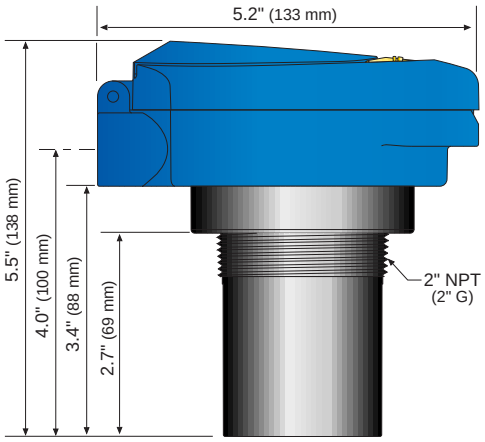
SPECIFICATIONS

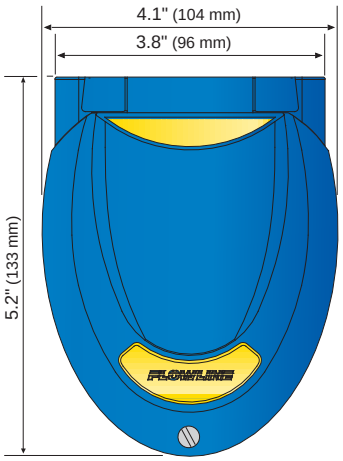
Step One

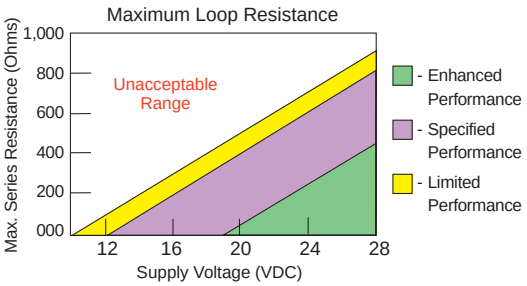
Range:	LU81: 4” to 16.4’ (10 cm to 5 m) LU83: 8” to 26.2’ (20 cm to 8 m) LU84: 12” to 32.8’ (30 cm to 10 m)
Accuracy:	+/- 0.2% of span in air
Resolution:	LU81: 0.039 (1 mm) LU83: 0.039 (1 mm) LU84: 0.078: (2 mm)
Beam width:	3” (7.6cm) dia.
Dead band	LU81: 4” (10cm) LU83: 8” (20cm) LU84” 12 (30cm)
Display type:	LCD, 6-digit
Display units:	Inch, cm or percentage
Display mode:	Air gap or liquid height
Memory:	Non-volatile
Supply voltage:	12- 28 VDC
Loop resist,:	500 Ohms @ 24 VDC
Signal output:	4 - 20 mA, two -wire
Signal invert:	4-20 mA, 20-4 mA
Calibration:	Push button
Fail-safety:	Selectable: 4 mA, 20 mA, 21 mA, 22 mA or hold last value
Process temp.:	F: -4° to 140° C: -20° to 60°
Temp comp,:	Automatic
Electronics temp.:	F: -40° to 160° C: -40° to 71°
Pressure:	30 psi (2 bar) @ 25 °C., derated @ 1.667 psi (113 bar) per °C, above 25 °C
Enclosure rating:	NEMA 4X (IP65)
Enclosure vent:	Water tight membrane
Encl. material:	PC/ABS FR
Trans. material:	PVDF
Process mount:	2” NPT (2” G)
Mount. gasket:	Viton®
Conduit entrance:	Dual, 1/2” NPT
Classification:	General purpose
CE compliance:	EN 61326 EMC

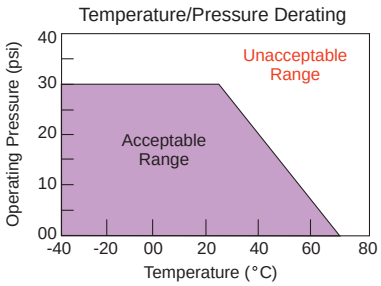
Side View

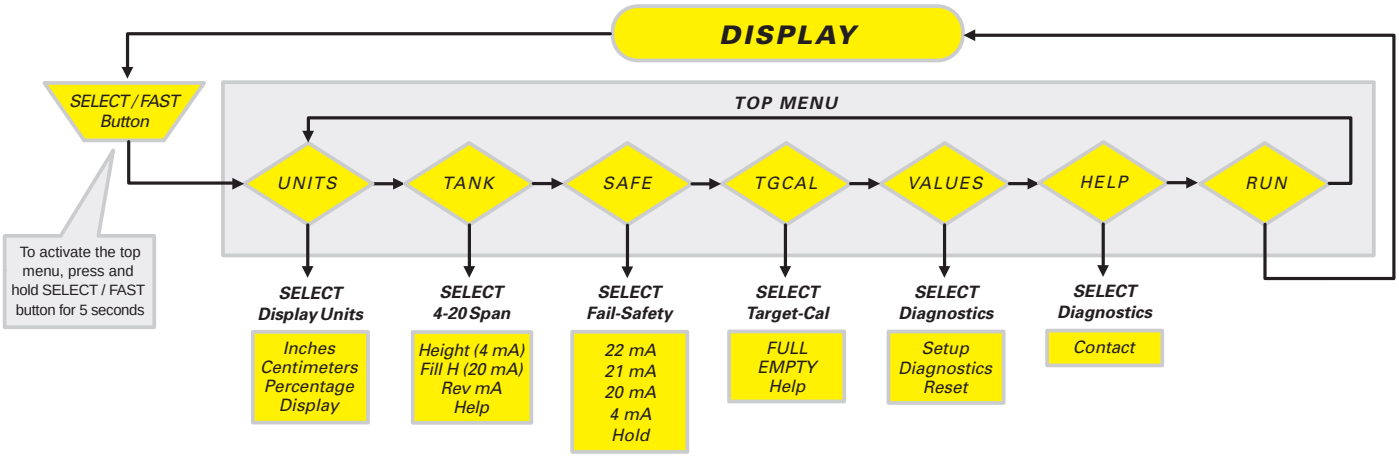


Top View









SAFETY

Step Two

⚠ **About this Manual:** PLEASE READ THE ENTIRE MANUAL PRIOR TO INSTALLING OR USING THIS PRODUCT. This manual includes information on the LU8_-51_1 Ultrasonic Level Transmitter from FLOWLINE. Please refer to the part number located on the transmitter label to verify the exact model configuration which you have purchased.

⚠ **User's Responsibility for Safety:** FLOWLINE 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 properly trained staff should install and/or repair this product. Install the transmitter with the Viton gasket and never overtighten the transmitter within the fitting. Always check for leaks prior to system start-up.

⚠ **Wiring and Electrical:** A supply voltage (loop power) of 12 -28 VDC is used to power the LU81/83/84 series. The sensor circuit should never exceed a maximum of 28 volts DC. Electrical wiring of the sensor should be performed in accordance with all applicable national, state, and local codes.

⚠ **Material Compatibility:** The LU8_ series enclosure is made of a flame retardant Polycarbonate (PC/ABS FR). The transducer is made of Polyvinylidene Fluoride (PVDF). Make sure that the model which you have selected is chemically compatible with the application media and it's environment.

⚠ **Enclosure:** While the transmitter housing is liquid-resistant the LU8_ series 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.

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

⚠ **Flammable, Explosive or Hazardous Applications:** Do not use the LU81/83/84 series of general purpose transmitters within classified hazardous environments.

⚠ ***Warning*** ⚠

Always use the Viton gasket when installing the LU8_-51_1 transmitter in its fitting, and always connect the shield wire to the common ground.

OVERVIEW

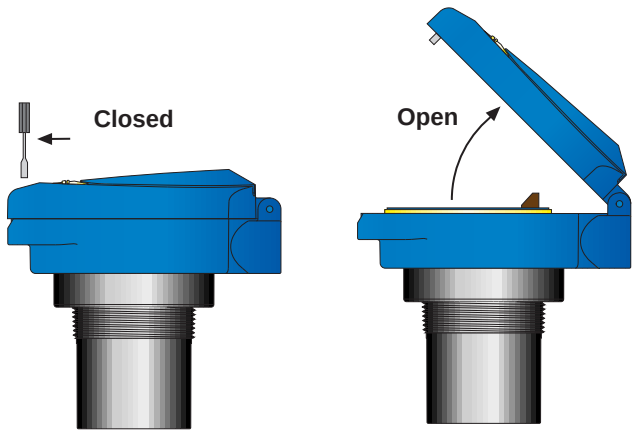
Step Three

A. Application: The general-purpose ultrasonic transmitter provides non-contact level detection up to 32.8' or 10m. The transmitter is well suited for a wide range of corrosive, waste and slurry type media, and is broadly selected for atmospheric bulk storage, day tank and waste sump applications.

B. Part Number: The part and serial numbers are located on the wrench flat. Check the part number on the product label and confirm which of the below model configurations you have purchased:

Part Number	Range	Supply	Mount
LU81-5101	16.4' (5 m)	12-28 VDC	2" NPT
LU81-5161	16.4' (5 m)	12-28 VDC	2" G
LU83-5101	26.2' (8 m)	12-28 VDC	2" NPT
LU83-5161	26.2' (8 m)	12-28 VDC	2" G
LU84-5101	32.2' (10 m)	12-28 VDC	2" NPT
LU84-5161	32.2' (10 m)	12-28 VDC	2" G

C. NEMA 4X Enclosure: The NEMA 4X (IP65) enclosure has a flip cover with two 1/2" NPT female conduit ports and an internal terminal strip for wiring. To open the enclosure, you will need a small small screwdriver. Insert the tool into the hole located at the top edge of the enclosure and turn counter-clockwide. Rotate the hinged cover up for 135° access to the faceplate screen and terminal strip.



Before closing the enclosure, make sure that the enclosure gasket is properly seated, and that any conduit fittings, liquid tight cable connectors and/or plugs are properly installed and sealed.

Handling Static-Sensitive Circuits/Devices

When handling the transmitter, the technician should follow these guidelines to reduce any possible electrostatic charge build-up on the technicians body and the electronic part.

1. *Always touch a known good ground source before handling the part. This should be repeated while handling the part and more frequently after sitting down from a standing position, sliding across the seat or walking a distance.*
2. *Avoid touching electrical terminals of the part unless making connections.*
3. *DO NOT open the unit cover until it is time to calibrate.*

PREPARATION

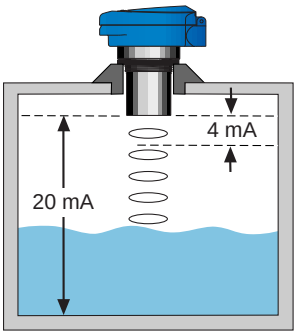
Step Four

A. Supply Voltage: The transmitter power supply voltage should never exceed a maximum of 28 VDC. Flowline controllers and meters have built-in 24 VDC power supplies for use with the transmitter. Alternative controllers and/or power supplies with a minimum output of 12 VDC may also be used with the transmitter for calibration and/or operation.

B. Cable Length: The cable length between the transmitter and it's point of termination may be extended up to a maximum of 1000 feet, using a well-insulated, shielded wire from 14 to 18 gauge.

C. Factory Span: All transmitter models are factory calibrated with 4 mA at their maximum range (tank empty) and 20 mA at their minimum range (tank full). **For optimum measurement performance up to 32' or 10m, model LU84-51_1 should be calibrated with 4 mA at it's minimum range (tank full) and 20 mA at it's maximum range (tank empty).** The 4 and 20 mA span set points can be reverse calibrated on all models.

LU84-51_1
Reverse Mode

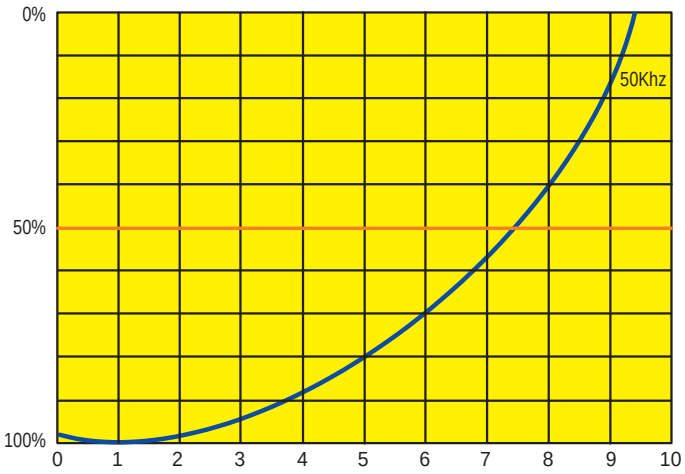


D. Maximum Applied Range: The Individual or cumulative effects of agitation, vapor or foam can reduce the overall quality of signal return and shorten the maximum applied range of the transmitter. To determine the maximum applied range of the transmitter in your application, refer to the below derating chart.

Maximum Applied Range Derating Chart

LU81/83/84-51_1

Agitation = 1-3 @ 50 kHz
Vapor = 3-5 @ 50 kHz
Foam = 4-6 @ 50 kHz



MENU ITEMS

Step Five

A. WARMUP: This is the initial power up mode. When this message is displayed, the transmitter is going through its power up routine, and validating the target value. After a short period of time, this message will disappear and be replaced by a numeric value.

B. FULL: Level has reached the programmed FULL set point.

C. EMPTY: Level has reached the programmed EMPTY set point

D. UNITS: Selectable in Inches Centimeters or Percent. The factory default is Inches.

E. INCHES: Inch units of measurement.

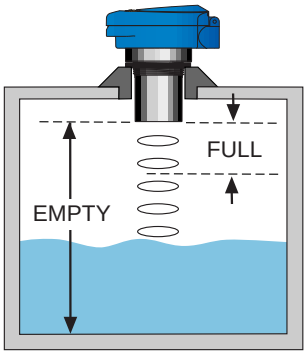
F. CM: Centimeters units of measurement.

G. PERCNT: 0-100% units of measurement. Percent is the calculated value based on the 4mA and 20mA set points.

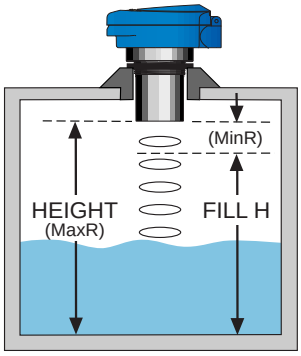
H. DISPLAY: Allows the user to select if the display will read in units of air or units of liquid. Factory default is units of air.

H. TANK: Menu through which the 4-20 mA span is adjusted.

I. HEIGHT: The point in inches or centimeters from the transducer face where the output will be 4 mA (generally the bottom of the tank). Factory default is the same as the unit's maximum range. Example: LU81 = 197" maximum range which is also the same 4 mA set point under factory default.



J. Fill H (Fill Height): The point in inches or centimeters from the bottom of the tank to the high level where the output will be 20 mA (generally the straight wall distance from the bottom of the tank). NOTE: The transmitter dead band is automatically subtracted from the FILL H. Example: LU81 = 4" dead band. Therefore the maximum FILL H is 197" [maximum range] - 4" [dead band] = 193".



K. REV mA (Reverse mA): Allows the user to select 20 mA at the bottom and 4 mA at the top of the tank (20-4 mA). Factory default is 4 mA (MaxR) at the bottom and 20 mA (MinR) at the top.

L. SAFE: The FAIL-SAFE current output of the transmitter if the acoustic signal is LOST. Selectable at 4 mA, 20 mA, 21 mA, 22 mA or HOLD. (HOLD is the last 4-20 mA value prior to LOST).

M. TG CAL: Allows the user to use an unknown distance for setting of the 4 mA and 20 mA span.

MENU ITEMS

Step Six

N. FULL: Target calibration technique that allows the user to enter the present distance from the transducer face to the liquid or a reflective target as the 20 mA (FULL) set point

O. EMPTY: Target calibration technique that allows the user to enter the present distance from the transducer face to the liquid or a reflective target as the 4 mA (EMPTY) set point.

P. WAIT: Indicates that you have selected either FULL or EMPTY and the transmitter is calculating the distance value.

Q. VALUES: Allow the user to view the present calibration settings that are programmed in the transmitter.

R. SETUP: Displays the present calibration settings such as UNITS, MinR, MaxR, and SAFE.

S. MINR: The lesser distance from the transducer to the full tank height of liquid.

T. MAXR: The greater distance from the transducer to the empty tank height of liquid.

U. RESET: Allows the user to reset the transmitter to its original factory default settings.

V. DIAG (Diagnostics): Allows the user to view the present values of LEVEL, TEMP, ECHO, POWER, MOUNT and VER.

W. LEVEL: Displays the current Inch, Centimeter or Percent measured value.

X. TEMP: Displays the temperature in the vessel at the transducer.

Y. ECHO: Displays the present acoustic signal strength.

Z. POWER: Displays the present acoustic power level

AA. MOUNT: Displays either QUIET (no fitting noise) or NOISY (potential fitting noise), If NOISY with transmitter performance issues, please contact Flowline to discuss your installation.

BB. VER (VERSION): Displays the transmitter software version.

CC. DONE: Indicates that the new value has been saved in memory (after depressing the SELECT/FAST key).

DD. ERROR: Indicates that the new value has NOT been saved in memory (after depressing the SELECT/FAST or EXIT key).

EE. RUN: When displayed, if the user depresses the SELECT/FAST key, the transmitter will exit the programming mode and return to the RUN mode for normal operation.

FF. UP / DOWN: Increases or decreases the SET 20 and SET 4 display values in the programming mode. NOTE: Simultaneously holding down the SELECT/FAST button while pressing the UP or DOWN button will increase the speed of the display.

PROGRAMMING

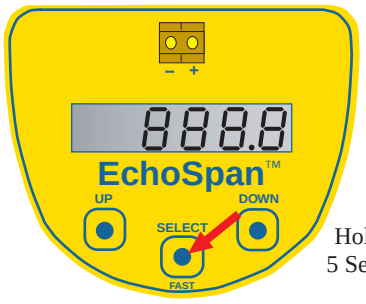
Step Seven

A. Introduction: The transmitter has two modes, RUN and PROGRAM. In the RUN mode, the transmitter is operational and the display will indicate the liquid height in inches, centimeters or percent.

In the PROGRAM mode, the display will indicate the selected mode of calibration. The transmitter arrives from the factory with its settings at 4 mA = maximum range and 20 mA = minimum range (defined by the dead band or minimum measurement distance). The transmitter is programmed with it's built-in display and three button keyboard. **Under normal application circumstances, users typically program the HEIGHT distance value, FILL H distance value and FAIL-SAFE mode.**

B. Entering the Program Mode: Press and hold the SELECT/FAST button for approximately 5 seconds until the display changes from a numeric value to PROG, indicating that you have entered the PROG mode.

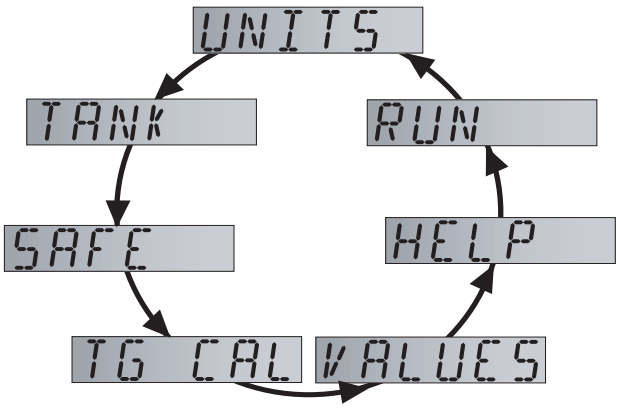
Note: When PROG mode is active, the EchoSpan will hold the last current value. The value will not change until the transmitter is returned to RUN Mode.



Hold for 5 Seconds

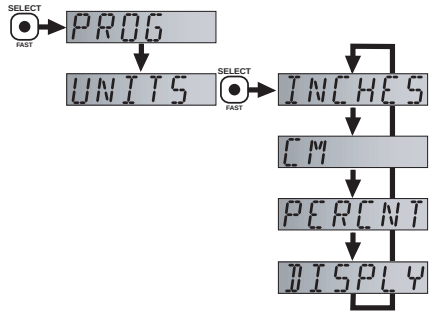
After entering the PROG mode, the display will scroll through the top menu, alternately flashing UNITS, TANK, SAFE, TG CAL, VALUES, HELP and RUN.

Top Menu



Step Eight

C. Programming UNITS: To change UNITS from INCHES to CM or PERCENT.

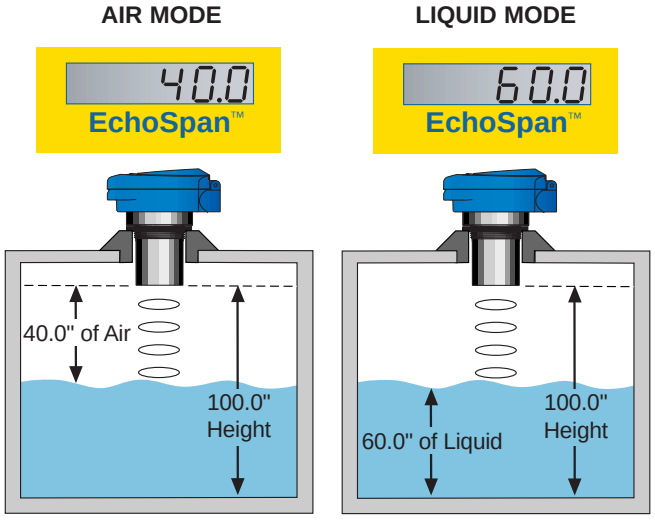


1. Press the SELECT/FAST button and hold it for 5 seconds until PROG appears.
2. When UNITS appears, press the SELECT/FAST button. The display will rotate between INCHES, CM, PERCENT and DISPLAY.
3. Press the SELECT/FAST button when the UNITS you want (INCHES, CM or PERCENT) appear. The display will then display SAVED.

You have successfully changed the UNITS function.

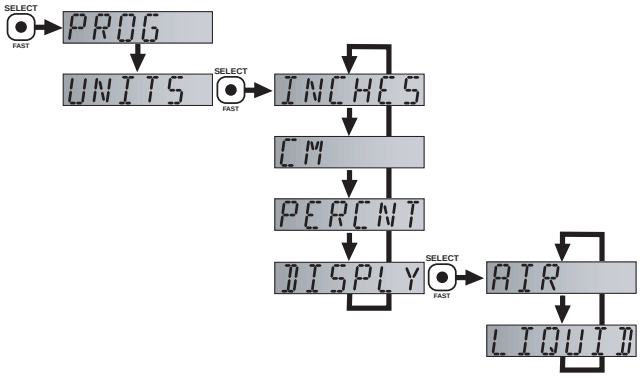
Note: *Percent units can only be selected after the transmitters Height (4 mA) and Fill H (20 mA) set points have been programmed. Therefore initial programming should always be done in INCH or CM UNITS.*

D. Display Mode: The transmitter is factory set such that the display reads the distance from the bottom of the transmitter to the liquid surface. This is also referred to as the Air distance (Air Mode). As the level of liquid increases, the display will decrease and vice versa. Conversely, the transmitter may be set to read the actual height of liquid in the tank (Liquid Mode). Below, a tank height of 100" will display 40.0, which represents 40.0" of air in the AIR Mode. In the Liquid Mode, the display will change to 60.0, which represents 60.0" of liquid.



Step Nine

E. Change Display Mode: To change the display to indicate the height of liquid, follow the instructions below:



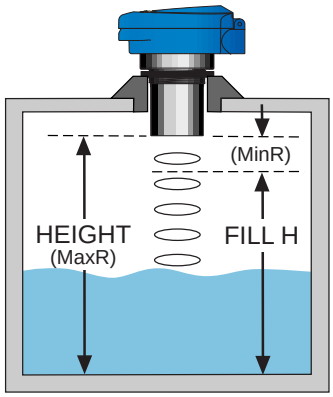
1. Press the SELECT/FAST button and hold it for 5 seconds until PROG appears.
2. When UNITS appears, press the SELECT/FAST button. The display will rotate between INCHES, CM, PERCENT and DISPLAY.
3. When DISPLAY appears, press the SELECT/FAST button. The display will rotate between AIR or LIQUID.
4. When LIQUID appears, press the SELECT/FAST button.

You have successfully programmed the LIQUID mode.

F. Programming Off Tank: If you know the dimensions of your tank, you may input the 4 mA and 20 mA set points manually without performing target calibration (requiring you to raise and lower the liquid level). To do so, review the following:

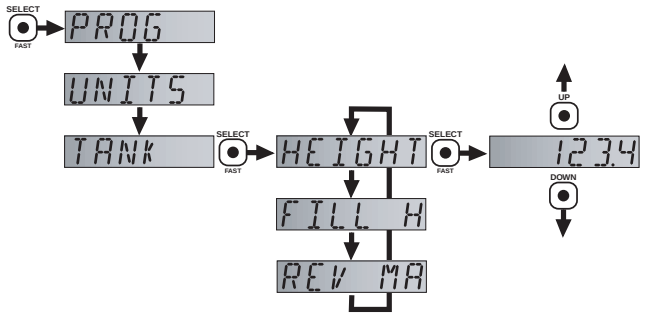
HEIGHT: The point in inches or centimeters from the transducer face where the output will be 4 mA (generally the bottom of the tank). Factory default is the same as the unit's maximum range. Example LU81 = 197" maximum range which is also the same 4 mA set point under factory default.

FILL H: The point in inches or centimeters from the bottom of the tank to the high level where the output will be 20 mA (generally the straight wall distance from the bottom of the tank). NOTE: The transmitter dead band is automatically subtracted from the FILL H. Example: LU81 = 4" dead band. Therefore the maximum FILL H is 197" [maximum range] - 4" [dead band] = 193".



Step Ten

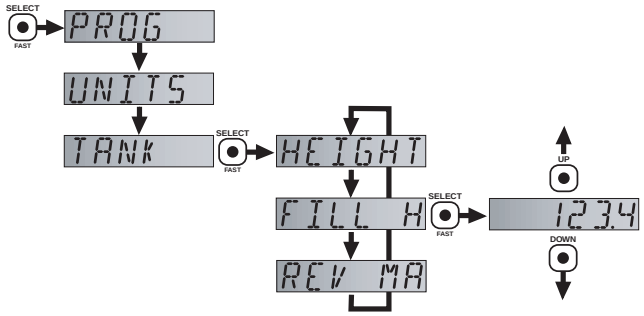
G. Programming HEIGHT: To change HEIGHT 4 mA value.



1. Press the SELECT/FAST button and hold it for 5 seconds until PROG appears.
2. When TANK appears, press the SELECT/FAST button. The display will rotate between HEIGHT, FILL H and REV mA.
3. When HEIGHT appears, press the SELECT/FAST button. The display will show a decimal reading in the selected UNITS.
4. Press the UP/DOWN buttons to increase or decrease this value to the distance from the transducer face to the bottom of the tank. NOTE: Simultaneously holding down the SELECT/FAST button while pressing the UP or DOWN button will increase the speed of the display.
5. When you have reached the desired value, press SELECT/FAST to SAVE.

You have successfully programmed the HEIGHT or 4 mA value.

H. Programming FILL H: To change FILL H 20 mA value.



1. Press the SELECT/FAST button and hold it for 5 seconds until PROG appears.
2. When TANK appears, press the SELECT/FAST button. The display will rotate between HEIGHT, FILL H and REV mA.
3. When FULL H appears, press the SELECT/FAST button. The display will show a decimal reading in the selected UNITS.
4. Press the UP/DOWN buttons to increase or decrease this value to the distance from the bottom of the vessel to the full point (typically the straight wall height).
5. When you have reached the desired value, press SELECT/FAST to SAVE it.

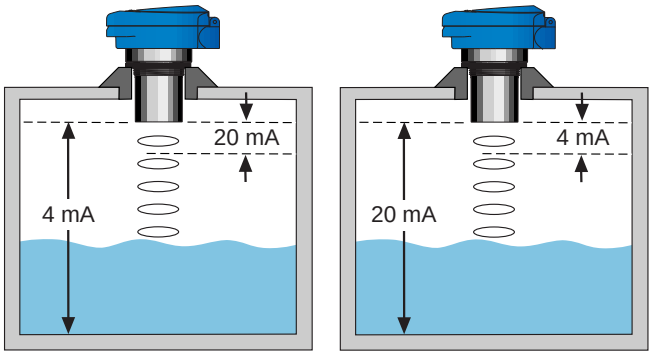
You have successfully programmed the FILL H or 20mA value.

NOTE: *You can increase the speed at which the display changes by pressing the SELECT/FAST button while simultaneously holding down the UP or DOWN button.*

PROGRAMMING

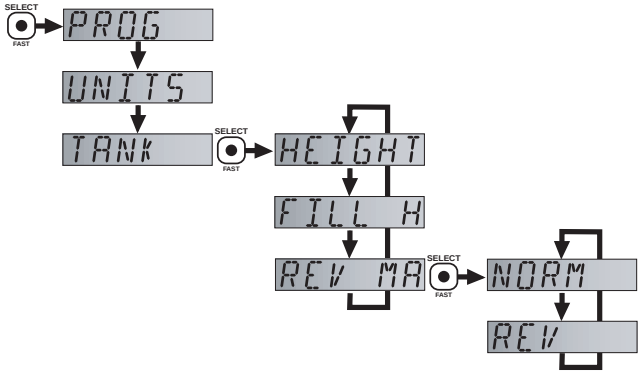
Step Eleven

I. Programming REV mA (Optional): In factory default, the transmitter operates with 4 mA at the maximum range (MaxR), and 20 mA at the dead band (MinR). Using the menu item REV mA, you can change the unit to reverse this to 20 mA at the furthest distance (MaxR) and 4 mA at the closest distance (MinR).



Normal mA Mode
MaxR (4 mA) set at empty tank and MinR (20 mA) set at full tank.

Reverse mA Mode
MaxR (20 mA) set at empty tank and MinR (4 mA) set at full tank.



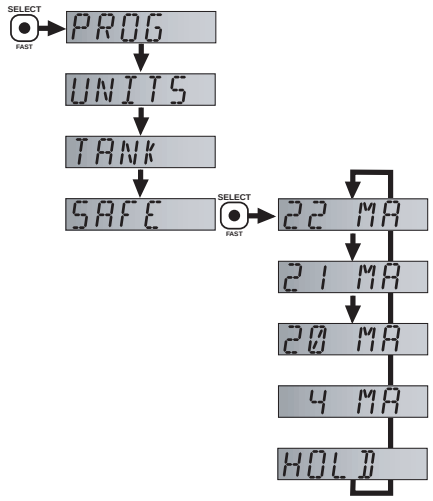
NOTE: *You must set HEIGHT and FULL R prior to reversing the 4 and 20 mA. Regardless of which mode you are in (Norm or Rev), changes to the HEIGHT or FULL R are always with respect to the original settings programmed.*

NOTE: *Any changes to the HEIGHT will effect the FULL R value. The FULL R will stay at the same physical level in the tank. An increase to the HEIGHT value will result in an equal increase to the FULL R value. A decrease to the HEIGHT value will result in an equal decrease to the FULL R value.*

PROGRAMMING

Step Twelve

J. Programming SAFE Mode: To change SAFE mode.



1. Press the SELECT/FAST button and hold it for 5 seconds until PROG appears.
2. When SAFE appears, press the SELECT/FAST button.
3. The display will now rotate through 22mA, 21mA, 20mA, 4mA and HOLD. When you reach the desired setting, press the SELECT/FAST button to SAVE it..

You have successfully programmed the SAFE mode.

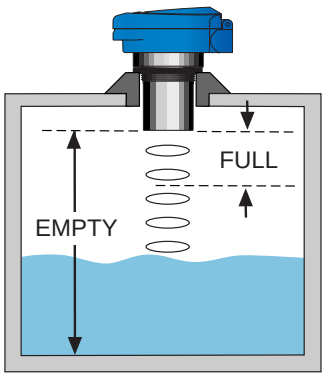
K. Programming Target Calibration (Optional): The transmitter's 4 mA and 20 mA set points can be target calibrated ON the tank by raising and lowering the liquid level, or OFF the tank using the distance to a flat reflective target such as a wall. Generally, target calibration is done ON the tank. To do so, follow the EMPTY and FULL tank programming steps on the next page.

***NOTE:** A transmitter installed on a tank operating in the factory default RUN mode will display the distance from the bottom of the sensor to the liquid surface. The value will decrease as the tank is filled or increase as the tank is emptied. Make sure that you do not overflow the tank or completely empty the tank while moving the liquid level to the desired high or low set point distance for target calibration.*

TG CAL: Allows the user to use an unknown distance for setting of the 4 mA and 20 mA span.

FULL: Target calibration technique that allows the user to enter the present distance from the transducer face to the liquid or a reflective target as the 20 mA (FULL) set point

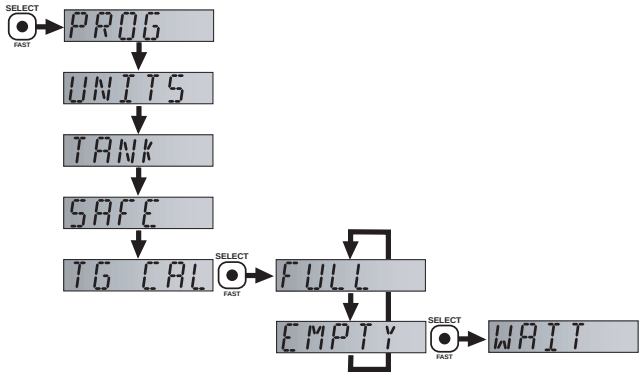
EMPTY: Target calibration technique that allows the user to enter the present distance from the transducer face to the liquid or a reflective target as the 4 mA (EMPTY) set point.



PROGRAMMING

Step Thirteen

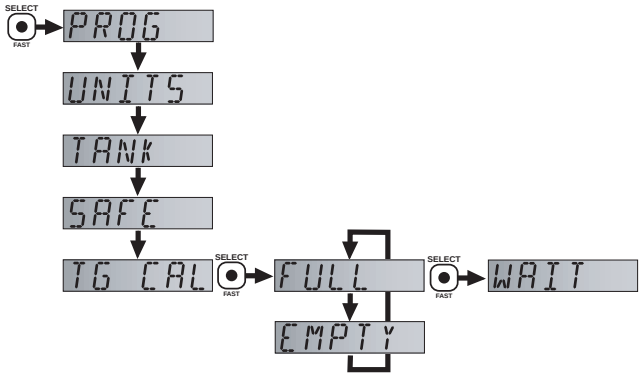
L. Programming TG CAL EMPTY Tank: With the tank EMPTY or the liquid in a low level state, apply power to the transmitter. Begin programming after WARMUP.



1. Press the SELECT/FAST button and hold it for 5 seconds until PROG appears.
2. When TG CAL appears, press the SELECT/FAST button. The display will rotate between FULL and EMPTY.
3. When EMPTY appears, press the SELECT/FAST button. WAIT will be displayed followed by SAVED.

You have successfully programmed the EMPTY or 4 mA value.

M. Programming TG CAL FULL Tank: With the tank FULL, or the liquid in a high level state, apply power to the transmitter. Begin programming after WARMUP.



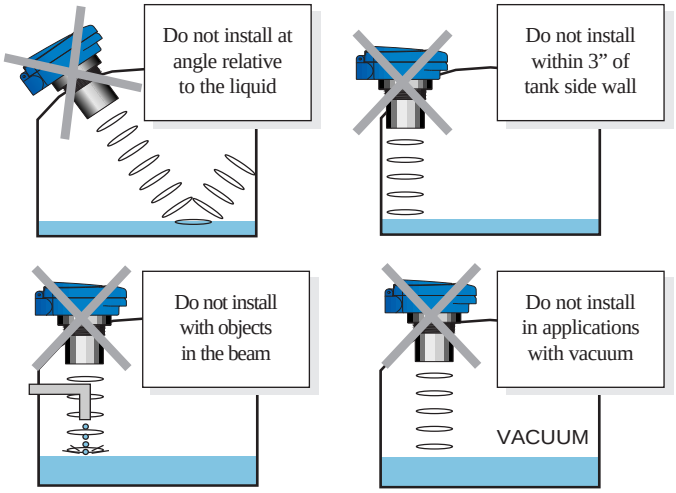
1. Press the SELECT/FAST button and hold it for 5 seconds until PROG appears.
2. When TGCAL appears, press the SELECT/FAST button. The display will rotate between FULL and EMPTY.
3. When FULL appears, press the SELECT/FAST button, WAIT will be displayed followed by SAVED.

You have successfully programmed the FULL or 20 mA value.

***Note:** The display will now indicate LEVEL height in the RUN mode.*

INSTALLATION

Step Fourteen

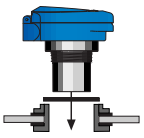


⚠ Warning ⚠

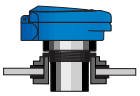
Flowline Ultrasonic transmitters have been optimized for use in non-metallic fittings. For best performance, avoid the use of metal fittings.

Install the appropriate installation fitting. Make sure that the fitting and transmitter threads are not damaged or worn. Install the transmitter with the included Viton mounting gasket. Hand tighten the transmitter within the fitting. Perform an installed leak test under normal process conditions prior to system start up.

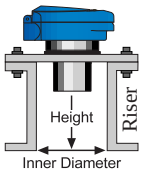
Gasket



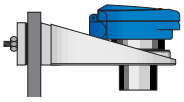
Adapter



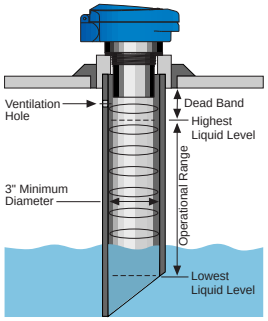
Flange



Bracket



Stand Pipe



A. Fitting Selection: Check the transmitter part number to determine the required 2" fitting thread type. The transmitter is commonly installed in tank adapters, flanges, brackets or stand pipes.

1. **Adapter:** Select a tank adapter fitting with minimal height so as to ensure that the installed transducer will not be substantially elevated into the fitting. Avoid tank adapter styles with threads and/or pipe stops forward of the installed transducer.

2. **Flange:** Tall flanges with narrow risers impede the acoustic signal. Select a fitting with the right riser height versus inner diameter geometry. The transmitter may be elevated up to 12" (30 cm) in a 6" (15 cm) riser, 8" (20 cm) in a 4" (10 cm) riser and 3" (7.6 cm) in a 2" (5 cm) riser. ***For risers greater than 12", use the Flowline EchoDucer, LU43 series.***

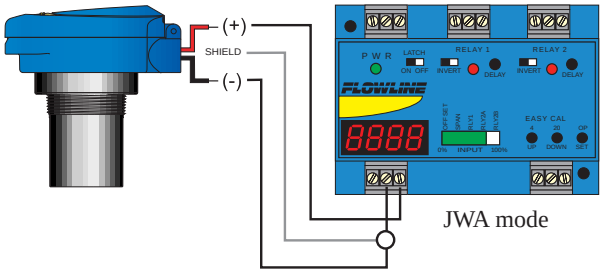
3. Bracket: The LM50-1001 bracket or equivalent can be used for open tank top installations against the side wall.

4. Stand Pipe: A stand pipe may be used to dampen turbulence or separate surface foam. Select a minimum 3" pipe for the stand pipe. The pipe length should run the measurement span. Cut a 45° notch at the bottom of the pipe and drill a 1/4" pressure equalization hole high in the dead band.

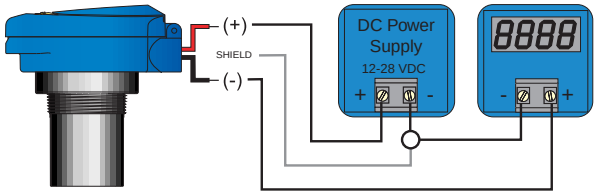
WIRING

Step Fifteen

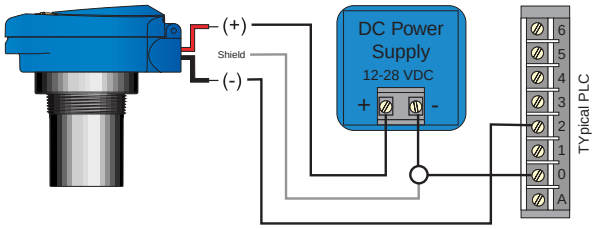
A. Wiring to a FLOWLINE LC52-1001 Controller



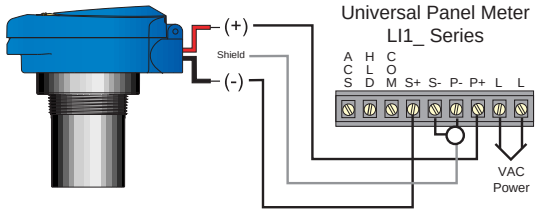
B. Wiring to a Typical Two-Wire Loop Powered Indicator



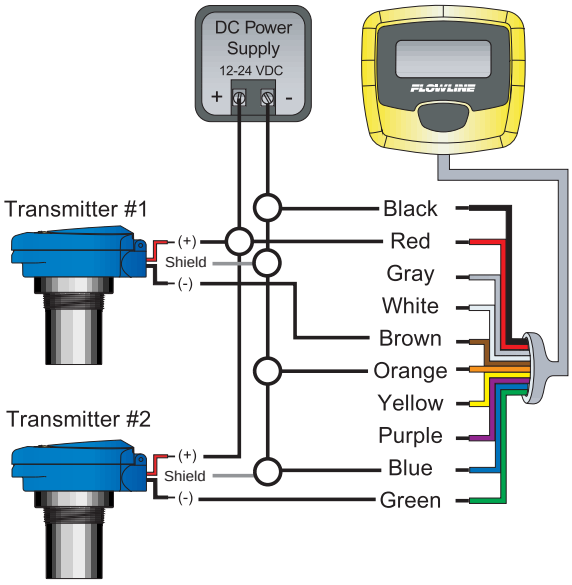
C. Wiring to a Typical Programmable Logic Controller



D. Wiring to a Flowline LI1_-1001 Universal Panel Meter



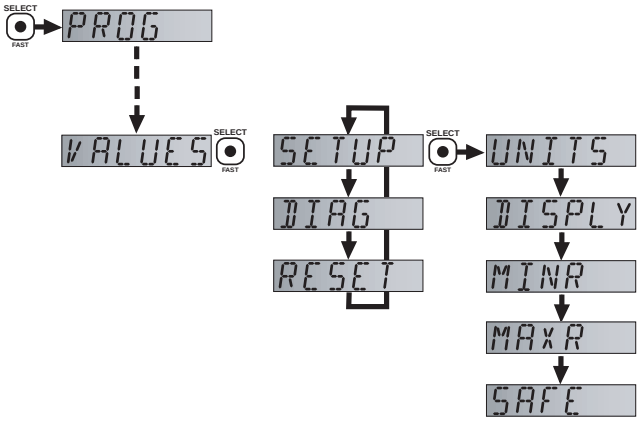
E. Wiring to a Flowline LI42-1001 MicroPoint Indicator



TROUBLESHOOTING

Step Sixteen

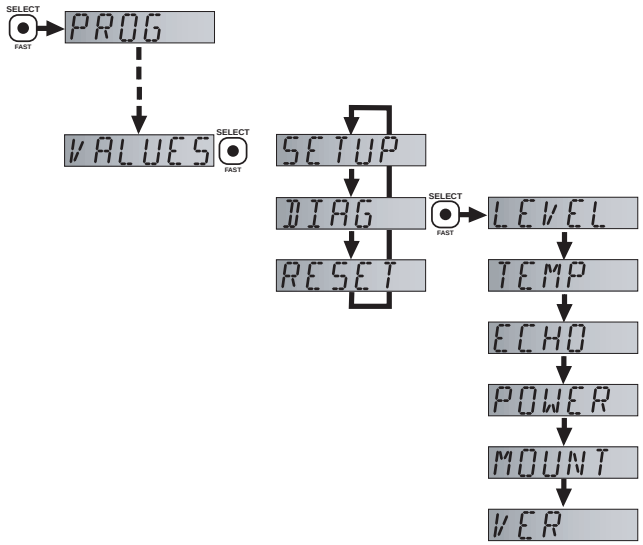
A. Viewing Programmed VALUES:



1. Press the SELECT/FAST button and hold it for 5 seconds until PROG appears.
2. When VALUES appears, press the SELECT/FAST button. The display will rotate between SETUP, DIAG and RESET.
3. When SETUP appears, press the SELECT/FAST button. You will now begin viewing calibration settings (UNITS, Display, MinR, MaxR and SAFE) that are programmed in the transmitter.

When complete the display will revert back to the VALUES menu.

B. Viewing DIAGNOSTICS:



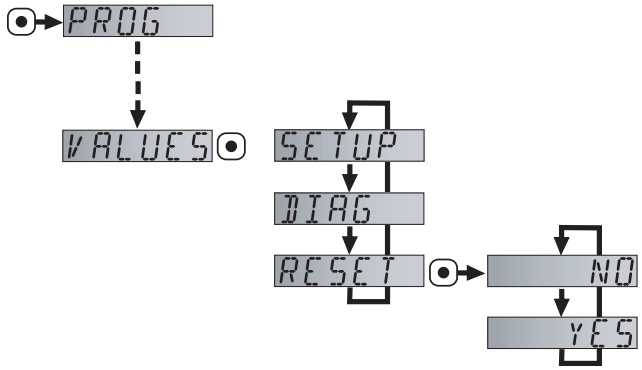
1. Press the SELECT/FAST button and hold it for 5 seconds until PROG appears.
2. When VALUES appears, press the SELECT/FAST button. The display will rotate between SETUP, DIAG and RESET.
3. When DIAG appears, press the SELECT/FAST button. You will now begin viewing diagnostic values (LEVEL, TEMP ECHO, POWER, MOUNT and VER) that may be relevant to the transmitter and it's performance in your application.

When complete the display will revert back to the VALUES menu.

TROUBLESHOOTING

Step Seventeen

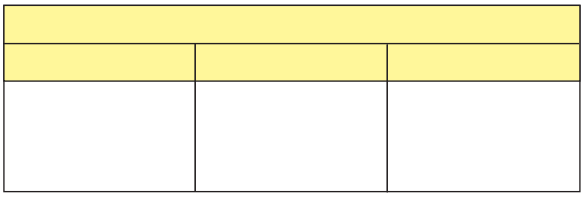
C. Factory RESET:



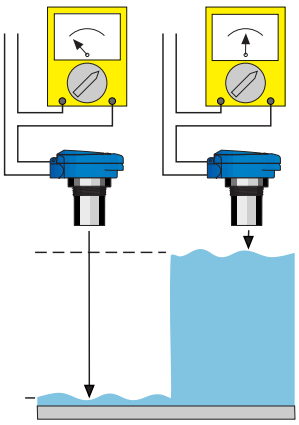
1. Press the SELECT/FAST button and hold it for 5 seconds until PROG appears.
2. When VALUES appears, press the SELECT/FAST button. The display will rotate between SETUP, DIAG and RESET.
3. When RESET appears, press the SELECT/FAST button. The display will rotate between YES or NO.
4. When YES appears, press the SELECT/FAST button.

Note: *FACTORY RESET resets the transmitter back to its original factory default settings: (20 mA = Minimum Range, 4mA = Maximum Range and SAFE = 22mA).*

D. Testing the Transmitter



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



4. Write down the information in DIAGNOSTICS (LEVEL, TEMP ECHO, POWER, MOUNT and VER) and have it ready when you contact your Flowline representative.