

## Frequently Asked Questions

**Q:** When I view the system before starting the test, there is always about  $\pm 0.005$  kN (0.1 lb) load in the vertical direction. Why? There is no contact between the vertical load cell and the specimen, so why is there a small fluctuation in the load and how can I make it zero?

**A:** There is always going to be a small load fluctuation of about 0.025% of load cell full capacity. To re-zero the load cell, please follow these steps:

1. Go to the System Monitor, and record the analog reading of the vertical load cell when it is at the no load condition (when the load cell is not in contact with anything).
2. Go to Calibrate Summary.
3. Overwrite the Offset value for the vertical load cell with the analog reading value from step one.
4. Click on the Apply and Ok buttons.
5. You should now see in the System Monitor that the vertical load cell is virtually zero.

Note: This re-zeroing process can be applied to other sensors such as a pressure transducer.

**Q:** What are the actual zero pressures for both the cell and the sample FlowTrac-II units at the beginning of a test?

**A:** The pressure sensor for either FlowTrac-II unit is internally located; therefore any column of water inside the tubing up to the cell will be registered at the beginning of the test. This assumes that there are no air bubbles trapped inside the lines. Conventionally, the zero pressure is the mid height of the soil sample in the cell when set onto the LoadTrac-II platen. To adjust for samples different heights, follow these steps for both the cell and sample FlowTrac-II units:

1. At the beginning of the test, open the Output valve (either using the key pad or through the PC).
2. Fill the output line with water, making sure that there are no air bubbles trapped.
3. Raise the line to the location that corresponds to the mid-height of the soil sample, and zero the pressure following the above procedure (by placing the Offset value from the System Monitor into the Calibration Summary).

**Q:** When I use report software, I cannot not change the scale as I want. For example, if I want to change the vertical displacement scale to negative 0.02, it will not change, but if I change it to negative 0.2 it will change. (In this particular case the default minimum value is negative 0.05). A similar thing happens to normal and shear stress scales too.

**A:** The software tries to keep both the vertical and horizontal scale in a ratio of 1:1 so that the Mohr circles are actually circles not ovals.

Thus, there are values in the scaling that are not acceptable to the software.

You may have to keep on trying different values.

**Q:** The platen moves down during the initialization phase until it triggers the lower limit, at which point the test stops, and an error message appears on the screen indicating that the lower limit switch is on. Why is this happening?

**A:** Here is what is going on:

The program takes into account the following when it tries to apply the vertical stress:

Axial load (+), uplift force due to the confining (cell) pressure (-), weight of the piston (+), and piston friction (-)

Obviously, there is an imbalance between all of the different vertical forces involved (vertical load, uplift force, friction force, weight of piston). This may be due to either calibration factors or incorrect values for the piston area, piston weight and friction force (or a combination of all of the above).

The only unknown in the equation is the piston friction. To get around this problem, compute the effective area of the piston actually required in the uplift computations. To do so, compute the change in the load reading due to the application of the confining pressure. The effective area of the piston is the change in load divided by the change in confining pressure.

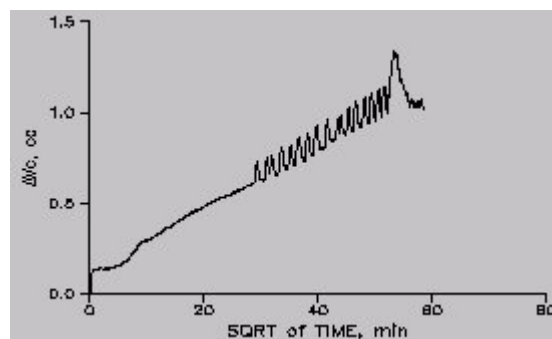
I have computed the effective area of the piston for our systems. The effective area turned out to be between 148 mm<sup>2</sup> (0.23 in<sup>2</sup>) and 225.8 mm<sup>2</sup> (0.35 in<sup>2</sup>) instead of the actual area of 587 mm<sup>2</sup> (0.197 in<sup>2</sup>). We typically use 0.33 in<sup>2</sup>. Then use 0 for both piston weight and piston friction. (They cancel each other.) Go to Options/Piston Settings to make these changes.

**Q: After running a successful test we ran into troubles with the report. We were not able to generate a report because all links on the report pull-down menu are inactive. Are we missing something or is the software not entirely installed?**

**A:** Once a test is finished or even while it is running,

1. Go to the **File** menu.
2. Click on **Load**; this will load the test data on the open window on the desktop.
3. Go back to **Report**. You should see now the **Graph**, **Settings**, and **Edit** menus all activated.
4. You can change units and scales, and edit the test data points.
5. Remember that every time you change or edit something, you will need to save the file, and load it again.

**Q: I noticed that the cell volume starts to fluctuate as soon as higher and higher cell pressure (greater than 900 kPa (125 psi) are being applied; see attached graph. Why does it do that?**



**A:** Because of the "stiffness and compliance" of the testing system, which is just a small volume of the tubing, we need to adjust the cell PID (Proportional Integral Derivative) parameters control.

There are under **Options/PID/ Cell Pressure**.

If you adjust the cell pressure proportional gain from to 1.00 to 0.25, you will see virtually no fluctuation in the pressure once it reaches the target value.

The PID control parameters are adjustable due to the nature of the different soil types and large variations in their stiffness, from very soft peat and organic soils to highly over-consolidated clays or even soft to medium rocks.

The max PID value is 5.00 (soft soils) and the minimum is 0.10 (stiff soils)

## PID CONTROL

Control of the pressure or load is accomplished by using a closed loop controller. At equally spaced time intervals called the control loop period, the controller compares the target load or pressure to the measured load or pressure. The loop error is the difference between the two. The controller uses this error to compute and send a signal to the micro-stepper motor in order to make adjustments to reduce the error by the next loop period.

The signal to the micro-stepper controls the micro-stepper's position. The loop error computed by the controller at every loop period is nothing but the additional required load or pressure to eliminate the error by the next loop period. In other words, the load rate is the error divided by the loop period.

$$\text{Signal} = \text{Error} / \text{Loop Period} / \text{Stiffness}$$

$$\text{GP} = 1 / \text{Loop Period} / \text{Stiffness}$$

$$\text{Signal (P)} = \text{GP} * \text{Error}$$

The above equation is the basic idea behind any proportional controller where GP is the proportional gain.

The controller employed by this system is actually a PID controller, where P is for proportional control, I is for integral control and D is the derivative controller.

### **Q: Can I fill up the cell chamber using the FlowTrac-II unit?**

**A:** It is not practical to fill up the cell chamber using the FlowTrac-II unit. The total volume of water required to fill up the standard chamber is about 2500 cc, and the total volume capacity of the FlowTrac-II unit is 250 cc.

The easiest and most practical way to fill up the chamber is to do so directly from the water faucet. Note: There is no particular requirement for the quality of the chamber water as long as the water is potable.

### **Q: During the test, a controller error message appears on the screen telling me that a limit switch is on; what should I do?**

**A:** A possible cause is:

A limit switch (from either the FlowTrac-II or the LoadTrac-II) has been triggered. Locate the FlowTrac-II or LoadTrac-II unit with the red flashing limit switch.

If FlowTrac-II:

Manually close the valve on the permeability cell connected to this FlowTrac-II. Depending on the status of the FlowTrac-II unit, refill if empty, or empty if full. Re-apply the pressure from before the error message; reopen the valve and then click on the **Retry** button.

If LoadTrac-II:

Lock the piston, manually move the platen, reapply the load from before the error message, unlock the piston, and click on the **Retry** button

**Q:** All values for the sensors under **View System Monitor** show values about 32000, and no sensor seems to be active.

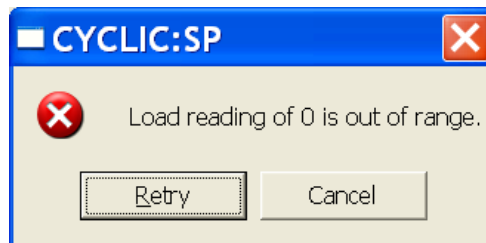
**A:** Possible causes are:

1. The SCU box is turned off
2. The 37-pin connector cable from the SCU to the back of the PC is not connected

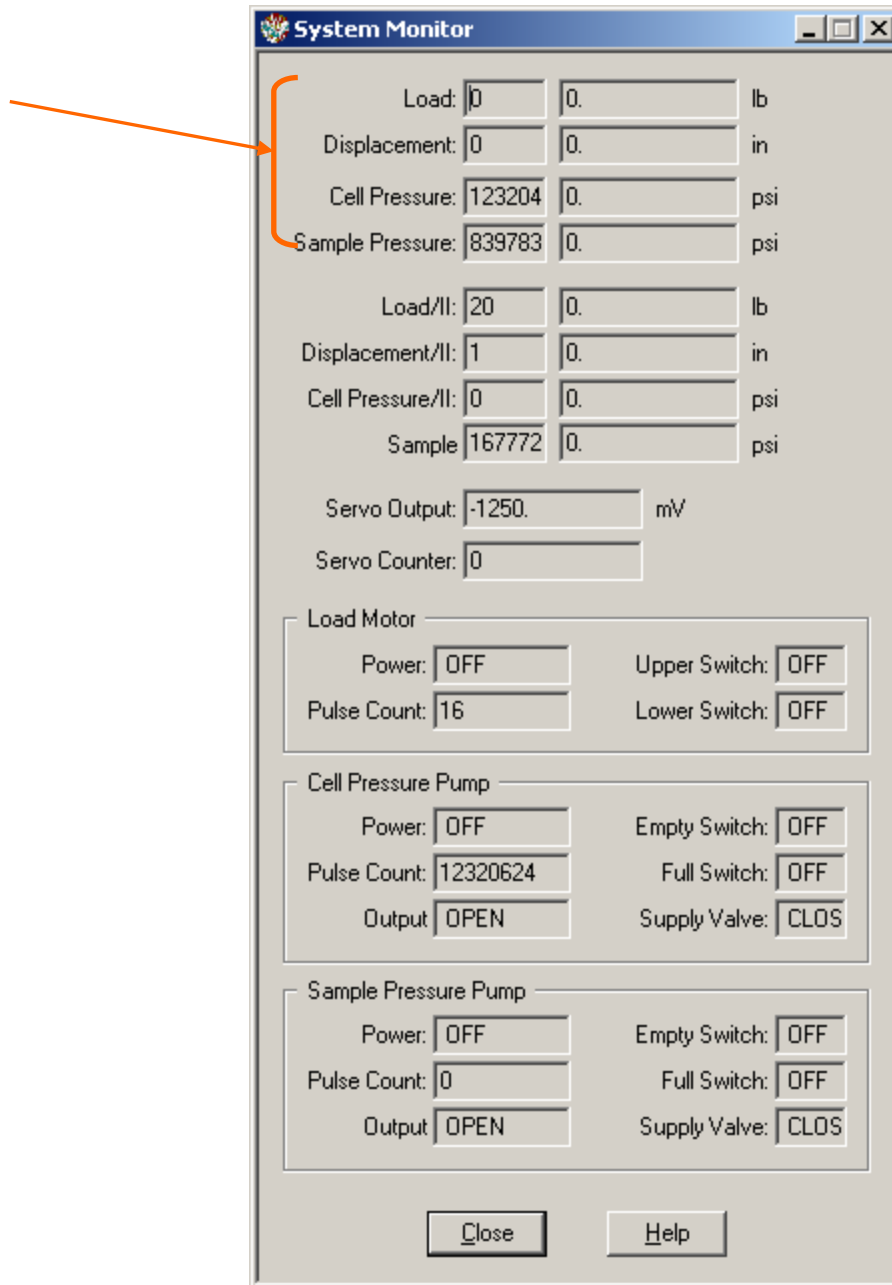
If the values shown are zeros, check to make sure that:

1. You have loaded a template file or a previously run test
2. The ID numbers on the LoadTrac-II and FlowTrac-II units match the ID numbers under **Options/Hardware**.

**Q:** Right after I start a test to save the file, the following message pops up on the screen. What is going on?



**A:** Check the **System Monitor**. If all sensors from the SCU (the first top five channels) show zero (0) readings as in the following example,



then there is another file opened at the same time with the same program. Close the other (s) program (s) and the test should proceed normally.

**Q: We have several units connected to the same PC. We were running only one of the units, so we shut off the remaining units. Then we got an error message stating that the unit was not responding. It seems that we lost communication with the unit. What is happening?**

**A:** A temporary loss of communication is a normal thing when you either shut off or boot up another unit connected to the same network. Any time a unit connected to the network is powered down or powered up, the network goes into a re-configuration mode, during which no communication is allowed. Depending on how many other units are on, this process may take some time. If you're lucky,

the Windows software will miss it. If you're not so lucky, you get the normal 'LoadTrac not responding' message. All you have to do is hit the **Retry** button and you should be all set.

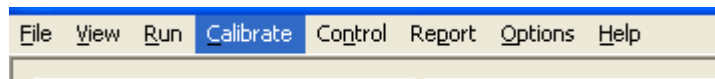
**Q: I noticed that the engineering readings on the LCD screen are different than the ones on the PC screen. Are they supposed to be the same? Did it affect the results of a test I just ran?**

**A: SYNCHRONIZING LCD AND PC SCREENS:**

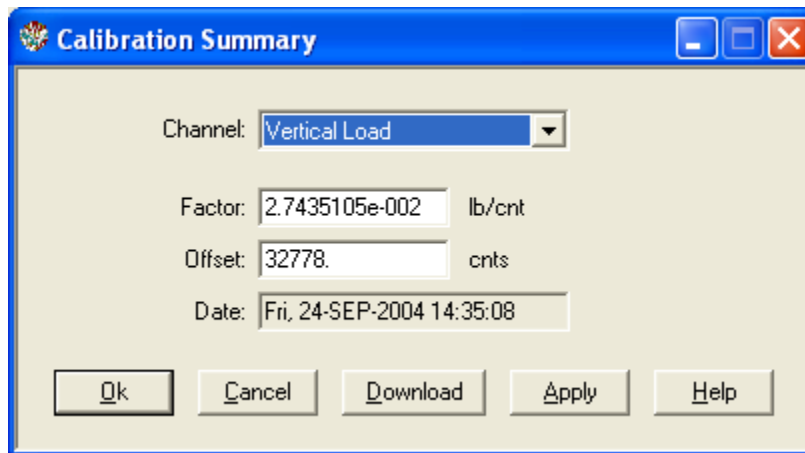
First, I would like to assure you that the mismatch of the engineering readings values between the LCD and the PC screens will not affect the results of any test that you have run through the PC software program.

Assuming that your calibration factors are correct, or that you have just finished a new calibration and need to update the calibration parameters on the embedded controller of the LoadTrac-II or FlowTrac-II or the ShearTrac-II, you can synchronize the engineering readings between the LCD and the PC screen by following these steps:

1. Go to the **Calibrate Summary** menu



2. Select the sensor that you want to synchronize



3. Click on the **Download** button. This will automatically transfer (copy and save) the current calibration parameters (**Factor** and **Offset**) into the embedded controller.
  4. Repeat the above procedure for the other sensors.
- You should now see that the PC and LCD screen values match.

**Q: After an electrical power problem, it seems that the system is not working properly. We suspect that the set-up values on the embedded controller are not correct. How do we revert to the original set-up values or default values set at the factory?**

**A: The default values may change either after an electrical power problem or due to inadvertent actions by the end user.**

You will need to revert back to the internal default values of your system by following these easy steps:

1. Turn off the LoadTrac-II (or FlowTrac-II or ShearTrac-II) unit.
2. Wait about 10 sec.
3. Turn it back on and immediately press the **ESC** key on the keypad to reset everything back to the default values.
4. You may have to manually reenter the **Node ID** number. (For example, the default value for the LoadTrac-II is 65.)

**Q: Can the software detect wrong values that are manually entered by the end user?**

**A:** Yes, the software program detects any erroneous data entry; examples include:

1. Negative values for sample dimensions, calibration factors, and **PID** control parameters
2. Zero values for sample dimensions, calibration factors (except for offset value), and **PID** control parameters
3. Wrong **Node ID** number
4. A malfunctioning sensor that it is giving an analog reading of either 0 (the minimum value) or 65535 (the maximum value)
5. Any unit (LoadTrac-II or FlowTrac-II) that is not on.

**Q: I am running a test. Do I need to wait until the end of the test to see the results?**

**A:** You do not need to wait until the end of the test. While the test is running:

1. Go to the **File** menu.
2. Select **Load**.
3. Go to the **Report** menu. You should now be able to see the partial data up to the point when you did the **Load**.
5. Repeat the above steps as the test progresses.

**Q: In many of our different test files, the calibration values in the Summary Table and the values in each sensor's individual calibration table are not in sync. Could you please explain which values the program uses, and how to make sure they are correct?**

**A:** All of the Geocomp control programs have similar menus for performing the calibration of any of the sensors related to the test. However, you must then copy the calibration that you obtained into the Summary Table. (If you have had to repeat the calibration procedure, be sure to use the correct value.)

The calibration factors in the Summary Table are the ones that the particular program uses when running a test.

Note that it is possible to have no calibration data in the calibration menu if you calibrate a sensor with one program (for example, **TRIAXIAL**) and later use a different program (for example, **ICON**): Each program will always use the calibration factors contained in its Summary Table.

**Q: Prior to cyclically loading the sample, the program wants to lower the bottom loading platen while extending the hydraulic piston. I presume that is done to put the hydraulic piston in the middle of its travel prior to cyclic loading. The program also allows you to skip this step. If one opts to skip this step, is there still a little upwards piston travel available?**

**The reason that I'm asking is that this "unloading" phase is putting an undesired load on the test specimen, and I've got some pore pressure changes.**

**A:** Yes, you are right that the piston at rest is fully extended, and prior to the cyclic phase we need the piston to be half way out so that it can extend and retract to its full travel of +/- 1.00 in. If you anticipate that the cyclic strain is going to be small, however, you could skip the "unloading" process when you judge that you have enough travel.

When the platen and the hydraulic piston are simultaneously moving, the load from the SCU should normally not vary by more than 1 lb. If you are observing relatively large loads that are creating excess pore pressure, this may be attributable to the alignment of the hydraulic piston with the cell.

**Q: What are the minimum specifications for a computer able to handle the new software for the lab equipment?**

**A:** Any PC that runs Windows-XP will do the job.

Typically, our software programs are only 500 Kb in size. Test data are stored in binary files that are typically 10 Kb in size.

**Q: Why are the engineering values shown on the PC different that the ones on the LoadTrac-II and FlowTrac-II?**

**A:** Only the calibrations that are on the computer are used during a test; the ones you see on the LoadTrac-II and FlowTrac-II are overridden by the program. (The values on the LoadTrac-II and FlowTrac-II are only used in checking the units' operation.)

You can easily synchronize the calibration factors/offsets by going to the **Calibrate Summary** window in the program and clicking on **Download** for all of the sensors. The program automatically copies the new calibration factors/offsets to the LoadTrac-II and FlowTrac-II units.