

RLB miniature PCB level incremental magnetic encoder sensor system



RLB is a PCB level incremental encoder sensor system consisting of a PCB sensor and a magnetic scale or a ring. It has been designed for embedded motion control applications as a position control loop feedback element in space constraint applications.

The information carrier is a periodically magnetised scale with a pole length of 2 mm. Radial or axial reading of the ring is possible.

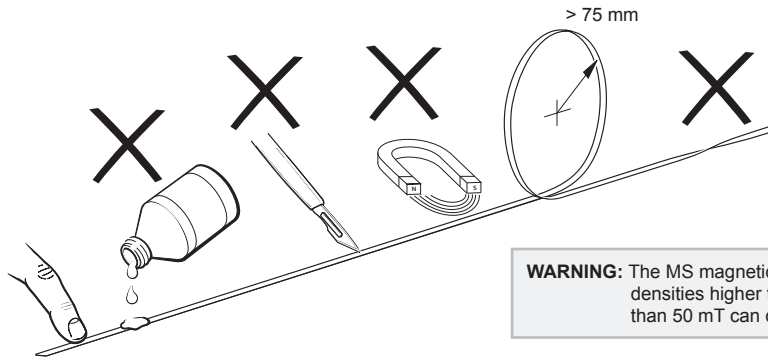
State of the art position sensing assures highly repeatable position measurement under wide installation tolerances and temperature ranges.

Position information is output in incremental quadrature format with the option of a periodic reference mark (every pole).

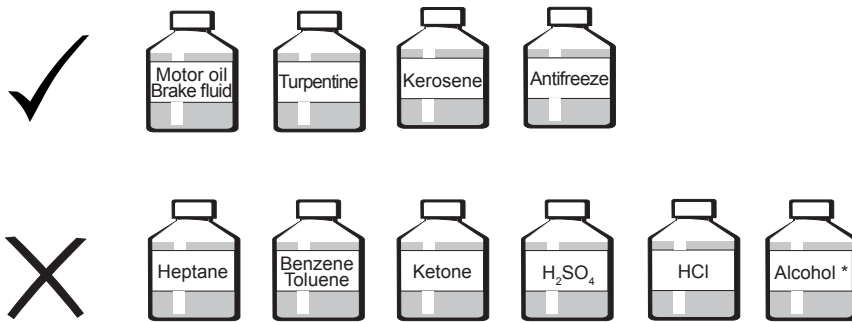
Maximum speed depends on the chosen resolution and minimum edge separation time; eg. for linear applications to 7 m/s at 1 μ m and to 75 m/s at 10 μ m. For more information about maximum speed in rotary applications go to [magnetic ring data sheet](#).

- Miniature design; 2 × 8 × 14 mm
- Incremental quadrature TTL output signals A, B, Z
- Periodic, bidirectional index impulse
- High speed operation
- Flex cable connection
- RoHS compliant- see Declaration of conformity

Storage and handling for linear magnetic scales



WARNING: The MS magnetic scale should not be exposed to magnetic field densities higher than 50 mT on its surface. Magnetic fields higher than 50 mT can damage the scale.

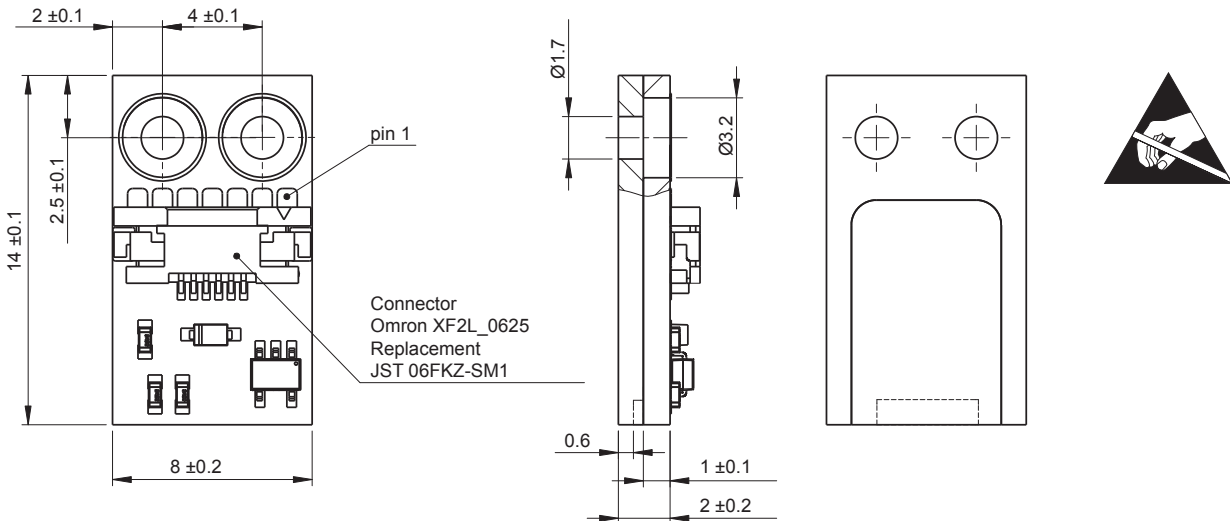


* Use of alcohol for cleaning is considered safe, however, it is not allowed to immerse the scale in alcohol.

For radial and axial ring storage and handling refer to [magnetic ring data sheet](#).

Dimensions

Dimensions and tolerances are in mm.

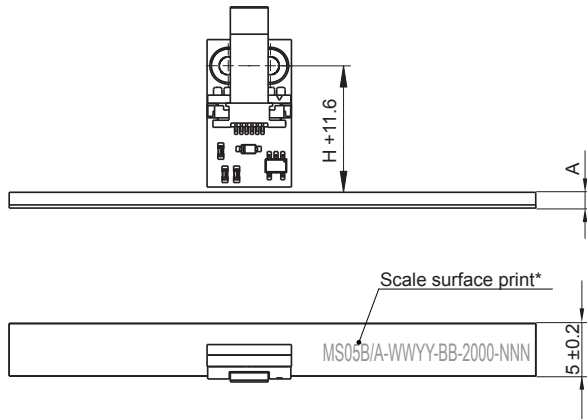


Connections

Pin	Signal
1	Error
2	+5 V
3	GND
4	Z
5	B
6	A

Installation tolerances

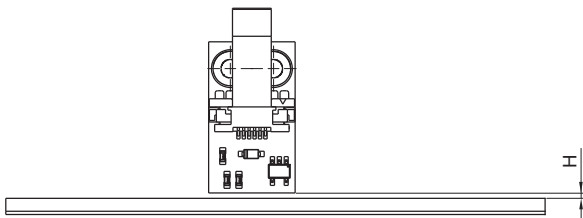
Dimensions and tolerances are in mm.



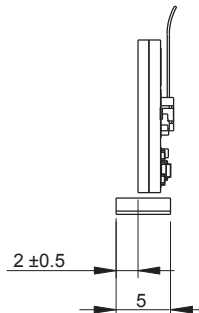
	Magnetic scale thickness (A)	Ride height (H)
With back-adhesion tape (option A)	1.5 ± 0.15	0.1–0.8
With back-adhesion tape, with cover foil (option B)	1.6 ± 0.15	0.1–0.7
No back-adhesion tape (option I)	1.3 ± 0.15	0.1–0.8
No back-adhesion tape, with cover foil (option N)	1.4 ± 0.15	0.1–0.7

* Scale surface print does not represent the actual part numbering. It is used for orientation purpose of the scale vs. readhead and contains information which allows the traceability of the scale to production data.

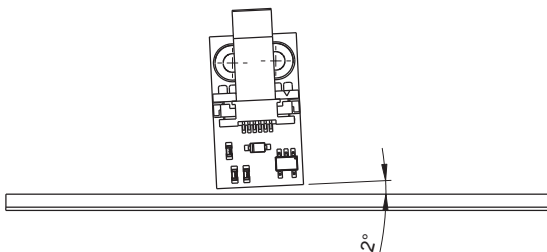
Ride height



Lateral offset



Pitch



Roll



Yaw



For radial and axial ring installation tolerances refer to [magnetic ring data sheet](#).

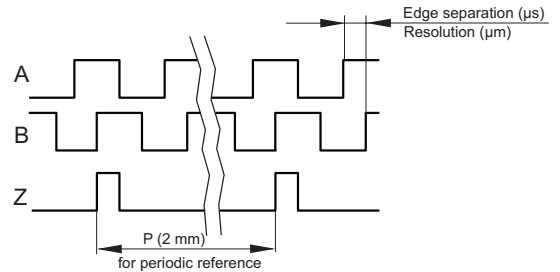
Technical specifications

System data											
Maximum length for MS scale	50 m										
Pole length	2 mm										
For rotary maximum speed table refer to magnetic ring data sheet . Available resolutions and maximum speed for linear application:											
Part numbering	Resolution (µm)	Counts / 2 mm	Maximum speed (m/s)								
			K	A	B	C	D	E	F	G	H
13B	≈ 0.244	8,192	1.82	0.91	0.23	0.11	0.06	0.03	0.02	0.01	0.01
12B	≈ 0.488	4,096	3.65	1.82	0.46	0.23	0.12	0.06	0.05	0.02	0.01
11B	≈ 0.976	2,048	7.30	3.65	0.91	0.46	0.24	0.12	0.10	0.05	0.02
2D0	1	2,000	7.47	3.73	0.93	0.47	0.24	0.12	0.10	0.05	0.02
1D6	1.25	1,600	9.33	4.67	1.17	0.58	0.30	0.16	0.12	0.06	0.03
10B	≈ 1.953	1,024	14.58	7.30	1.82	0.91	0.48	0.24	0.19	0.10	0.05
1D0	2	1,000	14.93	7.47	1.87	0.93	0.49	0.25	0.20	0.10	0.05
D80	2.5	800	18.67	9.33	2.34	1.17	0.61	0.31	0.25	0.12	0.06
09B	≈ 3.906	512	29.17	14.58	3.65	1.82	0.95	0.49	0.38	0.19	0.10
D50	4	500	29.87	14.93	3.73	1.87	0.97	0.50	0.39	0.20	0.10
D40	5	400	37.33	18.67	4.67	2.34	1.22	0.62	0.49	0.25	0.12
D32	6.25	320	46.67	23.33	5.84	2.91	1.52	0.78	0.61	0.31	0.16
08B	≈ 7.812	256	58.34	29.17	7.30	3.65	1.90	0.97	0.77	0.39	0.19
D20	10	200	74.67	37.33	9.33	4.67	2.43	1.24	0.98	0.50	0.25
D16	12.5	160	46.67	23.33	5.84	2.91	1.52	0.78	0.61	0.31	0.16
07B	15.625	128	80.00	58.34	14.58	7.30	3.81	1.94	1.53	0.77	0.39
D10	20	100	74.67	37.33	9.33	4.67	2.43	1.24	0.98	0.50	0.25
D08	25	80	46.67	23.33	5.84	2.91	1.52	0.78	0.61	0.31	0.16
06B	31.25	64	80.00	80.00	29.17	14.58	7.62	3.89	3.07	1.55	0.78
D04	50	40	46.67	23.33	5.84	2.91	1.52	0.78	0.61	0.31	0.16
05B	62.5	32	80.00	80.00	58.34	29.17	15.22	7.78	6.14	3.10	1.56
04B	125	16	n/a	80.00	80.00	58.34	30.43	15.56	12.28	6.19	3.11
03B	250	8	n/a	n/a	80.00	80.00	60.86	31.11	24.56	12.39	6.23
Minimum edge separation (µs)			0.07	0.12	0.50	1	2	4	5	10	20
Maximum count frequency (MHz)			15	8	2	1	0.5	0.25	0.2	0.1	0.05
Part numbering			K	A	B	C	D	E	F	G	H
Accuracy grade for MS scales	±40 µm/m										
Repeatability	Better than unit of resolution for movement in the same direction										
Hysteresis	< 2 µm up to 0.2 mm ride height										
Mechanical data											
Mass	RLB readhead 0.46 g; magnetic scale MS05 30 g/m; for radial and axial rings refer to magnetic ring data sheet										
Environmental conditions											
Temperature	Operating -30 °C to +85 °C										
	Storage -40 °C to +85 °C										
Vibrations (55 Hz to 2000 Hz)	300 m/s ² (IEC 60068-2-6)										
Shocks (11 ms)	300 m/s ² (IEC 60068-2-27)										

RLB2HD – Incremental, no line driver

Power supply	5 V \pm 0.25 V – voltage on readhead
Power consumption	< 20 mA
Output signals	Digital – TTL-level (A, B, Z)
Saturation voltage hi (I = –4 mA)	$V_{dd} - 0.4$ V
Saturation voltage lo (I = 4 mA)	0.4 V
Rise and fall time (c_c = 50 pF)	60 ns
ESD susceptibility of all pins	2 kV (HBM 100 pF, discharge through 1.5 k Ω)

Timing diagram – Incremental, periodic reference mark



Error output

To enable the successful diagnosis of faults, different types of errors are signalled on the Error line using a PWM formatted code as detailed below. In the case of amplitude or frequency failure the PWM cycle frequency is approximately 16.5 Hz (cycle duration: 60.7 ms).

Failure mode	Error output	Possible cause of failure
No error	High	Ride height too high
Amplitude error	Low: 75 % High: 25 %	Readhead removed from tape / ring Demagnetisation of magnetic tape / ring
Frequency error	Low: 50 % High: 50 %	Speed too high
Undervoltage	Low	Power supply low

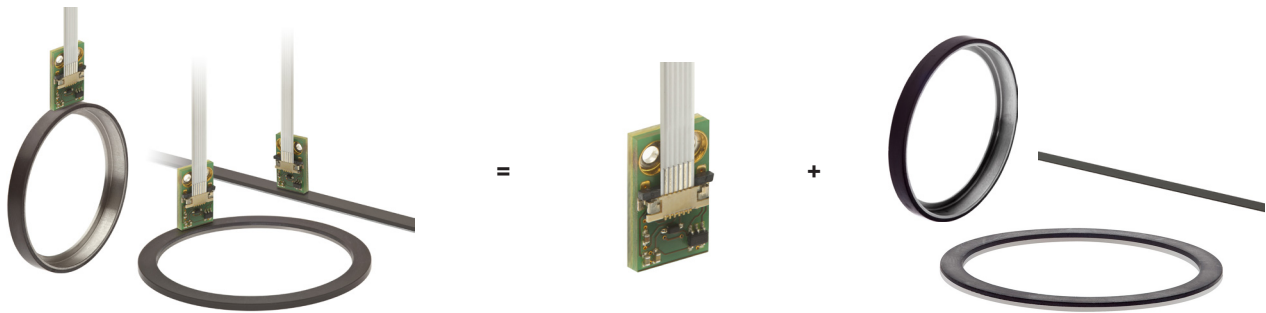
If an error in amplitude occurs, the conversion process is terminated and the incremental output signals are halted. An error in amplitude rules out the possibility of an error in frequency.

Error output is open collector type with built in pull up resistor. It can be used in "wired-or" configuration with other error signals in the system.

Reference mark

Periodic reference mark, every 2 mm (as per scale pitch). The RLB readhead should be ordered with reference mark option C. Magnetic scale or ring should be ordered with **no** reference mark. Position information is output in incremental quadrature format with periodic reference signals. Reference periods correspond to pole length of magnetisation.

Readhead part numbering



RLB system

RLB readhead
eg. RLB2HDA13BA00C00

Magnetic scale / ring
eg. MS05BM100A0000 for scale /
MR047B040B076B00 for ring

RLB 2 HD A 13B A 00 C 00

Pole length
2 - 2 mm pole length

Output type
HD - Incremental, no line driver

Interpolation factor

13B - 8192 (0.244 μm)	09B - 512	D10 - 100 (20 μm)
12B - 4096 (0.488 μm)	D50 - 500 (4 μm)	D08 - 80 (25 μm)
11B - 2048	D40 - 400 (5 μm)	06B - 64
2D0 - 2000 (1 μm)	D32 - 320	D04 - 40 (50 μm)
1D6 - 1600	08B - 256	05B - 32
10B - 1024	D20 - 200 (10 μm)	04B - 16 (125 μm)
1D0 - 1000 (2 μm)	D16 - 160	03B - 8 (250 μm)
D80 - 800	07B - 128	

* Not available for interpolation factors **03B** and **04B** interpolation.
** Not available for interpolation factors **03B**.

Special requirements
00 - No special requirements (standard)

Reference
C - Periodic as per scale pitch (2 mm)

Connection cable (FFC)
00 - Connector only
06 - With FFC, length 127 mm

Minimum edge separation (Frequency)
K - 0.07 μs (15 MHz)*
A - 0.12 μs (8 MHz)**
B - 0.5 μs (2 MHz)
C - 1 μs (1 MHz)
D - 2 μs (0.5 MHz)
E - 4 μs (0.25 MHz)
F - 5 μs (0.2 MHz)
G - 10 μs (0.1 MHz)
H - 20 μs (0.05 MHz)

Formula for linear application resolution

$$\text{Resolution } (\mu\text{m}) = \frac{2000}{\text{Interpolation}}$$

Formula for rotary application resolution

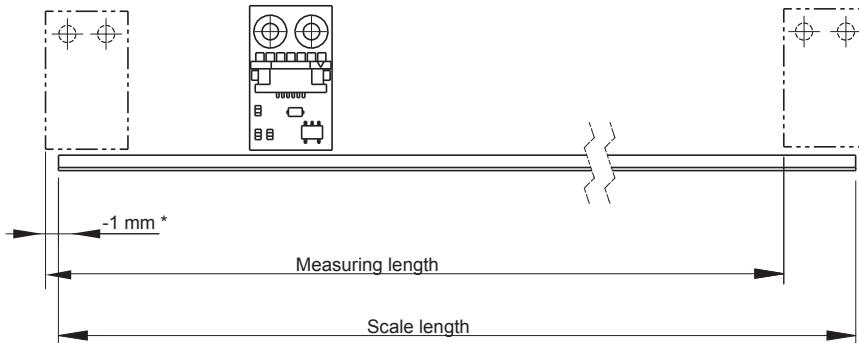
$$\text{Resolution (ppr)} = \frac{\text{cpr}}{4}$$

$$\text{Resolution (cpr)} = \text{Pole number} \times \text{Interpolation}$$

For radial and axial ring part numbering refer to [magnetic ring data sheet](#).

Series	Output type	N/A	Interpolation factor	Minimum edge separation	FFC Connections	Reference	Special Requirements
RLB2	HD	A	05B / D04 / 06B / D08 / D10 / 07B / D16 / D20 / 08B / D32 / D40 / D50 / 09B / D80 / 1D0 / 10B / 1D6 / 2D0 / 11B / 12B / 13B	K / A / B / C / D / E / F / G / H	00	C	00
			04B	A / B / C / D / E / F / G / H	06		
			03B	B / C / D / E / F / G / H	00		
					06		

Magnetic scale part numbering



* Beginning of measuring length from elastoferrite layer edge -1 mm
 Measuring length = Scale length - 10 mm

MS05 B M100 A 0000

Accuracy grade
B - $\pm 40 \mu\text{m/m}$

Scale length
xxxx - Where xxxx equals scale length in cm
Mxxx - Where xxx equals scale length in mm
 (for scale lengths below 1 m)

Position of reference mark
0000 - No reference mark

Options
A - VHB back-adhesive tape (standard)
B - VHB back-adhesive tape, with cover foil*
I - No back-adhesive tape
N - No back-adhesive tape, with cover foil*

* Cover foil supplied separately.

Cover foil part numbering

CF05 1000

Width of cover foil
CF05 - Width 5 mm

Foil length
xxxx - Where xxxx equals foil length in cm (eg. 0400 equals 400 cm of foil)

For radial and axial ring part numbering refer to [magnetic ring data sheet](#).

Accessories part numbering



USB encoder interface
E201



Connector adapter FFC to DB9
(connects to E201)
RLACC005



Magnet viewer
MM001

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Document issues

Issue	Date	Page	Corrections made
1	6. 11. 2014	-	New document
2	22. 12. 2014	3	Installation tolerance updated
		5, 6	Maximum speed tables for rings added
		7	Magnetic scale options added
		8	Accessories added
3	14. 1. 2015	5	76 pole ring resolutions corrected
4	18. 9. 2017	1	Ring reference and RoHS added
		2	Storage added and Dimensions amended
		4	Technical specifications amended
		5	Output description added
		6, 7, 8	Readhead, magnetic scale and accessories part numbering amended

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