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## HEATERS

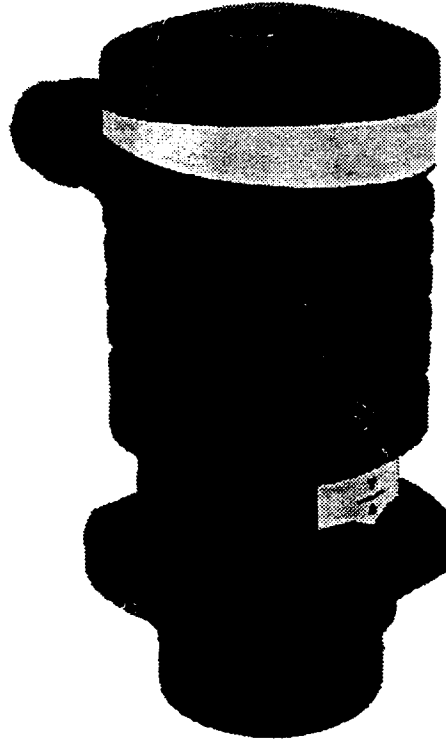
- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

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M2251/0467

# User's Guide



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## LVU-301 & LVU-303 Series Ultrasonic Level Transmitter

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

These products are not designed for use in, and should not be used for, hazardous applications.

It is the policy of OMEGA to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

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**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 Warranty does not cover normal wear and tear. This ensures that OMEGA's customers receive maximum coverage on each product.**

If the unit should malfunction, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Advanced Return (AR) number indicating upon receipt of the unit. OMEGA's standard OMEGA WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper installation, 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 being 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. OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any damage or error that results from the use of its products nor assumes responsibility for any damage or error that results from the use of its products in accordance with the information provided by OMEGA, either verbal or written. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. CLAIMS OF LIABILITY OF OMEGA WITH RESPECT TO THIS ORDER, WHETHER BASED ON CONTRACT, WARRANTY, NEGLIGENCE, MISFEASANCE, STRICT LIABILITY, OR OTHERWISE, SHALL NOT EXCEED THE PURCHASE PRICE OF THE COMPONENT UPON WHICH LIABILITY IS BASED. In no event shall OMEGA be liable for consequential, incidental or special damages.

**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 be used in or with any nuclear installation or activity, the purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent damage in transit.

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

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

OMEGA's policy is to make returning changes, not model changes, whenever an improvement is possible. OMEGA reserves the right to make changes without notice.

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**RETURN REQUESTS / INQUIRIES:** Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. ANY RETURN FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number shall 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 damage in transit.

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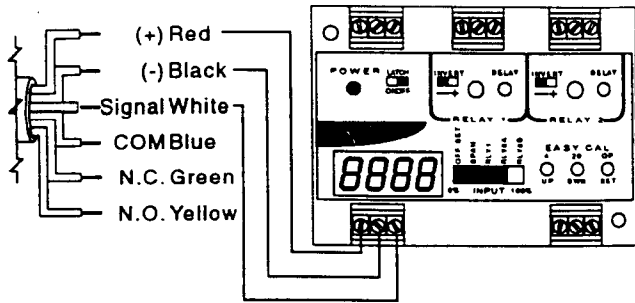
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# WIRING

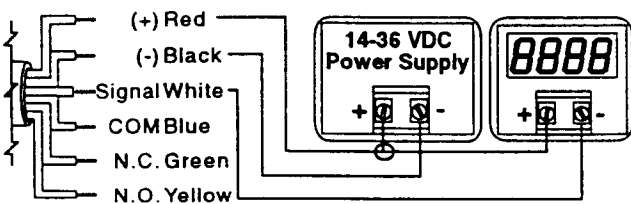
## Step Two

The transmitter requires 14-36 VDC power with at least 200 mA supply in order to operate.

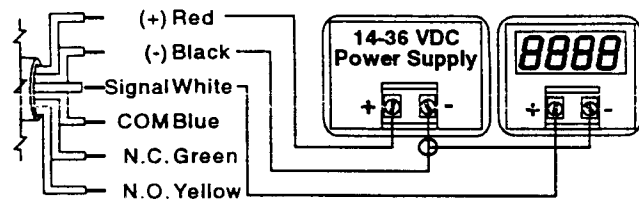
### 1. Wiring to a LVCN-51 Continuous Controller:



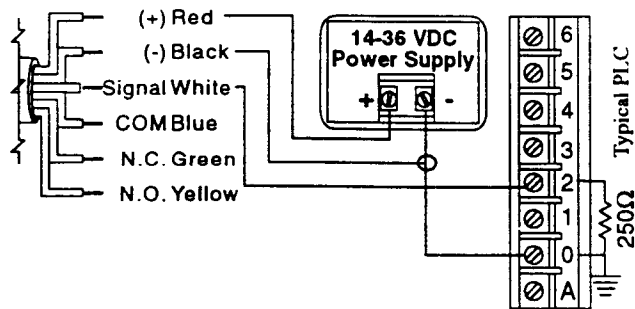
### 2. Wiring to a Two-Wire Loop Indicator (Model LVU-301):



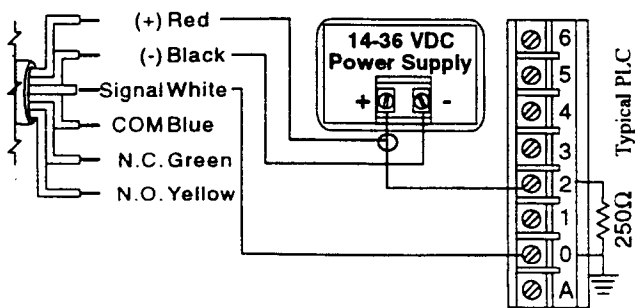
### 3. Wiring to a Two-Wire Loop Indicator (Model LVU-303):



### 4. Wiring to a PLC (Model LVU-303):



### 5. Wiring to a PLC (Model LVU-301):



# CALIBRATION

## Step Three

**Program current settings:** First determine the 4mA and 20 mA distances for the level transmitter. The 4mA setting is labeled EC4 and the 20 mA setting is labeled EC20. These settings represent the distance from the 4mA and 20 mA level to the bottom of the sensor. The EC4 value will be larger than the EC20.

**EC4:** Hold the [MENU] key until EC4 appears in the display. Release the key and wait until a value appears. This value is the level that the level transmitter reads. If this is acceptable, press [SET] to lock the value as the new EC4. If not, press either the [▲] or [▼] keys and the old setting for the EC4 will appear. From here, use the [▲] or [▼] keys to raise or lower the value to the correct measurement. Press the [SET] key to lock this value as the new EC4 value.

**EC20:** Hold the [MENU] key until EC20 appears in the display. Release the key and wait until a value appears. This value is the level that the level transmitter reads. If this is acceptable, press [SET] to lock the value as the new EC20. If not, press either the [▲] or [▼] keys and the old setting for the EC20 will appear. From here, use the [▲] or [▼] keys to raise or lower the value to the correct measurement. Press the [SET] key to lock this value as the new EC20 value.

**RLAY:** Only an indicator for the next two modes. The 10A relay is latched between the HSET and LSET points. To simply energize or de-energize the relay, HSET and LSET should be set to the same value.

**HSET & LSET:** Sets the high point and low point for relay activation. Press [MENU] key until either HSET or LSET appears. Wait for the display to change and press either [▲] or [▼] to change the numeric value. The [SET] key does not need to be pressed to lock in the value. Repeat process for the other setting.

**SAF1/SAF2:** The 10A relay inside the level transmitter can be used in a fail-safe design of your system. When [SAF1] is set, the relay will *de-energize* when the acoustic return signal is LOST. When [SAF2] is set, the relay will *energize* when the electronic signal is LOST. Response times will vary according to the setting of the level transmitter ([FAST] or [SLOW] modes).

**FAST/SLOW:** [FAST] is the standard in which the level transmitter operates. [SLOW] is designed to dampen out turbulence in tanks. In the [FAST] mode, the level transmitter will average 8 responses per second and update every second. In the [SLOW] mode, the level transmitter will average over the preceding 10 seconds. When used with [SAF1] or [SAF2], the time for the relay to default to is 30 seconds for the [FAST] mode, and 2.5 minutes for the [SLOW] mode.

**ALIN:** Indicates that the unit is in the Alignment mode. Display will show the return signal strength in dB's. Used as an indicator for mechanical alignment of the level transmitter and/or signal attenuation. Typical readings range between 0 and 50 dB's. For optimum alignment, first energize the unit and receive a valid return signal. The select the ALIN mode and adjust the level transmitter until the display is maximized.

**ON/OFF:** Used to toggle alignment [ON] or [OFF] with the [Set] key. The ALIN mode must be turned [OFF] when alignment is completed. This mode will not automatically default back to [LEVL].

**TANK:** Used as an indication for [TANK]. TANK sets the maximum tank height and will filter out all returns greater than the tank value. When the signal does exceed the tank value, the tank value will be displayed. Use the next setting to change the TANK value.

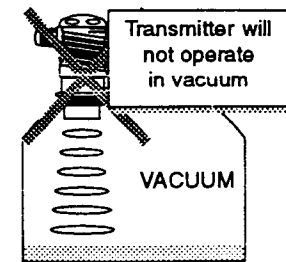
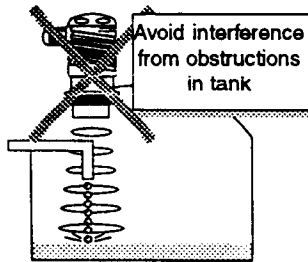
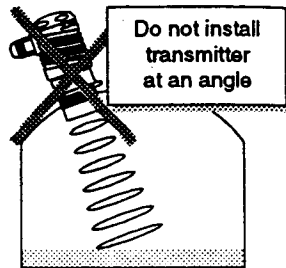
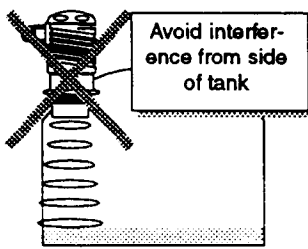
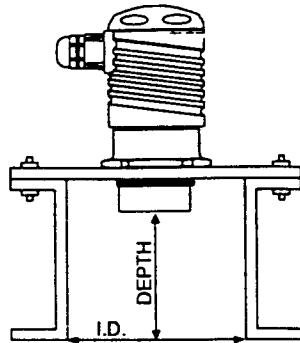
**(value):** Use the [▲] and [▼] buttons to change the current TANK value and press [SET] to enter the value. The level transmitter will limit the displayed level to this distance. The maximum distance is 300 inches.

# INSTALLATION

## Step Four

Mounting the level transmitter properly is critical to operation. If the level transmitter is installed such that it is recessed in a fitting or flange, follow the criteria listed below. For an I.D. less than 3", do not recess the level transmitter more than 1" for best results.

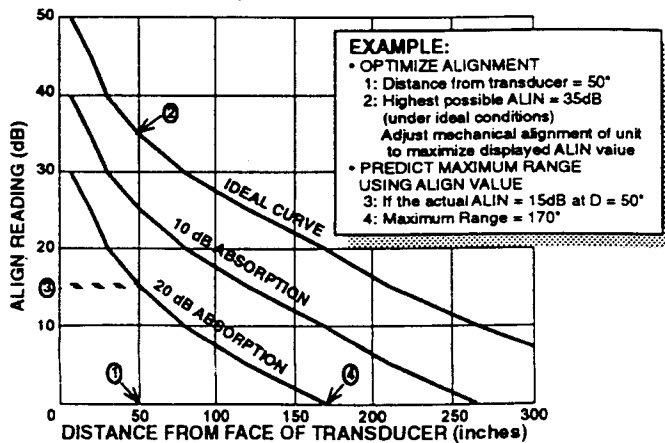
Flange I.D. (In)	Max. Depth (In)
3	3
4	7
5	11
6	15
7	19
8	26



### Maximum Application Range

The maximum range of the level transmitter is 24.5 feet at 110 dB. Yet a number of factors can reduce the overall quality of signal return and shorten the accurate range of the transmitter. To determine the maximum application range of the product, follow the signal return formula against the echo attenuation graph below.

### Echo Attenuation Graph



# TROUBLESHOOTING

## Step Five

**Factory Settings:** The level transmitter is preset at the factory. When powering up the sensor the first time, the factory settings will be active. If at any time in you need to return to these settings, remove power from the sensor and wait 10 seconds. Press the [Set] and [Menu] buttons simultaneously while powering up the sensor.

### FACTORY CALIBRATION

LEVEL	INCHES (cm)	SAF1/2	SAF1
EC 4	288" (731.2cm)	F/S	FAST
EC20	8" (20.3cm)	ALIN	N/A
RLAY	N/A	OFF	OFF
HSET	5" (12.6cm)	TANK	N/A
LSET	288" (731.2cm)	value	288" (731.2cm)

**Changing Display Units:** The level transmitter comes preset to measure in inches. To change the unit to display centimeters, remove power to the unit and wait 10 seconds. Press [▲] and [Set] simultaneously while powering up the sensor. The transmitter will now read in centimeters. To return to inches, remove power and wait 10 seconds. Press [▼] and [Set] simultaneously while powering up the sensor.

**LOST Signal:** A reading of LOST in the display of the level transmitter indicates the level transmitter is not receiving a valid return signal. If LOST appears, please check for:

1. Interference such as the side wall, ladders, seams, rungs or pipes within the transmitter's beam cone. The beam cone data is listed below.
2. Proper installation such that the transmitter is installed level and free from interference from the installation fitting.
3. Sufficient power being supplied to the transmitter. The transmitter requires 14-36 VDC power with a minimum supply of 200 mA.
4. Proper programming of the TANK function. For best results, set the TANK function as the distance from the bottom of the tank to the bottom of the transmitter.

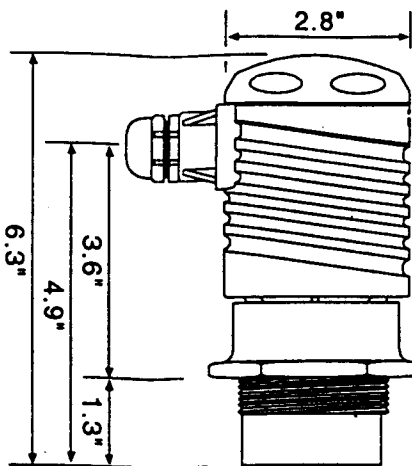
Range (Feet)	Radius (Inches)	Range (Feet)	Radius (Inches)
1'	2.6"	14'	23.1"
2'	4.2"	15'	24.7"
3'	5.7"	16'	26.3"
4'	7.3"	17'	27.8"
5'	8.9"	18'	29.4"
6'	10.5"	19'	31.0"
7'	12.1"	20'	32.6"
8'	13.6"	21'	34.2"
9'	15.2"	22'	35.7"
10'	16.8"	23'	37.3"
11'	18.4"	24'	38.8"
12'	20.0"	25'	40.5"
13'	21.5"		

**Current is always 4mA or 20 mA:** If the output of the level transmitter is always reading 4mA or 20 mA, check the input values for the transmitter. The display of the transmitter reads to the 1/10 of an inch or cm. A display of 1234 is 123.4" and not 1234".

# SPECIFICATIONS

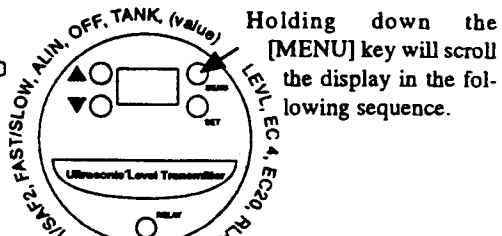
## Step One

Range:	0.5 to 24.5 feet
Accuracy:	± 0.25% of span (air)
Resolution:	0.125" (3 mm)
Frequency:	50 kHz
Pulse rate:	8 pulses per second
Blocking distance:	6" minimum
Display type:	4 segment LED
Display units:	Inch / cm
Supply voltage:	14-36 VDC
Consumption:	200 mA
Current flow:	Source / sink
Signal output:	4-20 mA, 12-36 VDC
Signal invert:	4-20 mA / 20-4 mA
Signal averaging:	Fast / slow
Calibration:	Push button
Relay current:	10 amp
Relay output:	250 VAC, 10A, 1/2 hp, SPDT
Relay indication:	ON / OFF status
Contact resistance:	30 milliohm
Fail-safe diagnostics:	Relay reverts to safe position
Temperature rating:	F: -4° to 140° C: -20° to 60°
Temp. compensation:	Automatic over entire range
Pressure rating:	30 psi @ 25 °C., derated @ 1.667 psi per °C. above 25 °C.
Enclosure rating:	NEMA 4X / IP65
Enclosure material:	Polypropylene
Transducer material:	Polyvinylidene Fluoride
Mounting threads:	2" NPT

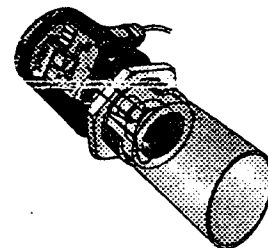
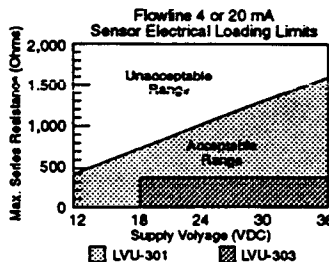
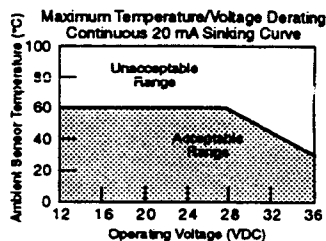
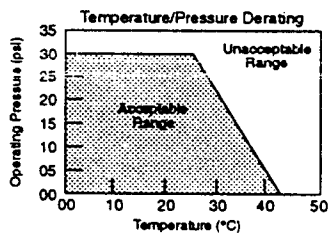
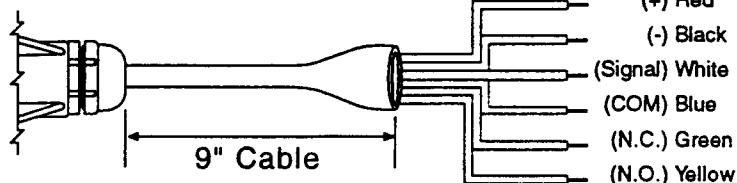


## Technology

An ultrasonic sound wave is pulsed eight times per second from the base of the transducer. The sound wave reflects against the process medium below and returns to the transducer. The microprocessor based electronics measure the time of flight between the sound generation and receipt, and translates this figure into the distance between the transmitter and process medium below.



Holding down the [MENU] key will scroll the display in the following sequence.



**⚠ About this Manual:** PLEASE READ THE ENTIRE MANUAL PRIOR TO INSTALLING OR USING THIS PRODUCT. This manual includes information on the ultrasonic level transmitter from OMEGA; model LVU-301 and LVU-303. Please refer to the part number located on the sensor label to verify the exact model which you have purchased.

**⚠ User's Responsibility for Safety:** OMEGA manufactures a wide range of liquid level sensors and technologies. While each of these technologies are designed to operate in a wide variety of applications, it is the user's responsibility to select a technology that is appropriate for the application, install it properly, perform tests of the installed system, and maintain all components. The failure to do so could result in property damage or serious injury.

**⚠ Proper Installation and Handling:** Use a proper sealant with all installations. Never overtighten the transmitter within the fitting. Always check for leaks prior to system start-up.

**⚠ Wiring and Electrical:** A supply voltage of 14-36 VDC is used to power the level transmitter. The sensor systems should never exceed a maximum of 36 VDC. Electrical wiring of the sensor should be performed in accordance with all applicable national, state, and local codes.

**⚠ Temperature and Pressure:** The transmitter is designed for use in application temperatures from -20 °C (-4 °F) to 60 °C (140 °F), and for use at pressures up to 30 psi @ 25 °C, derated @ 1.667 psi per °C above 25 °C.

**⚠ Material Compatibility:** The continuous ultrasonic level transmitter is made of two materials. The enclosure is of Polypropylene (PP) and the transducer is made of Polyvinylidene Fluoride (PVDF). Make sure that the model which you have selected is chemically compatible with the application liquids. While the transmitter housing is liquid-resistant when installed properly, it is not designed to be immersed. It should be mounted in such a way that it does not normally come into contact with fluid.

**⚠ Flammable, Explosive and Hazardous Applications:** The level transmitter systems should not be used within flammable or explosive applications.

**⚠ Make a Fail-Safe System:** Design a fail-safe system that accommodates the possibility of transmitter or power failure. In critical applications, OMEGA recommends the use of redundant backup systems and alarms in addition to the primary system.

## ⚠ Warning ⚠

*The LVU-303 is a sourcing transmitter which provides internal 4-20 mA excitation and should be used with a sinking device. The LVU-301 is a sinking transmitter which requires external 4-20 mA excitation and should be used with a sourcing device.*

*When installing the transmitter, never tighten the transmitter from the body. Always use the wrench flat located above the threads.*