Frequently Asked Questions

Q: When I view the system before starting the test, there is always about ± 0.005 kN (0.1 lb) load in either the vertical or horizontal load cell. The load cells are at zero load (no contact). Why there is 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 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.

Notes:
1.Repeat the same process for the horizontal load cell
2. The horizontal and vertical displacement sensors do not need to be re-zeroed, as the **SHEAR-DSS** program automatically re-zeros them at the beginning of the test.

Q: When I use report software, I cannot 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 vertical frame moves down during the consolidation 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: There may be a non-zero vertical load at the start of the test that it is higher than the load in the first step in the **Consolidation Table**. Go back and re-zero the vertical load cell.

Q: I noticed that for some very soft soil, it takes longer than one second for the vertical load to reach the specified load. Why does it do that?

A: Because of the stiffness of each soil type, you may need to adjust the vertical load PID (Proportional Integral Derivative) parameters control.

These are under **Options/PID/ Vertical Load**.
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 unconsolidated clays or even soft to medium rocks.
The max PID value is 5.00 (soft soils) and the minimum is 0.10 (stiff soils). The best way to adjust this value remains by trial and error during the testing.

PID CONTROL

Control of the load application is accomplished by using a closed loop controller. At equally spaced time intervals called the control loop period, the controller compares the target load to the measured load. 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 to eliminate the error by the next loop period. In other words, the load rate is the error divided by the loop period.

Signal = Error / Loop Period / Stiffness

GP = 1 / Loop Period / Stiffness

Signal (P) = GP * 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: 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, 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: We are having a problem running the report on one of our tests, and I was hoping you could offer your insight on the situation. The shear phase of the test was started and ran for 1.65 minutes, at which time we realized that it was not running at the desired rate. We then proceeded to enter in the desired rate as step 2 in the shear phase and told the program to go to the next step, which it did with no problem. We were then running at the desired rate for the remainder of the test. Our problem comes in that we cannot get the report function to load up step 2 of the shear phase, so our report is noting 1.65 minutes to failure at a maximum shearing load of around 8 psf. This is not the correct data and therefore does not lend itself to the phi angle and cohesion calculations necessary for what we are doing. Is there a way to get the program to accept ALL of the shear data, or at least the 2nd step, so we can use the report function? This data is saved as part of the file, as we can view it in table format.

A: The new version of the **SHEAR-DSS** program has a new option to report multiple steps within the shear phase.

Q: During the shear phase, I noticed that my displacement rate is slightly different than the one that I specified in the Shear Table. Why is that? How can I set it up correctly?

A: The difference in the displacement rate between the specified one and the actual one can be attributed to the following:

A.1 The horizontal displacement transducer calibration may be off. Check the calibration factor and if necessary recalibrate the displacement transducer sensor.

A.2 The horizontal load step multiplier may need to be adjusted. Assuming that the calibration factor for the displacement transducer is correct, then follow these simple steps to adjust the Horizontal load step multiplier:

- Manually run the ShearTrac-II-DSS horizontally until the horizontal displacement transducer reads around 15000 counts.
- Go to the **View System Monitor** and record both the pulse count for the horizontal load motor and the horizontal displacement reading.
- Now run the ShearTrac-II-DSS until the horizontal reads around 45000.
- Again record both the pulse count and the horizontal displacement reading.
- Compute the horizontal load step multiplier as follows:

$$\text{Horizontal Step Multiplier} = \Delta \text{ Horizontal travel} / \Delta \text{ Pulse count}$$

- Adjust the load step multiplier accordingly.

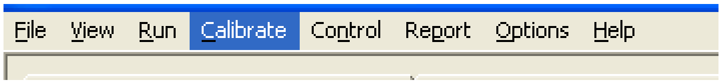
Q: We have several units connected to the same PC. We were running only one of the units, so we shut off the remaining units. Then we got an error message stating that the unit was not responding. It seems that we lost communication with the unit. What is happening?

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.

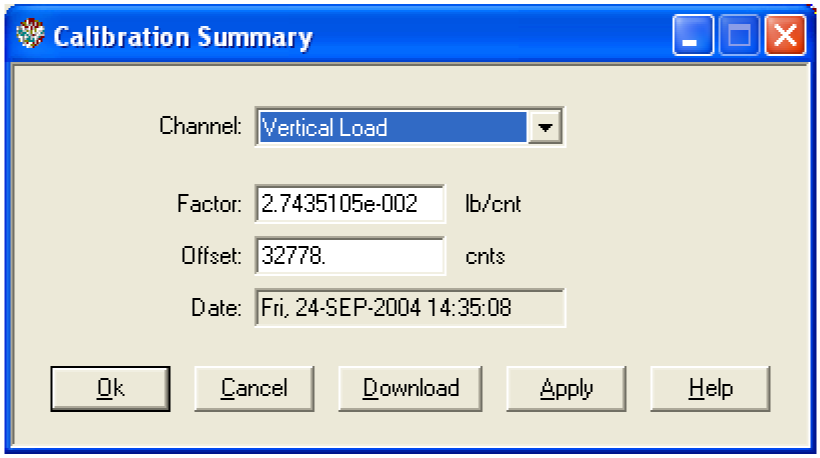
Q: I noticed that the engineering readings on the LCD screen are different than the ones on the PC screen. Are they supposed to be the same? Did it affect the results of a test I just ran?
A: <u>SYNCHRONIZING LCD AND PC SCREENS:</u>
First, I would like to assure you that the mismatch of the engineering 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 a LoadTrac-II-DSS or FlowTrac-II-DSS or the ShearTrac-II-DSS, 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 ShearTrac-II-DSS 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 Horizontal ShearTrac-II motor is 101.)

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-DSS, FlowTrac-II or ShearTrac-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, **ICON**) and later use a different program (for example, **SHEAR-DSS**): Each program will always uses the calibration factors contained in its Summary Table.

Q: Why is my final saturation value higher than 100%?

A: This value is sensitive to several factors:

- The specific gravity of the sample
- The water content
- The exact measurements of the inside diameter and height of the ring. (For instance, the diameter may be 2.489 inches instead of 2.500 inches, and the height may likewise vary. We recommend using precise calipers to measure the dimensions of the ring. This should only have to be done once.)

Q. How do I increase the responding time for the loading in the consolidation ?

A. According to ASTM standard D2435: **Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading** 1

Section 6.0

"Load application generally should be completed in a time corresponding to 0.01 t100 or

less. For soils where primary consolidation is completed in 3 min, load application should be less than 2 s."

It is easy to increase the response time of the closed-loop control by increasing the P-Gain under Options→ PID.

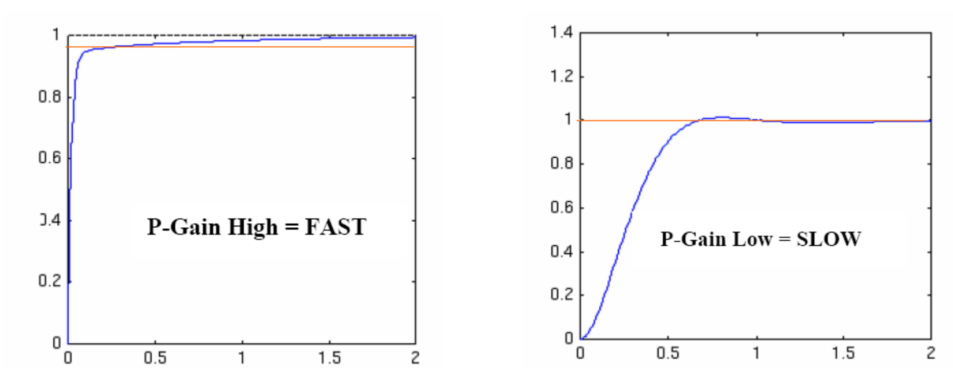
The higher the P-Gain the faster the load is applied; however the control may overshoot the target load depending on the stiffness of the soil. This gain can be changed on the fly while the test is running if further fine-tuning of the control is deemed necessary. You should use increments of 0.5 or less at a time. The trade off is that when a load specially a high one is applied rapidly, the soil if it is a very soft one can be "shocked" and it is a very stiff one, the load may take time to converge to the target value by a steeper over and under shots.

Sample stiffness	Recommended P-Gain value
LOOSE /VERY SOFT	5.0
MEDIUM SOFT/MEDIUM	2.0
DENSE/STIFF	0.5

The default values are the recommended values that should work fine with the majority of soils. The following diagrams illustrate the effect of the PID control on different soils stiffnesses. See illustrative graphs.

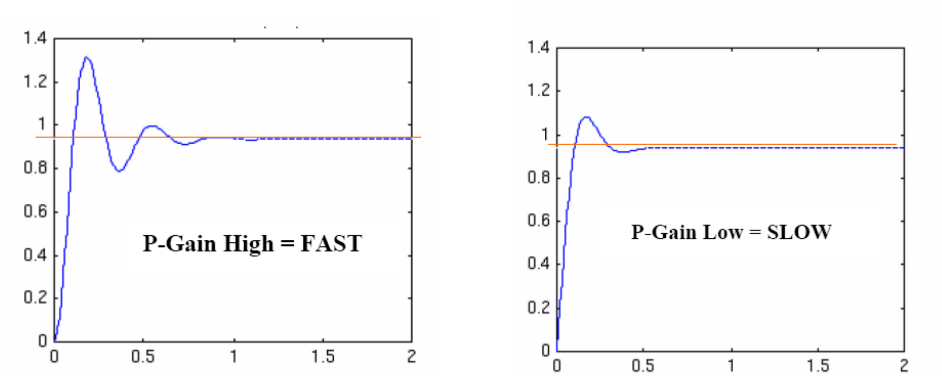
Soft or Loose Soil Samples

Load or Pressure vs. Response Time



Stiff or Dense Soil Samples

Load or Pressure vs. Response Time



Q: How is the excess pore water pressure Δu measured during the shear phase?

A. The shear phase of a Direct Simple Shear test is run under active height control according to ASTM Standard D6528, section 3.2.1. whereby the height of the specimen is kept constant through feed-back control of the vertical displacement. The sample area is constrained by the stacked rings which results in a constant volume. The change of vertical stress 6_n is the shear induced pore pressure.

Q. Although the Instruction Manual advises not to change the default PID values, the Troubleshooting section at the end of the booklet suggests different PID values for use with soft and hard samples? Is it possible to use other values than the three choices given? If so, how are we going to decide on what values to use? Please clarify.

A. The default values work for most of the soils; however in some case they do need to be fine-tuned to reflect the soil out of the normal range of stiffness such as for soft organic or highly stiff clays. So yes, you can change them by exercising caution (small increment in change at a time) in doing so.

Q. What are the effects and correlations between the PID values?

A. Effects of each of controllers P-Gain, D-Gain, and I-Gain on a closed-loop system are summarized in the table shown below.

CL RESPONSE	RISE TIME	OVERSHOOT	SETTLING TIME	S-S ERROR
P-Gain	Decrease	Increase	Small Change	Decrease
I-Gain	Decrease	Increase	Increase	Eliminate
D-gain	Small Change	Decrease	Decrease	Small Change

Note that these correlations may not be exactly accurate, because P, I, and D are dependent of each other. In fact, changing one of these variables can change the effect of the other two. For this reason, the table should only be used as a reference when you are determining the values for P, I and D.