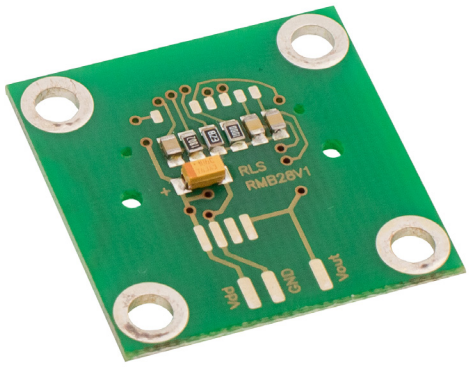
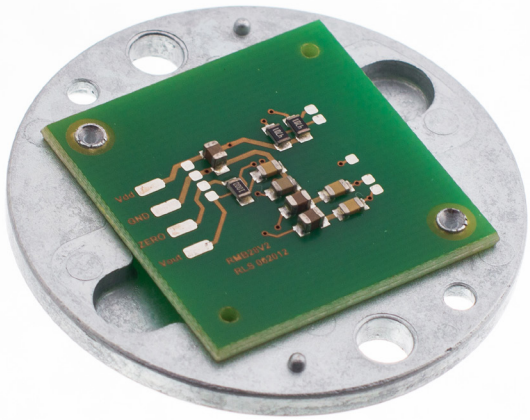
Data sheet
RMB28D01_17
Issue 17, 30th November 2021

RMB28 / RMF44 angular magnetic encoder modules





The images do not represent all variants.

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 on a metal flange with 44 mm diameter for easy mounting.

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.

The RMB28 and RMF44 encoder modules can be used in a wide range of OEM applications, including motor control and industrial automation.

Product range

RMB28AC / RMF44AC
Analogue sinusoidal output with a single sine/cosine period per revolution.

RMB28DC / RMF44DC
BiSS-C interface with up to 8,192 counts per revolution.

RMB28I / RMF44I
Incremental with up to 2,048 counts per revolution (320 to 8,192 counts per revolution with x4 evaluation).

RMB28MD / RMF44MD
Sine/Cosine + Absolute binary synchro-serial + Incremental, 5V.

RMB28SC / RMF44SC
Synchro serial interface (SSI) with up to 8,192 counts per revolution.

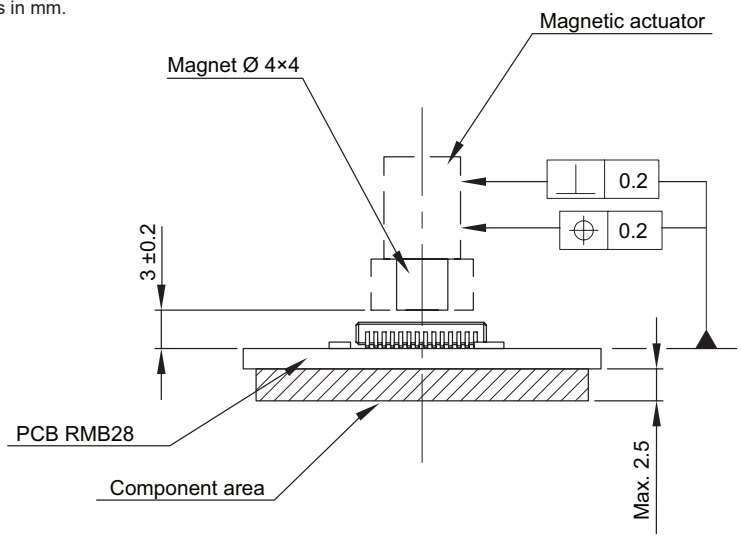
RMB28SI / RMF44SI
Synchro serial interface (SSI) and incremental outputs.

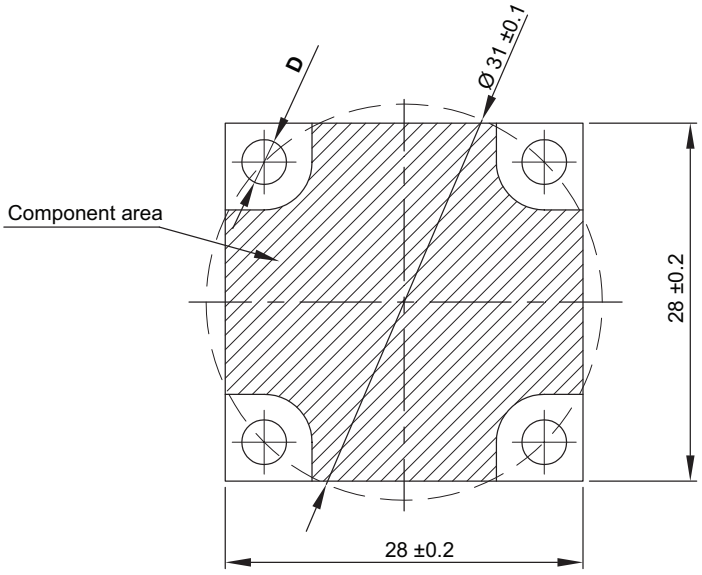
RMB28Vx / RMF44Vx
Linear voltage output in a range of variants.

- **28 mm square module with the option of 44 mm diameter metal flange**
- **Inexpensive solution for OEM integration**
- **5 V and 24 V power supply versions**
- **High speed operation to 60,000 rpm**
- **Absolute - to 13 bit resolution (8,192 counts per revolution)**
- **Industry standard absolute, incremental, analogue, commutation and linear voltage output formats**
- **Accuracy to ±0.5°**
- **RoHS compliant (lead free) - see Declaration of conformity**

RMB28 installation drawing

Dimensions and tolerances in mm.



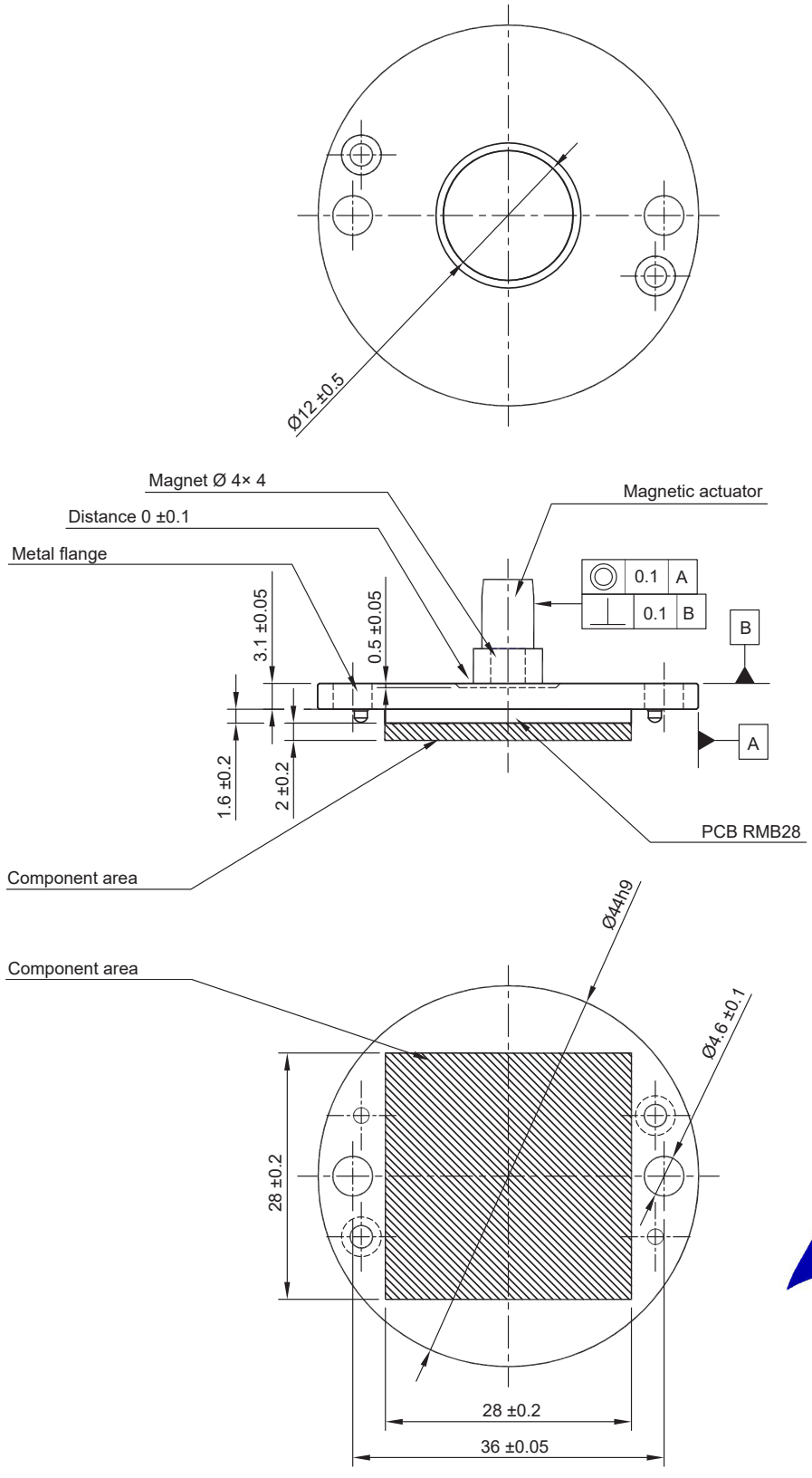


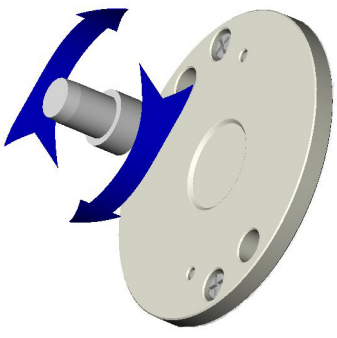
Output type	Hole diameter (D)
RMB28AC	$2.5^{\pm 0.1}$
RMB28DC	$2.5^{\pm 0.1}$
RMB28IC	$2.5^{\pm 0.1}$
RMB28IB	$3.5^{\pm 0.1}$
RMB28IE	$3.5^{\pm 0.1}$
RMB28MD	$3.5^{\pm 0.1}$
RMB28SC	$2.5^{\pm 0.1}$
RMB28SI	$2.5^{\pm 0.1}$
RMB28Vx	$3.5^{\pm 0.1}$

Clockwise (CW) rotation of magnet

RMF44 installation drawing

Dimensions and tolerances in mm.





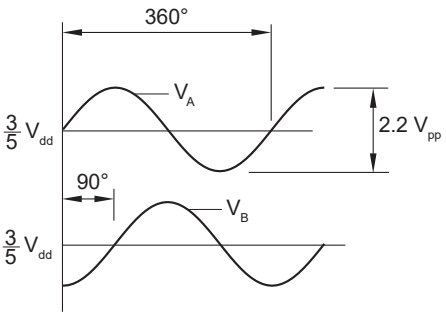
Clockwise (CW) rotation of magnet

RMB28AC / RMF44AC – Analogue sinusoidal

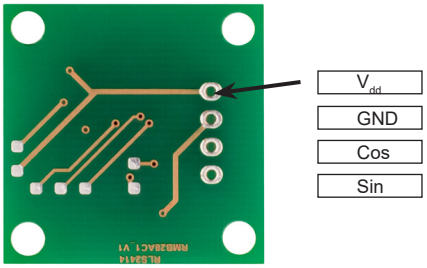
2 channels VA VB sinusoids (90° phase shifted, single ended)

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	V_{dd}/2 ±5 mV
Maximum speed	60,000 rpm	
Operating temperature	–40 °C to +125 °C	

Timing diagram



Connections

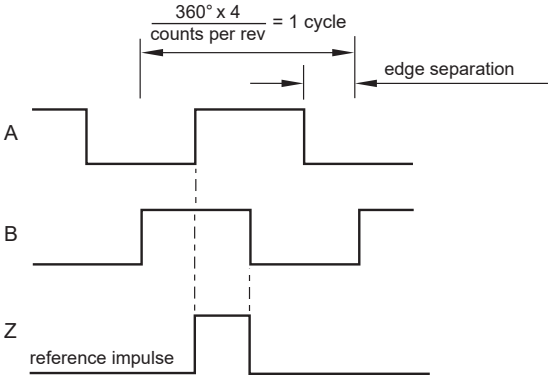


RMB28IE / RMF44IE – Incremental, Open Collector, NPN

Low cost alternative for ball bearing encoders

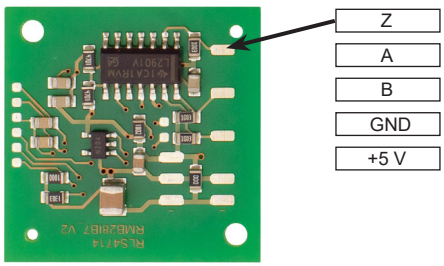
Power supply	V_{dd} = 5 V ±5 %
Current consumption	35 mA (not loaded)
Output signals	A, B, Z
Maximum output load	20 mA
Accuracy	Typ. ±0.5°
Hysteresis	0.18°
Resolution	320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 counts per revolution
Maximum speed	30,000 rpm
Temperature Operating and storage	–40 °C to +125 °C

Timing diagram

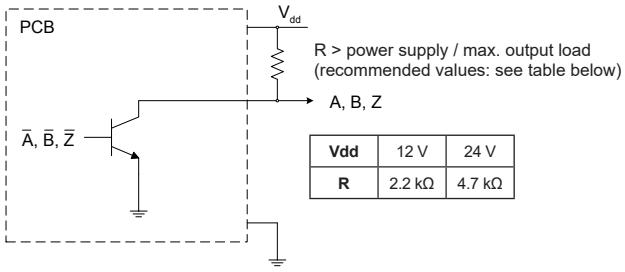


B leads A for clockwise rotation of magnet.

Connections



Recommended signal termination



Vdd	12 V	24 V
R	2.2 kΩ	4.7 kΩ

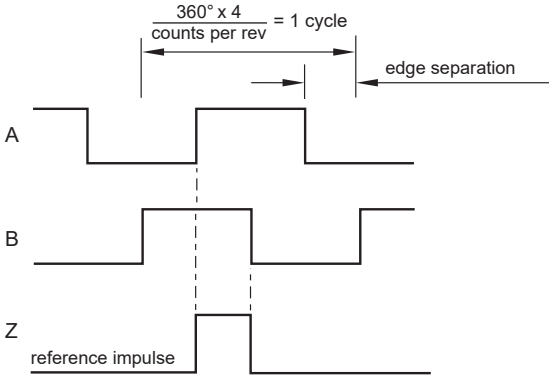
RMB28IC / RMF44IC– Incremental, RS422

Square wave differential line driver to RS422

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	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
Temperature Operating and storage	–40 °C to +125 °C –40 °C to +105 °C (with connector)

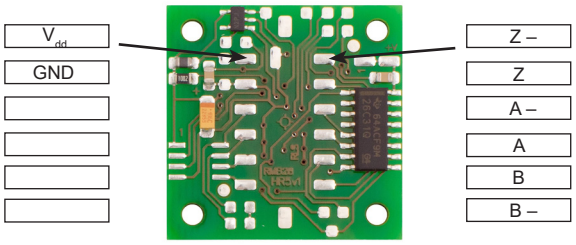
Timing diagram

Complementary signals not shown

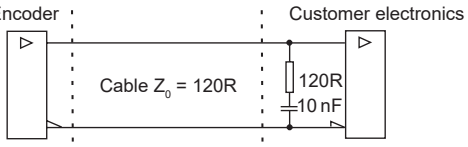


B leads A for clockwise rotation of magnet.

Connections



Recommended signal termination

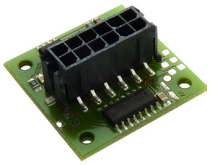


Connector type

Molex 43045-1219

Mating connector (Not provided)

Molex 43025-1200 (crimp terminal 43030-xxxx)

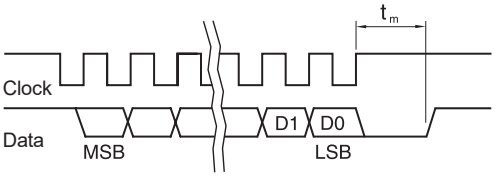


RMB28SC / RMF44SC – Absolute binary synchro-serial (SSI), RS422

Serial encoded absolute position measurement

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	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
Temperature Operating and storage	–40 °C to +125 °C –40 °C to +105 °C (with connector)

Timing diagram

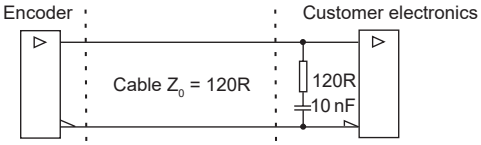


Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20 µs

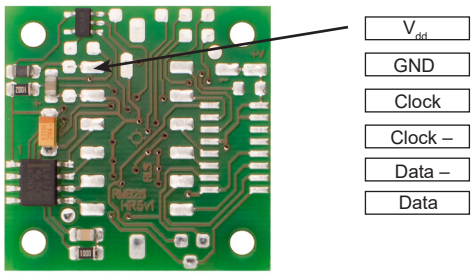
Position increases for clockwise rotation of magnet.

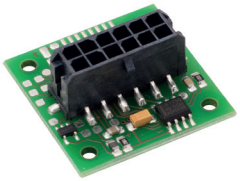
Recommended signal termination

For data output lines only



Connections





Connector type

Molex 43045-1219

Mating connector (Not provided)

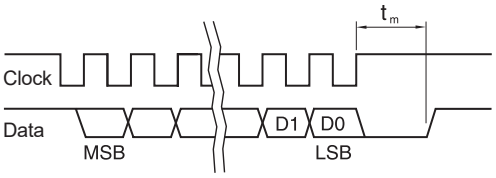
Molex 43025-1200 (crimp terminal 43030-xxxx)

RMB28SI / RMF44SI – 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.

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, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 counts per revolution
Maximum speed	30,000 rpm
Temperature Operating and storage	–40 °C to +125 °C –40 °C to +105 °C (with connector)

Timing diagram - SSI

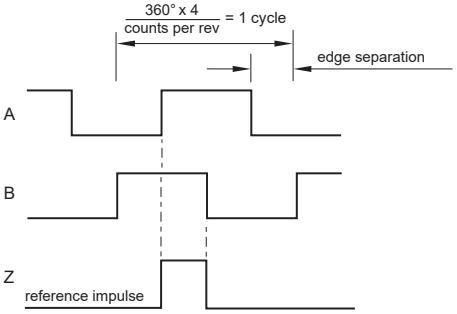


Clock ≤ 4 MHz 12.5 µs ≤ t_m ≤ 20.5 µs

Position increases for clockwise rotation of magnetic actuator.

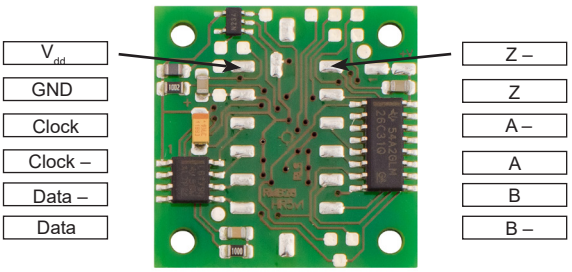
Timing diagram - Incremental

Complementary signals not shown



B leads A for clockwise rotation of magnetic actuator.

Connections

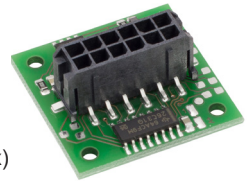


Connector type

Molex 43045-1219

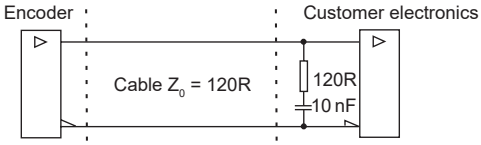
Mating connector (Not provided)

Molex 43025-1200 (crimp terminal 43030-xxxx)



Recommended signal termination

For incremental signals + SSI data output lines only



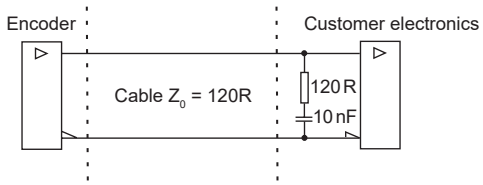
RMB28DC / RMF44DC – Absolute encoder with BiSS-C interface

Serial encoded absolute position measurement

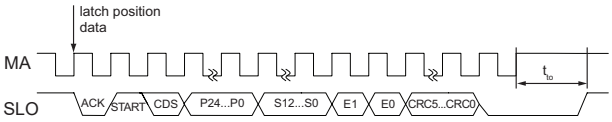
Output code	Natural binary
Power supply	V_{dd} = 5 V ±5 %
Current consumption	Max. 50 mA
Clock input	MA (RS422)
Data output	SLO (RS422)
Accuracy	Typ. ±0.5°
Hysteresis	0.18°
Resolution	320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 positions per revolution
Maximum speed	30,000 rpm
Operating temperature	–40 °C to +125 °C –40 °C to +105 °C (with connector)
Max MA frequency	8 MHz

Recommended signal termination

For data output lines only



Timing diagram – BiSS-C

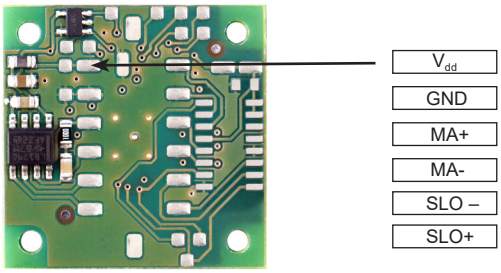


Data	Length	Description
P24 – P0	0 to 24 bit	Revolution counter value (length depends on the settings chosen)
S12 – S0	3 to 13 bit	Position inside the revolution (length depends on the resolution)
E1 – E0	2 bit	Error data
CRC5 – CRC0	5 to 6 bit	Cyclic redundancy check data; polynomial 0x43; inverted bit output

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.

Connections

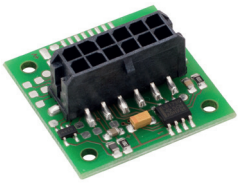


Connector type

Molex 43045-1219

Mating connector (Not provided)

Molex 43025-1200 (crimp terminal 43030-xxxx)

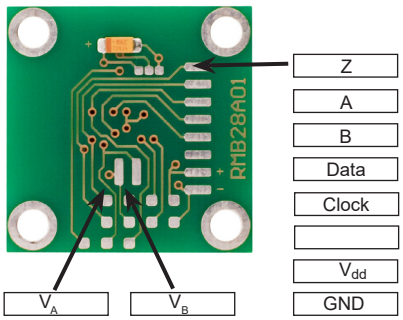


RMB28MD / RMF44MD – Sine/Cosine + Absolute binary synchro-serial (SSI) + Incremental

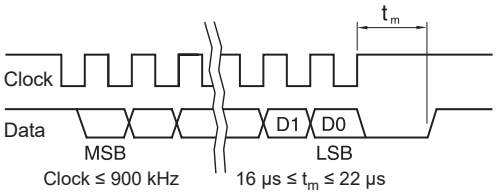
Complex feedback device for absolute position at start-up as well as during operation + incremental outputs

Output code	Natural binary	
Power supply	V_{dd} = 5 V ±5 %	
Current consumption	13 mA – incremental and SSI (not loaded)	
Incremental outputs	A, B, Z	
Sin/Cos outputs	Signal amplitude:	1.1 V ±0.2 V
	Signal offset	V_{dd}/2 ±5 mV
Data output	Serial data	
Data input	Clock	
Accuracy	±0.7°	
Hysteresis	0.45°	
Resolution	8 bit + 64 ppr (256 cpr) + one sine/ cosine period per revolution	
Maximum speed	60,000 rpm	
Temperature Operating and storage	–40 °C to +125 °C	

Connections

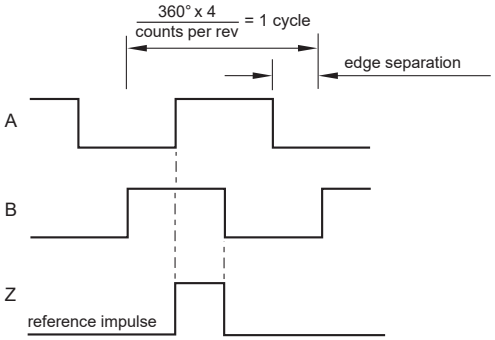


Timing diagram - SSI



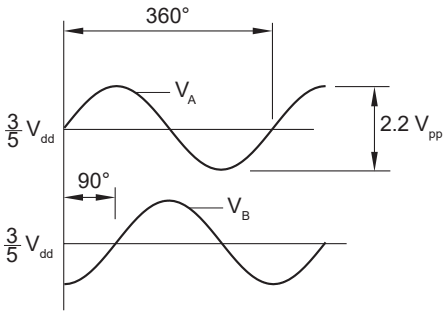
Position increases for clockwise rotation of magnet.

Timing diagram - Incremental



B leads A for clockwise rotation of magnet.

Timing diagram - Sine/Cosine

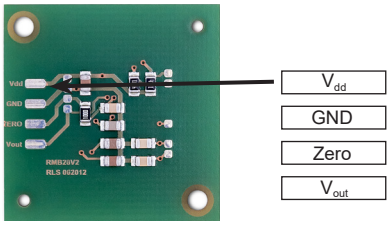


RMB28Vx / RMF44Vx – Linear voltage output

Alternative for potentiometers

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
Temperature Operating and storage	–40 °C to +125 °C

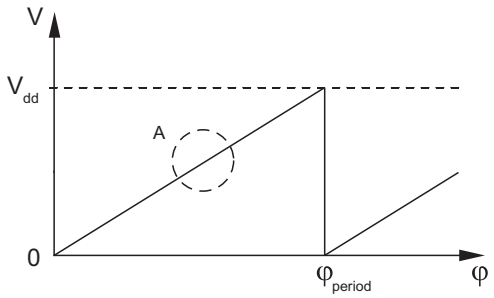
Connections

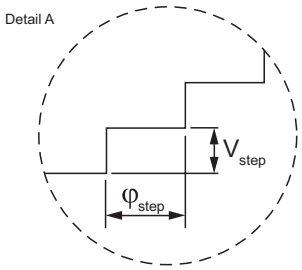


The digital relative angular position information is converted into linear voltage with a built-in 10 bit D/A converter. The linear output voltage swing ranges from 0 V and V_{dd} (5 V). The number of periods within one revolution (N_{period}) can be 1, 2, 4 or 8, representing one full swing over an 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 for linear voltage output





$$\varphi_{step} = \frac{\varphi_{period}}{N_{step}} \qquad V_{step} = \frac{V_{dd}}{N_{step}}$$

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

φ_{period}	N_{period}	N_{step}	φ_{step}
360°	1	1024	0.35°
180°	2	1024	0.18°
90°	4	1024	0.09°
45°	8	512	0.09°

Output type and electrical variant

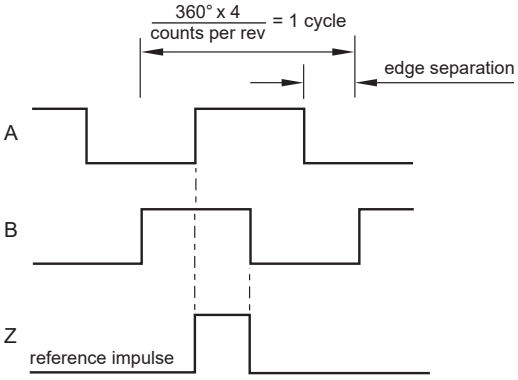
Rotation \ φ_{period}	**360°**	**180°**	**90°**	**45°**
Clockwise	VA	VB	VC	VD
Counterclockwise	VE	VF	VG	VH

RMB28IB / RMF44IB – Incremental, Open Collector, NPN

Square wave output

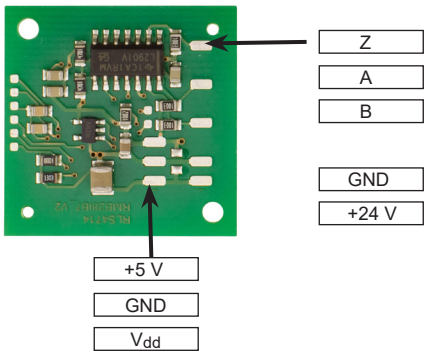
Power supply	V_{dd} = 8 V to 26 V
Current consumption	50 mA
Output signals	A, B, Z
Maximum output load	20 mA
Accuracy	Typ. ±0.5°
Hysteresis	0.18°
Resolution	80 to 2,048 pulses per revolution (320, 400, 500, 512, 800, 1,000, 1,024, 1,600, 2,000, 2,048, 4,096, 8,192 counts per revolution)
Maximum speed	30,000 rpm
Temperature Operating and storage	–40 °C to +125 °C

Timing diagram

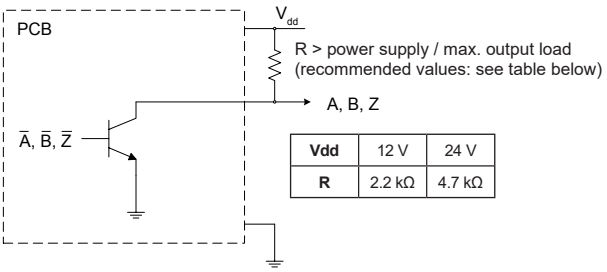


B leads A for clockwise rotation of magnet.

Connections



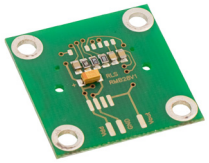
Recommended signal termination



Vdd	12 V	24 V
R	2.2 kΩ	4.7 kΩ

NOTE: RMB28IB / RMF44IB boards need 2 power supplies; pad V_{dd} needs 24 V and pad +5 V needs 5 V. Pads V_{in}, GND and +5 V have been provided to allow easy connection to a 3 terminal voltage regulator to generate 5 V from 24 V.

Part numbering



RMF44 IC 08B A 10

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

Output type
AC - Analogue sinusoidal, 5 V
DC - BiSS, RS422, 5 V
IB - Incremental, open collector, NPN, 24 V
IC - Incremental, RS422, 5 V
IE - Incremental, open collector, NPN, 5 V
MD - SSI + Incremental + Analogue sinusoidal, 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**

NOTE: Not all combinations are valid.

Shape
S - Square (for RMB28)
A - Standard 44 mm diameter aluminium flange (for RMF44)

Special requirements
10 - No special requirements (standard)
11 - With Molex connector (for **IC**, **SC** and **SI**)

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

For **MD**:
08B - 256 counts or positions per revolution

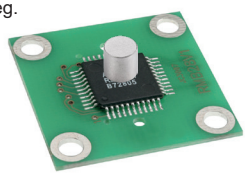
For **DC, IB, IC, IE, SC** and **SI** (counts/positions per revolution):

Decimal		
D32 - 320	**D80** - 800	**2D0** - 2000
D40 - 400	**1D0** - 1000	
D50 - 500	**1D6** - 1600	

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

For **Vx**:
10B - 1,024 steps per revolution

* For sample quantities of RMB28 supplied with a magnet please add “KIT” to the end of the required RMB28 part number, eg. RMB28IC09BS10KIT.



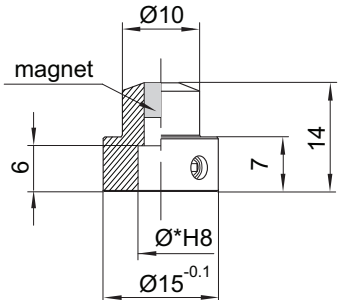
Series	Output type	Resolution	Shape	Special requirements
RMB28 / RMF44	AC	01S	S / A	10
	MD	08B		
	Vx	10B		
	IB	2D0 / 1D6 / 1D0 / D80 / D50 / D40 / D32 / 13B / 12B / 11B / 10B / 09B / 08B / 07B		10 / 11
	IE			
	IC			
	SC			
	SI			
	DC			

Magnetic actuator and magnet ordering information

Dimensions and tolerances in mm.

Actuator for integration onto shaft

Shaft = Ø*h7
Fixing: Grub screw provided

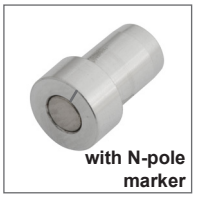


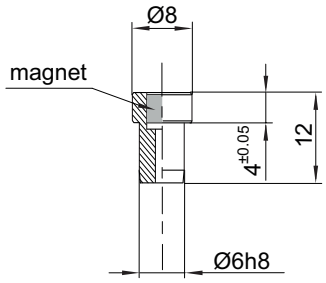
Part numbers:

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

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

Actuator for integration into shaft





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

Part numbers:

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

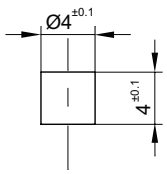
For resolutions from 10 bit absolute (800 cpr incremental) and above
RMH06A3A00

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: Glue (recommended – LOCTITE 648 or LOCTITE 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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Document issues

Issue	Date	Page	Amendments done
9	8. 3. 2017	General	RMF44 added
10	1. 2. 2018	3	RMF44 installation drawing amended
11	18. 5. 2018	3	RMF44 installation drawing amended
		4 - 6, 8, 9	Resolutions amended
12	27. 7. 2018	General	Resolution amended
13	17. 9. 2018	3	RMF44 installation drawing amended
14	29. 8. 2019	3	RMF44 installation drawing amended
15	19. 12. 2019	4, 10	Signal termination amended
16	13. 5. 2020	4	Recommended signal termination for RMB28IE / RMF44IE amended
		2, 8, 12	RMB28DC / RMF44DC added
17	30. 11. 2021	3	Drawing amended

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