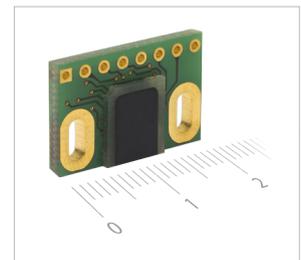


RLC2IC miniature PCB level incremental magnetic encoder sensor system



RLC2IC 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

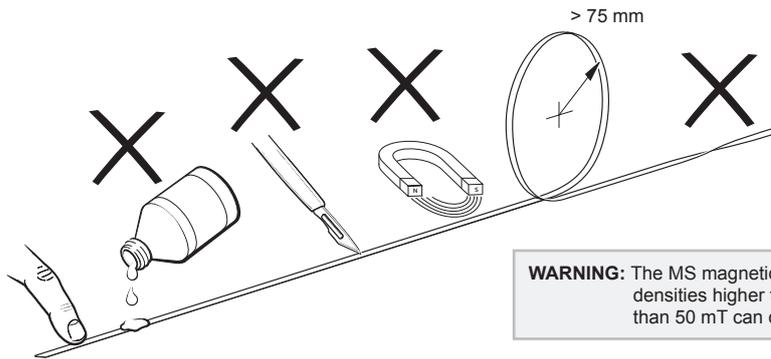
tolerances and temperature ranges.

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

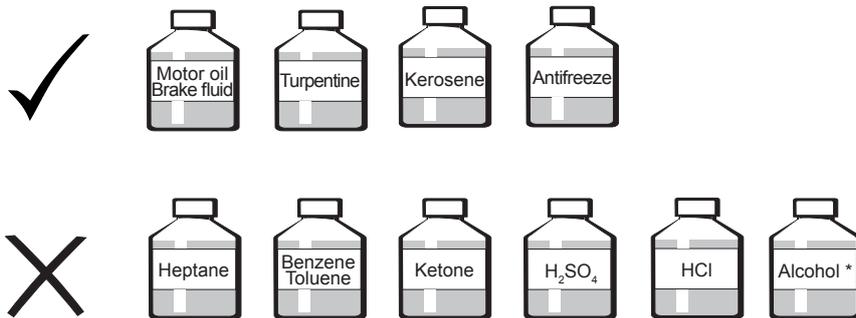
Maximum speed depends on the chosen resolution and minimum edge separation time; eg. for linear applications to 7 m/s at 1 μ m and to 75 m/s at 10 μ m. For more information about maximum speed in rotary applications go to [magnetic ring data sheet](#).

- Miniature design; 4 × 13.5 × 20 mm
- Incremental quadrature A, B, Z (RS422)
- Unique or periodic bidirectional index impulse
- High speed operation
- 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.

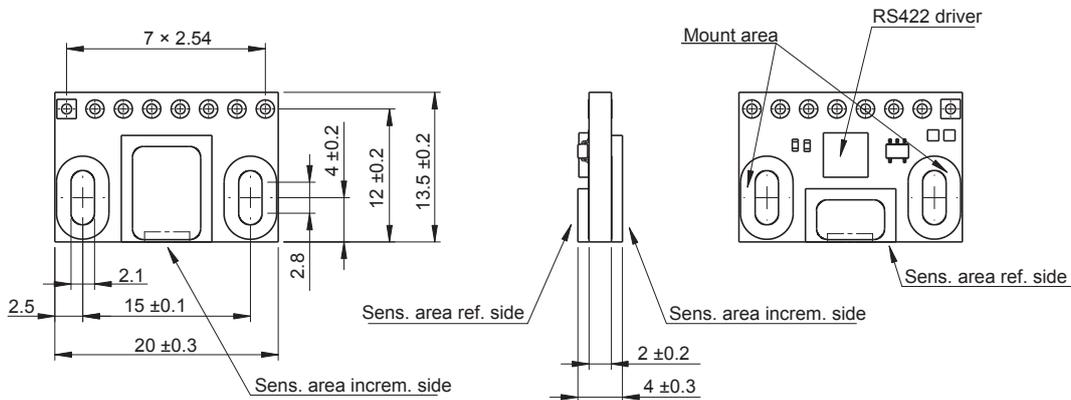


* Use of alcohol for cleaning is considered safe, however, it is not allowed to immerse the scale in alcohol.

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

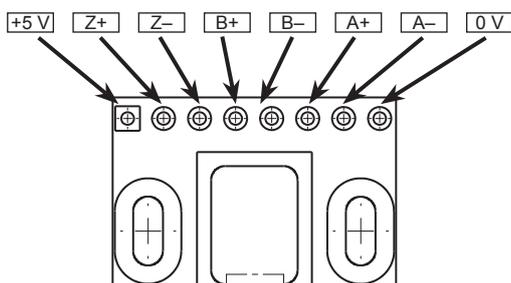
Dimensions

Dimensions and tolerances are in mm.



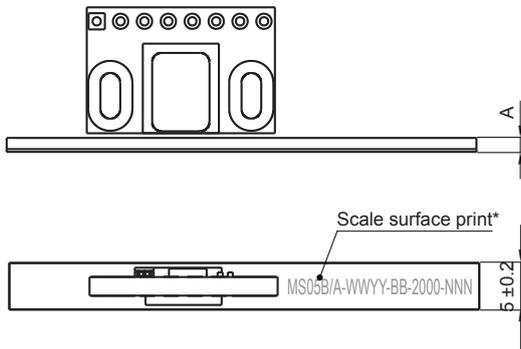
Connections

Front side



Installation tolerances

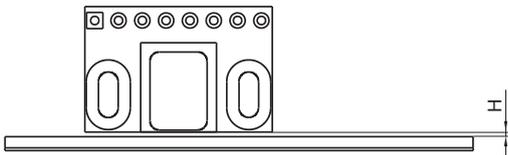
Dimensions and tolerances are in mm.



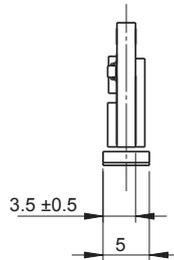
	Magnetic scale thickness (A)	Ride height (H)
With back-adhesion tape (option A)	1.5 ± 0.15	0.1–0.8
With back-adhesion tape, with cover foil (option B)	1.6 ± 0.15	0.1–0.7
No back-adhesion tape (option I)	1.3 ± 0.15	0.1–0.8
No back-adhesion tape, with cover foil (option N)	1.4 ± 0.15	0.1–0.7

* 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.

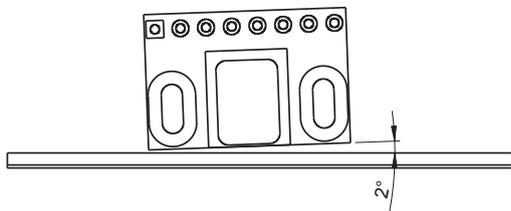
Ride height



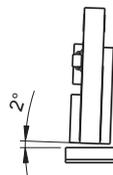
Lateral offset



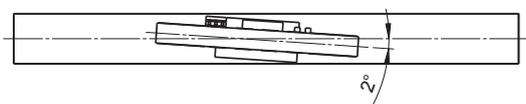
Pitch



Roll



Yaw



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

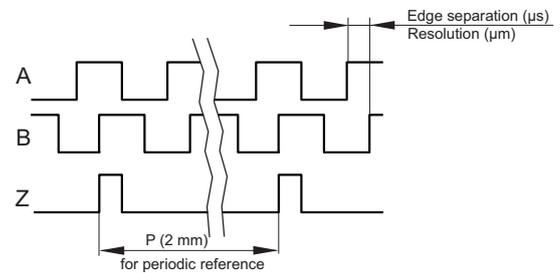
Technical specifications

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		RLC readhead 1.25 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)									

RLC2IC – Incremental, RS422

Power supply	5 V \pm 0.25 V – voltage on readhead	
Power consumption	< 30 mA	
Output signals	Digital – RS422 (A+, B+, Z+, A–, B–, Z–)	
High level output voltage ($I_{OH} = -20$ mA)	> 2.4 V	$V_{dd} - 0.4$ V
Low level output voltage ($I_{OL} = 20$ mA)	< 0.4 V	0.4 V
Rise and fall time ($c_c = 50$ pF)	< 10 ns	60 ns
ESD susceptibility of all pins	2 kV (HBM 100 pF, discharge through 1.5 k Ω)	
AWG for connection wires	≥ 21	

Timing diagram – Incremental, periodic reference mark

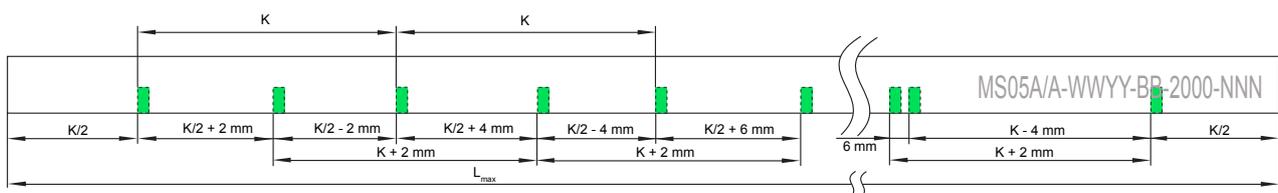


Reference mark

Reference marks can be provided in 2 ways:

- 1) Selected at point of order.** The RLC2IC readhead should be ordered with reference mark option A. Magnetic scale or ring should be ordered with reference mark. If required, the cover foil can be installed over the reference mark.
- 2) Periodic reference mark, every 2 mm (as per scale pitch).** The RLC2IC 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.

Distance coded reference marks. The readhead should be ordered with reference mark option A. The distance coded reference mark option provides multiple reference marks that are individually spaced according to specific mathematical algorithm. Absolute position is calculated after traversing 2 successive reference marks. Maximum length and minimal traverse depend on basic spacing (K) between reference marks, which is customer selectable at point of order. For further information please refer to [Distance coded reference mark data sheet \(LM10D17\)](#).



Multiple reference marks. For reference marks on multiple locations on the MS magnetic scale please contact RLS for a special part numbering.

Readhead part numbering



RLC2IC system

RLC2IC readhead
eg. RLC2ICA13BA00A00

Magnetic scale / ring
eg. MS05BM100AM010 for scale /
MR047B040A076B00 for ring

RLC 2 IC A 13B A 00 C 00

Pole length
2 - 2 mm pole length

Output type
IC - Incremental, RS422

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
A - With reference mark *
B - No reference mark
C - Periodic reference mark as per scale pitch (every 2 mm)

Connections
00 - No connector

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

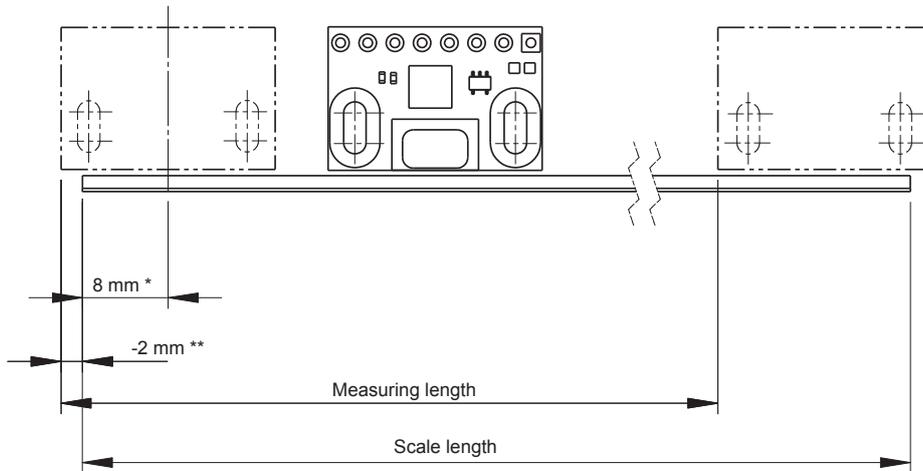
$$\text{Resolution (ppr)} = \frac{\text{cpr}}{4}$$

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

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
RLC2	IC	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	A / C	00
			04B	A / B / C / D / E / F / G / H		B	
			03B	B / C / D / E / F / G / H		C	
				B			

Magnetic scale part numbering



- * Minimal distance of reference mark from left edge = 8 mm
- ** Beginning of measuring length from elastoferrite layer edge = -2 mm
Measuring length = SL - 16 mm

MS05 B M100 A M010

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
- Dxxx - Distance coded reference mark; where xxx equals basic increment in mm
- Mxxx - Where xxx equals position of magnetised reference mark in mm
- xxxx - Where xxxx equals position of magnetised reference mark in cm

NOTE: Reference mark position will be within ± 0.1 mm from requested position.

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



Magnet viewer
MM0001

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Document issues

Issue	Date	Page	Corrections made
1	22. 12. 2014	-	New document
2	14. 1. 2015	5	76 pole ring resolutions corrected
3	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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