SeeLeveL II™

HOLDING TANK MONITORS

USER MANUAL

709-BTP7

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INTRODUCTION

Through decades of experience and development the SeeLeveL II™ tank monitor series has established itself as the gold standard in level measurement technology for the recreational vehicle industry.

The SeeLeveL II™ 709-BTP7 builds on previous experience to offer an exceptional combination of features, accuracy, and reliability, ensuring an excellent user experience. It provides monitoring of up to 7 tanks, including 2 FRESH, 2 BLACK, and 3 GREY water tank levels. With Bluetooth capability and the latest SeeLeveL RV 2.0 app, you can view real-time percentage readouts and receive alerts when tank levels are too high or too low. The 709-BTP7 monitors battery voltage and includes a pump switch for added convenience. In addition, the system can display the operating characteristics of each of the tank sending units, giving it unsurpassed diagnostic capability.

709-BTP7 Display Manual_v1.0 - 10-Jul-2024

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SAFETY INFORMATION

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this manual or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure. “Notes”, “Cautions”, and “Warnings” have been used to bring special matters to the immediate attention of the reader.

Safety Symbols

NOTE: expands on information for any procedures.

CAUTION: explains safety information that could cause damage to the product, including data loss.

WARNING: explains dangers that might result in personal injury or death.

Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

Pump and Heater Switch Safety Precaution

WARNING: All power circuits must be fused. A fuse is not provided with the system it is the installer’s responsibility to install a fuse with the maximum rating your model requires. **A relay may be required for models with a pump or heater switch. For information about the requirements for your model please refer to the Specifications document located on our website.**

For more detailed information please refer to the chapter entitled TROUBLESHOOTING GUIDE”, section “How to avoid damaging the display or pump switch due to excessive current”.

The Senders

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 auto calibrates so that it can read from Empty to Full regardless of the height of the tank.

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 properly, by monitoring the signal power the tank can be cleaned before the buildup gets excessive.

Multiple senders are available with the ability to double stack the senders to provide accurate level measurement for tank heights ranging from 3.5" to 34".
(See Sender Installation guide for available sender options-link on page 4)

The Display

The display receives the information from sender panels via a single 2 conductor wire and shows the level information in percent of full on a 3-digit LED display, from 0% to 100%. When the button for a particular tank is pressed, the display shows the level for that tank.

Battery Voltage

The system also shows the RV battery voltage by measuring the voltage which powers the display. The voltage is shown with a resolution of 0.1 volt.

LPG

The display can use an existing LPG electrical sender to show the LPG level. It can be automatically calibrated to any sender and shows the level information in percent of full on a 3-digit LED display, from 0% to 100%.

Diagnostics

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, shorted, cut, or if the sender panel is defective, then the display will indicate an error code. The various error codes are shown in the section entitled "TROUBLESHOOTING GUIDE".

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 level. In the very unlikely event there is an error, servicing is greatly aided with the diagnostic information.

Bluetooth®

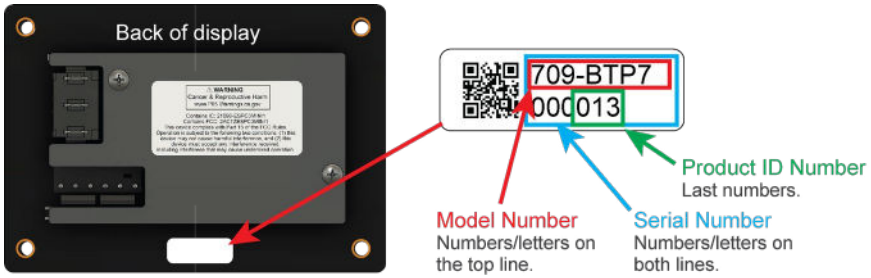
The display has *Bluetooth*® wireless technology, which allows you to check your tank levels, battery voltage, and LPG tank levels on any compatible smartphone or tablet device with a free downloadable app available on Google Play and iOS app stores.
(See separate manual for app installation and operation-link on page 4)

Alarm Output

The single common alarm output can be programmed to indicate a high or low sewage level, a high or low water level, or a high or low LPG level. More than one alarm can be assigned to the alarm output. This output can be connected to an indicator light and used to show a high sewer level and/or a low water level, alerting the user that attention is required. It could also be used to prevent toilet use if the black tank is full

Model and Serial Number Info

Before installing your system, look for the model and serial number on the back of the display, as shown below. Write these numbers below for future reference.



Document the following information for future reference.

Model Number: _____

Serial Number: _____

Date of purchase: _____

INSTALLATION INFORMATION

The installation for the complete system consists of mounting the display inside the RV, cutting, and mounting the senders to the sides of the tanks, connecting the wiring, and programming the display.

This manual provides information for the 709-BTP7 display which differs from other models due to the additional **ALT** button and red LED light. This button is needed for viewing and configuring secondary tanks. It is important to follow operation and configuration procedures for this model.

Installation Documentation Downloads

Other documentation will be required to complete installation for your specific model. Get them from our website Resource Library either by selecting the link below or scan the QR code and search for your model.

garnetinstruments.com/holding-tanks-resource-library/

RESOURCE LIBRARY

- Sender Installation Manual
- Wiring diagram
- SeeLeveL RV 2.0 App manual

Tools and Equipment to Install Display

- ☐ screwdriver or power driver
- ☐ wire cutters/stripper
- ☐ wire crimper
- ☐ electrical tape
- ☐ butt connectors
- ☐ saw to cut a hole for display (if required)

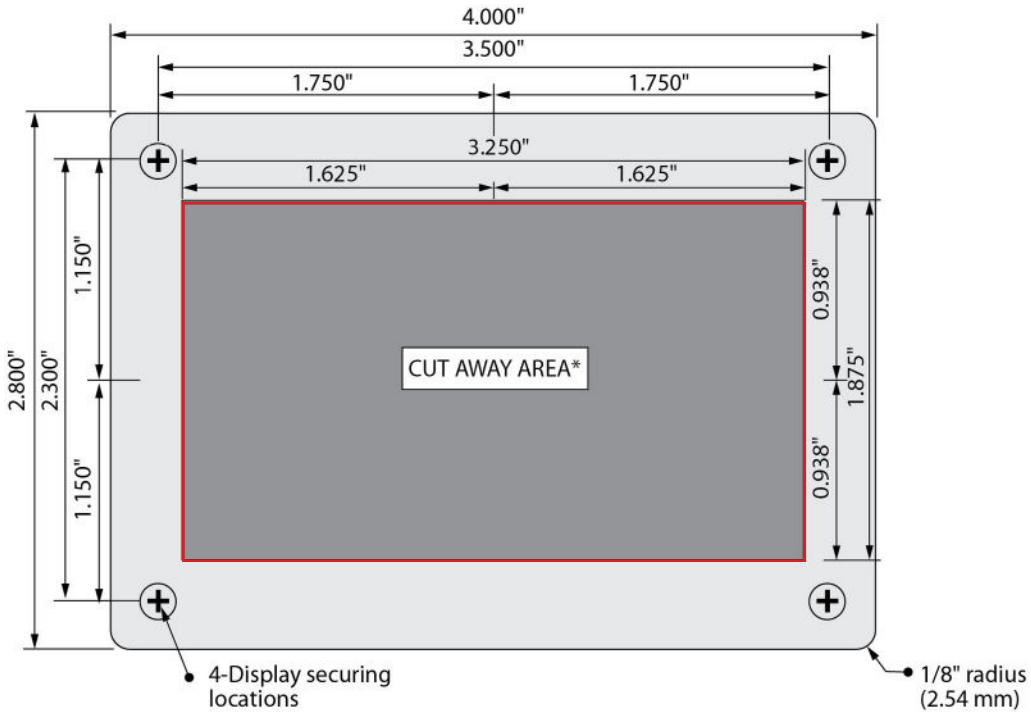
Optional items available to purchase if required. Go to our website for more information:

- ☐ Filler Panel to fit previous display hole that is too large.
- ☐ Gasket to prevent the display monitor from shorting if mounting to a metal surface.

The installation consists of mounting the display inside the RV, cutting and fastening the senders to the sides of the holding tanks, connecting the wiring, and programming the display. When wiring DO NOT use spade connectors to join wires, only use crimp-on butt connectors or solder the wires together.

Display Panel Mounting Template

Mount the display by cutting a hole in the wall with the given dimensions plus four screw holes. The thickness of the RV wall needs to be thick enough to retain the screws. The panel will be mounted onto the wall using the four included #4 screws, or different screws as required. The cutout diagram below is actual size and can be used as a template. The depth of each model varies 1" - 1 3/8" (25 - 35 mm), model dependent.

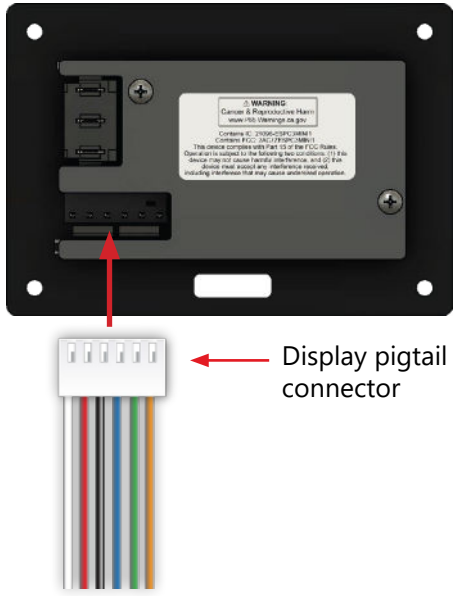


⚠ **CAUTION:** If mounting the display in a metal panel or wall there is a risk the display can short circuit causing permanent damage. Non-conductive mounting spacers are available to purchase to help prevent damaging the display. Contact Garnet or go to our website for further details. More installation tips are available in the "Troubleshooting and Installation Tips" section.

Connect Wiring to the Display

It is easier to connect the wiring to the display connector first, and then plug the connector into the display panel. **Refer to the wiring diagram for your model from our Resource Library using the link or QR code on page 4.**

The senders need to be grounded to a single ground wire from the display. **Make sure that the system ground is connected to the breaker panel ground.**



⚠ **WARNING:** All power circuits must be fused. A fuse is not provided with the system it is the installer's responsibility to install a fuse with the maximum rating your model requires.

A relay may be required for models with a pump or heater switch.

For information about the requirements for your model please refer to the specifications page and wiring diagram.

OPERATION GUIDE

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

To Read a Tank Level

1. Press and release the corresponding tank button to display the tank level. LED display shows the level in percent.

   FRESH or GREY or BLACK

   78 — LEVEL IN PERCENT

2. Display shuts off after 5 seconds.

   LEVEL IN PERCENT

3. To read the secondary Fresh/Grey/Black tanks, press and release **ALT** then press the button for the corresponding tank. The LED display will show the level and the ALT light will be on.

   ALT

   FRESH or GREY or BLACK

4. To view the 3rd grey tank (galley), press and release **ALT**, and then press **LPG**.

   ALT + LPG

5. Additionally, the screen will briefly flash "Fr 1" or "Fr2" before showing the level, to differentiate between the two fresh tank, or "Gr 1", "Gr2", Gr3" for the three grey tanks, and "bL 1" or "bL2" for the two black tanks.

   Fr 1 — LEVEL IN PERCENT
   Fr 2 — LEVEL IN PERCENT
   Gr 1 — LEVEL IN PERCENT
   Gr 2 — LEVEL IN PERCENT
   Gr 3 — LEVEL IN PERCENT
   bL 1 — LEVEL IN PERCENT
   bL 2 — LEVEL IN PERCENT

6. To continuously display a reading, press and release the desired button twice. For secondary tanks, **ALT** must be pressed and released first.

   FRESH + FRESH

7. Continuous display mode is indicated by a decimal point on the right hand side. The level is updated once per second. User can watch the level change while the tank is being filled or drained.

   78. — LEVEL IN PERCENT

8. Continuous display mode shuts off after 5 minutes. To end the hold mode sooner, press any tank button and display will shut off.

   FRESH = — LEVEL IN PERCENT

To Read the Battery Voltage

1. Press and release the **BATT** button to display the battery voltage. LED display shows the level in volts.

   BATT — 12.0 — LEVEL IN PERCENT

2. The display shuts off after 5 seconds.

   LEVEL IN PERCENT

3. To continuously display reading, press and release the **BATT** button twice.

   BATT + BATT

4. 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.

   12.6 — LEVEL IN PERCENT
   12.7 — LEVEL IN PERCENT

5. To read a tank level or LPG level, the corresponding button can be pressed at any time. The 5 second timeout is restarted every time a button is pressed.

   GREY or LPG

   23 — LEVEL IN PERCENT
   56 — LEVEL IN PERCENT

To disable or enable Always On Display (AOD):

1. Enter programming mode by pressing and holding **BATT** and **ALT,** after a few seconds, the display will briefly flash "SEt", indicating you are in the settings menu.

   BATT Hold + ALT Hold

   SEt — LEVEL IN PERCENT

2. To scroll through options, press **BLACK** to move upwards and **FRESH** to move downwards until the display indicates 'Aod' for always-on display.

   BLACK / FRESH

   Aod — LEVEL IN PERCENT

3. Press **ALT** and select between "On" and "OFF" using the **BLACK** and **FRESH** buttons, and make your selection.

   ALT + BLACK / FRESH

   On — LEVEL IN PERCENT
   OFF — LEVEL IN PERCENT

4. Press the **BATT** button to save and exit the programming mode.

   12.0 — LEVEL IN PERCENT

a. If you choose "On" then the battery voltage is continuously displayed very dimly to save power until the setting is disabled.

   BATT

To Read the LPG Tank Level

1. Press and release the **LPG** button to display the LPG level in percent.

2. The display shuts off after 5 seconds.

3. Press and release the **LPG** again, to display a new reading. The 5 second timer will be restarted.

4. To hold the **LPG** level on the screen, press, press **LPG** twice. Continuous display mode is indicated by a decimal point on the right hand side.

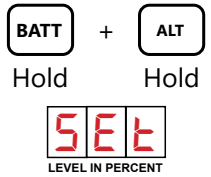
5. The display will shut off 5 minutes after the button is released.

6. To read another tank level or battery voltage, the corresponding button can be pressed at any time. The 5 second timeout is restarted every time a button is pressed.

Set the LED Brightness

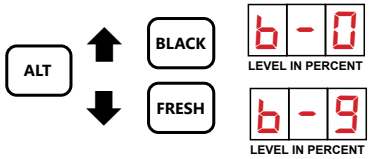
The LED brightness can be adjusted to suit the user and the operational circumstances. If it is to be used in the service bay area where sunlight can reach it, the LED brightness should be high.

1. To program the LED brightness, enter the brightness programming mode. To do this, press and hold down **BATT** and **ALT**. After a few seconds the display will briefly flash "SEt" indicating you are in the settings menu.



2. Scroll through options, press **BLACK** to move upwards and **FRESH** to move downwards until the display indicates "br ı" for brightness.

3. Press **ALT** again, and using the **FRESH** and **BLACK** buttons, select a value between 0 and 9. The current brightness level is displayed. b-0 is the minimum brightness and b-9 is the maximum brightness.

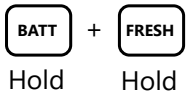


4. Press the **BATT** button to save and exit the programming mode.

Program the Number of Senders

To program the number of senders for each tank, the display needs to enter the sender programming mode. By default each tank is set for single sender application. This should only be done at the time of installation; there is no reason to change the number of senders afterward. Make sure that the number of senders programmed into the display matches with the number of senders connected; otherwise the display will show an error.

1. To configure the number of senders for a tank, hold down **BATT** and the button for the tank to be programmed.

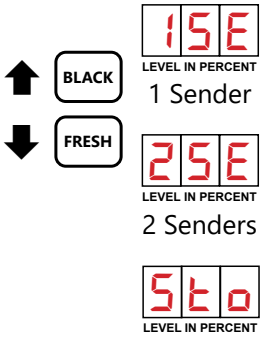


2. After a few seconds, the screen will briefly display the name of the tank that you are entering tank setup for, (i.e "Fr 1" for fresh 1), and then you are in the programming mode for that tank.

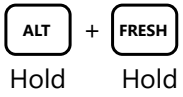
3. Use **FRESH** and **BLACK** to scroll up and down through the menu until "SEn" for senders is displayed. Press **ALT** to select.

4. Select the number of senders between 0 and 2 using the **FRESH** and **BLACK** buttons. Setting it to 0 disables that tank reading. " 1SE" indicates a single sender. "2SE" indicates a stacked pair of senders. Press **BATT** to save the setting.

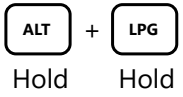
   The screen will briefly show "Sto" to indicate that the setting is being stored.



5. To configure the number of senders for a secondary tank, instead of holding **BATT** and the corresponding tank button, press and hold **ALT** and the corresponding tank button.



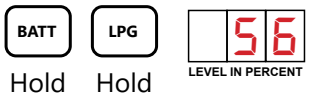
6. To access the setting for the third grey tank (galley), hold **ALT** and then hold **LPG**.



Calibrate the LPG Sender

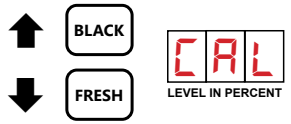
The LPG tank must be full when the sender is calibrated, otherwise the calibration will be invalid. Fill the LPG tank by using an alternate measurement method, such as weight, a spit valve, or a mechanical gauge on the tank.

1. To calibrate, hold both **BATT** and **LPG** buttons.

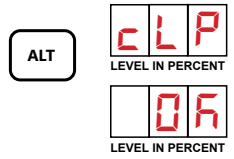


2. It will display "LPG" briefly to let you know you are in LPG programming mode.

3. Use **FRESH** and **BLACK** to scroll up and down through the menu until "CAL" for calibration is displayed.



4. Press **ALT** to calibrate. It will flash "cLP" to let you know a calibration is in process, and then "oA" to let you know it is done.

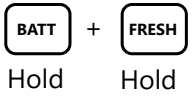


5. Press the **BATT** button to save and exit the programming mode.

Program Alarm Set Points for Each Tank

To program the alarm point for each tank, the display needs to enter the alarm programming mode.

1. To set an alarm for a tank, hold down **BATT** and the button for the tank to be programmed.



2. After a few seconds, the screen will briefly display the name of the tank that you are entering tank setup for, (i.e "Fr 1" for fresh 1), and then you are in the setup menu for that tank.

3. Use **FRESH** and **BLACK** to scroll up and down through the menu until "ALr" for alarm is displayed. Press **ALT** to enter the sub-menu.

4. The LED will display a symbol representing above ("n") on the left, and a number on the right. This means the alarm will trigger above the programmed threshold

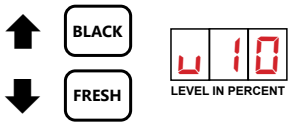
   ⚠ **NOTE:** The example on the right represents a warning alarm that will trigger above 90%.

5. Press and hold **FRESH** to change between above or below setting. Above the threshold is represented by the "n" symbol, below the threshold is represented by the "u" symbol.

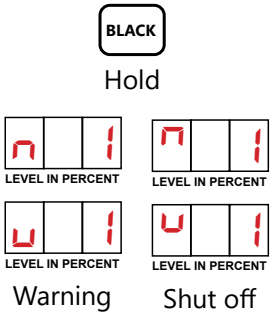
   ⚠ **NOTE:** The example on the right represents a warning alarms that will trigger above 90% for one tank and below 10% for another tank.

6. Use **FRESH** and **BLACK** to increase or decrease the alarm level, shown in percent. Setting alarm threshold to 0 disables it. Press **BATT** to save and exit.

   ⚠ **NOTE:** The example on the right represents a warning alarm that will trigger below 10%.



7. Press and hold **BLACK** to change between the shut down and warning alarm. The same above/below symbols are used, but the shut down alarm is represented by the symbol being in the top half of the digit, and warning symbol in the bottom half of the digit.
   - Two alarm set points are possible for each tank, tied to the same output. Most cases will only need 1 alarm.
   - An active alarm connects the orange wire to ground. It is suitable for small loads like LEDs or relay coils (max 750mA).



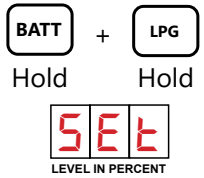
⚠ **NOTE: All alarms are tied to the single common alarm output. Additional alarms are possible with the external alarm module.**

Unless external alarm module is used the warn and shutdown will behave the same.

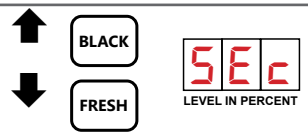
Program the Display as Primary or Secondary

This setting should normally only need to be done when installing the display. An optional second display can be added to the system. This allows for a display in the service bay and one inside the coach. To avoid reading errors when using dual displays, one display needs to be set to secondary mode. A display in secondary mode monitors the primary displays sender requests and will scan the tank levels at a much slower rate if the primary display is disconnected. The alarms are inactive on the secondary display. All displays are primary by default.

1. Hold both **BATT** and **LPG** buttons. After a few seconds the display will briefly flash "SEt", indicating you are in the settings menu.

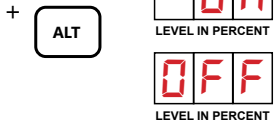


2. Use the **BLACK** to move up and **FRESH** to move down until the display reads "SEc" .



3. Press **ALT** to enter the menu. Choose between "On" and "OFF" using the **FRESH** and **BLACK** buttons, and make your selection.

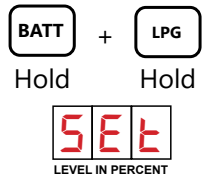
   On = Secondary mode
   Off = Primary mode (default)



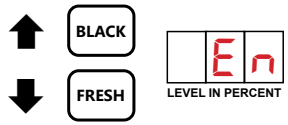
4. Press the **BATT** button to save and exit the programming mode.

Enable/Disable the LPG Sender

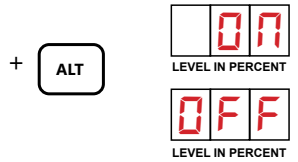
1. Hold both **BATT** and **LPG** buttons. Screen will flash "LPG" indicating you are in the LPG settings menu.



2. Use the **BLACK** to move up and **FRESH** to move down until the display reads "En" .



3. Press **ALT** to enter the menu. Choose between "On" and "OFF" using the **FRESH** and **BLACK** buttons, and make your selection.



4. Press the **BATT** button to save and exit the programming mode.

Error Codes

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

DISPLAY CODE	POSSIBLE CAUSE	SOLUTION
Open circuit 	1. If a sender is unresponsive. 2. There is an open circuit in the wiring so the sender is not connected.	See **Wiring Diagnostics** flowchart on page 14.
Short circuit 	Blue communication wire from senders to display is shorted to ground.	
Error 	Indicates signal corruption between the sender and display due to bad wiring, bad senders, or multiple senders programmed the same.	Check all the senders to make sure they are programmed correctly. If they are, replace the sender that is creating the error.
Stacked senders 	The display has been programmed for a single sender where stacked senders have been connected.	Change the senders or reprogram the display as required.
No top sender  **No bottom sender** 	The display has been programmed for double-stacked senders and one of these error codes are showing: • ntP - only the bottom sender is reporting • nbo - only the top sender is reporting	Correct the programming on the sender.
Calibration failure 	The memory used to store programming for battery voltage calibration value and tank sender signal values has failed.	Replace the display.
For LPG only 	The only LPG diagnostic code is the open circuit. If the wiring to the LPG sender is shorted then the LPG will always show "0".	

⚠ **NOTE**: There are no diagnostics for battery voltage.

Sender Diagnostics

These diagnostics can be used to check the senders:

Reviewing Sender Diagnostics

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. There are two diagnostics for the senders:

Sender 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. **Sender height** is the number of receive segments present in the sender.

PROBLEM	POSSIBLE CAUSE
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. ⚠ **NOTE:** Typical signal power should be 50% to 60%. The minimum signal power for proper operation is 20%. P00 is 100%
The number of segments on the sender reporting is less than the amount of segments on the sender.	One or more segments are not reporting. Either cut sender to a shorter length or replace the sender. ⚠ **NOTE:** The senders always 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.

Check Signal Power Diagnostics

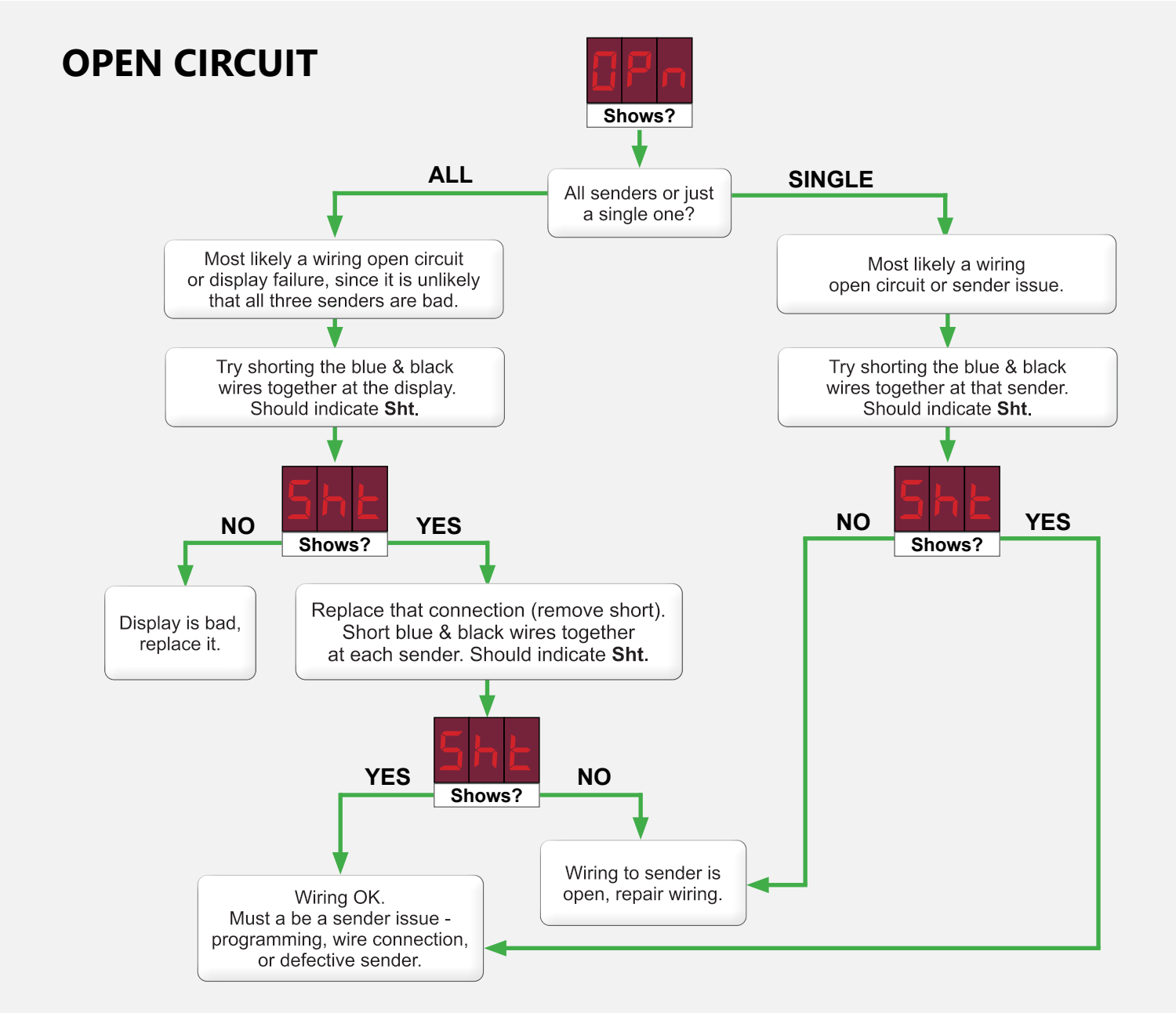
1. Press and hold the button for the tank to be checked until it displays the senders signal strength

Hold

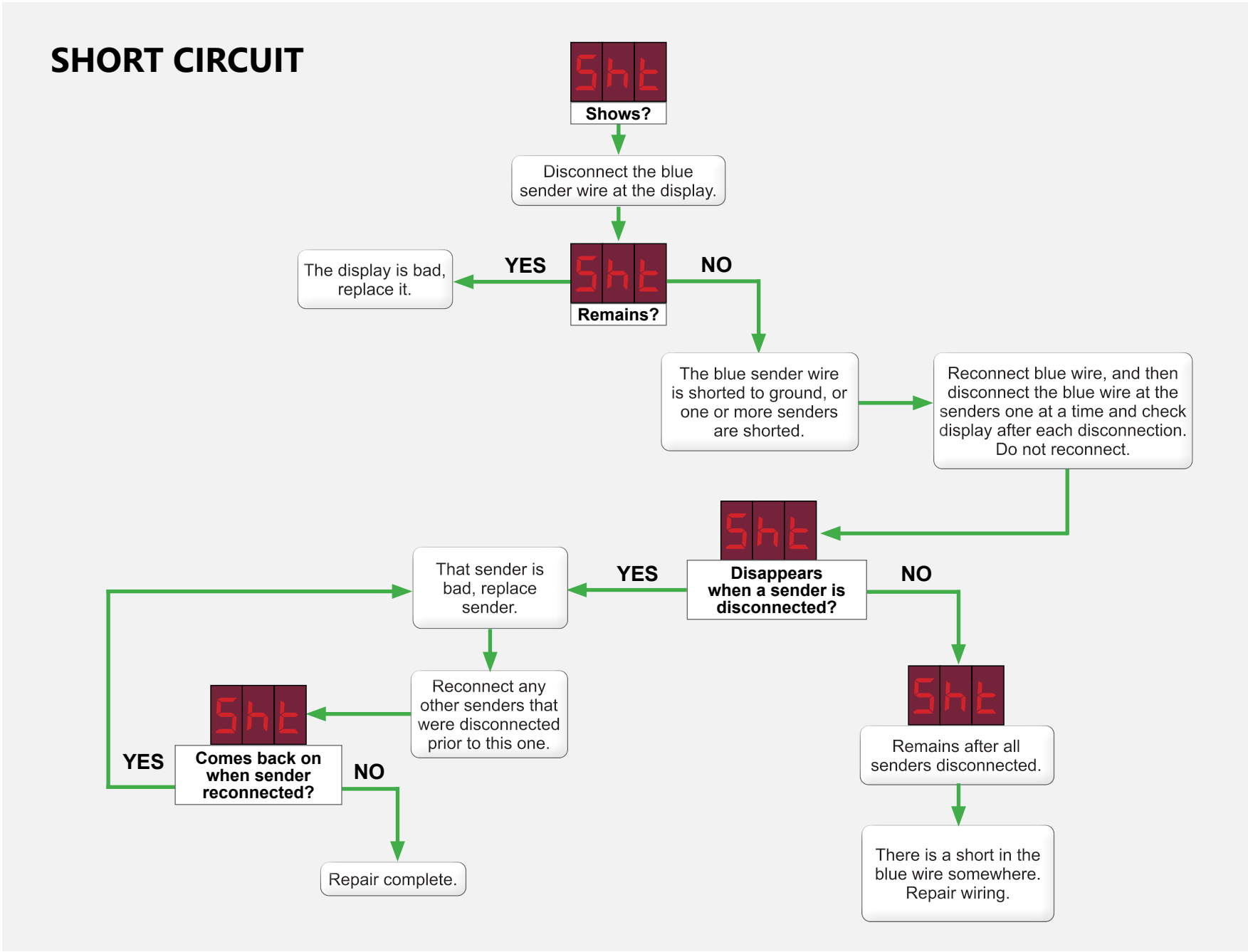
2. This is indicated by a "P" showing on the left digit, for example "P26" indicates a 26% signal power. "P00" is 100%.

3. After 5 seconds of showing the signal strength, the display will shut off.

Wiring Diagnostics



SHORT CIRCUIT



Troubleshooting & Installation Tips

What to do if the system freezes or is unresponsive

If the display is unresponsive, it may be "hung" due to a static discharge or electrical noise. Try rebooting it by shutting off the 12V power to it for a few seconds, then turning it back on.

What to do if operation becomes erratic or stops completely

Make sure all wiring connections are solid. Do not use spade connectors to join wiring as they will degrade over time. Use insulated crimp-on butt connectors or solder and insulate the wire connections.

What to do in dual console systems if the two displays do not read the same

For dual display console applications, if the consoles disagree the most likely reason is a bad console ground. Both console grounds, and the sender grounds, must be connected together with ground wiring. Do not depend on metal chassis components.

What to do if readings jump or are inaccurate

1. In rare cases, 120VAC interference has caused the readings to stall and create a gap; readings would skip from 50% to 70% and then begin to function again. The cause was wiring between consoles and senders being tied too close to entrance boxes for shore power or bundled with other high AC voltage lines or junction boxes.
2. Always ground the senders and the console to the same ground circuit. This is very important; RV's can have several ground circuits with resistance between them. We have had instances where two consoles are installed with a different ground for the service bay console and interior console. If you see different levels from each console on the same tank, then the ground circuit is not common. Connect both consoles to the same ground back to the breaker panel ground point.

What to do if the system indicates a residual or non-zero water level even though the tank is drained completely

1. This can be due to a convex tank bottom or a sloped tank bottom. In the case of the convex bottom tank a ring of water may remain after draining. In the case of the sloped bottom (to the drain valve side) a very small amount of water left in the tank will result in a non-zero level indication. In both of these cases, temporary installation of the sender using duct tape or masking tape will allow the installer to check the tank level before committing to a final sender position. The ends of the sender must be at least ¼" to ½" away from the tank bottom and top to allow for wall thickness. The exterior bottom & top of the tank are not the same as the interior bottom & top; depending on the tank wall thickness the inside height is ½" to 1" shorter than the outside height. Knowing the wall thickness of your tank will allow you to find the optimal sender position; placing the sender where it can "see" the water will ensure proper level calculation and sender operation.

> ⚠ **NOTE**: After cutting the sender to length and connecting the wires, be sure to tape down both sides of the sender to eliminate air gaps between the sender and tank surface which can cause low signal strength and unpredictable performance.

> ⚠ **NOTE: In the case of a convex tank bottom, usually found on large flat tanks, raising the sender is the best solution to accomplish a zero reading when the tank is empty. This may result in having to shorten the sender by an additional segment.**
>
> **On sloped tanks, which are used to promote complete draining, one alternative is to measure the end of the tank opposite from the drain valve. It may be necessary to extend the wire harness to be able to measure on the optimal side. On the drain valve side, the best choice is to elevate the sender to avoid reading a puddle at the drain valve.**

2. The signal strength should be in the 50% to 60% to align with previous range for best performance. If the low signal strength is indicative of a high resistance in a connector, a bad ground, or improper bonding of the sender to the tank (a possible air gap on one or both sides of the sender). With the display installed you can check the level on each tank.

> ⚠ **NOTE**: 20% is minimum signal for operation.

3. The close proximity of metal to the sender can be misinterpreted as water, since they have similar electrical characteristics. Any metal such as steel, aluminum, copper, or brass can affect the sender reading if it is closer than about 2" from the face of the sender. If there are metal frame pieces, brackets, straps, pipes, ducts, etc. close to the sender you may have to move the sender away from them. Trial positioning using tape is necessary to find optimal placement. Flexible pieces of metal can be held away from the sender with rubber wedged between the sender and the metal. If the metal is off to the side of the sender, or just butting to the edge then it is usually not a problem.
4. Make sure that metal doors or covers are far enough away from the sender, once everything is closed up the positioning may change. The symptoms of exposure to large metal components are usually a non-zero reading when the tank is empty, or the level appearing to jump suddenly as the tank is drained or filled.
5. On fresh tanks the potential to not be able to use all the water in the tank, we suggest you elevate the fresh sender 1" off the tank bottom and position the top of the sender to allow for vent position (if the vent is on the side of the tank). This way you should see '0' before the pump starts to suck air. Some tanks have a sump style draw system, in this case there is no concern with unusable water, just allow for the wall thickness when positioning the sender board (usually ½" to 1" margin from the outer shell). If the sender is positioned above the vent then the maximum reading may be less than 100%.
6. There may be a buildup on the inside walls of black and grey tanks. For coaches that have not been in service for a few years, the black tank may indicate a level even though it is empty. The likely cause is that the tank has a significant build-up, exceeding ½" thick. Redex is not an acceptable chemical to promote clean tank walls; it is far too slow to get the breakdown action started. Use an RV type of liquid chemical, Tissue Digester, or Sensor Cleaner. Happy Campers Holding Tank Extreme Cleaner available at www.happycampersworld.com, or Camp Champ available at www.campchamprv.com are two products we find work well. The next time you take a trip, leave with a high concentration of the chemical in the tank and approximately 30% full of fresh water. Drive for 2-3

days to allow the tank levels to rise through normal use. We recommend that you exceed the level that you see the system report when the tank is empty. After the sloshing and the soaking, hopefully the build-up will be flushed when the tank is drained and flushed. If symptoms persist additional treatments may be required. The waste did not build up on the tank wall in one day, so it may not dissolve in one treatment! Excessive build-up looks like water to the system as it holds a significant volume of water in the build-up area.

What to do if the system reads a zero water level at all times, or does not reach 100%

1. This may be due to excessive tank wall thickness. We have tested the sender on tanks with 3/8" wall thickness to ensure proper operation. If you encounter an excessively thick tank wall the symptom will be a zero reading regardless of the actual tank level. The cross check would be to test the sender on another tank by taping it in place temporarily, if it now works the tank wall thickness is well over 3/8". You can also use a 1 gallon jug or a 5 gallon pail as a test tank to crosscheck operation of the sender.
2. A symptom we have seen is the sender will not indicate 100% when the tank is full. If the sender is positioned too high on the tank, then water cannot reach high enough on the sender for it to read 100%. The top of the sender must be at least ¼" to ½" away from the top of the tank to allow for wall thickness.
3. Another possibility is a tank wall thickness issue that may occur at the corners or edges of the tank. This is not a common issue; the only correction you can make is to move the board, away from the thick area.

What to do if sender delamination occurs

1. We have had reports of the senders falling off the tanks or showing serious delamination. This is likely caused by a lack of tank surface preparation. Surface prep is very simple, wipe the area to be adhered to with products like Pro Bond, alcohol, or acetone. Do not use thinners because they leave residues which attack the adhesive. Ambient temperatures of less than 60°F or 15°C prevent the bonding agents in the adhesive from working properly; use a heat gun to warm the tank surface if necessary. Be sure the surface is dry. A heat gun is the best way to dry the bonding area. Finally, the surface of the tank must be smooth. The adhesive works much better on smooth surfaces, if necessary use an orbital sander with fine grit paper (220 grit) to quickly accomplish the desired smoothness.
2. Another possibility is the wiring harness pulling on the sender. Make sure the wiring to the tank sender is well supported so that it does not put a load on the sender. Be sure to support all connecting harnesses; do not let the board support the harness, this will in time cause delamination of the board from the tank. One simple way to do this is to use Gorilla tape across the top of the sender at a 90 degree angle to the sender orientation, with the wiring held in place by the tape.

> ⚠ **NOTE**: The wires from the sender must be routed straight up or to the right for reliable operation.

How to protect the sender from road spray and debris

1. On installations where the holding tank is exposed to under chassis road spray and flying rocks etc. we recommend the use of an auto body undercoat, which is easily purchased in auto parts stores. This tar based material clings well to the senders and protects from water and debris.
2. *Garnet tested solutions:* Gorilla Glue Waterproof Patch & Seal Tape (preferred); 3M Professional Grade Rubberized Undercoating, product code 03584; Dominion Sure Seal rubberized undercoating such as Gravel Guard Rocker Guard Coating.
3. For undercoat apply over the complete board using two coats. Do not use lacquer, enamel paint, or plastic paint for auto bumpers as these contain chemicals that will dissolve the conformal coating on the board and cause malfunctions.

How to avoid damaging the display when mounting

1. If mounting the display in a metal panel or wall there is a risk of damage due to a jagged opening or too small of an opening. The metal panel can short-circuit the display rendering it inoperable and requiring the installer to replace it. Ensure that the edges of the cutout are smooth and that no material is bent outward where it can dig into the display. Make sure that the cutout is large enough so that the display can be easily inserted without having to angle it. There is a ½" border all around the display to cover the edge of the hole, so if the hole is a bit larger than the minimum requirement it will still be covered by the display.
2. When fastening the display to the panel, make sure that it is centered in the hole and not resting on one edge.
3. Non-conductive mounting spacers are available to help prevent damaging the display. Contact Garnet for further details.

How to avoid damaging the display or pump switch due to excessive current

1. Please be aware that the water pump switch circuit has a limitation on current draw of 7.5 amps, some large pumps can draw over 10 amps. These high drain pumps must use a relay. The display console is not designed to handle this load and the display will be permanently damaged.
2. If the 12V supply line from the electrical panel does not have a 7.5 amp fuse, please be sure to install a fuse holder with a 7.5 amp automotive style fuse inline on the +12V red wire.

SPECIFICATIONS & CERTIFICATIONS

DISPLAY			
Display mounting panel	Size: 4" wide by 2.8" high (102 mm wide X 71 mm high). Depth varies, 1" - 1⅜" (25 - 35 mm), model dependent. Panel screws to wall.		
System power requirements	Display requires 12 Volts from the RV battery, the system will function from 11 to 16 Volts. Typical current drain is under 20mA, but can peak up to 200mA.		
Wiring	A single two wire conductor required from the display to the senders. All the senders are wired in parallel. 12 V power and ground required for display. ***LPG wiring***: A separate two wire conductor is required from the display to the LPG sender.		
LPG	Display will work with an LPG sensor with a maximum resistance of 50 ohms to 500 ohms. Display shows increasing level as resistance increases. System must be calibrated with the LPG tank full.		
Pump switch	The pump switch is rated for a maximum of 10 amps. The use of a relay is required if more than 10 amps is needed for the pump. ****The pump wiring must be fused at 10 amps.***		
Common alarm output	Maximum voltage: 16 volts DC Maximum current: 500 mA DC Polarity: The output makes a connection to ground when the alarm is on.		
SENDERS			
Model	710-AR	710-ES2	710-SS
Accuracy	+/- 8% or better, limited by resolution and tank height and shape.		
Resolution	1/4" (6 mm)	3/8" (10 mm)	1/2" (13 mm)
Sender materials	Flexible glass epoxy circuit board with conformal coating for circuit protection. Laminated on the back with 3M 300LSE bonding adhesive.		
Actual measurable space (height)	3" - 9"	4" - 12"	6" - 16"
Optimal tank height	3.5" - 10.5" (single) up to 19.5" (dual)	5.5" - 14" (single) up to 26" (dual)	7" - 18" (single) up to 34" (dual) **Note:** On 4-tank models, the Grey and Galley tanks can only have one sender
Sender dimensions	9.15" high x 2.45" wide	12.15" high x 2.45" wide	16" high x 2" wide (not including tabs)
Operating temperature range	+32 °F to +140 °F (0 °C to + 60 °C)		

SAFETY INFORMATION	
Compliance and Certifications	CAN ICES-003(B)/NMB-003(B) This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Contains FCC ID: 2AC7Z-ESPC3MINI1 Contains IC: 21098-ESPC3MINI1
⚠ WARNINGS	This product can expose you to chemicals including Nickel and Lead, which are known to the State of California to cause cancer, and lead which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.
	All power circuits must be fused. If a fuse is not provided with the system then it is the installer's responsibility to install a fuse. The fuse rating must be 7.5 amps for the display. For more detailed information please refer to the "TROUBLESHOOTING" section of the user manual.

WARRANTY & SERVICE INFORMATION

Find warranty claim process information refer to our support page on our website:

www.garnetinstruments.com/support/

DISCLAIMER OF WARRANTY ON HARDWARE

Garnet Instruments 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. 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, 286 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:

CANADA
Garnet Instruments
286 Kaska Road
Sherwood Park, AB T8A 4G7
CANADA
email: info@garnetinstruments.com

UNITED STATES
Garnet US Inc.
5360 Old Granbury Road
Granbury, TX 76049
USA
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NOTES: