



SEELEVEL™ PROSERIES

Gauge For Trucks

MODEL 810PS2 OWNERS MANUAL

REVISION 2

IMPORTANT OPERATOR INFORMATION

DATE INSTALLED: _____

UNIT NUMBER: _____

COMPARTMENT: _____

DISPLAY CALIBRATION UNITS (e.g. inches, m³): _____

MINIMUM TANK READOUT: _____

MAXIMUM TANK READOUT: _____

ALARM #1 POINT (IF APPLICABLE): _____

ALARM #2 POINT (IF APPLICABLE): _____

ALARM #3 POINT (IF APPLICABLE): _____

ALARM #4 POINT (IF APPLICABLE): _____

AUTOMATIC ALARM: WARNING LEVEL: _____

EMPTY LEVEL: _____

 **GARNET INSTRUMENTS LTD.**

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CHAPTER 1 OVERVIEW

Congratulations on purchasing the Garnet Instruments Model 810PS2 SeeLevel™ Gauge for Trucks. The 810PS2 represents the latest in state of the art liquid level measurement equipment for transport applications. The 810PS2 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 810PS2 has been designed to withstand the vibration and shock encountered in mobile applications. The components are weatherproof and can withstand blows from flying rocks, eliminating the need for protective enclosures. The sender bar in the tank can withstand steaming temperatures. The gauge operates entirely on internal batteries, so 12 volt truck power is not required (external alarms will require truck power).

The 810PS2 can display in any units, such as inches of level or cubic metres of volume. It has four alarm points which can be used to warn of impending overfills or to shut down loading of the truck in an overfill situation, and has an automatic, self resetting alarm point to operate a high level warning horn or light.

The 916 Total Programmer is used to program the 810PS2 to read the desired calibration units, and to set the alarm points. It is designed to be easily operated by people unfamiliar with electronics or computers.

CHAPTER 2 NEW FEATURES OF THE 810PS2

The 810PS2 has a number of enhancements over the previous 810PS series. It uses new technology in the display to provide a number of new features:

- 1) The calibration memory has been changed to a flash memory device which is much more secure and does not require power to maintain the memory contents. This should result in a much more reliable operation, with less chance of a lost or corrupted calibration.
- 2) The display can be programmed with a magnet for 8 or 11 bit operation, to work with bars in either 1/3, 1/4, or 1/6 inch mode. If a sender bar ends up in the wrong mode, then the display will show bad light and the number of bits received. The previous displays would either not accept bars in 11 bit (1/6 inch) mode or could not tell the difference between 8 bit and 11 bit modes. The mode is stored in the display in the same secure memory as the calibration.
- 3) The display has improved diagnostics:
 - a) If the wrong number of bits are received, then the display shows "bL:xx" where xx is the number of bits actually received.
 - b) If the batteries are getting low, the display will flash "batt" every few seconds.
 - c) By connecting together two end pins on the right hand side of the programming plug (looking at the back of the display), the display will show a basic inch calibration, which aids in troubleshooting to determine if the sender bar or display calibration is at fault.
 - d) If there is a fault during programming or if the memory is not functioning correctly, the display shows "Err".
 - e) If the memory does not have a valid value for the number of received bits (either 8 or 11) then the display shows "Prob".
 - f) If the display has no fibre connected and is exposed to strong light the display will show "Sun" indicating that sunlight is affecting the display. If a flickering light gets into the display opto then the display may show either "Sun" or "bL:xx" depending on the exact nature of the light getting in.
- 4) The optical receiver has been improved so it cannot be overloaded with too much light from the sender bar.
- 5) The display is powered entirely by four "AA" penlight alkaline cells instead of a combination of a lithium battery and AA cells. This allows the end user to be able to fully service any battery problems.

- 6) The fibre optic connector is field replaceable, so if it is broken or fails, the display can be quickly returned to service.
- 7) The display has a built in Spill Stop transmitter, so an additional Spill Stop module is no longer required when connecting the gauge to an 815 Spill Stop controller.
- 8) The display has the ability to drive a remote transmitter for applications which require the transfer of the data from the gauge to another piece of equipment.

CHAPTER 3

GAUGE DESCRIPTION

The 810PS2 gauge consists of a sender bar, a donut shaped float, a fibre optic interconnect cable, and a display. The 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 fibre optic cable to the display, which displays the level in appropriate units and operates the alarms, Spill Stop transmitter, and remote data transmitter.

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 fibre optic cable to the display, the fibre 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 916 Total Programmer. The calibration can be in inches, centimetres or volumetric units such as cubic metres or barrels. The entire display is enclosed in a cast aluminum box with a hinged cover, which is durable enough to be mounted on the truck or trailer without any additional protection. The hinged cover keeps the display face clean and operates an internal switch for LED control and alarm resetting. The tank level is shown on two displays - an LCD (Liquid Crystal Display) which takes very little power to operate and gives excellent daytime visibility, and an LED (Light Emitting Diode) display which has higher power consumption but gives excellent night time visibility. To reduce power drain the display only turns on the LED when the cover is open and when there is not enough light to see the LCD display. The entire display is powered by four replaceable alkaline AA cells giving about 1½ to 2 years of life under normal operation (assuming that the LEDs are on for about 2 hours per day).

The display contains four alarms which are programmed using the 916 Programmer. They can be set to turn on or off at any point in the tank. The alarm outputs are transistors which can handle up to 1 amp of DC current at 24 volts. The transistors are wired to complete a circuit to ground, so only one wire is needed to connect to each alarm.

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 external switches to disarm them.

Alarm 4 also has an extra transistor output on the purple wire. With this purple wire connected to a warning horn, alarm 4 functions as a self resetting high level warning alarm. Alarm 4 is programmed as the warning point, and alarm 3 is programmed near the tank empty point. When the product level rises in the tank and hits the warning point, the horn will sound. Closing and opening the lid of the display will silence the horn. When the tank is unloaded below the empty point, the alarm is reset so that it will sound again when the tank is filled to the warning point. This way the operator cannot forget to turn on the horn. The horn will sound at the warning point even if the lid is opened and closed prior to the product level hitting the warning point, and will sound with the lid in either the open or closed position when the warning point is reached.

The display has a Spill Stop transmitter for direct connection to a Garnet 815 SpillStop or 815U SpillStop Ultra controller. The transmitter operates in accordance with the programmed alarm points 1, 2, and 3. This provides the user with automated horn warnings and automated control of PTO loading to prevent product spills due to inadvertent overfilling of the tank.

Installation of the gauge consists of cutting a hole in the top of the tank and welding in a 1 inch coupler, and welding an anchor assembly to the bottom of the tank. The sender bar is cut to length, the end is sealed, and it is inserted from the top of the tank and fastened at the top with a compression fitting. The display is mounted at a convenient point on the truck frame or panel, and Synflex air brake hose is connected from the sender head to the display to house the fibre optic cable. The cable is connected at each end, and the gauge is programmed. Fastening on the covers for the head and display completes the installation. The bar can be removed later for service by disconnecting the fibre, unscrewing the compression fitting, and pulling it out.

CHAPTER 4

UNIQUE FEATURES

The 810PS2 gauge has been designed for maximum ease of installation and servicing, and for best operational features. The anchor at the bottom of the tank has a funnel portion to facilitate easy sender bar reinsertion, provides a shock mount for the float, and holds the float in place while the bar is removed so no tank entry is required for sender bar replacement. If the new sender bar is cut to the same length as the old, no re-calibration is required.

The float is molded from polyethylene for high 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 bar is programmed for 1/3" or 1/6" resolution by holding an ordinary magnet (included with the operators manual) under the head for a specific period of time, this can be done in the field if necessary. The resolution information is stored in three separate memories for security, but if for some reason this information is lost, the sender bar automatically defaults to 1/3".

The single fibre 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 fibre, so no special fibre end preparation is required. The fibre ensures that even with faulty wiring into the display, no explosion hazard can exist.

The display enclosure was designed to eliminate the need for an external enclosure, thus saving cost and room. The hinged cover has a magnetic latch which will not jam, and the hinge is very simple with plastic and stainless steel components, for long life and easy replacement. If alarms are not connected,

the only entry into the display enclosure is for the fibre cable, thus limiting the opportunity for water to enter the box. The internal circuitry is also protected against moisture with a protective coating. Along with being battery operated and not requiring truck power to operate, installation is simplified and reliability enhanced. The small size of the display enclosure also makes it easy to find an appropriate mounting location. The dual displays ensure 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 alarms can be programmed to turn either on or off to save terminals and wiring, and uses transistors rather than relays to increase current capability, eliminate sparking, and eliminate gauge battery power drain.

CHAPTER 5

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.

LOCTITE

FLUID COMPATIBILITY CHART

for metal threaded fittings sealed with Loctite® Sealants

LIQUIDS, SOLUTIONS & SUSPENSIONS

LEGEND:

● Use Loctite #592, 567, 565, 569, 545, 580, 571, 242, 577, 572, 542, 565, 545, 243

† Use Loctite #277, 271, 554, 270, 277, 554

■ Not Recommended

□ <10% (same as ●)

>10% (same as †)

* <5% (same as ●)

<5% (same as †)

Abrasive Coolant ●
Acetaldehyde ●
Acetate Solvents ●
Acetimide ●
Acetic Acid ●
Acetic Acid □
Acetic Acid - glacial ●
Acetic Anhydride ●
Acetone ●
Acetyl Chloride ●
Acetylene (Liquid Phase) ●
Acid Clay ●
Acrylic Acid ●
Acrylonitrile ●
Activated Alumina ●
Activated Carbon ●
Activated Silica ●
Alcohol-Allyl ●
Alcohol-Amyl ●
Alcohol-Benzyl ●
Alcohol-Butyl ●
Alcohol-Ethyl ●
Alcohol-Furfuryl ●
Alcohol-Hexyl ●
Alcohol-Isopropyl ●
Alcohol-Methyl ●
Alcohol-Propyl ●
Alum-Ammonium ●
Alum-Chrome ●
Alum-Potassium ●
Alum-Sodium ●
Alumina ●
Aluminum Acetate ●
Aluminum Bicarbonate ●
Aluminum Bifluoride ●
Aluminum Chloride ●
Aluminum Sulfate ●
Ammonia Anhydrous ■
Ammonia Solutions ■
Ammonium Bisulfite ●
Ammonium Borate ●
Ammonium Bromide ●
Ammonium Carbonate ●
Ammonium Chloride ●
Ammonium Chromate ●
Ammonium Fluoride ●
Ammonium Fluorosilicate ●
Ammonium Formate ●
Ammonium Hydroxide ■
Ammonium Hyposulfite ●
Ammonium Iodide ●
Ammonium Molybdate ●
Ammonium Nitrate ●
Ammonium Oxalate ●
Ammonium Persulfate ●
Ammonium Phosphate ●
Ammonium Picrate ●
Ammonium Sulfate ●

Ammonium Sulfate Scrubber ●
Ammonium Sulfide ●
Ammonium Thiocyanate ●
Amyl Acetate ●
Amyl Amine ●
Amyl Chloride ●
Aniline ●
Aniline Dyes ●
Anodizing Bath ●
Antichlor Solution ●
Antimony Acid Salts ●
Antimony Oxide ●
Antioxidant Gasoline ●
Aqua Regia ■
Argon ●
Armeen § ●
Arochlor § ●
Aromatic Gasoline ●
Aromatic Solvents ●
Arsenic Acid ●
Asbestos Slurry ●
Ash Slurry ●
Asphalt Emulsions ●
Asphalt Molten ●

Bagasse Fibers ●
Barium Acetate ●
Barium Carbonate ●
Barium Chloride ●
Barium Hydroxide □
Barium Sulfate ●
Battery Acid □
Battery Diffuser Juice ●
Bauxite (See Alumina) ●
Bentonite ●
Benzaldehyde ●
Benzene ●
Benzene Hexachloride ●
Benzene in Hydrochloric Acid ●
Benzoic Acid ●
Benzotriazole ●
Beryllium Sulfate ●
Bicarbonate Liquor ●
Bilge Lines ●
Bleach Liquor ●
Bleached Pulp ●
Borax § Liquors ●
Boric Acid ●
Brake Fluids ●
Brine Chlorinated ●
Brine Cold ●
Bromine Solution †
Butadiene ●
Butyl Acetate ●
Butyl Alcohol ●
Butyl Amine ●
Butyl Cellosolve § ●
Butyl Chloride ●
Butyl Ether - Dry ●
Butyl Lactate ●
Butyral Resin ●
Butyraldehyde ●
Butyric Acid □

Cadmium Chloride ●
Cadmium Plating Bath ●
Cadmium Sulfate ●
Calcium Acetate ●

Calcium Bisulfate ●
Calcium Carbonate ●
Calcium Chlorate ●
Calcium Chloride ●
Calcium Chloride Brine ●
Calcium Citrate ●
Calcium Ferrocyanide ●
Calcium Formate ●
Calcium Hydroxide ●
Calcium Lactate ●
Calcium Nitrate ●
Calcium Phosphate ●
Calcium Silicate ●
Calcium Sulfamate ●
Calcium Sulfate ●
Calcium Sulfite ●
Camphor ●
Carbitol ●
Carbolic Acid (phenol) □
Carbon Bisulfide ●
Carbon Black ●
Carbon Tetrachloride ●
Carbonic Acid □
Carbowax § ●
Carboxymethyl Cellulose ●
Carnauba Wax ●
Casein ●
Casein Water Paint ●
Celite ●
Cellosolve § ●
Cellulose Pulp ●
Cellulose Xanthate ●
Cement Dry/Air Blown ●
Cement Grout ●
Cement Slurry ●
Ceramic Enamel ●
Ceric Oxide ●
Chalk ●
Chemical Pulp ●
Chestnut Tanning ●
China Clay ●
Chloral Alcoholate ●
Chloramine ●
Chlorinated Hydrocarbons ●
Chlorinated Paperstock ●
Chlorinated Solvents ●
Chlorinated Sulphuric Acids ■
Chlorinated Wax ●
Chlorine Dioxide ■
Chlorine Liquid ■
Chlorine Dry ■
Chloroacetic Acid □
Chlorobenzene Dry ●
Chloroform Dry ●
Chloroformate Methyl ●
Chlorosulfonic Acid ■
Chrome Acid Cleaning □
Chrome Liquor □
Chrome Plating Bath □
Chromic Acid 10% ●
Chromic Acid 50% (cold) ■
Chromic Acid 50% (hot) ■
Chromium Acetate ●
Chromium Chloride ●
Chromium Sulfate ●
Classifier ●
Clay ●
Coal Slurry ●

Coal Tar ●
Cobalt Chloride ●
Copper Ammonium Formate ●
Copper Chloride ●
Copper Cyanide ●
Copper Liquor ●
Copper Naphthenate ●
Copper Plating, Acid Process ●
Copper Plating, Alk. Process ●
Copper Sulfate ●
Core Oil ●
Corundum ●
Creosote ●
Creosote-Cresylic Acid ●
Cyanide Solution ●
Cyanuric Chloride ●
Cyclohexane ●
Cylinder Oils ●

De-Ionized Water ●
De-Ionized Water Low Conductivity ●
Detergents ●
Developer, photographic ●
Dextrin ●
Diacetone Alcohol ●
Diammonium Phosphate ●
Diamylamine ●
Diatomaceous Earth Slurry ●
Diazo Acetate ●
Dibutyl Phthalate ●
Dichlorophenol ●
Dichloro Ethyl Ether ●
Dicyandamide ●
Dielectric Fluid ●
Diester Lubricants ●
Diethyl Ether Dry ●
Diethyl Sulfate ●
Diethylamine ●
Diethylene Glycol ●
Diglycolic Acid ●
Dimethyl Formamide ●
Dimethyl Sulfoxide ●
Dioxane Dry ●
Dioxidene ●
Dipentene - Pinene ●
Diphenyl ●
Distilled Water (Industrial) ●
Dowtherm § ●
Drying Oil ●
Dust-Flue (Dry) ●
Dye Liquors ●
Emery - Slurry ●
Emulsified Oils ●
Enamel Frit Slip ●
Esters General ●
Ethyl Acetate ●
Ethyl Alcohol ●
Ethyl Amine ●
Ethyl Bromide ●
Ethyl Cellosolve § ●
Ethyl Cellosolve Slurry § ●
Ethyl Formate ●
Ethyl Silicate ●
Ethylene Diamine ●
Ethylene Dibromide ●
Ethylene Dichloride ●
Ethylene Glycol ●

Ethylenediamine Tetramine ●

Fatty Acids ●
 Fatty Acids Amine ●
 Fatty Alcohol ●
 Ferric-Floc ●
 Ferric Chloride ●
 Ferric Nitrate ●
 Ferric Sulfate ●
 Ferrocence-Oil Sol ●
 Ferrous Chloride ●
 Ferrous Oxalate ●
 Ferrous Sulfate10% ●
 Ferrous Sulfate (Sat) ●
 Fertilizer Sol ●
 Flotation Concentrates ●
 Fluoride Salts ●
 Fluorine, Gaseous or Liquid ●
 Fluorolube ●
 Fluosilic Acid ●
 Flux Soldering ●
 Fly Ash Dry ●
 Foam Latex Mix ●
 Foamite ●
 Formaldehyde (cold) ●
 Formaldehyde (hot) †
 Formic Acid (Dil cold) ●
 Formic Acid (Dil hot) †
 Formic Acid (cold) ●
 Formic Acid (hot) †
 Freon § †
 Fuel Oil ●
 Fuming Nitric Red ■
 Fuming Sulfuric ■
 Fuming Oleum ■
 Furfural ●

Gallic Acid * Gallium Sulfate ●
 Gasoline-Acid Wash ●
 Gasoline-Alk. Wash ●
 Gasoline Aviation ●
 Gasoline Copper Chloride ●
 Gasoline Ethyl ●
 Gasoline Motor ●
 Gasoline Sour ●
 Gasoline White ●
 Gluconic Acid ●
 Glue-Animal Gelatin ●
 Glue-Plywood ●
 Glutamic Acid ●
 Glycerine Lye-Brine ■
 Glycerol ●
 Glycine ●
 Glycine Hydrochloride ●
 Glycol Amine ●
 Glycolic Acid ●
 Glyoxal ●
 Gold Chloride ●
 Gold Cyanide ●
 Granodine ●
 Grape Pomace Graphite ●
 Grease Lubricating ●
 Green Soap ●
 Grinding Lubricant ●
 Grit Steel ●
 Gritty Water ●
 Greenwood Stock ●
 GRS Latex ●
 Gum Paste ●
 Gum Turpentine ●
 Gypsum ●

Halane Sol ●
 Halogen Tin Plating ●
 Halowax § ●
 Harvel-Trans Oil ●
 Heptane ●
 Hexachlorobenzene ●
 Hexadiene ●
 Hexamethylene Tetramine ●
 Hexane ●
 Hydrazine ●
 Hydrazine Hydrate ●
 Hydrobromic Acid □
 Hydrochloric Acid ●
 Hydrocyanic Acid □
 Hydroflouric Acid ■
 Hydrogen Peroxide (dil) ●
 Hydrogen Peroxide (con) †
 Hydroponic Sol ●
 Hydroquinone ●
 Hydroxyacetic Acid ●
 Hypo ●
 Hypochlorous Acid ●

Ink ●
 Ink in Solvent-Printing ●
 Iodine in Alcohol ●
 Iodine-Potassium Iodide ●
 Iodine Solutions ●
 Ion Exchange Service ●
 Ion Exclusion Glycol ●
 Irish Moss Slurry ●
 Iron Ore Taconite ●
 Iron Oxide ●
 Isobutyl Alcohol ●
 Isobutyraldehyde ●
 Isooctane ●
 Isopropyl Alcohol ●
 Isocyanate Resin ●
 Isopropyl Acetate ●
 Isopropyl Ether ●
 Itaconic Acid ●

Jet Fuels ●
 Jeweler's Rouge ●
 Jig Table Slurry ●
 Kaolin-China Clay § ●
 Kelp Slurry ●
 Kerosene ●
 Kerosene Chlorinated ●
 Ketone ●
 Lacquer Thinner ●
 Lactic Acid ●
 Lapping Compound ●
 Latex-Natural ●
 Latex-Synthetic ●
 Latex Synthetic Raw ●
 Laundry Wash Water ●
 Laundry Bleach ●
 Laundry Blue ●
 Laundry Soda ●
 Lead Arsenate ●
 Lead Oxide ●
 Lead Sulfate ●
 Lignin Extract ●
 Lime Slaked ●
 Lime Sulfur Mix ●
 Liquid Ion Exchange ●
 Lithium Chloride ●
 LOX (Liquid O2) ■

Ludox ●
 Lye ■

Machine Coating Color ●
 Magnesite Slurry ●
 Magnesite ●
 Magnesium Bisulfite ●
 Magnesium Carbonate ●
 Magnesium Chloride ●
 Magnesium Hydroxide ●
 Magnesium Sulfate ●
 Maleic Acid ●
 Maleic Anhydride ●
 Manganese Chloride ●
 Manganese Sulfate ●
 Melamine Resin ●
 Menthol ●
 Mercaptans ●
 Mercuric Chloride ●
 Mercuric Nitrate ●
 Mercury ●
 Mercury Dry ●
 Methane ●
 Methyl Alcohol ●
 Methyl Acetate ●
 Methyl Bromide ●
 Methyl Carbitol ●
 Methyl Cellosolve § ●
 Methyl Chloride ●
 Methyl Ethyl Ketone ●
 Methyl Isobutyl Ketone ●
 Methyl Lactate ●
 Methyl Orange ●
 Methylamine ●
 Methylene Chloride ●
 Mineral Spirits ●
 Mixed Acid, Nitric/Sulfuric ■
 Monochloroacetic Acid ●
 Morpholine ●
 Mud ●

Nalco Sol. ●
 Naphtha ●
 Naphthalene ●
 Naval Stores Solvent ●
 Nematocide ●
 Neoprene Emulsion ●
 Neoprene Latex ●
 Nickel Acetate ●
 Nickel Ammonium Sulfate ●
 Nickel Chloride ●
 Nickel Cyanide ●
 Nickel Fluoborate ●
 Nickel Ore Fines ●
 Nickel Plating Bright ●
 Nickel Sulfate ●
 Nicotinic Acid □
 Nitrate Sol. ●
 Nitration Acid(s) ■
 Nitric Acid ■
 Nitric Acid10% □
 Nitric Acid 20% †
 Nitric Acid Anhydrous ■
 Nitric Acid Fuming ■
 Nitro Aryl Sulfonic Acid ●
 Nitrobenzene-Dry ●
 Nitrocellulose ●
 Nitrofurane ●
 Nitroguanidine ●
 Nitroparaffins-Dry ●
 Nitrosyl Chloride ●

Norite Carbon ●
 Nuchar ●

Oakite § Compound ●
 Oil, Creosote ●
 Oil, Emulsified ●
 Oil, Fuel ●
 Oil, Lubricating ●
 Oil, Soluble ●
 Oleic Acid, hot ●
 Oleic Acid, cold ●
 Ore Fines-Flotation ●
 Ore Pulp ●
 Organic Dyes ●
 Oxalic Acid cold ●
 Ozone, wet ■
 Paint-Linseed Base ●
 Paint-Water Base ●
 Paint-Remover-Sol. Type ●
 Paint-Vehicles ●
 Palmitic Acid ●
 Paper Board Mill Waste ●
 Paper Coating Slurry ●
 Paper Pulp ●
 Paper Pulp with Amun. ●
 Paper Pulp with Dye ●
 Paper Pulp, bleached ●
 Paper Pulp, bleached-washed ●
 Paper Pulp Chlorinated ●
 Paper Groundwood ●
 Paper Rag ●
 Paper Stocks, fine ●
 Paradichlorobenzene ●
 Paraffin Molten ●
 Paraffin Oil ●
 Paraformaldehyde ●
 Pectin Solution Acid ●
 Pentachlorethane ●
 Pentaerythritol Sol. ●
 Perchlorethylene (Dry) ●
 Perchloric Acid
 Perchloromethyl Mercaptan ●
 Permanganic Acid ■
 Persulfuric Acid ■
 Petroleum Ether ●
 Petroleum Jelly ●
 Phenol Formaldehyde Resins ●
 Phenol Sulfonic Acid ●
 Phenolic Glue ●
 Phloroglucinol ●
 Phosphate Ester ●
 Phosphatic Sand ●
 Phosphoric Acid 85% hot ■
 Phosphoric Acid 85% cold †
 Phosphoric Acid 50% hot †
 Phosphoric Acid 50% cold †
 Phosphoric Acid 10% cold ●
 Phosphoric Acid 10% hot †
 Phosphorous Molten ●
 Phosphotungstic Acid ●
 Photographic Sol. ●
 Phthalic Acid ●
 Phytate
 Phytate Salts ●
 Pickling Acid, Sulfuric ●
 Picric Acid Solutions ●
 Pine Oil Finish ●

Loctite product numbers in red are worldwide or application-specific products

(This is a list of chemical stability only. It does not constitute approval for use in the processing of food, drugs, cosmetics, pharmaceuticals, and ingestible chemicals.) Loctite products are not recommended for use in pure oxygen or chlorine environments or in conjunction with strong oxidizing agents.

LOCTITE

FLUID COMPATIBILITY CHART

for metal threaded fittings sealed with Loctite® Sealants

LIQUIDS, SOLUTIONS & SUSPENSIONS GASES

LEGEND:

● Use Loctite #592, 567, 565, 569, 545, 580, 571, 242, 577, 572, 542, 565, 545, 243
† Use Loctite #277, 271, 554, 270, 277, 554
■ Not Recommended
□ <10% (same as ●)
▷ >10% (same as †)
* <5% (same as ●)
<5% (same as †)

Plating Sol. as follows:

Brass Cyanide ●
Bronze-Cyanide ●
Chromium & Cadmium Cyanide ●
Cobalt Acid ●
Copper Acid ●
Copper Alk. ●
Gold Cyanide ●
Iron-Acid ●
Lead-Fluoro ●
Nickel Bright ●
Platinum ●
Silver-Cyanide ●
Tin-Acid ●
Tin Alk. Barrel ●
Zinc Acid ●
Zinc Alk. Cyanide ●
Polyacrylonitrile Slurry ●
Polypentek ●
Polysulfide Liquor ●
Polyvinyl Acetate Slurry ●
Polyvinyl Chloride ●
Porcelain Frit ●
Potash □
Potassium Acetate ●
Potassium Alum. Sulfate ●
Potassium Bromide ●
Potassium Carbonate ●
Potassium Chlorate ●
Potassium Chloride Sol ●
Potassium Chromate ●
Potassium Cyanide Sol. ●
Potassium Dichromate ●
Potassium Ferricyanide ●
Potassium Hydroxide ■
Potassium Iodide ●
Potassium Nitrate ●
Potassium Perchlorate ●
Potassium Permanganate ●
Potassium Persulfate ●
Potassium Phosphate ●
Potassium Silicate ●
Potassium Sulfate ●
Potassium Xanthate ●
Press Board Waste ●
Propionic Acid ●
Propyl Alcohol ●
Propyl Bromide ●
Propylene Glycol ●
Pumice ●
Pyranol ●
Pyridine ●
Pyrogalllic Acid ●
Pyrogen Free Water ●
Pyrole ●
Pyromellitic Acid ●

Quebracho Tannin ●
Rag Stock Bleached ●
Rare Earth Salts ●
Rayon Acid Water ●
Rayon Spin Bath ●
Rayon Spin Bath spent ●
Resorcinol ●
River Water ●
Road Oil ●
Roccal ●
Rosin-Wood ●
Rosin in Alcohol ●
Rosin Size ●
Rubber Latex ●
Safrol ●
Salt Alkaline ●
Salt Electrolytic ●
Salt Refrg. ●
Sand-Air Blown Slurry ●
Sand-Air Phosphatic ●
Sea Coal ●
Sea Water ●
Selenium Chloride ●
Sequestrene ●
Sewage ●
Shellac ●
Shower Water ●
Silica Gel ●
Silica Ground ●
Silicone Tetrachloride ●
Silicone Fluids ●
Silver Cyanide ●
Silver Iodide-Aqu. ●
Silver Nitrate ●
Size Emulsion ●
Skelly Solve E, L ●
Slate to 400 Mesh ●
Soap Lye ■
Soap Solutions (Stearates) ●
Soap Stone Air Blown ●
Soda Pulp ●
Sodium Acetate ●
Sodium Acid Fluoride ●
Sodium Aluminate ●
Sodium Arsenate ●
Sodium Benzene Sulfonate ●
Sodium Bichromate ●
Sodium Bisulfite ●
Sodium Bromide ●
Sodium Carbonate ●
Sodium Chlorate ●
Sodium Chlorite ●
Sodium Cyanide ●
Sodium Ferricyanide ●
Sodium Formate ●
Sodium Glutamate ●
Sodium Hydrogen Sulfate ●
Sodium Hydrosulfite ●
Sodium Hydrosulfide ●
Sodium Hydrochloride ●
Sodium Hydroxide ■
Sodium Hydro. 20% cold ●
Sodium Hydro. 20% hot †
Sodium Hydro. 50% cold †
Sodium Hydro. 50% hot ■

Sodium Hydro. 70% cold †
Sodium Hydro. 70% hot ■
Sodium Hypochlorite ●
Sodium Lignosulfonate ●
Sodium Metasilicate ●
Sodium Molten ●
Sodium Nitrate ●
Sodium Nitrite-Nitrate ●
Sodium Perborate ●
Sodium Peroxide ■
Sodium Persulfate ●
Sodium Phosphate-Mono ●
Sodium Phosphate-Tri ●
Sodium Potassium Chloride ●
Sodium Salicylate ●
Sodium Sesquicarbonate ●
Sodium Silicate ●
Sodium Silcofluoride ●
Sodium Stannate ●
Sodium Sulfate ●
Sodium Sulfide ●
Sodium Sulfite ●
Sodium Sulfhydrate ●
Sodium Thiocyanate ●
Sodium Thiosulfate ●
Sodium Tungstate ●
Sodium Xanthate ●
Solox-Denat. Ethanol ●
Soluble Oil ●
Solvent Naphthas ●
Sorbic Acid ●
Sour Gasoline ●
Soybean Sludge-Acid ●
Spensol Solution ●
Stannic Chloride ●
Starch ●
Starch Base ●
Steam Low Pressure ●
Stearic Acid ●
Steep Water ●
Sterilization Steam ●
Stillage Distillers ●
Stoddard Solvent ●
Styrene ●
Styrene Butadiene Latex ●
Sulfamic Acid ●
Sulfan-Sulfuric Anhydride ●
Sulfathiazole ●
Sulfite Liquor ●
Sulfite Stock ●
Sulfonated Oils ●
Sulfones ●
Sulfonic Acids ●
Sulfonyl Chloride ●
Sulfur Slurry ●
Sulfur Solution ●
in Carbon Disulfide ●
Sulphuric Acid 0-7% †
Sulphuric Acid 7-40% †
Sulphuric Acid 40-75% †
Sulphuric Acid 75-95% ■
Sulphuric Acid 95-100% ■
Sulphurous Acid †
Sulfuryl Chloride ●
Surfactants ●
Synthetic Latex ●
Taconite - Fines ●

Talc - Slurry ●
Tankage - Slurry ●
Tannic Acid (cold) †
Tamin ●
Tar & Tar Oil ●
Tartaric Acid ●
Television Chemicals ●
Tergitol § ●
Terpineol ●
Tetraethyl Lead ●
Tetrahydrofuran ●
Tetranitromethane ●
Textile Dyeing ●
Textile Finishing Oil ●
Textile Printing Oil ●
Thiocyanic Acid ●
Thioglycollic Acid ●
Thionyl Chloride ●
Thiophosphoryl Chloride ●
Thiourea ●
Thorium Nitrate ●
Thymol ●
Tin Tetrachloride ●
Tinning Sol. DuPont ●
Titania Paper Coating ●
Titanium Oxide Slurry ●
Titanium Oxy Sulfate ●
Titanium Sulfate ●
Titanium Tetrachloride ●
Toluol ●
Toluene ●
p-Toluene Sulfonic Acid †
Transil Oil ●
Trichloroacetic Acid ●
Trichlorethane 1,1,1 ●
Trichlorethylene ●
Trichlorethylene-Dry ●
Tricresyl Phosphate ●
Triethanolamine ●
Triethylene Glycol ●
Trioxane ●
Tungstic Acid ●
Turpentine ●
UCON § Lube ●
Udylite Bath-Nickel ●
Undecylenic Acid ●
Unichrome Sol. Alk. ●
Uranium Salts ●
Uranyl Nitrate ●
Uranyl Sulfate ●
Urea Ammonia Liquor ●
Vacuum to 100 Micron ●
Vacuum below 100 Micr. ●
Vacuum Oil ●
Vanadium Pentoxide ●
Slurry ●
Varnish ●
Varsol-Naphtha Solv. ●
Versene § ●
Vinyl Acetate Dry or Chloride Monomer ●
Vinyl Chloride Latex Emul. ●
Vinyl Resin Slurry ●
Viscose ●
Vortex-Hydroclone ●

Water-Acid - Below pH7 ●
Water pH7 to 8 ●
Water Alkaline - Over pH8 ●
Water Mine Water ●
Water River ●
Water Sandy ●
Water "White" - low pH ●
Water "White" - high pH ●
Wax ●
Wax Chlorinated ●
Wax Emulsions ●
Weed Killer Dibromide ●
Weisberg Sulfate Plating ●
Wood ground pulp ●
Wort Lines ●

X-Ray Developing Bath ●
Xylene ●

Zelan ●
Zeolite Water ●
Zinc Acetate ●
Zinc Bromide ●
Zinc Chloride ●
Zinc Cyanide-Alk. ●

Zinc Fines Slurry ●
Zinc Flux Paste ●
Zinc Galvanizing ●
Zinc Hydrosulfite ●
Zinc Oxide in Water ●
Zinc Oxide in Oil ●
Zinc Sulfate ●
Zincolate ●
Zirconyl Nitrate ●
Zirconyl Sulfate ●

Acetylene ●
Acid & Alkali Vapours ●
Air ●
Amine ●
Ammonia ●

Butane ●
Butadiene Gas/Liquid ●
Butylene Gas/Liquid ●
By-Product Gas (Dry) ●

Carbon Dioxide ●
Carbon Disulfide ●
Carbon Monoxide ●
Chloride Dry ●

Chlorine Dry ■
Chlorine Wet ■
Coke-oven Gas-cold ●
Coke-oven Gas-hot †
Cyanogen Chloride ●
Cyanogen Gas ●

Ethane ●
Ether-see Diethyl Ether ●
Ethylene ●
Ethylene Oxide ●

Freon § (11-12-21-22) †
Furnace Gas hot †
Furnace Gas cold ●

Gas drip oil ●
Gas flue ●
Gas manufacturing ●
Gas natural ●

Helium ●
Hydrogen Gas-cold ●
Hydrogen Chloride ●
Hydrogen Cyanide ●
Hydrogen Sulfide wet & dry ●

Isobutane ●
Methane ●
Methyl Chloride ●

Natural gas dry ●
Nitrogen gas ●
Nitrous Oxide ●

Oil-Solvent Vapor ●
Oxygen ■
Ozone ■

Producer Gas 50 PSI ●
Propane ●
Propylene ●

Steam ■
Sulfur Dioxide ●
Sulfur Dioxide dry ●
Sulfur Trioxide Gas ■
Sulfuric Acid Vapor ●

NOTE: 1. The above information does not constitute a recommendation of sealant use. It is intended only as a guide for consideration by the purchaser with the expectation of favorable confirming test results. It is impossible to test sealant reaction with the multitude of chemicals in existence, therefore, compatibility has been estimated based on a wide variety of customer experience.
2. With the stringent action of such chemicals as Freon, strong cold acids and caustics, thorough evaluation is suggested. Sealing of hot corrosive chemicals is not recommended.
3. Contact Loctite Corporation for use with chemicals not covered by this information.

§Listing(s) may be Brand Name(s) or Trademarks for chemicals of Corporations other than Loctite.

Loctite product numbers in red are worldwide or application-specific products.

(This is a list of chemical stability only. It does not constitute approval for use in the processing of foods, drugs, cosmetics, pharmaceuticals, and ingestible chemicals). Loctite products are not recommended for use in pure oxygen or chlorine environments or in conjunction with strong oxidizing agents.

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LOCTITE

Loctite Americas

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LT-836A (8/00) 0004-618

CHAPTER 6

810PS2 SENDER BAR PROGRAMMING

The 810PS2 sender bar is identified by an “X” in the serial number, for example 810X-9999. It can be programmed for either 1/3” 8 bit operation or 1/6” 11 bit operation. The reason that the bar sends more bits for 1/6” operation is that there are twice as many points to send. The 810PS2 display must be programmed to match the mode of the bar, so if the bar is in 1/3” mode the display must be in 1/3” mode, and if the bar is in 1/6” mode the display must be in 1/6” mode. If the modes do not match, the display will show bL: 8 or bL:11.

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

For security, the bar holds its mode information in three different memory locations and continually takes the best two out of three as being the correct mode. If any one location is corrupted it is automatically repaired. If the bar ever loses its mode information completely, it will default to 1/3” operation.

The bars are always shipped in 1/3” mode, so they only need to be programmed if the 1/6” mode is desired. If a bar is in 1/6” mode it can be programmed back to 1/3” mode. A bar can be reprogrammed any number of times. The bar mode is programmed by holding a magnet underneath the head for a specific period of time. The magnet can either be the one supplied, or a float can be used – slide it right up against the head (this can only be done before the compression fitting is on). The magnet is in the correct position when the opto appears to flicker continuously instead of flashing.

To program a bar to 1/6” mode, hold the magnet under the head for 12 seconds. The LED should appear to flicker continually during this time. Remove the magnet after the 12 seconds, the LED will respond with 6 long flashes (1 second on, 1 second off, 1 second on, etc.). After the 6 long flashes, the bar will resume normal operation. If desired, the bar can be plugged into the 916 OPTICAL INPUT, the # BITS should show 11. Note that the timing window is from 9 to 15 seconds, so you don’t have to be exact.

To program a bar to 1/3” mode, hold the magnet under the head for 6 seconds. The LED should appear to flicker continually during this time. Remove the magnet after the 6 seconds, the LED will respond with 3 long

flashes (1 second on, 1 second off, 1 second on, etc.). After the 3 long flashes, the bar will resume normal operation. If desired, the bar can be plugged into the 916 OPTICAL INPUT, the # BITS should show 8. Note that the timing window is from 3 to 9 seconds, so you don't have to be exact.

If the magnet is held in position for less than 3 seconds or more than 15 seconds, the bar mode will not change. The bar can be programmed to either mode regardless of the mode it is currently in, so if in doubt about the mode feel free to reprogram.

There are two magnets taped to the back of this manual which can be used to program the bar. Stack them together when used. Be careful of the magnetic strip on your credit cards and bank cards when using magnets.

CHAPTER 7

TROUBLESHOOTING GUIDE

There are only 5 serviceable components in the gauge: the float, the sender bar, the interconnecting fibre optic cable, the display, and the display AA batteries.

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 fibre 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 fibre, or if the fibre 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 fibre optic cable is disconnected from the display, a flashing red light should be visible from the end of the fibre.

If the AA batteries are low, the display should flash "batt" every few seconds. If the batteries are almost dead, the display will be dim, blank, erratic, or read "no L" or "bL:xx".

If the display reads erratically but the batteries are OK, check for water inside the head or display, and for a poor end cap seal.

To test a sender bar:

1. Make sure the sender is flashing about once a second from the optical connector. If it is not, the sender is dead and must be replaced.
2. If the sender is flashing, plug a piece of fibre into the sender optical connector and the other end of the fibre into the **OPTICAL INPUT** on the 916 programmer. The top left 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 fibre, if it is good and fully inserted then the bar output is defective and the bar must be replaced. Ensure that the number of bits is correct (1/3" is 8 bits and 1/6" is 11 bits). If necessary reprogram the bar with a magnet (see the bar programming section) to put it into the correct mode. If the number of bits is not 8 or 11 then the bar is defective and must be replaced.

3. Press and hold for one second the appropriate mode button on the programmer to match the mode of the bar (**810PS 1/3"** or **810PS 1/6"**). Now press and hold for one second the **BAR TEST** button to put the programmer into the bar test mode. The inch display will now show what the bar is putting out. Slowly run a float up the bar while watching the inch display to verify bar operation. If the bar does not operate correctly then it must be replaced. Note that it is faster to test the bar in 1/3" resolution, if it works for 1/3" it will work for 1/6". To return the programmer to normal operation press the **Power On & Reset** button.
4. If a programmer is not available, a quick test can be made of the bar by jumpering the two top pins on the programming plug in the display. This converts the display into reading raw inches only, the calibration is ignored. Run the float up and down on the bar to see if the inches change in a consistent manner. The bar should read around 80 to 85 inches when the float is near the top. The bottom reading will vary depending on the length of the bar.

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

To test a display:

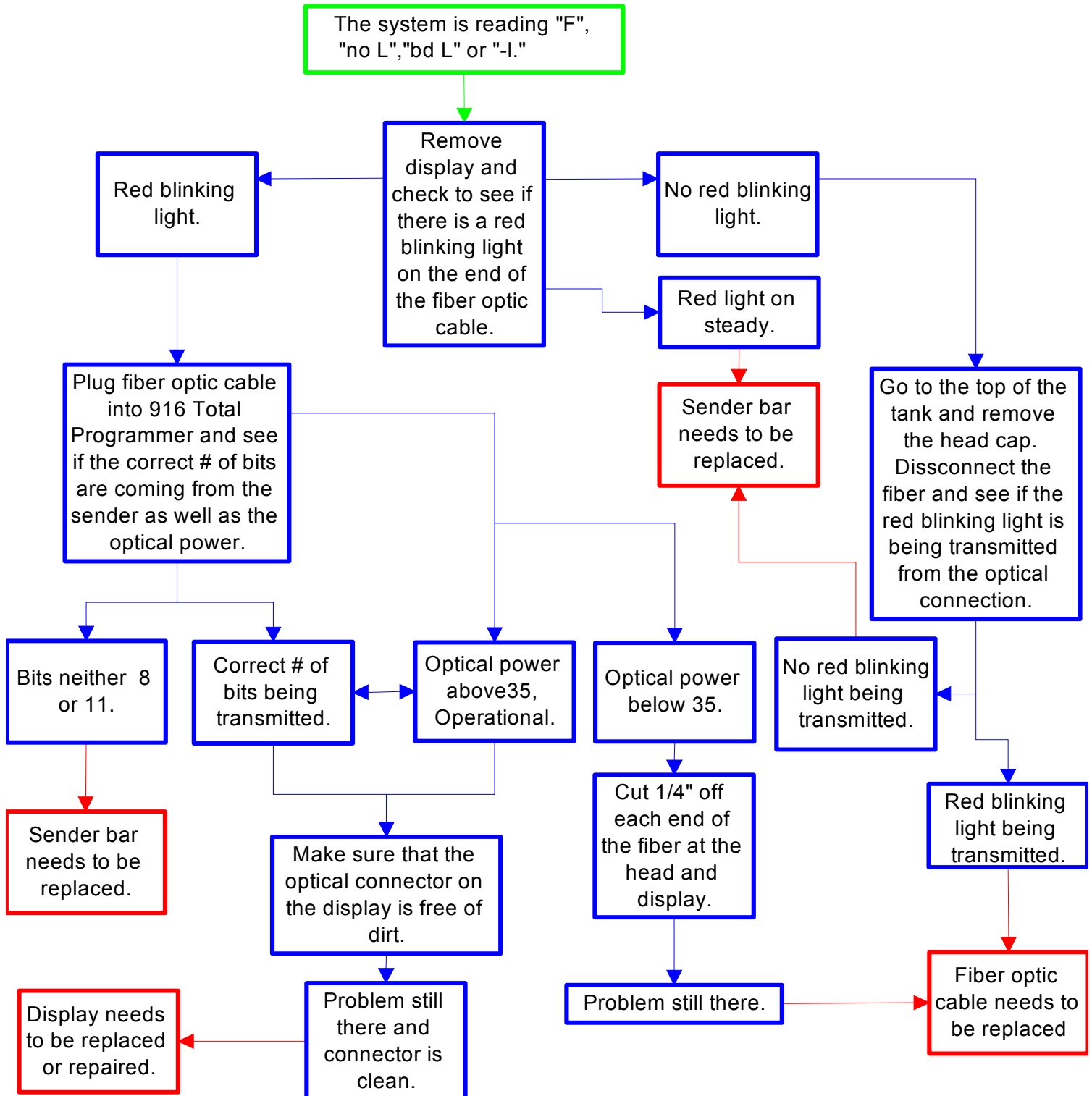
1. The display should show "no L" with no fibre connected. Note that if the optical connector on the display is exposed to ambient light the display may read "bd L" or "Sun". If neither of these is the case then the display is defective and must be replaced. Note that it is possible for the display to "hang up" and freeze its display if it is exposed to excessive static shock or strong radio signals. If this is the case it should automatically reset itself within a few seconds.
2. If the LCD works but not the LED, check the AA batteries and the battery holders. Make sure corrosion or debris is not preventing contact. Make sure the wires are connected to the battery holder. If the red display still does not work, the display is defective and must be replaced. Make sure that you allow at least 15 seconds for the red display to start after inserting the batteries.

3. Press the appropriate mode button to match what the display should be. Plug a piece of fibre from the **OPTICAL OUTPUT** of the 916 programmer to the optical connector on the display. If the display shows “no L” then it is defective and must be replaced (make sure the end of the fibre going into the display is flashing!). If the display shows “bd L” then it may be in the wrong mode. Reprogram the mode according to the instructions in the programming section. If it does not respond then it is defective and must be replaced.
4. If the display shows some strange reading when the fibre is plugged in, it may need reprogramming. Copy the existing programming into an unused memory on the 916 (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 916 plug, if not it is defective. After the 916 plug is removed the display should match the reading on the 916 calibration display, if it does not then the display is defective.
5. If only the alarms do not work then copy the calibration into the 916 to check if the points are programmed. If they are then connect a fibre from the 916 **OPTICAL OUTPUT** to the display optical connector. Connect the positive terminal of an ohm meter to the alarm wire, and the negative terminal of the ohm meter to the ground (green) wire. Use the inch up/down buttons on the 916 to run the display up to test the alarms. If the purple wire is being tested then make sure that both A3 and A4 are correctly programmed and run the display from below A3 to make sure that previous bypassing is cleared.

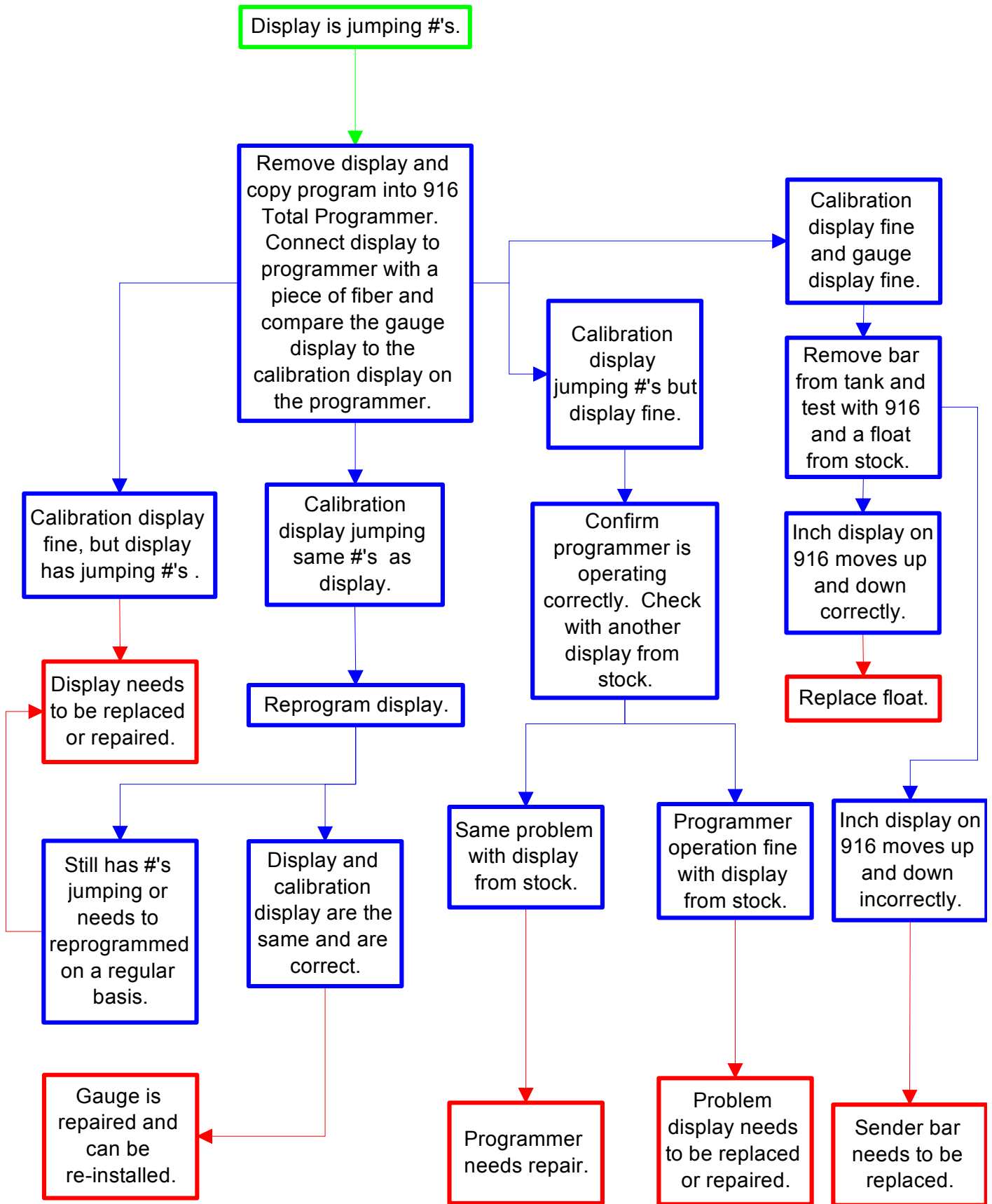
SEELEVEL TRUCK GAUGE BLOCK DIAGRAM

There are five basic parts to the system,

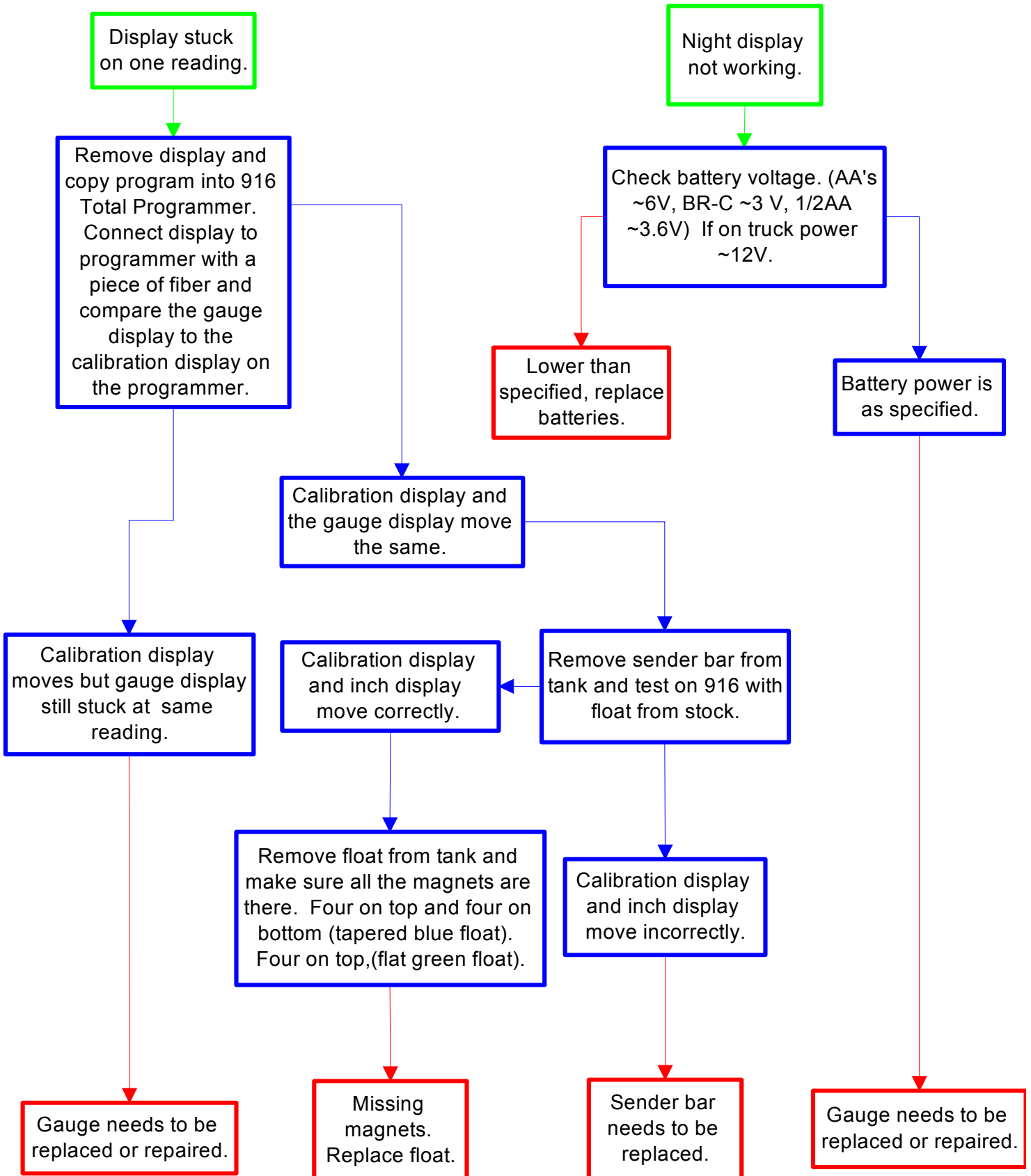
- 1) The Float
- 2) The Sender Bar
- 3) The Fiber Optic Cable
- 4) The Display
- 5) The Night Display



SEELVEL TRUCK GAUGE BLOCK DIAGRAM



SEEL LEVEL TRUCK GAUGE BLOCK DIAGRAM



CHAPTER 8

SERVICE AND WARRANTY INFORMATION

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

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

LIMITATION ON WARRANTIES

These warranties are the only warranties, expressed or implied, upon which products are sold by Garnet and Garnet makes no warranty of merchantability or fitness for any particular purpose in respect to the products sold. Garnet products or parts thereof assumed to be defective by the purchaser within the stipulated warranty period should be returned to the seller, local distributor, or directly to Garnet for evaluation and service. Whenever direct factory evaluation, service or replacement is necessary, the customer must first, by either letter or phone, obtain a Returned Material Authorization (RMA) from Garnet Instruments directly. No material may be returned to Garnet without an RMA number assigned to it or without proper factory authorization. Any returns must be returned freight prepaid to: Garnet Instruments Ltd, 288 Kaska Road, Sherwood Park, Alberta, T8A 4G7. Returned warranted items will be repaired or replaced at the discretion of Garnet Instruments. Any Garnet items under the Garnet Warranty Policy that are deemed irreparable by Garnet Instruments will be replaced at no charge or a credit will be issued for that item subject to the customer's request.

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

Garnet Instruments Ltd.
288 Kaska Road
Sherwood Park, Alberta
Canada T8A 4G7
E-mail: tstalker@garnetinstruments.com

The display operates on four alkaline AA cells, which should last for one to three years, depending on how long the lid is open and whether it is during the day or at night. To replace the batteries, remove the four screws holding the display cover on to access them on the back of the display face. Due to the uncontrolled nature of the amount of time that the LED display is on, the AA battery lifetime is not guaranteed.