Datasheet
LM13D02_01
Issue 1, 17th November 2008

RLS
Rotary and Linear Motion Sensors

LM13 Linear magnetic encoder system

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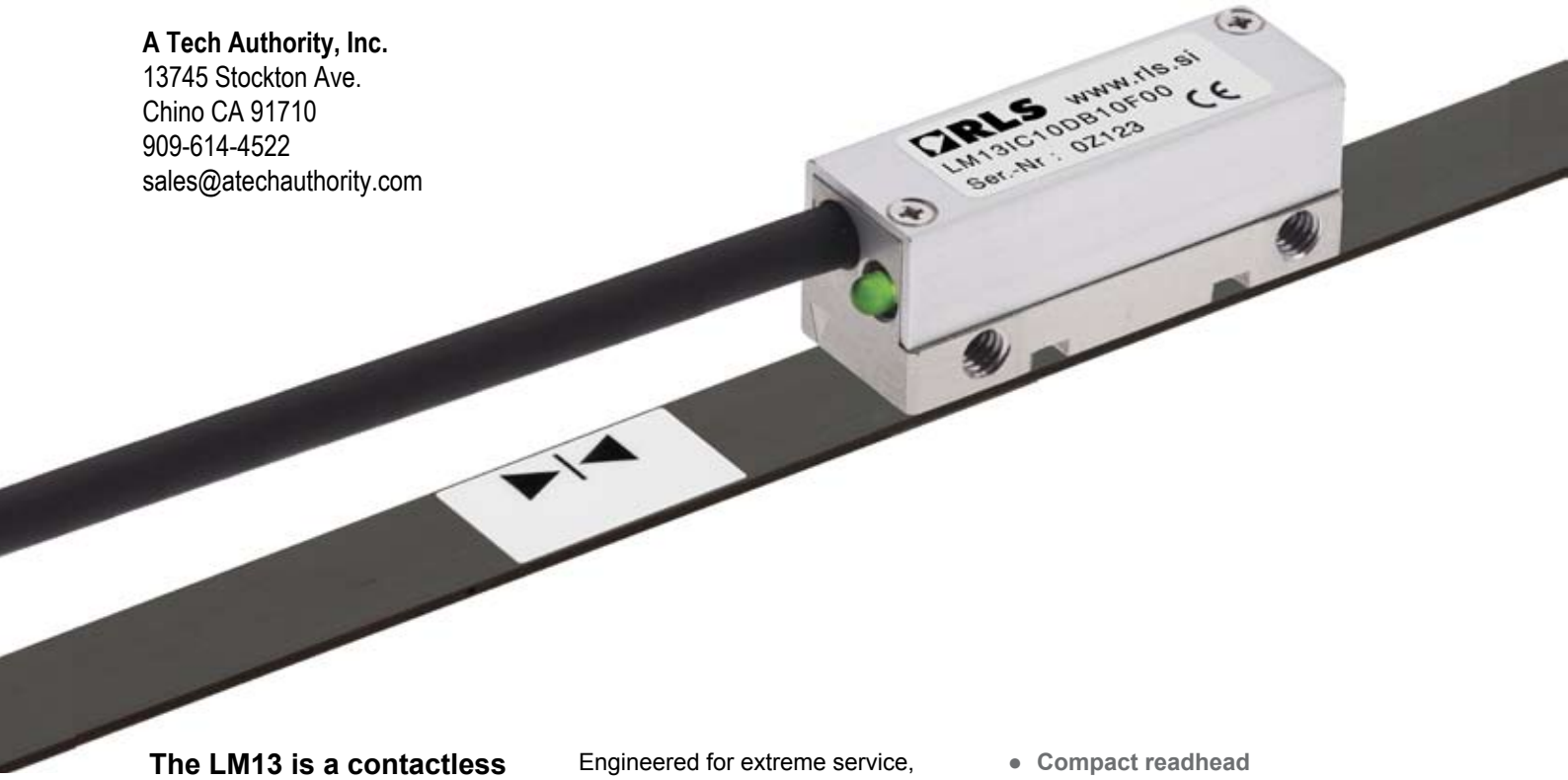


The LM13 is a contactless high-speed linear magnetic system designed for use in harsh environments.

The system consists of a compact readhead and a separate self-adhesive magnetic scale.

Simple to install, the LM13 features an integral set-up LED on the readhead, wide installation tolerances and an applicator tool for the adhesive-backed magnetic scale. A bidirectional reference is provided that can be actuated either by a preset mark integrated within the scale or by adding a reference sticker on top of the scale with the help of a self-aligning installation tool.

The encoders come with a range of digital resolutions including 1 µm, 2 µm, 4 µm, 5 µm, 10 µm, 20 µm, 25 µm, 50 µm, 125 µm and 250 µm. The LM13 is capable of velocities up to 25 m/s; even at 1 µm resolution it is capable of 4 m/s.

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

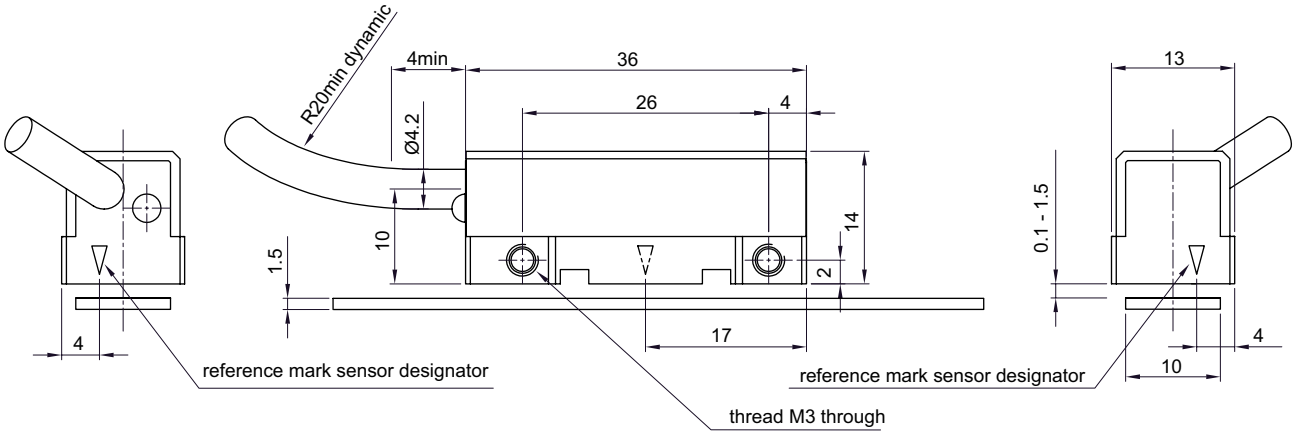
The non-contact, frictionless design eliminates wear while reducing hysteresis giving precision at high speeds and accelerations.

The LM13 linear encoder system 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.

- **Compact readhead**
- **Resolutions from 250 µm to 1 µm**
- **Stick-on reference mark**
- **High speed operation**
- **Excellent dirt immunity**
- **Integral set-up LED**
- **Axis lengths of up to 100 m**
- **High reliability from proven non-contact sensing technology**
- **Industry standard digital outputs**
- **Repeatability inside resolution**

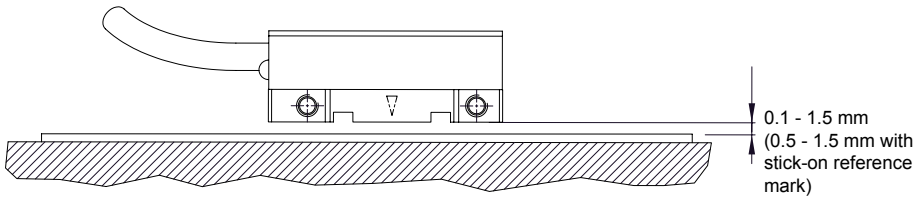
LM13 Dimensions

Dimensions and tolerances in mm.

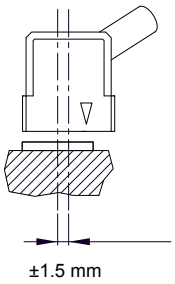


LM13 Installation tolerances

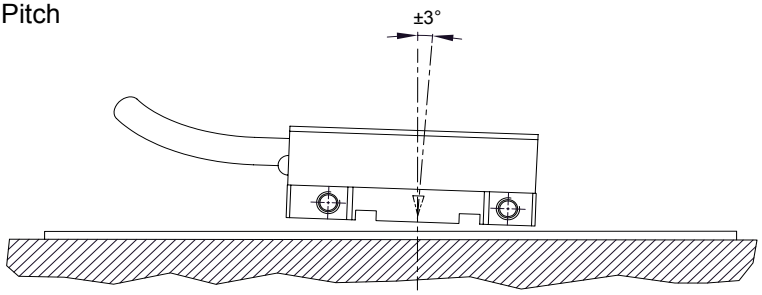
Ride height



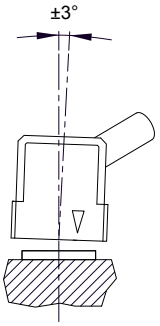
Lateral offset



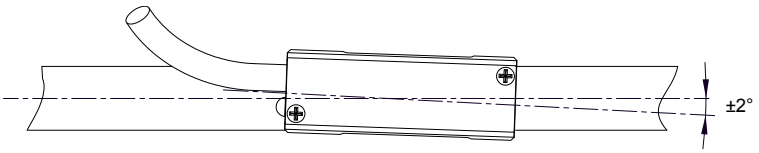
Pitch



Roll



Yaw



LM13 Technical specifications

System data						
Maximum measuring length	50 m (100 m special order)					
Pole length	2 mm					
Available resolutions for digital outputs	1 µm, 2 µm, 4 µm, 5 µm, 10 µm, 20 µm, 25 µm, 50 µm, 125 µm and 250 µm					
Maximum speed for digital outputs	**Resolution (µm)**	**Maximum velocity (m/s)**				
	1	4.16	1.04	0.52	0.26	0.13
	2	8.32	2.08	1.04	0.52	0.25
	4	16.64	4.16	2.08	0.99	0.51
	5	20.80	5.20	2.59	1.30	0.63
	10	25.00	10.40	5.20	2.59	1.27
	20	25.00	10.40	5.20	2.59	1.27
	25	25.00	6.50	3.25	1.62	0.79
	50	25.00	6.50	3.25	1.62	0.79
	125	25.00	25.00	25.00	25.00	15.14
	250	25.00	25.00	25.00	25.00	25.00
	Edge separation (µs)	0.12	0.50	1	2	4
	Count frequency (kHz)	8333	2000	1000	500	250
Sensor/magnetic scale gap	With periodic or machined reference: 0.1 to 1.5 mm With stick-on reference: 0.5 to 1.5 mm					
Error band	±40 µm at 20 °C					
Linear expansion coefficient	(11±1) × 10^{-6}/K					
Repeatability	Better than unit of resolution					
Sub divisional error	±3.5 µm for < 0.7 mm ride height (to ensure SDE remains under ±3.5 µm order option 01 that provides alarm and red LED at 0.7 mm ride height) ±7.5 µm for 1 mm ride height ±15 µm for 1.5 mm ride height					
Electrical data						
Power supply	4.6 V to 7 V - reverse polarity protected *					
Power consumption (without any load)	< 30 mA for digital output type					
Voltage drop over cable	ΔU = 21.4 mV/m - without load					
Output signals	Digital - Differential RS422, short circuit protected					
Cable	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	Operating -10 °C to +80 °C (cable under non-dynamic conditions: -20 °C to +85 °C) Storage -40 °C to +85 °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/s^2 (IEC 60068-2-6)					
Shocks (11 ms)	300 m/s^2 (IEC 60068-2-27)					

* On readhead with 1 m cable; for longer cables please consider voltage drop on cable (21.4 mV/m without load, 62 mV/m with 120 Ω load per channel pair)

Digital output signals

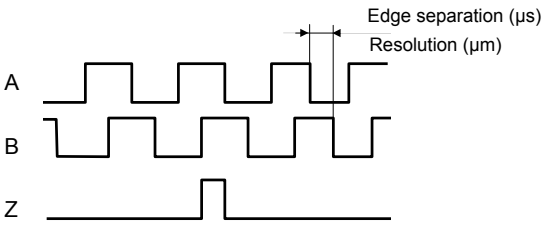
Square wave differential line driver to EIA RS422

Power supply voltage	4.6 V to 7 V * Reverse polarity protection
Incremental signals	2 square-wave signals A, B and their inverted signals A-, B-
Reference mark signal	1 or more square-wave pulse Z and its inverted pulse Z-
Signal level	Differential line driver to EIA standard RS422: $U_H \geq 2.5$ V at $-I_H = 20$ mA $U_L \leq 0.5$ V at $I_L = 20$ mA
Permissible load	$Z_O \geq 100\ \Omega$ between associated outputs $I_L \leq 20$ mA max. load per output Capacitive load ≤ 1000 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 ns (with 1 m cable and recommended input circuit)

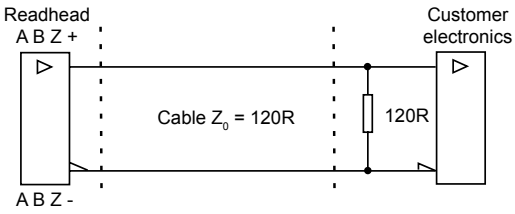
* On readhead with 1 m cable; for longer cables please consider voltage drop on cable (21.4 mV/m without load, 62 mV/m with 120 Ω load per channel pair)

Timing diagram

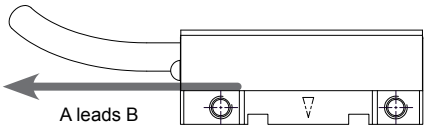
Complementary signals not shown



Recommended signal termination



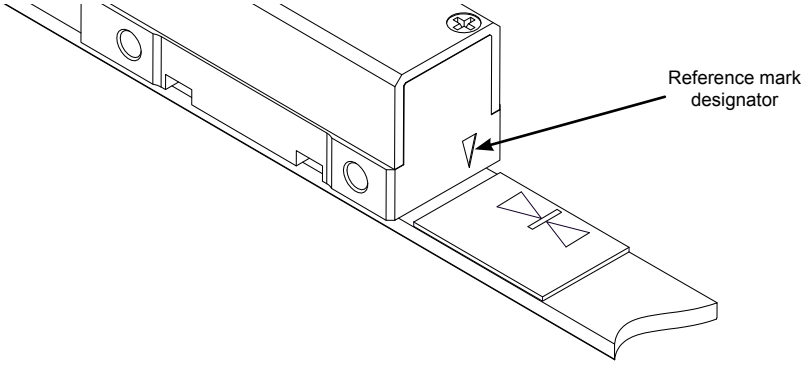
Positive direction



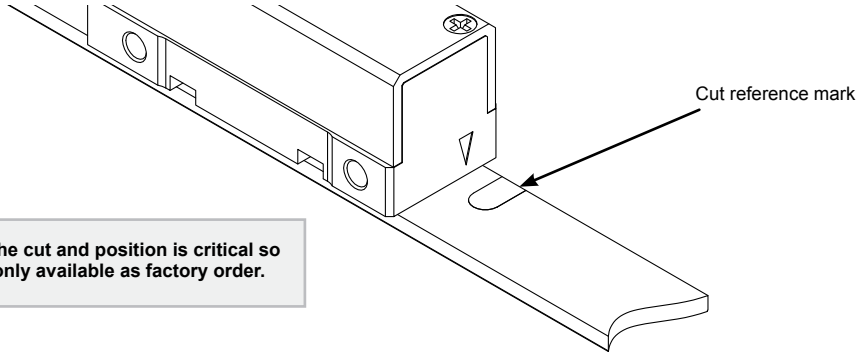
Reference mark

The repeatable bi-directional reference signal can be provided in 3 ways.

1) **Stick-on reference mark.** The LM13 readhead should be ordered with the reference mark option. After installation of the scale a reference mark sticker can be applied to the scale at the required position using the reference mark applicator tool. Ensure that the reference sticker is oriented to the corresponding side of the readhead that has the reference mark designator marked.



2) **Selected at point of order.** The LM13 readhead should be ordered with the reference mark option. If required the cover foil can be installed over the cut reference mark.



NOTE: The shape of the cut and position is critical so this option is only available as factory order.

3) **Every 2 mm.** The LM13 readhead should be ordered with this specific mode activated only.

LM13 readhead part numbering

LM13 system = Readhead + Scale

Readhead part number
eg **LM13IC2D0CA10F00**

Magnetic scale part number
eg **MS10B1000B0032**

LM13 IC 2D0 C A 10 F 00

Output type
IC - Incremental, RS422; 5 V power supply

Resolution
2D0 - 1 µm
1D0 - 2 µm
D50 - 4 µm
D40 - 5 µm
D20 - 10 µm
D10 - 20 µm
D08 - 25 µm
D04 - 50 µm
04B - 125 µm
03B - 250 µm

Minimum edge separation
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)

Special requirements
00 - No special requirements (standard)
01 - 0.7 mm ride height alarm

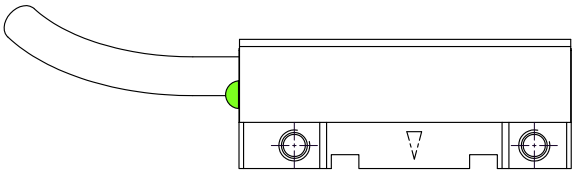
Connector option
A - 9 pin D type plug
D - 15 pin D type plug
F - Flying lead (no connector)

Cable length
10 - 1.0 m (standard)

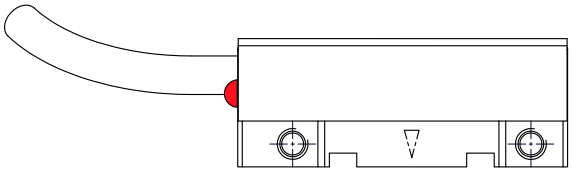
Reference
A - With reference
B - No reference
C - Periodic as per scale pitch (2 mm)

Set-up LED

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

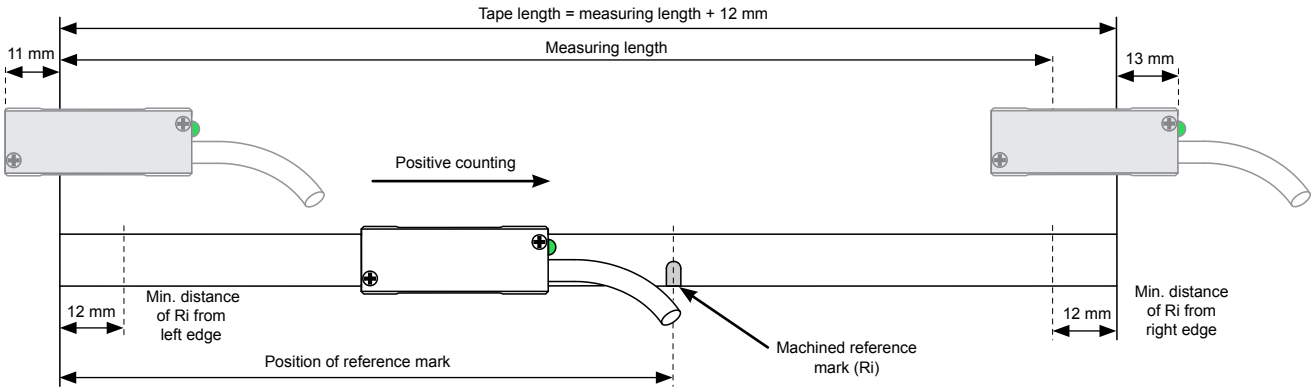


Green LED = good signal strength / set-up



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

Magnetic scale part numbering



MS10 B 1000 B 0032

Precision class
B - 40 µm/m

Tape length
xxxx - Where xxxx equals tape length in cm
NOTE: tape length = measuring length + 12 mm

Position of reference mark
0000 - No reference mark
xxxx - Where xxxx equals position of machined reference mark in cm
NOTE: Reference mark position will be within ±1 cm from requested position.

Cover foil
A - No cover foil
B - Cover foil supplied (separately - 5 cm longer than tape)

Accessories part numbering

Cover foil **CF10 1000**

Foil length
xxxx - Where xxxx equals foil length in cm

Stick-on reference mark	**LM10SRM00**
Applicator tool for stick-on reference mark	**LM10ARM00**
Applicator tool for magnetic scale and cover foil	**LM13ASC00**

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Document issues

Issue	Date	Page	Corrections made
1	17. 11. 2008	-	New document

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