❖ GARNET
INSTRUMENTS LTD.

SEELEVEL II™ Tank Monitor

For Recreational Vehicles
Model 711/711T

Owner's Manual

IMPORTANT OPERATOR INFORMATION

DATE INSTALLED:_____

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

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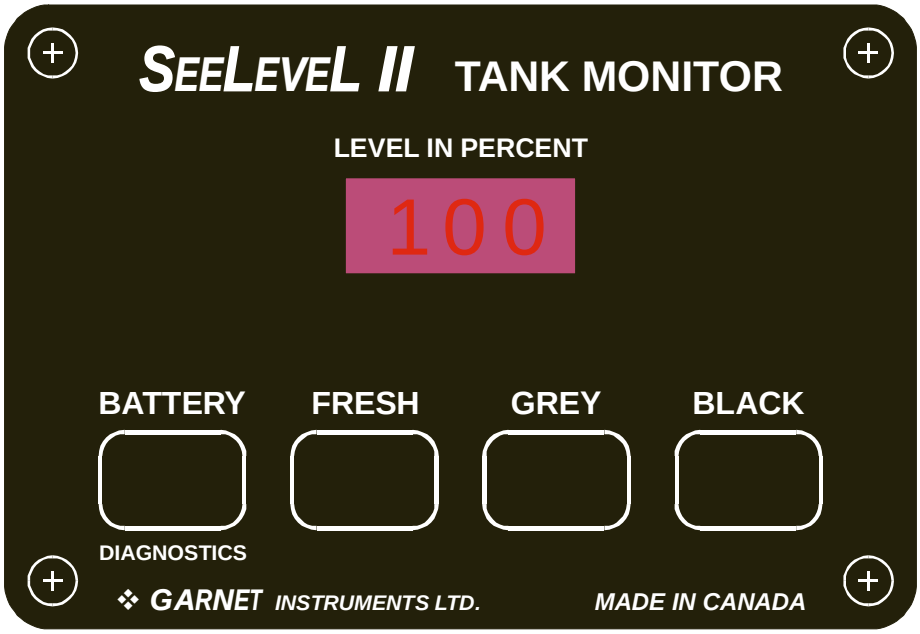
TABLE OF CONTENTS

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, and the inside temperature (optional). 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.



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 (optional). If the inside temperature option is not present, the display will be blank when not showing a tank level. 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 optional inside temperature is measured with a digital temperature sensor mounted to the inside of the display panel. The temperature can be programmed to read in degrees Celsius or Fahrenheit and is accurate to within 3 degrees F (1.5 degrees C). If the sensor fails the display will go blank.

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.

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 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 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.

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 temperature:

1. The temperature 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 or voltage 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. If the internal temperature sensor fails so that it cannot communicate with the display microprocessor, the display will indicate this by blanking the LED display.

CHAPTER 4
DISPLAY CALIBRATION

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

1. Turn off the 12V RV power to the display. Hold down the GREY and BLACK buttons 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 " ^{o}C" or " ^{o}F", based on what is currently programmed into the display.
4. To alternate between Fahrenheit and Celsius, press any of the tank buttons, 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.

To program the LED brightness:

1. If the display is to be used inside the coach, the LED brightness should be low. If it is to be used in the service bay area where sunlight can reach it, the LED brightness should be high.
2. Turn off the 12V RV power to the display. Hold down the FRESH and GREY buttons and turn on the 12V power to the display.
3. The display will turn on and will show "bri" to indicate that this is the brightness programming mode. When this occurs release the buttons.
4. The display will now indicate the brightness that is currently programmed by showing "b-1", "b-2", "b-3", or "b-4", where "b-1" is the minimum brightness and "b-4" is the maximum brightness.
5. Press the GREY tank button to increase brightness, or the FRESH tank button to decrease brightness.
6. When the display shows the correct brightness, turn off the 12V power, the programming is complete.

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

CHAPTER 5
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 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.
2. 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.
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 by showing "Err" on the LED display.
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 "bot". If the sender has been programmed as a top sender, the display will show "toP".
5. 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.
6. 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 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 in

the troubleshooting process. Note that there are no diagnostics for the 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 6
SERVICE AND WARRANTY INFORMATION

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

Garnet Instruments Ltd. 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 Instruments 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 Instruments Ltd, 284 Kaska Road, Sherwood Park, Alberta, T8A 4G7. 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 Instruments 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 Instruments Ltd.
284 Kaska Road
Sherwood Park, Alberta
Canada T8A 4G7
Email: service@rvgauge.com

CHAPTER 7
SPECIFICATIONS

Resolution:	1/4 inch (6 mm)
Accuracy:	+/- 5% or better, limited by resolution and tank shape
Operating temperature range:	+32 to +140 ^{o}F (0 to + 60^{o}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 4 3/4"” wide by 3 1/4” high by 1” thick (120mm wide X 83mm high X 25mm deep). Panel screws to wall. Required cutout size is 3 3/4” 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.
Temperature sensor:	Semiconductor sensor with integral A/D converter. Accuracy +/- 3 degrees Fahrenheit (+/- 1.5 degrees Celsius).