

# User's Guide



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# **LV800 SERIES**

# **Capacitance Point Level Sensors**



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The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

**WARNING:** These products are not designed for use in, and should not be used for, human applications.



This manual contains the information necessary to ensure a safe and successful installation. Please read and comply with the section on page 9 of this manual pertaining to SAFETY. Doing so will ensure proper operation of the equipment and the safety of all personnel.



Before discarding shipping container, please inspect it thoroughly and verify that all parts ordered are accounted for. Sometimes smaller parts become stuck under carton flaps and other packaging materials.

## PRE-INSTALLATION CONSIDERATIONS

**Choosing a Location:** (See Figure 2)

- 1) **Material Flow** - When selecting a location for the LV800, choose a point in the vessel where the probe will be out of the direct flow of incoming and outgoing material to prevent any mechanical damage that may be caused by the pressure of the flow. The LV800 must be positioned at a point where incoming material will reach and cover the probe in its normal flow, and when receding, will flow away from the probe in an even manner. For best results, choose a position where a majority of the probe, not just the tip, will be covered. This is particularly important when detecting materials with low relative dielectric constants and low product densities. The unit will not operate as a "tip sensitive" device. For extended length models, allow for at least 8 to 12 inches (203-305 mm) of probe coverage. When sensing highly conductive materials, or those with a high dielectric constant, the LV800 can perform as a "tip sensitive" sensor.
- 2) **Vessel Contact** - Select an area where the probe can not contact any internal structure elements of the vessel.
- 3) **Driven Shield Penetration** - Select a location which ensures that the driven shield section protrudes into the vessel and is not recessed in the mounting neck.
- 4) **Multiple Probe Proximity** - If more than one sensor is mounted in the vessel, do not place the sensors closer than 18 inches (457 mm) from one another.

**Cover Removal:** (See Figure 1)

Before loosening the cover, loosen or remove the cover lock screw. Spanner slots are incorporated on the top of the cover which should be used to loosen the cover from the housing. Use a flat bar for initial loosening. DO NOT use a strap or chain type wrench. Keep hands clear of threads on the cover and housing to avoid contact with the thread lubricant.

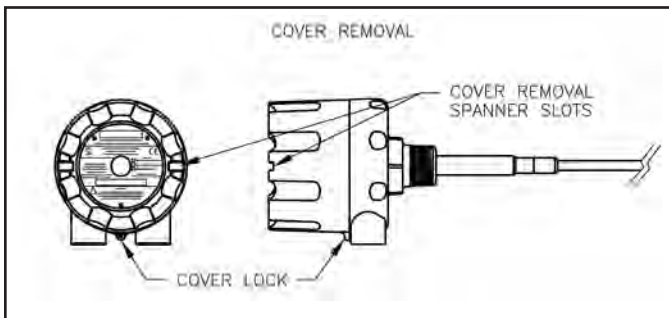


Figure 1

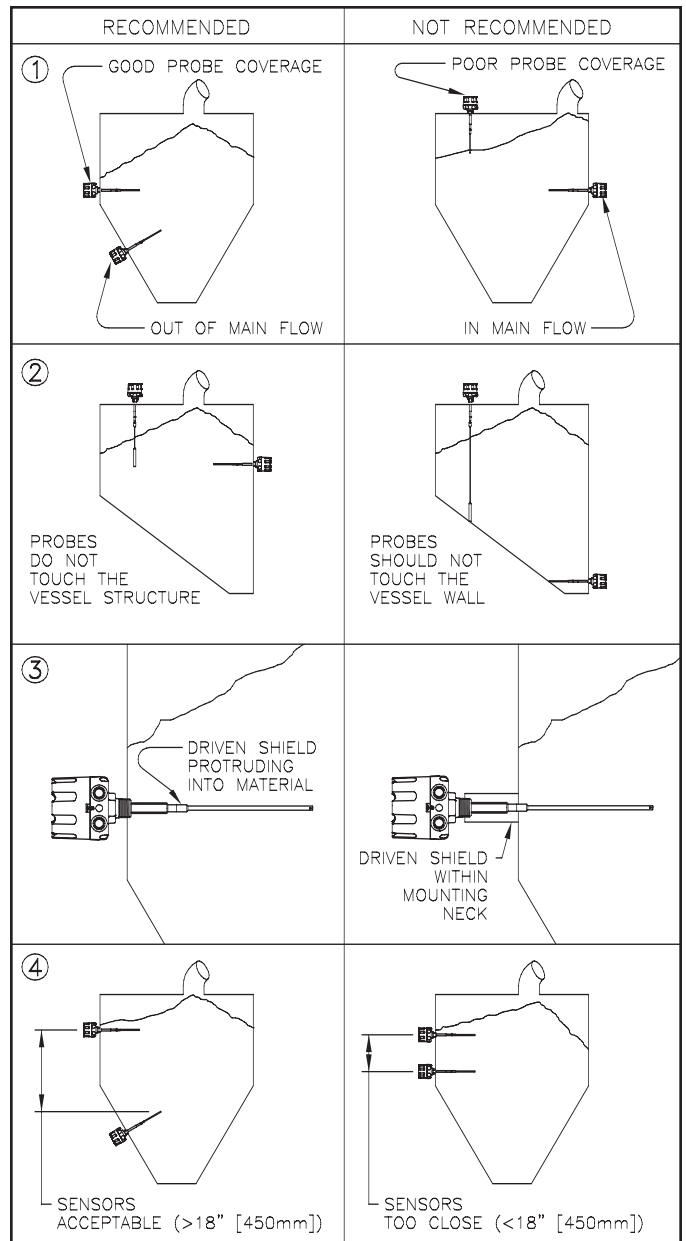


Figure 2

## MECHANICAL INSTALLATION

### Standard, Food Grade and Stub Probe Mounting:

(See Figures 3 & 4)

- 1) Select a mounting location in accordance with the Pre-Installation Recommendations.
- 2) If using a welded fitting, cut a hole into the side/top of the vessel corresponding to the mounting connection (1-1/4" NPT or 3/4" NPT). If using a mounting plate, cut a 2-1/2 inch (64 mm) center hole and six 11/32 inch (9mm) mounting holes (for 5/16" bolts) on a 7 inch (178 mm) bolt circle. Use mounting plate as a template.
- 3) Weld fitting or attach mounting plate to vessel wall.
- 4) Insert probe through fitting. Do not use sealant tapes (e.g. Teflon tape) or putties. When using the 1-1/4" NPT connection, grease threads with anti-seize then thread unit tightly into place by gripping and rotating housing. When using the 3/4" NPT connection, thread unit tightly into place by gripping and rotating 15/16 inch (24 mm) wrench flats provided on fitting. Continuity between sensor mounting point and vessel wall must be maintained to assure proper probe operation.

DIMENSIONS ARE SHOWN IN INCHES WITH MILLIMETER EQUIVALENT IN BRACKETS

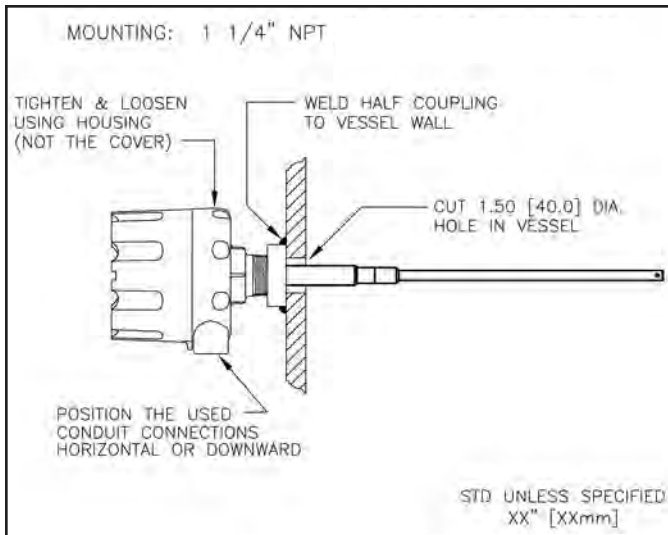


Figure 3

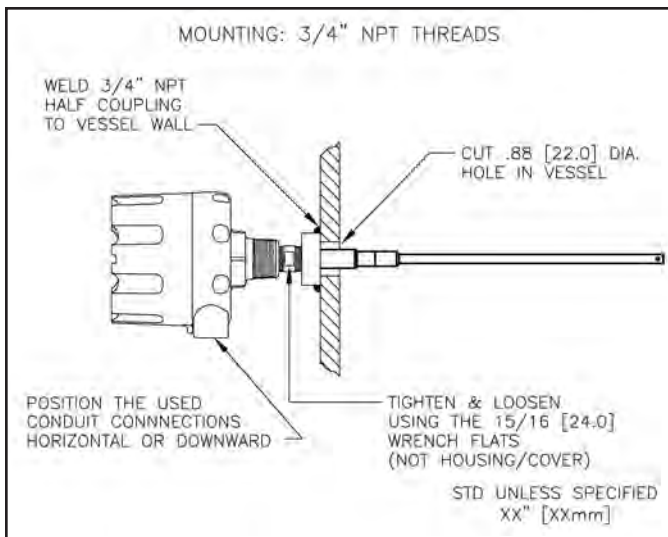


Figure 4

## ELECTRICAL INSTALLATION

### Factory Wiring:

The LV800 probe wires are connected to the backside of the PCB. **DO NOT** alter this connection. Doing will likely cause improper operation of the sensor.

### ⚠ Permanently Connected Equipment:

Disconnecting devices shall be included in the system installation. In installations where multiple circuits are used (i.e. independent circuits for power input and output relay), individual disconnects are required. The disconnects shall be within close proximity of the equipment, accessible to operators, and marked appropriately as the disconnect for the associated circuit. Assure the disconnect ratings are appropriately sized for the circuit protected (See Specifications).

### Circuit Separation:

Two cable entry locations are provided to aid in maintaining separation of "hazardous live" (typically mains voltages such as 115VAC and 230VAC) and limited circuits (typically control voltages less than 30Vrms or 42.4VDC). However, since the LV800 single wiring compartment can not absolutely protect against physical contact between multiple circuits, it is required that all wiring used must have an insulation rating of 300V minimum, and a temperature rating of 80° C (176° F) minimum.

### ⚠ Protective Earthing: ⊕

Each LV800 is provided with a "protective conductor terminal" which shall be terminated to the local earth ground potential to eliminate shock hazard in the unlikely event of internal insulation breakdown. Select wire size that can carry in excess of the sum of all circuit's maximum amperage.

### Power Input: (See Figure 5)

The LV800 is designed to accept either 115VAC or 230VAC (factory set). Verify the intended voltage supply is compatible with the voltage configuration indicated on the electronics and the external nameplate. Connect power as shown in Figure 5. Select wire size that can deliver suitable voltage and current for the application.

### Output Relay Contacts: (See Figure 5)

The LV800 is equipped with one or two sets of isolated contacts which indicates whether or not material is being detected within the vessel. This output is also influenced by the selection of the "fail-safe" switch as described in the "Calibration" section of this manual. The designations on the circuit board relate to the contact status when the material is "not" sensed and the fail-safe switch is in the "low" mode. These contacts can be connected to any type of control device, provided that ratings are observed (See Specifications). Select wire size that can deliver suitable voltage and current for the application.

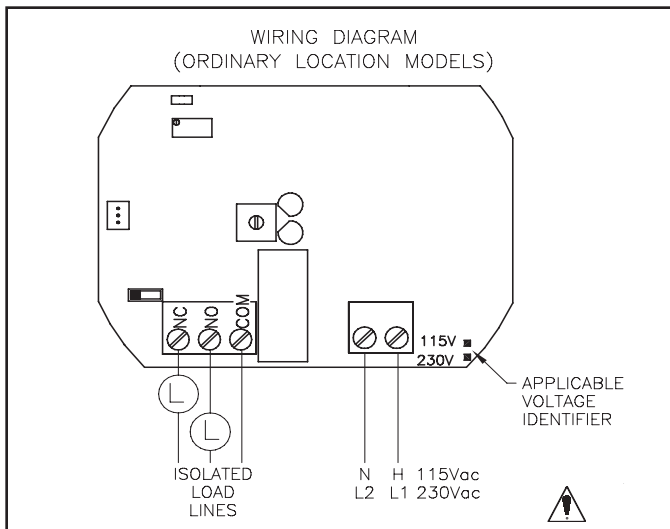


Figure 5

## CALIBRATION

### Sensitivity: (See Figure 6)

Sensitivity is set in the field via a "Sense Adjust" 25-turn potentiometer.

The "Sense Adjust" tunes the sensitivity of the LV800 to the material being sensed. Rotating the adjustment in a clockwise direction will increase the sensitivity making the material easier to "detect". There are two different procedures which can be used in the calibration process. Both utilize the simple "2-Step Calibration" procedure. One procedure sets the sensitivity with the probe being exposed to the material, while the second procedure exposes the probe to free air only. Since the capacitance being measured is directly related to the material being sensed, the best results will be achieved by setting the calibration while the probe is exposed to the application material.

### 2-Step Calibration- probe exposed to material

- 1) While the probe is not covered with material, rotate "Sense Adjust" clockwise just until "Sense" (yellow) LED turns on.
- 2) Permit the application material to cover the probe. **While counting the number of revolutions**, rotate "Sense Adjust" counter-clockwise until the "Sense" (yellow) LED turns off. Reposition "Sense Adjust" at the half way point between the LED on and LED off settings. (e.g. After inserting the probe into the material, if it takes 2 counter-clockwise turns of "Sense Adjust" for the "Sense" (yellow) LED to turn off, then "Sense Adjust" should be repositioned 1 clockwise turn.)

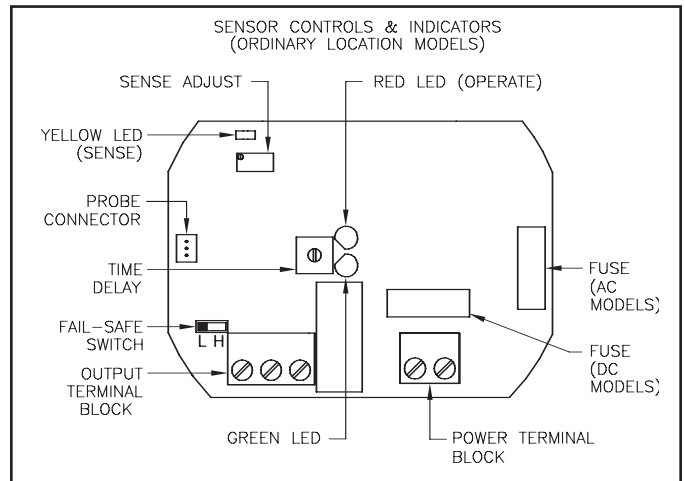


Figure 6

### 2-Step Calibration- probe exposed to free air only

- 1) Rotate "Sense Adjust" clockwise just until the "Sense" (yellow) LED turns on.
- 2) Reposition "Sense Adjust" a number of turns counter-clockwise with respect to the three described sensitivities below (see Figure 7). It is desirable to reposition "Sense Adjust" in accordance to "2-Step Calibration - probe exposed to material" procedure once material can cover the probe. Materials with high dielectric constants or conductivity, require the sensitivity adjustment further counter-clockwise than those applications with low dielectric constants.

SENSITIVITY SETTING OF THE LV800			
SENSITIVITY DESCRIPTION	NO. OF ADJ TURNS	MATERIAL DIELECTRICS	TYPICAL APPLICATIONS
HIGH	0-1	1.5-3.0	PLASTICS, SOAP, OILS, RUBBER, CEMENT
MED	1-3	3.0-9.0	GRAINS, FERTILIZERS, FEED, SALT
LOW	> 3	> 9.0	WASTEWATER, SLURRIES, ANY WATER BASED SOLUTIONS

Figure 7

**Delay:**

A potentiometer is provided for setting the time delay between the time material is "sensed" (Yellow LED on) and the time the relay contact output changes (Red LED on). Units have a 1-turn potentiometer. A clockwise rotation will increase the delay from .25 to 15 seconds. This adjustment minimizes false signals associated with temporary material shifts. The delay between the time material is "not sensed" (Yellow LED off) and the time the relay contact output changes (Red LED off) is fixed at .25 seconds.

**Fail-safe:** (see Figure 8)

The term fail-safe refers to the output signal condition which occurs with a loss of power to the probe. A switch permits selection of either low or high fail-safe.

**High Fail-Safe:** The relay will de-energize when material is sensed at high level or with power loss.

**Low Fail-Safe:** The relay will de-energize when material is below low level or with power loss. Note the designations on the electronics label refer to the relay contact status when no material is sensed and low fail-safe is selected (Relay is de-energized). The designations are reversed when no material is sensed and high fail-safe is selected (Relay is energized).

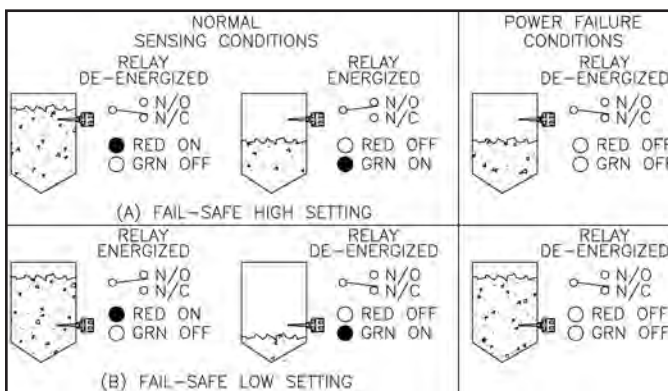


Figure 8

**Indicators:** (See Figure 9)

**1) Yellow LED** - Its status describes the "sensing" condition of the LV800. Illumination indicated that the amount of capacitance established by the "Sense Adjust" has been detected. Its status is not affected by the time delay setting of the fail-safe setting. This LED can only be seen when the cover has been removed.

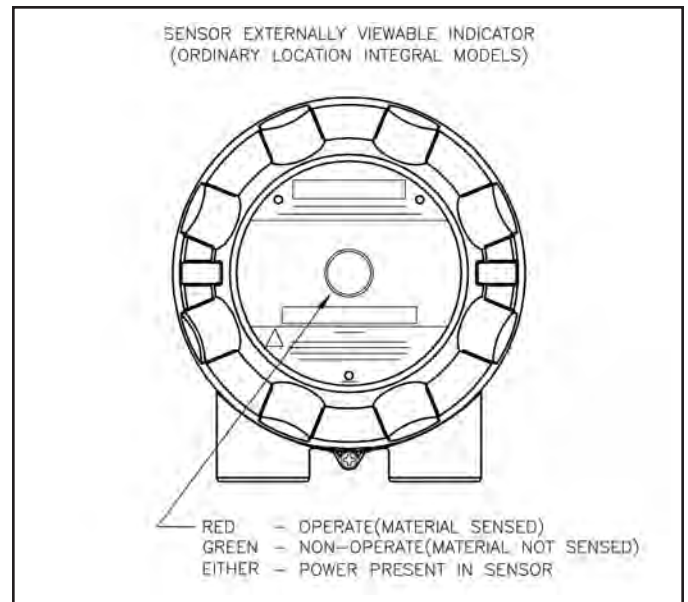


Figure 9

- 2) Red LED** - Its status describes the "operate/output" condition of the LV800. Illumination indicated the relay is in the "operate/material sensed" condition. Its state is influenced by the time delay setting but not by the fail-safe setting. This LED is aimed at the lens in the cover so it can be seen with the cover on or off.
- 3) Green LED** - Its status indicates "no material sensed" condition of the LV800 in combination with the time delay setting. If material has not been sensed for a long enough time (as set by the time delay setting), this LED will be illuminated. The red and green LEDs should never be illuminated at the same time. The green LED's state is not affected by the fail-safe setting. This LED is also aimed at the lens in the cover so that it can be seen with the cover on or off.

## TROUBLESHOOTING

### **PROBLEM: Sensor will not sense material**

#### **CAUSE/SOLUTION:**

- 1) Verify power is applied to the sensor.
- 2) Verify "Sense Adjust." Reposition adjustment clockwise therefore making the probe more sensitive to "difficult to sense" materials.
- 3) Verify probe coverage when sensing is expected. The sensor is not designed to be "tip sensitive." Permit significant probe coverage before expecting material sensing.
- 4) Verify electrical continuity between sensor housing and vessel wall.
- 5) Verify connection of the electronic module to the probe.

### **PROBLEM: Sensor remains in the "SENSE" mode even when material is absent**

#### **CAUSE/SOLUTION:**

- 1) Verify the active probe is not in direct contact with any internal vessel structure. If so, reposition sensor.
- 2) Verify "Sense Adjust" setting. Reposition adjustment counter-clockwise therefore making the probe less sensitive to "easy to sense" materials.
- 3) Verify there is not a large buildup of material between the active probe and the probe housing. See "Cleaning" in the "Maintenance" section of this bulletin.

### **PROBLEM: Sensor does not seem to hold its calibration**

#### **CAUSE/SOLUTION:**

- 1) Verify that the "sense adjust" is positioned at ideal point as described in 2-Step Calibration procedure. Placing setting too close to threshold can create nuisance false signals.
- 2) Maximize probe coverage of material being sensed. "Difficult to detect" materials (i.e. low dielectric or light materials) are more easily detected when more probe is covered. Avoid setups where "probe tip sensitivity" is required.
- 3) Insure electrical continuity between the probe's mounting point (3/4" NPT or 1 1-4" NPT) and the bin wall. Sealant tapes (i.e. Teflon tape) can electrically isolate these regions and make sensing more difficult.
- 4) Assess the temperature swing that the electronics sees in application. Applications with "difficult to detect" materials and that experience a wide temperature swing are the most vulnerable. Consult factory for support.

### **PROBLEM: Output contacts perform opposite of designations (N/O, N/C)**

#### **CAUSE/SOLUTION:**

- 1) Designations on PCB relate to relay status when in "Fail-Safe Low" mode and when no material is sensed. If "Fail-safe High" mode is used, the designations are reversed. Swap wire terminations of N/O and N/C if necessary. Changing the fail-safe selection is not recommended.

## MAINTENANCE



### **Fuse Replacement:**

The fuse incorporated into the LV800 PCB is not intended for operator replacement. A qualified technician can replace the applicable fuse according to the following specifications. If necessary, consult the factory for additional technical assistance or for return of the LV800.

#### **115VAC**

F1: 5x20mm, 0.63A Time Lag (Slo-Blo), 250VAC

Littelfuse: #218.063

Bussman: #GDC-63mA

#### **230VAC**

F1: 5x20mm, 0.32A Time Lag (Slo-Blo), 250VAC

Littelfuse: #218.032

Bussman: #GDC-32mA

### **Preventive Maintenance:**

The LV800 design is virtually maintenance free. In typical applications, once the sensor is properly calibrated, it will operate without any further attention. In abrasive applications, probe condition should be periodically observed. Although the probe's construction is made with high quality engineering plastics, heavy abrasion can wear away the probe's insulators. This can influence the calibration and eventually lead to sensor failure. The electronics are housed in a weatherproof enclosure. In addition the PCBs are conformal coated with a silicone-based material to further prevent electrical influence by condensation. The sensor electronics should periodically be observed for any signs of contamination caused by improper enclosure protection (i.e. insure cover is fully engaged, and that wire entries are properly sealed.)

### **Cleaning Requirements:**

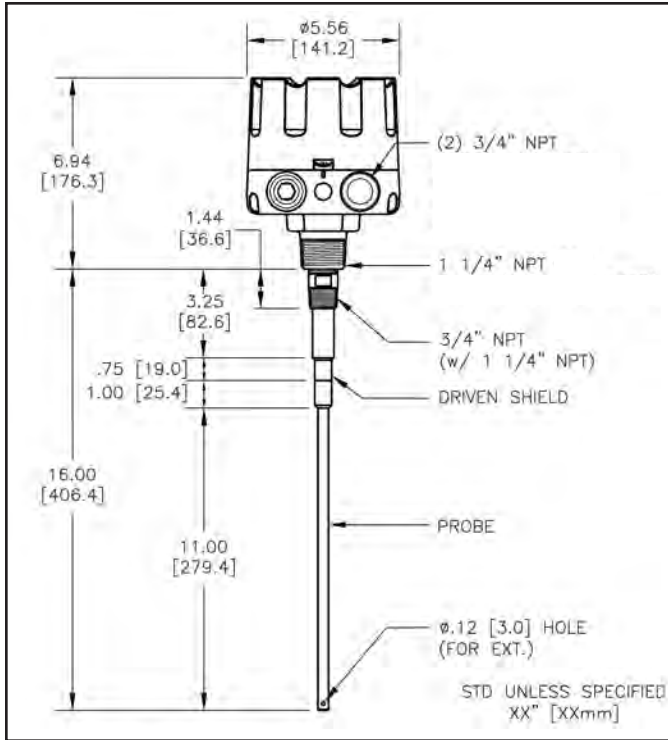
Environmental and hazardous location protection is highly dependent on the proper installation of the cover to the housing. A lubricant is applied to the housing/cover threads to enhance ability to twist-on twist-off cover. Clean and re-lubricate threads if necessary to insure trouble-free operation. Do not physically alter threads in anyway otherwise environmental or hazardous location protection could be compromised.

The driven shield feature of the LV800 is designed to minimize the need for cleaning the probe portion of the sensor. In applications where material build-up is so excessive that electronics can not adequately compensate, probe cleaning may be necessary. If so, wipe the probe with a clean damp cloth from the housing to the probe tip.

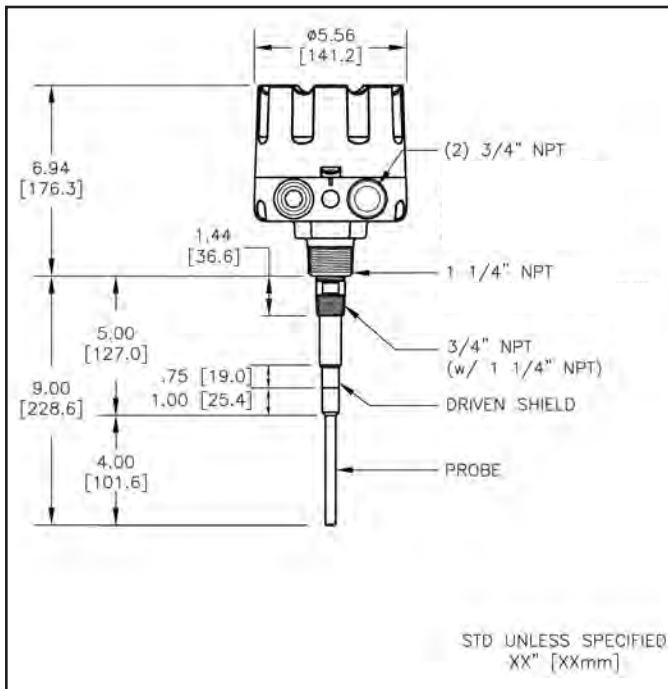


# MECHANICALS

DIMENSIONS ARE SHOWN IN INCHES WITH MILLIMETER EQUIVALENT IN BRACKETS



Standard Probe



Stub Probe

## SAFETY



### General Safety

**CAUTION:** It is essential that all instructions in this manual be followed to ensure proper operation of the equipment and safety of operating personnel. Use of equipment not specified herein, may impair protection provided by equipment. The use of this symbol is used throughout manual to highlight important safety issues. Please pay particular attention to these items.



### Electrical Shock Caution

Certain LV800 models are powered with HIGH VOLTAGE. No operator serviceable parts are inside. All servicing is to be performed by qualified personnel. Each MK-2e is provided with a "protective conductor terminal" which shall be terminated to earth ground potential (See Electrical Installation). This product's design complies with EN61010-1 installation category II and pollution degree 2.

### Electromagnetic Compatibility (EMC)

The LV800 was tested and found to comply with the standards listed below. The LV800 should not be used in residential or commercial environments. Compliance to EMC standards was demonstrated by means of a test setup using the following installation methods.

- 1) LV800 enclosure was connected to earth ground (protective earth).
- 2) No specific wiring convention was used to supply power or to retrieve output signal from the LV800.

#### EMC Emissions:

Meets	EN 61326-1	Electrical Equipment for Control Use, EMC
	EN 55011	Radiated and conducted emissions (Class A- industrial)
	EN 61000-3	Fluctuations/Flicker

Meets	FCC Part 15B:	RF Devices, Unintentional Radiators
	CISPR 11	Radiated and conducted emissions (Class A- industrial)

#### EMC Immunity:

Meets	EN 61326-1	Electrical Equipment for Control Use, EMC
	IEC 1000-4-2	Electrostatic discharge (industrial)
	IEC 1000-4-3	RF radiated EM fields (industrial)
	IEC 1000-4-4	Electrical fast transients (industrial)
	IEC 1000-4-5	Electrical surges (industrial)
	IEC 1000-4-6	RF conducted EM energy (industrial)
	IEC 1000-4-8	Power frequency magnetic fields (industrial)
	IEC 1000-4-11	Source voltage deviation

## SPECIFICATIONS

<b>Power:</b>	115VAC (±15%); 2.5VA; 50/60Hz / 230VAC (±15%); 2.5VA; 50/60Hz
<b>Altitude:</b>	6562 ft (2000 m) max
<b>Installation Category:</b>	II
<b>Pollution Degree:</b>	4 (Reduced to 2 by enclosure) Suitable for indoor/outdoor use
<b>Ambient Op Temp:</b>	-40° F (-40° C) to +150° F (+65° C)
<b>*Internal Bin Temp:</b>	To +176° F (+80° C) w/alum. mount (<104° F (40° C) ambient) To +400° F (+204° C) w/SS mount (<122° F (50° C) ambient)
<b>Output Relay:</b>	SPDT, 5A @ 250VAC, 30VDC maximum
<b>External Indicators:</b>	Red and green LEDs indicating power and operating mode
<b>Sensitivity:</b>	Multi-turn potentiometer adjustment 0.5pf to 150 pf
<b>Stability:</b>	±0.015pf per degree F (±0.027pf per degree C) @ 0.5pf setting
<b>Time Delay:</b>	0.25 to 15 sec delay-to-activate, adjustable 0.25 sec delay-to-deactivate, fixed
<b>Fail-Safe:</b>	Switch selectable - HI/LO
<b>Build-up Immunity:</b>	Protected via driven shield to 150 ohm load
<b>Enclosure:</b>	Cast alum screw-on cover, beige polyester pwdr coat, NEMA 4, IP66
<b>Conduit Connection:</b>	Two (2) 3/4" NPT connections
<b>**Approvals:</b>	CSA <sub>US</sub> CSA <sub>C</sub> Ordinary Locations, CE Mark (Ordinary location only)
<b>Standard/Food Grade Probe</b>	
Mounting:	1-1/4" NPT alum or combo 3/4" NPT 316SS and 1-1/4" NPT alum
Probe Material:	3/8in(9.5mm) dia. 316SS probe & guard, PPS insulators
Probe Length:	16in(406mm) from alum mounting
Temp (Probe Only):	PPS +450° F (+232° C) max;
Pressure:	50 psi(3.5 bar) max (alum connection); 150 psi(10 bar) max (3/4" NPT SS)
<b>Stub Probe</b>	
Mounting:	1-1/4" NPT alum, or combo 3/4" NPT 316SS and 1-1/4" NPT alum
Probe Material:	3/8in(9.5mm) dia. 316SS probe & guard, PPS insulators
Probe Length:	Cut to customer specification; application dependent
Temp (Probe Only):	PPS +450° F (+232° C) max
Pressure:	50 psi(3.5 bar) max (aluminum); 150 psi(10 bar) max (3/4 NPT SS)

\*Influenced by mounting, material thermal conductivity and ambient temperature.



## WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

## RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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## **TEMPERATURE**

- ☑ Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- ☑ Wire: Thermocouple, RTD & Thermistor
- ☑ Calibrators & Ice Point References
- ☑ Recorders, Controllers & Process Monitors
- ☑ Infrared Pyrometers

## **PRESSURE, STRAIN AND FORCE**

- ☑ Transducers & Strain Gages
- ☑ Load Cells & Pressure Gages
- ☑ Displacement Transducers
- ☑ Instrumentation & Accessories

## **FLOW/LEVEL**

- ☑ Rotameters, Gas Mass Flowmeters & Flow Computers
- ☑ Air Velocity Indicators
- ☑ Turbine/Paddlewheel Systems
- ☑ Totalizers & Batch Controllers

## **pH/CONDUCTIVITY**

- ☑ pH Electrodes, Testers & Accessories
- ☑ Benchtop/Laboratory Meters
- ☑ Controllers, Calibrators, Simulators & Pumps
- ☑ Industrial pH & Conductivity Equipment

## **DATA ACQUISITION**

- ☑ Data Acquisition & Engineering Software
- ☑ Communications-Based Acquisition Systems
- ☑ Plug-in Cards for Apple, IBM & Compatibles
- ☑ Datalogging Systems
- ☑ Recorders, Printers & Plotters

## **HEATERS**

- ☑ Heating Cable
- ☑ Cartridge & Strip Heaters
- ☑ Immersion & Band Heaters
- ☑ Flexible Heaters
- ☑ Laboratory Heaters

## **ENVIRONMENTAL MONITORING AND CONTROL**

- ☑ Metering & Control Instrumentation
- ☑ Refractometers
- ☑ Pumps & Tubing
- ☑ Air, Soil & Water Monitors
- ☑ Industrial Water & Wastewater Treatment
- ☑ pH, Conductivity & Dissolved Oxygen Instruments