❖ GARNET
INSTRUMENTS LTD.

SEELEVEL II™ Tank Monitor

For Recreational Vehicles
Model 712TT Manual

IMPORTANT OPERATOR INFORMATION

DATE INSTALLED:
SERIAL NUMBER:

	Signal Power	Tank Height
Black Water Tank		
Grey Water Tank		
Fresh Water Tank		

PRINTED IN CANADA

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CHAPTER 1
OVERVIEW

The SeeLeveL II Tank Monitor 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 II will monitor RV battery voltage, fresh water holding tank level, grey and black sewer tank levels, one LPG tank, and inside and outside temperatures. The information is displayed on a 3 digit alpha-numeric LED display. In addition, the system can display the operating characteristics of each of the tank sending units, giving it unsurpassed diagnostic capability.

Model 712TT

CHAPTER 2
SYSTEM DESCRIPTION

The SeeLeveL II consists of a display unit that mounts inside the RV, sender panels that adhere to the sides of the holding tanks, and an external temperature sensor mounted to the exterior of the RV. Two conductor wiring is used to connect each sender panel/sensor to the display.

The Sender: Each sender panel is a flexible self adhesive printed circuit board which is adhered 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 or sewer level information to the display, it sends a digital code that has built in error detection, making it highly unlikely for the display to read an incorrect level, even if the wiring is marginal. 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 damaged or 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 power 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 shows the inside temperature as the default display when no buttons are pressed. When a button for a particular tank is pressed, the display changes from showing inside temperature to showing the level for that tank. If the button is pressed and released, the display will show the level for about 5 seconds and then revert back to inside temperature automatically. If another button is pressed before the temperature reappears, then the new level will immediately be shown. If the same button is pressed twice, the display will hold on that tank and continue to show updated levels for 5 minutes before reverting to temperature. This allows the user to monitor the filling or draining of a tank. By pressing two buttons at once, the diagnostic functions can be accessed.

The display receives the information from the three sender panels via two wire cables. If the wiring is disconnected or cut, or if the sender panel is damaged, then the display will indicate the appropriate fault condition.

The system also shows the RV battery voltage by measuring the voltage which powers the display.

The LPG level system will show the percent level by using the resistance sender which comes with the LPG tank. This reading will only be as accurate as the LPG sender. There are no diagnostics possible with the LPG.

The inside temperature is measured with a digital temperature sensor mounted to the inside of the display panel. The outside temperature is measured with a remote digital temperature sensor which is mounted on the outside of the RV, and connected via two wire cables. The temperature can be programmed to read in degrees Celsius or Fahrenheit and is accurate to within 3 °F (1.5 °C). Any sensor failure will be shown on the display.

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 fluid level, and in the very unlikely event it does occur, the user can verify what is happening with the diagnostic information.

Full operation of the display is described in detail in the next chapter.

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 six 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 show the level in percent on the LED display. If no other button is pressed, then the display will revert to showing inside temperature after about 5 seconds.
2. 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 level. The 5 second timeout is restarted every time a button is pressed.
3. To continuously display a reading, press and release the desired button, and then press the same button a second time. While the button is held down for the second time, the display will show "hld". When the button is released, the display will be in hold mode, which is indicated by the decimal point on the right hand side turning on. While the display is in the hold mode it will recheck the level once per second so the user can watch the level change while the tank is being filled or drained. The display will automatically revert to showing inside temperature after 5 minutes in hold mode. To end the hold mode before the 5 minutes is up, press the same button again, while the button is held down the display will show "OFF". When the button is released the display will revert to showing inside temperature.
4. If a sender or its wiring is not operating properly, the following codes are shown on the display:
   a. If a sender is unresponsive or there is an open circuit in the wiring so that the sender is not connected, the display will indicate an open circuit by showing "OPn" on the LED display.
   b. If a sender is shorted or there is an short circuit in the wiring, the display will indicate an short circuit by showing "Sht" on the LED display.
   c. If a sender is sending bad data, there is damaged wiring, or if there is electrical interference, the display will indicate a data error by showing "Err" on the LED display.
   d. If the display has been programmed for a single sender, and the sender has been programmed as a bottom sender, the display will

show "bot". If the sender has been programmed as a top sender, the display will show "toP".

e. 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, then the display will show "ntP" indicating that no top sender is being received. If the top is working but no bottom sender is being received, then the display will show "nbo". If neither sender is working, then the display will show "OPn". If a sender has not been programmed for top or bottom operation, the display will show "sin" indicating that a single sender is connected.

f. For the LPG tank, "Opn" indicates an open circuit in the wiring or a bad resistance sender in the LPG tank. If there is a short in the wiring, the display will read zero all the time.

To read the battery voltage:

1. Press the BATTERY button and release it, the display will show the battery voltage on the LED display.
2. If no other button is pressed, then the display will revert to showing inside temperature after about 5 seconds. If the BATTERY button is held down, the display will continuously recheck the voltage and show the updated value. The reading may flicker back and forth between two values, for example, 12.6 and 12.7 volts. This is normal behavior for a digital voltage display.
3. If another button is pressed before the 5 second time is up for the BATTERY button, the display will immediately switch to showing the value for the new button. The 5 second timeout is restarted every time a button is pressed.

To read the temperatures:

1. The temperatures can be programmed to be in either degrees Celsius or Fahrenheit. Refer to the programming section to obtain instructions on how to set this.
2. The display shows the inside temperature as the default, which means that the inside temperature is displayed whenever a level, voltage, or outside temperature is not being displayed. The inside temperature sensor is mounted just behind the display panel, and will read the temperature at that point. If Fahrenheit is selected, the display will show "73F" for example, and if Celsius is selected, the display will show "21C" for example. If the temperature is below zero or above 99, then the

display will show "- - F" or "- - C", indicating that the temperature is beyond the range of the display, and that you have a serious problem inside your RV.

3. To read the outside temperature, press the OUTSIDE TEMP button and release it, the display will show the temperature on the LED display. The outside temperature sensor should be mounted somewhere on the outside of the RV where it can sense external temperature. The outside temperature display is different from the inside one, the "F" or "C" is not displayed, so the measurement range is from -40C/-40F to 100C/212F. If no other button is pressed, then the display will revert to showing inside temperature after about 5 seconds.

4. If another button is pressed before the 5 second time is up for the OUTSIDE TEMP button, the display will immediately switch to showing the value for the new button. The 5 second timeout is restarted every time a button is pressed.

5. To continuously display the outside temperature, press and release the OUTSIDE TEMP button, and then press the OUTSIDE TEMP button a second time. While the button is held down for the second time, the display will show "hld". When the button is released, the display will be in hold mode, which is indicated by the decimal point on the right hand side turning on. While the display is in the hold mode it will recheck the outside temperature once per second. The display will automatically revert to showing inside temperature after 5 minutes in hold mode. To end the hold mode before the 5 minutes is up, press the OUTSIDE TEMP button again, while the button is held down the display will show "OFF". When the button is released the display will revert to showing inside temperature.

6. If the internal temperature sensor fails so that it cannot communicate with the display microprocessor, the display will indicate this by showing "Err" on the LED display. If the outside temperature sensor fails, the display will show "OPn", "Sht", or "Err" the same as a defective level sender.

To review the sender diagnostics:

1. The sender diagnostics can 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. Note that there are no diagnostics for the LPG, battery voltage, or temperature.

2. There are two diagnostics for the senders: the signal power, and the sender height.
    a. The signal power 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. The minimum signal power for proper operation is 5%.
    b. The sender height is simply the length of the sender(s) in inches. The senders auto calibrate to the length that they are cut, so this diagnostic allows the user to confirm the length and to make sure that the auto calibration is working properly.
3. To check the diagnostics, press and hold the button for the tank to be checked, the display will show the level for that tank.
4. While continuing to hold down the button for the tank, press the BATTERY/**DIAGNOSTICS** button, the display will show "dIA" while the buttons are held down, then release both buttons. The display will change to showing the signal power diagnostic. This is indicated by a "P" showing on the left digit, for example "P26" indicates a 26% signal power.
5. Press the tank button again (the display will show "dIA" while the button is held down), the display will change to showing the sender height. This is indicated by a small "h" showing on the left digit, for example "h23" indicates that the senders are 23 inches high.
6. Press the tank button again to revert to inside temperature (the display will show "OFF" while the button is held down). If at any time a button is not pressed then the display will automatically revert to inside temperature after 5 seconds.

CHAPTER 4
DISPLAY CALIBRATION

To calibrate the LPG sender:

1. The LPG tank must be full when the sender is calibrated, otherwise the calibration will be invalid. Fill the LPG tank by using an alternate measurement method, such as weight, a spit valve, or a mechanical gauge on the tank.
2. Turn off the 12V RV power to the display. Hold down the BATTERY and LPG buttons and turn on the 12V power.
3. The display will turn on and will show "LP2". When this occurs the buttons can be released.
4. When the display shows "dun" the calibration is complete. Turn off the 12V power to complete the calibration procedure.
5. If necessary, the LPG can be recalibrated at another time.

To calibrate the temperature readouts to degrees F or degrees C:

1. Turn off the 12V RV power to the display. Hold down the BATTERY and the OUTSIDE TEMP button and turn on the 12V power to the display.
2. The display will turn on and will show "F-C" to indicate the choice between Fahrenheit and Celsius. When this occurs release the buttons.
3. The display will now show "°C" or " °F", based on what is currently programmed into the display.
4. To alternate between Fahrenheit and Celsius, press the OUTSIDE TEMP button, each time the button is pressed the display will switch to the other temperature.
5. When the display shows the correct temperature mode, turn off the 12V power, the calibration is complete.

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. Turn off the 12V RV power to the display. Hold down the BATTERY and the tank button (FRESH, GREY, or BLACK) and turn on the 12V power to the display.
2. The display will turn on and will show "FrS" if doing the number of senders for the fresh tank, "GrS" if doing the grey tank, or "bLS" if doing the black tank. When this occurs release the buttons.

3. The display will now show "1SE" or "2SE", based on what is currently programmed into the display. These are the only two options, the display will not work with more than two senders per tank.
4. To change the number of senders, press the tank button. 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.

The battery voltage is calibrated at the factory. This should never need to be changed.

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 5 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. The senders need to be grounded to a single ground wire from the display.

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
Yellow 18 gauge	Pump power output
White 18 gauge	Heater power output
Orange 18 gauge	Heater pilot out input
Green 18 gauge	LPG tank
Yellow w/Green 18 gauge	Not used on the Model 712TT
White w/Blue 22 gauge	External temperature sensor

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!

No holes punched for single sender
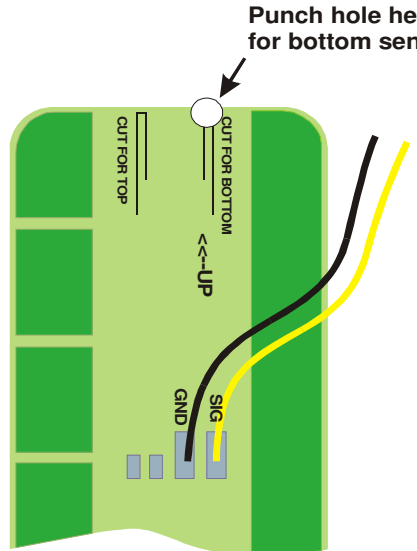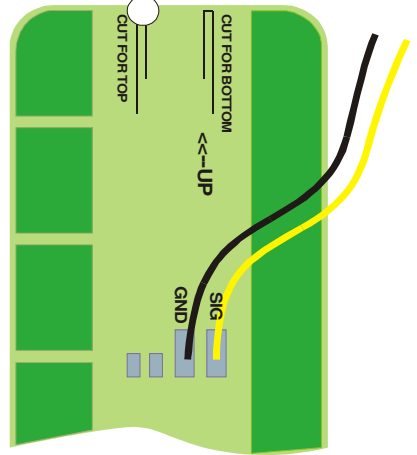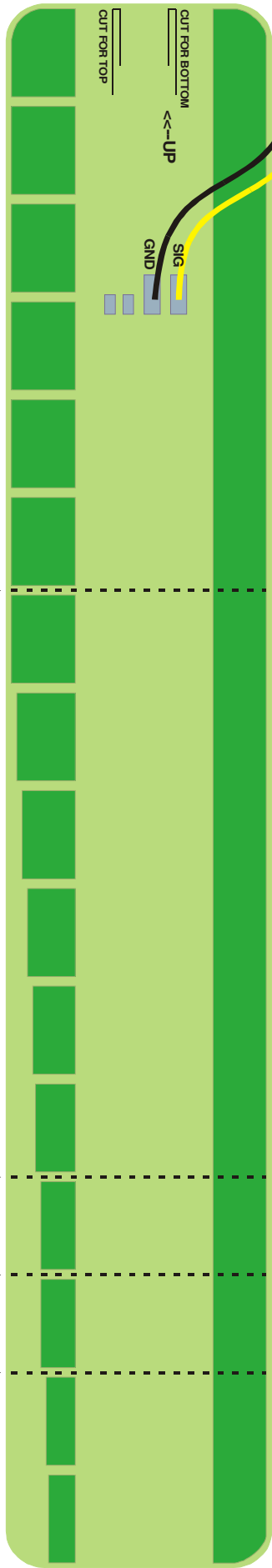
TOP OF SENDER

Punch hole here for top sender

CUT FOR TOP

CUT FOR BOTTOM

<<—UP

GND

SIG

Route wires to the right, away from the sender.

6" minimum

Minimum sender length is 6 inches

Only cut between pads when cutting the sender to length

BOTTOM OF SENDER

CUT FOR TOP

CUT FOR BOTTOM

<<—UP

GND

SIG

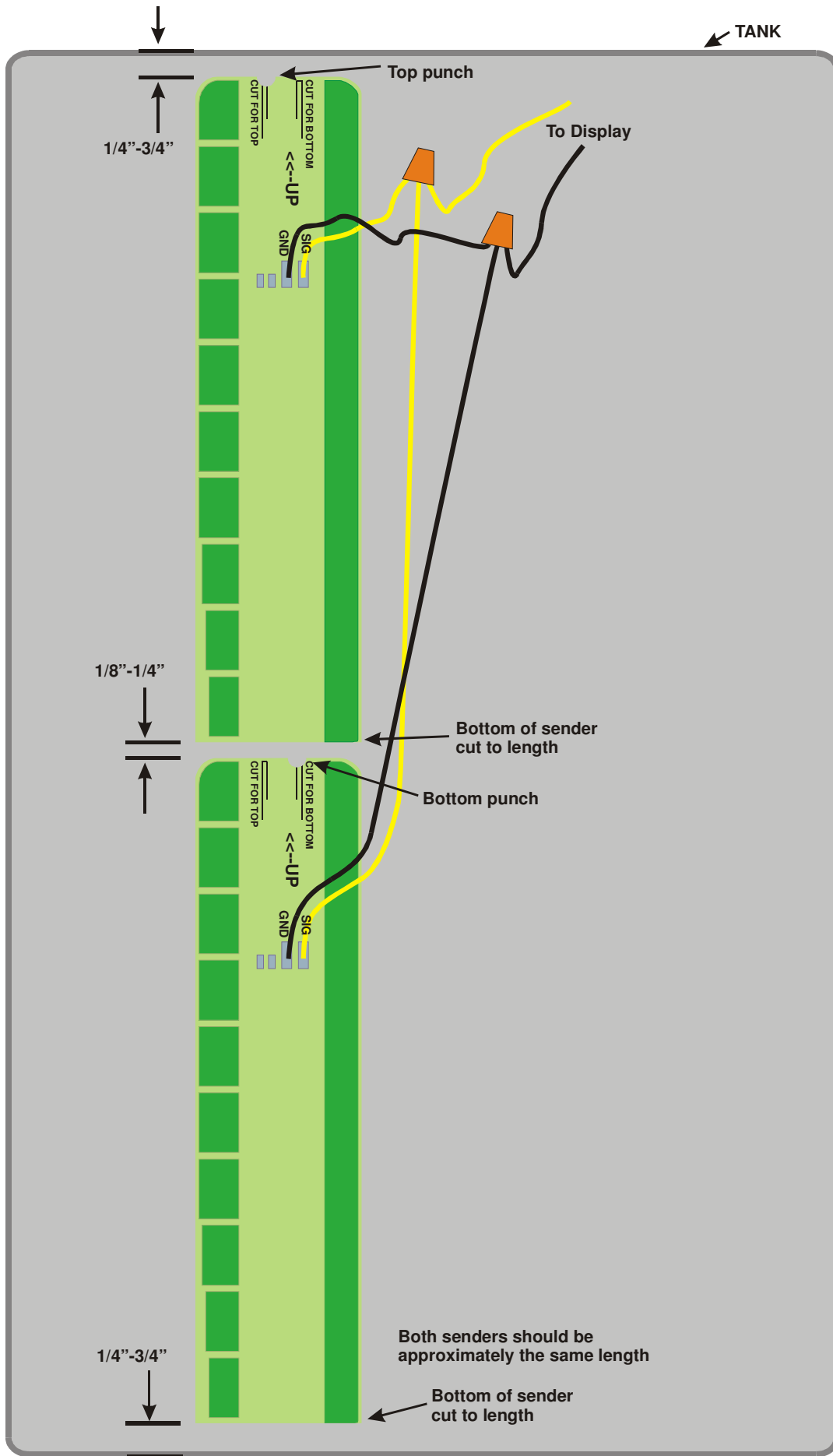**Punch hole here for bottom sender**

CUT FOR TOP

CUT FOR BOTTOM

<<—UP

GND

SIG

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 two holding tanks.

13. Mount the outside temperature sensor in a location where it can sense ambient temperature without being exposed to excessive road spray or debris. Avoid mounting it where it will be in direct sunlight or exposed to engine, furnace, refrigerator, hot water tank, or generator heat. Use RTV Silicone or good double sided tape to mount the sensor. Connect the yellow wire to the outside temperature wire from the display, and the black wire to ground. If you have a ground available at the chosen location then you will need to run just one wire to the display. You should use 18 gauge wire and use Marrette or crimp connectors to fasten the wires together.

14. 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 at least 12% (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. The gauge will work with maximum signal strengths as low as 5%, but it is good to have at least 12% at installation so that there is some margin available for buildup in the tank. 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.

15. Verify that the battery voltage reads correctly. If it appears low, make sure you have good wiring for the 12 volt power and the ground.

16. Calibrate the LPG by filling the tank and following the instructions in the display programming section. Set the temperature to °F or °C by following the instructions in the display programming section.

TANK

Top punch

CUT FOR TOP
CUT FOR BOTTOM

1/4"-3/4"

To Display

<<-UP

GND SIG

1/8"-1/4"

**Bottom of sender
cut to length**

Bottom punch

CUT FOR TOP
CUT FOR BOTTOM

<<-UP

GND SIG

**Both senders should be
approximately the same length**

1/4"-3/4"

**Bottom of sender
cut to length**

Typical Two Stacked Sender Installation

CHAPTER 6
TROUBLESHOOTING GUIDE

THIS SECTION PENDING

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
Dual Temperature Version

Resolution: 1/4 inch (6 mm)

Accuracy: +/- 5% or better, limited by resolution and tank shape

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 6 3/4"" wide by 3 3/4" high by 1" thick (146mm wide X 95mm high X 25mm deep). Panel screws to wall. Required cutout size is 5 1/4" wide by 2 1/4" high.

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 and external temperature sensor. 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.

Temperature sensors: Semiconductor sensors with integral A/D converters. Accuracy +/- 3°F(+/- 1.5°C).

This manual has been provided courtesy of My RV Works, Inc.

www.myrvworks.com

You can find more RV service manuals here:

www.myrvworks.com/manuals