EMC compliance
The LM13 encoder system conforms to the relevant harmonised European standards for electromagnetic compatibility as detailed below.

BS EN 61326

Features of RLS’s encoder systems and similar products are the subjects of the following patents and patent applications:

GB 0720972.9
EP 0514081
EP 0388453
US 5,241,173
US 5,063,685
JP 3,202,316
JP 2837483

Further information
For further information relating to the installation of LM13 encoder system, see also the LM13 data sheet or LM13 DPI data sheet (part no. LM13D02 or LM13D04). These can be downloaded from our website www.rls.si and are also available from your local representative.

Disclaimer
Considerable effort has been made to ensure that the contents of this document are free from inaccuracies and omissions. However, RLS merilna tehnika d.o.o. makes no warranties with respect to the contents of this document and specifically disclaims any implied warranties. RLS merilna tehnika d.o.o. reserves the right to make changes to this document and to the product described herein without obligation to notify any person of such changes.

Storage and handling
Storage and handling continued

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.

Motor oil
Brake fluid
Benzene
Toluene
Kerosene
Heptane
Ketone
H₂SO₄
HCl
Antifreeze
Turpentine
Alcohol

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.

System description
The LM13 encoder system consists of an LM13 readhead on MS magnetic scale offering a range of industry standard digital and analogue output options.

Reference mark
The repeatable bi-directional reference signal can be provided in 4 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 detector installed.

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.

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

4. Distance coded reference mark. The distance coded reference mark option provides multiple reference marks that are individually spaced according to specific mathematical algorithm. For further information please refer to Distance coded reference mark data sheet (LM10D17).

LED indicator
The LM13 set-up LED provides visual feedback of signal strength, error condition, for set-up and diagnostic use.

Green indicates good signal strength/set-up
Red indicates poor signal strength - adjustment required

A RENISHAW associate company
**LM13 system dimensions**

Dimensions and tolerances in mm.

**NOTE:** Ensure recommended M3 readhead fixing screws are tightened to 0.5 Nm to 0.7 Nm.

**Readhead installation tolerances**

- **Ride height**
- **Pitch**
- **Yaw**
- **Roll**
- **Lateral offset**

<table>
<thead>
<tr>
<th>Magnetic scale thickness (D)</th>
<th>Ride height (H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No cover foil, cut or magnetised reference mark</td>
<td>1.5³/²</td>
</tr>
<tr>
<td>No cover foil, stick-on reference mark</td>
<td>1.5³/²</td>
</tr>
<tr>
<td>With cover foil, cut or magnetised reference mark</td>
<td>1.65³/²</td>
</tr>
<tr>
<td>With cover foil, stick-on reference mark</td>
<td>1.65³/²</td>
</tr>
</tbody>
</table>

* For larger ride height (H) please see LM15 linear encoder system (LM15D01).

**General specifications**

- **Power supply**
  4.7 V to 7 V – reverse polarity protected; voltage on readhead (see note below)
- **Power supply rise time**
  (< 1 ms)
- **Power consumption**
  (< 35 mA for digital output type)
  (< 50 mA for analogue output type)
- **Voltage drop over cable**
  ~ 13 mV/m – without load
  ~ 54 mV/m – with 120 Ω load
- **Environmental sealing**
  IP68 (according to IEC 60529)
- **Temperature**
  Operating -10 °C to +80 °C (cable under non-dynamic conditions: -20 °C to +85 °C)
  Storage -40 °C to +85 °C
- **Shock**
  300 m/s², 11 ms (IEC 60068-2-27)
- **Vibration**
  300 m/s², 55 Hz to 2000 Hz (IEC 60068-2-6)
- **Mass**
  Readhead (1 m cable, no connector) 80 g, Cable (1 m) 34 g, Magnetic scale (1 m) 60 g, Cover foil (1 m) 3.5 g
- **Cable**
  Ø4.2³/² mm, PUR high flexible cable, drag-chain compatible, double-shielded
  8 × 0.05 mm²; durability: 20 million cycles at 20 mm bend radius

**Electrical connections**
Readhead installation

Please refer to the MS magnetic scale installation guide (LM13D10) for installation of magnetic scale. Once the scale is installed the readhead can be easily adjusted on the machine using the set-up LED indicator.

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.

LM13IC – Connections for digital outputs (RS422)

<table>
<thead>
<tr>
<th>Function</th>
<th>Signal</th>
<th>Colour</th>
<th>15 pin D type plug (option D)</th>
<th>9 pin D type plug (option A)</th>
<th>15 pin HD type plug (option H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>5 V</td>
<td>Brown</td>
<td>7</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>0 V</td>
<td>White</td>
<td>2</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Incremental signals</td>
<td>A+</td>
<td>Green</td>
<td>14</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>A-</td>
<td>Yellow</td>
<td>6</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>B+</td>
<td>Blue</td>
<td>13</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>B-</td>
<td>Red</td>
<td>5</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Reference mark</td>
<td>Z+</td>
<td>Pink</td>
<td>12</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Z-</td>
<td>Grey</td>
<td>4</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Shield</td>
<td>Inner</td>
<td>-</td>
<td>15</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Outer</td>
<td>-</td>
<td>Case</td>
<td>Case</td>
<td>Case</td>
</tr>
</tbody>
</table>

Timing diagram

Complementary signals not shown

Recommended signal termination

Cable Z₀ = 120Ω

LM13AV – Connections for analogue outputs (1 Vpp)

<table>
<thead>
<tr>
<th>Function</th>
<th>Signal</th>
<th>Colour</th>
<th>15 pin D type plug (option L)</th>
<th>9 pin D type plug (option A)</th>
<th>9 pin D type plug (option P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>5 V</td>
<td>Brown</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>0 V</td>
<td>White</td>
<td>12</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Analogue signals</td>
<td>V₁</td>
<td>Green</td>
<td>9</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>V₁⁻</td>
<td>Yellow</td>
<td>1</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>V₂</td>
<td>Blue</td>
<td>10</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>V₂⁻</td>
<td>Red</td>
<td>2</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Reference mark</td>
<td>V₀</td>
<td>Pink</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>V₀⁻</td>
<td>Grey</td>
<td>11</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Shield</td>
<td>Inner</td>
<td>-</td>
<td>15</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Outer</td>
<td>-</td>
<td>Case</td>
<td>Case</td>
<td>Case</td>
</tr>
</tbody>
</table>

Timing diagram

(V₁⁺) - (V₁⁻) 0 V

(V₂⁺) - (V₂⁻) 0 V

(V₀⁺) - (V₀⁻) 0 V

0.6 Vpp - 1.2 Vpp with 120Ω termination

0.8 Vpp - 1.2 Vpp with 120Ω termination

Recommended signal termination

V₀⁺, V₁⁺, V₁⁻, V₂⁻, V₀⁻

120Ω

A RENISHAW associate company