

**GCM4 Software User Guide
Static Pile Test Applications
PILE PRO**

Updated November 2017

Ver. 2.80

INTRODUCTION

Automated remote or real-time data collection can be easily accomplished using our distributed network hardware components. Our GCM4 controller module can connect multiple data collection nodes (GST modules) or in-place inclinometers over significantly long cable lengths. Our Real Time Monitoring Software allows viewing of plots and reduced data for field testing applications where the GCM is connected to a PC computer. Alternatively, the GCM can be connected to an internet modem for long-term automated geotechnical or structural monitoring projects. This document provides a description of how to use our GCM4 and multiple GST modules to monitor and display static pile test results using a PC field computer.

PILE TESTING HARDWARE

The static pile testing application uses one GCM4 (Figure 5) and one or more GST data collection modules connected end-to-end using a single CAN network cable as shown in Figure 1.

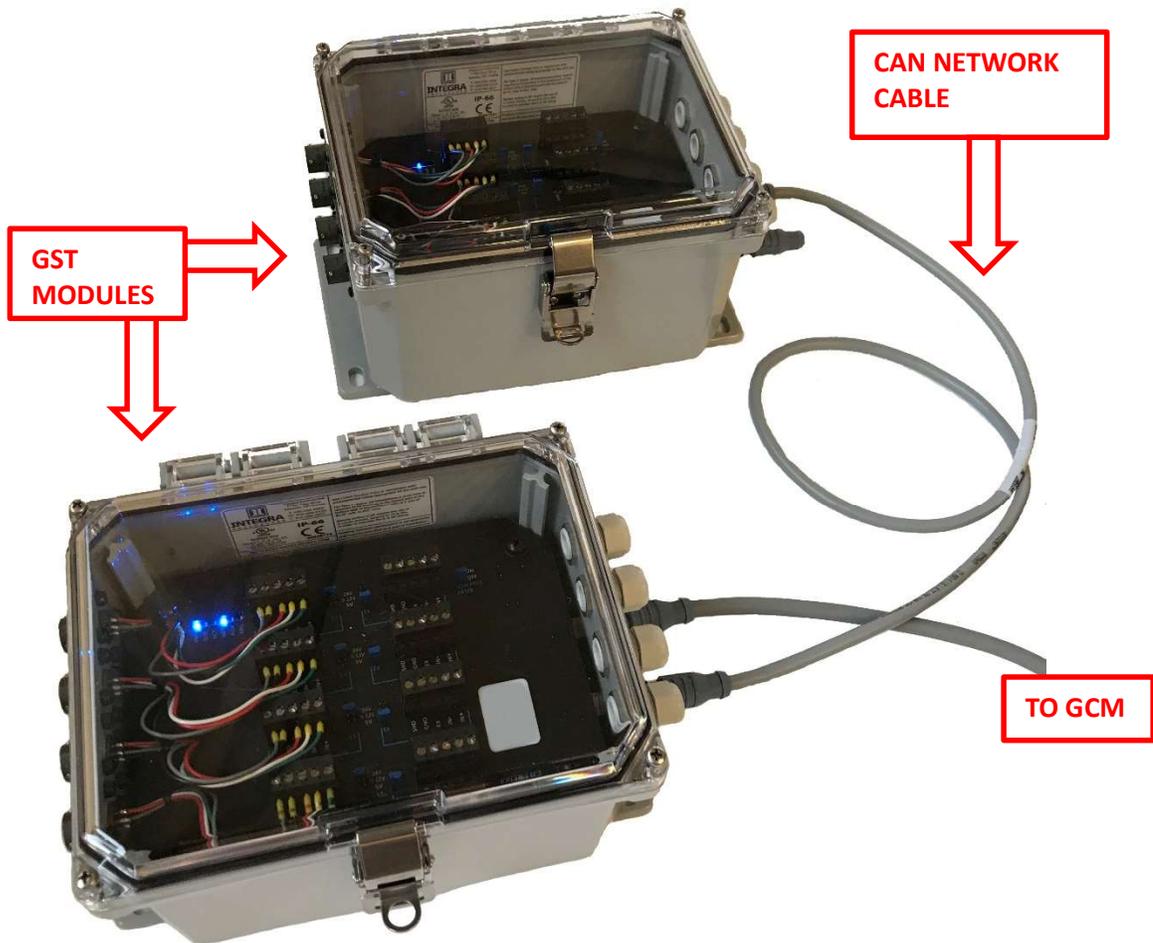


Figure 1 – GST Modules

Each GST module is mounted inside a waterproof enclosure and includes a connection panel containing a series of removable plugs for connecting load cells, LVDTs, and strain gauges to different input channels (Figure 2).

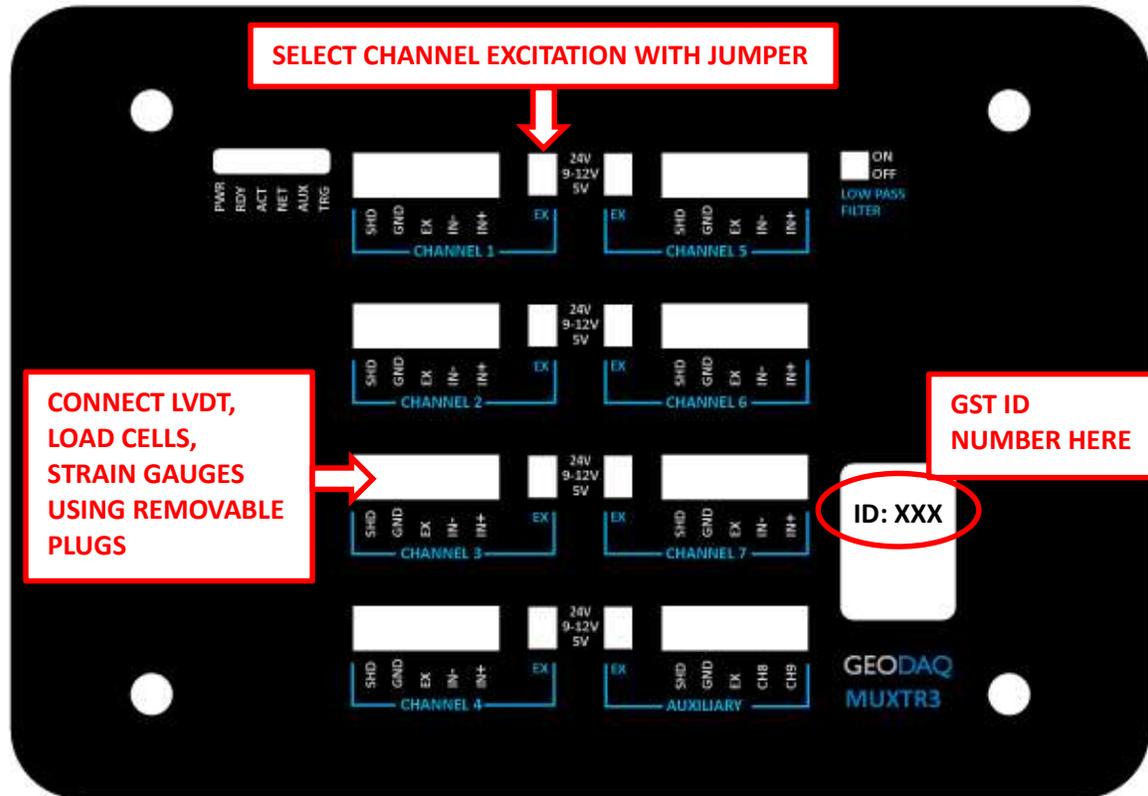


Figure 2 – GST Connection Panel

Connect pile testing sensors to each channel using the removable plug with the following definitions:

- GND: Ground
- EX: Sensor Excitation (5 volts, 9-12 volts, and optional 24 volts)
- IN-: Sensor output signal low (ground for single-ended sensors)
- IN+: Sensor output signal high
- SHD: Cable shield connection

The excitation voltage can be configured for each channel individually by positioning the blue jumper next to the desired voltage. Figure 3 shows the correct position for a 5 volt and 9 to 12 volt excitation. **Connection of the jumper as shown in Figure 4 will short two excitation voltages together and cause damage.**

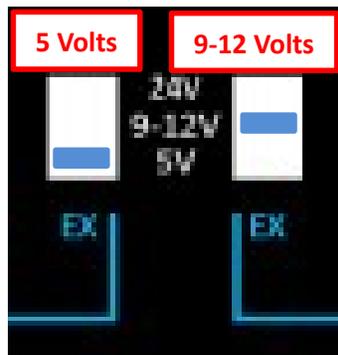


Figure 3 – Example Excitation Voltage Configuration for 5 Volts and 9-12 Volts

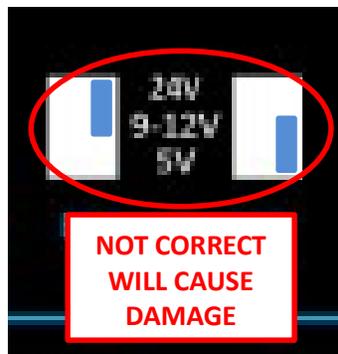


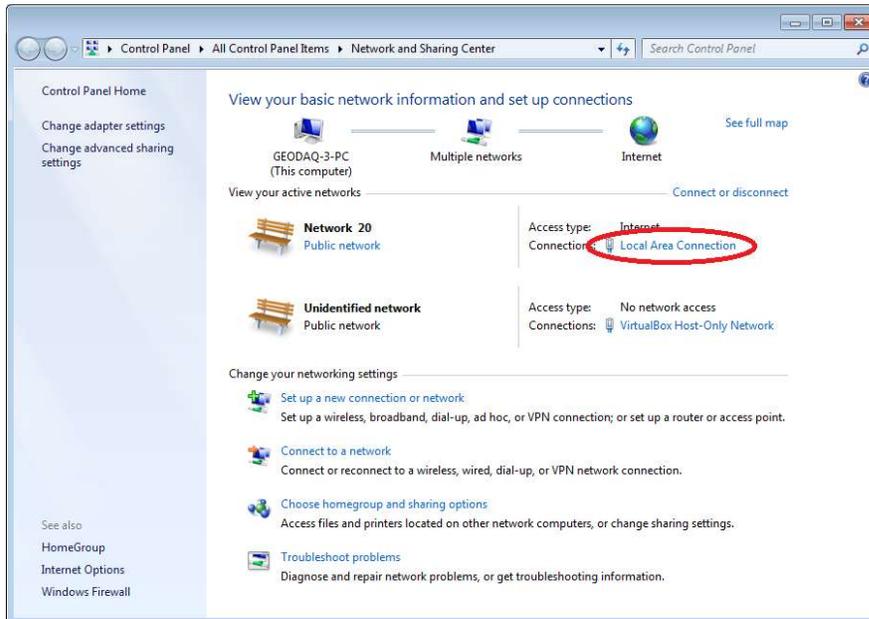
Figure 4 – Incorrect Excitation Voltage Connection



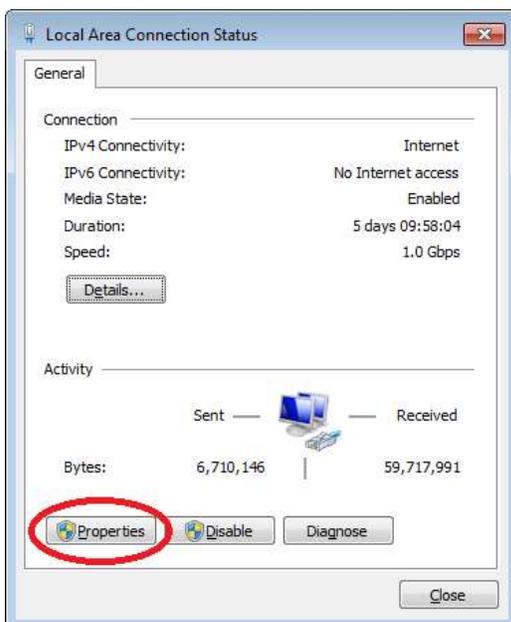
Figure 5 – GCM Controller Module with Enclosure

NETWORK SETUP FOR WINDOWS 7, 8, and 10

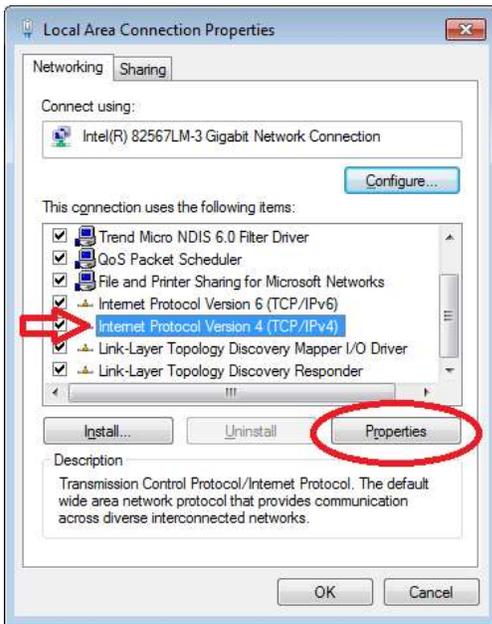
On the bottom right corner, right click the Network button and click “Open Network and Sharing Center”. Click the hyperlink for the Ethernet Connection. The default setting is “Local Area Connection”. Depending on how the computer is configured, the hyperlink may be called “Ethernet”.



In the “Local Area Connection Status” or “Ethernet Status” window, click “Properties”



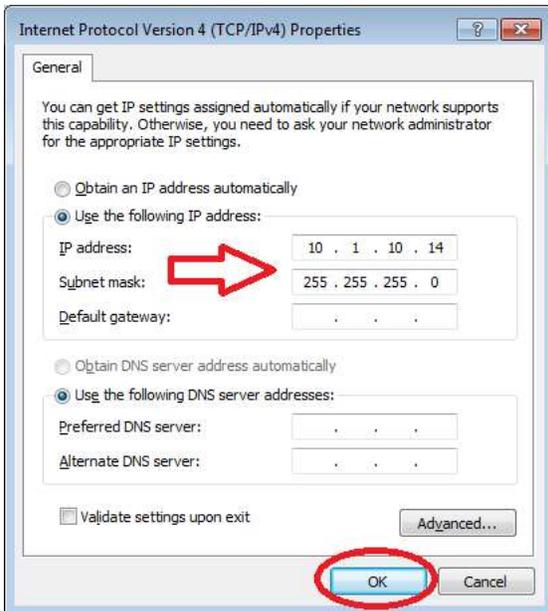
Select “Internet Protocol Version 4 (TCP/IPv4)” and click “Properties”



Enter the IP Configuration as below and click “OK”

IP address: 10.1.10.14

Subnet mask: 255.255.255.0



After clicking “OK”, the computer is configured to communicate with the GCM4, so you can close the network configuration windows.

STATIC PILE TEST SOFTWARE GUIDE

Start the Real Time Monitoring Software program and follow these steps:

STEP 1: Create Output File and Configure GCM4

Pile load test readings will be collected and saved to file. Click the “Output File” button as shown in Figure 6, and select a file to append readings to or create a new file. If you do not open or create a new file before starting a pile test, a file name will be created for you using a current time stamp number. It is important to verify the new file has been created and data is being saved during each test. Two files will be created. One file contains results in engineering units and the other file has raw data and has the file extension “.RAW”.

The default operation settings as shown in Figure 6 will work well for a typical static pile load test.

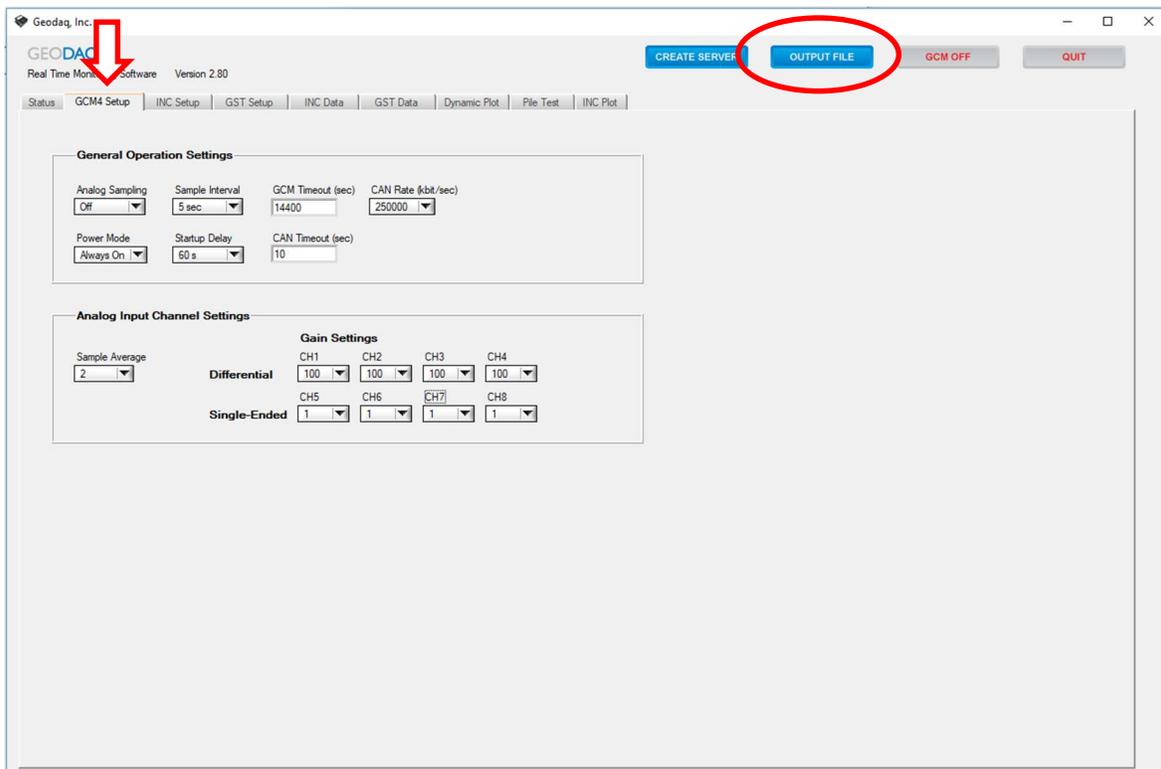


Figure 6 – GCM4 Setup

The following list provides a description of some of the options under the GCM Setup TAB:

Sample Interval: You can change the sample interval if you would like to record readings at faster or slower time intervals.

Analog Sampling: You can turn this on to collect additional information from the GCM like temperature, voltage levels, and current draw. Turning this ON will limit the sample interval.

CAN Rate: This parameter determines how fast data is transferred from each GST module to the GCM unit. Longer cables and increased number of GST modules may require a slower CAN rate to transfer data correctly.

GCM and CAN Timeout: These parameters provide a time limit for how long the GCM will wait for all of the GST modules to report each reading or how long the GCM will operate before automatically rebooting itself.

STEP 2: Setup GST Module(s) Information

The pile load test application collects data from one or more GST modules. Each GST module can acquire readings from seven (7) differential or single-ended inputs plus two (2) channels for single-ended inputs. Additional sensors or transducers can be monitored by adding GST modules to the network. First, select the “GST Setup” TAB shown in Figure 7. You can configure each GST manually or recall setup information from a previously saved file.

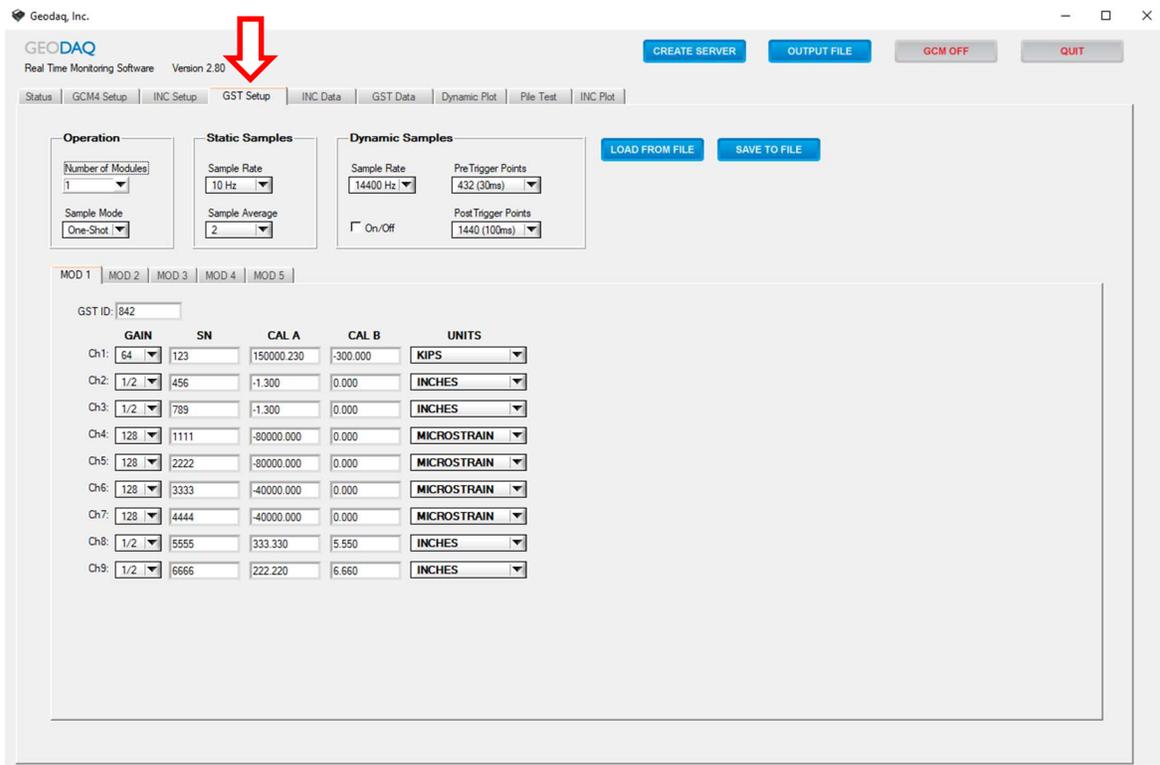


Figure 7 – GST Setup

Setup GST Information for First Time

- Select the Number of GST Modules connected to the GCM4.
- For each GST module, enter the GST ID and the parameters for each channel (GAIN, SN, CAL A, CAL B, and UNITS). These parameters are described below.
- After all the ID numbers and channel parameters have been entered, click “SAVE TO FILE” button and create a file name for your pile test setup.

Recall GST Setup Information from File

- Click the “LOAD FROM FILE” button.
- Select the file containing the GST module setup information.
- Review the ID numbers and channel parameters and make changes as needed. If changes are made, re-save setup file.

Results displayed on the screen are calculated using the following equation where output is in units of volts:

$$\text{Result} = \text{Output} * \text{Cal A} + \text{Cal B}$$

The following table provides a voltage input range for various gain settings on the GST module. Typical gain settings for LVDT instruments might be Gain = 0.5 or 1 while load cells and strain gauges might be Gain = 64 or 128.

Input Gain	Input Range (Volts)
0.5	+/- 5
1	+/- 2.5
2	+/- 1.25
4	+/- 0.625
8	+/- 0.3125
16	+/- 0.15625
32	+/- 0.078125
64	+/- 0.0390625
128	+/- 0.01953125

STEP 3: Connect GCM4 and Create Server

Perform the following steps to power on the GCM4 and establish communication between the PC and the GCM4:

- Connect an Ethernet cable from the PC to the GCM4.
- Confirm that the power switch on the GCM4 is in the OFF position.
- Connect the power cable to a 12 volt power supply. The power supply should have the capacity to source up to 5 Amps.
- Toggle the power switch to the ON position. After the GCM and COM LED lights turn on, click the “Create Server” button.
- The message shown in Figure 8 indicates a successful connection with the GCM4.
- If you see an IP number different than 10.1.10.14, turn the power switch to the OFF position, restart the software and repeat the connection procedure.

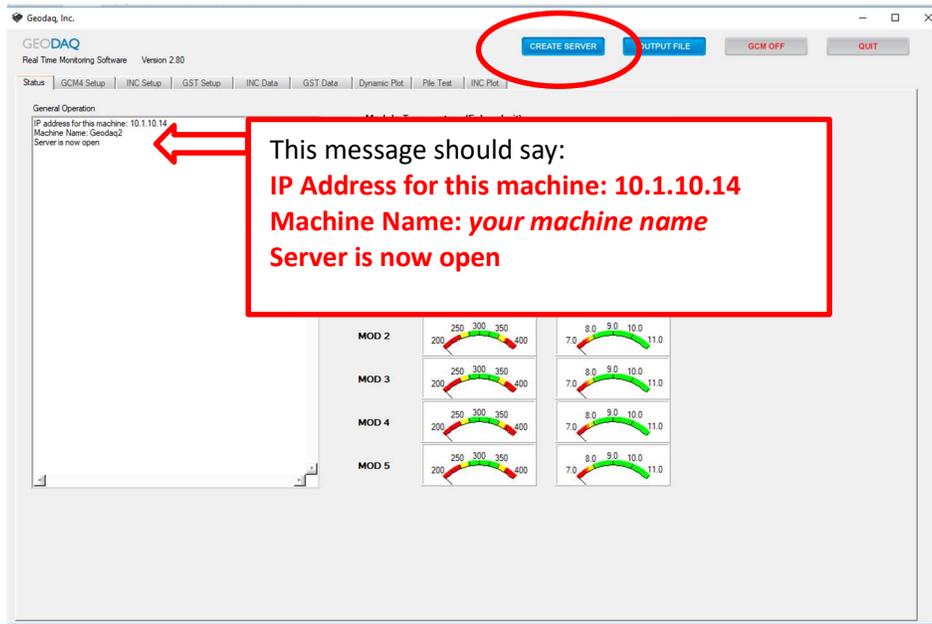


Figure 8 – Create Server

STEP 4: Viewing Static Pile Test Results

The GCM4 will automatically begin sampling about 30 seconds after completing STEP 3. Both raw and reduced results can be viewed in tabular format by clicking on the “GST Data” tab as shown in Figure 9.

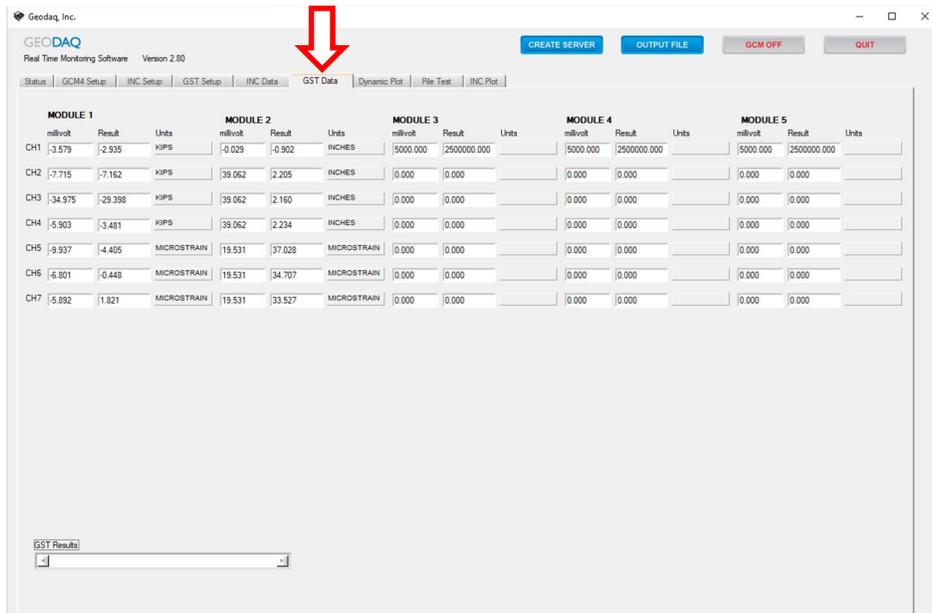


Figure 9 – Tabular Data Results

Plots of pile load and displacement can be viewed in real-time by clicking on the “Pile Test” tab and the “LOAD DISPLACEMENT” tab as shown in Figure 10. Up to four load cells can be added together by selecting the checkbox and entering the appropriate module and channel number in the area labeled “FORCE”. Up to four displacement transducers (LVDT) can be averaged together by selecting the checkbox and entering the module and channel number in the area labeled “DISPLACEMENT”. Individual displacement values can be plotted by selecting the checkbox, module and channel in the area labeled “SERIES”.

Displacements shown in these plots are calculated by subtracting the most recent reading from a baseline reading. By default, the very first reading (or record) is selected as the baseline. The user can change the baseline at any time by adjusting the “Baseline Record”. The user can also change the maximum and minimum plot scale at any time by changing the input values shown in the “X-Axis Scale” or “Y-Axis Scale” areas. Automatic scaling occurs if the “Auto” checkbox is selected. The X-Axis can be placed on the top or bottom of the plot by toggling the “X-Axis Top” button. The Y-Axis can be displayed in reverse order by toggling the “Y-Axis Up” button. The sign of displacement calculations can also be changed using the Normal/Reverse toggle button.

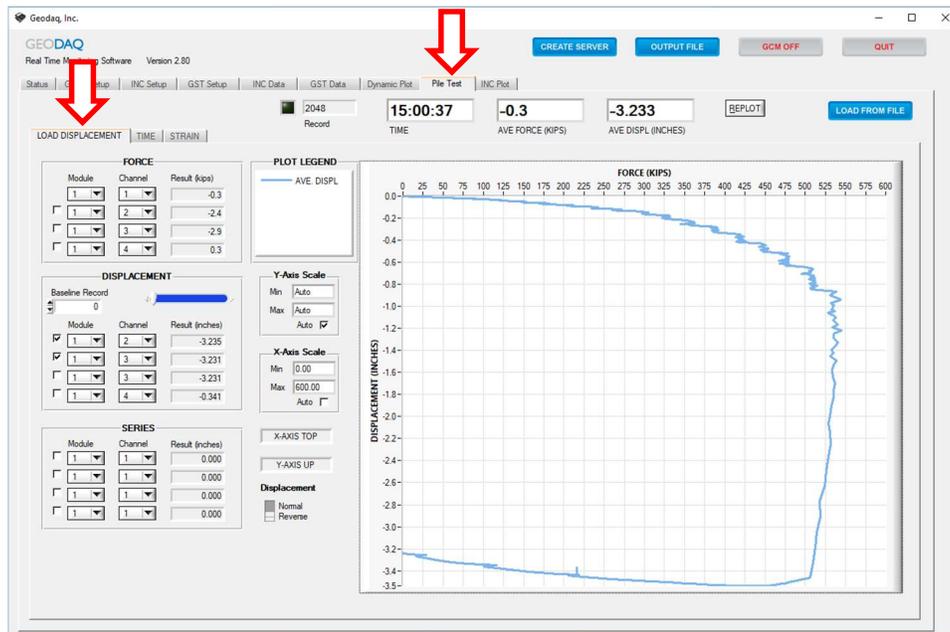


Figure 10 – Pile Load Displacement Plot

Time series plots can be viewed in real-time by clicking on the “Pile Test” tab and the “TIME” tab as shown in Figure 11. Any channel on any module can be viewed by selecting the checkbox and entering the module number and channel number. If the test pile is instrumented with strain gauges, pile forces along the length of the test pile can be viewed by clicking on the “STRAIN” tab as shown in Figure 12. In order to view pile forces as shown in Figure 12, checkboxes with module numbers and channel numbers need to be entered for each strain gauge under the “TIME” tab (Figure 11). The depth of each strain gauge and values for elastic modulus and cross-sectional area of the pile need to be provided under the “STRAIN” tab.

Previous pile test results can be viewed by loading the GST setup information (STEP 2) and clicking the “LOAD FROM FILE” button shown in Figure 10. The loaded file must be a raw data file with the file extension “.RAW”. Follow the same procedure above to select viewable modules and channels and click the “REPLOTT” button to update the plots.

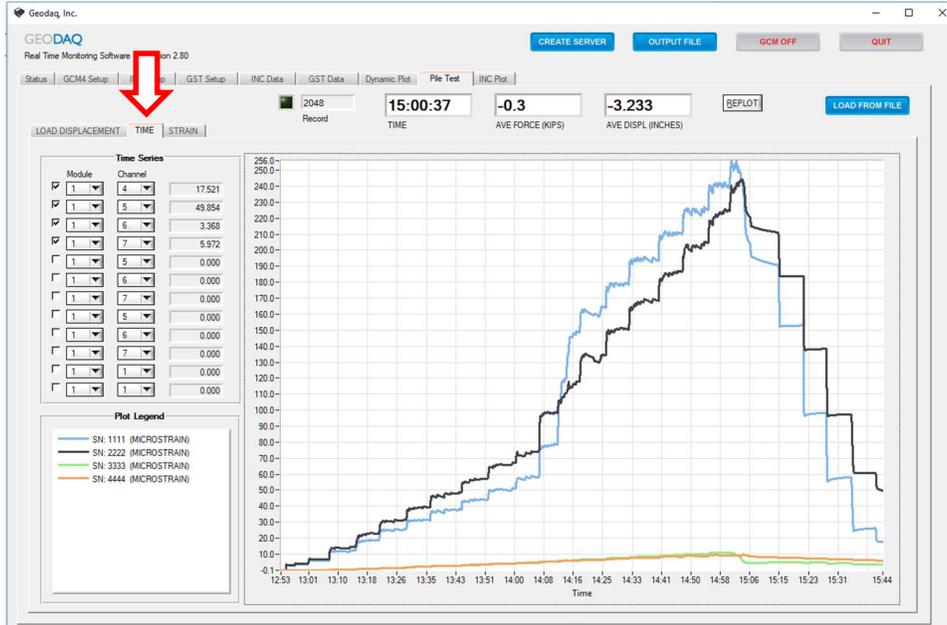


Figure 11 – Time Series Plots

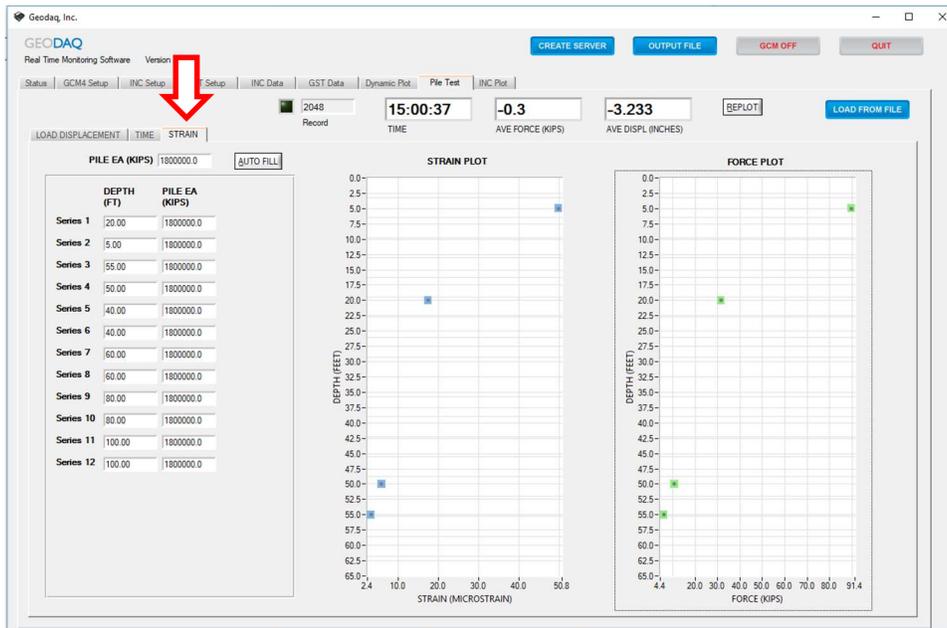


Figure 12 – Strain and Pile Force Plots

Powering Down GCM4

When inclinometer monitoring is complete, the GCM4 should be powered down using the following procedure:

- Click the “GCM OFF” button (see Figure 13).
- Wait for the GCM4 to complete the current sample. When the sample is complete and the GCM4 begins the process of powering down, the LP1 LED on the GCM4 will flash rapidly.
- Wait for the LP1 LED to stop flashing and then turn the GCM4 power switch to the OFF position.
- Click the “QUIT” button.

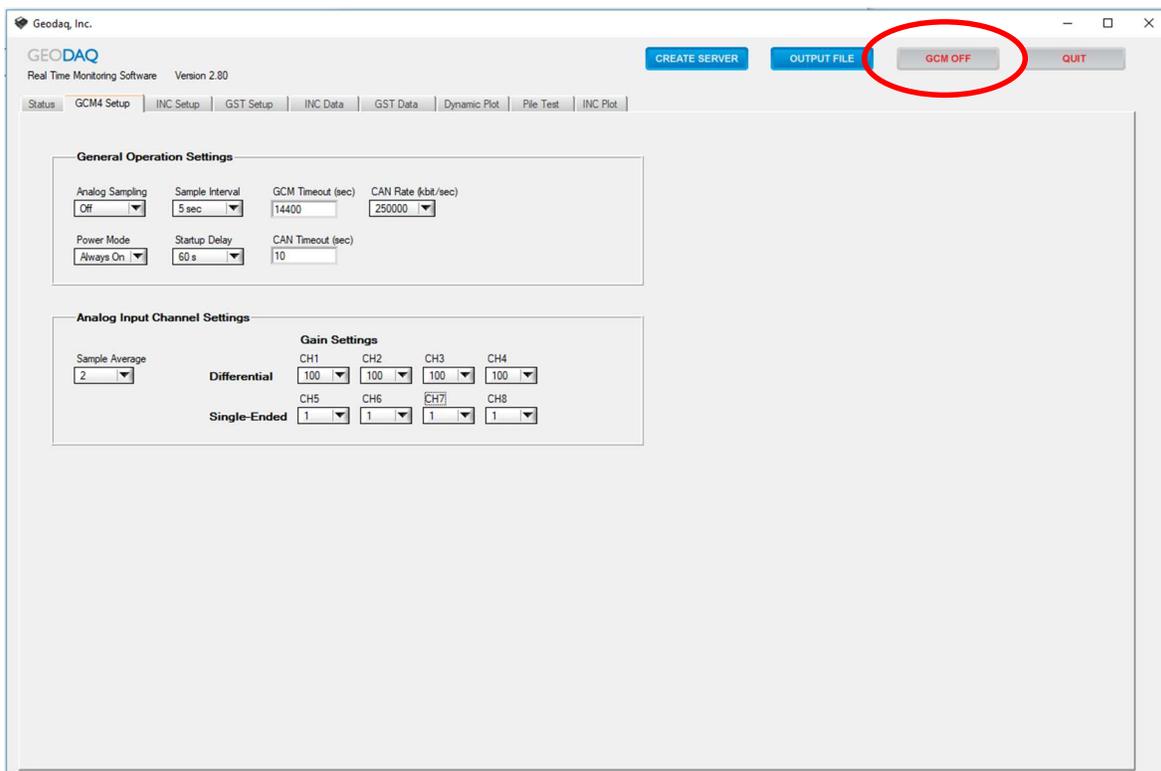


Figure 13 – GCM4 Power Down