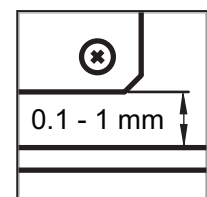


LM13 magnetic ring encoder system



The LM13 is a contactless high-speed magnetic ring encoder designed for use in harsh environments.

The LM13 features a compact sealed readhead that rides at up to 1.0 mm from the ring's surface. Simple to install, the LM13 features an integral set-up LED on the readhead and wide installation tolerances.

Engineered for extreme service, the solid-state LM13 encoder operates from -10 °C to +80 °C, has water-proof sealing to IP68 and is highly resistant to shock, vibrations and pressure. The robust magnetic ring is also resistant to a range of chemicals commonly found in industry.

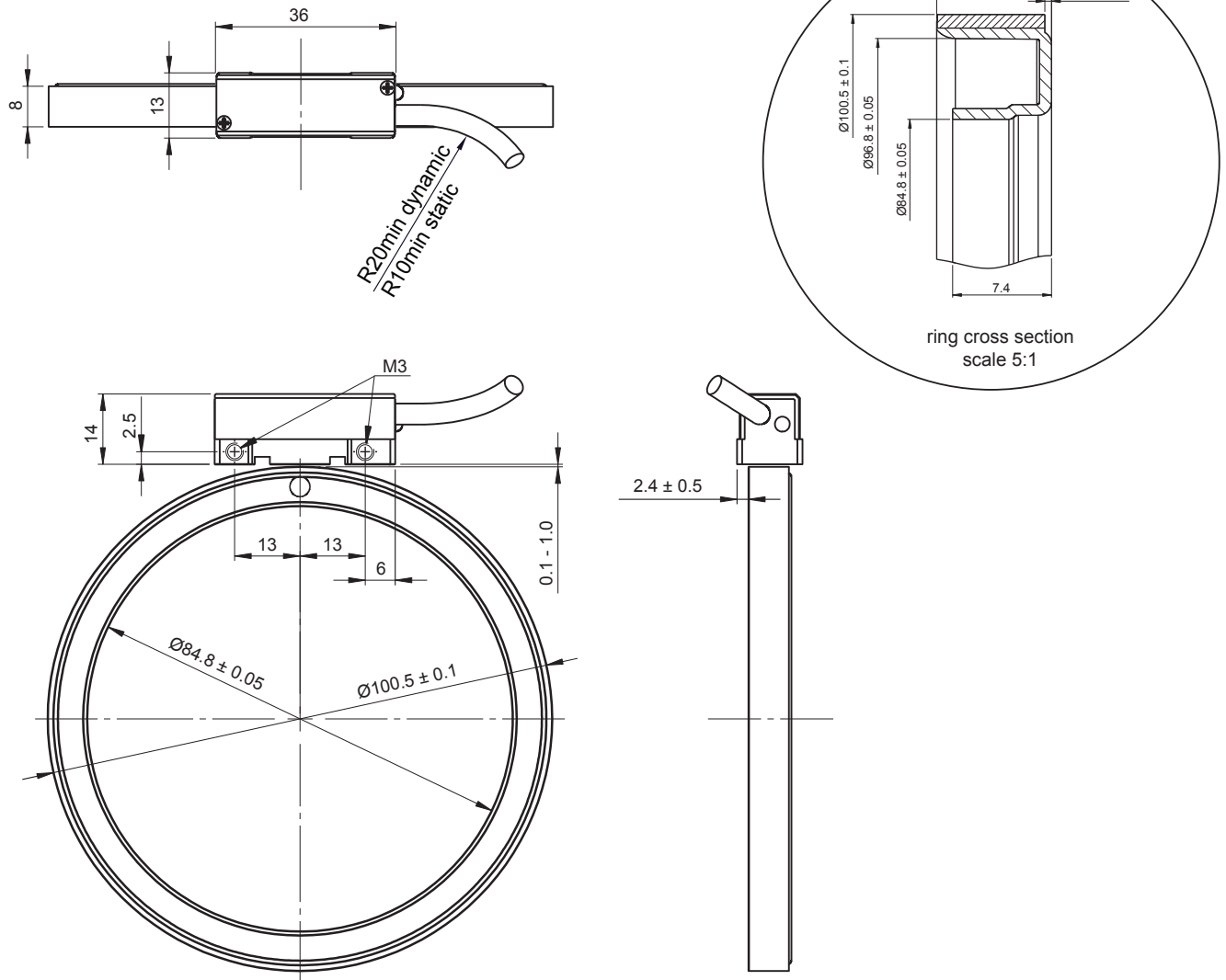
The non-contact, frictionless design eliminates wear while reducing hysteresis.

The LM13 encoders brings reliable solutions to tough, hard-working applications including woodworking, stone-cutting, sawing, metalworking, textiles, printing, packaging, plastics processing, automation and assembly systems, laser/flame/water-jet cutting, electronic assembly equipment etc.

- Resolutions from 1,280 to 327,680 counts per revolution
- High speed operation to 20,000 revolutions per minute
- Excellent dirt immunity
- Integral set-up LED
- High reliability from proven non-contact sensing technology
- Industry standard digital and analogue outputs

LM13 dimensions

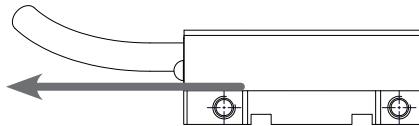
Dimensions and tolerances in mm.



Positive direction

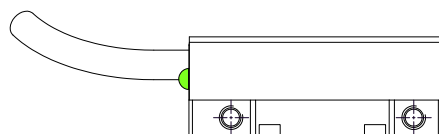
Digital output signals – A leads B

Analogue output signals (1 V_{pp}) – V_1 leads V_2

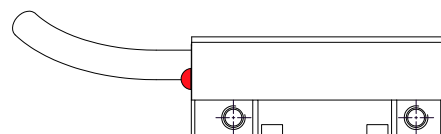


Set-up LED

The readhead can be easily adjusted on the machine using the set-up LED indicator.



Green LED = good signal strength / set-up



Red LED = poor signal strength - adjustment required
A, B, A-, B- outputs become high impedance

LM13 technical specifications

System data							
Pole length	2.25° (approx. 2 mm)						
Available resolutions and maximum speed	For analogue voltage output type: 8,000 rpm						
	For digital output type:						
	Resolution (counts per revolution)	Interpolation factor	Maximum speed (revolutions per minute)				
	327,680	2,048	759	191	95	45	23
	320,000	2,000	780	195	98	46	24
	256,000	1,600	975	244	122	58	30
	163,840	1,024	1,521	378	190	91	46
	160,000	1,000	1,560	390	195	93	48
	128,000	800	1,950	486	244	116	59
	81,920	512	3,045	759	293	181	93
	80,000	500	3,120	780	390	186	95
	64,000	400	3,900	975	486	232	119
	51,200	320	4,875	1,218	609	290	149
	40,960	256	6,093	1,521	759	360	186
	32,000	200	7,800	1,950	975	462	238
	25,600	160	4,875	1,218	609	303	149
	20,480	128	8,000*	3,045	1,521	723	369
	16,000	100	7,800	1,950	975	462	238
	12,800	80	4,875	1,218	609	303	149
	10,240	64	8,000**	6,093	3,045	1,449	741
	6,400	40	4,875	1,218	609	290	149
	5,120	32	8,000**	8,000*	6,093	2,901	1,485
	2,560	16	N/A	8,000**	8,000*	5,802	2,970
	1,280	8	N/A	8,000**	8,000**	8,000*	5,943
	Edge separation (µs)		0.12	0.50	1	2	4
	Count frequency (kHz)		8333	2000	1000	500	250

* 12,000 rpm when special requirement 20 chosen.
** 20,000 rpm when special requirement 20 chosen.

Repeatability		Better than unit of resolution	
Hysteresis		< 12 arc sec up to 0.5 mm ride height	
Sub divisional error		±14 arc sec for < 0.7 mm ride height ±30 arc sec for 1 mm ride height	
Mass	Readhead (1 m cable, no connector) 79.6 g, Readhead (1 m cable, with connector) 132.4 g, Cable (1 m) 34 g, Magnetic ring 42 g		

Cable data	
Voltage drop over cable	13 mV/m – without load 54 mV/m – with 120 Ω load
Cable	Ø4.2 ^{+0.2} mm, PUR high flexible cable, drag-chain compatible, double-shielded 8 × 0.05 mm ² ; durability: 20 million cycles at 20 mm bend radius

Environmental conditions			
Temperature	Readhead	Operating	-10 °C to +80 °C (cable under non-dynamic conditions: -20 °C to +85 °C)
		Storage	-40 °C to +85 °C
	Ring	Operating and storage	-40 °C to +120 °C
Environmental sealing		IP68 (according to IEC 60529)	
EMC Immunity		IEC 61000-6-2 (particularly: ESD: IEC 61000-4-2; EM fields: IEC 61000-4-3; Burst: IEC 61000-4-4; Surge: IEC 61000-4-5; Conducted disturbances: IEC 61000-4-6; Power frequency magnet fields: IEC 61000-4-8; Pulse magnetic fields: IEC 61000-4-9)	
EMC Interference		IEC 61000-6-4 (for industrial, scientific and medical equipment: IEC 55011)	
Vibrations (55 Hz to 2000 Hz)		300 m/s² (IEC 60068-2-6)	
Shocks (11 ms)		300 m/s² (IEC 60068-2-27)	

* 12,000 rpm when special requirement 20 chosen.
 ** 20,000 rpm when special requirement 20 chosen.

LM13IC – Digital output signals, RS422

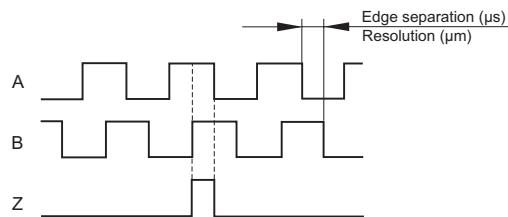
Square wave differential line driver to EIA RS422

Power supply *	4.7 V to 7 V – voltage on readhead Reverse polarity protection
Power supply rise time (for PRG option only)	< 1 ms
Power consumption (without any load)	< 35 mA
Output signals	3 square-wave signals A, B, Z and their inverted signals A-, B-, Z-
Reference signal	1 or more square-wave pulse Z and its inverted pulse Z-
Signal level	Differential line driver to EIA standard RS422: $U_H \geq 2.5 \text{ V}$ at $-I_H = 20 \text{ mA}$ $U_L \leq 0.5 \text{ V}$ at $I_L = 20 \text{ mA}$
Permissible load	$Z_0 \geq 100 \Omega$ between associated outputs $I_L \leq 20 \text{ mA}$ max. load per output Capacitive load $\leq 1000 \text{ pF}$ Outputs are protected against short circuit to 0 V and to +5 V
Alarm	High impedance on output lines A, B, A-, B-
Switching time (10 to 90 %)	t_+ , $t_- < 30 \text{ ns}$ (with 1 m cable and recommended input circuit)
Cable length *	max. 100 m

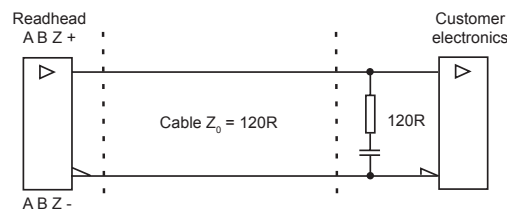
* Please consider voltage drop over cable.

Timing diagram

Complementary signals not shown



Recommended signal termination



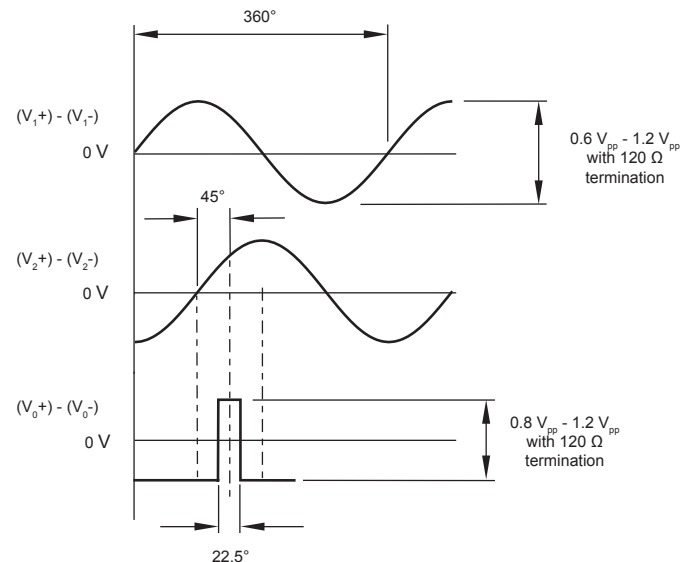
LM13AV – Analogue output signals (1 V_{pp})

2 channels V_1 and V_2 differential sinusoids (90° phase shifted)

Power supply *	4.7 V to 7 V – voltage on readhead Reverse polarity protection	
Power consumption (without any load)	< 50 mA	
Output signals	V_1 , V_2 , V_0	
Sine / cosine signals	Amplitude (with 120 Ω termination)	0.6 V_{pp} to 1.2 V_{pp}
	Phase shift	90° $\pm$ 0.5°
Reference signal	Amplitude (with 120 Ω termination)	0.8 V_{pp} to 1.2 V_{pp}
	Position	45°
	Width	22.5°
Termination	$Z_0 = 120 \Omega$ between associated outputs	
Cable length *	max. 50 m	

* Please consider voltage drop over cable.

Timing diagram



Programming (for IC output type only)

Readheads can be ordered preset to the required resolution or provided so that they can be programmed as needed on the machine to the chosen resolution. This programming is carried out by connecting the readhead to a computer via a programming interface. The readhead must be ordered with the PRG option to use this function.

LM13 readhead part numbering

LM13 magnetic ring
encoder system

=

Readhead



+

Ring



Readhead part number
eg **LM13IC10DBA10F00**

Ring part number
eg **MN00134**

LM13 IC 10D B A 10 F 00

Output type

IC - Incremental, RS422; 5 V
AV - Analogue voltage, 1 V_{pp}; 5 V

Resolution

000 - for **AV** output type

For **IC** output type

11B - 327,680 cpr	D50 - 80,000 cpr	D10 - 16,000 cpr
2D0 - 320,000 cpr	D40 - 64,000 cpr	D08 - 12,800 cpr
1D6 - 256,000 cpr	D32 - 51,200 cpr	06B - 10,240 cpr
10B - 163,840 cpr	08B - 40,960 cpr	D04 - 6,400 cpr
1D0 - 160,000 cpr	D20 - 32,000 cpr	05B - 5,120 cpr
D80 - 128,000 cpr	D16 - 25,600 cpr	04B - 2,560 cpr
09B - 81,920 cpr	07B - 20,480 cpr	03B - 1,280 cpr

PRG - Programmable from 327,680 cpr to 1,280 cpr
(preset to 320,000 cpr)

Minimum edge separation

For **AV** output type

A - N/A

For **IC** output type

A - 0.12 µs (8.3 MHz) *
B - 0.5 µs (2 MHz)
C - 1 µs (1 MHz)
D - 2 µs (0.5 MHz)
E - 4 µs (0.25 MHz)

* Default for **PRG** option.

NOTE: Not available with 1,280 cpr and 2,560 cpr resolution options.

Special requirements

00 - No special requirements (standard)
20 - High speed version **

** Please check the maximum speed table
on page 3 for available options

Connector option

A - 9 pin D type plug
D - 15 pin D type plug (for **IC** output type)
L - 15 pin D type plug (for **AV** output type)
H - 15 pin high density D type plug (for **IC** output type)
P - 9 pin D type plug (for **AV** output type)
F - Flying lead (no connector)

Cable length

10 - 1.0 m (standard)

Reference

A - With reference
B - No reference
C - Periodic as per ring pitch (every 2.25°)

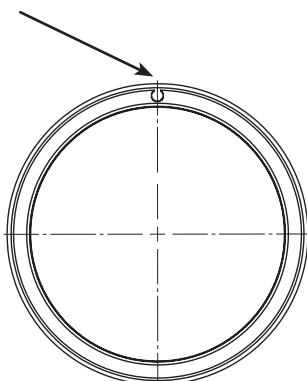
100.5 mm diameter ring part number

MN00134

100.5 mm diameter ring with reference mark part number

MN00147

Position of reference mark



Head office

RLS merilna tehnika d.o.o.
Poslovna cona Žeje pri Komendi
Pod vrbami 2
SI-1218 Komenda
Slovenia

T +386 1 5272100
F +386 1 5272129
E mail@rls.si
www.rls.si

Document issues

Issue	Date	Page	Corrections made
1	6. 1. 2009	-	New document
2	19. 6. 2009	5	Added connector option H
3	16. 9. 2009	2, 4	Amended the diimensions image and positive direction image added
4	5. 5. 2011	3	Maximum speed table updated
		4	Analogue voltage output added
		5	High speed version as special requirement option added

RENISHAW  is our worldwide sales support partner for Magnetic Encoders.

Australia
T +61 3 9521 0922
E australia@renishaw.com

Austria
T +43 2236 379790
E austria@renishaw.com

Brazil
T +55 11 4195 2866
E brazil@renishaw.com

Canada
T +1 905 828 0104
E canada@renishaw.com

The People's Republic of China
T +86 10 8448 5306
E beijing@renishaw.com

Czech Republic
T +420 5 4821 6553
E czech@renishaw.com

France
T +33 1 64 61 84 84
E france@renishaw.com

Germany
T +49 7127 9810
E germany@renishaw.com

Hong Kong
T +852 2753 0638
E hongkong@renishaw.com

Hungary
T +36 23 502 183
E hungary@renishaw.com

India
T +91 20 6674 6751
E india@renishaw.com

Israel
T +972 4 953 6595
E israel@renishaw.com

Italy
T +39 011 966 10 52
E italy@renishaw.com

Japan
T +81 3 5366 5316
E japan@renishaw.com

The Netherlands
T +31 76 543 11 00
E benelux@renishaw.com

Poland
T +48 22 577 11 80
E poland@renishaw.com

Russia
T +7 495 231 1677
E russia@renishaw.com

Singapore
T +65 6897 5466
E singapore@renishaw.com

Slovenia
T +386 1 52 72 100
E mail@rls.si

South Korea
T +82 2 2108 2830
E southkorea@renishaw.com

Spain
T +34 93 663 34 20
E spain@renishaw.com

Sweden
T +46 8 584 90 880
E sweden@renishaw.com

Switzerland
T +41 55 415 50 60
E switzerland@renishaw.com

Taiwan
T +886 4 2473 3177
E taiwan@renishaw.com

UK
T +44 1453 524524
E uk@renishaw.com

USA
T +1 847 286 9953
E usa@renishaw.com

For all other countries
Please contact RLS' head office

T +386 1 52 72 100
E mail@rls.si