

Tips for Installation, Troubleshooting, Calibration, and Operation of SmartSwitch Tank Management Systems

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Overview of SmartSwitch Tank Management Systems

The *SmartSwitch* models TC-8000, TM-4000, and the TD-4000 utilize a pressure-type level sensor as one of several options to provide fluid level indication for display at the Master Display Unit (MDU).

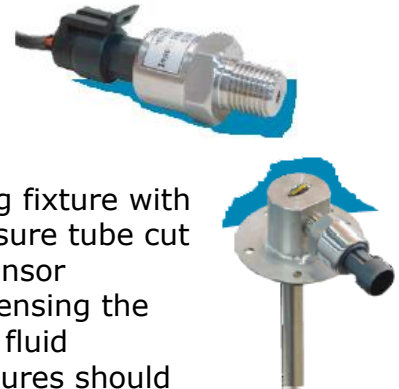
The maximum number of tanks which can be connected to each system is as follows: TC-8000 (eight tanks), TM-4000 (four tanks) and TD-4000 (four tanks).

The TC-8000 and the TM-4000 employ a network technology with Input/Output Units ("IOU's" or "tank controllers") distributed throughout the vessel and mounted near the tanks. Level sensors are wired directly to the IOU and the IOU transmits a level signal over a two-wire network to the Master for display as either a bar graph or % full/gallons/litres. IOU's can control macerator or fuel transfer pumps as an option.

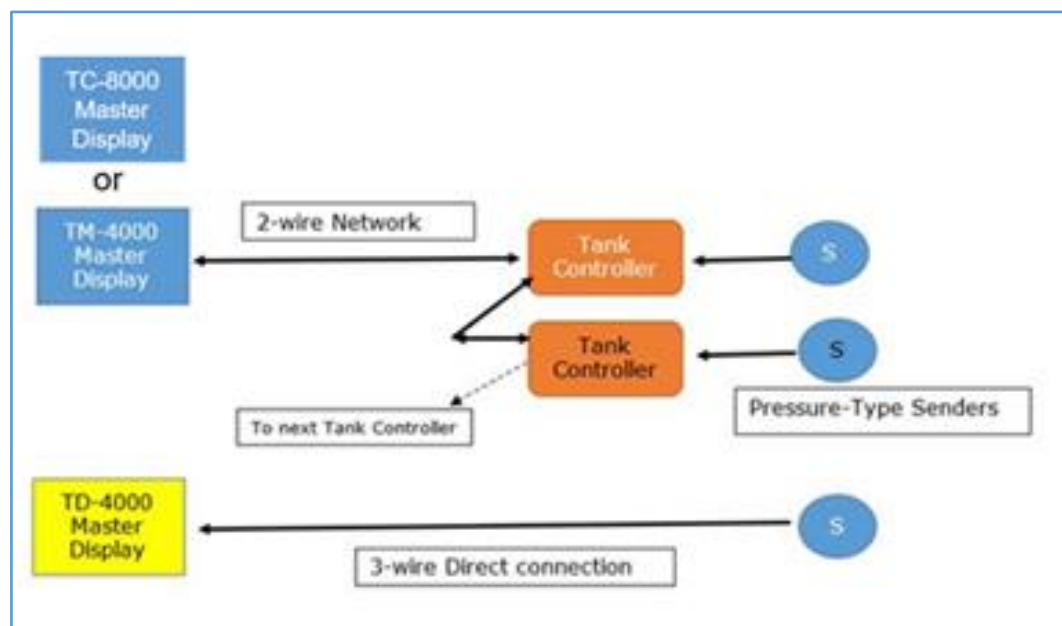
The TD-4000 is a hardwired system and as such does not use a two-wire network and IOU's to provide a level signal to the Master Station. Rather, the three wires from each level sensor are connected directly to the Master Station.

All the *SmartSwitch* systems use the model SEN-S/S pressure-type level sensors, however, there are several possible mounting locations. These include:

- Bottom side wall of the tank
- Fuel or water discharge line
- Top mounted, which utilizes a stainless-steel mounting fixture with SAE 5-bolt pattern common to level senders and pressure tube cut to the proper depth for the tank. The top mounted sensor measures the pressure at the bottom of the tank by sensing the air pressure in the tube which will be the same as the fluid pressure at the bottom of the tube. Top-mounted fixtures should always be used for waste tanks.



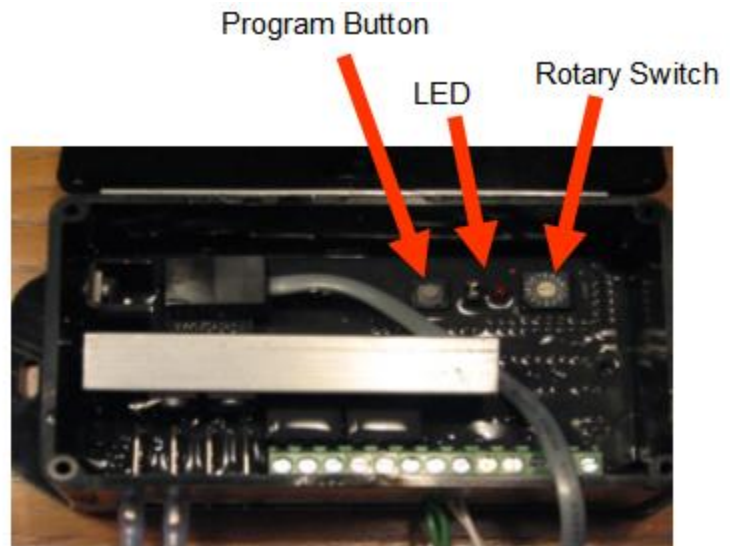
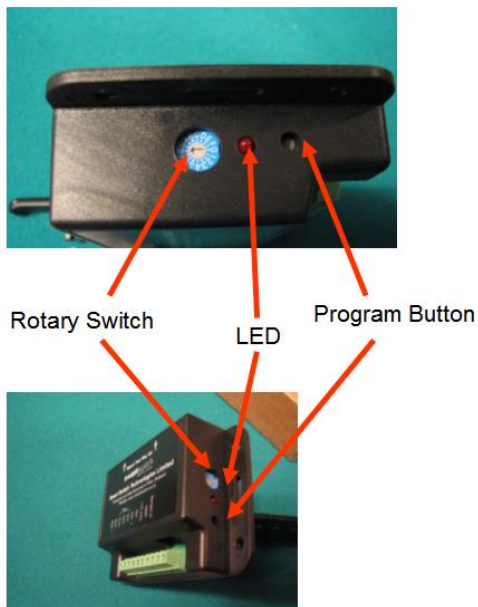
Comparison of TC-8000/TM-4000 Network and TD-4000 Hardwired Configurations



Pressure Sensor Calibration for TC-8000 and TM-4000 Systems

The TC-8000 and the TM-4000 both use the model HB-200 IOU (Input/Output Unit) for level sensing only or model HB-200/P IOU for level sensing and pump control. These IOU's are a black control boxes mounted near the tank. Because the TC and TM are network systems, each IOU must have a unique address. This address is set on a rotary switch on the side of the IOU (HB-200) or under the cover of the IOU (HB-200/P).

Valid IOU addresses are "2" through "5" for the four-tank systems (TM) and "2" through "9" for the eight-tank system (TC).



HB-200 Input/Output Unit

HB-200/P Input/Output Unit

The calibration process is essentially a "pairing" operation between the IOU and the SEN-S/S sensor. The steps in this process are as follows:

1. Determine whether you have a regular or irregular shaped tank and if you will use the two or five-point calibration process. (Note that regularly shaped (rectangular vertical cross section) can use the "2-point calibration process, whereas irregularly shaped tanks must use the 5-point process.)
2. Decide which of calibration techniques you will use. SEE CALIBRATION TECHNIQUES PAGE 5. The various techniques use either the tank itself or a tube or other container for an "off-line" calibration.
- 3. If this is a retrofit of an existing system, find and record the position of the rotary switch which will indicate the address of that IOU. (You must return the switch to that address after calibration.)**

Using a small screwdriver, turn the rotary switch to the "0" position, the calibration position.

- 4.
5. Using programming button, set "EMPTY" with the probe in open air or at a level which you establish as the desired low point as follows:
 - a. Press and hold down the Program Button (on the IOU) until the LED comes on (approx. 3 seconds). The LED will begin flashing rapidly as it reads the value for the tank low point. Four slower flashes indicate it has set the tank low point.
 - b. Fill the tank or calibration tube to the required TANK FULL LEVEL. Wait approx. 30 seconds for the fluid to settle. Press and release the Program Button. The LED will begin flashing rapidly as it reads the value for the tank high point and once again, four slower flashes indicate it has set the tank high point. The unit will automatically leave program mode and the LED will go off. The device is now ready for use.
6. **IMPORTANT! Return rotary switch to position you recorded in step 3.**

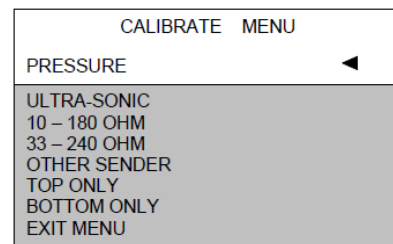
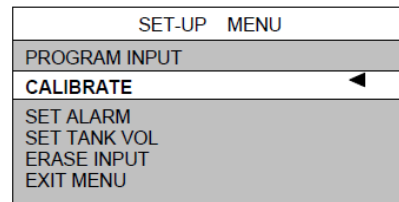
Pressure Sensor Calibration for TD-4000 Systems

Carefully read and understand the Sensor Programming Section from the TD-4000 Instruction Manual.

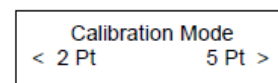
After setting up all input names and other characteristics from the "Programming Instructions" using the instructions from the Manual, you may now proceed to calibrate the inputs. (Note that "Sensor Programming" appears in a separate section from "Programming Instructions".)

The calibration steps are as follows:

1. Press and hold down the Backlight key. Holding the backlight key, press and hold the Scroll key. Hold together for 3 seconds. This will bring you to the Set-Up Menu.
2. Use the Scroll or Backlight key on the Master Display to scroll to "Calibrate" and press the Pump Key. This will bring you to the Calibrate Menu.
3. Use the Scroll or Backlight key to scroll to the tank input requiring calibration.
4. Press the Pump key once to set the input to be calibrated.
5. Use the Scroll or Backlight key to scroll through the list of sensor options. Once you have found the "Pressure Sensor", press the Pump key.
6. Select 2 or 5-point calibration using the Backlight (for 2 point) or Scroll (for 5 point) key.
7. Follow the on-screen prompts to set the full and empty points carefully following the instructions in the manual.



If Pressure is selected the display will now show:

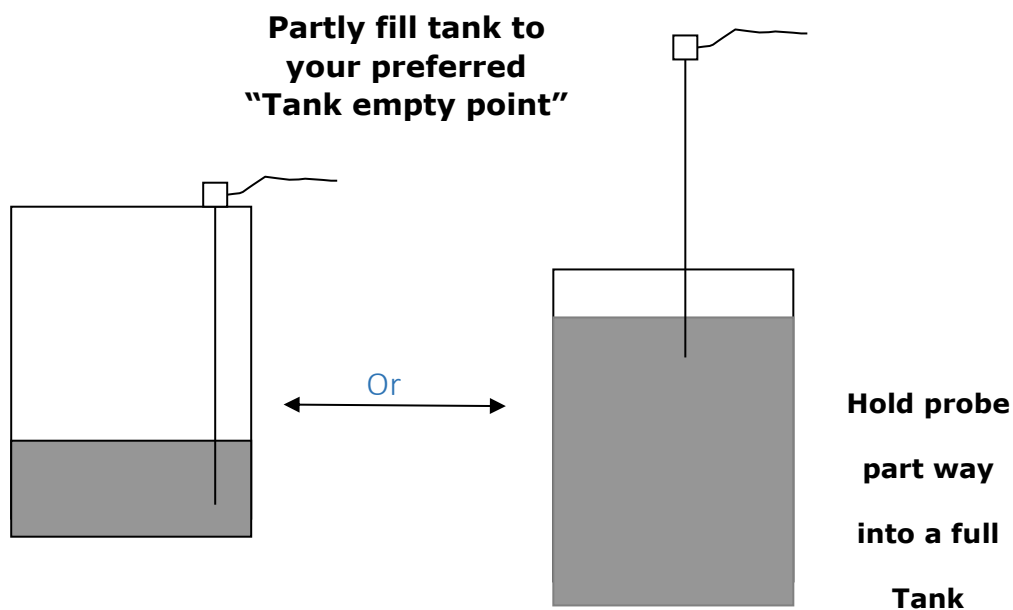
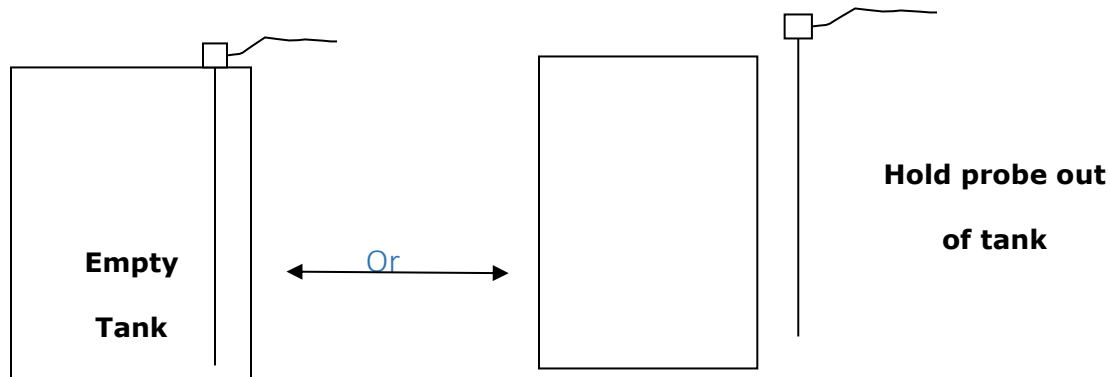


Calibration Techniques for Top Mounted Pressure Senders

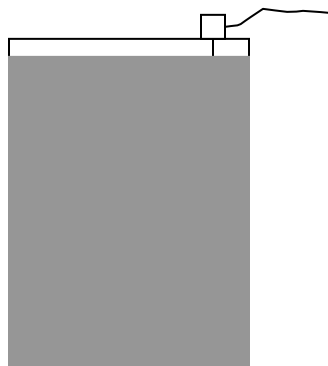
2 Point Calibration Using the Holding Tank

Setting Empty: (four different options)

Either start with an empty tank or remove the probe from a full tank or place a portion of the probe into a full tank to set empty point other than the tank actually being empty.



Setting Full:
Fully insert probe into tank



Diesel and water are different weights therefore either calculate the difference using the method below or use the actual fluid the tank is being calibrated for. Diesel fuel weighs 83.3% per volume of water. Therefore, if calibrating for fuel but using water, a factor of 16.7% needs to be deducted from the water level height to provide proper calibration. For example, if "Full" equals 20 inches of fuel depth, mark a line on the sender probe at 16.66 inches ($20 \times 0.833 = 16.66$).

2-Point (1) Calibration using a Calibration Tube

Any container deep enough to accommodate the full length of the SEN-S/S probe can be used for calibration, including a section of tubing as small as ½ inch in diameter as shown in the photos below.



The procedure is as follows:

- Fill calibration tube with water to a level that, when the probe is inserted into the tube, water will overflow the top of the tube.
- Set "EMPTY" with the probe in open air or by partially inserting the probe into a full tube to set a preferred "Empty" point (as shown on page 5)
- To set "FULL", insert probe completely into tube,

Note 1: The calibration tube technique can be used for 5-point calibration (described on the following page) if you know the point heights which correspond to the various volumes of fluid. In this process you mark the probe and insert into a full container or tube to the marked points setting each point as you insert the probe, being sure that the water spills over the top at each calibration point. In this way the top of the tube can be used as your reference point.

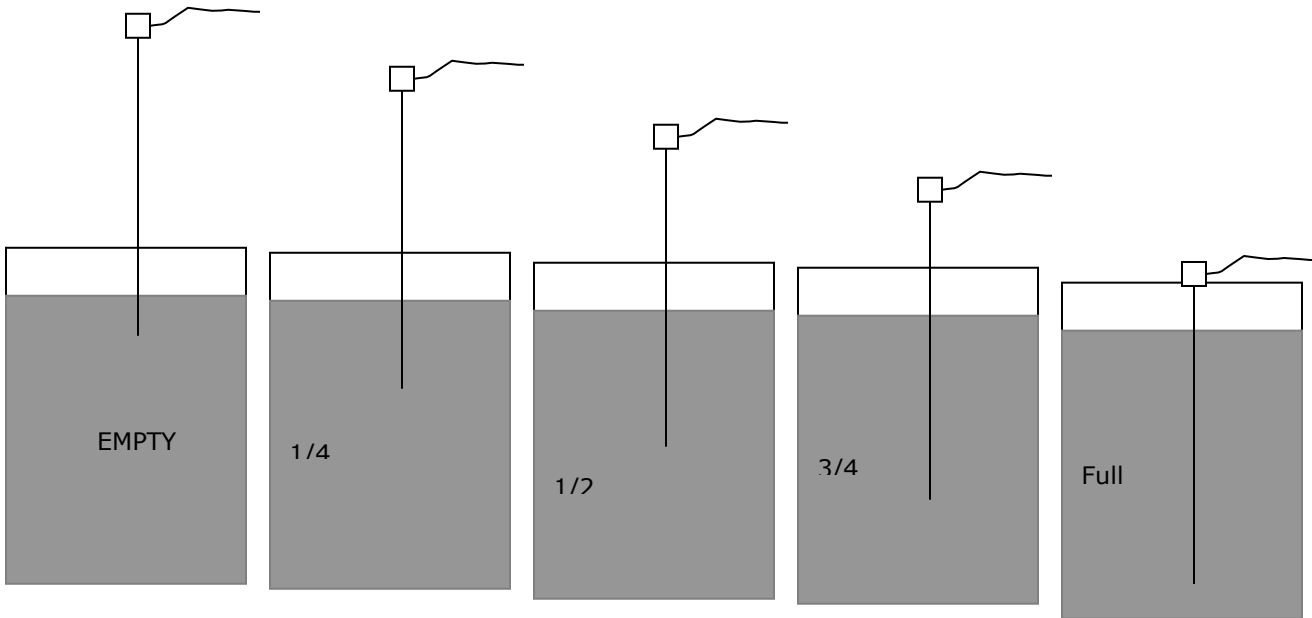
Note that water can be used to set the level for a diesel fuel tank using the formula shown in the box on page 5.

5 Point Calibration Using the Tank:

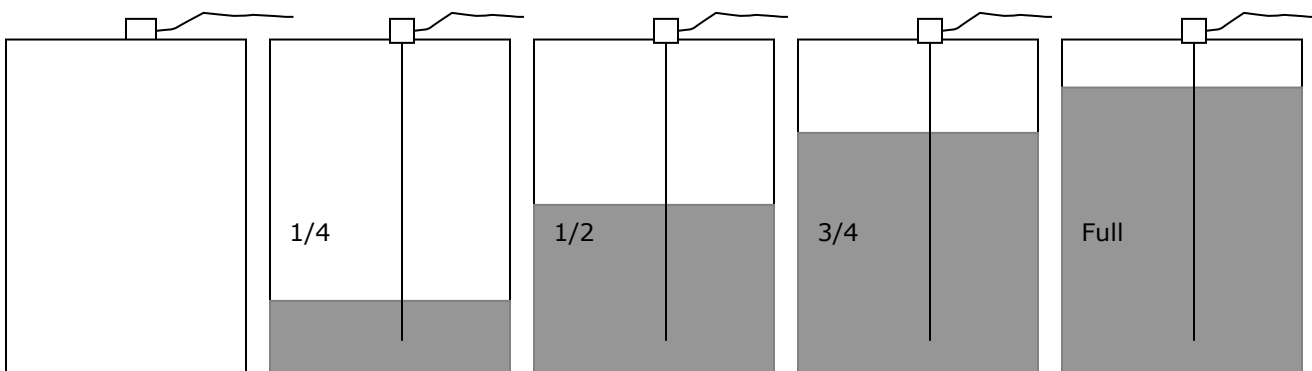
An irregularly shaped tank means that the volume of liquid in the tank is not directly proportional to the depth of the liquid. Therefore, the *SmartSwitch* 5-point

calibration system allows the tank to be effectively divided into four separate tanks to closely approximate the actual volume in the tank.

As illustrated in the second example below, with the probe fully inserted into the tank, you would meter a known amount of liquid into the tank and record the actual level for each point in the calibration process. For example, if a tank holds 100 gallons, after setting the low or "empty" point, you would add 25 gallons and set the $\frac{1}{4}$ point, and so forth until the last (FULL) point has been set at which point the unit will leave the program mode. Or if you know the point heights which correspond to the various volumes of fluid, you can mark the probe and insert into a full tank to the marked points setting each point as you insert the probe. (First example below)



Or



Installation Considerations for Pressure Level Senders

Locating the Pressure Sensor



Installation cost depends on the location chosen to install the pressure sensor.



The model SEN-S/S 100 (left) can be mounted in the fuel/water delivery lines or, when combined with a stainless-steel top-mount fixture (right), the sender assembly is mounted at the top of the tank.

Choosing the location for new senders

This is a key decision. Owners may opt for a top-mounting solution because of the ease of the installation. The question to consider is:

Is there sufficient access to the top of the tank to install a mounting fixture whose length equals the depth of the tank?

If the answer is "Yes", this may be the easiest and most cost-effective solution.

Top Mounting

For boats without existing senders, a $\frac{3}{4}$ inch hole is drilled in the top of the tank to accept the fixture's "pressure tube" which extends to the bottom of the tank. The flange is mounted using 5 stainless steel screws.

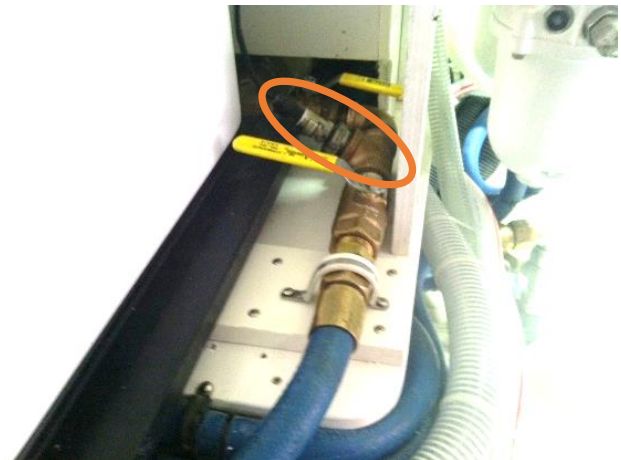
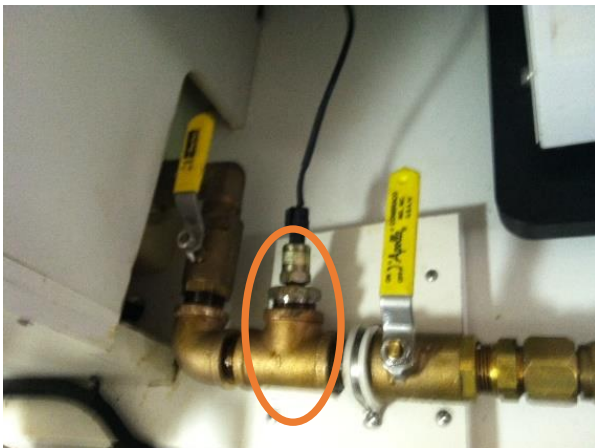
For boats with an existing sender, drilling may not be required. Just remove the existing sender and mount the pressure sender assembly flange using the same mounting holes if sender uses the industry standard SAE 5-hole pattern.

Delivery Line Mounting

Installation of the SEN-S/S100 senders in the delivery lines requires inserting a "T" fitting into each fuel/water delivery line as illustrated in these installation photos for port and starboard fuel tanks on an Eastbay 50.

The hardware required for this modification is a shutoff valve on each side of a $\frac{3}{4}$

inch
pipe



thread "T" fixture which accepts the SEN-S/S100 sender unit.

Installation of the SEN-S/S Top-Mounted Sender Assembly



Replacing a BEP Ultrasonic Sender

The SmartSwitch top-mount fixture's mounting screw pattern is identical to the BEP sender – but note that in the SAE 5-bolt pattern, the holes are NOT symmetrically placed around the rim of the flange. That is, the holes will match in only one orientation.

No drilling should be required to mount the sender assembly. The BEP sender has a $\frac{3}{4}$ to 1-inch hole in the center which is sufficient to accept the pressure tube of the SEN sender assembly. Mounting holes should match.

Stainless steel screws should be used to mount the flange and a silicone caulk or other gasket material should be placed under the flange prior to tightening.

For installation in a new tank or an existing tank with a different sender arrangement

Select an appropriate location with sufficient access above the tank to insert the pressure tube, remembering that the tube is approximately equal to the depth of the tank. There is no restriction on the location relative to the side wall of the tank.

If the sending unit is being mounted where no previous sender was mounted, six holes must be drilled in the top of the tank. These include a center hole approximately $\frac{3}{4}$ inch in diameter for the pressure tube and five holes sized for the mounting screws.

Note that many senders use the same SAE 5-hole pattern as the SmartSwitch SEN-S/S sender assembly, in which case you may not need to drill new holes.

Stainless steel screws should be used to mount the flange and a silicone caulk or other gasket material should be placed under the flange prior to tightening.

Top Only and Bottom Only Calibration for SmartSwitch TM-4000, TC-8000, and TD-4000

After calibrating the bottom and top settings of a tank you may wish to go back and change either of these settings individually. The top and bottom calibration can be done ONLY AFTER an initial calibration has been completed. This is a fine-tuning process.

If Top Only is selected: the system will read the current level of the tank and calibrate this as the top level for that tank.

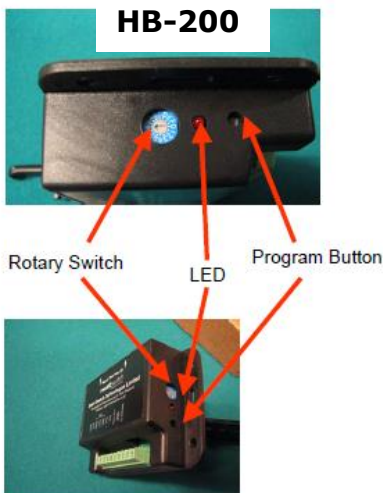
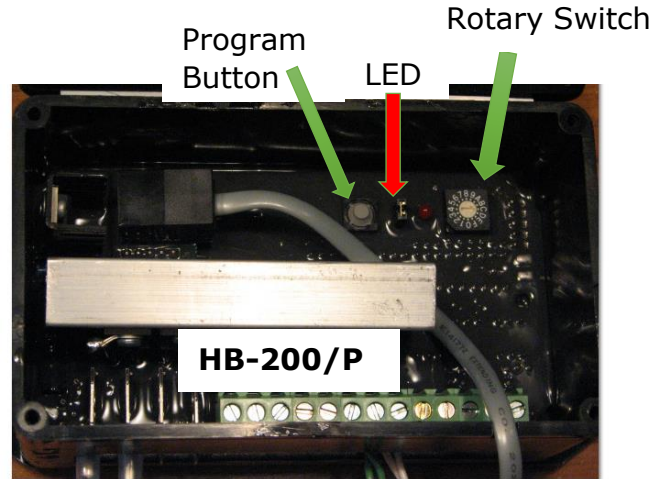
If Bottom Only is selected: the system will read the current level of the tank and calibrate this as the bottom level for that tank.

To set top only or bottom only calibration points for:

TM-4000 and TC-8000

Find the Rotary Switch in the Input/Output Unit (The Rotary Switch is accessed under the cover in the HB-200/P Unit and on the side of the case of the HB-200)

Important: Prior to moving switch to the calibration position, note the switch position as this is the tank's address. The switch must be returned to this position after calibration and before returning the tank to operation.



The Bottom Only setting can be changed by turning the Rotary Switch to position A.

Press and hold down the Program Button (on the IOU) until the LED comes on (approx. 3 seconds), this will set the current tank level as the tank low point. Press and release the program button, the LED will give 3 quick flashes. The tank low point has now been saved and the unit will automatically leave program mode. **Important: Return the rotary switch to the tank's original address.** The device is now ready for use.

The Top Only setting can be changed by turning the Rotary Switch to position B

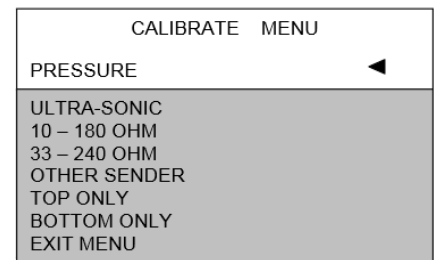
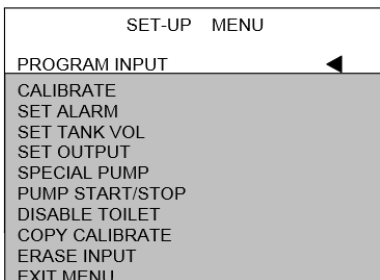
Press and hold down the Program Button (on the IOU) until the LED comes on (approx. 3 seconds), this will set the tank high point. Press and release the Program Button, the LED will give 3 quick flashes. The tank high point has now been saved and the

unit will automatically leave program mode. **Important: Return the rotary switch to the tank's original address.** The device is now ready for use.

TD-4000

The "program mode" brings up the "Set-Up Menu". (See manual to enter the program mode) Select "Calibrate".

From the Calibrate Menu, select either Top Only or Bottom Only. The top or bottom level will be set when you make this selection, and the display will return the Set-Up Menu.



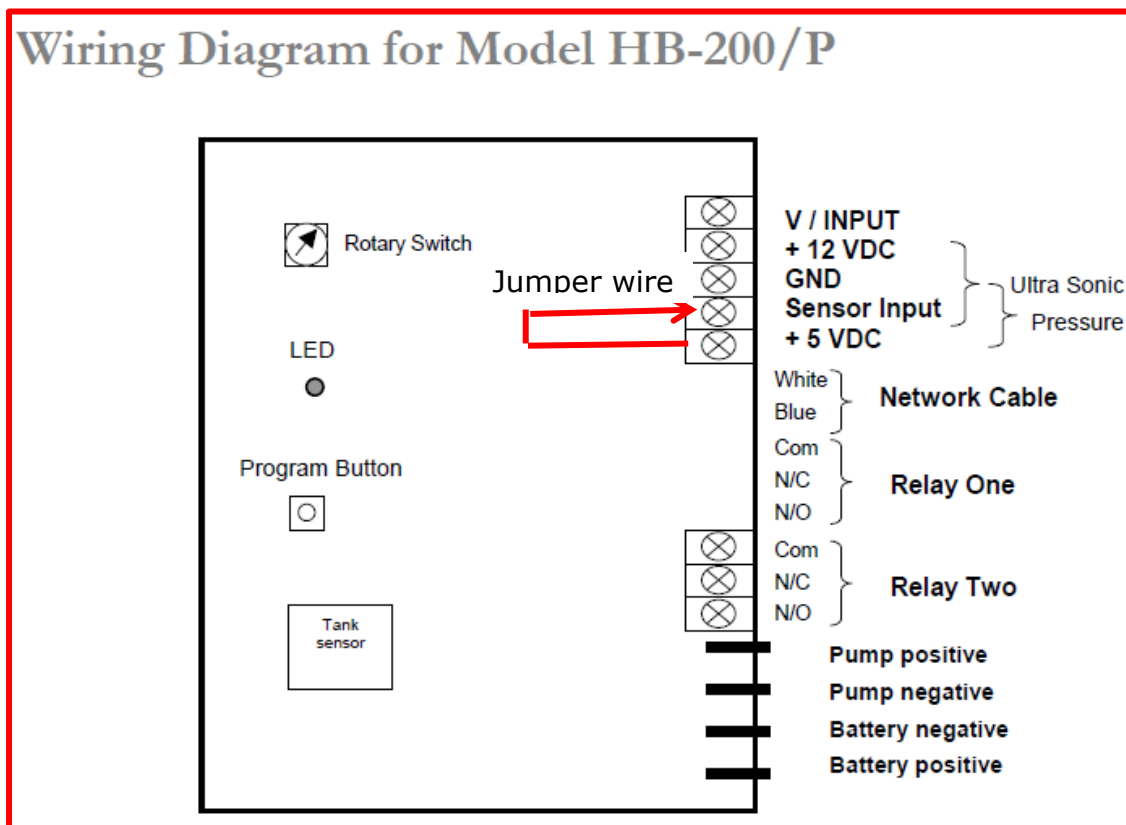
Pumping out a tank in the event of a level sensor failure

Method One

Open the cover on the IOU (Tank Controller) by removing the 4 screws. Find the "Program Button". Looking at the IOU with the terminals facing down, the programming button lies to the left of both the rotary switch and the LED programming light. Push this button. This will turn the pump on. Push again to turn the pump off.

Method Two

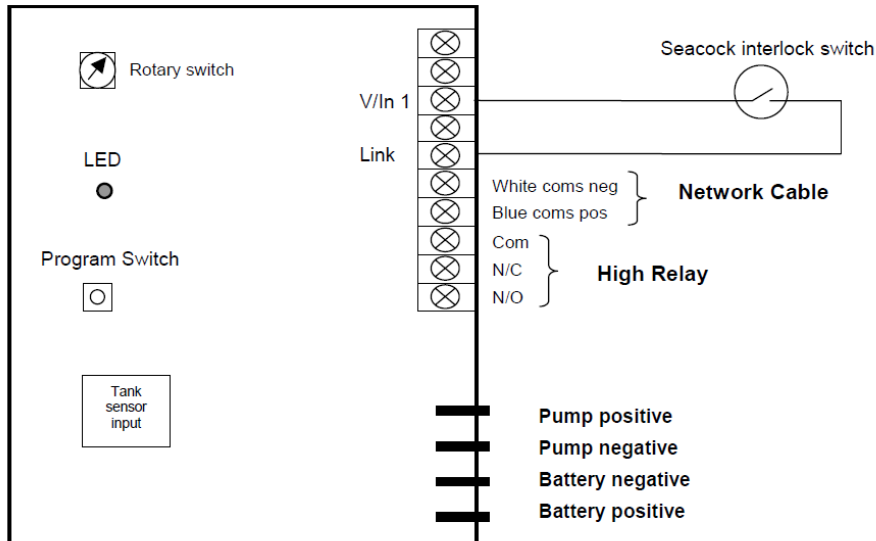
The TM-4000 and TC-8000 systems will only allow the pump to start if the sensed level is above EMPTY. This feature is employed to prevent the pump from running dry and damaging the impeller. You can defeat this feature by causing the system to sense a full tank. Here's how: The sensor input terminal is looking for 5v which equals "FULL" to the system. To satisfy this, put a temporary jumper wire from the "5 volt" terminal to the "Sensor" input terminal, the system will read "full" and, using the PUMP key on the Master Display, you can run the pump to empty the tank. (The terminals are accessed by removing the IOU cover as in Method One.)



Replacing HT-100/P I/O Unit with HB-200/P

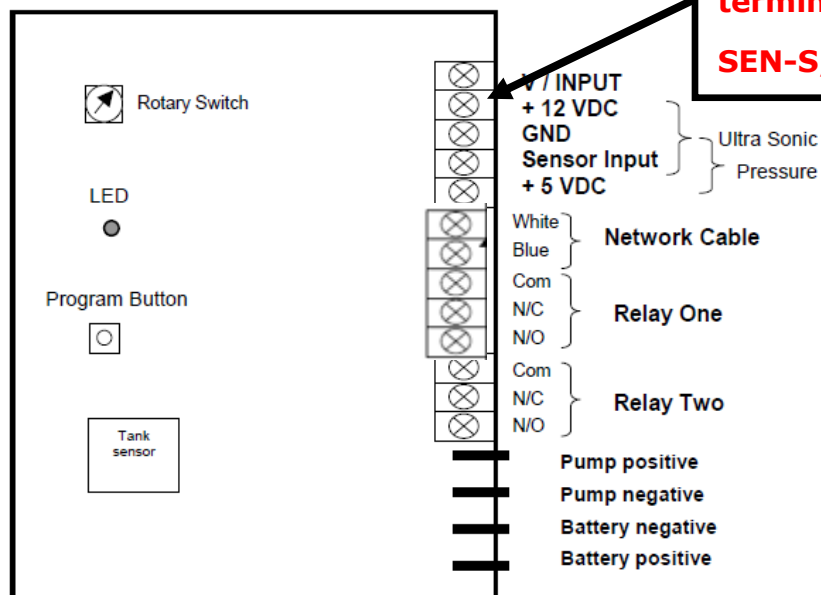
Existing TM-4000 Input/Output Unit (Tank Controller) Wiring

Wiring Diagram for Model HT-100/P



NEW TM-4000 Input/Output Unit (Tank Controller) Wiring

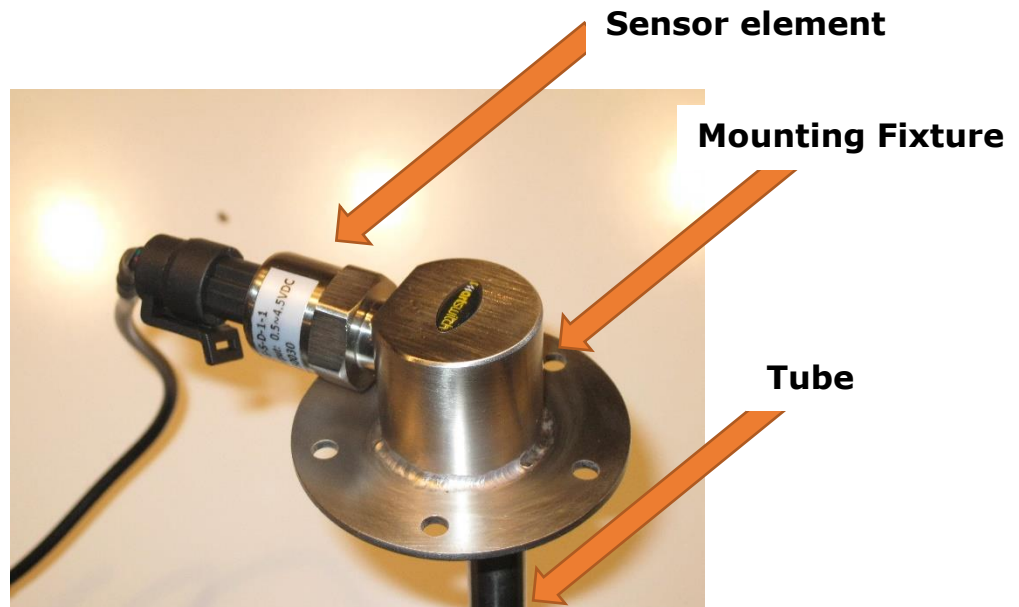
Wiring Diagram for Model HB-200/P



CAUTION:
DO NOT use this 12v terminal for the SEN-S/S100 sensor

2

Replacing SEN-S/S 100 Level Sensor in an existing SmartSwitch Top Tank Mounting Fixture



In the SEN-S/S100/600 sender assembly, the mounting fixture's pressure tube extends to near the bottom of the tank. The proper operation of the top mounted pressure sensor depends on an air column inside tube such that virtually no liquid is inside the tube. Thus, the pressure felt by the sensor element through this air column is the same as that at the bottom of the tank and that pressure is translated to a fluid level.

Therefore, to replace the sensor element in an installed top fixture, the tank must be either completely empty – or - the stainless-steel top mounting fixture must be completely withdrawn from the tank. This is to ensure that the fixture's probe has no liquid inside the tube.

The sensor element must be mounted into the threaded section of the mounting fixture using a **liquid pipe thread compound** suitable for gas. If this joint is not 100% airtight fluid will migrate into the tube and the sensor will not operate correctly. DO NOT use Teflon tape for this installation. It will not provide a permanent air-tight seal and will slowly lose pressure over hours or days.

Special Pump Feature for TM-4000, TC-8000, and TD-4000 Tank Management Systems with Pump Control

SPECIAL PUMP FEATURE is used for holding tanks with a filter on breather vent and **using pressure-type level sensors**:

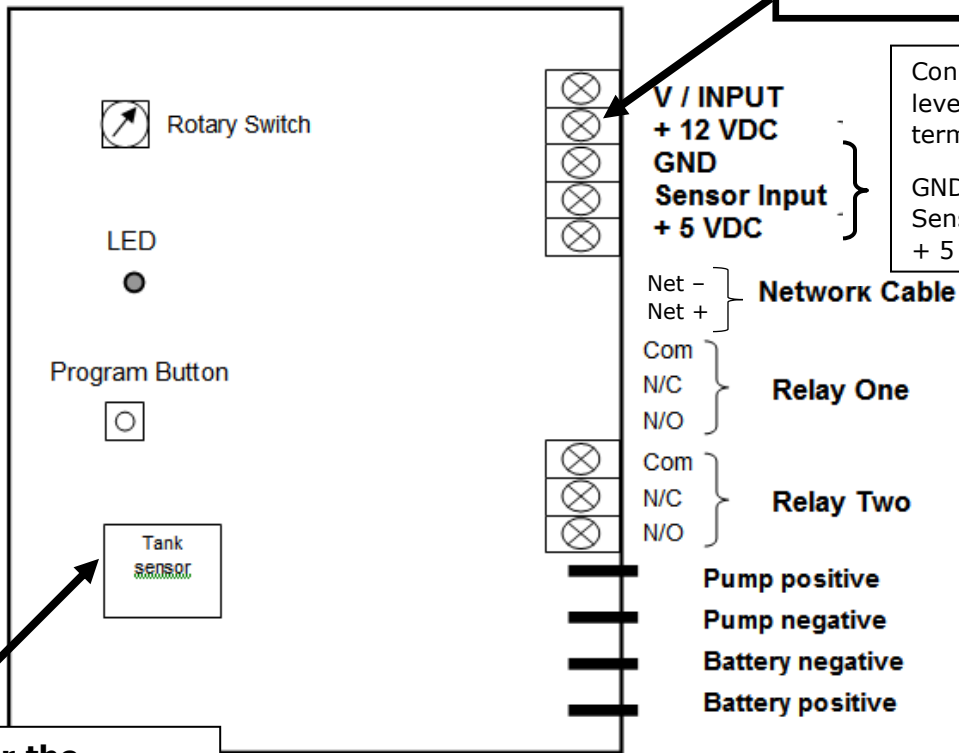
Explanation: When the pump is turned on liquid is removed from the tank faster than air can replace it due to the constrictive nature of the air filter causing a partial vacuum which is felt by the pressure sensor.

The Special Pump feature allows the pump to run for a pre-set time without looking at the tank level. (Which will be incorrect as described above). During this period the display will flash: "PUMPING" The pump will then turn off for one minute allowing the tank to equalize its pressure. The Master Display will show "EQUALIZING" during this period. The control system will then look at the tank level and turn the pump back on for a time period. This time will be based on the actual tank level (e.g. if the tank level is low the time period will be short). This procedure will continue until the tank is empty.

IMPORTANT: Special Pump Feature: **This feature can only be implemented on later model systems. Check the menu on the programming screen at the master display to see if this feature is listed**

Wiring Diagram for Model HB-200/P

CAUTION:
DO NOT use this 12v terminal for the SEN-S/S100 sensor



Connect SEN-S/S100 level sensor to these terminals

GND = Black
Sensor Input = Green
+ 5 VDC = Red

Not Used for the SEN-S/S100 Level Sensor

TD-4000 Setup and Operation for Day Tank and Fuel Transfer



There are three choices for transfer of fuel from tank to tank. They are:

- Manual transfer with auto pump shutdown of sending tank
- Day Fuel
- Fuel Transfer

Manual transfer of fuel from tank A to Tank B with auto pump shutdown when Tank A is empty

- In this option, tank A is designated as “**Transfer**” and B is designated as “**Fuel Tank**” (step 4 of the programming).
- Next, from the Main Menu scroll to “Set Output” to designate which of the two outputs will be associated with the Tank A and **controlling Pump 1**. (Output 1 – blue wire / Output 2 – white wire) You will be returned to the Main Menu.
- Next, on the Main Menu scroll to the “Pump Start/Stop” option. Identify the tank number associated with Tank A and program its high and low levels. You will be returned to the Main Menu.
- Scroll to “Exit Menu” to save data.

Transfer Operation: To transfer, push the PUMP key from the **Tank A screen**. Pumping will commence and the PUMP symbol will appear either flashing or steady on all screens. The pump will be shut down when the preset low level has been reached in Tank A.

Manual transfer of fuel from tank A to Tank B with auto pump shutdown when Tank B is full

- In this option, tank A is designated as “**Fuel Tank**” and B is designated as “**Transfer**” (step 4 of the programming).
- Next, from the Main Menu scroll to “Set Output” to designate which of the two outputs will be associated with the Tank B and **controlling Pump 1**. (Output 1 – blue wire / Output 2 – white wire) You will be returned to the Main Menu.
- Next, on the Main Menu scroll to the “Pump Start/Stop” option. Identify the tank number associated with Tank B and program its high and low levels. You will be returned to the Main Menu.
- Scroll to “Exit Menu” to save data.

Transfer Operation: To transfer, push the PUMP key from the **Tank B screen**. Pumping will commence and the PUMP symbol will appear either flashing or steady on all screens. The pump will be shut down when the preset high level has been reached in Tank B.

Automatic Transfer of Fuel from Tank A to Tank B (Day Fuel)

If you select **Day Fuel** as the “Input Type” (step 4 of the “Program Tank” operation), the TD-4000 will automatically turn on the transfer pump when the day tank reaches a programmed low level and begin to move fuel to the day tank. At the programmed high level, the transfer pump will automatically shut down.

To implement this function, you must **first designate the “Tank Type” for Tank B (diagram above) as a Day Tank**. After setting the alarm point and designating audible alarm (Y/N), setting the volume in gallons or liters, you will be returned to the main menu.

Scroll to the menu item “Pump Start/Stop”. Identify the Input # (1 – 4) associated with Day Tank (B). Then set the “pump start” tank level by moving the bar graph up or down (scroll and backlight keys) and, in same manner, set the “pump stop” level. You will be returned to the Main Menu.

Next, from the Main Menu scroll to “Set Output” to designate which of the two outputs will be associated with the Day Tank (B). (Output 1 – blue wire / Output 2 – white wire) You will be returned to the Main Menu.

Next program **Tank A**’s Input Type as a “**Fuel Tank**” (step 4) and set name, volume, and low level alarm point. You will be returned to the Main Menu.

Scroll to “Exit Menu” to save data.

Now, the Day Tank will automatically be maintained at a level between the low and high levels set during tank programming. Whenever fuel is being pumped into the Day Tank, the PUMP symbol will begin flashing on the Day Tank (tank B) display and a steady PUMP symbol on Tank A’s display. No manual intervention is required; however, the pump can be shut down at any time by pressing the Pump key. It will be necessary to verify Tank A has sufficient fuel at all times since the pump will operate irrespective of Tank A’s level. A visual indicator and optional audible alarm will be generated if the fuel level drops below the preset alarm point.

Fuel Transfer between Tanks A and B in either direction

Generally, the Fuel Transfer option is used when fuel is to be transferred back and forth between Tanks A and B.

- i. In this option, both tanks A and B are designated as “**Transfer Tank’s**” (step 4 of the programming).
- ii. Next, from the Main Menu scroll to “Set Output” to associate each tank with the pump that fills that tank. In the diagram above, **Tank A will be associated with Pump 2** since Pump 2 fills Tank A from Tank B. Similarly **Pump 1 will be associated with Tank B** since it fills Tank B from Tank A.
- iii. After programming the outputs for each tank, you will be returned to the Main Menu.
- iv. Next, on the Main Menu scroll to the “Pump Start/Stop” option. Identify the tank number associated with Tank A and program its high and low levels. You will be returned to the Main Menu. Identify the tank number associated with Tank B and program its high and low levels. You will be returned to the Main Menu.
- v. Scroll to “Exit Menu” to save data.

In operation you MUST start the transfer operation by pushing the PUMP key FROM THE SCREEN of the TANK TO BE FILLED. For example, if you want to transfer fuel from Tank A to Tank B, go to Tank B’s screen display and push the PUMP key. The pump will start, the PUMP symbol will flash, and pumping will continue until either Tank B’s high limit is reached or the pump is shut off by pressing the pump button while on screen B.

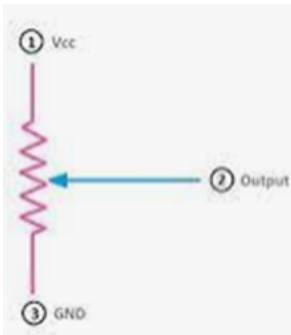
The operation is similar for transfer from tank B to tank A. Go to Tank A’s screen display and push the PUMP key. The pump will start, the PUMP symbol will flash, and pumping will continue until either Tank A’s high limit is reached or the pump is shut off by pressing the pump button while on screen A.

If it is desirable to stop the transfer automatically if the sending tank is empty, or at its low limit, rather than the receiving tank being full, the pump associated with each tank must be reversed. That is, Tank A must be associated with output #1 (pump #1) and tank B with output #2 (pump #2) and pumping must be initiated from the sending tank

Calibration of the tank depth with potentiometer for TM-4000/TC-8000

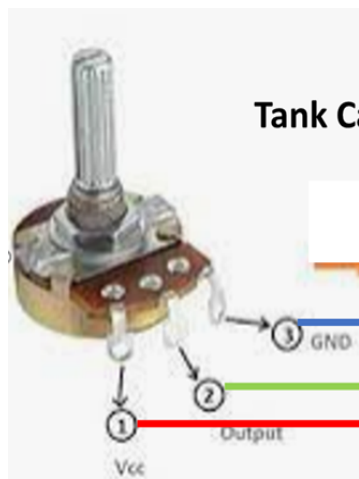
To do the calibration, use a 50k ohm potentiometer for a pressure sensor calibration. NOTE: Pots with other ohmage values may be satisfactory.

1. **Before you do the calibration**, connect the unmounted sensor to the input terminals on the IOU (tank controller) on TM-4000 or TC-8000 models or and read the zero-pressure value at the Sensor In terminal. It should be between 0.45 and 0.52 v **at zero pressure**. If not, you may have a bad sensor, although some units may have a zero-pressure reading as low as 40v.

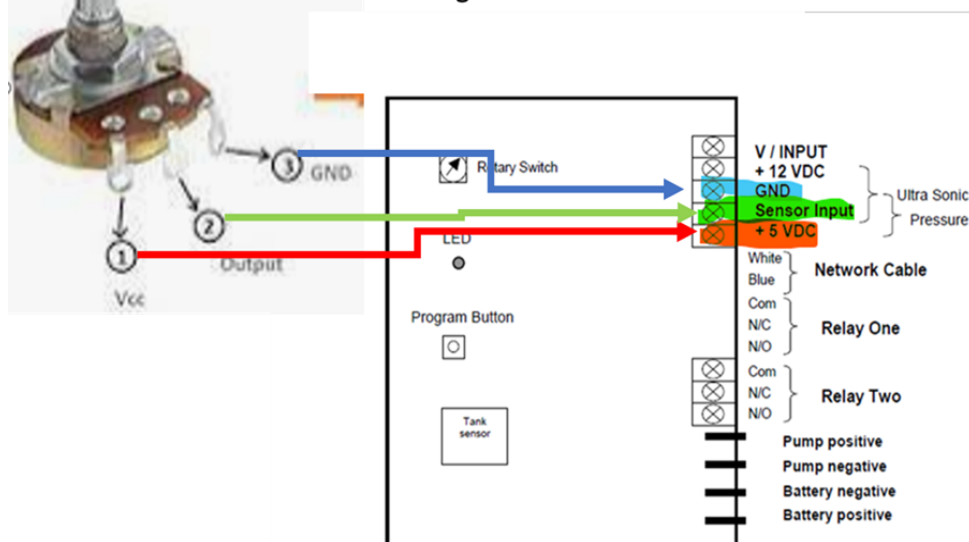


2. **Now connect the two side legs of the pot to the +5v and GND terminals, and the center leg to the "Sensor In" terminal.** Use this rule of thumb to set the Empty voltage and then the Full voltage: **Water (fresh or waste) it should 0.10v per inch – for fuel, the reading should be 0.083v per inch.** Example for water: $[(\text{depth of tank} \times 0.10) + \text{zero pressure value}]$
Example for 18 in tank: $18\text{in} \times 0.10 + 0.50 = 2.3\text{v}$ at full (for Zero press = 0.50)

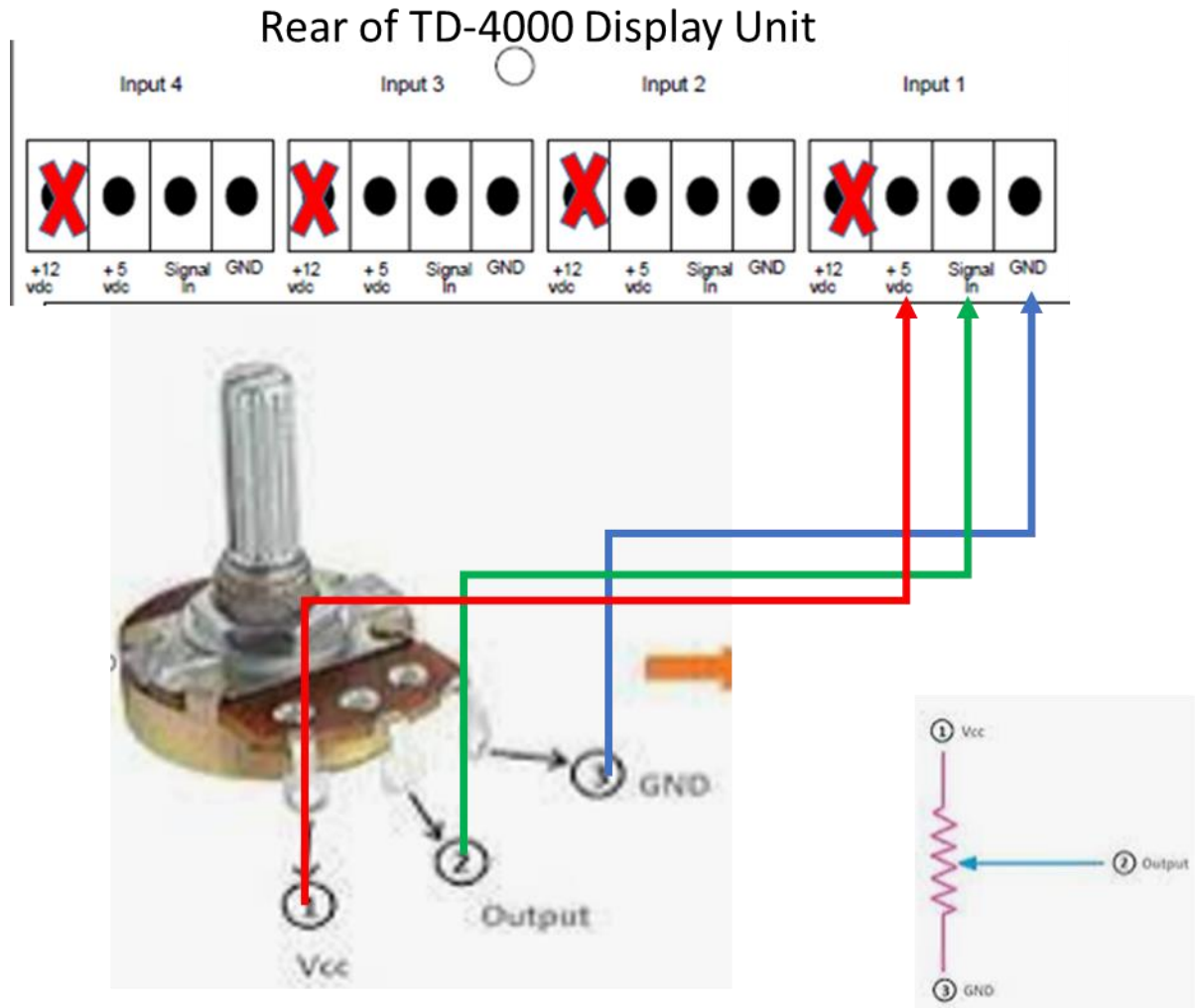
3. **Remember that the Empty voltage may not be zero pressure.** For a line mounted sensor, the bottom of the tank and the true empty may have several inches of liquid above the sensor since it is mounted in the delivery line and the delivery line may be below the bottom of the tank.
4. After you do a full calibration, **you can do a fine tuning of the Empty and Full settings if necessary.** See page 10 of the "Tips" for **top only and bottom** only fine tuning.



Tank Calibration for the SmartSwitch model TM-4000 Using a Potentiometer – Maritimo Black Tank



Tank Level Calibration with Potentiometer – TD-4000



Trouble Shooting Pressure Sensor

1. Find the input on the rear of the TD-4000, or on the IOU (tank controller) for the TM-4000 or TC-8000, that corresponds to the tank with bad readings.
2. Measure the voltage between the +5v and GND. It should measure approx 5v. For the TD-4000, if it does not read 5v, the TD-4000 Master Display may be faulty. For the TM-4000 and TC-8000, the IOU is faulty.
3. Measure the voltage between the Signal In and GND. If the tank is empty, the reading should be approx 0.40v and .050v. If the tank has water (fresh or waste) it should read approx $[0.10\text{v per inch} + 0.5\text{v}]$. If the liquid is fuel, the reading should be $[0.083\text{v per inch} + 0.5\text{v}]$. Example for water: $((\text{depth of water} \times 0.10) + 0.50)$. For 18 in tank full of water: $(18 \times 0.10) + 0.50 = 2.3\text{v}$ when full.
4. If there is a major difference, then the sensor is faulty.

**SmartSwitch Model SEN-S/S 100 Stainless Steel Pressure Sensor
Calibration Voltage Settings for Water/Waste Water and Fuel Tanks**

SEN-S/S 100 Voltage Settings					
	Zero Depth =	0.5	volts	0.10	per in
Tank Depth inches	Voltage setting for Water	Voltage setting for Fuel	Tank Depth cm		
47		4.4	120		
45		4.3	115		
43		4.1	110		
41		3.9	105		
39	4.4	3.8	100		
37	4.2	3.5	95		
35	4.0	3.4	90		
33	3.8	3.2	85		
31	3.6	3.0	80		
30	3.5	2.9	75		
28	3.3	2.7	70		
26	3.1	2.5	65		
24	2.9	2.4	60		
22	2.7	2.2	55		
20	2.5	2.0	50		
18	2.3	1.9	45		
16	2.1	1.7	40		
14	1.9	1.6	35		
12	1.7	1.4	30		
10	1.5	1.2	25		
8	1.3	1.1	20		
6	1.1	0.9	15		
4	0.9	0.7	10		
2	0.7	0.6	5		
0	0.5	0.5	0		