperature	–40 °C to +125 °C

Timing diagram

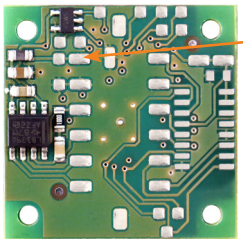


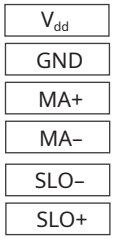
V_A leads V_B by 90° for clockwise rotation of magnetic actuator.

DC – Absolute encoder with BiSS-C interface

Connections

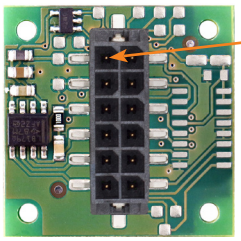
Board A

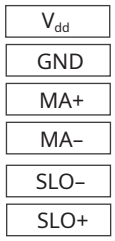




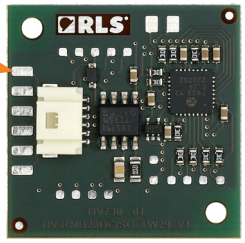
Board B

Board A, with connector





Board B, with connector



Connector type
Molex 43045-1219
Mating connector (Not provided)
Shell: Molex 43025-1200
Crimp terminal: Molex 43030-xxxx

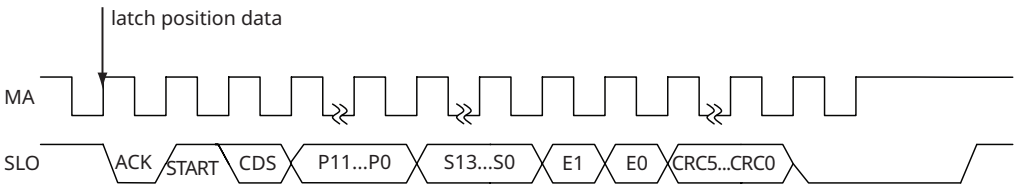
Connector type
Molex 501568-0607
Mating connector (Not provided)
Shell: Molex 501330-0600
Crimp terminal: Molex 501334-xxxx

Specifications

Output code	Natural binary
Power supply	V_{dd} = 5 V ±5 %
Current consumption	**Board A:** 35 mA **Board B:** 65 mA
Clock input	MA (RS422)
Data output	SLO (RS422)
Accuracy	Typ. ±0.5°
Hysteresis	0.18°
Resolution	**Board A:** 320, 400, 500, 512, 800, 1000, 1024, 1600, 2000, 2048, 4096, 8192 positions per revolution **Board B:** 360, 3600, 4000, 8000, 10000, 16000, 16384 positions per revolution*
Revolution counter	12 bit (4,096 revolutions)
Maximum speed	30,000 rpm
Operating temperature	–40 °C to +125 °C –40 °C to +105 °C (with connector)
Max MA frequency	8 MHz

* For other resolutions **contact RLS**.

Timing diagram – BiSS C



Data	Length	Description
P11 – P0	0 or 12 bit	Revolution counter value when enabled (see Part numbering/resolution)*
S13 – S0	7 to 14 bit	Position inside the revolution (length depends on the resolution)
E1 – E0	2 bit	Error data
CRC5 – CRC0	6 bit	Cyclic redundancy check data; polynomial 0x43; inverted bit output

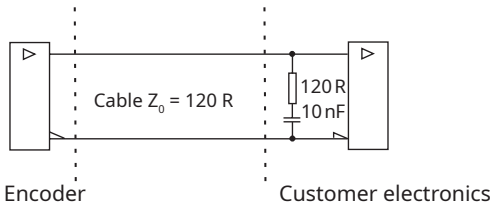
* The revolution counter counts the number of mechanical revolutions of the shaft or magnet of the encoder. Counting is possible only when the encoder is powered. When the encoder is powered off, the revolution counter is reset to 0.

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.**

Recommended signal termination

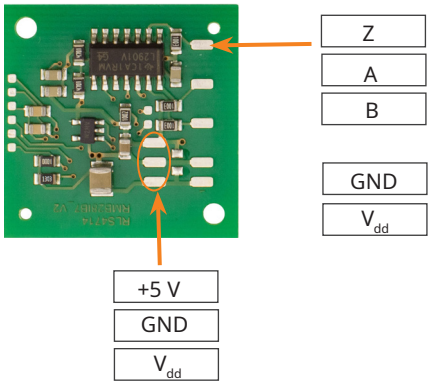
For data output lines only



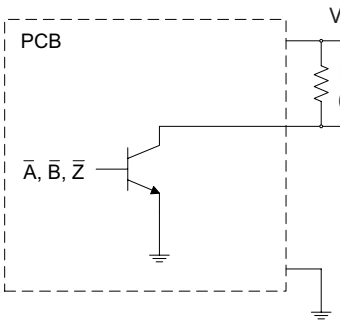
IB – Incremental, open collector NPN

Square wave output

Connections



Recommended signal termination



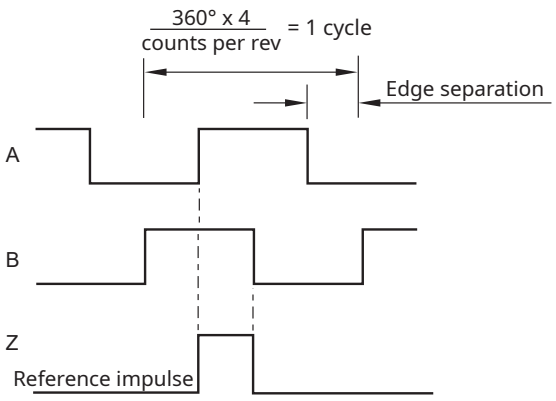
V_{dd}	12 V	24 V
R	2.2 kΩ	4.7 kΩ

RMB28IB / RMF44IB boards need 2 power supplies; pad V_{dd} and pad +5 V. Pads V_{dd}, GND and +5 V have been provided to allow easy connection to a 3 terminal voltage regulator to generate 5 V from V_{dd}.

Specifications

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, 1000, 1024, 1600, 2000, 2048, 4096, 8192 counts per revolution)
Maximum speed	30,000 rpm
Operating temperature	–40 °C to +125 °C

Timing diagram



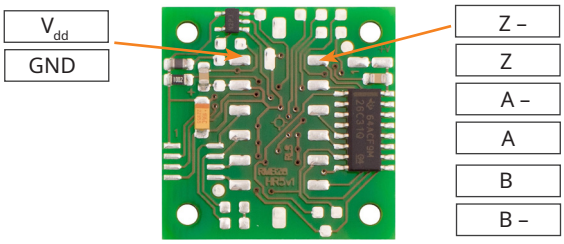
B leads A for clockwise rotation of magnetic actuator.

IC – Incremental, RS422

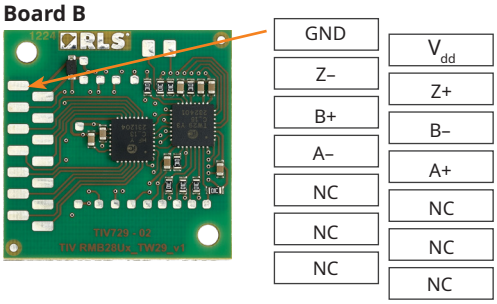
Square wave differential line driver to RS422

Connections

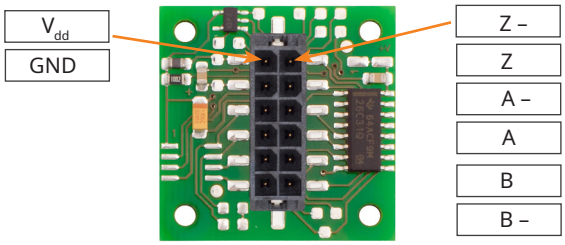
Board A



Board B

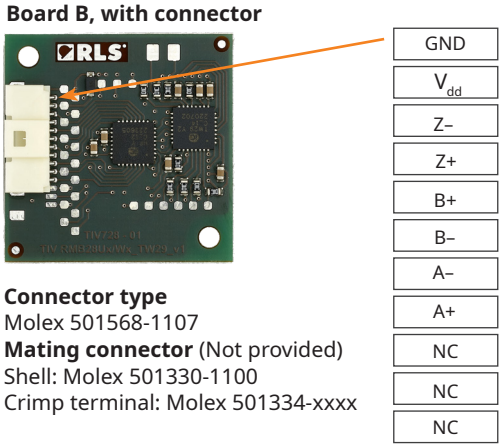


Board A, with connector



Connector type
Molex 43045-1219
Mating connector (Not provided)
Shell: Molex 43025-1200
Crimp terminal: Molex 43030-xxxx

Board B, with connector



Connector type
Molex 501568-1107
Mating connector (Not provided)
Shell: Molex 501330-1100
Crimp terminal: Molex 501334-xxxx

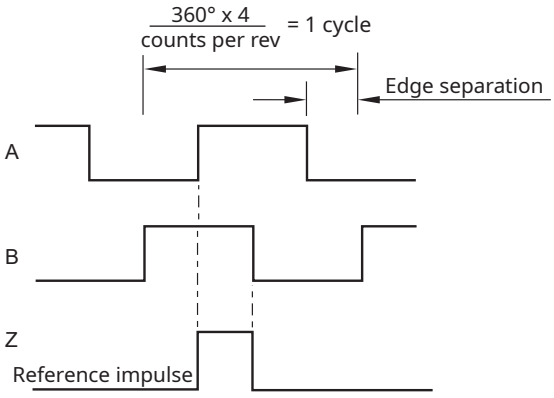
Specifications

Power supply	V_{dd} = 5 V ±5 %
Current consumption	**Board A:** 35 mA **Board B:** 65 mA
Output signals	A, B, Z, A–, B–, Z– (RS422)
Accuracy	Typ. ±0.5°
Hysteresis	0.18°
Resolution	**Board A:** 320, 400, 500, 512, 800, 1000, 1024, 1600, 2000, 2048, 4096, 8192 counts per revolution **Board B:** 360, 3600, 4000, 8000, 10000, 16000, 16384 counts per revolution*
Maximum speed	30,000 rpm
Operating temperature	–40 °C to +125 °C –40 °C to +105 °C (with connector)

* For other resolutions **contact RLS**.

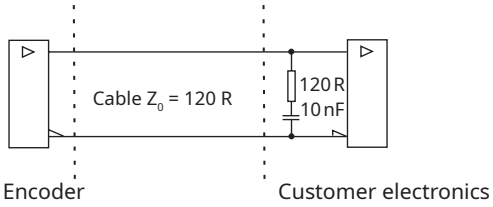
Timing diagram

Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

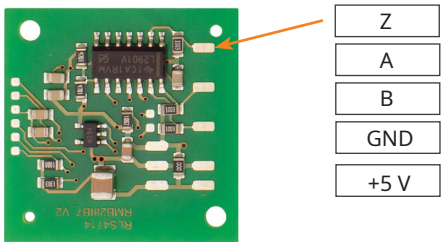
Recommended signal termination



IE – Incremental, open collector, NPN

Low cost alternative for ball bearing encoders

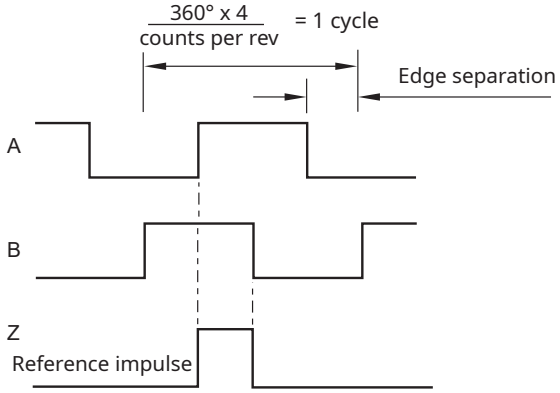
Connections



Specifications

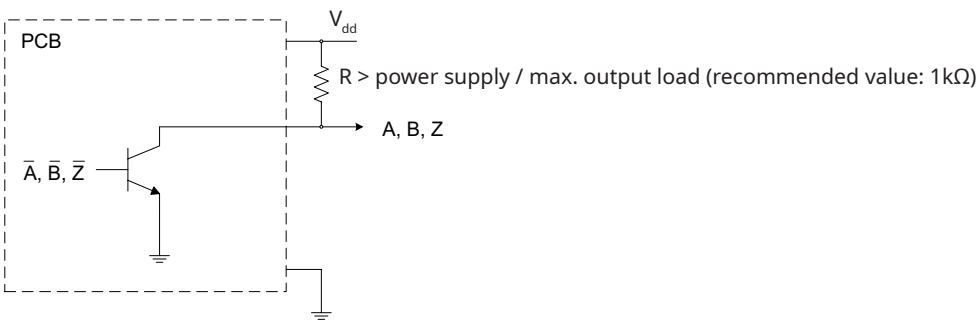
Power supply	V_{dd} = 5 V ±5 %
Current consumption	35 mA (not loaded)
Output signals	A, B, Z
Maximum output load	20 mA
Accuracy	Typ. ±0.5°
Hysteresis	0.18°
Resolution	320, 400, 500, 512, 800, 1000, 1024, 1600, 2000, 2048, 4096, 8192 counts per revolution
Maximum speed	30,000 rpm
Operating temperature	–40 °C to +125 °C

Timing diagram



B leads A for clockwise rotation of magnetic actuator.

Recommended signal termination

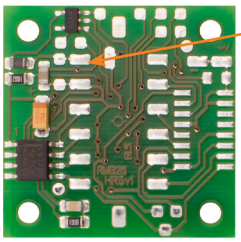


SC – Absolute binary synchro-serial (SSI), RS422

Serial encoded absolute position measurement

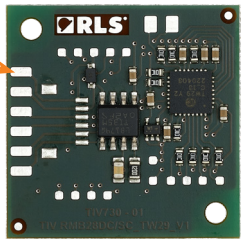
Connections

Board A

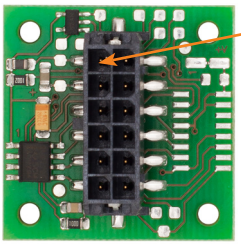


V_{dd}
GND
Clock
Clock –
Data –
Data

Board B

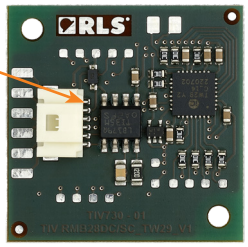


Board A, with connector



V_{dd}
GND
Clock
Clock –
Data –
Data

Board B, with connector



Connector type
Molex 501568-0607
Mating connector (Not provided)
Shell: Molex 501330-0600
Crimp terminal: Molex 501334-xxxx

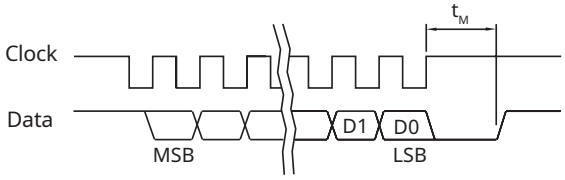
Connector type
Molex 43045-1219
Mating connector (Not provided)
Shell: Molex 43025-1200
Crimp terminal: Molex 43030-xxxx

Specifications

Output code	Natural binary
Power supply	V_{dd} = 5 V ±5 %
Current consumption	**Board A:** 35 mA **Board B:** 65 mA
Data output	Serial data (RS422)
Data input	Clock (RS422)
Accuracy	Typ. ±0.5°
Hysteresis	0.18°
Resolution	**Board A:** 320, 400, 500, 512, 800, 1000, 1024, 1600, 2000, 2048, 4096, 8192 positions per revolution **Board B:** 360, 3600, 4000, 8000, 10000, 16000, 16384 positions per revolution*
Maximum speed	30,000 rpm
Operating temperature	–40 °C to +125 °C –40 °C to +105 °C (with connector)

* For other resolutions **contact RLS**.

Timing diagram

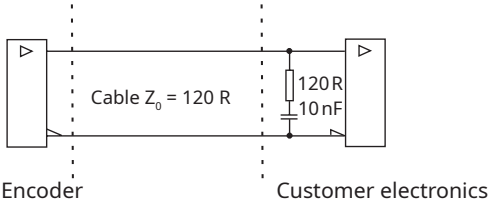


Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20.5 µs

Position increases for clockwise rotation of magnetic actuator.

Recommended signal termination

For data output lines only

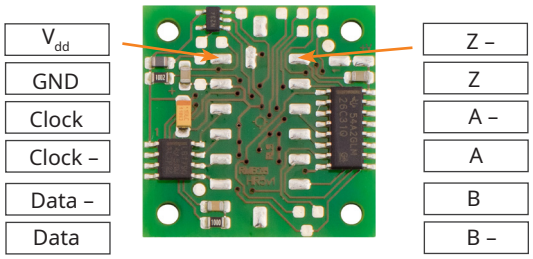


SI – Absolute binary synchro-serial (SSI) + Incremental, RS422

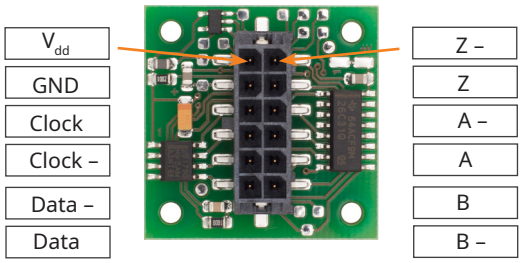
Complex feedback device for absolute position at start up as well as during operation + incremental outputs.
Both the incremental and the SSI output always have the same fixed resolution.

Connections

Without connector



With connector



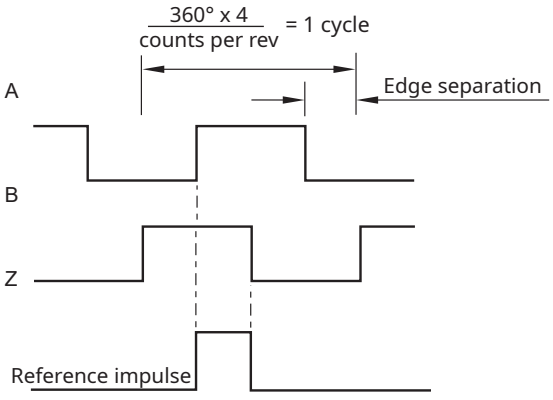
Connector type
Molex 43045-1219
Mating connector (Not provided)
Shell: Molex 43025-1200
Crimp terminal: 43030-xxxx

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	320, 400, 500, 512, 800, 1000, 1024, 1600, 2000, 2048, 4096, 8192 counts per revolution
Maximum speed	30,000 rpm
Operating temperature	–40 °C to +125 °C –40 °C to +105 °C (with connector)

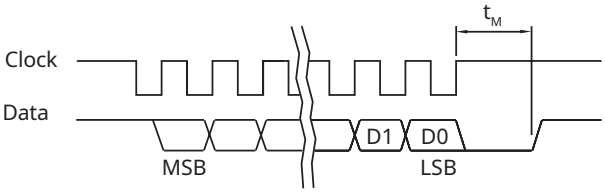
Timing diagram - Incremental

Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

Timing diagram - SSI

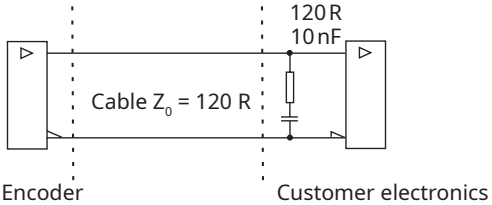


Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20.5 µs

Position increases for clockwise rotation of magnetic actuator.

Recommended signal termination

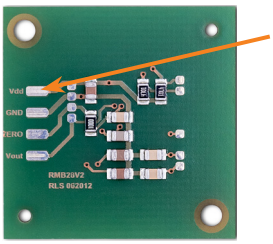
For incremental signals + SSI data output lines only



Vx – Linear voltage output

Alternative for potentiometers

Connections



V_{dd}
GND
-
V_{out}

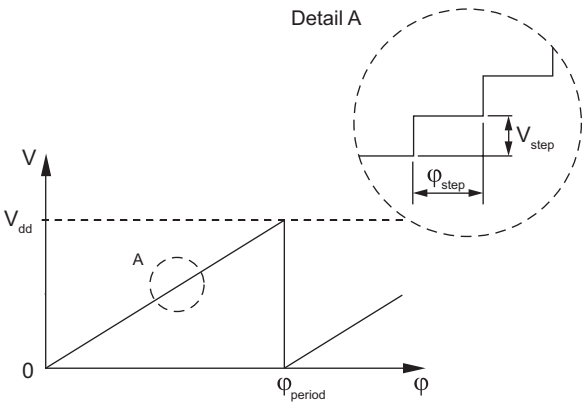
Specifications

Power supply	V_{dd} = 5 V ± 5 %
Current consumption	Typ. 26 mA
Output voltage	0 V to V_{dd}
Output loading	Max. 2 mA
Nonlinearity	1 %
Resolution of DAC	10 bit
Maximum speed	30,000 rpm
Operating temperature	–40 °C to +125 °C

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.

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

Part numbering

RMF44 IC 08B A 10

Series
RMB28 - RMB28 encoder module
RMF44 - RMB28 encoder module on 44 mm diameter metal flange
RMF58 - RMB28 encoder module on 58 mm diameter metal flange

Output type
AC - Analogue sinusoidal, 5 V
DC - Absolute natural binary BiSS, RS422, 5 V
IB - Incremental, open collector, NPN, 24 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

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

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

For **IA**, **IB**, **IE** and **SI** (counts/positions per revolution):

Decimal			**Binary**		
2D0 - 2000	D80 - 800	D32 - 320	13B - 8192	10B - 1024	07B - 128
1D6 - 1600	D50 - 500		12B - 4096	09B - 512	
1D0 - 1000	D40 - 400		11B - 2048	08B - 256	

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

Decimal					**Binary**		
16D - 16000	4D0 - 4000	1D6 - 1600	D50 - 500	D32 - 320	14B - 16384	11B - 2048	08B - 256
10D - 10000	3D6 - 3600	1D0 - 1000	D40 - 400		13B - 8192	10B - 1024	
8D0 - 8000	2D0 - 2000	D80 - 800	D36 - 360		12B - 4096	09B - 512	

For **DC** with enabled 12 bit revolution counter:

Binary		
14M - 16384	**11M** - 2048	**08M** - 256
13M - 8192	**10M** - 1024	**07M** - 128
12M - 4096	**09M** - 512	

For other resolutions **contact RLS**.

For **Vx:**
10B - 1,024 counts/positions per revolution

Shape
S - Square (for RMB28)
A - Standard 44 mm or 58 mm flange (for RMF44 and RMF58)

Special requirements
10 - No special requirements (standard)
11 - With Molex connector – top entry, board A (for output types **IC**, **SC**, **DC** and **SI**)
12 - With Molex connector – side entry, board B (for output types **IC**, **SC**, **DC**)

For commutation outputs please refer to **Commutation and incremental magnetic encoder solutions.**

Not all combinations are valid. Please refer to the table of available combinations on the next page.

Table of available combinations

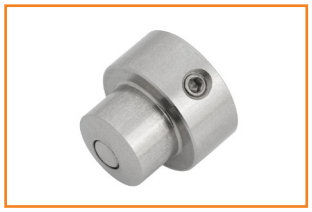
Series	Output type	Resolution	Shape	Special requirements
RMB28 / RMF44 / RMF58	AC	01S	S / A*	10
	Vx	10B		
	IB	2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 13B / 12B / 11B / 10B / 09B / 08B / 07B		10
	IC	2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 13B / 12B / 11B / 10B / 09B / 08B / 07B		10
				11
		D36 / 3D6 / 4D0 / 8D0 / 10D / 16D / 14B		10
				12
	IE	2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 13B / 12B / 11B / 10B / 09B / 08B / 07B		10
	SC	2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 13B / 12B / 11B / 10B / 09B / 08B / 07B		10
				11
		D36 / 3D6 / 4D0 / 8D0 / 10D / 16D / 14B		10
				12
	SI	2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 13B / 12B / 11B / 10B / 09B / 08B / 07B		10
				11
	DC	2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 13B / 12B / 11B / 10B / 09B / 08B / 07B / 13M / 12M / 11M / 10M / 09M / 08M / 07M		10
				11
		D36 / 3D6 / 4D0 / 8D0 / 10D / 16D / 14B / 14M		10
				12

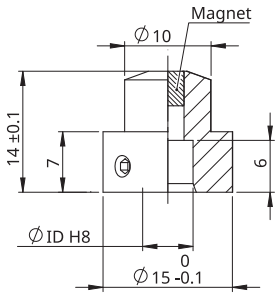
* S for RMB28
  A for RMF44 and RMF58

For commutation outputs please refer to **Commutation and incremental magnetic encoder solutions.**

Magnetic actuator and magnet ordering information

Actuator for integration onto shaft





Shaft = Ø ID h7
Fixing: Grub screw provided

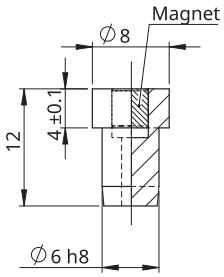
* Hole diameter for nominal shaft size.
See table on the right for more information on available shaft sizes.

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



with N-pole marker

Hole = Ø6G7
Fixing: Adhesive (recommended – LOCTITE 648 or 2701)

Part numbers:

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

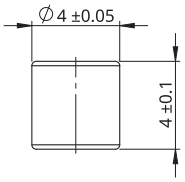
For resolutions from 10 bit absolute (800 cpr incremental) and above
RMH06A3A00

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: 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)

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Global support

Visit our **website** to contact your nearest sales representative.

Document issues

Issue	Date	Page	Description
1	29. 11. 2024	General	Redesign of RMB28D01
2	17. 7. 2025	10, 13, 15, 16	Pictures of boards with connectors added
		18	Special requirements amended