linear encoders
with current or
voltage output

user manual
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1.0: Introduction

**Introduction**

The LE12/25 Linear Encoder with current or voltage output, when used with suitable interfacing electronics, provide a precision linear measurement system. The current version (designated I) provides industrial standard current in-phase and quadrature-phase signals. The voltage version (designated V) provides equivalent voltage signals.

**model no.**
- LE/12/SV
- LE/12/SI
- LE/25/SV
- LE/25/SI
- LE/12/PV
- LE/12/PI
- LE/25/PV
- LE/25/PI

Solartron also produce a digital version of the Linear Encoders, which can be used with Solartron DRO’s or the Orbit network to create measuring systems.

**This Manual**

Describes the Linear Encoder types LE12/25 both pneumatic and spring versions with either current or voltage output.

This manual details the handling, installation and operation of the encoder and describes the electrical interfaces.
2.0: Safety Summary

Terms in this manual

**WARNING** statements identify conditions or practices that could result in personal injury or loss of life.

**CAUTION** statements identify conditions or practices that could result in damage to the equipment or other property.

Symbols in this manual

![Symbol] This symbol indicates where applicable cautionary or other information is to be found.

WARNINGS:

Do not operate in an explosive atmosphere
To avoid explosion, do not operate this equipment in an explosive atmosphere.

Air Pressure
On LE/12/P and LE/25/P variants under no circumstances should the recommended maximum overpressure of 1.0 bar be exceeded.

NOTES:

This equipment contains no user serviceable parts
This equipment must be returned to your Solartron dealer for all servicing and repair (see section 10.0).

Low Voltage
This equipment operates at below the SELV and is therefore outside the scope of the Low Voltage Directive.
3.0: Designation of Parts

Items Supplied
Linear Encoder Probe in packaging case.
Standard tip (measuring contact) fitted.
Finger lift lever.
Locking tool.
Operating instructions.
Calibration chart.
Plus other accessories as ordered.
4.0: Handling & Maintenance

The Solartron range of Linear Encoders are precision instruments and should be handled with care. Where possible, the Linear Encoder should be stored in its protective box when not being used.

These Linear Encoders are designed to be maintenance free; additional periodic lubrication is unnecessary. Contacts with solvents should be avoided. Any attempt to dismantle the Linear Encoder will invalidate the warranty.
5.0: Mechanical Installation

**CAUTIONS**

Ensure that the probe is not subjected to excessive over-travel, or side loading at the tip greater than that corresponding to a 0.5mm lift on a Ø3 ball.

When mounting the Linear Encoder avoid the risk of distortion of the bearing assembly by over-tightening of the mounting screws around the clamping shank.

**Notes:**

It is important to ensure that the probe is perpendicular to the measuring table to avoid introducing cosine errors.

Do not use excessive torque when tightening gauge stand clamp screws (see next section).

Keep cable away from moving parts to avoid potential damage.

Protect probe against shock loading or impact!
5.0: Mechanical Installation (continued)

5.1 Clamping Configurations

When mounting Linear Encoder do not over tighten clamp screws.

Recommended maximum tightening torque

\[
\text{Torque} = \frac{0.28d \left( \left( \frac{P}{P_{\text{Id}}} \right) + 0.15 \right)}{1 - (0.15 \left( \frac{P}{P_{\text{Id}}} \right))}
\]

Where
- \( d \) = screw dia mm
- \( P \) = screw pitch mm

assuming a ‘V’ form thread and 0.15 coefficient of friction.

Note: A clearance hole in the fixturing of Ø9.5mm is advisable around the gaiter for satisfactory operation.
5.0: Mechanical Installation (continued)

5.2 Replacing the probe tip

1. Slide back gaiter (fitted to IP65 and pneumatic versions only) to reveal the hole in the shaft.
2. Insert locking tool (supplied) in the hole.
3. Unscrew tip while holding locking tool to prevent any damage to the read head.
4. Install new tip while holding locking tool.
5. Torque tip to 18-22 cNm.
6. Slide down gaiter, (IP65 and pneumatic versions only).
6.1 Finger lift lever
Snaps over probe tip enabling tip to be lifted without transferring heat to shaft.

6.2 Cable lift
Allows tip to be retracted without touching Linear Encoder. Cable retract screws into probe body after removal of blanking screw.

6.3 Pneumatic operation
A Pneumatic nozzle is fitted as standard to LE/12/P & LE/25/P. By applying air between 0.5 & 0.8 bar, measuring tip will extend to meet component under test. On no account should a pressure exceeding 1.0 bar be applied.

WARNING: Damage/injury could be caused if the maximum recommended air pressure is exceeded.

CAUTION
Ensure that the air supply for pneumatic operation is clean, dry and oil free.
7.0: Electrical Interface

The Linear Encoder provides either a current output or a voltage output corresponding to the format below. The signals are differential. These signals are designed to be compatible with industry standard electronics.

<table>
<thead>
<tr>
<th>Signals</th>
<th>Current</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Phase</td>
<td>7 - 16 uApp</td>
<td>0.6 to 1.2Vpp</td>
</tr>
<tr>
<td>Quadrature Phase</td>
<td>7 - 16 uApp</td>
<td>0.6 to 1.2Vpp</td>
</tr>
<tr>
<td>Reference Mark</td>
<td>5 uAp nominal</td>
<td>0.5Vp nominal into 120 ohm load</td>
</tr>
</tbody>
</table>
### 7.0: Electrical Interface (continued)

#### 7.1 Current probe

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$I_1$</td>
<td>In Phase current +</td>
</tr>
<tr>
<td>2</td>
<td>$/I_1$</td>
<td>In Phase current -</td>
</tr>
<tr>
<td>3</td>
<td>$+5\text{ Vdc}$</td>
<td>Probe power supply</td>
</tr>
<tr>
<td>4</td>
<td>$0\text{ Vdc}$</td>
<td>Probe power return</td>
</tr>
<tr>
<td>5</td>
<td>$I_2$</td>
<td>Quadrature phase current +</td>
</tr>
<tr>
<td>6</td>
<td>$/I_2$</td>
<td>Quadrature phase current -</td>
</tr>
<tr>
<td>7</td>
<td>$I_0$</td>
<td>Reference current +</td>
</tr>
<tr>
<td>8</td>
<td>$/I_0$</td>
<td>Reference current -</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Not connected to probe</td>
</tr>
</tbody>
</table>

**Note:** Connector housing is connected to cable screen and therefore probe body.
7.0: Electrical Interface (continued)

7.2 Voltage probe

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( V_2 )</td>
<td>Quadrature phase voltage -</td>
</tr>
<tr>
<td>2</td>
<td>5V dc</td>
<td>Sense</td>
</tr>
<tr>
<td>3</td>
<td>( V_0 )</td>
<td>Reference voltage +</td>
</tr>
<tr>
<td>4</td>
<td>( \overline{V}_0 )</td>
<td>Reference voltage -</td>
</tr>
<tr>
<td>5</td>
<td>( V_1 )</td>
<td>In Phase voltage +</td>
</tr>
<tr>
<td>6</td>
<td>( \overline{V}_1 )</td>
<td>In Phase voltage -</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>No connection</td>
</tr>
<tr>
<td>8</td>
<td>( V_2 )</td>
<td>Quadrature phase voltage +</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>No connection</td>
</tr>
<tr>
<td>10</td>
<td>0V dc</td>
<td>Probe power return</td>
</tr>
<tr>
<td>11</td>
<td>0V dc</td>
<td>Sense</td>
</tr>
<tr>
<td>12</td>
<td>5V dc</td>
<td>Probe power supply</td>
</tr>
</tbody>
</table>

Note: Connector housing is connected to cable screen and therefore probe body.

7.0: Electrical Interface
8.0: Specification

<table>
<thead>
<tr>
<th>Model</th>
<th>LE12</th>
<th>LE25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>12mm (0.5&quot;)</td>
<td>25mm (1.0&quot;)</td>
</tr>
<tr>
<td>Resolution</td>
<td>Dependant on subsequent electronics</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>± 0.5µm (20 millionths inch)</td>
<td></td>
</tr>
<tr>
<td>Reference temp</td>
<td>20°C (68°F)</td>
<td></td>
</tr>
<tr>
<td>Slew rate</td>
<td>0.5 m/sec (1.5 ft/sec)</td>
<td></td>
</tr>
<tr>
<td>Operating attitude</td>
<td>ANY</td>
<td></td>
</tr>
<tr>
<td>Gauging forces: (typical at mid stroke)</td>
<td>Downwards 0.6N (60gm) (2.1 oz)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Upwards 0.01N (10gm) (0.3 oz)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Horizontal 0.5N (50gm) (1.7 oz)</td>
<td></td>
</tr>
<tr>
<td>Max side load</td>
<td>0.1N (100gm) (3.5 oz)</td>
<td></td>
</tr>
<tr>
<td>Shock</td>
<td>100g (6ms)</td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>10g (50-2000 Hz)</td>
<td></td>
</tr>
<tr>
<td>Cable length</td>
<td>2m</td>
<td></td>
</tr>
</tbody>
</table>

Temp range
- Operating 0° to 50°C (32° to 122°F)
- Storage -20° to +70°C (-4° to 158°F)

IP Rating
- Probe: IP50 (IP65 optional)

Mounting
- 8mm h6

Tip thread size
- M2.5x6 deep

Supply Voltage
- 5V ± 0.25VDC

Supply Current (max)
- 20mA

EMC
- EN50081-1 & EN50082-2
9.0: Outline Drawings

<table>
<thead>
<tr>
<th></th>
<th>LE/12/S</th>
<th>LE/12/P</th>
<th>LE/25/S</th>
<th>LE/25/P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>55.0</td>
<td>45.0</td>
<td>92.0</td>
<td>66.0</td>
</tr>
<tr>
<td></td>
<td>43.0</td>
<td>56.0</td>
<td>66.0</td>
<td>92.0</td>
</tr>
<tr>
<td>B</td>
<td>70.5</td>
<td>70.5</td>
<td>33.0</td>
<td>33.0</td>
</tr>
<tr>
<td>C</td>
<td>66.0</td>
<td>66.0</td>
<td>69.5</td>
<td>69.5</td>
</tr>
</tbody>
</table>

Note:
All dimensions in mm
All dimensions stated are nominal
9.0: Outline Drawings (continued)

Connector

Note:
All dimensions in mm
All dimensions stated are nominal
ADDENDUM - Electrical Interface

Voltage Probe 15 way D Type Plug

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$V_1$</td>
<td>In Phase Voltage +</td>
</tr>
<tr>
<td>2</td>
<td>0V</td>
<td>Power Supply Return</td>
</tr>
<tr>
<td>3</td>
<td>$V_2$</td>
<td>Quadrature Voltage +</td>
</tr>
<tr>
<td>4</td>
<td>+5V</td>
<td>Power</td>
</tr>
<tr>
<td>5</td>
<td>Not Connected</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Not Connected</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>$/V_0$</td>
<td>Reference Voltage -</td>
</tr>
<tr>
<td>8</td>
<td>Not Connected</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>$/V_1$</td>
<td>In Phase Voltage -</td>
</tr>
<tr>
<td>10</td>
<td>0V</td>
<td>Power Supply Return</td>
</tr>
<tr>
<td>11</td>
<td>$/V_2$</td>
<td>Quadrature Voltage -</td>
</tr>
<tr>
<td>12</td>
<td>+5V</td>
<td>Power</td>
</tr>
<tr>
<td>13</td>
<td>Not Connected</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>$V_0$</td>
<td>Reference Voltage +</td>
</tr>
<tr>
<td>15</td>
<td>Not Connected</td>
<td></td>
</tr>
<tr>
<td>SHELL</td>
<td>Screen</td>
<td>Cable Screen/shield</td>
</tr>
</tbody>
</table>

Note Pin 2 and Pin 10 connected internally.
Note Pin 4 and Pin 12 connected internally.
Also Available at Solartron Metrology

Gauging Transducers
Displacement
Mini Probe
Block Gauge
Linear Encoder
SI3000
SI7500
Orbit Network
Orbit USB Interface Module
Orbit RS232 Interface Module
Orbit PCI Network Card
Devices returned for service/repair/calibration should be shipped prepaid to your distributor or, if purchased directly from Solartron Metrology, to the relevant Sales Office.

The shipping container should be marked: ‘For the Attention of the Customer Services Department’

The following information should accompany the device(s):

1. Contact details of company/person returning device, including return shipping instructions.

2. A statement of service required.

3. Description of the device fault and the circumstances of the failure, including application environment and length of time in service.

Alternatively there is a returns form available on our website, follow the link to “Service Repair and Recalibration”.

Please note:
A standard assessment charge is applicable on all non-warranty devices returned for repair. Customer damage and any device found, upon inspection, to have no fault will be considered non-warranty.

Please contact the Sales Office or Distributor for warranty terms, service options and standard charges.

Adherence to these procedures will expedite handling of the returned device and will prevent unnecessary additional charges for inspection and testing to determine the condition.

Solartron Metrology reserves the right to repair or replace goods returned under warranty.

All repairs are guaranteed for 3 months (unless otherwise stated).

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