

# PRINCETON CAPACITIVE FUEL LEVEL PROBES

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## Instructions

These instructions are for the bendable and non-bendable probes. The bendable probes are mounted using a SAE 5 bolthole pattern. A backing plate can be used to adapt tanks without this bolthole pattern. The non-bendable probes can be mounted with the SAE 5 bolthole pattern or press fit with a rubber grommet.

## Theory of operation

The probe senses a change in fuel level using a capacitive sensor formed by two metal conductors. No current passes through the fuel. The aluminum outer tube is at ground potential through an isolation capacitor. The inner brass rod has a signal on it through a 1 Meg ohm resistor. There is a digital microprocessor that filters and conditions the signal providing a very stable fuel level reading.

The leads from the probe are protected from miss wiring of the probe. The supply voltage can be from 10 to 28 volts continuous. The plus power supply lead is protected to 70 VRMS and 48 volts DC for short durations.

## Probe operation

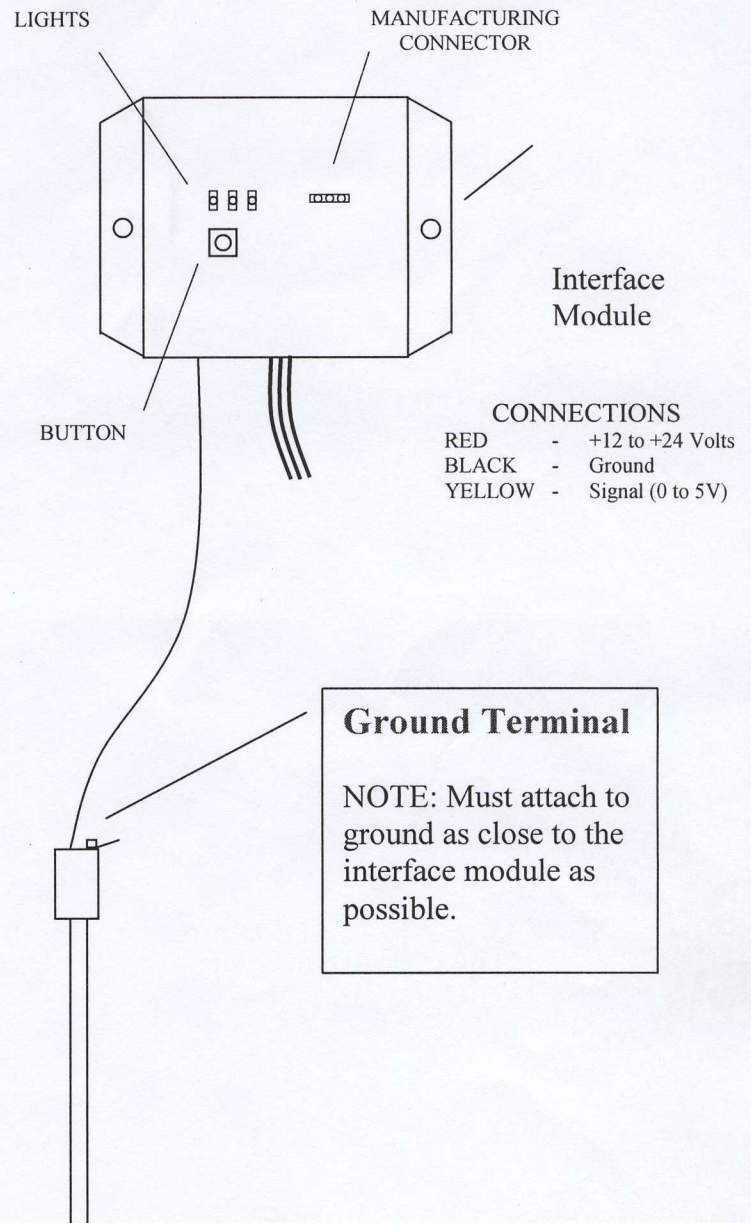
The probe has two modes of operation, calibration and run. The probe comes from the factory in the calibration mode. To calibrate the probe see the calibration instructions.

When power is applied and the probe has been calibrated the probe will perform a self-test sequence. The middle light flashes quickly while this process takes place. The output of the probe will go to full for 1 second and then empty for 1 second. This allows a visual test of both the gauge and the probe for proper operation. The output is filtered with a RC network and therefore does not change rapidly. The gauge will read full very briefly. After the self-test a heartbeat will flash every 2 seconds on the middle light. The current level is updated without averaging to get a reading quickly at power-up.

The output of the probe is digitally filtered by two methods. The first is an averaging function. Readings are averaged for 60 seconds before being passed to the second digital filter. This type of filtering works well with fuel because of low frequency sloshing. With float type probes this is seen in the indicator rocking back and fourth. The averaging method eliminates this.

The second digital filter is a low pass filter that behaves like a RC filter with a long time constant. The output will change slowly. The main benefit from this filter is the elimination of high frequency oscillations.

Because of the filtering used the fuel level reading will be very stable. It can take up to 120 seconds to update an actual change in fuel quantity. Even while filling the tank this is not a problem.





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## General Calibration Information

- ❑ The probe can be recalibrated an unlimited number of times.
- ❑ The calibration sequence is **empty** first then ¼, ½, ¾ and **full** for **5 set point** models, **empty** then **full** for **2 set point** models.
- ❑ Calibration can be entered or restarted at any time.
- ❑ Probes are shipped with calibration activated. When power is applied the left light will be flashing.
- ❑ To enter calibration mode, hold the button down while turning on the power.
- ❑ Power can be removed during the calibration process after any set point (lights flashing). When power is returned the probe will continue.
- ❑ The empty set point can take as long as 16 seconds. All other set points are less than 2 seconds.
- ❑ Water affects the probe giving a reading of full. Water will not hurt the probe. The surface tension of water will make it hard to be removed from the probe. Gently tapping the probe will help.
- ❑ The likelihood of ever getting water in the probe other than deliberately exposing the probe to water is remote. There would have to be significant amount of water in the fuel tank (the unusable portion) to reach the bottom of the probe. The probe should be at least a ¼ of an inch above the bottom of the tank.

## Calibration (2SP & 5SP)

- ❑ Hold down the button while turning the power on. (If the left light is not already flashing.)
- ❑ **5 set point** models - all three lights will be on while holding the button down.
- ❑ **2 set point** models - both outer lights will be on and the center light will be flashing.
- ❑ Release the button. The left light will be flashing. Indicating **Empty** set point.
- ❑ Place the amount of fuel you want to read **Empty** in the tank.
- ❑ Press the button. The left light will stay on (stop flashing) while the initial calibration is performed. This can take as long as 16 seconds. The rest of the set points will take less than 2 seconds.
- ❑ **2 set point** models – The right light will be flashing. Place the amount of fuel you want to read **Full** in the tank. Press the button. The light will stay on for a second. The probe is now calibrated.
- ❑ **5 set point** models – Place the amount of fuel that you want to read for the next set point. Refer to table 1. Press the button. Continue until done.
- ❑ After the **Full** set point has been entered the middle light will flash about every five seconds. This indicates the probe is functioning and outputting fuel level information.

<div> <div>⦿ Flashing</div> <div>○ Off</div> </div>	
⦿○○	EMPTY SET POINT
⦿⦿○	¼ SET POINT
○⦿○	½ SET POINT
○⦿⦿	¾ SET POINT
○○⦿	FULL SET POINT
Table 1	Set point modes

<div> <div>● ON</div> <div>○ OFF</div> </div>	
●○○ / ○●○	DATA ERROR
●●● / ○○○	SHORT
●●○ / ○○●	UNSTABLE
Table 2	Error codes

## Error Codes

- ❑ **DATA ERROR** – The data stored in eeprom is not valid. Action to take: Recalibrate. If the error persists contact technical support.
- ❑ **SHORT** – This error can only happen during empty set point calibration. It indicates that the probe could not be calibrated. Most likely cause is contact between the copper and aluminum tubes from shortening. The presence of water in the probe would act the same as a short. Action to take: Check for any contact between the rods, remove any water, and recalibrate.
- ❑ **UNSTABLE** - This error can only happen during empty set point calibration. It indicates that the fuel level was not stable. Action to take: Recalibrate while insuring that the level of the fuel is not changing during calibration.

### Limited Lifetime Warranty

Princeton Electronics, Inc. will repair or replace any probe found to have a manufacture defect. Probes that have been shortened, or the leads cut cannot be exchanged or returned for credit unless they are found to have a manufacturer defect.

### Disclaimer

This fuel probe is for reference only, the operator is responsible to visually inspect fuel quantities prior to use. Relying solely on a fuel gage could result in unexpected engine stoppage.

Because Princeton Electronics, Inc. does not install the fuel monitoring system; we rely solely on the installer to insure proper installation.