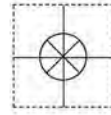


**1 YEAR**  
WARRANTY



# User's Guide

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## **LVCN210, LVCN318 & LVCN414 Series Ultrasonic Level Sensor**



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

The small tank sensor is an innovative level sensor family that replaces float, conductance and pressure sensors that fail due to contact with dirty, sticking and scaling media in small (< 4'/1.25m) to medium (<18'/5.5m) tall tanks. Applied in skid, machine, tool and process applications, the general purpose sensors are available with single and multi-function capabilities including measurement, switching and control.

**New Features**

- Easily change output from distance to volume
- Select from 6 standard tank shapes or a 16 point strapping table for customer/odd size tanks

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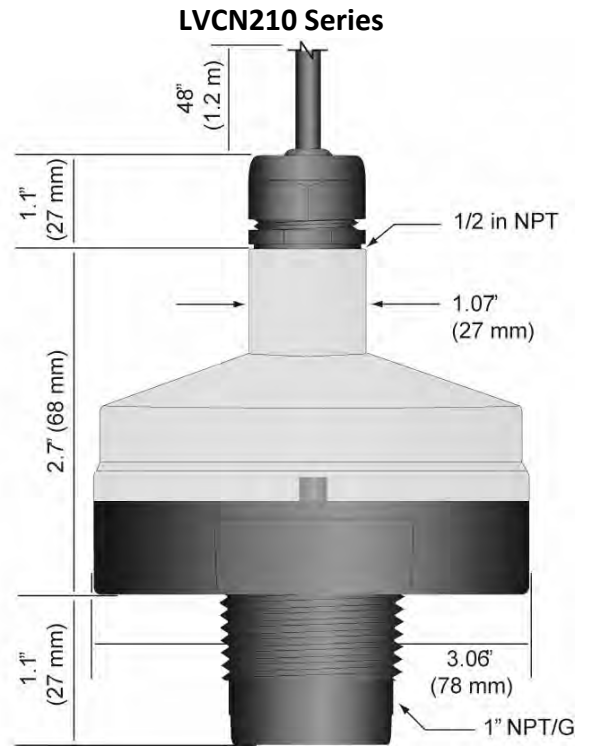
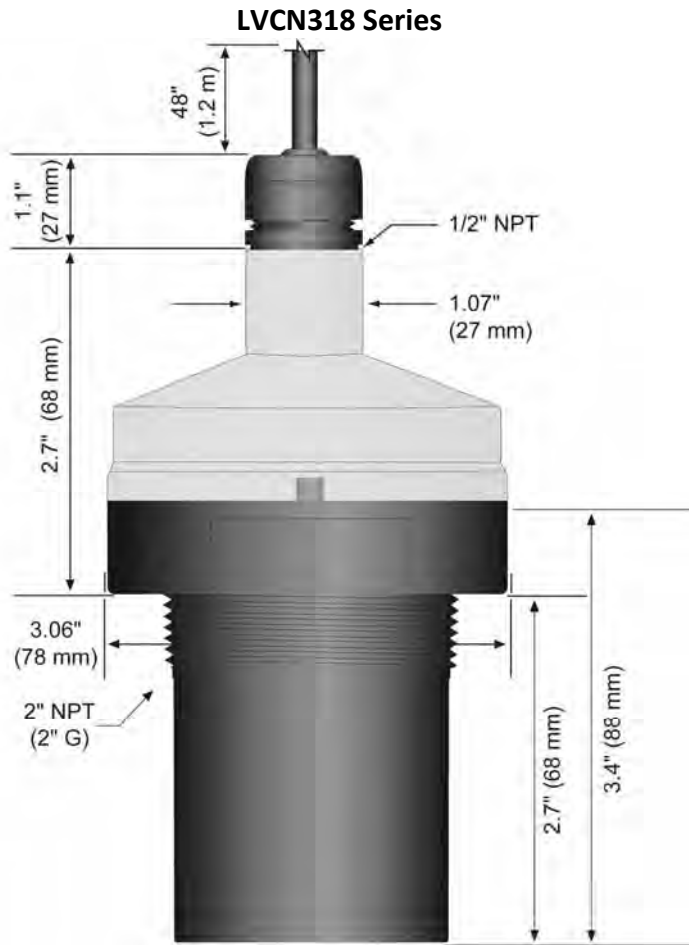
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**SPECIFICATIONS**

**Step Two**

Range:	LVCN414-I / LVCN414 / LVCN414-R / LVCN414-V: 49.2" (1.25m) LVCN210: 9.8' (3.0m) LVCN318: 18.0' (5.5m)
Accuracy:	LVCN414-I / LVCN414 / LVCN414-R / LVCN414-V: 0.125" (3mm) LVCN210: +/- 0.2% of range LVCN318: +/- 0.2% of range
Resolution:	LVCN414-I / LVCN414 / LVCN414-R / LVCN414-V: 0.019" (0.5mm) LVCN210: 0.039" (1mm) LVCN318: 0.079" (2mm)
Dead band:	LVCN414-I / LVCN414 / LVCN414-R / LVCN414-V: 2" (5cm) LVCN210: 4" (10 cm) LVCN318: 8" (20 cm)
Beam width:	LVCN414-I / LVCN414 / LVCN210 / LVCN414-R / LVCN414-V: 2" (5cm) dia. LVCN318: 3" (7.6cm) dia.
Configuration:	LVCN414-SW (software) PC Windows USB ® 2.0
Memory:	Non-volatile
Supply voltage:	LVCN414-I / LVCN414 / LVCN210 / LVCN318: 24 VDC (loop) LVCN414-R: 12-24 VAC/VDC LVCN414-V: 12-28 VDC
Consumption:	0.5 W
Loop resistance:	LVCN414-I / LVCN414 / LVCN210 / LVCN318: 400 Ohms max
Signal output:	LVCN414-I / LVCN414 / LVCN210 / LVCN318: 4-20 mA, two-wire LVCN414-V: 0-5V, 0-10V, 976-2000Hz
Frequency:	LVCN414-V only: sink current, 15 mA nominal
Signal invert:	LVCN414-I / LVCN414 / LVCN210 / LVCN318: 4-20 mA or 20-4 mA LVCN414-V: 5-0V, 10-0V, 2000-976Hz

Signal fail-safe:	LVCN414-I / LVCN414 / LVCN210 / LVCN318: 4 mA, 20 mA, 21 mA, 22 mA or hold last LVCN414-V: Full, empty or hold last
Contact type:	LVCN414 / LVCN210 / LVCN318 / LVCN414-R: (4) SPST relays
Contact rating:	LVCN414 / LVCN210 / LVCN318 / LVCN414-R: 60 VA, 1A maximum
Contact fail-safe:	LVCN414 / LVCN210 / LVCN318 / LVCN414-R: Power loss: Hold last, Power on: Open, close or hold last
Hysteresis:	LVCN414 / LVCN210 / LVCN318 / LVCN414-R: Selectable
Process temp.:	F: 20° to 140° C: -7° to 60°
Temp. comp.:	Automatic
Ambient temp.:	F: -31° to 140° C: -35° to 60°
Pressure:	MWP = 30 PSI
Enclosure rating:	Type 6P encapsulated, corrosion resistance & submersible
Encl. material:	Polycarbonate
Strain relief mat'l.:	Thermoplastic Elastomer (TPE)
Trans. material:	PVDF
Cable jacket mat'l.:	Polyurethane
Cable type:	9-conductor, shielded
Cable length:	48" (1.2 m)
Process mount:	LVCN414-I / LVCN414 / LVCN414-R / LVCN414-V / LVCN210: 1" NPT LVCN318: 2" NPT
Mount gasket:	FKM
Classification:	General purpose
Compliance:	CE, RoHS



**LVCN414-I, LVCN414, LVCN414-R & LVCN414-V Series**



⚠ **About this Manual:** PLEASE READ THE ENTIRE QUICK START PRIOR TO INSTALLING OR USING THIS PRODUCT. This manual includes information on the small tank series Ultrasonic Level Switch, controller and transmitter from OMEGA ENGINEERING. Please refer to the part number located on the switch label to verify the exact model configuration, which you have purchased.

⚠ **User's Responsibility for Safety:** OMEGA ENGINEERING manufactures a broad range of level sensing technologies. While each of these sensors is designed to operate in a wide variety of applications, it is the user's responsibility to select a sensor model 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:** Only professional staff should install and/or repair this product. Install the transmitter with the included FKM gasket and never over tighten the transmitter within the fitting. Always check for leaks prior to system start-up.

⚠ **Wiring and Electrical:** A supply voltage of 12 to 28 VDC (VAC for LVCN414-R series only) is used to power the ultrasonic sensor. Electrical wiring of the transmitter should be performed in accordance with all applicable national, state, and local codes.

⚠ **Material Compatibility:** The enclosure is made of Polycarbonate (PC). The transducer is made of Polyvinylidene Fluoride (PVDF). Make sure that the model, which you have selected, is chemically compatible with the application media.

⚠ **Enclosure:** While the transmitter housing is liquid-resistant the Ultrasonic sensor is not designed to be operational when immersed. It should be mounted in such a way that the enclosure and transducer do not come into contact with the application media under normal operational conditions.

#### ⚠ **Safety**

- ⚠ Installation should be done by properly trained staff
- ⚠ Supply voltage should never exceed a maximum of 28 VDC
- ⚠ Make sure the sensor is chemically compatible with your application
- ⚠ Design a fail-safe system that accommodates the possibility of sensor and/or power failure
- ⚠ This sensor should not be used in classified hazardous environments

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

⚠ **Flammable, Explosive or Hazardous Applications:** *The sensor should not be used within classified hazardous environments.*

⚠ **Warning:** Always use the FKM gasket when installing the ultrasonic sensor, and make sure that all electrical wiring of the switch is in accordance with applicable codes.

The small tank ultrasonic sensor is offered in different models. Depending on the model purchased, you may or may not have been shipped all the components shown below. You do however, need a sensor, USB® Fob and FKM gasket to configure, install and operate the ultrasonic sensor.

P/N	Max. Range	Dead Band	Thread	Fob	* Outputs	
LVCN414-I-B LVCN414-I	4.1' (1.25 m)	2" (5cm)	1" NPT	No Fob	1	
LVCN414-I-G-B LVCN414-I-G				Fob Included		
LVCN414-B LVCN414	4.1' (1.25 m)	2" (5cm)	1" NPT	No Fob		1,2
LVCN414-G-B LVCN414-G				Fob Included		
LVCN210-B LVCN210	9.8' (3.0 m)	4" (10cm)	1" NPT	No Fob	1,2	
LVCN210-G-B LVCN210-G				Fob Included		
LVCN318-B LVCN318	18.0' (5.5 m)	8" (20cm)	2" NPT	No Fob		1,2
LVCN318-G-B LVCN318-G				Fob Included		
LVCN414-R-B LVCN414-R	4.1' (1.25 m)	2" (5cm)	1" NPT	No Fob	2	
LVCN414-R-G-B LVCN414-R-G				Fob Included		
LVCN414-V-B LVCN414-V	4.1' (1.25 m)	2" (5cm)	1" NPT	No Fob		3, 4
LVCN414-V-G-B LVCN414-V-G				Fob Included		

- FKM Gasket
  - Part #204038 – used with LVCN414-I, LVCN414, LVCN414-R & LVCN414-V series
  - Part #200128 – used with LVCN210 series
  - Part #200129 – used with LVCN318 series
- USB® Fob (Part #LVCN414-USB) included with LVCN414-I, LVCN414, LVCN210, LVCN318, LVCN414-R and LVCN414-V series.
  - Fob is not included with the LVCN414-I-B, LVCN414-B, LVCN210-B, LVCN318-B, LVCN414-R-B and LVCN414-V-B series.
- Quick Start Guide
- \*Outputs
  1. 4-20 mA, loop powered output
  2. 4 SPST 60 VA relays
  3. Voltage (0 to 2.5, 5 or 10 VDC) output
  4. Frequency (976-2000Hz.) output

The small tank ultrasonic sensor is configured through a free PC software program (LVCN414-SW). The software is a free download from OMEGA ENGINEERING's website. ***You must download and install the software prior to plugging in the USB® Fob.***

- Please go to <http://www.omega.com/ftp>.
- Click on Flow, Level, pH, Environmental, and Pressure Section and press on **Products**
- Select the **LVCN414** folder
- Select the installer - **LVCN414InstallerverXpXX.zip**
  - This will download the installer onto your computer.
  - Once completed, run the installer.

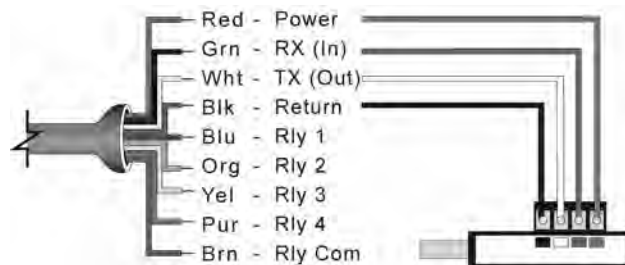
#### LVCN414-SW Software System Requirements

Windows® 2000, XP, Vista, 7, 8  
 32 or 64-bit system  
 1 USB® 2.0 port  
 10 mB hard drive space  
 256 mB RAM  
 Internet connection

#### USB® Fob Interface

The ultrasonic sensor communicates with LVCN414-SW software through a USB® interface called a Fob. Before plugging your Fob into your computer's USB® port, be sure that you have installed the LVCN414-SW software on your computer.

Connect the red, green, white and black wires from sensor into the correct terminals on the Fob. Tighten the screws on the terminals and plug your Fob into the USB® port of your computer.

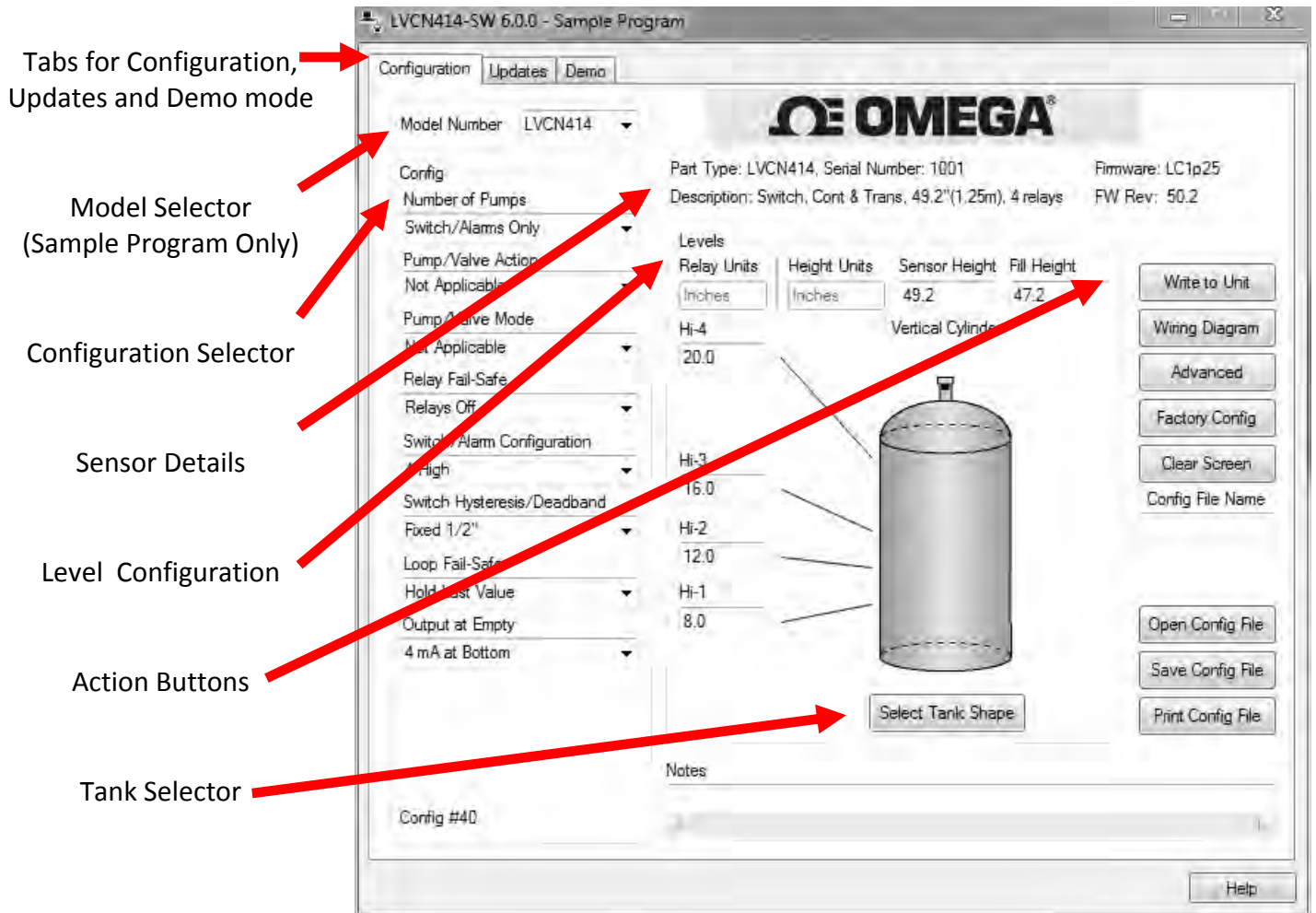


***Wiring identical for all series – Use only the Red, Black, Green and White wires.***

- The maximum cable distance between the computer and ultrasonic sensor is 15'. This only applies when configuring the sensor.
- Once the ultrasonic sensor is configured and prior to installation, isolate the white and green wires from active power to prevent a short of the configuration circuit.
- **Note:** When using the Fob, do not add VDC power. The Fob, when connected to the computer, will provide the required power to the ultrasonic sensor.



With the ultrasonic sensor connected to your computer, open the LVCN414-SW software by clicking on the software's icon. Follow steps 1-3 to configure the transmitter. Click "Help" in the lower right hand corner and open the help menu for additional instructions. If you need additional assistance using the software, please contact an OMEGA ENGINEERING Applications engineer.



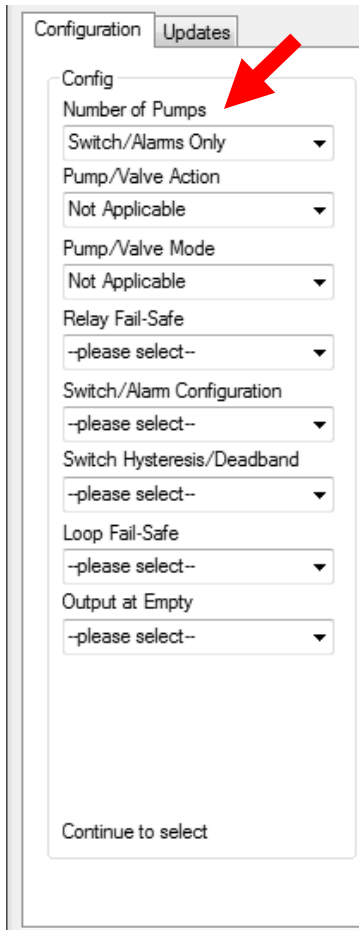
Above Screen Capture is for the LVCN414 Series.

### Configuring LVCN414, LVCN210 & LVCN318 Series with LVCN-414-SW Software

1. Output Configuration
  - a. Configures the relays in terms of pump/valve operations as well as high or low alarms.
  - b. Sets fail-safe for the relays and the sensor's output (current, voltage or frequency).
2. Tank Shape Selection
  - a. Defines the shape of the tank as well as the dimensional information for the tank with respect to the sensor's location on the tank.
3. Level Configuration
  - a. Enters the distance values for the operational range of the sensor.
4. Write to Unit
  - a. Uploads the configuration into the sensor.
  - b. Provides a custom wiring diagram.

## 1. Output Configuration

This section is where you select the application's configuration settings. Start from the top and work to the bottom, choosing the selections that are applicable to your configuration. **“Not Applicable”** will automatically show when a selection doesn't apply to your configuration settings, and you may move on. All configuration settings must be selected or have **“Not Applicable”** before you can continue to the next step. **Note:** Pressing the Clear Screen button will reset the configuration table and allow access to all of the features.



The screenshot shows a configuration interface with two tabs: 'Configuration' and 'Updates'. The 'Configuration' tab is active. Below the tabs is a 'Config' section containing several dropdown menus. A red arrow points to the 'Number of Pumps' dropdown menu, which is currently set to 'Switch/Alarms Only'. Other dropdown menus include 'Pump/Valve Action' (set to 'Not Applicable'), 'Pump/Valve Mode' (set to 'Not Applicable'), 'Relay Fail-Safe' (set to '-please select-'), 'Switch/Alarm Configuration' (set to '-please select-'), 'Switch Hysteresis/Deadband' (set to '-please select-'), 'Loop Fail-Safe' (set to '-please select-'), and 'Output at Empty' (set to '-please select-'). At the bottom of the configuration area is a button labeled 'Continue to select'.

### Number of Pumps

This feature allows you to select the number of pumps or valves used. This is the setting that activates the control capabilities of up to two relays. Control relays are often referred to as Latching relays.

- **Switch/Alarms Only** – The relays will be standard single point relays (High and/or Low alarms). Relays are non-latching.
- **1- Pump/Valve** – One relay will be configured as a control or latching relay (relay will have a start level and a separate stop level). Use this setting to control one pump or valve for automatic filling or emptying of a tank.
- **2-Pumps/Valves** – Two relays are configured as control or latching relays. Each relay will have a unique start level and a common stop level. Use this setting to control two pumps or valves for automatic filling or emptying of a tank.
- **4-20mA Transmitter Only** – This setting will disengage all of the relays. Use this function if you are not using any relays and using only the 4-20 mA current output.

**Note:** Right click on any menu that you may have questions on to open the help menu.

**Note:** To reset, press the Clear Screen button.

Configuration Updates

Config

Number of Pumps  
1-Pump/Valve

Pump/Valve Action  
Empties Tank

Pump/Valve Mode  
Simplex

Relay Fail-Safe  
-please select-

Switch/Alarm Configuration  
-please select-

Switch Hysteresis/Deadband  
-please select-

Loop Fail-Safe  
-please select-

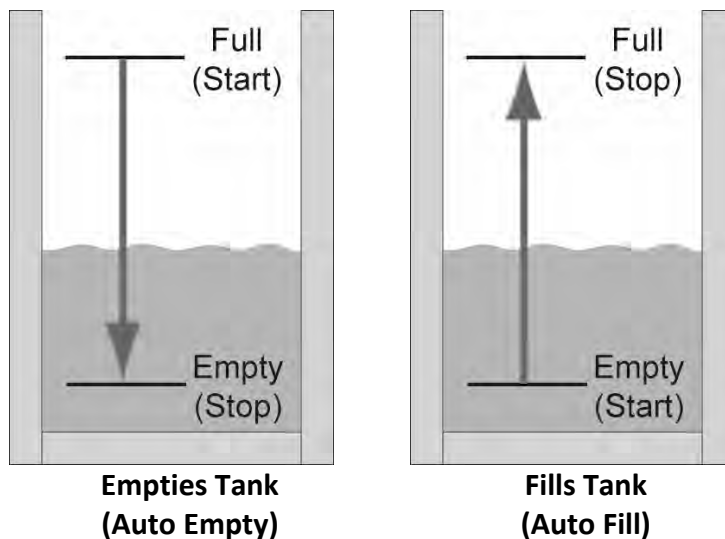
Output at Empty  
-please select-

Continue to select

### Pump/Valve Action

This feature allows you to select if the pumps or valves will be used to automatically fill or empty the tank. For 2-Pump/Valve mode, both devices must be the same (automatic fill or empty). You cannot set one relay for fill and the other for empty.

- **Empties Tank** – Will set relay(s) to automatically empty a tank. Start level will be above the Stop level for each relay.
- **Fills Tank** – Will set relay(s) to automatically fill a tank. Start level will be below the Stop level for each relay.
- **Not Applicable** – Appears when this function is not available (such as when **Switch/Alarms Only** or **4-20mA Transmitters Only** are selected).



**Note:** Right click on any menu that you may have questions on to open the help menu.

**Note:** To reset, press the Clear Screen button.

Configuration Updates

Config

Number of Pumps  
1-Pump/Valve

Pump/Valve Action  
Empties Tank

Pump/Valve Mode  
Simplex

Relay Fail-Safe  
-please select-

Switch/Alarm Configuration  
-please select-

Switch Hysteresis/Deadband  
-please select-

Loop Fail-Safe  
-please select-

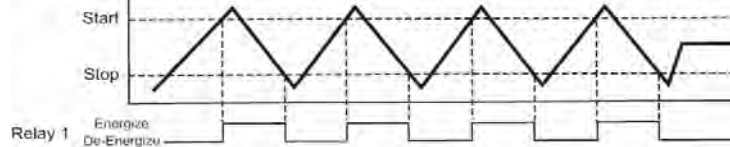
Output at Empty  
-please select-

Continue to select

### Pump/Valve Mode

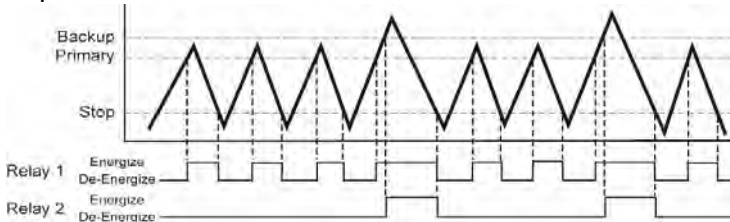
This feature allows you to select the mode for a control or latching relay. Pump/Valve mode is not active for Switch/Alarms Only or 4-20 mA Transmitter Only.

- **Simplex** – Allows for the relay to be used as an automatic fill or empty. This is the default and only configuration when **1-Pump/Valve** is selected.



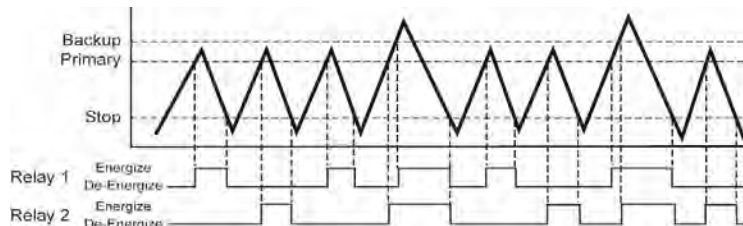
**Simplex used to Empty Tank (example)**

- **Lead/Lag** – Allows for the two relays to have unique start levels and a common stop level. The first relay will be identified as the lead relay and the second relay as the lag. Each time the lead level is reached, the first relay will always start. The lag relay will only start when the lag level is reached. All relays will stop at the common off level.



**Lead/Lag used to Empty Tank (example)**

- **Duplex** - Allows for the two relays to have two different start levels, a common stop level and will alternate the relays when the first start level is reached. The two relays will alternate each time the lead level is reached and the remaining relay will start when the lag level is reached. All relays will stop at the common off level.



**Duplex used to Empty Tank (example)**

- **Not Applicable** – Appears when this function is not available (such as when **Switch/Alarms Only** or **4-20mA Transmitters Only** are selected).

**Note:** Right click on any menu that you may have questions on to open the help menu.

**Note:** To reset, press the Clear Screen button.

Configuration Updates

Config

Number of Pumps  
1-Pump/Valve

Pump/Valve Action  
Empties Tank

Pump/Valve Mode  
Simplex

Relay Fail-Safe  
Pumps/Valves Off

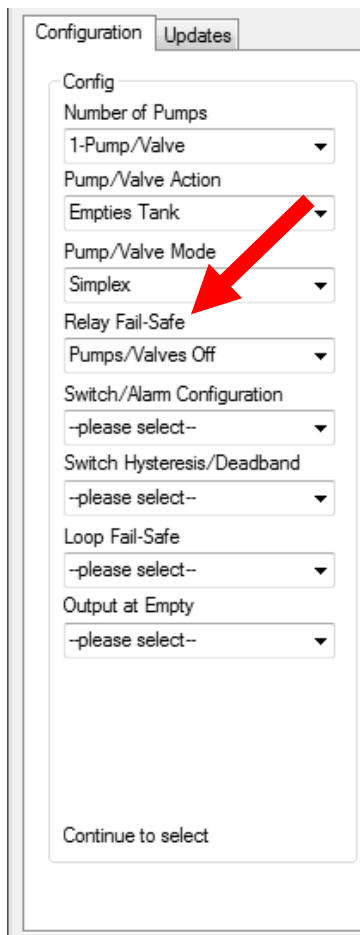
Switch/Alarm Configuration  
-please select-

Switch Hysteresis/Deadband  
-please select-

Loop Fail-Safe  
-please select-

Output at Empty  
-please select-

Continue to select



### Relay Fail-Safe

This feature allows you to select the fail-safe state for the relays. When the sensor regains signal, the output current will revert back to the current level condition.

- **Relays Off** - The relays will revert to the OFF state. Appears when **Switch/Alarms Only** is selected.
- **Relays On** - The relays will revert to the ON state. Appears when **Switch/Alarms Only** is selected.
- **Hold State** - The relay(s) will remain in the same state as the last echo detected. When the sensor regains signal, the relays will revert to the level when the signal was regain.
- **Pump/Valves Off** - The relays will revert to the OFF state. Appears when **1-Pump/Valve** or **2-Pumps/Valves** are selected.
- **Pump/Valves On** - The relays will revert to the ON state. Appears when **1-Pump/Valve** or **2-Pumps/Valves** are selected.
- **Not Applicable** – Appears when this function is not available (such as when **Transmitters Only** are selected).

**Note:** Right click on any menu that you may have questions on to open the help menu.

**Note:** To reset, press the Clear Screen button.

Configuration Updates

Config

Number of Pumps  
1-Pump/Valve

Pump/Valve Action  
Empties Tank

Pump/Valve Mode  
Simplex

Relay Fail-Safe  
Pumps/Valves Off

Switch/Alarm Configuration  
1-Low, 1-High

Switch Hysteresis/Deadband  
-please select-

Loop Fail-Safe  
-please select-

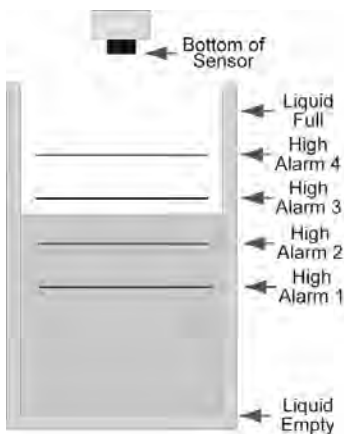
Output at Empty  
-please select-

Finish Selections

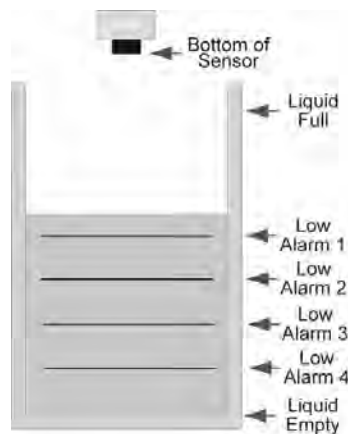
### Switch/Alarm Configuration

This feature allows you to select the operation for the switches / alarms (used as a high or low alarm). This setting adjusts the number of available relays based upon the previous settings.

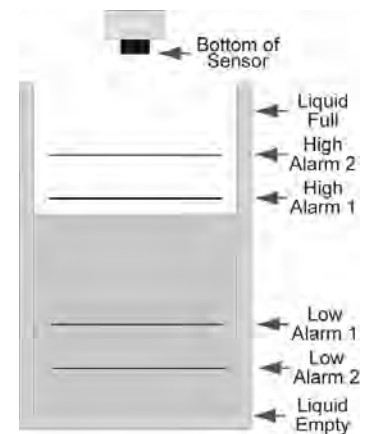
- **No Alarm** – Turns off all of the remaining relays.
- **High Alarm Options** – Set from 1 to 4 High Alarms (**1-High, 2-High, 3-High, 4-High**).
- **Low Alarm Options** – Set from 1 to 4 Low Alarms (**1-Low, 2-Low, 3-Low, 4-Low**).
- **Combination Alarms** – Set a combination of High and Low Alarms (**1-Low 1-High, 1-Low 2-High, 2-Low 1-High, 2-Low 2-High, 1-Low 3-High, 3-Low 1-High**).
- **Not Applicable** – Appears when this function is not available (such as when **Transmitters Only** is selected).



**High Alarm Options  
(4 High)**



**Low Alarms Options  
(4 Low)**



**Combination Alarms  
(2 High and 2 Low)**

**Note:** Right click on any menu that you may have questions on to open the help menu.

**Note:** To reset, press the Clear Screen button.

Configuration Updates

Config

Number of Pumps  
1-Pump/Valve

Pump/Valve Action  
Empties Tank

Pump/Valve Mode  
Simplex

Relay Fail-Safe  
Pumps/Valves Off

Switch/Alarm Configuration  
1-Low, 1-High

Switch Hysteresis/Deadband  
Fixed 1/2"

Loop Fail-Safe  
-please select-

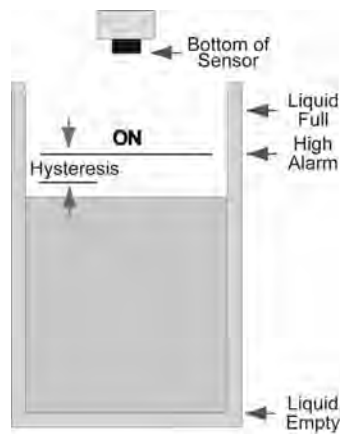
Output at Empty  
-please select-

Finish Selections

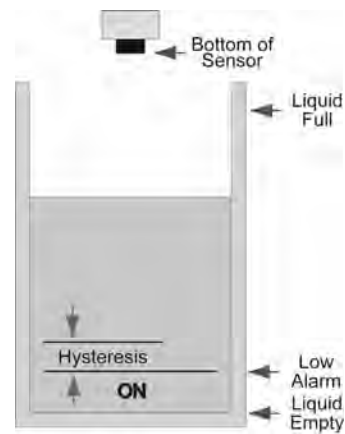
### Switch Hysteresis/Dead band

This feature allows you to select a hysteresis or dead band for the remaining high and/or low alarms.

- **Options for Hysteresis/Dead band** – No Hysteresis, 1/4", 1/2", 1", 2", 1/2 cm, 1cm, 2 cm, 5 cm or Not Applicable.
- **High Alarms** – Relay activates above set point. Relay will deactivate when level goes below the set point plus the value of the hysteresis.
- **Low Alarms** – Relay activates below set point. Relay will deactivate when level goes above the set point plus the value of the hysteresis.



**High Alarm w/ Hysteresis**



**Low Alarm w/ Hysteresis**

**Note:** Right click on any menu that you may have questions on to open the help menu.

**Note:** To reset, press the Clear Screen button.

Configuration Updates

Config

Number of Pumps  
1-Pump/Valve

Pump/Valve Action  
Empties Tank

Pump/Valve Mode  
Simplex

Relay Fail-Safe  
Pumps/Valves Off

Switch/Alarm Configuration  
1-Low, 1-High

Switch Hysteresis/Deband  
Fixed 1/2"

Loop Fail-Safe  
Empty

Output at Empty  
4 mA at Bottom

Config #9

### Loop Fail-Safe - (Not Available with LVCN414-R series)

This feature allows you to select the fail-safe current output if the sensor fails to detect a return signal. When the sensor regains signal, the output current will revert back to the current level condition.

- **Hold Last Value** - The output will remain in the same state as the last echo detected. Example: If the output was 6.7 mA just prior to the lost signal, the device will continue to output 6.7 mA. Sensor will indicate the level when signal was regain.
- **Empty** - The output will revert to the current value for an empty condition. When **4 mA at Bottom** is selected, the sensor will output 4 mA when a fail-safe condition occurs. If **20 mA at Bottom** is selected, the sensor will output 20 mA when a fail-safe condition occurs.
- **Full** - The output will revert to the current value for a full condition. When **4 mA at Bottom** is selected, the sensor will output 20 mA when a fail-safe condition occurs. If **20 mA at Bottom** is selected, the sensor will output 4 mA when a fail-safe condition occurs.
- **Overfill (21mA)** - The output current will go to 21mA when the return signal is lost.
- **Overfill (22mA)** - The output current will go to 22mA when the return signal is lost.

### Output at Empty - (Not Available with LVCN414-R series)

This feature allows you to select the orientation of the 4 to 20mA output (4 to 20 mA or 20 to 4 mA). Choose which output setting best fits the application. Typical installations are set with **4 mA at Bottom**. This will not affect the performance of the sensor other than the output. The factory default is 4mA at bottom and 20mA at top. *When connecting your sensor to a display, you must account for your output settings.*

- **4mA at Bottom** - The output current will be 4mA when the sensor measures an empty tank and 20mA when the sensor measures a full tank.
- **20mA at Bottom** - The output current will be 20mA when the sensor measures an empty tank and 4mA when the sensor measures a full tank.

**Note:** Right click on any menu that you may have questions on to open the help menu.

**Note:** To reset, press the Clear Screen button.



Config

Loop Fail-Safe  
Hold Last Value ▼

Output at Empty  
4 mA at Bottom ▼

Startup Condition  
Empty ▼

Config #0

### Loop Fail-Safe

This feature allows you to select the fail-safe current output if the sensor fails to detect a return signal. When the sensor regains signal, the output current will revert back to the current level condition.

- **Hold Last Value** - The output will remain in the same state as the last echo detected. Example: If the output was 6.7 mA just prior to the lost signal, the device will continue to output 6.7 mA. Sensor will indicate the level when signal was regain.
- **Empty** - The output will revert to the current value for an empty condition. When **4 mA at Bottom** is selected, the sensor will output 4 mA when a fail-safe condition occurs. If **20 mA at Bottom** is selected, the sensor will output 20 mA when a fail-safe condition occurs.
- **Full** - The output will revert to the current value for a full condition. When **4 mA at Bottom** is selected, the sensor will output 20 mA when a fail-safe condition occurs. If **20 mA at Bottom** is selected, the sensor will output 4 mA when a fail-safe condition occurs.
- **Overfill (21mA)** - The output current will go to 21mA when the return signal is lost.
- **Overfill (22mA)** - The output current will go to 22mA when the return signal is lost.

### Output at Empty

This feature allows you to select the orientation of the 4 to 20mA output (4 to 20 mA or 20 to 4 mA). Choose which output setting best fits the application. Typical installations are set with **4 mA at Bottom**. This will not affect the performance of the sensor other than the output. The factory default is 4mA at bottom and 20mA at top. *When connecting your sensor to a display, you must account for your output settings.*

- **4mA at Bottom** - The output current will be 4mA when the sensor measures an empty tank and 20mA when the sensor measures a full tank.
- **20mA at Bottom** - The output current will be 20mA when the sensor measures an empty tank and 4mA when the sensor measures a full tank.

**Note:** Right click on any menu that you may have questions on to open the help menu.

**Note:** To reset, press the Clear Screen button.

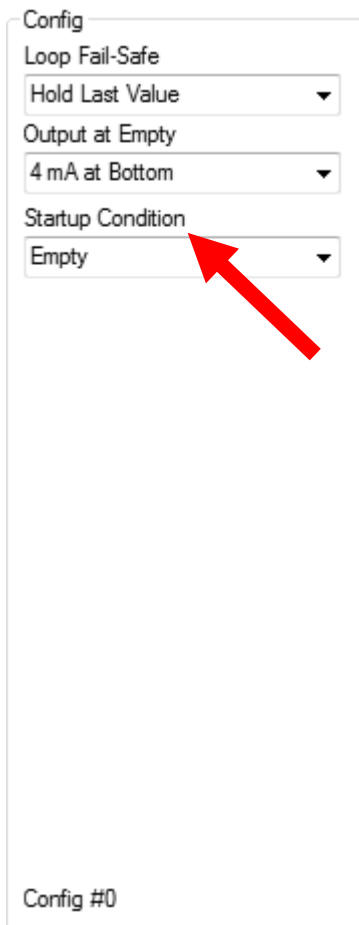
Config

Loop Fail-Safe  
Hold Last Value ▼

Output at Empty  
4 mA at Bottom ▼

Startup Condition  
Empty ▼

Config #0



### Startup Condition

This feature allows you to select the startup current when power is first applied to the sensor. The LVCN414-I will consume the selected power while it is acquiring the level of the liquid. When the correct level has been identified, the output will adjust to the correct output. Use this feature to avoid false alarms with the controller when power is first applied.

- **Empty** - The current output will revert to the current value for an empty condition. When **4 mA at Bottom** is selected, the sensor will output 4 mA while the sensor powers up. If **20 mA at Bottom** is selected, the sensor will output 20 mA while the sensor powers up.
- **Mid Tank (12 mA)** – The output will hold at 12 mA until the correct level is read.
- **Full** - The output will revert to the current value for a full condition. When **4 mA at Bottom** is selected, the sensor will output 20 mA while the sensor powers up. If **20 mA at Bottom** is selected, the sensor will output 4 mA while the sensor powers up.
- **Overfill (22mA)** - The output current will go to 22mA while the sensor powers up.

**Note:** Right click on any menu that you may have questions on to open the help menu.

**Note:** To reset, press the Clear Screen button.

Config

Select Output  
-please select-

Maximum Output  
-please select-

Minimum Output  
-please select-

Output at Empty  
-please select-

Fail-Safe Output  
-please select-

Startup Condition  
-please select-

Continue to select

### Select Output

This feature sets the output for the LVCN414-V series. The output can either be a voltage output or a frequency output.

- **Voltage** – Select this option for a voltage output. You will be able to select voltage scale of 0-2.5V, 0-3.3V, 0-5V or 0-10V.
- **Frequency** – Select this option for a frequency/pulse output. The output will be fixed from 976 to 2000 Hz.

### Maximum Output

This sets the maximum output for the LVCN414-V series. If Voltage was selected above, then the maximum value will be in Volts. If Frequency is selected, then the maximum value will be in Hertz.

- **Voltage** – Choose from: 2.5 Volts, 3.3 Volts, 5 Volts or 10 Volts.
- **Frequency** – This value is fixed at 2000 Hz.

### Minimum Output

This sets the minimum output for the LVCN414-V series. If Voltage was selected above, then the minimum value will be in Volts. If Frequency is selected, then the minimum value will be in Hertz.

- **Voltage** – Choose from: 0.25 Volts, 0.5 Volts, 0.833 Volts, 1 Volt or 2 Volts.
- **Frequency** – This value is fixed at 976 Hz.

**Note:** Right click on any menu that you may have questions on to open the help menu.

**Note:** To reset, press the Clear Screen button.

Config

Select Output  
 --please select--

Maximum Output  
 --please select--

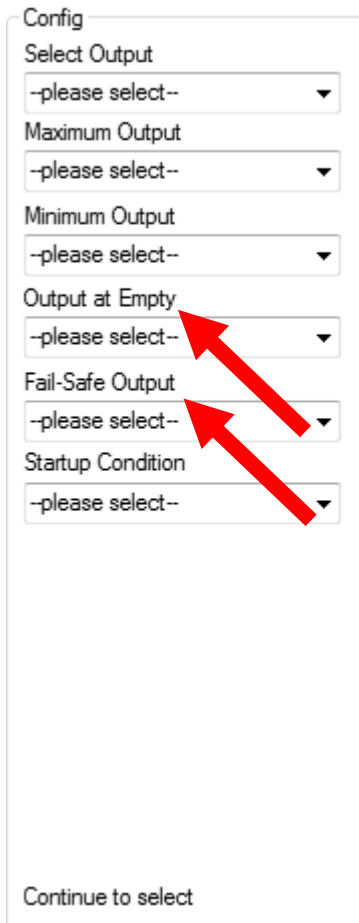
Minimum Output  
 --please select--

Output at Empty  
 --please select--

Fail-Safe Output  
 --please select--

Startup Condition  
 --please select--

Continue to select



### Output at Empty

This feature allows you to select the orientation of the voltage or frequency output (ex. Empty = 1 volt and full = 10 volts vs. empty = 10 volts and full = 1 volt). Choose which output setting best fits the application. Typical installations are set with **Minimum Output**. This will not affect the performance of the sensor other than the output. *When connecting your sensor to a display, you must account for your output settings.*

- **Minimum Output** - The output current will be the smallest value. If reading in Voltage, this will be the minimum output voltage. If reading in Frequency, this will be 976 Hz.
- **Maximum Output** - The output current will be the largest value. If reading in Voltage, this will be the maximum output voltage. If reading in Frequency, this will be 2000 Hz.

### Fail-Safe Output

This feature allows you to select the fail-safe output if the sensor fails to detect a return signal. When the sensor regains signal, the output current will revert back to the current level condition.

- **Hold Last Value** - The output will remain in the same state as the last echo detected. Example: If the output was 6.7 volts just prior to the lost signal, the device will continue to output 6.7 volts. Sensor will indicate the level when signal was regain.
- **Empty** - The output will revert to the current value for an empty condition. When **Minimum Output** is selected, the sensor will output the lowest voltage or frequency value when a fail-safe condition occurs. If **Maximum Output** is selected, the sensor will output the highest voltage or frequency value when a fail-safe condition occurs.
- **Full** - The output will revert to the current value for a full condition. When **Minimum Output** is selected, the sensor will output the highest voltage or frequency value when a fail-safe condition occurs. If **Maximum Output** is selected, the sensor will output the lowest voltage or frequency value when a fail-safe condition occurs.

**Note:** Right click on any menu that you may have questions on to open the help menu.

**Note:** To reset, press the Clear Screen button.

Config

Select Output  
 -please select- ▼

Maximum Output  
 -please select- ▼


Minimum Output  
 -please select- ▼

Output at Empty  
 -please select- ▼

Fail-Safe Output  
 -please select- ▼

Startup Condition  
 -please select- ▼

Continue to select



### Startup Condition

This feature allows you to select the startup current when power is first applied to the sensor. The LVCN414-V will consume the selected power while it is acquiring the level of the liquid. When the correct level has been identified, the output will adjust to the correct output. Use this feature to avoid false alarms with the controller when power is first applied.

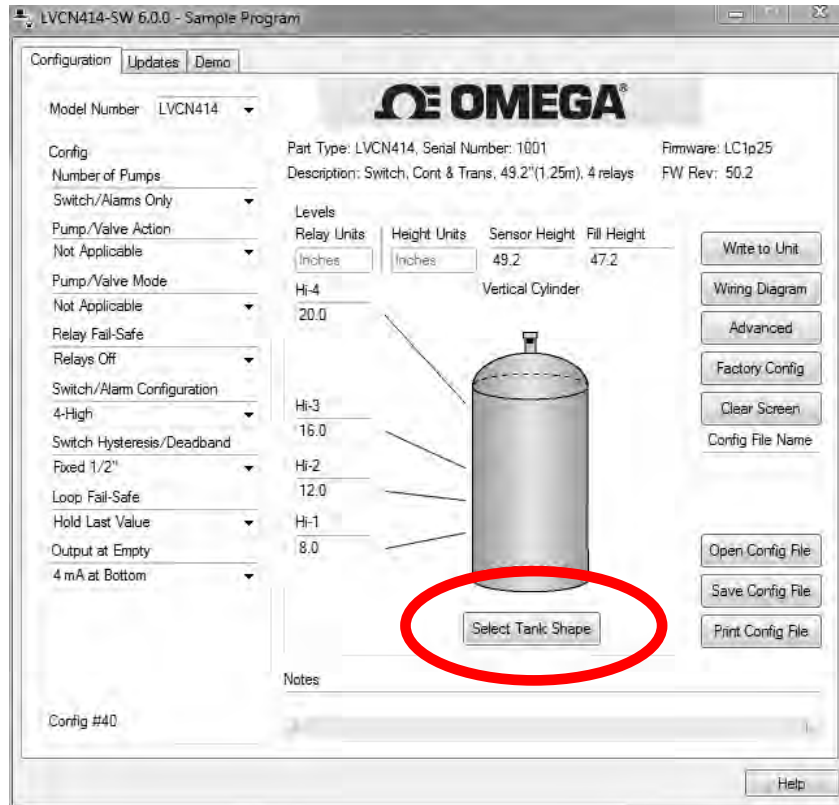
- **Empty** - The output will revert to the current value for an empty condition. When **Minimum Output** is selected, the sensor will output the lowest voltage or frequency value until the true level is acquired. If **Maximum Output** is selected, the sensor will output the highest voltage or frequency value until the true level is acquired.
- **Mid Tank** – The output will hold at the mid level of the **Minimum** and **Maximum Output** until the correct level is read.
- **Full** - The output will revert to the current value for a full condition. When **Minimum Output** is selected, the sensor will output the highest voltage or frequency value until the true level is acquired. If **Maximum Output** is selected, the sensor will output the lowest voltage or frequency value until the true level is acquired.

**Note:** Right click on any menu that you may have questions on to open the help menu.

**Note:** To reset, press the Clear Screen button.

## 2. Tank Shape Selection

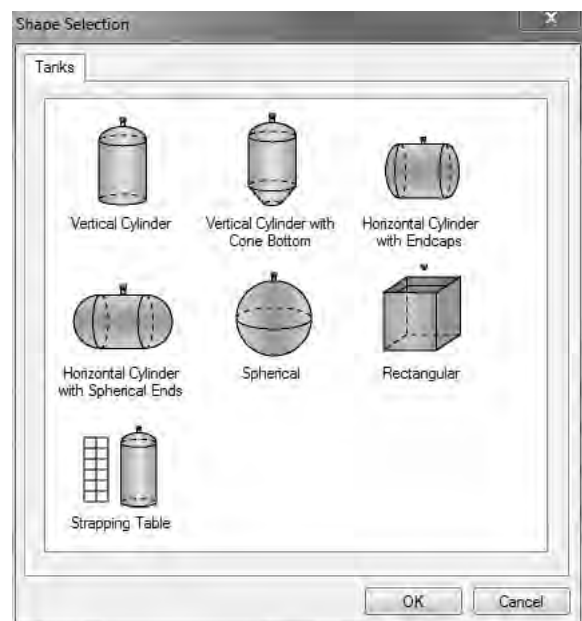
The sensor may be configured in volumetric units (Gallons or Liters) or Distance (Height of Liquid) units (inches, cm, feet or meters). The LVCN-414-SW software will default in Distance (Height of Liquid) with units of Inches. To change the units or to change from Distance to Volume, press the Select Tank Shape button located near the center of the window.



**Shape Selection Window:** This window will show the different tank shape options available in WebCal™.

- **Vertical Cylindrical**
- **Vertical Cylindrical with Cone Bottom**
- **Horizontal Cylindrical with Endcaps**
- **Horizontal Cylindrical with Spherical Ends**
- **Spherical**
- **Rectangular**
- **Strapping Table** – Use this feature for manual entry of measured tank distances and volumes.

Select any of the above tank shapes and press OK to confirm.



**Dimensional Entry – Vertical Cylindrical Example:** Choose the Sensor Output Units as Distance or Volume. After choosing the Sensor Output Units, select the units of measurement in the pull down to the left.

Sensor Output Units

Distance      Inches ▾

Volume

Units of Measurement	
Distance	Volume
Inches	Gallons
Cm	Liters
Feet	
Meters	

#### Distance – Sensor Output Units:

Enter the dimensions of the tank. You must enter data in all fields shown.

**Sensor Height:** Distance from the bottom of the tank to the bottom of the transducer.

**Fill Height:** Distance from the bottom of the tank to the maximum liquid height.

**Riser Height:** Distance the sensor is recessed within a riser, measured from the bottom of the sensor to the inside of the tank.

Dimensional Entry - Vertical Cylinder

Sensor Output Units

Distance      Inches ▾

Volume

Dimensions:

Units: Inches ▾

S - Sensor Height: 49.2

F - Fill Height: 47.2

R - Riser Height: 0.0

#### Volume – Sensor Output Units:

Enter the dimensions of the tank. You must enter data in all fields shown.

**Sensor Height:** Distance from the bottom of the tank to the bottom of the transducer.

**Fill Height:** Distance from the bottom of the tank to the maximum liquid height.

**Riser Height:** Distance the sensor is recessed within a riser, measured from the bottom of the sensor to the inside of the tank.

**Tank Height:** Distance from the bottom of the tank to the top of the straight side wall.

**Diameter:** Distance of the inside tank diameter.

Dimensional Entry - Vertical Cylinder

Sensor Output Units

Distance

Volume      Gallons ▾

Dimensions:

Units: Inches ▾

S - Sensor Height: 49.2

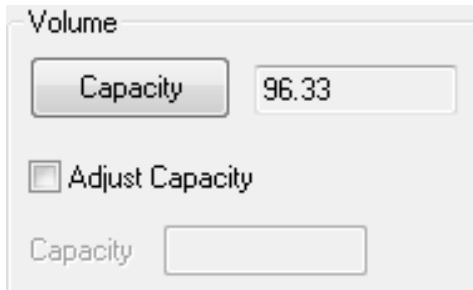
F - Fill Height: 47.2

R - Riser Height: 0.0

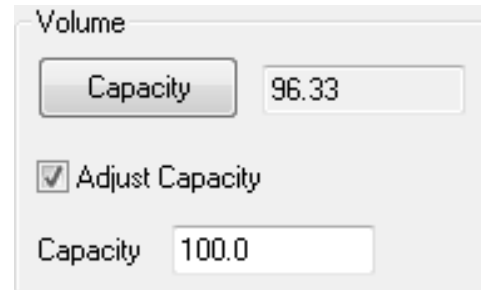
H - Tank Height: 47.2

D - Diameter: 24.5

**Volume – Tank Capacity:** After entering the dimensions, press the Capacity button to show the Calculated Capacity of the tank. If the Calculated Capacity is slightly different than the expected capacity, click on the Adjust Capacity box and enter the expected capacity of the tank. If the Adjusted Capacity is more than 10% of the Calculated Capacity, recheck the dimensions information entered above.



The screenshot shows a dialog box titled "Volume". It contains a "Capacity" button and a text field displaying "96.33". Below this, there is a checkbox labeled "Adjust Capacity" which is currently unchecked. At the bottom, there is another "Capacity" label followed by an empty text input field.



The screenshot shows the same "Volume" dialog box. The "Adjust Capacity" checkbox is now checked. The text field above it still shows "96.33". The text field at the bottom now contains the value "100.0".

When all dimensions are entered, press the Apply button to return to the previous Configuration window.



The screenshot shows a horizontal control bar containing four buttons: "Apply", "Select Tank Shape", "Cancel", and "Help".

- **Apply** – Transfers the dimensions to the original Configuration window.
- **Tanks** – Returns to the previous Shape Selection window.
- **Cancel** – Returns to the Configuration window without saving any information.

**Help** – Jumps to the Help menu.



**Dimensional Entry – Horizontal Cylindrical with Endcaps Example:** Choose the Sensor Output Units as Distance or Volume. After choosing the Sensor Output Units, select the units of measurement in the pull down to the left.

Sensor Output Units

Distance      Inches

Volume

Units of Measurement	
Distance	Volume
Inches	Gallons
Cm	Liters
Feet	
Meters	

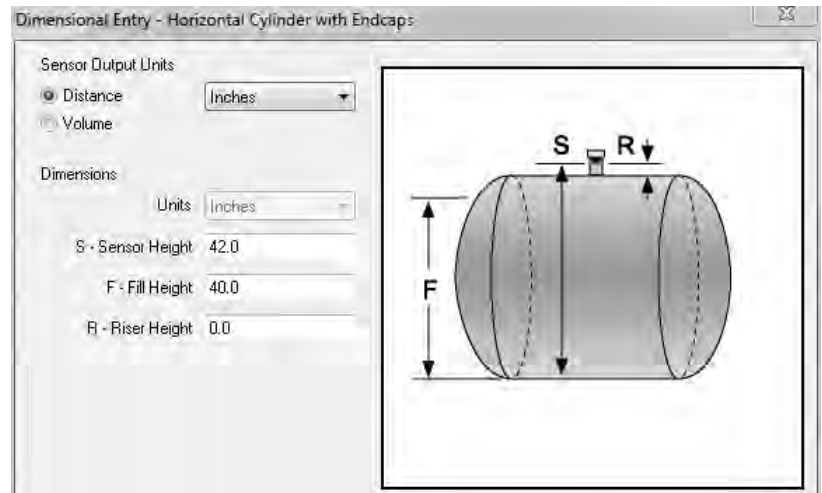
**Distance – Sensor Output Units:**

Enter the dimensions of the tank. You must enter data in all fields shown.

**Sensor Height:** Distance from the bottom of the tank to the bottom of the transducer.

**Fill Height:** Distance from the bottom of the tank to the maximum liquid height.

**Riser Height:** Distance the sensor is recessed within a riser, measured from the bottom of the sensor to the inside of the tank.



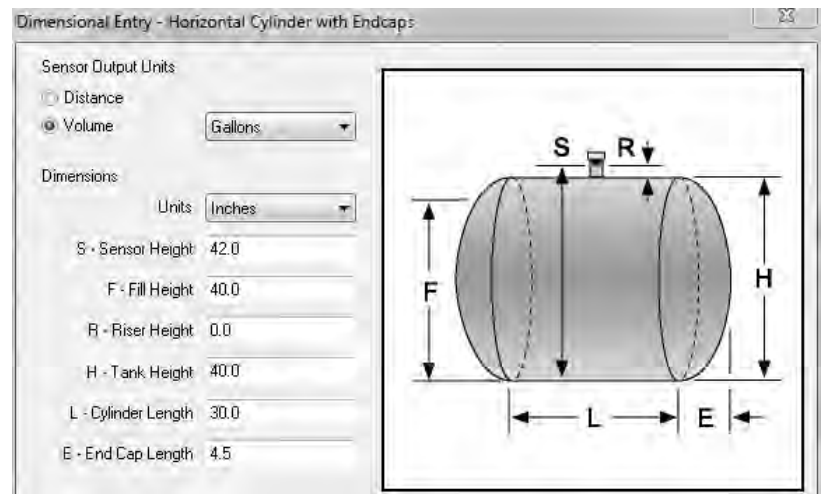
**Volume – Sensor Output Units:**

Enter the dimensions of the tank. You must enter data in all fields shown.

**Sensor Height:** Distance from the bottom of the tank to the bottom of the transducer.

**Fill Height:** Distance from the bottom of the tank to the maximum liquid height.

**Riser Height:** Distance the sensor is recessed within a riser, measured from the bottom of the sensor to the inside of the tank.

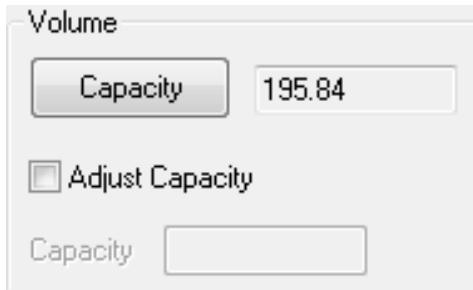


**Tank Height:** Distance from the bottom of the tank to the top of the straight side wall.

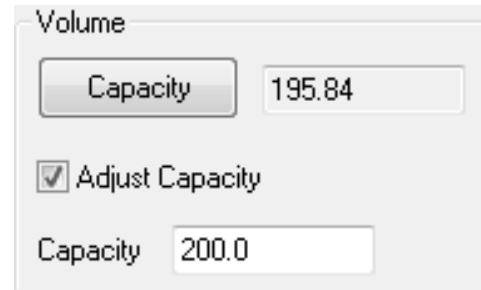
**Cylinder Length:** Distance of the straight length of the tank.

**End Cap Length:** Distance of one end cap. Both end caps will be used in the volume calculation.

**Volume – Tank Capacity:** Upon entering the dimensions, press the Capacity button to show the Calculated Capacity of the tank. If the Calculated Capacity is slightly different than the expected capacity, click on the Adjust Capacity box and enter the expected capacity of the tank. If the Adjusted Capacity is more than 10% of the Calculated Capacity, recheck the dimensions entered above.

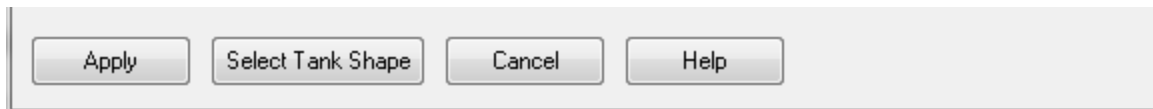


The screenshot shows a dialog box titled "Volume". It contains a "Capacity" button next to a text field displaying "195.84". Below this is a checkbox labeled "Adjust Capacity" which is currently unchecked. At the bottom, there is another "Capacity" label followed by an empty text input field.



The screenshot shows the same "Volume" dialog box. The "Adjust Capacity" checkbox is now checked. The text field next to the "Capacity" button still shows "195.84". The text field at the bottom, which was empty in the previous screenshot, now contains the value "200.0".

When all dimensions are entered is completed, press the Apply button to return to the previous Configuration window.



The screenshot shows a horizontal control bar with four buttons: "Apply", "Select Tank Shape", "Cancel", and "Help".

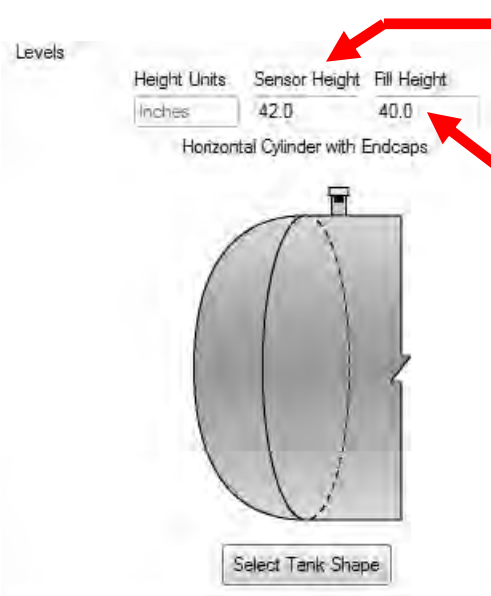
- **Apply** – Transfers the dimensions back to the original Configuration window.
- **Tanks** – Returns to the previous Shape Selection window.
- **Cancel** – Returns to the Configuration window without saving any information.

**Help** – Jumps to the Help menu.

### 3. Level Configurations

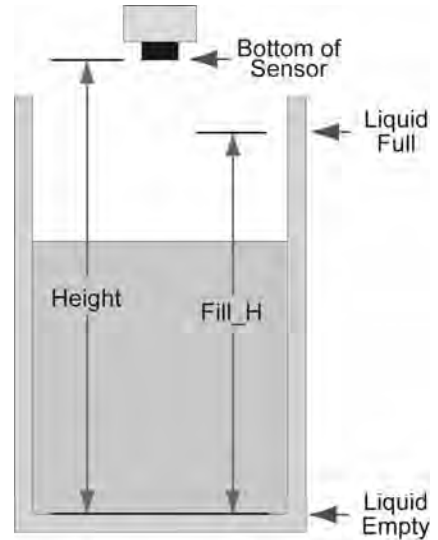
This section is where you enter application measurement values. This applies to all versions of the ultrasonic sensor. You must enter the Sensor Height and Fill Height values.

- For the LVCN414-I, LVCN414, LVCN210 and LVCN318 series, the **Sensor Height** and **Fill Height** values determine the operational range for the 4-20 mA output.
- For the LVCN414-V series, the **Sensor Height** and **Fill Height** values determine the operational range for the voltage or frequency output.



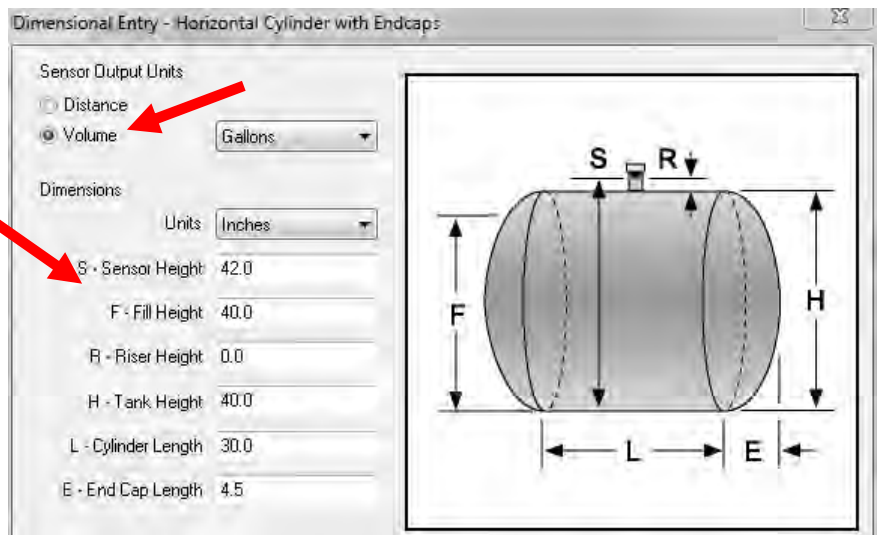
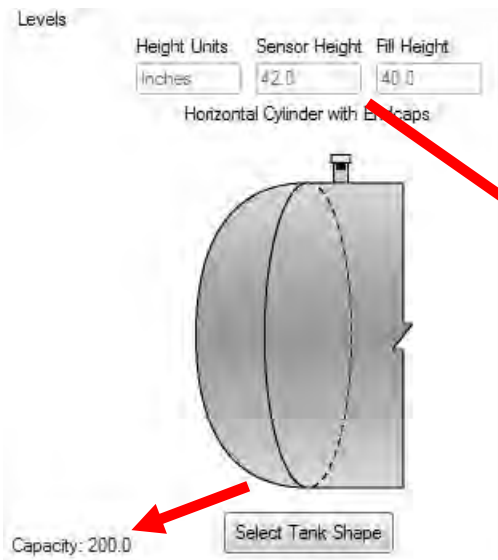
**Sensor Height:** Distance from the bottom of the tank to the bottom of the transducer.

**Fill Height:** Distance from the bottom of the tank to the maximum liquid height.



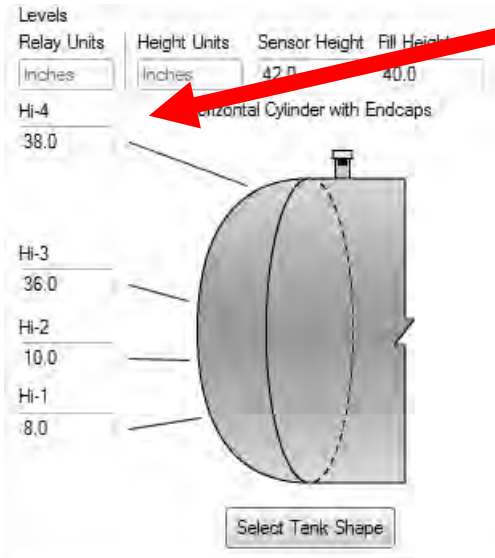
### Sensor configured in Volume

If **Volume** is selected for the **Sensor Output Units**, then the **Sensor Height** and **Fill Height** values cannot be changed on this page. They must be adjusted on the **Dimensional Entry Page**. **Note: the Capacity of the tank will appear in the lower left corner when Volume is selected under Sensor Output Units.**



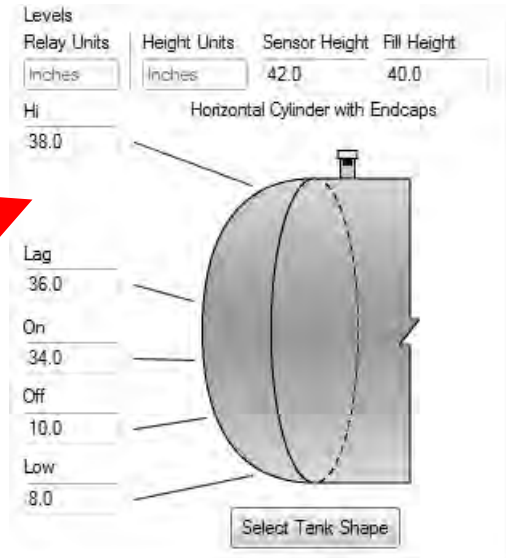
**Relay Values: (LVCN414, LVCN210, LVCN318 and LVCN414-R series only)**

This section is where you enter the operational values for relays. You must enter values within all of the fields shown. The value fields shown are based upon the configuration of the sensor. All values must be in the units of operation selected above and are based upon units of liquid. All relay values must be greater than Liquid Empty (0) and less than Liquid Full (Fill Height).



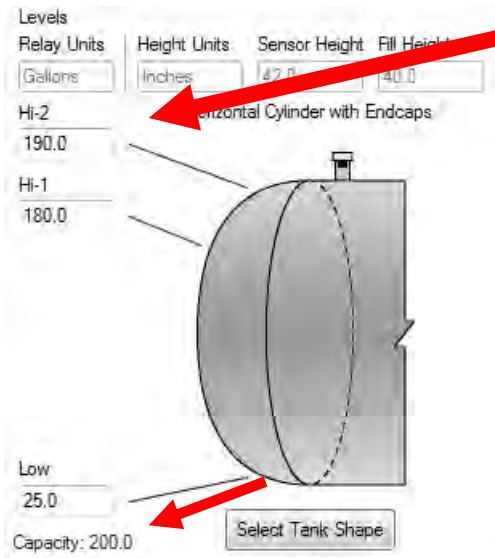
**Example:** This sample shows 4 High Level Alarms. As the level increases from the bottom –up, each alarm will activate.

**Example:** This sample shows a 2-Pump Lead/Lag operation with a High and Low alarm. The pumps will automatically empty the tank and the alarms will activate if the level gets too high or low.



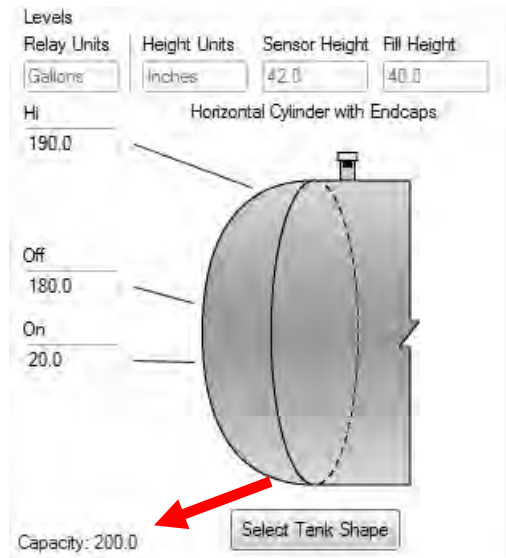
**Sensor configured in Volume**

If **Volume** is selected for the **Sensor Output Units**, then the relay values must be entered in the units selected (Gallons or Liters) from the **Dimensional Entry Page**. **Note:** the **Capacity** of the tank will appear in the lower left corner when **Volume** is selected under **Sensor Output Units**.



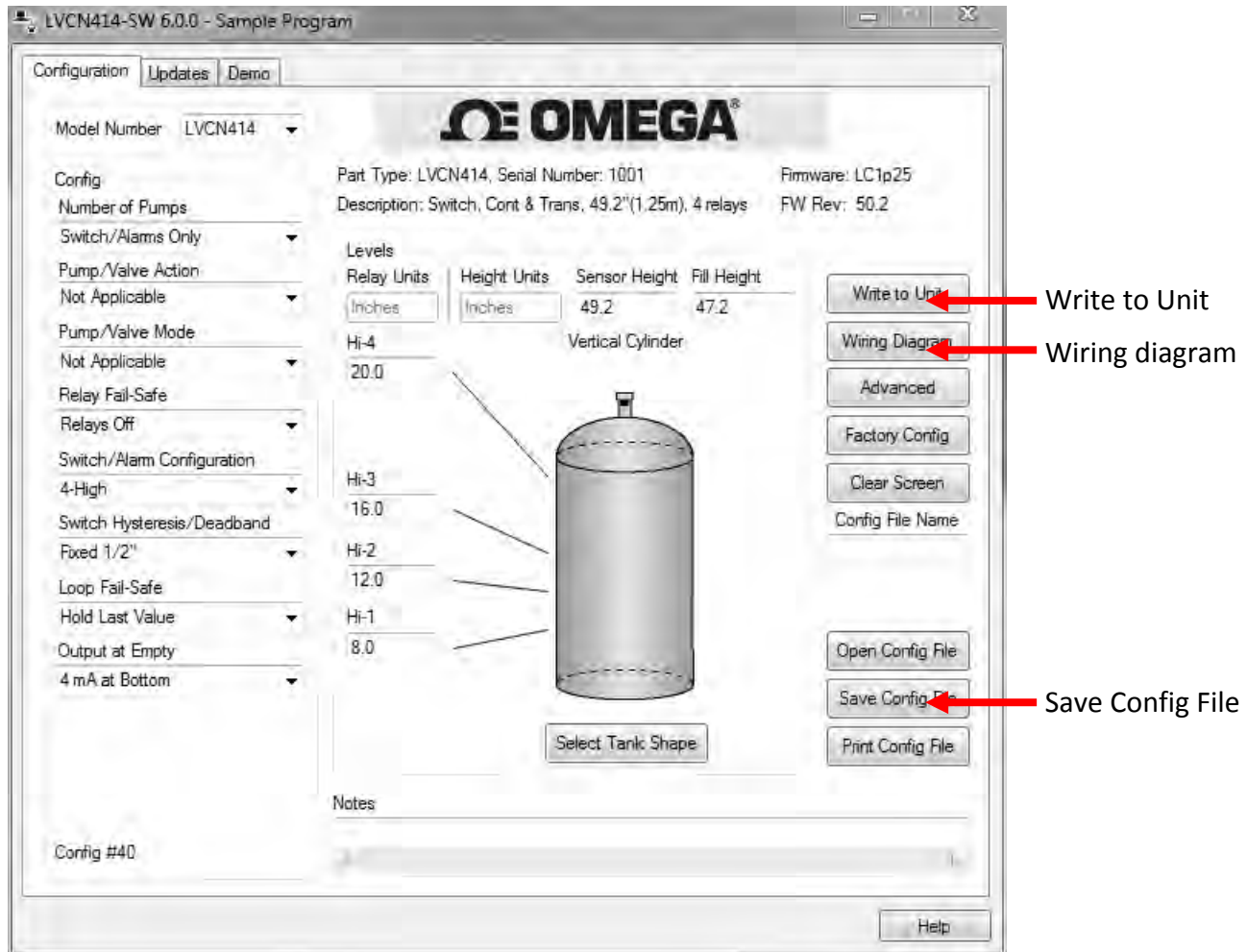
**Example:** This sample shows 2 High Level & 1 Low Level Alarms. The values are in units of Gallons.

**Example:** This sample shows a 1-Pump fill operation with a High alarm. The pump/valve will automatically fill the tank and the alarms will activate if the level gets too high. Again, the values for the relays are in units of Gallons.



#### 4. Write to Unit

After you have entered configuration, tank shape information and level configurations, click **“Write to Unit”** to load the configuration into the memory of the sensor. When completed, this configuration will remain inside the sensor’s memory and will not change unless the sensor is connected to LVCN-414-SW software and a new configuration is written to the sensor. Loss of power will not change or lose the configuration within sensor memory.

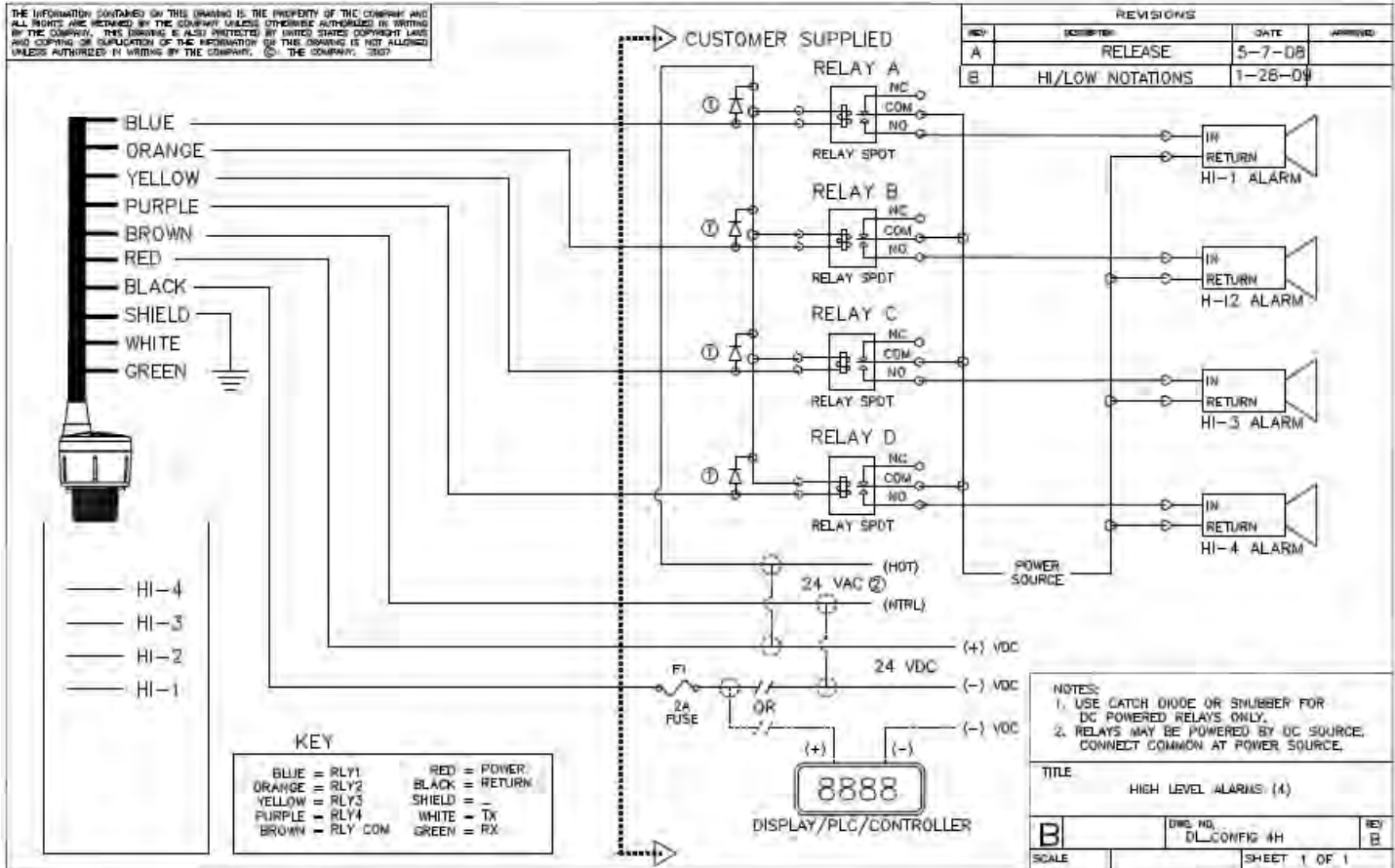


Next, use the file management features to save your configuration by clicking **“Save Config File”** and print your wiring diagram by clicking **“Wiring Diagram.”**

**“Save Config File”** will save this configuration as a text file which can be loaded back into the LVCN-414-SW software by pressing the **“Open Config File”** button. It is good practice to save the configuration file for each different configuration with a unique name for easy identification. If using multiple sensors in identical applications, then use of a single configuration file is recommended.

**“Wiring Diagram”** will display a PDF file showing the unique wiring for the specific configuration created. The PDF can be printed or Emailed. It is good practice to save the wiring diagram as a backup.

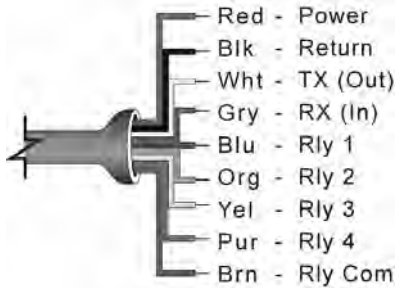
Wiring Diagram - Sample



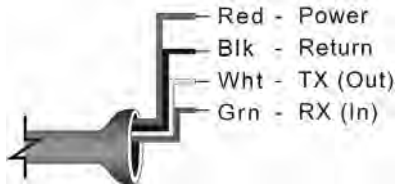
**Diagram will change based upon the configuration of the sensor, use the LVCN414-SW software to view appropriate wiring diagram.**

**Wiring:** Once the ultrasonic sensor has been installed, follow the Wiring Diagram provided by the software. A typical wiring diagram is shown above. OMEGA ENGINEERING recommends using a qualified licensed electrician to wire the sensor and your application’s components.

- ▲ Configure your ultrasonic sensor with the LVCN414-SW software and use the wiring diagram button to view the appropriate diagram. Each configuration will have its own unique diagram. The diagram above is only a sample and should not be used as a wiring diagram.
- ▲ Always use stepper relays between the sensor and external loads. For DC circuits use a catch diode such as 1N4148, shown on the Wiring diagram shown above.
- ▲ Once configured, isolate the white and green wires from active power to prevent a short of the configuration circuit.

**Wire Connections:**

**LVCN414, LVCN210, LVCN318 &  
LVCN414-R Series**



**LVCN414-I Series**



**LVCN414-V Series**

**Red & Black**

Red and Black leads are for connection to a 24 VDC power supply or to a 4-20 mA loop power source (LVCN414-I, LVCN414, LVCN210 & LVCN318 series only). The red and black wires can be extended up to 1,000 feet using a 22 gauge or larger wire, however do not extend the green and white wires.

**White & Green**

White and Green leads are reserved for use with the LVCN414-SW software and should not be connected during usage in the application. These wires should not be connected to the software while power is supplied from any source other than the LVCN414-USB series Fob. The maximum cable distance between the computer and the sensor is 15'.

***Never allow the white or green wires to touch any power supply.***

**Blue, Orange, Yellow, Purple & Brown – (LVCN414, LVCN210, LVCN318 & LVCN414-R Series only)**

Blue, Orange, Yellow & Purple wires are the relay contacts (normally open) from each of the relays respectively. The Brown wire is the common for all the relays. Relay selection is determined by the configuration.

**Blue & Brown – (LVCN414-V Series only)**

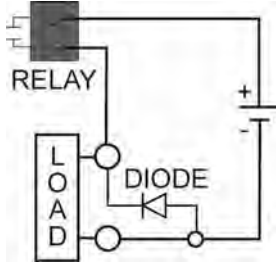
Use the Brown wire for the Frequency output. Use the Blue wire for the Voltage output.

**General notes for electrical connections, usage and safety:**

- Where personal safety or significant property damage can occur due to a spill, the installation must have a redundant backup safety system installed.
- Wiring should always be completed by a licensed electrician.
- Supply voltage should never exceed 28 VDC.
- Always use stepper relays between the sensor and external loads. For DC circuits use a catch diode such as 1N4148, shown on previous page.
- Protect the sensor from excessive electrical spikes by isolating the power, whenever possible.
- The sensor materials must be Chemically compatible with the liquids to be measured.
- Design a fail-safe system for possible sensor and/or power failure.
- Never use the sensor in environments classified as **Hazardous**.

### Switching Inductive Loads

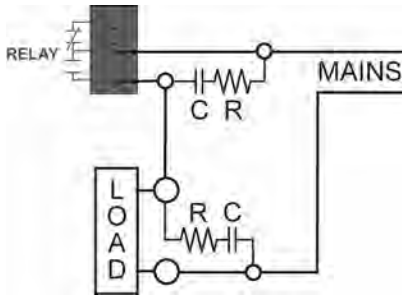
The use of suppressors (snubbers) is strongly recommended when switching inductive loads to prevent disrupting the microprocessor's operation. The suppressors also prolong the life of the relay contacts. Suppression can be obtained with a catch diode for DC circuits and a resistor-capacitor (RC) for AC circuits.



#### Catch Diode

- Always use stepper relays between the sensor and external loads. For DC circuits use a catch diode such as 1N4148, shown on left.

Refer to the following circuits for RC network assembly and installation:



#### Choose R and C as follows:

- R: 0.5 to 1 Ohms for each volt across the contacts
- C: 0.5 to 1  $\mu$ F for each amp through closed contacts

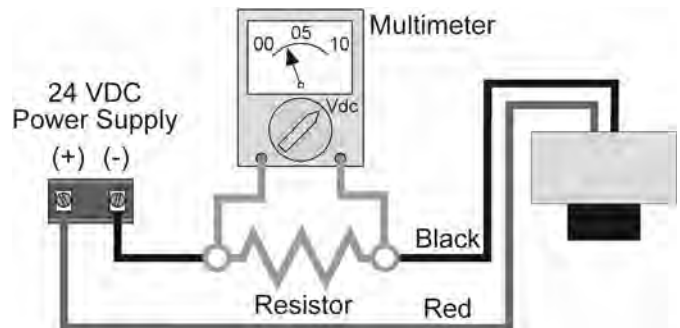
#### Notes:

1. Use capacitors rated for 250 VAC.
2. RC networks may affect load release time of solenoid loads. Check to confirm proper operation.
3. Install the RC network at the meters relay screw terminals. An RC network may also be installed across the load. Experiment for best results.

### Voltage Output – (LVCN414-I, LVCN414, LVCN210 & LVCN318 Series only)

The ultrasonic sensor can be used as a 0 to 5 or 0 to 10 VDC output device. A resistor will need to be added to the circuit to enable a voltage output (refer to the wiring diagram below).

- 0-5 VDC output
  - Add a 250 Ohm resistor
  - Actual output will be 0.8 to 5 VDC
- 0-10 VDC output
  - Add a 500 Ohm resistor
  - Actual output will be 2 to 10 VDC



When using the LVCN414-SW software, under **Number of Pumps**, select **4-20mA Transmitter Only** to simplify the configuration.



The ultrasonic sensor should always be mounted perpendicular to the liquid surface and installed using the provided FKM mounting gasket. Make sure that the fitting and transmitter threads are not damaged or worn. Always *hand-tighten* the transmitter within the fitting. Perform an installed leak test under normal process conditions prior to system start up. **Note:** *The preferred mounting fitting for the LVCN414-I, LVCN414, LVCN210, LVCN414-R & LVCN414-V series is a plastic (2" thread x 1" thread) reducer bushing.*

**Mounting Guide**

1. Do not mount at an angle
2. Liquid should never enter the dead band
3. Side Wall:
  - a. Mount at least 2" from the side wall
  - b. For LVCN318 Series - mount at least 3" from the side wall
4. Do not mount where obstacles will intrude on sensor's beam width
  - a. See Specifications, Step Two
5. Do not mount in a vacuum
6. Avoid mounting in the center of a dome top tank.
7. In cone bottom tank, position the sensor over the deepest part of the tank.

**Installation in existing fittings:** If the existing fitting is larger than the threads of the sensor, select a reducer bushing such as the LVU800-2N40 (2" thread x 1" thread) or LVU800-3N40 (3" thread x 2" thread).



LVU800-2N40



LVU800-3N40

<p><i>Do not install at angle relative to the liquid.</i></p>	
<p><i>Do not install within 3" of tank sidewall.</i></p>	
<p><i>Do not install with objects in the beam.</i></p>	
<p><i>Do not install in applications with vacuum.</i></p>	

**Metal Tanks (LVU2710 series)**

Omega Engineering ultrasonic transmitters have been optimized for use in non-metallic fittings.

1. For best performance, avoid the use of metallic fittings.
  - a. Use a plastic 2" x 1" reducer bushing (such as LVU800-2N40) or a plastic 1" tank adapter (such as LVU800-1B).
2. While installations directly into a 1" metal fitting are not recommended, acceptable results may be obtained if the 1" fitting is a half coupling in form and the outer diameter of the coupling is tightly wrapped in vinyl tape to dampen vibrations.

**Fitting Selection:** Check the part number to determine the required fitting mount size and thread type. The ultrasonic sensor is commonly installed in tank adapters, flanges, brackets or standpipes. **Note:** Always include the gasket when installing the Sensor.

1. **Tank Adapter:** Select a tank adapter fitting for the LVCN414-I, LVCN414, LVCN210, LVCN414-R, LVCN414-V or LVCN318 series.
  - a. For best results, select a 2" tank adapter (LVU800-2B) and add a plastic 2" by 1" reducer bushing (LVU800-2N80).
  - b. Avoid tank adapter (thread x thread) styles and/or pipe stops forward of the installed transducer.
  - c. Always mount the tank adapter so the majority of fitting is outside the tank.
    - i. Never mount the tank adapter upside down or the bulk of the material is inside the tank.

**2" Tank Adapter  
Socket x Thread  
(LVU800-2B shown)**



**Tank Adapter (LVU800-2B)  
w/ 2" x 1" Reducer Bushing  
(LVU800-2N80 shown)**

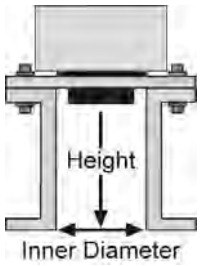


**Tank Adapter  
Thread x Thread**



**Do not use thread x thread**

2. **Riser:** Installations with tall, narrow risers can impede the acoustic signal.
  - a. **Core Out Concrete:** Applications where tank with a concrete ceiling that has been cored out can also be considered as a riser type application. In these applications follow a 2:1 ratio (Inner Diameter to Core Height) for the diameter of the core.
  - b. **LVCN318 Series:** 2" (5 cm) diameter risers should be no taller than 4" (10cm). Larger diameter risers should be no taller than 12" (30.5 cm).
  - c. **LVCN414-I, LVCN414, LVCN210, LVCN414-R & LVCN414-V Series:**

	Riser Specifications	
	Inner Diameter	Maximum Height
	2" (5cm)	3" (7.6cm)
	4" (10cm)	8" (20cm)
	6" (15cm)	12" (30cm)

**Note:** Do not exceed the dimensions listed above.



**Note:** If attempting to raise the sensor above the top of the tank to allow for a higher fill capacity, avoid the use of tall and narrow risers. The example to the left exceeds the dimensions listed in the **Riser Specifications** chart. Use a larger tank adapter which takes into account the **Riser Specifications**.

3. **Flange (LVCN414-I, LVCN414, LVCN210, LVCN414-R & LVCN414-V series):** If installing on a flange, select a flange with a thread that is above the plane of the flange.
  - a. *The LVCN318 series works well with Flange installations.*
  - b. Avoid the use of blind flanges with tapped threads or flanges where the threads are even with the plane of the flange, such as the Banjo 1" Poly ANSI Flange (series AF100).
  - c. Use a flange with a 2" thread and add a 2" to 1" reducer bushing to complete the installation.

**2" Flange w/  
thread out of plane  
(LVU800-2F shown)**



**1" Flange w/  
thread in plane**



**2" Flange w/  
reducer bushing  
(LVU800-2N80 shown)**



**Do not use thread in plane**

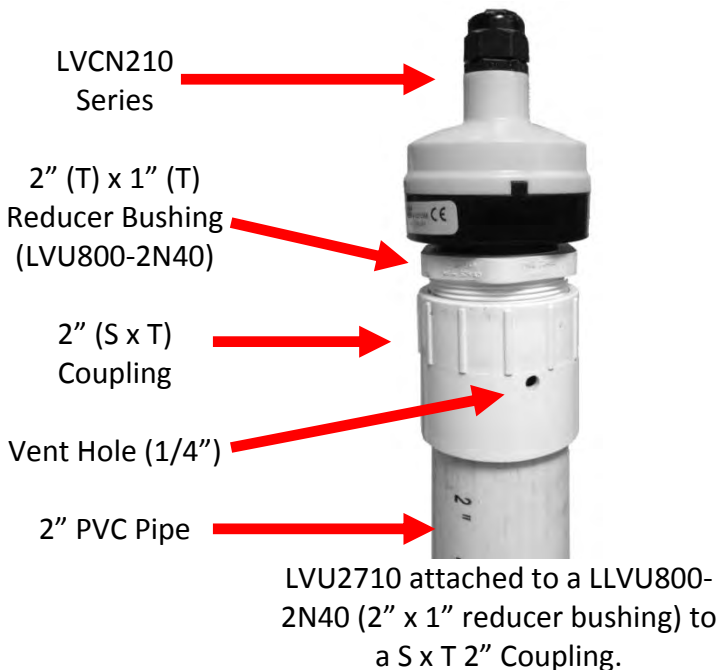
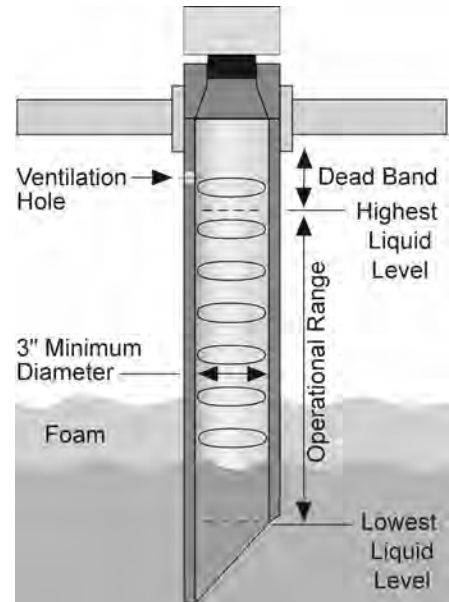
4. **Side Mount Bracket:** For installations in open tanks and sumps, use the LVM-30 series side mount bracket.
  - a. For the LVCN414-I, LVCN414, LVCN210, LVCN414-R & LVCN414-V series, order the LVM-30 side mount bracket and add a plastic 2"x 1" Reducer Bushing.
  - b. For the LVCN318 series, order the LVM-30 side mount bracket.



**LVM-30 Series Shown**

5. **Stand Pipe:** A standpipe may be used to dampen turbulence or when foam is present in the application.

- a. Pipe can be made of any material.
- b. Select a minimum 3" ID pipe for the stand pipe.
  - i. A 2" pipe is usable with the LVCN414-I, LVCN414, LVCN210, LVCN414-R & LVCN414-V series, but is the minimum.
  - ii. Pipes larger than 3" can also be used.
- c. Use a coupling and reducer bushing to attach the sensor to the pipe.
  - i. Be sure to use a plastic reducing bushing such as 2" Thread x 1" Thread fitting (ex: LVU800-2N80) or 2" Slip x 1" Thread fitting (ex: LVU800-2S80).
  - ii. For the LVCN318 series, use a reducer bushing such as 3" Thread x 2" Thread fitting (ex: LVU800-2N80) or 3" Slip x 2" Thread fitting (ex: LVU800-3S80).
- d. The pipe length should run the measurement span and the bottom of the pipe should remain submerged at all times to prevent foam from entering the pipe.
- e. Cut a 45° notch at the bottom of the pipe and drill a 1/4" pressure equalization hole in the dead band.
- f. The pumps should not drive liquid past the open end of the stand pipe which causes the liquid in the pipe to oscillate.



Avoid the use of a tee within the stand pipe. A tee can create false signals which will interfere with the sensor's performance.

This tool is designed to help solve operational issues. Changing these setting will alter the performance of your unit. Please read through this HELP file to assist you in making adjustments or if still unclear about a specific issue, please contact OMEGA ENGINEERING, Applications Engineering.

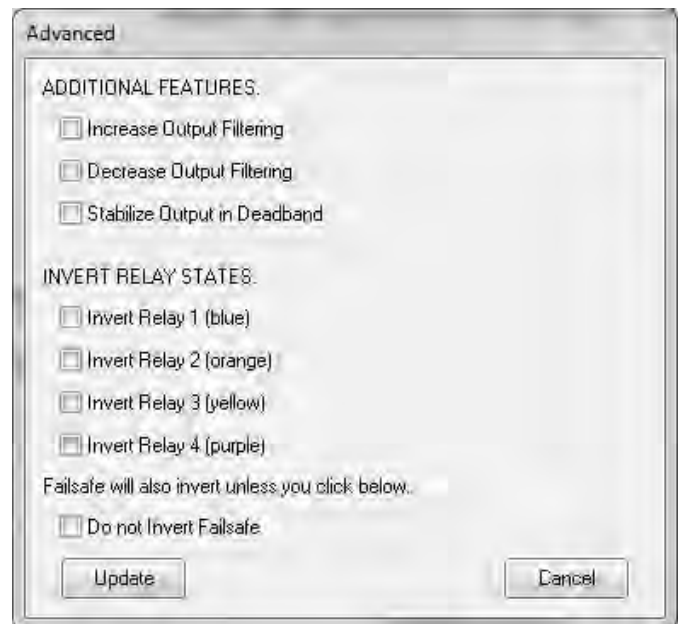
**Note:** When the Advanced Button is highlighted with a RED border, this indicates you have selected an advanced feature.

- Increase Output Filtering:** Placing a check mark in the box will increase the filtering (averaging) of the analog output. Use this filter if the 4 to 20 mA output requires a smooth output for the application such as open channel flow measurement.
- Decrease Output Filtering:** Placing a check mark in the box will eliminate all filtering (averaging) of the analog output. Enables a pulse by pulse level reading. Use this filter to see changes in level after every sound pulse.

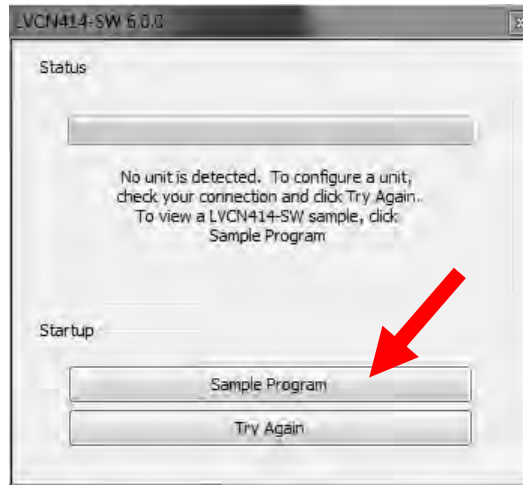
**Note:** Never check increase output filtering and decrease output filtering at the same time.

- Stabilize Output in Deadband:** Placing a check mark in the box will activate a filter to hold the output at Full if the level enters the dead band of the sensor. This filter requires the level to leave the dead band at a smooth and steady rate.

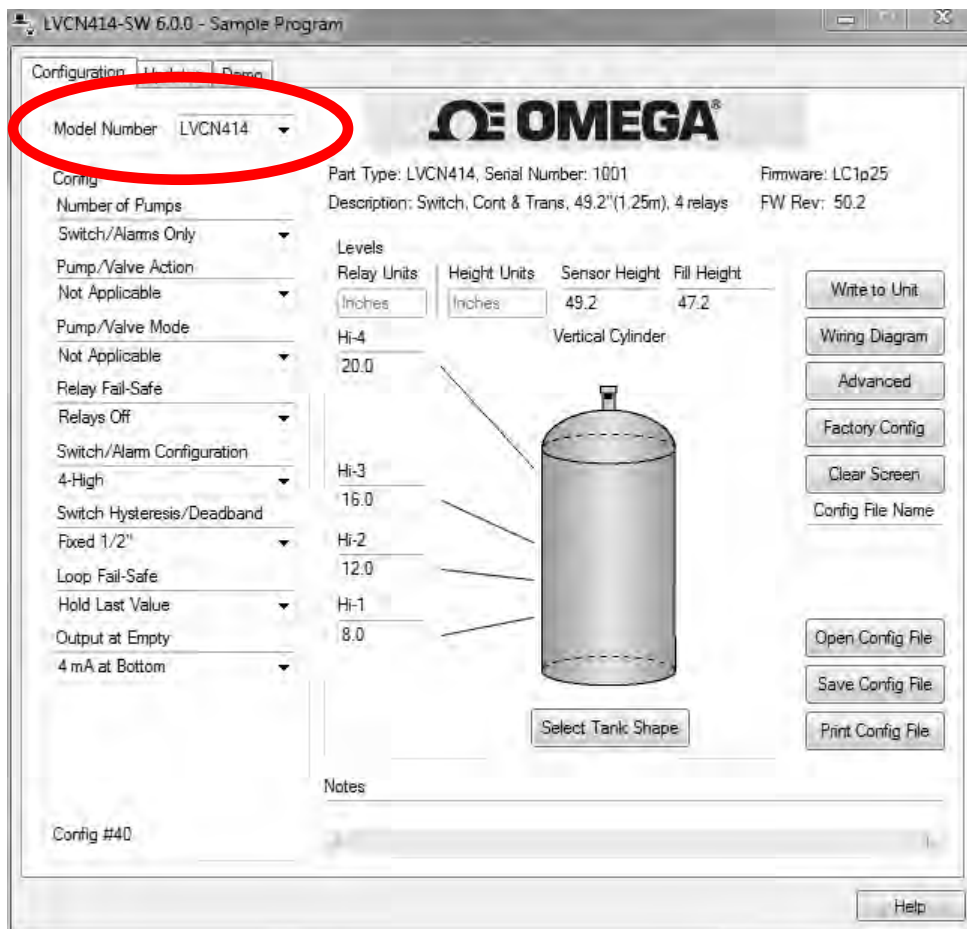
- Invert Relay States:** Placing a check mark in any of the four boxes will reverse the state of that relay. For example, if relay 4 is a high alarm that energizes above 50.0" of liquid, checking the invert box will reverse so the relay will energize when it is below 50" of liquid. Inverting the relay will also invert the fail-safe of the relay. If the relay is fail-safe On, Inverting the relay will make it fail-safe Off.
- Fail-Safe will also invert unless you check below:** This button will not invert the fail-safe when a relay is inverted.



**Sample Program:** A sample version of the LVCN-414-SW software is available anytime a sensor is not attached to the software. The Sample Program shows all the features in the Configuration Tab of the software. Any configuration can be opened (Open Config File), Saved (Save Config File) or Printed (Print Config File) with the Sample Program. Sample Program cannot be viewed if a sensor is attached to the computer via the USB® Fob. To view the Sample Program, start the LVCN-414-SW software when a sensor is not attached to the computer. At the opening screen, select **Sample Program**.



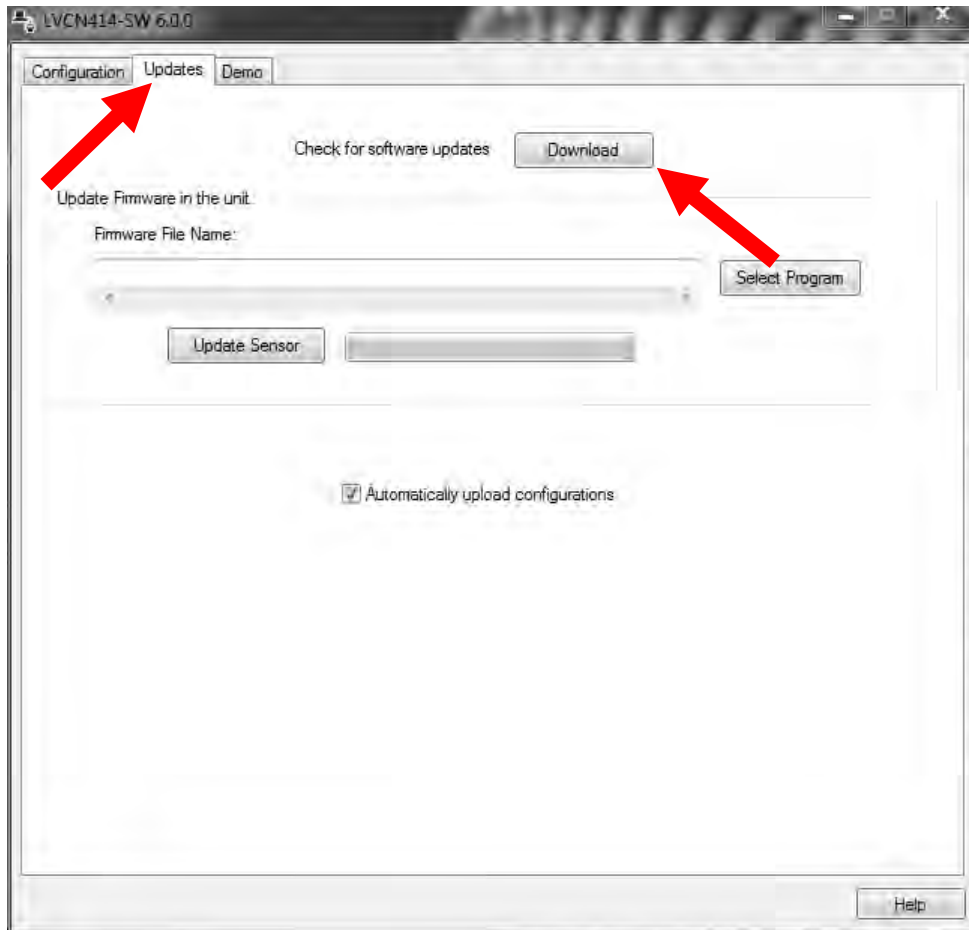
Select your model type in the upper right-hand corner. **Note:** When saving or opening a configuration, make sure the Model Number matches the sensors you intend to use.



### Updating LVCN414-SW Software

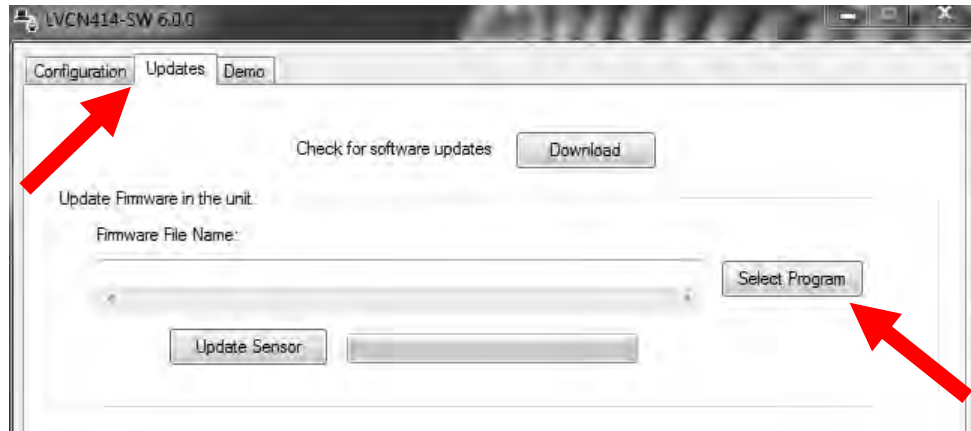
The software can be updated directly within the software. Simply click on the **Updates** Tab at the top of the window and press the **Download** button. Make sure that your computer has access to the Internet. If not, an error window will appear.

When the **Download** button is pressed, the software will check the version of software you are using with the most recent version at OMEGA ENGINEERING. If the versions are similar, a window indicating that the most recent version is installed. If not, then a window will appear asking to download the latest version. Follow the instructions for installing the latest version.

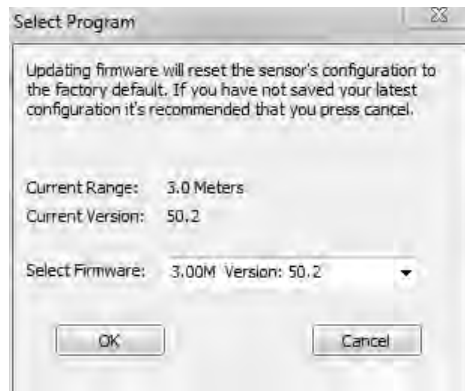


### Updating Transmitter Firmware

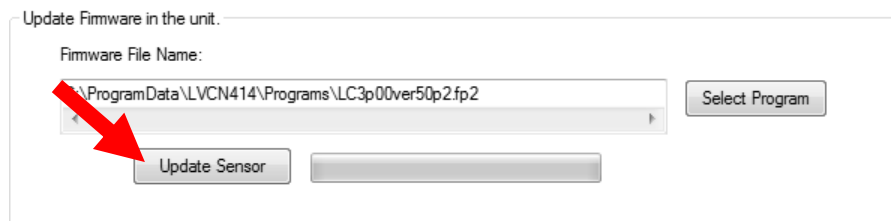
The software can also be used to update firmware inside the ultrasonic sensor. This feature allows the sensor to be updated when new features are added. First open the LVCN414-SW software with an ultrasonic sensor connected and the latest version of the software installed to your PC.



Click on the **Updates** Tab and then click on **Select Program** to select the firmware update.



Select the latest version of the firmware file and click on OK.



Confirm that the address is correct and then click on **Update Sensor** to begin the firmware update. This step should take less than 1 minute. You can follow the progress with the status bar to the right of the Update Sensor button. When completed, click on the Configuration tab to configure the transmitter. *Remember, when the firmware has been updated, the unit will return to its original factory settings.*

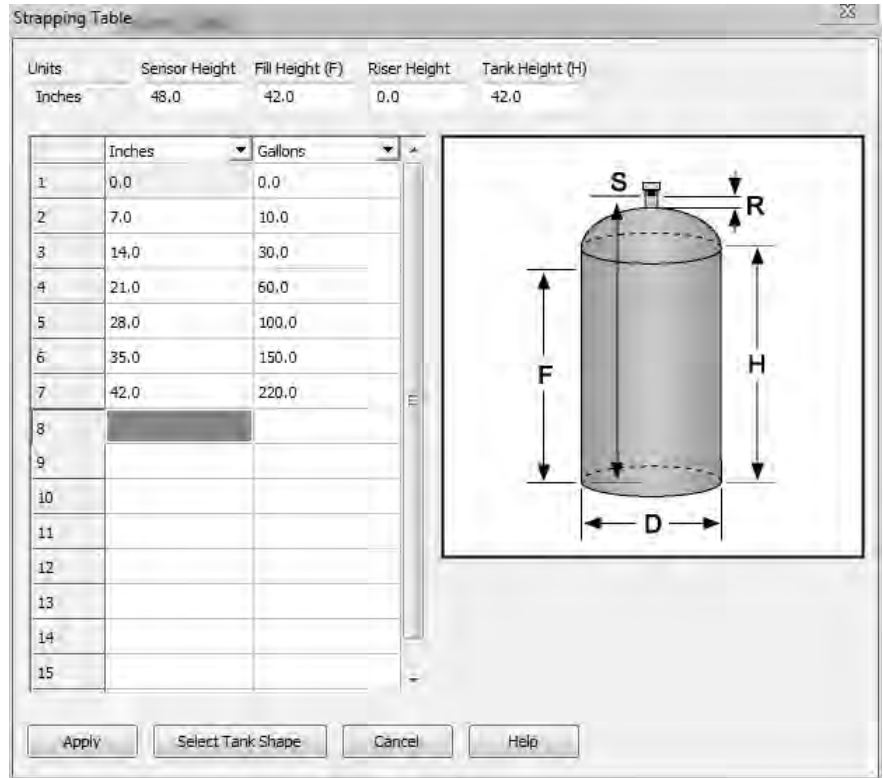
- If there is a communication interruption during the update, the process will stop. It is OK to click on Update Sensor again to start the process over again.



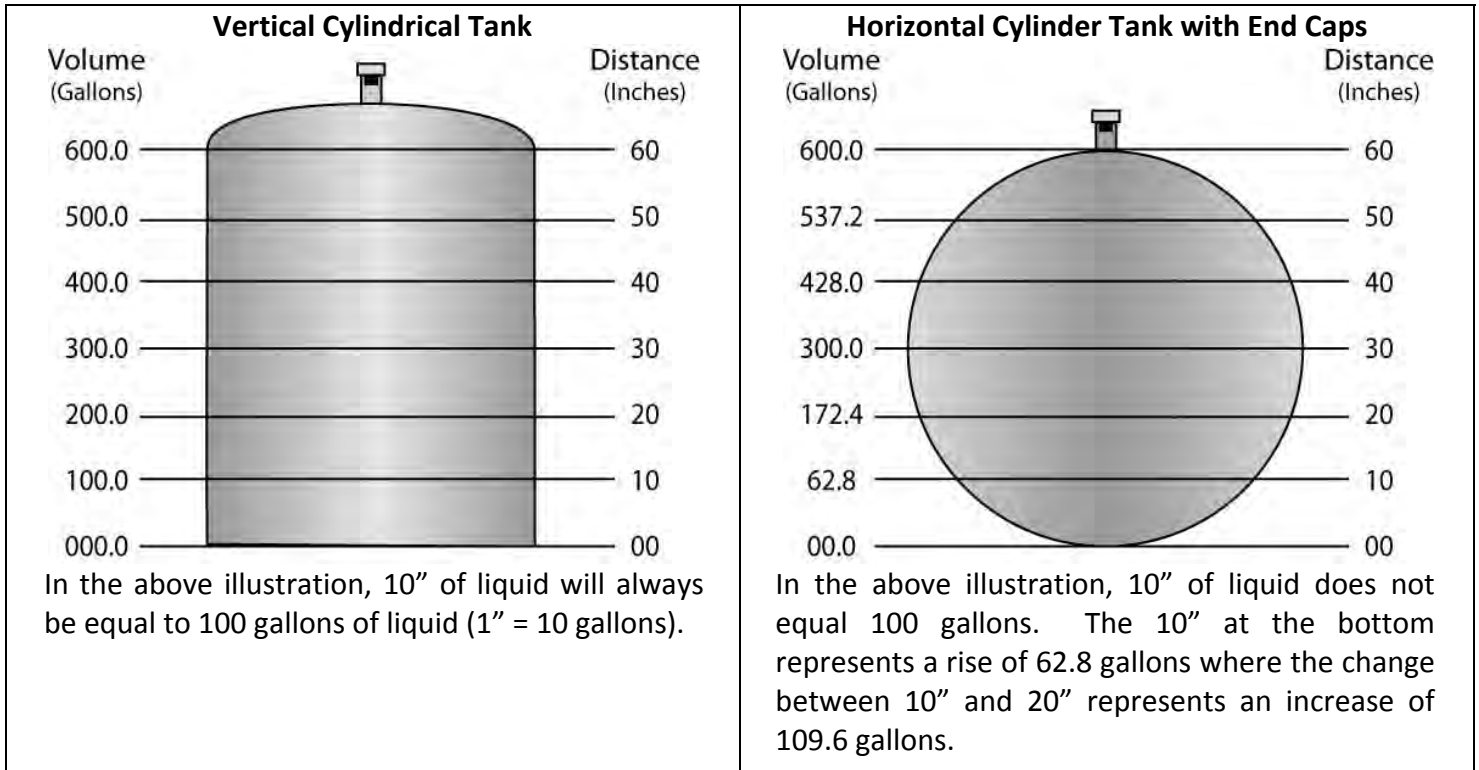
**Strapping Table:** LVCN-414-SW Software features a strapping table that enables you to enter up to 16 custom reference points instead of using the standard tank shapes. This feature is ideal for odd shaped tanks or tanks where specific levels are known volumes of liquid.

To access the Strapping Table, click on **Strapping Table** in the Shape Selection Window and press “OK”.

- Enter the Sensor Height, Fill Height, Riser Height and Tank Height. This information is used to configure the sensor to the tank.
- The Strapping Table also has two columns of 16 points for entering the known tank data.
- Select the dimensions and/or volume at the top of the two columns and enter the tank data.
- When done, press “Apply” to transfer the data and return to the Configuration window.



**Linear vs. Non-Linear:** Two of the shapes (Vertical Cylinder Tank and Rectangular Tank) will always provide a linear output, regardless of selecting Distance or Volume. The remaining four shapes (Vertical Cylinder Tank with Cone Bottom, Horizontal Cylinder Tank with End Caps, Horizontal Cylinder Tank with Spherical End Caps and Spherical Tank) will have a linear output when Distance is selected, but will have a non-linear output when volume is selected.

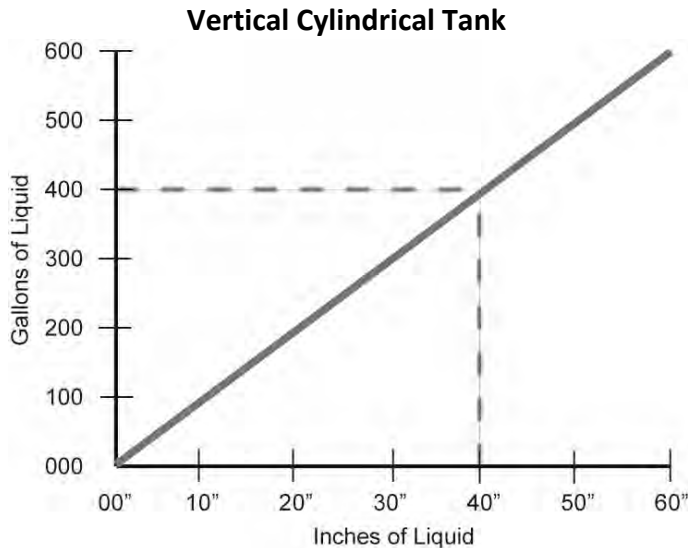


When volume is selected, the 4-20 mA output from the sensor will be proportional to the volume of the tank, not the height of the tank. This means that the current output will track the volume of the tank (in gallons or liters) within a non-linear tank (Vertical Cylinder Tank with Cone Bottom, Horizontal Cylinder Tank with End Caps, Horizontal Cylinder Tank with Spherical End Caps or Spherical Tank).

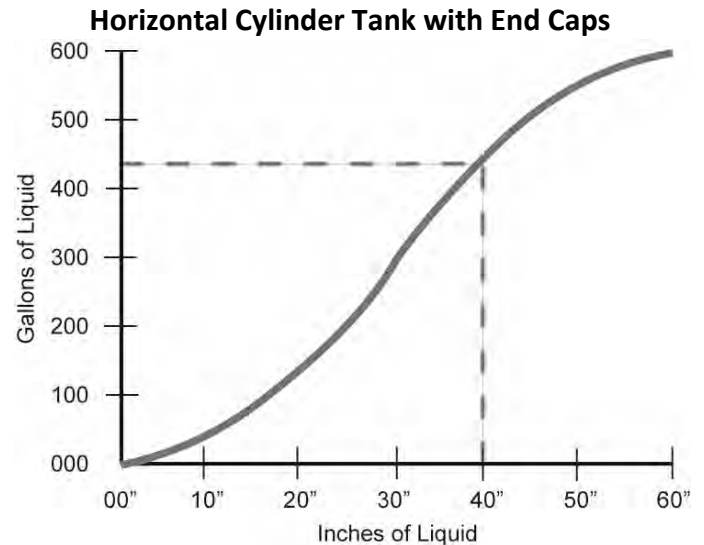
When connecting the signal output to a display, the signal will follow the volume of the tank. The display will also reflect the volume of the tank and not the height of the liquid.

**Example #1 (Volume Output):** in the above illustrations, @ 20" of liquid, the display will show 200.0 gallons in the Vertical Cylindrical Tank. However, in the Horizontal Cylinder Tank with End Caps, the same level of 20" would show 172.4 gallons.

**Example #2 (Current Output):** In the illustrations on the previous page, the 4mA signal is set at 0" (0.0 gallons) and the 20 mA signal is set to 60" (600.0 gallons). In the Vertical Cylindrical Tank, 40" of liquid will output a current signal of 14.67mA. However, in the Horizontal Cylindrical Tank with End Caps, 40" of liquid will output a current signal of 15.41mA. A simple loop display set with 4mA = 0 gallons and 20 mA = 600 gallons will show two different volumes based upon the tank shape configuration. Vertical Cylindrical Tank will show 400.0 gallons while Horizontal Cylindrical Tank with End Caps will show 428.0 gallons.



In the above illustration, 10" of liquid will always be equal to 100 gallons of liquid (1" = 10 gallons).



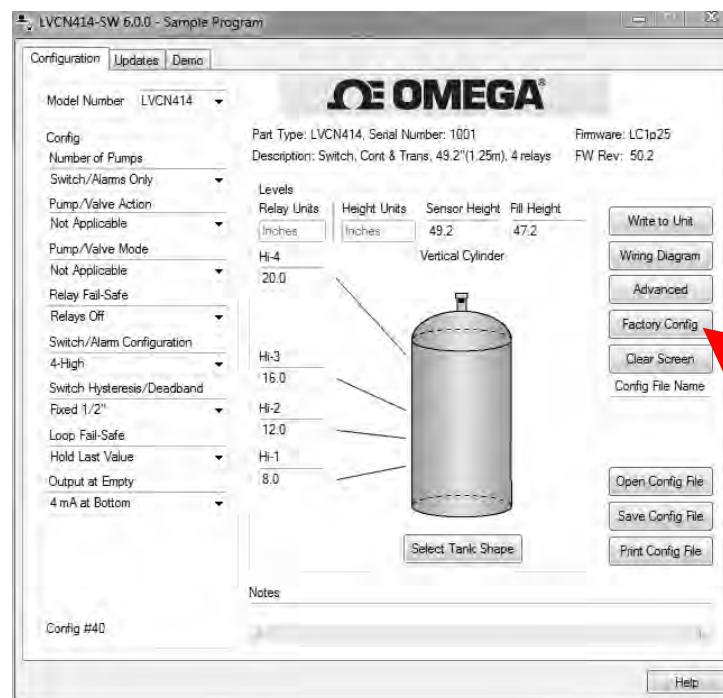
In the above illustration, 1" of liquid does not equal 10 gallons. The 10" at the bottom represents a rise of 62.8 gallons where the change between 10" and 20" represents an increase of 109.6 gallons.

### Factory Default

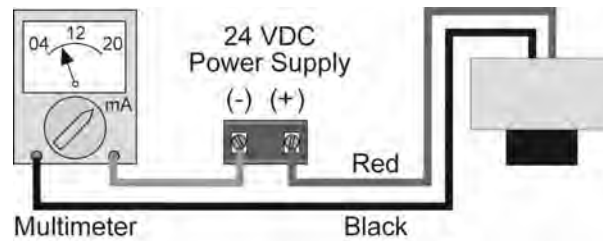
Pressing the **Factory Config** button in the Configuration menu will return the screen to the following settings. Out of the box, the ultrasonic sensor will output a 4-20 mA output that is maximized for its operational range. The transmitter can be used in the original factory setting without configuration with the LVCN4141-SW Software. Use the table below to identify the configuration of the sensor out of the box.

**Factory Defaults Table**

Part Number	Sensor Height	Fill Height	Loop Fail-Safe	Output at Empty	Startup Condition
<b>LVCN414 Series</b>	49.2" (125 cm)	47.2" (119.8 cm)	Overfill (22 mA)	4 mA @ Bottom	Empty
<b>LVCN210 Series</b>	118.1" (300 cm)	114.1" (290 cm)	Overfill (22 mA)	4 mA @ Bottom	Empty
<b>LVCN318 Series</b>	216.5" (550 cm)	530 cm (208.7")	Overfill (22 mA)	4 mA @ Bottom	Empty



## Testing the Transmitter – LVCN414-I, LVCN414, LVCN210, LVCN318 series only



1. Connect a multimeter in series with the black wire to read the current output.
2. Verify that the current increases (tank filling) and decreases (tank emptying) appropriately in the calibrated span.

If not, carefully observe and attempt to correlate any installation, level or application event for more specific troubleshooting direction.

## Demo Page

To view the Demo page (shown here), click the **Demo** tab on the top of the screen.



The demo page is a simulation, useful for verifying the configuration. There is not enough power going to the unit to power the relays in the Demo mode. The larger numbers represent the liquid level while the smaller numbers show the distance from the transducer to the surface.

The sensor must be pointed at a flat perpendicular surface while in the Demo mode. If not, the display will read LOST.

- If the display reads EMPTY, then the target is further away from the sensor than the Sensor Height setting.
- If the display reads FULL, then the target is closer to the sensor than the Fill-Height setting.

PROBLEM	SOLUTION
Transmitter indicates a current of 0 mA	Check the wiring for an open circuit. An open circuit is the most common issue with a 0 mA signal.
Transmitter jumps to a current reading between 19 and 20 mA	Check the installation of the transmitter. Bad installation fittings will cause false signals near the top of the tank, which typically translates to a signal between 19 and 20 mA. Also look for interference just below the transmitter. If the transmitter is installed in a metal fitting, switch to a plastic fitting.
Transmitter indicates a current over 23 mA	Immediately check the wiring for a short circuit. The sensor is current limited to 22 mA. Anything above 23 mA indicates a short circuit.
Transmitter always jumps to the LOST condition	Check the dimensional configuration ( <b>Height</b> and <b>Fill-H</b> ) of the sensor. Make sure that the <b>Fill-H</b> setting corresponds to the full level of liquid (from the bottom up) and not the distance from the transmitter to the liquid (top down).
Output of transmitter is opposite of the level of liquid	Check the <b>Output at Empty</b> Setting.
No Unit Detected	<p>LVCN414-SW software cannot detect the sensor connected to the computer.</p> <ul style="list-style-type: none"> <li>• Check that the Fob is connected to the USB port.</li> <li>• Check that all four wires (Red, Black, White and Green) are securely attached to the Fob.</li> <li>• Check in Device Manager that both drivers (Configuration &amp; EchoFob) are present.</li> </ul>
Internet error. The server name or address could not be resolved.	<p>This is a warning indicating the computer configuring the sensor is not connected to the internet. Click <b>OK</b> to continue. OMEGA ENGINEERING recommends being connecting to the internet for all configurations. Not being connected to the internet will not prevent the sensor from being configured.</p> <p>To turn off this warning, go to the <b>Updates</b> Tab and click on the check box "Automatically upload configurations". Click on NO in the new window and the previous check box will become unchecked. WebCal™ will no longer attempt to connect to the internet. Clicking on the check box will restore this feature.</p>
Cannot access some of the features in Configuration	As choices are made in Configuration, the software will begin to eliminate functions that are no longer active. To reset Configuration or get access to all the features, click on the <b>Clear Screen</b> button.
Relay closes, but does not open again	An inductive kick may be holding the relay closed. If switching 24 VDC, use a diode that has been installed to act as a snubber (see page 25 and 26).
Relay chatters on and off repeatedly	Most likely the turbulence in the tank is causing the chatter. Increase the Hysteresis setting to correct.



## 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.

**OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. 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. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, 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(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,

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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