SSI Technologies - Application Note FT-AN1
Fluid-Trac® 2-Wire Level Sensor
(Resistive Emulation)

Product Description

The Fluid-Trac® 2-wire level sensor is a non-contact liquid level sensor that can be used as a more reliable and accurate replacement for standard 30-240 ohm resistive float sender, reed-switch tube sensors or capacitive tube senders. The FluidTrac® 2-wire level sensor is commonly used to work with fuel gauges in the automotive, marine and construction industries.

Measurement Technology

The traditional resistive float sender uses a potentiometer attached to a float at the end of an actuating arm to provide a level indication. This technology interfaces with the instrument cluster's fuel gauge which is typically a coil driven needle gauge. As the resistive float sender's resistance changes with level, the current through the coil in the gauge changes causing a deflection of the needle. This approach has been used for many years.

Fluid-Trac® uses ultrasonic technology to generate a high frequency sound wave and measure the time for the echo to reflect off of the liquid's surface and return. The distance from the level sensor to the liquid is calculated based on the speed of sound. The measured distance is converted into a voltage that drives the gauge based on a strapping table contained in the level sensor.

Product Features

- **More Accurate:** Distance accuracy of +/- 2.5% full scale span of distance.

- **More reliable:** Fluid-Trac® is non-contacting. Resistive float senders have a wiper that slides across a resistive strip that with time can wear out and cause intermittent or complete loss of the signal

- **Non-Invasive:** Fluid-Trac® mounts to the same opening as the resistive float sender but does not protrude into the tank.

- **Easier to install or Service:** Fluid-Trac® has no components to protrude into the fluid that need to be bent for removal.

- **Better Design:** With a minimum clearance required, access panels or Pye Plates can be eliminated.

- **Digital Filtering:** Digital filtering eliminates errors due to liquids sloshing in mobile tanks.

- **Tank Profiling:** Factory programmable strapping tables for unique tank shapes.

- **Chemical compatibility:** Fluid-Trac® works with a wide variety of media including gasoline, diesel fuel, urea (ADBLUE), oils, hydraulic fluid and black/gray water.

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- **Minimal Dead Band:** No bottom dead band like on other senders. Optional Fluid-Trac® mounting adapter can be used to reduce or potentially eliminate the top dead band of 2 inches.

- **Repeatable performance:** Because of the electronic nature of the product, the Fluid-Trac® will generate the same signal every time with a tolerance of + 2% of reading, full scale.

- **Reproducible performance:** With no coils or moving parts, customers can be certain that the Fluid-Trac® that is installed on one product will have identical performance as the next unit.

- **American Boat and Yacht Council (ABYC) Certified**

Electrical Interface

The output drive of the Fluid-Trac® 2-Wire Level Sensor emulates the signal of a resistive float sender. An equivalent circuit for the electrical interface is shown below:
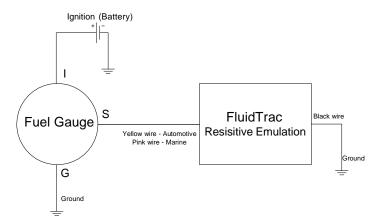

Figure 1. Fluid-Trac ® Interface to Fuel Gauge

As shown in Figure 1, the Fluid-Trac® 2-Wire Level Sensor interfaces using the same two wires as the float sender.

The Fluid-Trac® 2-wire level sensor is designed to work with many popular analog fuel gauges (such as Auto Meter, Faria, VDO, Livorsi Marine, Teleflex) that have nominal coil impedances from 90 to 150 ohms. The Fluid-Trac® 2-wire level sensor will emulate a 30-240 Ohm standard float sender for these gauges. It should be noted that while the output signal is more accurate, the reading device (gauge) is also a part of this system and does impact the accuracy of readings.

The Fluid-Trac® three wire level sensor is to be used on electronic dashes, which commonly have much higher pull-up resistors.

Mounting

The Fluid-Trac® 2-Wire Level Sensor can mount in a variety of ways. Common mounting styles use 1 3/16" machine threaded or the standard SAE 1810 5-bolt pattern. The SSI Gasket must be used to install the sender. When mounting, it is important to place the Fluid-Trac® level sensor's face in the center of the tank perpendicular to the liquid level and with no obstructions in the beam path to the liquid.

In low clearance applications, the Fluid-Trac® 2-wire level sensor bolts in and bolts out quickly. There are no extended swing arms or tubes to bend or cut as with the resistive float or reed switch senders.
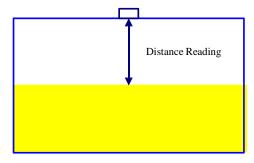

Figure 2. Fluid-Trac® Tank Mounting

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Operating Angle

Level sensor mounting that is not perpendicular to the fluid causes a reduction in level sensor performance. As shown in Figure 3, the amount of returned sound energy is dependent on target angle.
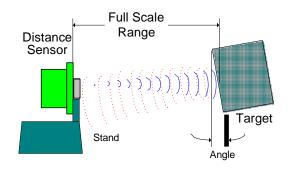

Figure 3. Mounting Considerations.

The Fluid-Trac® 2-wire level sensor maximum operating range (tank depth) decreases with target angle. The maximum operating angle is 6 ° but can be increased to 15° with an optional focus tube.

If the Fluid-Trac® liquid level sensor is pointed into free space (outside of the maximum operating angle) no echoes will be received. Under this no echo condition the sensor output will hold at its last output until valid echoes are received.

Response Time

Fluid-Trac® 2-wire level sensor has a factory programmed digital filter to reduce error caused by sloshing fluids.

Motion of the liquid media can impact the performance of a level sensor. Wave motion creates noise in the measured data because the level sensor measures one distance at the wave peak and another distance during the wave troughs.

In certain highway and marine applications, this difference can be as high as 30% of full scale especially when traveling on curvy roads or in choppy waters. For fuel level applications, the liquid level changes at a much slower rate (fuel consumption) than 1 inch per second. A 4 minute filter may be factory programmed for this high slosh condition.

Note: When filling a tank with a Fluid-Trac® 2-wire level sensor containing a digital filter, the level sensor will not indicate an instantaneous level change. The output voltage will be updated at the response time corresponding to the programmed digital filter.

SSI engineering works with customers to assure the correct digital filtering is applied for their specific application needs.

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Electrical Specifications

Output Sink Current	20-200mA
Fluid-Trac ® Emulated Resistance	30-240 Ω
Range	2 inches to 32 inches
Range (Gasoline*)	2 inches to 24 inches
Distance Resolution	0.07 inches
Distance Accuracy	+/- 2.5% of span
Operating Temp Range	-40 to 85 ° C
Storage Temp Range	-50 to 100 ° C

* Note: Gasoline range is different due to the density of gasoline vapors. Gasoline vapors are denser as the temperature increases which results in the speed of sound being slower.

Other Specifications

SAE 5 Bolt Torque	10-15 in/lbs
1 3/16" Threaded Torque	3-5 ft/lbs

Packard Electric Part	FluidTrac P/N	Mating P/N
Connector Assembly	12162343	12052644
Terminal	12045773	12048074
Seal	12048086	12048086
Terminal Position Assurance (clip)	12052634	12052634

Note: The Fluid-Trac® 2-wire level sensor comes with an integral gasket that must be used when mounting. Mating connector parts and bolts are not included.

Tested Conditions

Input Supply Transients	Reverse Battery 24 Volts Over Voltage 24 Volts
Transients	Load Dump 120 Volts ESD 15 KV
EMI	50 V/m Operating 100 V/m Recovery
Mechanical Shock	18 G Shock
Drop Test	4 Ft. Drop Test
Vibration	4 Grms 8 hrs each axis
Humidity	85 % humidity @ 85 °C for 1000 hrs
Chemical Compatibility	Gasoline, Diesel Fuel, Motor Oil, urea (ADBLUE), Water, Potable Water, Ethanol, Hydraulic Fluid, Engine Coolant

Note: Fluid-Trac® is American Boat and Yacht Council (ABYC) Certified.

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