



SEELEVEL I™ Tank Indicator

**Model 707
Shop Manual
Dual Sender Version**

IMPORTANT OPERATOR INFORMATION

DATE INSTALLED: _____

SERIAL NUMBER: _____

	Max Signal	
Black Water Tank		
Grey Water Tank		
Fresh Water Tank		

❖ GARNET INSTRUMENTS LTD.

SEELVEL I™ Tank Indicator

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CHAPTER 1 OVERVIEW

The SeeLevel 1 Tank Indicator represents a massive leap forward in level measurement technology for the Recreational Vehicle industry. The SeeLevel has a combination of features, accuracy, reliability, and diagnostic capability that have never been available before.

The SeeLevel will monitor the water and sewer holding tanks and the LP Gas tank, showing the levels on a color coded LED bar graph with a resolution of 1/8 of the tank. In addition, the system can display the operating characteristics of each of the tank sending units, giving it unsurpassed diagnostic capability.

Model 707



CHAPTER 2

SYSTEM DESCRIPTION

The SeeLevel consists of a display unit that mounts inside the RV, and sender panels that stick to the side of the holding tank. Two conductor wiring is used to connect each sender panel to the display.

The Sender: Each sender panel is a flexible self adhesive printed circuit board which is stuck to the side of the holding tank. The sender panel can be cut to length to match the height of the tank, and it auto calibrates itself so that it can read from Empty to Full regardless of the height of the tank. The sender scans the water level through the tank wall using advanced digital techniques programmed into the sender microprocessor. When the sender transmits the water level information to the display, it sends a digital code that has built in error detection, making it impossible for the display to read an incorrect level, even if the wiring is bad. In addition to the level, the sender also transmits diagnostic information about its operation. This information can be used to determine if there is buildup of sludge on the inside of the tank, or to determine if the sender is delaminating from the side of the tank. If sludge buildup in the tank becomes extreme the gauge will cease to operate (the tank will always read empty), so by monitoring the signal level the tank can be cleaned before the buildup gets excessive. If the tank is more than 16 inches tall, two senders can be stacked to allow measurement of levels up to 32 inches.

The Display: The display receives the information from the three sender panels via two wire cables. When the front panel button for a particular tank is pressed, the display powers up and displays the level for that tank. If the button is pressed and released, the display will show the level for about 5 seconds and then shut down automatically. If another button is pressed before the display shuts down, then the new level will immediately be shown. If the button is held down for more than five seconds, then the display will continue to get level information from the sender and display it for as long as the button is held down. By pressing two buttons at once, the diagnostic functions can be accessed, these are described in detail in the next chapter.

If a sender is operating properly and connected to the display with good wiring, then the display will show the level normally. If the wiring is disconnected or cut, or if the sender panel is dead, then the display will indicate an open circuit by showing two red lights, one on each end of the bar graph. If the wiring is shorted together, or if the signal conductor is grounded out, then the display will indicate a short circuit by showing a bar of green lights with an orange light at each end. If the display receives corrupted data, then it will indicate an error by showing a red-orange-green pattern illustrated in the following section.

With these diagnostic features and the digital nature of the tank level sensing technology, it is almost impossible for the system to indicate an incorrect water level, and in the very unlikely event it does occur, the user can verify what is happening with the diagnostic information.

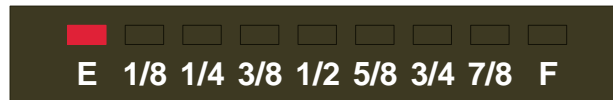
CHAPTER 3 OPERATING INSTRUCTIONS

The display is the only system component that is accessed by the user. All user input to the display is done using the four buttons along the bottom of the display. Operation of the display is as follows:

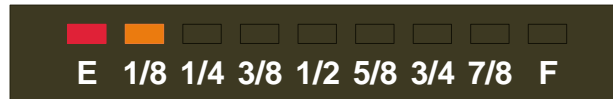
To read a tank level:

1. Press the button corresponding to the tank to be checked and release it. The display will power up and show the level on the bar graph.
 - a. If the fresh water or LPG tank is being checked, then the display will show a row of green LEDs, with each LED indicating 1/8 of the tank. For example, if the tank is 5/8 full, then 5 green LEDs will be lit. If the level is down to 1/8 of the tank, then one red and one orange LED will be lit, and if the tank is empty then a single red LED will be lit.

FRESH/LPG
EMPTY



FRESH/LPG
1/8 TANK



FRESH/LPG
5/8 TANK



FRESH/LPG
FULL



- b. If a sewer tank is being checked, then the display will show the same row of green LEDs with each LED indicating 1/8 of the tank, except that the 7/8 LED will be orange and the full LED will be red.

GREY/BLACK
EMPTY



GREY/BLACK
5/8 TANK



GREY/BLACK
7/8 TANK



GREY/BLACK
FULL



2. If no other button is pressed, then the display will shut itself off after about 5 seconds. If the button is held down, the display will recheck the level once per second and will show the updated level.
3. If another button is pressed before the 5 second time is up for the first button, the display will immediately switch to showing the new tank. The 5 second timeout is restarted every time a button is pressed.

CHAPTER 4 DISPLAY CALIBRATION

To calibrate the number of senders for each tank:

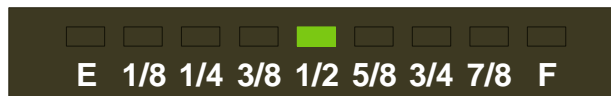
1. This should only be done at the time of installation, there is no reason to change this afterward.
2. Turn off the 12V RV power to the display. Hold down the tank button (FRESH, GREY, or BLACK) and turn on the 12V power to the display. Continue to hold down the button for 5 seconds until the display comes on and shows the number of senders calibration code (green-orange-red in the 3/4-7/8-F positions). If the button is released before the five seconds are up, the calibration will not be done, and the display will power up normally.

CALIBRATE
NUMBER OF
SENDERS

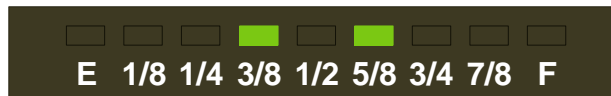


3. Release the button. The display will now show either one or two green LEDs lit up, based on what is currently programmed into the display for that tank. One LED indicates that the display is calibrated for one sender, and two LEDs indicates that the display is calibrated for two senders (stacked). These are the only two options, the display will not work with more than two senders per tank.

CALIBRATION:
1 SENDER



CALIBRATION:
2 SENDERS



4. To change the number of senders, press the tank button again, each time the button is pressed the display will switch to the other number.
5. When the display shows the correct number of senders, turn off the 12V power, the calibration is complete for that tank. Each tank will need to be calibrated individually using this procedure.

To calibrate the LPG sender:

1. The LPG tank must be full when the sender is calibrated, otherwise the calibration will be invalid.
2. Make sure that the 12V RV power to the display is turned off. Hold down the LP button and turn on the 12V power to the display. Continue to hold down the button for 5 seconds until the display shows full (all green LEDs on). If the button is released before the five seconds are up, the calibration will not be done.

FRESH/LPG
FULL



3. Release the button, the calibration is done. The display will now shut down. The LPG can be recalibrated as many times as desired.

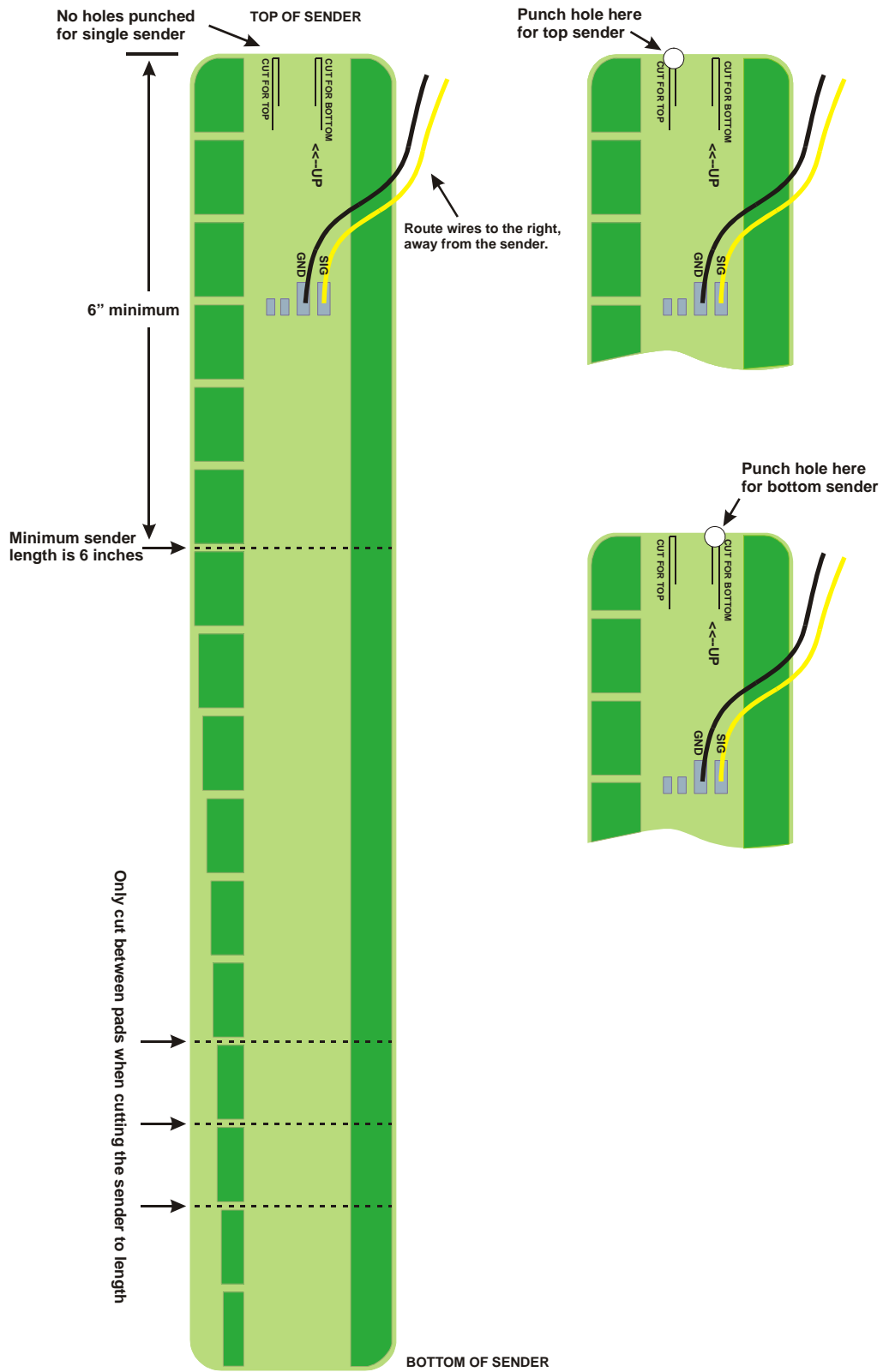
CHAPTER 5

INSTALLATION GUIDE (NEW OEM INSTALLATIONS ONLY)

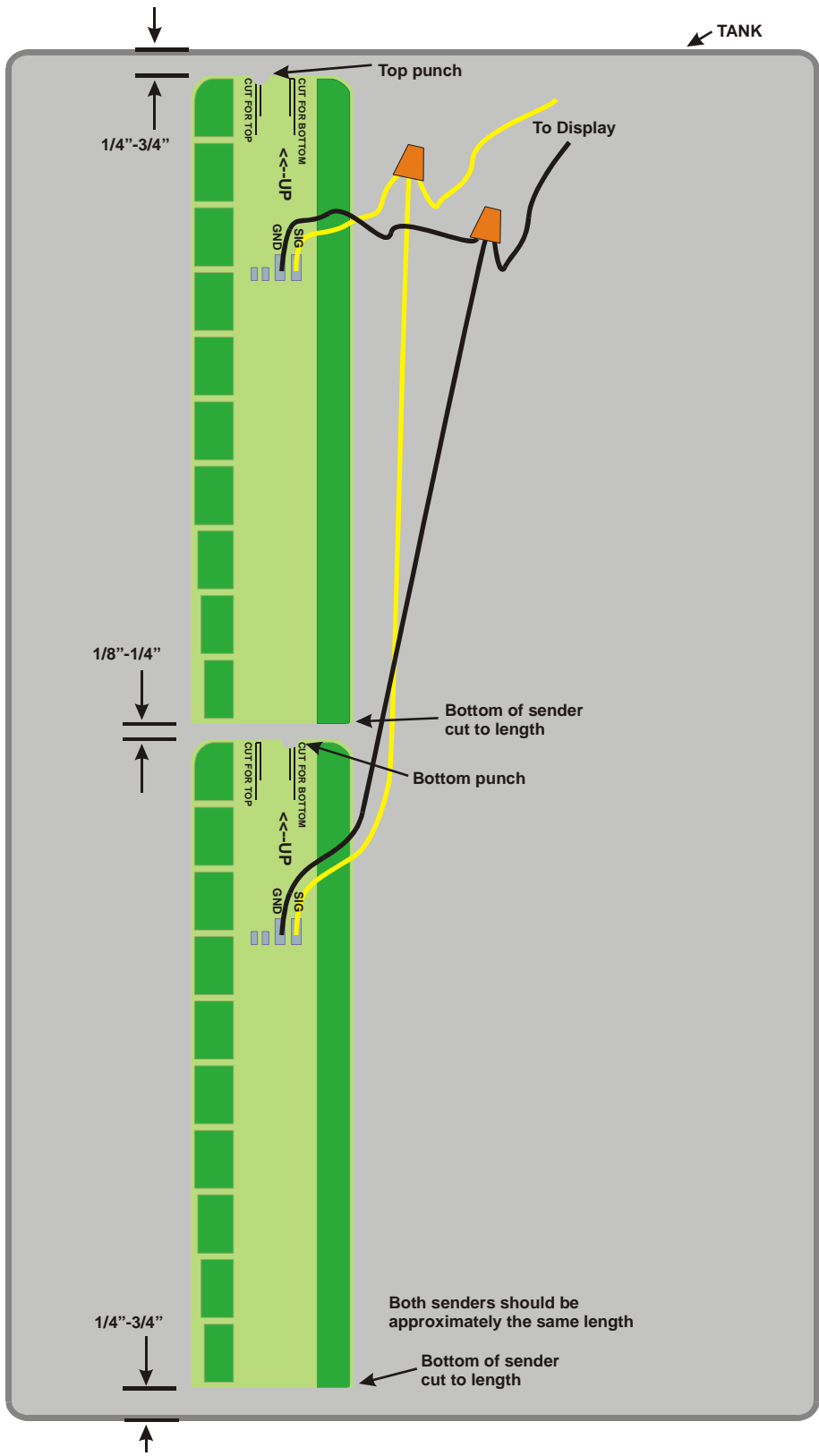
1. The installation consists of mounting the display inside the RV, cutting and fastening the senders to the sides of the holding tanks, connecting wiring, and programming the display.
2. Mount the display by cutting a hole in the wall 4 3/4" wide by 2 3/4" high and bringing the wiring out through the hole to connect to the display panel connector.
3. Connect the wiring according to the following table. It is easier to connect the wiring to the display connector first, and then plug the connector into the display panel. One pair of wires is required to connect each of the senders. Alternatively, the senders can be grounded locally with a single wire running to the display for each tank.

Wire Color	Function
Red 18 gauge	+12V power input to monitor
Black 18 gauge	Ground
Blue 22 gauge	Fresh water tank sender
Grey 22 gauge	Grey water tank sender
Brown 22 gauge	Black water tank sender
Green 18 gauge	LPG tank

4. Determine where to mount the senders on the tanks. They will need to have a flat area on the side of the tank large enough so the whole width of the sender is in contact with the side of the tank, all the way from the top to the bottom of the tank. Make sure that any metal is at least an inch away from the sender. Clean the area well so that there is no dust, grease, oil, water, etc., that would prevent the adhesive on the sender from sticking.
5. Measure the height of the tank to determine how long the senders should be. For tanks less than 17" tall, follow step 6. For tanks greater than 17" tall, follow step 7.
6. For tanks less than 17" tall, a single sender is used. The sender ends should be 1/4" to 3/4" away from the top and bottom of the tank, to allow for the thickness of the tank top and bottom and any bows in them (see the diagrams). The senders are calibrated to account for this distance from the bottom of the tank. The sender is cut to the nearest even inch in length, for example, a system with a tank height of 11.75 inches, cut the sender to be 11 inches long, this allows 3/8" at each end when the sender is centered vertically on the tank.
IMPORTANT: Do not cut the sender shorter than 6 inches! The sender will not work if it is cut less than 6 inches.
7. For tanks greater than 17" tall, two stacked senders are used. The sender ends should be 1/4" to 3/4" away from the top and bottom of the tank, to allow for the thickness of the tank top and bottom and any bows in them (see the diagrams). The senders are calibrated to account for this distance from the bottom of the tank. In addition, there needs to be a gap of 1/8" to 1/4" between the two senders. Therefore total length of both senders will be: tank height-1/4"-1/4"-1/8", then rounded down to the nearest whole inch. The top and bottom senders should be approximately the same length for best results. For example, if the tank height is 22", then 22"-1/4"-1/4"-1/8"=21 3/8", so the total length of both senders will be 21 inches. Make one sender 10" long and the other 11" long.



8. To make the senders the right length (assuming they are too long) they will need to cut off with a pair of scissors. The end to be cut is the bottom end, which is the opposite end from the top where the wires come out (see the diagrams). DO NOT cut the sides, and DO NOT cut the sender shorter than 6 inches. The cut must be in between the sensor pads, and the cut must be made parallel to the existing bottom end. Double check your measurements, if the sender is cut too short, it cannot be lengthened.
9. For two stacked sender systems, the senders need to be programmed so they know that they are being used as top or bottom senders. As shown in the diagrams, punch a hole or snip a bit of the sender away to cut the line on the sender corresponding to its position. For the bottom sender, cut the line next to the text "CUT FOR BOTTOM", and for the top sender, cut the line next to the text "CUT FOR TOP". DO NOT cut any lines for single sender systems!
10. Once the sender is cut to length, carefully peel the backing paper off the adhesive. Do this slowly to prevent the adhesive from being ripped off the sender, and to prevent the backing paper from ripping. Be careful not to bend the sender sharply in the process. Position the sender over the side of the tank and carefully stick it down. MAKE SURE THAT THE END WITH WIRES IS POINTING UP!! Position the bottom of the sender at least 1/4" above the bottom of the tank, and more if required to equalize the space at the top and bottom of the tank. Make sure that the sender is square with the tank. You only have one shot at this, if you try to peel it off the tank once it is stuck the sender may be damaged by the sharp bending. Carefully press the sender down to the tank so that all of the adhesive is contacting the tank wall.
11. Connect the yellow wire to the wire from the display corresponding to that tank. For two stacked sender systems, connect the two yellow wires together, then connect these to the display (see the diagrams). Connect the black wire from each sender to ground. Use Marrette or crimp connectors to fasten the wires together. Make sure that the wires from the sender are routed away from the sender, if they drape over the sender they could affect the reading. Secure the wires with tie wraps or something similar so that the wires do not rattle or press against the sender, this may result in sender damage or wires breaking over time.
12. Do steps 4 to 12 for the other three holding tanks.
13. All that remains now is calibration and testing. The tank senders will self calibrate to whatever length they are cut, so they will always read from 0 to 100%. The display needs to be set to a one or two sender system for each tank. Follow the directions under the display programming section for this. Make sure you do it for each tank. For the initial test, have the tank at least 1/4 full of water or sewage, and verify that the percent level reading looks correct (see the section **To read a tank level**) and that the signal power is in the green (see the section **To review the sender diagnostics**). If the signal power is too low, make sure that the sender is well stuck to the side of the tank and that the tank is reasonably clean inside, as a large buildup will reduce signal strength. Note that the system "learns" about the characteristics of the tank with use, so the readings may be inaccurate when the tank is empty or almost empty when the system is first tested. Once the tank has been filled at least 1/4 full the system will be properly "taught" and should read correctly after that.
14. Calibrate the LPG by filling the tank and following the instructions in the display programming section.



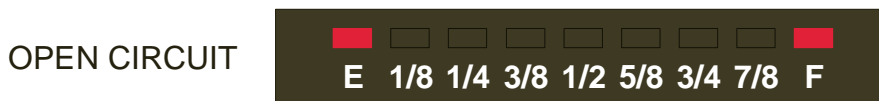
Typical Two Stacked Sender Installation

CHAPTER 6 TROUBLESHOOTING GUIDE

Display trouble codes:

If a sender or its wiring is not operating properly, the following codes are shown on the display:

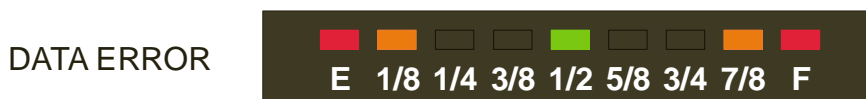
1. If a single sender or pair of stacked senders are unresponsive or there is an open circuit in the wiring so that the sender(s) are not connected, the display will indicate an open circuit by showing the E and F LEDs in red.



2. If a sender is shorted or there is a short circuit in the wiring, the display will indicate a short circuit by showing the middle 5 LEDs in green and the 1/8 and 7/8 LEDs in orange.



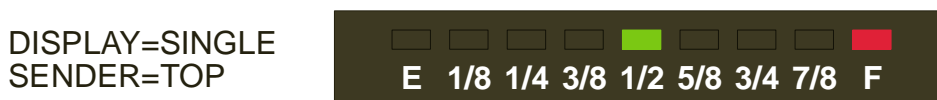
3. If a sender is sending bad data, there is damaged wiring, or if there is electrical interference, the display will indicate a data error as shown below.



4. If the display has been programmed for a single sender, and the sender has been programmed as a bottom sender, the display will show the following code:



5. If the display has been programmed for a single sender, and the sender has been programmed as a top sender, the display will show the following code:



6. If the display has been programmed for 2 stacked senders for tall tanks, and only the bottom sender is working and the top one is not being received, then the

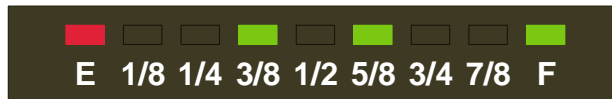
display will show the following code:

DISPLAY=DUAL
SENDER=BOTTOM ONLY



7. If the display has been programmed for 2 stacked senders for tall tanks, and only the top is working but no bottom sender is being received, then the display will show the following code:

DISPLAY=DUAL
SENDER=TOP ONLY



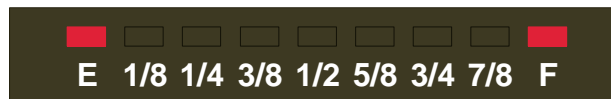
8. If a sender has not been programmed for top or bottom operation, the display will indicate that a single sender is connected by showing the following code:

DISPLAY=DUAL
SENDER=SINGLE ONLY



9. For the LPG tank, if there is a short in the wiring, the display will read zero all the time. If there is an open circuit in the wiring or a bad resistance sender in the LPG tank, the following code indicates an open circuit:

OPEN CIRCUIT




To review the sender diagnostics:

1. The sender diagnostics should be reviewed periodically to check for any degradation of the tank senders. If a sender appears to be malfunctioning, reviewing the diagnostics should be the first step in the troubleshooting process. Note that there is no diagnostic for the LPG.
2. The diagnostic for the senders is the signal power. This is an indication of how much signal is being transmitted through the tank wall and picked up by the receive part of the sender. If the signal power is too low, it can indicate a sender which is detached from the tank, excessive buildup on the inside of the tank, bad wiring to the sender, low battery voltage, or a defective sender.
3. To check the diagnostic, press and hold the button for the tank to be checked, the display will power up and show the level for that tank.
4. While continuing to hold down the button for the tank, press the LPG button. The display will change from showing the level to showing the signal power diagnostic.

5. If the signal power is too low to operate, the following code is shown:


SIGNAL POWER
TOO LOW TO OPERATE



E 1/8 1/4 3/8 1/2 5/8 3/4 7/8 F

6. If the signal power is low but adequate to operate, the gauge will function properly but there will not be any margin for degradation in the future. The code for this signal power level is the following:

SIGNAL POWER
LOW BUT ADEQUATE



E 1/8 1/4 3/8 1/2 5/8 3/4 7/8 F

7. If the signal power is good, the following code is shown:

SIGNAL POWER
GOOD



E 1/8 1/4 3/8 1/2 5/8 3/4 7/8 F

8. The diagnostic display will remain on for 5 seconds. The display must time out for the 5 seconds before it will respond to another button.

CHAPTER 7

SERVICE AND WARRANTY INFORMATION

The warranty will apply only if the warranty card shipped with the equipment has been returned to Garnet Technologies Inc.

Garnet Technologies Inc. warrants equipment manufactured by Garnet to be free from defects in material and workmanship under normal use and service for a period of one year from the date of sale from Garnet or an Authorized Dealer. The warranty period will start from the date of purchase or installation as indicated on the warranty card. Under these warranties, Garnet shall be responsible only for actual loss or damage suffered and then only to the extent of Garnet's invoiced price of the product. Garnet shall not be liable in any case for labor charges for indirect, special, or consequential damages. Garnet shall not be liable in any case for the removal and/or reinstallation of defective Garnet equipment. These warranties shall not apply to any defects or other damages to any Garnet equipment that has been altered or tampered with by anyone other than Garnet factory representatives. In all cases, Garnet will warrant only Garnet products which are being used for applications acceptable to Garnet and within the technical specifications of the particular product. In addition, Garnet will warrant only those products which have been installed and maintained according to Garnet factory specifications.

LIMITATION ON WARRANTIES

These warranties are the only warranties, expressed or implied, upon which products are sold by Garnet and Garnet makes no warranty of merchantability or fitness for any particular purpose in respect to the products sold. Garnet products or parts thereof assumed to be defective by the purchaser within the stipulated warranty period should be returned to the seller, local distributor, or directly to Garnet for evaluation and service. Whenever direct factory evaluation, service or replacement is necessary, the customer must first, by either letter or phone, obtain a Returned Material Authorization (RMA) from Garnet Technologies directly. No material may be returned to Garnet without an RMA number assigned to it or without proper factory authorization. Any returns must be returned freight prepaid to: Garnet Technologies Inc., Suite 8, 125 M&M Ranch Road, Granbury, Texas, 76049. Returned warranted items will be repaired or replaced at the discretion of Garnet Instruments. Any Garnet items under the Garnet Warranty Policy that are deemed irreparable by Garnet Technologies will be replaced at no charge or a credit will be issued for that item subject to the customer's request.

If you do have a warranty claim or if the equipment needs to be serviced, contact the installation dealer. If you do need to contact Garnet, we can be reached as follows:

Garnet Technologies Inc.
Suite 8, 125 M&M Ranch Road
Granbury, Texas, 76049
Email: sales@rvgauge.com

CHAPTER 8 SPECIFICATIONS

Resolution:	1/4 inch (6 mm) or 1/8 tank, whichever is greater
Accuracy:	+/- 5% or better from the senders, display shows every 1/8 tank
Operating temperature range:	+32 to +140 °F (0 to + 60°C)
Sender materials:	0.008" thick glass epoxy circuit board with conformal coating for circuit protection. Laminated on the back with 3M 300LSE Bonding Adhesive.
Display mounting panel:	Black panel, approximately 5 3/4" wide by 3 3/4" high by 1" thick (146mm wide X 95mm high X 25mm deep). Panel screws to wall.
System power requirements:	Display requires 12 volts from the RV battery, the system will function from 11 volts to 16 volts. Current drain is less than 200mA.
Wiring:	Two wire conductor required from the display to each sender. 12 V power and ground required for display. Single wire required for LPG sender if sender grounded at tank.
LPG sender characteristics:	Display will work with an LPG sender maximum resistance of 50 ohms to 500 ohms. Display shows increasing level as resistance increases. System must be calibrated with the LP tank full.