

# EchoFlo

2.5m 1.25m



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**mace**   
Water Monitoring Solutions

## QUICK START GUIDE



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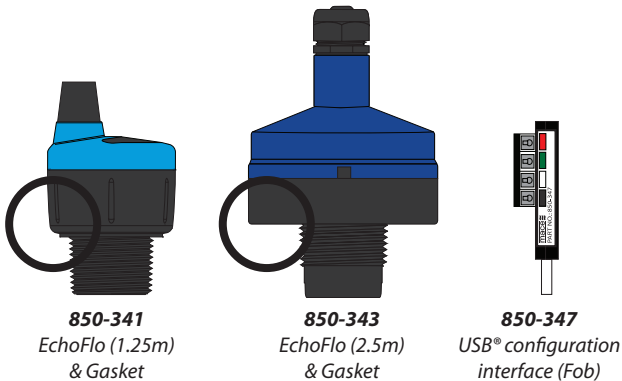
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# 1. Introduction

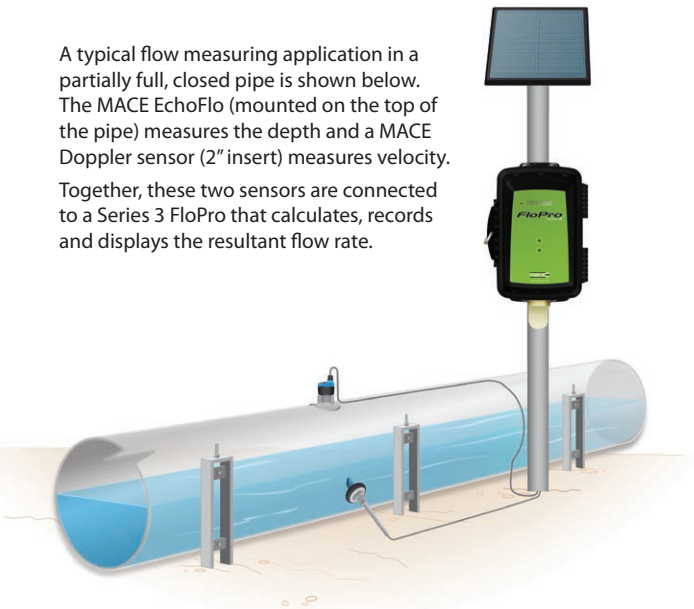
This Quick Start Guide describes the installation of the EchoFlo and interfacing with a Series 3 FloPro or HydroMace 3000. The EchoFlo system consists of four components:

- The EchoFlo ultrasonic sensors (1.25m or 2.5m range)
- The Viton® Gasket
- The USB® configuration interface (Fob)
- EchoCal software enabling you to configure your EchoFlo

**IMPORTANT:** The minimum version of EchoCal required to communicate with the EchoFlo is Version 5.17.0. The version number is displayed on the EchoCal program banner. The latest version of EchoCal is available for download from [www.macemeters.com](http://www.macemeters.com)



A typical flow measuring application in a partially full, closed pipe is shown below. The MACE EchoFlo (mounted on the top of the pipe) measures the depth and a MACE Doppler sensor (2" insert) measures velocity. Together, these two sensors are connected to a Series 3 FloPro that calculates, records and displays the resultant flow rate.



# 2. Communicating with EchoFlo

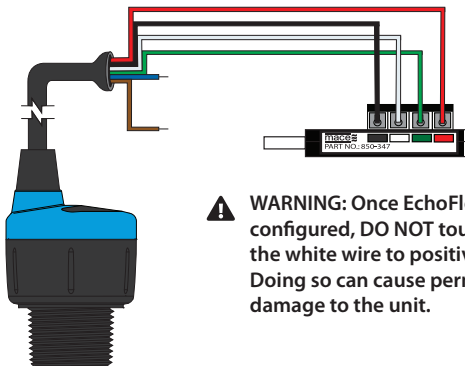
EchoFlo communicates with EchoCal using a USB® interface called a Fob.

1. Install EchoCal on your computer by double clicking "**MacInstallerVX.X.X**" icon and following the prompts.

ECHOCAL SYSTEM REQUIREMENTS: Windows® XP, 10 MB hard drive space, 256 MB RAM, One USB® 2.0 port, Internet connection.

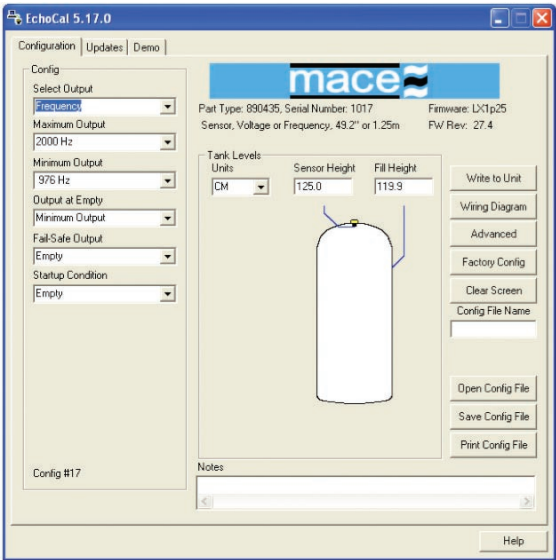
2. Connect the red, green, white and black wires from EchoFlo into the correct terminals on the Fob. Tighten the screws on the terminals and plug your Fob into the USB® port of your computer.

**⚠ WARNING:** Before plugging the Fob into your computer's USB® port, you **MUST** install EchoCal on your computer.



**⚠ WARNING:** Once EchoFlo is configured, **DO NOT** touch the white wire to positive (+). Doing so can cause permanent damage to the unit.

3. Double click the EchoCal icon and communication with the EchoFlo connected to your PC will commence. The following EchoCal dialogue box will appear.



## 3. Configuring EchoFlo

1. Start from the top of the “Config” area of **EchoCal** and work to the bottom, choosing the selections that are applicable.

**NOTE:** If the sensor is already configured with a **Frequency** output and it needs to be changed to a **Voltage** output (or vice versa) click “Clear Screen”.

2. All configuration settings must be selected before you can continue. The recommended settings for connection to a MACE Series 3 device are shown on the right.

Config

|                   |                |
|-------------------|----------------|
| Select Output     | Frequency      |
| Maximum Output    | 2000 Hz        |
| Minimum Output    | 976 Hz         |
| Output at Empty   | Minimum Output |
| Fail-Safe Output  | Empty          |
| Startup Condition | Empty          |

3. In the “Tank Levels” area of EchoCal select the:

### Units:

Units of measure

### Sensor Height:

Distance from the bottom of the pipe or tank to the bottom of the sensor.

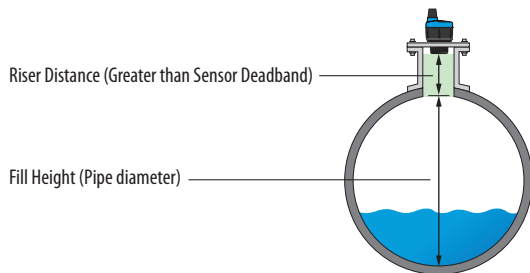
### Fill Height:

Tank - Distance from the bottom of the tank to the maximum liquid height.

Pipe - Distance of the inner pipe diameter as shown below.

Tank Levels

|       |               |             |
|-------|---------------|-------------|
| Units | Sensor Height | Fill Height |
| CM    | 125.0         | 119.9       |



**NOTE:** The “Riser Distance” in a pipe **MUST** always be greater than the “Sensor Deadband” (refer to Table 1 over page).

4. After you have entered configurations and tank values, click “Write to Unit” and send the configuration to EchoFlo. Now use EchoCal’s file management features to save your configuration by clicking “Save Config File”. A wiring diagram may be displayed by clicking “Wiring Diagram”.

**NOTE:** Be sure to record the “Sensor Height” and “Fill Height” before exiting EchoCal as these will be needed during the calibration process.

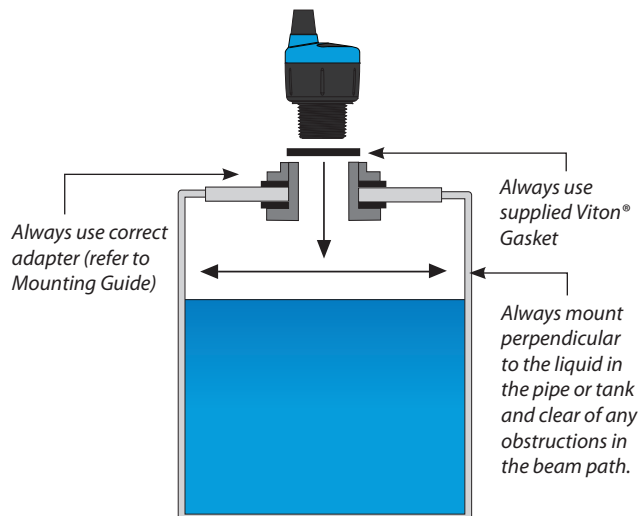
## 4. Position and Mount

Positioning and mounting EchoFlo is critical to the sensor performing correctly. EchoFlo should always be mounted perpendicular to the liquid in the pipe or tank, clear of any obstructions in the beam path. Not doing so will result in poor performance.

### Mounting Guide

**IMPORTANT:**

1. Do not mount at an angle
2. Liquid should NEVER enter the deadband
3. Mount at least 2” from the side wall
4. When pipe mounting, always install such that the bottom of the pipe is within the sensor’s range
5. Do not mount where obstacles will intrude on 2” beam width
6. Do not mount in a vacuum
7. Never screw directly into the pipe or tank, ALWAYS use a NON-METALLIC fitting
8. Always use an adapter with the minimal height possible

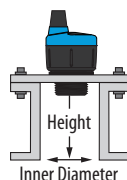


### Adapter:

Select an adapter with minimum height to ensure that EchoFlo's sensor will not be substantially elevated inside the fitting.

### Riser:

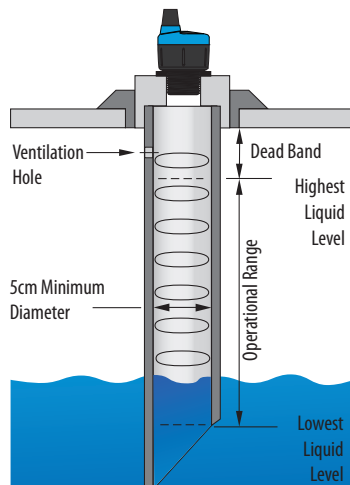
Use the **Riser Specifications** Guide and match your riser's inner diameter with the height.



| Riser Specifications |             |
|----------------------|-------------|
| Inner Dia.           | Max. Height |
| 5cm (2")             | 10cm (4")   |
| 7.6cm (3")           | 15cm (6")   |
| 10cm (4")            | 20cm (8")   |
| 15cm (6")            | 30cm (12")  |

### Stand Pipe:

Use a stand pipe when surface foam or turbulence are present. Use a 2" diameter pipe or larger with a length that runs the distance of the span. Cut a 45° notch at the bottom and a 1/4" hole within 2" from bottom of the sensor face.



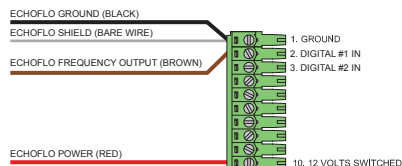
**NOTE:** The remaining sections of this guide describe the detailed wiring, configuration and calibration of an EchoFlo with a MACE Series 3 device.

## 5. Wiring the EchoFlo to a MACE Series 3 FloPro or HydroMace 3000

Each MACE I/O card provides inputs for connecting up to two Frequency output configured EchoFlo's. Each EchoFlo is wired into the Digital input terminals available on the I/O card as shown in the diagram below.

In this example the EchoFlo is connected to Digital #1

### ECHOFLO WIRING TO FREQUENCY INPUT ON TERMINAL STRIP

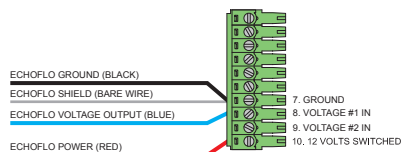


**NOTE:** MACE recommends using the EchoFlo in it's Frequency output mode for simple configuration and calibration as detailed in the following sections of this guide.

Alternatively each MACE I/O card provides inputs for connecting up to two Voltage output configured EchoFlo's. Each EchoFlo is wired into the Voltage input terminals available on the I/O card as shown in the diagram below.

In this example the EchoFlo is connected to Voltage #1

### ECHOFLO WIRING TO VOLTAGE INPUT ON TERMINAL STRIP



**WARNING:** Once EchoFlo is configured, DO NOT touch the white wire to positive (+). Doing so can cause permanent damage to the unit.

1. The maximum cable run is 30m (66ft).
2. Three-core shielded instrument cable should be used for extended cable runs.
3. A waterproof terminal box should be used when extending the cable.
4. The USB Fob will ONLY operate through the standard cable length of 1.2m (48").

**NOTE:** Ensure that the cable attached to the EchoFlo is not permanently terminated so that it can be accessed for any future configuration changes.

## 6. Configuring an EchoFlo “Depth” channel using FloCom+

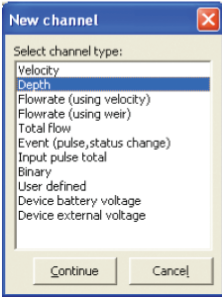
The EchoFlo is connected to a MACE Series 3 device by plugging the pre-wired terminal strip into an I/O card within the device.

1. Using MACE FloCom+ software, connect to the device using the serial port and configure the following settings:

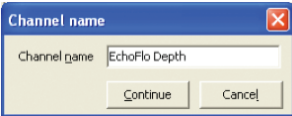
- Enable “**Sensor power**” and select at least a 20 second warm up time (a longer period may be required to record a stable reading in some applications).
- Add an I/O module

**NOTE:** Refer to the relevant MACE Series 3 product manual for detailed instruction on the above steps

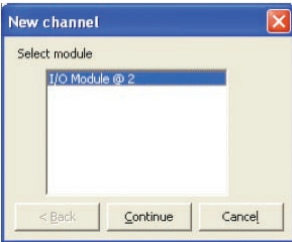
2. Select “**Configure Channels**” and click “**Add**” and the “**New Channel**” dialogue box will appear. Select the “**Depth**” channel type and click “**Continue**”.



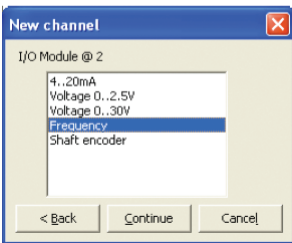
3. The “**Channel name**” dialogue box will appear. Enter a channel “**Name**” in to the text field (16 character maximum). This “**name**” will also be displayed on the Series 3 device main LCD if enabled. Click “**Continue**”.



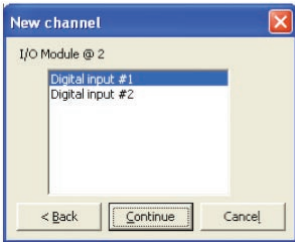
4. In the “**New channel**” dialogue box highlight the “**I/O Module**” option from which the named channel will receive its value. Click “**Continue**” and a new dialogue box will appear with the available input types listed.



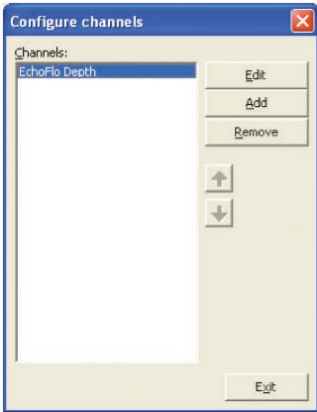
5. Select the “**Frequency**” input type from the “**I/O Module @ 2**” list. Click “**Continue**” and then select the appropriate input from which the named channel will receive its value.



6. In this example the channel named “**EchoFlo Depth**” will be calculated using a sensor attached to “**I/O Module @ 2**” on “**Digital input #1**”. Click “**Continue**” to complete the new channel.



6. The “**Configure channels**” dialogue box will re-appear with the new channel listed.



## 7. Calibrating an EchoFlo “Depth” channel using FloCom+

After following the previous configuration steps the EchoFlo must be calibrated. Table 1 below lists relevant information for both EchoFlo models including the “**Slope**” and “**Offset**” values for sensors configured over their “**Effective Sensor Range**”.

TABLE 1: EchoFlo Slope and Offset Values

| Model/Part#            | 1.25m (850-341) |          | 2.5m (850-343) |         |
|------------------------|-----------------|----------|----------------|---------|
|                        | Metric          | US       | Metric         | US      |
| Sensor Range           | 1.25m           | 49.2"    | 2.5m           | 98.4"   |
| Deadband               | 0.05m           | 2"       | 0.1m           | 4"      |
| Effective Sensor Range | 1.2m            | 47.2"    | 2.4m           | 94.4"   |
| Slope                  | 0.00117         | 0.04609  | 0.00234        | 0.09218 |
| Offset                 | -1.13766        | -44.9875 | -2.28          | -89.975 |
| Full Scale output      | 2000Hz          | 2000Hz   | 2000Hz         | 2000Hz  |
| Zero output            | 976Hz           | 976Hz    | 976Hz          | 976Hz   |

## Calculating the EchoFlo Slope & Offset

The Slope and Offset values of the installed EchoFlo are dependent on the **“Fill Height”** as entered during the EchoCal configuration procedure.

**NOTE:** The following calculations are based on the EchoFlo being configured with a frequency output.

### Manually calculating Slope

$$\text{Slope} = \text{Fill Height} \div \text{Sensor Span}$$

**Sensor Span:** Is the difference between the sensor output at the top of the **“Fill Height”** (2000Hz) and the sensor output at the bottom (976Hz). The frequency output of an EchoFlo has a span of 1024Hz .

### Manually calculating Offset

$$\text{Offset} = - (\text{Slope} \times \text{Sensor output at zero})$$

**Metric example** - you wish to calculate the slope and offset for an EchoFlo that has been configured with a **“Fill Height”** of 0.75m (75cm). The following calculations will provide the sensor's slope and offset:

$$\begin{aligned}\text{Slope} &= 0.75 \div (2000-976) \\ &= 0.75 \div 1024 \\ &= 0.00073\end{aligned}$$

$$\begin{aligned}\text{Offset} &= - (0.00073 \times 976) \\ &= - 0.71484\end{aligned}$$

**US example** - you wish to calculate the slope and offset for an EchoFlo that has been configured with a **“Fill Height”** of 30”.

The following calculations will provide the sensor's slope and offset:

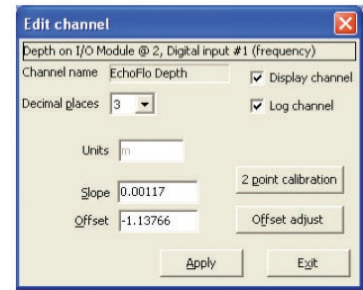
$$\begin{aligned}\text{Slope} &= 30 \div (2000-976) \\ &= 30 \div 1024 \\ &= 0.02929\end{aligned}$$

$$\begin{aligned}\text{Offset} &= - (0.02929 \times 976) \\ &= - 28.59375\end{aligned}$$

**NOTE:** Be sure to record the relevant **“Slope”** and **“Offset”** values.

## Entering Slope and Offset

1. In the **“Configure channels”** dialogue box click **“Edit”** and the **“Edit channel”** dialogue box will appear. Enter the relevant **“Slope”** and **“Offset”** values as determined using the previous calculations. Alternatively, Table 1 lists the values for EchoFlo's configured with their full effective sensor range.

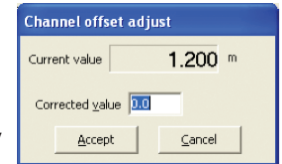


**WARNING:** Be sure to enter the correct values for the selected depth units

## Fine tuning the EchoFlo depth reading

The **“Offset adjust”** function is used to fine tune the depth reading whenever the sensor is deployed.

1. Click **“Offset adjust”** from the **“Edit channel”** dialogue box and the **“Channel offset adjust”** dialogue box appears. The **“Current value”** from the sensor is displayed at the top of the window and is updated approximately once per second.



2. To adjust the **“Current value”**, enter your current measured value in the **“Corrected value”** field.

3. Click on the **“Apply”** button to calculate the new **“Offset”** parameter value for the associated channel. Clicking on the **“Cancel”** button terminates the procedure without altering the offset value.

**WARNING:** When calibrating a depth channel, measurements should ALWAYS be carried out from the **BOTTOM** of the channel/pipe to the top of the water level

## 8. Safety

1. Installation should be undertaken by properly trained staff
2. Supply voltage should NEVER exceed a maximum of 24 VDC
3. Make sure the sensor is chemically compatible with your application
4. Design a fail-safe system that accommodates the possibility of sensor and/or power failure.
5. This sensor should not be used in classified hazardous environments