Unpacking Instructions

WARNING

Do not place the equipment on an uneven or unstable surface.

CAUTION

Do not apply power to the equipment until all connections have been made.

The carrier will not honor claims for damage due to improper handling.

When you receive the shipment, inspect the container and equipment for signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

The carrier will not honor claims for damage due to improper handling.

Environment Monitoring and Control

Environmental Monitoring

- pH and Conductivity
- Flow and Level

Environmental Control

- Electric Heaters
- Data Acquisition Systems
- Power Supplies
- Temperature

The OMEGA Complete Measurement and Control Handbook is a comprehensive guide to the measurement and control of physical quantities. It includes information on sensors, transmitters, recorders, and controllers. The handbook is available for free by calling 1-800-USA-WHEN. For more information, visit www.omega.com.

Call for Your Free Handbook Request Form Today: (203) 359-RUSH
The LVU-1000 series is available in a variety of sizes and materials to suit virtually any application. Standard mounting configurations include a NPT and 2" NPT fittings. Flange mounting is also available to meet user specifications. Sensor materials of construction include CPVC, 316 SS, Kynar or Teflon.

Based on the latest ultrasonic technologies, the LVU-1000 series provides an efficient, reliable and cost effective means of level control. An integral ultrasonic sensor and a compact, remote electronic control unit offer accuracy, cost efficiency and ease of installation.

The LVU-1000 series consists of 2 major components: a non-contacting ultrasonic sensor and a compact, remote electronic control unit. Each system is provided in a variety of sizes and materials to suit virtually any application. Sensor materials of construction include CPVC, 316 SS, Kynar or Teflon.

The LVU-1000 series is available in a variety of sizes and materials to suit virtually any application. Standard mounting configurations include a NPT and 2" NPT fittings. Flange mounting is also available to meet user specifications. Sensor materials of construction include CPVC, 316 SS, Kynar or Teflon.

Based on the latest ultrasonic technologies, the LVU-1000 series provides an efficient, reliable and cost effective means of level control. An integral ultrasonic sensor and a compact, remote electronic control unit offer accuracy, cost efficiency and ease of installation.
Principles of Operation

In operation, the electronics generates an electronic signal which is converted by the sensor (mounted on top of the vessel) to a burst of ultrasonic pulses. These pulses are transmitted through the air to the liquid surface. As the pulses reach the liquid surface, they are reflected back to the sensor. The received echoes are converted back to an electronic signal, which is then sent to the microprocessor. The microprocessor calculates the time it takes for the pulses to travel to the liquid surface and back. This "Time of Flight" is directly proportional to the distance of the liquid surface from the sensor. The microprocessor then compares these calculated values with user programmed system parameters to provide the required control outputs.
4. Be sure that all wiring is carefully dressed to prevent pinching between the housing and the cover.

Installation

The sensor is mounted on the top of the vessel with the sensor facing downward. A clear path, free of any obstructions, must be provided between the sensor and the liquid surface. Due to the narrow sensor beam pattern, vertical-axis positioning of the sensor is important.

1. For sensors provided with an NPT threaded fitting, drill a suitable hole in the vessel top and tap for the correct NPT thread. In thin walled vessels, or vessels constructed of material not suitable for tapping, weld or braze a bushing to accept the sensor.

2. Screw the sensor into the threaded fitting, being careful not to cross thread the sensor. When possible, the use of a pipe compound or sealing tape is recommended. Avoid overtightening.

3. For flange mounted sensors, simply bolt the sensor/flange assembly to the proper mating flange connection.

4. Route the sensor cable to the electronic control unit and connect per the Wiring diagram (see figure 1).

Control Unit Installation

1. Open control unit enclosure and remove the printed circuit board.

2. Connect power and control wiring to the control unit as shown in the wiring diagram (see figure 1).

3. Complete power and control wiring to the enclosure. Observe all applicable local electrical codes and regulations. A neat and tidy appearance of any obstructions must be provided down to the sensor. Be sure that all wiring is carefully dressed to prevent pinching.

4. Reassemble the proper mounting flange/cover.

Any source of alternating current or high voltage should be utilized. Avoid routing the sensor cable in close proximity to it. INstallation

Avoid routing the sensor cable in close proximity to any source of alternating current or RFI.
Figure 2 Sensor Diagram

MATERIAL:

KYNAR
Teflon
316 SS

Figure 1 Wiring Diagram

Installation

Caution

Do not attempt to remove a threaded sensor from the vessel with the cable attached to the control unit, otherwise cable may be damaged.
Customized response times and output damping to meet special application requirements. Call factory for application assistance.

- Optional "lost echo" alarm relay, in place of alarm relay.
- External (front covered mounted) 4 digit display for local indication.

Optional Features

- External (front covered mounted) 4 digit display for local indication.
- Enhanced noise rejection algorithm ignores spurious signals and other noise sources such as 60 cycle and RFI.
- Enhanced noise rejection algorithm ignores spurious signals and other noise sources such as 60 cycle and RFI.
- Internal 4 digit display provides programming prompts, system feedback, and "lost echo" condition modes (user selectable).
- Fully isolated analog output with programmable output offset.
- User selectable alarm mode or distance operating mode.
- Four programmable alarm point relays.
- Simple 2 button programming.
- Sensor temperature range.
- Automatic temperature compensation for sound velocity errors due to temperature variations over the entire velocity range.

Standard Features

- Inharmonics or experience computer based systems, would otherwise only be possible through the use of multiple cases. A single LVU-1000 can accomplish control functions which until to present a wide variety of control functions. In many standard programmable relays and variable options can be achieved, the LVU-1000 series is an extremely versatile instrument. It is many.

General

Operating Modes and System Features
The liquid level, while the display mode will provide an analog output proportional to the liquid level. The display will toggle between displaying mode or distance mode, depending on the previously programmed mode. Reversing the liquid level and distance mode will read the liquid level in the opposite mode of operation, e.g., for distance mode, the liquid level will read the liquid level.

Pressing the Increment button now will toggle the display between "H" and "d". The height mode of operation will provide an analog output proportional to the liquid level, while the distance mode will provide an inverse ratio of the liquid level.

The onboard display will issue the prompt "SLdH". Press Enter once and the onboard display will issue the prompt "CODE". Release both Enter and Increment and then press the Enter button. The onboard programming display will issue the prompt "CODE". Hold the Enter and Increment button for approximately 3 seconds. The onboard programming display will issue the prompt "CODE". Hold the Enter and Increment buttons for approximately 3 seconds. The onboard programming display will issue the prompt "CODE".

Open control unit enclosures and simultaneously depress and release both the Enter and Increment buttons. After approximately 3 seconds, the system will automatically return to the operating mode, saving only those parameter values already entered.

Upon completion of the Calibration procedure, the analog output may be verified by following the Calibration Verification Procedure (see step 11).

Calibration Procedure

(see step 11)

Upon completion of the Calibration procedure, the Analog Output may be verified by following the Calibration Verification Procedure.

1. Open control unit enclosures and simultaneously depress and release both the Enter and Increment buttons. After approximately 3 seconds, the onboard programming display will issue the prompt "CODE". Hold the Enter and Increment buttons for approximately 3 seconds. The onboard programming display will issue the prompt "CODE". Hold the Enter and Increment buttons for approximately 3 seconds. The onboard programming display will issue the prompt "CODE".

2. Release both Enter and Increment and then press the Enter button once to bypass this prompt (this prompt is for factory use only, and is not user accessible).

3. Open control unit enclosures and simultaneously depress and release both the Enter and Increment buttons.

During the Calibration procedure, no button is pressed everywhere within this manual. Programming from the list and the Calibration Diagram found in the LVU-1000 series is calibrated via push-button entry switches.
Pressing Increment will toggle the programming Display Function Modes. Press Enter to store the desired Mode.

If you have selected display mode 1 at the "SLdF" prompt, then you have chosen Custom Display Scaling and the unit proceeds to step 6a in the following manner, otherwise the unit proceeds to step 7.

4 digit panel-mounted display (if provided). Press Enter now, and the on board programming display will indicate a digit of 0 or 1, depending on the previously entered selection. The Display Function Modes are as follows:

Mode 0: Display reads distance of target from sensor in inches.

Mode 1: Display indicates value of linear range programmable by the user. See the calibration parameter -- programming this mode.

Press Enter now, and the on board programming display will indicate the previously programmed zero value, with the "hundreds" digit flashing. Press Enter now, and the display will indicate the previously provided a closer Zero Point. Consult factory.

At this time the analog output may be configured to provide a closer Zero Point. Consult factory.

Zero Point is normally 12" from the sensor face. Upon entry of the Zero Point, the display will issue the prompt (the 'Tens" place) will now be flashing. Repeat the above steps for the "Tens", "Inches", and "Tenths of inches" places to obtain the desired Zero point as measured in inches from the sensor face.

The procedure in step 4 is where the desired Span in inches from the sensor face is measured.

The Span is the measurement range in inches as measured from the Zero Point.

5. After entering the desired Span, the system will issue the prompt: "SLdF" for "select display function". The Span is the measurement range in inches as measured from the Zero Point.

3. The next prompt to be displayed will be "SLOS" for "select analog offset". The Analog offset determines if the analog output signal is referenced to zero or some offset.

2. The next prompt to be displayed will be "SL-0" for "select zero".

1. If the display will now issue the "SL-O" prompt, for "select zero", the system will now issue the "SL-0" prompt for "select zero".

The display will now issue the "SL-O" prompt, for "select zero", the system will now issue the "SL-0" prompt, for "select zero".

0. Display the Analog Offset, which assigns a current analog output (0-20 ma vs. 4-20 ma for a current output, or 0-10 V dc vs. 2-10 V dc for a voltage output). Press Enter to display the previously entered selection (either 0 or 1). Pressing Increment now will toggle the display between 0 and 1. Entering "1" will invoke the current analog output (0-20 ma vs. 4-20 ma for a current output, or 0-10 V dc vs. 2-10 V dc for a voltage output), depending on the previously entered selection (either 0 or 1). Entering "0" will disable the analog output.

Display the Analog Offset, which assigns a current analog output (0-20 ma vs. 4-20 ma for a current output, or 0-10 V dc vs. 2-10 V dc for a voltage output). Press Enter to display the previously entered selection (either 0 or 1). Pressing Increment now will toggle the display between 0 and 1. Entering "1" will invoke the current analog output (0-20 ma vs. 4-20 ma for a current output, or 0-10 V dc vs. 2-10 V dc for a voltage output), depending on the previously entered selection (either 0 or 1). Entering "0" will disable the analog output.

The Analog offset determines if the analog output signal is referenced to zero or some offset.
Specifications

System Calibration

Figure 3 Calibration Diagram

- Range: 1 to 30 feet
- Resolution: 0.1 ft
- Accuracy: ±0.5% of full scale
- Repeatability: ±0.1% of full scale
- Temperature Compensation: Automatic over full range of sensor operating temperature
- Ambient Operating Temperature: +22°F to +120°F
- Ambient Pressure: Sensor-22°F to +120°F
- Temperature Range: +/-1°F to +/-1°F
- Cable: 100 feet (optional)
- Mounting: NEMA 4X (standard)
- Electronics: 4-20 mA dc (isolated)
- Output Signal: 0 to 5 V dc, 2 to 10 V dc, 24 V ac, 230 V ac optional
- Input Power: 115 V ac, 208 V ac, 240 V ac, 208 V dc or 230 V dc optional
- Programmed zero and span, height and distance
- Four digit (optional)
- Four 1 OA SPDT relays, programmable in increments of 0.1
- Lost echo indicator/relay (optional)
- Alarm Outputs: Four 1 A ST or STS, programmable in increments of 0.1
- Display: Four digit (optional)
- Controls: 4-20 mA dc (optional) or 0-10 V dc
- Component Signal: Input Power
- Component Compensation: Repeatability
- Component Accuracy: ±1% of full scale
- Component Repeatability: ±0.5% of full scale
- Component Range: 1 to 30 feet (LV: 1010)
- Component Temperature: ±12 feet (LV: 1000)
- Component Mounting: NEMA 4X (standard)
- Component Electronics: 4-20 mA dc (isolated)
Lost Echo Mode: The Lost Echo Modes are as follows:

1. The last Echo mode selected is displayed. Press Enter to select the desired mode. Pressing Increment will toggle the programming display through the available lost Echo modes. Pressing Enter will initiate the current lost Echo mode (either 0, 1, or 2). If the lost Echo mode (either 0, 1, or 2) is selected, the display will then issue the prompt "SLLE" for "Select Lost Echo Mode." The last Echo mode selected determines the status of the analog output should a loss of valid return echoes occur. Press the Enter button now and the display will then issue the alarm point 4.

2. Repeat step 2 for Alarm Points 1, 2, and 3 (Alarms SLA1.3)

3. After Alarm Point 4 is entered, the display will then issue the prompt "SLA4." Repeat step 2 for Alarm Points 1, 2, and 3 (Alarms SLA1.3)

4. Alarm Points are always programmed in inches from the sensor face, regardless of Operating Mode.

5. Repeat step 2 for Alarm Points 2, 3, and 4 (Alarms SLA1.3)

6. After Alarm Point 4 is entered, the display will then issue the prompt "SLA4." Repeat step 2 for Alarm Points 1, 2, and 3 (Alarms SLA1.3)

7. The next prompt issues the "SLdP" prompt for "Select Decimal Place." Pressing Enter causes the display to advance and show the previously programmed Decimal Place. Pressing Increment will step the display through the above decimal place values. Once the desired decimal place is displayed, press Enter to select that value. Now the unit proceeds with step 7 of this Calibration Procedure.

8. The unit issues the "SLHI" prompt for "Select High, maximum display value." Pressing Enter causes the display to advance and show the previously programmed high value. Again, ignore the decimal point on the display value. Proceed as in the Calibration Procedure step 4 to enter the desired arbitrary high point.

9. Again, ignore the decimal point on the onboard display.

NOTE: The function is entered by pressing the Increment button twice. Pressing the Increment button once will display the decimal point on the display value. If this error is detected, the unit will return to step 5 of the Calibration Procedure.

NOTE: The unit issues the "SLLO" prompt for "select Low, minimum display value." Pressing Enter causes the display to advance and show the previously programmed low value. Again, ignore the decimal point on the display value. If this error is detected, the unit will return to step 5 of the Calibration Procedure.

Linear Characterization Brief Description:

The LVU-1000 series allows the user to enter a four digit minimum arbitrary value, a four digit maximum arbitrary value, and a decimal position. The display output is then linearly scaled between these two values across the previously programmed Span (Calibration Procedure Step 5). The display always increases or decreases in a linear manner. The displayed value is then linearly scaled between these two values. The unit checks that the Low value is not greater than the High value. If this error is detected, the unit returns to step 5 of the Calibration Procedure.

System Calibration
Select "H" for Height Mode or "D" for Distance Mode. Allows for an analog output referenced to Zero or some Offset reference (4-20 mA vs 0-20 mA for a current output, or a 2-10 V dc vs 0-10 V dc for a voltage output). Select 0 to disable the Offset; select 1 to invoke the Offset.

Programs the system Zero point as measured from the sensor face in inches. The system Zero is the point at which the level is closest to the sensor face.

Programs the system Span as measured in inches from the system Zero point.

Defines the operational mode of the optional 4 digit display. Mode "0" displays target distance from sensor in inches. Mode "1" displays user defined Linear scaled output.

Linear Characterization sub-mode that defines the minimum value that the display should indicate.

Linear Characterization sub-mode that defines the maximum value that the display should indicate.

Linear Characterization sub-mode that defines the decimal digits to be displayed.

Programs Alarm Point 1 as measured in inches from the sensor face.

Programs Alarm Point 2 as measured in inches from the sensor face.

Programs Alarm Point 3 as measured in inches from the sensor face.

Programs Alarm Point 4 as measured in inches from the sensor face.

- Mode 0: Analog output goes to minimum output.
- Mode 1: Analog output holds last valid reading.
- Mode 2: Analog output goes to maximum output.
- Mode 3: Analog output ignores any output.

Analog output calibration verification procedure:

1. To verify the analog output of the LVU-1000 series, connect a digital current meter or voltmeter to the Analog Output terminals (refer to Wiring Diagram, page 3-3). Access the Calibration Mode by simultaneously pressing and holding the Enter and Increment buttons, until the "SL_O" (Select Span) prompt is issued. Verify that the Analog output is correct per the selected Operating Mode. The programming displays will display the system "heartbeat", a pulsing output.

2. Upon entry of the desired Output Mode, the system will return to the operating mode. The programming displays will display the selected Operating Mode, the selected Output Mode, and the selected Offset (if any) as configured through the Analog Output setup.

Analog output calibration:

Verify that the Analog output is correct per the selected Operating Mode. The programming displays will display the system "heartbeat", a pulsing output.

- Mode 0: Analog output goes to minimum output.
- Mode 1: Analog output holds last valid reading.
- Mode 2: Analog output goes to maximum output.
- Mode 3: Analog output ignores any output.

Analog output calibration verification procedure:

1. To verify the analog output of the LVU-1000 series, connect a digital current meter or voltmeter to the Analog Output terminals (refer to Wiring Diagram, page 3-3). Access the Calibration Mode by simultaneously pressing and holding the Enter and Increment buttons, until the "SL_O" (Select Span) prompt is issued. Verify that the Analog output is correct per the selected Operating Mode. The programming displays will display the system "heartbeat", a pulsing output.

2. Upon entry of the desired Output Mode, the system will return to the operating mode. The programming displays will display the selected Operating Mode, the selected Output Mode, and the selected Offset (if any) as configured through the Analog Output setup.

Analog output calibration:

Verify that the Analog output is correct per the selected Operating Mode. The programming displays will display the system "heartbeat", a pulsing output.

- Mode 0: Analog output goes to minimum output.
- Mode 1: Analog output holds last valid reading.
- Mode 2: Analog output goes to maximum output.
- Mode 3: Analog output ignores any output.
LO VALUE: __ inches from sensor face
ALARM 2: __ inches from zero
ALARM 1: __ inches from sensor face
ALARM 0: __ inches from sensor face
ALARM 3: __ inches from sensor face
ALARM 4: __ inches from sensor face

LOST ECHO MODE:
- Mode 0: Output goes to minimum.
- Mode 1: Output holds last reading.
- Mode 2: Output goes to maximum.
- Mode 3: Select last echo.

Analog Offset:
- Analog offset programs the analog output condition in the event of a missed return echo for more than 8 seconds:
  - Mode 0: Output goes to minimum.
  - Mode 1: Output holds last reading.
  - Mode 2: Output goes to maximum.
  - Mode 3: Select last echo.

DISTANCE MODE:
- Onboard display will display:
  - Range: 0-20 m (0-10 V)
  - Height Mode: 0
  - Display Mode: 0

HEIGHT MODE:
- Select Lost Echo Mode:
- Analog Offset:
- Distance Mode:
- Height Mode:

SYSTEM CONFIGURATION
- PROGRAMMABLE PARAMETERS, PROGRAMMED BY:
- SITE/LOCATION ID:
- UNIT SERIAL NUMBER:
- DATE:
- JOB:
- PROGRAMMING PROMPT LIST