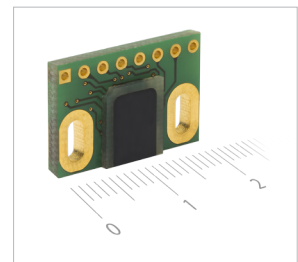
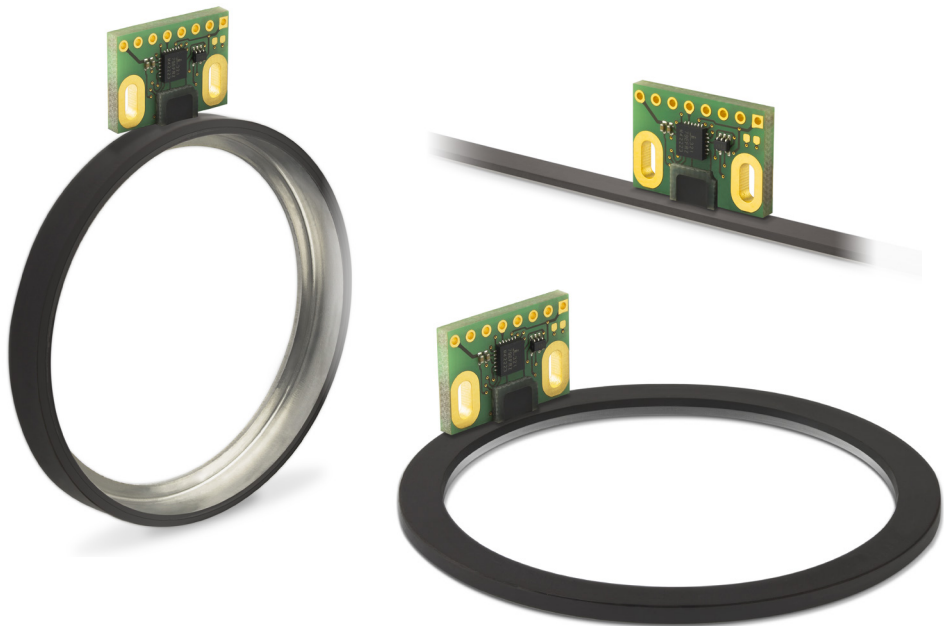


## RLC2IC miniature PCB level incremental magnetic encoder sensor system



**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

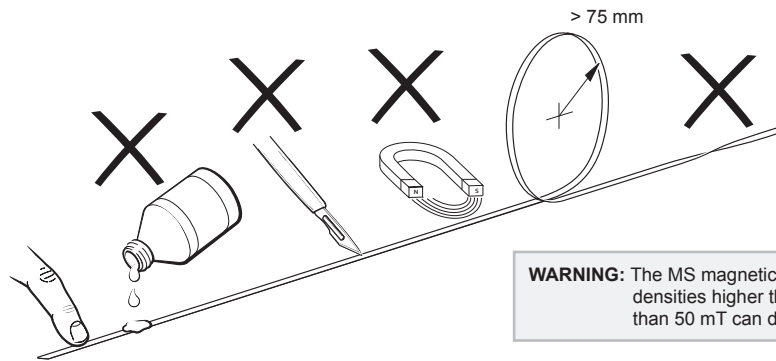
tolerances and temperature ranges.

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

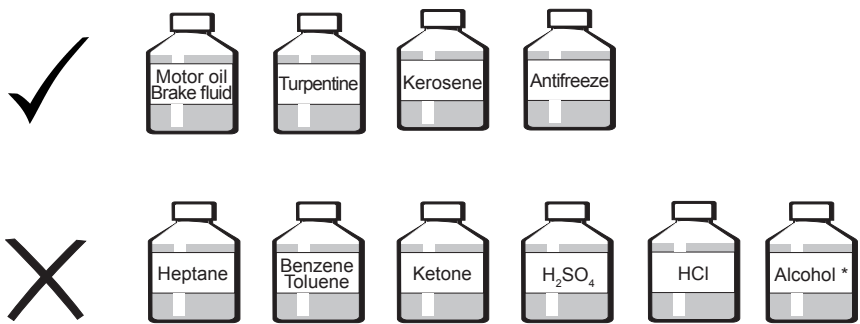
Maximum speed depends on the chosen resolution and minimum edge separation time; eg. for linear applications to 7 m/s at 1  $\mu$ m and to 75 m/s at 10  $\mu$ m. For more information about maximum speed in rotary applications go to [magnetic ring data sheet](#).

- 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.

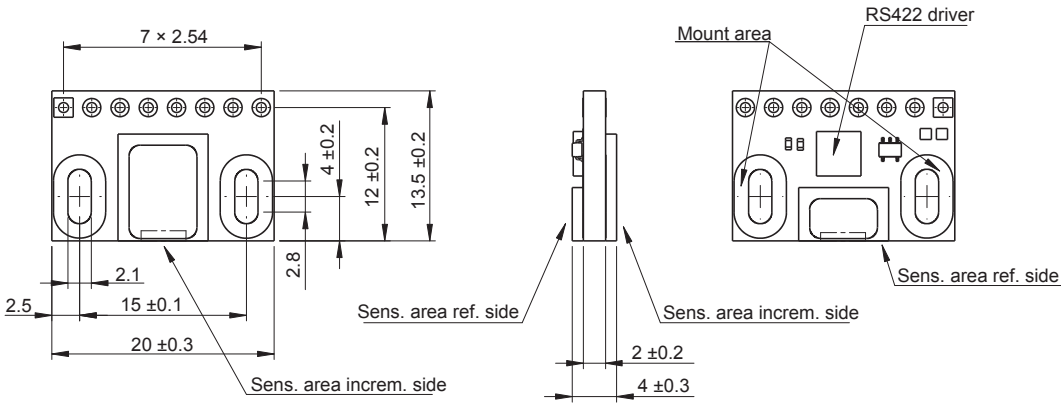


\* Use of alcohol for cleaning is considered safe, however, it is not allowed to immerse the scale in alcohol.

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

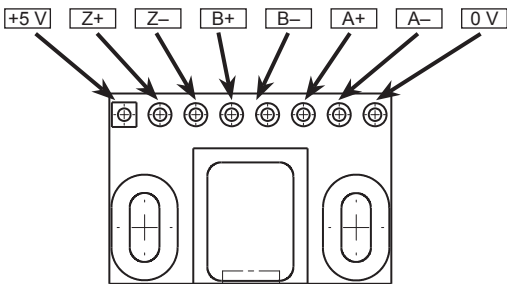
Dimensions

Dimensions and tolerances are in mm.



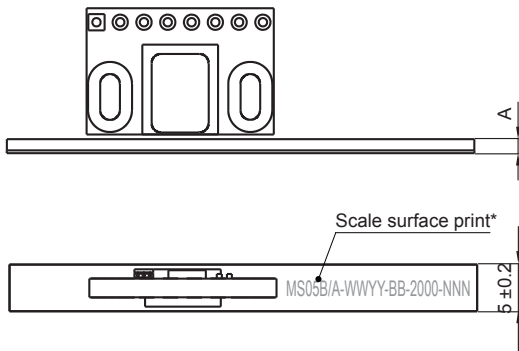
Connections

Front side



## Installation tolerances

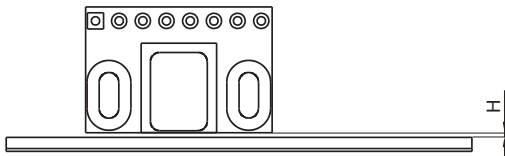
Dimensions and tolerances are in mm.



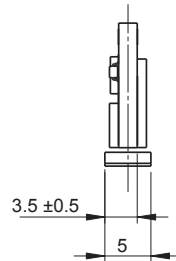
	Magnetic scale thickness (A)	Ride height (H)
With back-adhesion tape (option A)	$1.5 \pm 0.15$	0.1–0.8
With back-adhesion tape, with cover foil (option B)	$1.6 \pm 0.15$	0.1–0.7
No back-adhesion tape (option I)	$1.3 \pm 0.15$	0.1–0.8
No back-adhesion tape, with cover foil (option N)	$1.4 \pm 0.15$	0.1–0.7

\* 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.

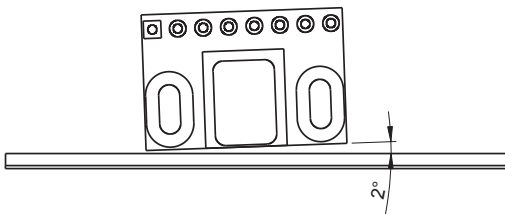
Ride height



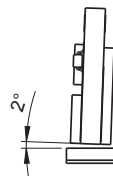
Lateral offset



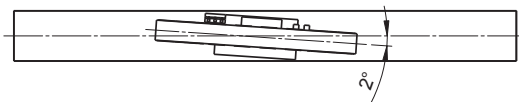
Pitch



Roll



Yaw



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

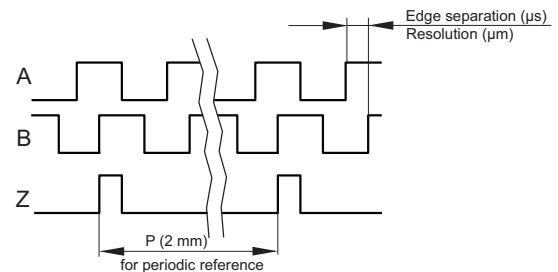
## Technical specifications

System data											
Maximum length for MS scale			50 m								
Pole length			2 mm								
For rotary maximum speed table refer to <a href="#">magnetic ring data sheet</a> . Available resolutions and maximum speed for linear application:											
Part numbering	Resolution (µm)	Counts / 2 mm	Maximum speed (m/s)								
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/s² (IEC 60068-2-6)								
Shocks (11 ms)			300 m/s² (IEC 60068-2-27)								

## RLC2IC – Incremental, RS422

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

Timing diagram – Incremental, periodic reference mark

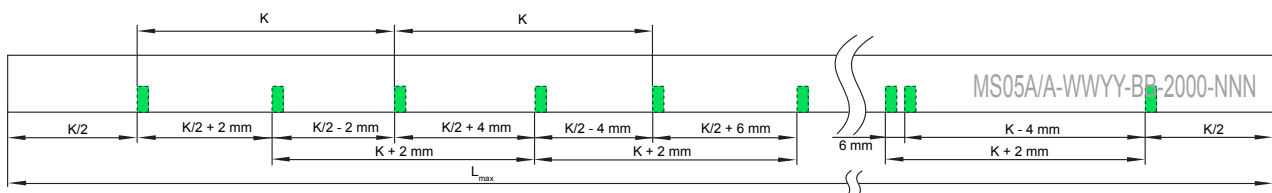


## Reference mark

Reference marks can be provided in 2 ways:

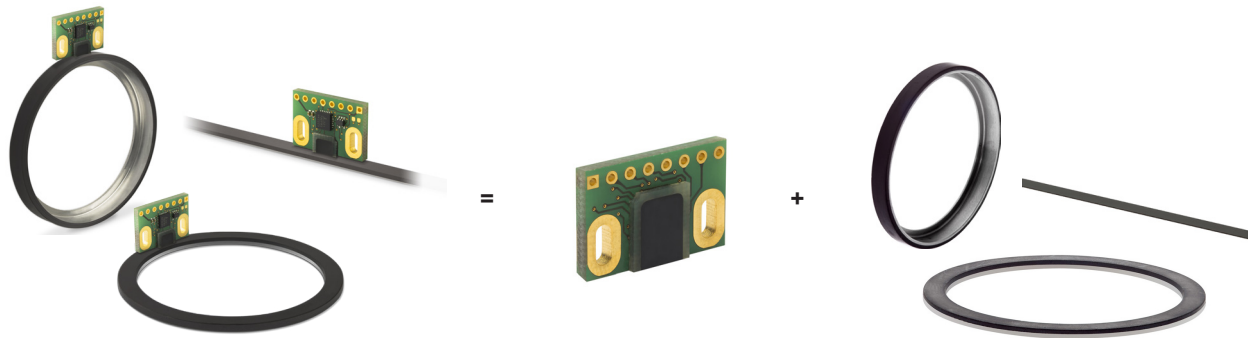
- 1) Selected at point of order.** The RLC2IC readhead should be ordered with reference mark option A. Magnetic scale or ring should be ordered with reference mark. If required, the cover foil can be installed over the reference mark.
- 2) Periodic reference mark, every 2 mm (as per scale pitch).** The 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		Special requirements 00 - No special requirements (standard)		Reference	
13B - 8192 (0.244 µm)		09B - 512		D10 - 100 (20 µm)		A - With reference mark *		Connections	
12B - 4096 (0.488 µm)		D50 - 500 (4 µm)		D08 - 80 (25 µm)		B - No reference mark		Minimum edge separation (Frequency)	
11B - 2048		D40 - 400 (5 µm)		06B - 64		C - Periodic reference mark as per scale pitch (every 2 mm)		K - 0.07 µs (15 MHz) *	
2D0 - 2000 (1 µm)		D32 - 320		D04 - 40 (50 µm)		D - 2 µs (0.5 MHz)		A - 0.12 µs (8 MHz) **	
1D6 - 1600		08B - 256		05B - 32		E - 4 µs (0.25 MHz)		B - 0.5 µs (2 MHz)	
10B - 1024		D20 - 200 (10 µm)		04B - 16 (125 µm)		F - 5 µs (0.2 MHz)		C - 1 µs (1 MHz)	
1D0 - 1000 (2 µm)		D16 - 160		03B - 8 (250 µm)		G - 10 µs (0.1 MHz)		D - 2 µs (0.5 MHz)	
D80 - 800		07B - 128				H - 20 µs (0.05 MHz)		E - 4 µs (0.25 MHz)	

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

\*\* Not available for interpolation factors 03B.

### Formula for linear application resolution

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

### Formula for rotary application resolution

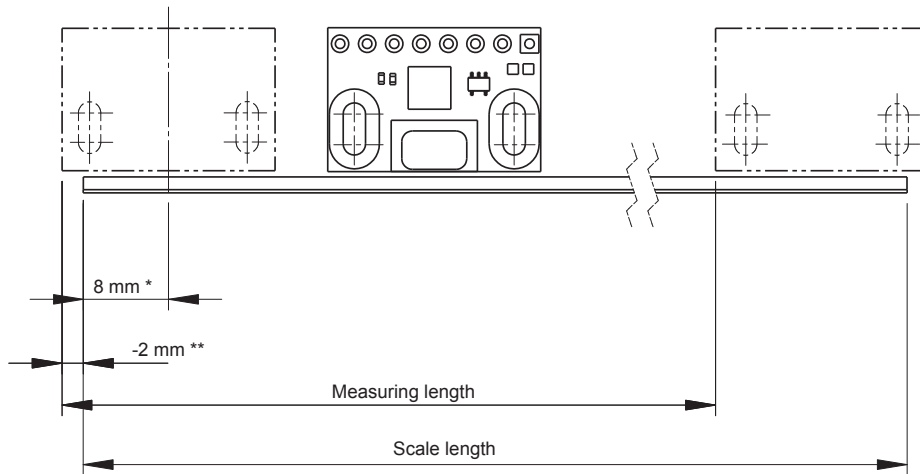
$$\text{Resolution (ppr)} = \frac{\text{cpr}}{4}$$

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

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  $\pm 0.1 \text{ mm}$  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



## Head office

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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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