

SSI Technologies - Application Note FT-AN3

Fluid-Trac® 2-Wire (Resistive Emulation) Level Sensor Interface to Analog Fuel Gauges

Fuel Gauge Application

This application note covers the Fluid-Trac® 2-wire fuel level sensor used as a replacement for a standard 33-240 Ohm resistive float fuel sender to interface with either 12V or 24V analog fuel gauges.

Traditional float fuel sender

Fuel monitoring systems consists of two components – a float fuel sender and a gauge. The float fuel sender measures the level of fuel in the tank and sends the information to the fuel gauge to display the level.

A traditional float fuel sender is a 33-240 Ohm resistive float fuel sender. It consists of a float attached to an actuating arm (rod) with a variable resistor (potentiometer) mounted at the end of this rod. These devices tend to be inaccurate, showing empty even though there are gallons left in the tank and displaying full for extended periods after a fill-up.

The resistive float fuel sender interfaces with the fuel gauge via a wiper that slides across the resistive material of the potentiometer. As the resistance of the float fuel sender changes with the float's position, the current through the coil in the fuel gauge changes causing a deflection of the needle.

When you fill your fuel tank, the float is actually submerged at the top of the fuel tank; it will not start to drop until the fuel level drops below the float bottom. As a result, inaccurate full level readings are observed.

Also the float fuel sender often does not have a full range of motion to the bottom of the fuel tank. So that the fuel gauge indicates empty even with gallons left inside the fuel tank.

The float fuel sender does not work well in irregular shaped fuel tanks. When the float is located at the middle of the tank, it will indicate a level of half full. This may not be the case, especially on fuel tanks that are much smaller at the base.

Fluid-Trac® Ultrasonic Fuel Level Sensor



The Fluid-Trac® 2-Wire fuel level sensor replaces the traditional resistive float fuel sender as a more robust and accurate fuel level sender in fuel monitoring systems with stationary or mobile fuel tanks with \leq 32 inch depths

The Fluid-Trac® 2-Wire fuel level sensor uses ultrasonic technology to generate a high frequency sound wave that reflects off of the fuel surface. The time for the echo to reflect off of the fuel and return to the fuel level sensor is used to calculate the level of the fuel inside the fuel tank. The distance from the sensor to the fuel is calculated, using the speed of sound. This measured distance is then compared to a strapping table (unique for the fuel tank) and converted into a voltage that drives the fuel gauge to indicate the correct fuel level.

The Fluid-Trac® 2-Wire fuel level sensor has a distance accuracy of +/- 0.125 inches. Every fuel level sensor is programmed with a strapping table to take into account the unique shape of the fuel tank. If the fuel tank is irregularly shaped with the mid point of the tank holding only 1/3 fuel capacity, the fuel level sensor

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will indicate 1/3 capacity not 1/2 capacity as a traditional float fuel sender may.

The Fluid-Trac® 2-Wire fuel level sensor is mounted on top of the fuel tank. It mounts to the same opening as the resistive float fuel sender. It is non-contacting (no float arm inside the fuel tank) and does not have any parts to wear out. The resistive float fuel sender's wiper slides across a resistive strip that can wear out over time which may result in intermittent or even a complete loss of the signal to the fuel gauge.

The Fluid-Trac® 2-Wire fuel level sensor operates in temperature ranges from -40°C to +85°C and is programmable with a digital filtering to reduce error caused by fluid sloshing in mobile fuel tanks. With a float fuel sender, as the fuel sloshes to one side of the tank, the needle on the fuel gauge responds quickly to an incorrect fuel level.

The Fluid-Trac® 2-wire fuel level sensor is not affected by corrosive fuel additives or low sulfur fuels.

Electrical Interface

Two common fuel gauges are moving coil gauges and bi-metallic strip gauges. Moving coil fuel gauges use magnetism to move the needle to indicate fuel level. Moving coil fuel gauges have a coil connected to the supply terminals. The magnetic field created is dependant on the supply voltage and the current flowing through the fuel gauge. As the magnetic field increases, the needle will move to indicate fuel level. The fuel sender passes a current that will vary the magnetic field to indicate the correct fuel level.

Bi-metallic fuel gauges use heat to move the needle to indicate fuel level. They have a resistor that either wraps around or is located near a bimetallic strip. The bimetallic strip is attached to the needle of the gauge and is composed of two different types of metals. These two different metals contract and expand at different rates with heating and cooling. This allows the bimetallic strip to bend and move the needle to indicate fuel level. The fuel sender passes a current that goes

through this fuel gauge resistor to indicate the correct fuel level.

The Fluid-Trac® 2-Wire fuel level sensor has a ratio metric PWM output (20 mA to 200mA). This current output emulates a 30-240 ohm resistive float fuel sender.

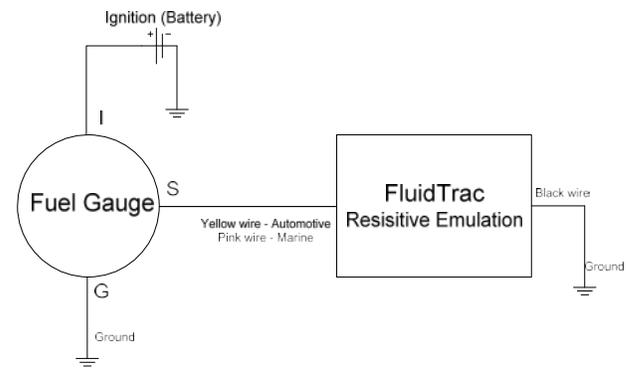


Figure 1. Fluid-Trac® 2-Wire Fuel Interface to Fuel Gauge

As shown in Figure 1, the Fluid-Trac® 2-Wire Fuel Level Sensor interfaces using the same two wires as the float fuel sender. The Fluid-Trac® two wire fuel level sensor is designed to work with analog gauges that have nominal coil impedances from 90 to 150 ohms.

Mounting

The Fluid-Trac® 2-wire fuel level sensor can mount in a variety of ways. Common mounting styles are either 1 3/16" machine threaded or the standard SAE 5-bolt pattern. When mounting the Fluid-Trac® it is important to keep the mounting parallel to the fuel level and in the center of the fuel tank.

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