EchoSwitch II
Manual – MN300650
Revision B

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Preface
This manual explains how to use the EchoSwitch II, LU74, LU77 and LU78 series controller.

Warranty, Service & Repair
To register your product with the manufacturer, go to the Flowline website for on-line registration.
The website address is as follows:

www.flowline.com

On-line Warranty Registration can be found under Contact Us in the Navigation Bar along the side of the home page.

If for some reason your product must be returned for factory service, go to the Flowline website to receive a Material Return Authorization number (MRA), providing the following information:

1. Full Part Number, Full Serial Number
2. Name and telephone number of someone who can answer technical questions related to the product and its application.
3. Return Shipping Address
4. Brief Description of the Symptom
5. Brief Description of the Application

On-line Material Return Authorization can be found under Contact Us in the Navigation Bar along the side of the home page. Click on *Return Authorization* to begin the MRA request. Once you have received a MRA number, ship the product prepaid in its original packing to:

Flowline Factory Service
MRA_____
10500 Humbolt Street
Los Alamitos, CA 90720

To avoid delays in processing your repair, write the MRA on the shipping label. Please include the information about the malfunction with your product. This information enables our service technicians to process your repair order as quickly as possible.

Warranty

Flowline warrants to the original purchaser of its products that such products will be free from defects in material and workmanship under normal use and service in accordance with instructions furnished by Flowline for a period, which is equal to the shorter of one year from the date of purchase of such products or two years from the date of manufacture of such products. Flowline's obligation under this warranty is solely and exclusively limited to the repair or replacement, at Flowline's option, of the products or components, which Flowline's examination determines to its satisfaction to be defective in material or workmanship within the warranty period. Flowline must be notified pursuant to the instructions below of any claim under this warranty within thirty (30) days of any claimed lack of conformity of the product. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original warranty period.

Returns

Products cannot be returned to Flowline without Flowline's prior authorization. To return a product that is thought to be defective, go to www.flowline.com, and submit a customer return (MRA) request form and follow the instructions therein. All warranty and non-warranty product returns to Flowline must be shipped prepaid and insured. Flowline will not be responsible for any products lost or damaged in shipment.

Limitations

This warranty does not apply to products which: 1) are beyond the warranty period or are products for which the original purchaser does not follow the warranty procedures outlined above; 2) have been subjected to electrical, mechanical or chemical damage due to improper, accidental or negligent use; 3) have been modified or altered; 4) anyone other than service personnel authorized by Flowline have attempted to repair; 5) have been involved in accidents or natural disasters; or 6) are damaged during return shipment to Flowline. Flowline reserves the right to unilaterally waive this warranty and dispose of any product returned to Flowline where: 1) there is evidence of a potentially hazardous material present with the product; or 2) the product has remained unclaimed at Flowline for more than 30 days after Flowline has dutifully requested disposition. This warranty contains the sole express warranty made by Flowline in connection with its products. ALL IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION, THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY DISCLAIMED. The remedies of repair or replacement as stated above are the exclusive remedies for the breach of this warranty. IN NO EVENT SHALL FLOWLINE BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND INCLUDING PERSONAL OR REAL PROPERTY OR FOR INJURY TO ANY PERSON. THIS WARRANTY CONSTITUTES THE FINAL, COMPLETE AND EXCLUSIVE STATEMENT OF WARRANTY TERMS AND NO PERSON IS AUTHORIZED TO MAKE ANY OTHER WARRANTIES OR REPRESENTATIONS ON BEHALF OF FLOWLINE. This warranty will be interpreted pursuant to the laws of the State of California. If any portion of this warranty is held to be invalid or unenforceable for any reason, such finding will not invalidate any other provision of this warranty.

Introduction:

The EchoSwitch II is a general-purpose ultrasonic level switch that provides the end user the ability to control up to three unique devices (pump, valves and/or alarms) through an advanced non-contact technology. EchoSwitch II features push button configuration that uses real engineering values for setting up the relay operation(s). Each relay is a SPDT Form "C" contact rated at 60 VA, 1A max and can be sued as an alarm set point (1 level for ON and Hysteresis) or as pump or valve set points (1 level for ON and a separate level for OFF).

New Features

- Simple digital push button configuration, ***no more target calibration***.
- Pump simplex, duplex and triplex option.
- Integrated timer for pump / valve delay and pump alternation.
- Available in a 3m (9.8'), 5.5m (18.0') or 8m (26.2') maximum range.

Table of Contents

About this Manual:

PLEASE READ THE ENTIRE MANUAL PRIOR TO INSTALLING OR USING THIS PRODUCT. This manual includes information on the EchoSwitch II series Ultrasonic Level Switch from FLOWLINE. 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:

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 switch with the included Viton gasket and never over tighten the switch within the fitting. Always check for leaks prior to system start-up.

Wiring and Electrical:

A supply voltage of 95-250 VAC is used to power the EchoSwitch II. Electrical wiring of the switch 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 switch housing is liquid-resistant the EchoSwitch II 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.

The enclosure has a flip cover with dual 1/2" NPT female conduit ports and an internal terminal strip for wiring. To open the enclosure, you will need a small insertion tool such as a screwdriver. Loosen the locking screw located at the top front of the enclosure. Rotate the hinged cover up for 135° access to the faceplate and terminal strips. Before closing the enclosure, make sure that the enclosure gasket is properly seated, and that any conduit fittings, cable connectors or plugs are installed correctly 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 technician's 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.

Make a Fail-Safe System:

Design a fail-safe system that accommodates the possibility of switch and/or power failure. FLOWLINE recommends the use of redundant backup systems and alarms in addition to the primary system.

The switch has (3) relay channels. Each relay is a SPDT (single pole, double throw) type rated at 60 VA, 1A Max. Normally open (NO) or normally closed (NC) operation is user selected based on the desired system control and fail-safe logic. Always design a fail-safe system that accommodates for the possibility of relay and/or power failure. The "normal" relay state is where the relay coil is de-energized and the Red relay LED is OFF. Therefore, if power is cut OFF to the switch it will de-energize the relay. Make sure that the de-energized state is the safe state in your system design. As such, if switch power is lost, a pump will turn OFF if it is connected to the normally open side of the relay.

Flammable, Explosive or Hazardous Applications:

EchoSwitch II should not be used within classified hazardous environments.

Warning:

Always use the Viton gasket when installing the EchoSwitch II, and make sure that all electrical wiring of the switch is in accordance with applicable codes.

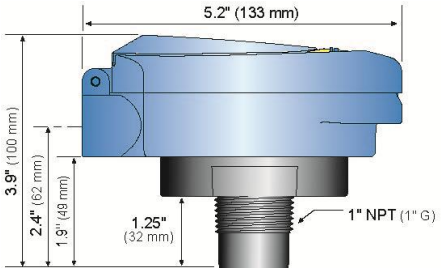
Specifications:

Range:	LU74: 8" to 18.0' (20 cm to 5.5m) LU77: 4" to 9.8' (10 cm to 3m) LU78: 8" to 26.2' (20 cm to 8m)
Repeatability:	0.25" (6.35 mm)
Effective Beam width:	3" (7.6 cm) dia.
Dead band:	LU74: 8” (20 cm) LU77: 4” (10 cm) LU78: 8” (20 cm)
LCD indication:	Level and relay status
Configuration:	Push button, digital (3)
Supply voltage:	95-250 VAC
Contact type:	(3) SPDT relays
Contact rating:	60 VA, 1A max
Contact fail-safety:	Programmable / selectable

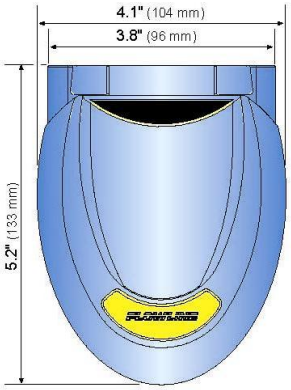
Temp. comp.:	Automatic
Electronics temp.:	F: -40° to 140° C: -40° to 60°
Pressure:	MWP = 30 PSI
Enclosure rating:	NEMA 4X (IP65)
Enclosure vent:	Water tight membrane
Encl. material:	Polycarbonate
Encl. hardware:	Brass and stainless
Trans. material:	PVDF
Process mount:	LU74: 2” NPT (G) LU77: 1” NPT (G) LU78: 2” NPT (G)
Mount. gasket:	Viton®
Conduit entrance:	Dual, 1/2” NPT
Classification:	General purpose
Compliance:	RoHS
Approvals:	CE

Dimensions:

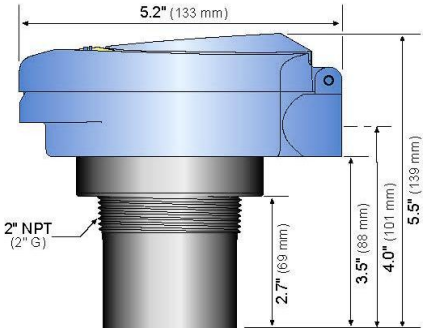
Side View
LU77 Series



Top View
All Models



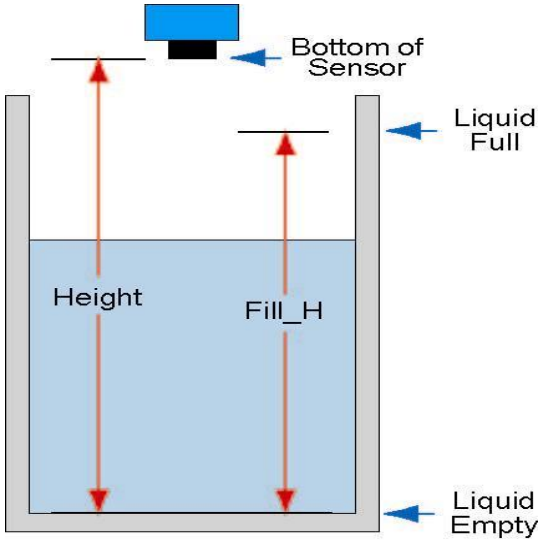
Side View
LU74 & LU78 Series

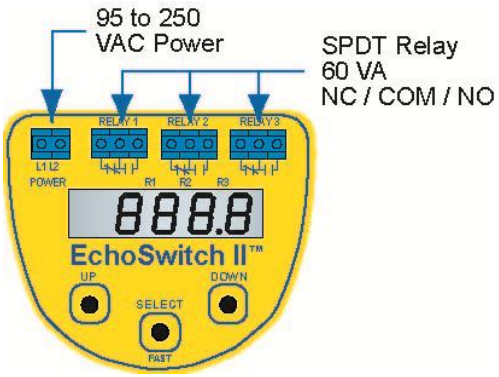


Getting Started:

EchoSwitch II can be configured before installation. The switch features non-volatile memory, so the set points configured before installation will not be lost when the switch is powered down. To start, all you need is the following information:

- Basic Tank Information
  - HEIGHT – Distance from the transducer face to the bottom of the tank.
  - FILL-H – Maximum fill height of the liquid from the bottom of the tank.
- Set Points:
  - You will need the measured distance from the bottom of the tank to each set point. These values will all be in the same distance value (inches, centimeters, feet or meters) and will all be measured from the bottom of the tank.
- Power:
  - Provide input power to the EchoSwitch II.



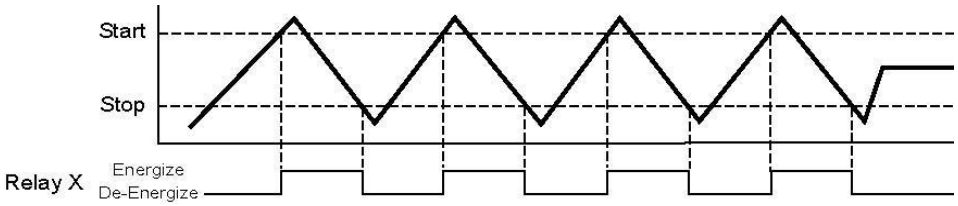


Getting around:

EchoSwitch II is configured by the use of three push buttons (UP, DOWN and SELECT) and a LCD display. As a lockout feature, the buttons are inactive until the SELECT button is held down for 5 seconds, and then the display will begin to scroll through the top level of the configuration menu.

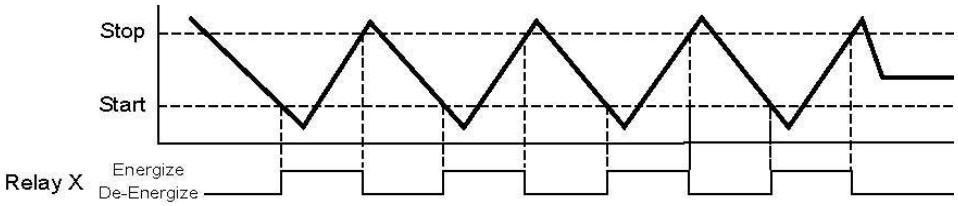
Top Level

- The Configuration menu will continue to scroll through the items below until the **SELECT** button is pressed.
- **UNITS – TANK – RELAY 1 – RELAY 2 – RELAY 3 – SAFE – (*MPLEX*) - HELP - RUN**
- To return to the Operational mode of EchoSwitch, press SELECT while RUN appears in the display.
- **UNITS** – Allows end user to select the units for configuration and operation. Select between Inches, Centimeters, Feet, Meters or Percent. Press EXIT to return to the Top Level menu.
- **TANK** – Allows the end user to configure the operational range for the switch.
    - **HEIGHT** – Distance from the transducer face to the bottom of the tank.
    - **FILL-H** – Maximum fill height of the liquid from the bottom of the tank.
    - Press Exit to return to the Top level Menu
    - Note: if UNITS is set to Percent, then TANK will not appear. To view TANK, set UNITS to any of the following: Inches, Centimeters, Feet or Meters
- **RELAY 1, 2 or 3** – Allows end user to configure the function and operation of each relay. Each relay has a small black circle that appears when the relay is energized. When the relay is de-energized, the black circle disappears.
    - **PUMP** – Pump operation allows for two separate level set points (Relay ON and Relay OFF). Choose between the EMPTY or FILL operation. Both operations require setting a level for ON and another level for OFF
        - **EMPTY** – used to control a pump that empties a tank.



Typically, Relay ON is the HIGH set point and Relay OFF the LOW set point. Relay will energize at the high set point (ON) and remain on until the level reaches the low set point (OFF) and will remain off until the level returns to the high set point (ON).

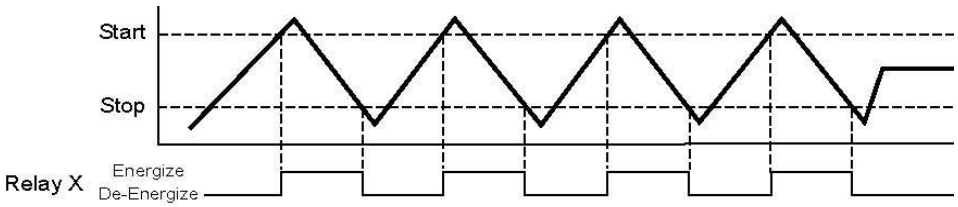
        - **FILL** – used to control a pump that fills a tank.



Typically, Relay ON is the LOW set point and Relay OFF the HIGH set point. Relay will energize at the low set point (ON) and remain on until the level reaches the high set point (OFF) and will remain off until the level returns to the low set point (ON).

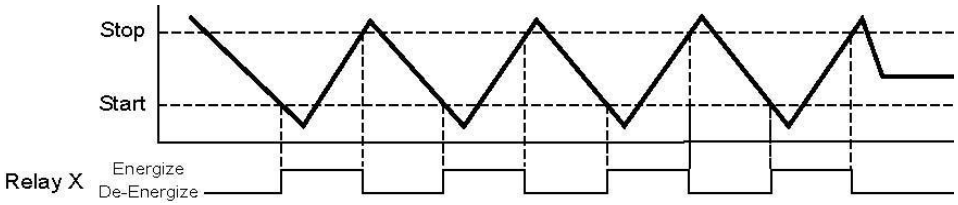
- **DELAY** – used as a start pump delay when the ON setting is reached. The delay pump (in seconds) will delay the start of the value for this period.

- **VALVE** – Valve operation allows for two separate level set points (Relay ON and Relay OFF). Choose between the EMPTY or FILL operation. Both operations require setting a level for ON and another level for OFF
  - **EMPTY** – used to control a valve that empties a tank.



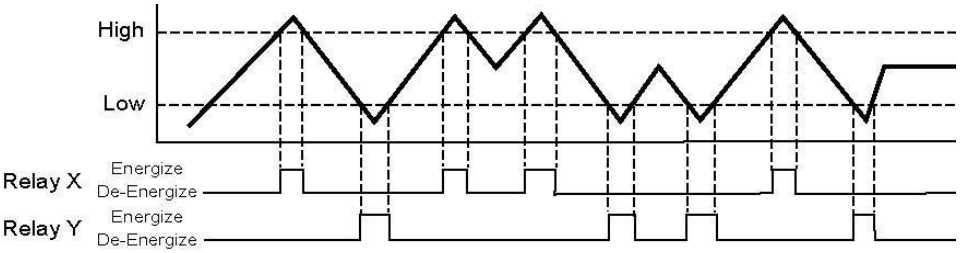
Typically, Relay ON is the HIGH set point and Relay OFF the LOW set point. Relay will energize at the high set point (ON) and remain on until the level reaches the low set point (OFF) and will remain off until the level returns to the high set point (ON).

  - **FILL** – used to control a valve that fills a tank.



  - Typically, Relay ON is the LOW set point and Relay OFF the HIGH set point. Relay will energize at the low set point (ON) and remain on until the level reaches the high set point (OFF) and will remain off until the level returns to the low set point (ON).
  - DELAY – used as a start valve delay when the ON setting is reached. The delay value (in seconds) will delay the start of the value for this period.

- **ALARM** – Alarm operation allows for a single set point (Relay ON and OFF at the same level). Choose between HIGH and LOW operation. Both operations will require a single set point and a setting for the Hysteresis (HYSTER)



  - **HIGH** – used to control a High Level alarm. Relay will energize (ON) when the level is above the setting and will de-energize (OFF) when the level falls below the setting plus the added distance from the hysteresis (HYSTER).

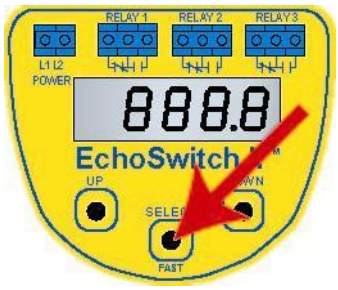
        - **LOW** – used to control a Low Level alarm. Relay will energize (ON) when the level is below the setting and will de-energize (OFF) when the level rises above the setting plus the added distance from the hysteresis (HYSTER).
        - **HYSTER** – Used to reduce chatter by creating a hysteresis or differential for the Alarm set point. The HYSTER value will adjust the OFF position of the Alarm setting by the HYSTER value.
- **SAFE** – Each relay can be individually configured to its independent fail-safe setting. Choose between ON, OFF or HOLD
    - **ON** – Energizes the relay when a fail-safe condition occurs
    - **OFF** – De-energizes the relay when a fail-safe condition occurs
    - **HOLD** – Keeps the relay in its current state when a fail-safe condition occurs
- **M-PLEX** – when two or three relays are configured as pumps, they can be inter–connected to alternate between each cycle. M-PLEX is only available when 2 or more relays are set for pumps. M-PLEX will not appear when only 1 relay is set for a pump or when the relay functions do not match (ex: Relay 1 set for a filling pump and Relay 2 set for an emptying pump). Selecting NO-ALT will turn OFF the M-PLEX.
- **HELP** – Provides setup information, the ability to reset the EchoSwitch II and a simulation mode to test the relay function
    - **SETUP** – Will display the setting for all functions of EchoSwitch II
    - **RESET** – Will reset the EchoSwitch II back to its original factory setting
    - **SIM-T** – SIM(ulation)-T(est) will allow the end user to simulate changes to level to verify the relay settings. Using the UP and DOWN buttons will increase
    - **TEST P** – This is a production test feature used by the factory to confirm operation. ***This mode should only be used when supervised by a Flowline representative.***
- **RUN** – Returns the unit to normal measurement and control mode

Feature Guide

FEATURE	ACCESS BY
Easy to use MENU	Press and hold SELECT key until MENU is displayed approximately 5 seconds. The menu items will rotate through display, press SELECT to change an item.
Many UNITS of measurement.	In the MENU mode, press select when UNITS is display, then select INCHES, CM (centimeter), FEET, METERS or PERCENT.
No cumbersome measure required. Set point distances are relative to the tank bottom.	In MENU mode, select the TANK item and set the HEIGHT of the tank from the transducer face to the bottom of the tank. Set the Fill Height (FILL-H) to the maximum fill height of the liquid from the bottom of the tank. Now all of the set points are from the bottom of the tank up.
Easy PUMP programming	In MENU mode, when the relay you wish to program is showing, press SELECT, then select PUMP, then FILL or EMPTY, then set the ON or OFF points. The DELAY is a start pump delay used in batch processing applications.
DELAY Pump turn on.	In MENU mode, select relay and set the pump actions desired, when the DELAY menu item is displayed press and set the turn on delay time in seconds. The pump will now delay after the set point is reached before turn on.
Easy ALARM programming	In MENU mode, when the relay you wish to program is showing, press SELECT, then when ALARM appears select it, then select HIGH or LOW, then set the ON point. The hysteresis (HYSTER) sets the OFF point the distance set in HYSTER away form the ON point.
Easy ALTERNATE with DUPLEX and TRIPLEX pumps	Just program the least two relays as pumps and the M-PLEX menu item will appear in the top menu, select it and then select either NO ALT (No alternation), DUPLEX (two pumps) or TRIPLEX (three pumps). Note you can have three pumps programmed and only duplex two of them. This is useful during servicing.
TIMED BASED ALTERNATE pumps	In MENU mode, program at least two relays as pumps and select M-PLEX menu. Select either DUPLEX or TRIPLEX and then select A-TIME. Change the values (in hours) to the time you which the pumps to alternate. The cycle-by-cycle alternation will be disabled and the time base will take over.

How to enter the MENU

1. Press and hold SELECT key (approximately 5 seconds) until MENU is displayed.
2. The menu items will rotate through display.
3. Press SELECT to change an item.



How to configure UNITS

1. In the MENU mode, press select when UNITS is display.
2. Press SELECT to choose between INCHES, CM (centimeter), FEET, METERS or PERCENT.
3. Select EXIT to return to the Top Level Menu.

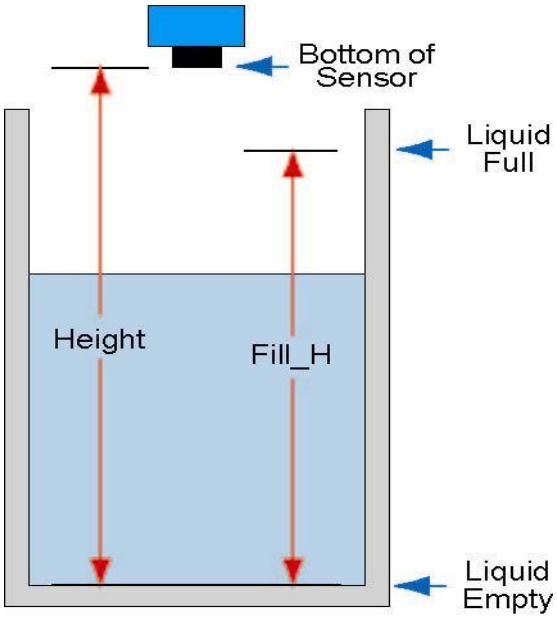
Note: Reading the level of liquid in Percent

- Flowline recommends that when selecting PERCENT, configure the Height and Fill_H settings before selecting PERCENT in order to span the EchoSwitch II for your application requirements.
- When in PERCENT, the operational span will be based upon the last TANK settings, typically the factory settings for Height and Fill_H.

EchoSwitch II	Height	Fill_H
LU74 Series	216.5” (550cm)	208.5” (529.7cm)
LU77 Series	118.1” (300 cm)	114.1” (289.8cm)
LU78 Series	315.0” (800 cm)	307.0” (779.7 cm)

- When PERCENT is selected, the TANK settings (Height and Fill_H) will be disabled.

How to configure the Operational range of EchoSwitch II



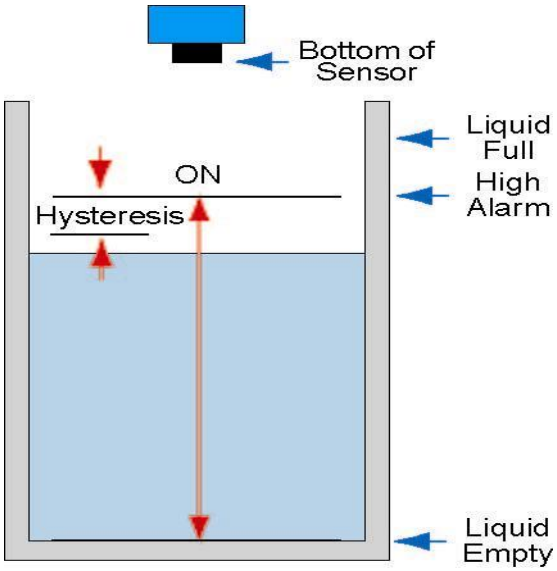
No cumbersome measurement is required via Target Calibration to establish set points. Set point distances are relative to the tank bottom

1. In MENU mode, select the TANK item
2. Select HEIGHT.
3. Using the UP and DOWN buttons, set the HEIGHT of tank from the transducer face to the bottom of the tank.
4. To enter the value, press and hold SELECT (Approximately 2 seconds) until SAVED is displayed.
5. When FILL-H appears, press SELECT.
6. Using the UP and DOWN buttons, set the fill Height (FILL-H) to the maximum fill height of the liquid from the bottom of the tank.
7. Press and hold SELECT (2 seconds) to enter the value.
8. Select EXIT to return to Top Level Menu.

Note:

- Flowline recommends that when selecting PERCENT, configure the Height and Fill H settings before selecting PERCENT in order to span the EchoSwitch II for your application requirements.
- When PERCENT is selected, the TANK settings (Height and Fill_H) will be disabled.

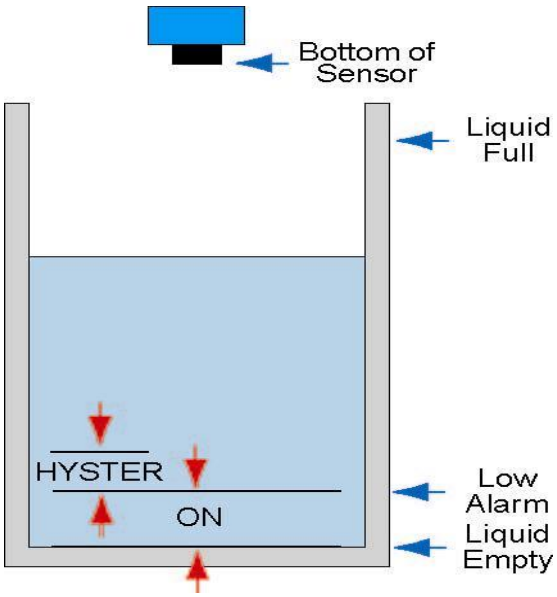
How to set a HIGH ALARM



Note: *The hysteresis (HYSTER) setting can be used to eliminate chattering of the relay.*

1. In MENU mode, when the relay you wish to program is appears, press SELECT.
2. When ALARM appears, press SELECT.
3. When HIGH appears, press SELECT.
4. Using the UP and DOWN buttons, set the HIGH (ON) point for the relay.
5. To enter the value, press and hold SELECT (Approximately 2 seconds) until SAVED is displayed.
6. When HYSTER appears, press SELECT.
7. Hysteresis [HYSTER] is the distance away from the original ON setting where the Alarm will turn OFF.
8. Using the UP and DOWN buttons, set the HYSTER (OFF) set point for the relay.
9. Press and hold SELECT (2 seconds) to enter the value.
10. Select EXIT to return to Top Level Menu.

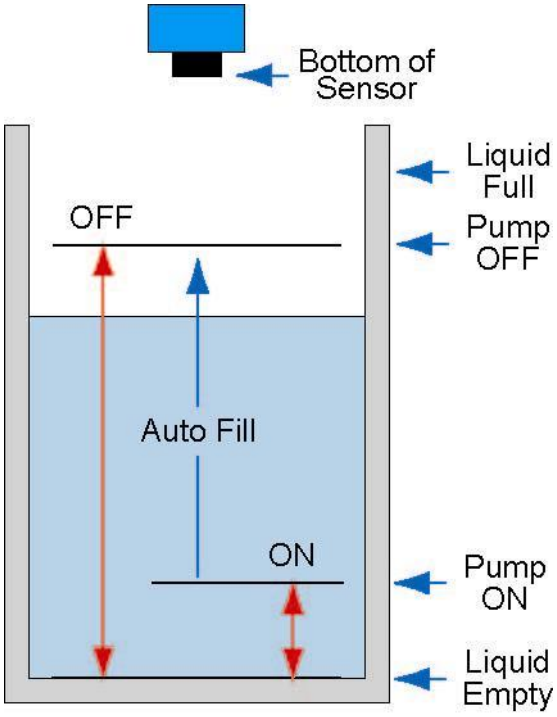
How to set a LOW ALARM



Note: *The hysteresis (HYSTER) setting can be used to eliminate chattering of the relay.*

1. In MENU mode, when the relay you wish to program is appears, press SELECT.
2. When ALARM appears, press SELECT.
3. When LOW appears, press SELECT.
4. Using the UP and DOWN buttons, set the LOW (ON) set point for the relay.
5. To enter the value, press and hold SELECT (Approximately 2 seconds) until SAVED is displayed.
6. When HYSTER appears, press SELECT.
7. Hysteresis [HYSTER] is the distance away from the original ON setting where the Alarm will turn OFF.
8. Using the UP and DOWN buttons, set the HYSTER (OFF) set point for the relay.
9. Press and hold SELECT (2 seconds) to enter the value.
10. Select EXIT to return to Top Level Menu.

How to Fill a tank/vessel with a pump.

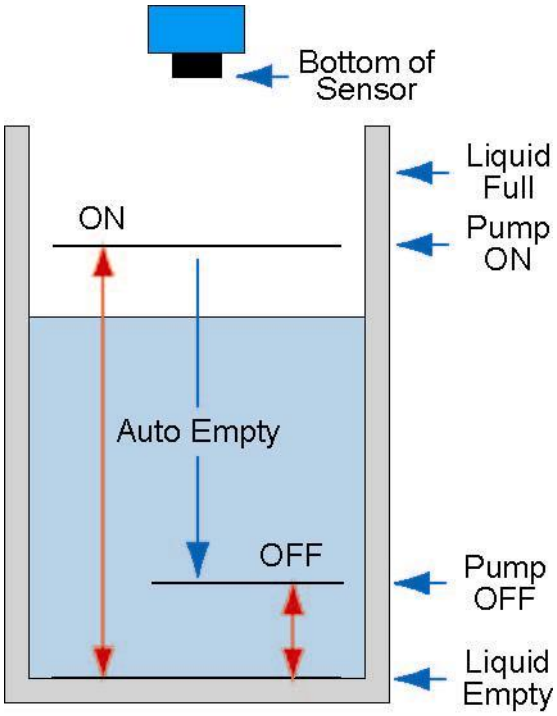


1. In MENU mode, when the relay you wish to program is appears, press SELECT.
2. When PUMP appears, press SELECT.
3. When FILL appears, press SELECT.
4. When ON appears, press SELECT.
5. Using the UP and DOWN buttons, set the ON set point for the relay. The ON setting is always the level where the relay will energize and will be the lower level between the two set points.
6. To enter the value, press and hold SELECT (Approximately 2 seconds) until SAVED is displayed.
7. When OFF appears, press SELECT.
8. Using the UP and DOWN buttons, set the OFF set point for the relay. The OFF setting is always the level where the relay will de-energize and will be the higher level between the two set points.
9. Press and hold SELECT (2 seconds) to enter the value.

If you want to add a delay when the PUMP starts, continue on to step 10. If no delay is required, jump to step 13.

10. When DELAY appears, press SELECT.
11. Using the UP and DOWN buttons, set the DELAY time in seconds. Pump delay can be set from 0 to 600 seconds.
12. Press and hold SELECT (2 seconds) to enter the value.
13. Select EXIT to return to Top Level Menu.

How to Empty a tank/vessel with a pump.

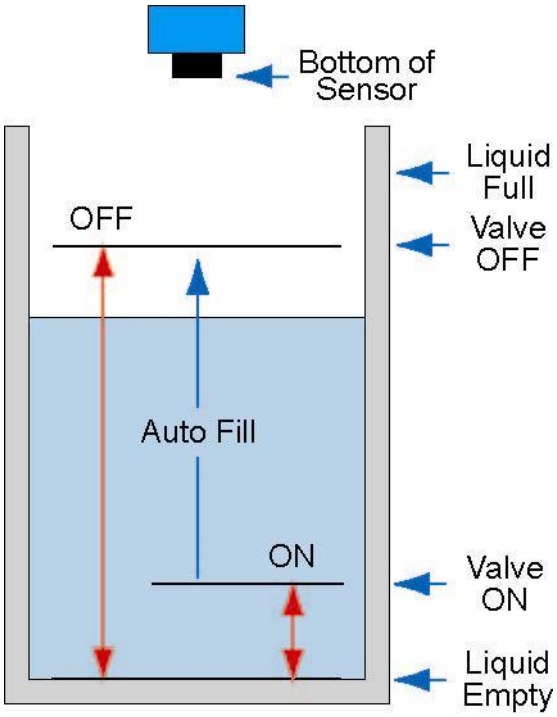


1. In MENU mode, when the relay you wish to program is appears, press SELECT.
2. When PUMP appears, press SELECT.
3. When EMPTY appears, press SELECT.
4. When ON appears, press SELECT.
5. Using the UP and DOWN buttons, set the ON set point for the relay. The ON setting is always the level where the relay will energize and will be the higher level between the two set points.
6. To enter the value, press and hold SELECT (Approximately 2 seconds) until SAVED is displayed.
7. When OFF appears, press SELECT.
8. Using the UP and DOWN buttons, set the OFF set point for the relay. The OFF setting is always the level where the relay will de-energize and will be the lower level between the two set points.
9. Press and hold SELECT (2 seconds) to enter the value.

If you want to add a delay when the PUMP starts, continue on to step 10. If no delay is required, jump to step 13.

10. When DELAY appears, press SELECT.
11. Using the UP and DOWN buttons, set the DELAY time in seconds. Pump delay can be set from 0 to 600 seconds.
12. Press and hold SELECT (2 seconds) to enter the value.
13. Select EXIT to return to Top Level Menu.

How to Fill a tank/vessel with a valve.

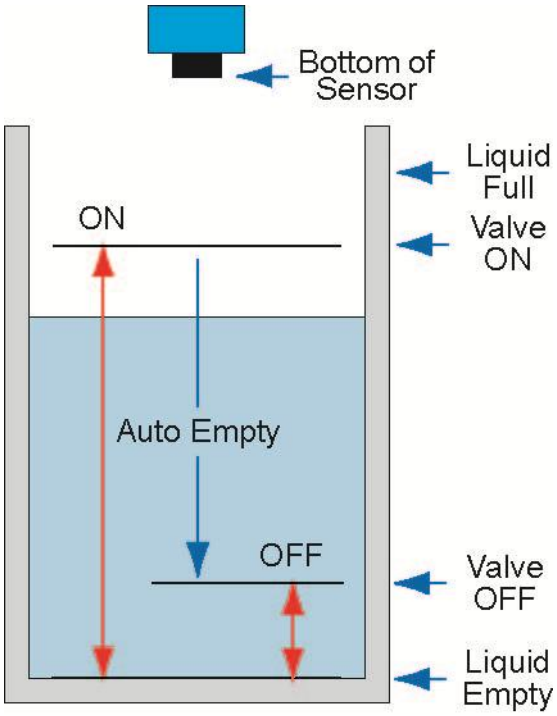


1. In MENU mode, when the relay you wish to program is appears, press SELECT.
2. When VALVE appears, press SELECT.
3. When FILL appears, press SELECT.
4. When ON appears, press SELECT.
5. Using the UP and DOWN buttons, set the ON set point for the relay. The ON setting is always the level where the relay will energize and will be the lower level between the two set points.
6. To enter the value, press and hold SELECT (Approximately 2 seconds) until SAVED is displayed.
7. When OFF appears, press SELECT.
8. Using the UP and DOWN buttons, set the OFF set point for the relay. The OFF setting is always the level where the relay will de-energize and will be the higher level between the two set points.
9. Press and hold SELECT (2 seconds) to enter the value.

If you want to add a delay when the VALVE starts, continue on to step 10. If no delay is required, jump to step 13.

10. When DELAY appears, press SELECT.
11. Using the UP and DOWN buttons, set the DELAY time in seconds. Valve delay can be set from 0 to 600 seconds.
11. Press and hold SELECT (2 seconds) to enter the value.
12. Select EXIT to return to Top Level Menu.

How to Empty a tank/vessel with a valve.



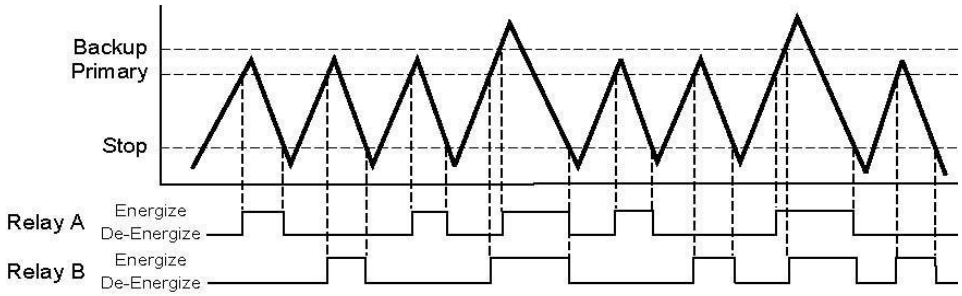
1. In MENU mode, when the relay you wish to program is appears, press SELECT.
2. When VALVE appears, press SELECT.
3. When EMPTY appears, press SELECT.
4. When ON appears, press SELECT.
5. Using the UP and DOWN buttons, set the ON set point for the relay. The ON setting is always the level where the relay will energize and will be the higher level between the two set points.
6. To enter the value, press and hold SELECT (Approximately 2 seconds) until SAVED is displayed.
7. When OFF appears, press SELECT.
8. Using the UP and DOWN buttons, set the OFF set point for the relay. The OFF setting is always the level where the relay will de-energize and will be the lower level between the two set points.
9. Press and hold SELECT (2 seconds) to enter the value.

If you want to add a delay when the VALVE starts, continue on to step 10. If no delay is required, jump to step 13.

10. When DELAY appears, press SELECT.
11. Using the UP and DOWN buttons, set the DELAY time in seconds. Valve delay can be set from 0 to 600 seconds.
12. Press and hold SELECT (2 seconds) to enter the value.
13. Select EXIT to return to Top Level Menu.

How to Duplex two relays

Duplex enables EchoSwitch II to use two relays to alternate after each cycle while performing a lead-lag operation. To begin, configure two relays in the same mode (ex: two relays are set as PUMPs that FILL or two relays set as PUMPs that EMPTY). Be sure to set one relay with an ON Set Point at the Primary Level and the other relay ON Set Point at the Backup Level. Setting the relays with the same ON level will have cause both relays to turn on at the same time. Once this is completed, see the steps below. Example below shows two relays (A and B) used to Auto Empty a tank:



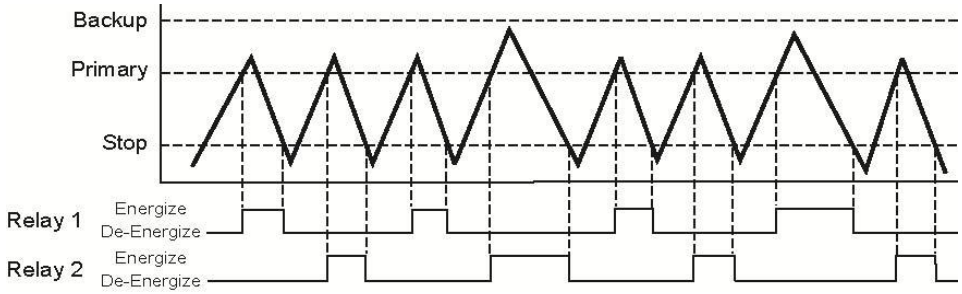
1. Make sure at least two relays are in the same mode for pumps. If this is not true, then M-PLEX will not appear.
2. When M-PLEX appears, press SELECT.
3. When DUPLEX appears, press SELECT.

If three relays are configures in the same mode, continue to step 4. If not, jump to step 5.

4. EchoSwitch II will allow you to select which two of three relays you would like to duplex. When the correct combination of relays (R1_R2, R2_R3 or R1_R3) is shown, press SELECT.
5. Select EXIT to return to Top Level Menu.

How to Alternate two relays

Alternate enables EchoSwitch II to use two relays to alternate after each cycle. The configuration of Alternate is identical to Duplex with the exception of the Backup level is at a setting where the level will never achieve set point. To begin, configure two relays in the same mode (ex: two relays are set as PUMPs that FILL or two relays set as PUMPs that EMPTY). Be sure to set one relay with an ON Set Point at the Primary Level and the other relay ON Set Point at the Backup Level. Setting the relays with the same ON level will have cause both relays to turn on at the same time. The Backup level must be set to a level out of range (level will never reach this setting). Once this is completed, see the steps below. Example below shows two relays (A and B) used to Auto Empty a tank:



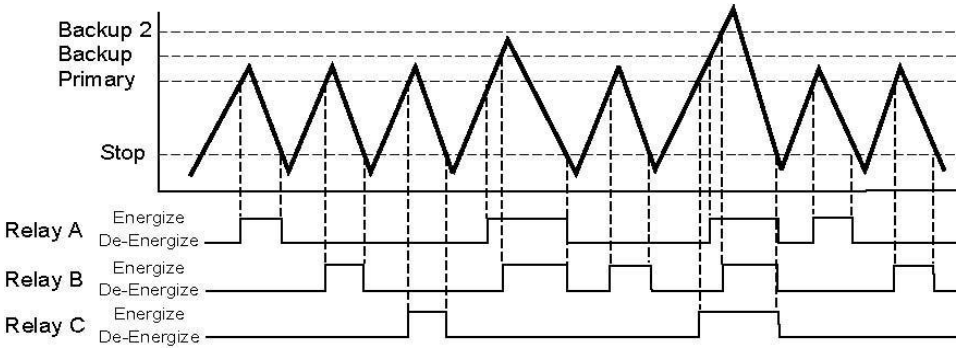
1. Make sure at least two relays are in the same mode for pumps. If this is not true, then M-PLEX will not appear.
2. When M-PLEX appears, press SELECT.
3. When DUPLEX appears, press SELECT.

If three relays are configures in the same mode, continue to step 4. If not, jump to step 5.

4. EchoSwitch II will allow you to select which two of three relays you would like to duplex. When the correct combination of relays (R1_R2, R2_R3 or R1_R3) is shown, press SELECT.
5. Select EXIT to return to Top Level Menu.

How to Triplex three relays

Triplex enables EchoSwitch II to use three relays to alternate after each cycle while performing a lead lag-lag operation. To begin, configure all three relays in the same mode (ex: all relays are set as PUMPs that FILL or all relays set as PUMPs that EMPTY). Be sure to set all three relay with different ON Set Point, one for Primary, one for Backup and the other for Backup 2). Setting all three relays with the same ON level will have cause the relays to all turn on at the same time. Example below shows three relays (A, B and C) used to Auto Empty a tank:



1. Make sure all three relays are in the same mode. If this is not true, then TRIPLX will not appear.
2. When M-PLEX appears, press SELECT.
3. When TRIPLX appears, press SELECT.
4. Select EXIT to return to Top Level Menu.

How to turn off M-PLEX (DUPLEX or TRIPLEX).

1. When M-PLEX appears, press SELECT.
2. When NO ALT appears, press SELECT.
3. Select EXIT to return to Top Level Menu.

How to Time Alternate relays

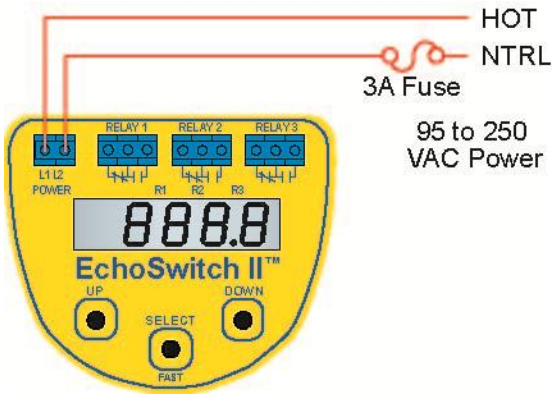
This function is only operational when two or more relays are configured as pumps performing the same function (either filling or emptying).

1. Make sure at least two relays are in the same mode. (ex: two relays are set as PUMPs that FILL or three relays are set as PUMPs that EMPTY. If this is not true, then M-PLEX will not appear.
2. When M-PLEX appears, press SELECT.
3. Choose between DUPLEX or TRIPLX and press SELECT.
4. When A-TIME appears, press SELECT.
5. When HOURS appears, press SELECT.
6. Using the UP and DOWN buttons, set the Alternating Time in Hours. Alternating Time can be set from 0 to 600 hours.
7. Press SELECT to enter the value.
8. Select EXIT to return to Top Level Menu.

Electrical

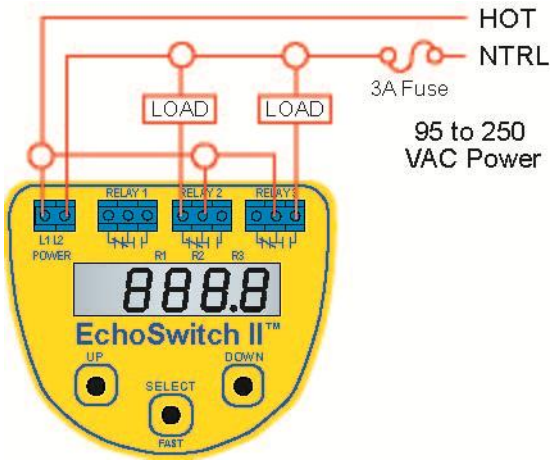
Input Power

The EchoSwitch II is powered from 95 to 250 VAC power. Power is applied to the L1 and L2 terminals. Typically, Hot is applied to L1 and Neutral to L2. The power terminals are mechanically isolated so the inputs can be reversed.



Relay Connection

The EchoSwitch II features three 60 VA, 1A max SPDT relays. All three relays are isolated and can be wired to switch either Normally Open (NO) or Normally Closed (NC). The example below shows Relay 2 wired NC and Relay 3 wired NO. Make sure to select a relay state that is fail-safe and takes into account when power is lost to the EchoSwitch II.

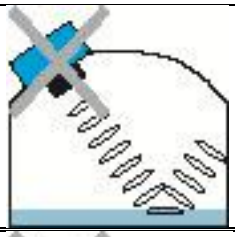
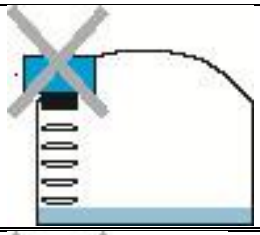
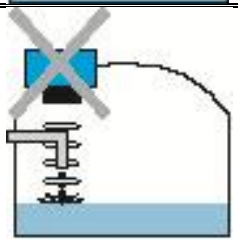
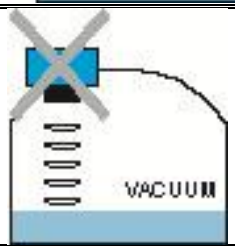


Installation

The EchoSwitch II should always be mounted perpendicular to the liquid surface and installed using the provided Viton 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 LU77 series is the LM52-1400 (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. For LU77 Series - mount at least 2" from the side wall
    b. For DL74 & LU78 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 on page 8
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.

Do not install at angle relative to the liquid.		*Do not install within 3" of tank sidewall.*	
Do not install with objects in the beam.		*Do not install in applications with vacuum.*	

Installation in existing fittings

If the existing fitting is larger than the threads of the EchoSwitch II, select a reducer bushing such as the LM52-1400 (2" thread x 1" thread) or LM52-2400 (3" thread x 2" thread).

Metal Tanks (LU77 series)

Flowline 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 the LM52-1400 or a plastic 1" flange, such as the LM52-1850 for metallic tanks.
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. EchoSwitch II is commonly installed in tank adapters, flanges, brackets or standpipes. Note: Always include the gasket when installing the EchoPod.

1. **Tank Adapter:** Select a tank adapter fitting, such as the LM52-1890 for the LU74 series or the LM52-2890 for the LU74 & LU78 series.
    a. *For best results, select a 2" tank adapter and add a reducer bushing such as the LM52-1400, thread x thread, reducer bushing.*
    b. Avoid tank adapter (thread x thread) styles and/or pipe stops forward of the installed transducer.

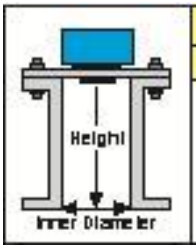
2" Tank Adapter Socket x Thread

Tank Adapter w/ 2"x1" Reducer Bushing

Tank Adapter Thread x Thread

Do not use thread x thread

2. **Riser:** Installations with tall, narrow risers can impede the acoustic signal.
    a. **LU74 & LU78 Series:** 2" (5 cm) diameter risers should be no taller than 5" (12.7 cm). Larger diameter risers should be no taller than 12" (30.5 cm).
    b. **LU77 Series:**



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

Note: *Do not exceed the dimensions listed above*

3. **Flange (LU77 series):** If installing on a flange, select a flange with a thread that is above the plane of the flange, such as the LM52-1850.
    a. *The LU74 & LU78 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.

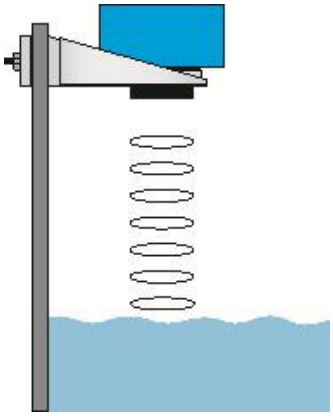
2” Flange w/ thread out of plane

2” Flange w/ thread in plane

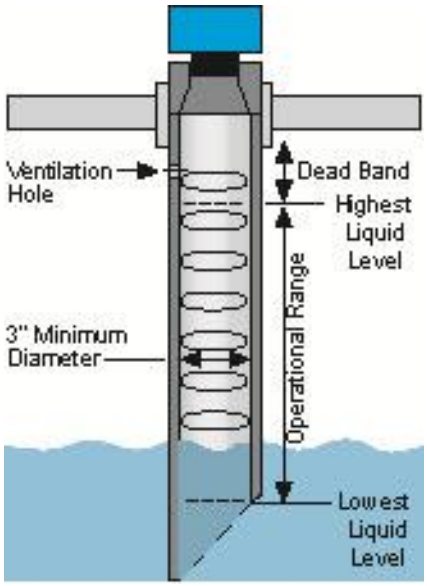
Do not use thread in plane

2” Flange w/ Reducer Bushing

4. **Side Mount Bracket:** For installations in open tanks and sumps, use the LM50 series side mount bracket.
    a. For the LU77 series, order the LM50-1001-1, which includes a 2”x 1” Reducer Bushing.
    b. For the LU74 & LU78, series, order the LM50-1001 side mount bracket.



5. **Stand Pipe:** A standpipe maybe 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 LU77 series, but is the minimum.
        ii. Pipes larger than 3” can also be used.
    c. Use a coupling and reducer bushing to attach the EchoPod to the pipe.
        i. With the LU77 series, be sure to use a plastic reducing bushing such as LM52-1400 2” T x 1” T fitting or the LM52-1410 2” S x 1” T fitting.
    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.



Appendix

Setup:

You can view how the EchoSwitch II is configured.

1. From the main MENU level, press SELECT when HELP appears.
2. When SETUP appears, press the SELECT key.
3. Setup will display the following information:
    a. Units, Height, Fill_H, Relay 1, Relay 2, Relay 3
    b. The following will be shown for each relay
        i. Relay Function, On Setting, Off Setting, Safe Setting and Delay
4. When completed, press SELECT when appears EXIT to return to the main program level.

Reset:

EchoSwitch II enables the end user to reset specific relays or the entire configuration within the level controller.

R All – Resets the entire EchoSwitch II
RST R1 – Resets only the settings associated with Relay 1
RST R2 – Resets only the settings associated with Relay 2
RST R3 – Resets only the settings associated with Relay 3

Follow the instructions below to reset EchoSwitch II

1. From the main MENU level, press SETUP when HELP appears.
2. When RESET appears, press the SELECT key.
3. Select the type of Reset required (Rall, RST 1, RST 2 or RST 3) and press SELECT
4. When completed, press SELECT when appears EXIT to return to the main program level.

Simulation (SIM-T)

This mode enables the end user to simulate changes in level without having the level of liquid move. The display will simulate level of liquid and will turn the relays ON and OFF according to how they were configured. For example, if Relay 1 is set as a High Alarm with an ON setting for 100.0 inches and a Hysteresis of 2.0 inches, then when the display goes above 100.0, Relay 1 will energize and when the level falls below 98.0, Relay 1 will de-energize. This function can be used to test the wiring and to verify if the configuration is set accordingly.

Please note: *Simulation mode will energize and de-energize all configured relays. Any devices wired to the relays will become active during simulation mode.*

Follow the instructions below to begin the Simulation mode (SIM-T)

1. From the main MENU level, press SETUP when HELP appears.
2. When SIM-T appears, press the SELECT key.
3. The display will start at 0.0. Press the UP button to begin increasing the level of liquid. Use the DOWN button to simulate the lowering of liquid in the tank.
4. To increase speed, hold the SELECT button while hold the UP or DOWN keys.
5. To exit, press and hold the SELECT key.
6. Press SELECT when appears EXIT to return to the main program level.

Test Parameters

This mode runs diagnostic tests that confirm operation of EchoSwitch II. ***This mode should only be used when supervised by a Flowline representative.***

Troubleshooting

PROBLEM	SOLUTION
TANK does not appear on the main menu	Units function is set for PERCENT on EchoSwitch II: When Units is set for PERCENT, the TANK function is disabled. To re-enable TANK, change units to INCHES, CM, FEET or METERS.
Display always jumps to the LOST condition	Check the dimensional configuration (**Height** and **Fill-H**) of the EchoSwitch II. Make sure that the **Fill-H** setting corresponds to the full level of liquid (from the bottom up) and not the distance from the sensor to the liquid (top down).
M-PLEX does not appear on the main menu	None of the relays are configured the same: M-PLEX will only appear when 2 or 3 relays are configured as the same function. For example, two or more relays are configured as Pumps that Auto Fill. M-PLEX will not appear if a relay is configured as an Auto Empty Pump and an Auto Empty Valve.
Display shows FULL	Level of liquid is above the FILL_H setting: Check the FILL_H setting, making sure the FILL_H setting is high enough so the level of liquid is below the FILL_H setting
Display shows EMPTY	Level of liquid is beyond the HEIGHT setting: Check the HEIGHT setting, making sure the HEIGHT setting is low enough so the level of liquid is above the HEIGHT setting
Pumps or Valves do not alternate	1. M-PLEX is set for NO-ALT or A-TIME is set above 0: a. If M-PLEX is set for NO-ALT, then the relays will not alternate. Change M-PLEX to either DUPLEX or TRIPLX to begin alternation. b. If A-TIME is set for anything above 0 hours, then the pumps will only alternate after the A_TIME set has been reached. For example, if A-TIME is set for 3 hours, then the relays will only switch after each 3 hour period. To alternate after each cycle, change A-TIME to 0 hours 2. The ON levels for the relays are set to the same setting. Change the ON set point to another value.
Relay closes, but does not open again	An inductive kick may be holding the relay closed. If switching 24 VDC, make sure a diode has been installed to act as a snubber.
Relay chatters on and off repeatedly	Most likely the turbulence in the tank is causing the chatter. Increase the Hysteresis setting to correct.

User Settings:

Fill out the chart below and keep as a record of your configuration.

Tank

Height =	Fill-H =

Relay #1

Pump		Valve		Alarm	
Fill	Empty	Fill	Empty	High	Low
ON =		ON =		ON =	
OFF =		OFF =		Hysteresis =	
Delay =		Delay =			

Relay #2

Pump		Valve		Alarm	
Fill	Empty	Fill	Empty	High	Low
ON =		ON =		ON =	
OFF =		OFF =		Hysteresis =	
Delay =		Delay =			

Relay #3

Pump		Valve		Alarm	
Fill	Empty	Fill	Empty	High	Low
ON =		ON =		ON =	
OFF =		OFF =		Hysteresis =	
Delay =		Delay =			

M-Plex

No-Alt	Duplex	Triplex
Relays 1 & 2	Relays 2 & 3	Relays 3 & 1
A-Time ON OFF	Hours:	