



EFG-4000 USER'S GUIDE

THIS INFORMATION PACKET INCLUDES THE FOLLOWING INFORMATION.

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GENERAL PRODUCT INFORMATION

OPERATION:

The probe that is used with this gauge has been custom designed according to your specifications on the Order Form. **These include: Tank shape. Box 1 = Nipple Height. Box 2 = Primary tank height. Box 3 = Total height of nipple and tank.** (An accurate tank measurement from the top of the pipe nipple, that the gauge is to be installed on, to the inside bottom of the tank). The nipple that the gauge is mounted to must be straight up and down. Use of this probe on a tank other than the one it was custom designed for, or in a liquid product other than the one it was designed for, may provide inaccurate results. The probe must never contact the bottom of the tank, rest against the side of the drop tube (if used), or be allowed to touch any internal structures. Please refer to Order Form for more details.

POWER:

The EFG-4000 is powered by a 3.6 volt high energy lithium battery. Projected life of the battery has been determined to be between five (5) and eight (8) years. The manufacturer recommends that the battery be replaced by the customer every five (5) years to eliminate any reduction in performance. Batteries are available through Greenleaf Gauge or can be purchased at quality electronic supply stores.

MEASUREMENTS:

The EFG-4000 will display up to four digits, and can be programmed to show measurable units in gallons, liters, pounds, inches, or % full. The same four digit display is used during setup, calibration, and to display operation or error messages. Tanks over 9999 gallons use a fixed right digit on the screen print.

INSTALLATION:

The EFG-4000 must be installed in accordance with your local regulations and manufacturer's specifications. Failure to do so may affect the long term service of the gauge and may void the warranty. Any regulatory issues should be directed to your local entity having jurisdiction over issues involved.

IMPORTANT NOTICE:

The EFG-4000 is to be used only as a general accuracy liquid level monitor and **should not be relied upon** by the operator to prevent a tank overflow. The operator must monitor the tank filling process and prevent any overfills regardless of the status of the gauge.

HELP: For technical help please contact us at 208-453-1714, or toll free 888-88-GAUGE (888-884-2843). Our fax numbers are 208 459-3365, or 888-884-4145. Or visit us online at www.scpeimember.com.

ASSEMBLY INSTRUCTIONS

NOTICE TO INSTALLER: Tank dimensions, Type of liquid, and True total gallons must match the tank that you are working on. Any compromise will result in inaccurate readings from the gauge.

Please remember that even though the probe is well made, the material is very thin walled (0.035") and needs to be handled with care at all times. TXD = Transducer

NOTICE TO TANK MANUFACTURERS AND DISTRIBUTORS

We recommend the gauge and probe be installed at the final destination. If it is necessary to install the gauge and probe before shipping to the final destination, the probe may be allowed to swing freely in the tank but precautions must be taken to eliminate it from "hanging up" on any internal tank structures. The probe must not be allowed to rub on anything in the tank during normal operation or it will severely reduce the accuracy of the gauge.

TO ASSEMBLE "ONE SECTION" PROBE

1. Remove the probe and the gauge from the shipping boxes. Take care to remove all packing materials (bubble wrap, tape, etc.) from the units. Place the probe and gauge on top of the tank.
2. Apply a quality pipe thread sealant to the 2" pipe nipple threads. During installation, be cautious that the probe does not fall into the tank before the bead chain is snapped into the bead chain coupling on the bottom of the TXD. Now insert the probe down into the 2" pipe nipple.
3. To connect the probe to the TXD, simply snap the free end of the chain on the top of the probe into the end coupling connected to the split ring located at the bottom of the TXD. (See **Figure 2**) The bead **MUST** snap in place or it is not seated correctly. Once this has been done, screw the gauge/TXD combo onto the pipe nipple. Care must be taken to ensure that you do not cross thread the gauge as you screw it onto the nipple. **When the tank is empty the probe should never touch the bottom of the tank.** Refer to **QUICK START GUIDE** included with the gauge before installation to know the correct measurements you need.

This gauge has been calibrated at the manufacturer to your specifications. Please refer to the Quick Start Guide for details. If your gauge or the probe specifications do not match your tank dimensions and requirements, you will need to purchase a different probe. If you need to re-calibrate the gauge, this can be easily accomplished by following the instructions page titled Why we use calibration weights.

TO ASSEMBLE "MULTI-SECTION" PROBES

Remove the probe sections from the shipping container and the packing materials. Please use only the cotter pins provided to connect the sections of the multi-section probe, as all components are carefully weighed. (See **Figure 3**) Lower the probe into the tank beginning with the bottom section. Carefully slide the sections together over the joining plug and align the matching colored arrows then insert and set cotter pins. Repeat procedure until all sections are connected and lowered into the tank. Connect the fully assembled probe to the transducer making sure the bead snaps into place. Continue installation with steps 3 and 4 in "TO ASSEMBLE ONE SECTION PROBE" instructions.

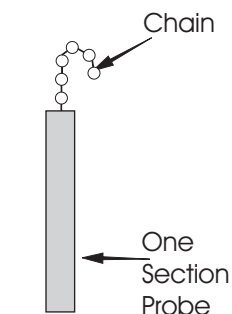


Figure 1

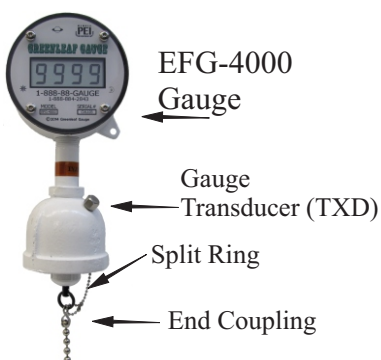


Figure 2

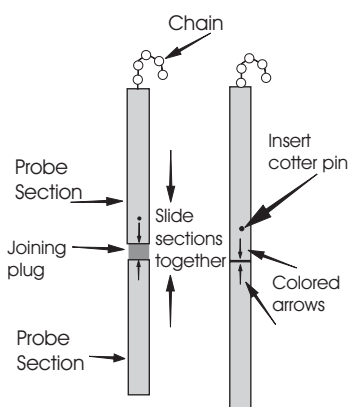



Figure 3

PROGRAMMING DETAILS

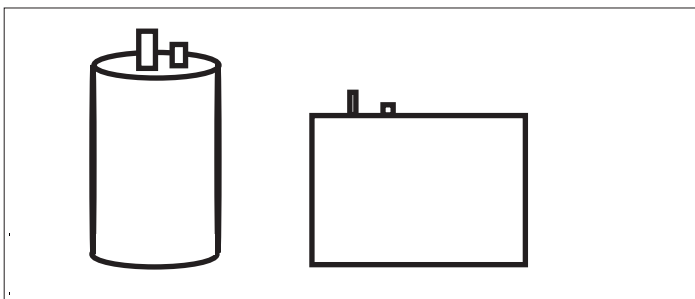
EFG-4000

Normally new gauges are already programmed. The steps below would not be needed.

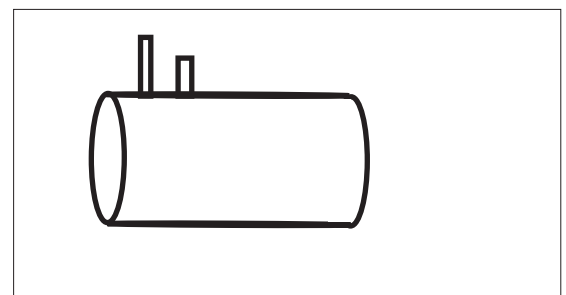
Included with the EFG-4000 is a pocket magnet. This is the tool used in the re-programming of the gauge. On the face of the gauge, you will find three symbols which are also important to the calibration process. These three symbols are: 

PLEASE READ ALL INSTRUCTIONS BEFORE PROGRAMMING THE GAUGE.

Prior to programming, determine what shape of tank the gauge will be used on. See diagrams below.



STRAIGHT TANKS



ROUND TANKS

OR

SYMBOLS USED DURING CALIBRATION MODE:

- | | | | |
|------|-------------------------------|------|---|
| ---- | Tank select mode | -LP- | Low calibration point |
| -00- | Round tank program | -HP- | High calibration point |
| -11- | Straight tank program | -05- | Off set value (Optional input) |
| -PP- | Program tank capacity | -E5- | End of setup mode |
| P*** | Extends range to 10,999 units | (*) | <u>Represents any numerical value, 0 through 9</u> |

SYMBOLS THAT MAY BE USED DURING OPERATING MODE:

- HELP** Gauge may alternate **HELP** with one of the following error messages. **DO NOT FILL TANK** until the problem has been corrected and the gauge is operating properly.
- | | | | |
|------|--|------|---|
| -*** | Negative number- the gauge has gone below the determined zero level | H*** | Reading has gone past gauge's maximum display capabilities of 9999 units. |
| EEEE | Measurement has exceeded the set capacity limit, or float is resting on the bottom of the tank | -LB- | Internal power or connection failure. |
| | | -EE- | Reading has gone below extended range. |
| | | (*) | <u>Represents any numerical value, 0 through 9</u> |

FOR TANKS OVER 11,000 MEASURABLE UNITS:

If the tank to be measured is larger than 10,000 units, Greenleaf Gauge offers a **SOLAR GAUGE™** model EFG-8000 which allows the operator to take accurate measurements up to 99,990 measurable units as well as many other options.

For more information, contact your equipment distributor or Greenleaf Gauge at 208-453-1714 or toll free 888-88-GAUGE (888-884-2843).

Why we use Calibration Weights and the Calibration Procedure

The Calibration Weights procedure should only be performed “as Needed” and is normally not required.

Brief background: The GREENLEAF GAUGE is a positive displacement device. By simply knowing the weight of a fluid and displacing a known amount of fluid, in this case with a sealed, weighted, specific length probe hung at precisely the correct place in the tank, one can then measure the amount of liquid in the tank. The GREENLEAF GAUGE uses several different weight referenced transducers to meet the design issues of different liquids, tank heights, and shapes. Tanks ranging in size from a few inches high to over 50 feet tall can be gauged. Each Transducer produces a unique electronic/numeric output based on standard reference weights. The calibration weight standard must be within less than 1/100 of a gram of the target test weight. Depending on your specific transducer, you will need a combination of two different weights to derive the two correct calibration numbers. **WHY IS THIS IMPORTANT?** These two unique calibration numbers **MUST** then be used in the transducer section of the gauge program that this transducer is connected to. Failure to do so will result in the gauge being unable to track the liquid volume correctly. In other words it will display gallons, but the readings may be way off from what is actually in the tank at that time.

Transducer's Serial Numbers, Sizes, and The HC and LC Numbers

Current production transducers sizes are: A, B, C, D, E, and H. You can determine your transducer(s)' size from the unique serial number labeled on the ½” pipe portion at the top part of the transducer. Current transducer styles have a test port and the letter P in the serial number, i.e. TRB123PC. Older transducer serial numbers are 3 letters and 3 numbers and a letter, i.e. TRC124B. The large printed serial number is followed by two smaller printed numbers the LC and the HC. The top number starts with 4 digits and LC, i.e. 2106 LC. The bottom number starts with 3 to 4 digits and HC, i.e. 1019 HC. The LC number **MUST** always be a larger value than the HC number.

NOTE: IF INSTALLING A NEW TRANSDUCER, CALIBRATION IS NOT REQUIRED.

Installing a newly purchased transducer does NOT require performing any part of finding the calibration numbers by using the weights in the calibration procedure. Be sure you are installing the same size, i.e. an A for an A. Changing the size of transducer **will** require changing the probe also. They both must be in the same weight range. New Transducers are labeled with the -LC- and the -HC- numbers. You **MUST** enter in the new transducer calibration numbers into the gauge transducer calibration section at the time of installation. **FAILURE TO ENTER THE NEW LC & HC NUMBERS INTO THE PROGRAMMING WILL RESULT IN FALSE READINGS.** The previous calibration numbers are no longer relevant and if not changed the gauge will not read the volume correctly.

The Tool list for calibrating/recalibrating a gauge:

2 calibration magnets*

1 set of calibration weights

Standard tools for the conduit and wiring for disconnecting from the top of the transducer

Standard tools required when dealing with a 2” pipe nipple.

*You will need two pocket magnets like the one supplied by GREENLEAF GAUGE (they both must be used at the same time). We can supply them or you can substitute a pickup magnet sold at tool/parts houses that easily picks up a 5/16 nut. Magnets that pick up more than 2 ounces maybe too strong making stepping through the program difficult.

PREPARATION STEPS FOR CALIBRATION

- Disconnect the transducer and remove the conduit from the top of your transducer.
- As you start pulling the un-screwed transducer up off the tank be prepared to disconnect the stainless steel bead chain from the probe at the coupler on the bottom of the transducer rod's slit ring. It will un-snap in only one direction.
- On short tanks just pull out the probe. On tall tanks; have a clamp or tools ready to hold onto the probe still hanging in the tank until you are ready for reassembly. Letting a probe fall back down into the tank would = A BAD DAY
- With the tank open, take a "stick reading" of the height of the liquid in the tank and record it.
- Take the transducer down to the gauge and temporarily connect it directly to the gauge wire screw terminals. (Temporarily remove any of the existing transducer wires at the gauge during this brief time)
- Have the transducer held rigidly in a straight up and down position (NOTE: Tank nipples and bungs that are not straight up and down will cause poor performance. There are special transducers available that can adjust to different angles.)

Extremely Important

- Have free access to the bottom of the transducer so the weights can easily be changed.
- Be out of any wind so the weights can hang down off the transducer without being disturbed, i.e. no wind & no vibrations. Wait until any swinging movement has stopped before taking a reading.
- Have direct access to the face of the gauge to activate the proper switches with your Magnets.
- Be able to clearly view the display and record the readings for later use.

How to Select the Correct Calibration weights

All transducer sizes, except the H, require a set of reference weights consisting of the sizes 0.5, 1.0, 2.0 pound weights made to a standard of +/- 0.01 gram of the target weight. The size H requires one additional 1.0 pound weight to be added to the set. GREENLEAF GAUGE sells these weights in a kit, but if you choose to produce your own make very sure you are within the tolerance standard. Below is a quick reference for which weights will be needed. Use which ever combination of the weights to produce the correct weight needed.

Transducer Size	Weight to use for the LC#	Weight to use for the HC#
A	1.0#	0.5#
B	2.0#	1.0#
C	2.5#	1.0#
D	3.0#	1.0#
E	3.5#	1.0#
H	4.0#	1.0#

It is important to note that the heavier weight (LC) must always be used first even if you only want to check on the lighter weight (HC)

Site considerations: Up or down?

Normally it is easier to take the gauge/transducer combo off of the top of the tank and bring it down to the ground. However, calibration can be done using the weights with the gauge/transducer combo from the top of the tank if you have additional help. This is a judgment call that has to be made at each site. Whichever method you choose the calibration procedure will need to be followed.

Calibration Procedure

-also see flow chart-

Finding the -LC- number. Hang the heavy weight for your size of transducer (chosen from the chart) on the transducer split ring. At the same time, place one magnet on the Star symbol and one magnet on the Moon symbol. Hold them there until the numeric display changes to 2 numbers, a dash, and a single letter or a number: i.e. 40-4 or 80-E depending on the age and model of the gauge your working on. Once the display reads this pattern remove both magnets. Using one magnet, place and hold it against the Star symbol on the left hand side of the gauge. Hold the magnet there until the display shows a 3 or 4 digit number and do not lift the magnet. Lightly tap on the body of the transducer a few times to settle the weight. Do this until the reading always goes back to the same number. With no movement from the hanging weight, record the four-digit number. Having recorded the number and having a still steady display remove the magnet. (This is the LC number). Remove the heavy weight and replace it with the light weight.

Finding the LC number must always precede finding the HC number. If the -LC- number process is skipped and you just try getting the -HC- number only, the gauge will NOT perform correctly.

Finding the -HC- number. Hang the light weight for your size of transducer (chosen from the chart) on the transducer split ring. Using one magnet, place and hold it against the Moon symbol on the right hand side of the gauge. Hold the magnet there until the display shows a 3 or 4 digit number and do not lift the magnet. Lightly tap on the body of the transducer a few times to settle the weight. Do this until the reading always goes back to the same number. With no movement from the hanging weight, record the four-digit number. Having recorded the number and having a still steady display remove the magnet. (This is the HC number).

Remove the light weight from the base of the transducer; we are done using the calibration weights. You now have both of the current calibration numbers to compare and enter into the transducer section of the gauge program. Before re-assembling the gauge system, measure the liquid level in the tank again if there is any possibility that it might have changed. Use the same port as the transducer and probe. Reassemble the gauge system. Determine if the liquid level can stay undisturbed for a few minutes so a comparison can be made to the readout of the gauge. Verify that the liquid level readout displayed on the gauge is within the working +/- tolerance as the liquid level of the tank chart. (Normal +/- tolerance is +/- 1% of the true total capacity of the tank) Make sure it is the correct tank chart for the tank you are working on.

Don't ass-u-me it is correct! Verify it is the right Tank Chart!

The first part of the gauge program is listed in detail in the Online User's Guide. Note the web address is printed on the face of the gauge directly below the solar cell.

The gauge may still be in the mode showing the two numbers a dash and one number or letter. Place the magnet on the Planet symbol and hold it there until the display changes, then pull the magnet away. It will either display a number or an error code depending if everything has been put back together correctly.

Now we need to go through the gauge setups dealing with the tank information in the program and write them down. Proceed into the transducer section of the program (See below “Entering the LC and HC into the Gauge”) and adjust the transducer calibration numbers. You may want to refer to the block flow diagram that is provided with these directions. (Some of these labels differ in order and may be different depending on the products and the programs, call in for assistance if help is needed.)

Hold the magnet on the Planet symbol until the readout goes to dashes across the display. Pull it away. What you should see in the display is typically -00- for a horizontal cylindrical tank or -ll- for a straight sided tank. Verify that the tank shape matches your tank. (Again please call us for assistance if something just doesn't make sense.)

Perform the next several steps by holding the magnet on the Planet symbol until the readout changes. Pull the magnet away and record the numbers shown in the display.

-PP- : total tank capacity

-LP- : lowest number that the gauge will measure at the bottom of the tank (amount of liquid in the tank below the bottom of the probe).

-HP- : value computed for the liquid type *around* 75% full. **Never change this number!** If you believe this number needs to be changed call for technical assistance.

-OS- : any off set number either + or – but **never greater than 2% of the actual total tank capacity**, normally it is just zero's. Make note of this number then adjust it to zero's for now.

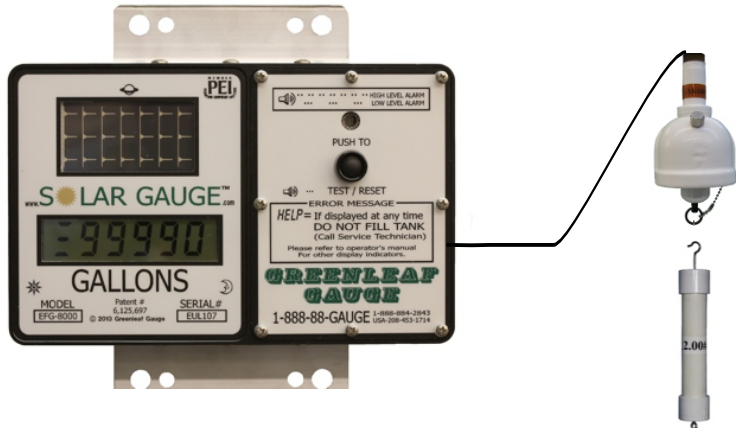
End- Hold on planet until display changes to LC. Lifting magnet will result in starting at the beginning.

Entering the LC and HC into the gauge. When you place the magnet to the Planet symbol after the OS numbers appear do not lift the magnet but hold it there (maybe up to 26 seconds) until the display shows -end (depending on the model) then CHANGES to -LC- in the display (again depending of which model). NOW you can pull the magnet away. If you pull it away before the -LC- shows you will have to go clear back through the above program steps again to get back to this step in the programming.

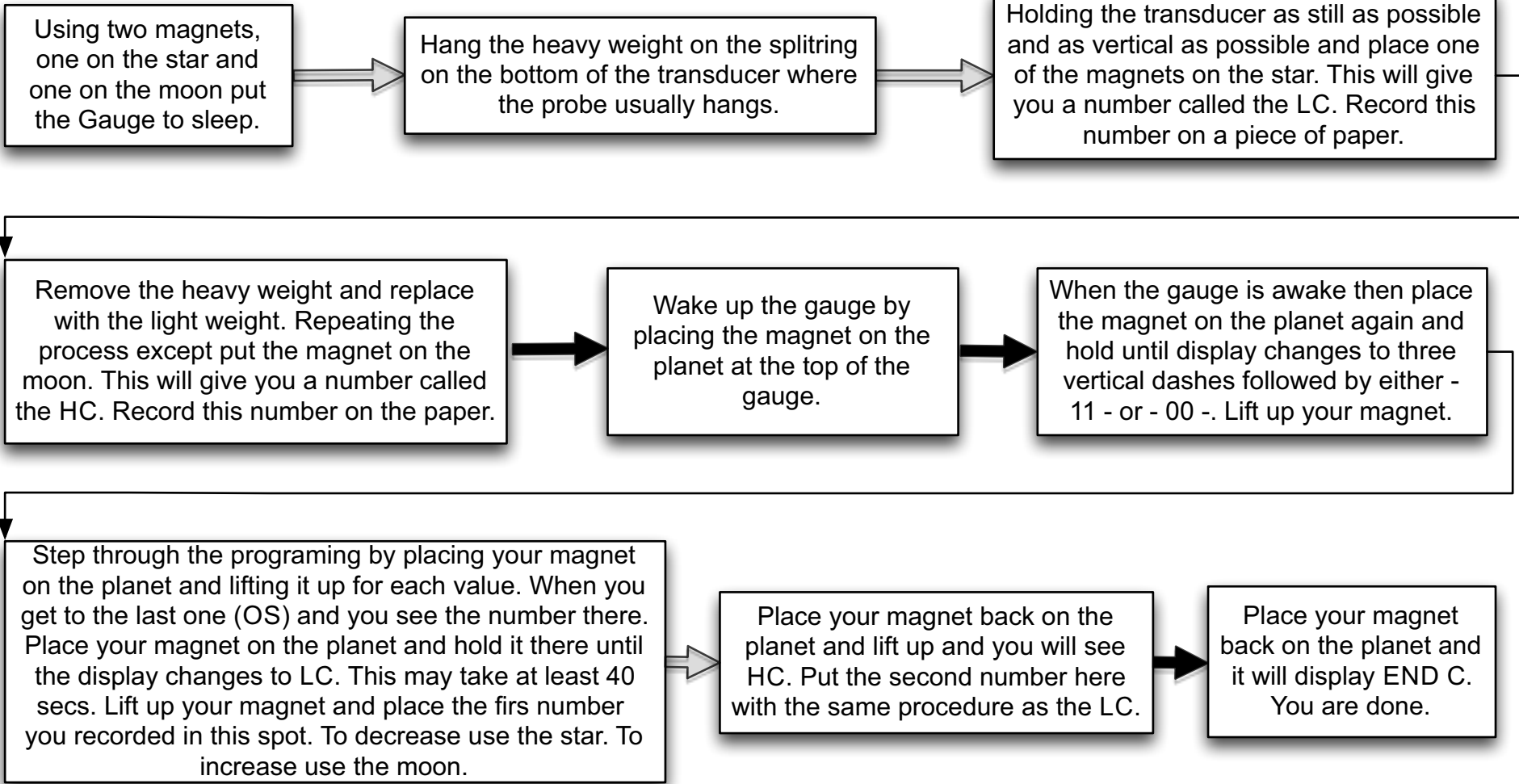
The number that shows after you had the -LC- in the display should first be recorded and then needs to be changed so it matches the number you recorded during the calibration weight procedure. It is easy to change the number: to decrease the number place the magnet on the Star, to increase the number place the magnet on the Moon. Once you have set the number in the display to match the -LC- number from the weights procedure you need to do the same thing for the -HC- number.

Place one magnet to the Planet symbol again and hold it there until the display changes and shows -HC- (depending on the model) in the display. Remove the magnet. The number that now shows after you had the -HC- in the display should first be recorded and then needs to be changed so it matches the number you recorded during the calibration weight procedure. It is easy to change the number, to decrease the number place the magnet on the Star, to increase the number place the magnet on the Moon. Once you have set the number in the display to match the -HC- number you are done changing calibration settings.

Take the magnet to the top and hold it against the planet symbol. The display will change to -endC (depending on which model) pull the magnet away. The display should now read out the quantity in your tank within the +/- tolerance. Any time you wait longer than about 30 seconds in the setup portion of the gauge program, you will fall out of the set up program and will have to start over again. The numeric values are in a secure area of the device and should always be there unless the above process changes them. If the set up numbers ever change without human intervention, the gauge is failing and will need to be replaced.



- Heavy and Light Weight
- A Transducer = 1 lb and 0.5 lb
- B Transducer = 2 lb and 1 lb
- C Transducer = 2.5 lb and 1 lb
- D Transducer = 3 lb and 1 lb
- E Transducer = 3.5 lb and 1 lb
- H Transducer = 4.0 lb and 1 lb



Differences in your recorded -LC- and -HC- numbers and number's stored previously in the set up values in the gauge program.

The four common reasons for a difference in your new numbers compared to the old numbers:

- 1 The most common reason for a difference in the old and new numbers is that someone has replaced the old transducer and installed a new transducer connected to this gauge but did not finish the installation. Installation of a new transducer must include the entering in of the new calibration numbers. The -LC- and the -HC- numbers are labeled on the new transducer.
- 2 The transducer has aged and over time the numbers have shifted.
- 3 Water damage at the top of the transducer where the three wires come out has, over the years, slowly entered the electronic components and is changing their performance. This type of damage will eventually make the transducer stop working.
- 4 Lightning events may have affected the electronics and changed their performance.

-This is the rule: -LC- numbers may not change more than 5 counts and still be serviceable. IF the number difference is greater than 5 counts replace the transducer UNLESS it is a different transducer than what the gauge was programmed for.

Call us if you need help to determine this, we track all of the serial numbers we sell.

-This is the rule: -HC- number cannot differ more than 2 counts. If it is a greater difference than the 2 counts the transducer needs to be replaced. UNLESS it is a different transducer than what the gauge was programmed for. You can always check on the serial number area on the transducer and see if your numbers are very close to what you have found. If they are both different numbers then probably the transducer has been changed out and not programmed into the gauge. Again call us if you need assistance to determine that.

Please have the serial numbers of the parts you'll be asking about when you call for assistance.

Other Calibration Issues

The -LC- and the -HC- numbers are not the only numbers in the gauge program that will affect the accuracy of the gauge. The first section of the gauge program deals with numbers based off the tank information, the second section deals with the transducer's unique calibration values. It takes correct information entered in both sections for the gauge program to accurately track the tank liquid. If you have unanswered questions please call us with the serial number and we can provide you documentation on file. Normally matching the order data to the actual on site measurements will show where any problem lies and we can address what changes need to be made so that the gauge can track the tank contents accurately.

NOTE: We have a wide variety of products and to list every programming option would not be helpful in this type of document. Please feel free to call in for assistance, we service what we sell and have replacement parts in stock to get your system going.

Contact Us:

E-mail: support@solargauge.com Outside the USA use Country code first:

Phone: Voice: 208-453-1714 Voice: 1-888-884-2843

Fax: 208-459-3365 Fax: 1-888-884-4145

Web site: www.solargauge.com

TROUBLESHOOTING

Possible error messages that may be displayed on EFG-4000 model Solar Gauge.

HELP Gauge will alternate the *HELP* error message code with one of the following error messages to help identify the problem area to correct. DO NOT FILL TANK until the problem has been corrected and the gauge is operating properly.

-*** Indicates a negative number. It may continue into the extended range until the gauge displays *-EE-*. For accuracy, the gauge should be re-calibrated using Calibration Weights. (*) Represents any numerical value, 0 through 9.

-EE- Reading has gone below the extended range. Re-calibrate gauge to correct error using Calibration Weights.

EEEE Measurement has exceeded the set capacity of the tank. This could be due to an overflow, or the float is resting on the bottom of the tank from improper installation. Check measurements &/or re-calibrate.

-LB- Internal power (the Battery) or connection problem between hardware or caused by hardware normally requires new hardware.

'5PF9 Loss of connection of the black wire between the gauge and transducer.

PRIOR TO CONTACTING GREENLEAF GAUGE FOR TECHNICAL SUPPORT, PLEASE VERIFY ORDER INFORMATION, GAUGE SETTINGS, AND COMPLETE THE FOLLOWING INFORMATION.

1. Gauge Serial # _____
2. Order # (if known) _____
3. **Accurate** measurement from bottom of tank to top of pipe nipple _____
4. **Actual** capacity of tank. Refer to formulas below. _____
5. Type of liquid in the tank _____
6. Current liquid level (inches or gallons) Please be accurate _____
8. Error messages displayed on gauge console _____
7. Changes or adjustments to original equipment _____
9. Other information _____

TO DETERMINE GALLONS PER TANK

Cylindrical tanks- measure in inches:

$$\text{Length X Diameter X Diameter X .0034} = \text{Gallons}$$

(Diameter = Circumference divided by 3.14)

Rectangular tanks- measure in inches:

$$\text{Length X Width X Depth X .004329} = \text{Gallons}$$

TECHNICAL ASSISTANCE

Greenleaf Gauge
P. O. Box 309
Greenleaf, ID 83626
888-884-2843
208-453-1714
Fax 208-459-3365
e-mail: support@solargauge.com
Web site www.solargauge.com

SPECIFICATIONS Model EFG-4000

Supply Source.....	3.6 volt High Energy Lithium battery Customer replaceable
Accuracy.....	+ / - 1.0% optimal + / - 2.0% typical
Housing.....	Aluminum - 4" diameter x 1.75" D Total height - 9"
Indicators.....	4 digit LCD digital
Operating Temperature.....	-30° F to +140° F
Warranty.....	1 year

IMPORTANT NOTICE:

The EFG-4000 is to be used only as a general accuracy liquid level monitor and **should not** be relied upon by the operator to prevent a tank overflow. The operator must monitor the tank filling process and prevent any overfills regardless of the status of the gauge.

REPAIR AND RETURN POLICIES

REPAIRS

In the event you have a problem with this product, it may need to be returned to Greenleaf Gauge for repairs. Before returning the product, contact Greenleaf Gauge for warranty status and detailed instructions for returning the gauge. Gauges covered by warranty will be replaced at no cost to the customer, providing the terms of the warranty have been followed. Call Greenleaf Gauge at 208-453-1714 or toll free 888-884-2843 for instructions on returning the gauge. If the gauge is past the warranty period, it may be returned for a core credit toward the purchase of a new gauge providing there are no signs of misuse, abuse, damage, or attempted repair.

RETURNS

To return your gauge for repairs contact Greenleaf Gauge for complete details concerning warranty issues as well as shipping requirements. Greenleaf Gauge can be contacted at 208-453-1714 or toll free 888-884-2843, our fax number is 208-459-3365 or toll free fax at 888-884-4145, or visit us on our web site at www.solargauge.com.

Repairs and returns will be handled by:

Greenleaf Gauge
P. O. Box 309
20675 N. Friends Rd.
Greenleaf, Idaho 83626