Tank Level Monitor System

One of the first projects I felt necessary for the boat was a tank level monitor system. The boat did have a fresh water tank monitor gauge, but nothing for the holding tank, which I believe is just as important. Overfilling a full holding tank can risk its rupture, and at the very least, promote odors due to waste potentially laying in the hoses.

Peggie Hall has an excellent book concerning boat waste systems (Get Rid of Boat Odors, ISBN 1-892399-15-6), and anyone with odor problems should read it. It will likely pinpoint the problem.

For this project, I wanted something more than a waste tank monitor; because I already had a fresh water gauge, I could have simply added another dial. I wanted a system that could monitor all of the tanks on board, which included:

- Waste Tank
- Port and Starboard Fresh Water Tank
- Port and Starboard Fuel Tank
- Head Deodorant Tank

The boat has an electric head, which includes a deodorant tank that adds a bit of deodorant with each use. This is in addition to the treatment the holding tank received each time is it emptied. OK, maybe monitoring such a small tank is a bit silly, but what the heck, if the monitoring system has enough spare channels, why not?

Monitoring the fuel tanks is important because the boat has a single helm on the flybridge, and the fuel gauges are mounted way up on the bridge. Equally restrictive is that the ignition switch must be on, and a rocker switch depressed to read the fuel tank levels. This is a bit cumbersome, and I felt that if I could monitor the tanks from below, I could determine if a trip to the gas dock is in order before the next outing.

The fresh water tank setup is a bit strange; both tanks fill with a single deck fitting, and both discharge through a Tee-fitting. At present, only the Starboard tank has a float gauge on it. It is assumed that the Port tank's level will always equal the Starboard tank level. However, to keep the boat level, I plan on adding a Y-Valve in the future so I can keep the boat trimmed as needed by having different water levels in the tanks.

My requirement then was a system that could monitor 6 tanks, three of which already have float type sensors, and the other three to be determined. I came across a relatively new product while doing research for the tank monitor system, the "Legacy Profile 8" tank monitoring system by New Providence Marine.
The major selling point of this monitor system is that it can use a multitude of different sensors, and each sensor can be programmed for a foil or standard 240-to-33 ohm sensor.
The monitor system is available through Ferriello Sales (www.FerrielloSales.Com). Currently there are 4 products available - two 8-tank monitor systems and two single tank systems. You can purchase foil or PVC sensors from them, or use industry standard 240-to-33 ohm sensors. In addition, if you have LP gas on board, you can use a 0-90 ohm sensor for that device as well.
I talked to the company at length when I made my purchase. For personalized service, I recommend you call them rather than purchase via their web page. The company's focus is on customer service, and it is about the best I have seen. For instance, they realize that many boaters are only at their boats on weekends, so when you buy a system, you get the engineer's cell phone, so you can call on weekends if you have any problems installing your system. That to me is what customer service should be.

On to the project

I ordered the monitor panel and three of the foil sensors. You have to purchase the foil sensors separately, because you may wish to mix sensors as I did. I plan on using the float sensors already in the tanks for the remaining channels.
After you carefully plan out the wiring routes you are going to use, the first step is determining the location of the monitor. This was already decided for me, because I plan on replacing the existing fresh water gauge.

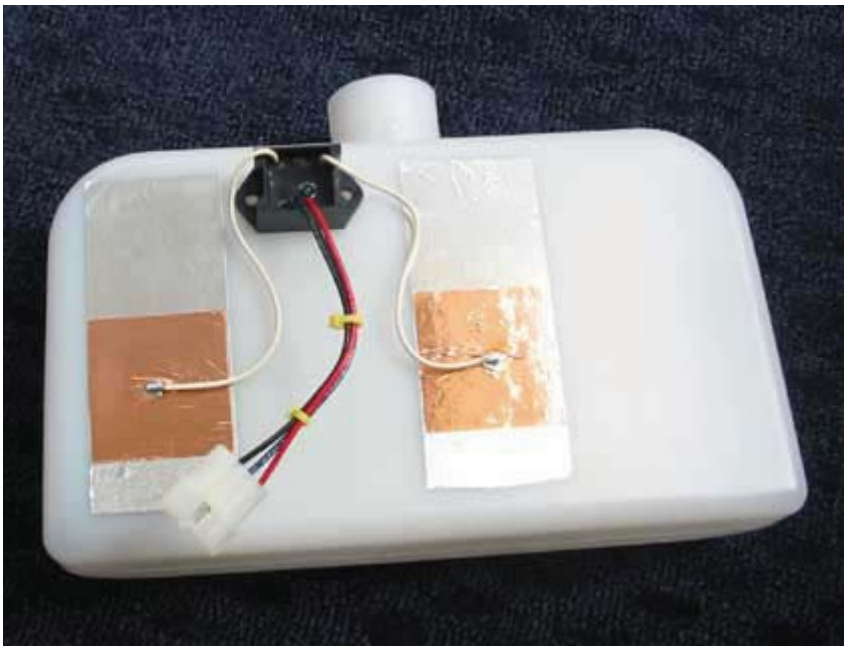
With many boats, the Carver 325 no exception, there seems to be few straight lines. Mostly this is due to the curvature of the hull, deck surfaces and the like. While this is a natural effect of the boat's geometry, it does result in some aesthetic challenges. You may have to "fake" the location a bit to ensure an aesthetic installation. Plan the cutout for the panel carefully, by using blue tape, and laying out the cutout with a permanent marker. My favorite tool for these kinds of cuts is a Dremel saw attachment for a rotary tool. When making these cuts, make sure there are no obstructions, wires, or anything else behind the panel you are cutting.

That completes the easy part; now its time to install the sensors and run the wiring. Since three of the sensors are already installed, I only have to install three foil sensors. One issue with the foil sensors is that you have to have a bit of clearance along one surface of your tank to mount the sensor. If you do not have this clearance, you can purchase an internal sensor. Another issue with the foil sensors are that they need to be installed in a non-metallic tank. You should contact the company if you have difficulties in deciding what sensors you need.

A word to the wise; find yourself a wire marking kit, such as those sold by Ideal Products (the large home centers have them). Marking each wire allows you to make sure you do not make a wiring mistake - which is quite easy given the number of wires that must be connected.

US Coast Guard regulations and accepted boat building practices both require the exclusive use of stranded wiring. For this project, I used 16AWG Marine Rated wiring. You can use 18AWG wire, but according to the rules, only if you bundle the wires together. Any wire run by itself must be 16AWG.

The easiest sensor to install is for the deodorant tank, so I will show most detail on this sensor. Starting with the easiest sensor also allows you to become familiar with its installation without becoming frustrated.



The first item to be done is to clean the area of the sensor installation with alcohol. Then cut two of the supplied aluminum strips to length, one inch shorter than the tank height. The strips are self-adhesive, and are very sticky. It is easy to ruin the strips if you are not careful. When you get the strips cut, remove the backing and place the first strip on the tank so that it is 1/2 in from both top and bottom. The second strip parallels the first - 3 to 4 inches apart.

Next, locate the sending unit between the two aluminum strips, remove the tape backing and secure it in place. When the sending unit has been placed, remove the backing from the copper pads and center them on the aluminum strips.

Since the tank has to be removable, I added a Molex power connector to the sensor so I could remove the tank. These connectors are available from Radio Shack or any electronics parts store.

This completes the sensor installation. One nice feature of the sending unit is a LED that helps in troubleshooting the sensor, should you have to.

The deodorant tank is wired to the monitor, then reassembled to the head. I used existing wiring looms or channels whenever possible, which in this example, provides a no-show installation.

In a similar fashion, the next tank to be tackled is the holding tank. This was a bit more difficult due to the restrictive access to the engine room, as well as less access to the tank side. I used euro-style connectors here along with wiring loom to finish the installation. All screws that I put into the side of the structural members were dipped in sealant so that I do not violate the integrity of the boat stringers. It is very important that you do not damage your boat while installing a project.

The last foil sensor to be installed was on the Port side water tank. Access to this area proved to be quite difficult, as well as running the wire. Take a break if you have to, and think about the installation for a few minutes. This sometimes brings a solution to light. The fuel tanks were simple; all I had to do is to run a second wire (orange wire at the top) to the existing sending unit. I was assured by the company that this will not result in

an inaccurate reading at either the Profile monitor or the existing gauges at the bridge. Both the tank gauges and Profile monitor can co-exist on the float sensor.

Now that all of the sensors have been installed and wiring run, its time to connect everything to the monitor. I found that while the panel is constructed pretty well, I suggest that you use a strain relief on the wiring near the panel.

The connections to the monitor panel differ depending on whether or not you are using a foil or float sensor. Four resistors are included for float type sensors that must be used, and the instructions are very clear on how to do this.

The wiring is pretty simple really - if you marked each wire as I suggested. Use crimp on terminals for every connection. This is the only acceptable method of securing stranded wire (and you did use stranded wire, didn't you).

Connecting to the starboard freshwater tank and power connections to the monitor was easy because I simply re-used the connections for the analog fresh water gauge that I removed.

The last step to finish the installation is to attach the panel, apply power, then configure and calibrate the sensors. There are a few global settings, such as how many sensors you are using, alarm conditions (such as to turn off the alarm at night), backlighting, how frequent the sensors are scanned, and others. One nice feature of this panel is that you can add sensors to the panel at any time (up to the maximum of 8) without having to return the panel to the factory for reprogramming.

Each sensor channel is configured one at a time. A nifty feature is that there are two labels for each sensor that describes it. For instance, "Waste Tank" can be programmed in for the holding tank. Other configuration parameters include whether to alarm on full, empty, or no alarm at all, sensor type, and tank shape. Tank shape is significant;

because if you have a V shape tank, the reading will be off if the sensor simply read resistance. This improves the accuracy of the monitor.

Generally the foil sensors need to be calibrated (the float sensors typically do not). To calibrate the tank, you must empty it, calibrate the empty point, then fill it, and recalibrate the full point. Fortunately, calibrating the empty and full points can be done independently. Therefore, calibrating the holding tank is as simple as waiting until the tank is full - calibrate the full point, have the tank pumped out, then calibrate the empty point.

The completed project is both functional and aesthetically pleasing, and provides that custom enhancement to the boat.