SeeLevel Special™

Truck Multi-Tank Dispensing System

MODEL 809-DM MANUAL

IMPORTANT OPERATOR INFORMATION

DATE INSTALLED:_____

UNIT NUMBER:_____

COMPARTMENTS: _____

DISPLAY CALIBRATION UNITS (e.g. pints, gallons):_____

MINIMUM TANK READOUT: _____

MAXIMUM TANK READOUT:_____

BYPASS RESET ALARM POINT (A3): _____

OVERFILL HORN WARNING POINT (A2):_____

OVERFILL SHUTDOWN POINT (A1):_____

Printed in Canada

GARNET

Liquid management solutions, your way.

CANADA
Garnet Instruments
286 Kaska Road
Sherwood Park, AB T8A 4G7

USA
Garnet US Inc.
5360 Old Granbury Road
Granbury, TX 76049

garnetinstruments.com

1-800-617-7384

GARNET
SEELEVEL SPECIAL™
Truck Multi Tank Dispensing System

MODEL 809-DM

Table of Contents

809-DM Manual_v5.3 - 04-Sep-2018

CHAPTER 1 - OVERVIEW

Congratulations on purchasing the Garnet Instruments Model 809-DM SeeLevel Special™ Gauge for Trucks. The SeeLevel represents the state of the art in liquid level measurement equipment for transport applications. The SeeLevel is designed for reliable, accurate level measurement of sour or sweet crude oil, chemicals, acids, water, condensate, gasoline, or diesel fuel. The liquid level is determined by sensing the position of a magnetic float using a series of reed switches arranged in a vertical sensing bar. This technology has no moving parts except for the float, and can operate over a range of product temperatures from -40°C to +90°C (-40°F to +194°F).

The 809-DM SeeLevel has been designed to withstand the vibration and shock encountered in mobile applications.

The 809-DM SeeLevel can display in any units, such as inches of level, pints, quarts, gallons, barrels, or cubic metres of volume. It has multiple alarm relay and transistor outputs which can be used to operate horns, lights, pumps, valves, or engines.

The 817 Truck Gauge Programmer is used to program the SeeLevel to read the desired calibration units. It is designed to be easily operated by people unfamiliar with electronics or computers.

The 809-DM is designed specifically for trucks with multiple tanks (up to 6, plus up to 3 water tanks using additional 808P2 gauges) which are used to accurately dispense chemicals. Front panel controls, remote communications, PTO sensing, and a full complement of alarm outputs make it a complete solution for this type of truck. Battery operation of the basic level functions allows checking of tank levels even with the truck turned off.

CHAPTER 2 - GAUGE DESCRIPTION

The 809-DM SeeLeveL gauge consists of six sender bars, six donut shaped floats, fiber optic interconnect cables, and a display. Each sender bar is mounted vertically in the tank with the float sliding up and down around it in accordance with the fluid level. The sender bar sends the fluid level information via fiber optic cable to the display, which displays the level in appropriate units and operates the alarms and remote data transmitter. Up to three more tanks can also be monitored using the Remote Inputs on the 809-DM.

The float contains magnets which activate reed switches inside the stainless steel sender bar to indicate the level of the fluid. The activated switches are detected by the microprocessor at the top of the bar. The microprocessor operates from a long life lithium battery giving about 10 years of life. The level information is relayed through the fiber optic cable to the display, the fiber being used to maintain electrical isolation between the sender bar and the display, allowing operation in flammable liquids.

The display converts the level information to volume according to the calibration programmed into it with the 817 Truck Gauge Programmer. The calibration can be in inches or volumetric units such as cubic metres or barrels, and each tank can have its own calibration. The tank level is shown on an illuminated LCD (Liquid Crystal Display) which gives excellent visibility. The display operates from a 10 year lithium battery, with 12 volt truck power operating the LCD illumination, alarms, and remote communications. The entire display is enclosed in a 6" by 6" by 4" weatherproof enclosure which can be mounted inside or outside of the truck cab.

The 809DM system is designed for body trucks with up to 6 product tanks. It also has remote inputs to connect up to 3 other Garnet gauge systems, which may be used for water tanks on the same truck. The system provides remote communications via a serial port which can be used to remotely program the amount of product to be dispensed, as well as to be able to remotely monitor the tank levels, alarms, and truck PTO status.

Only one tank is viewed at a time, selected by the buttons on the front panel. However, when not dispensing, all of the tanks are scanned to keep the alarm and remote communication information up to date. During dispensing, only the viewed tank is monitored to make sure that it is kept up to date as quickly as possible.

Each tank has its own set of alarms, with each set of 6 having a common output to operate lights, horns, engine shutdowns, or valves. The dispense alarm can be programmed from the front panel using the push buttons; it is used to accurately dispense the correct amount of product by sounding a horn or shutting a valve when the amount to be dispensed has been reached. The rising level alarm activates if a tank level not being viewed rises more than a few inches to alert the operator that the wrong tank is being filled. The overfill warning alarm is programmed into the gauge with the 817 programmer, and is used to warn the operator that the tank being filled has reached its maximum level. The overfill shutdown alarm is also programmed into the gauge with the 817 programmer, and functions as an emergency shutdown to prevent the tank from being overfilled and causing a spill.

See Chapter 5 for details of alarm operation.

WARNING: The use of alarm points is entirely at the owner's risk due to the nature of connecting external horns or lights, the reliability of external horns or lights, and the requirement for truck power to operate them.

Installation of the gauge is straight forward, consisting of mounting one sender bar in each of the tanks, mounting the display at a convenient location, connecting the sender bars to the display with the provided fibre optic cable, and wiring the display to truck power and the various alarm lights, horns, shutdowns, or valves. Programming the calibrations and alarm points into the display completes the installation. Any of the components can be easily replaced for servicing. Chapter 10 describes the installation in detail.

CHAPTER 3 - UNIQUE FEATURES

The SeeLeveL gauge has been designed for maximum ease of installation and servicing, and for best operational features. The anchor at the bottom of the tank provides a shock mount for the float. If the sender bar needs replacement, the new sender bar can be cut to the same length as the old so that no re-calibration is required.

The polyethylene float has good chemical resistance, good esthetic appearance, and high durability due to the "give" in the plastic. The light weight of the polyethylene allows the float size to be minimized while allowing it to float on the lowest density products.

The sender bar has no moving parts and is completely filled with potting material to enhance reliability. The use of a digital rather than analog sensing technique lowers power consumption to permit battery operation, and ensures high accuracy with no drift or degradation. To accommodate different tank sizes, the bar is simply cut to length with a hacksaw, and the cut end sealed with a cap to prevent moisture or product contamination. This way only one size needs to be stocked, and a perfect fit is ensured. The sender head is very low in profile to satisfy rollover requirements; the maximum height is less than 5 inches above the top of the tank so that it will not protrude above the spillway. The sender bar provides a high resolution of either 1/6" or 1/10".

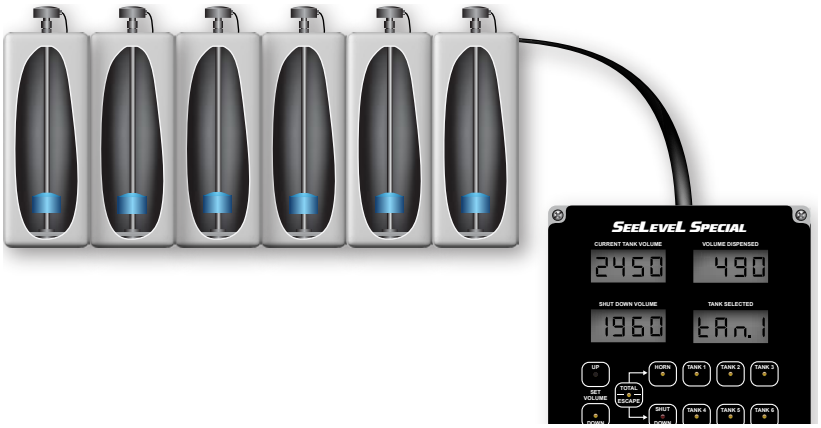
The single fiber optic cable connecting the sender head to the display can be disconnected at both ends. There is approximately 10 times as much light as is required for operation available for the fiber, so no special fiber end preparation is required. The fiber ensures that even with faulty wiring into the display, no explosion hazard can exist.

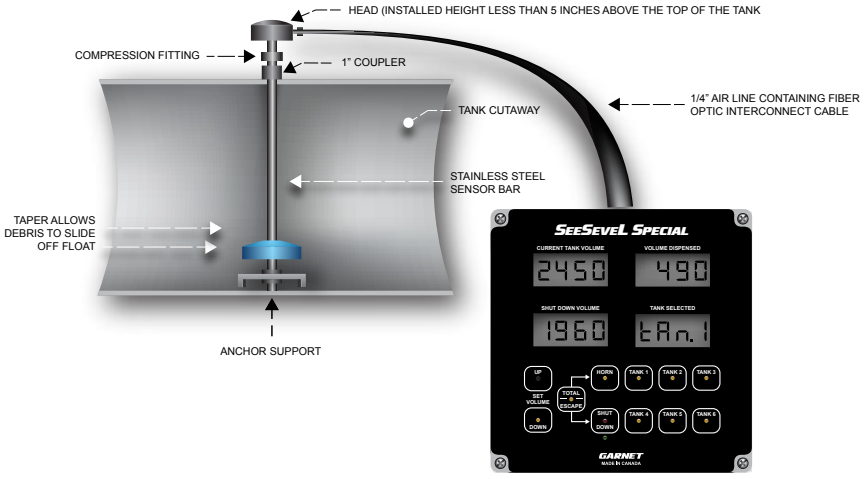
The small size of the display box also makes it easy to find an appropriate mounting location. The illuminated LCD ensures that the gauge display is always visible, regardless of ambient lighting conditions.

The use of an on-site programmer eliminates downtime waiting for factory calibration parts, and allows easy reprogramming should the need arise. The entire display, including decimal point, is completely programmable to whatever units are desired. In addition to numbers, the letters F, U, L, and E can be programmed to provide displays such as FULL, E, etc. The alarm can be programmed to turn either on or off to save terminals and wiring,

and uses a relay to increase current capability, and minimize gauge battery power drain. The user can set the dispense alarm with front panel buttons, so that no programmer is required when dispensing at a site.

GENERAL MECHANICAL ASSEMBLY





Display window description:

1. The upper left display shows the volume of product in the selected tank. The lower right display shows the tank number selected. When the 12 volt power is active, then the displays are illuminated for night viewing.
2. Normally, the upper right and lower left displays are blank. When dispensing, the upper right display shows the amount that has been dispensed, and the lower left shows the volume when the dispensing will be complete. During alarm events these two displays will show the alarm information.
3. During dispense volume programming, the displays are used for programming functions; see the alarm section for a full description of that.
4. The lower right display also shows the alarm bypass status, the leftmost decimal indicates a bypassed overfill warning alarm. The third decimal (xxx.x) indicates a bypassed overfill shutdown alarm. See the alarm section for full details.

Display scanning operation:

1. When not dispensing, the gauge continuously scans all of the tanks for alarm events and to keep the remote communication information up to date.
2. The **viewed tank** is the one that currently is showing its level on the upper left display. The tank number of the viewed tank is shown on the lower right display. To select the viewed tank, see the next section below.
3. A **scanned tank** is any of the other five tanks that are not being viewed. The gauge will select which of the six sender bars to receive in order to do the scan.
4. The scanning order always gives priority to the viewed tank, with the receiving of the scanned tanks occurring in between the receiving of the viewed tank. For example, if tank 2 is the viewed tank, the scanning will occur as follows: 2-1-2-3-2-4-2-5-2-6-2-1-2-3-2-4-2-5-2-6-2 and so on.
5. Since each sender bar sends out its data about every 700ms, it can take up to 10*700ms=7 seconds to complete a scan. However, since the bars are transmitting randomly, a typical scan will take less time than this. If the gauge starts to receive a sender bar when it is already part way through its transmission,

the gauge will recognize this and wait for another complete transmission before going to the next sender.

6. During dispensing, it is important for the gauge to focus on the viewed tank so that it can respond as quickly as possible when the dispensing amount has been reached. This is why scanning is not done during dispensing.

Select a tank to view:

1. The lower right display shows the tank number currently selected. To select another tank, press and hold the corresponding tank button until the display changes to the new tank number.
2. The tank buttons are illuminated by amber/orange LEDs for night visibility. The selected tank will have the LED brightly illuminated.
3. If the 12 volt power to the gauge is not active, then the LEDs will not work but the tank buttons and the tank volume information will still function.

Check the software version of the main processor:

1. Either unplug the fibre optic cable from the tank being viewed, or disconnect the ribbon cable between the display face and the base circuit board. The display must be showing "no L" in order to check the version.
2. Press and hold the UP and HORN buttons on the front of the display. The display will show "rX.XX code", where X.XX will be a number like 5.18, which is the software code version of the main processor.
3. Release the buttons to return to normal operation. Reconnect the fibre or ribbon cable.
4. See the section on Serial Interface Commands to find the software version of the remote communications processor.

How to connect and program the PTO input:

1. The PTO input senses the state of the truck PTO in order to know when loading or dispensing is occurring. Alarm operation is affected by PTO status, see the alarm section for full details.

2. The PTO status is normally detected by an air pressure switch connected to the PTO pneumatic control line. This switch may already be present on the truck for other purposes, such as an indicator light, or it may need to be installed as part of the gauge installation.
3. Normally the PTO switch will have one side connected to ground, and the other side connected to the PTO input on the gauge. If one side of the PTO switch is connected to 12 volts instead of ground, then an external load such as an indicator light must be used. See the appropriate wiring diagram for details.
4. There are two parameters that must be set in order for the PTO sensing to work properly, the PTO pull-up resistor and the PTO polarity.
5. The PTO pull-up resistor must be turned on if the air pressure switch has one side connected to ground and the other side is not connected to a light bulb or any other load. If there is a light to indicate PTO status from the switch, then the pull-up can be turned off. To set the pull-up, connect the 809DM Serial Port Tester to the connectors in the base of the gauge display and turn it on. Press the PULLUP PTO I/P button and then ENTER to check the current status of the pull-up. To change it, press the same button and then either 0 or 1 (as shown on the Tester screen) to configure the pull-up.
6. The PTO polarity must be set to match the type of switch used to detect the air pressure. If the switch has one side connected to ground and closes when the PTO is engaged, then the input will be grounded when the PTO is engaged (e=0). Conversely, if the switch opens during engagement, then the input will be grounded when the PTO is disengaged (e=1). If one side of the switch is connected to 12 volts, then this will reverse the polarity of the switch.
7. To check the polarity, connect the 809DM Serial Port Tester to the connectors in the base of the gauge display and turn it on. Verify that the PTO is either engaged or disengaged. Then press the PTO STATUS button on the Tester and then ENTER, the Tester screen will then show what the gauge thinks is the PTO status. If this is incorrect, then press the SHIFT and PTO I/P POLAR buttons at the same time on the Tester, then ENTER to show the current polarity setting. To change the setting, press the SHIFT and PTO I/P POLAR buttons again followed by either 0 or 1 as required. Then press ENTER to properly configure the polarity.
8. Verify that the gauge now is properly sensing the PTO polarity using the PTO STATUS button on the Tester.

Program the 809-DM gauge for the correct number of tanks:

1. The 809-DM is fixed at six tanks for the main processor software version 5.18 and above.
2. Previous versions were programmable for less than six tanks, but this feature was removed since all applications had six tanks. This simplified installation and programming, and reduced that possibility of errors.

CHAPTER 5 - ALARM OPERATION

There are are four alarm sources which operate three alarm outputs:

1. A dispense alarm which operates the dispense alarm output relay. This relay has normally open contacts that close when the alarm is active. The contacts can be wired to 12 volts or ground to activate a sounder, horn, light, or valve control. The contacts are rated at 20 amps.
2. A rising level alarm and an overfill warning alarm which share a warning alarm transistor output. This transistor output provides a connection to ground when either alarm is active. It can also be connected to a horn or light. The transistor is rated at 1 amp.
3. An overfill shutdown alarm which operates the overfill shutdown output relay. This relay has normally open contacts that break the circuit when the alarm is active. These contacts can be wired to 12 volts or ground to perform a shut down function. The contacts are rated at 20 amps.

The application of these outputs is up to the user, any one of them may be ignored or connected to external controls.

The dispense alarm is used to monitor how much product is being dispensed by the operator. The desired amount to be dispensed is entered into the gauge with the front panel buttons, and when the tank level drops to the point where that amount has been dispensed from the tank the dispense alarm will be triggered. This alerts the operator to stop dispensing at that point. The dispense alarm output relay is usually connected to a sounder and/or a light to provide audible and/or visual indication of the alarm. Operation of the dispense alarm is independent of PTO status.

To set the amount to dispense, press the UP and DOWN buttons at the same time. Within 1 second the displays will show "SEt ALAr", release the buttons and the top right display will change to 0 showing the amount to be dispensed, and the bottom left display will show the trip point, which will read the current level right now.

Use the UP button to increase the amount to be dispensed, shown on the top right display. The bottom left display will show the changing alarm trip point. If you go too far, use the DOWN button to reduce the dispense amount. Press and hold the UP or DOWN

button to go fast. When the desired dispensing amount is shown in the top right display, press the HORN button to store the value. The displays will show "ALAr Stor" while the button is pressed to show that the value has been stored. If no button is pressed for 1 minute the system will time out and exit and no values will be stored. If you want to quit without saving anything, press the TOTAL/ESCAPE button. If the amount to be dispensed is set to zero, the display will show "ALAr CLr" when the HORN button is pressed and the dispense alarm will be cleared.

To check the settings as the product is dispensing, press the TOTAL button, the bottom left display will show the remaining amount still to be dispensed, the top right shows the total amount that was originally set, and the top left shows the starting volume.

When the amount to be dispensed has been reached, the current tank volume will match the shut down volume, and the volume dispensed will show the amount that was originally programmed. Pressing the TOTAL button at this point will cause the lower left display to show "done". The dispense alarm will be tripped which lights the HORN LED and energizes the dispense output relay, activating the sounder or light connected to the relay. This indicates to the operator that the dispensing valve should be closed immediately. If dispensing is continued past this point, the alarm will continue to be active and the volume dispensed will continue to increase. The lower left display will continue to show "done" when the TOTAL button is pressed.

To deactivate the alarm when dispensing is complete, press the HORN button. This will turn off the dispense relay output and the HORN LED. The upper right display will show "done" while the HORN button is pressed. The displays will still show the volume dispensed and the shut down volume until a new dispense amount is programmed. Any dispense settings will be cleared when a different tank is selected.

The rising level alarm is used to alert the operator to improper tank loading or filling which causes a rise in level in a tank which is not being currently viewed. The gauge continually scans the level of all of the tanks whenever the system is not in dispensing mode. If the level of any tank not currently displayed rises by more than 30 increments (5 inches in 1/6" mode or 3 inches in 1/10" mode), then the rising level alarm is triggered. The rising level alarm does not function for the viewed tank.

When a tank is scanned, the minimum level measured is stored as the starting point for the rising level calculation. Every time a scan occurs (typically every few seconds) the measured level is

compared with the stored level. If the new level is lower than the stored amount, then the new level is stored as the starting point. If the new level is the same as the stored level, nothing further is done. If the new level is higher than the stored level, and if the scanned tank is one not being viewed, then the difference is calculated to see if it exceeds 30 increments.

When the level has risen more than 30 increments, the alarm is triggered. This turns on the HORN LED and activates the warning alarm output which sounds the warning horn or lights the warning light. The display will show the tank number in alarm in the upper right hand display (e.g. "tAn3") and "rISE" in the lower left display. If there are multiple alarms occurring, then the display will show each alarm indication in turn. When the PTO is disengaged, the display and HORN LED will show the alarm but the alarm output will be off. This prevents slosh from activating the warning horn during driving.

To acknowledge (bypass) the alarm, the tank that is alarming must be first selected as the viewed tank using the corresponding tank button. Then the HORN button must be pressed, this will deactivate the warning alarm output and reset the rising level alarm. While the HORN button is pressed the upper left display will show "bYPS". The level that is shown when bypassed will become the new starting point for subsequent rising level calculations. If multiple tanks are in alarm at the same time, they all must be bypassed before the alarm is deactivated.

The overfill warning alarm complements the rising level alarm. It shares the same output and only operates on the tank being viewed. The trip point of the alarm is set using the 817 Truck Gauge Programmer as A2, with the bypass reset point as A3. This alarm is normally used during tank filling to alert the operator that the tank is at the full point. It will also serve as a warning that the tank has been unintentionally filled.

When the tank level is below the trip point the alarm is off and the warning alarm output is not active. When the tank level rises so that it is equal to or above the trip point, the alarm is activated, which turns on the HORN LED and activates the warning alarm output. There is no additional indication on the display when the alarm is triggered. When the PTO is disengaged, the HORN LED will show the alarm but the alarm output will be off. This prevents slosh from activating the warning horn during driving.

To bypass the alarm, press the HORN button, this will turn off the HORN LED and the alarm output. While the HORN button is pressed the upper left display will show "bYPS". The left decimal

(t.An1) on the lower right display will turn on to indicate that there is a bypassed overfill warning alarm for that tank. The bypass is automatically removed when the tank level drops below the A3 set point, which is normally set near the minimum operating tank level. This automatic reset of the bypass ensures the alarm is active the next time the tank is filled. The bypass can also be manually removed by pressing the TOTAL and HORN buttons at the same time.

The overfill shutdown alarm is used as an emergency shutdown of the loading process to prevent tank overfilling and spills. The shutdown alarm works on all tanks, whether viewed or scanned. The trip point of the alarm is set using the 817 Truck Gauge Programmer as A1, with the bypass reset point as A3. The shutdown point is always above the warning point. This alarm is a backup used during tank filling to shut down the loading process if the operator is unable to shut off loading. In addition, if a fault occurs which fills any of the tanks to a dangerously high level, the alarm will provide an emergency shutdown. The shutdown is normally used to turn off the truck engine or loading pump.

When the tank level is below the trip point the alarm is off and the shutdown alarm output allows the truck engine or loading pump to operate. The green LED below SHUT DOWN button will be on. When the tank level rises so that it is equal to or above the trip point, the alarm is activated, which turns off the green LED, turns on the red SHUT DOWN LED and turns off the truck engine or loading pump. The upper right display shows the tank number that is in shutdown alarm (whether the viewed tank or a scanned tank) and the lower left display shows "FULL". If there are multiple tanks in either shutdown or rising level alarm, then the display will show each alarm indication in turn. When the PTO is disengaged, the display will show the alarm but the green LED will be on and the alarm output will continue to allow engine or pump operation. This prevents slosh from shutting down the engine during driving.

Only the viewed tank can be bypassed. Consequently, a scanned tank in alarm must be selected as the viewed tank using the corresponding tank button. To bypass, press the SHUT DOWN button, this will turn off the SHUT DOWN LED, turn on the green LED, and allow the engine or pump to be restarted. While the SHUT DOWN button is pressed the upper left display will show "bYPS". The right decimal (tAn.1) on the lower right display will turn on to indicate that there is a bypassed overfill shutdown alarm for that tank. If both the warning and shutdown alarms are bypassed then both decimals will be on (t.An.1). The bypass is automatically removed when the tank level drops below the A3 set point, which is normally set near the minimum operating tank

level. This automatic reset of the bypass ensures the alarm is active the next time the tank is filled. The bypass can also be manually removed by pressing the TOTAL and SHUT DOWN buttons at the same time. If multiple tanks are in alarm, they all must be bypassed before the alarm is turned off.

To program the overfill warning and shutdown alarm points:

1. Using the 817 programmer, set alarm 1 for the overfill shutdown point, alarm 2 for the overfill warning point, and alarm 3 for the bypass removal (minimum tank level) point. Alarm 1 must be higher than alarm 2, and alarm 2 must be higher than alarm 3.
2. All three of the alarms must be programmed as shutdown.
3. A3 should be set a few inches above the normal minimum tank operating level. This way tank sloshing will not inadvertently remove the bypasses and activate an alarm, and yet ensure that the bypasses are removed prior to filling during normal tank operation.

CHAPTER 6 - CALIBRATION PROGRAMMING INSTRUCTIONS

The 809-DM must have the volume calibration programmed into it for each of the tanks. The 817 Truck Gauge Programmer is used to program calibrations and to set offsets. When the programming plug is connected to the gauge, the gauge display will show "prog" within a couple of seconds. Do not start programming the gauge until "prog" is shown. After the plug has been removed, the gauge display will show "donE" for a moment. The tank number to be programmed must be selected before plugging in the programmer, and the programmer must be unplugged before the next tank can be selected.

Program the 809-DM gauge display into inches:

1. Turn on the programmer.
2. Make sure the inch mode is correct.
3. Select a memory location with **MEM LOC**.
4. Press the **INCH MEM (SHIFT – 1)** button to put inches into the memory. If the inches are already in memory from a previous calibration, it is not necessary to do it again, but make sure that they are the correct inches (1/6 or 1/10).
5. Select the tank number to be programmed using the tank buttons on the front panel. Each tank needs to be programmed individually.
6. Make sure that the fibers from the sender bars are connected to the opto connectors on the base PCB, and that the ribbon cable is connected between the display face and the base PCB. Plug the programmer plug into the display face, the display should show "prog" and the tank number being programmed.
7. Press the **BAR** button. The INCHES display on the programmer should show some inch reading, if it shows "no L" or "bad L' check the fiber connection and the bar mode (1/6 or 1/10 inch). NOTE: The black fiber optic cable connector MUST be shaded from direct sunlight. See the 817 User Manual for further information.
8. Measure the distance from the bottom of the tank to the middle of the float, this is the bottom reading. Use the **OFFSET** buttons on the programmer to obtain this reading on the CALIBRATION display. **NOTE**: The calibration offset is carried over when memory locations are changed.
9. Press the **PROG** button to transfer the calibration to the gauge.

10. When the operation is complete, unplug the programmer from the gauge and verify gauge operation.
11. To program the next tank, repeat steps 5 to 10. Note that the programmer plug must be disconnected to select a tank, the tank buttons will not respond when the programmer is plugged in.

Copy one 809-DM gauge display to another (can also copy from an 808P2 or 810PS/810PS2):

1. Turn on the programmer.
2. Make sure the inch mode is correct.
3. Select a memory location with **MEM LOC**.
4. Select the tank to be copied to or from using the tank buttons on the front panel.
5. Plug the programmer plug into the gauge display to be copied from. Press the **COPY** button to copy the gauge calibration into memory.
6. When the operation is complete, unplug the programmer plug from the first gauge and plug it into the gauge display to be copied to. Press the **PROG** button to transfer the calibration to the second gauge.
7. When the operation is complete, unplug the programmer from the gauge and verify gauge operation.
8. To program the next tank, repeat steps 4 to 7. Note that the programmer plug must be disconnected to select a tank, the tank buttons will not respond when the programmer is plugged in.

Program a 809-DM gauge display from a table of calibration values:

1. Obtain a table of inches versus volume
2. Turn on the programmer.
3. Make sure the inch mode is correct.
4. Select a memory location with **MEM LOC**.
5. Press the **CLEAR MEM** button to erase any previous calibration.
6. Starting at the 0 inch value of volume calibration, use the **0 to decimal, E, F, L, U,** or **BL** buttons on the keypad to enter the calibration. Press the **ENTER** button to store the value in memory. When **ENTER** is pressed, the inches will go to

the next value. If you make a mistake, use the **BACK** button to erase the entry, or if **ENTER** has already been pressed, use **INCHES** ↓ to go back to that inch value and re-enter the correct value. If more than 4 numbers are entered the previous ones will scroll off the left of the display. If **ENTER** is pressed before any numbers, nothing will happen.

7. After the table has been entered, use the **INCHES** buttons to review the table to make sure it is correct. If a calibration value is incorrect, simply re-enter it and press **ENTER**.
8. Continue with the same procedure as in Program the 809-DM gauge display into inches from step 5. When setting the bottom reading, use the calibration table to look up the volume corresponding to the distance to the middle of the float. Use the **OFFSET** buttons to obtain this reading on the CALIBRATION display.

Program a 809-DM gauge display from a table stored in memory:

1. Turn on the programmer.
2. Make sure the inch mode is correct.
3. Select the desired memory location with **MEM LOC**.
4. After the table has been entered, use the **INCHES** buttons to review the table to make sure it is correct. If a calibration value is incorrect, simply re-enter it and press **ENTER**.
5. Continue with the same procedure as in Program the 809-DM gauge display into inches from step 5. When setting the bottom reading, use the calibration table to look up the volume corresponding to the distance to the middle of the float. Use the **OFFSET** buttons to obtain this reading on the CALIBRATION display.

CHAPTER 7 - SERIAL INTERFACE COMMANDS

The following section describes the defined 809-DM serial commands. The serial data requests are ASCII data strings. Throughout this section <CR> represents a single carriage return character (hexadecimal 0x0D). In this section Red text represents serial data being received by the 809-DM. Blue text represents serial data being transmitted from the 809-DM. Either uppercase or lowercase characters can be used, the response will be in the case that is used to make the request.

To communicate with the gauge for testing purposes, the 809DM Serial Port Tester can be used. It has all of the serial commands preprogrammed for easy reference. Press the corresponding button (or SHIFT and the button at the same time) followed by ENTER to query the current setting of any of the parameters. Press the button followed by the number sequence as indicated on the Tester screen, followed by ENTER to set any of the parameters. The Tester will interpret the gauge response with English phrases to make it easy to know what the settings are.

PTO change
During normal operations, a change of PTO status causes the 809-DM to send out a comma separated list of values corresponding to the PTO status followed by the number of channels being monitored. The transmit is done after a programmable delay.

p,E,11.16,79.00, 0.00, 0.00, 0.00, 0.00<CR>

The next example shows the PTO disengaged and only two channels being monitored.

p,D,11.16,79.00<CR>

The next example shows the PTO engaged and all six compartments having invalid data.

p,E,NOSIG,NOSIG,NOSIG,NOSIG,NOSIG,NOSIG<CR>

The level reading will always be five characters including the decimal place. If no decimal place is present a space character will pad the least significant byte. NOSIG shows no valid level data. ERROR shows level data error.

Set PTO configuration
There are four items to configure:

1. Resistor pullup on or off.
2. PTO engagement polarity high or low.

3. Transmit delay upon PTO disengagement.
4. Transmit delay upon PTO engagement.

'u=1' turns the PTO pullup on, 'u=0" turns the PTO pullup off.

u=1<CR>	u=0<CR>
u,1<CR>	u,0<CR>

'e=1' means the PTO is engaged when the signal is high (+12V), 'e=0' means the PTO is engaged when the signal is low (ground).

e=1<CR>	e=0<CR>
e,1<CR>	e,0<CR>

'w=0' to 'w=99' sets the delay in seconds after the PTO has disengaged before the level is read and transmitted. Numbers larger than 99 will be ignored. This gives time for the liquid agitation due to loading to settle. During this delay new gauge values will be continue to be read. Once the delay expires, new gauge values will be ignored.

w=0<CR>	w=60<CR>
w,0<CR>	w,60<CR>

'x=0' to 'x=99' sets the delay in seconds after the PTO has engaged before the level is read and transmitted. Numbers larger than 99 will be ignored. This gives time for the liquid agitation due to the trucking moving to settle. If the delay is set to 0, then the stored values obtained when the PTO was disengaged will be transmitted, since there will not have been any time to read the new values from the gauges.

x=0<CR>	x=60<CR>
x,0<CR>	x,60<CR>

Request PTO configuration
'u' requests the PTO configuration for the pullup.

Pullup turned on	Pullup turned off
u<CR>	u<CR>
u,1<CR>	u,0<CR>

'e' requests the PTO configuration for the engagement polarity.

Engaged when high	Engaged when low
e<CR>	e<CR>
e,1<CR>	e,0<CR>

'w' requests the delay in seconds after the PTO has disengaged before the level is read and transmitted.

w<CR>	w<CR>
w,0<CR>	w,60<CR>

'x' requests the delay in seconds after the PTO has engaged before the level is read and transmitted.

x<CR>	x<CR>
x,0<CR>	x,10<CR>

PTO status request

'p' requests the PTO status from the 809-DM where 'E' is PTO engaged and 'D' is PTO disengaged.

Engaged	Disengaged
p<CR>	p<CR>
p,E<CR>	p,D<CR>

Scan all compartments

's' request a scan of all configured compartments, including the remote inputs if enabled. The 809-DM sends out a comma separated list of values corresponding to the PTO status followed by the number of channels being monitored.

s<CR>
s,D,11.16,79.00, 0.00, 0.00, 0.00, 0.00<CR>

s<CR>
s,E,11.16,79.00<CR>

Scan a specific compartment

's1' to 's6' request a scan of a specific compartment. The 809-DM sends out a value corresponding to the requested compartment. 's7' to 's9' transmits the remote tank levels.

s1<CR>	s2<CR>	s3<CR>
s1,11.16<CR>	s2,79.00<CR>	s3, 0.00<CR>
s4<CR>	s5<CR>	s6<CR>
s4, 0.00<CR>	s5, 0.00<CR>	s6, 0.00<CR>

Request Number of Channels

'c' reads the number of channels being monitored and displayed on the LCD screen. This normally corresponds to the number of connected SEELEVEL™ gauges (see above).

c<CR>	c<CR>
c,1<CR>	c,6<CR>

Set Viewing/Working Tank and Dispensing Amount

The 809-DM can be remotely programmed to dispense set amounts out of specific tanks. The format is as follows: f=tank number: number of units to dispense alarm, number of units must be 3 digits. Number of units is number of gauge increments (eg 1/3" or 1/6").

f=3:006<CR>
f,3:006<CR>

This example would set the display to tank 3, and set the dispense alarm set point to 6 increments. With a 1/6" increment, the dispense alarm would activate after a change of 1".

Any error in formatting or number of compartments returns f,?
Setting the dispense units to zero clears the dispense alarm.

Set Update Interval (0=no automatic updates)

The 809-DM can be configured to automatically send updates on a timed interval. The update interval is specified in seconds, the value must be between 0 and 99,999 seconds. Values larger than 99,999 will be ignored. Within approximately one second of setting the interval, the first interval transmission will be done.

i=60<CR>	i=7200<CR>
i,60<CR>	i,7200<CR>

By setting the update interval to 0, automatic updates are turned off.

i=0<CR>
i,0<CR>

Set Transmit Interval Options

The 809-DM can be configured to send or not send interval updates during the time that the PTO is disengaged. Updates are always sent during the time that the PTO is engaged.

Do send	Do not send
o=1<CR>	o=0<CR>
o,1<CR>	o,0<CR>

Request Transmit Interval Options

Do send	Do not send
o<CR>	o<CR>
o,1<CR>	o,0<CR>

Interval Update

When an auto update interval has been defined, the 809-DM sends out a comma separated list of values corresponding to the PTO status followed by the number of channels being monitored on the defined interval, followed by the time and date. The interval is specified in seconds.

i,E,11.16,79.00, 0.00, 0.00, 0.00, 0.00,12:48:16A Mar 23 2008<CR>

Dispensing Status Request

'b' requests the 809-DM dispensing status.

Dispensing	Not dispensing
b<CR>	b<CR>
b,1<CR>	b,0<CR>

Set number of Remote Tanks
'h=' sets the number of remote inputs to be scanned. 'h=0' is no water tank scanning, 'h=1' one remote tank, 'h=2' two remotes, 'h=3' three remotes.
One water tank input being scanned

h=1<CR>
h,1<CR>

Request Alarm Status
'a' requests the current alarm status. The reply is 'a,A4-A3-A2-A1' where '0' means that an alarm is open, and '1' means an alarm is closed. 'Invalid' is sent if any compartment is in error.

a<CR>
a,0-0-1-1<CR>

Request Time
't' requests the current time and date.

t<CR>
t,12:48:16AM Mar 23 2008<CR>

Set Time
't=' set the time. The format is hour, minute, second, A or P, each represented by 2 digits and separated by a colon. The hour may or may not have the leading zero, but the minutes and seconds must have the leading zero.

t=04:46:09P<CR>
t, 4:46:09P Mar 04 2008<CR>

t=12:06:09A<CR>
t, 12:06:09A Mar 04 2008<CR>

Set Date
'd=' set the date. The format is month, date, year, each represented by 2 digits and separated by a colon. The month may or may not have the leading zero, but the date and year must have the leading zero.

d=03:04:08<CR>
t,12:48:16A Mar 4 2008<CR>

d=3:04:08<CR>
t,12:48:16A Mar 4 2008<CR>

Version Request
'v' requests the current 809-DM software version.

v<CR>
v,SeeLeveL 809DM,HW E,SW 5.18<CR>

Newer versions of gauge software may report more information.

CHAPTER 8 - SENDER BAR OPTIONS

The sender bar for an 809-DM can be either a 1/6" resolution bar or a 1/10" resolution bar. The 1/6" bar is identified by an "810X" in the serial number, for example 810X-99999. It must be paired with the appropriate 1/3-1/6" float. The 1/10" bar is identified by an "810HX" in the serial number, for example 810HX-99999. It must be paired with the appropriate 1/10" float. Either sender bar sends out the same 11 bit data format so there is no change required at the display other than programming in the correct volume calibration to match the resolution of the bar.

CAUTION: If the bar is being used with a display other than an 808PS2, 809-DM, OR 810PS2, contact your dealer or Garnet Instruments before attempting to operate the bar in 1/6" mode with the different display.

CHAPTER 9 - SENDER BAR LIMITS OF RESISTIVITY

The temperature of the product being transported should be limited to approximately +90°C (+194°F). Damage to the float and sender bar can occur if this value is exceeded.

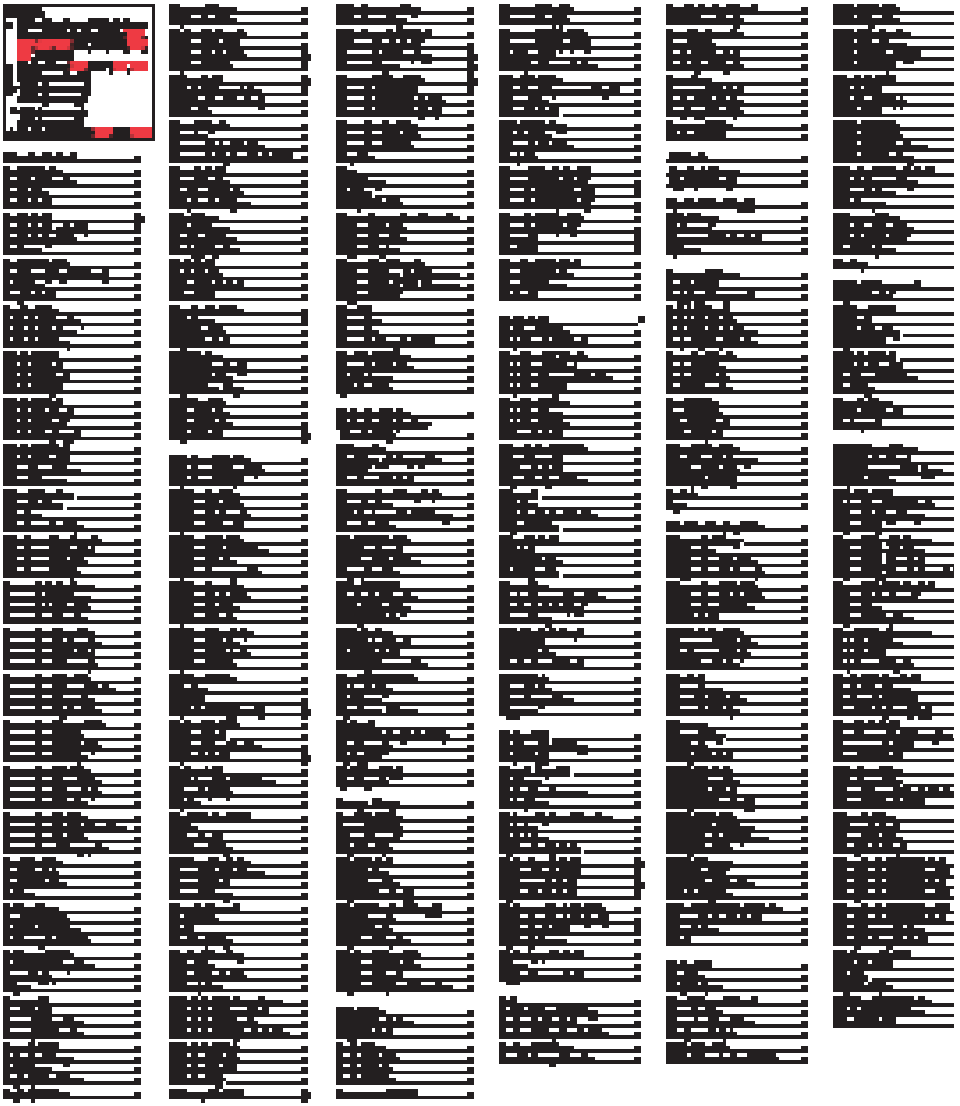
The tube used in the manufacturing of the sender bar is seamless 316 stainless steel. **It should be noted that certain corrosive products, as well as high concentrations of acid products, may attack the stainless steel and cause perforations to develop. It is the operator's responsibility to determine the products compatibility with the sender bar.**

WARNING: Perforation of the sender bar or heat damage is not warrantable.

The Loctite products used to secure the end cap can be attacked by certain chemicals as well. For reference, a chemical resistance chart from Loctite showing product compatibility with various chemicals can be found on the following pages.

The 680 retaining compound we specify is similar to Loctite #592, 567, 565, 569, 545, 580, 571, 242, 577, 572, 542, 565, 545, 243. If you require more information, please call the Loctite Corporation, in Canada, 1-800-263-5043, in USA, 1-800-562-8483.

FLUID COMPATIBILITY CHART



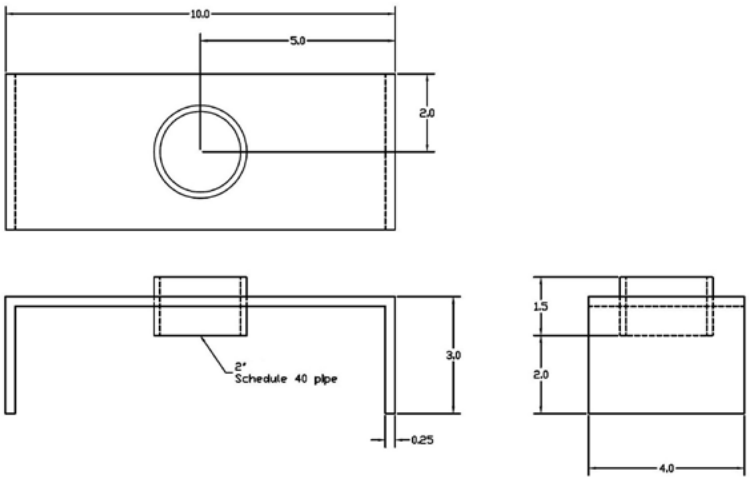
FLUID COMPATIBILITY CHART

LIQUIDS, SOLUTIONS & SUSPENSIONS

GASES

1. Pick a spot in the tank for the sender bar to be mounted. It should be as close to the middle of the tank as possible. Allow room for the head at the top of the sender bar. Make sure that the float will not contact any baffles or other obstructions in the tank. It is preferable if the float can be accessed from the hatch, to make any future service work easier. For this reason do not mount the float behind a baffle where it can't be reached from the hatch.
2. Drill or cut a hole in the top of the tank to mount a 1 inch NPT coupler (not provided). Weld the top coupler in place.
3. Slide the compression fitting over the sender bar, threads facing down, and insert the bar through the coupler and align it vertically in the tank. Determine how much length needs to be cut off the bottom of the bar. At a minimum the bar should be mounted 1 inch off the bottom of the tank to allow for tank expansion and contraction. For tanks greater than 75 inches in height, increase the gap to 1.5 inches. Cut the bar with a hack saw and trim the exposed circuit board with a sharp knife. **Do not use a disk type cutoff saw since the heat generated will short circuit the internal circuit board.**
4. Ensure that the compression fitting is on the bar and clean the end of the bar and the inside of the end cap with Loctite 7070 Cleaner. Spray Loctite T7471 Primer onto both the end of the bar and the inside of the end cap. Allow the primer to dry for a few minutes. Apply a bead of Loctite 680 Retaining Compound around the bottom of the tube and around the top of the end cap. Place the cap onto the end of the tube with a twisting motion so that the retaining compound is smeared completely on the portion of the bar where the end cap is. To remove entrapped air, place the end on the floor and rock the bar until excess air has escaped. Keep the end cap in position by gently clamping the bar in a vise with the end against a solid object. Avoid setting the end cap against a cold floor, as this will slow the curing process. The curing time should be about an hour at room temperature. **The Loctite must be set before the tank is put into service. Bar failure due to a leaking end cap is NOT covered by warranty.** Note that a kit with all the required Loctite products is available from Garnet. For further details on the Loctite products see the Loctite Compatibility Chart located in Support Documents on our website, www. garnetinstruments.com.

5. Make up an anchor by cutting a 4" X 16" piece of 1/4" thick material. Bend each end down at 90 degrees (see the diagram below), so the resulting flat piece is about 4" X 10" inches with 3" sides. Drill a hole to insert a 2"ID schedule 40 pipe in the center of the plate, weld tube to plate. Insert the bar into the tank and slide the anchor assembly over the sensor bar with the "U" facing down. Align the sensor bar vertically and weld the anchor in place to the bottom of the tank. Pull the sensor bar up a bit and slide the float (cone side up) over the bar. Lower the bar back into the anchor.



6. Tighten the base of the compression fitting into the coupler. Lift the bar 1" off the bottom of the tank, and tighten down the compression fitting nut. Raise and lower the float a few inches to set the bottom reading.
7. Pick a spot for the display. Make sure that the display is visible during normal operation of dispensing from the tanks and filling of the tanks. Make up a bracket to hold the box in position and mount the box, but leave the front panel off. The front panel is held on by the four small Phillips screws in the corners.
8. Route 1/4" Nylon air brake hose (Synflex) from each sender head to the display and fasten with a brass insert and compression fitting at the head end. Drill holes in the side of the box (make sure the front panel is out) for the fiber and the wiring. At the lowest point in the air line insert a T fitting with approximately two feet of Synflex hanging down to provide a drain for any water than may get into the system. Locate

the end of the Synflex near to the display box and feed the fiber optic cable through the hose, leaving about 12 inches extra at the head end. Route the fiber into the box through the hole that was drilled.

9. Cut the fiber ends square with a sharp knife and insert the fiber into the connectors at each end and tighten the connector lock nuts. Make sure that the fiber is loosely coiled inside the enclosure and is not pulled tight or bent sharp. The display should change from reading "no L" to some inch value as soon as the fiber is connected. If not, check that the fiber ends are clean and cut square, and that the fiber is fully inserted into the connectors at each end.
10. Inspect the head cap for casting flash, lightly sand or scrape off any casting protrusions. Make sure that there is grease on the rubber O-ring and snap on the head cap.
11. At the display, connect the wiring according to the following table. It is only necessary to connect the wires that are required for the application. The +12V power and ground wires must be connected for the gauge to function. All other wires are either optional or are for optional accessories.

Wire Color (6 pin pigtail)	**Function**
GREEN/YELLOW	Dispense Alarm Common
WHITE	Dispense Alarm Normally Open
GREY	Overfill shutdown Alarm Common
YELLOW	Overfill shutdown Alarm Normally Open
ORANGE	Auxiliary Alarm (for future use)
BLUE	Overfill warning Alarm

Wire Color (9 pin pigtail)	Function
RED	+12V power input (required)
BLACK	Ground (required)
BLACK	Ground (additional if needed)
YELLOW/WHITE	Serial Port Receive
PURPLE/WHITE	Serial Port Transmit
PURPLE	PTO Input (required for serial data transmission and alarm operation)
BROWN	Remote Input 1
GREEN/WHITE	Remote Input 2
GREY/WHITE	Remote Input 3

12. Contact Garnet for wiring diagrams and external connection information. To program the alarms see the alarm programming section.
13. Program the gauge as directed in the programming section. To determine the bottom reading of the gauge, measure from the bottom of the tank to the middle of the straight vertical part of the float when the float is resting on the anchor. Do NOT set the gauge to read "0" at the bottom since this will not result in a correct reading when the float is actually floating on the product. In addition, if the gauge ever goes below "0" due to tank expansion, it will read some nonsensical value since this region has not been programmed.
14. Fasten on the front panel with the four Phillips screws in the corners. Do not over tighten the screws, the front panel may crack. Verify the correct orientation of the front panel to ensure the gasket is correctly seated.
15. Verify gauge operation by lifting each float. Record the unit number, calibration units, minimum and maximum readout values, and any alarm points programmed in the IMPORTANT OPERATOR INFORMATION area on the front page of the owner's manual. **The truck operator must be given the owner's manual upon delivery with all front page data filled in.**

CHAPTER 11 - TROUBLESHOOTING GUIDE

There are only 4 serviceable components in the gauge: the float, the sender bar, the interconnecting fiber optic cable, and the display.

If the float is sunk, the display will read the bottom tank reading all the time. If the float is partially sunk, the reading may rise and then fall as the tank is filled. If the float has lost its magnets, the reading on the display will stay the same as the fluid level changes, or the reading may appear to stick at one value then suddenly jump to a much different value.

If the fiber is damaged or the sender bar is dead, the display will read "no L" on the display. If the light level is poor due to a damaged or excessively bent fiber, or if the fiber is not fully inserted, or if the display is not programmed for the same resolution as the sender, the display will show "bL:xx", where xx is the number of bits being received. If the fiber optic cable is disconnected from the display, a flashing red light should be visible from the end of the fiber.

If the display reads erratically, check for water inside the head or display, and for a poor end cap seal. If no problem can be seen, the display will require factory servicing.

In addition to the diagnostic tools built into the 817 programmer, there are two testers available from Garnet to assist in troubleshooting and testing. The 899 Multi Bar Simulator has 6 optical outputs to simulate all 6 bars at once. The simulated levels from each bar can be adjusted independently to test display and alarm operation. The 809DM Serial Port Tester is able to communicate via the serial port to test serial operation and to program various parameters in the gauge. In addition, it has alarm indicators and PTO switches to allow observation and testing of all alarm functions. Between these two testers every aspect of the 809DM display can be tested.

To test the sender bar:

1. If the sender is flashing, plug a piece of fiber into the sender optical connector and the other end of the fiber into the black OPTO input connector on the 817 programmer. The display shows the number of bits the bar is sending and the optical power. If the optical power is poor (less than 70), then check the fiber, if it is good and fully inserted then the bar output is bad and the bar must be replaced. Ensure that the number of

bits is correct (1/6" and 1/10" is 11 bits). If the number of bits is not 11 then the bar is bad and must be replaced.

2. Make sure the programmer inch mode is correct to match the bar. Now press the BAR TST button to put the programmer into the bar test mode. The INCHES display will now show what the bar is putting out. Slowly run a float up the bar while watching the INCHES display to verify bar operation. If the bar does not operate correctly then it must be replaced. To return the programmer to normal operation press the BACK button.

Note: If the programmer is being used to test a bar outside in bright sunlight, the sunlight may penetrate right through the black optical input connector and overwhelm the optical input. If this happens the programmer will appear to not respond to pressing the **BAR** or **BAR TST** button. It will be necessary to shade the connector with your hand to ensure proper operation.

To test the display:

1. Make sure the programmer inch mode is correct to match the display. Plug a piece of fiber from the grey **OPTO** output connector of the 817 programmer to the optical connector on the display. If the display shows "no L" then it is bad and must be replaced (make sure the end of the fiber going into the display is flashing!).
2. If the display shows some strange reading when the fiber is plugged in, it may need reprogramming. Copy the existing programming into an unused memory on the 817 (just in case) and then program the display in inches or a known good program. The display should show "prog" within a couple of seconds of plugging in the 817 plug, if not it is bad. After the 817 plug is removed the display should match the reading on the 817 calibration display, if it does not then the display is bad.

Troubleshooting block diagrams are available on our website, www.garnetinstruments.com

CHAPTER 12 - SERVICE & WARRANTY INFORMATION

The warranty will only apply if the warranty has been registered online from the Garnet Instruments registration web page.

Go online to seelevelsupport.com/ and select "Register Warranty".

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 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, 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 Granbury Road
Granbury, TX 76049
USA
email: infous@garnetinstruments.com