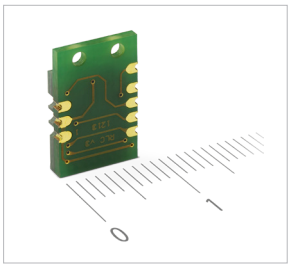
Data sheet
RLCD03_02
Issue 2, 14th January 2015

RLC2HD miniature PCB level incremental magnetic encoder sensor system



RLC2HD is a PCB level incremental encoder sensor system consisting of a PCB sensor and magnetic scale or 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.

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

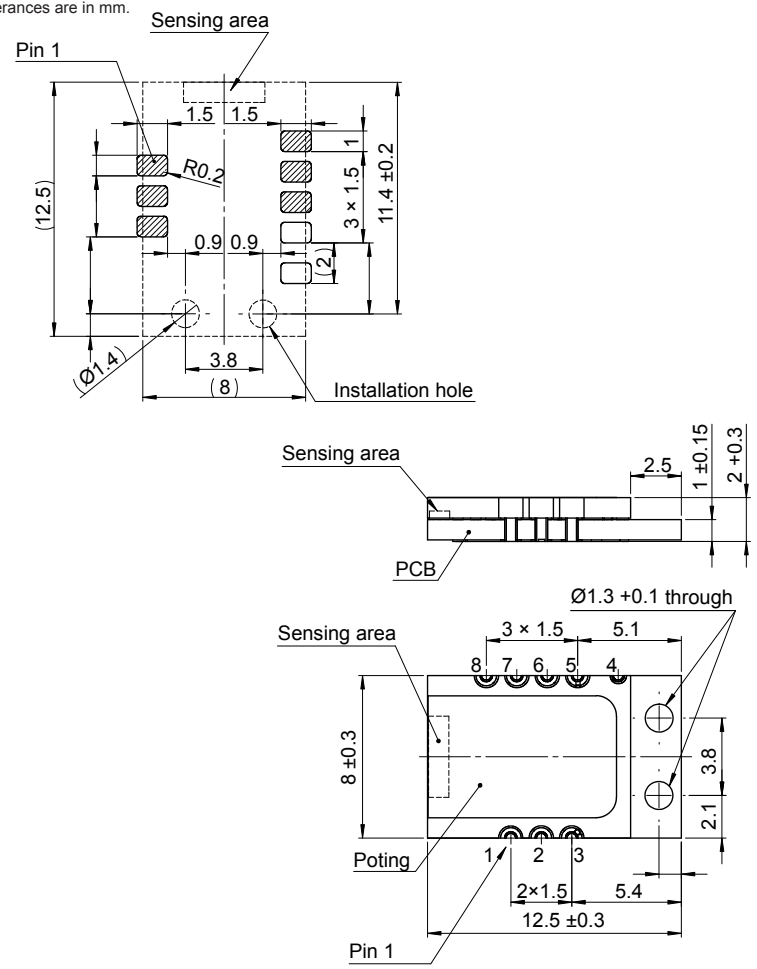
The maximum traverse velocity depends on the chosen resolution and minimum edge separation time, to 7.5 m/s at 1 µm and to 75 m/s at approx. 10 µm.

The RLC2HD is a moisture sensitive device. It should be soldered immediately after the transportation packaging has been opened. If not, baking procedure should be performed.

- **Miniature design**
- **Incremental quadrature TTL output signals A, B, Z**
- **Periodic, bidirectional index impulse**
- **Resolutions from 0.244 µm for linear and up to 622,592 cpr for rotary applications (76 pole ring)**
- **High speed operation**
- **RoHS compliant**

RLC2HD dimensions

Dimensions and tolerances are in mm.

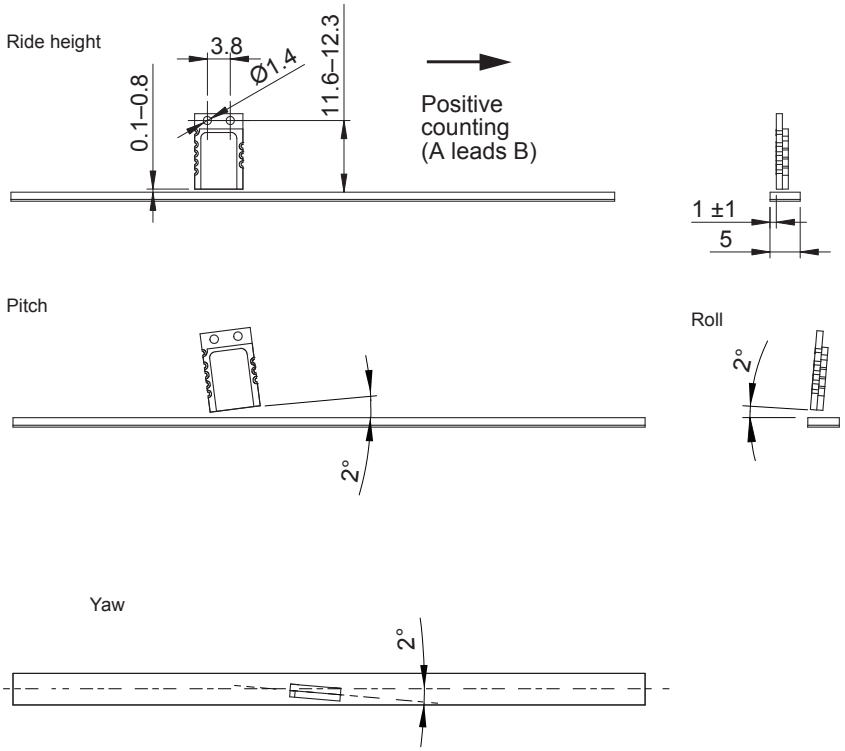


Connections

Pin	Signal
1	Vdd (+5 V)
2	Vdd (+5 V)
3	GND (0 V)
4	NC
5	NC
6	Z
7	B
8	A

RLC2HD installation tolerances

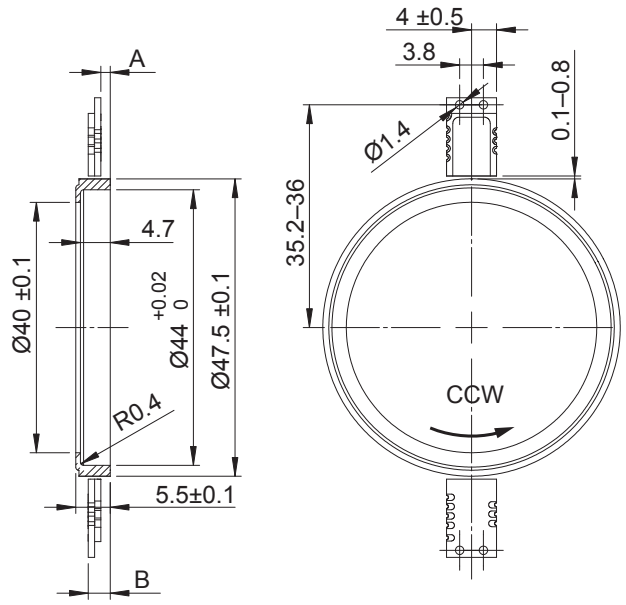
Linear application



RLC2HD installation tolerances continued

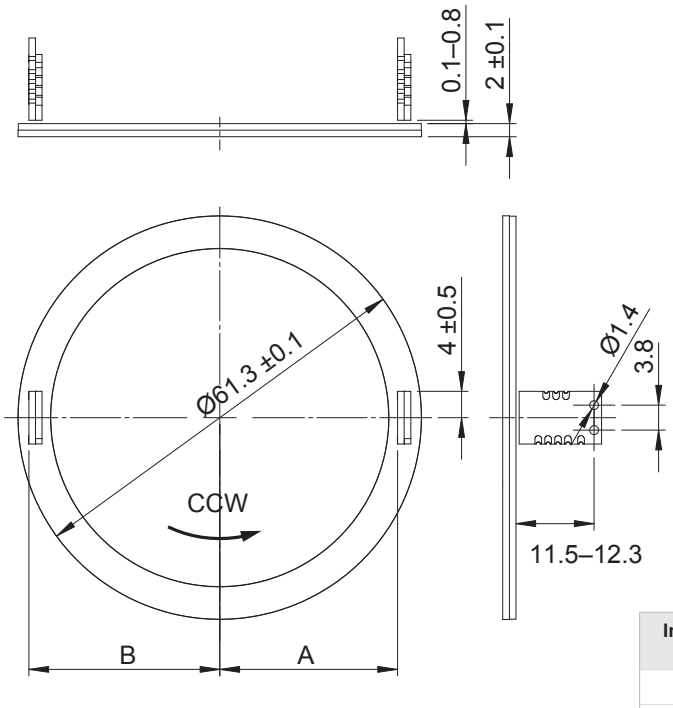
Dimensions and tolerances are in mm.

Radial ring application **MR047B040A076B00 (76 poles)**



Installation type	Distance	Counting at CCW rotation
A	2 ±1	Positive (A leads B)
B	4 ±1	Negative (B leads A)

Axial ring application **MR061C051A092B00 (92 poles)**
MR061C051A090B00 (90 poles)



Installation type	For 90 poles	For 92 poles	Counting at CCW rotation
A	28 ±0.1	28.4 ±0.1	Positive (A leads B)
B	29.8 ±0.1	30.2 ±0.1	Negative (B leads A)

RLC2HD technical specifications

System data	
Pole length	2 mm
Available resolutions and maximum speed	For rotary applications: See tables on pages 5 and 6 For linear applications:

Ordering code	Interpolation factor	Resolution (µm)	Maximum speed (m/s)								
13B	**8192**	**0.244140625**	1.82	0.91	0.23	0.11	0.06	0.03	0.02	0.01	0.01
12B	**4096**	**0.48828125**	3.65	1.82	0.46	0.23	0.12	0.06	0.05	0.02	0.01
11B	**2048**	**0.9765625**	7.30	3.65	0.91	0.46	0.24	0.12	0.10	0.05	0.02
2D0	**2000**	**1**	7.47	3.73	0.93	0.47	0.24	0.12	0.10	0.05	0.02
1D6	**1600**	**1.25**	9.33	4.67	1.17	0.58	0.30	0.16	0.12	0.06	0.03
10B	**1024**	**1.953125**	14.58	7.30	1.82	0.91	0.48	0.24	0.19	0.10	0.05
1D0	**1000**	**2**	14.93	7.47	1.87	0.93	0.49	0.25	0.20	0.10	0.05
D80	**800**	**2.5**	18.67	9.33	2.34	1.17	0.61	0.31	0.25	0.12	0.06
09B	**512**	**3.90625**	29.17	14.58	3.65	1.82	0.95	0.49	0.38	0.19	0.10
D50	**500**	**4**	29.87	14.93	3.73	1.87	0.97	0.50	0.39	0.20	0.10
D40	**400**	**5**	37.33	18.67	4.67	2.34	1.22	0.62	0.49	0.25	0.12
D32	**320**	**6.25**	46.67	23.33	5.84	2.91	1.52	0.78	0.61	0.31	0.16
08B	**256**	**7.8125**	58.34	29.17	7.30	3.65	1.90	0.97	0.77	0.39	0.19
D20	**200**	**10**	74.67	37.33	9.33	4.67	2.43	1.24	0.98	0.50	0.25
D16	**160**	**12.5**	46.67	23.33	5.84	2.91	1.52	0.78	0.61	0.31	0.16
07B	**128**	**15.625**	80.00	58.34	14.58	7.30	3.81	1.94	1.53	0.77	0.39
D10	**100**	**20**	74.67	37.33	9.33	4.67	2.43	1.24	0.98	0.50	0.25
D08	**80**	**25**	46.67	23.33	5.84	2.91	1.52	0.78	0.61	0.31	0.16
06B	**64**	**31.25**	80.00	80.00	29.17	14.58	7.62	3.89	3.07	1.55	0.78
D04	**40**	**50**	46.67	23.33	5.84	2.91	1.52	0.78	0.61	0.31	0.16
05B	**32**	**62.5**	80.00	80.00	58.34	29.17	15.22	7.78	6.14	3.10	1.56
04B	**16**	**50**	NA	80.00	80.00	58.34	30.43	15.56	12.28	6.19	3.11
03B	**8**	**125**	NA	NA	80.00	80.00	60.86	31.11	24.56	12.39	6.23
		Edge separation (µs)	0.07	0.12	0.50	1	2	4	5	10	20
		Minimum 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
Electrical data	
Power supply	5 V ± 0.25 V
Power consumption (without load)	< 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 kΩ)
Maximum AWG for connection wires	21
Mechanical data	
Mass	RLC: 1.25 g; MR050C: 8 g; MR047B: 9 g
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)
Moisture level	MSL6 (IPC/JEDEC-J-STD-020)
Baking procedure	48 h/125 °C or according to IPC/JEDEC-J_STD_033

Available resolutions and maximum speed for MR047B040B076B00 (radial ring, 76 poles)

Ordering code	Resolution (cpr)	Interpolation factor	Maximum speed (rpm)								
13B	**622,592**	**8,192**	720	360	90	45	23	12	9	5	2
12B	**311,296**	**4,096**	1,440	720	180	90	47	24	19	10	5
11B	**155,648**	**2,048**	2,880	1,440	360	180	94	48	38	19	10
001	**152,000**	**2,000**	2,949	1,472	368	184	96	49	39	20	10
1D6	**121,600**	**1,600**	3,682	1,844	461	230	120	61	48	24	12
10B	**77,824**	**1,024**	5,754	2,880	720	360	188	96	76	38	19
002	**76,000**	**1,000**	5,893	2,949	739	368	192	98	78	39	20
D80	**60,800**	**800**	7,371	3,682	922	461	240	123	97	49	25
09B	**38,912**	**512**	11,514	5,754	1,440	720	375	192	151	76	38
D50	**38,000**	**500**	11,792	5,893	1,472	739	384	196	155	78	39
005	**30,400**	**400**	14,735	7,371	1,844	922	481	246	194	98	49
D32	**24,320**	**320**	18,423	9,208	2,305	1,149	601	307	242	122	61
08B	**19,456**	**256**	23,027	11,514	2,880	1,440	752	384	303	153	77
010	**15,200**	**200**	29,476	14,735	3,682	1,844	960	491	388	196	98
D16	**12,160**	**160**	18,423	9,208	2,305	1,149	601	307	242	122	61
07B	**9,728**	**128**	32,508	23,027	5,754	2,880	1,503	768	606	306	154
020	**7,600**	**100**	29,476	14,735	3,682	1,844	960	491	388	196	98
D08	**6,080**	**80**	18,423	9,208	2,305	1,149	601	307	242	122	61
06B	**4,864**	**64**	32,508	32,508	11,514	5,754	3,006	1,535	1,212	611	307
050	**3,040**	**40**	18,423	9,208	2,305	1,149	601	307	242	122	61
05B	**2,432**	**32**	32,508	32,508	23,027	11,514	6,006	3,070	2,424	1,222	614
04B	**1,216**	**16**	NA	32,508	32,508	23,027	12,013	6,141	4,847	2,445	1,229
03B	**608**	**8**	NA	NA	32,508	32,508	24,025	12,282	9,695	4,889	2,458
Edge separation (µs)			0.07	0.12	0.50	1	2	4	5	10	20
Minimum 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**

Available resolutions and maximum speed for MR061C051B090B00 (axial ring, 90 poles)

Ordering code	Resolution (cpr)	Interpolation factor	Maximum speed (rpm)								
13B	**737,280**	**8,192**	608	304	76	38	20	10	8	4	2
12B	**368,640**	**4,096**	1,216	608	152	76	40	20	16	8	4
11B	**184,320**	**2,048**	2,432	1,216	304	152	79	41	32	16	8
001	**180,000**	**2,000**	2,491	1,243	311	156	81	41	33	17	8
1D6	**144,000**	**1,600**	3,109	1,557	389	194	101	52	41	21	10
10B	**92,160**	**1,024**	4,859	2,432	608	304	159	81	64	32	16
002	**90,000**	**1,000**	4,976	2,491	624	311	162	83	65	33	17
D80	**72,000**	**800**	6,224	3,109	779	389	203	104	82	41	21
09B	**46,080**	**512**	9,723	4,859	1,216	608	317	162	128	65	32
D50	**45,000**	**500**	9,957	4,976	1,243	624	325	166	131	66	33
005	**36,000**	**400**	12,443	6,224	1,557	779	406	207	164	83	41
D32	**28,800**	**320**	15,557	7,776	1,947	971	507	259	205	103	52
08B	**23,040**	**256**	19,445	9,723	2,432	1,216	635	324	256	129	65
010	**18,000**	**200**	24,891	12,443	3,109	1,557	811	415	327	165	83
D16	**14,400**	**160**	15,557	7,776	1,947	971	507	259	205	103	52
07B	**11,520**	**128**	25,047	19,445	4,859	2,432	1,269	648	512	258	130
020	**9,000**	**100**	24,891	12,443	3,109	1,557	811	415	327	165	83
D08	**7,200**	**80**	15,557	7,776	1,947	971	507	259	205	103	52
06B	**5,760**	**64**	25,047	25,047	9,723	4,859	2,539	1,296	1,023	516	259
050	**3,600**	**40**	15,557	7,776	1,947	971	507	259	205	103	52
05B	**2,880**	**32**	25,047	25,047	19,445	9,723	5,072	2,593	2,047	1,032	519
04B	**1,440**	**16**	NA	25,047	25,047	19,445	10,144	5,186	4,093	2,064	1,038
03B	**720**	**8**	NA	NA	25,047	25,047	20,288	10,371	8,187	4,129	2,075
Edge separation (µs)			0.07	0.12	0.50	1	2	4	5	10	20
Minimum 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**

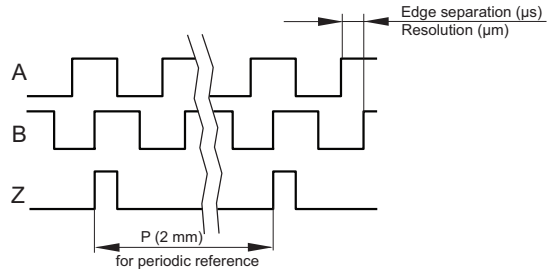
Available resolutions and maximum speed for MR061C051B092B00 (axial ring, 92 poles)

Ordering code	Resolution (cpr)	Interpolation factor	Maximum speed (rpm)								
13B	**753,664**	**8,192**	595	297	74	37	19	10	8	4	2
12B	**376,832**	**4,096**	1,190	595	149	74	39	20	16	8	4
11B	**188,416**	**2,048**	2,379	1,190	297	149	78	40	31	16	8
001	**184,000**	**2,000**	2,437	1,216	304	152	79	41	32	16	8
1D6	**147,200**	**1,600**	3,042	1,523	380	190	99	51	40	20	10
10B	**94,208**	**1,024**	4,753	2,379	595	297	155	79	63	32	16
002	**92,000**	**1,000**	4,868	2,437	610	304	159	81	64	32	16
D80	**73,600**	**800**	6,089	3,042	762	380	198	101	80	40	20
09B	**47,104**	**512**	9,511	4,753	1,190	595	310	159	125	63	32
D50	**46,000**	**500**	9,741	4,868	1,216	610	318	162	128	65	32
005	**36,800**	**400**	12,172	6,089	1,523	762	397	203	160	81	41
D32	**29,440**	**320**	15,219	7,607	1,904	950	496	254	200	101	51
08B	**23,552**	**256**	19,023	9,511	2,379	1,190	621	317	250	126	63
010	**18,400**	**200**	24,350	12,172	3,042	1,523	793	406	320	162	81
D16	**14,720**	**160**	15,219	7,607	1,904	950	496	254	200	101	51
07B	**11,776**	**128**	25,047	19,023	4,753	2,379	1,242	634	501	252	127
020	**9,200**	**100**	24,350	12,172	3,042	1,523	793	406	320	162	81
D08	**7,360**	**80**	15,219	7,607	1,904	950	496	254	200	101	51
06B	**5,888**	**64**	25,047	25,047	9,511	4,753	2,483	1,268	1,001	505	254
050	**3,680**	**40**	15,219	7,607	1,904	950	496	254	200	101	51
05B	**2,944**	**32**	25,047	25,047	19,023	9,511	4,962	2,536	2,002	1,010	508
04B	**1,472**	**16**	NA	25,047	25,047	19,023	9,923	5,073	4,004	2,020	1,015
03B	**736**	**8**	NA	NA	25,047	25,047	19,847	10,146	8,009	4,039	2,030
Edge separation (µs)			0.07	0.12	0.50	1	2	4	5	10	20
Minimum 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**

NOTE: Other ring sizes available upon request.

RLC2HD – Incremental, no line driver

Timing diagram – Incremental, periodic reference mark



RLC2HD readhead part numbering

RLC 2 HD A 13B A 00 C 00

Pole length
2 - 2 mm pole length

Output type
HD - Incremental

Interpolation factor

13B - 8192 (0.244 µm)	**09B** - 512	**D10** - 100
12B - 4096 (0.488 µm)	**D50** - 500	**D08** - 80
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
D80 - 800	**07B** - 128	

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)

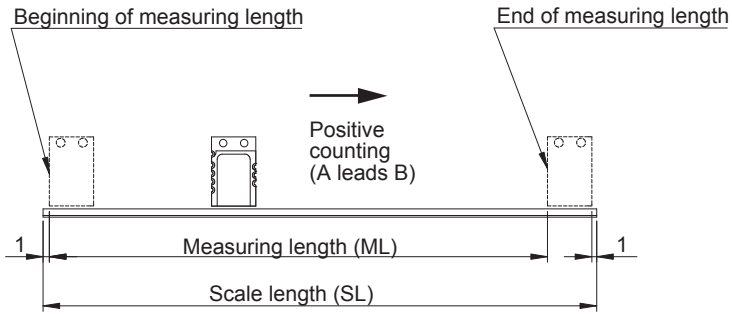
Connections
00 - No connector

Special requirements
00 - No special requirements (standard)
07 - Tape and reel packaging

* Not available with **03B** interpolation.

** Not available with **03B** and **04B** interpolation.

Magnetic scale part numbering



ML = SL–10

MS05 B M100 A 0000

Series
MS05 - 5 mm width, 2 mm pole

Accuracy grade
B - ±40 µm/m

Scale length
Mxxx - Where xxx equals scale length in **mm**
xxxx - Where xxxx equals scale length in **cm**

Options
A - Back-adhesion tape (standard)
B - Back-adhesion tape, with CF05 cover foil*
D - Special back-adhesion tape with additional moisture and solvent resistance
E - Special back-adhesion tape with additional moisture and solvent resistance, with CF05 cover foil*
I - No back-adhesion tape
N - No back-adhesion tape, with CF05 cover foil*

* Cover foil supplied separately.

Cover foil part numbering

CF05 1000

Foil length
xxxx - Where xxxx equals foil length in **cm** (eg. 0400 equals 400 cm of foil)
Mxxx - Where xxx equals foil length in **mm** (eg. M040 equals 40 mm of foil)

Magnetic ring part numbering

Counts per revolution = Nr. of poles × Interpolation

Radial ring **MR 047 B 040 B 076 B 00**

Axial ring **MR 061 C 051 B 092 B 00**

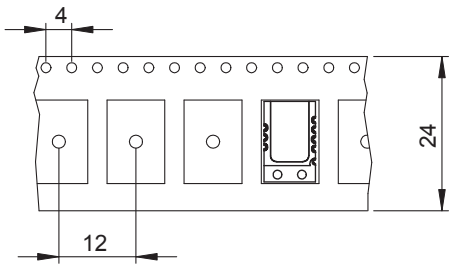
Number of poles
092 - 92 poles
090 - 90 poles

Special requirements
00 - No special requirements
02 - With back-adhesion tape

NOTE: Other ring sizes available upon request.

Tape and reel packaging - special option 07

W24/P12/T0.3 in 13" reel



Accessories part numbering

USB encoder interface

E201

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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