Quick Start Guide

Laser displacement sensor that supports IO-Link communication with analog and discrete (switched) outputs. This guide is designed to help you set up and install the L-GAGE LM Analog/Discrete Laser Sensor. For complete information on programming, performance, troubleshooting, dimensions, and accessories, please refer to the Instruction Manual at www.bannerengineering.com. Search for p/n 205812 to view the manual. Use of this document assumes familiarity with pertinent industry standards and practices.

WARNING:
• Do not use this device for personnel protection
• Using this device for personnel protection could result in serious injury or death.
• This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

Features and Indicators

Three LED indicators provide ongoing indication of the sensing status.

1. Analog Output LED Indicator
   Solid Amber = Displayed distance is within the taught analog output window
   Off = Displayed distance is outside the taught analog output window

2. Power LED Indicator
   Solid Green = Normal operation, power On and laser On
   Flashing Green (1 Hz) = Power On and laser Off (laser enable mode)

3. Discrete Output LED Indicator
   Solid Amber = Discrete Output is On
   Off = Discrete Output is Off

Laser Description and Safety Information

CAUTION:
• Return defective units to the manufacturer.
• Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
• Do not attempt to disassemble this sensor for repair. A defective unit must be returned to the manufacturer.

Class 2 Laser Models (LM150 Models)

CAUTION:
• Never stare directly into the sensor lens.
• Laser light can damage your eyes.
• Avoid placing any mirror-like object in the beam. Never use a mirror as a retroreflective target.

For Safe Laser Use - Class 2 Lasers
• Do not stare at the laser.
• Do not point the laser at a person’s eye.
• Mount open laser beam paths either above or below eye level, where practical.
• Terminate the beam emitted by the laser product at the end of its useful path.

Reference IEC 60825-1:2007, Section 8.2.
Class 2 Lasers

Class 2 lasers are lasers that emit visible radiation in the wavelength range from 400 nm to 700 nm, where eye protection is normally afforded by aversion responses, including the blink reflex. This reaction may be expected to provide adequate protection under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

Class 2 Laser Safety Notes

Low-power lasers are, by definition, incapable of causing eye injury within the duration of a blink (aversion response) of 0.25 seconds. They also must emit only visible wavelengths (400 to 700 nm). Therefore, an ocular hazard may exist only if individuals overcome their natural aversion to bright light and stare directly into the laser beam.

Class 1 Laser Models (LM80 Models)

Class 1 lasers are lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

Laser wavelength: 655 nm  Output: < 0.33 mW  Pulse Duration: 45 µs to 1750 µs

Installation Instructions

Sensor Installation

**Note:** Handle the sensor with care during installation and operation. Sensor windows soiled by fingerprints, dust, water, oil, etc. may create stray light that may degrade the peak performance of the sensor. Blow the window clear using filtered, compressed air, then clean as necessary using 70% isopropyl alcohol and cotton swabs or water and a soft cloth.

Install the Safety Label

The safety label must be installed on or near the LM sensors.

**Note:** Position the label on the cable or near the sensor in a location that has minimal chemical exposure.

1. Remove the protective cover from the adhesive on the label.
2. Wrap the label around the LM cable, as shown.
3. Press the two halves of the label together.
Sensor Orientation

Correct sensor-to-object orientation is important to ensure proper sensing. See the following figures for examples of correct and incorrect sensor-to-object orientation as certain placements may pose problems for sensing distances.

![Correct/Incorrect Orientation](image)

Figure 4. Orientation by a wall

Figure 5. Orientation in an opening

Figure 6. Orientation for a turning object

Figure 7. Orientation for a height difference

Figure 8. Orientation for a color or luster difference

Figure 9. Orientation for a highly reflective target

Applying tilt to sensor may improve performance on reflective targets. The direction and magnitude of the tilt depends on the application, but a 15° tilt is often sufficient.

Mount the Device

1. If a bracket is needed, mount the device onto the bracket.
2. Mount the device (or the device and the bracket) to the machine or equipment at the desired location. Do not tighten the mounting screws at this time.
3. Check the device alignment.
4. Tighten the mounting screws to secure the device (or the device and the bracket) in the aligned position.

Wiring Diagrams

The bare shield wire is connected internally to the sensor housing and should be connected as follows:

- If the sensor housing is mounted so that it is in continuity with both the machine frame and earth ground, connect the bare wire (also) to earth ground.
- If the sensor housing is mounted so that it is insulated from the machine frame and you are experiencing noise, connecting the bare wire to -V dc (together with the blue wire), may help.
- If the sensor is mounted so that it is in continuity with the machine frame, but not with earth ground, do not connect the bare wire (e.g. cut off the bare wire).
Configuration Instructions

Sensor Programming

Program the sensor using the buttons on the RSD1 remote sensor display accessory, via IO-Link, or the remote input (limited programming options).

If you are using the RSD1 for programming, from Run mode, use the buttons to access the Quick Menu and the Sensor Menu. See the instruction manual (p/n 205812) for more information on the options available from each menu. For TEACH options, follow the TEACH instructions in the instruction manual.

In addition to programming the sensor, use the remote input to disable the buttons for security, preventing unauthorized or accidental programming changes. See the instruction manual for more information.

Remote Display Buttons and the LM

Use the RSD1 buttons **Down, Up, Enter, and Escape** to view or change RSD1 settings and information and to program a connected sensor.

- **Down and Up Buttons**
  - Press **Down and Up** to:
    - Access the Quick Menu from Run mode
    - Navigate the menu systems
    - Change programming settings
    - Change individual digit values in distance based settings

  When navigating the menu systems, the menu items loop.
  Press **Down and Up** to change setting values. Press and hold the buttons to cycle through numeric values. After changing a setting value, the value slowly flashes until the change is saved using the **Enter** button.

- **Enter Button**
  - Press **Enter** to:
    - Access the Sensor Menu from Run mode
    - Access the submenus
    - Move right one digit in distance based settings
    - Save changes

  In the RSD1 Menu, a check mark ‘·’ in the lower right corner of the display indicates that pressing **Enter** accesses a submenu.
  Press **Enter** to save changes. New values flash rapidly, and the sensor returns to the parent menu.
Escape Button
Press and hold Escape for 4 seconds to:
• Access the RSD1 Menu while in Run mode
Press Escape to:
• Leave the current menu and return to the parent menu

Important: Pressing Escape discards any unsaved programming changes.

In the RSD1 Menu, a return arrow in the upper left corner of the display indicates that pressing Escape returns to the parent menu.
Press and hold Escape for 2 seconds to return to Run mode from the RSD1 Menu.

Quick Menu
The sensor includes a Quick Menu with easy access to view and change the analog and discrete output switch points.
Access the Quick Menu by pressing Down or Up from Run mode. When in the Quick Menu, the current distance measurement displays on the first line and the menu name and the analog value alternate on the second line of the display.
Press Enter to access the switch points.
Press Down or Up to change the switch point to the desired value.
Press Enter to save the new value and return to the Quick Menu.

Sensor Menu (MENU)
Access the Sensor Menu by pressing Enter from Run mode. The Sensor Menu is also accessible from the Quick Menu: navigate to MENU and press Enter. The Sensor Menu includes several submenus that provide access to view and change sensor settings and to view sensor information.
From Run mode, press **Enter** to enter the top-level menu system (A_OUT, D_OUT, INPUT, MEASURE, etc).

**SensorMenu Full Map**

**Top Menu**

**Sub-Menus**

**MENU A_OUT**

**Adj20mA +150.00mm**

**Adj4mA +050.00mm**

**Tch4mA 50.00mm**

**Tch20mA 150.00mm**

**Tch2Pt Tch20mA**

**Tch2Pt Tch4mA**

**WndSize +030.00mm**

**Tch12mA 100.00mm**

**TchMid Tch12mA**

**TchMid WndSize**

**Slope Negative**

**Slope Positive**

**LossSig 20.5 mA**

**LossSig Hold**

**LossSig 3.5 mA**

**A_OUT Adj4mA**

**A_OUT Adj20mA**

**A_OUT Tch2Pt**

**A_OUT TchMid**

**A_OUT Slope**

**A_OUT LossSig**

**Offset 0mm**

**TchMid Offset**

**Average 512**

**Average 256**

**Average 128**

**Average 64**

**Average 32**

**Average 16**

**Average 8**

**Average 4**

**Average 2**

**Average 1**

**MENU INPUT**

**INPUT Active**

**INPUT Type**

**Active High (PNP)**

**Active Low (NPN)**

**Type LasrEnbl**

**Type Teach**

**Type Trigger**

**Type SyncMstr**

**Type SyncSlve**

**Type Disabled**

**MENU MEASURE**

**MEASURE Trigger**

**MEASURE Speed**

**Speed 4 ms**

**Speed 2 ms**

**Speed 1 ms**

**Speed 0.25 ms**

**Trigger Average**

**Trigger Sample**

**Trigger Max**

**Trigger Min**

**Trigger Range**

**Trigger TrackMax**

**Trigger TrackMin**

**MENU DISPLAY**

**DISPLAY Units**

**Units in**

**Units mm**

**DISPLAY Zero Zero Near**

**Zero Far**

**DISPLAY Shift Shift Off**

**Shift SetZero**

**Shift AutoSet**

**MENU INFO**

**INFO Version**

**Version 1.0.0**

**INFO Model**

**Model LM150KI**

**INFO P/N**

**INFO S/N**

**INFO CommP/N**

**INFO CommVer**

**Menu Reset**

**RESET No**

**RESET Yes**

**Top Menu Sub-Menus**

**Run Mode**

**Enter Quick Menu Loop (see Quick Menu diagram)**

**Enter Top Menu**

**Go back to parent menu**

**Press to save setting**

**Press and hold to go back to Run mode**

**Press and hold 4 seconds to go back to Run mode**

**Track Off**

**Track HS**

**Track On**

**DualSPt 75P**

**Track (in Dual mode only)**

**SPtRef (in SPt mode only)**

**Offset 0 mm (in SPtRef Custom mode only)**

**Factory default setting**

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L-GAGE® LM Series Laser Sensor

www.bannerengineering.com - Tel: + 1 888 373 6767

P/N 205811 Rev. D
Specifications

Supply Voltage (Vcc)
10 V dc to 30 V dc
Use only with a suitable Class 2 power supply (North America)

Power and Current Consumption, exclusive of load
Normal Run Mode: 1.5 W, Current consumption < 62 mA at 24 V dc

Supply Protection Circuitry
Protected against reverse polarity and transient overvoltages

Ambient Light Immunity
10,000 lux

Construction
Housing: stainless steel
Window: acrylic

Output Ratings
Discrete Output: 50 mA maximum (protected against continuous overload and short circuit)
Output saturation voltage (PNP): < 3 V at 50 mA
Output saturation voltage (NPN): < 2.5 V at 50 mA
Analog current output (LM...I Models): 500 Ω maximum
Analog voltage output (LM...U Models): 1000 Ω minimum

Maximum Torque
1.5 N·m

Remote Input
Allowable Input Voltage Range: 0 to Vcc
Active Low (internal weak pullup—sinking current):
High State: > 3.6 V
Low State: < 2.4 V
Active High (internal weak pulldown—sourcing current):
High State: > Vcc - 2.9 V
Low State: < Vcc - 4.6 V

Minimum Window Size, Analog and Discrete
LM80:
Analog: 1 mm
Discrete: 0.024 mm
LM150:
Analog: 1 mm
Discrete: 0.1 mm

Minimum Object Separation
LM80:
Uniform targets (6% to 90% reflectivity) 40–70 mm: 0.04 mm
Uniform targets (6% to 90% reflectivity) 70–80 mm: 0.06 mm
Non-uniform targets (6% to 90% reflectivity): 0.4 mm
LM150:
Uniform targets (6% to 90% reflectivity) 50–120 mm: 0.120 mm
Uniform targets (6% to 90% reflectivity) 120–150 mm: 0.140 mm
Non-uniform targets (6% to 90% reflectivity): 0.8 mm

Environmental Rating
IEC IP67

Operating Conditions
−10 °C to +55 °C (+14 °F to +131 °F)
90% at +55 °C maximum relative humidity (non-condensing)

Storage Temperature
−35 °C to 60 °C (~31°F to 140 °F)

Certifications

1 Performance with 6% to 90% reflectivity with 128x averaging. With 1x averaging, repeatability of ± 0.004 mm from 40 to 80 mm.
2 Performance with 6% to 90% reflectivity with 128x averaging. With 1x averaging, repeatability of ± 0.005 mm from 50 to 120 mm and ± 0.010 mm from 120 to 150 mm.
3 The accuracy specification refers to the possible absolute offset when installing a sensor without taking any reference measurement. Linearity is the more relevant specification for most applications.
### Typical Beam Spot Size

![Beam Spot Pattern](image)

<table>
<thead>
<tr>
<th>LM80 Distance (mm)</th>
<th>40</th>
<th>60</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>0.90</td>
<td>0.63</td>
<td>0.37</td>
</tr>
<tr>
<td>y</td>
<td>0.42</td>
<td>0.31</td>
<td>0.21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LM150 Distance (mm)</th>
<th>50</th>
<th>100</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>2.12</td>
<td>1.44</td>
<td>0.77</td>
</tr>
<tr>
<td>y</td>
<td>0.68</td>
<td>0.49</td>
<td>0.31</td>
</tr>
</tbody>
</table>

### Required Overcurrent Protection

**WARNING:** Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

Overcurrent protection is required to be provided by end product application per the supplied table. Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply. Supply wiring leads < 24 AWG shall not be spliced. For additional product support, go to www.bannerengineering.com.

<table>
<thead>
<tr>
<th>Supply Wiring (AWG)</th>
<th>Required Overcurrent Protection (Amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>22</td>
<td>3.0</td>
</tr>
<tr>
<td>24</td>
<td>2.0</td>
</tr>
<tr>
<td>26</td>
<td>1.0</td>
</tr>
<tr>
<td>28</td>
<td>0.8</td>
</tr>
<tr>
<td>30</td>
<td>0.5</td>
</tr>
</tbody>
</table>

### FCC Part 15 and CAN ICES-3 (B)/NMB-3(B)

This device complies with part 15 of the FCC Rules and CAN ICES-3 (B)/NMB-3(B). Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules and CAN ICES-3 (B)/NMB-3(B). These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the manufacturer.

### Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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For patent information, see www.bannerengineering.com/patents.

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*Beam spot size is the D4σ measured value*