

# EchoBeam<sup>®</sup>

80 GHz Radar Liquid & Solid Level Transmitter



## LR83 & LR85 Series Display Manual (Addendum to LevelTap™ Manual)



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## SENSOR MODELS

Offered in two different models, EchoBeam® is an FMCW radar level sensor that provides a continuous output proportional to the liquid or solids level in a tank or sump. Available outputs include 4-20mA, 4-20mA w/ HART and ModBus RTU. Make sure that the model purchased is appropriate for your application.

| Series | Max Range Liquid | Max Range Solids | Beam Angle | Material | Mounting   | Application  |
|--------|------------------|------------------|------------|----------|--|--|
| LR83   | 98.42'<br>(30m)  | 49.21'<br>(15m)  | 6°         | PVDF     | 1½" NPT<br><br>(1½" G)   | <p><b>Liquids:</b> Measures large bulk storage tanks up to 30m or difficult process tank applications or open channel flow.</p> <p><b>Solids:</b> Measures small to medium silos or stockpiles up to 15m.</p>  |
| LR85   | 393.7'<br>(120m) | 198.8'<br>(60m)  | 4°         | PFA      | 3" NPT<br>(M80 x 3)<br><br>or<br><br>Gimbaled<br><br>3" ANSI<br>(DN80) | <p><b>Liquids:</b> Measures large bulk storage tanks up to 120m or difficult process tank applications.</p> <p><b>Solids:</b> Measures medium to large silos up to 60m, including those with significant dust or very limited measurement space.</p> |

**SETUP OVERVIEW**

The below list highlights the initial steps required to set up your transmitter for operation.

**Step 1: Set the Units of Measurement**

Select the Units of Measurement (inches, feet, millimeters, centimeters or meters) that will be used by the sensor and displayed by the App (and sensor push button display module if applicable to your model).

**Step 2: Set the Application**

Select the type of Application media (liquid or solids) that the sensor will measure.

**Step 3: Set the Fail-Safe Option**

Select the Fail-Safe Output (3.9mA, 20.5mA, 22mA or Hold Last Value) that the sensor will use to indicate that it cannot measure a valid signal return or level.

**Step 4: Set the Sensor Height (4mA)**

Input the Sensor Height distance or 4mA set point which corresponds to the tank empty setting.

**Step 5: Set the Fill-Height (20mA)**

Input the Fill Height distance or 20mA set point which corresponds to the tank full setting.

**Step 6: Set the Display Value**

Select the level Display Value (Height, Distance, Current, Percent) that will be indicated by the App (and sensor push button display module if applicable to your model).

**Step 7: Set the Sensor Name**

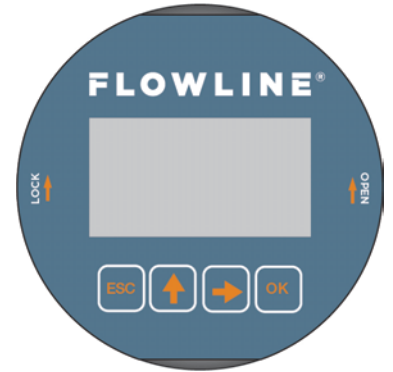
Input a unique Sensor Name to identify the device (location, tank and/or media) within 36 characters.

**Step 8: Check the EchoCurve**

This is a quick diagnostic tool to determine if the transmitter is reading the correct level.

USING THE DISPLAY

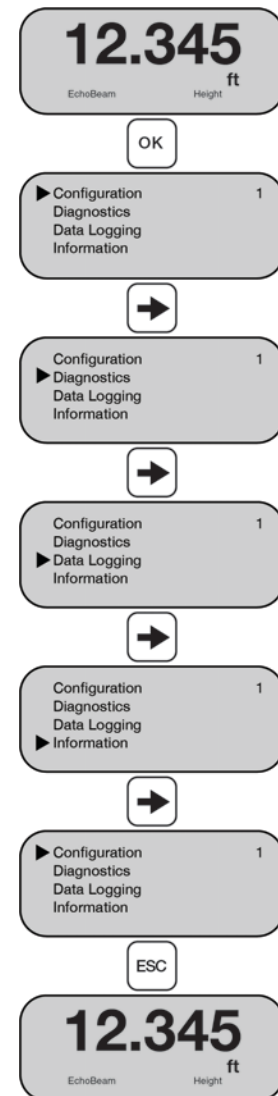
The display module features a dot matrix LCD display with 4 push buttons on a removable puck. Out of the box, the display indicates level in feet and depicts the level on a bar graph at the right side of the display. The four buttons perform the following functions:



|   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• <b>ESC</b> <ul style="list-style-type: none"> <li>○ Exit configuration mode</li> <li>○ Return to a higher menu level</li> <li>○ Display EchoCurve</li> </ul> </li> </ul>                             | <ul style="list-style-type: none"> <li>• <b>UP Arrow</b> <ul style="list-style-type: none"> <li>○ Modify parameter values</li> <li>○ Choose display mode</li> </ul> </li> </ul>   |
| <ul style="list-style-type: none"> <li>• <b>RIGHT Arrow</b> <ul style="list-style-type: none"> <li>○ Choose configuration options</li> <li>○ Choose parameter digits to edit</li> <li>○ Display contents of parameters</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• <b>OK</b> <ul style="list-style-type: none"> <li>○ Enter Menu and Options</li> <li>○ Confirm configuration options</li> <li>○ Confirm changes to parameters</li> </ul> </li> </ul> |

Menu Introduction

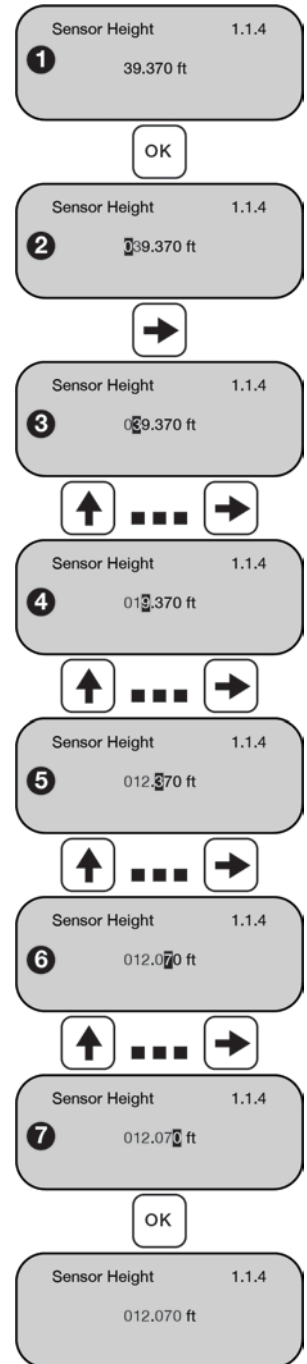
1. To enter the Main Menu (from the Main Screen), press the **OK** button.
2. Use the **Right Arrow** button to scroll through the Main Menu options.
  1. Configuration – Below are the configuration menu functions:
    - a. Basic
    - b. Advanced
  2. Diagnostics – Below are the diagnostic menu functions:
    - a. Choose Curve
    - b. Simulation
    - c. Sensor Status
  3. Data Logging – Below are the data logging menu functions:
    - a. Enable
    - b. View Distance Data
    - c. View EchoCurve Data
    - d. Clear Memory
  4. Information – Below are the information menu functions:
    - a. Information
    - b. Software Version
    - c. Write Protect
    - d. Language
    - e. Factory Reset
3. To select one of the functions, press **OK**.
4. To exit the programming mode, press **ESC**.



**CHANGING DISPLAY VALUES**

The numeric values are set using the **Right Arrow** and **Up Arrow** buttons. Press the **Right Arrow** button to select the next digit and the **Up Arrow** button to increment the digit value. The digit being changed is highlighted. Press the **OK** button to accept a setting or the **ESC** button to exit without saving changes. The below exercise illustrates how to change the value of an Empty Configuration. Follow the steps to change the setting from 39.370 ft to 12.000 ft. This example applies to all functional settings starting from the Main Menu.

- 1) From the Sensor Height Screen, press **OK** to begin changing the display value.
  - a) The first digit “0” will now be highlighted.
- 2) Press **Right Arrow** to move from the first digit to the second digit.
  - a) The second digit “3” will now be highlighted.
- 3) Press **Up Arrow** repeatedly until the second digit scrolls from “3” to “1”.
  - a) Each press of the **Up Arrow** will increase the digit by 1.
    - i) When the value reaches 9, it will drop to 0 and begin again.
    - ii) Stop pressing **Up Arrow** when the second digit is highlighted as “1”.
  - b) Press **Right Arrow** to move one digit to the right.
    - i) The third digit “9” will now be highlighted.
- 4) Press **Up Arrow** repeatedly until the third digit scrolls from “9” to “2”.
  - a) Stop pressing **Up Arrow** when the third digit is highlighted as “2”.
  - b) Press **Right Arrow** to move one digit to the right.
    - i) The fourth digit “3” will now be highlighted.
- 5) Press **Up Arrow** repeatedly until the fourth digit scrolls from “3” to “0”.
  - a) Stop pressing **Up Arrow** when the fourth digit is highlighted as “0”.
  - b) Press **Right Arrow** to move one digit to the right.
    - i) The Fifth digit “7” will now be highlighted.
- 6) Press **Up Arrow** repeatedly until the fifth digit scrolls from “7” to “0”.
  - a) Stop pressing **Up Arrow** when the fifth digit is highlighted as “0”.
  - b) Press **Right Arrow** to move one digit to the right.
    - i) The Sixth digit “0” will now be highlighted.
- 7) Press **OK** to accept the setting as **12.000**.

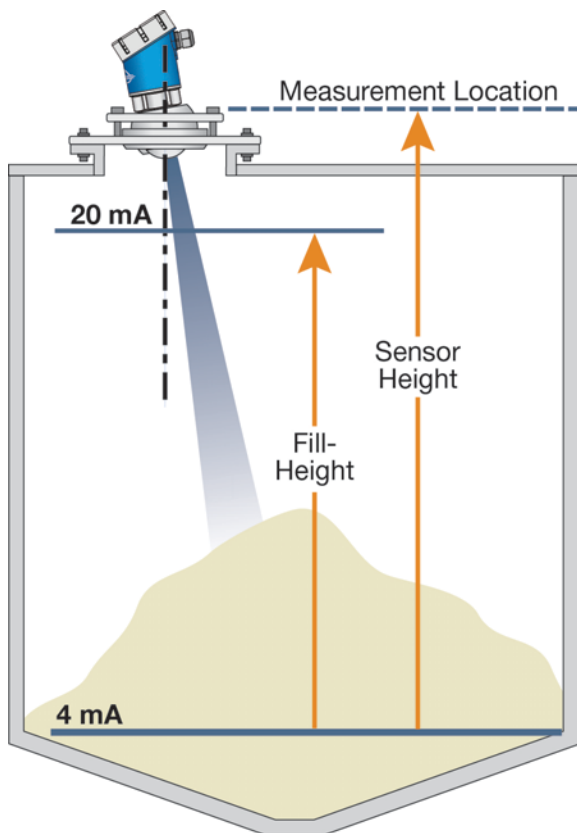


**MEASURE THE TANK (BASIC DIMENSIONS)**

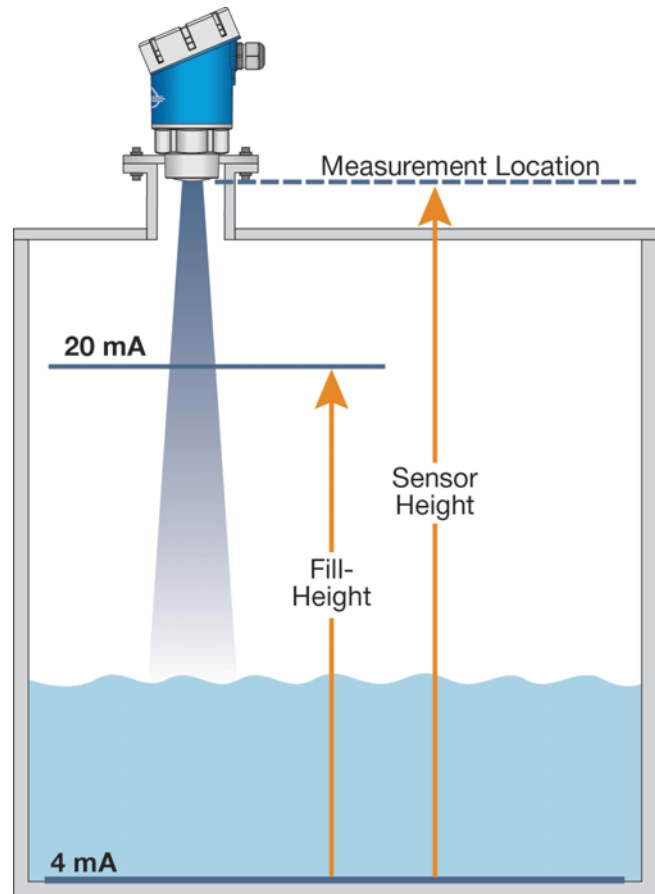
EchoBeam® measures the distance between the sensor and the liquid or solids surface below. Measuring the tank is one of the most important aspects in configuring the transmitter. When measuring the tank, consider the location of the transmitter with respect to fittings, risers, dome tops and bottoms, and identify where the measurements are taken from the transmitter. The basic measurements for configuration are described to the right:

- Sensor Height
- Fill-Height

All measurements are made from the bottom of the tank up to the bottom of the sensor (Sensor Height) or to the operational full for the tank (Fill-Height).



**Example: Mounting in a Solid**



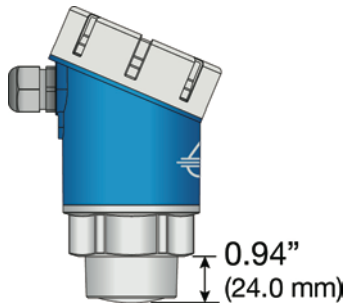
**Example: Mounting in a Liquid**



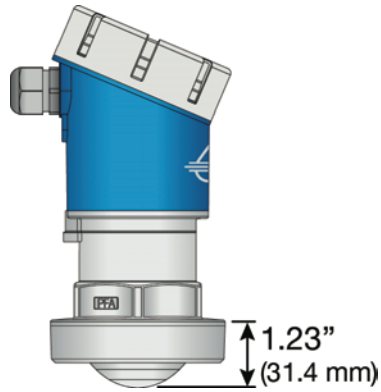
## CONFIRM THE TANK MEASUREMENTS

All measurements with EchoBeam® are referenced from the bottom of the transmitter. Once the transmitter has been installed, you may need to adjust your original measurements due to the location of the EchoBeam® in the application. Shown below are the offsets from the bottom of the EchoBeam® to the top of the mounting threads. Use the offsets to calculate the exact location of the transmitter's point of measurement.

**LR83 Series**

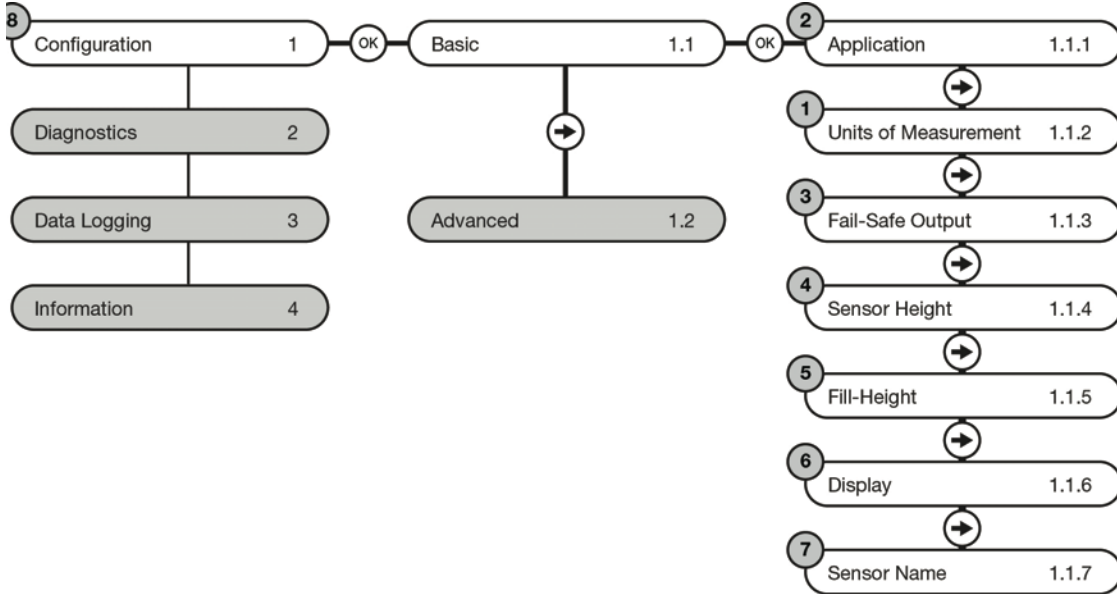


**LR85 Series**



**BASIC CONFIGURATION OVERVIEW USING PUSH BUTTON DISPLAY**

Below are the 8 basic steps to configure the sensor for operation. Each step is described in detail on the following pages:



**Step 1: Set the Units of Measurement**

Select the Units of Measurement (inches, feet, millimeters, centimeters or meters) that will be used by the sensor and displayed by the App (and sensor push button display module if applicable to your model).

**Step 2: Set the Application Medium**

Select the type of Application media (liquid or solids) that the sensor will measure.

**Step 3: Set the Fail-Safe Option**

Select the Fail-Safe Output (3.9mA, 20.5mA, 22mA or Hold Last Value) that the sensor will use to indicate that it cannot measure a valid signal return or level.

**Step 4: Set the Sensor Height (4mA)**

Input the Sensor Height distance or 4mA set point which corresponds to the tank empty setting.

**Step 5: Set the Fill-Height (20mA)**

Input the Fill Height distance or 20mA set point which corresponds to the tank full setting.

**Step 6: Set the Display Value**

Select the level Display Value (Height, Distance, Current, Percent) that will be indicated by the App (and sensor push button display module if applicable to your model).

**Step 7: Set the Sensor Name**

Input a unique Sensor Name to identify the device (location, tank and/or media) within 36 characters.

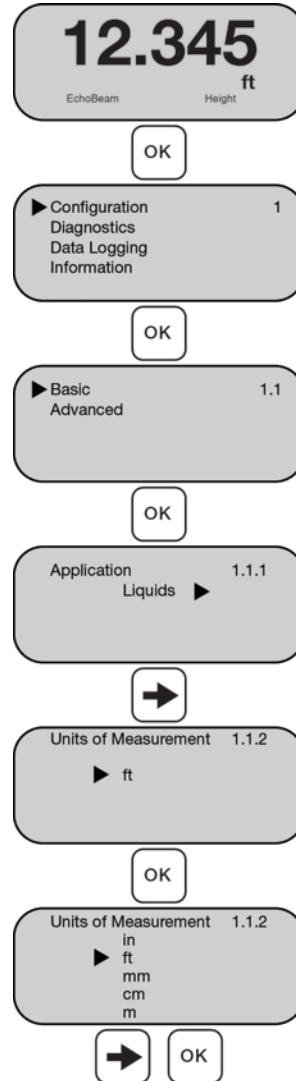
**Step 8: Check the EchoCurve**

This is a quick diagnostic tool to determine if the transmitter is reading the correct level.

## STEP 1 - SET THE UNITS OF MEASUREMENT

This function sets the units for all measurement values to be entered into the transmitter. Options for units of measurement are inches, feet, millimeters, centimeters or meters.

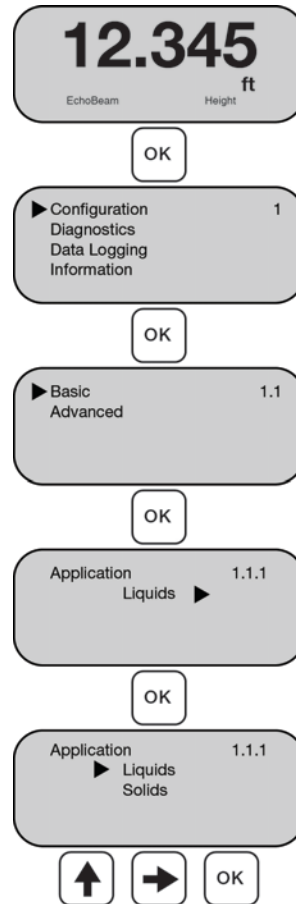
- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **OK** to advance into Basic Menu (Application screen will appear).
- 4) Press **Right Arrow** to scroll to Units of Measurement.
- 5) Press **OK** to change the setting for Units of Measurement.
  - a) Press **Right Arrow** to move the triangle to the desired setting.
  - b) When the setting (unit of measurement) is correct, press **OK** to save the setting.
- 6) When done, press **ESC** to return to the Basic Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a third time to return to the Main Screen, or if you want to advance directly into Application Medium, press **Right Arrow**.



## STEP 2 - SET THE APPLICATION MEDIUM

This function informs the transmitter of the media that is being measured.

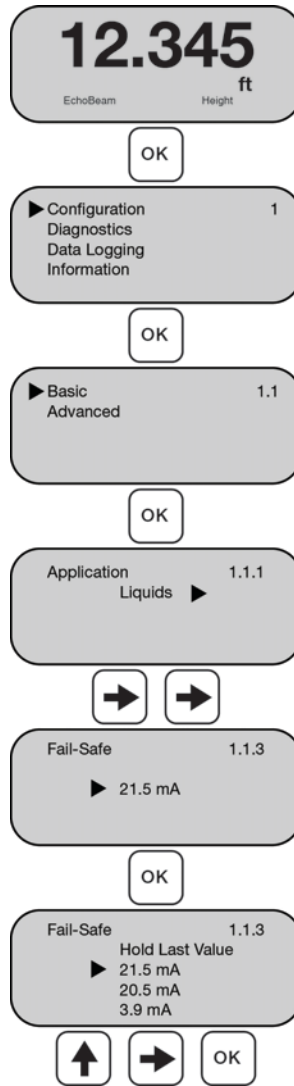
- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **OK** to advance into Basic Menu (Application screen will appear).
- 4) Press **OK** to change the setting for Application Medium.
  - a) Press **Up Arrow** or **Right Arrow** to move the triangle to the desired setting.
  - b) Options for Application Medium are Liquids or Solids.
  - c) When the setting (Application Medium) is correct, press **OK** to save the setting.
- 5) When done, press **ESC** to return to the Basic Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a third time to return to the Main Screen, or if you want to advance directly into Fail-Safe, press **Right Arrow**.



## STEP 3 - SET THE FAIL-SAFE OPTION

This function sets the default output when EchoBeam® is not able to acquire a valid return signal.

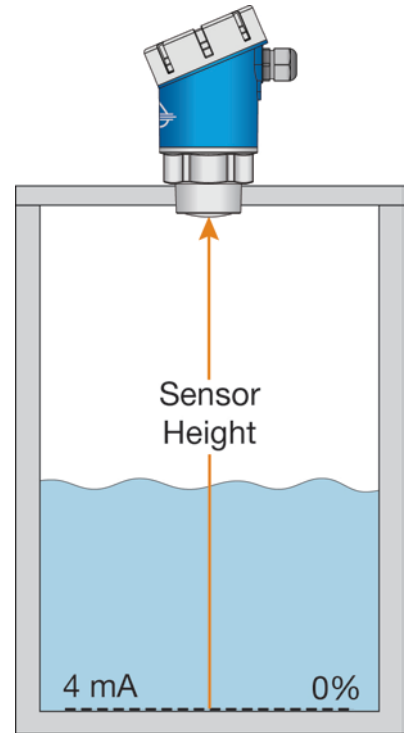
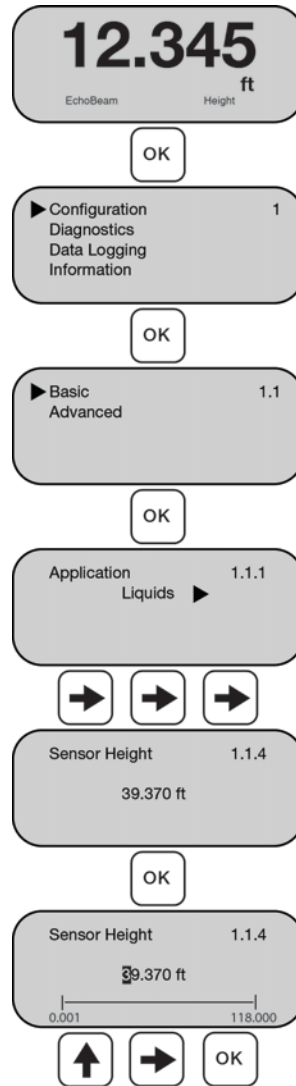
- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **OK** to advance into Basic Menu.
- 4) Press **Right Arrow** (at least two times) to scroll to Fail-Safe.
- 5) Press **OK** to change the value for Fail-Safe.
  - a) Press **Up Arrow** or **Right Arrow** to move the triangle to the desired setting.
  - b) Options for Fail-Safe are Hold Last Value, 21.5mA, 20.5mA or 3.9mA.
  - c) When the value is correct, press **OK** to save the setting.
- 6) When done, press **ESC** to return to the Basic Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a third time to return to the Main Screen, or if you want to advance directly into Sensor Height, press **Right Arrow**.



**STEP 4 - SET THE SENSOR HEIGHT (4mA)**

This function sets the Sensor Height set point for the transmitter corresponding 4mA to empty.

- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **OK** to advance into Basic Menu.
- 4) Press **Right Arrow** (at least three times) to scroll to Sensor Height.
- 5) Press **OK** to change the value for Sensor Height.
  - a) Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c) When the value is correct, press **OK** to save the setting.
- 6) When done, press **ESC** to return to the Basic Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a third time to return to the Main Screen, or if you want to advance directly into Fill-Height, press **Right Arrow**.



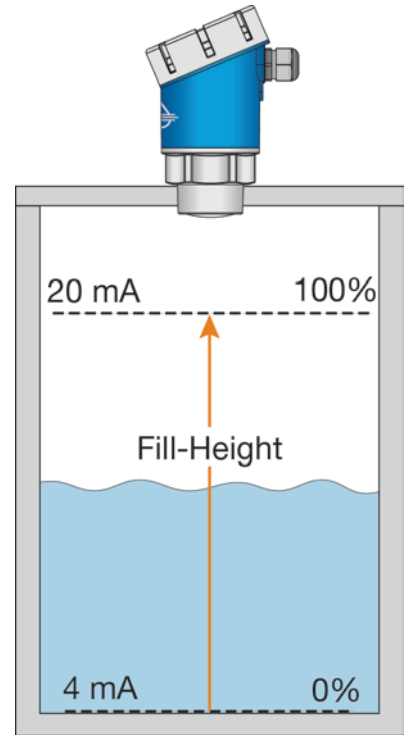
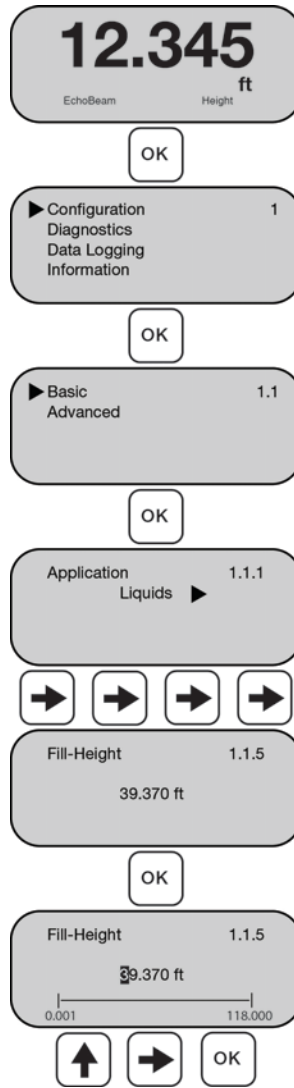
**Note:** If Fill-Height is greater than Sensor Height, the Sensor Height change will not be saved.

**Note:** The Dead Band and Maximum Range are automatically set based on the Sensor Height and Fill-Height. After writing to unit, the Dead Band is set to 0.9 x (Sensor Height – Fill-Height) and the Maximum range is set to 1.05 x (Sensor Height).

**STEP 5 - SET THE FILL-HEIGHT (20mA)**

This function sets the Fill-Height set point for the transmitter corresponding 20mA to full.

- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **OK** to advance into Basic Menu (Application screen will appear).
- 4) Press **Right Arrow** (at least four times) to scroll to Fill-Height.
- 5) Press **OK** to change the value for Fill-Height.
  - a) Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c) When the value is correct, press **OK** to save the setting.
- 6) When done, press **ESC** to return to the Basic Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a third time to return to the Main Screen, or if you want to advance directly into Display, press **Right Arrow**.



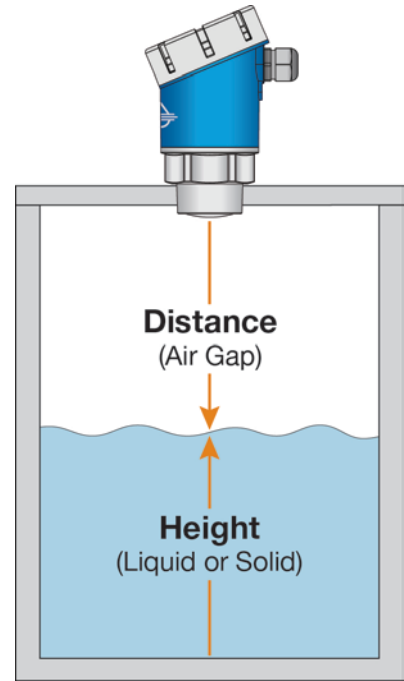
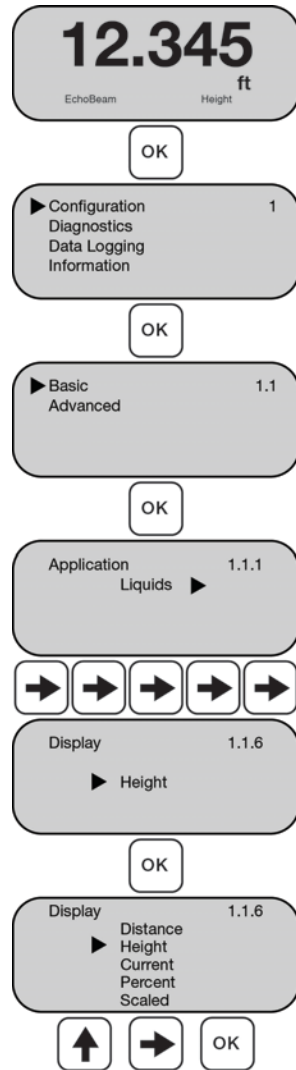
**Note:** If Fill-Height is greater than Sensor Height, the Fill-Height change will not be saved.

**Note:** The Dead Band and Maximum Range are automatically set based on the Sensor Height and Fill-Height. After writing to unit, the Dead Band is set to 0.9 x (Sensor Height – Fill-Height) and the Maximum range is set to 1.05 x (Sensor Height).

## STEP 6 - SET THE DISPLAY VALUE

EchoBeam® can display (on the local display or within the LevelTap™ App) either the liquid/solids level or the air gap above the liquid/solids.

- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **OK** to advance into Basic Menu (Application screen will appear).
- 4) Press **Right Arrow** (at least five times) to scroll to Display.
- 5) Press **OK** to change the setting for Display.
  - a) Press **Up Arrow** or **Right Arrow** to move the triangle to the desired setting.
  - b) When the setting is correct, press **OK** to save the setting.
- 6) When done, press **ESC** to return to the Basic Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a third time to return to the Main Screen, or if you want to advance directly into Sensor Name, press **Right Arrow**.



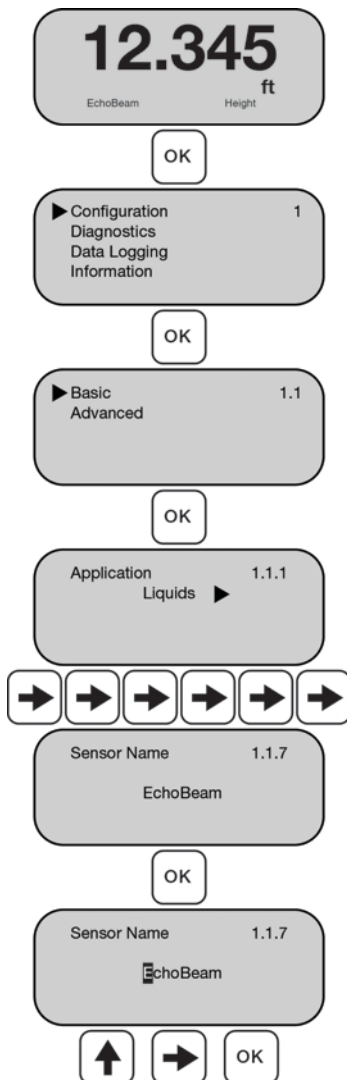


**STEP 7 - SET THE SENSOR NAME**

This enables you to provide a unique name or identifier for each transmitter. This is the name of the transmitter that appears as the main identifier when using the LevelTap™ App.

**Note:** It is easier to use the LevelTap™ App to change this setting than with this display. Please refer to the **LR80, LR81, LR83 & LR85 Series Manual** for instructions to set the Sensor Name.

- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **OK** to advance into Basic Menu (Application screen will appear).
- 4) Press **Right Arrow** (at least six times) to scroll to Sensor Name.
- 5) Press **OK** to change the setting for Sensor Name.
  - a) Press **Up Arrow** to increase the value of the character highlighted. **Up Arrow** will scroll from A to Z, then 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c) When the setting is correct, press **OK** to save the setting.
- 6) When done, press **ESC** to return to the Basic Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a third time to return to the Main Screen.



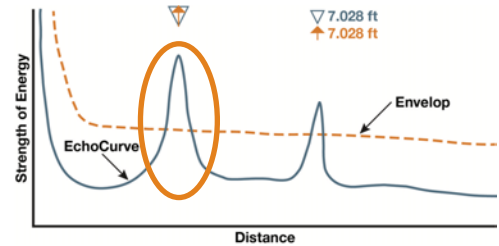
**Note:** Only Capital / Upper Case letters are available when using the display.

**STEP 8 - CHECK THE ECHOCURVE**

EchoCurve presents a physical representation of the return signal across the operational range for the radar transmitter. From the Main Screen, press **ESC** to view the EchoCurve.

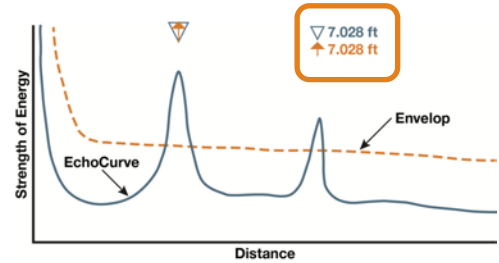
There are two components to observe when looking at the EchoCurve:

- **Check the Peak(s) along the EchoCurve**
  - Ideally, there should be a significant peak which represents the liquid or solids level in the tank.
  - This peak should be above the Envelope Line (Threshold Filter).
  - There may be more, and smaller peaks located before and after the large peak.



**Echo Peaks along the EchoCurve**

- **Check the Location of Peak (Return)**
  - There are two values above EchoCurve.
  - The bottom value represents the air gap distance from the radar transmitter to the liquid level.
  - The top value represents the air gap distance from the radar transmitter to the peak amplitude location.



**Location of Echo Return**

- These two values should be close to one another (or the same value).
  - The example above indicates that the liquid level is located 7.208 feet away (Bottom Value) and the peak amplitude is located 7.208 feet away (Top Value) from the radar transmitter.
  - The liquid or solids level should be at this peak location.

- **Change the Distance Scaling**

- The distance scaling for the EchoCurve defaults to a scale of 0 to 118' (0 to 36m) for the LR83 and 0 to 393' (0 to 120m) for the LR85.
- Press **Up Arrow** to change the Scale

| Series | Default     | Up Arrow   | Up Arrow    | Up Arrow    | Up Arrow    |
|--------|-------------|------------|-------------|-------------|-------------|
| LR83   | 118' (36m)  | 59' (18m)  | 30' (9m)    | 9' (3m)     | 118' (36m)  |
| LR85   | 393' (120m) | 197' (60m) | 98.4' (30m) | 32.8' (10m) | 393' (120m) |

- **Show the Envelope Curve**

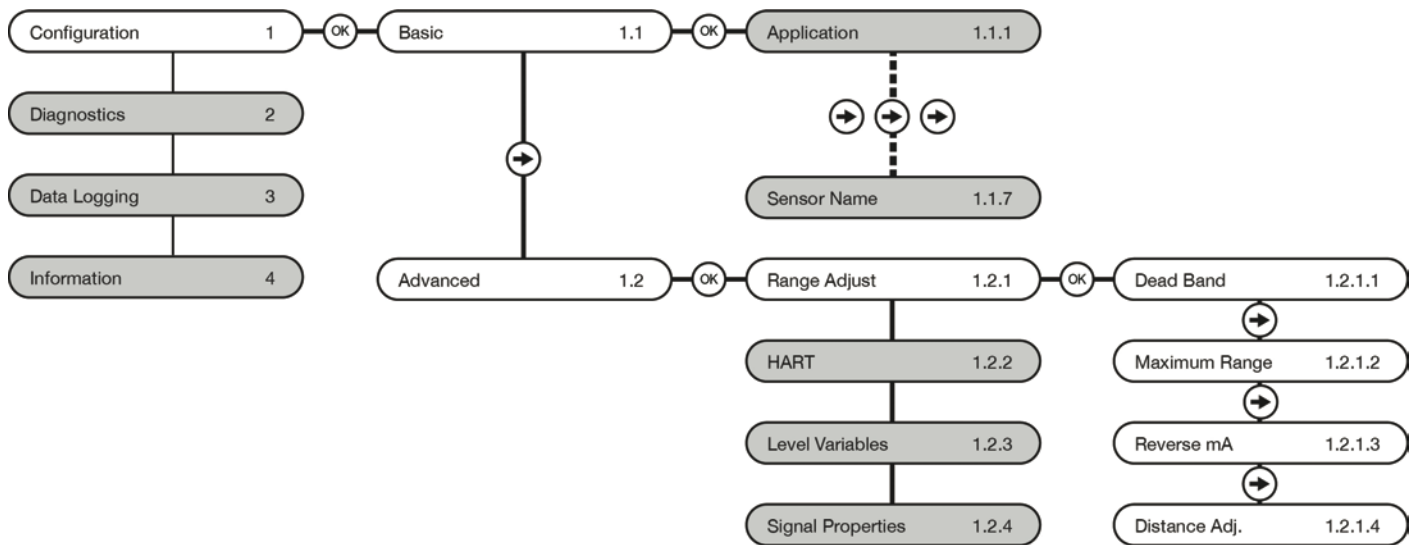
- The Envelope Curve does not appear when the EchoCurve is first viewed (default).
- To show the Envelope Curve, press **Right Arrow**.
- To remove the Envelope Curve, press **Right Arrow**.

### ADVANCED ADJUSTMENTS OVERVIEW

These optional functions are used to change the transmitter output characteristics.

**Note:** These adjustments should only be performed after having completed the configuration steps previously described with the transmitter installed on the tank. Where so, perform the following applicable Advanced Adjustments.

- Dead Band
- Maximum Range
- Reverse mA
- Distance Adjust

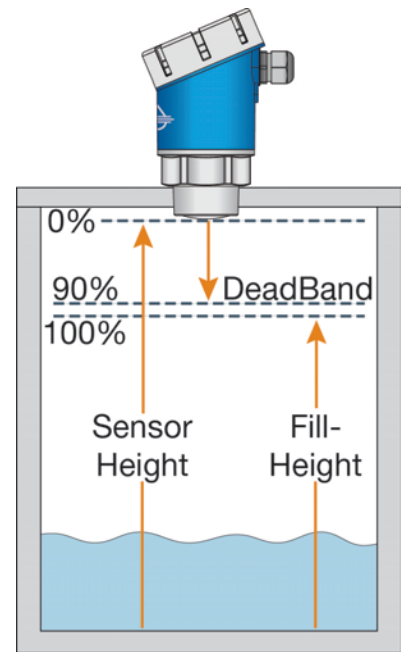
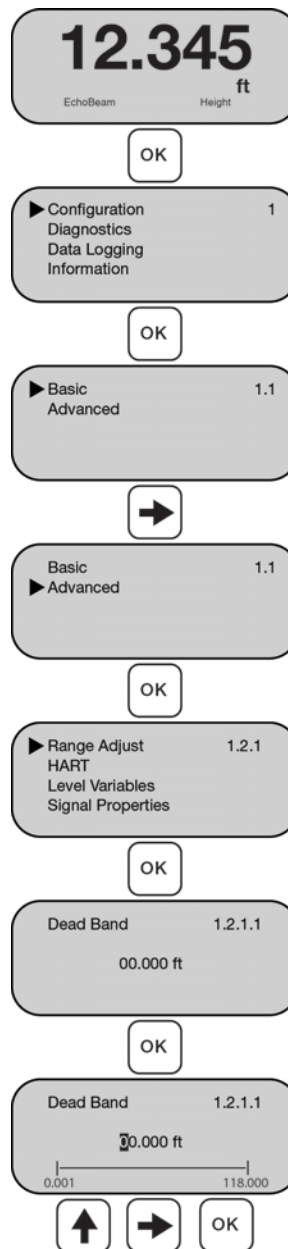


### DEAD BAND

This setting defines the minimum distance that the EchoBeam® will detect valid echo returns. EchoBeam® will not read a level above this setting. All values will be in the Units previous defined during configuration. Default setting will be at 90% of the difference between the Sensor Height and Fill-Height values.

- If Sensor Height = 20 feet and Fill-Height = 19 feet, the difference between the two values is 1 foot.
- 90% of 1 foot is 0.9 feet (set Dead Band to 0.900 feet)

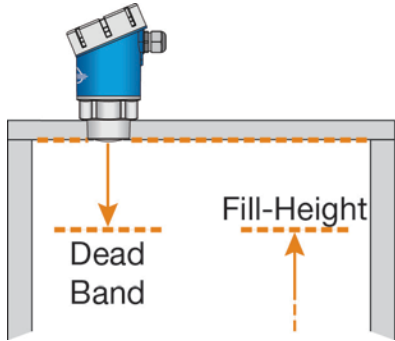
- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **Right Arrow** to switch to Advanced.
- 4) Press **OK** to advance into Advanced Menu.
- 5) Press **OK** to advance into Range Adjust. Menu.
- 6) Press **OK** to change the value for Dead Band.
  - a) Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c) When the value is correct, press **OK** to save the setting.
- 7) When done, press **ESC** to return to the Range Adjust Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen, or If you want to advance directly into Maximum Range, press **Right Arrow**.



**Note:** Dead Band is completely independent from the 20mA setting (Fill-Height). If the Dead Band is set below the location of the Fill-Height, then the transmitter will not measure above the Dead Band. The maximum level will not correspond to the current at the Dead Band.

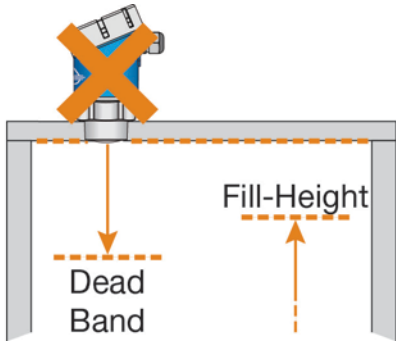
While the Dead Band setting is typically configured to be at the same level as Fill-Height, they are completely independent settings.

### Dead Band Equals Fill-Height



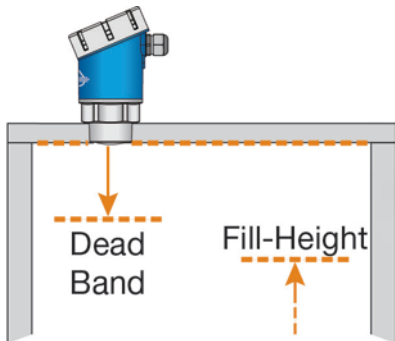
In this example, the Dead Band is located at the same level as the Fill-Height setting.

### Dead Band Below Fill-Height



In this example, the Dead Band is located at a lower level in the tank with respect to the Fill-Height setting.

### Dead Band Above Fill-Height



In this example, the Dead Band is located at a higher level in the tank with respect to the Fill-Height setting.

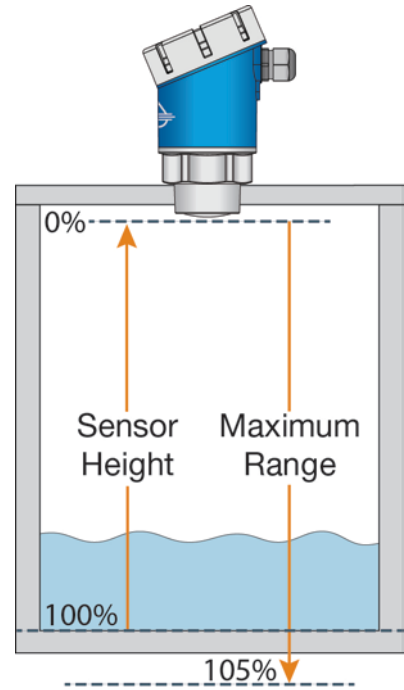
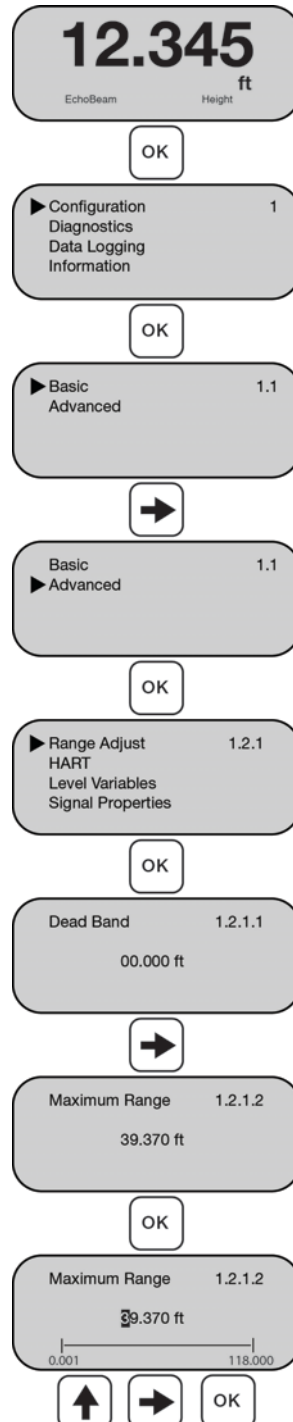
**Note:** The Dead Band is always measured from the transmitter face down to the liquid or solid while the Fill-Height is measured from the bottom of the tank up. Under most applications, they will never be the same value.

### MAXIMUM RANGE

This setting defines the maximum distance that the sensor will detect valid echo returns. EchoBeam® will not read a level beyond this setting. All values will be in the Units previously defined during configuration.

- Suggested setting will be 105% greater than the Sensor Height value.
- If Sensor Height = 20 feet, then Maximum Range should be set to 21.0 feet.

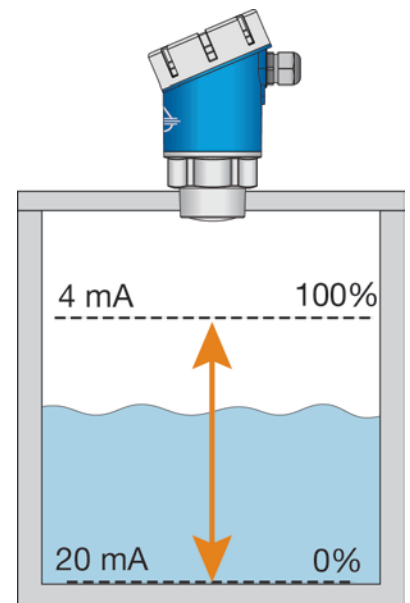
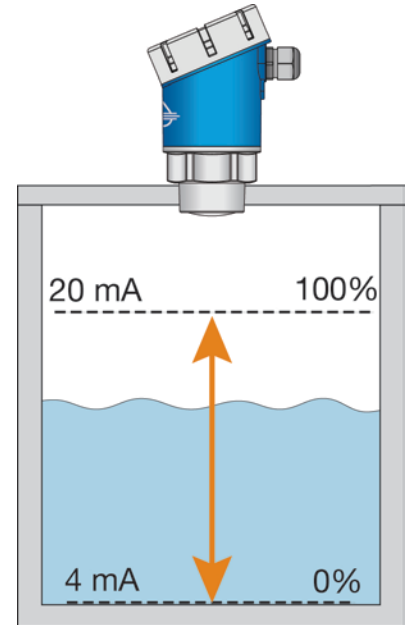
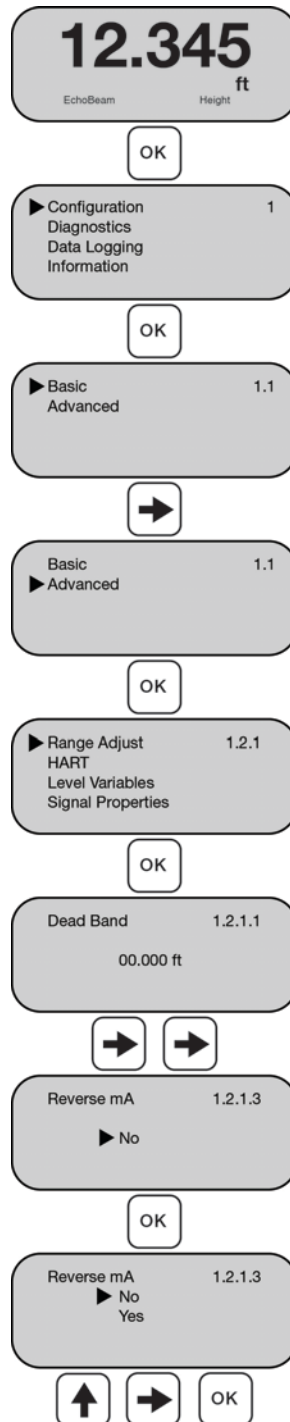
- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **Right Arrow** to switch to Advanced.
- 4) Press **OK** to advance into Advanced Menu.
- 5) Press **OK** to advance into Range Adjust. Menu (Dead Band screen will appear).
- 6) Press **Right Arrow** to scroll to Maximum Range.
- 7) Press **OK** to change the value for Maximum Range.
  - a) Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c) When the value is correct, press **OK** to save the setting.
- 8) When done, press **ESC** to return to the Range Adjust Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen, or if you want to advance directly into Reverse mA, press Right Arrow.



### REVERSE mA

This function sets the current output at either 4-20 mA or 20-4 mA. Selecting 4-20 mA sets the output with 4mA @ bottom and 20mA @ top of the tank. This is the standard output used in most applications. Selecting 20-4 mA sets the output with 20mA @ bottom and 4mA @ top of the tank. This is an optional output sometimes used in applications where the level is maintained at a high level.

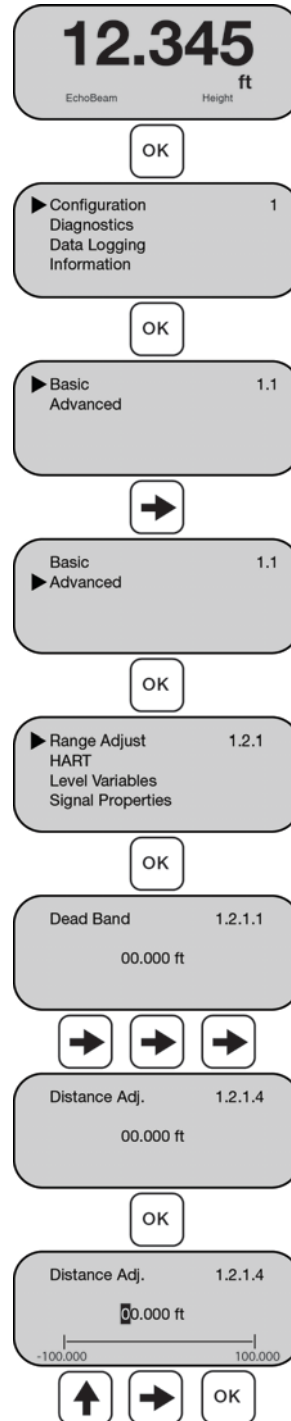
- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **Right Arrow** to switch to Advanced.
- 4) Press **OK** to advance into Advanced Menu.
- 5) Press **OK** to advance into Range Adjust Menu (Dead Band will appear).
- 6) Press **Right Arrow** (at least two times) to scroll to Reverse mA.
- 7) Press **OK** to change the setting for Reverse mA.
  - a) Press the **Up Arrow** or **Right Arrow** to toggle the triangle between No (4-20mA) and Yes (20-4mA).
  - b) When the setting is correct, press **OK** to save the setting.
- 8) When done, press **ESC** to return to the Range Adjust Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen, or If you want to advance directly into Distance Adjust, press **Right Arrow**.



### DISTANCE ADJUST

This function allows the factory set distance of a measured value to be adjusted. **Note:** This function should only be performed by a trained technician. Never change this setting unless instructed by a Flowline representative. Be sure to record this setting if a Factory Reset is performed.

- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **Right Arrow** to switch to Advanced.
- 4) Press **OK** to advance into Advanced Menu.
- 5) Press **OK** to advance into Range Adjust Menu (Dead Band will appear).
- 6) Press **Right Arrow** (at least three times) to scroll to Distance Adj.
- 7) Press **OK** to change the value for Distance Adj.
  - a) Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c) When the value is correct, press **OK** to save the setting.
- 8) When done, press **ESC** to return to the Range Adjust Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen.



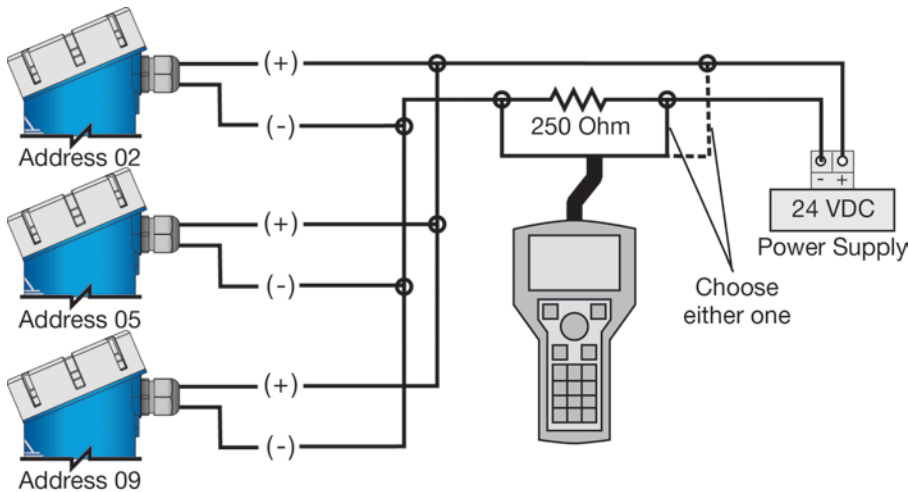


ADVANCED ADJUSTMENTS OVERVIEW - HART

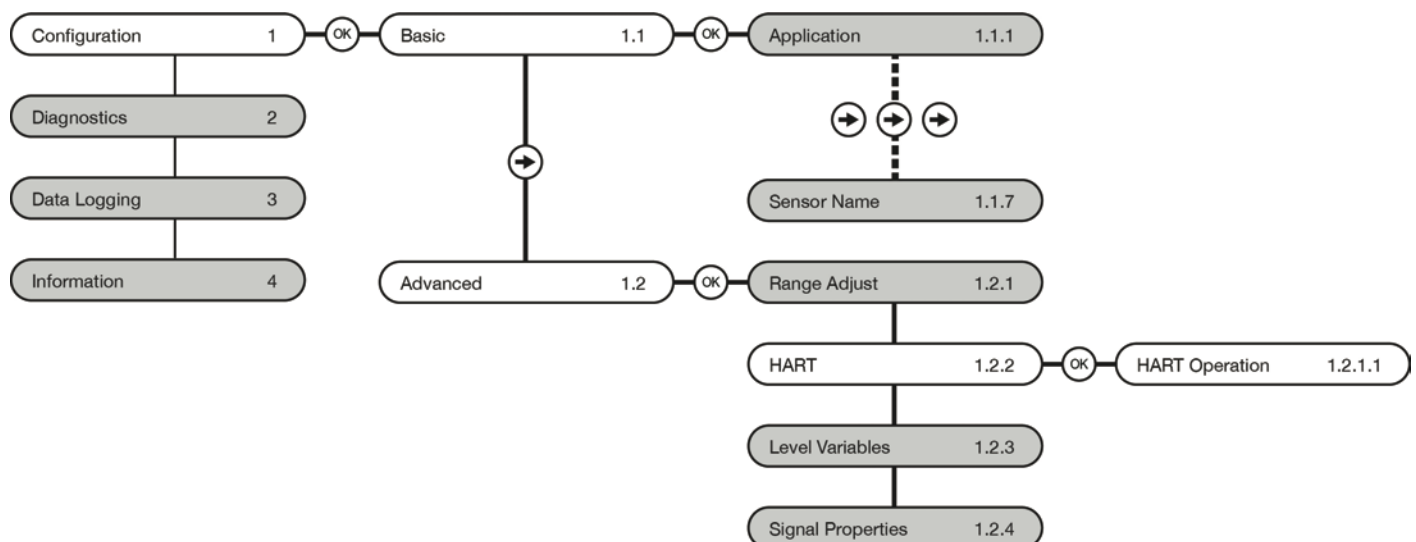
HART supports an operation mode capable of supporting multiple HART instruments on the same pair of wires. This is known as multidrop mode. A unique address number must be assigned to each device to differentiate one sensor from another. Multiple HART devices may be wired in parallel (along the same wire pair) making sure none of the HART addresses are set to 00. While in multidrop mode, the current consumption for the sensor can be preset at either 4mA or 8mA. Use a power supply that can provide power for all devices wired in the same loop.

**Note:** The default address is 00. If only a single device is installed on a pair of wires, then you do not need to change the default address. If multiple devices are sharing the same pair of wires, then the address must be changed.

**Note:** Multidrop mode is slow. Expect a slow response time of several seconds.



**Note:** These adjustments should only be performed after having completed the configuration steps previously described with the transmitter installed on the tank. Where so, perform the following applicable Advanced Adjustments.



## HART

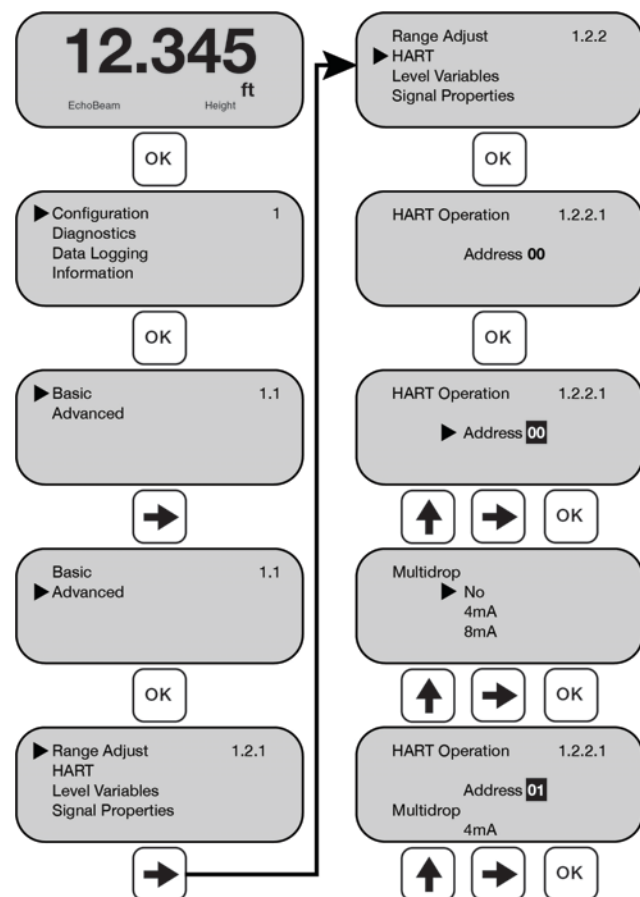
This function allows the sensor's address as well as the current consumption to be changed to allow EchoBeam® to operate in multidrop mode.

**Note:** This function should only be performed by a trained technician. Never change this setting unless instructed by a Flowline representative. Be sure to record this setting if a Factory Reset is performed.

- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **Right Arrow** to switch to Advanced.
- 4) Press **OK** to advance into Advanced Menu.
- 5) Press **Right Arrow** to scroll to HART.
- 6) Press **OK** to enter HART Operation.
- 7) Press **OK** to change the address number
  - a) Press **Right Arrow** to increase the address by one digit.
  - b) Press **Up Arrow** to decrease the address by one digit.
  - c) When the value is correct, press **OK** to save the setting.
- 8) Use the **Right Arrow** and **Up Arrow** to scroll to the desired Multidrop sensor consumption.
  - a) When the value is correct, press **OK** to save the setting.

**Note:** You must select a current setting of 4mA or 8mA for Multidrop to be active.

- 9) Review the Address and Multidrop consumption. When done, press **ESC** to return to the Range Adjust Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen.

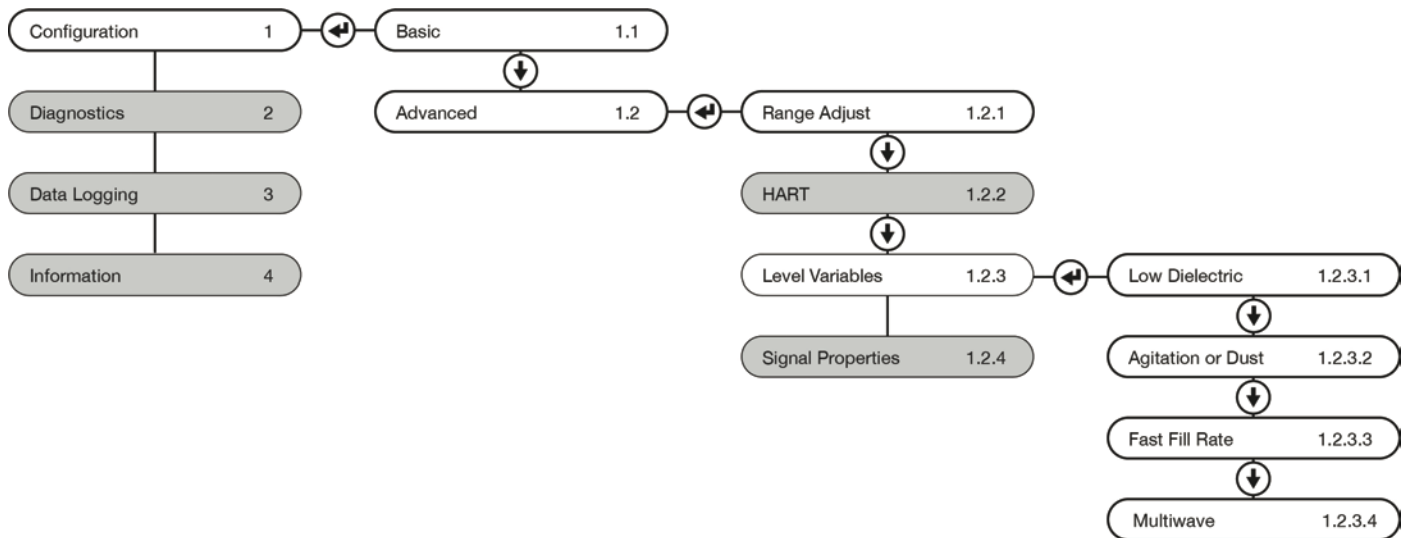


**PROCESS ADJUSTMENTS OVERVIEW (LEVEL VARIABLES)**

These optional functions are intended to improve transmitter performance in applications with the below process and/or installation characteristics.

**Note:** These adjustments should only be performed when (after having completed the configuration steps previously described with the transmitter installed on the tank) the transmitter is not performing to your satisfaction. Where so, perform the following applicable Process Adjustments.

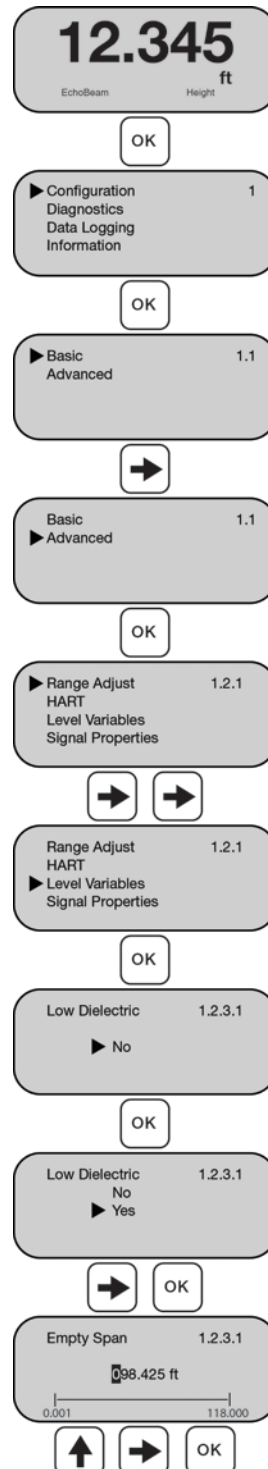
- Low Dielectric
- Liquid Surface is Turbulent or Agitated Surface
- Fast Filling or Emptying of the Liquid/Solid
- Multiwave



### LOW DIELECTRIC

Used when measuring a medium with a low dielectric constant and the reflection from the bottom of the tank is stronger than the medium reflection. Selections are YES or NO with the **Default being NO**. If YES is selected, then enter the Empty Span value (distance from tank bottom to the bottom of the sensor) so the transmitter can filter out the tank bottom.

- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **Right Arrow** to switch to Advanced.
- 4) Press **OK** to advance into Advanced Menu.
- 5) Press **Right Arrow** (at least two times) to scroll to Level Variables.
- 6) Press **OK** to advance into Level Variables Menu (Low Dielectric will appear).
- 7) Press **OK** to change the setting for Low Dielectric.
  - a) Press the **Up Arrow** or **Right Arrow** to toggle the triangle between Yes and No.
  - b) When the setting is correct, press **OK** to save the setting.
- 8) If Yes is selected, then you must enter the distance from the bottom of the EchoBeam® to the liquid surface. This is how the transmitter will identify the actual liquid in the application.
  - a) Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c) When the value is correct, press **OK** to save the setting.
- 9) When done, press **ESC** to return to the Range Adjust. Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen.

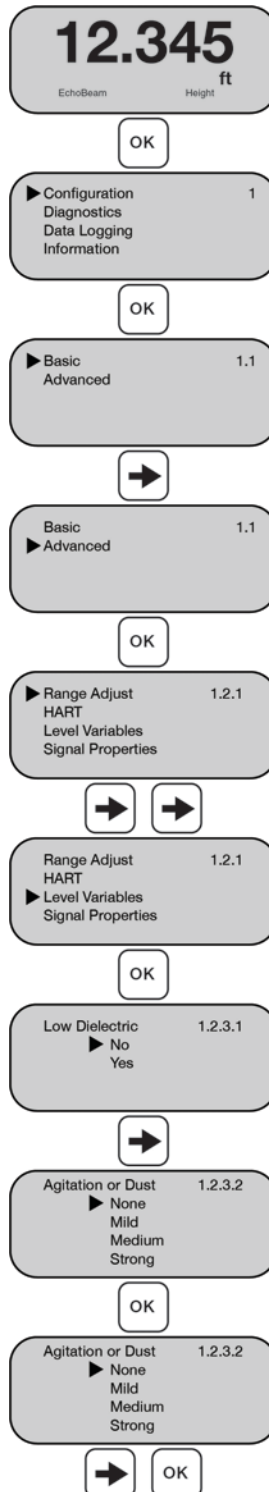


### TURBULENT OR AGITATED SURFACE

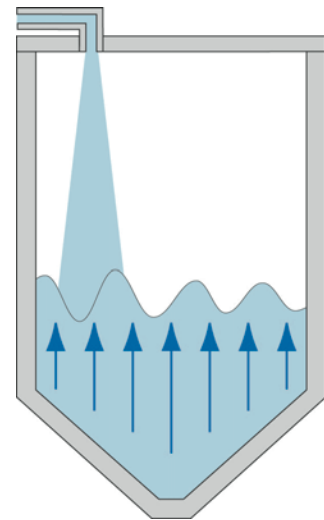
If the liquid surface is turbulent or agitated, set Turbulent Surface to Yes.

**Note:** Turbulent or agitated surfaces can occur when tanks are filled from the top without a down pipe, or when a mixer or air agitation is used within the tank.

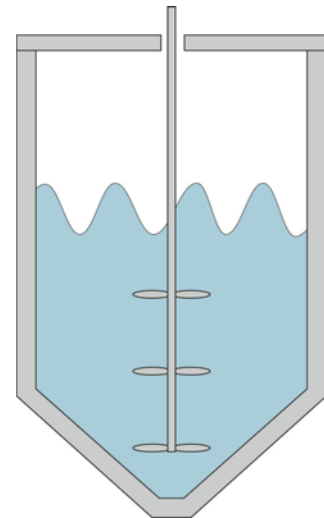
- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **Right Arrow** to switch to Advanced.
- 1) Press **OK** to advance into Advanced Menu.
- 2) Press **Right Arrow** (at least two times) to scroll to Level Variables.
- 3) Press **OK** to advance into Level Variables Menu (Low Dielectric will appear).
- 4) Press **Right Arrow** to scroll to Agitation or Dust.
- 5) Press **OK** to change the setting for Agitation or Dust.
  - a) Press **Up Arrow** or **Right Arrow** to scroll through the 4 settings for Agitation or Dust.
  - b) The options for Agitation or Dust are None, Mild, Medium or Strong.
  - c) When the setting is correct, press **OK** to save the setting.
- 9) When done, press **ESC** to return to the Range Adjust Menu, press **ESC** to return to the Advanced Menu, **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen.



**Turbulence from Tank Fill**



**Agitation from Mixer**

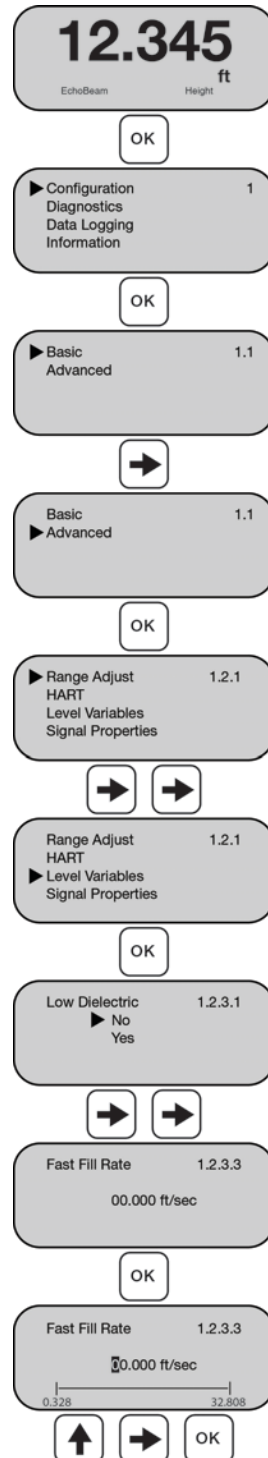


### FAST FILLING OR EMPTYING

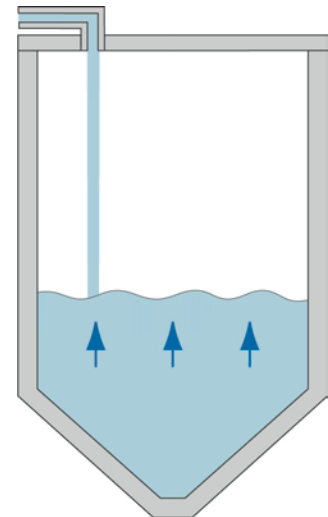
If the speed of liquid level rise or fall within the tank is greater than a rate of 1" per second (25.4mm/sec), set Fast Level Change to YES.

**Note:** Fast filling or emptying can occur when multiple pumps are operating or when a weather event increases the amount of liquid entering the tank.

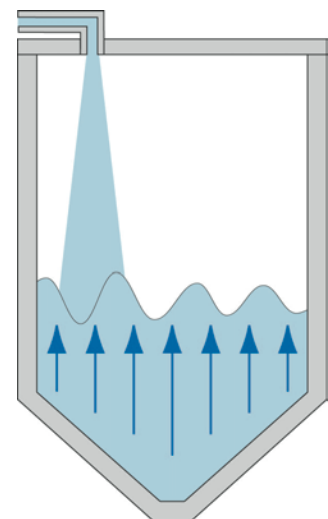
- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu. Press **Right Arrow** to switch to Advanced.
- 3) Press **OK** to advance into Advanced Menu.
- 4) Press **Right Arrow** (at least two times) to scroll to Level Variables.
- 5) Press **OK** to advance into Level Variables Menu (Low Dielectric will appear).
- 6) Press **Right Arrow** (at least two times) to scroll to Fast Fill Rate.
- 7) Press **OK** to change the value for fast Fill Rate.
  - a) Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c) When the value is correct, press **OK** to save the setting.
- 8) When done, press **ESC** to return to the Range Adjust Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen.



**Normal Level Change**



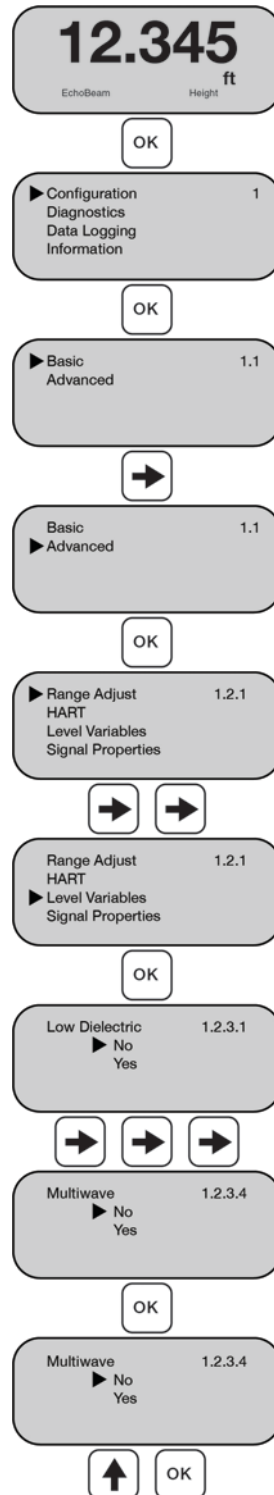
**Fast Level Change**



### MULTIWAVE

Used when there are multiple return echoes displayed in the EchoCurve.

- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **Right Arrow** to switch to Advanced.
- 6) Press **OK** to advance into Advanced Menu.
- 7) Press **Right Arrow** (at least two times) to scroll to Level Variables.
- 8) Press **OK** to advance into Level Variables Menu (Low Dielectric will appear).
- 9) Press **Right Arrow** (at least three times) to scroll to Multiwave.
- 10) Press **OK** to change the setting for Multiwave.
  - a) Press **Up Arrow** or **Right Arrow** to scroll through the setting of Yes or No.
  - b) When the setting is correct, press **OK** to save the setting.
- 10) When done, press **ESC** to return to the Range Adjust Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen.

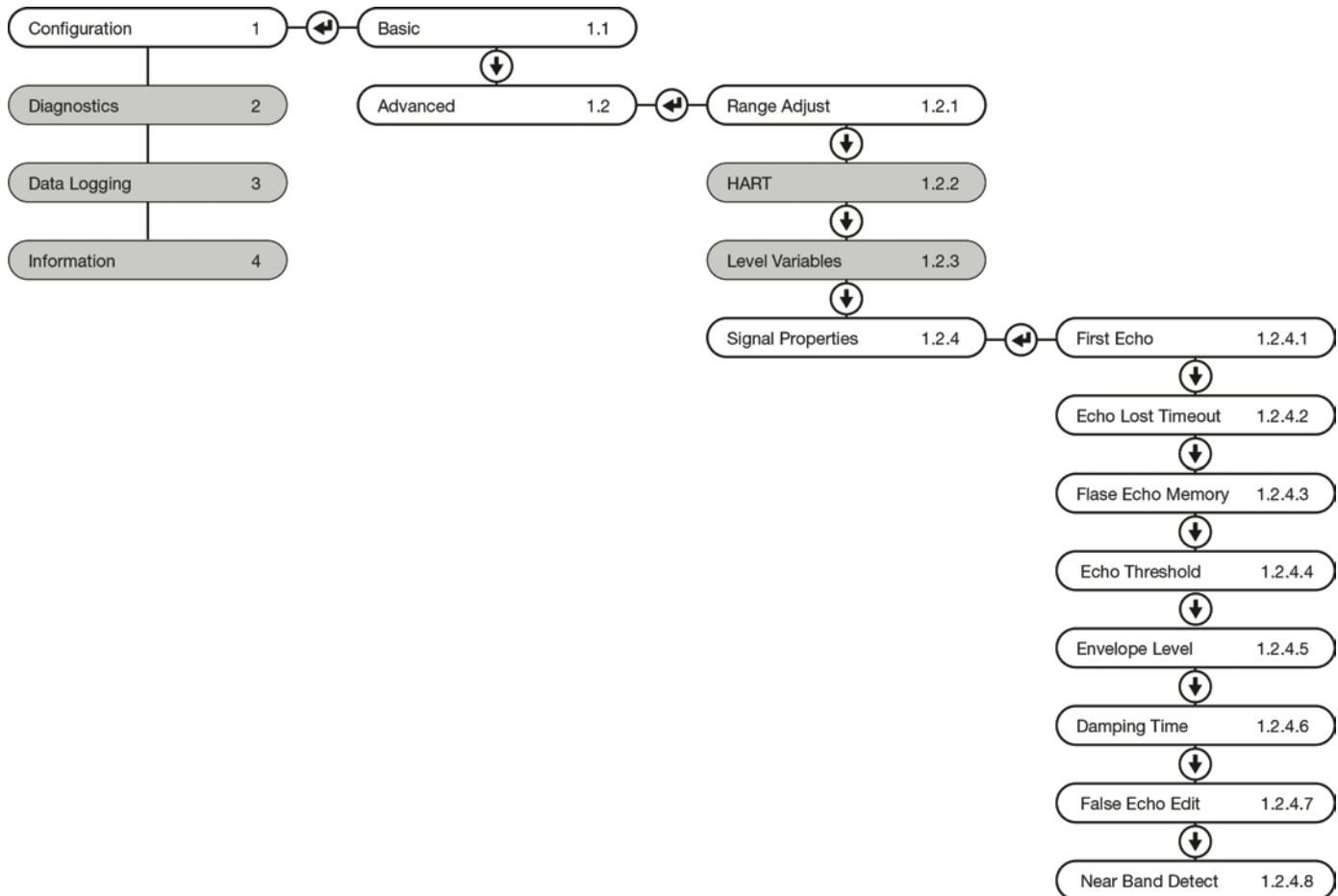


**PROCESS ADJUSTMENTS OVERVIEW**

These optional functions are intended to improve transmitter performance in applications with the below process and/or installation characteristics.

**Note:** These adjustments should only be performed when (after having completed the configuration steps previously described with the transmitter installed on the tank) the transmitter is not performing to your satisfaction. Where so, perform the following applicable Process Adjustments.

- First Echo
- Echo Lost Timeout
- False Echo Memory
- Echo Threshold
- Envelope Level
- Damping Time
- False Echo Edit
- Near Band Detect



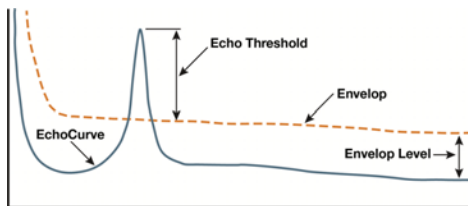
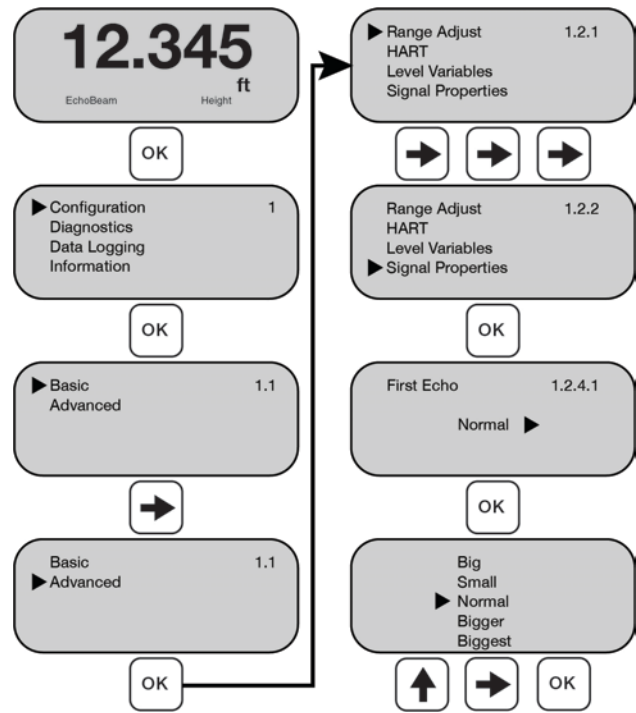


**FIRST ECHO**

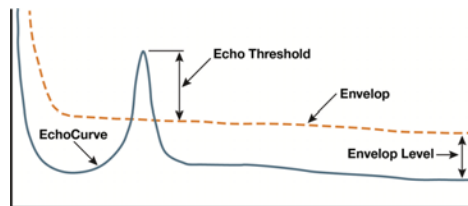
Used when the sensor has difficulty seeing the first echo return. This setting adjusts the peak strength (dB) of the first echo. **Default is Normal.** The settings are listed below:

- Normal – No adjustment
- Small – Amplitude of the first wave decreased by a factor of 0.7.
- Big – Amplitude of the first wave increased by a factor of 1.2.
- Bigger – Amplitude of the first wave increased by a factor of 2.
- Biggest – Amplitude of the first wave increased by a factor of 15.

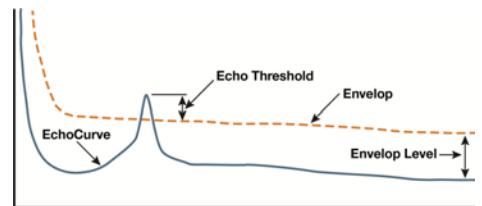
- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **Right Arrow** to switch to Advanced.
- 4) Press **OK** to advance into Advanced Menu.
- 5) Press **Right Arrow** (at least three times) to scroll to Signal Properties.
- 6) Press **OK** to advance into Signal Properties Menu (First Echo will appear).
- 7) Press **OK** to change the setting for First Echo.
  - a) Press the **Up Arrow** or **Right Arrow** to toggle the triangle between Big, Small, Normal, Bigger and Biggest.
  - b) When the setting is correct, press **OK** to save the setting.
- 8) When done, press **ESC** to return to the Signal Properties Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen.



First Echo peak is extraordinarily strong and can be reduced.



First Echo peak is normal, and no adjustment is required.



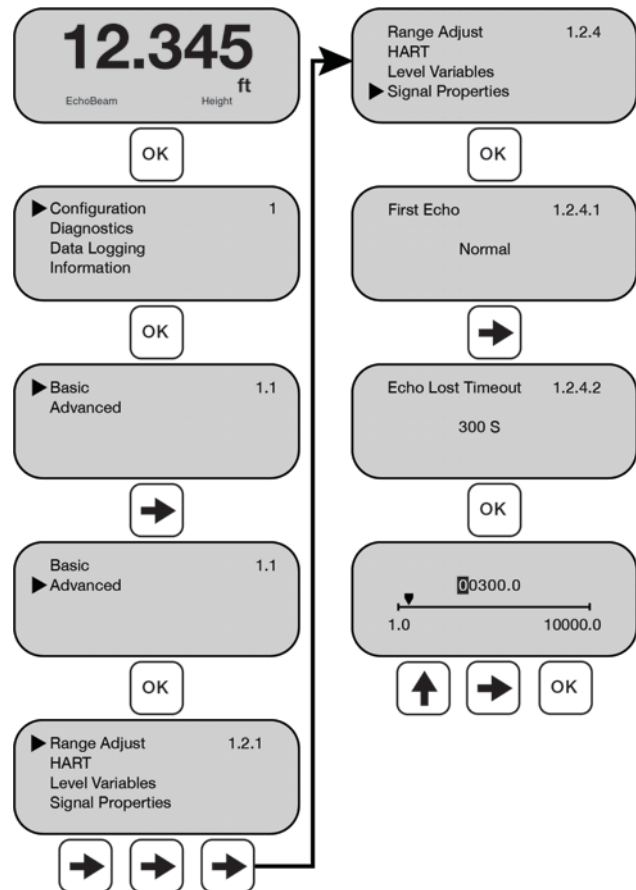
First Echo peak is weak and can be increased.

## ECHO LOST TIMEOUT

Sets the length of time the transmitter will look for a valid reading. If the time set is passed, the output will switch to the Fail-Safe setting. When this occurs, the display will show E14 (no signal).

- Time value can be set from 1 to 10000.0 seconds.

- From the Main Screen, press **OK** to advance into the Main Menu.
- Press **OK** to advance into the Configuration Menu.
- Press **Right Arrow** to switch to Advanced.
- Press **OK** to advance into Advanced Menu.
- Press **Right Arrow** (at least three times) to scroll to Signal Properties.
- Press **OK** to advance into Signal Properties Menu (First Echo will appear).
- Press **Right Arrow** (at least once) to scroll to Echo Lost Timeout.
- Press **OK** to change the setting for Echo Lost Timeout.
  - Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - When the value is correct, press **OK** to save the setting.
- When done, press **ESC** to return to the Signal Properties Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen.

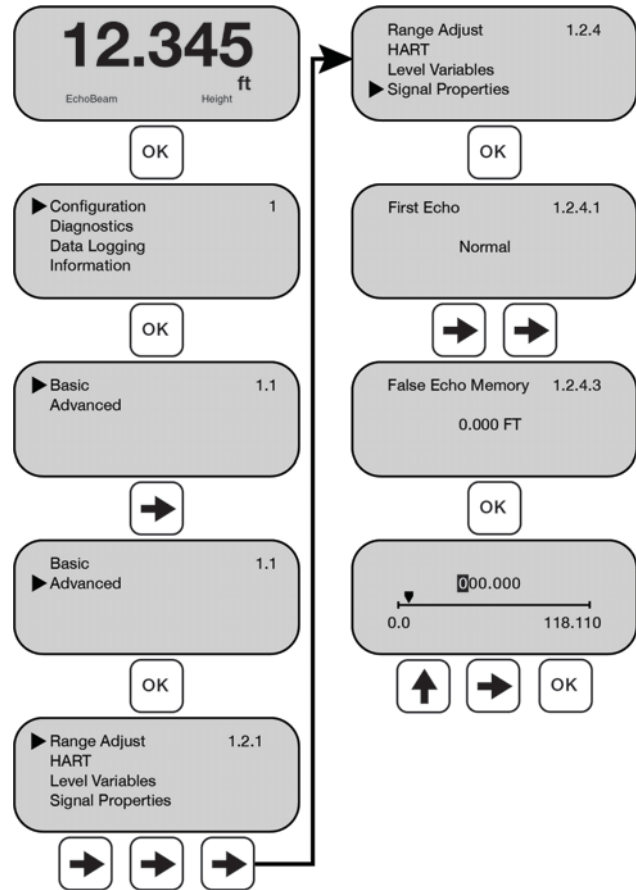


**FALSE ECHO MEMORY**

This is the location of a False Echo that is filtered from being considered as a valid echo response. The default is 0 feet (0m).

- A False Echo memory can be set from the minimum range to the maximum range of the sensor.

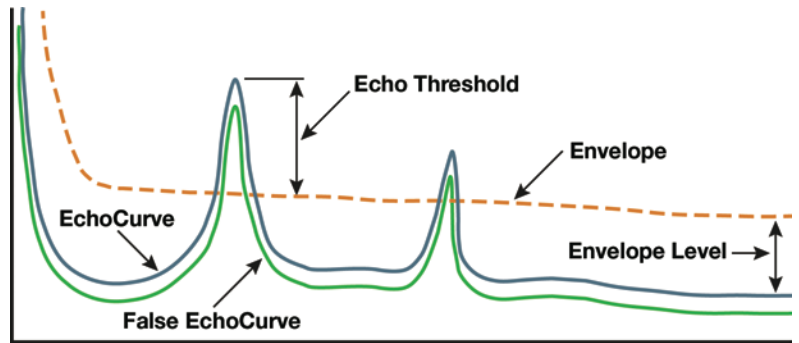
- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **Right Arrow** to switch to Advanced.
- 4) Press **OK** to advance into Advanced Menu.
- 5) Press **Right Arrow** (at least three times) to scroll to Signal Properties.
- 6) Press **OK** to advance into Signal Properties Menu (First Echo will appear).
- 7) Press **Right Arrow** (at least two times) to scroll to False Echo Memory.
- 8) Press **OK** to change the setting for False Echo Memory.
  - a) Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c) When the value is correct, press **OK** to save the setting.
- 9) When done, press **ESC** to return to the Signal Properties Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen.



**Note:** Flowline suggests setting False Echo Memory value to 0.95 x Valid Distance Value.

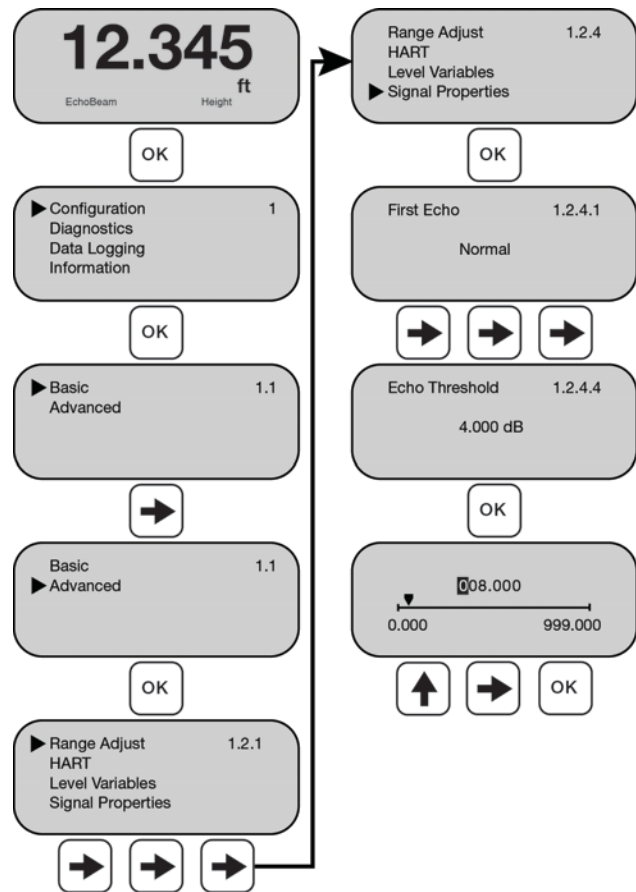
**ECHO THRESHOLD**

Echo Threshold and Envelope Level are both tied to the Envelope. Echo Threshold is the difference the return signal must exceed above the Envelope so that the return signal can be considered a valid level (liquid or solids). Echo Threshold is in units of dB. When the return signal is weak, decreasing the Echo Threshold will help to identify the signal.



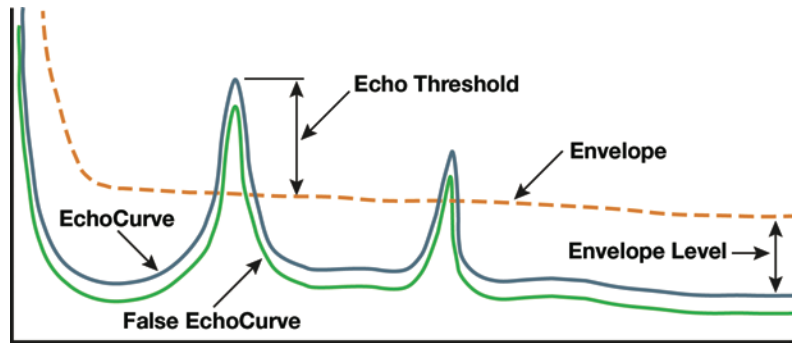
- An echo threshold value can be set from 0.000 to 999.000.

- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **Right Arrow** to switch to Advanced.
- 4) Press **OK** to advance into Advanced Menu.
- 5) Press **Right Arrow** (at least three times) to scroll to Signal Properties.
- 6) Press **OK** to advance into Signal Properties Menu (First Echo will appear).
- 7) Press **Right Arrow** (at least three times) to scroll to Echo Threshold.
- 8) Press **OK** to change the setting for Echo Threshold.
  - a) Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c) When the value is correct, press **OK** to save the setting.
- 9) When done, press **ESC** to return to the Signal Properties Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen.



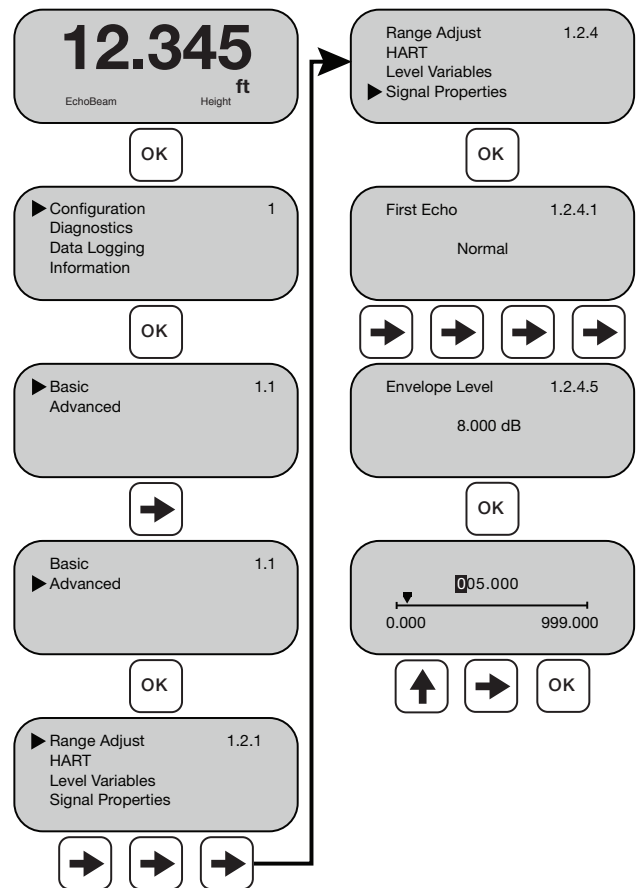
**ENVELOPE LEVEL**

Echo Threshold and Envelope Level are both tied to the Envelope. Envelope Level is the difference between the EchoCurve, and the actual Envelope, and it adjusts with the shape of the EchoCurve. Envelope Level is in units of dB. When the return signal is competing with other signals, increasing the Envelope level will help to filter out the extra signals.



- An envelope level value can be set from 0.000 to 999.000.

- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **Right Arrow** to switch to Advanced.
- 4) Press **OK** to advance into Advanced Menu.
- 5) Press **Right Arrow** (at least three times) to scroll to Signal Properties.
- 6) Press **OK** to advance into Signal Properties Menu (First Echo will appear).
- 7) Press **Right Arrow** (at least four times) to scroll to Envelope Level.
- 8) Press **OK** to change the setting for Envelope Level.
  - a) Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c) When the value is correct, press **OK** to save the setting.
- 9) When done, press **ESC** to return to the Signal Properties Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen.

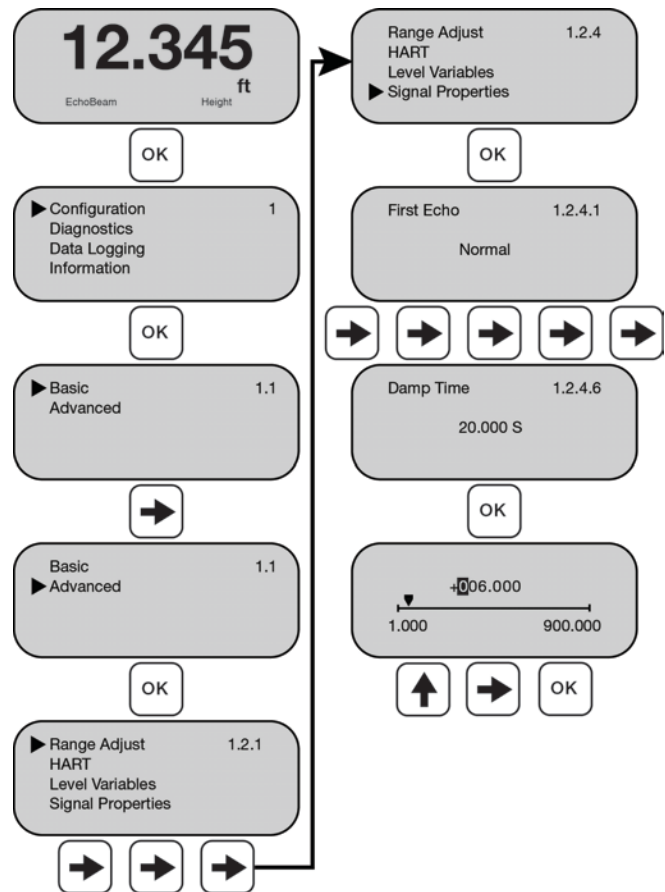


**DAMPING TIME**

This function sets the sampling rate for which the sensor updates the current output. The value is entered in seconds with a default of 20 seconds. Decreasing the value will make the output more responsive to level changes. Increasing the value will make the output less responsive to level changes.

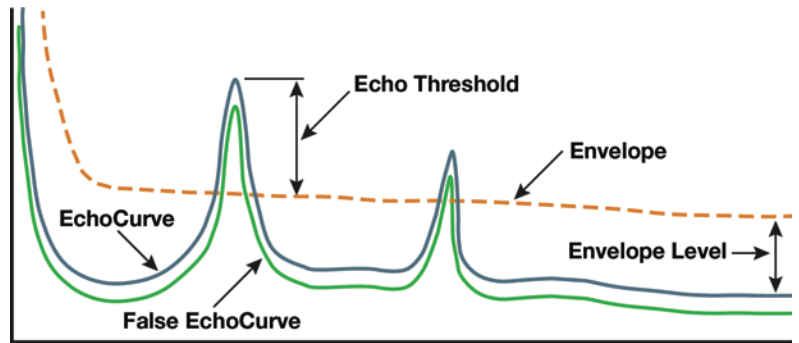
- The damping time value can be set from 1 to 900 seconds.

- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **Right Arrow** to switch to Advanced.
- 4) Press **OK** to advance into Advanced Menu.
- 5) Press **Right Arrow** (at least three times) to scroll to Signal Properties.
- 6) Press **OK** to advance into Signal Properties Menu (First Echo will appear).
- 7) Press **Right Arrow** (at least five times) to scroll to Damping Time.
- 8) Press **OK** to change the setting for Damping Time.
  - a) Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c) When the value is correct, press **OK** to save the setting.
- 9) When done, press **ESC** to return to the Signal Properties Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen.



**FALSE ECHO EDIT**

Allows for any identified False Echo to be edited. Use this setting after a False EchoCurve has been created. Enter the starting point distance, starting point intensity (dB), end point distance, and end point intensity (dB) according to the menu prompts. When completed, a straight line will be generated to connect the two points as a False Echo.

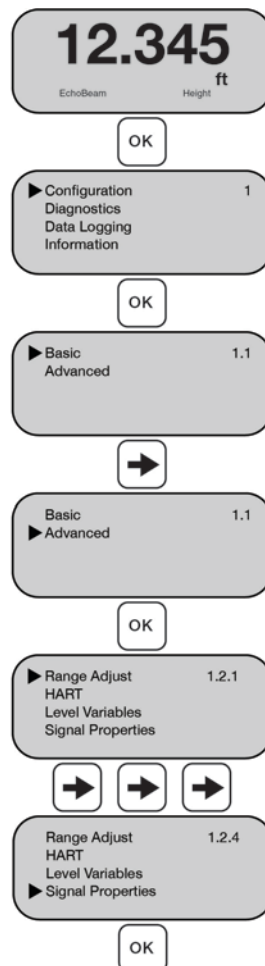


**Note:** Consult Factory prior to changing any settings in False Echo Edit.

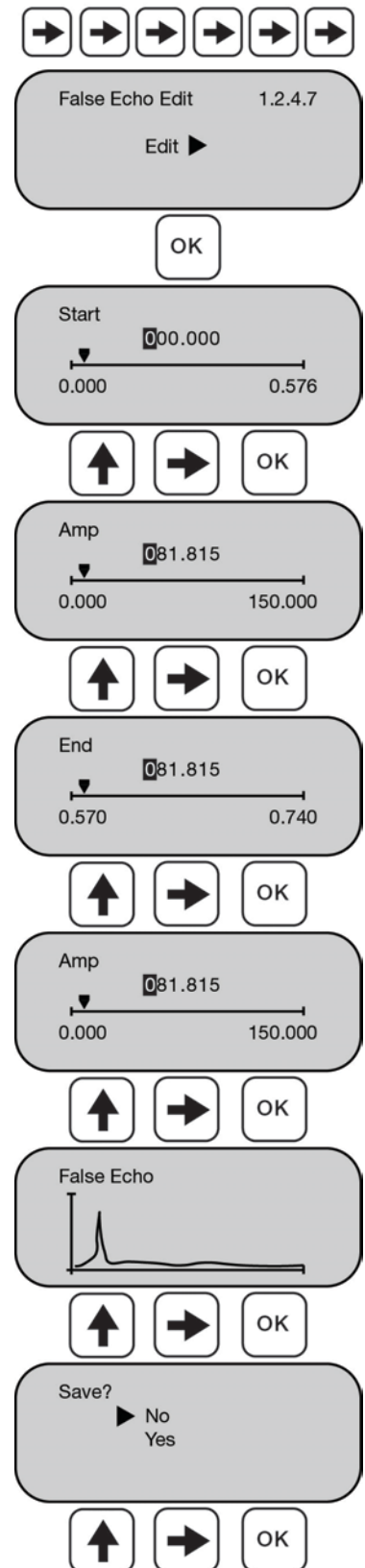
- Starting point distance (Start) and end point distance (End) values can be set from 0.000 to maximum distance set when the False EchoCurve was created. The units will be in the units previously selected.
- Starting point intensity and end point intensity values can be set from 0.000 dB to 150.000 dB.

**Note:** If a False EchoCurve is not created or active, then False Echo Edit is off.

- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **Right Arrow** to switch to Advanced.
- 4) Press **OK** to advance into Advanced Menu.
- 5) Press **Right Arrow** (at least three times) to scroll to Signal Properties.
- 6) Press **OK** to advance into Signal Properties Menu (First Echo will appear).



- 7) Press **Right Arrow** (at least six times) to scroll to False Echo Edit.
- 8) Press **OK** to edit the False EchoCurve.
- 9) Enter the Starting Point Distance (Start) using the Up Arrow and Right Arrow.
  - a) Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
- 10) When the value is correct, press **OK** to save the setting. Enter the Starting Point Intensity (Amp) using the Up Arrow and Right Arrow.
  - a) Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
- 11) When the value is correct, press **OK** to save the setting. Enter the Ending Point Distance (End) using the Up Arrow and Right Arrow.
  - a) Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c) When the value is correct, press **OK** to save the setting.
- 12) Enter the Ending Point Intensity (Amp) using the Up Arrow and Right Arrow.
  - a) Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b) Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c) When the value is correct, press **OK** to save the setting.
- 13) Review the new false EchoCurve verifying the signals you want removed are identified.
  - a) Press **OK** to continue.
- 14) Under Save? select **YES** if the New EchoCurve is correct or select **NO** if the New EchoCurve is not correct.
  - a) Use the Right Arrow and Up Arrow to toggle between Yes and NO.
  - b) When the value is correct, press **OK** to save the setting.
- 15) When done, press **ESC** to return to the Signal Properties Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen.



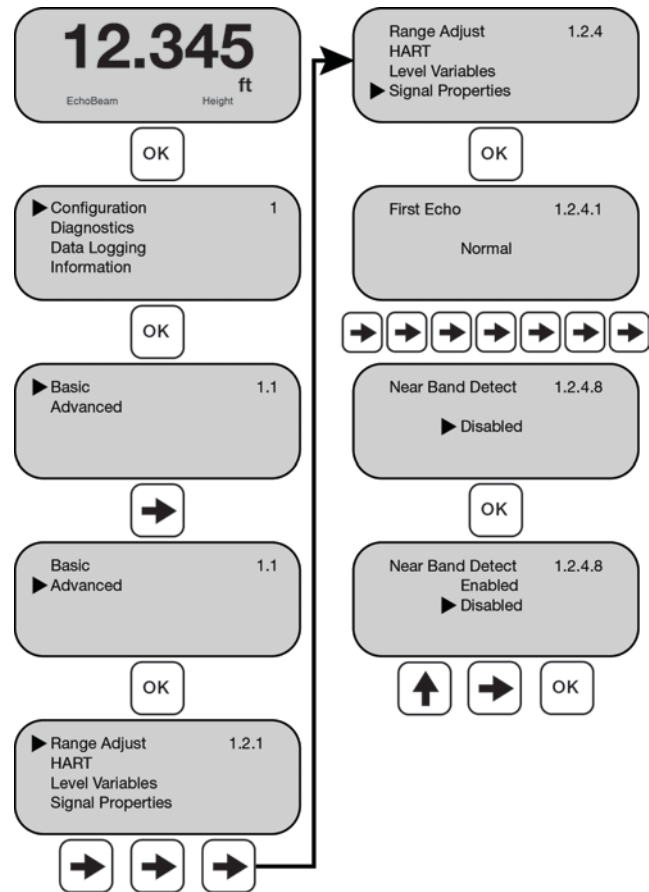


### NEAR BAND DETECT

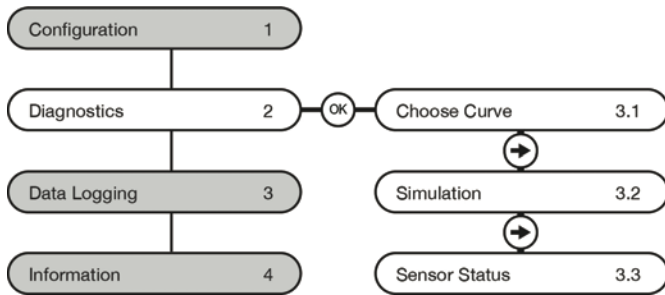
This function is used when level is close to the bottom of the sensor. When enabled, the EchoBeam will use an alternative algorithm to determine the actual level within 3.28 ft (1m) from the transmitter.

Note: the alternative algorithm will ignore the envelope within this window.

- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **OK** to advance into the Configuration Menu.
- 3) Press **Right Arrow** to switch to Advanced.
- 4) Press **OK** to advance into Advanced Menu.
- 5) Press **Right Arrow** (at least three times) to scroll to Signal Properties.
- 6) Press **OK** to advance into Signal Properties Menu (First Echo will appear).
- 7) Press **Right Arrow** (at least seven times) to scroll to Near Band Detect.
- 8) Press **OK** to change the setting for Near Band Detect.
  - a) Press **Up Arrow** or Right Arrow to select Disabled or Enabled.
  - b) When the setting is correct, press **OK** to save the setting.
- 9) When done, press **ESC** to return to the Signal Properties Menu, press **ESC** to return to the Advanced Menu, press **ESC** again to return to the Configuration Menu and press **ESC** a fourth time to return to the Main Screen.



The features below are used to view EchoCurve, False EchoCurve, activate a simulation or observe the sensor’s status.



- **Choose Curve**

This setting enables the selection of the standard EchoCurve or the False EchoCurve for viewing.

- **Simulation**

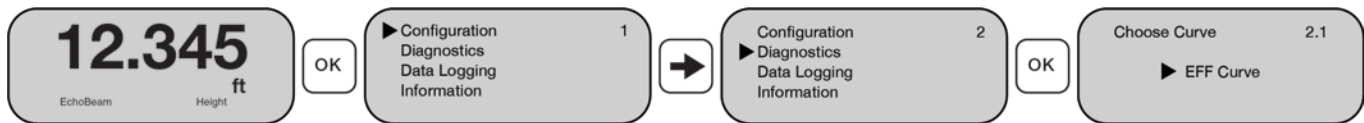
Allows for the EchoBeam to output a specific value regardless of the level of media in the application. The output can be set in either units of mA or length (feet or meters).

- **Sensor Status**

Lists several key settings for the EchoBeam®.

**ENTERING DIAGNOSTICS MENU**

To enter Diagnostics, follow below:



- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **Right Arrow** once to move the triangle to Diagnostics.
- 3) Press **OK** to advance into Diagnostics.
- 4) Use the **Right Arrow** and **Up Arrow** to toggle between the Choose Curve (2.1), Simulation (2.2) and Sensor Status (2.3) screens.

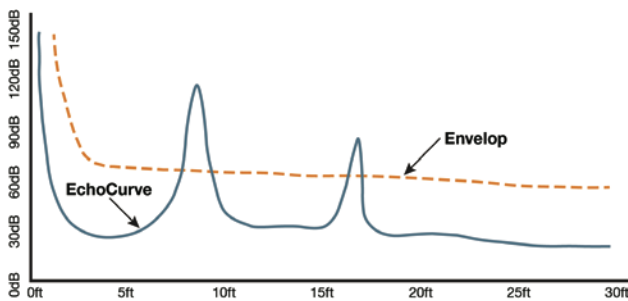
**CHOOSE CURVE**

This function allows the selection to view either the EchoCurve (default) or the False EchoCurve. The EchoCurve graphically displays the primary echo return(s) the transmitter sees, the location and amplitude of the return(s), and the numeric air gap distance from the bottom of the transmitter to the level below. The False EchoCurve graphically displays the echoes which are removed from consideration as acceptable media return signals.

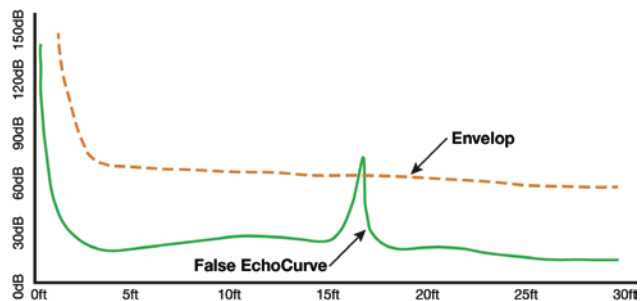
**Note:** This step should only be performed after having completed the prior eight configuration steps and with the transmitter installed on the tank.

Below shows the basics for an EchoCurve and a False EchoCurve.

**EchoCurve Example**

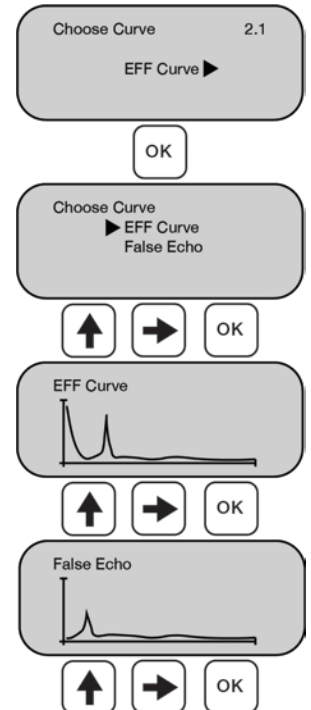


**False EchoCurve Example**



- **Vertical Axis (Y-axis)** - Provides the strength of the signal being measured by the radar transmitter. The value is in units of decibels (dB).
- **Horizontal Axis (X-axis)** - Provides the distance away from the bottom of the radar transmitter. The value is in units of length (i.e., Feet, Meters, etc.)
  - As you move from left to right, you are moving further away from the bottom of the transmitter (level getting lower).
- **EchoCurve** - Graphically displays the primary echo return(s) the transmitter sees, the location and amplitude of the return(s), and the numeric air gap distance from the bottom of the transmitter to the level below. Always check to see if the peak matches the location of the level.
- **Envelope** - This is the baseline that is used to identify a potential level reading. Any signal below this line will be ignored while any signal above the line is a potential level reading.
- **False EchoCurve** - Graphically displays the echoes which are removed from consideration as acceptable media return signals. Creating a False EchoCurve will help to filter out potential false signals and will improve the performance of EchoBeam®.

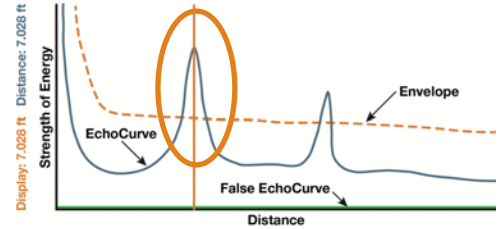
- 1) From the Choose Curve (2.1) screen, press **OK** to enter Choose Curve.
- 2) Select either EFF Curve or False Echo.
  - a. Press **Up Arrow** or **Right Arrow** to toggle between the two curves.
  - b. Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c. When the curve is selected, press **OK** to view the curve.
- 3) EFF Curve (EchoCurve) graphically displays the primary echo return(s) the transmitter sees, the location and amplitude of the return(s), and the numeric air gap distance from the bottom of the transmitter to the level below. Always check to see if the peak matches the location of the level.
  - a. Press **Up Arrow** to toggle between different ranges on the X-axis.
  - b. Press **Right Arrow** to toggle between showing and not showing the Envelope.
  - c. When done, press **OK** to leave
- 4) False EchoCurve graphically displays the echoes which are removed from consideration as acceptable media return signals. Creating a False EchoCurve will help to filter out potential false signals and will improve the performance of EchoBeam®.
  - a. When done, press **OK** to leave.



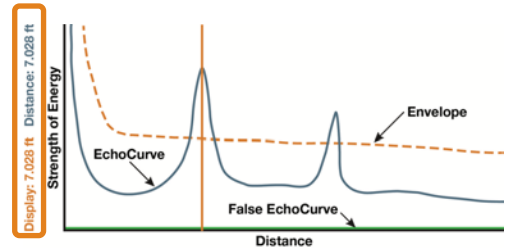
**WHAT IS A GOOD ECHOCURVE?**

EchoCurve presents a physical representation of the return signal across the operational range for the radar transmitter. There are two components to observe when looking at the EchoCurve:

- **Check the Peak(s) along the EchoCurve**
  - Ideally, there should be a significant peak which represents the liquid or solids level in the tank.
  - This peak should be above the Orange Line (Threshold Filter).
  - There may be more, and smaller peaks located before and after the large peak.
- **Check the Location of Peak (Return)**
  - To the left of the EchoCurve, there are two values.
  - Display Value represents the air gap distance from the radar transmitter to the level.
  - Distance Value represents the air gap distance from the radar transmitter to the peak amplitude location.
  - These two values should be close to one another (or the same value).
    - The example above indicates that the liquid level is located 7.028 feet away (Display Value) and the peak amplitude is also located 7.028 feet away (Distance Value) from the radar transmitter.
    - The liquid or solids level should be at this peak location.



**Echo Peaks along the EchoCurve**

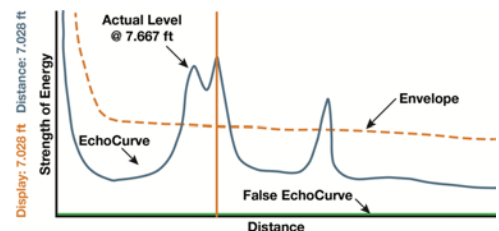
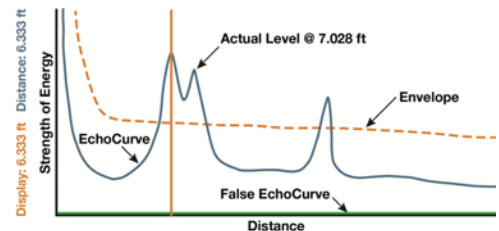


**Location of Echo Return**

**WHAT IS A BAD ECHOCURVE?**

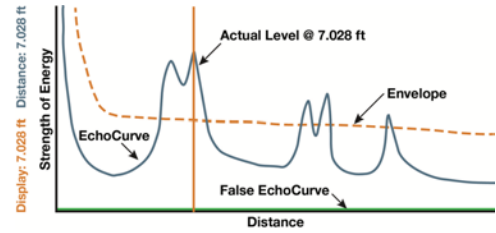
There are several elements which indicate a bad EchoCurve.

- **Peak before the liquid or solids level**
  - If the most significant peak is ahead of/above the actual level of liquid or solids, this typically indicates interference from a physical object that is reflecting the radar energy back to the transmitter.
  - Performing a False EchoCurve will allow the EchoBeam® to filter out this false signal.
- **Peak after the liquid or solids level**
  - If the most significant peak is behind/below the actual level of liquids or solids, this typically indicates interference from a physical object that is reflecting the radar energy back to the transmitter.
  - Performing a False EchoCurve will allow the EchoBeam® to filter out this false signal.

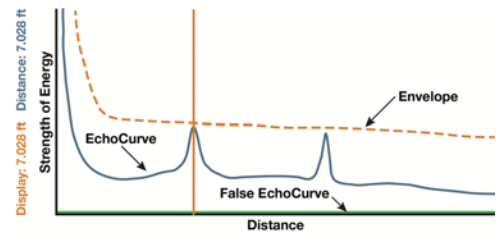


**WHAT IS A BAD ECHOCURVE?**

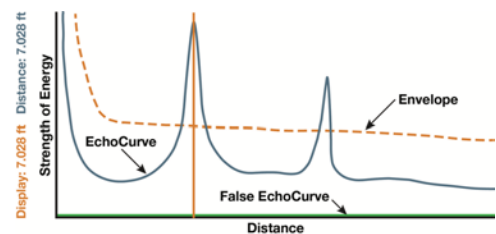
- **Multiple peaks before or after the liquid or solids level**
  - If there are multiple peaks, the EchoBeam® may have trouble identifying which is the correct peak (liquid or solids level).
  - Performing a False EchoCurve will allow the EchoBeam® to filter out the false signals.
  - Also consider activating the Multiwave filter which can be found under Configuration > Advanced > Settings > Level Variables.
    - Change variable from NO to YES.



- **Peak underneath the orange line**
  - If the most significant peak is beneath the orange line (Threshold Filter), then the return signal is weak.
  - Consider changing the first Echo filter, which can be found under Configuration > Advanced > Settings > Signal Properties.
    - Change variable from the default of Normal to Big, Bigger or Biggest.
    - Big will increase the peak by -10dB, Bigger by -20dB and Biggest by -40dB.
  - Performing a False EchoCurve will also allow the EchoBeam® to filter out this false signal, making it easier to identify the actual liquid or solids level.



- **Peak way above the orange line**
  - If the most significant peak is way above the orange line (Threshold Filter), then the return signal is strong and could affect the accuracy when the level is close to full.
  - Consider changing the first Echo filter, which can be found under Configuration > Advanced > Settings > Signal Properties.
    - Change variable from the default of Normal to Small which will decrease the peak by -10dB.

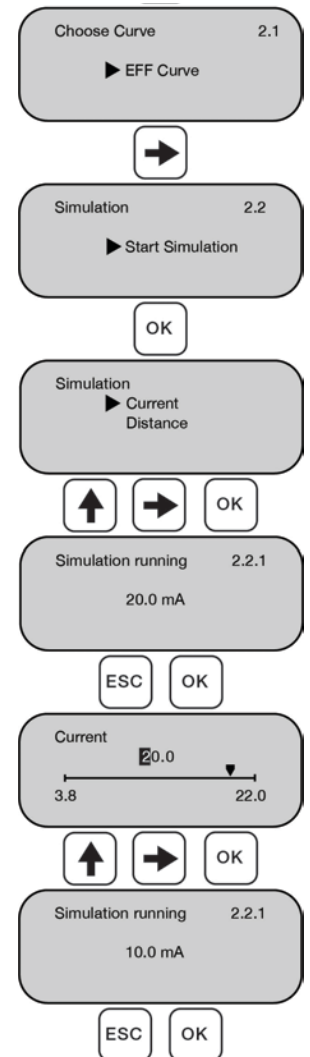


**SIMULATION**

Simulate various level conditions by manually adjusting the output of EchoBeam®. This can be used to confirm functionality of a system without having to wait for the level in the tank to rise or fall to a specific level.

- For example, if you need a high alarm to activate at 95%, you can use Simulate to output the equivalent current for 95% without having to raise the liquid or solids level to the actual 95%.
- Current Output - This method explicitly sets the current output (4-20mA) to the desired value.
- Distance - This method uses distance from the sensor’s measurement location to set the current output (4-20mA) between the Empty and Full Configuration values.

- 1) From the Choose Curve (2.1) screen, press **Right Arrow** to switch to Simulation.
- 2) Press **OK** to change the setting for Simulation.
  - a. Press **Up Arrow** or **Right Arrow** to scroll through the setting of Current or Distance.
  - b. When the setting is correct, press **OK** to save the setting.
- 3) The Simulation is now running and is displaying the current or distance that is being sent by the current output of the sensor.
  - a. Press **OK** to change the value.
  - b. Press **ESC** to exit Simulation.
- 4) Enter the value that the sensor will simulate using the Up Arrow and Right Arrow.
  - a. Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b. Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c. Press **OK** to simulate the new value and to return the previous screen (Simulation Running).
- 5) From the Simulation running screen, you can either select a new value by pressing **OK** or you can exit by pressing **ESC**.

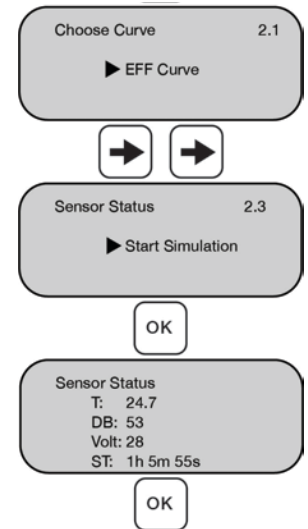


**SENSOR STATUS**

View all values measured by the transmitter including:

- (T) Temperature – Internal temperature of the transmitter
- DB – Value is in dB with a range from 0 to 150
- Volt – The voltage being read by the sensor
- Start Time – How long the EchoBeam® has been running

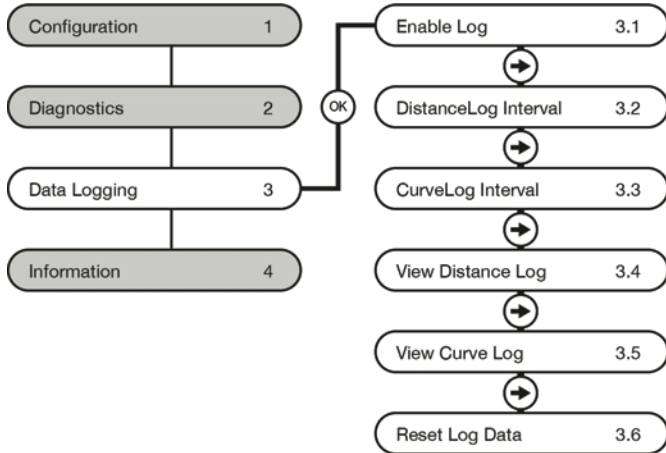
- 1) From the Choose Curve (2.1) screen, press **Right Arrow** twice to switch to Sensor Status.
- 2) Press **OK** to view Sensor Status.
- 3) Press **OK** to leave Sensor Status.





## DATA SAMPLING

EchoBeam® can sample the last 1,000 data points as well as the last 10 EchoCurves. The data and the EchoCurves can be exported for review with the use of the LevelTap™ App. These values are stored in the memory of the transmitter following a first in, first out logic.



- **Enable Log**

This setting enables the data sampling within EchoBeam®. Select YES to turn the data sampling ON and NO to turn data sampling OFF.

- **DistanceLog Interval**

Set the time between data points.

The setting is entered in Hours, Minutes and Seconds with a minimum interval of 5 seconds and a maximum interval of 24 hours.

- **CurveLog Interval** can be set from a minimal interval of 3 minutes to a maximum interval of 24 hours.

Set the time data between EchoCurves.

The setting is entered in Hours, Minutes and Seconds with a minimum interval of 3 minutes and a maximum interval of 24 hours.

- **View Distance Log**

View data plot of distance over time.

- **View Curve Log**

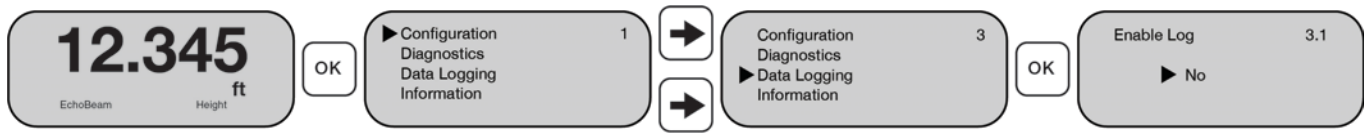
View the last 10 signal return plots.

- **Reset Log Data**

This setting will clear the memory of the last data points and the last EchoCurves.

## ENTERING DATA SAMPLING MENU

To enter Data Sampling, follow below:

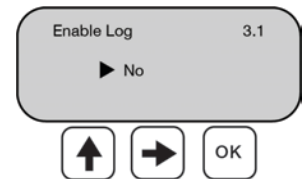


- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **Right Arrow** twice to move the triangle to Data Sampling.
- 3) Press **OK** to advance into Data Sampling.
- 4) Use the **Right Arrow** and **Up Arrow** screens to toggle between the Enable Log (3.1), Distance Log Interval (3.2), Curve Log Interval (3.3), View Distance Log (3.4), View Curve log (3.5) and Reset Log Data (3.6) screens.

## ENABLE LOG

Use this feature to turn Data Sampling ON and OFF.

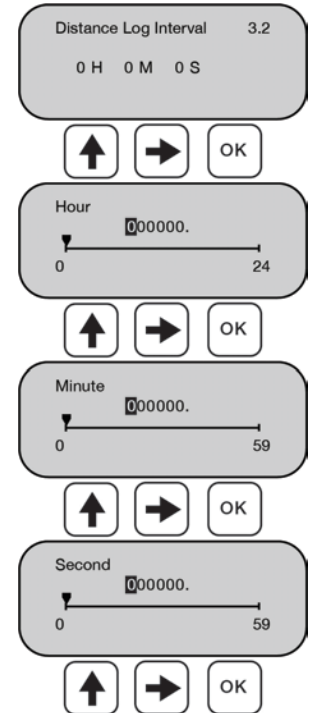
- 1) From the Enable Log (3.1) screen, press **OK** to enter Enable Log.
- 2) Press **Right Arrow** or **Up Arrow** to toggle between No and Yes.
- 3) Press **OK** to save setting.



**DISTANCE LOG INTERVAL**

Use this feature to set the time interval for each sample. Up to 1,000 points will be stored following the first in, first out protocol. Distance Log Interval can be set from a minimal interval of 5 seconds to a maximum interval of 24 hours.

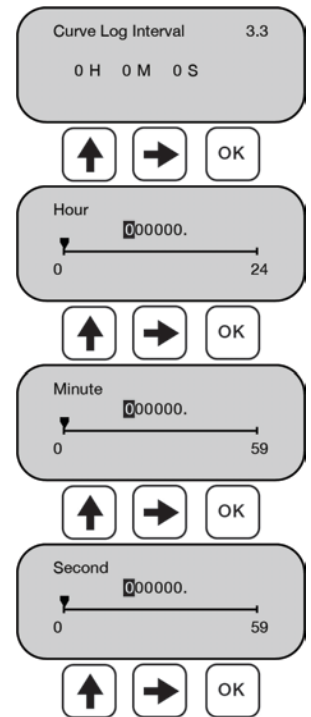
- 1) From the Distance Log Interval (3.2) screen, press **OK** to enter Distance Log Interval
- 2) The first screen is the Hour setting.
  - a. Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b. Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c. When the Hour value is correct, press **OK** to save the setting.
- 3) The second screen is the Minute setting.
  - a. Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b. Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c. When the Minute value is correct, press **OK** to save the setting
- 4) The third screen is the Second setting.
  - a. Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b. Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c. When the Second value is correct, press **OK** to save the setting.



**CURVE LOG INTERVAL**

Use this feature to set the time interval between each EchoCurve sample. Up to 10 EchoCurves will be stored following the first in, first out protocol. Curve Log Interval can be set from a minimal interval of 3 minutes to a maximum interval of 24 hours.

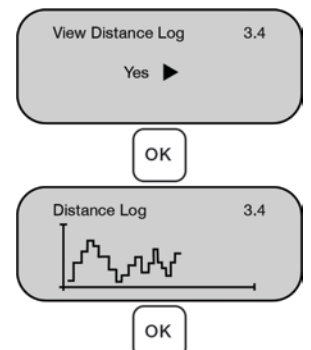
- 1) From the Curve Log Interval (3.3) screen, press **OK** to enter Curve Log Interval.
- 2) The first screen is the Hour setting.
  - a. Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b. Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c. When the Hour value is correct, press **OK** to save the setting.
- 3) The second screen is the Minute setting.
  - a. Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b. Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c. When the Minute value is correct, press **OK** to save the setting
- 4) The third screen is the Second setting.
  - a. Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b. Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c. When the Second value is correct, press **OK** to save the setting.



**VIEW DISTANCE LOG**

Use this feature to view the data in a graph with the X-axis representing time and the Y-axis representing the media value.

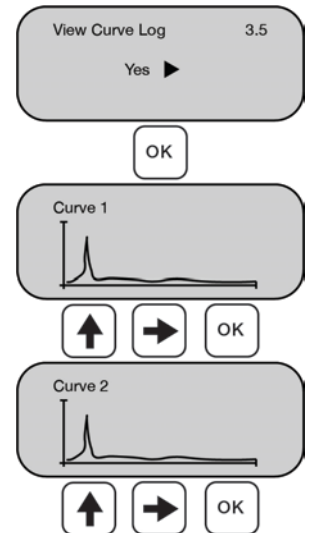
- 1) From the View Distance Log (3.4) screen press **OK** to view the Distance Log.
- 2) To leave the Distance Log screen, press **OK**.



**VIEW CURVE LOG**

Use this feature to view the stored EchoCurves. Use the **Right Arrow** and **Up Arrow** to toggle between the various EchoCurves (up to 10 will be stored). Data on an EchoCurve is shown with the X-axis representing distance away from the sensor and the Y-axis representing the strength of the signal.

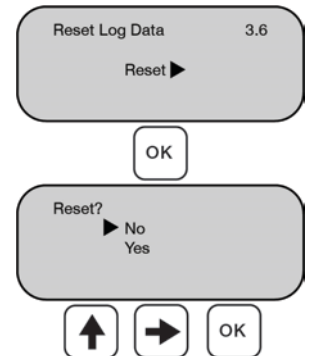
- 1) From the View Curve Log (3.5) screen, press **OK** to view the Curve Log.
- 2) Press the **Right Arrow** or **Up Arrow** to scroll through the last 10 EchoCurves.
- 3) To leave the Curve Log screen, press **OK**.



**RESET LOG DATA**

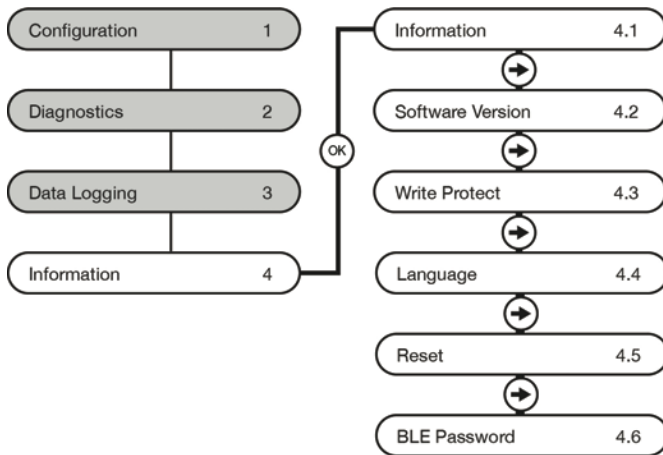
Use this feature to reset all the data sampled (Distance Data and EchoCurves). Activating the reset will erase both sets of data.

- 1) From the Reset Log Data (3.6) screen, press **OK**.
- 2) Press **Right Arrow** or **Up Arrow** to toggle between No and Yes.
- 3) Press **OK** to save setting.



**INFORMATION**

These features are used to provide enhanced information about the EchoBeam<sup>®</sup>, to change the language shown on the display, and to reset the device.



- **Information**

Lists the basic information for the EchoBeam<sup>®</sup> including the product type (Type), the serial number (ID) and the Production Date (PD).

- **Software Version**

Lists the four software versions used by the EchoBeam<sup>®</sup>. These include the Mother Board (MB) version, the Digital Signal Processor (DSP) version, the LCD display version and the RF processor version.

- **Write Protect**

Enables the sensor to be protected with a 6-digit security code. The code prevents the changing of parameters without entering the code prior to making any change.

- **Language**

Enables the screen language to be changed from English to Chinese or vice versa.

- **Reset**

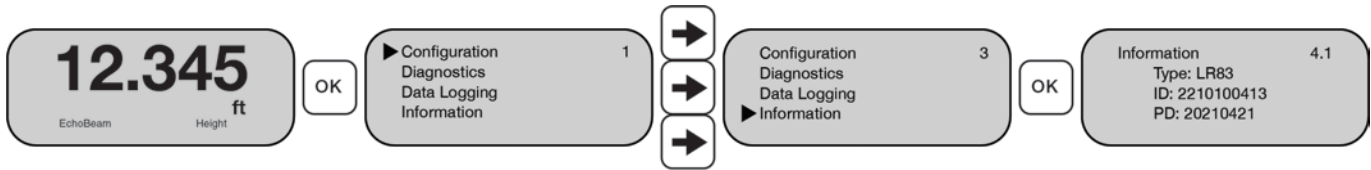
Enables all the sensor's settings to be returned to the factory settings. If this feature is enacted, you will need to re-configure the device for operation in the application.

- **BLE Password**

Enables a password (6-digit code) to be created to limit access to the sensor via Bluetooth<sup>®</sup>.

ENTERING INFORMATION MENU

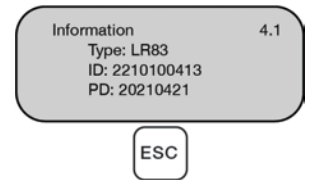
To enter Information, follow below:



- 1) From the Main Screen, press **OK** to advance into the Main Menu.
- 2) Press **Right Arrow** three times to move the triangle to Information.
- 3) Press **OK** to advance into Information.
- 4) Use the **Right Arrow** and **Up Arrow** to toggle between the Information (4.1), Software Version (4.2), Write Protect (4.3), Language (4.4), Reset (4.5) and BLE Password (4.6) screens.

INFORMATION

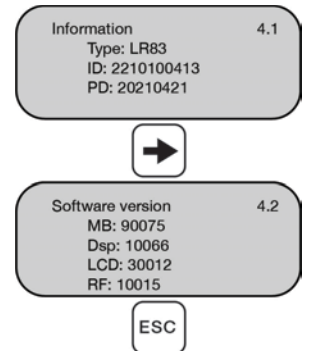
This feature lists the basic information for the EchoBeam® including the product type (Type), the serial number (ID) and the Production Date (PD).



SOFTWARE VERSION

This feature lists the four software versions used by the EchoBeam®. These include the Mother Board (MB) version, the Digital Signal Processor (DSP) version, the LCD display version and the RF processor version.

- 1) From the Information (4.1) screen, press **Right Arrow** to switch to Software Version.
- 2) When done, press **ESC** to exit.

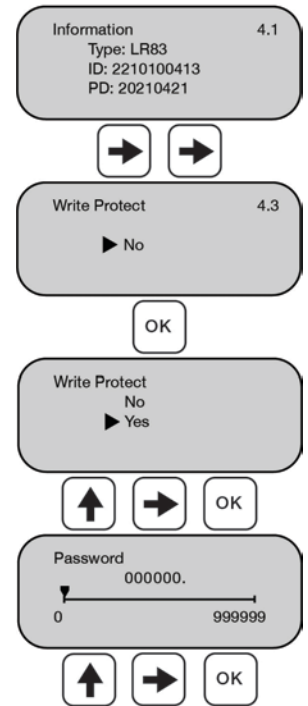


**WRITE PROTECT**

Enables the sensor to be protected with a 6-digit security code. The code prevents the changing of parameters without entering the code prior to making any change.

**Note:** This function should only be performed by a trained technician. The code must be stored in a safe location.

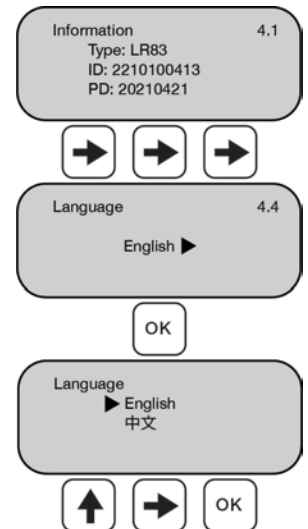
- 1) From the Information (4.1) screen, press **Right Arrow** (two times) to switch to Write Protect.
- 2) Press **OK** to advance into Write Protect.
  - a. Press **Up Arrow** or **Right Arrow** to scroll through the setting of Yes or No.
  - b. When the setting is correct, press **OK** to save the setting.
- 3) Enter the value that the sensor will use as a password using the **Up Arrow** and **Right Arrow**.
  - a. Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b. Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c. Press **OK** to accept this as the password.
- 4) Press **ESC** to exit.



**LANGUAGE**

Enables the screen language to be changed from English to Chinese or vice versa.

- 1) From the Information (4.1) screen, press **Right Arrow** (three times) to switch to Language.
- 2) Press **OK** to advance into Language.
  - a. Press **Up Arrow** or **Right Arrow** to scroll through the setting of English or Chinese.
  - b. When the setting is correct, press **OK** to save the setting.
- 3) Press **ESC** to exit.



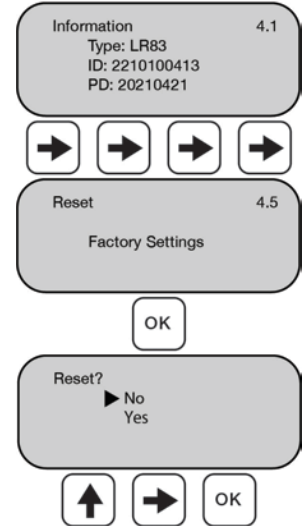


**RESET**

Enables all the sensor’s settings to be returned to the factory settings. If this feature is enacted, you will need to re-configure the device for operation in the application.

- 1) From the Information (4.1) screen, press **Right Arrow** (four times) to switch to Reset.
- 2) Press **OK** to advance into Reset.
  - a. Press **Up Arrow** or **Right Arrow** to scroll through the setting of No or Yes.
  - b. When the setting is correct, press **OK** to reset the sensor.
- 3) Press **ESC** to exit.

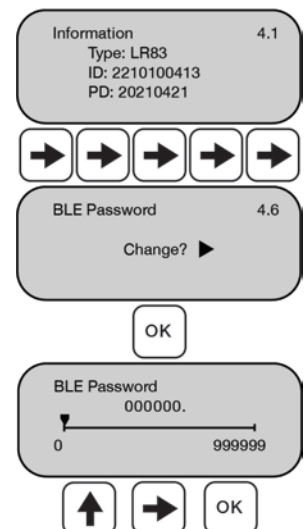
| Series               | LR83               | LR85                |
|----------------------|--------------------|---------------------|
| Sensor Name          | LR83               | LR85                |
| Application          | Liquids            | Solids              |
| Units of Measurement | Ft                 | Ft                  |
| Fail-Safe Output     | 20.5mA             | 20.5mA              |
| Sensor Height        | 98.42 ft (30m)     | 393.70 ft (120m)    |
| Fill-Height          | 97.42 ft (29.69m)  | 392.70 ft (119.70m) |
| Display Value        | Liquid Height      | Solid Height        |
| Dead Band            | 0.90 ft (0.27m)    | 0.90 ft (0.27m)     |
| Maximum Range        | 103.35 ft (31.50m) | 413.39 ft (126m)    |



**BLE PASSWORD**

Enables a password (6-digit code) to be created to limit access to the sensor via Bluetooth®.

- 1) From the Information (4.1) screen, press **Right Arrow** (five times) to switch to BLE Password.
- 2) Press **OK** to advance into BLE Password.
- 3) Enter the value that the sensor will use as a password using the **Up Arrow** and **Right Arrow**.
  - a. Press **Up Arrow** to increase the value of the number highlighted. **Up Arrow** will scroll from 0 to 9 and back again.
  - b. Press **Right Arrow** to move one segment to the right. **Right Arrow** will scroll left to right and then back to the first segment.
  - c. Press **OK** to accept this as the password.
- 4) Press **ESC** to exit.



**TROUBLESHOOTING OVERVIEW**

| Problem   | Solution   |
|---|--|
| Transmitter output is between 0mA to 3.9mA                  | Check wiring for open circuit.   |
| 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.  |
| Transmitter output > 22mA                                   | Immediately check wiring for short circuit. EchoBeam® is current limited to 22 mA. Anything above 22 mA indicates a short circuit.   |
| Transmitter always jumps to the Fail-Safe condition         | Check the dimensional configuration (Sensor Height and Fill-Height) of EchoBeam®. Make sure that the Fill-Height setting corresponds to the full level of liquid or solids (measured from the bottom up) and not the distance from the transmitter to the surface of the liquid or solids (not the air gap). |
| Transmitter output reaches 4mA before the tank is empty     | Check the Sensor Height setting. If this setting is too short, the transmitter will reach 4mA before the tank is empty.  |
| Transmitter output will not reach 4mA                       | Check the Maximum Range setting. If this is set too short, the transmitter will never reach 4mA and will always be short.  |
| Transmitter output reaches 20mA before the tank is full     | Check the Fill-Height setting. If this setting is too short, the transmitter will reach 20mA before the tank is full.  |
| Transmitter output will not reach 20mA                      | Check the Dead Band setting. If this is set too large, the transmitter will never reach 20mA and will always be short.   |
| Transmitter output jumps up and down erratically.           | Check the cable for electrical interference, typically from VFDs or motors located close to the transmitter and/or cable. Make sure the cable is shielded or in metal conduit. Also check the grounds for all the local equipment.   |

**ERROR CODES – 4-20MA/HART WITH DISPLAY**

| Error Code | Display Code | Error Definition  |
|------------|--------------|---|
| E1         | CommErr      | Display communication error. Typically appears when display module is not attached correctly. May also indicate communication error between the display and the main electronics.                                   |
| E2         | EEPromError  | ROM write error. EEPROM is no longer operational broken. Transmitter requires factory service.  |
| E3         | PLL ERR      | Antenna circuit error. The circuitry that controls the antenna is no longer operational. Transmitter requires factory service.  |
| E7         | sysbusy      | Processor is slow or is not processing requests. This can occur with low voltage. Check power supply for an unexpected drawing down of power. Also check transmitter for a large amount of data is being requested. |
| E8         | LOWPOWER     | Low voltage. Check the power supply for an unexpected drawing down of power.  |
| E14        | NOSIGNALERR  | Has no valid echo signal. Check the EchoCurve for an unusual signal return.   |

**ERROR CODES - MODBUS**

| Error Code | Display Code | Error Definition  |
|------------|--------------|---|
| 0x0004     |              | Measurement status (read-only);   |
| E1         | CommErr      | Display communication error. Typically appears when display module is not attached correctly. May also indicate communication error between the display and the main electronics.                                   |
| E2         | EEPromError  | ROM write error. EEPROM is no longer operational broken. Transmitter requires factory service.  |
| E3         | PLL ERR      | Antenna circuit error. The circuitry that controls the antenna is no longer operational. Transmitter requires factory service.  |
| E7         | sysbusy      | Processor is slow or is not processing requests. This can occur with low voltage. Check power supply for an unexpected drawing down of power. Also check transmitter for a large amount of data is being requested. |
| E8         | LOWPOWER     | Low voltage. Check the power supply for an unexpected drawing down of power.  |
| E14        | NOSIGNALERR  | Has no valid echo signal. Check the EchoCurve for an unusual signal return.   |

**FACTORY SETTINGS**

Below are the Sensor Height (4mA) and Fill-Height (20mA) factory settings for each sensor.

| Sensor Name          | LR83          | LR85          |
|----------------------|---------------|---------------|
| Application          | Liquids       | Solids        |
| Units of Measurement | Ft            | Ft            |
| Fail-Safe Output     | 20.5mA        | 20.5mA        |
| Sensor Height        | 98.42 ft      | 393.7 ft      |
| Fill-Height          | 97.42 ft      | 392.7 ft      |
| Display Value        | Liquid Height | Liquid Height |
| Dead Band            | 0.90 ft       | 0.90 ft       |
| Maximum Range        | 103.33 ft     | 413.4 ft      |

**Tank Conditions**

|                   |          |          |
|-------------------|----------|----------|
| Low Dielectric    | No       | No       |
| Surface Agitation | None     | None     |
| Fast Fill Rate    | 0.656 ft | 0.656 ft |
| Multiwave         | No       | No       |

**USER CONFIGURATION**

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

**Configuration**

|                                   |                        |
|-----------------------------------|------------------------|
| Sensor Name:                      | Application:           |
| Units of Measurement:             | Fail-Safe Output:      |
| Sensor Height:                    | Fill-Height:           |
| Display Value:            Air Gap | Height of Liquid/Solid |
| Dead Band:                        | Maximum Range:         |

**Tank Conditions**

|  |   |
|--|---|
| Low Dielectric:            No            Yes | Surface Agitation:                      |
| Fast Fill Rate:                              | Multiwave:            No            Yes |

**MODBUS OUTPUT DEFINITIONS**

**Communication Parameters:**

|                     |                       |
|---------------------|-----------------------|
| Hardware interface: | RS485                 |
| Baud rate:          | 9600                  |
| Modbus RTU:         | 8, N, 1               |
| Error Checking:     | CRC16 polynomial A001 |
| Default Address:    | 01                    |

**Modbus function codes supported:**

Function 03 - Read Register/s

Function 06 - Write Single Register

**Examples:**

*Function 03 - Read Register/s*

Read Registers - Address = 1, starting from register 00H through 0AH (10 registers)

Host sends data (HEX):

01 03 00 00 000A c5cd

Sensor response:

01 03 14 XX-XX (20bytes) crc

*Function 06 - Write Single Register*

Write Register - Address = 1, 05H (Range in cm) 1000cm

Host sends data (HEX):

01 06 00 05 03e8 9975

Sensor response:

01 06 0005 03e8 9975 (write was successful)

\*\*If the return value is different than the write failed or the data exceeded the limit\*\*

**Address range supported:**

00 to 99 (sensor display value)

**Register Mapping:**

|        |   |   |
|--------|---|---|
| 0x0000 | Distance measurement in centimeters (read only)                               |   |
| 0x0001 | Distance measurement in millimeters (read only)                               |   |
| 0x0002 | Level measurement in centimeters (read-only)                                  |   |
| 0x0003 | Level measurement in millimeters (read-only)                                  |   |
| 0x0004 | Measurement status (read-only);   |   |
|        | 0   | = Normal  |
|        | 1   | = Comm Err - Display not connected or broken                              |
|        | 2   | = EEPROM Err - write failure, EEPROM is broken                            |
|        | 3   | = PLL Err - antennae circuit is broken                                    |
|        | 7   | = SYSBUSY - Slow response due to large data request or low supply voltage |
|        | 8   | = LOWPOWER - Low Voltage - check power supply                             |
|        | 14  | = NOSIGNALERR - No valid echo signal                                      |
| 0x0005 | Range Value in centimeters (read and write);                                  |   |
| 0x0006 | Blanking distance (dead zone) in centimeters (read and write);                |   |
| 0x0007 | Low-level (Sensor Height) adjustment in centimeters (read and write);         |   |
| 0x0008 | High-level (Fill-Height?) adjustment in centimeters (read and write);         |   |
| 0x0009 | Signal Strength (read-only)   |   |
|        | 0   | = Min   |
|        | 150   | = Max   |
| 0x000A | Distance measurement in millimeters (4-byte Integer, read-only, high 16 bits) |   |
| 0x000B | Distance measurement in millimeters (4-byte integer, read-only, low 16 bits)  |   |
| 0x000C | Distance measurement in meters (4-byte float, read-only, high 16 bits)        |   |
| 0x000D | Distance measurement in meters (4-byte float, read-only, low 16 bits)         |   |
| 0x000E | Level measurement in millimeters (4-byte integer, read-only, high 16 bits)    |   |
| 0x000F | Level measurement in millimeters (4-byte integer, read-only, low 16 bits)     |   |
| 0x0010 | Level measurement in meters (4-byte float, read-only, high 16 bits)           |   |
| 0x0011 | Level measurement in meters (4-byte float, read-only, low 16 bits)            |   |
| 0x0012 | Temperature (4-byte float, read-only, upper 16 bits)                          |   |
| 0x0013 | Temperature (4-byte float, read-only, lower 16 bits)                          |   |

### 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 of 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 under this warranty will be warranted only for the remainder of the original warranty period. Any product provided as a replacement under this warranty will be warranted for the full two years from the date of manufacture.*

### 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](http://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.*

*For complete product documentation, video training, and technical support, go to [www.flowline.com](http://www.flowline.com). For phone support, call 562-598-3015 from 8am to 5pm PST, Mon - Fri. (Please make sure you have the Part and Serial number available.)*