

# **RLC2HD** miniature incremental magnetic encoder module

RLC2HD is a PCB-level incremental encoder system consisting of a PCB sensor and a magnetic scale or ring. It is designed for embedded motion control applications as a position control loop element in applications with limited space.

The state-of-the-art position detection guarantees a highly repeatable position measurement under wide installation tolerances and temperature ranges. The position information is output in incremental quadrature format with the periodic reference mark option (each pole).



## **Features and benefits**

- Miniature design: 8 x 2.1 x 12.5 mm
- Incremental quadrature A, B, Z (TTL)
- Periodic-bidirectional reference mark
- ► High-speed operation

- Suitable for use with linear scale, radial and axial rings
- SMT solder to a customer PCB board
- RoHS compliant



HIGH OPERATING

SPEED

MINIATURE

DESIGN

EASY INSTALLATION WITH SOLDERING

# **General information**

The RLC2HD is a miniature rotary and linear encoder that can be used in space-constrained applications. The readhead provides a single-ended incremental signal and is ideally soldered to the customer's electronics.

## Choose your RLC2HD system

The robust RLC2HD readhead is compatible with the RLS incremental scale MS05 as well as the RLS axial and radial rings. You can select the length of the MS05 scale up to 50 m. There is also a wide range of axial and radial incremental rings available. To ensure safety and reliability, the scale MS05 and the radial rings can be optionally covered with a protective stainless steel foil.

#### RLC2HD + magnetic scale



More about the MS magnetic scales can be found in the MSD01 at **RLS media center**.

#### RLC2HD + radial magnetic ring



More about the radial rings can be found in the MR02D02 at **RLS media center**.

#### RLC2HD + axial magnetic ring





# Storage and handling

All data given below refer to the readhead only. Complete systems with magnetic scale or ring may have other limitations. For more information, see the MSD01, MR02D02 or MR01D01 data sheet at **RLS Media center.** 

Storage temperature

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–40 °C to +85 °C



Up to 70 % non-condensing

Humidity



The encoder is a mechanically sensitive component. Handle it by its edges, touch it lightly, minimize pressure and eliminate bending while maintaining a secure grip to prevent falls. Maximize cleanliness. When it's not in use, place it in an ESD protective packaging (box or tray).



#### Readhead is ESD sensitive - handle with care.

Do not touch electronic circuit, wires or sensor area without proper ESD protection or outside of ESD controlled environment.

## Packaging

Up to 20 pcs packaged individually in an antistatic box. 20+ units packaged in trays (max. 120 pcs per tray, 21 trays per box).

## Tape and reel packaging (special option 07)

W24/P12/T0.3 in 13" reel



# **Dimensions and installation drawings**

Dimensions and tolerances are in mm. Dimensions without tolerance values are in accordance with ISO 2768-m.

#### PCB footprint



Detail A: Valid for all 8 pads





3D model available for download at **RLS Media center.** 



## Installation instructions

When mounting the RLB, make sure that only the mounting surfaces of the PCB assembly are in contact with the mounting bracket. All other parts of the PCB assembly should maintain a minimum distance of 0.1 mm from other metal objects. All permissible distance and angle tolerances must be strictly complied according to the mounting instructions found at MSD01, MR01D01 or MR02D02 data sheet at **RLS Media center**.



- It is important that the space between the readhead and the magnetic scale is maintained over the entire measuring range.
- The magnetic encoder system must be used in accordance with the specified degree of protection. The following factors must be taken into account: IP protection class, operating temperature, external magnetic field, humidity level, mechanical load and EMC compatibility.
- The magnetic encoder system is sensitive to the external magnetic fields. The magnitude of the influence on the magnetic encoder system depends on the magnitude and direction of the external magnetic field. In particular, the rapidly changing stray magnetic fields affect the system and can alter its function. Magnetic field strength within 1 mT reduces the accuracy of the system. Field strengths greater than 1 mT will cause the system to malfunction and as a result the readhead will report an incorrect position. Magnetic field strengths greater than 25 mT will cause irreversible damage to the magnetic scale or ring and will have to be replaced.

# **Technical specifications**

## System data

Pole length		2 mm			
Maximum measuring length		50 m			
System accuracy	Linear application MS05 magnetic scale	±10 μm/m / ±20 μm/m / ±40 μm/m Different accuracy grades of MS05 magnetic scale available. Refer to MSD01			
		available at <b>RLS Media center.</b>			
	Rotary application	<b>Axial:</b> Refer to MR01D01 available at <b>RLS media center.</b> <b>Radial:</b> Refer to MR02D02 available at <b>RLS media center.</b>			
Hysteresis		< 3 μm (at 0.3 mm ride height)			
Repeatability (unidirectional)		< 1 µm			
Reference mark		Periodic			
Set-up time		< 10 ms (after power supply voltage is set in operating range)			
Resolution		Max. 13 bit (~0.244 $\mu m$ ) For details refer to the Table of available resolutions.			
Maximum speed	Linear application	Refer to MSD01 available at <b>RLS media center</b>			
	Rotary application	Axial: Refer to MR01D04 available at RLS media center.			
		Radial: Refer to speed calculator available at <u>RLS website</u> .			
Electrical dat	а				
Power supply		5 V ±0.25 V – voltage on readhead			
Current consumption		< 20 mA			
Reverse polarity protection		Without reverse polarity protection			
Mechanical d	lata				
Mass		1.25 g			

# 

## Environmental data

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 (6 ms)		300 m/s <sup>2</sup> (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		
Humidity		70 % non condensing		
External magnetic field during operation		< 1 mT		
ESD immunity		HBM, Class 2 ±2kv		

## **Reflow data**

Moisture level	MSL6
Maximum reflow temperature	245 °C

Solder in 24h after bag is opened.

# **Electrical connections**



DATA SHEET RLCD03\_05

## **Output type**

#### Incremental, no line driver

RLC2HD

# Specifications Output signals Digital - TTL-level (A, B, Z) Saturation voltage hi (I = -4 mA) V<sub>dd</sub> - 0.4 V Saturation voltage Io (I = 4 mA) 0.4 V Rise and fall time (c<sub>c</sub> = 50 pF) 60 ns

## **Timing diagram**



## Positive direction

Digital output signals – A leads B



For more information, see the MSD01, MR02D02 or MR01D01 data sheet at **RLS Media center**.



# Part numbering

		RLC	2	HD	Α	13B	Α	00	С	00
Polo longth	-									
<b>2</b> - 2 mm										
Output type										
HD - Incremental, no l	ine driver									
Option										
A - Standard										
Interpolation factor (	Resolutions)*									
<b>13B</b> - 8192 (~0.244 μm) <b>12B</b> - 4096 (~0.488 μm) <b>11B</b> - 2048 (~0.976 μm) <b>2D0</b> - 2000 (~1 μm) <b>1D6</b> - 1600 (~1.25 μm) <b>1D6</b> - 1024 (~1.953 μm) <b>1D0</b> - 1000 (~2 μm) <b>D80</b> - 800 (~2.5 μm) * For exact values see table <b>Minimum edge separ</b> <b>K</b> - 0.07 μs (15 MHz) <b>A</b> - 0.12 μs (8 MHz) <b>B</b> - 0.5 μs (2 MHz) <b>C</b> - 1 μs (1 MHz)	09B - 512 (~3.906 μ D50 - 500 (~4 μm) D40 - 400 (~5 μm) D32 - 320 (~6.25 μm 08B - 256 (~7.812 μ D20 - 200 (~10 μm) D16 - 160 (~12.5 μm 07B - 128 (~15.625 e of Available resolutions ation E - 4 μs (0.25 MHz) F - 5 μs (0.2 MHz) G - 10 μs (0.1 MHz) H - 20 μs (0.05 MHz)	um) um) um) ) m) μm) 5.	D10 D08 O6B D04 O5B O4B O3B	- 100 (~20 - 80 (~25 ) - 64 (~31.2 - 40 (~50 ) - 32 (~62.5 - 16 (~125 - 8 (~250 )	μm) um) 25 μm) um) 5 μm) μm) um) Iller must	support t	he			
<b>D</b> - 2 μs (0.5 MHz)		enco	der is us	sed below	the maxi	mum spee	ed.			
Connector										
00 - No connector, thr	ough-hole									
Reference mark										
C - Periodic reference Reference periods c no reference mark.	e mark as per scale pitch ( orrespond to pole length of n	every 2 nagnetisa	mm) ation. Mag	gnetic scale	or ring mu	ıst be order	ed with			
Special requirements										

- **00** No special requirements (standard)
- 07 Tape and reel packaging (for large quantities see page 3)

Not all part number combinations are valid. Please refer to the table of available combinations on the next page for available options.

#### Pole Output Interpolation Minimum edge Reference Special Option Series Connector length type factor separation mark requirements K/A/B/C/D/E/ xxx\* F/G/H A/B/C/D/E/F RLC 2 HD А 04B 00 С 00/07 /G/H B/C/D/E/F/ 03B G/H

Table of available combinations

\*Please check the table below for available interpolation factors.

For the part numbering of the MS incremental magnetic scale or the MR radial and axial incremental magnetic ring, refer to the MSD01, MR02D02 or MR01D01 data sheet at **RLS Media Center**.

# **Available resolutions**

Table of available resolutions

Part number	Pole length [mm]	Interpolation factor	Resolution [µm]	
13B	_	213	0.244140625	
12B	_	212	0.48828125	
11B	_	211	0.9765625	
2D0	_	2000	1	
1D6	_	1600	1.25	
10B	_	210	1.953125	
1D0	-	1000	2	
D80	_	800	2.5	
09B	_	29	3.90625	
D50	_	500	4	
D40	_	400	5	
D32	2	320	6.25	
08B	-	28	7.8125	
D20	_	200	10	
D16	_	160	12.5	
07B	_	27	15.625	
D10	_	100	20	
D08	_	80	25	
06B	-	26	31.25	
D04	_	40	50	
05B	_	25	62.5	
04B	_	24	125	
03B		2 <sup>3</sup>	250	

#### **Resolutions calculation**

Resolution [µm]	Pole length [µm]	2000	
	Interpolation factor	Interpolation factor	

For ring applications:

CPR – Counts per revolution (resolution)

Resolution [CPR] = Pole number\* x Interpolation factor

PPR – Pulses per revolution

Resolution [PPR] = <u>Resolution [CPR]</u> 4

\*See pole numbers in the MR01D01 or MR02D02 data sheet at **RLS Media center.** 



## Accessories



USB encoder interface **E201-9Q** 

E201-9Q should be used with adapter to transfer from single ended to differential.



## Head office

#### RLS Merilna tehnika d. o. o.

Poslovna cona Žeje pri Komendi Pod vrbami 2 SI-1218 Komenda Slovenia

T +386 1 5272100 E mail@rls.si

#### www.rls.si

#### **Global support**

Visit our website to contact your nearest sales representative.

Date	Issue	Page	Description
19. 12. 2022	4	ieneral New design, data amended	
7. 4. 2023	F	6	Installation instructions data added
	5	8	Output type specifications amended

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