

FLOWMETER INSTALLATION INSTRUCTIONS

Rev 1, 4/25/2005

SAFETY FIRST:

- ❑ Follow ALL safety precautions when working on motor equipment-wear safety glasses!
- ❑ Fuel vapors and liquid are extremely flammable and explosive, personal injury and/or property damage could occur.
- ❑ Complete all work in a well-ventilated area.
- ❑ ALWAYS disconnect (-) negative battery cable before any electrical work.

SPECIFICATIONS:

- ❑ Models: 40 GPH & 80 GPH
- ❑ Analog Meter: Indicates Current Fuel Usage
- ❑ Digital Display: Indicates Fuel Rate, Total Fuel, & Trip Fuel
- ❑ Operating Voltage: 12 (10-16) Volt Negative Ground
- ❑ Supported Sensors: 231, 233, & 20 B
- ❑ Capabilities: 2 Engines with 2 Flow Sensors (feed & return) Per Engine
- ❑ Connections: Two 6-Pin Deutsch #DT06-6S
6-Wire Pigtail Harness Part #FFH
- ❑ Illumination: Red LED
- ❑ Mounting: 3.4" Hole
- ❑ Max Panel Thickness: 1/2"
- ❑ Operating Temp: -20°C – +85°C
- ❑ Sealing: Fully Sealed to 5 psi
- ❑ Vibration: 10G, Random, 50-2000 Hz

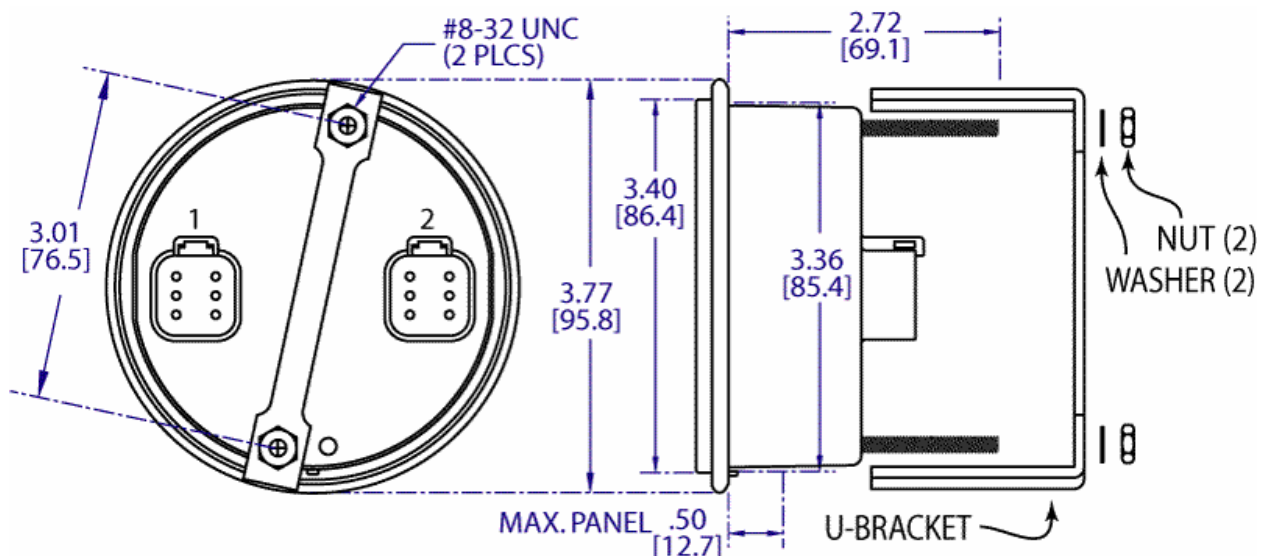
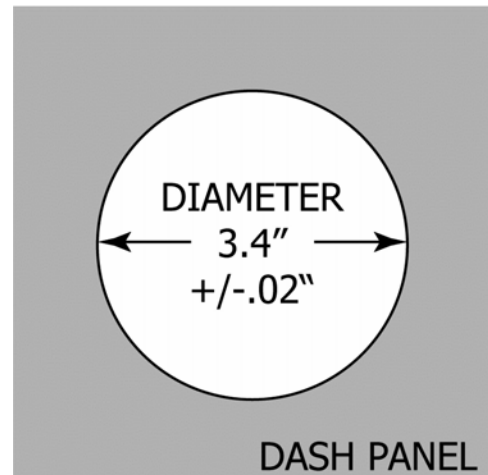
PRECAUTIONS:

- ❑ This instrument should be installed by a competent marine mechanic.
- ❑ Read ALL instructions before installing instrument.
- ❑ **FOR ACCURATE RESULTS, THIS UNIT MUST BE PROPERLY CALIBRATED.**

FLOWMETER MOUNTING:

1. Disconnect (-) negative battery cable.
2. Recommended panel hole size is 3.4" ±0.02" or 68.4mm ±0.5mm.
3. Insert the instrument in the panel and place the U-Bracket over the mounting studs.
4. Install one washer & one nut on each stud over the U-Bracket.
5. Tighten the nuts (4 to 6 in.-Lb.) to secure the instrument.

CAUTION: DO NOT OVER-TORQUE!



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FLOWMETER WIRING CONNECTOR 1:

Disconnect (-) negative battery cable before doing any electrical work.

Use 18-ga. or larger wire to make all electrical connections.

1. Connect the **RED** wire (pin 1) to a switched 12 volt source (properly fused).
2. Connect the **ORANGE** wire (pin 2) to the white wire of the PORT feed flow sensor.
3. Connect the **BLUE** wire (pin 3) to the 12 volt instrument lighting circuit.
4. Connect the **WHITE** wire (pin 4) to the white wire of the PORT return flow sensor. Only used with return style fuel systems.
5. Connect the **GRAY** wire (pin 5) to one terminal of a momentary contact push-button switch. Connect the other push-button terminal to an electrical ground.
6. Connect the **BLACK** wire (pin 6) to a secure electrical ground.

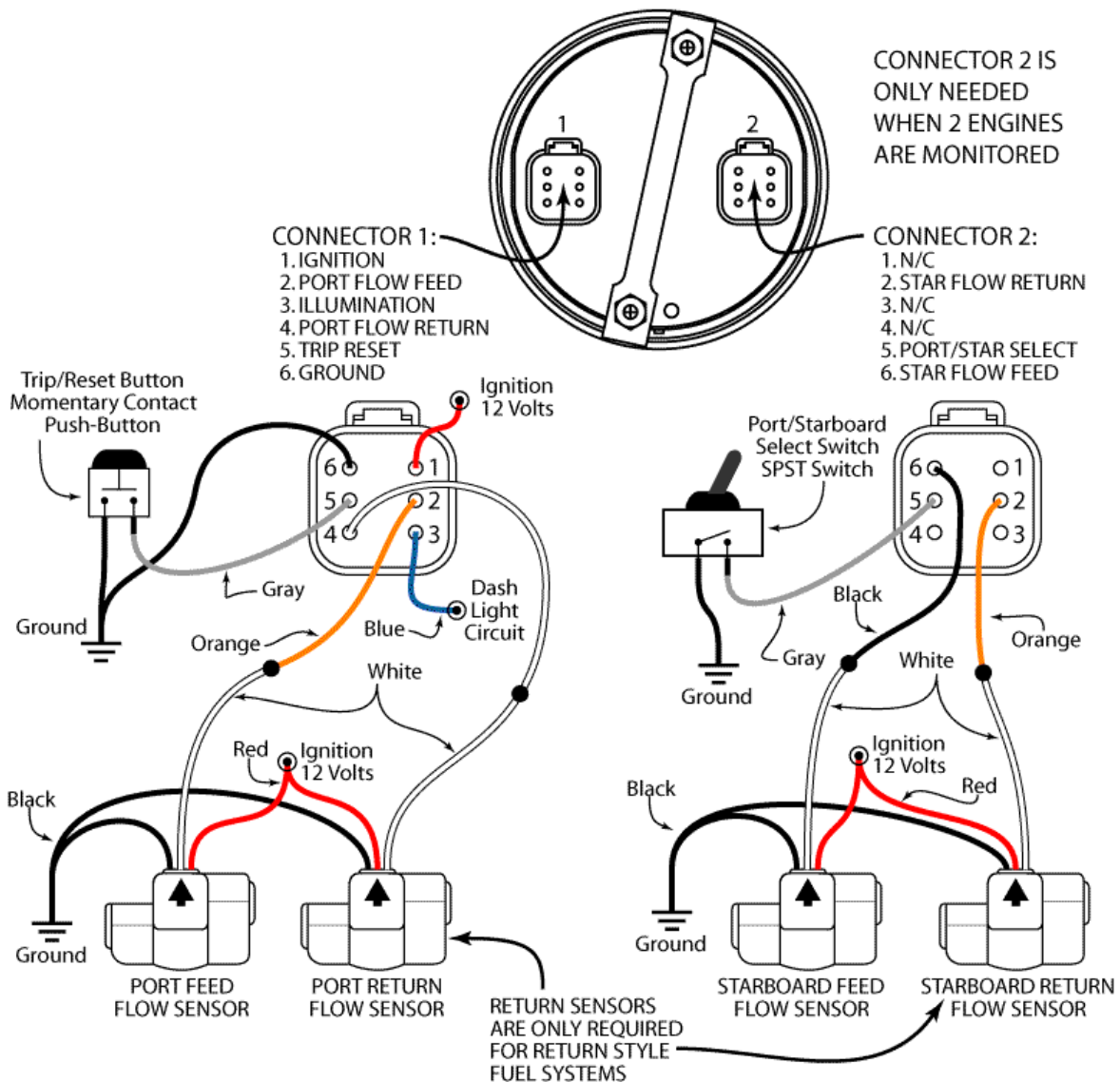
NOTE: Connector 2 is only needed for dual engines.

Disconnect (-) negative battery cable before doing any electrical work.

Use 18-ga. or larger wire to make all electrical connections.

1. **RED** wire (pin 1) – No connection.
2. Connect the **ORANGE** wire (pin 2) to the white wire of the STARBOARD return flow sensor. Only used with return style fuel systems.
3. **BLUE** wire (pin 3) – No connection.
4. **WHITE** wire (pin 4) – No connection.
5. Connect the **GRAY** wire (pin 5) to one terminal of a single-pole-single-throw switch. Connect the other switch terminal to an electrical ground.
6. Connect the **BLACK** wire (pin 6) to the white wire of the STARBOARD feed flow sensor.
7. After verifying all electrical connections, reconnect the (-) negative battery cable and check for proper operation and complete the calibration/set-up procedure.

FLOWMETER WIRING CONNECTOR 2:

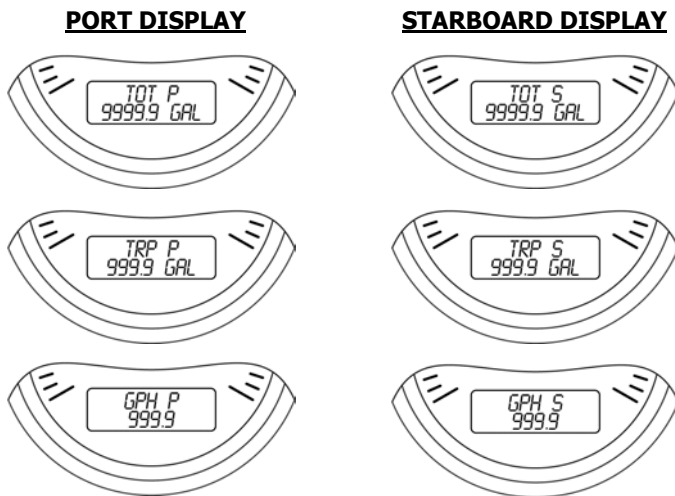


FLOWMETER INSTALLATION INSTRUCTIONS

GENERAL OPERATION:

WARNING: The Flowmeter must be properly set-up and calibrated before use. Failure to follow proper set-up and calibration procedures can cause erroneous readings.

- The analog pointer indicates actual fuel usage for the PORT or STARBOARD engines, depending on the PORT/STARBOARD select switch position. To switch between the PORT and STARBOARD engines, change the position of the PORT/STARBOARD select switch.
- The digital display will indicate the total fuel consumed (gallons), trip fuel usage (gallons), and actual fuel usage (gallons/hour) for both PORT or STARBOARD engines, depending on the PORT/STARBOARD select switch position. To switch between the PORT and STARBOARD engines, Change the position of the PORT/STARBOARD select switch.



- Tap the trip/reset button to scroll through the items on the digital display.
- While viewing any total or trip parameter, it can be reset by pressing & holding the trip/reset button for 5 seconds.

Fuel flow sensor installation instructions

- This flow sensor must be mounted in a solid, secure, and horizontal location, as low in the entire fuel system as possible. The fuel needs to exit the sensor and travel "up-hill" from the location that the sensor is mounted. The outlet should be at least 1 or 2 inches lower than the fuel pump inlet, priming bulb, or the pulsation dampener (if used for your application). Install the sensor(s) 12" upstream of the fuel pump, priming bulb, or the pulsation dampener to improve the system accuracy. The location to mount the sender is critical; take some time to find the best possible location. It needs to be solid; away from water, heat, any moving parts, and most importantly, safe.
- The model number 231 and 20 B gasoline sensors must be installed downstream of a fuel filter or water separator. If your application is a carb-fed inboard or I/O engine using a diaphragm fuel pump, and is not listed below, you **MAY** need to use a gasoline pulsation dampener. If you experience severely inaccurate readings, your application **MAY** require a pulsation dampener. These are available for purchase through Livorsi Marine, and the model number is **PD**.

*****Important note – the following applications DO NOT require a pulsation dampener*****

- Outboard gasoline engines including Ficht, Optimax, 2 & 4-cycle.
 - Closed loop EFI gasoline outboard, inboard, and I/O engines.
 - Open return EFI gasoline inboard and I/O engines.
- Make sure that the location of the sensor to be mounted is a low or the lowest point of the fuel system, and that when the fuel exits the sensor it must travel up hill slightly. One or two inches of vertical rise is adequate, and more is ok. The sensor **MUST** be protected by and installed downstream of a fuel filter or water separator. The sensor is tolerant of fine debris; however, a coarse screen (up to 800 microns) or a water separator is all that is required.

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- For the best possible operation, it is highly recommended that the sensor be installed between the fuel filter and the fuel pump inlet. There should be AT LEAST twelve inches of fuel hose (more is ok) between the sensor and the fuel pump inlet.
- If required, the pulsation dampener must be installed horizontally, with its orientation arrow pointing up.
- When plumbing your sensor into your fuel system, plan carefully to minimize the number of 90 degree elbow fittings and pipe fittings. Excessive use may cause a high vacuum, fuel restricting pressure drop across the fuel system. If severe enough, engine damage may result. Whenever possible, use large radius hose bends instead of elbows. Small radius hose bends create twice as much pressure drop as a straight piece of hose does. If two pieces of hose are connected by a fitting, remove that portion and replace it with a single piece of hose cut to the correct length. Refer to your engine owner's manual for the maximum fuel pump vacuum. A vacuum gauge can be used to confirm that the system is within the manufacturer's limits. The use of one (1) 90 degree elbow is the equivalent of adding 15' of additional hose.
- If any swivel fittings are used (JIC or SAE), their mating surfaces MUST be sealed with AP 50 Copper Conical Sealing Washers or Flaretite Fitting Seals - these washers or seals can be obtained at any local hydraulic supply house.

CAUTION – DO NOT OVERTIGHTEN FLOW SENSOR FITTINGS. Over-tightening may crack the sensor's case. Cracks cause leaks and fuel leaks sometimes cause catastrophic explosions or fire, or both.

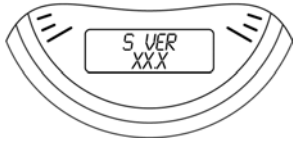
- Torque pipe thread fittings to a MAXIMUM of 15 ft-LBS, (180 inch-LBS) or the same as two full turns of the fitting beyond hand tight (whichever comes first). Use a fuel-proof pipe thread sealant when installing the fittings into the flow sensor's ports (i.e., LockTite PST, Rector Seal, Jomar, etc).
- Route the wiring from the sensor in a manner that will keep them from any water, fuel, heat, or moving parts, and so they do not touch or interfere with the plumbing to the sensor.
- Sensors are marked with the orientation and fuel flow direction arrows. They MUST be installed with these markings in the correct direction.
- Once the mounting location has been determined and confirmed to be safe, solid, and free of water, heat, and any moving parts, install the sensor with the orientation arrows point UP. Fuel MUST enter through the port inlet marked IN or with the inward pointing fuel flow arrow, and exit through the port marked OUT or with the outward pointing arrow.

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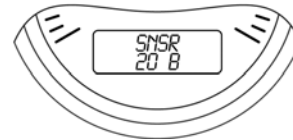
CALIBRATION/SET-UP:

Set-up mode is used to configure the parameters that effect the operation of the flowmeter. Each parameter has a specific function and must be set correctly for accurate operation.

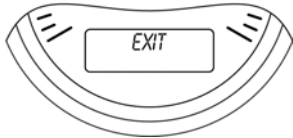
Flow Sensor Set-Up:



- ❑ The Flowmeter supports 3 different flow sensors for use with specific flow requirements. Consult your dealer for additional flow sensor information and selection.
- ❑ The supported flow sensors are models 231, 233 & 20 B.
 1. With the key off depress and hold the trip/reset button.
 2. Turn the key on and the display will run through a self-test and display the software version.
 3. Release the trip/reset button after the software version is displayed.
 4. The current **Sensor Type** is displayed. To change the sensor type, press & hold the trip/reset button until the display flashes, then tap the trip/reset button to change the sensor type.



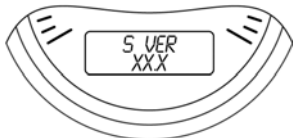
5. Press and hold the trip/reset button to select the sensor.
6. Tap the trip/reset button to scroll to the Exit option



7. Press and hold the trip/reset button to exit the set-up mode.

Meter Damping Set-Up:

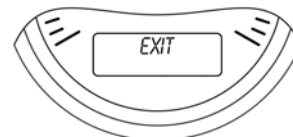
- ❑ The meter damping parameter allows the user to select the level of damping, or how quickly the meter responds to changes in fuel flow. If the meter exhibits constant fluctuations, increase the damping.
- ❑ There are two damping options, high "H" and low "L".
 1. With the key off depress and hold the trip/reset button.
 2. Turn the key on and the display will run through a self-test and display the software version.
 3. Release the trip/reset button after the software version is displayed.



4. Tap the trip/reset button until the current sensor **damping** is displayed. To change the sensor damping, press & hold the trip/reset button until the display flashes, then tap the trip/reset button to change the damping.



5. Press and hold the trip/reset button to select the sensor damping.
6. Tap the trip/reset button to scroll to the Exit option



7. Press and hold the trip/reset button to exit the set-up mode.

FLOWMETER INSTALLATION INSTRUCTIONS

CALIBRATION/SET-UP CONTINUED:

Idle Calibration Set-Up:

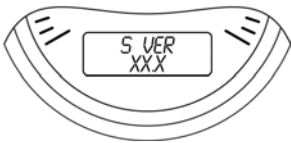
ATTENTION! The Idle Calibration is only needed when the fuel system is a "return" style with 2 flow sensors, one sensor in the "feed" line to the engine and another in the "return" line back to the tank. If the fuel system is not a "return" style, do not complete this calibration.

- ❑ The idle calibration parameter allows the user to adjust the meter's calibration to approximately match the flow sensor signal under known operating conditions.
- ❑ Before proceeding with the idle calibration, the engine must be at operating temperature and run above 1800 RPM for 1 to 2 minutes to purge any trapped air from the fuel system.

NOTE: If both PORT and STARBOARD engines are connected, the idle calibration procedure must be executed twice, once for the PORT engine and once for the STARBOARD engine. The value displayed/changed depends on the PORT/STARBOARD switch position. P or S after FCAL indicates which will be changed.

With the key off depress and hold the trip/reset button.

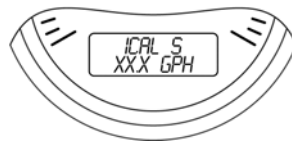
1. Turn the key on and start the engine. Continue holding the trip/reset button until the display runs through the self-test and display the software version.



2. Release the trip/reset button after the software version is displayed.
3. Tap the trip/reset button to scroll to the **Idle Calibration** parameter.

IMPORTANT: The engine must be running and at normal operating temperature to set the Idle Calibration.

4. With the PORT/STARBOARD switch in the PORT position, the current idle calibration value is displayed. To change the idle calibration value (adjustment range is 0.1 to 5.0 GPH), press & hold the trip/reset button until the display flashes, then tap the trip/reset button to change the idle calibration value. Refer to the chart below for the correct GPH value for your engine.



Horsepower	Naturally Aspirated	Turbocharged Supercharged
100-400	0.1 to 0.5 GPH	0.3 to 0.7 GPH
400-750	0.8 GPH	1.0 GPH
750-1000	1.0 GPH	1.5 GPH
1000-1250	2.0 GPH	2.5 GPH
1250-1500	3.0 GPH	3.5 GPH
1500-2000	3.5 GPH	4.0 GPH
2000-3000	4.5 GPH	5.0 GPH

5. Press and hold the trip/reset button to select the idle calibration.
6. The display will indicate to wait 15 seconds while the Flowmeter acquires flow information from the sensors.
7. After acquiring the information, the Flowmeter will exit the calibration/set-up mode automatically.
8. If a second engine is connected set the PORT/STARBOARD selector switch to the STARBOARD position and repeat the idle calibration for the second engine.

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CALIBRATION/SET-UP CONTINUED:

Final Calibration Set-Up:

- ❑ The final calibration parameter allows the user to adjust the meter's calibration based on actual fuel consumption.
- ❑ Before proceeding with the final calibration, the fuel tank(s) must be filled completely.
- 1. Start the engine(s) (do not depress and hold the trip/reset button this time).
- 2. Reset the "total" fuel consumed for both PORT and STARBOARD engines. To do this, set the PORT/STARBOARD switch to PORT and tap the trip/reset button until the total fuel consumed is on the display, then press and hold the trip/reset button until the display resets to zero.



- 3. Set the PORT/STARBOARD switch to STARBOARD, tap the trip/reset button until the total fuel consumed is on the display, then press and hold the trip/reset button until the display resets to zero.



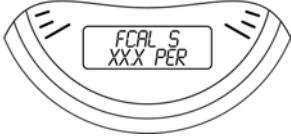
- 4. Consume approximately 25 gallons of fuel while running the boat at normal cruising speeds.
- 5. Return to the fuel pump and refill the tank(s) completely and record the fuel required to fill each tank.
- 6. Calculate the correction factor (for both PORT and STARBOARD engines) using the following formula:

$$FCAL = \frac{\text{FUEL PUMP READING} - \text{TOTAL FLOWMETER READING}}{\text{TOTAL FLOWMETER READING}} \times 100$$

- 7. With the key off depress and hold the trip/reset button.
- 8. Turn the key on and start the engine. Continue holding the trip/reset button until the display runs through the self-test and display the software version.



- 9. Release the trip/reset button after the software version is displayed.
- 10. Tap the trip/reset button to scroll to the **Final Calibration** parameter.



EXAMPLE: FLOWMETER READING HIGHER THAN FUEL PUMP READING

$=$
 $=$
 $\times 100$

FCAL P = -2.0% ROUNDED TO THE NEAREST 0.5%

EXAMPLE: FLOWMETER READING LOWER THAN FUEL PUMP READING

$=$
 $=$
 $\times 100$

FCAL P = 2.0% ROUNDED TO THE NEAREST 0.5%

NOTE: If both PORT and STARBOARD engines are connected, the final calibration value for both can be set at this time. The value displayed/changed depends on the PORT/STARBOARD switch position. P or S after FCAL indicates which will be changed.

FLOWMETER INSTALLATION INSTRUCTIONS

CALIBRATION/SET-UP CONTINUED:

Final Calibration Set-Up:

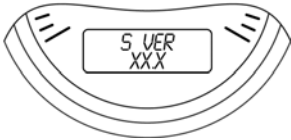
11. With the PORT/STARBOARD switch in the PORT position, the current PORT final calibration value is displayed. To change the final calibration value (adjustment range is -20% to +10% with a resolution of 0.1%), press & hold the trip/reset button until the display flashes, then tap the trip/reset button to change the final calibration value.
12. If a STARBOARD engine is used set the PORT/STARBOARD switch to the STARBOARD position and repeat the procedure above for the STARBOARD final calibration.
13. Press and hold the trip/reset button to select the final calibration.
14. Tap the trip/reset button to scroll to the Exit option
15. Press and hold the trip/reset button to exit the set-up mode.
16. The Flowmeter total fuel should now match the recorded amount of fuel added at the pump for both PORT and STARBOARD engines.
17. If the above is not found to be true, and the calibration cannot be dialed in, you MAY be in need of a pulsation dampener (if you have a carbureted engine), please contact Livorsi Marine tech line for further assistance.

Restore Default Calibration Information:

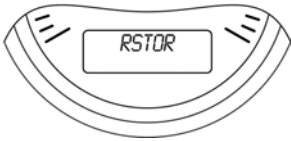
- ❑ The restore parameter allows the user to restore the meter's calibration information back to the factory default parameters.

WARNING! ALL CALIBRATION DATA WILL BE LOST!

1. With the key off depress and hold the trip/reset button.
2. Turn the key on and the display will run through a self-test and display the software version.
3. Release the trip/reset button after the software version is displayed.



4. Tap the trip/reset button to scroll to the **Restore** option



5. Press and hold the trip/reset button to select the restore option.



6. To exit **without** restoring the defaults, press and hold the trip/reset button now.
7. Tap the trip/reset button to toggle from **NO** to **YES**.



8. Press and hold the trip/reset button to restore the factory default calibration information.
9. The complete calibration/set-up procedure must now be completed for accurate operation.



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