HUMBOLDT

Humboldt Material Testing Software

Manual

version 1.1

Humboldt Material Testing Software

Material Testing and Analysis Software

The following Humboldt products are compliant with HMTS:

HM-2325A MiniLogger four-channel analog data acquisition unit

Ideal for: Triaxial, UU, CU, CD, one dimensional consolidation, direct shear and other tests

HM-2330D MiniLogger four-channel analog to digital data acquisition unit

Ideal for: Triaxial, UU, unconfined, one dimensional consolidation, direct shear and other tests

HM-2560A ShearScan 10 Pneumatic Direst/Residual Shear Apparatus

Meets ASTM D3080, AASHTO T236 and BS 1377 standards

HM-2700A Direct Residual Shear Apparatus with analog inputs

Meets ASTM D3080, BS 1377 standards

HM-2700D Direct Residual Shear Apparatus with digital inputs

Meets ASTM D3080, BS 1377 standards

HM-3000 Digital MasterLoader

Covers: CBR, UU, CU, UC, Marshall and Hveem Tests

ASTM: D1883, D2850, D2166, D4767 and D1559

AASHTO: T193, T296, T297, T208, T245 and T246

BS 1377: Part 4: 1990, BS 1377: Part 7: 1990, BS 1377: Part 8: 1990, BS 598: Part 107

Humboldt Material Testing Software Manual

Printed: October 2006 in (Raleigh, North Carolina USA)

Publisher

Humboldt Scientific, Inc.

Managing Editor

Mahir Al-Nadaf

Technical Editors

Shawn Brady
Tim Safley

Cover Designer

Tim Safley

Contact us:

Humboldt Scientific, Inc.
551D Pylon Dr.
Raleigh, North Carolina 27606
USA

1.800.537.4183 or 919.832.6509
FAX:919.833.5283

hsi@ehumboldt.com

Table of Contents

Disclaimer of Responsibility

SAFE USE OF EQUIPMENT

Use of instruments, apparatus and equipment described in this manual may involve hazardous procedures and/or materials. Use may also be subject to regulatory limitations. Information in this manual is not attended to address the many safety, legal and regulatory issues associated with use.

It is the responsibility of the user to:

1. Follow appropriate methods to insure that industry standards are met for all safety and health issues resulting from use.

2. Determine applicability of all regulatory limitations prior to use.

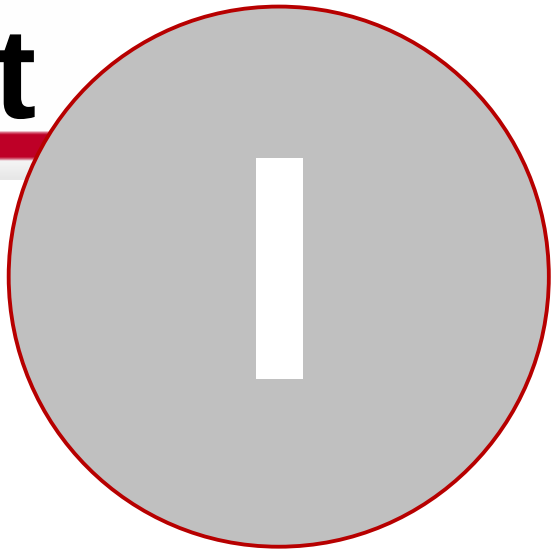
3. Be familiar with all applicable test standards and test procedures.

4. Comply with all applicable Federal, State and Local laws and regulations relating to the use of such goods.

Neither Humboldt nor other manufacturers of equipment sold by Humboldt can assume any liability express or implied for user's failure to follow Industry standards for safety and health, or to comply with applicable regulatory limitations, standards and procedures.

Humboldt Material Testing Software Manual

Part



1 Introduction

1.1 About the Manual

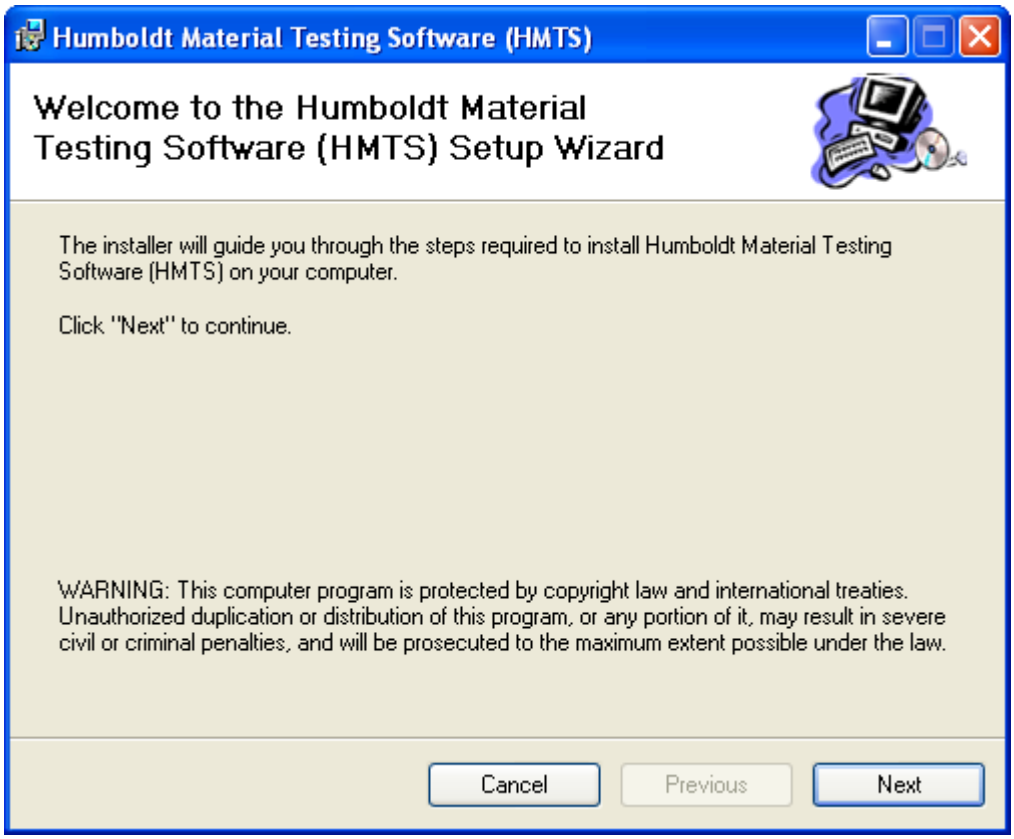
The Humboldt Material Testing Software Manual was made to be a reference guide used in conjunction with the Humboldt Material Testing Software. This manual has been divided into eight parts to help simplify your testing process. The first part will guide you in the installation of the software and how to remove it if necessary. The second part deals with settings and views and will help you configure your computer for optimum performance and show you how to set up your software for testing and registration purposes. Part three will explain how to connect your devices properly and help you understand the connection scheme and device options. Part four will guide you in the calibration process. It shows anything from how to follow the calibration wizard, to retrieving your calibration, to how to manage your calibrations. In part five, you will discover how to retrieve, view and export your data that you have collected in your tests. The sixth part will walk you through the testing process. Here, you can find out how to import or export a test, run a specific test or create your own test. The seventh part is home to Appendix A. Here you can view the test calculations for a specific test. Finally, in Appendix B (part eight), are the instructions to replace the EPROM. The index at the end of the manual was made for a quick, topical keyword search.

1.1.1 Software Installation

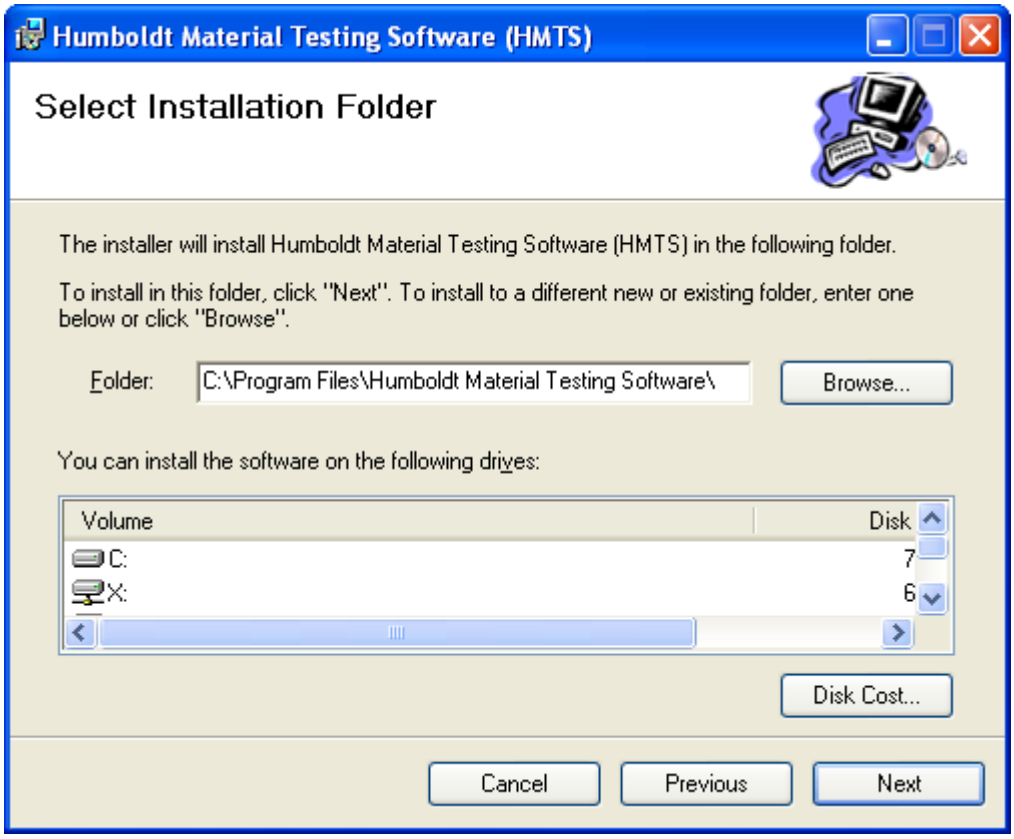
Follow these steps to install the Humboldt Material Testing Software on your computer.

Step 1: Insert the Material Testing Software CD into the CD-ROM drive of your computer.

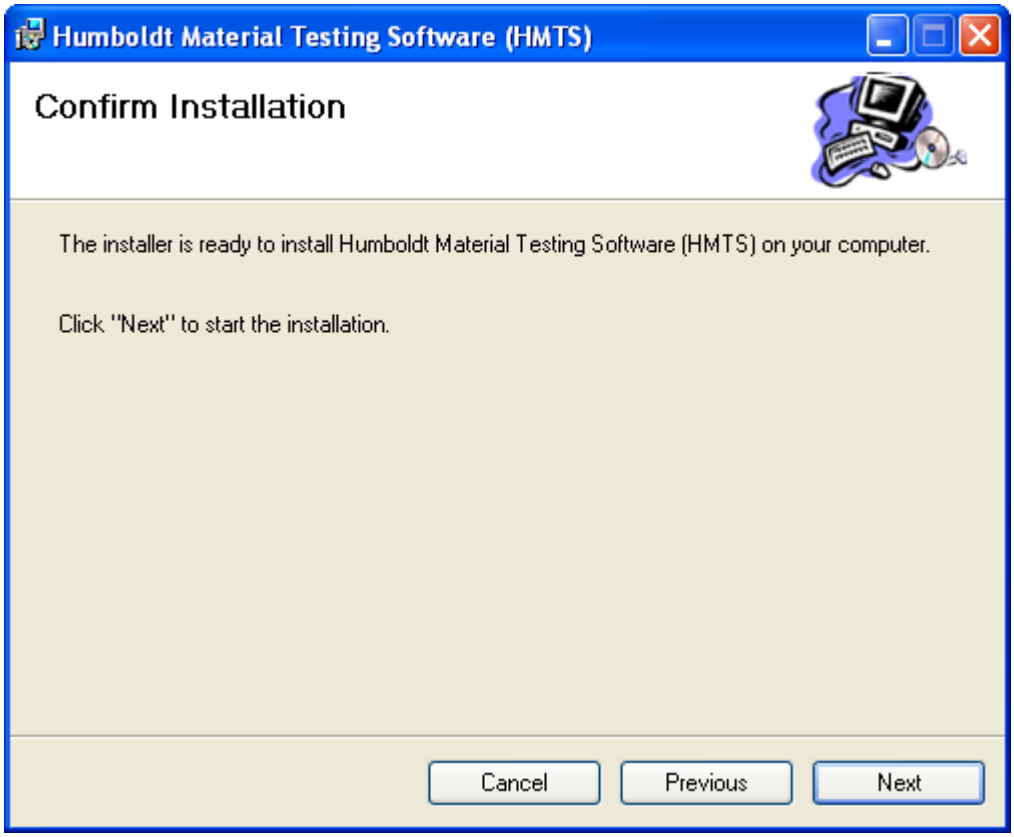
Step 2: The Setup Wizard will automatically start. Click "Next" to continue.



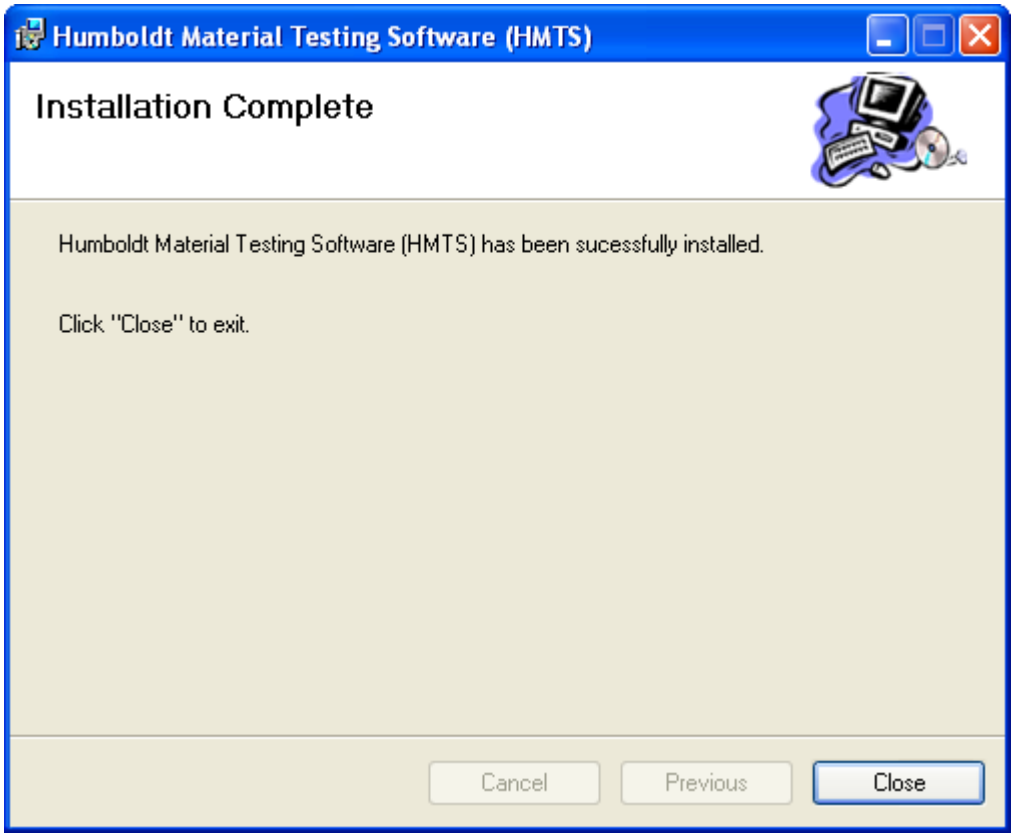
Step 3: Select the installation folder. Choose the folder that you would like to install HMTS on or click next to install the software on your default folder.



Step 4: Click "Next" to begin installation.



Step 5: Click "Close" to exit. HMTS is now installed on your computer.



Step 6: A HMTS icon has been added to your desktop. Use this shortcut to access the HMTS program.

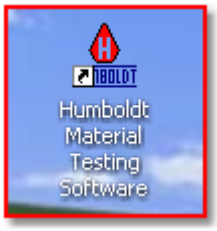


Figure 1: HMTS shortcut.

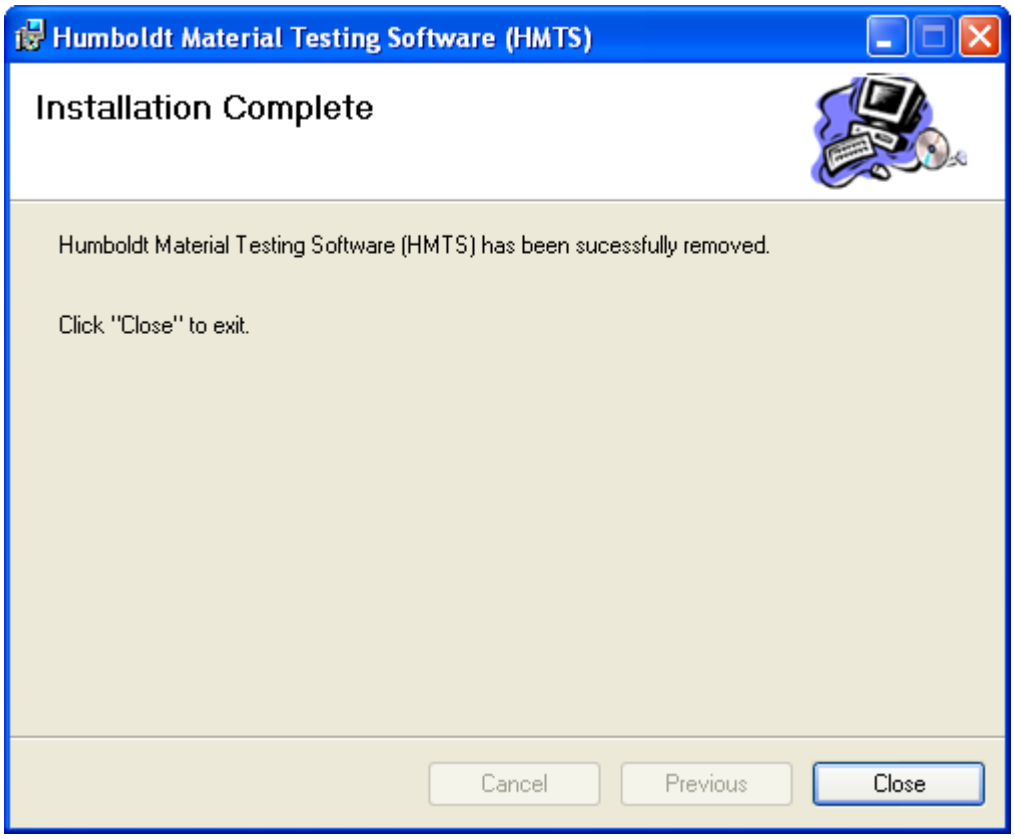
1.1.2 Software Removal

You can remove HMTS by using the software CD or if you do not have the CD, by using the control panel of your computer.

Removal by CD

Step 1: Insert the HMTS CD into the CD-ROM drive of your computer. The Setup Wizard window will appear and prompt you to either "repair" or "remove" the software.

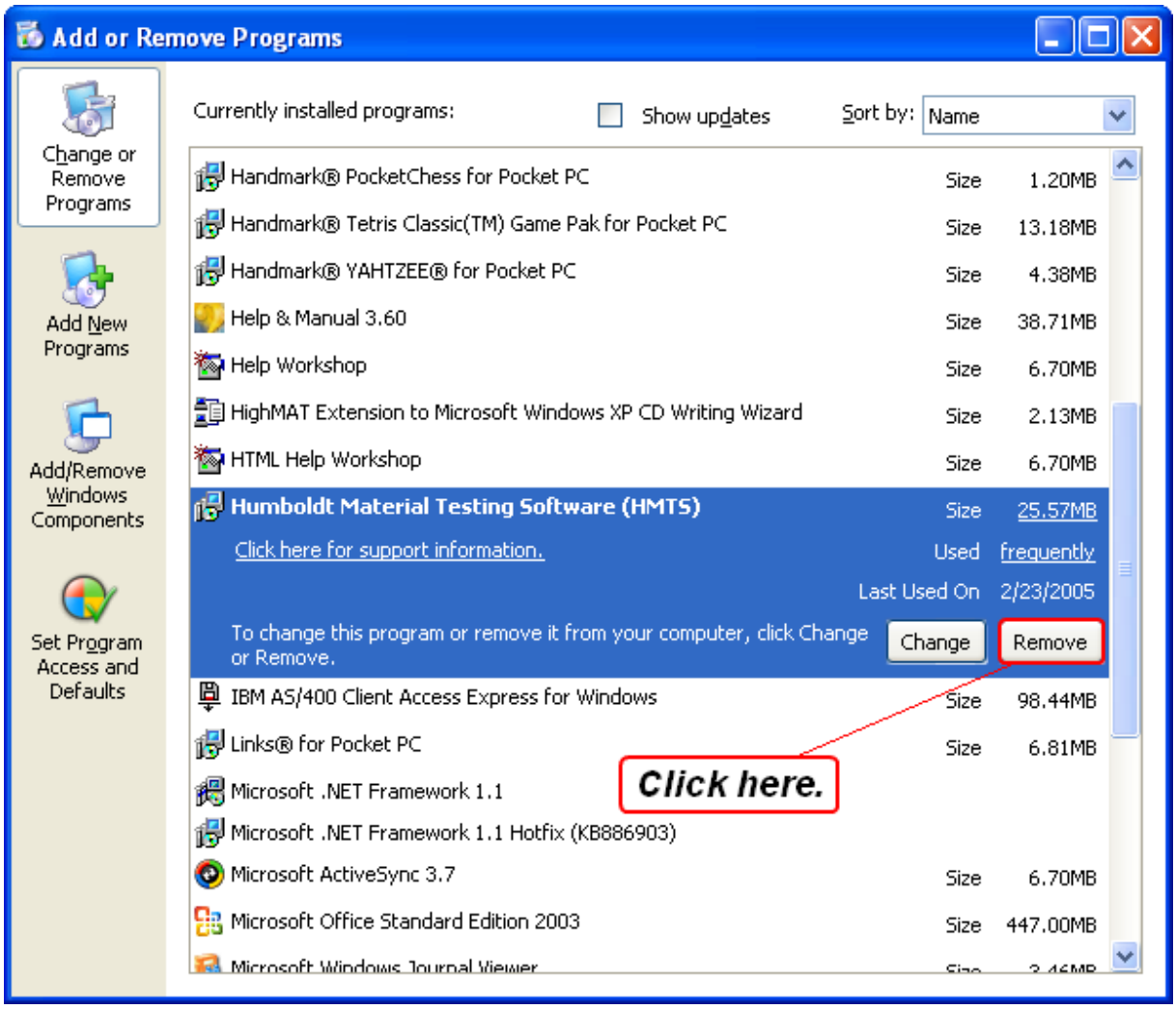
Step 2: Check "Remove Humboldt Material Testing Software (HMTS)" and then click "Finish." After the HMTS is deleted from your computer, you will get a message letting you know that the software was successfully removed.



Removal by Computer

Step 1: Click on "Start" then "Control Panel" then "Add or Remove Programs."

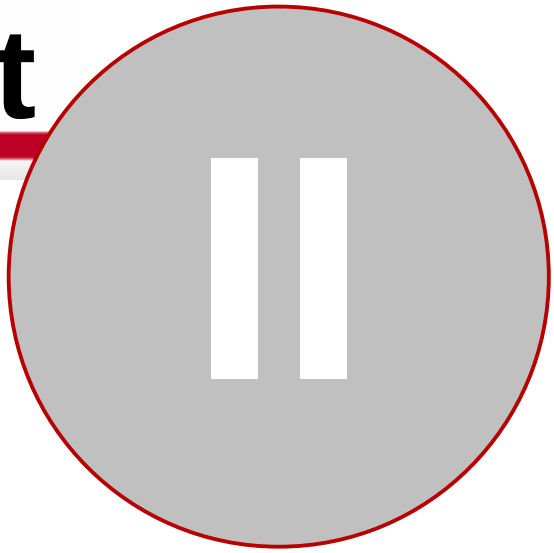
Step 2: Scroll down until you see "Humboldt Material Testing Software (HMTS)."



Step 3: Click "Remove."

Humboldt Material Testing Software Manual

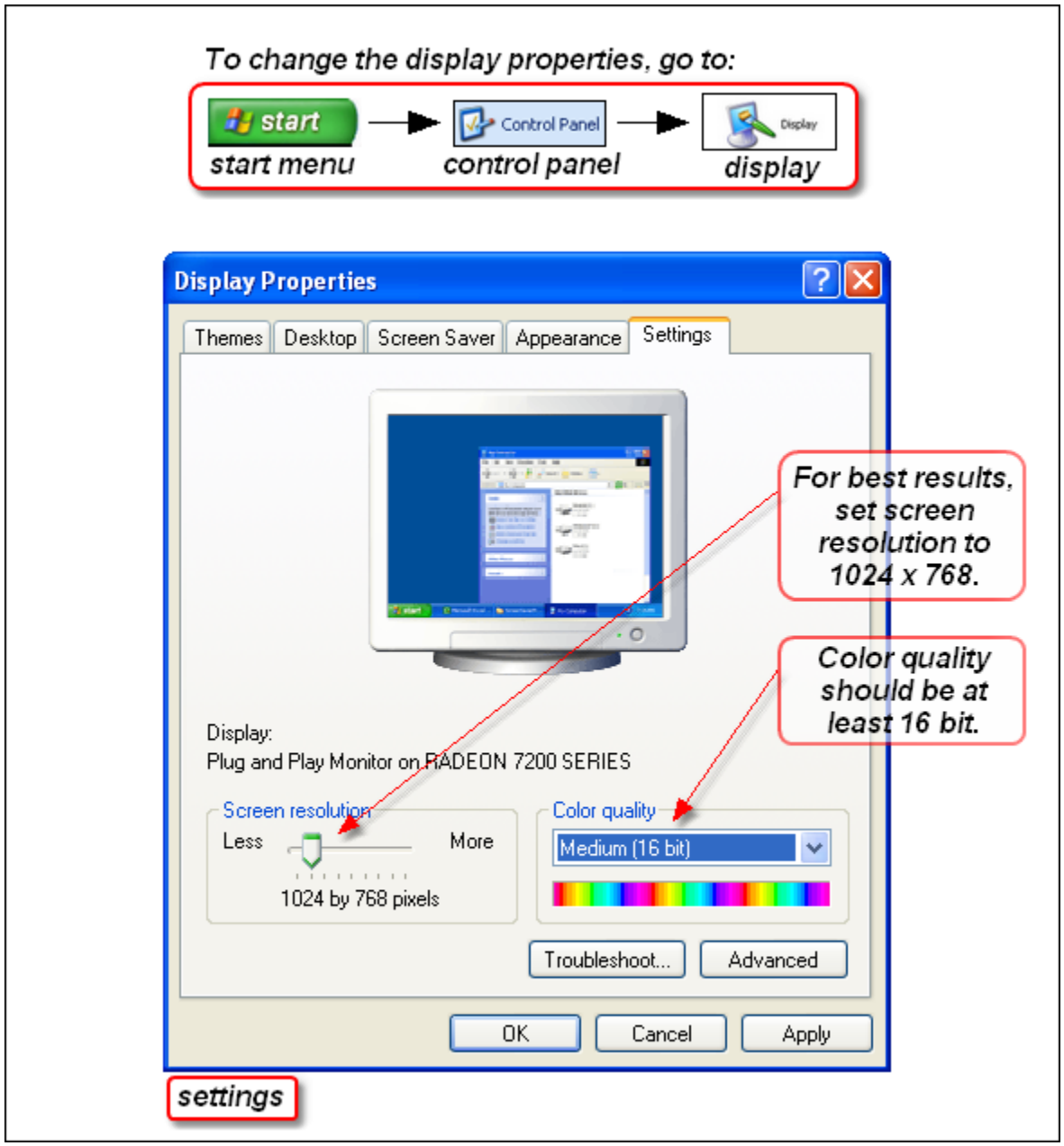
Part



2 Settings and Views

2.1 Recommended Resolution

Note: For best results in using **HTMS software** on your computer, set the **screen resolution** to 1024 x 768 and set your color settings to at least 16 bit.



2.2 Settings

2.2.1 Communication Port

The communication port is the port which the devices are connected to and which the software will use to communicate with the device.

The type of port that software connects to is an **RS-232 port**. This is a nine pin connector located on the back of the computer.

The cable that goes from the computer to the device is a standard RS-232 cable containing a 9-pin female connector and a 9-pin male connector. This cable can be purchased from Humboldt Scientific, Inc. or from your local electronics store.

NOTE: If you are connecting multiple devices to you pc you will need a RS-485 converter which can only be obtained from Humboldt Scientific, Inc. Call 1-800-537-4182 for more information. Please see Connection Scheme 25 for more information on connections.

The computer contains up to four communication ports. The software will default to port 1 the first time the software is used. This may not be the correct port and can cause a conflict with a non-Humboldt device if the wrong port is chosen.

Changing the Communication Port:

1. Select **Tools**
2. Select the **Communication** item from the list selection on the left.
3. A list of available ports will be shown. The software will only allow you to select ports that are available, and will show the status of the ports on your computer. The **Check Ports** will refresh the port status. See Image 1.1.
4. The communication port and what the device is connected to can be chosen here.
5. The **Baud-Rate** is the speed to use for the serial port. The default setting is 19200, but some older machines will use a speed of 9600. If using version 3.0 or greater of the software always leave the baud-rate at 19200.

Note: Multiple machines used in parallel have to all be the same speed. A combination of 19200 and 9600 will not work.

6. Select ***Ok*** or ***Apply*** buttons to set the current settings.

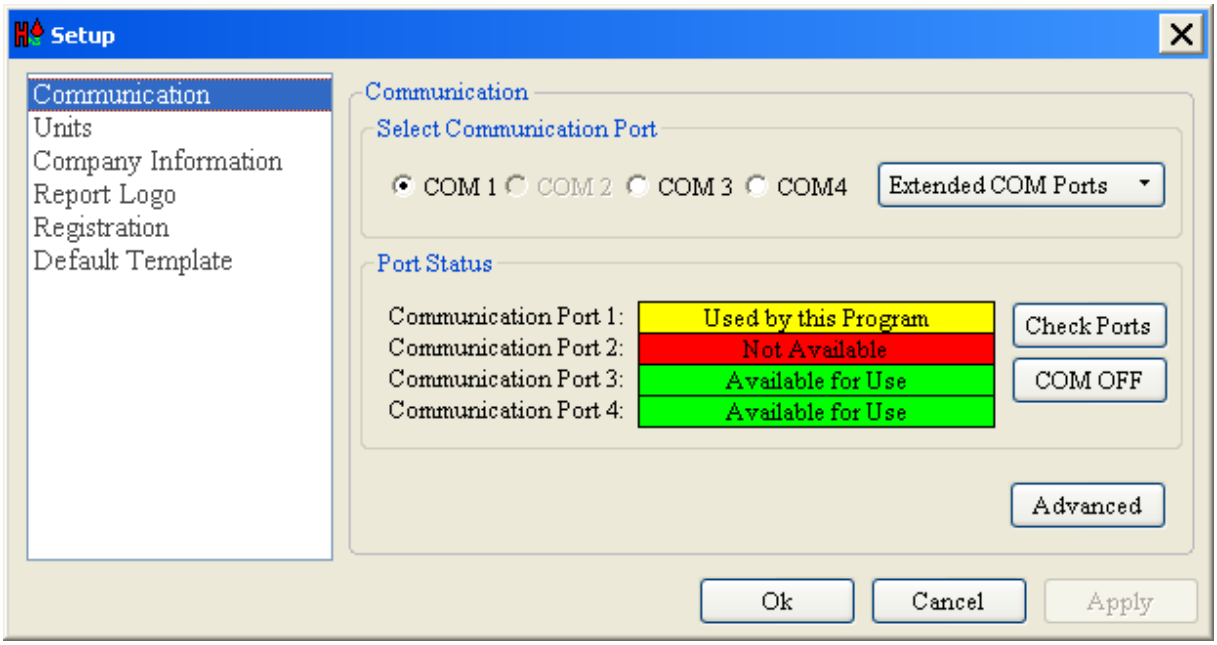


Image 1.1 (This computer contained only one communication port).

2.2.2 Default Units

The default units are the units that the software will use for the device values. The software units can be different from the device units. This means that the setting for this will display all values from test, configurations, and devices in this format.

Note: The default value is English when the program is first used.

Changing Units:

1. Select **Tools**
2. Select the **Units** item from the list selection on the left.
3. Select either **English** or Metric units. The current value set will be selected.
4. Select ***Ok*** or ***Apply*** buttons to set the current settings.

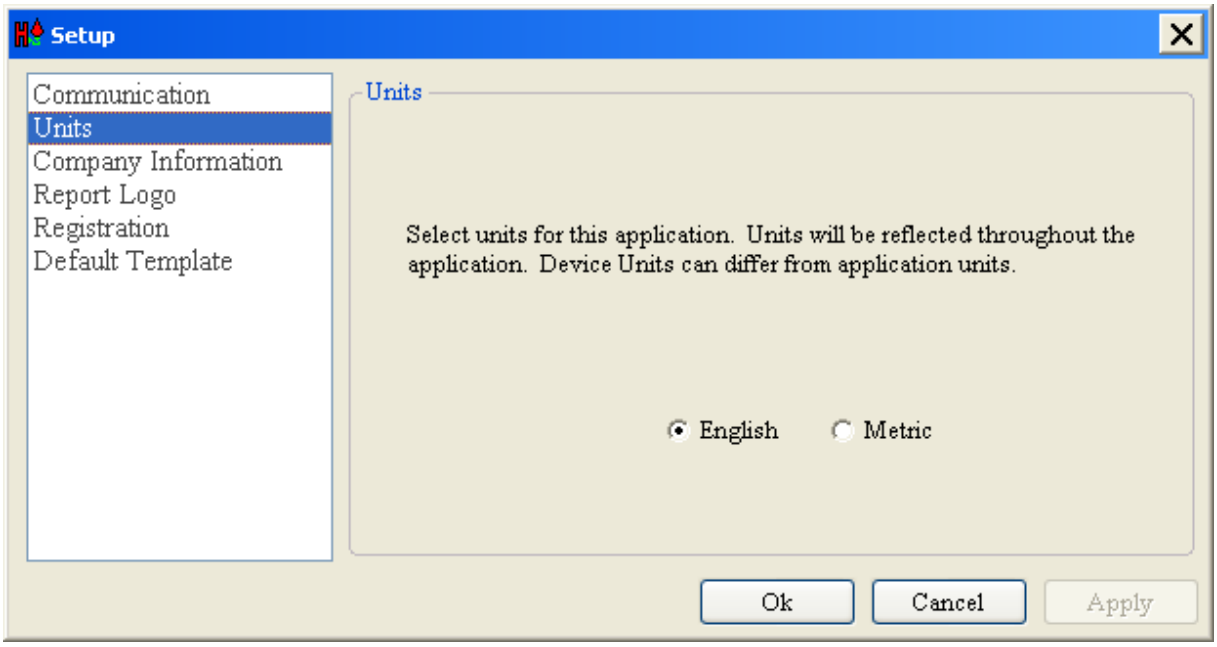
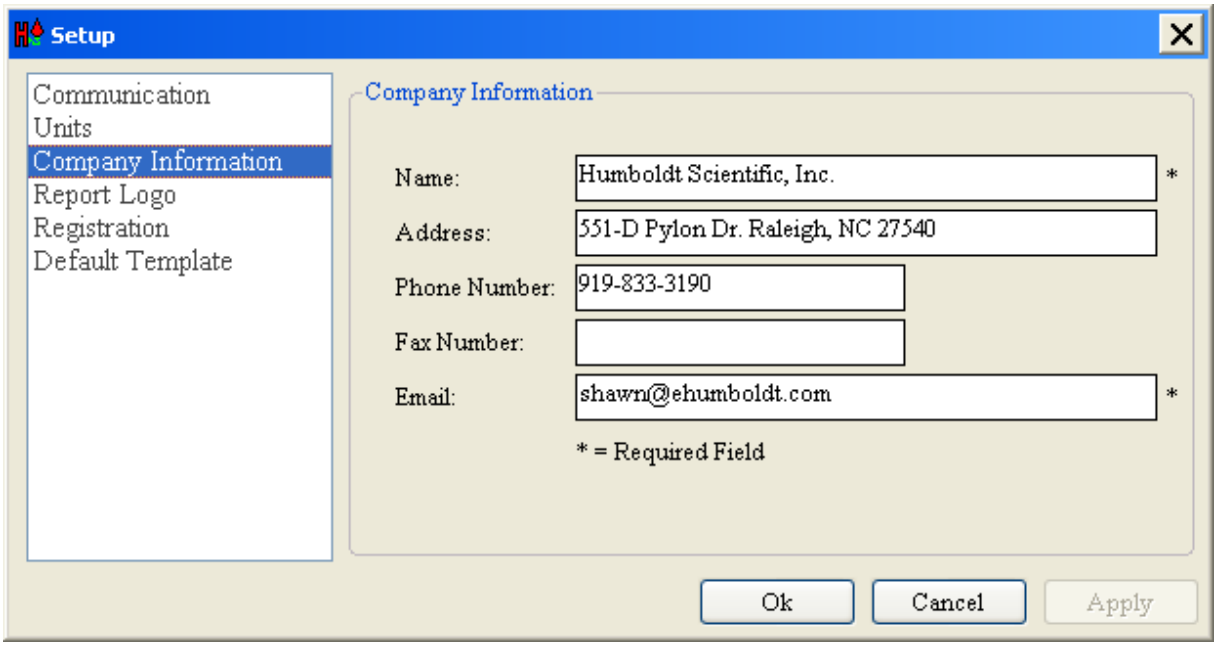


Image 1.2 (English Units have been chosen).

2.2.3 Company Information and Report Logo

Company Information

Company Information is the pertinent information that will be placed at the top of reports created using the Humboldt Material Testing Software. The software allows you to store one set of data. The information only needs to be set once, and this will be populated throughout newly created reports.

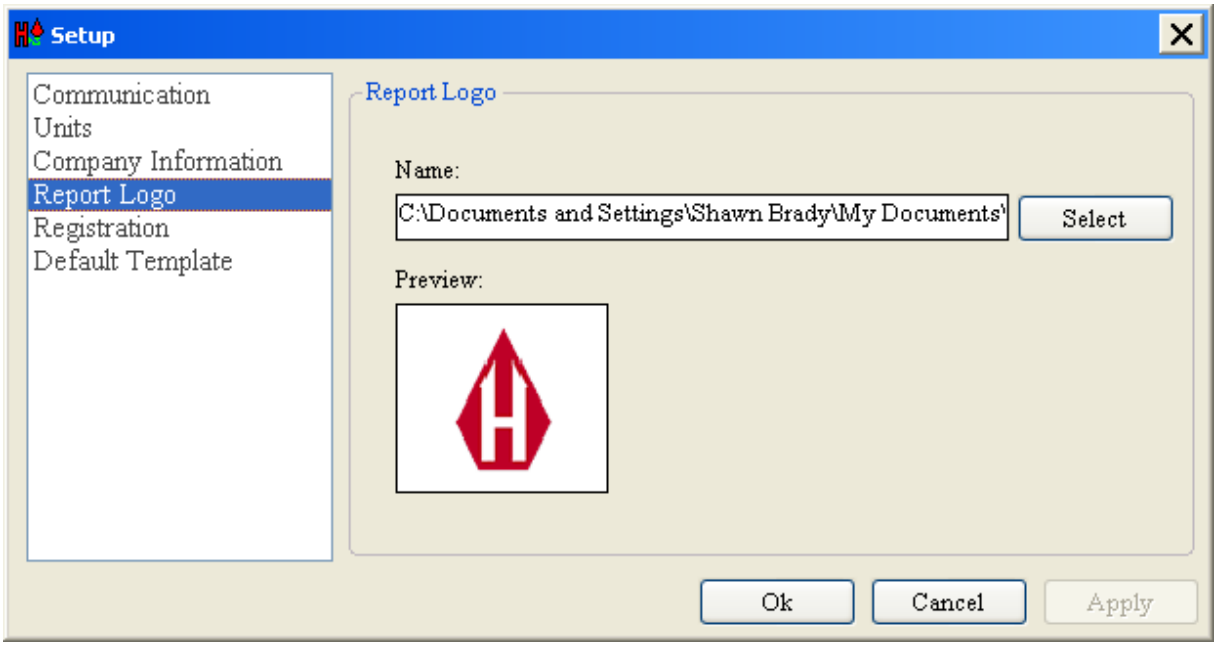


To edit this information:

1. Select **Tools**
2. Select the **Company Information** item from the list selection on the left.
3. After completing press the **Apply** or **Ok** buttons.

Logo Information

Logo Information is a custom graphic that will be placed within the report each time a new report is generated from the Humboldt Material Testing Software.



To edit the logo:

1. Select **Tools**
2. Select the **Report Logo** item from the list selection on the left.
3. After completing press the **Apply** or **Ok** buttons.

2.2.4 Registration

The HMTS requires that all testing modules be registered. This also applies to the User Defined Test 197 as well. Even though it is a free generic testing module, we would still like to have it registered so we can notify you of future updates. Registration will only be used to better serve you.

The registration received will work for only the computer the software was installed on, and can not be used on multiple machines. For multiple machines, please call or email Humboldt Scientific, Inc. (800) 537-4183 for further information.

Once a test module is registered, it is good for the lifetime of the software. Even if you uninstall and reinstall the software, the registration key you receive will still be good for that test module on the computer it was originally registered.

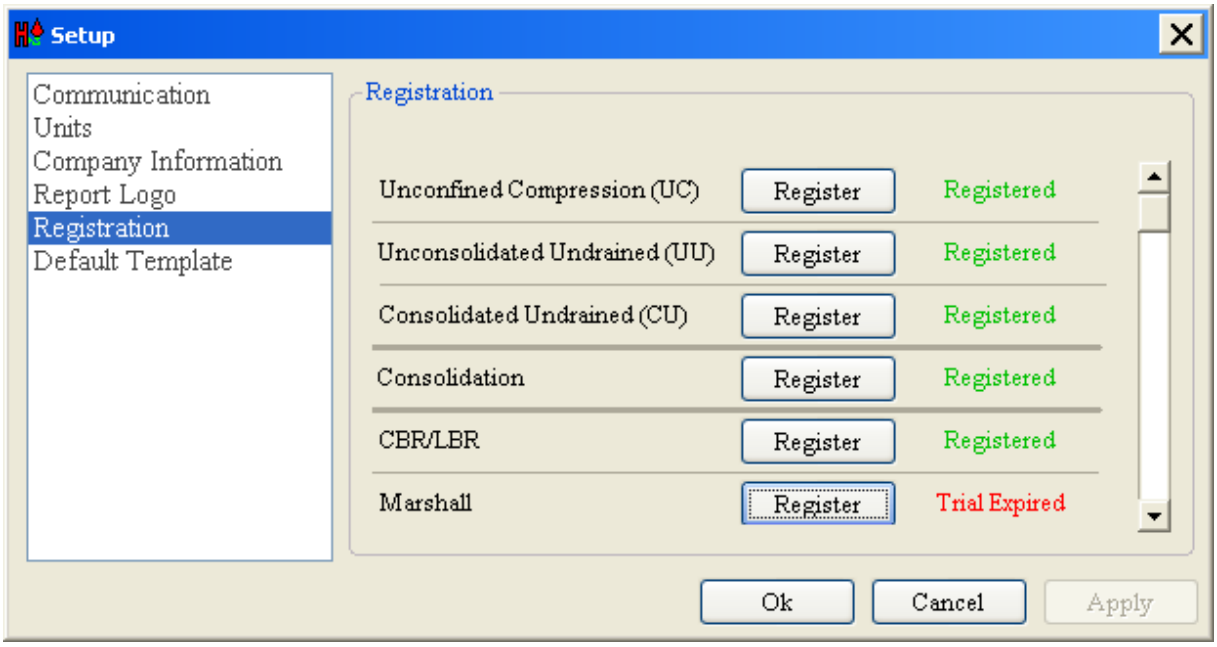
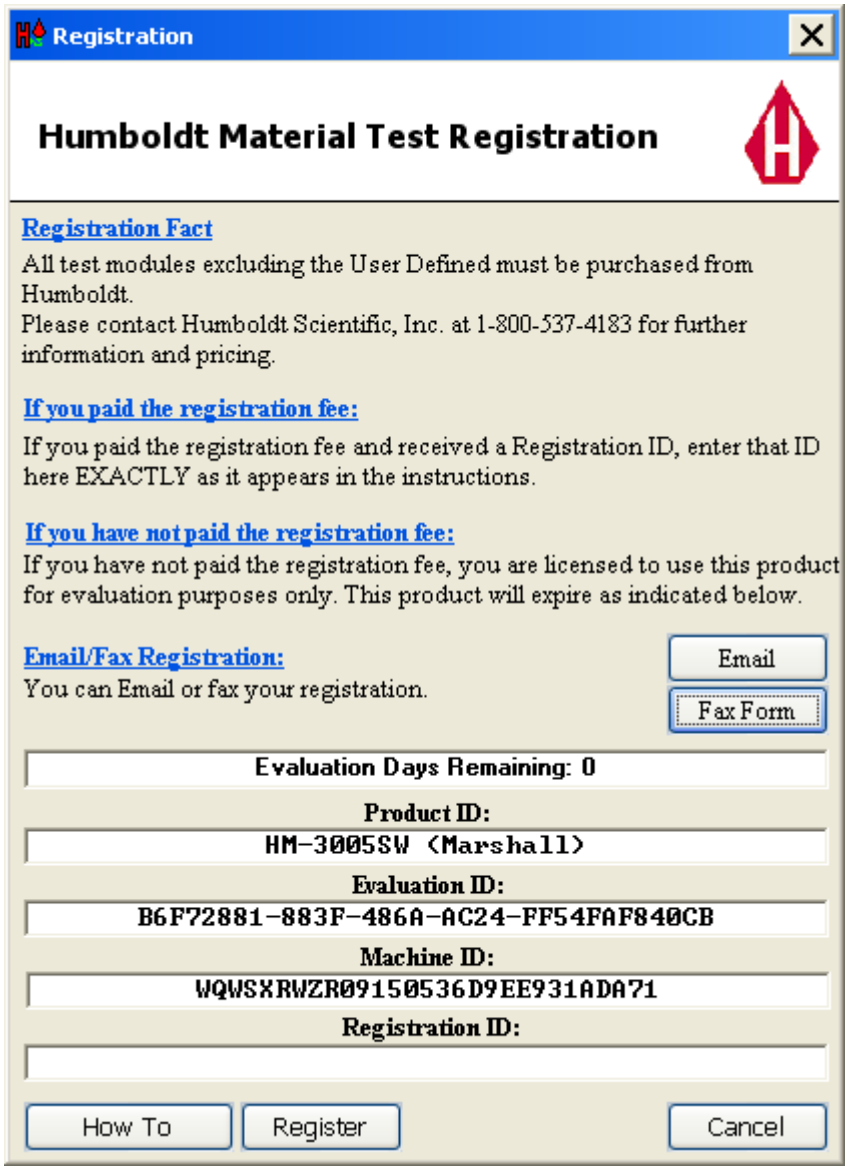


Figure 1: Test Registration Status window.

To edit this information:

1. Select **Tools**
2. Select the **Registration** item from the list selection on the left.
3. This will show all the test modules that have been registered and have not been registered.
4. Go to the desired test module and click on the **register** button.



5. This will show you your evaluation ID and machine ID, you will need to have these handy to register the software by phone. To request registration by email, simply click the **Email** Request button.
6. To Request registration by email or by fax you will need to have the Company Information 15 section filled in. Your information will be sent to Humboldt and you will be contacted by telephone or by email.
7. Once you have received your Registration ID, enter in the ID, click Register and your module will be registered.

» **Note:** The registration key needs to be entered exactly how it appears.

2.2.5 Default Template

The default template lets you select what template will be used for a test. Sometimes this is necessary if Humboldt has made some custom template modifications for you, or you have created or modified a template to better suit your needs.

Note: The default value is English when the program is first used.

Changing Units:

1. Select **Tools**
2. Select the **Default Template** item from the list selection on the left.
3. Select the test you would like to change the template for.
4. Select the **Browse** button to select the location of the new template you will be using.
5. To switch back to the default template that was installed with HMTS, click the **Default** button.
6. Click the **Apply** button to commit any changes.

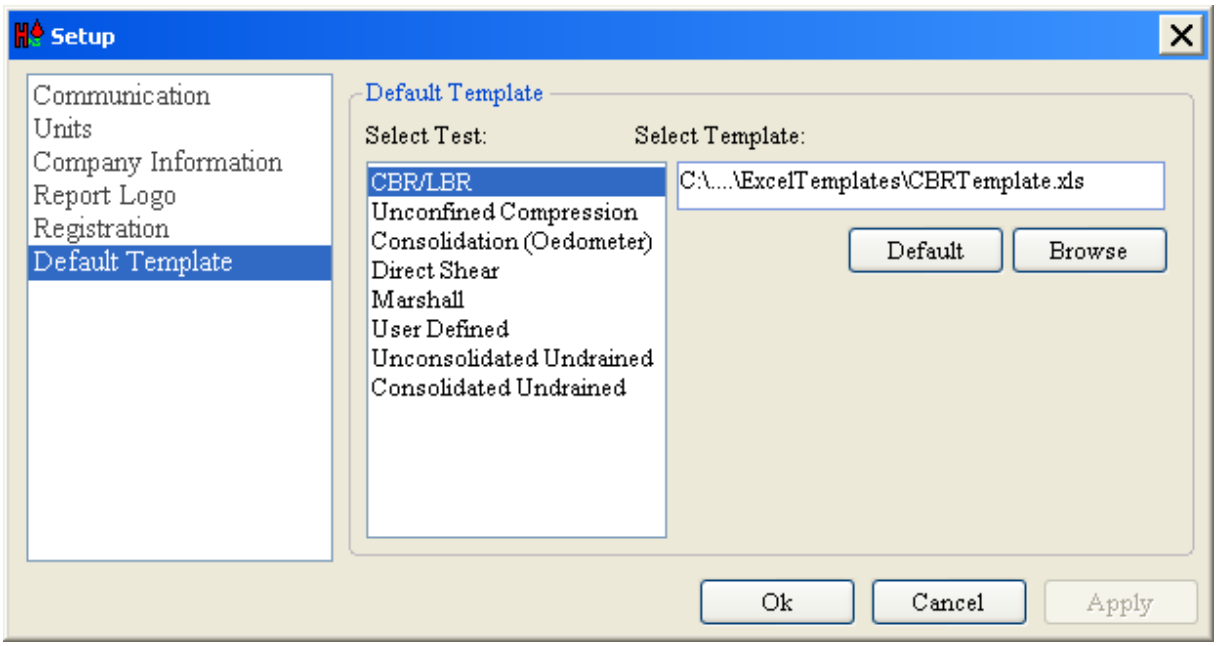


Image 1 Template Options.

2.3 Views

2.3.1 Views

The Humboldt Material Testing Software has many different views that can be added to enhance the look and feel of the application.

HMTS Views:

- **Device Browser** - displays all the currently connected and unconnected devices. Specific actions can be made on connected devices by clicking on the device. See Device Browser 26 for more information.

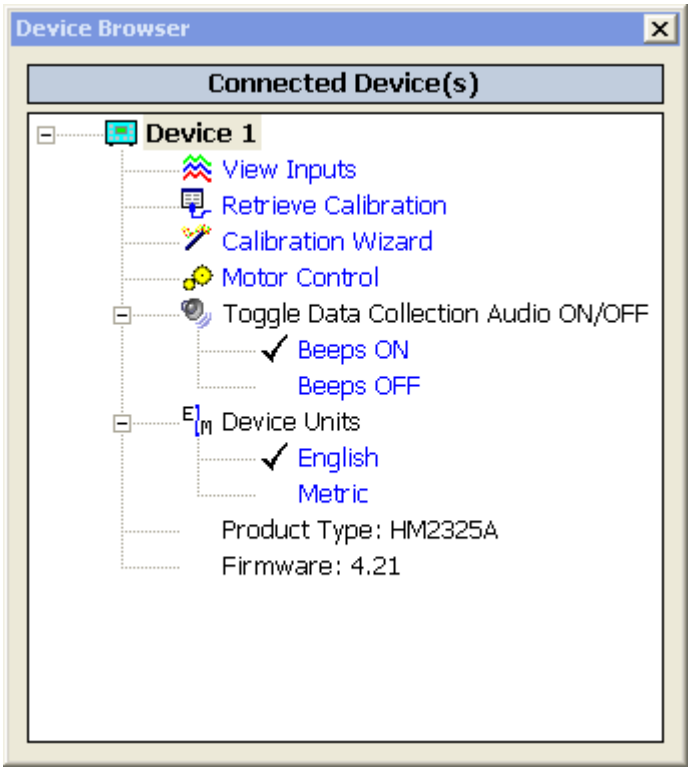
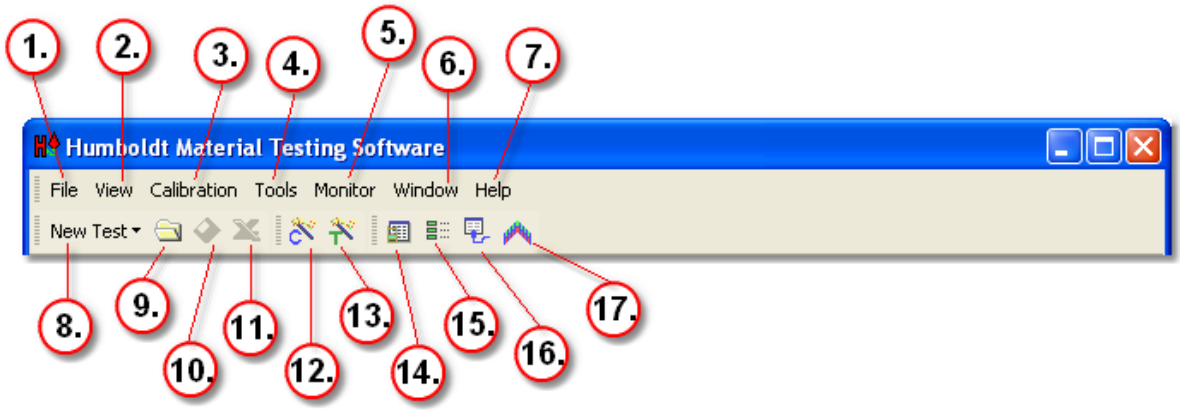


Figure 1: Device Browser

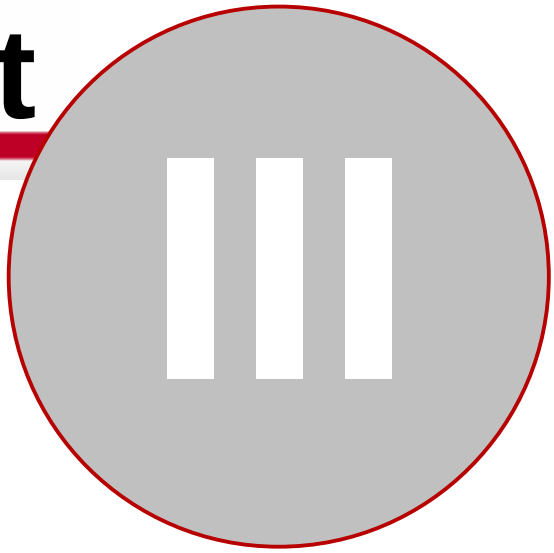
- **Toolbar** - the "control panel" of the software. The toolbar can be modified to your preferences to make navigation with HMTS easier and more manageable.



1. File Menu. (New Test, Open Test, Save Test & Exit)
2. View Menu. (File Browser, Device Browser, Toolbars & Refresh)
3. Calibration Menu. (Retrieve Calibrations, Calibration Wizard & Management, Import & Export Calibrations
4. Tools Menu. (Download & View/Export Machine Test Data, Device Names, Motor Control & Setup)
5. Monitor Menu. (Monitor Calibrations or All Devices)
6. Window Menu. (Tile Horizontally or Vertically, Cascade & Arrange Icons)
7. Help Menu. (Contents, Index, Search, About & Device Statistics)
8. New Test Menu. (Open a new test or use the Test Template Wizard)
9. Open an existing project.
10. Save currently selected project.
11. Export test to Excel.
12. Calibration Wizard.
13. Test Template Wizard.
14. Calibration Management.
15. Device Names.
16. Retrieve Calibrations.
17. Consolidation Load Frame Calibration/Sequence.

Humboldt Material Testing Software Manual

Part



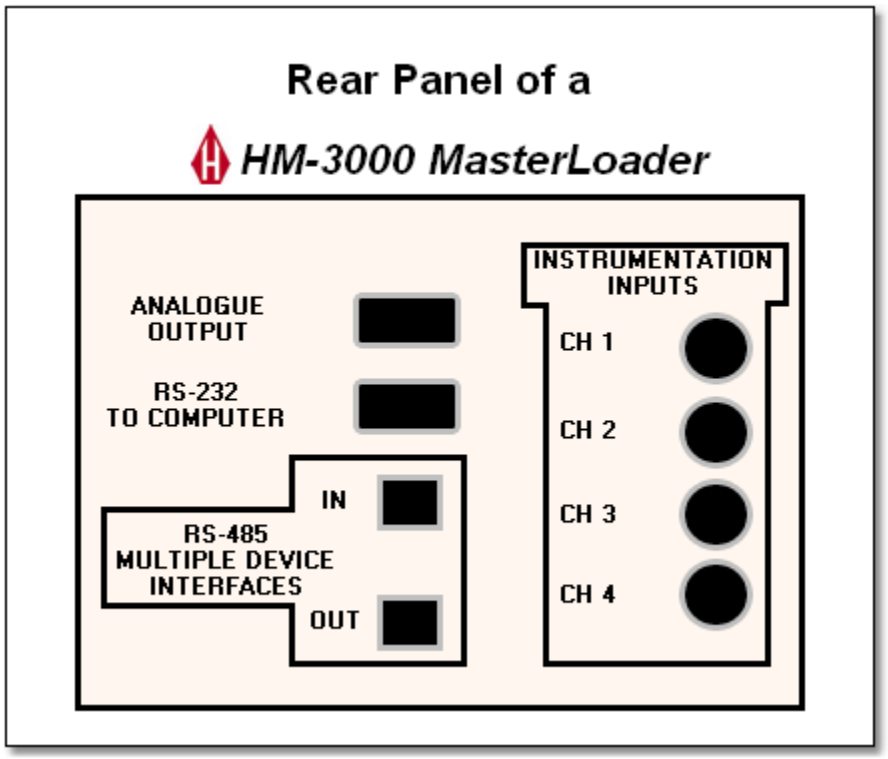
3 Connected Devices

3.1 Connections

The Humboldt Material Testing Software can handle many different connected devices. Up to 25 devices can be connected at once, making the HMTS capable of handling up to 100 channels. This is a lot of devices and channels to keep up with, but the HMTS will do the work for you, handling the connected devices and giving you the ability to rename the devices with names that you create.

Single Device Connection
A single device is connected to the computer by a serial cable.

Multiple Device Connection
If more than one devices are connected, one of the devices will have a Category 5 network cables (CAT5) network cable connected to the IN/OUT connection. The other end of the CAT5 cable will have a converter (supplied by Humboldt) connected to it. The other end of the converter will have an RS-232 cable connected to it, which will connect to your computer. Multiple boxes will be connected through the IN and OUT connections with CAT5. Devices connected to computer can be seen in the Device Browser 26.



The above image shows an example of a HM-3000 back panel. This is located on the back of the machine. You will notice that there are six sockets for connection.

CONNECTION	DESCRIPTION
Analogue OUTPUT	**(OUTPUT)** Connection for outputting data to an external device such as a printer
RS-232 TO COMPUTER	**(INPUT/OUTPUT)** Connection to a computer with Microsoft Windows running the HMTS or Hyper Terminal.
RS-485 MULTIPLE DEVICE INTERFACES IN	**(INPUT/OUTPUT)** Connection to another device communicating with a PC.
RS-485 MULTIPLE DEVICE INTERFACES OUT	**(INPUT/OUTPUT)** Connection to another device communicating with a PC.
INSTRUMENTATION INPUTS CH 1	**(INPUT)** Measurement Instrument using channel 1.
INSTRUMENTATION INPUTS CH 2	**(INPUT)** Measurement Instrument using channel 2.
INSTRUMENTATION INPUTS CH 3	**(INPUT)** Measurement Instrument using channel 3.
INSTRUMENTATION INPUTS CH 4	**(INPUT)** Measurement Instrument using channel 4.

To see examples of how a device or multiple devices are connected go to Connection Scheme 25.

3.2 Connection Scheme

Since the Humboldt Material Testing Software handles single and multiple devices connected to the computer, you need to know how to connect them all.

Single Device Connection

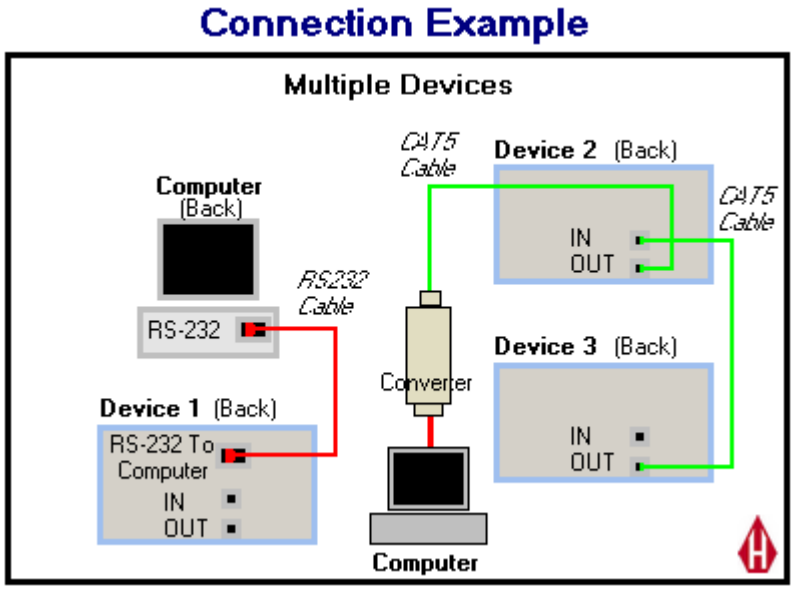
1. Using the RS-232 cable, connect one end to the RS-232 TO COMPUTER connection located on back of device.
2. Plug the other end into a spare RS-232 port located on the back of the computer you wish to use.

Multiple Device Connection

1. Connect one end of the RS-232 to your computer and the other end to RS-232 to RS485 convert supplied by Humboldt.
2. Using CAT5 network cable connect one end to the RS-485 converter and the other end to the IN of one or your devices.

3. Using more CAT5 cable, connect another device to the OUT connection of the device connected to the converter and the other end to the IN connection on the next devices.
4. For a third machine or more, connect the Cat5 cable to the IN connection located on the next to last machine to the OUT machine on the last machine.

See the diagram for an example of both connection schemes.



3.3 Device Browser

The device browser shows connected devices, and allows you to perform specific tasks to that device. Below is a sample view of the device browser with one device connected, it also shows the options available for that device.

If the device is not connected or not communicating with the PC, then it will not show up in the Connected Device(s) list.

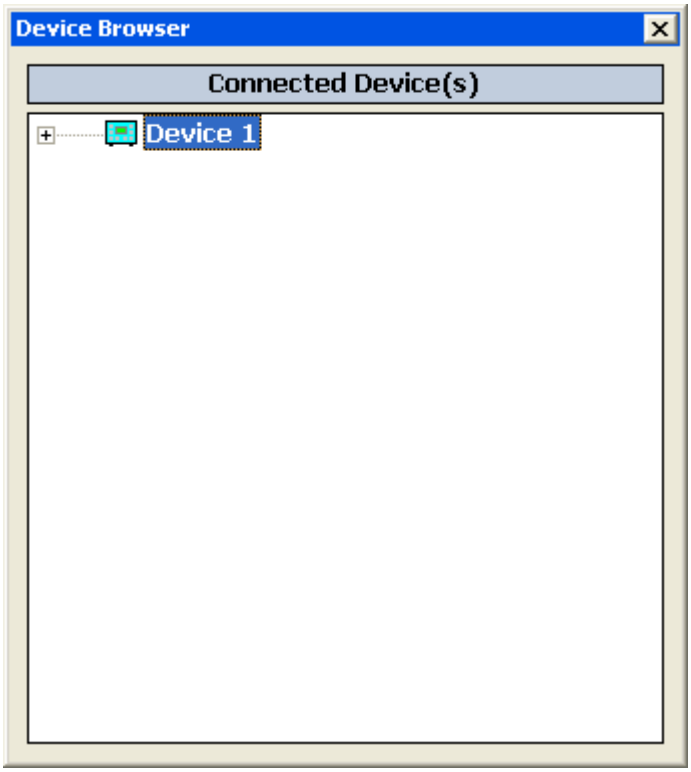


Image DB1: A single device connected.

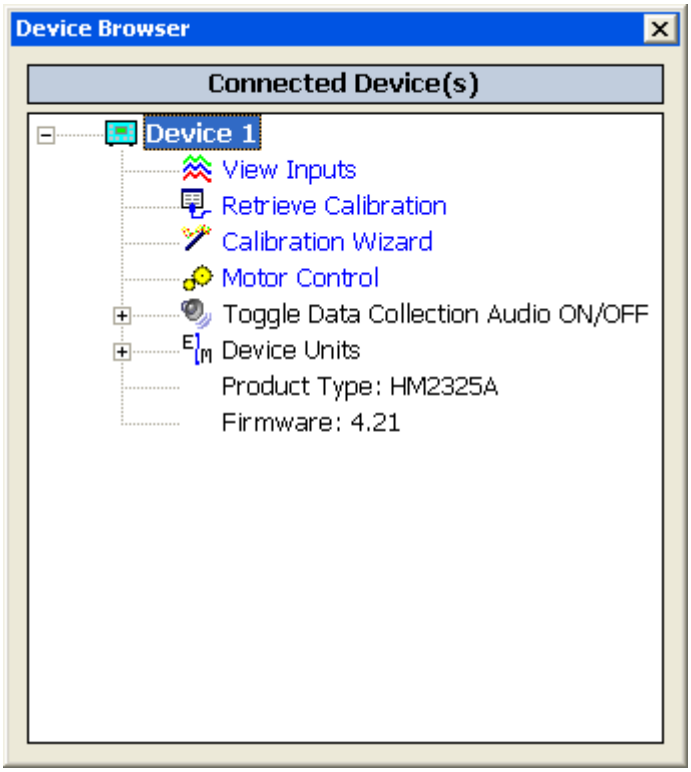


Image DB3: Expanded Device options.

To see device specific options click on the device name (the above image device name would be Device 1) and the node will expand to show you available options for the device.

Device options include:

- View Channel Data - clicking on this will show you the current channel data for the device. You can view the channels data as its raw form, its slope, its calibration value, and its calibration value with a tear.
- Retrieve Current Calibration - clicking this will bring up the retrieve calibration form. See Retrieve Calibration Guide 53 for more information.
- Channel Calibration Wizard - this will bring up the Calibration Wizard 34.
- Motor Control - Brings up the motor control toolbar. This can be used to set the motor speed, and move the motor up an down.
- Device Units - Shows the current units the device is set to (current units will be indicated with a check beside the unit name). To change click on the desired unit. This does not affect the software units, only the device units. See Default Units 14 for more information on application units vs. device units.
- Audio ON/OFF - toggles logging beeps on or off.
- Product Type - will indicate what type of device is connected.
- Firmware - the firmware version of the connected device.

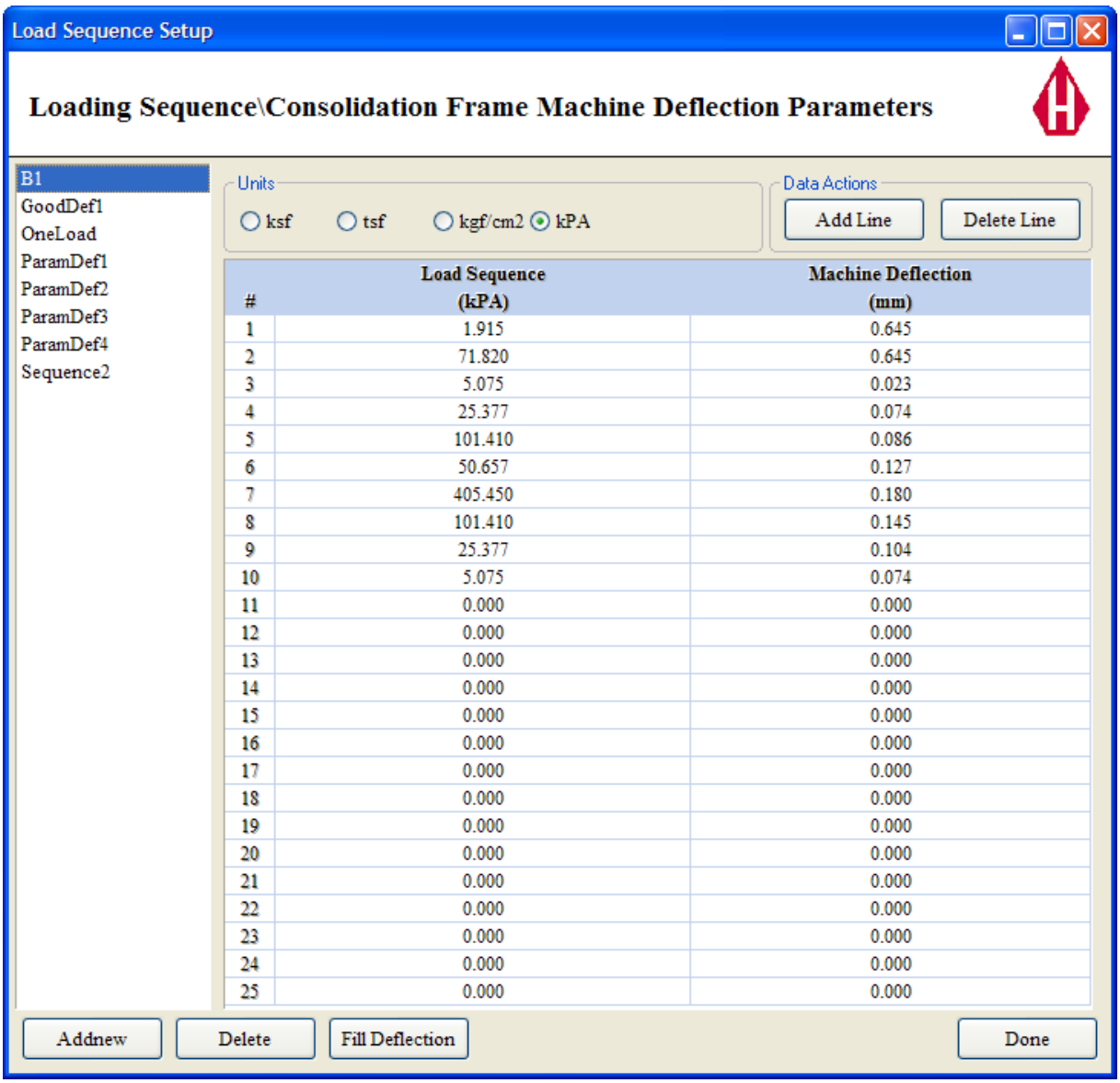
Humboldt Material Testing Software Manual

Part IV

4 Consolidation Load Frame Calibration/Sequence Tool

4.1 Consolidaiton Load Frame Calibration/Sequence Tool

The Consolidation Load Frame Calibration/Sequence Tool will allow you to create load sequences to use with consolidation tests and any test that contains a consolidation phase. This tool can contain many different frame parameters that you can add to and change.



#	Load Sequence (kPA)	Machine Deflection (mm)
1	1.915	0.645
2	71.820	0.645
3	5.075	0.023
4	25.377	0.074
5	101.410	0.086
6	50.657	0.127
7	405.450	0.180
8	101.410	0.145
9	25.377	0.104
10	5.075	0.074
11	0.000	0.000
12	0.000	0.000
13	0.000	0.000
14	0.000	0.000
15	0.000	0.000
16	0.000	0.000
17	0.000	0.000
18	0.000	0.000
19	0.000	0.000
20	0.000	0.000
21	0.000	0.000
22	0.000	0.000
23	0.000	0.000
24	0.000	0.000
25	0.000	0.000

Figure 1: Load Sequence and deflection tool.

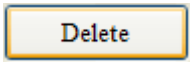
Selecting

The column on the left hand side in Figure 1 show all available load sequence tables. Select a sequence to view its parameters.

Addnew

To add a new load sequence table, click on the Addnew button. A new item will be added. To change the name, double-click on the name you would like to change and type a new name for the frame parameters.

Delete

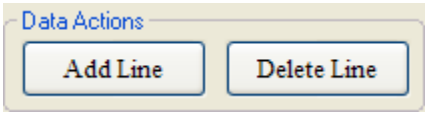


To delete a load sequence, select an item from the left pane and click on the Delete button.

Units

Select the units you would like to enter your frame parameters into the table. You can switch units at any time.

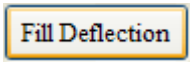
Data Action



Add Line - allows you to insert a line anywhere in the table. Since the table only allows a miximum of 25 rows, if you insert a row the entire table will be shifted and the last row will be deleted.

Delete Line - allows you to delete a line anywhere in the table. Since the table only allows a maximum of 25 rows, if you delete a row the entire table will shift and a new row will be added at the end.

Fill Deflection



Will fill the deflection values of your currently selected frame parameters with deflection values that are contained in another set of parameters.

Humboldt Material Testing Software Manual

Part V

5 Calibration

5.1 Calibrations Intro

Once a device is connected to your pc and you can see that device in the Device Browser 26 you will need to have calibrations for each input that is on that piece of hardware. Not every input on the device needs to be calibrated, but if you are going to use the calibrated inputs on a connected device, the software must contain a calibration for each input.

If you have read your manuals that came with any of your Humboldt hardware you will notice that you can't have more that one calibration on an input. HMTS solves that problem. It allows you to have multiple calibrations for any input, they are store and can not be lost, and HMTS allows you to switch between them. This can be a great tool when you want to run many test with multiple transducer configurations and one logger.

Calibration Tools

- Calibration Wizard - the Calibration Wizard 34 will assist you with automated and manual calibrations of device inputs
- Calibration Retrieval - if an input has already been calibrated, and you only need to retrieve the calibration, use the Retrieve Calibration Tool 53.
- Calibration Management - if you only need to manage a calibration, use the Calibration Management Tool 59

5.2 Calibration Wizard

5.2.1 Calibration Wizard

The calibration wizard is a step-by-step way to guide you through the calibration and configuration of a channel. It was built to streamline this process and make it easier to understand.

The calibration wizard supports two types of calibrations:

- Automated Calibration - sets up the calibration of a channel based on the specifics of the transducer values. These values consist of the transducer specifics.
- Manual Calibration - sets up the calibration of a channel by guiding you through the setup of a channel. You are required to fill in all the information for the channel.

Calibration Guide:

Step 1: Open the Calibration Wizard from the Wizards Menu within the Humboldt Material Testing Software. Click "Next" to continue.

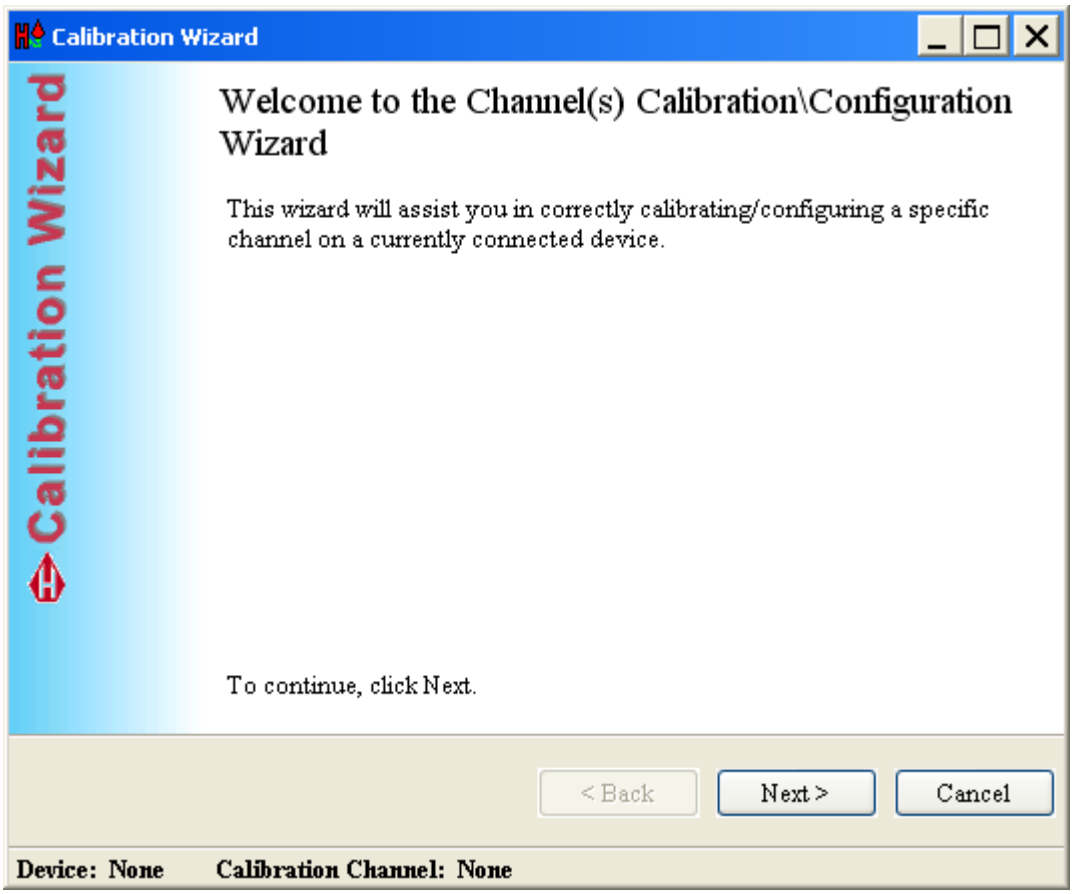


Figure 1: Initial Calibration Wizard Screen.

Step 1a: Select Units to calibrate selected device in.

Step 2a: Select a device to calibrate. Only devices currently connected can be calibrated.

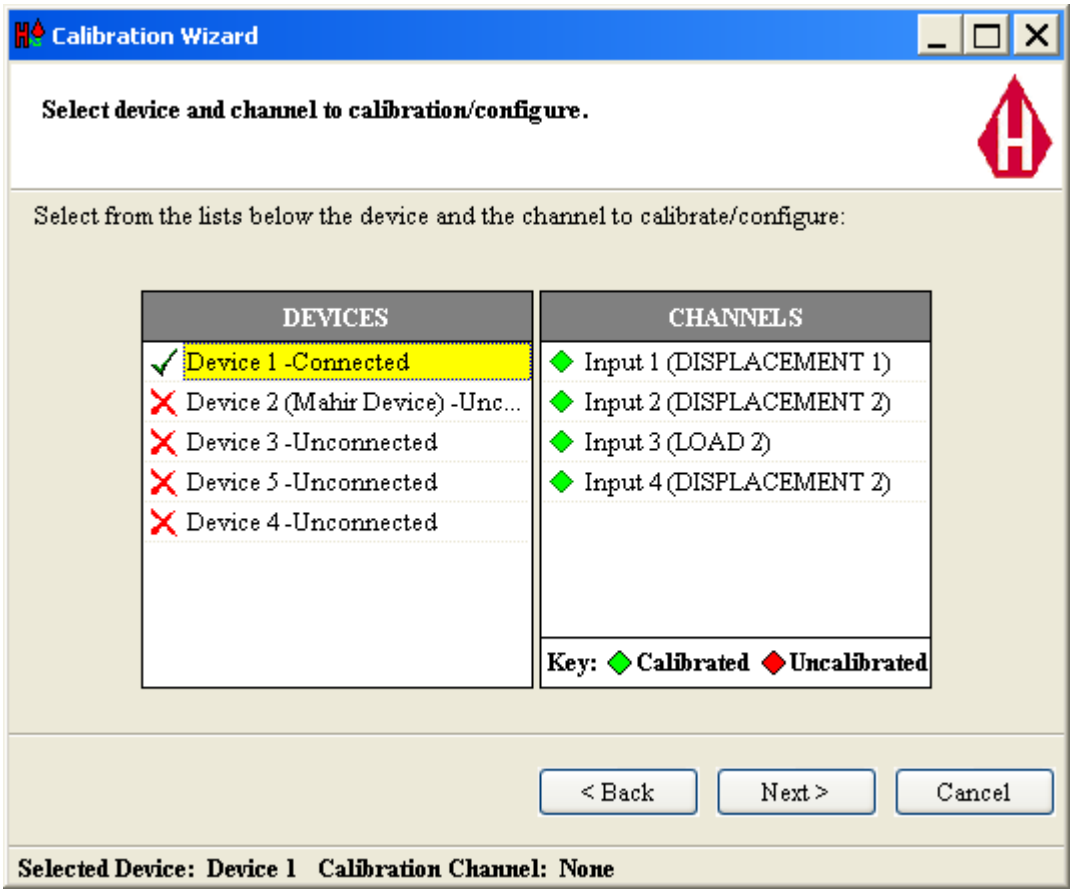


Figure 2: Device selection.

Step 2b: Select a channel to calibrate. Calibrated channels will be displayed in **green** and uncalibrated in **red**.

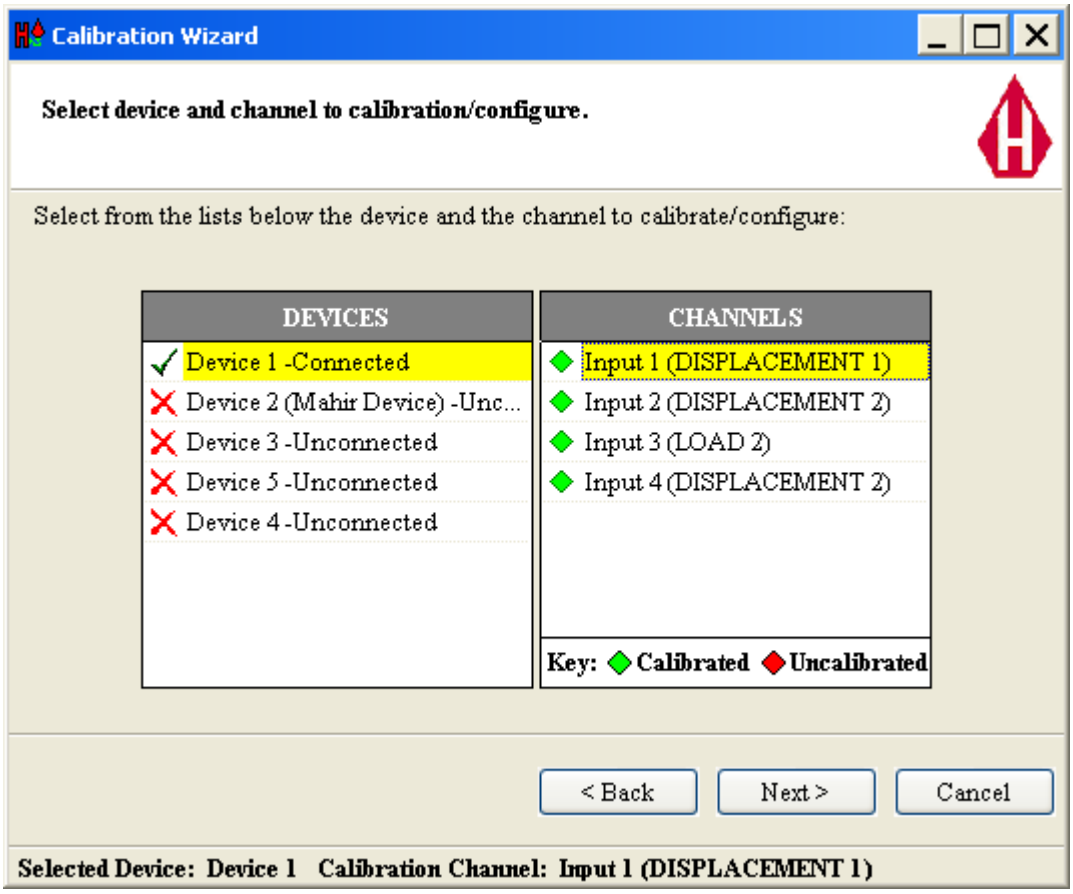


Figure 3: Channel selection.

Step 3: Next, select the method in which you would like to calibrate the selected channel.

To calibrate against a known mV, continue to this topic:
Calibrate Against Known mV 45

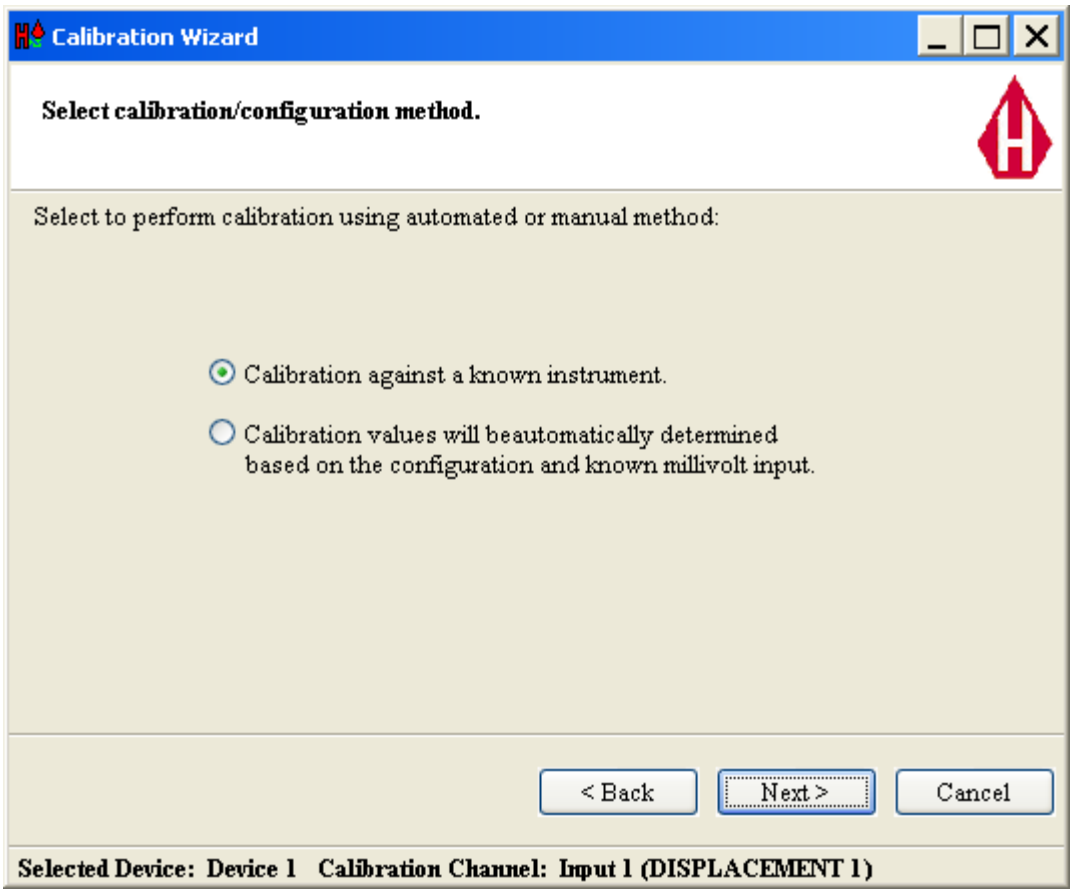


Figure 4: Automated/Manual Calibration.

Step 4: Set the Engineering Min and Max Values. These values represent the upper limit of the channel. For example, if you wanted a channel to represent the values from 0 to 1000 lbs then the max value would be set to 1000.

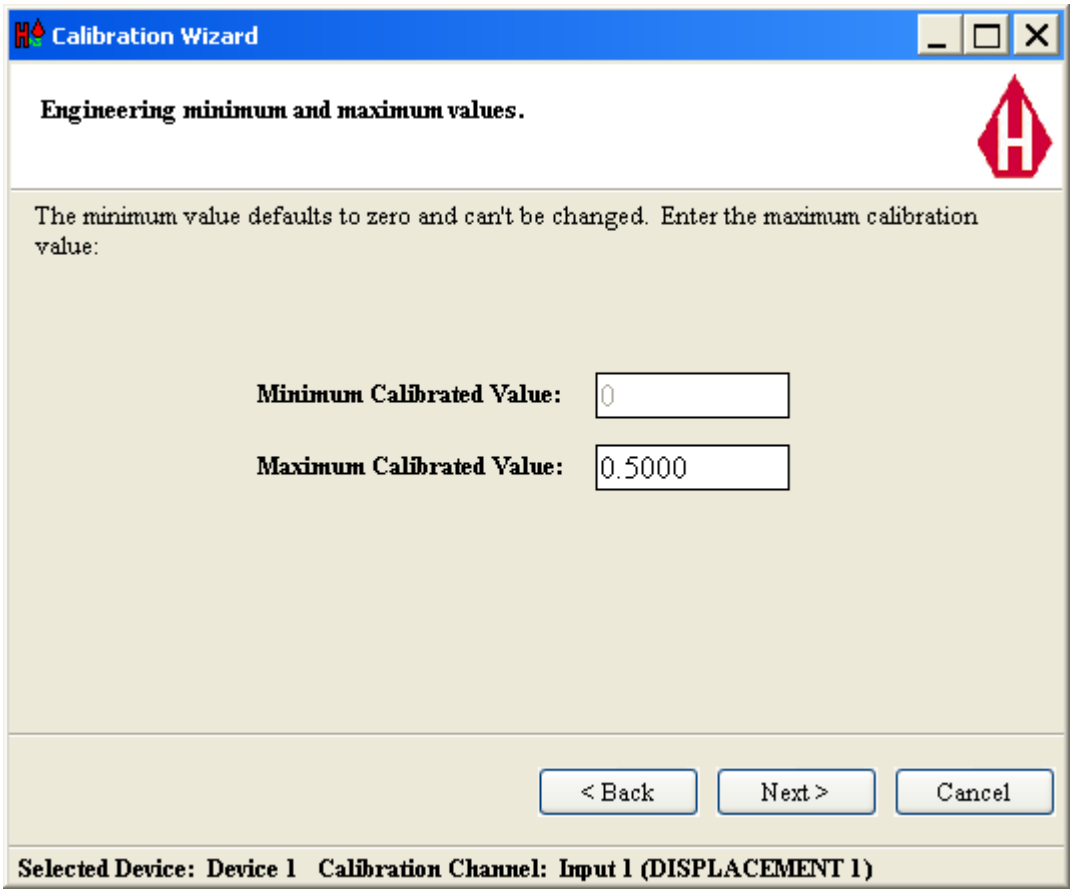


Figure 5: Max Engineering Value.

Step 5: The gain is a channel multiplier that allows the channel to reach above the Max value set in step 4. The current selected device/channel gain is selected for you. Push the transducer in all the way, and if the *Current Channel Raw Data Value* shown in this step is less than the Engineering Max then select a higher gain. Just make sure the *Current Channel Raw Data* is greater than the Engineering Max when the transducer is fully depressed.

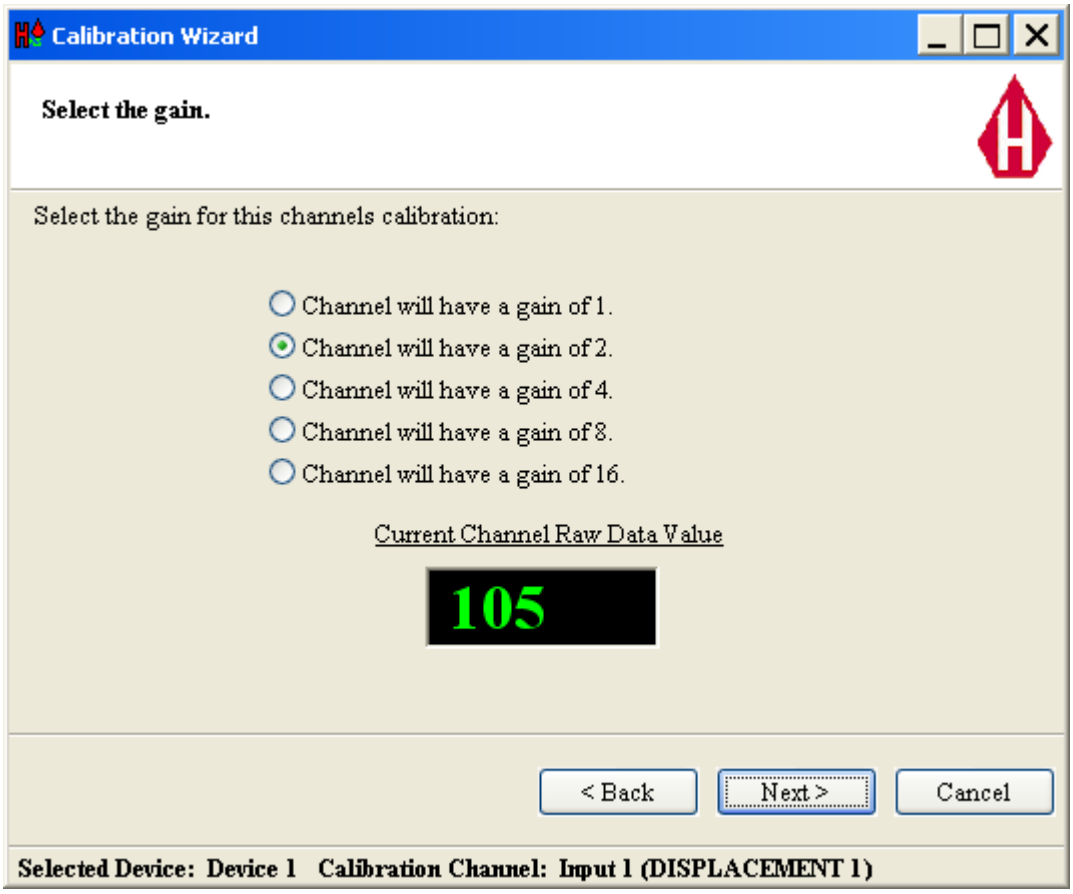


Figure 6: Gain Setup.

Step 6: This is the Calibration Zero and Max, which represents the raw A-to-D values at the zero point and the maximum point. To set the Zero value, with the transducer depressed, click the *Zero Set* button. This will set the zero (value displayed in red). To set the Max value, with the transducer pressed all the way in or the desired amount, click the *Max Set* button (value displayed in **red**). Once both of these are set the *Engineering Value* will be set. The range for this was set in step 4. You can press and depress the transducer to see if the desired engineering value was achieved.

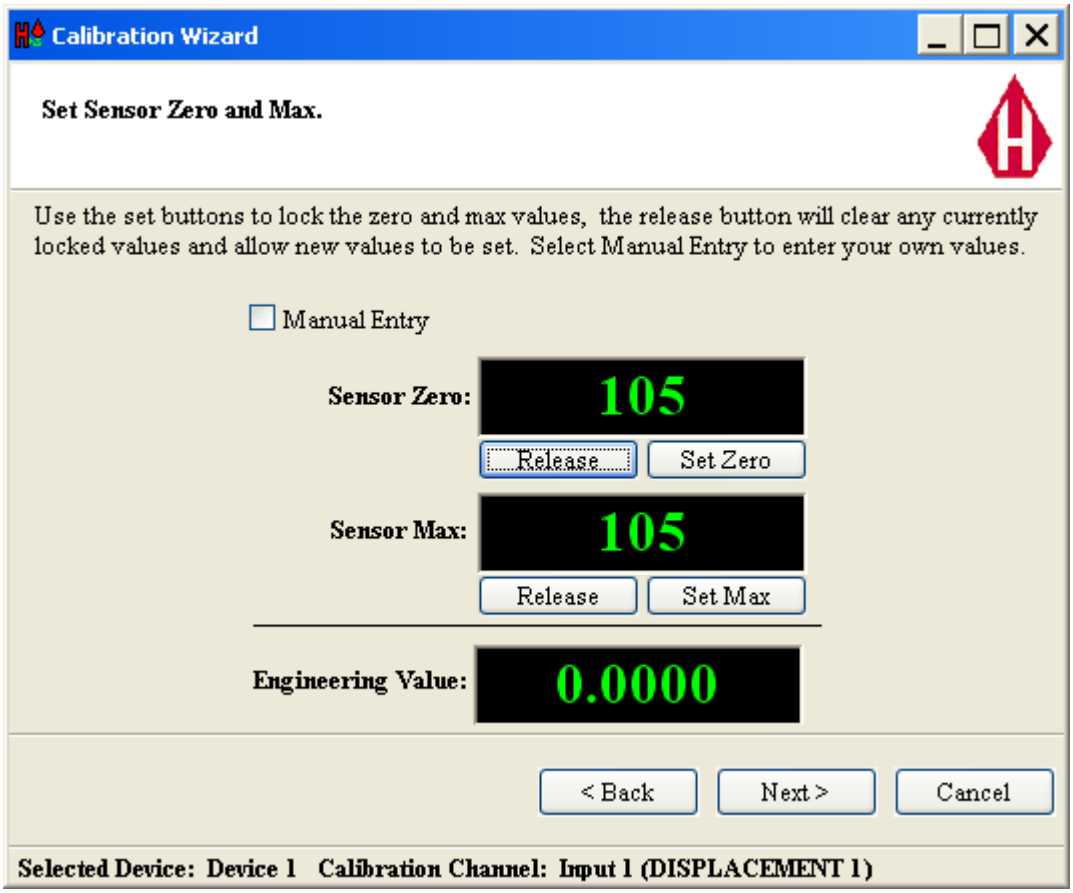


Figure 7: Calibration Zero and Max.

Step 7 (Optional): You will notice the Manual Entry selection in Figure 7. Clicking this will allow you to key in the zero value and the max value. This is useful for calibrating digital instruments.

Step 8: Select a name for the channel.

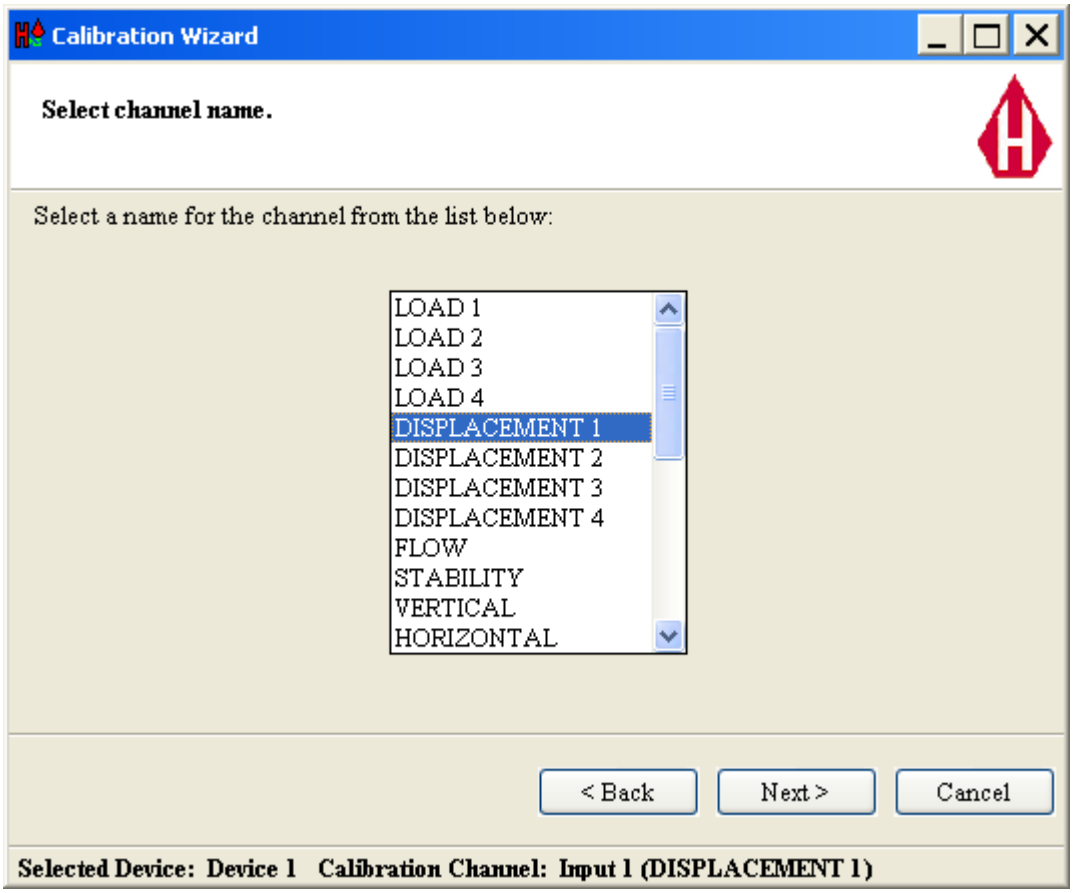


Figure 8: Channel name.

Step 9: Verify channel setup. Here you can also supply a custom name for the channel by selectioin the Use custom name option. After doing this you can input your own name for the channel in the input box next to the Use custom name checkbox. A calibration comment can also be added for this channel at this point.

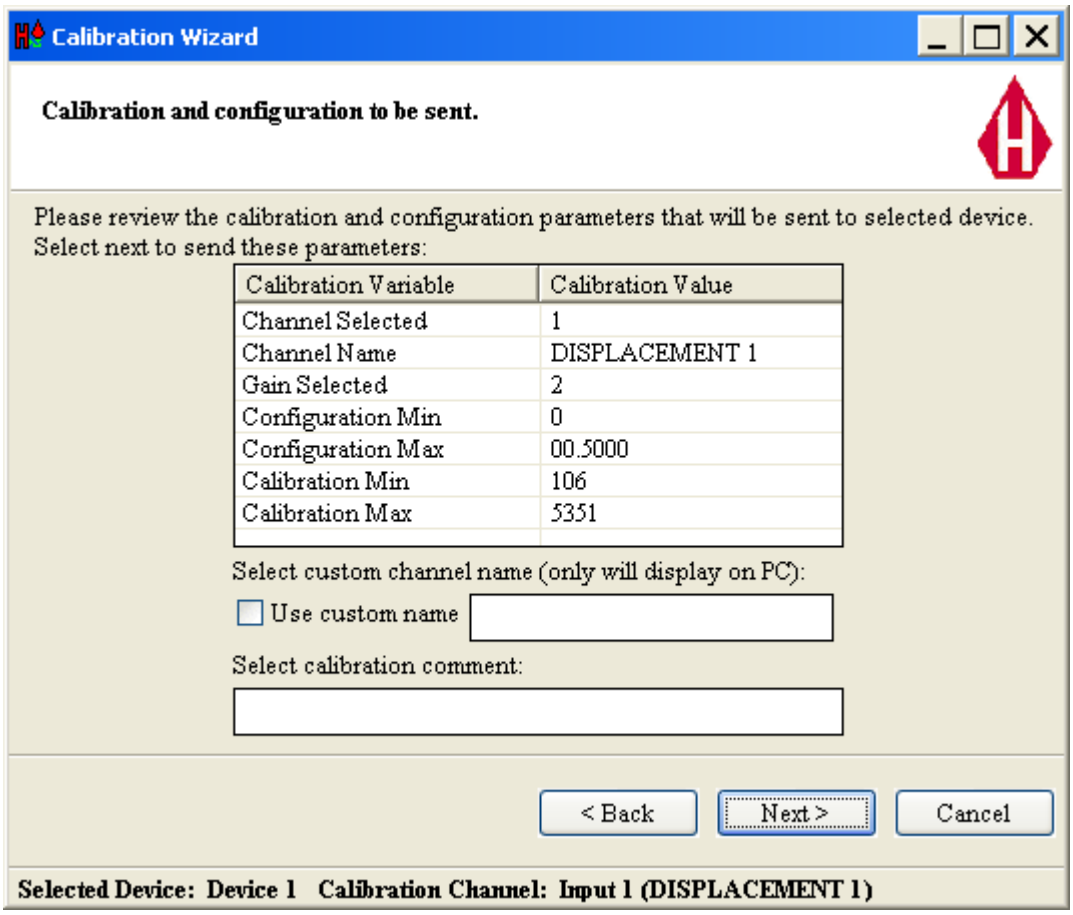


Figure 9: Test configuration.

Step 10: The calibration/configuration will be sent to the device. You will be prompted if the calibration was received or not received. If the calibration was not received then you will be given the option to resend or start another calibration. Once the calibration is received you can add transducer information for the channel you just calibrated, close the wizard by clicking the Cancel button, or calibrate another channel by clicking the Next button.

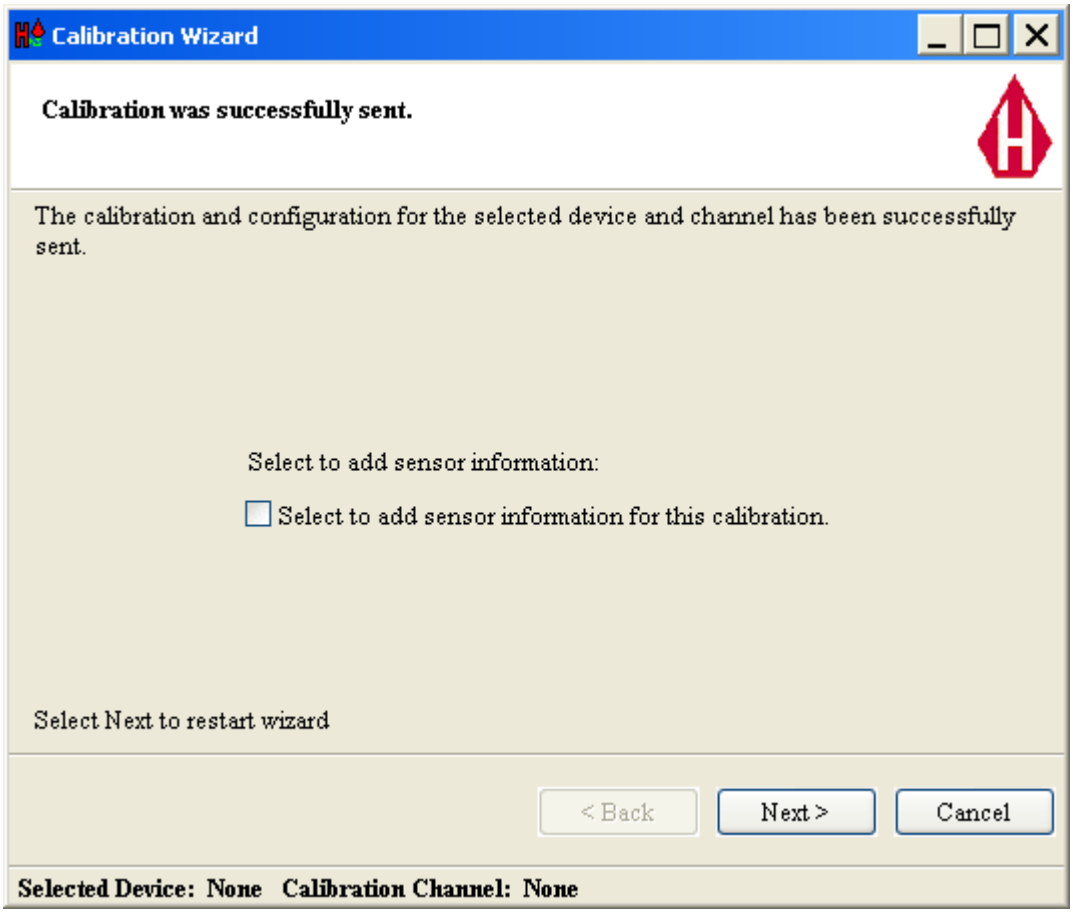


Figure 10: Calibration successfully sent.

5.2.2 Calibrate Against a Known mV

Calibrating against a know mV input uses the specs from a given input device to automatically calibrate the channel for you. You will find the information necessary to perform this method of calibration by referring to the calibration sheet that shipped with the input your wishing to calibrate.

Calibrating Against A Known mV Input

Step 1: Select the **Calibration with a known millivolt input.**

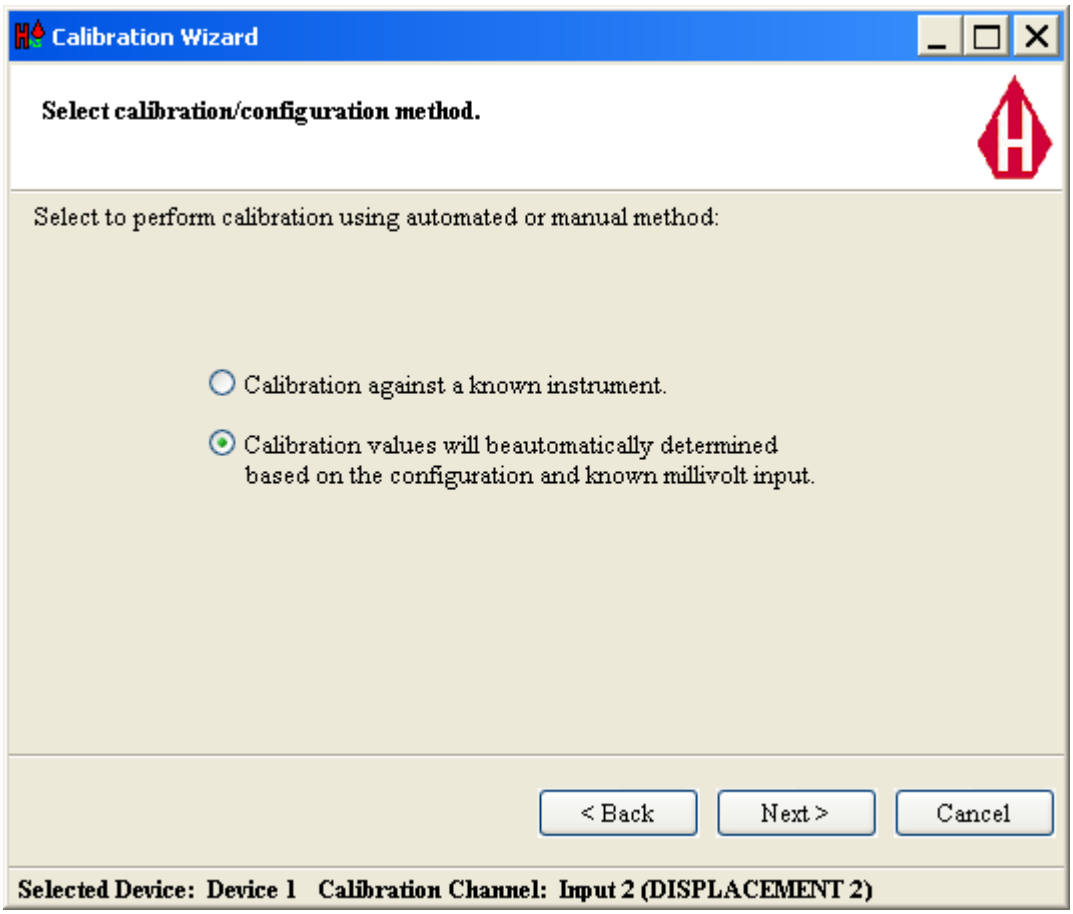


Figure 1: Known millivolts selection.

Step 2: Select a transducer setting to use for the calibration. If none are present then select **AddNew**. The transducers setting will be categorized by the type of transducer. calibration it was.

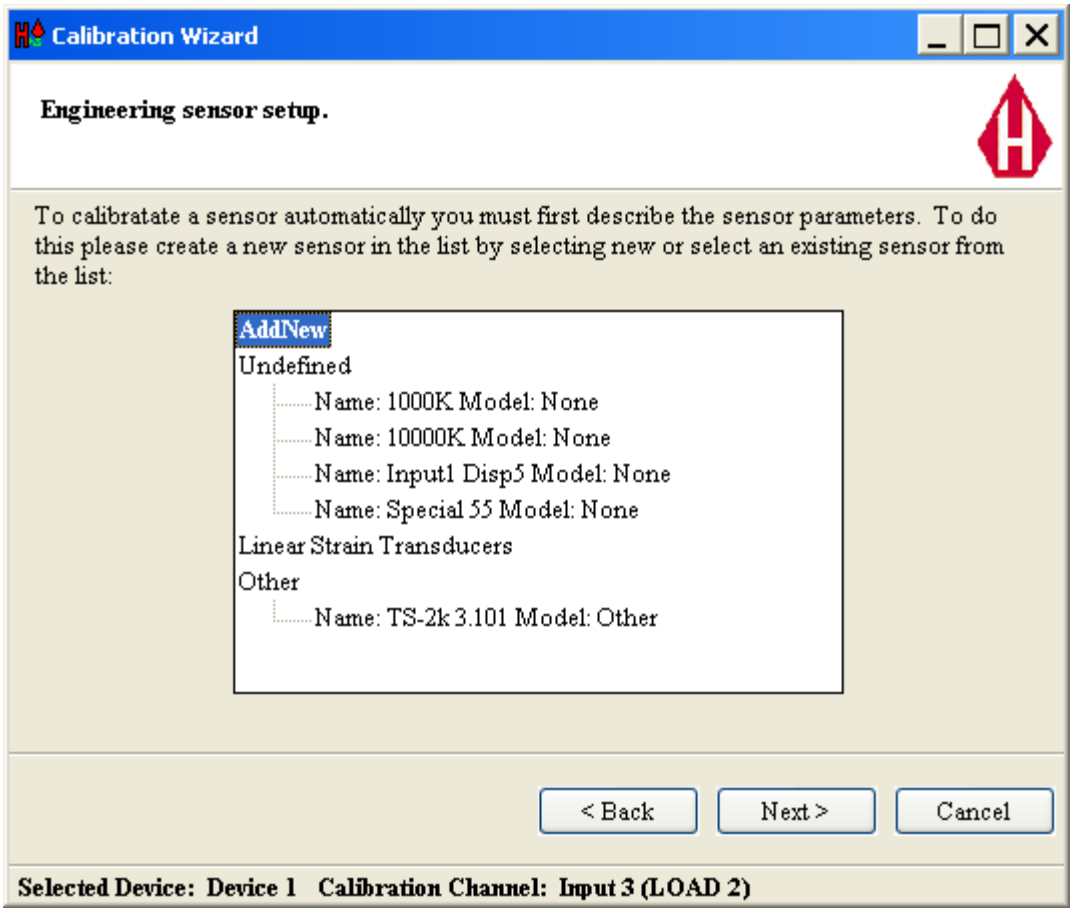


Figure 2: Transducer information selection. Addnew or Existing.

Step 3: Fill in the information for this transducer. This will be saved in the Transducer Database for further use.

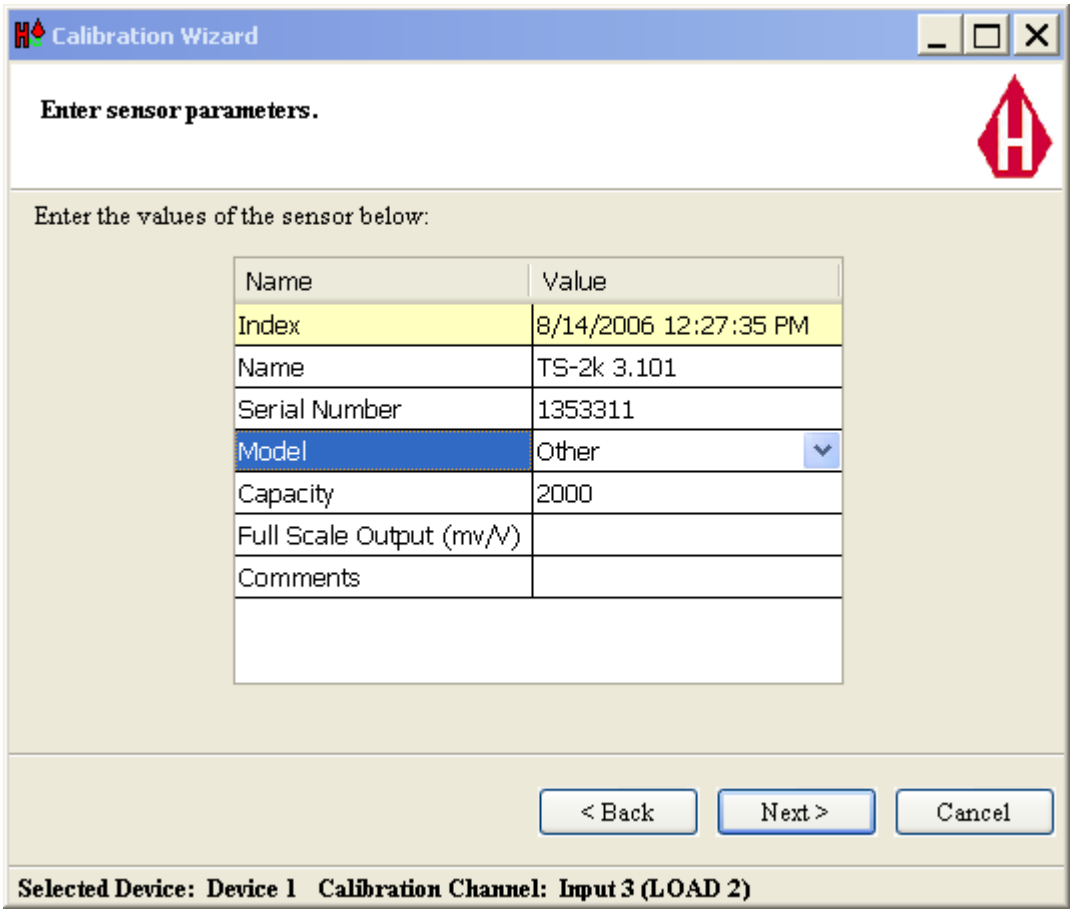


Figure 3: Transducer entry.

Step 4: Set the Engineering Min and Max Values. These values represent the upper limit of the channel. For example, if you wanted a channel to represent the values from 0 to 1000 lbs then the max value would be set to 1000. Once the Next button is clicked, you will hear the machine beep as the software will try to determin the Zero and Max for this channel. This can take a few seconds.

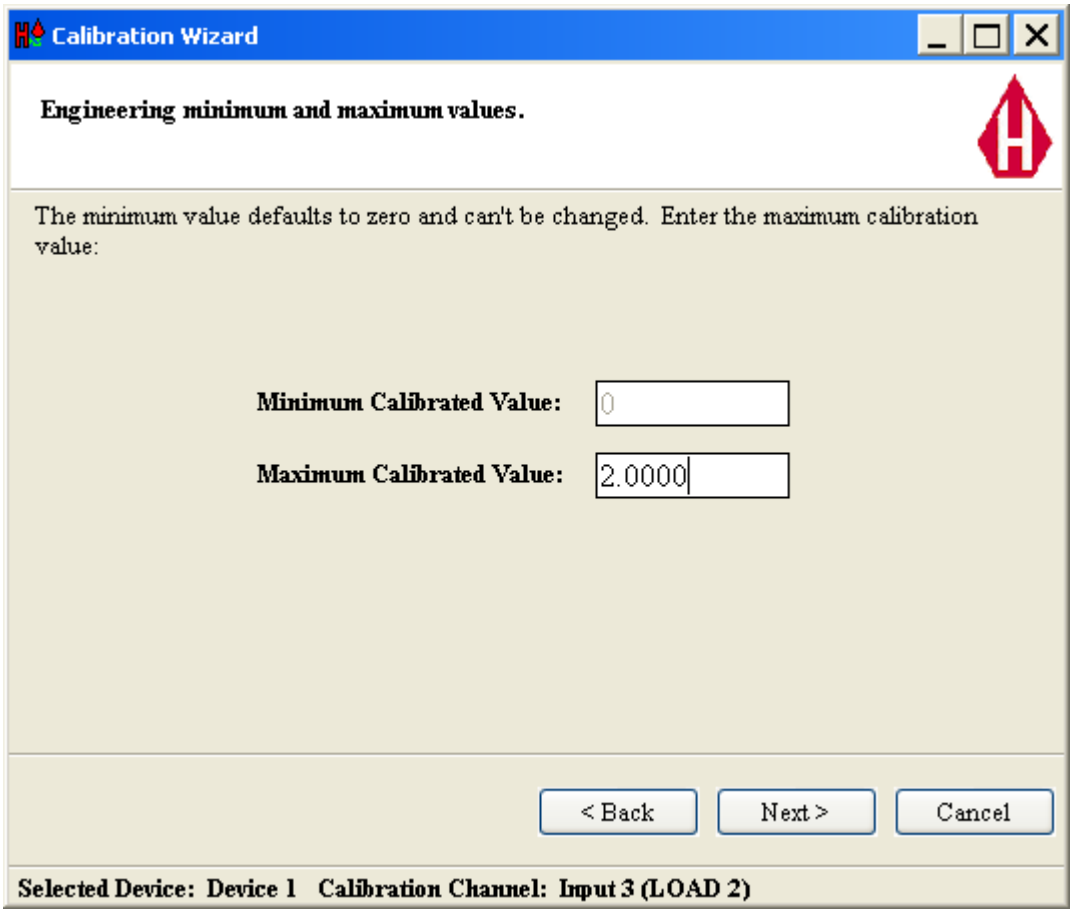


Figure 4: Max Engineering Value.

Step 5 (Optional): Use the back button to view the gain that was selected automatically. The gain is a channel multiplier that allows the channel to reach above the Max value set in step 2. The current selected device/channel gain is select for you. Push the transducer in all the way, and if the *Current Channel Raw Data Value* shown in this step is less than the Engineering Max then select a higher gain. Make sure the *Current Channel Raw Data* is greater than the Engineering Max when the transducer is fully depressed.

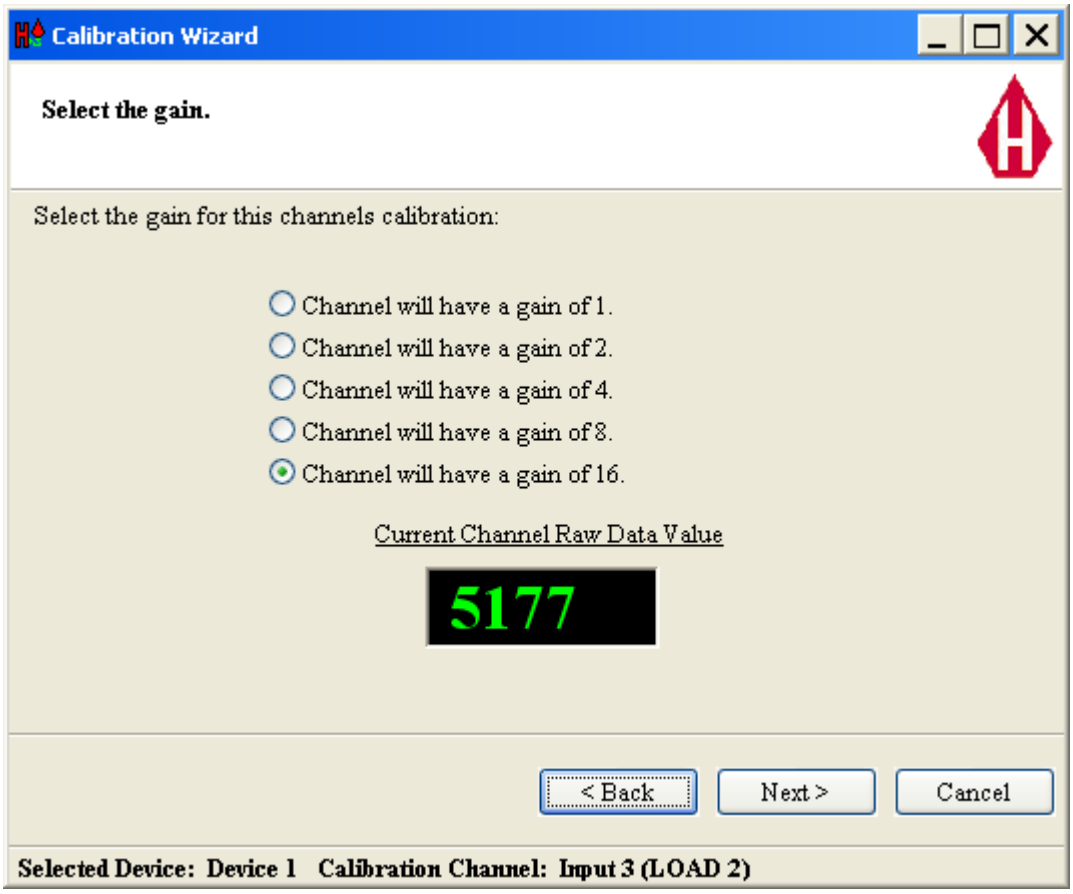


Figure 5: Gain Setup.

Step 6: This is the Calibration Zero and Max, which represents the raw A-to-D values at the zero point and the maximum point. To set the Zero value, with the transducer depressed click the *Zero Set* button. This will set the zero (value displayed in red). To set the Max value, with the transducer pressed all the way in or the desired amount, click the *Max Set* button (value displayed in red). Once both of these are set the *Engineering Value* will be set. The range for this was set in step 1. You can press and depress the transducer to see if the desired engineering value was achieved.

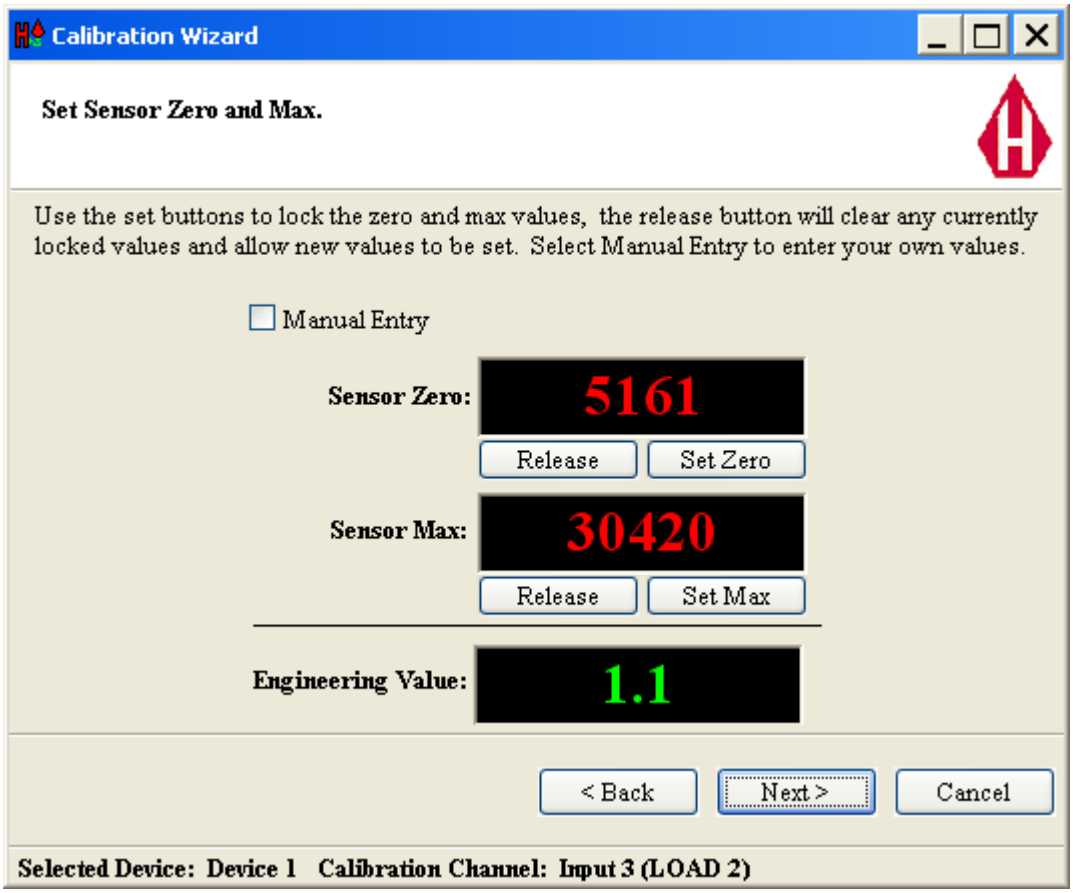


Figure 6: Calibration Zero and Max.

Step 7 (Optional): You will notice the Manual Entry selection in Figure 6. Clicking this will allow you to key in the zero value and the max value. This is useful for calibrating digital instruments.

Step 8: Select a name for the channel.

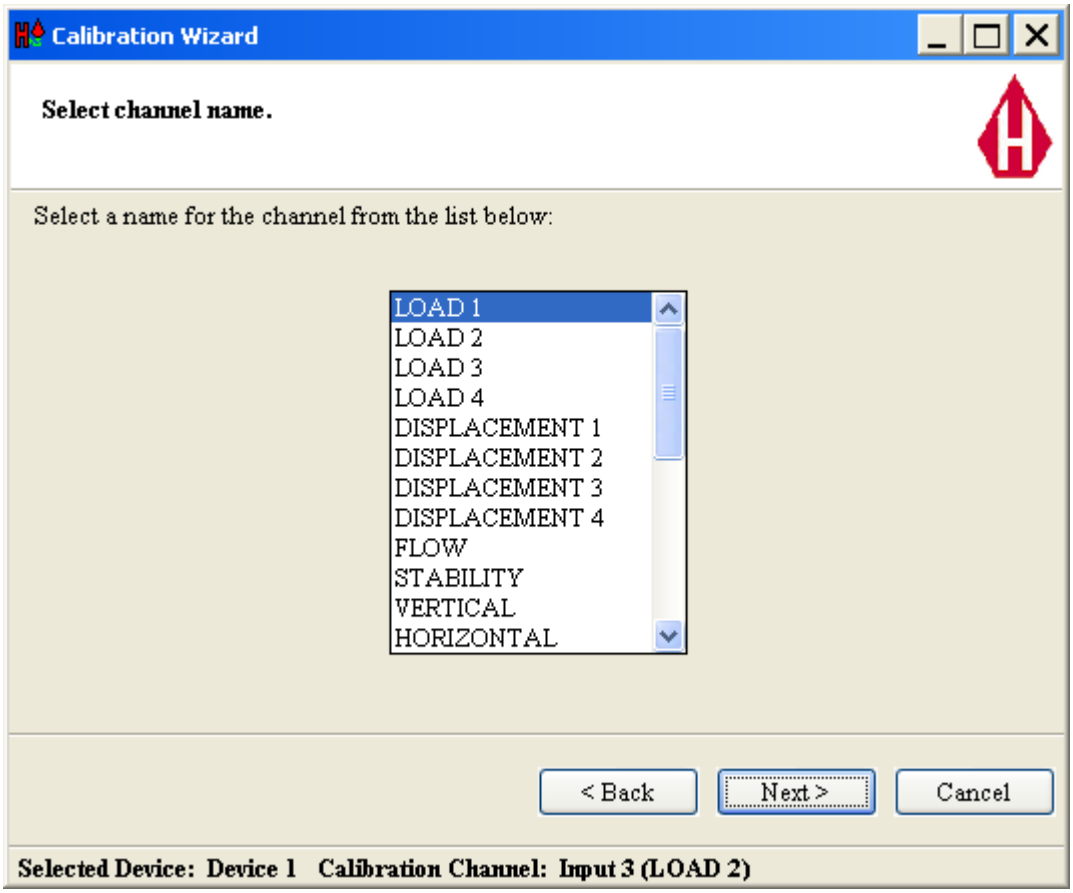


Figure 7: Channel name.

Step 9: Verify channel setup.

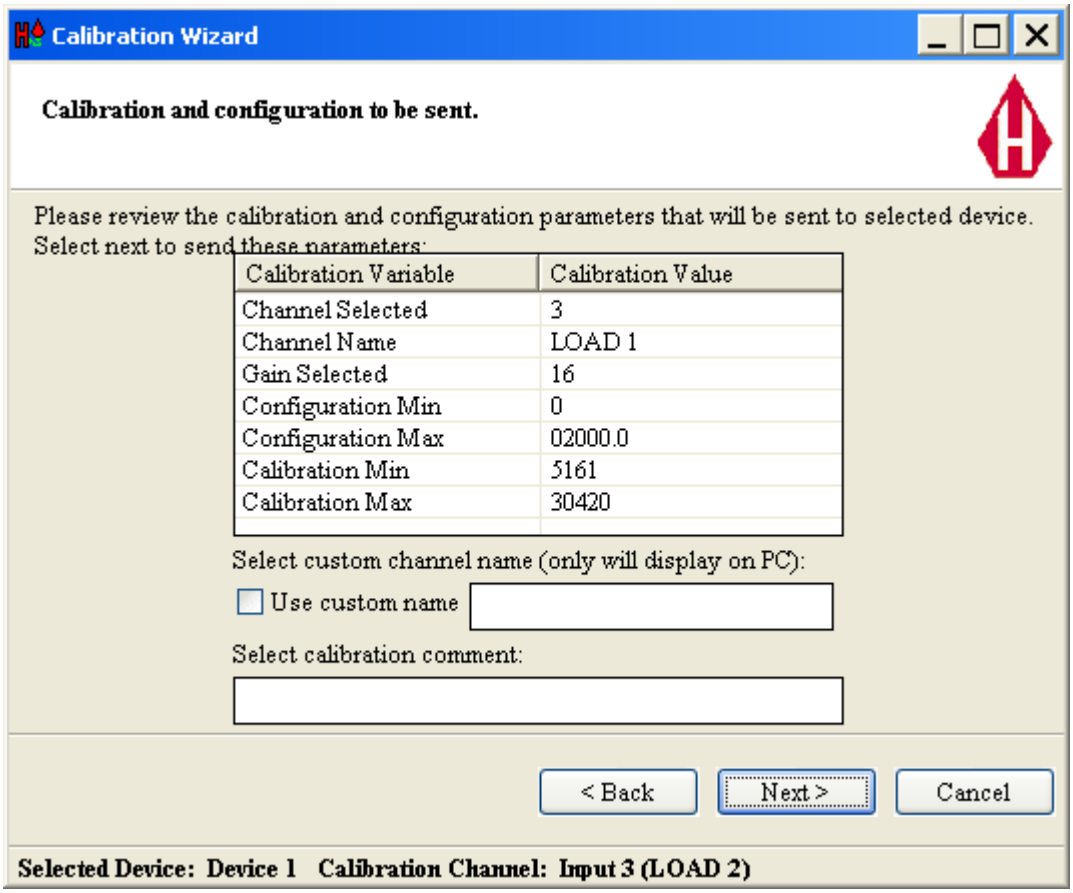
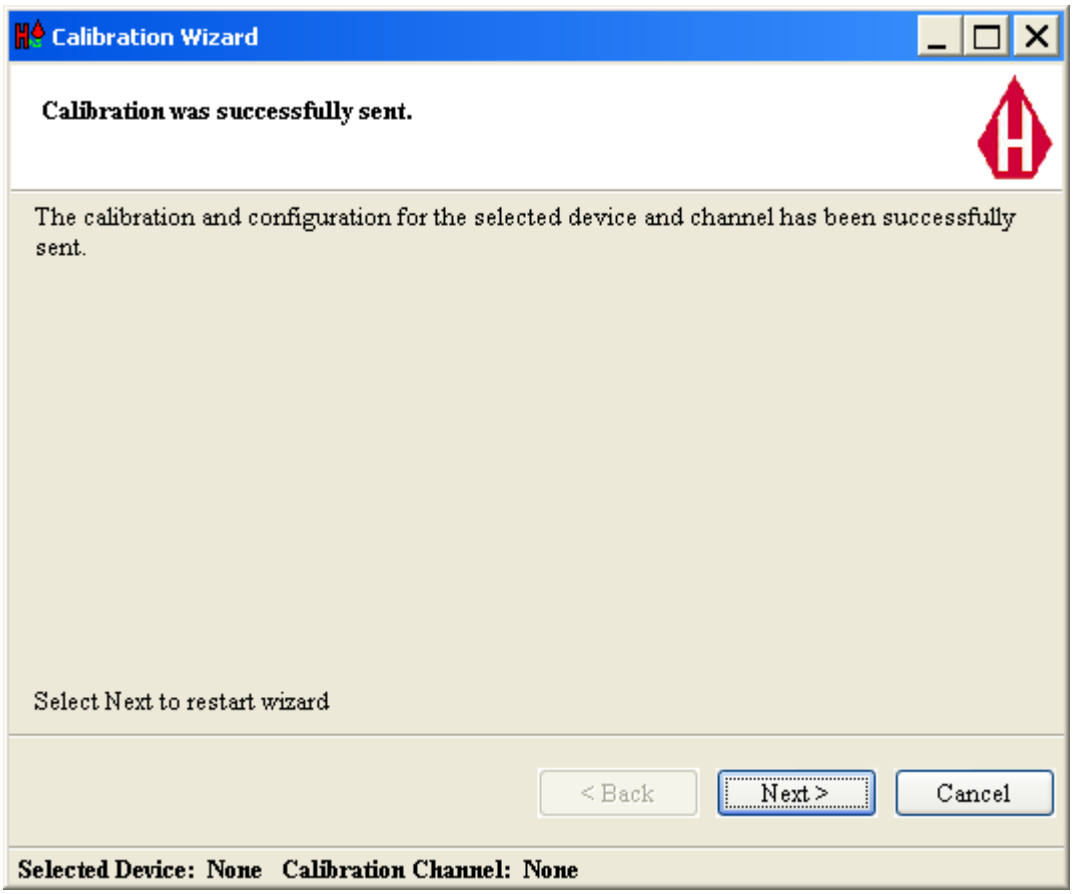


Figure 8: Channel Verification.

Step 10: The calibration/configuration will be sent to the device. You will be prompted if the calibration was received or not received. If the calibration was not received then you will be given the option to resend or start another calibration. Once the calibration is received you can close the wizard or calibrate another channel.



5.3 Retrieve Calibration

5.3.1 Retrieve Calibration Guide

Sometimes it is necessary to retrieve a calibration from a connected device. You might want to retrieve the calibration if it is a new installation of the Humboldt Material Testing

Software, a channel is calibrated using the device and the HMTS needs to be updated, or the calibrations were lost for HMTS.

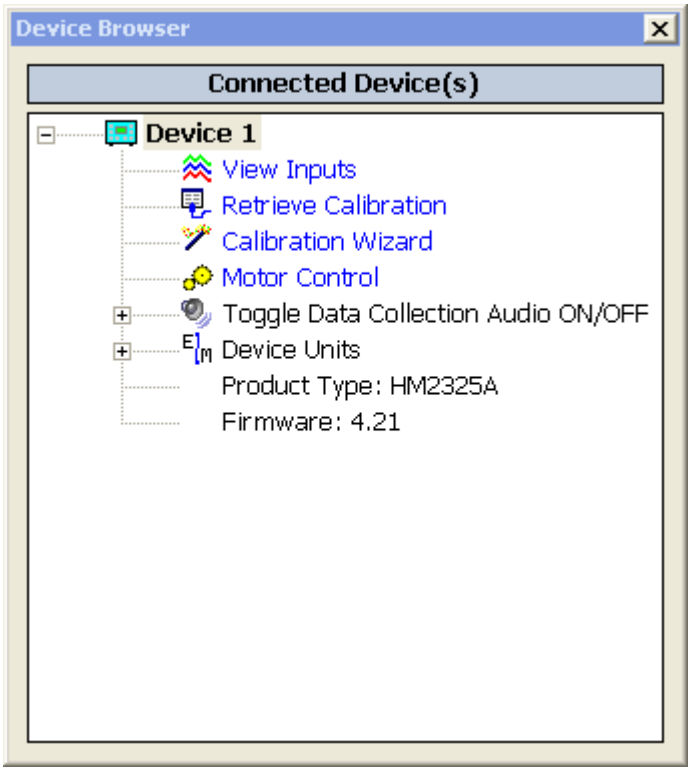
The retrieve calibration tool can be located by expanding the connected device node located in the Device Availability window and selecting *Retrieve Current Calibration* Selection.

The channel calibration can be retrieved from the device. The calibration is not set until the *Set Calibration* button is pressed with checked calibrations. See Managing Calibration Guide 59 for retrieving and setting calibrations.

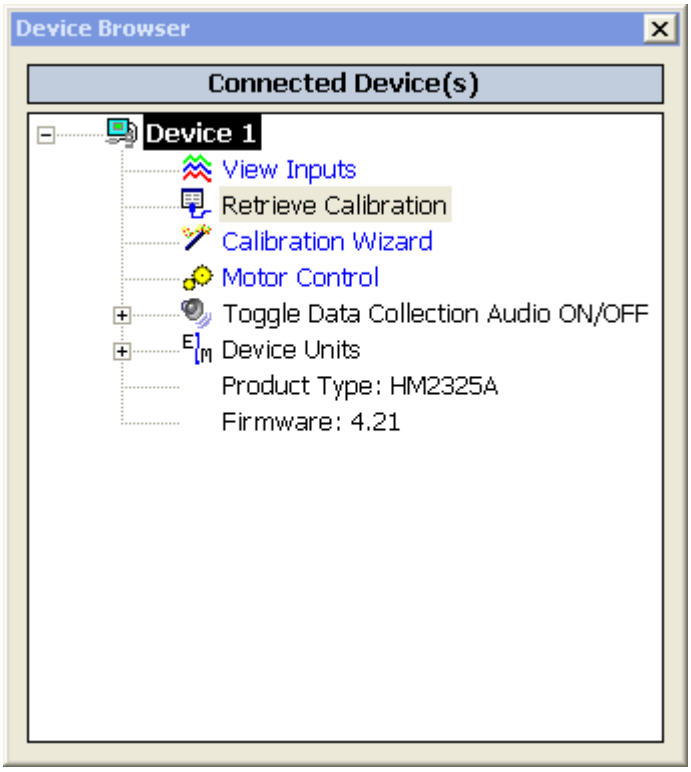
Note: If a channel is calibrated already and stored, and you want to retrieve the calibration from the device, the new calibration will replace the old calibration within the application. The calibration will not be erased, but can be viewed and used again with the Calibration Management 57 tool.

Follow these steps for retrieving and setting calibrations:

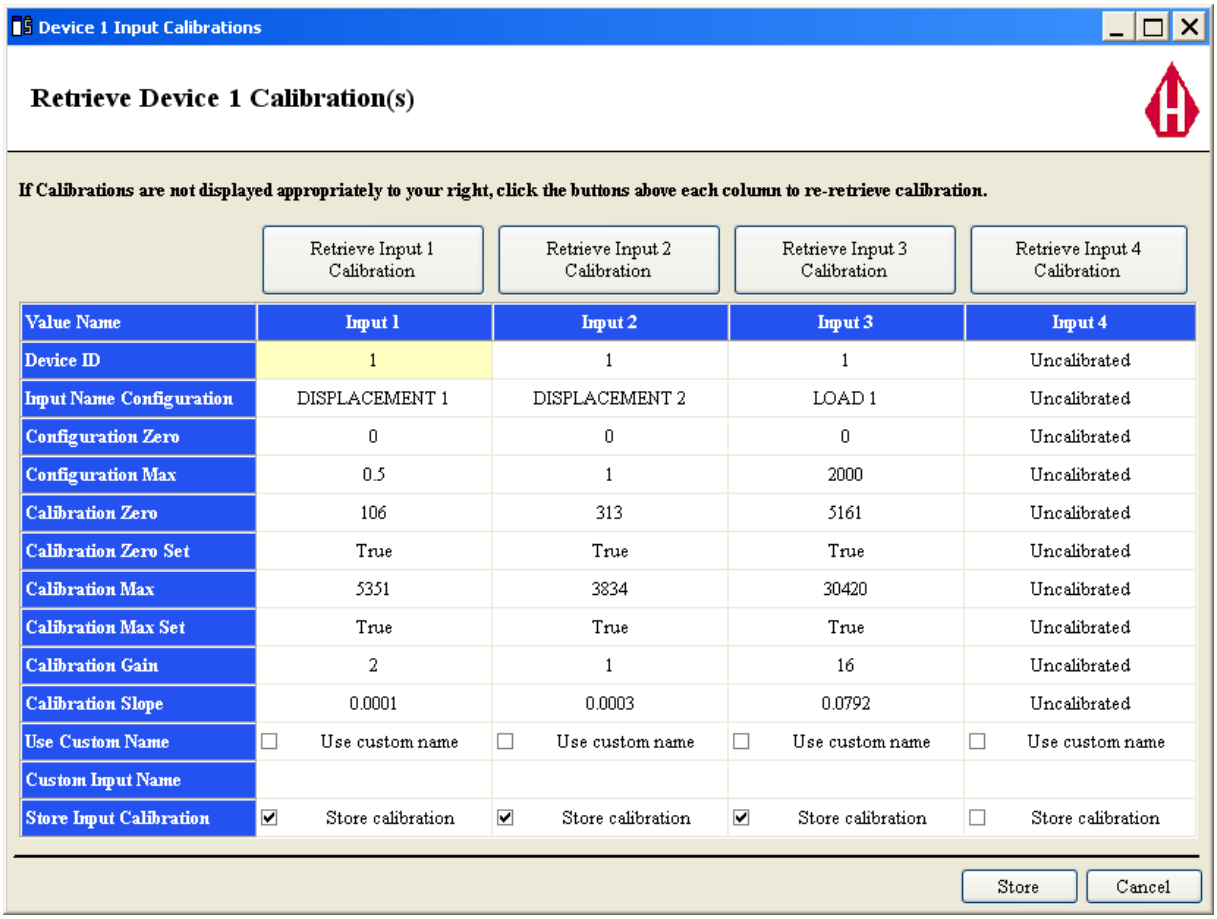
Step 1: Expand the desired device from the Connected Device(s) Window within the Device Browser.



Step 2: Click the *Retrieve Calibration* item to open the Retrieve Tool.



Step 3: Form will load and grab any calibrated channels from the device. If any channels should contain calibrations, but do not click the *Retrieve Input 1 Calibration, Retrieve Input 2 Calibration, Retrieve Input 3 Calibration, or Retrieve Input 4 Calibration* button to retrieve calibration data from the device. The device will beep and channel calibration will be shown under the clicked button.



Step 4: To store calibration, check the desired calibration you wish to set by clicking on the *Store Input Calibration* check box for each channel you would like to store calibrations. Channels you wish to store will have a check mark next to them.

Step 5: If you wish to attach a custom name to a channel, click on the *Use Custom Name* check box for each channel you would like to set a custom name for. After check the option to use a custom name, click on blank below the check box and type a custom name to use. If you are re-retrieving calibration data from a channel that the software already has a current calibration for and a custom name, that custom name will show up in the *Custom Input Name* area and the *Use Custom Name* check box will be checked for that channel. If you would not like to use that custom name, uncheck the *Use Custom Name* check box.

Step 6: To set calibration, select the *Store* button. To cancel, select the *Cancel* button.

Step 7: The screen with then automatically exit the Retrieve calibration screen.

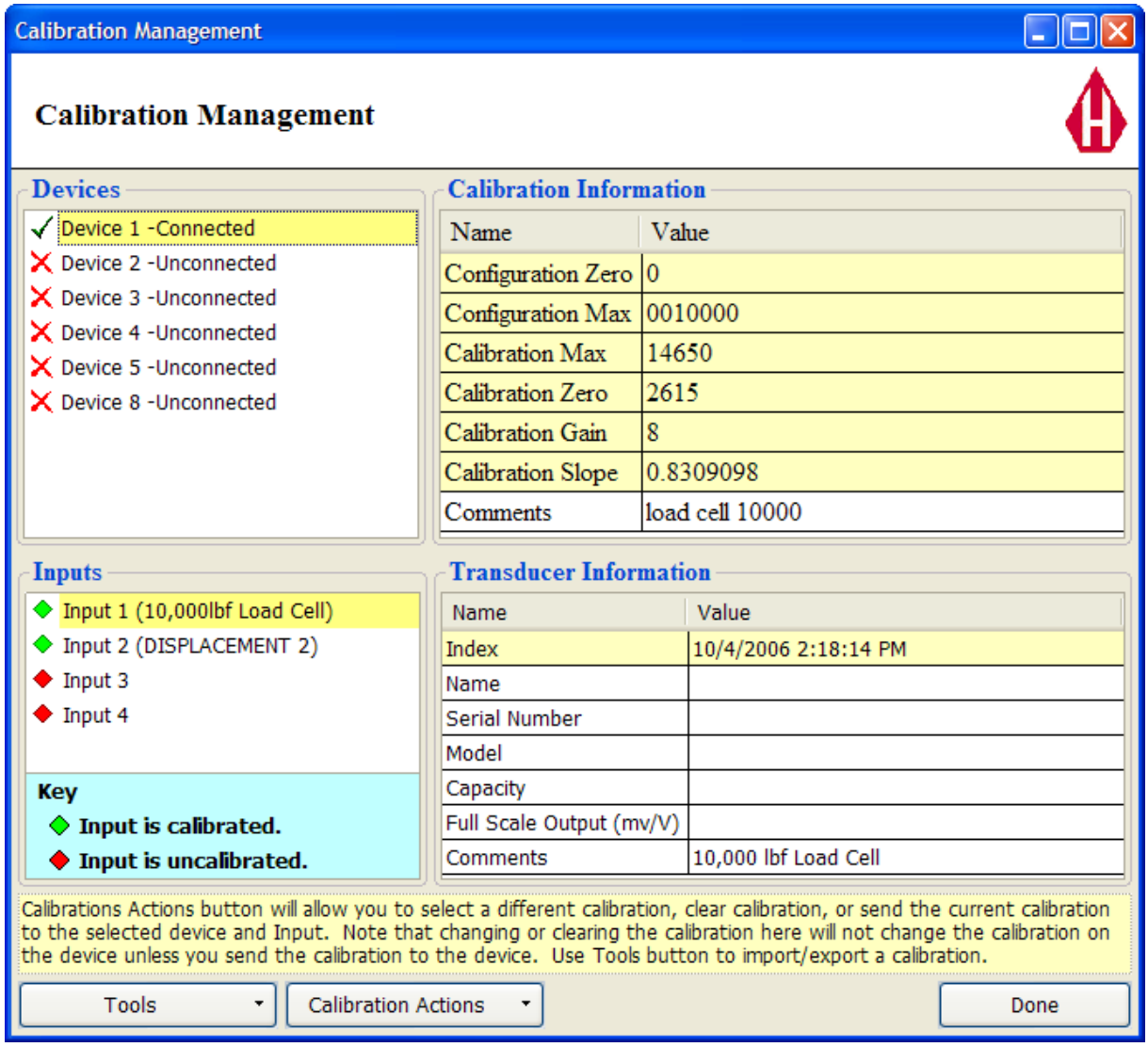
5.4 Managing Calibrations

5.4.1 Calibration Management

The Managing Calibrations tool will help you manage your calibrations. Since the Humboldt Material Testing Software saves all calibrations, even old calibrations that have been replaced, it might be necessary to review and compare your current calibration with past calibrations, or simply view what settings are currently in use for the connected devices. If a calibration is lost on a device you are using, the latest calibration can be easily set using the Managing Calibrations and Configurations tool.

To open the Calibrations Management select 'Calibration' and then 'Calibration Managment' from the main menu in your HMTS software.

To change the calibration see the Managing Calibration Guide 59.



Devices

This section shows all devices that have been connected to this computer. You can see in the above picture that there have been six devices connected at one point. If a device has a check mark next to it, it is connected.

Inputs

Once a device has been chosen, you will see a list of inputs. There will be four inputs per device. Calibrated channels will have a green diamond next to them, and uncalibrated channels will have a red diamond next to them.

Calibration Information

This will show you information about what the computer currently has for the calibration it is using for the device and input selected. This may not be the same calibration that is on the device itself. This information cannot be edited except for the comments field. Once a calibration is performed or received from the device, it is permanently stored. Comments can be added at any time.

Transducer Information

Once a device and input have been selected, information about the transducer used with the calibration can be seen. The transducer information can be changed and added at any time.

5.4.2 Managing Calibration Guide

Viewing Calibrations and Configurations:

1. Open the Managing Calibration and Configuration tool, this can be found under Tools.
2. Select a device and input to view a calibration for.

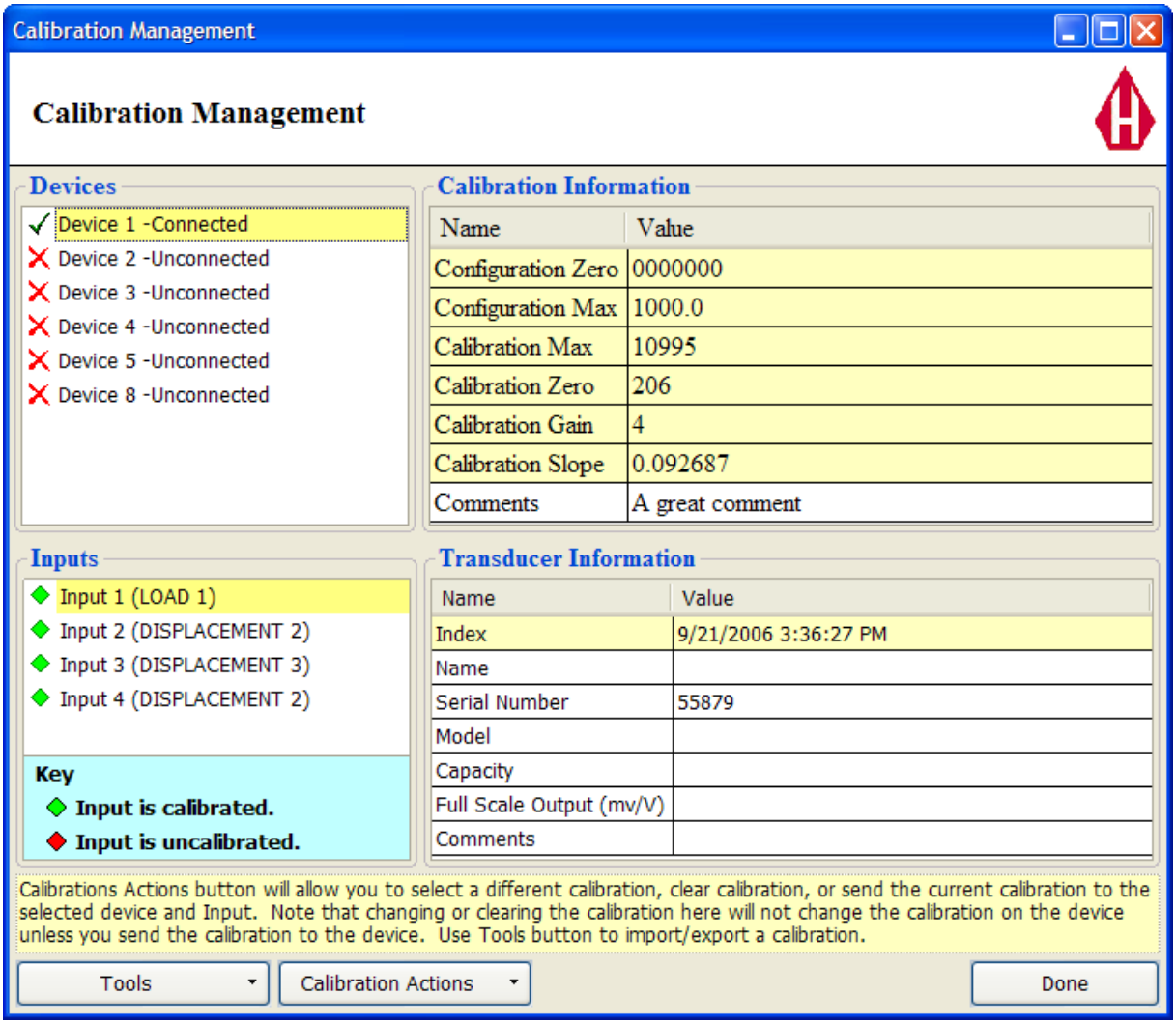


Figure MCG1: Calibration Management window.

3. Transducer information can always be edited for a device. Simply edit what you want and you will be presented with a save button once you start editing.

Changing the calibration:

1. Select Change Calibration button. This will reveal all the calibrations possible for this input. Only calibrations calibrated for this device and input will be shown.

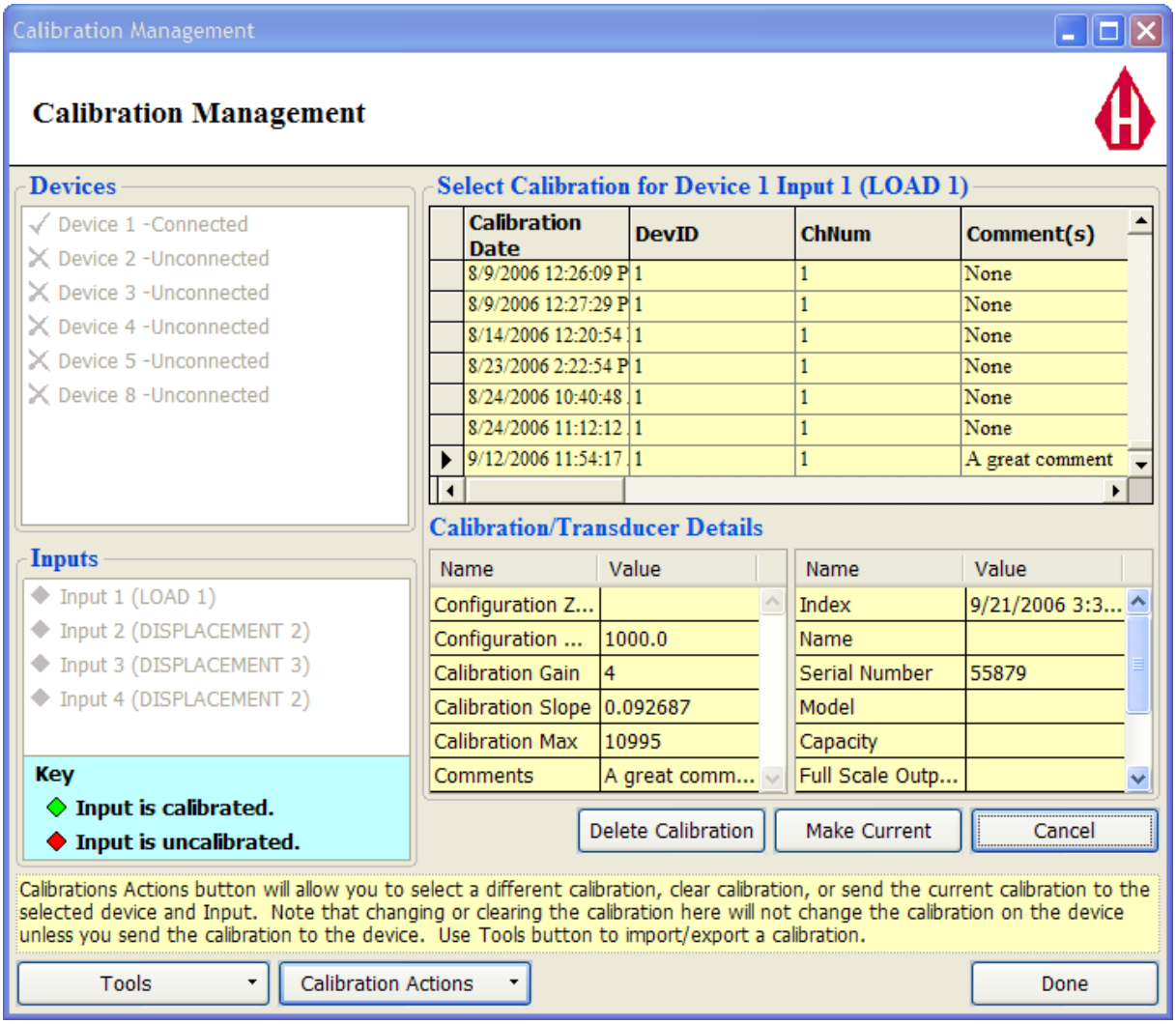


Figure MCG2: Using a different calibration for an input.

2. Selecting calibrations from the Database view will show their values in the Selected calibration and transducer information section.

3. Click on the Select button to select to use this calibration for the selected device and input. You can always go back to what you had before.

4. After clicking the select button the calibration will be set for the software. This does not change the hardware setting though. If you wish to change the hardware setting also, click the Send Calibration button. This will be necessary if the new calibration uses a different calibration than the previous calibration.

Clearing a calibration:

1. Select a device and input.

2. Press the *Clear* button. This clears the software calibration, but not the calibration on the device. To clear the calibration on the device, do this from the device panel.

Humboldt Material Testing Software Manual

Part VI

6 Retrieving and Viewing/Exporting Test Data

There could be instances where you have performed a test using the machine and not the computer, but want to retrieve the test data from the machine. To aid you with this task, Humboldt Material Testing Software ships with a couple tools. One retrieves test data from the machine, and the other views and exports the test data to Excel.

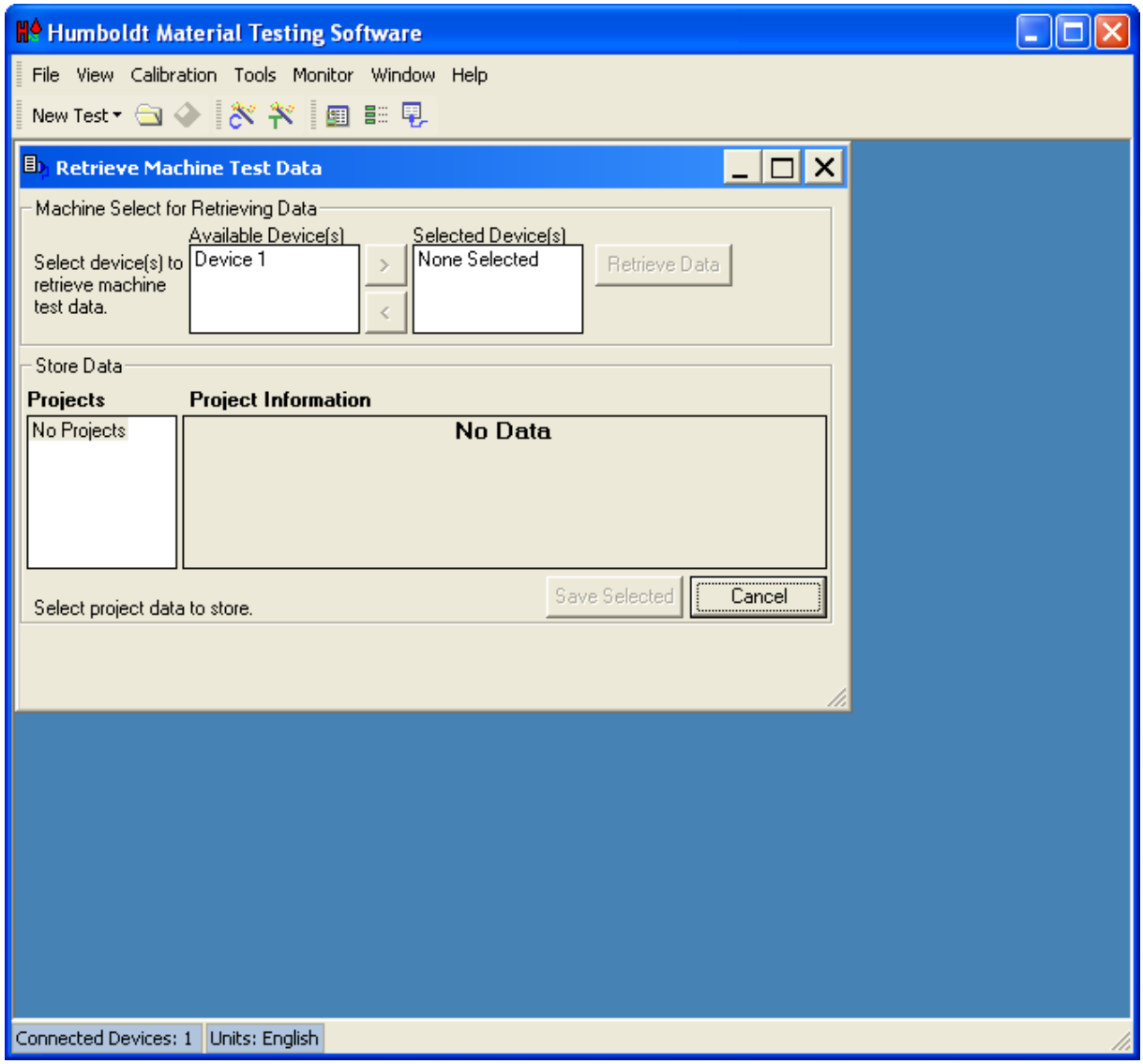
To Retrieve Data: goto Tools/Download Machine Test Data
Help with Retrieving Data 64

To View/Export Test Data: goto Tools/ViewExport Machine Test Data
Help with View/Export Retrieved Data 66

6.1 Retrieving Data

If a test has been performed using the Humboldt Machine and not the HMTS software then the **Retrieve Test Data** Tool can help.

From the main menu select **Tools/Download Machine Test Data**



NOTE: The communication method for Retrieving Test data in this manner differs from the communication method used in the rest of the software. In order to download the test data this way, all communication with devices is paused. Make sure that no other tests are running using the software before performing this option.

Steps for retrieving data:

1. Select a device from the Available Device(s) list, and use the right arrow to the left of the list to add it to the selected devices list. Note, more than one device can be selected and added to the Selected Device(s) list.

2. Once you have at least one device in the Selected Device(s) list, click the Retrieve Data button. This will begin the data retrieval process.

3. After a test has been received, it will be populated in the Projects List. Click on a project to view the test values received.

4. If multiple projects were downloaded, then multiple projects can be selected and will be highlighted in yellow. To highlight multiple projects, hold the Shift key and left click on the projects from the Projects list box.

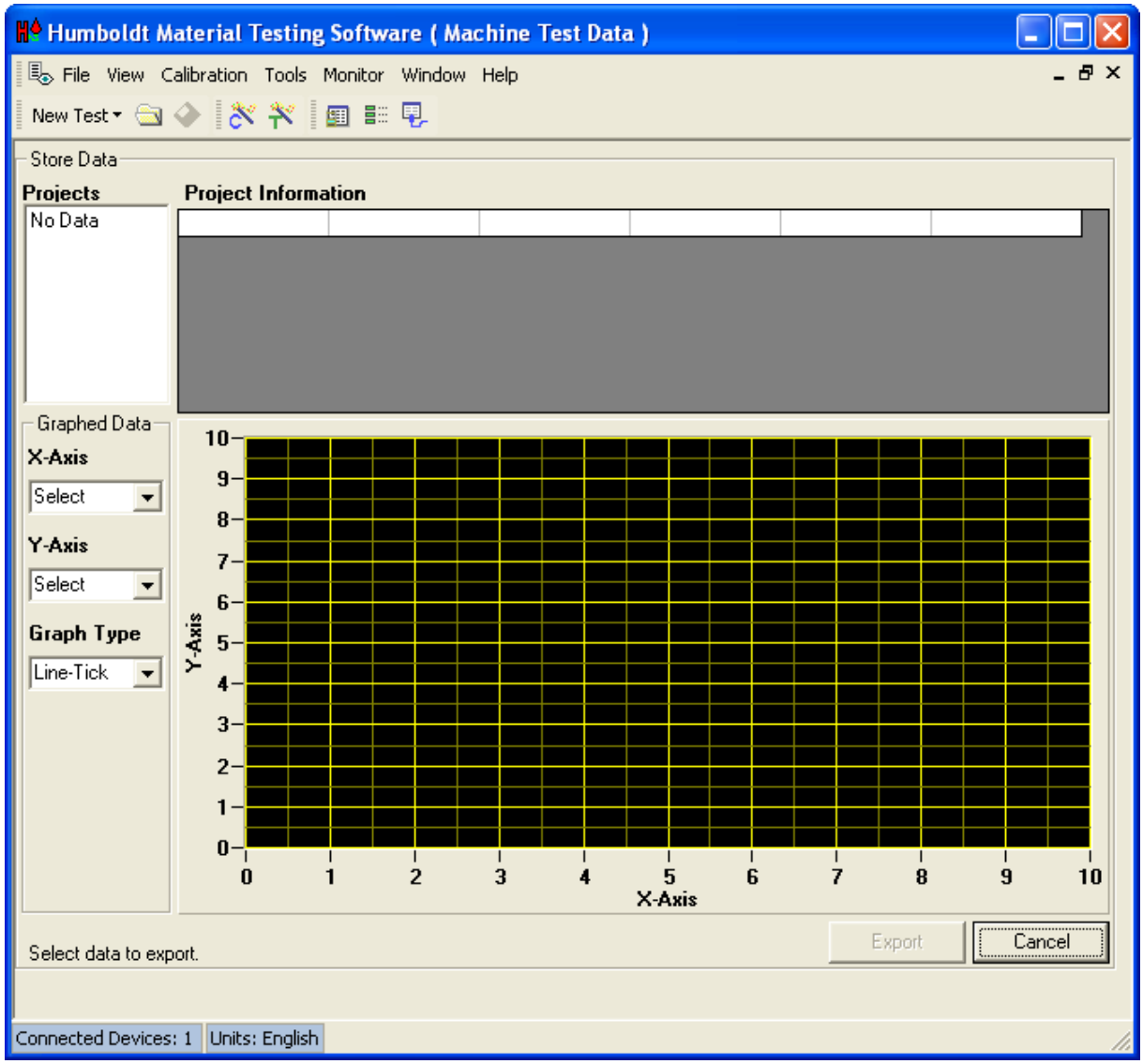
5. Select the desired projects to save, and click on the Save Selected button.

6. You will be prompted if you would like to view the newly saved data. Click Yes or open the Tools/ViewExport Retrieved Test Data.

Click here for help with View/Export Retrieved Data 66.

6.2 View/Export Retrieved Data

After information has been retrieved using the Retrieving Data 64 tool, the information can then be viewed with graphs and exported.



To View Data:

Select a project from the Projects Listed. The information will be displayed in the Project Information window.

View Data Graph:

After a project has been selected, a graph of the data can be displayed. Simply select what you would like to graph using the X-Axis and Y-Axis drop down lists.

Projects Name Change:

To change the name of a project, single left-click on the name of the project in the projects window. Once the text is highlighted, type the name change and press enter.

Exporting Data:

Select a project from the project list and click the Export button.

Humboldt Material Testing Software Manual

Part VII

7 Tests

Humboldt Material Testing Software has the ability to do many different tests. The software includes all the tests, but only the User Defined test is free of charge. All other tests contain a trial period, once the trial period expires the tests can be purshased separately.

Humboldt Material Testing Software testing capabilities:

7.1 Project Information

Summary: The Project Information page contains general information about the project you are currently working with. This is also where global items for the test can be manipulated. Not all information has to be completed, this information can be completed at any time.

Project Information Items:

- **Test Units -** Select what units you want to perform this test in (English or Metric). If switching between english and metric, all values in the test will be switched and displayed in the desired value even if the test was not performed in those units.

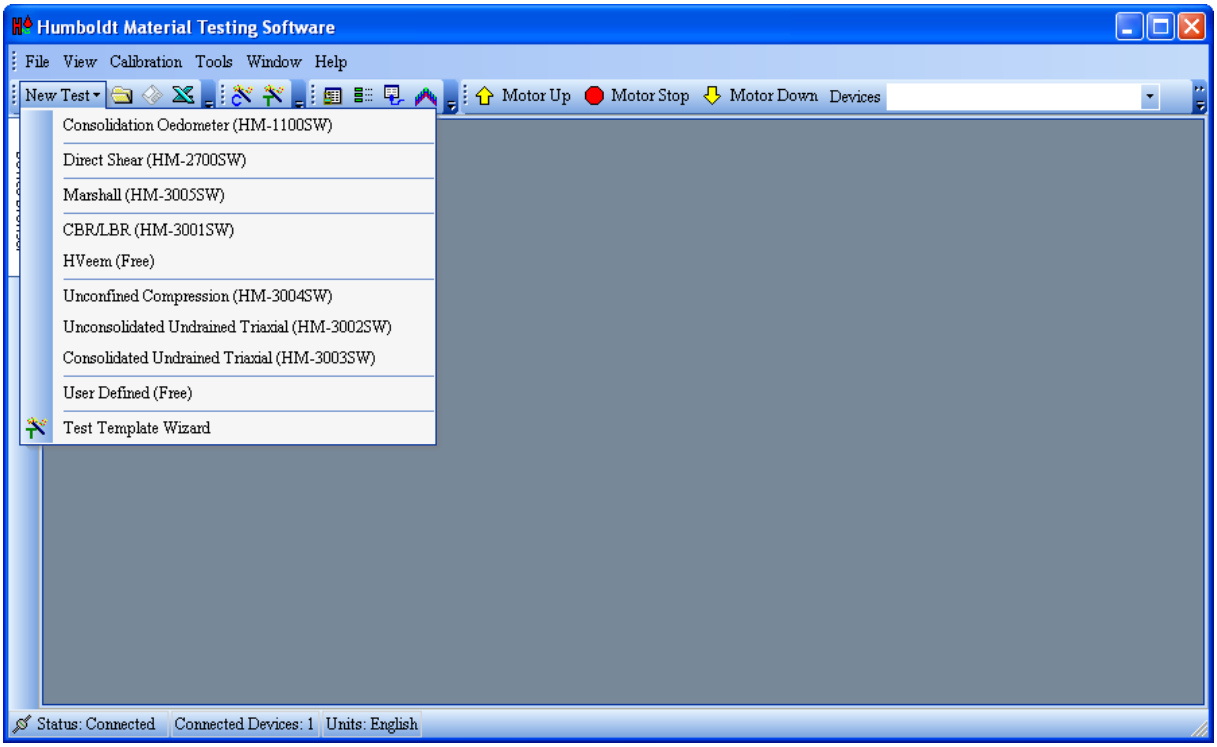
- **Calculation Method * -** This can only be found in the CBR/LBR test. Use this to select if you would like to find CBR or LBR values in the tabulation section.

- **Test Standard -** The test standard you are following when running the current test (default is ASTM).
- **Project Name -** Name of project.
- **Project Number -** Number designation of project.
- **Sample Location -** Location where sample was obtained from.
- **Client -** The client that this test is being performed form.
- **Job Number -** Number designation for this job.
- **Sample Number -** Sample number given for this test.
- **Date of Sampling -** Date when this sample was originally obtained.
- **Sampling Time -** Time when this sample was originally obtained.
- **Date of Receiving Sample -** Date when this sample was received for testing.
- **Received Time -** Time when this sample was received for testing.
- **Boring Number -** Boring number designation.
- **Remarks -** Any general remarks for this test.

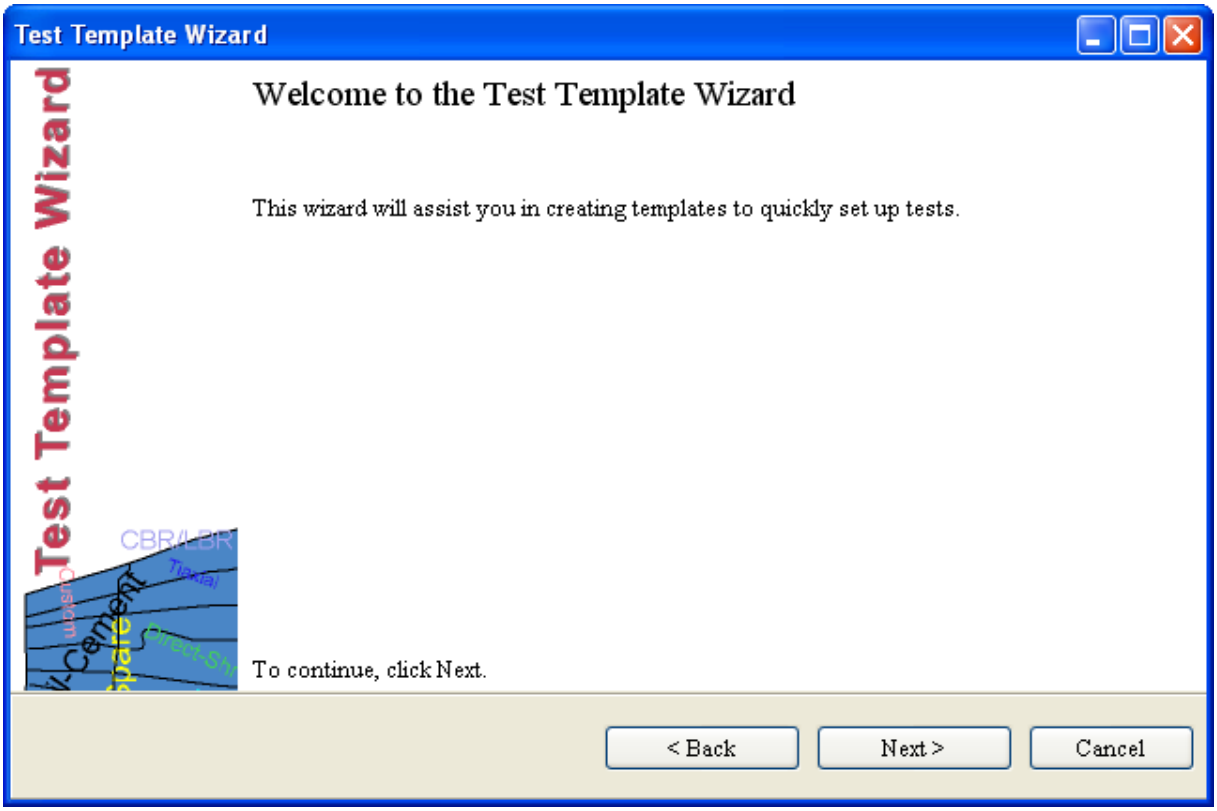
7.2 Test Template Wizard

The Test Template Wizard is a step-by-step guide to help you create templates for your tests.

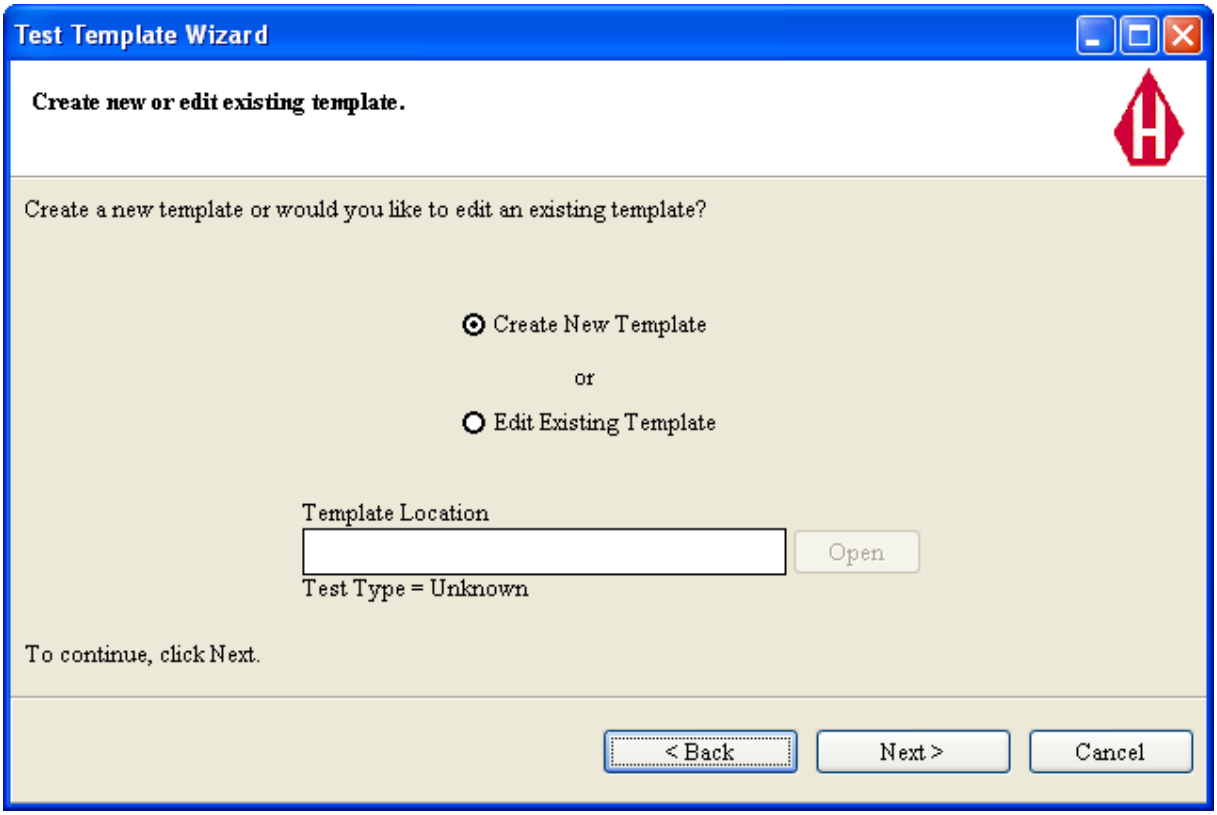
Step 1: In the **New Test** menu, click on **Test Template Wizard**.



Step 2: The Test Template Wizard will load to the start screen. Click "Next" to begin.

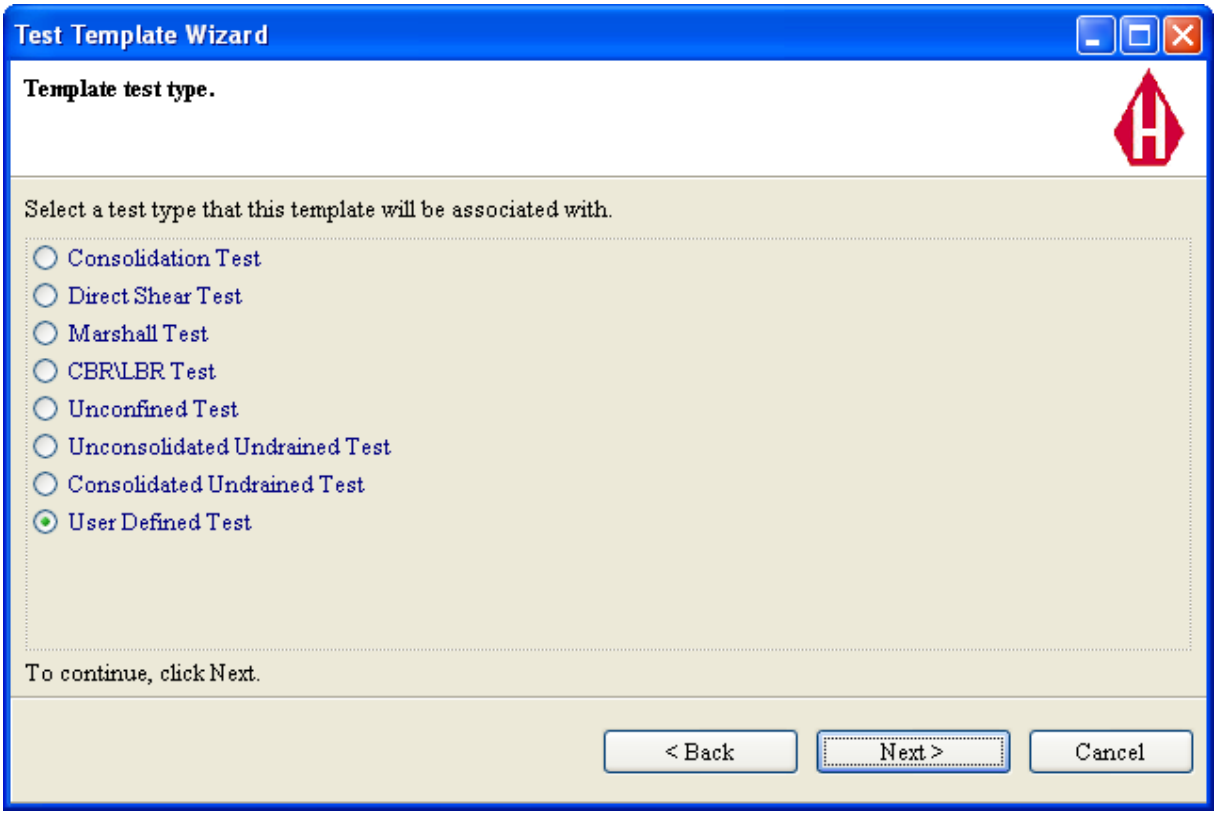


Step 3: Click either **Create New** or **Edit Existing Template** and then click "Next."

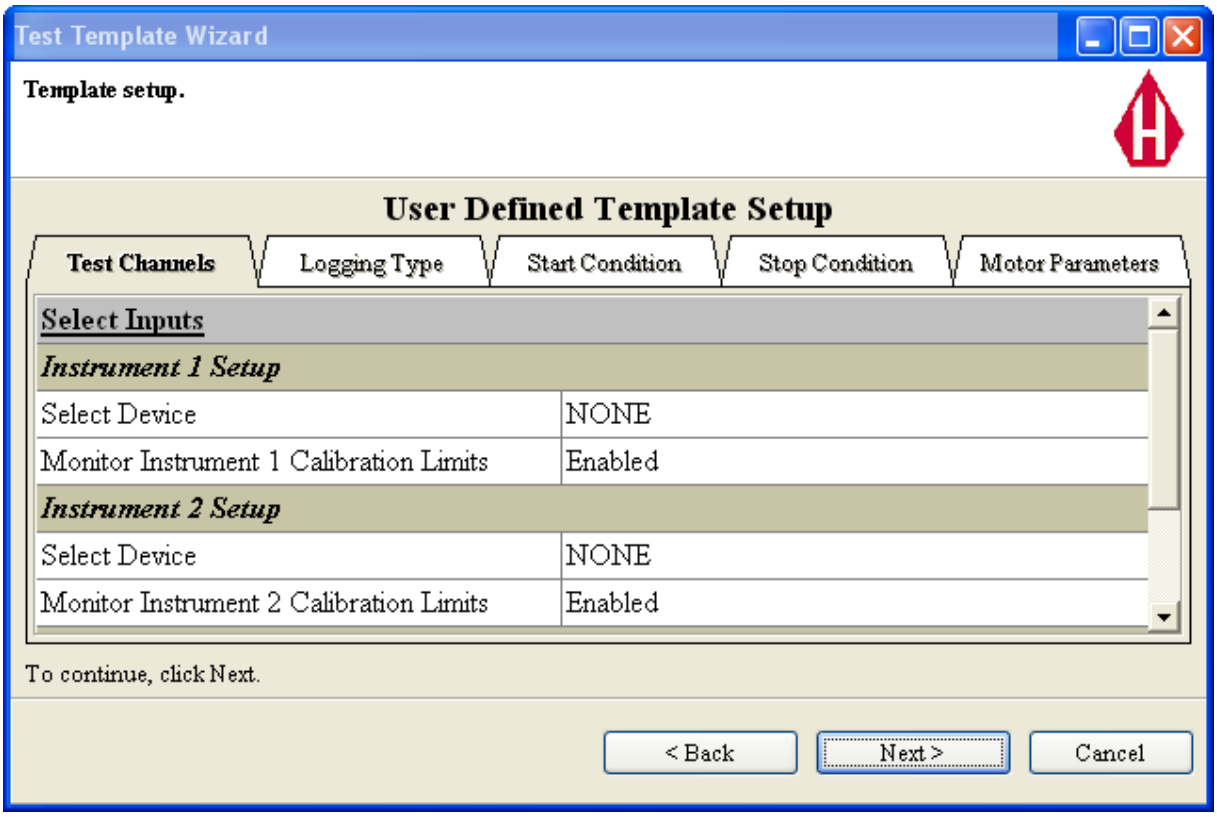


Note: If you choose to edit an existing template, click the "Open" button to the right and select your template location. Locate the file that you would like to use and then click "Next" to continue with the Test Template Wizard.

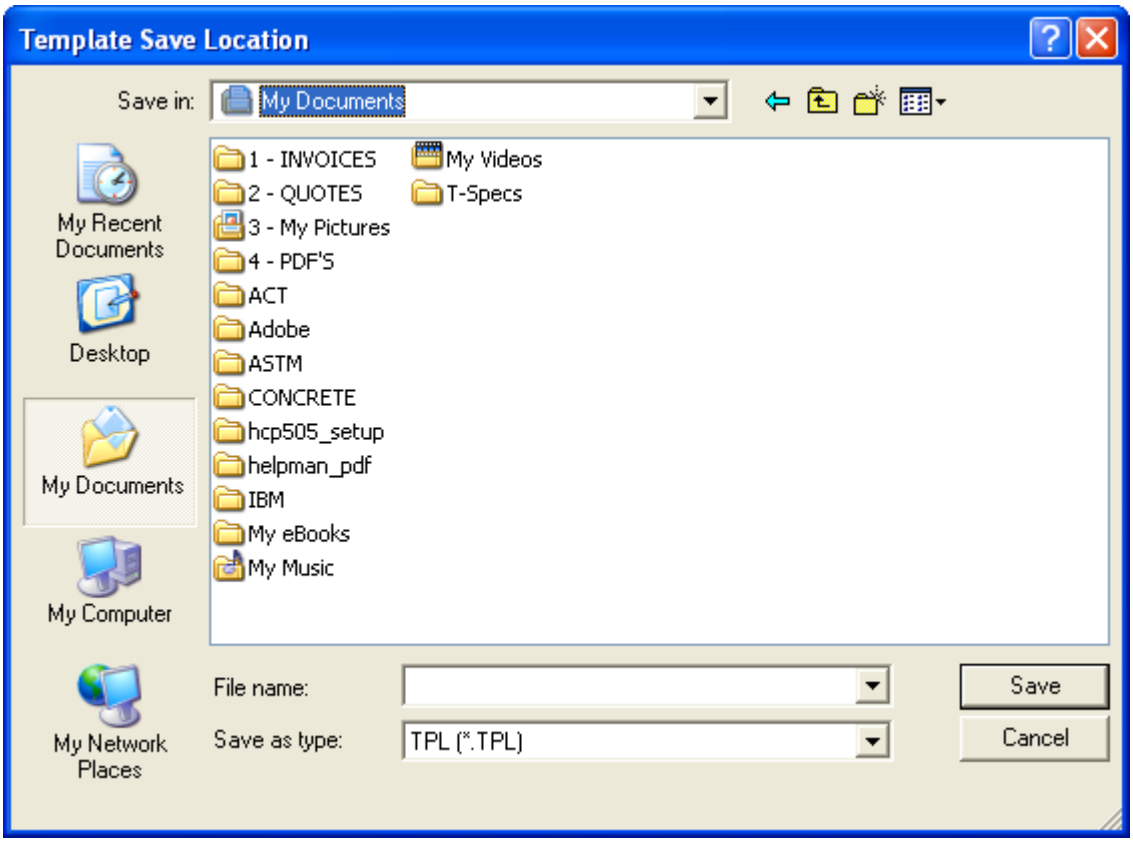
Step 4: Choose which test you would like to create a template for the click "Next."



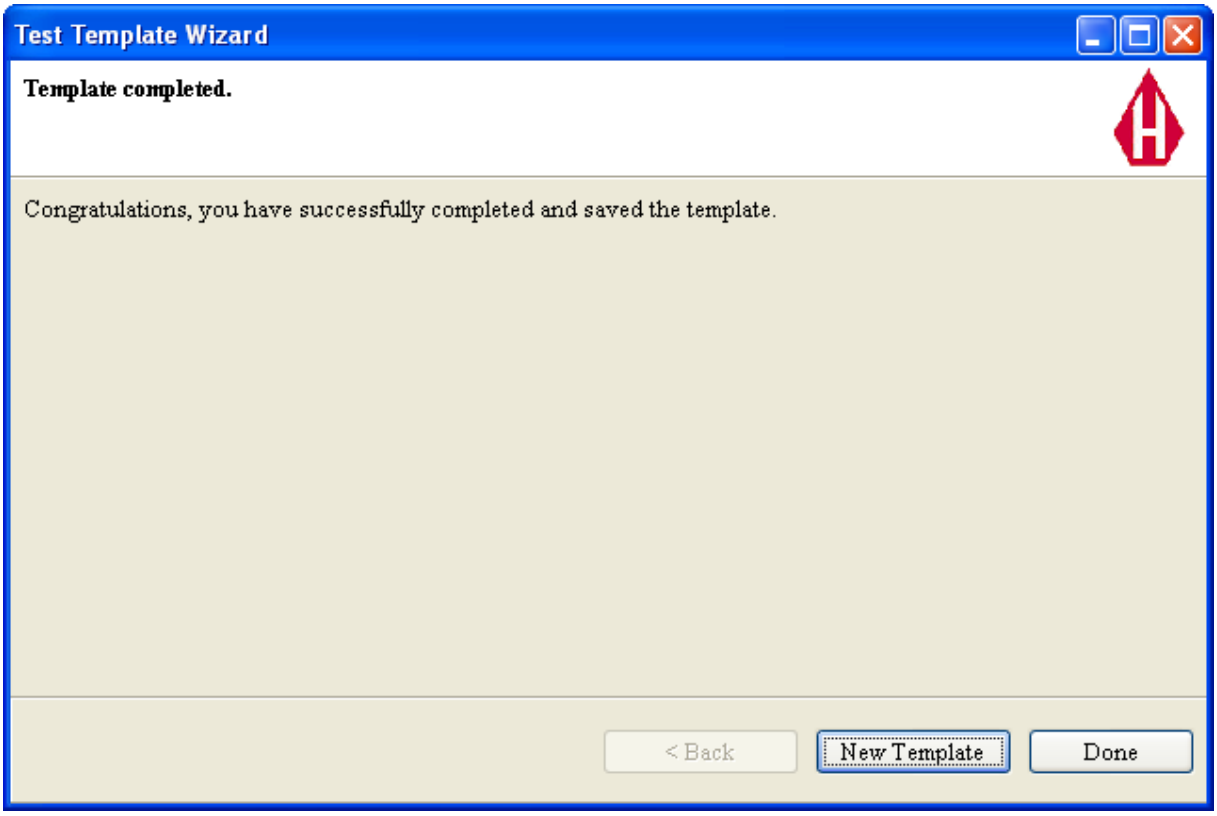
Step 5: Fill in all of the information for the Test Setup. (ex. In the User Defined Test Setup you would input data for Channels, Logging Type, Trigger Condition, Stop Condition, Motor Parameters & other.) Once this is completed, click "Next."



Step 6: You will now be prompted to save the template. Choose the location on your computer where you would like to save the document, then name it and click "Save."



Step 7: You have now completed the Test Template Wizard. You can either create and **New Template** or click **Done** to exit the wizard.



7.3 Automated Tests

This section will help you understand HMTS's automated test window. If you need to know how to setup an automated test, please Click here 70.

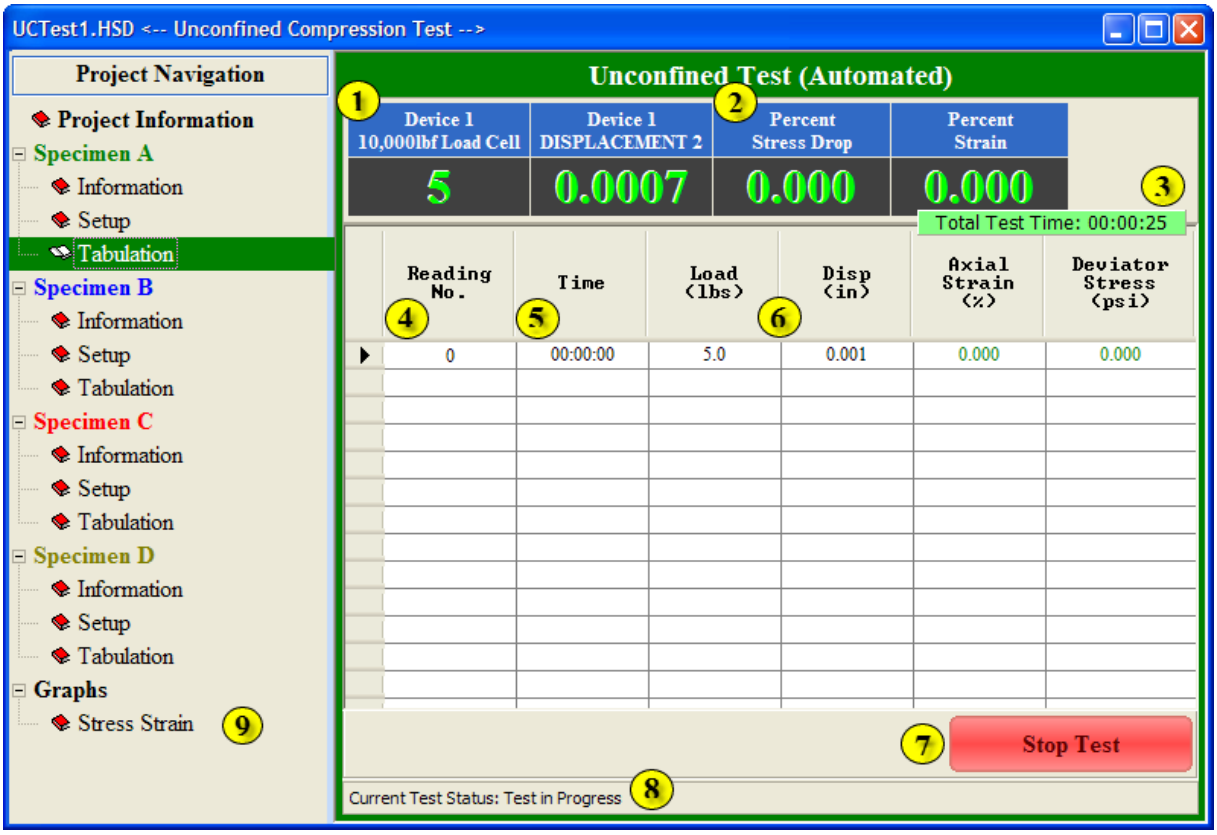


Figure 1: Automated Test Window.

Automotated Test Window Description

1. Depending on the test you will have from 1 to 4 inputs involved in a test. The inputs involved in the test will be listed from left to right and will contain the device number or name if one has been given and the input or input name if one was assigned. The inputs will show the current value and should represent exactly what the device the input is connected to is displaying. Values will be displayed in Yellow, Green, or Red. See below for color descriptions.

   Color Descriptions
   - YELLOW - test trigger has not been met.
   - GREEN - test trigger was met and test is in progress.
   - RED - test stop condition was met, an error occured in the test, or the user pressed the Stop Test button.

2. Some test show extended values. For example, the Triaxial series of test show Percent Stress Drop and Percent Strain. The values are calculated continually.

3. This will show the current number of seconds that have passed since the test was activated and the number of seconds since the test triggered. Color for this will be displayed in Yellow, Green, or Red depending on the current test state. See below for

color descriptions.

Color Descriptions
- YELLOW - time ellapsed in seconds since test was activeated.
- GREEN - test trigger was met. time ellapsed since test trigger.
- RED - test stop condition was met, an error occured in the test, or the user pressed the Stop Test button.

4. Tabulated data index. Number of data points collected.

5. Ellapsed time that a data point was received.

6. Values in black represent data points received from hardware. Any values in green are calculated values calculated from specimen information parameters and data points received.

7. The stop test button can be used at any time during testing to stop the test. If a test does not contain a stop condition the Stop Test button will have to be used to stop the test.

8. Display any status messages. Some messages will be displayed here as well as in a popup box.

9. List of any graphs that can be viewed. Graphs can be viewed while a test is running, clicking on a graph will not stop a test.

7.4 Test Recovery

The Humboldt hardware and HMTS software have safeguards built into them to assure that tests running stay running. We know how lengthy and complicated test can be, that is why we have spent much time and energy into assuring your test runs smoothly.

CAUTION: ALL TEST NEED TO BE STOPPED IN HMTS BEFORE ANOTHER TEST USING ANY OF THE CURRNETLY RUNNING TESTS INPUTS CAN BE USED.

SCENARIO 1

I was running a test and my PC shut down.

Answer: All you need to do is start HMTS and open the test that is still running, the software will continue where it left off and retrieve any missed data points.

SCENARIO 2

I was running a test and I accidently closed the test, HMTS is still running.

Answer: Just open the test again, the software will continue where it left off and retrieve any missed data points.

SCENARIO 3

I was running a test and HMTS encountered a problem.

Answer: If HMTS is still open, you will need to close it. Open HMTS and open the test. The software will continue where it left off and retrieve any missed data points.

SCENARIO 4

I lost power to my test equipment; HMTS is still runing.

Answer: If power is lost to your test equipment the test will be comprimised. Turn the equipment back on. HMTS will collect any points from it, but the test will not collect any more data point or follow any trigger or stop conditions.

SCENARIO 5

I lost power to my test equipment and HMTS is not running anymore due to power failure or error.

Answer: If power is lost to your test equipment the test will be comprimised. Turn the equipment back on, open the HMTS software, and then open the test. The test will continue where it left off, but no data will be collected and trigger and stop conditions will not be valid. The test will need to be stopped.

7.5 Re-retrieve Test Data

The HMTS allows you to re-retrieve test data. This is primarily used if a test stopped and did not retrieve all the data or is missing points. This button is only visible when an automated test is not in progress.

NOTE: This only allows data to be collected that is already present on the test devices, it does not allow the test to continue running or restart the test where it left off.

CAUTION: Before you can re-retrieve any test data you will be prompted to see if you meet the criteria necessary to re-retrieve the test data. Follow the prompts very closely, a wrong selection could comprimise the test data that currently exists.

Directions

1. Click on the Re-retrieve Test Data Button.

2. You will be prompted "Have devices and channels used by this test changed since last tests?".

   Answer Yes:

   If the test setup has changed. You will not be able to re-retrieve any data.

   Answer No:

   You will continue to the next prompt.

3. Next you will see the prompt "Have channels utilized for this test been used by any other tests since the test was completed?".

   Answer Yes:

   If you have used the devices and channels used in this test in another test. You will not be able to re-retrieve any data. If you do continue the data you currently have might mix with data from another test and your test data will be useless.

   Answer No:

   You will continue to the next prompt.

4. The final prompt is "Recollect all data for this test, even data already received?".

   Answer Yes:

   If you would like to recollect all data for this test, even points that are not missing any data.

   Answer No:

   If you only want to retrieve missing data points.

5. Depending on your answer to item 4 the data will be retrieve or recollected.

6. Press the Stop Re-retrieving Test Data button to stop collecting data.

7.6 Reporting

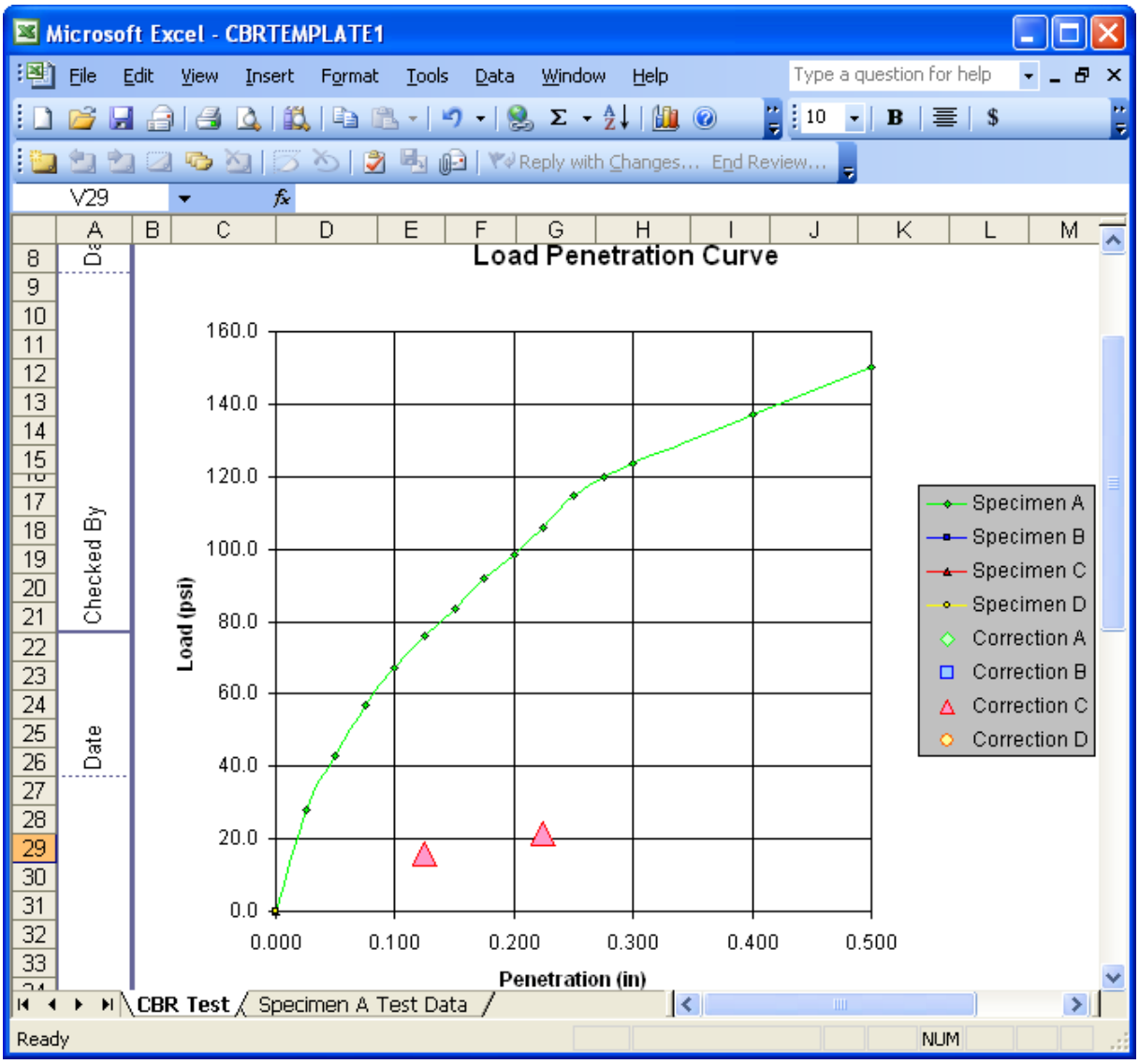
To make a report for your test, click on the Excel icon located in the toolbar or in the File menu click on the Export Test Report button to see your exporting/report options.

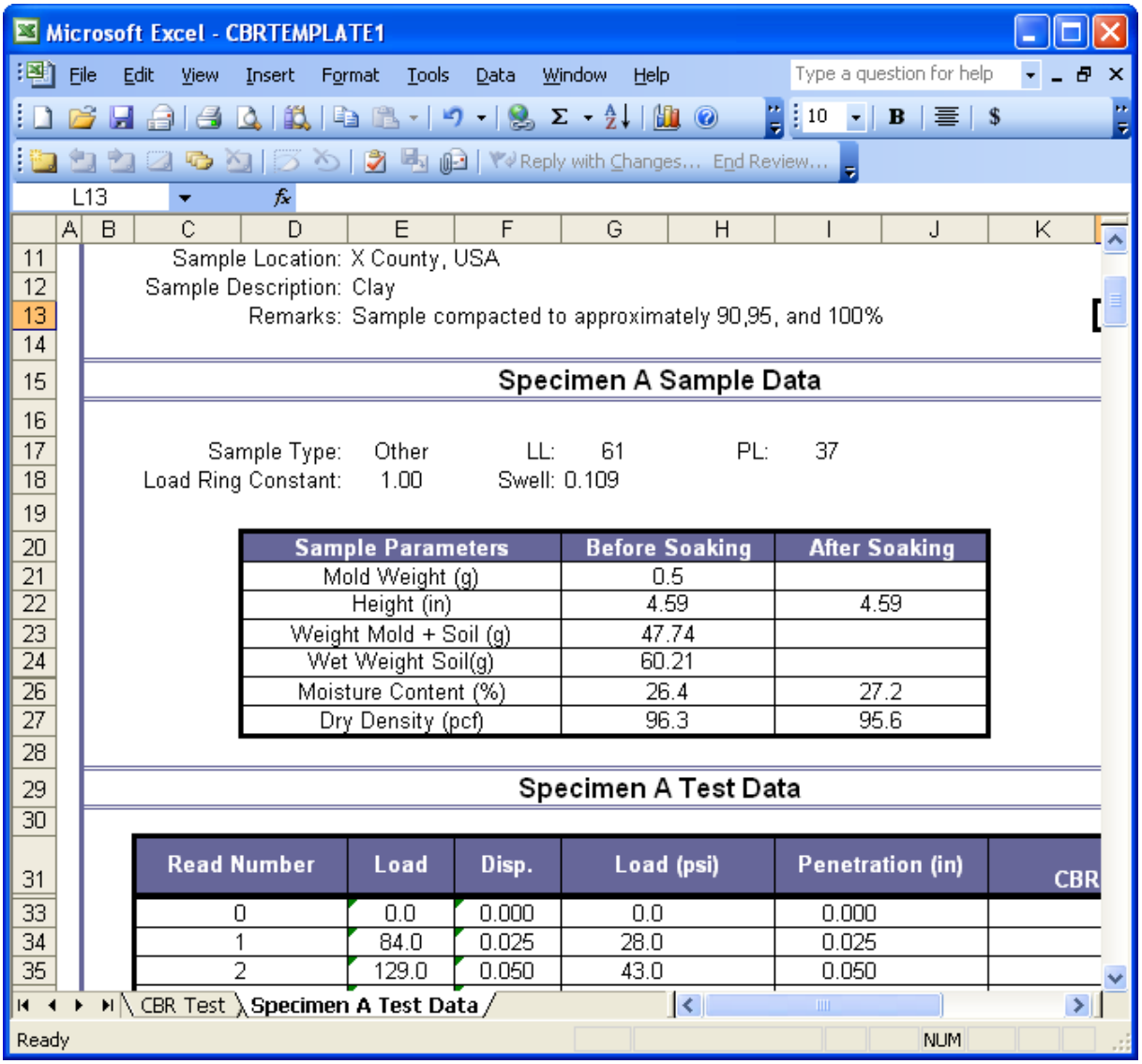
If you wish to only make a report for a single specimen, then click on Create Report for Specimen <A...D>. If you wish to make a report for all specimen then click on Create Report for All Specimen.

Note: Create Report for All Specimen button will only create a report containing specimen that have test results.

Sample Reports:

Below are two examples of what your report will look like (CBR test report shown). You must have Microsoft Excel installed on your computer to access and print the reports.





7.7 Consolidation (Oedometer)

7.7.1 Consolidation (Oedometer) Test

The Consolidation Test was designed to allow users to perform a consolidation test from start to finish using their equipment and the Humboldt Material Testing Software.

This test contains a trial period, once the trial period has expired, you will need to purchase the software. Once you have purshased the software Humboldt will provide a registration key for the Consolidation Test module. Once the software is registered you will have unlimited use of the Consolidation Test and Reports. For more information on registering a test module see: Registration 17.

For more information or to purchase this module please contact Humboldt at 1-800-537-4183 and ask for software part number ***HM-1100SW***.

Consolidation Test Features:

- Test Setup specific to consolidation test requirements
- Test Information is stored, and all calculations are performed for you
- Live tests (real time)
- Live graphing capabilities
- Complete report of test including all calculation and graphs required for testing
- Review and export tests using Microsoft Excel
- Smart Test. Will automatically pick up where it left off if the test was not finished due to unexpected events within your computer.

More Information

- For Information on the project information sheet, goto Consolidation (Oedometer) Project Information 86 help.
- For Information on specimen information sheets, goto Consolidation (Oedometer) Specimen Information 86 help.
- For Information on specimen setup sheets, goto Consolidation (Oedometer) Test Setup Guide 90 help.
- For Information on specimen tabulation sheets, goto Consolidation (Oedometer) Test Results 92 help.
- For Information on specimen graph sheets, goto Consolidation (oedometer) Graphs 95 help.

Note: To export to Microsoft Excel, Excel must be installed on your computer.

7.7.2 Consolidation (Oedometer) Project Information

HOWTO OPEN: To get to the Project Information screen for a specific test, open the desired test or select a new Consolidation Test. The project information for the project will be the first thing to load.

Note: The Consolidation Test Project Information holds all values and descriptions that will be global to all specimens in project. Not all information has to be filled in, this form is mainly for reporting purposes only.

Project Information

- Test Units - Units for the entire test. All values and tabulated values will be represented in either English or Metric.
- Test Standard - Test standard used for this test.
- Project Name - Name of this project.
- Project Number - Number designation for this project.
- Sample Location - Location sample was taken from.
- Client - Client this test is being performed for.
- Job Number - Number designation for job.
- Sample Number - Number designation for this sample.
- Sample Description - Description of sample.
- Date of Sampling - When sample was taken.
- Sampling Time - Time of sample.
- Date of Receiving Sample - When the sample was received by lab.
- Received Time - Time sample was received by lab.
- Boring Numer - Boring number.
- Remarks - Any additional remarks.

7.7.3 Consolidation (Oedometer) Specimen Information

HOWTO OPEN: To get to the test information screen for a specific test, open the desired test or select a new consolidation Test. Click Information for the desired Specimen in the Project Navigation pane. The test information for that specimen will load.

The Consolidation has values that will be required for report purposes and for calculating tabulated values correctly. Values can be entereded before or after the test. The program will prompt you if any values are missing for test calculations. If you decide not to fill in all values and the values are required for tabulation calculations, after the test has finished, you can enter the values in and tabulated values will be recalculated.

To enter information on the Specimen Information page, click in the box to the right of the description field and add your information.

Consolidation Specimen Parameters

Specimen Information

- **Sample Description -** description of the visible characteristics of this specimen.
- **Depth -** depth at which this sample was taken from.
- **Test Procedure -** test procedure used when evaluating this sample.
- **Sample Type -** specifies for report whether this sample was remolded or undisturbed.
- **Molding Date -** date this sample was place in a mold.
- **Test Date -** date this sample was tested.
- **Liquid Limit -** sample liquid limit.
- **Plastic Limit -** sample plastic limit.
- **Plasticity Index** - sample plasticity index.
- [**SG**] **Specific Gravity -** specific gravity at location of testing. Assumed or Measured
- **Remarks -** any further remarks for this test that you want to include in the report.

Initial Specimen Parameters

Initial Specimen Dimensions Worksheet

- Initial Height Reading 1 – 3: three different height measurements taken of the specimen.
- Initial Diameter Reading 1 – 3: three different diameter measurements taken of the specimen.
- [***IH***] Initial Height - average height of the specimen based on height readings 1 – 3. Zero heights are not averaged in.
- [***ID***] Initial Diameter: average diameter of the specimen based on diameter readings 1 – 3. Zero diameters are not averaged in.
- [***IA***] Initial Area: area of the specimen based on diameter.

$$IA = ID^2$$

- [***IV***] Initial Volume: volume of the specimen based on height and diameter.

$$IV = IA * IH$$

[**RW**] Weight of Ring - weight of ring.

Moisture Information Worksheet

- [**MW**] Weight of Moist Soil + Container: weight of moist soil + weight of

container measurement.

- [**DS**] Weight of Dry Soil + Container: weight of dried soil + weight of container measurement.
- [**WC**] Weight of Container: weight of container.
- [**MC**] Moisture Percentage: moisture content calculation.

$$MC = (MW - DS) / (DS - WC) * 100$$

[**MWR**] Initial Specimen Moist Weight + Ring Weight

[**IMW**] Initial Moist Weight - not shown in information sheet

$$IMW = MW - MWR$$

[**IDD**] Initial Dry Density - calculated initial dry density.

[**sw**] Weight of Solids = (IMW / pc) / (1 + IMC /100)
[**v**] Volume = PI * (ID / ic)^2 / 4 * (IH / ic)
IDD = sw / v

[**pc**] Gram → Pound = 453.9
[**ic**] Inch → Foot = 12

[**IWD**] Initial Wet Density - calculated initial wet density.

[**v**] Volume = PI * (ID / ic)^2 / 4 * (IH / ic)

IWD = (IMW / pc) / v

[**pc**] Gram → Pound = 453.9
[**ic**] Inch → Foot = 12

[**IS**] Initial Saturation - calculated initial saturation.

[**v**] Volume = (PI * ID^2) / 4 * IH
[**sw**] Weight of Solids = IMW / (1 + IMC / 100)
[**vx**] Initial Volume = (sw * (IMC / 100)) / cf
[**vv**] Voids Volume = v – (sw / (SG * cf))

IS = vx / vv * 100

[**cf**] in^3 → cm^3 = 16.387

[**IVR**] Initial Void Ratio - calculated initial void ratio.

[dm] Dry mass = (MWR - RW) / (1 + IMC / 100)

[hs] Height of solids = (dm / (IA * SG * 0.99821)) * 0.06102376
[hv] Height of voids = IH - hs

IVR = hv / hs

Final Specimen Parameters

Final Height Source - use this to set if the final height is retrieved from the summary or input manually.

[**FH**] Final height - final height after test is completed.

Final Moisture Information Worksheet

- [**FMW**] Weight of Moist Soil + Container: weight of moist soil + weight of container measurement.
- [**FDS**] Weight of Dry Soil + Container: weight of dried soil + weight of container measurement.
- [**FWC**] Weight of Container: weight of container.
- [**FMC**] Moisture Percentage: moisture content calculation.

FMC = (FMW – FDS) / (FDS – FWC) * 100

[**FMWR**] Final Specimen Moist Weight + Ring Weight - final weight of ring and sample.

[**FMW**] Final Moist Weight - not show in information sheet.

FMW = FMWR - WR

[**FDD**] Initial Dry Density - calculated initial dry density.

[**sw**] Weight of Solids = (FMW / pc) / (1 + FMC /100)
[**v**] Volume = PI * (ID / ic)^2 / 4 * (IH / ic)
IDD = sw / v

[**pc**] Gram → Pound = 453.9
[**ic**] Inch → Foot = 12

[**FWD**] Initial Wet Density - calculated initial wet density.

[**v**] Volume = PI * (ID / ic)^2 / 4 * (IH / ic)

IWD = (FMW / pc) / v

[**pc**] Gram → Pound = 453.9
[**ic**] Inch → Foot = 12

[**FS**] Initial Saturation - calculated initial saturation.

[**v**] Volume = (PI * ID^2) / 4 * IH
[**sw**] Weight of Solids = FMW / (1 + FMC / 100)
[**vx**] Initial Volume = (sw * (FMC / 100)) / cf
[**vv**] Voids Volume = v – (sw / (SG * cf))

FS = vx / vv * 100

[**cf**] $in^3 \rightarrow cm^3 = 16.387$

[**FVR**] Initial Void Ratio - calculated initial void ratio.

[dm] Dry mass = FMW / (1 + FMC / 100)
[hs] Height of solids = (dm / (FA * SG * 0.99821)) * 0.06102376
[hv] Height of voids = IH - hs

FVR = hv / hs

7.7.4 Consolidation (Oedometer) Test Setup Guide

HOWTO OPEN: To get to the test setup screen for a specific test, open the desired test or select a new Consolidation Test. Select the Setup for the desired Specimen in the Project Navigation pane. The test seup for that specimen will load.

To run an automated test you must setup the test parameters. The Consolidation test is a single phase test with multiple load sequences. Use the tabs at the top of the test setup to navigate between eash phases test setup.

Once all the setup information has been filled in for the specified phase, that phase can be run. If any setup parameters are incorrect you will be prompted. When you press the Run Test button, if you are running a new test or there is no data for this specimen and phase the test will begin immediately. If data exists for the specimen and phase, you be prompted whether you want to over write the data or not.

Consolidation Test Setup Parameters

The consolidation stage can be run with the hardware. You need to input the test parameters for this test.

If you want input test data manually, just goto the tabulation section for that specimen and select the consolidation tab. From here you can manually input consolidation test data.

Note: To run the consolidation stage you will need to have your Initial Height and Height after Saturation filled in the specimen information sheet. You can still run the test, but it is recommended you fill this value in. See Consolidated Undrained Triaxial Specimen Information 171 for more.

Consolidation Setup Explanation:

- Load Sequences

  Select Load Sequnce - Click on this item to select a load sequence to use for the consolidation phase of this test. A sequence must be selected to run the test. Sequences can be created or modified using the Consolidation Load Frame Calibration/Sequence Tool 30.

- Consolidation Channels

  Select Displacement Device - Select the device that the displacement transducer is connected to.
  Select Displacement Input - Select the channel that the displacement transducer is located at on the volume device you selected.
  Channel Reverse - Select this if the displacment transducer is an anolog transducer and is calibrated opposite normal. Default is No.

- Logging Type (Elapsed Time Table can only be selected)

  Value - The consolidation data points will be gathered using a user defined table of time intervals. Click on this box to setup a time table to use with your test.

- Stop Condition

  Conidtion - Select Time Delay, Distance (Up/Forward), Distance (Down/Reverse), or None for user stop.

  Time Delay

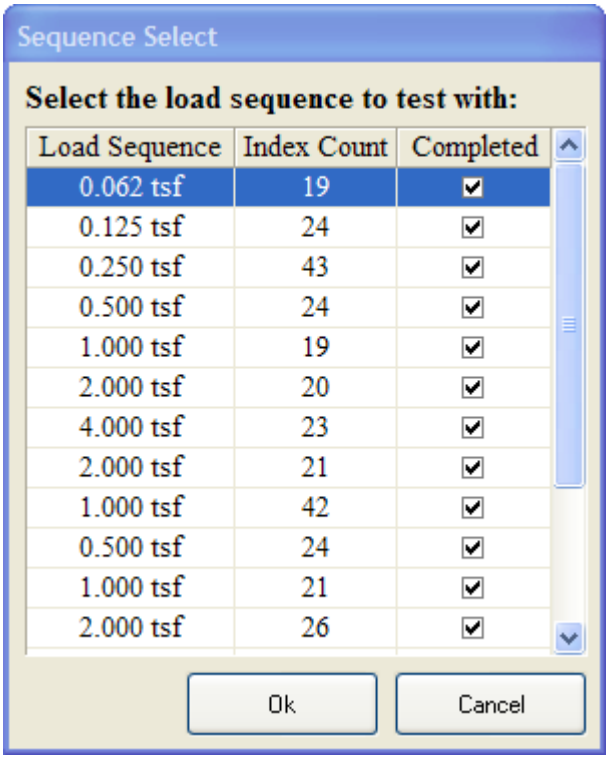
  Value - time (HH:MM:SS:m) to delay before the test will stop. This is time from when the test start condition is met.

  Distance (Up/Forward) or Distance (Down/Reverse)

  Device - Device the stop condition will occure on.
  Input - Input on the device the stop condition will occure.
  Value - when the device and input selected have travelled this value the test will stop. This is the distance from when the test start condition is met.

Consolidation Test Sequence Select

The consolidation test is not automated to move from one sequence to the next, but it will prompt you before running the test what sequence it things your ready to run.



Click Ok to start the selected sequence and Cancel to abort.

7.7.5 Consolidation (Oedometer) Test Results

HOWTO OPEN: To get to the tabulation screen for a specific test, open the desired test or select a new Consolidation Test. Select Tabulation for the desired Specimen in the Project Navigation pane. The Tabulation for that specimen will load.

The tabulation sheet is where live tests are shown as well as where you will edit any test data if necessary. When a test is running you can not edit data for that specimen.

Note: The User Defined test does not allow you to edit any test data after a test is completed.

Data Entry (All Phases)

- The enter key will move to the next editable cell, if it is at the end of a row, it will move to the next editable cell in the next row.

- If you are at the end of the data and at the last editable field when you press the Enter key a new row will automatically be inserted for you.

- Data Entry Hot Keys (Hold a key combination to apply desired action).

  INSERT = CTRL + i - will insert a row beneath the current row.

  DELETE = CTRL + d - will delete the current row.

  DELETE ALL = CTRL + a - will delete all rows.

- Only certain columns for each phase can be edited. Editable fields are in black, excluding the Reading No. The Reading number is generated at all times by the software.

  Consolidation Phase Editable Fields: Elapsed Time and Displacement.

  Shear Phase Editable Fields: Elapsed Time, Horizontal Deformation, and Vertical Deformation.

Automated Testing

- See the Consolidation (Oedometer) Test Setup Guide 90 for more information on setting up a test.

- All data points are received from the hardware. Any points that appear to be missing will be updated if they are present on the machine.

- If the computer shuts down in the middle of a test. Start the computer, open HMTS, and open the test, the test will gather any missed data points and continue where it left off.

- If you have set the start condition, the stop condition, or both and the computer shuts down before the start or stop condition was met, the devices in the test will handle those conditions even if the computer was not running when they occured.

- If a motor was envloved in a test and a stop condition was met, the motor will stop regardless if the HMTS software and that test were open.

- If operator stop was selected and the HMTS software and test envolving the motor was not opened, the motor will not stop. The test will continue collecting points until you stop the motor manually or you stop the test in the HMTS software.

- The HMTS software and the running tests do not have to be opened at all times.

Consolidation Tabulation Calculations

Note: All calculations are done in English (SI units). All metric calculations are converted from its english equivalent.

Time = (HHH:MM:SS) Time the point was taken. When running an automated test the time is the elapsed time. Each point contains a time stamp it receives from the hardware. The elapsed time is the difference between the previous data index and the current data index.

Displacement = Data entry.

Channel Not Reversed
Settlement = Current Displacement - First Displacement - Deformation Value from load sequence table.
Channel Reversed
Settlement = First Displacement - Current Displacement - Deformation Value from load sequence table.

Void Ratio = hv / hs

[dm] Dry Mass = (Weight of ring and sampe - Weight of ring) / (1 + Initial moisture content / 100)
[hs] Height of Solids = (dm / (Initial area * Specific gravity * 0.99821)) * 0.06102376
[hv] Height of Voids = (Initial height - hs) - Settlement

Consolidation Tabulation Calculations

Load Sequence = Sequence number.

Cummulative Change in Height = height change after each load sequence.

Specimen Height = final height after each load sequence.

Height of Voids = initial height - height of solids - cummulative change in height.

Vertical Strain = cummulative change in height / initial height * 100

Void Ratio = height of voids / height of solids

t90 Fitting Time (can be manually entered) = obtained from t90 tangent line.

t50 Fitting Time (can be manually entered) = obtained from t50 tangent line.

t90 Cv = (0.848 * (cummulative change in height / 2)^2) / average height during consol

Note: Value is converted to ft^2/year in english and mm^2 /sec in metric

t50 Cv = (0.197 * (cummulative change in height / 2)^2) / average height during consol

Note: Value is converted to ft^2/year in english and mm^2 /sec in metric

7.7.6 Consolidation (oedometer) Graphs

HOWTO OPEN: To get to the graphs for a specific test, open the desired test or select a new Consolidation Test. Select the desired graph from the Project Navigation pane. The selected graph will load.

All graphs are updated when the data changes. If you would like set the graph area yourself, use the Options located at the top of each graph window.

If a graph has no data, it will not show a grid, but a blue window with only a title.

If you are unhapply with the scaling chosen by the software use the Manual Scaling options located in the toolbar above the graph.

DRAWING INSTRUCTIONS: Some graphs contain tool for constructing tangent lines.

Drawing lines

1. Click on the tool item to start the drawing process.
2. Move your cursor into the graph area, you should notice that a point follows your cursor.
3. Click in the graph area, this point is where your line will start.
4. Move your cursor in the graph area and you will see a line being drawn.
5. Click in the graph area again and this will finish the drawing sequence and your line will be drawn.

Editing lines

1. In the graph area click on an end point of a line.
2. By moving your cursor, you will see that you can reposition the lines endpoint.
3. Click again at the desired location to reposition the line.

Placing points

1. Click on the tool item to start the drawing process.
2. Move your cursor into the graph area, you should notice that a point follows your cursor.
3. Click in the graph area to place the point at that location.

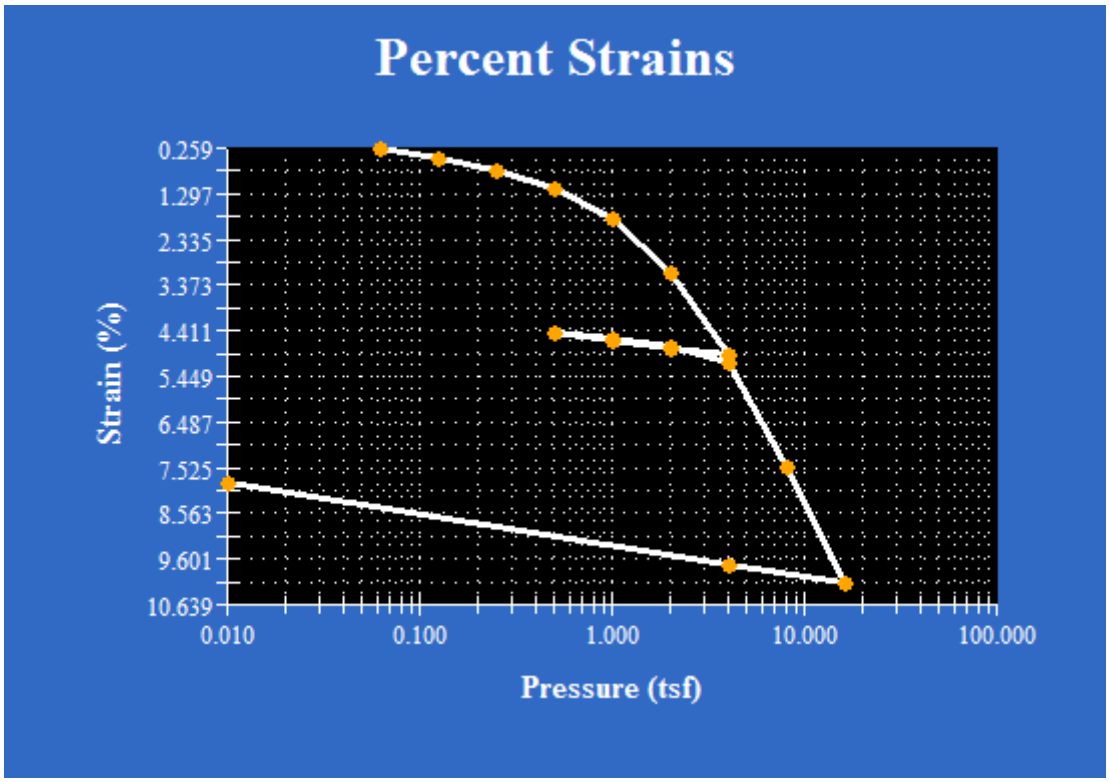
Moving points

1. In the graph area click on the point to move.
2. Move your cursor to location you would like to place the endpoint at.

3. Click in the graph area to reposition the point at that location.

Available Graphs

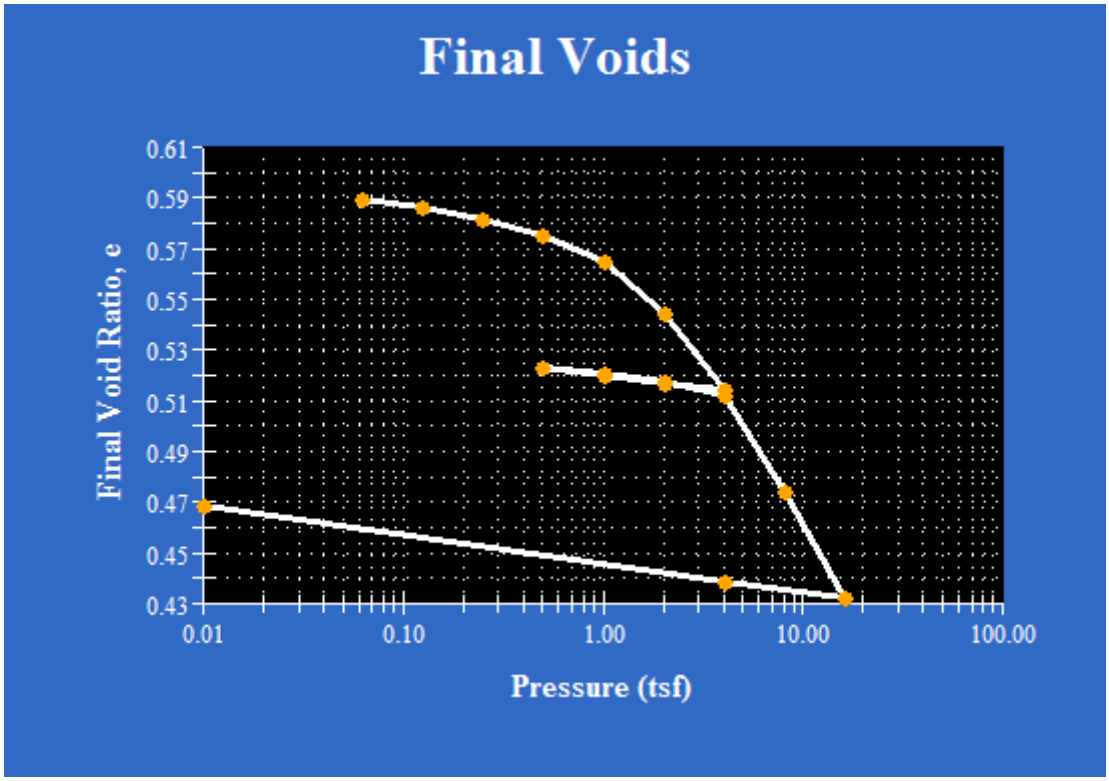
- ***Percent Strain***



X-Axis - Pressure
Y-Axis - Strain

Graph Actions (located on toolbar above graph)
- None

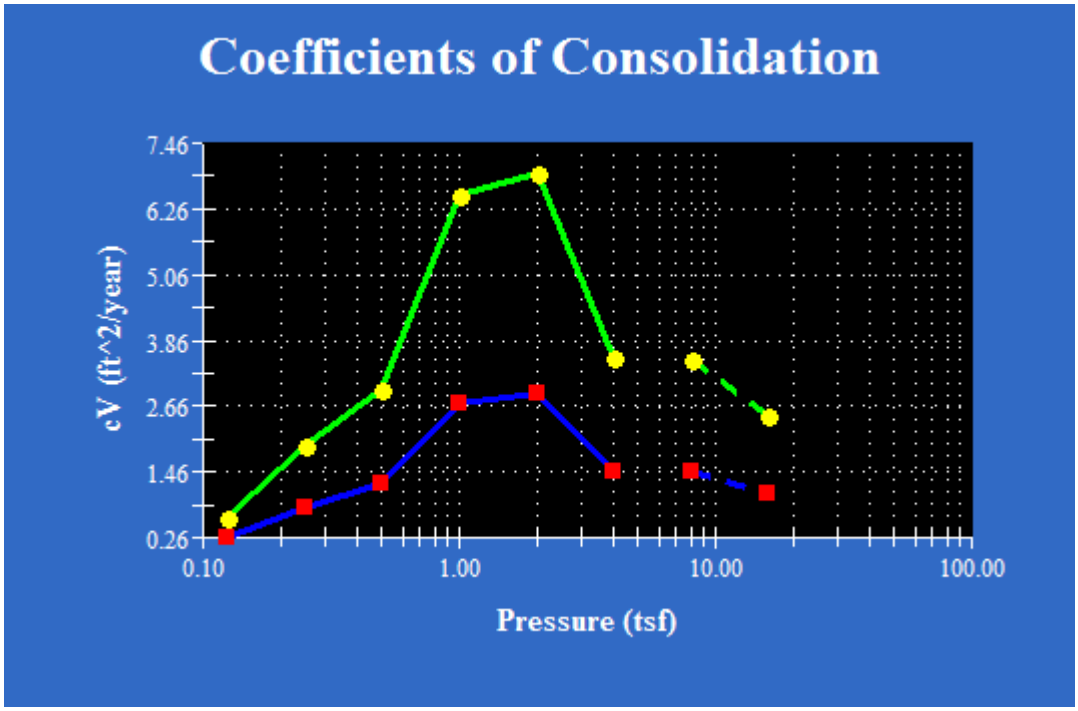
- ***Final Voids***



X-Axis - Pressure
Y-Axis - Final Void Ratio

Graph Actions (located on toolbar above graph)
- None

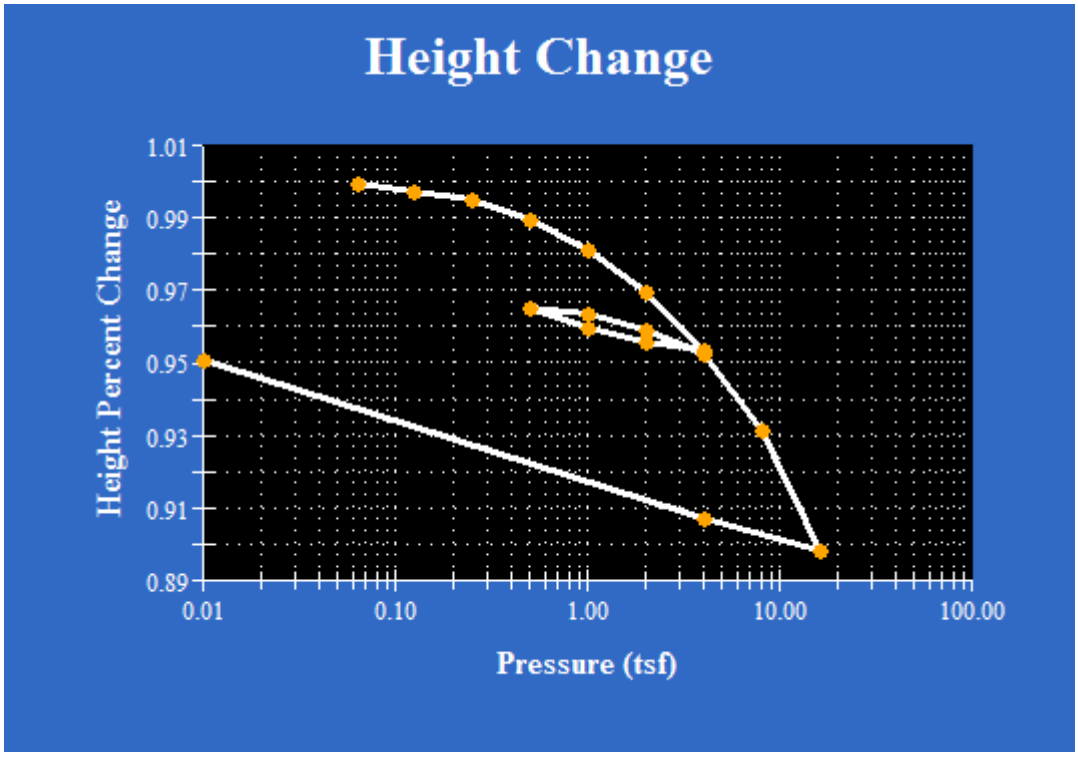
- ***Final Voids***



X-Axis - Pressure
Y-Axis - cV values

Graph Actions (located on toolbar above graph)
- Cv From t50 x 10^3 toggle plot on/off
- Cv From t90 x 10^3 toggle plot on/off

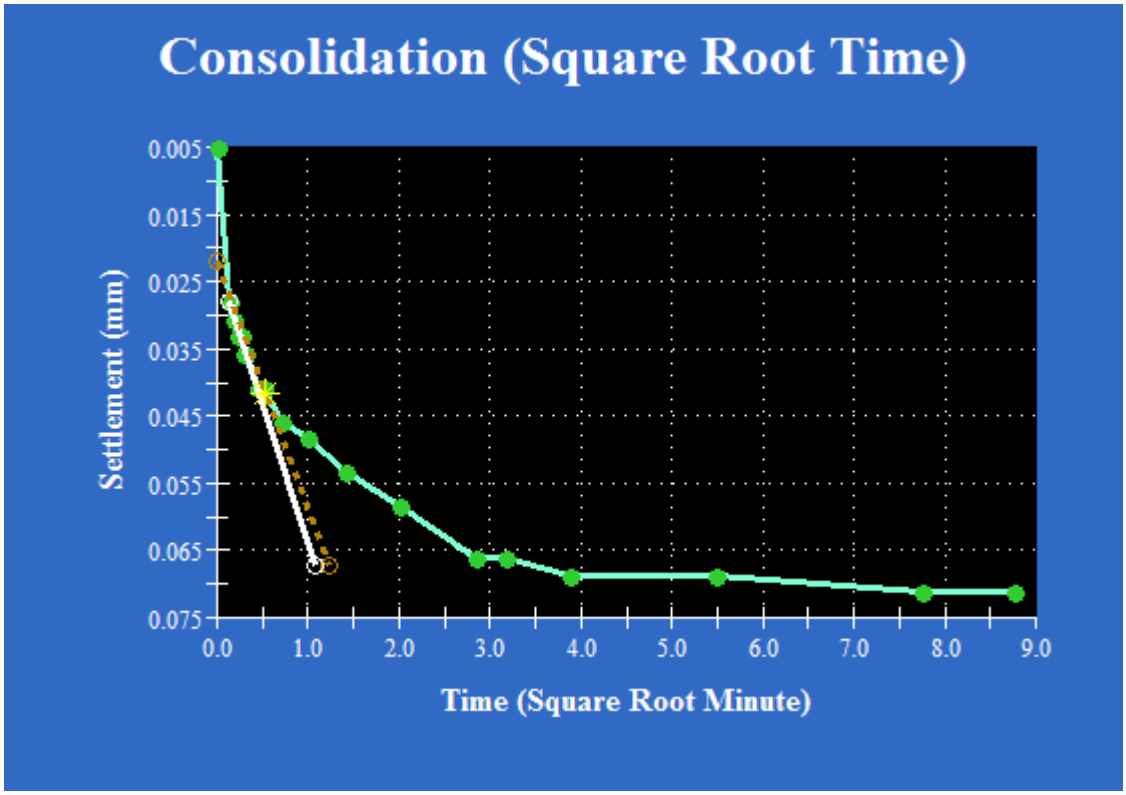
- ***Height Change***



X-Axis - Pressure
Y-Axis - Height Percent Change

Graph Actions (located on toolbar above graph)
- None

- ***Consolidation (Square Root Graph)***



X-Axis - Time in sqaure root minute
Y-Axis - Volume in cc's

Graph Actions (located on toolbar above graph)

- Consolidation Sequence: Select what sequence you would like to view.
- Plot Specimen: Only one specimens plot can be viewed at a time. Click on the plot you would like to work with.
- t90 Calculations Tool (SQR): Toggle this view the tangent line tool for determining your t50 and strain rate for the shear stage motor value.

» **WARNING**: Please refer to the appropriate standard for determining the t50.

t90 Calculations Tool (SQR)

- Draw Tangent

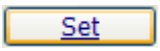
  This button will allow you to place the extension line of initial linear portion of the time-deformation curve. Once this line is drawn the software will draw another line that is 1.15 times the inital linear portion of the time-deformation curve.

- Select t90

This button will allow you place a point at t90.

- The Estimated Failure Strain can be selected between 1% and 5%. The default value is 4%.
- 

Use this button to clear all lines, points, and calculations. The time-deformation curve is not cleared.

- 

This button will place the calculated strain rate into the speed value in the Shear phase in the test setup sheet for the selected specimen.

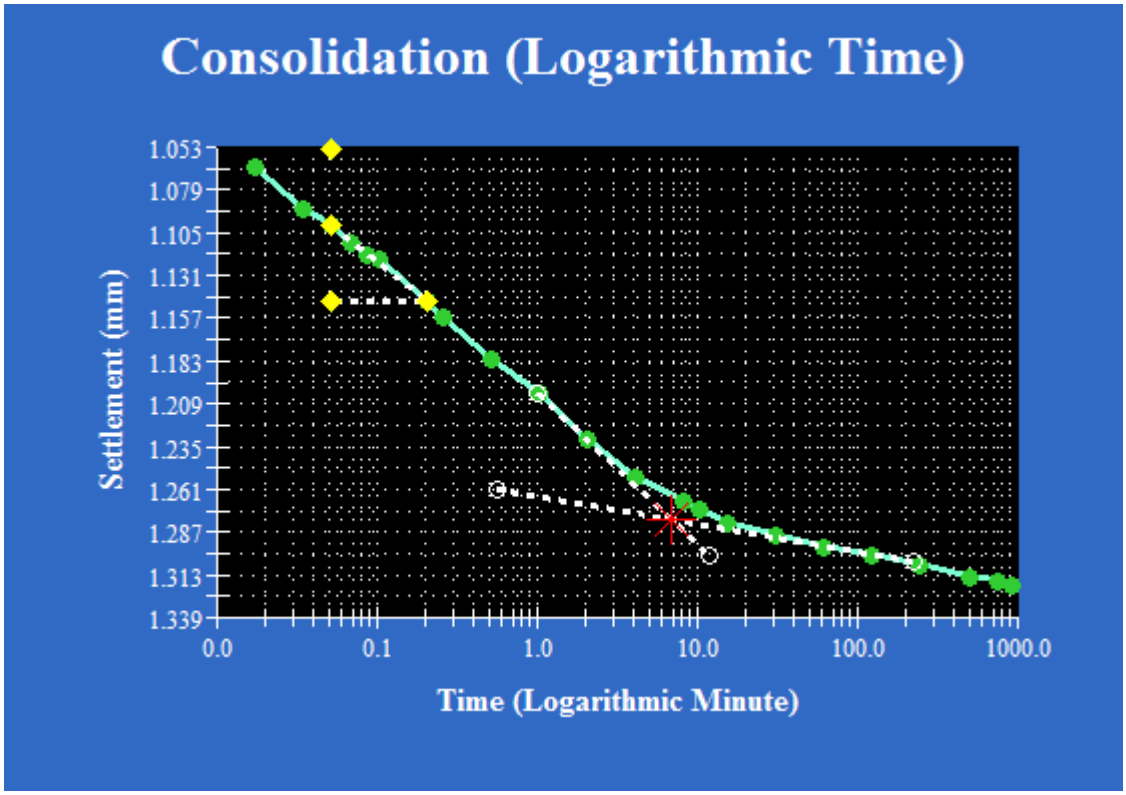
- Once the tangent line has been drawn and the t90 point has been selected, the t50 value and Strain Rate value will be calculated.

  t50 Calculations = $(t90 * (5/9))^2$

  Shear Rate = height after consolidation * (Estimated Failure Strain / 1000) / (t90 * (5/9))

- ***Consolidation (Logarithmic Graph)***

The data for this plot is from the Consolidation stage.



X-Axis - Time in logarithmic minute
Y-Axis - Volume in cc's

Graph Actions (located on toolbar above graph)

- Consolidation Sequence: Select what sequence you would like to view.
- Plot Specimen: Only one specimens plot can be viewed at a time. Click on the plot you would like to work with.
- t50 Calculations Tool (LOG): Toggle this view the tangent line tool for determining your t50 and strain rate for the shear stage motor value.

» **WARNING**: Please refer to the appropriate standard for determining the t50.

t50 Calculations Tool (LOG)

- Draw Intersection Lines

  Pressing this button will place two lines on the graph, you will need to position these line accordingly. These lines can be used to draw an extension line of the final linear portion of the time-deformation curve, as well as an extention line of the steepest lenear portion of the curve.

- Select Intersection Point

This button will allow you to select the d100 point which is the intersection of the two lines drawn above.

- Determine 0% Consolidation

  Use this button to select a point in time, once a point is selected a triangulation tool will help you find the time four times the point selected.

- The Estimated Failure Strain can be selected between 1% and 5%. The default value is 4%.

- Reset

Use this button to clear all lines, points, and calculations. The time-deformation curve is not cleared.

- Set

This button will place the calculated strain rate into the speed value in the Shear phase in the test setup sheet for the selected specimen.

- Once the intersection lines have been drawn, the intersection point selected, and the 0% consolidation selected, the t50 value and Strain Rate value will be calculated.

  d50 = (d0 + d100) / 2
  Software searches data for the point closest to d50 and determines a line from two points around this data point. From this line the t50 value is determined.

  Shear Rate = height after consolidation * (Estimated Failure Strain / 1000) / t50

7.8 Direct Shear Test

7.8.1 Direct Shear Test

The Direct Shear Test was designed to allow users to perform a DS test from start to finish using their equipment and the Humboldt Material Testing Software.

This test contains a trial period, once the trial period has expired, you will need to purchase the software. Once you have purshased the software Humboldt will provide a registration key for the Direct Shear Test module. Once the software is registered you will have unlimited use of the Direct Shear Test and Reports. For more information on registering a test module see: Registration 17.

For more information or to purchase this module please contact Humboldt at 1-800-537-4183 and ask for software part number ***HM-2700SW***.

Direct Shear Test Features:

- Test Setup specific to DS requirements
- Test Information is stored, and all calculations are performed for you
- Live tests (real time)
- Live graphing capabilities
- Complete report of test including all calculation and graphs required for testing
- Review and export tests using Microsoft Excel
- Smart Test. Will automatically pick up where it left off if the test was not finished due to unexpected events within your computer.

More Information

- For Information on the project information sheet, goto Direct Shear Project Information 104 help.
- For Information on specimen information sheets, goto Direct Shear Specimen Information 105 help.
- For Information on specimen setup sheets, goto Direct Shear Test Setup Guide 110 help.
- For Information on specimen tabulation sheets, goto Direct Shear Test Results 114 help.
- For Information on specimen graph sheets, goto Direct Shear Graphs 117 help.

Note: To export to Microsoft Excel, Excel must be installed on your computer.

7.8.2 Direct Shear Project Information

HOWTO OPEN: To get to the Project Information screen for a specific test, open the desired test or select a new Direct Shear Test. The project information for the project will be the first thing to load.

Note: The Direct Shear Test Project Information holds all values and descriptions that will be global to all specimens in project. Not all information has to be filled in, this form is mainly for reporting purposes only.

Project Information

- Test Units - Units for the entire test. All values and tabulated values will be represented in either English or Metric.
- Test Standard - Test standard used for this test.
- Project Name - Name of this project.
- Project Number - Number designation for this project.
- Sample Location - Location sample was taken from.
- Client - Client this test is being performed for.
- Job Number - Number designation for job.
- Sample Number - Number designation for this sample.
- Sample Description - Description of sample.
- Date of Sampling - When sample was taken.
- Sampling Time - Time of sample.
- Date of Receiving Sample - When the sample was received by lab.
- Received Time - Time sample was received by lab.
- Boring Numer - Boring number.
- Remarks - Any additional remarks.

7.8.3 Direct Shear Specimen Information

HOWTO OPEN: To get to the test information screen for a specific test, open the desired test or select a new Direct Shear Test. Click Information for the desired Specimen in the Project Navigation pane. The test information for that specimen will load.

The Direct Shear Test (DS) has values that will be required for report purposes and for calculating tabulated values correctly. Values can be entereded before or after the test. The program will prompt you if any values are missing for test calculations. If you decide not to fill in all values and the values are required for tabulation calculations, after the test has finished, you can enter the values in and tabulated values will be recalculated.

To enter information on the Specimen Information page, click in the box to the right of the description field and add your information.

Direct Shear Specimen Parameters

Specimen Information

- **Sample Description -** description of the visible characteristics of this specimen.
- **Depth -** depth at which this sample was taken from.
- **Test Procedure -** test procedure used when evaluating this sample.
- **Sample Type -** specifies for report whether this sample was remolded or undisturbed.
- **Molding Date -** date this sample was place in a mold.
- **Test Date -** date this sample was tested.
- **Liquid Limit -** sample liquid limit.
- **Plastic Limit -** sample plastic limit.
- [**SG**] **Specific Gravity -** specific gravity at location of testing. Assumed or Measured
- **Remarks -** any further remarks for this test that you want to include in the report.

Initial Specimen Parameters

Sample Shape - what is the shape of the sampe. This value will determine how the area of the sample is calculated.

Specimen Dimensions Worksheet

ROUND Sample Shape

- Initial Height Reading 1 – 3: three different height measurements taken of the specimen.
- Initial Diameter Reading 1 – 3: three different diameter measurements taken of the specimen.
- [***IH***] Initial Height - average height of the specimen based on height readings 1 – 3. Zero heights are not averaged in.
- [***ID***] Initial Diameter: average diameter of the specimen based on diameter readings 1 – 3. Zero diameters are not averaged in.
- [***IA***] Initial Area: area of the specimen based on diameter.

$$IA = ID^2$$

- [***IV***] Initial Volume: volume of the specimen based on height and diameter.

$$IV = IA * IH$$

SQUARE Sample Shape

- Initial Height Reading 1 – 3: three different height measurements taken of the specimen.
- Initial Width Reading 1 – 3: three different width measurements taken of the specimen.
- [***IH***] Initial Height - average height of the specimen based on height readings 1 – 3. Zero heights are not averaged in.
- [***IW***] Initial Width - average width of the specimen based on width readings 1 – 3.

Zero widths are not averaged in.

- [***IA***] Initial Area: area of the specimen based on width.

$$IA = IW^2$$

- [***IV***] Initial Volume: volume of the specimen based on height and width.

$$IV = IA * IH$$

NOTE: All initial values are excluding Area and Volume are back calculated from the final specimen parameters.

[**IMC**] Initial Moisture Content - Initial Moisture Content calculation.

$$IMC = (TW - FWD\_DISH - FW\_DISH) / (FWD\_DISH - FW\_DISH) * 100$$

[**TWR**] Total Wet Weight of Ring & Soil - weight of ring + soil.
[**RW**] Ring Weight - weight of ring.

[**TW**] Total Wet Weight of Soil - calculated weight of soil.

$$TW = TWR - RW$$

[**IWD**] Initial Wet Density

$$IWD = TW / pc / (IV / ic^3)$$

[**pc**] Gram → Pound = 453.9
[**ic**] Inch → Foot = 12

[**IDD**] Initial Dry Density

$$IDD = IWD / (IMC / 100 + 1)$$

[**IS**] Initial Saturation

[**vc**] Volume Converted = IV * cf
[**vs**] Volume of Solids = (TW / (IMC / 100 + 1)) / SG

$$FS = (TW - (TW / (IMC / 100 + 1))) / (vc - vs) * 100$$

[**cf**] in^3 → cm^3 = 16.387

[**IVR**] Initial Void Ratio

IVR = (62.428 * SG) / IDD -1

NOTE: The software will assume a water density of 62.428 (temperature of 33C or 89.6F) if a temperature is not provided in the specimen information for this test. If a temperature is provided, the water density will be calculated from that temperature.

[**IPOR**] Initial Porosity - calcualted final porosity value.

[**vc**] Volume Converted = IV * cf
[**vs**] Volume of Solids = (TW / (IMC / 100 + 1)) / SG

IPOR = (vc - vs) / vc * 100

[**cf**] $in^3 \rightarrow cm^3 = 16.387$

Consolidation Stage Parameters

[**ICH**] Initial Reference Height Reading: height of specimen at beginning of consolidation stage.
[**FCH**] Final Reference Height Reading: height of specimen at end of consolidation stage.

[**CH**] Height After Consolidation: height of specimen after consolidation stage.

CH = IH + (FCH – ICH)

NOTE: If FCH and ICH are bother zero, then CH will equal SH.

Shear Stage Parameters

[**NF**] Normal Force - Normal force value.

[**NF_CALC**] Normal Force - Normal force conversion depending if units are in English or Metric.

NF_CALC = NF * 144

[**NL_LBS**] Normal Load in lbs - calculated Normal Load in lbs.

NL_LBS = NF * IA

[**NL_KG**] Normal Load in kg - calculated Normal Load in kg.

NL_KG = NL_LBS * 0.45359237

[**NL_KN**] Normal Load in kN - calculated Normal Load in kN.

NL_KN = NL_LBS * 0.004448223

Final Specimen Parameters

[**FWW_DISH**] Weight of Wet Soil & Dish - final weight of soil and dish.
[**FWD_DISH**] Weight of Dry Soil & Dish - final weight of dried soil and dish.
[**FW_DISH**] Weight of Dish - weight of dish.

[**FMC**] Final Moisture Content - calculated final moisture content value.

FMC = ((FTW - FW_DISH) / (FWD_DISH - FW_DISH)) / (FWD_DISH - FW_DISH) * 100

[**FWR**] Final Wet Weight of Ring & Soil - final wet weight of ring and soil.

[**FTW**] Final Total Wet Weight of Soil - calculated final wet weight of soil.

FTW = FWR - WR

[FWD] Final Wet Density - calculated final wet density.

$FWD = FTW / pc / (IV / ic^3)$

[**pc**] Gram → Pound = 453.9
[**ic**] Inch → Foot = 12

[FDD] Final Dry Density - calculated final dry density.

FDD = FWD / (FMC / 100 + 1)

[FS] Final Saturation - calculated final saturation value.

[**vc**] Volume Converted = IV * cf
[**vs**] Volume of Solids = (FTW / (FMC / 100 + 1)) / SG

FS = (FTW - (FTW / (FMC / 100 + 1))) / (vc - vs) * 100

[**cf**] $in^3 \rightarrow cm^3 = 16.387$

[FVR] Final Void Ratio - calcualted final void ratio.

FVR = (62.428 * SG) / FDD -1

NOTE: The software will assume a water density of 62.428 (temperature of 33C or 89.6F) if a temperature is not provided in the specimen information for this test. If a temperature is provided, the water density will be calculated from that temperature.

[FPOR] Final Porosity - calcualted final porosity value.

[**vc**] Volume Converted = IV * cf
[**vs**] Volume of Solids = (FTW / (FMC / 100 + 1)) / SG

FPOR = (vc - vs) / vc * 100

[**cf**] $in^3 \rightarrow cm^3 = 16.387$

7.8.4 Direct Shear Test Setup Guide

HOWTO OPEN: To get to the test setup screen for a specific test, open the desired test or select a new Direct Shear Test. Select the Setup for the desired Specimen in the Project Navigation pane. The test seup for that specimen will load.

To run an automated test you must setup the test parameters. The Direct Shear test is a multiphase test. Use the tabs at the top of the test setup to navigate between eash phases test setup.

Once all the setup information has been filled in for the specified phase, that phase can be run. If any setup parameters are incorrect you will be prompted. When you press the Run Test button, if you are running a new test or there is no data for this specimen and phase the test will begin immediately. If data exists for the specimen and phase, you be prompted whether you want to over write the data or not.

Direct Shear Specimen Test Setup Parameters

The test setup window for the Consolidated Undrained Test contains two phases of tests.

1. ***Phase 1: Consolidation***

   The consolidation stage can be run with the hardware. You need to input the test parameters for this test.

   If you want input test data manually, just goto the tabulation section for that specimen and select the consolidation tab. From here you can manually input consolidation test data.

Note: To run the consolidation stage you will need to have your Initial Height and Height after Saturation filled in the specimen information sheet. You can still run the test, but it is recommended you fill this value in. See Direct Shear Specimen Information 105 for more.

Consolidation Setup Explanation:

- Load Sequences

  Select Load Sequnce - Click on this item to select a load sequence to use for the consolidation phase of this test. A sequence must be selected to run the test. Sequences can be created or modified using the Consolidation Load Frame Calibration/Sequence Tool 30.

- Consolidation Channels

  Select Displacement Device - Select the device that the displacement transducer is connected to.
  Select Displacement Input - Select the channel that the displacement transducer is located at on the volume device you selected.
  Channel Reverse - Select this if the displacment transducer is an anolog transducer and is calibrated opposite normal. Default is No.

- Logging Type (Elapsed Time Table can only be selected)

  Value - The consolidation data points will be gathered using a user defined table of time intervals. Click on this box to setup a time table to use with your test.

- Stop Condition

  Conidtion - Select Time Delay, Distance (Up/Forward), Distance (Down/Reverse), or None for user stop.

  Time Delay

  Value - time (HH:MM:SS:m) to delay before the test will stop. This is time from when the test start condition is met.

  Distance (Up/Forward) or Distance (Down/Reverse)

  Device - Device the stop condition will occure on.
  Input - Input on the device the stop condition will occure.
  Value - when the device and input selected have travelled this value the test will stop. This is the distance from when the test start condition is met.

2. ***Phase 2: Shear***

The shear stage can be run with the hardware. You need to input the test parameters for this test.

If you want input test data manually, just goto the tabulation section for that specimen and select the consolidation tab. From here you can manually input shear test data.

Note: To run the consolidation stage you will need to have your Area after Consolidation, Cell Pressure, and Membrane Thickness filled in the specimen information sheet. You can still run the test, but it is recommended you fill this value in. See Direct Shear Specimen Information 105 for more.

Shear Setup Explanation:

- Shear Channels

  Select Shear Force Device - Select the device that the shear force transducer is connected to.
  Select Shear Force Input - Select the channel that the shear force transducer is located at on the load device you selected.

  Select Horizontal Deformation Device - Select the device that the horizontal deformation transducer is connected to.
  Select Horizontal Deformation Input - Select the channel that the horizontal deformation transducer is located at on the horizontal deformation device you selected.

  Select Vertical Deformation Device - Select the device that the vertical deformation transducer is connected to.
  Select Vertical Deformation Input - Select the channel that the vertical deformation transducer is located at on the vertical deformation device you selected.

- Logging Type

  Condition - Elapsed Time Table, Distance Table, or Time Interval.

  Elapsed Time Table

  Value - The shear data points will be gathered using a user defined table of time intervals. Click on this box to setup a time table to use with your test.

  Distance Table

  Device - Device to gather points at specified distance intervals.
  Input - Input of selected device to gather points at specified distance intervals

Distance Increment - Is the motor going Up/Forward or Down/Reverse.
Value - The shear data points will be taken using a user defined table of distance intervals. Click on this box to setup a distance table to use with your test.

Time Interval

Value - time (HH:MM:SS:m) when data points will be gathered. This will happen at the interval specified.

- Start Condition

  Condition - Select Greater Than or Less Than.

  Greater Than or Less Than

  Device - Device the start condition will occure on.
  Input - Input on the device the start condition will occure.
  Current Value - shows the current value the device and input selected are currently reading.
  Value - when the device and input selected are greater than or less than this value the test will start.

- Stop Condition

  Automated Passes - select then number of passes that the shear test will try to accomplish automatically.

  Stop Type - Others or User Stop.

  Others - Use this to select a stop condition.

  Percent Strain - When the axial strain reaches this amount. This is measured from when the test start condition is met.

  Percent Drop of Maximum Deviator Stress - When the deviator stress drops by the specified amount.

  User Stop - If you want to manually stop the test.

  Conidtion - Select Greater Than, Less Than, Time Delay, Distance (Up/Forward), or Distance (Down/Reverse).

  Greater Than or Less Than

  Device - Device the stop condition will occure on.
  Input - Input on the device the stop condition will occure.

Value - when the device and input selected are greater than or less than this value the test will stop.

Time Delay

Value - time (HH:MM:SS:m) to delay before the test will stop. This is time from when the test start condition is met.

Distance (Up/Forward) or Distance (Down/Reverse)

Device - Device the stop condition will occure on.
Input - Input on the device the stop condition will occure.
Value - when the device and input selected have travelled this value the test will stop. This is the distance from when the test start condition is met.

- Motor Parameters

Motor Type - Computer Controlled or None. Select none if you are not using a motor or if you are not using a Humboldt motor.

Computer Controlled

Device - Device that the motor exists on. NOTE: Only Humboldt hardware containing a motor can be controlled.

Forward Speed - speed in in/min or mm/min. When the test is activated, the motor will start, the motor will continue running throughout the entire test untill the stop condition is met.

Reverse Speed - if doing a multi-pass direct shear, this is the speed that the motor will travel back to begin the next pass.

7.8.5 Direct Shear Test Results

HOWTO OPEN: To get to the tabulation screen for a specific test, open the desired test or select a new Direct Shear Test. Select Tabulation for the desired Specimen in the Project Navigation pane. The Tabulation for that specimen will load.

The tabulation sheet is where live tests are shown as well as where you will edit any test data if necessary. When a test is running you can not edit data for that specimen.

Note: The User Defined test does not allow you to edit any test data after a test is completed.

Data Entry (All Phases)

- The enter key will move to the next editable cell, if it is at the end of a row, it will move to the next editable cell in the next row.

- If you are at the end of the data and at the last editable field when you press the Enter key a new row will automatically be inserted for you.

- Data Entry Hot Keys (Hold a key combination to apply desired action).

  INSERT = CTRL + i - will insert a row beneath the current row.

  DELETE = CTRL + d - will delete the current row.

  DELETE ALL = CTRL + a - will delete all rows.

- Only certain columns for each phase can be edited. Editable fields are in black, excluding the Reading No. The Reading number is generated at all times by the software.

  Consolidation Phase Editable Fields: Elapsed Time and Displacement.

  Shear Phase Editable Fields: Elapsed Time, Horizontal Deformation, and Vertical Deformation.

Automated Testing (Consolidation and Shear Phases)

- See the Direct Shear Test Setup Guide 110 for more information on setting up a test.

- All data points are received from the hardware. Any points that appear to be missing will be updated if they are present on the machine.

- If the computer shuts down in the middle of a test. Start the computer, open HMTS, and open the test, the test will gather any missed data points and continue where it left off.

- If you have set the start condition, the stop condition, or both and the computer shuts down before the start or stop condition was met, the devices in the test will handle those conditions even if the computer was not running when they occured.

- If a motor was envloved in a test and a stop condition was met, the motor will stop regardless if the HMTS software and that test were open.

- If operator stop was selected and the HMTS software and test envolving the motor was not opened, the motor will not stop. The test will continue collecting points until you stop the motor manually or you stop the test in the HMTS software.

- The HMTS software and the running tests do not have to be opened at all times.

Direct Shear Tabulation Calculations

Note: All calculations are done in English (SI units). All metric calculations are converted from its english equivalent.

1. ***Consolidation Phase***

   Time = (HHH:MM:SS) Time the point was taken. When running an automated test the time is the elapsed time. Each point contains a time stamp it receives from the hardware. The elapsed time is the difference between the previous data index and the current data index.

   Displacement = Data entry.

   Channel Not Reversed
   Settlement = Current Displacement - First Displacement - Deformation Value from load sequence table.
   Channel Reversed
   Settlement = First Displacement - Current Displacement - Deformation Value from load sequence table.

   Void Ratio = hv / hs

   [dm] Dry Mass = (Weight of ring and sampe - Weight of ring) / (1 + Initial moisture content / 100)
   [hs] Height of Solids = (dm / (Initial area * Specific gravity * 0.99821)) * 0.06102376
   [hv] Height of Voids = (Initial height - hs) - Settlement

2. ***Shear Phase***

   Time = (HHH:MM:SS) Time the point was taken. When running an automated test the time is the elapsed time. Each point contains a time stamp it receives from the hardware. The elapsed time is the difference between the previous data index and the current data index.

   Shear Force = Data entry.

   Horizontal Deformation = Data entry.

   Vertical Deformation = Data entry.

   Shear Force = Current Shear Force - Shear Force at beginning of test.

Horizontal Deformation = Current Horizontal Deformation - Horizontal Deformation at beginning of test.

Vertical Deformation = Current Vertical Deformation - Vertical Deformation at beginning of test.

Axial Strain = (Current Horizontal Deformation - Horizontal Deformation at beginning of test) / Sample Height.

Shear Stress Stress = Shear Force / Initial Area * 144.

7.8.6 Direct Shear Graphs

HOWTO OPEN: To get to the graphs for a specific test, open the desired test or select a new Direct Shear Test. Select the desired graph from the Project Navigation pane. The selected graph will load.

All graphs are updated when the data changes. If you would like set the graph area yourself, use the Options located at the top of each graph window.

If a graph has no data, it will not show a grid, but a blue window with only a title.

If you are unhapply with the scaling chosen by the software use the Manual Scaling options located in the toolbar above the graph.

DRAWING INSTRUCTIONS: Some graphs contain tool for constructing tangent lines.

Drawing lines

1. Click on the tool item to start the drawing process.
2. Move your cursor into the graph area, you should notice that a point follows your cursor.
3. Click in the graph area, this point is where your line will start.
4. Move your cursor in the graph area and you will see a line being drawn.
5. Click in the graph area again and this will finish the drawing sequence and your line will be drawn.

Editing lines

1. In the graph area click on an end point of a line.
2. By moving your cursor, you will see that you can reposition the lines endpoint.
3. Click again at the desired location to reposition the line.

Placing points

1. Click on the tool item to start the drawing process.
2. Move your cursor into the graph area, you should notice that a point follows your cursor.

3. Click in the graph area to place the point at that location.

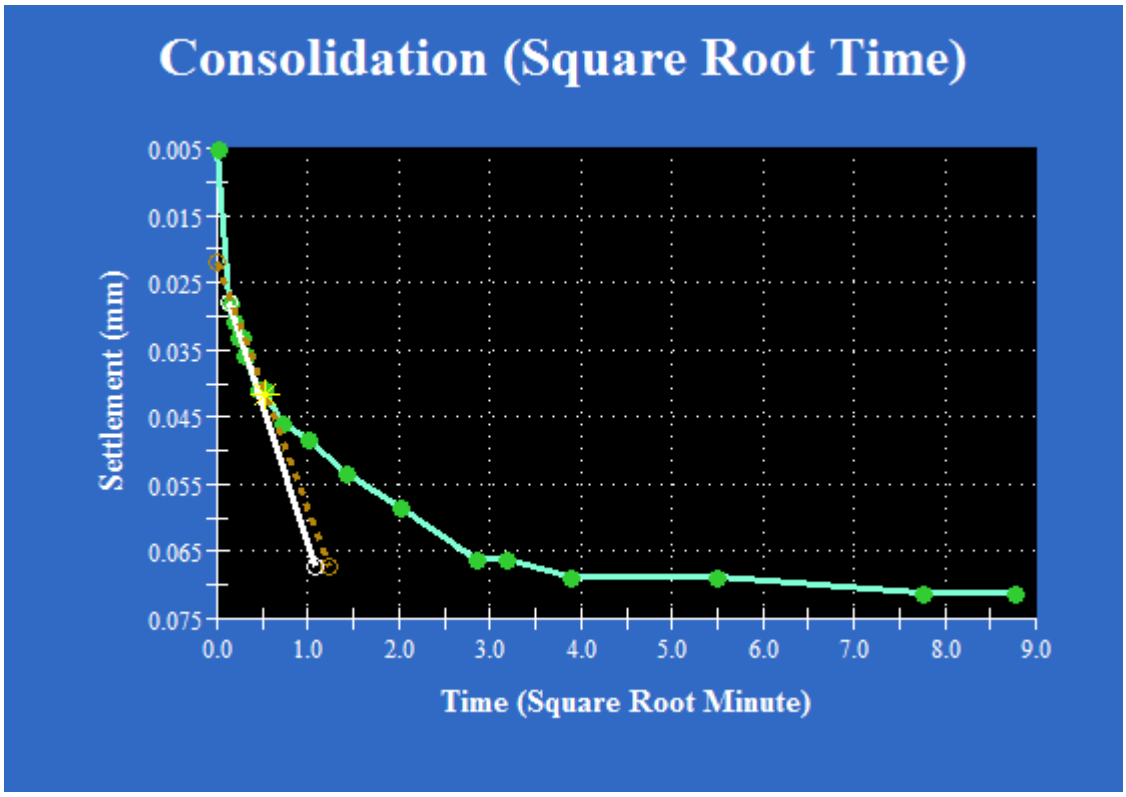
Moving points

1. In the graph area click on the point to move.
2. Move your cursor to location you would like to place the endpoint at.
3. Click in the graph area to reposition the point at that location.

Available Graphs

- ***Consolidation (Square Root Graph)***

The data for this plot is from the Consolidation stage.



X-Axis - Time in sqaure root minute
Y-Axis - Volume in cc's

Graph Actions (located on toolbar above graph)

- Consolidation Sequence: Select what sequence you would like to view.
- Plot Specimen: Only one specimens plot can be viewed at a time. Click on the plot you would like to work with.
- t90 Calculations Tool (SQR): Toggle this view the tangent line tool for determining your t50 and strain rate for the shear stage motor value.

WARNING: Please refer to the appropriate standard for determining the t50.

t90 Calculations Tool (SQR)

- Draw Tangent

  This button will allow you to place the extension line of initial linear portion of the time-deformation curve. Once this line is drawn the software will draw another line that is 1.15 times the inital linear portion of the time-deformation curve.

- Select t90

  This button will allow you place a point at t90.

- The Estimated Failure Strain can be selected between 1% and 5%. The default value is 4%.

- Reset

  Use this button to clear all lines, points, and calculations. The time-deformation curve is not cleared.

- Set

  This button will place the calculated strain rate into the speed value in the Shear phase in the test setup sheet for the selected specimen.

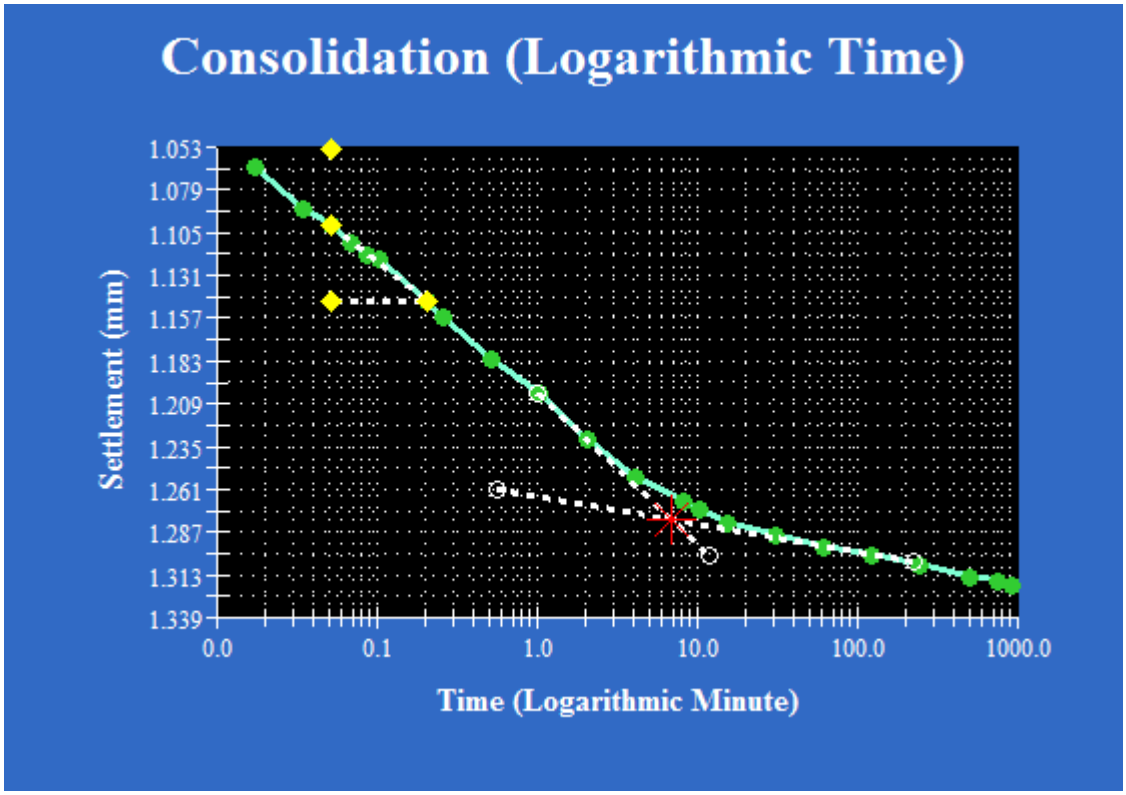
- Once the tangent line has been drawn and the t90 point has been selected, the t50 value and Strain Rate value will be calculated.

  t50 Calculations = $(t90 * (5/9))^2$

  Shear Rate = height after consolidation * (Estimated Failure Strain / 1000) / (t90 * (5/9))

- ***Consolidation (Logarithmic Graph)***

  The data for this plot is from the Consolidation stage.



X-Axis - Time in logarithmic minute
Y-Axis - Volume in cc's

Graph Actions (located on toolbar above graph)

- Consolidation Sequence: Select what sequence you would like to view.
- Plot Specimen: Only one specimens plot can be viewed at a time. Click on the plot you would like to work with.
- t50 Calculations Tool (LOG): Toggle this view the tangent line tool for determining your t50 and strain rate for the shear stage motor value.

» **WARNING**: Please refer to the appropriate standard for determining the t50.

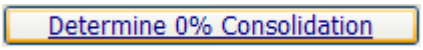
t50 Calculations Tool (LOG)

- Draw Intersection Lines

  Pressing this button will place two lines on the graph, you will need to position these line accordingly. These lines can be used to draw an extension line of the final linear portion of the time-deformation curve, as well as an extention line of the steepest lenear portion of the curve.

- Select Intersection Point

This button will allow you to select the d100 point which is the intersection of the two lines drawn above.

- 

  Use this button to select a point in time, once a point is selected a triangulation tool will help you find the time four times the point selected.

- The Estimated Failure Strain can be selected between 1% and 5%. The default value is 4%.

- 

Use this button to clear all lines, points, and calculations. The time-deformation curve is not cleared.

- 

This button will place the calculated strain rate into the speed value in the Shear phase in the test setup sheet for the selected specimen.

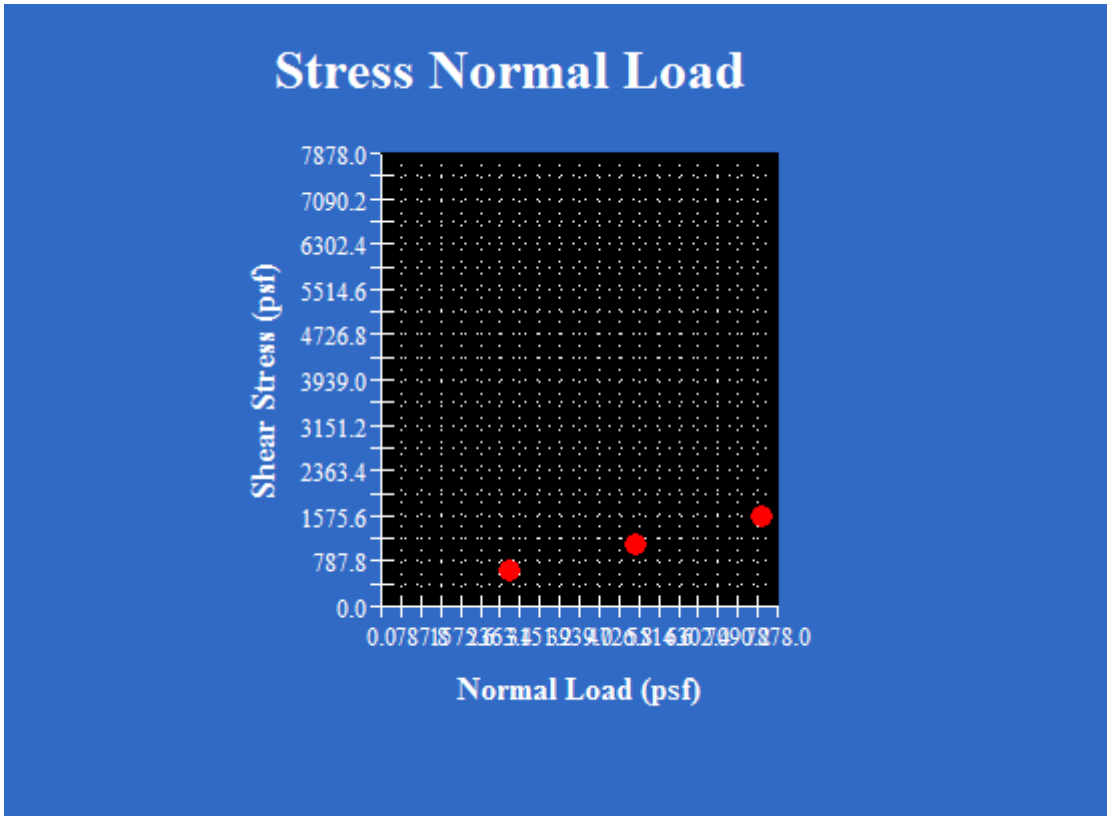
- Once the intersection lines have been drawn, the intersection point selected, and the 0% consolidation selected, the t50 value and Strain Rate value will be calculated.

  d50 = (d0 + d100) / 2
  Software searches data for the point closest to d50 and determines a line from two points around this data point. From this line the t50 value is determined.

  Shear Rate = height after consolidation * (Estimated Failure Strain / 1000) / t50

- ***Stress Normal Load***

  The data for this plot is from the Shear stage.



X-Axis - Normal Load
Y-Axis - Shear Stress

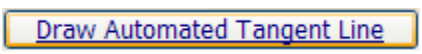
Graph Actions (located on toolbar above graph)

- Normal Stress Tangent Tool will allow you to draw a tangent line and calculate Phi and C from this tangent line.

» **WARNING**: Please refer to the appropriate standard for determining Phi and C.

Normal Stress Tangent Tool

- Will allow you to draw a tangent line. From this tangent the the Phi angle and the C value will be calculated.



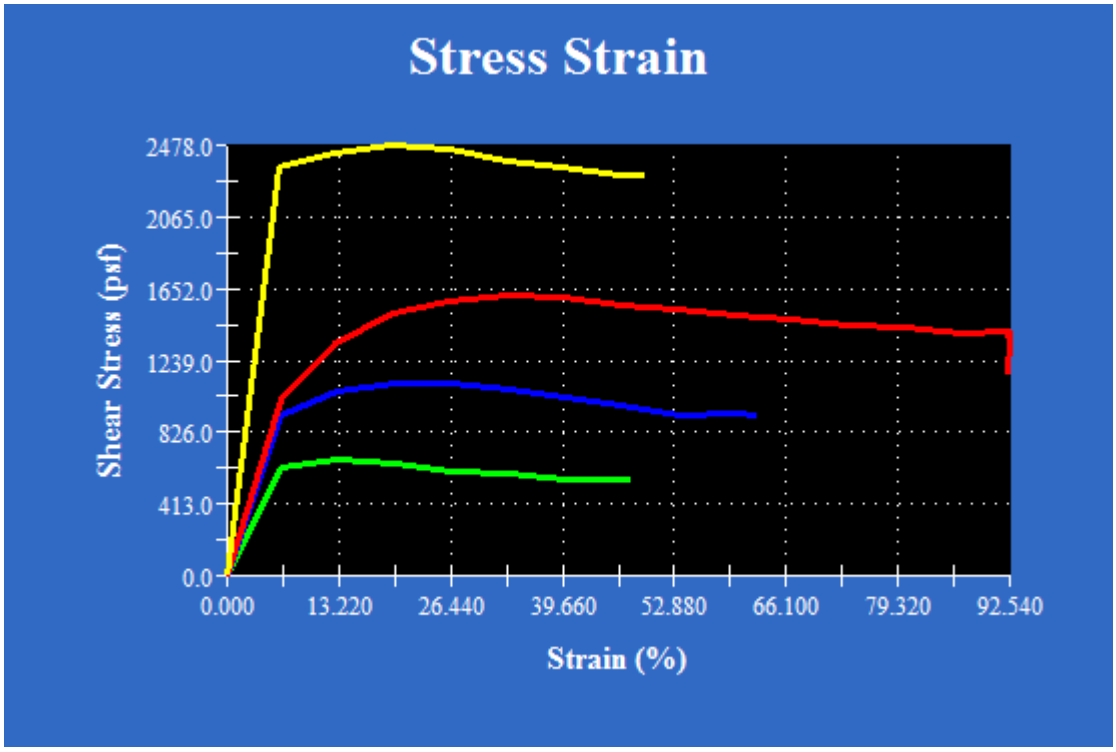
- This will attempt to calculated the tangent line for you. The Phi angle and the C values will be calculated.

Reset

- This will clear and tangent line drawn as well as the Phi angle and the C values.

- Stress Strain

  The data for this plot is from the Shear stage.



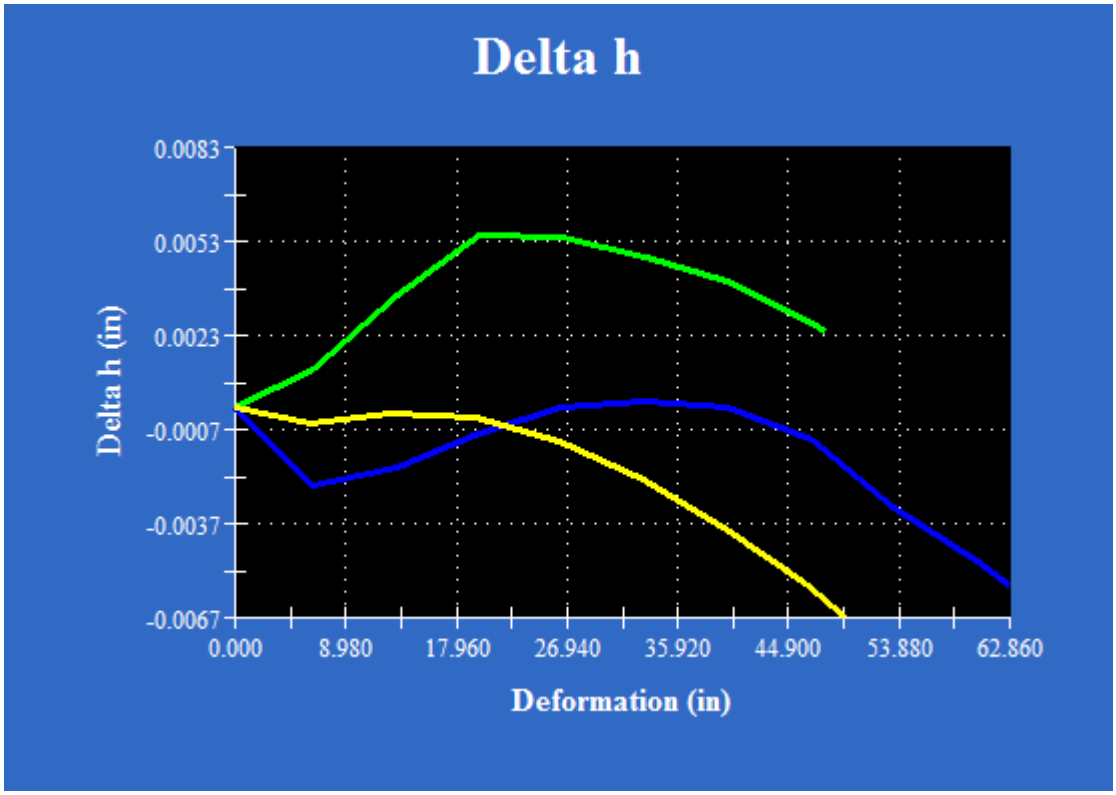
  X-Axis - Axial Strain
  Y-Axis - Shear Stress

  Graph Actions (located on toolbar above graph)

  Plot All Shear Passes - clicking this will allow you to show a plot of all shear passes. When this is turned on, only one specimen and its passes can be viewed at a time. If plot all shear passes is turned off, all specimens can be viewed together, but only the final shear pass is shown for each specimen.

- ***Delta h***

  The data for this plot is from the Shear stage.



X-Axis - Deformation
Y-Axis - Delta h

Graph Actions (located on toolbar above graph)
Toggle graphing of specimen on or off. By default all are on.

7.9 Marshall Test

7.9.1 Marshall Test

The Marshall Test Module was designed to allow users to perform a Marshall test from start to finish using their equipment and the Humboldt Material Testing Software.

This test contains a trial period, once the trial period has expired, you will need to purchase the software. Once you have purshased the software Humboldt will provide a registration key for the Unconfined Compression Test module. Once the software is registered you will have unlimited use of the Marshall Test and Reports. For more information on registering a test module see the Registration 17 section.

For more information or to purchase this module please contact Humboldt at 1-800-537-4183 and ask for software part number ***HM-3005SW***.

Marshall Test Features:

- Test Setup specific to Marshall Test requirements
- Test Information is stored, and all calculations are performed for you
- Live tests (real time)
- Live graphing capabilities
- Complete report of test including all calculation and graphs required for testing
- Review and export tests using Microsoft Excel
- Smart Test. Will automatically pick up where it left off if the test was not finished due to unexpected events within your computer.

More Information

- For Information on the project information sheet, goto Direct Shear Project Information 104 help.
- For Information on specimen information sheets, goto Marshall Specimen Information 127 help.
- For Information on specimen setup sheets, goto Marshall Test Setup 128 help.
- For Information on specimen tabulation sheets, goto Marshall Tabulation 129 help.
- For Information on specimen graph sheets, goto Marshall Graphs 131 help.

Note: To export to Microsoft Excel, Excel must be installed on your computer.

7.9.2 Marshall Project Information

HOWTO OPEN: To get to the Project Information screen for a specific test, open the desired test or select a new Marshall Test. The project information for the project will be the first thing to load.

Note: The Marshall Test Project Information holds all values and descriptions that will be global to all specimens in project. Not all information has to be filled in, this form is mainly for reporting purposes only.

Project Information

General Information

- Test Units - Units for the entire test. All values and tabulated values will be represented in either English or Metric.
- Project Name - Name of this project.
- Project Number - Number designation for this project.
- Client - Client this test is being performed for.
- Job Number - Number designation for job.
- Mix Type - Type of mix.
- Sample Number - Number designation for this sample.
- Sample Source - Source of sample, its origination.
- Sample Location - Location the sample was taken form.
- Sample Description - Description of sample.
- Date of Sampling - When sample was taken.
- Sampling Time - Time of sample.
- Date of Receiving Sample - When the sample was received by lab.
- Received Time - Time sample was received by lab.
- Size of Sample - Sample size.
- Test Date - Date testing began.
- Test Time - Time testing began.
- Test Method - Method or standard used for test.
- Test Method Variation - Description of variation in testing method.
- Area Number - Number of area.
- Lot Number - Lot number.
- Lot Size - Lot Size.
- Sender Name - Name of sample sender.
- Remarks - Any additional remarks.

Bitumen Information

- Bitumen Percent - Percent of bitumen.
- Bitument Type - Type of bitumen.
- Specific Gravity Bitumen - Bitumen's specific gravity.
- Bulk Specific Gravity Aggregate - Aggregate's specific gravity (Bulk).
- Effective Specific Gravity Aggregate - Aggregate's specific gravity (Effective).
- Design Build Specific Gravity - Specific gravity of design build.
- Number of Blows on Each Face - number of blows to the specimen.
- Stability Immersion Time - Immersion time for the stability test.
- Stability Test Temperature - The temperature in degrees C of the the sability test.
- Method of Determing Flow - method used to determine the flow.

7.9.3 Marshall Specimen Information

HOWTO OPEN: To get to the test information screen for a specific test, open the desired test or select a new Marshall Test. Click Information for the desired Specimen in the Project Navigation pane. The test information for that specimen will load.

The Marshall Test has values that will be required for report purposes and for calculating tabulated values correctly. Values can be entereded before or after the test. The program will prompt you if any values are missing for test calculations. If you decide not to fill in all values and the values are required for tabulation calculations, after the test has finished, you can enter the values in and tabulated values will be recalculated.

To enter information on the Specimen Information page, click in the box to the right of the description field and add your information.

Marshall Specimen Parameters

Specimen Information

- **Test Procedure -** test procedure used when evaluating this sample.
- **Mix Type -** type of mix.
- **Date of Test -** date the specimen was tested.
- **Remarks -** any further remarks for this test that you want to include in the report.

Specimen Parameters

[**T**] Thickness - Thickness of the specimen.
[**D**] Diameter - Diameter of the specimen.
[**DM**] Dry Mass in Air - Dry mass of the specimen.
[**SSD**] SSD Mass in Air - SSD mass of the specimen.
[**WM**] Mass in Water - Mass of specimen in water.

[**BV**] Bulk Volume - calculated bulk volume.

BV = SSD - WM

[**BSG**] Bulk Specific Gravity - calculated bulk specific gravity.

BSG = DM / BV

[**DENS**] Density - calculated density.

DENS = BSG * wd

[wd] water density = 62.428

[**MTSG**] Maximum Theoretical Specific Gravity - calculated maximum theoretical specific gravity.

MTSG = 100 / ((100 - Bitumen Percent)) / Effective Specific Gravity Aggregate + Bitumen Percent / Bitumen Specific Gravity

NOTE: These values came from the Marshall Project Information 125.

[**VM**] Voids in Mix - calculated voids in mix.

VM = 100 * ((MTSG - BSG) / MTSG)

[**BV**] Bitumen by Volume - calculated bitumen by volume.

BV = BSG * Bitument Percent / Bitumen Specific Gravity

NOTE: These values came from the Marshall Project Information 125.

[**VMA**] V.M.A - calculated V.M.A.

VMA = 100 - BSG * (100 - Bitumen Percent) / Bulk Specific Gravity Aggregate

NOTE: These values came from the Marshall Project Information 125.

[**VFB**] V.F.B - calculated V.F.B.

VFB = 100 * ((VMA - VM) / VMA)

7.9.4 Marshall Test Setup

HOWTO OPEN: To get to the test setup screen for a specific test, open the desired test or select a new Marshall Test. Select the Setup for the desired Specimen in the Project Navigation pane. The test seup for that specimen will load.

To run an automated test you must setup the test parameters. The Marshall Test is a single phase test.

Once all the setup information has been filled in. If any setup parameters are incorrect you will be prompted. When you press the Run Test button, if you are running a new test or there is no data for this specimen the test will begin immediately. If data exists for the specimen and phase, you be prompted whether you want to over write the data or not.

Marshall Test Setup Parameters

To run a test with connected hardware, you will need to input test setup parameters.

If you want input test data manually, just goto the tabulation section for that specimen. From here you can manually input UC test data.

» NOTE: To run the test you do not need to have anything filled in the specimen information sheet.

» CAUTION: Because of the high rate of data aquisition with the Marshall Test, the channels required for this test must be on the same device.

Setup Explanation:

Marshall Channels

Select Load Device - Select the device that the load transducer is connected to.
Select Load Input - Select the channel that the load transducer is located at on the load device you selected.

Select Displacement Device - Select the device that the Displacement transducer is connected to.
Select Displacement Input - Select the channel that the Displacement transducer is located at on the Displacement device you selected.

7.9.5 Marshall Tabulation

HOWTO OPEN: To get to the tabulation screen for a specific test, open the desired test or select a new Marshall Test. Select Tabulation for the desired Specimen in the Project Navigation pane. The Tabulation for that specimen will load.

The tabulation sheet is where live tests are shown as well as where you will edit any test data if necessary. When a test is running you can not edit data for that specimen.

» **Note:** The User Defined test does not allow you to edit any test data after a test is completed.

Data Entry

- The enter key will move to the next editable cell, if it is at the end of a row, it will move to the next editable cell in the next row.

- If you are at the end of the data and at the last editable field when you press the Enter key a new row will automatically be inserted for you.

- Data Entry Hot Keys (Hold a key combination to apply desired action).

  INSERT = CTRL + i - will insert a row beneath the current row.

DELETE = CTRL + d - will delete the current row.

DELETE ALL = CTRL + a - will delete all rows.

- Only certain columns can be edited. Editable fields are in black, excluding the Reading No. The Reading number is generated at all times by the software.

  Time, Load, Disp fields can be edited in the UC Test.

Automated Testing

- See the Marshall Test Setup 128 for more information on setting up a test.
- All data points are received from the hardware. Any points that appear to be missing will be updated if they are present on the machine.
- If the computer shuts down in the middle of a test. Start the computer, open HMTS, and open the test, the test will gather any missed data points and continue where it left off.
- If you have set the start condition, the stop condition, or both and the computer shuts down before the start or stop condition was met, the devices in the test will handle those conditions even if the computer was not running when they occured.
- If a motor was envloved in a test and a stop condition was met, the motor will stop regardless if the HMTS software and that test were open.
- If operator stop was selected and the HMTS software and test envolving the motor was not opened, the motor will not stop. The test will continue collecting points until you stop the motor manually or you stop the test in the HMTS software.
- The HMTS software and the running tests do not have to be opened at all times.

Marshall Tabulation Calculations

» **Note:** All calculations are done in English (SI units). All metric calculations are converted from its english equivalent.

Time = (HHH:MM:SS) Time the point was taken. When running an automated test the time is the elapsed time. Each point contains a time stamp it receives from the hardware. The elapsed time is the difference between the previous data index and the current data index.

Stability = Data entry.

Flow = Data entry.

Corrected Stability = Current Stability - Stability at Beginning of Test

Corrected Flow = Current Flow - Flow at Beginning of Test

Flow

Units in English
= Corrected Flow / 0.001 in

Units in Metric
= Corrected Flow / 0.25 mm

7.9.6 Marshall Graphs

HOWTO OPEN: To get to the graphs for a specific test, open the desired test or select a new Marshall Test. Select the desired graph from the Project Navigation pane. The selected graph will load.

All graphs are updated when the data changes. If you would like set the graph area yourself, use the Options located at the top of each graph window.

If a graph has no data, it will not show a grid, but a blue window with only a title.

If you are unhapply with the scaling chosen by the software use options located in the toolbar above the graph.

DRAWING INSTRUCTIONS: Some graphs contain tool for constructing tangent lines.

Drawing lines

1. Click on the tool item to start the drawing process.
2. Move your cursor into the graph area, you should notice that a point follows your cursor.
3. Click in the graph area, this point is where your line will start.
4. Move your cursor in the graph area and you will see a line being drawn.
5. Click in the graph area again and this will finish the drawing sequence and your line will be drawn.

Editing lines

1. In the graph area click on an end point of a line.
2. By moving your cursor, you will see that you can reposition the lines endpoint.
3. Click again at the desired location to reposition the line.

Placing points

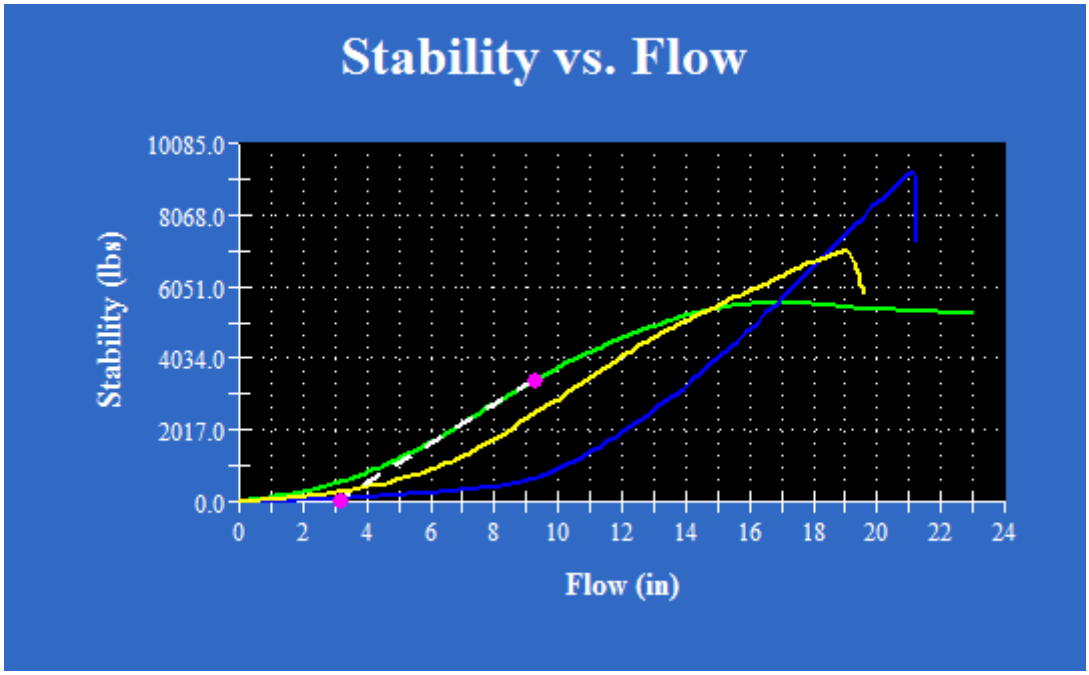
1. Click on the tool item to start the drawing process.
2. Move your cursor into the graph area, you should notice that a point follows your cursor.
3. Click in the graph area to place the point at that location.

Moving points

1. In the graph area click on the point to move.
2. Move your cursor to location you would like to place the endpoint at.
3. Click in the graph area to reposition the point at that location.

Available Graphs

- Load vs. Flow

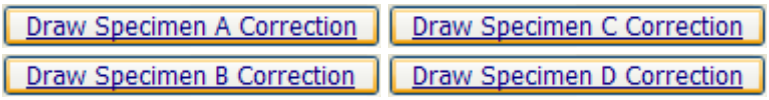


X-Axis - Flow
Y-Axis - Stability

Graph Actions (located on toolbar above graph)
- Specimen Toggle: Toggle graphing of specimen on or off. By default all are on.
- Flow Correction Tool: Toggle this to show flow correction tools. Allows you to draw flow correction lines for each specimen.

» **WARNING**: Please refer to the appropriate standard for determining the correction lines for Marshall Testing.

Penetration Correction



Use this to start drawing correction lines for each specimen. Using the specimen toggle buttons to hide specimens you are not currently drawing for, this will make drawing correction lines easier. The correction line will calculate a corrected Stability and Flow value once the line is drawn or manipulated.

7.10 CBR/LBR Test (ASTM D 1883)

7.10.1 CBR/LBR Test

The CBR/LBR Test was designed to allow users to perform a CBR or LBR test from start to finish using their equipment and the Humboldt Material Testing Software.

This test contains a trial period, once the trial period has expired, you will need to purchase the software. Once you have purshased the software Humboldt will provide a registration key for the Unconsolidated Undrained Triaxial Test module. Once the software is registered you will have unlimited use of the CBR/LBR Test and Reports. For more information on registering a test module see the Registration 17 section.

For more information or to purchase this module please contact Humboldt at 1-800-537-4183 and ask for software part number ***HM-3001SW***.

CBR/LBR Test Features:

- Test Setup specific to CBR and LBR requirements based on the American Standard Test Method and British Standards.
- Test Information is stored, and all calculations are performed for you
- Live tests (real time)
- Live graphing capabilities
- Complete report of test including all calculation and graphs required for testing
- Review and export tests using Microsoft Excel

- Smart Test. Will automatically pick up where it left off if the test was not finished due to unexpected events within your computer.

More Information

- For Information on the project information sheet, goto CBR/LBR Project Information 135 help.
- For Information on specimen information sheets, goto CBR/LBR Specimen Information 135 help.
- For Information on specimen setup sheets, goto CBR/LBR Test Setup Guide 138 help.
- For Information on specimen tabulation sheets, goto CBR/LBR Tabulation 140 help.
- For Information on specimen graph sheets, goto CBR/LBR Graphs 142 help.

Note: To export to Microsoft Excel, Excel must be installed on your computer.

7.10.2 CBR/LBR Project Information

HOWTO OPEN: To get to the Project Information screen for a specific test, open the desired test or select a new CBR/LBR Test. The project information for the project will be the first thing to load.

Note: The CBR/LBR Test Project Information holds all values and descriptions that will be global to all specimens in project. Not all information has to be filled in, this form is mainly for reporting purposes only.

Project Information

- Test Units - Units for the entire test. All values and tabulated values will be represented in either English or Metric.
- Test Standard - Test standard used for this test.
- Project Name - Name of this project.
- Project Number - Number designation for this project.
- Client - Client this test is being performed for.
- Job Number - Number designation for job.
- Sample Number - Number designation for this sample.
- Sample Description - Description of sample.
- Date of Sampling - When sample was taken.
- Sampling Time - Time of sample.
- Date of Receiving Sample - When the sample was received by lab.
- Received Time - Time sample was received by lab.
- Boring Numer - Boring number.
- Remarks - Any additional remarks.

7.10.3 CBR/LBR Specimen Information

HOWTO OPEN: To get to the test information screen for a specific test, open the desired test or select a new CBR/LBR Test. Click Information for the desired Specimen in the Project Navigation pane. The test information for that specimen will load.

The CBR/LBR Test has values that will be required for report purposes and for calculating tabulated values correctly. Values can be entereded before or after the test. The program will prompt you if any values are missing for test calculations. If you decide not to fill in all values and the values are required for tabulation calculations, after the test has finished, you can enter the values in and tabulated values will be recalculated.

To enter information on the Specimen Information page, click in the box to the right of the description field and add your information.

CBR/LBR Specimen Parameters

Specimen Information

- **Sample Description -** description of the visible characteristics of this specimen.
- **Depth -** depth at which this sample was taken from.
- **Test Procedure -** test procedure used when evaluating this sample.
- **Test Method for Preparation and Compaction** - explanation of the method of preparation and compaction for current specimen.
- **Sample Type -** specifies for report whether this sample was remolded or undisturbed.
- **Molding Date -** date this sample was place in a mold.
- **Test Date -** date this sample was tested.
- **Liquid Limit -** sample liquid limit.
- **Plastic Limit -** sample plastic limit.
- **Surcharge Weight** - surcharge weight.
- **Maximum Dry Density** - measured maximum dry density.
- **Optimum Moisture Content** - measured optimum moisture content.
- **Number of Blows** - number of blows.
- **Remarks -** any further remarks for this test that you want to include in the report.

Initial Specimen Parameters

Mold Information Worksheet

- Mold ID - stored ID that uniquely represents the mold used for this CBR/LBR test.
- [**D**] Diameter - diameter of the mold.
- [**W**] Weight - weight of mold.

Moisture Information Worksheet

- [**MW**] Weight of Moist Soil + Container: weight of moist soil + weight of container measurement.
- [**DS**] Weight of Dry Soil + Container: weight of dried soil + weight of container measurement.
- [**WC**] Weight of Container: weight of container.
- [**MC**] Moisture Percentage: moisture content calculation.

$$MC = (MW - DS) / (DS - WC) * 100$$

[**H**] Height - measured height of soil.

[**MWS**] Weight of Mold + Soil - measured weight of mold + weight of soil.

[**WS**] Weight of Soil - weight of soil calculated by the software.

$$WS = MWS - WC$$

[**IWD**] Initial Wet Density: wet density of the specimen calculated by the software.

[cv] Cylinder Volume = $PI * (D/2)^2 * H$

$$IWD = WS / pc / (cv / ic^3)$$

[**pc**] Gram → Pound = 453.59237
[**ic**] Inch → Foot = 12

[**IDD**] Initial Dry Density: dry density of the specimen calculated by the software.

$$IDD = IWD / (MC / 100 + 1)$$

Final Specimen Parameters

Soaking Information Worksheet

- Elapsed Time in Hours - Initial and final time in hours of soaking.
- Height Reading - [**ish**] Initial and [**fsh**] final heights.

[**SW**] Swell % = abs(fsh - ish) / H * 100

[**SSH**] Soaked Sample Height = abs(fsh - ish) + H

Moisture Content Worksheet

- [**FMW**] Weight of Moist Soil + Container: weight of moist soil + weight of container measurement.
- [**FDS**] Weight of Dry Soil + Container: weight of dried soil + weight of container measurement.
- [**FWC**] Weight of Container: weight of container.
- [**FMC**] Moisture Percentage: moisture content calculation.

$$FMC = (FMW - FDS) / (FDS - FWC) * 100$$

[**FWD**] Initial Wet Density: wet density of the specimen calculated by the software.

[cv] Cylinder Volume = $PI * (D/2)^2 * SSH$

$$FWD = WS / pc / (cv / ic^3)$$

[**pc**] Gram → Pound = 453.59237
[**ic**] Inch → Foot = 12

[**FDD**] Initial Dry Density: dry density of the specimen calculated by the software.

$$FDD = FWD / (MC / 100 + 1)$$

7.10.4 CBR/LBR Test Setup Guide

HOWTO OPEN: To get to the test setup screen for a specific test, open the desired test or select a new CBR/LBR Test. Select the Setup for the desired Specimen in the Project Navigation pane. The test seup for that specimen will load.

To run an automated test you must setup the test parameters. The CBR/LBR Test is a single phase test.

Once all the setup information has been filled in. If any setup parameters are incorrect you will be prompted. When you press the Run Test button, if you are running a new test or there is no data for this specimen the test will begin immediately. If data exists for the specimen and phase, you be prompted whether you want to over write the data or not.

CBR/LBR Test Setup Parameters

To run a test with connected hardware, you will need to input test setup parameters.

If you want input test data manually, just goto the tabulation section for that specimen. From here you can manually input CBR/LBR test data.

» Note: To run the test you will need to have the initial height and initial diameter filled in the specimen information sheet. You can still run the test, but it is recommended you fill these value in. See CBR/LBR Specimen Information 135 for more details.

Setup Explanation:

- CBR/LBR Channels

  Select Load Device - Select the device that the load transducer is connected to.
  Select Load Input - Select the channel that the load transducer is located at on the load device you selected.

  Select Displacement Device - Select the device that the Displacement transducer is connected to.
  Select Displacement Input - Select the channel that the Displacement transducer

is located at on the Displacement device you selected.

- Logging Condition

  Surcharge Weights - Specifiy if you are using surcharge weights or not. If you are using surcharge weight you will be prompted after 10 lbs have been loaded to add your surcharge weights. If you are not using surcharge weights select 'Not Using' and you will not be prompted during test to add surcharge weights.

  Condition - Distance Interval or Interval Table.

  Distance Interval

  Device - Device to gather points at specified distance interval.
  Input - Input of selected device to gather points at specified distance interval.
  Distance Increment - Is the motor going Up/Forward or Down/Reverse.
  Value - The test will store a point at this interval.

  Interval Table

  Device - Device to gather points at specified distance interval.
  Input - Input of selected device to gather points at specified distance interval.
  Distance Increment - Is the motor going Up/Forward or Down/Reverse.
  Value - Table of interval values that points will be gathered at.

- Stop Condition

  Penetration Value - Value to stop the CBR/LBR Test. Typically this value is 0.5 in.

- Motor Parameters

  Motor Type - Computer Controlled or None. Select none if you are not using a motor or if you are not using a Humboldt motor.

  Computer Controlled

  Device - Device that the motor exists on. NOTE: Only Humboldt hardware containing a motor can be controlled.

  Value - speed in in/min or mm/min. When the test is activated, the motor will start, the motor will continue running throughout the entire test untill the stop condition is met.

7.10.5 CBR/LBR Tabulation

HOWTO OPEN: To get to the tabulation screen for a specific test, open the desired test or select a new CBR/LBR Test. Select Tabulation for the desired Specimen in the Project Navigation pane. The Tabulation for that specimen will load.

The tabulation sheet is where live tests are shown as well as where you will edit any test data if necessary. When a test is running you can not edit data for that specimen.

Note: The User Defined test does not allow you to edit any test data after a test is completed.

Data Entry

- The enter key will move to the next editable cell, if it is at the end of a row, it will move to the next editable cell in the next row.
- If you are at the end of the data and at the last editable field when you press the Enter key a new row will automatically be inserted for you.
- Data Entry Hot Keys (Hold a key combination to apply desired action).

  INSERT = CTRL + i - will insert a row beneath the current row.

  DELETE = CTRL + d - will delete the current row.

  DELETE ALL = CTRL + a - will delete all rows.

- Only certain columns can be edited. Editable fields are in black, excluding the Reading No. The Reading number is generated at all times by the software.

  Time, Load, Disp fields can be edited in the CBR/LBR Test.

Automated Testing

- See the CBR/LBR Test Setup Guide 138 for more information on setting up a test.
- All data points are received from the hardware. Any points that appear to be missing will be updated if they are present on the machine.
- If the computer shuts down in the middle of a test. Start the computer, open HMTS, and open the test, the test will gather any missed data points and continue where it left off.

- If you have set the start condition, the stop condition, or both and the computer shuts down before the start or stop condition was met, the devices in the test will handle those conditions even if the computer was not running when they occured.

- If a motor was envloved in a test and a stop condition was met, the motor will stop regardless if the HMTS software and that test were open.

- If operator stop was selected and the HMTS software and test envolving the motor was not opened, the motor will not stop. The test will continue collecting points until you stop the motor manually or you stop the test in the HMTS software.

- The HMTS software and the running tests do not have to be opened at all times.

CBR/LBR Tabulation Calculations

Note: All calculations are done in English (SI units). All metric calculations are converted from its english equivalent.

Time = (HHH:MM:SS) Time the point was taken. When running an automated test the time is the elapsed time. Each point contains a time stamp it receives from the hardware. The elapsed time is the difference between the previous data index and the current data index.

Load = Data entry.

Disp = Data entry.

Force on Plunger = abs(Load - Initial Load) / 3

Penetration = Disp - Initial Disp

CBR

ASTM:

At 0.1 inch
= Force on Plunger / 1000 psi * 100

At 0.2 inch
= Force on Plunger / 1500 psi * 100

At 0.3 inch
= Force on Plunger / 1900 psi * 100

At 0.4 inch
= Force on Plunger / 2300 psi * 100

At 0.5 inch
= Force on Plunger / 2600 psi * 100

BS:

At 2.0 mm
= Force on Plunger / 11.5 Kn * 100

At 2.5 mm
= Force on Plunger / 13.2 Kn * 100

At 4.0 mm
= Force on Plunger / 17.6 Kn * 100

At 5.0 mm
= Force on Plunger / 20.0 Kn * 100

At 6.0 mm
= Force on Plunger / 22.0 Kn * 100

At 8.0 mm
= Force on Plunger / 26.3 Kn * 100

LBR

ASTM:

At 0.1 inch
= Force on Plunger / 800 psi * 100

BS:

LBR is not calculated in the BS.

7.10.6 CBR/LBR Graphs

HOWTO OPEN: To get to the graphs for a specific test, open the desired test or select a new CBR/LBR Test. Select the desired graph from the Project Navigation pane. The selected graph will load.

All graphs are updated when the data changes. If you would like set the graph area yourself, use the Options located at the top of each graph window.

If a graph has no data, it will not show a grid, but a blue window with only a title.

If you are unhapply with the scaling chosen by the software use options located in the toolbar above the graph.

DRAWING INSTRUCTIONS: Some graphs contain tool for constructing tangent lines.

Drawing lines

1. Click on the tool item to start the drawing process.

2. Move your cursor into the graph area, you should notice that a point follows your cursor.
3. Click in the graph area, this point is where your line will start.
4. Move your cursor in the graph area and you will see a line being drawn.
5. Click in the graph area again and this will finish the drawing sequence and your line will be drawn.

Editing lines

1. In the graph area click on an end point of a line.
2. By moving your cursor, you will see that you can reposition the lines endpoint.
3. Click again at the desired location to reposition the line.

Placing points

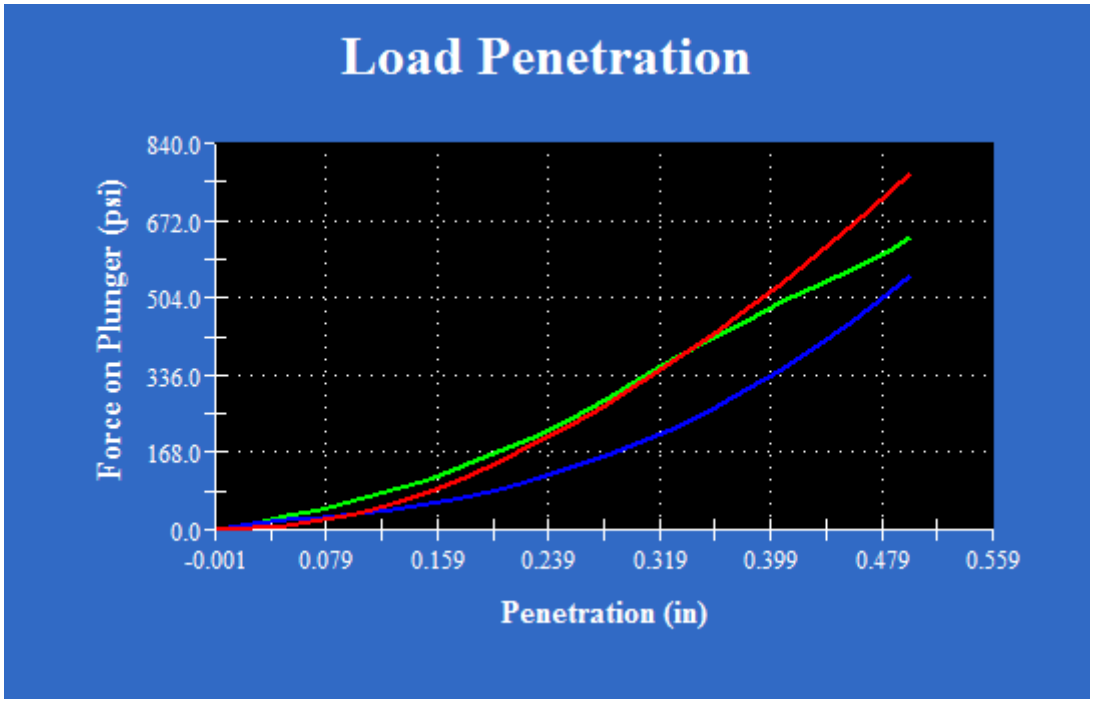
1. Click on the tool item to start the drawing process.
2. Move your cursor into the graph area, you should notice that a point follows your cursor.
3. Click in the graph area to place the point at that location.

Moving points

1. In the graph area click on the point to move.
2. Move your cursor to location you would like to place the endpoint at.
3. Click in the graph area to reposition the point at that location.

Available Graphs

- Load Penetration



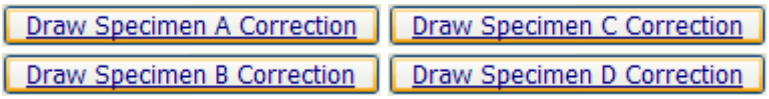
X-Axis - Penetration
Y-Axis - Force on Plunger

Graph Actions (located on toolbar above graph)

- Specimen Toggle: Toggle graphing of specimen on or off. By default all are on.
- Penetration Correction Tool: Toggle this to show penetration correction tools. Allows you to draw CBR/LBR correction lines for each specimen.

» **WARNING**: Please refer to the appropriate standard for determining the correction lines for CBR/LBR.

Penetration Correction



Use this to start drawing correction lines for each specimen. Using the specimen toggle buttons to hide specimens you are not currently drawing for, this will make drawing correction lines easier.

7.11 HVeem (Free)

7.11.1 HVeem (Free)

HVeem help is under construction, Please contact Humboldt for more information or help.

7.12 Unconfined Compression Test (ASTM D 2166-00)

7.12.1 Unconfined Compression Test

The Unconfined Compression test was designed to allow users to perform a UC test from start to finish using their equipment and the Humboldt Material Testing Software.

This test contains a trial period, once the trial period has expired, you will need to purchase the software. Once you have purshased the software Humboldt will provide a registration key for the Unconfined Compression Test module. Once the software is registered you will have unlimited use of the Unconfined Compression Test and Reports. For more information on registering a test module see the Registration 17 section.

For more information or to purchase this module please contact Humboldt at 1-800-537-4183 and ask for software part number ***HM-3004SW***.

Unconfined Compression (UC) Test Features:

- Test Setup specific to UC requirements
- Test Information is stored, and all calculations are performed for you
- Live tests (real time)
- Live graphing capabilities
- Complete report of test including all calculation and graphs required for testing
- Review and export tests using Microsoft Excel
- Smart Test. Will automatically pick up where it left off if the test was not finished due to unexpected events within your computer.

More Information

- For Information on the project information sheet, goto Unconfined Compression Project Information 147 help.

- For Information on specimen information sheets, goto Unconfined Compression Specimen Information 147 help.
- For Information on specimen setup sheets, goto Unconfined Compression Test Setup Guide 150 help.
- For Information on specimen tabulation sheets, goto Unconfined Compression Tabulation 152 help.
- For Information on specimen graph sheets, goto Unconfined Compression Graphs 154 help.

Note: To export to Microsoft Excel, Excel must be installed on your computer.

7.12.2 Unconfined Project Information

HOWTO OPEN: To get to the Project Information screen for a specific test, open the desired test or select a new Unconfined Compression Test. The project information for the project will be the first thing to load.

Note: The Unconfined Compression Test Project Information holds all values and descriptions that will be global to all specimens in project. Not all information has to be filled in, this form is mainly for reporting purposes only.

Project Information

- Test Units - Units for the entire test. All values and tabulated values will be represented in either English or Metric.
- Test Standard - Test standard used for this test.
- Project Name - Name of this project.
- Project Number - Number designation for this project.
- Client - Client this test is being performed for.
- Job Number - Number designation for job.
- Sample Number - Number designation for this sample.
- Sample Description - Description of sample.
- Date of Sampling - When sample was taken.
- Sampling Time - Time of sample.
- Date of Receiving Sample - When the sample was received by lab.
- Received Time - Time sample was received by lab.
- Boring Numer - Boring number.
- Remarks - Any additional remarks.

7.12.3 Unconfined Compression Specimen Information

HOWTO OPEN: To get to the test information screen for a specific test, open the desired test or select a new Unconfined Compression Test. Click Information for the desired Specimen in the Project Navigation pane. The test information for that specimen will load.

The Unconfined Compression Test (UC) has values that will be required for report purposes and for calculating tabulated values correctly. Values can be entereded before or after the test. The program will prompt you if any values are missing for test calculations. If you decide not to fill in all values and the values are required for tabulation calculations, after the test has finished, you can enter the values in and tabulated values will be recalculated.

To enter information on the Specimen Information page, click in the box to the right of the description field and add your information.

Unconfined Compression Specimen Parameters

Specimen Information

- **Sample Description -** description of the visible characteristics of this specimen.
- **Depth -** depth at which this sample was taken from.
- **Test Procedure -** test procedure used when evaluating this sample.
- **Sample Type -** specifies for report whether this sample was remolded or undisturbed.
- **Molding Date -** date this sample was place in a mold.
- **Test Date -** date this sample was tested.
- **Liquid Limit -** sample liquid limit.
- **Plastic Limit -** sample plastic limit.
- [**SG**] **Specific Gravity -** specific gravity at location of testing. Assumed or Measured
- **Remarks -** any further remarks for this test that you want to include in the report.

Specimen Parameters

Specimen Dimensions Worksheet

- Height Reading 1 – 3: three different height measurements taken of the specimen.
- Diameter Reading 1 – 3: three different diameter measurements taken of the specimen.
- [***H***] Height - average height of the specimen based on height readings 1 – 3. Zero heights are not averaged in.
- [***D***] Diameter: average diameter of the specimen based on diameter readings 1 – 3. Zero diameters are not averaged in.
- [***A***] Area: area of the specimen based on diameter.

$$A = D^2$$

- [***V***] Volume: volume of the specimen based on height and diameter.

$$V = A * H$$

Moisture Information Worksheet

- [**MW**] Moist Weight of Soil + Container: soaked soil weight + weight of container.
- [**DS**] Weight of Dry Soil + Container: soaked soil that was dried weight + weight of container.
- [**WC**] Weight of Container: weight of container.
- [**MC**] Average Moisture: Calculated – average moisture content of top third, middle third, and bottom third of sample.

(T3…T1) = (MW – DS) / (DS – WC) * 100

MC = Average of T3…T1 excluding zeros

[**IMW**] Initial Moist Weight - moist weight of specimen.

[**DD**] Dry Density: dry density of the specimen calculated by the software.

[**sw**] Weight of Solids = (IMW / pc) / (1 + MC /100)
[**v**] Volume = PI * $(D / ic)^2$ / 4 * (H / ic)
DD = sw / v

[**pc**] Gram → Pound = 453.59237
[**ic**] Inch → Foot = 12

[**WD**] Wet Density: wet density of the specimen calculated by the software.

[**v**] Volume = PI * $(D / ic)^2$ / 4 * (H / ic)

WD = (IMW / pc) / v

[**pc**] Gram → Pound = 453.59237
[**ic**] Inch → Foot = 12

[**S**] Saturation: saturation of soil calculated by the software

[**v**] Volume = (PI * D^2) / 4 * H
[**sw**] Weight of Solids = IMW / (1 + MC / 100)
[**vx**] Initial Volume = (sw * (MC / 100)) / cf
[**vv**] Voids Volume = v – (sw / (SG * cf))

S = vx / vv * 100

[**cf**] in^3 → cm^3 = 16.387064

[**VR**] Void Ratio: void ration of the specimen, calculated by the software

VR = (62.428 * SG) / DD -1

NOTE: The software will assume a water density of 62.428 (temperature of 33C or 89.6F) if a temperature is not provided in the specimen information for this test. If a temperature is provided, the water density will be calculated from that temperature.

7.12.4 Unconfined Compression Test Setup Guide

HOWTO OPEN: To get to the test setup screen for a specific test, open the desired test or select a new Unconfined Compression Test. Select the Setup for the desired Specimen in the Project Navigation pane. The test seup for that specimen will load.

To run an automated test you must setup the test parameters. The Unconfined Compression Test is a single phase test.

Once all the setup information has been filled in. If any setup parameters are incorrect you will be prompted. When you press the Run Test button, if you are running a new test or there is no data for this specimen the test will begin immediately. If data exists for the specimen and phase, you be prompted whether you want to over write the data or not.

Unconfined Compression Test Setup Parameters

To run a test with connected hardware, you will need to input test setup parameters.

If you want input test data manually, just goto the tabulation section for that specimen. From here you can manually input UC test data.

» Note: To run the test you will need to have the initial height, initial diameter, cell pressure, and membrane thickness filled in the specimen information sheet. You can still run the test, but it is recommended you fill these value in. See Unconfined Compression Specimen Information 147 for more details.

Setup Explanation:

- Unconfined Channels

  Select Load Device - Select the device that the load transducer is connected to.
  Select Load Input - Select the channel that the load transducer is located at on the load device you selected.

  Select Displacement Device - Select the device that the Displacement transducer is connected to.
  Select Displacement Input - Select the channel that the Displacement transducer is located at on the Displacement device you selected.

- Logging Type

  Condition - Elapsed Time Table, Distance Interval, or Time Interval.

  Elapsed Time Table

Value - The shear data points will be gathered using a user defined table of time intervals. Click on this box to setup a time table to use with your test.

Distance Interval

Device - Device to gather points at specified distance interval.
Input - Input of selected device to gather points at specified distance interval.
Distance Increment - Is the motor going Up/Forward or Down/Reverse.
Value - The test will store a point at this interval.

Time Interval

Value - time (HH:MM:SS:m) when data points will be gathered. This will happen at the interval specified.

- Start Condition

  Condition - Select Greater Than, Less Than, or Time Delay. Select None if you do not want to use a start condition and you would like to test to start immediately.

  Greater Than or Less Than

  Device - Device the start condition will occure on.
  Input - Input on the device the start condition will occure.
  Current Value - shows the current value the device and input selected are currently reading.
  Value - when the device and input selected are greater than or less than this value the test will start.

  Time Delay

  Value - time (HH:MM:SS:m) to delay before the test will start.

- Stop Condition

  Stop Type - Others or User Stop.

  Others - Use this to select a stop condition.

  Percent Strain - When the axial strain reaches this amount. This is measured from when the test start condition is met.

  Percent Drop of Maximum Deviator Stress - When the deviator stress drops by the specified amount.

User Stop - If you want to manually stop the test.

Conidtion - Select Greater Than, Less Than, Time Delay, Distance (Up/Forward), or Distance (Down/Reverse).

Greater Than or Less Than

Device - Device the stop condition will occure on.
Input - Input on the device the stop condition will occure.
Value - when the device and input selected are greater than or less than this value the test will stop.

Time Delay

Value - time (HH:MM:SS:m) to delay before the test will stop. This is time from when the test start condition is met.

Distance (Up/Forward) or Distance (Down/Reverse)

Device - Device the stop condition will occure on.
Input - Input on the device the stop condition will occure.
Value - when the device and input selected have travelled this value the test will stop. This is the distance from when the test start condition is met.

- Motor Parameters

Motor Type - Computer Controlled or None. Select none if you are not using a motor or if you are not using a Humboldt motor.

Computer Controlled

Device - Device that the motor exists on. NOTE: Only Humboldt hardware containing a motor can be controlled.

Value - speed in in/min or mm/min. When the test is activated, the motor will start, the motor will continue running throughout the entire test untill the stop condition is met.

7.12.5 Unconfined Compression Tabulation

HOWTO OPEN: To get to the tabulation screen for a specific test, open the desired test or select a new Unconfined Compression Test. Select Tabulation for the desired Specimen in the Project Navigation pane. The Tabulation for that specimen will load.

The tabulation sheet is where live tests are shown as well as where you will edit any test data

if necessary. When a test is running you can not edit data for that specimen.

Note: The User Defined test does not allow you to edit any test data after a test is completed.

Data Entry

- The enter key will move to the next editable cell, if it is at the end of a row, it will move to the next editable cell in the next row.
- If you are at the end of the data and at the last editable field when you press the Enter key a new row will automatically be inserted for you.
- Data Entry Hot Keys (Hold a key combination to apply desired action).

  INSERT = CTRL + i - will insert a row beneath the current row.

  DELETE = CTRL + d - will delete the current row.

  DELETE ALL = CTRL + a - will delete all rows.

- Only certain columns can be edited. Editable fields are in black, excluding the Reading No. The Reading number is generated at all times by the software.

  Time, Load, Disp fields can be edited in the UC Test.

Automated Testing

- See the Unconfined Compression Test Setup Guide 150 for more information on setting up a test.
- All data points are received from the hardware. Any points that appear to be missing will be updated if they are present on the machine.
- If the computer shuts down in the middle of a test. Start the computer, open HMTS, and open the test, the test will gather any missed data points and continue where it left off.
- If you have set the start condition, the stop condition, or both and the computer shuts down before the start or stop condition was met, the devices in the test will handle those conditions even if the computer was not running when they occured.
- If a motor was envloved in a test and a stop condition was met, the motor will stop regardless if the HMTS software and that test were open.

- If operator stop was selected and the HMTS software and test envolving the motor was not opened, the motor will not stop. The test will continue collecting points until you stop the motor manually or you stop the test in the HMTS software.

- The HMTS software and the running tests do not have to be opened at all times.

Unconfined Compression Tabulation Calculations

Note: All calculations are done in English (SI units). All metric calculations are converted from its english equivalent.

Time = (HHH:MM:SS) Time the point was taken. When running an automated test the time is the elapsed time. Each point contains a time stamp it receives from the hardware. The elapsed time is the difference between the previous data index and the current data index.

Load = Data entry.

Disp = Data entry.

Axial Strain = (current displacement - initial displacement) / Initial height.

Deviator Stress = (current load - initial load) / Initial area.

7.12.6 Unconfined Compression Graphs

HOWTO OPEN: To get to the graphs for a specific test, open the desired test or select a new Unconfined Compression Test. Select the desired graph from the Project Navigation pane. The selected graph will load.

All graphs are updated when the data changes. If you would like set the graph area yourself, use the Options located at the top of each graph window.

If a graph has no data, it will not show a grid, but a blue window with only a title.

If you are unhapply with the scaling chosen by the software use options located in the toolbar above the graph.

DRAWING INSTRUCTIONS: Some graphs contain tool for constructing tangent lines.

Drawing lines

1. Click on the tool item to start the drawing process.
2. Move your cursor into the graph area, you should notice that a point follows your cursor.
3. Click in the graph area, this point is where your line will start.
4. Move your cursor in the graph area and you will see a line being drawn.

5. Click in the graph area again and this will finish the drawing sequence and your line will be drawn.

Editing lines

1. In the graph area click on an end point of a line.
2. By moving your cursor, you will see that you can reposition the lines endpoint.
3. Click again at the desired location to reposition the line.

Placing points

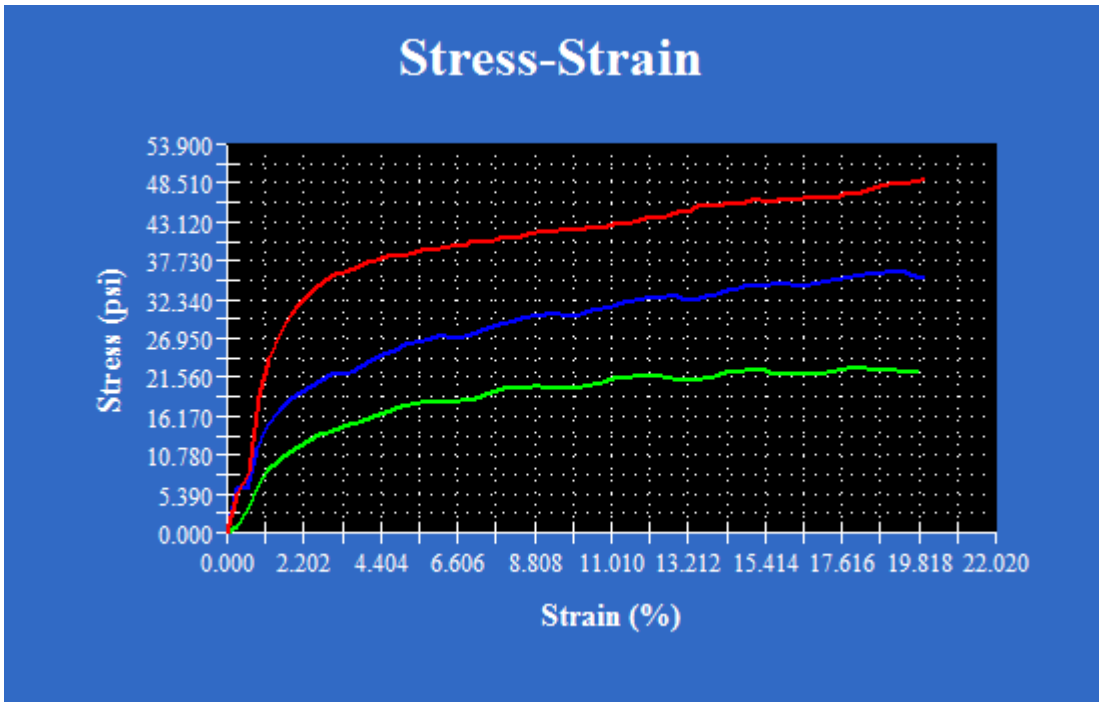
1. Click on the tool item to start the drawing process.
2. Move your cursor into the graph area, you should notice that a point follows your cursor.
3. Click in the graph area to place the point at that location.

Moving points

1. In the graph area click on the point to move.
2. Move your cursor to location you would like to place the endpoint at.
3. Click in the graph area to reposition the point at that location.

Available Graphs

- Stress Strain



X-Axis - Axial Strain
Y-Axis - Deviator Stress

Graph Actions (located on toolbar above graph)
Toggle graphing of specimen on or off. By default all are on.
Penetration Correction Tool: Allow you to draw CBR/LBR correction lines for each specimen.

WARNING: Please refer to the appropriate standard for determining correction lines for the CBR/LBR.

Penetration Correction Tool

7.13 Triaxial Test (ASTM D 2850)

7.13.1 Unconsolidated Undrained Triaxial Test

The Unconsolidated Undrained Triaxial test was designed to allow users to perform a UU test from start to finish using their equipment and the Humboldt Material Testing Software.

This test contains a trial period, once the trial period has expired, you will need to purchase the software. Once you have purshased the software Humboldt will provide a registration key for the Unconsolidated Undrained Triaxial Test module. Once the software is registered you will have unlimited use of the Unconsolidated Undrained Triaxial Test and Reports. For more information on registering a test module see the Registration 17 section.

For more information or to purchase this module please contact Humboldt at 1-800-537-4183 and ask for software part number ***HM-3002SW***.

Consolidated Undrained (UU) Triaxial Test Features:

- Test Setup specific to UU requirements
- Test Information is stored, and all calculations are performed for you
- Live tests (real time)
- Live graphing capabilities
- Complete report of test including all calculation and graphs required for testing
- Review and export tests using Microsoft Excel
- Smart Test. Will automatically pick up where it left off if the test was not finished due

to unexpected events within your computer.

More Information

- For Information on the project information sheet, goto Unconsolidated Undrained Project Information 158 help.
- For Information on specimen information sheets, goto Unconsolidated Undrained Triaxial Specimen Information 158 help.
- For Information on specimen setup sheets, goto Unconsolidated Undrained Triaxial Test Setup Guide 161 help.
- For Information on specimen tabulation sheets, goto Unconsolidated Undrained Triaxial Tabulation 164 help.
- For Information on specimen graph sheets, goto Unconsolidated Undrained Graphs 166 help.

Note: To export to Microsoft Excel, Excel must be installed on your computer.

7.13.2 Unconsolidated Undrained Project Information

HOWTO OPEN: To get to the Project Information screen for a specific test, open the desired test or select a new Unconsolidated Undrained Test. The project information for the project will be the first thing to load.

Note: The Unsonsolidated Undrained Test Project Information holds all values and descriptions that will be global to all specimens in project. Not all information has to be filled in, this form is mainly for reporting purposes only.

Project Information

- Test Units - Units for the entire test. All values and tabulated values will be represented in either English or Metric.
- Test Standard - Test standard used for this test.
- Project Name - Name of this project.
- Project Number - Number designation for this project.
- Client - Client this test is being performed for.
- Job Number - Number designation for job.
- Sample Number - Number designation for this sample.
- Sample Description - Description of sample.
- Date of Sampling - When sample was taken.
- Sampling Time - Time of sample.
- Date of Receiving Sample - When the sample was received by lab.
- Received Time - Time sample was received by lab.
- Boring Numer - Boring number.
- Remarks - Any additional remarks.

7.13.3 Unconsolidated Undrained Triaxial Specimen Information

HOWTO OPEN: To get to the test information screen for a specific test, open the desired test or select a new Unconsolidated Undrained Triaxial Test. Click Information for the desired Specimen in the Project Navigation pane. The test information for that specimen will load.

The Unconsolidated Undrained Triaxial Test (UU) has values that will be required for report purposes and for calculating tabulated values correctly. Values can be entereded before or after the test. The program will prompt you if any values are missing for test calculations. If you decide not to fill in all values and the values are required for tabulation calculations, after the test has finished, you can enter the values in and tabulated values will be recalculated.

To enter information on the Specimen Information page, click in the box to the right of the

description field and add your information.

Unconsolidated Undrained Triaxial Specimen Parameters

Specimen Information

- **Sample Description -** description of the visible characteristics of this specimen.
- **Depth -** depth at which this sample was taken from.
- **Test Procedure -** test procedure used when evaluating this sample.
- **Sample Type -** specifies for report whether this sample was remolded or undisturbed.
- **Molding Date -** date this sample was place in a mold.
- **Test Date -** date this sample was tested.
- **Liquid Limit -** sample liquid limit.
- **Plastic Limit -** sample plastic limit.
- [**SG**] **Specific Gravity -** specific gravity at location of testing. Assumed or Measured
- [***MT***] **Membrane Thickness -** Thickness of membrane use on this specimen.
- **Remarks -** any further remarks for this test that you want to include in the report.

Initial Specimen Parameters

[**CP**] Cell Pressure - cell pressure for test.

Specimen Dimensions Worksheet

- Initial Height Reading 1 – 3: three different height measurements taken of the specimen.
- Initial Diameter Reading 1 – 3: three different diameter measurements taken of the specimen.
- [***IH***] Initial Height - average height of the specimen based on height readings 1 – 3. Zero heights are not averaged in.
- [***ID***] Initial Diameter: average diameter of the specimen based on diameter readings 1 – 3. Zero diameters are not averaged in.
- [***IA***] Initial Area: area of the specimen based on diameter.

$$IA = ID^2$$

- [***IV***] Initial Volume: volume of the specimen based on height and diameter.

$$IV = IA * IH$$

Initial Moisture Information Worksheet

- [**IMW**] Moist Weight of Soil + Container: soaked soil weight + weight of container.

- [**IDS**] Weight of Dry Soil + Container: soaked soil that was dried weight + weight of container.
- [**IWC**] Weight of Container: weight of container.
- [**IMC**] Average Moisture: Calculated – average moisture content of top third, middle third, and bottom third of sample.

(T3…T1) = (IMW – IDS) / (IDS – IWC) * 100

IMC = Average of T3…T1 excluding zeros

[**IMW**] Initial Moist Weight - moist weight of specimen.

[**IDD**] Initial Dry Density: dry density of the specimen calculated by the software.

[**sw**] Weight of Solids = (IMW / pc) / (1 + IMC /100)
[**v**] Volume = PI * (ID / ic)^2 / 4 * (IH / ic)
IDD = sw / v

[**pc**] Gram → Pound = 453.59237
[**ic**] Inch → Foot = 12

[**IWD**] Initial Wet Density: wet density of the specimen calculated by the software.

[**v**] Volume = PI * (ID / ic)^2 / 4 * (IH / ic)

IWD = (IMW / pc) / v

[**pc**] Gram → Pound = 453.59237
[**ic**] Inch → Foot = 12

[**IS**] Initial Saturation: saturation of soil calculated by the software

[**v**] Volume = (PI * ID^2) / 4 * IH
[**sw**] Weight of Solids = IMW / (1 + IMC / 100)
[**vx**] Initial Volume = (sw * (IMC / 100)) / cf
[**vv**] Voids Volume = v – (sw / (SG * cf))

IS = vx / vv * 100

[**cf**] in^3 → cm^3 = 16.387064

[**IVR**] Void Ratio: void ration of the specimen, calculated by the software

IVR = (62.428 * SG) / IDD -1

NOTE: The software will assume a water density of 62.428

(temperature of 33C or 89.6F) if a temperature is not provided in the specimen information for this test. If a temperature is provided, the water density will be calculated from that temperature.

Final Moisture

Final Moisture Information Worksheet: final data to computer final moisture.

[**FMW**] Moist Weight of Soil + Container: soaked soil weight + weight of container.

[**FDS**] Weight of Dry Soil + Container: soaked soil that was dried weight + weight of container.

[**FWC**] Weight of Container: weight of container.

[**FMC**] Average Moisture: Calculated – average moisture content of top third, middle third, and bottom third of sample.

(T3…T1) = (FMW – FDS) / (FDS – FWC) * 100

FM = Average of T3…T1 excluding zeros

[**FM**] Final Moisture Content: final moisture percentage calculations.

7.13.4 Unconsolidated Undrained Triaxial Test Setup Guide

HOWTO OPEN: To get to the test setup screen for a specific test, open the desired test or select a new Unconsolidation Undrained Triaxial Test. Select the Setup for the desired Specimen in the Project Navigation pane. The test seup for that specimen will load.

To run an automated test you must setup the test parameters. The Unconsolidation Undrained Triaxial test is a single phase test.

Once all the setup information has been filled in. If any setup parameters are incorrect you will be prompted. When you press the Run Test button, if you are running a new test or there is no data for this specimen the test will begin immediately. If data exists for the specimen and phase, you be prompted whether you want to over write the data or not.

Unconsolidated Undrained Triaxial Specimen Test Setup Parameters

To run a test with connected hardware, you will need to input test setup parameters.

If you want input test data manually, just goto the tabulation section for that specimen. From here you can manually input UU test data.

» Note: To run the test you will need to have the initial height, initial diameter, cell pressure, and membrane thickness filled in the specimen information sheet. You can still

run the test, but it is recommended you fill these value in. See Unconsolidated Undrained Triaxial Specimen Information 158 for more details.

Setup Explanation:

- UU Channels

  Select Load Device - Select the device that the load transducer is connected to.
  Select Load Input - Select the channel that the load transducer is located at on the load device you selected.

  Select Displacement Device - Select the device that the Displacement transducer is connected to.
  Select Displacement Input - Select the channel that the Displacement transducer is located at on the Displacement device you selected.

- Logging Type

  Condition - Elapsed Time Table, Distance Table, or Time Interval.

  Elapsed Time Table

  Value - The shear data points will be gathered using a user defined table of time intervals. Click on this box to setup a time table to use with your test.

  Distance Table

  Device - Device to gather points at specified distance intervals.
  Input - Input of selected device to gather points at specified distance intervals
  Distance Increment - Is the motor going Up/Forward or Down/Reverse.
  Value - The shear data points will be taken using a user defined table of distance intervals. Click on this box to setup a distance table to use with your test.

  Time Interval

  Value - time (HH:MM:SS:m) when data points will be gathered. This will happen at the interval specified.

- Start Condition

  Condition - Select Greater Than, Less Than, or Time Delay. Select None if you do not want to use a start condition and you would like to test to start immediately.

  Greater Than or Less Than

Device - Device the start condition will occure on.
Input - Input on the device the start condition will occure.
Current Value - shows the current value the device and input selected are currently reading.
Value - when the device and input selected are greater than or less than this value the test will start.

Time Delay

Value - time (HH:MM:SS:m) to delay before the test will start.

- Stop Condition

Stop Type - Others or User Stop.

Others - Use this to select a stop condition.

Percent Strain - When the axial strain reaches this amount. This is measured from when the test start condition is met.

Percent Drop of Maximum Deviator Stress - When the deviator stress drops by the specified amount.

User Stop - If you want to manually stop the test.

Conidtion - Select Greater Than, Less Than, Time Delay, Distance (Up/Forward), or Distance (Down/Reverse).

Greater Than or Less Than

Device - Device the stop condition will occure on.
Input - Input on the device the stop condition will occure.
Value - when the device and input selected are greater than or less than this value the test will stop.

Time Delay

Value - time (HH:MM:SS:m) to delay before the test will stop. This is time from when the test start condition is met.

Distance (Up/Forward) or Distance (Down/Reverse)

Device - Device the stop condition will occure on.
Input - Input on the device the stop condition will occure.
Value - when the device and input selected have travelled this value the test will stop. This is the distance from when the test start condition is met.

- Motor Parameters

  Motor Type - Computer Controlled or None. Select none if you are not using a motor or if you are not using a Humboldt motor.

  Computer Controlled

  Device - Device that the motor exists on. NOTE: Only Humboldt hardware containing a motor can be controlled.

  Value - speed in in/min or mm/min. When the test is activated, the motor will start, the motor will continue running throughout the entire test untill the stop condition is met.

7.13.5 Unconsolidated Undrained Triaxial Tabulation

HOWTO OPEN: To get to the tabulation screen for a specific test, open the desired test or select a new Unconsolidated Undrained Triaxial Test. Select Tabulation for the desired Specimen in the Project Navigation pane. The Tabulation for that specimen will load.

The tabulation sheet is where live tests are shown as well as where you will edit any test data if necessary. When a test is running you can not edit data for that specimen.

Note: The User Defined test does not allow you to edit any test data after a test is completed.

Data Entry

- The enter key will move to the next editable cell, if it is at the end of a row, it will move to the next editable cell in the next row.

- If you are at the end of the data and at the last editable field when you press the Enter key a new row will automatically be inserted for you.

- Data Entry Hot Keys (Hold a key combination to apply desired action).

  INSERT = CTRL + i - will insert a row beneath the current row.

  DELETE = CTRL + d - will delete the current row.

  DELETE ALL = CTRL + a - will delete all rows.

- Only certain columns can be edited. Editable fields are in black, excluding the Reading No. The Reading number is generated at all times by the software.

  Time, Load, Disp fields can be edited in the UU Test.

Automated Testing

- See the Unconsolidated Undrained Triaxial Test Setup Guide 161 for more information on setting up a test.
- All data points are received from the hardware. Any points that appear to be missing will be updated if they are present on the machine.
- If the computer shuts down in the middle of a test. Start the computer, open HMTS, and open the test, the test will gather any missed data points and continue where it left off.
- If you have set the start condition, the stop condition, or both and the computer shuts down before the start or stop condition was met, the devices in the test will handle those conditions even if the computer was not running when they occured.
- If a motor was envloved in a test and a stop condition was met, the motor will stop regardless if the HMTS software and that test were open.
- If operator stop was selected and the HMTS software and test envolving the motor was not opened, the motor will not stop. The test will continue collecting points until you stop the motor manually or you stop the test in the HMTS software.
- The HMTS software and the running tests do not have to be opened at all times.

Unconsolidated Undrained Triaxial Tabulation Calculations

Note: All calculations are done in English (SI units). All metric calculations are converted from its english equivalent.

Time = (HHH:MM:SS) Time the point was taken. When running an automated test the time is the elapsed time. Each point contains a time stamp it receives from the hardware. The elapsed time is the difference between the previous data index and the current data index.

Load = Data entry.

Disp = Data entry.

Corrected Area = Initial Area / (1 - Axial Strain)

Axial Strain = (current displacement - initial displacement) / Initial height.

Deviator Stress = (current load - initial load) / Initial area.

Corrected Deviator Stress = (current load - initial load) / corrected area.

Corrected Deviator Stress w/Membrane correction:

Corrected Deviator Sress = Corrected Deviator Stress - (4 * YM * Membrane Thickness * Axial Strian) / Square Root(4 * Initial Area / PI).

[**YM**] Youngs Modulus = 200

o3 (Principle Stress Minor) = Initial Sample Pressure from specimen informa

o1 (Principle Stress Major) = corrected deviator stress + o3

o1 / o3 = Exactly what it says

P = (o1 + o3) / 2

Q = (o1 - o3) / 2

7.13.6 Unconsolidated Undrained Graphs

HOWTO OPEN: To get to the graphs for a specific test, open the desired test or select a new Unconsolidation Undrained Triaxial Test. Select the desired graph from the Project Navigation pane. The selected graph will load.

All graphs are updated when the data changes. If you would like set the graph area yourself, use the Options located at the top of each graph window.

If a graph has no data, it will not show a grid, but a blue window with only a title.

If you are unhapply with the scaling chosen by the software use the Manual Scaling options located in the toolbar above the graph.

DRAWING INSTRUCTIONS: Some graphs contain tool for constructing tangent lines.

Drawing lines

1. Click on the tool item to start the drawing process.
2. Move your cursor into the graph area, you should notice that a point follows your cursor.
3. Click in the graph area, this point is where your line will start.
4. Move your cursor in the graph area and you will see a line being drawn.
5. Click in the graph area again and this will finish the drawing sequence and your line will be drawn.

Editing lines

1. In the graph area click on an end point of a line.

2. By moving your cursor, you will see that you can reposition the lines endpoint.
3. Click again at the desired location to reposition the line.

Placing points

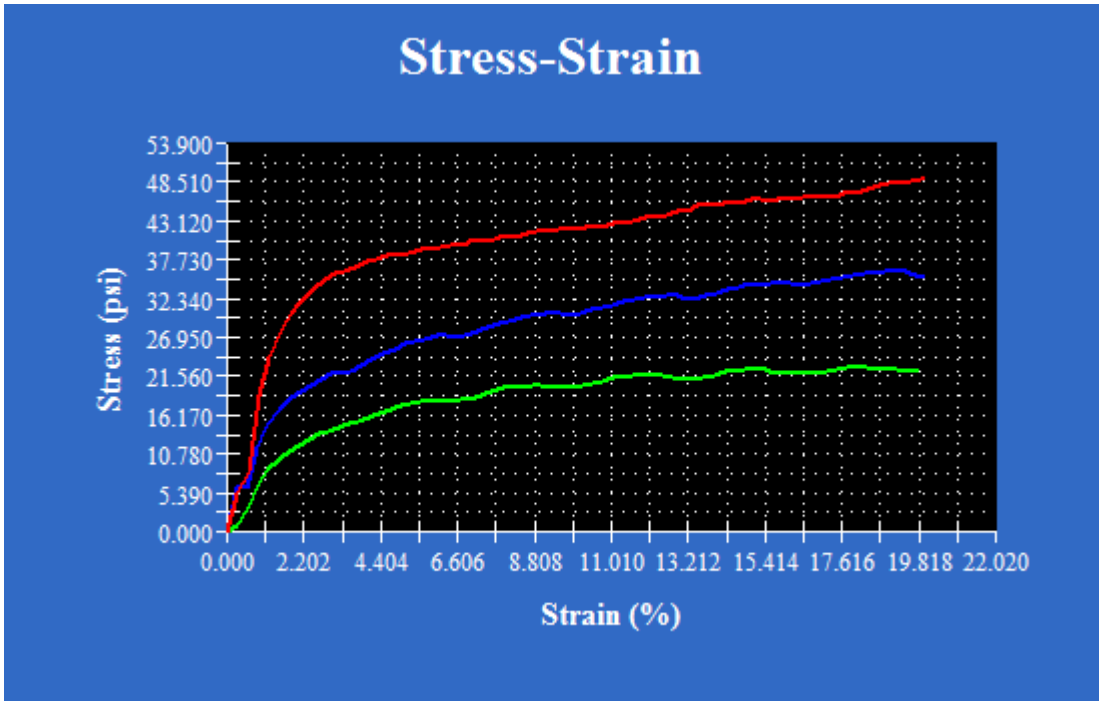
1. Click on the tool item to start the drawing process.
2. Move your cursor into the graph area, you should notice that a point follows your cursor.
3. Click in the graph area to place the point at that location.

Moving points

1. In the graph area click on the point to move.
2. Move your cursor to location you would like to place the endpoint at.
3. Click in the graph area to reposition the point at that location.

Available Graphs

- Stress Strain

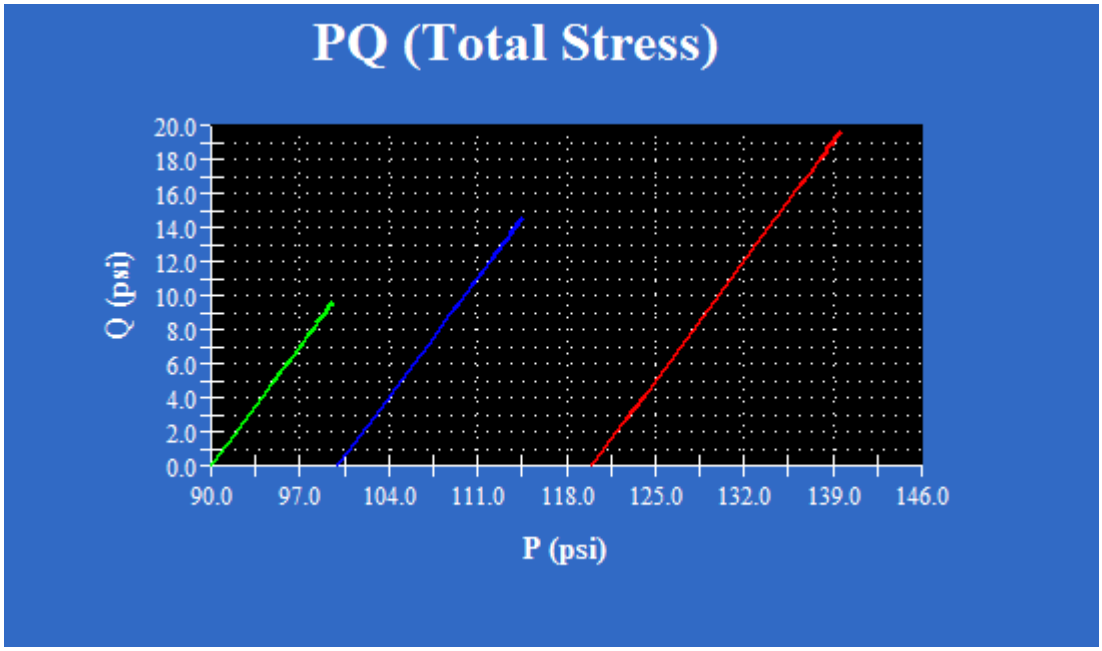


X-Axis - Axial Strain
Y-Axis - Deviator Stress

Graph Actions (located on toolbar above graph)

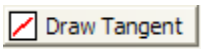
Toggle graphing of specimen on or off. By default all are on.

- PQ (Total Stress)



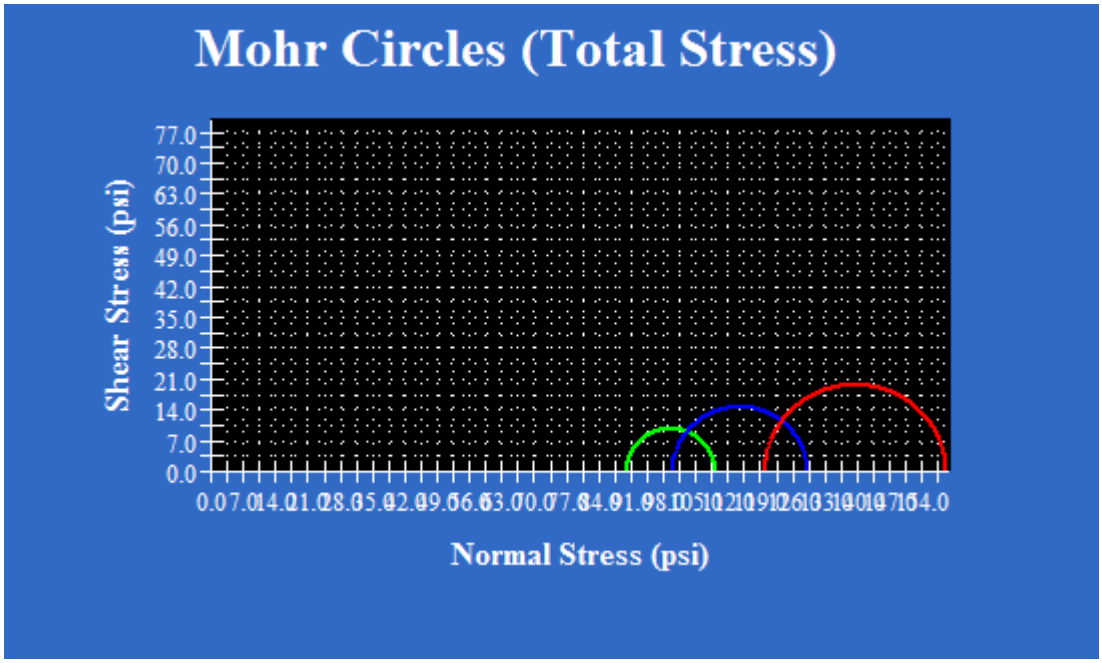
X-Axis - P
Y-Axis - Q

Graph Actions (located on toolbar above graph)
Toggle graphing of specimen on or off. By default all are on.



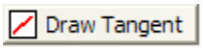
Use this button to draw a tangent line. From this tangent line the Strength Intercept and Friction Angle will be calculated.

- Mohr Graph (Total Stress)



X-Axis - Axial Strain
Y-Axis - Principle Stress Ratio

Graph Actions (located on toolbar above graph)
Toggle graphing of specimen on or off. By default all are on.



Use this button to draw a tangent line. From this tangent line the Strength Intercept and Friction Angle will be calculated.

7.14 Triaxial Test (ASTM D 4767)

7.14.1 Consolidated Undrained Triaxial Test

The Consolidated Undrained Triaxial test was designed to allow users to perform a CU test from start to finish using their equipment and the Humboldt Material Testing Software.

This test contains a trial period, once the trial period has expired, you will need to purchase the software. Once you have purshased the software Humboldt will provide a registration key for the Consolidated Undrained Triaxial Test module. Once the software is registered you will have unlimited use of the Consolidated Undrained Triaxial Test and Reports. For more information on registering a test module see: Registration 17.

For more information or to purchase this module please contact Humboldt at 1-800-537-

4183 and ask for software part number ***HM-3003SW***.

Consolidated Undrained (CU) Triaxial Test Features:

- Test Setup specific to CU requirements
- Test Information is stored, and all calculations are performed for you
- Live tests (real time)
- Live graphing capabilities
- Complete report of test including all calculation and graphs required for testing
- Review and export tests using Microsoft Excel
- Smart Test. Will automatically pick up where it left off if the test was not finished due to unexpected events within your computer.

More Information

- For Information on the project information sheet, goto Consolidated Undrained Project Information 171 help.
- For Information on specimen information sheets, goto Consolidated Undrained Triaxial Specimen Information 171 help.
- For Information on specimen setup sheets, goto Consolidated Undrained Triaxial Test Setup Guide 176 help.
- For Information on specimen tabulation sheets, goto Consolidated Undrained Triaxial Tabulation 181 help.
- For Information on specimen graph sheets, goto Consolidated Undrained Graphs 184 help.

Note: To export to Microsoft Excel, Excel must be installed on your computer.

7.14.2 Consolidated Undrained Project Information

HOWTO OPEN: To get to the Project Information screen for a specific test, open the desired test or select a new Consolidated Undrained Test. The project information for the project will be the first thing to load.

Note: The Consolidated Undrained Test Project Information holds all values and descriptions that will be global to all specimens in project. Not all information has to be filled in, this form is mainly for reporting purposes only.

Project Information

- Test Units - Units for the entire test. All values and tabulated values will be represented in either English or Metric.
- Test Standard - Test standard used for this test.
- Project Name - Name of this project.
- Project Number - Number designation for this project.
- Client - Client this test is being performed for.
- Job Number - Number designation for job.
- Sample Number - Number designation for this sample.
- Sample Description - Description of sample.
- Date of Sampling - When sample was taken.
- Sampling Time - Time of sample.
- Date of Receiving Sample - When the sample was received by lab.
- Received Time - Time sample was received by lab.
- Boring Numer - Boring number.
- Remarks - Any additional remarks.

7.14.3 Consolidated Undrained Triaxial Specimen Information

HOWTO OPEN: To get to the test information screen for a specific test, open the desired test or select a new Consolidation Undrained Triaxial Test. Click Information for the desired Specimen in the Project Navigation pane. The test information for that specimen will load.

The Consolidated Undrained Triaxial Test (CU) has values that will be required for report purposes and for calculating tabulated values correctly. Values can be entereded before or after the test. The program will prompt you if any values are missing for test calculations. If you decide not to fill in all values and the values are required for tabulation calculations, after the test has finished, you can enter the values in and tabulated values will be recalculated.

To enter information on the Specimen Information page, click in the box to the right of the

description field and add your information.

Consolidated Undrained Triaxial Specimen Parameters

Specimen Information

- **Sample Description -** description of the visible characteristics of this specimen.
- **Depth -** depth at which this sample was taken from.
- **Test Procedure -** test procedure used when evaluating this sample.
- **Sample Type -** specifies for report whether this sample was remolded or undisturbed.
- **Molding Date -** date this sample was place in a mold.
- **Test Date -** date this sample was tested.
- **Liquid Limit -** sample liquid limit.
- **Plastic Limit -** sample plastic limit.
- [**SG**] **Specific Gravity -** specific gravity at location of testing. Assumed or Measured
- [***FP***] **Filter Paper Strips -** Choose if filter paper strips were used for this test or not used.
- [***MT***] **Membrane Thickness -** Thickness of membrane use on this specimen.
- **Remarks -** any further remarks for this test that you want to include in the report.

Initial Specimen Parameters

Specimen Dimensions Worksheet

- Initial Height Reading 1 – 3: three different height measurements taken of the specimen.
- Initial Diameter Reading 1 – 3: three different diameter measurements taken of the specimen.
- [***IH***] Initial Height - average height of the specimen based on height readings 1 – 3. Zero heights are not averaged in.
- [***ID***] Initial Diameter: average diameter of the specimen based on diameter readings 1 – 3. Zero diameters are not averaged in.
- [***IA***] Initial Area: area of the specimen based on diameter.

$$IA = ID^2$$

- [***IV***] Initial Volume: volume of the specimen based on height and diameter.

$$IV = IA * IH$$

Initial Moisture Information Worksheet

- [**IMW**] Moist Weight of Soil + Container: soaked soil weight + weight of container.

- [**IDS**] Weight of Dry Soil + Container: soaked soil that was dried weight + weight of container.
- [**IWC**] Weight of Container: weight of container.
- [**IMC**] Average Moisture: Calculated – average moisture content of top third, middle third, and bottom third of sample.

(T3…T1) = (IMW – IDS) / (IDS – IWC) * 100

IMC = Average of T3…T1 excluding zeros

[**IMW**] Initial Moist Weight - moist weight of specimen.

[**IDD**] Initial Dry Density: dry density of the specimen calculated by the software.

[**sw**] Weight of Solids = (IMW / pc) / (1 + IMC /100)
[**v**] Volume = PI * (ID / ic)^2 / 4 * (IH / ic)
IDD = sw / v

[**pc**] Gram → Pound = 453.9
[**ic**] Inch → Foot = 12

[**IWD**] Initial Wet Density: wet density of the specimen calculated by the software.

[**v**] Volume = PI * (ID / ic)^2 / 4 * (IH / ic)

IWD = (IMW / pc) / v

[**pc**] Gram → Pound = 453.9
[**ic**] Inch → Foot = 12

[**IS**] Initial Saturation: saturation of soil calculated by the software

[**v**] Volume = (PI * ID^2) / 4 * IH
[**sw**] Weight of Solids = IMW / (1 + IMC / 100)
[**vx**] Initial Volume = (sw * (IMC / 100)) / cf
[**vv**] Voids Volume = v – (sw / (SG * cf))

IS = vx / vv * 100

[**cf**] in^3 → cm^3 = 16.387

[**IVR**] Void Ratio: void ration of the specimen, calculated by the software

IVR = (62.428 * SG) / IDD -1

NOTE: The software will assume a water density of 62.428 (temperature of 33C or 89.6F) if a temperature is not provided in the specimen information for this test. If a temperature is provided, the

water density will be calculated from that temperature.

Saturation Stage Parameters

Initial Burette Reading - burette reading at beginning saturation stage.
Final Burette Reading - burette reading at end of saturation stage.

[**ISH**] Initial Reference Height Reading - height of specimen at beginning of saturation stage.

[**FSH**] Final Reference Height Reading - height of specimen at end of saturation stage.

[**SH**] Height After Saturation: height of specimen after saturation stage.

$$SH = IH + (FSH - ISH)$$

NOTE: If ISH and FSH are both zero, then SH will just be the ISH.

[**SA**] Area After Saturation: area of specimen after saturation stage.

$$SA = (IV - (3 * IV * ((ISH - FSH) / IH))) / SH$$

NOTE: If ISH and FSH are both zero, then SA will equal IA.

[**SV**] Volume After Saturation: volume of specimen after saturation stage.

$$SV = SA * SH$$

NOTE: If ISH and FSH are both zero, then SV will equal IV.

Consolidation Stage Parameters

[**IB**] Initial Burette Reading: burette reading at beginning consolidation stage.
[**FB**]Final Burette Reading: burette reading at end of consolidation stage.

[**ICH**] Initial Reference Height Reading: height of specimen at beginning of consolidation stage.
[**FCH**] Final Reference Height Reading: height of specimen at end of consolidation stage.

[**CH**] Height After Consolidation: height of specimen after consolidation stage.

$$CH = SH + (FCH - ICH)$$

NOTE: If FCH and ICH are bother zero, then CH will equal SH.

[**CA**] Area After Consolidation: area of specimen after consolidation stage.

CA = (IV - (3 * IV * ((ISH - FSH) / IH)) - (abs(FB - IB) * cincube)) / CH

[**cincube**] - $cm^3 \rightarrow in^3 = 0.0610237$

[**CV**] Volume After Consolidation: volume of specimen after consolidation stage.

CV = CA * CH

Shear Stage Parameters

[**CP**] Cell Pressure: cell pressure used for shear stage.
[**BP**] Back Pressure: back pressure used for shear stage.
[**ECP**] Effective Consolidation Pressure: calculated effective pressure used in shear stage.

ECP = CP – BP

Final Specimen Parameters

Final Moisture Information Worksheet: final data to computer final moisture.

[**FMW**] Moist Weight of Soil + Container: soaked soil weight + weight of container.
[**FDS**] Weight of Dry Soil + Container: soaked soil that was dried weight + weight of container.
[**FWC**] Weight of Container: weight of container.
[**FMC**] Average Moisture: Calculated – average moisture content of top third, middle third, and bottom third of sample.

(T3…T1) = (FMW – FDS) / (FDS – FWC) * 100

FM = Average of T3…T1 excluding zeros

[**FM**] Final Moisture Content: final moisture percentage calculations.

[**FMW**] Final Moist Weight: moist weight of specimen.

[**FDD**] Final Dry Density: dry density of the specimen calculated by the software.

[**ws**] weight of solids (lbs) = FMW / (1 + FM / 100) / pc
[**v**] volume after consol(in^3 to ft^3) = CV * (1 / ic^3)

FDD = ws / v

[**pc**] Gram →Pound = 453.9
[**ic**] Inch → Foot = 12

- [**FVR**] Final Void Ratio: void ration of the specimen, calculated by the software

[**ws**] weight of solids (grams) = FMW / (1 + FM / 100)
[**v**] volume after consol ($in^3 \rightarrow ft^3$) = CV * (1 / ic^3)
[**vs**] volume of solids (cc) = WS / SG
[**vv**] volume of voids (cc) = v * cc - vs

FVR = vv / vs

[**cc**] $ft^3 \rightarrow$ cc = 28316.85

7.14.4 Consolidated Undrained Triaxial Test Setup Guide

HOWTO OPEN: To get to the test setup screen for a specific test, open the desired test or select a new Consolidation Undrained Triaxial Test. Select the Setup for the desired Specimen in the Project Navigation pane. The test seup for that specimen will load.

To run an automated test you must setup the test parameters. The Consolidation Undrained Triaxial test is a multiphase test. Each phase of the test except for the saturation phase has its own test setup. Use the tabs at the top of the test setup to navigate between eash phases test setup.

Once all the setup information has been filled in for the specified phase, that phase can be run. If any setup parameters are incorrect you will be prompted. When you press the Run Test button, if you are running a new test or there is no data for this specimen and phase the test will begin immediately. If data exists for the specimen and phase, you be prompted whether you want to over write the data or not.

Consolidated Undrained Triaxial Specimen Test Setup Parameters

The test setup window for the Consolidated Undrained Test contains three phases of tests.

1. ***Phase 1: Saturation***

   If you select the saturation phase you will be directed to the tabulation page with the saturation phase selected for you. The saturation phase can not be run with the hardware, the data for the saturation phase needs to be manually entered.

   If you select the saturation phase in the test setup window and the test has not been saved yet, you will be asked to save the test first before proceeding to the saturation tabulation sheet.

2. ***Phase 2: Consolidation***

The consolidation stage can be run with the hardware. You need to input the test parameters for this test.

If you want input test data manually, just goto the tabulation section for that specimen and select the consolidation tab. From here you can manually input consolidation test data.

» Note: To run the consolidation stage you will need to have your Initial Height and Height after Saturation filled in the specimen information sheet. You can still run the test, but it is recommended you fill this value in. See Consolidated Undrained Triaxial Specimen Information 171 for more.

Consolidation Setup Explanation:

- Consolidation Channels

  Select Volume Device - Select the device that the volume transducer is connected to.
  Select Volume Input - Select the channel that the volume transducer is located at on the volume device you selected.

- Logging Type (Elapsed Time Table can only be selected)

  Value - The consolidation data points will be gathered using a user defined table of time intervals. Click on this box to setup a time table to use with your test.

- Start Condition

  Condition - Select Greater Than, Less Than, or Time Delay. Select None if you do not want to use a start condition and you would like to test to start immediately.

  Greater Than or Less Than

  Device - Device the start condition will occure on.
  Input - Input on the device the start condition will occure.
  Current Value - shows the current value the device and input selected are currently reading.
  Value - when the device and input selected are greater than or less than this value the test will start.

  Time Delay

  Value - time (HH:MM:SS:m) to delay before the test will start.

- Stop Condition

Stop Type - Others or User Stop.

Others - Use this to select a stop condition.

User Stop - If you want to manually stop the test.

Conidtion - Select Greater Than, Less Than, Time Delay, Distance (Up/Forward), or Distance (Down/Reverse).

Greater Than or Less Than

Device - Device the stop condition will occure on.
Input - Input on the device the stop condition will occure.
Value - when the device and input selected are greater than or less than this value the test will stop.

Time Delay

Value - time (HH:MM:SS:m) to delay before the test will stop. This is time from when the test start condition is met.

Distance (Up/Forward) or Distance (Down/Reverse)

Device - Device the stop condition will occure on.
Input - Input on the device the stop condition will occure.
Value - when the device and input selected have travelled this value the test will stop. This is the distance from when the test start condition is met.

3. ***Phase 3: Shear***

The shear stage can be run with the hardware. You need to input the test parameters for this test.

If you want input test data manually, just goto the tabulation section for that specimen and select the consolidation tab. From here you can manually input shear test data.

» Note: To run the consolidation stage you will need to have your Area after Consolidation, Cell Pressure, and Membrane Thickness filled in the specimen information sheet. You can still run the test, but it is recommended you fill this value in. See Consolidated Undrained Triaxial Specimen Information 171 for more.

Consolidation Setup Explanation:

- Consolidation Channels

Select Load Device - Select the device that the load transducer is connected to.
Select Load Input - Select the channel that the load transducer is located at on the load device you selected.

Select Displacement Device - Select the device that the Displacement transducer is connected to.
Select Displacement Input - Select the channel that the Displacement transducer is located at on the Displacement device you selected.

Select Pore Presure Device - Select the device that the Pore Presure transducer is connected to.
Select Pore Presure Input - Select the channel that the Pore Presure transducer is located at on the Pore Presure device you selected.

- Logging Type

  Condition - Elapsed Time Table, Distance Table, or Time Interval.

  Elapsed Time Table

  Value - The shear data points will be gathered using a user defined table of time intervals. Click on this box to setup a time table to use with your test.

  Distance Table

  Device - Device to gather points at specified distance intervals.
  Input - Input of selected device to gather points at specified distance intervals
  Distance Increment - Is the motor going Up/Forward or Down/Reverse.
  Value - The shear data points will be taken using a user defined table of distance intervals. Click on this box to setup a distance table to use with your test.

  Time Interval

  Value - time (HH:MM:SS:m) when data points will be gathered. This will happen at the interval specified.

- Start Condition

  Condition - Select Greater Than, Less Than, or Time Delay. Select None if you do not want to use a start condition and you would like to test to start immediately.

  Greater Than or Less Than

  Device - Device the start condition will occure on.
  Input - Input on the device the start condition will occure.

Current Value - shows the current value the device and input selected are currently reading.
Value - when the device and input selected are greater than or less than this value the test will start.

Time Delay

Value - time (HH:MM:SS:m) to delay before the test will start.

- Stop Condition

Stop Type - Others or User Stop.

Others - Use this to select a stop condition.

Percent Strain - When the axial strain reaches this amount. This is measured from when the test start condition is met.

Percent Drop of Maximum Deviator Stress - When the deviator stress drops by the specified amount.

User Stop - If you want to manually stop the test.

Conidtion - Select Greater Than, Less Than, Time Delay, Distance (Up/Forward), or Distance (Down/Reverse).

Greater Than or Less Than

Device - Device the stop condition will occure on.
Input - Input on the device the stop condition will occure.
Value - when the device and input selected are greater than or less than this value the test will stop.

Time Delay

Value - time (HH:MM:SS:m) to delay before the test will stop. This is time from when the test start condition is met.

Distance (Up/Forward) or Distance (Down/Reverse)

Device - Device the stop condition will occure on.
Input - Input on the device the stop condition will occure.
Value - when the device and input selected have travelled this value the test will stop. This is the distance from when the test start condition is met.

- Motor Parameters

Motor Type - Computer Controlled or None. Select none if you are not using a motor or if you are not using a Humboldt motor.

Computer Controlled

Device - Device that the motor exists on. NOTE: Only Humboldt hardware containing a motor can be controlled.

Value - speed in in/min or mm/min. When the test is activated, the motor will start, the motor will continue running throughout the entire test untill the stop condition is met.

7.14.5 Consolidated Undrained Triaxial Tabulation

HOWTO OPEN: To get to the tabulation screen for a specific test, open the desired test or select a new Consolidation Undrained Triaxial Test. Select Tabulation for the desired Specimen in the Project Navigation pane. The Tabulation for that specimen will load.

The tabulation sheet is where live tests are shown as well as where you will edit any test data if necessary. When a test is running you can not edit data for that specimen.

Note: The User Defined test does not allow you to edit any test data after a test is completed.

Data Entry (All Phases)

- The enter key will move to the next editable cell, if it is at the end of a row, it will move to the next editable cell in the next row.
- If you are at the end of the data and at the last editable field when you press the Enter key a new row will automatically be inserted for you.
- Data Entry Hot Keys (Hold a key combination to apply desired action).

  INSERT = CTRL + i - will insert a row beneath the current row.

  DELETE = CTRL + d - will delete the current row.

  DELETE ALL = CTRL + a - will delete all rows.

- Only certain columns for each phase can be edited. Editable fields are in black, excluding the Reading No. The Reading number is generated at all times by the software.

  Saturation Phase Editable Fields: Time, Cell Pressure, Pore Pressure, and Burette

Reading.

Consolidation Phase Editable Fields: Elapsed Time and Burette Reading.

Shear Phase Editable Fields: Load, Axial Deformation, and Pore Pressure

Automated Testing (Consolidation and Shear Phases)

- See the Consolidated Undrained Triaxial Test Setup Guide 176 for more information on setting up a test.
- All data points are received from the hardware. Any points that appear to be missing will be updated if they are present on the machine.
- If the computer shuts down in the middle of a test. Start the computer, open HMTS, and open the test, the test will gather any missed data points and continue where it left off.
- If you have set the start condition, the stop condition, or both and the computer shuts down before the start or stop condition was met, the devices in the test will handle those conditions even if the computer was not running when they occured.
- If a motor was envloved in a test and a stop condition was met, the motor will stop regardless if the HMTS software and that test were open.
- If operator stop was selected and the HMTS software and test envolving the motor was not opened, the motor will not stop. The test will continue collecting points until you stop the motor manually or you stop the test in the HMTS software.
- The HMTS software and the running tests do not have to be opened at all times.

Consolidated Undrained Triaxial Tabulation Calculations

» **Note:** All calculations are done in English (SI units). All metric calculations are converted from its english equivalent.

1. ***Saturation Phase***

   Time = (HHH:MM:SS) Time the point was taken. When running an automated test the time is the elapsed time. Each point contains a time stamp it receives from the hardware. The elapsed time is the difference between the previous data index and the current data index.

   Cell Pressure = Data entry.

Pore Pressure = Data entry.

Burette Reading = Data entry.

Volume Change = burrette reading - burette reading at the beginning of test.

Cell Pressure = current cell pressure - previous cell pressure reading.

Pore Pressure Change = current pore pressure - previous pore pressure.

B Value = pore pressure / cell pressure.

2. ***Consolidation Phase***

Time = (HHH:MM:SS) Time the point was taken. When running an automated test the time is the elapsed time. Each point contains a time stamp it receives from the hardware. The elapsed time is the difference between the previous data index and the current data index.

Burette Reading = Data entry.

Volume Change = burette reading - initial burette reading.

3. ***Shear Phase***

Time = (HHH:MM:SS) Time the point was taken. When running an automated test the time is the elapsed time. Each point contains a time stamp it receives from the hardware. The elapsed time is the difference between the previous data index and the current data index.

Load = Data entry.

Axial Deformation = Data entry.

Pore Pressure = Data entry.

Change in Pore Pressure = current pore pressure - initial pore pressure.

Axial Strain = (current axial deformation - initial axial deformation) / height after consolidation.

Deviator Stress = (current load - initial load) / area after consolidation.

Corrected Deviator Stress = (current load - initial load) / corrected area after consolidation. The corrected area after consolidation = area after consolidation / (1 - axial strain)

Corrected Deviator Stress w/Filter paper correction:

Perimeter (p) = 0.5 * (0.5 * Initial sample diameter * PI * 2).

Filter Paper Const (fp) = 1.1 (lb/in)

Axial Strain > 2% = fp * p / area after consolidation.

or

Axial Strain = 50 * axial strain * fp * p / area after consolidation.

o3 = current pore pressure - pore pressure at beginning of test.

o1 = corrected deviator stress + o3

o'3 = o3 - (pore pressure - pore pressure at beginning of test)

o'1 = corrected deviator stress + o'3

o'1 / o'3 = Exactly what it says

Abar:

Change in pore pressure = 0: Abar = 0

or

Abar = change in pore pressure / (o1 - o3)

P = (o1 + o3) / 2

Q = (o1 - o3) / 2

P' = (o'1 + o'3) / 2

7.14.6 Consolidated Undrained Graphs

HOWTO OPEN: To get to the graphs for a specific test, open the desired test or select a new Consolidation Undrained Triaxial Test. Select the desired graph from the Project Navigation pane. The selected graph will load.

All graphs are updated when the data changes. If you would like set the graph area yourself, use the Options located at the top of each graph window.

If a graph has no data, it will not show a grid, but a blue window with only a title.

If you are unhapply with the scaling chosen by the software use the Manual Scaling options located in the toolbar above the graph.

DRAWING INSTRUCTIONS: Some graphs contain tool for constructing tangent lines.

Drawing lines

1. Click on the tool item to start the drawing process.
2. Move your cursor into the graph area, you should notice that a point follows your cursor.
3. Click in the graph area, this point is where your line will start.
4. Move your cursor in the graph area and you will see a line being drawn.
5. Click in the graph area again and this will finish the drawing sequence and your line will be drawn.

Editing lines

1. In the graph area click on an end point of a line.
2. By moving your cursor, you will see that you can reposition the lines endpoint.
3. Click again at the desired location to reposition the line.

Placing points

1. Click on the tool item to start the drawing process.
2. Move your cursor into the graph area, you should notice that a point follows your cursor.
3. Click in the graph area to place the point at that location.

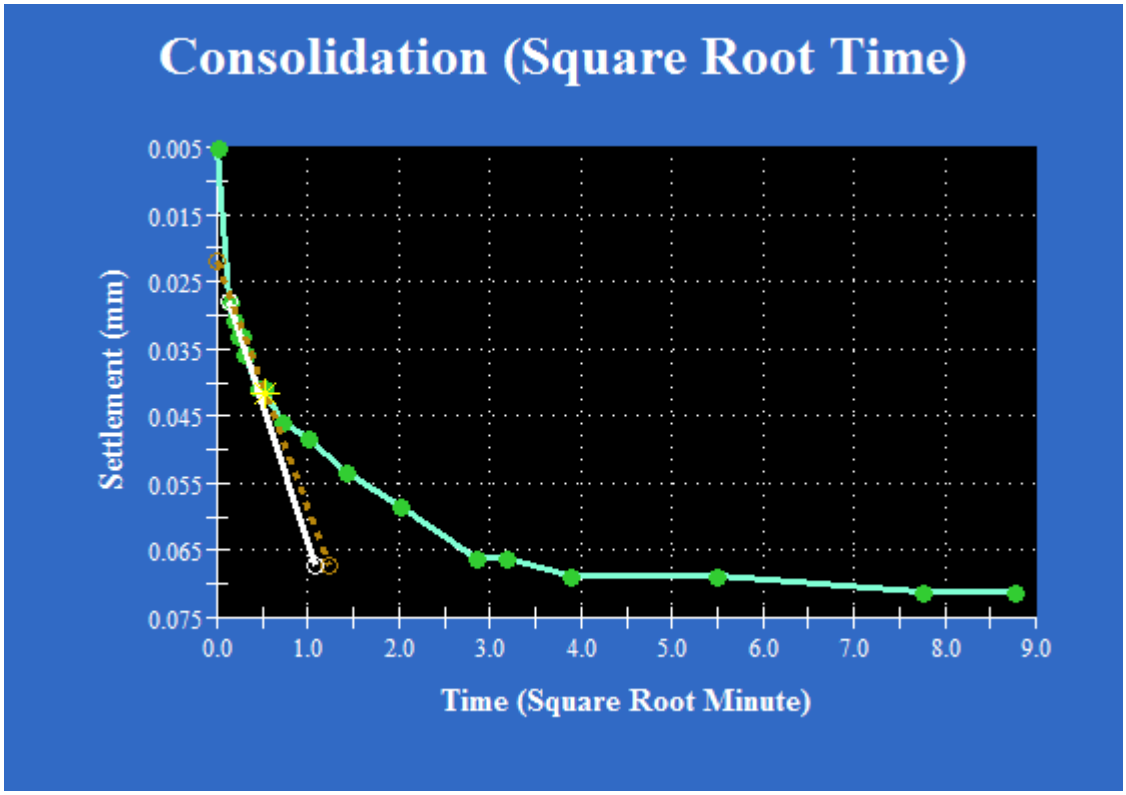
Moving points

1. In the graph area click on the point to move.
2. Move your cursor to location you would like to place the endpoint at.
3. Click in the graph area to reposition the point at that location.

Available Graphs

- ***Consolidation (Square Root Graph)***

  The data for this plot is from the Consolidation stage.



X-Axis - Time in sqaure root minute
Y-Axis - Volume in cc's

Graph Actions (located on toolbar above graph)

- Plot Specimen: Only one specimens plot can be viewed at a time. Click on the plot you would like to work with.
- t90 Calculations Tool (SQR): Toggle this view the tangent line tool for determining your t50 and strain rate for the shear stage motor value.

» **WARNING**: Please refer to the appropriate standard for determining the t50.

t90 Calculations Tool (SQR)

- Draw Tangent

  This button will allow you to place the extension line of initial linear portion of the time-deformation curve. Once this line is drawn the software will draw another line that is 1.15 times the inital linear portion of the time-deformation curve.

- Select t90

  This button will allow you place a point at t90.

- The Estimated Failure Strain can be selected between 1% and 5%. The default value is 4%.

- 

Use this button to clear all lines, points, and calculations. The time-deformation curve is not cleared.

- 

This button will place the calculated strain rate into the speed value in the Shear phase in the test setup sheet for the selected specimen.

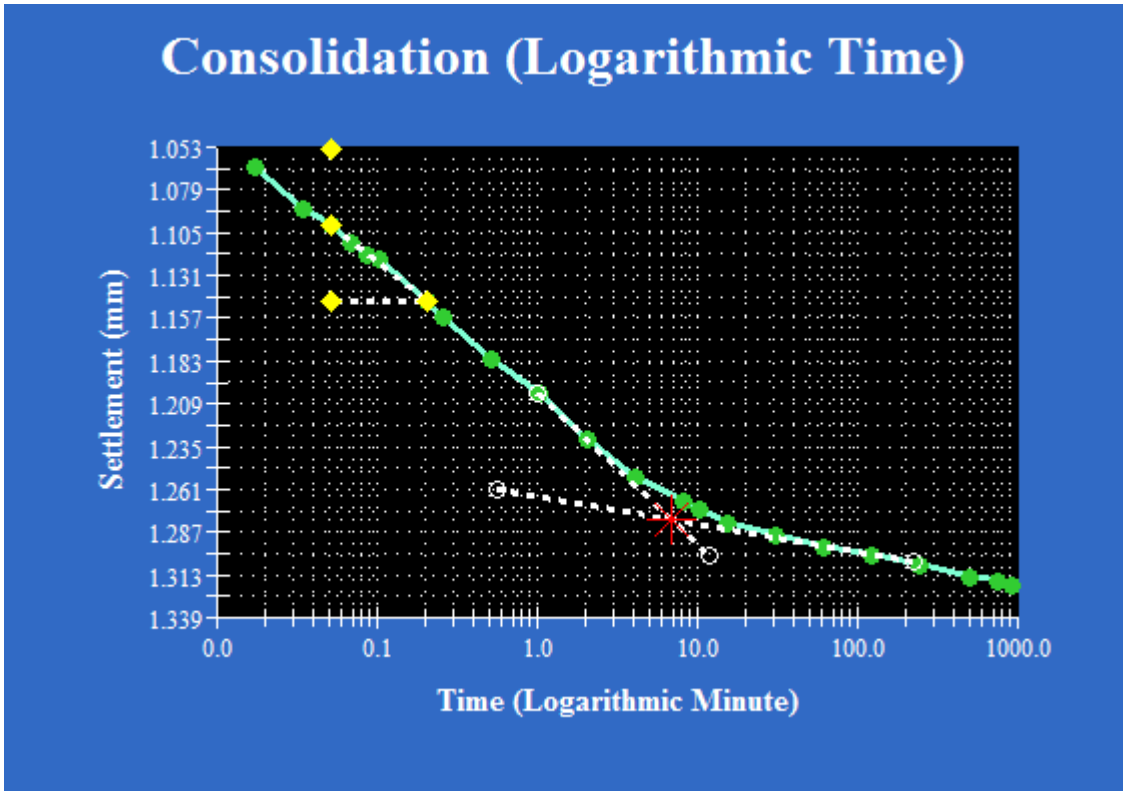
- Once the tangent line has been drawn and the t90 point has been selected, the t50 value and Strain Rate value will be calculated.

  t50 Calculations = $(t90 * (5/9))^2$

  Shear Rate = height after consolidation * (Estimated Failure Strain / 1000) / (t90 * (5/9))

- ***Consolidation (Logarithmic Graph)***

  The data for this plot is from the Consolidation stage.



X-Axis - Time in logarithmic minute
Y-Axis - Volume in cc's

Graph Actions (located on toolbar above graph)

- Plot Specimen: Only one specimens plot can be viewed at a time. Click on the plot you would like to work with.
- t50 Calculations Tool (LOG): Toggle this view the tangent line tool for determining your t50 and strain rate for the shear stage motor value.

» **WARNING**: Please refer to the appropriate standard for determining the t50.

t50 Calculations Tool (LOG)

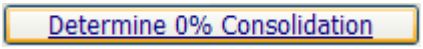
- Draw Intersection Lines

  Pressing this button will place two lines on the graph, you will need to position these line accordingly. These lines can be used to draw an extension line of the final linear portion of the time-deformation curve, as well as an extention line of the steepest lenear portion of the curve.

- Select Intersection Point

  This button will allow you to select the d100 point which is the intersection of

the two lines drawn above.

- 

  Use this button to select a point in time, once a point is selected a triangulation tool will help you find the time four times the point selected.

- The Estimated Failure Strain can be selected between 1% and 5%. The default value is 4%.

- 

Use this button to clear all lines, points, and calculations. The time-deformation curve is not cleared.

- 

This button will place the calculated strain rate into the speed value in the Shear phase in the test setup sheet for the selected specimen.

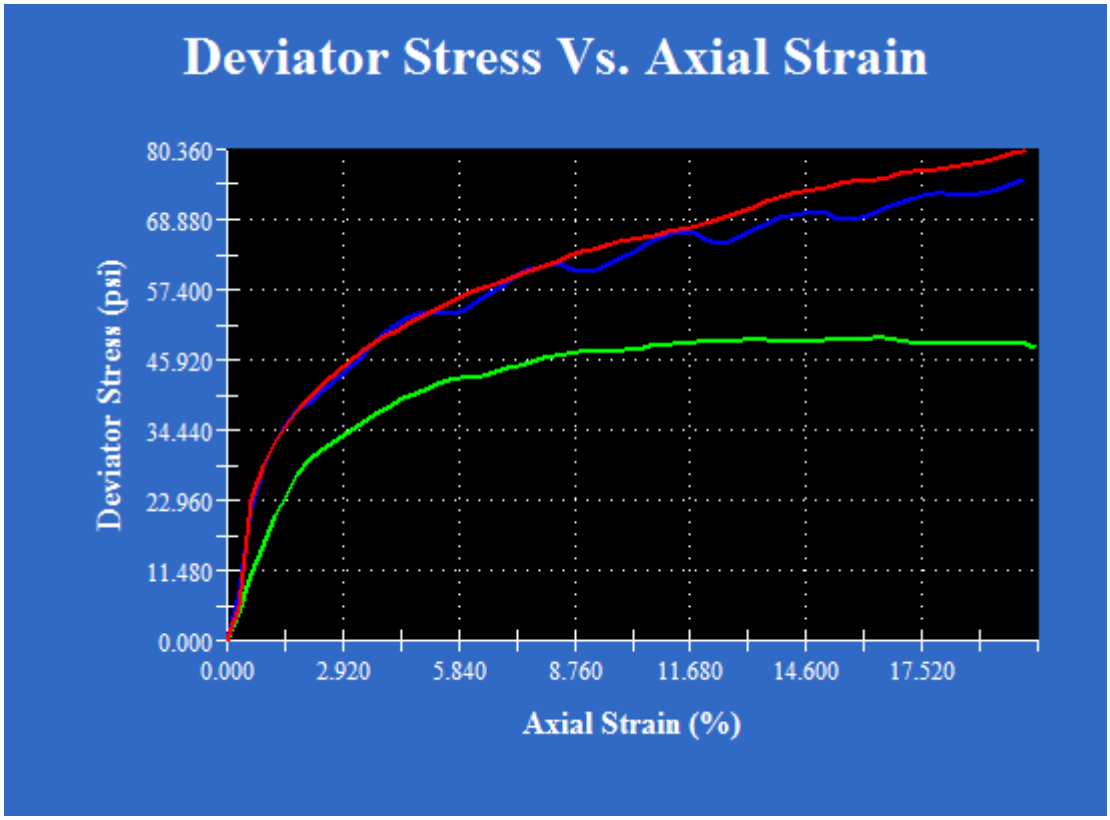
- Once the intersection lines have been drawn, the intersection point selected, and the 0% consolidation selected, the t50 value and Strain Rate value will be calculated.

  d50 = (d0 + d100) / 2
  Software searches data for the point closest to d50 and determines a line from two points around this data point. From this line the t50 value is determined.

  Shear Rate = height after consolidation * (Estimated Failure Strain / 1000) / t50

- Stress Strain

  The data for this plot is from the Shear stage.

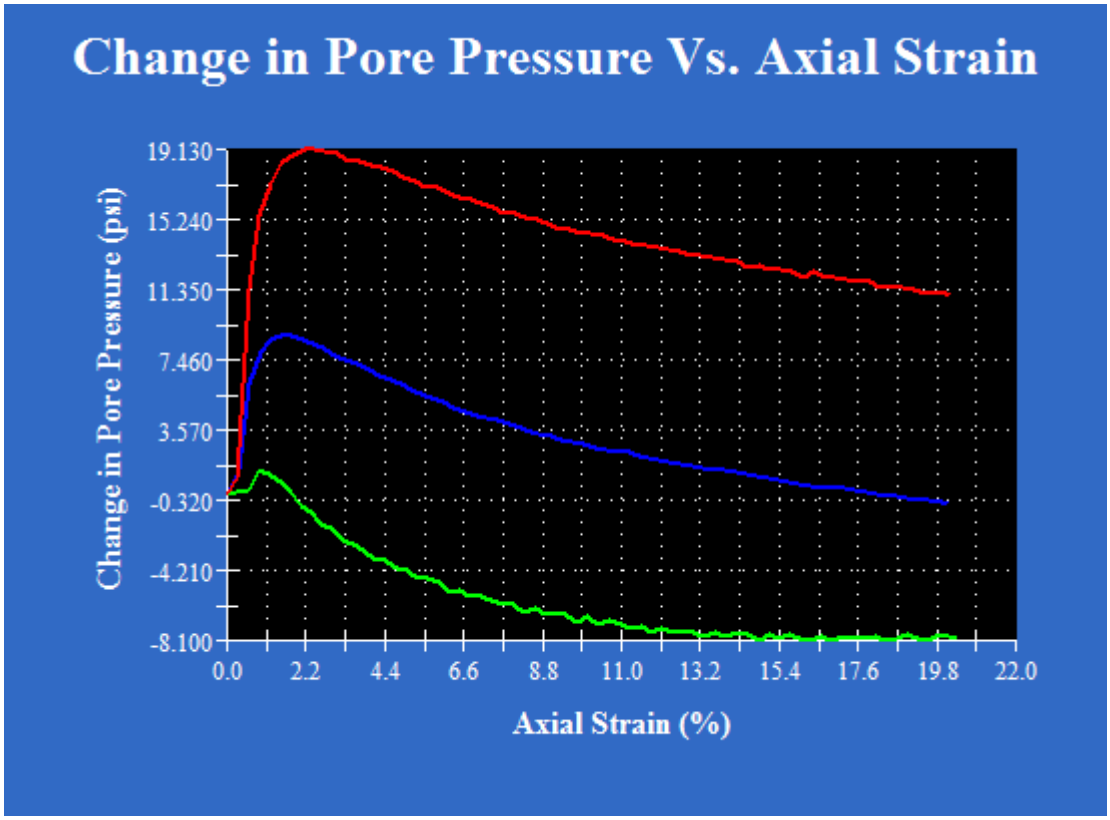


X-Axis - Axial Strain
Y-Axis - Deviator Stress

Graph Actions (located on toolbar above graph)
Toggle graphing of specimen on or off. By default all are on.

- Pore Pressure Percent Strain

The data for this plot is from the Shear stage.

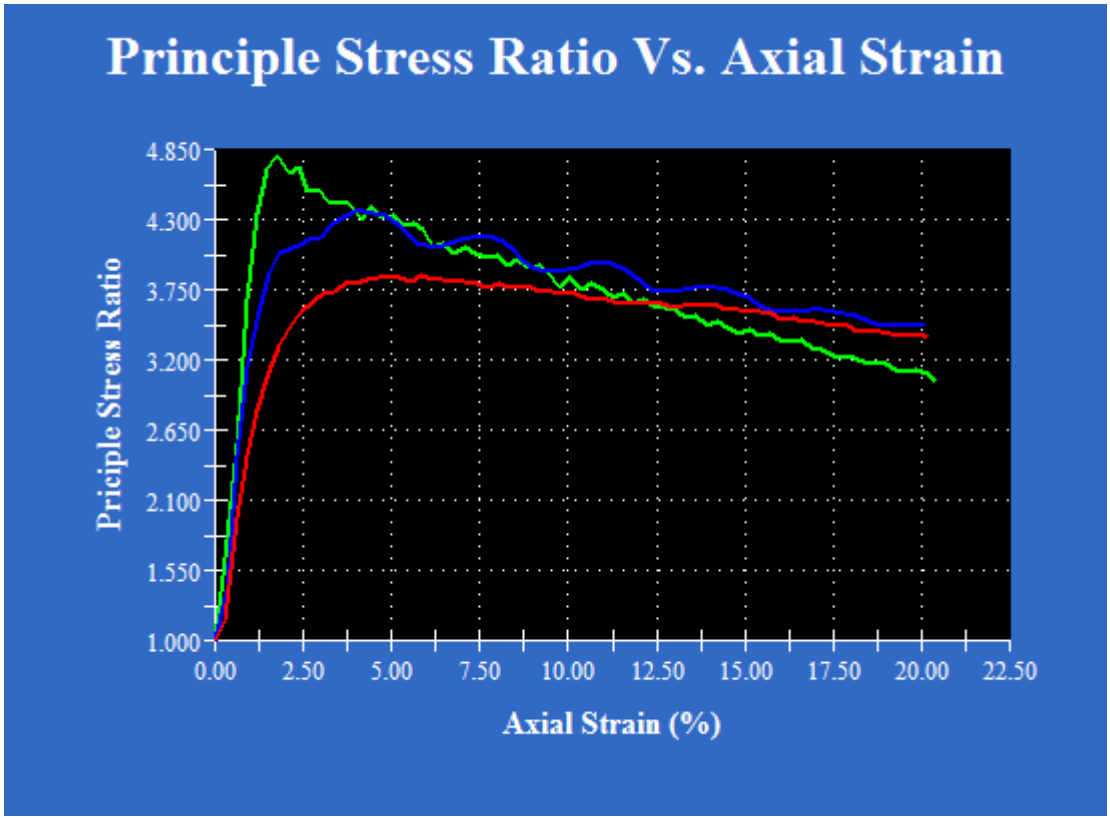


X-Axis - Axial Strain
Y-Axis - Change in Pore Pressure

Graph Actions (located on toolbar above graph)
Toggle graphing of specimen on or off. By default all are on.

- Principle Stress Ratio Percent Strain

The data for this plot is from the Shear stage.

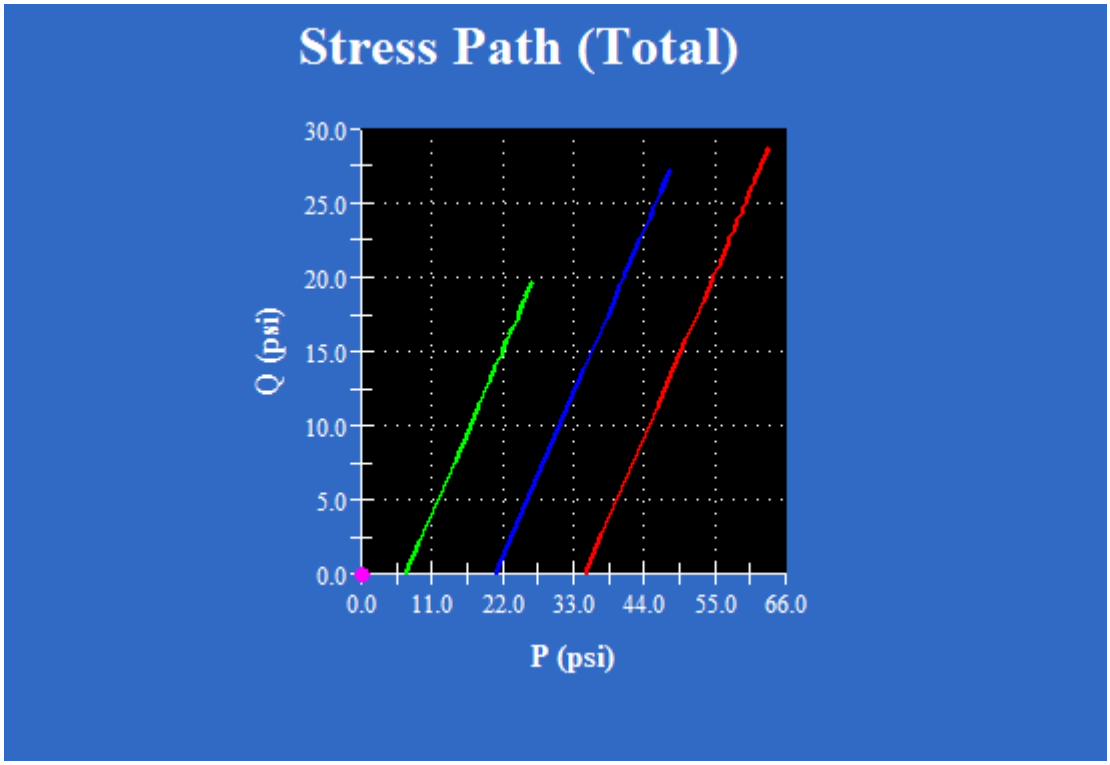


X-Axis - Axial Strain
Y-Axis - Principle Stress Ratio

Graph Actions (located on toolbar above graph)
Toggle graphing of specimen on or off. By default all are on.

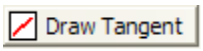
- PQ (Total Stress)

The data for this plot is from the Shear stage.



X-Axis - P
Y-Axis - Q

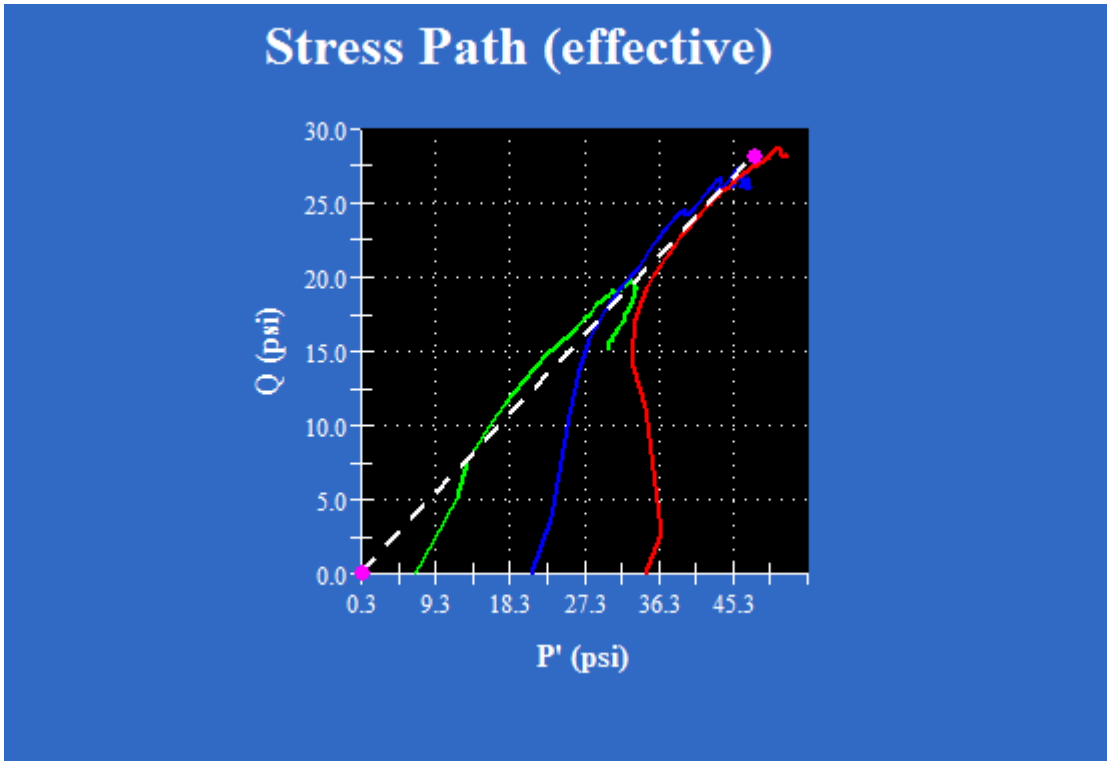
Graph Actions (located on toolbar above graph)
Toggle graphing of specimen on or off. By default all are on.



Use this button to draw a tangent line. From this tangent line the Strength Intercept and Friction Angle will be calculated.

- P'Q (Effective Stress)

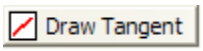
The data for this plot is from the Shear stage.



X-Axis - P'
Y-Axis - Q'

Graph Actions (located on toolbar above graph)

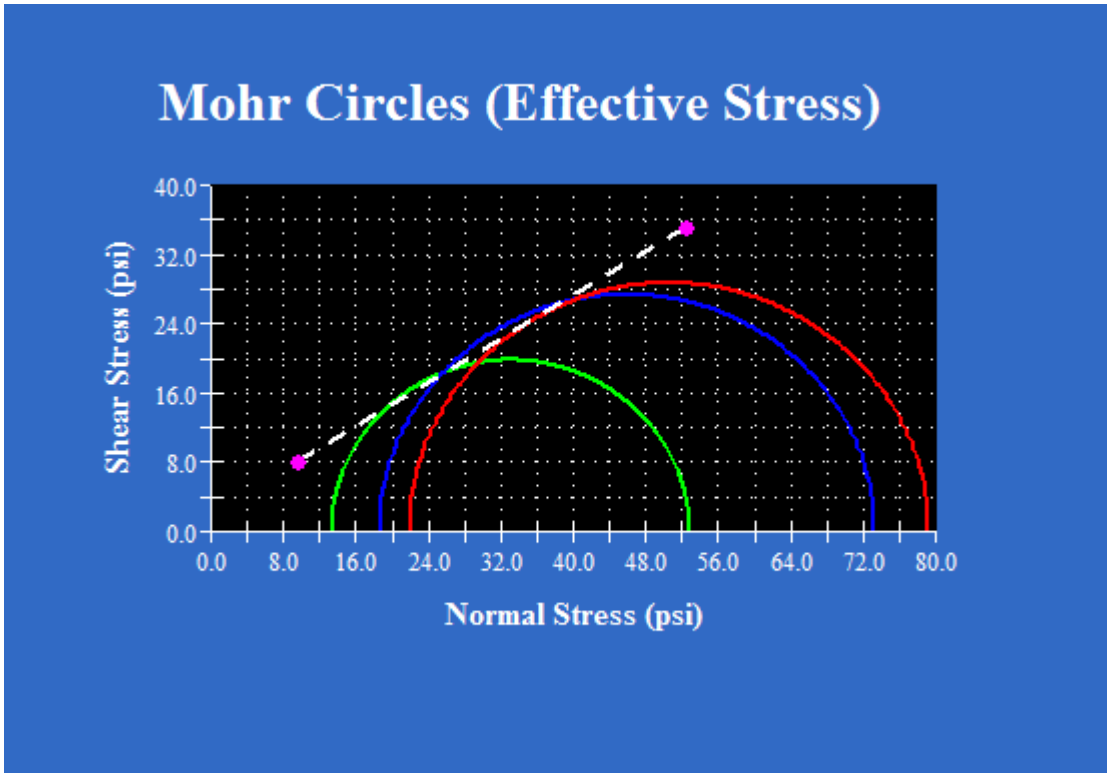
Toggle graphing of specimen on or off. By default all are on.



Use this button to draw a tangent line. From this tangent line the Strength Intercept and Friction Angle will be calculated.

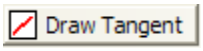
- Mohr Graph (Effective Stress)

The data for this plot is from the Shear stage.



X-Axis - Axial Strain
Y-Axis - Principle Stress Ratio

Graph Actions (located on toolbar above graph)
Toggle graphing of specimen on or off. By default all are on.



Use this button to draw a tangent line. From this tangent line the Strength Intercept and Friction Angle will be calculated.

Calculation Methods Tool

- Calculation method selection.

  Choose between Maximum Deviator Stress, Maximum Princople Stress Ratio, or Maximum Shear Stress (Axial Strain). This selection will determine how the Mohr circle is calculated.

- Values

  In the values section the tangent line can be cleared. Clearing the tangen line will erase the strenght intercept and friction angle values.

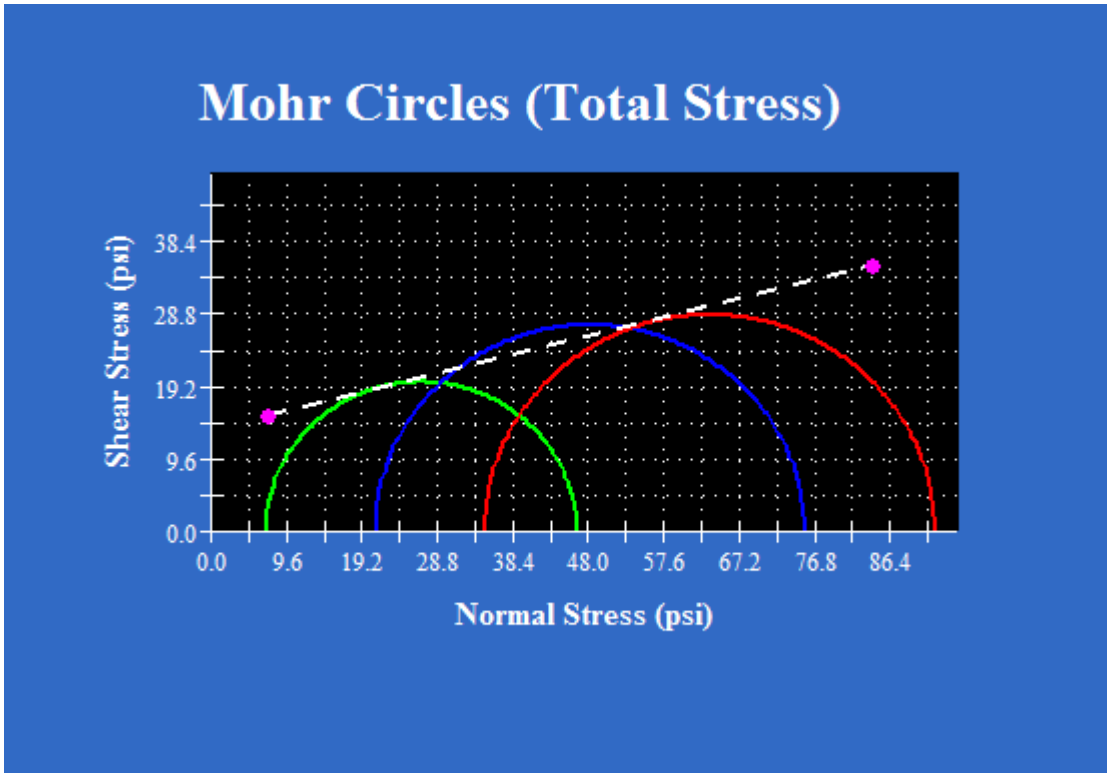
  In this section you can also view the values of axial strain, corrected deviator

stress, minor stress, major stress, and stress ratio. These values are maximum values determined by the selected calculation method.

- Use this drop down box to choose what calculation method will be used in the exported data.

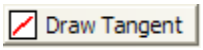
- Mohr Graph (Total Stress)

The data for this plot is from the Shear stage.



X-Axis - Axial Strain
Y-Axis - Principle Stress Ratio

Graph Actions (located on toolbar above graph)
Toggle graphing of specimen on or off. By default all are on.



Use this button to draw a tangent line. From this tangent line the Strength Intercept and Friction Angle will be calculated.

Calculation Methods Tool

- Calculation method selection.

Choose between Maximum Deviator Stress, Maximum Princople Stress Ratio, or Maximum Shear Stress (Axial Strain). This selection will determine how the Mohr circle is calculated.

- Values

  In the values section the tangent line can be cleared. Clearing the tangen line will erase the strenght intercept and friction angle values.

  In this section you can also view the values of axial strain, corrected deviator stress, minor stress, major stress, and stress ratio. These values are maximum values determined by the selected calculation method.

- Use this drop down box to choose what calculation method will be used in the exported data.

7.15 User Defined Test

7.15.1 User Defined Test

The User Defined Test was designed to allow users who have not purchased specific tests (or if a test is still under development) to perform tests using their equipment and the Humboldt Material Testing Software. The User Defined Test is very customizable, but lacks the power of a specific test. For example, there is no place to store sample information, and the exported report is very limited.

User Defined Test Features:

- Live tests (real time)
- Live graphing capabilities
- Review and export tests using Microsoft Excel
- Smart Test. Will automatically pick up where it left off if the test was not finished due to unexpected events within your computer.

More Information

- For Information on specimen setup sheets, goto User Defined Test Setup Guide 198.
- For Information about automated testing goto User Defined Test 197.
- For Information on specimen graph sheets, goto User Defined Graphs 202.

7.15.2 User Defined Test Setup Guide

HOWTO OPEN: To get to the test setup screen for a specific test, open the desired test or select a new User Defined Test. The Setup page will be the first page loaded.

To run an automated test you must setup the test parameters. The User Defined Test does not allow any specimen information data.

Once all the setup information has been filled in. If any setup parameters are incorrect you will be prompted. When you press the Run Test button, if you are running a new test or there is no data for this specimen the test will begin immediately. If data exists you be prompted whether you want to over write the data or not.

» The user defined test is not a multiple specimen test. You will need to run a new User Defined test for each specimen. If you use the same test for multiple samples you will overwrite any previously tested data.

User Defined Test Setup Parameters

To run a test with connected hardware, you will need to input test setup parameters.

Setup Explanation:

- Test Channels

  Instrument 1...4 Setup

  Select Device - Select up to four devices to be used with this test.
  Select Input - Depending on how many device you have selected, you will have to have a channe corresponding with that device. You can not use the same device and channel multiple times in the test.
  Monitor Instrument Calibration Limits - Select this to enable/disable monitoring calibration maximums. Disabling this will allow a test to disregard and continue running if the selected device and channel exceeds it maximum calibration.

- Logging Type

  Condition - Elapsed Time Table, Distance Table, Distance Interval, or Time Interval.

  Elapsed Time Table

  Value - The shear data points will be gathered using a user defined table of time intervals. Click on this box to setup a time table to use with your test.

Distance Table

Device - Device to gather points at specified distance intervals.
Input - Input of selected device to gather points at specified distance intervals.
Distance Increment - Is the motor going Up/Forward or Down/Reverse.
Value - The shear data points will be taken using a user defined table of distance intervals. Click on this box to setup a distance table to use with your test.

Distance Interval

Device - Device to gather points at specified distance intervals.
Input - Input of selected device to gather points at specified distance interval.
Distance Increment - Is the motor going Up/Forward or Down/Reverse.
Value - The data points will be continually taken at this interval.

Time Interval

Value - time (HH:MM:SS:m) when data points will be gathered. This will happen at the interval specified.

- Start Condition

Initial Reading(s)

First Point(s) Take at Trigger Value(s) - select this to record the point 0 values when the trigger occurs.
First Point(s) Taken at Initial Value(s) - select this to record the point 0 values test is activated. This mean point 0 data values could be recorded before the trigger value occurs.

Condition - Select Greater Than, Less Than, or Time Delay. Select None if you do not want to use a start condition and you would like to test to start immediately.

Greater Than or Less Than

Device - Device the start condition will occure on.
Input - Input on the device the start condition will occure.
Current Value - shows the current value the device and input selected are currently reading.
Value - when the device and input selected are greater than or less than this value the test will start.

Time Delay

Value - time (HH:MM:SS:m) to delay before the test will start.

- Stop Condition

  Stop Type - Others or User Stop.

  Others - Use this to select a stop condition.

  Percent Strain - When the axial strain reaches this amount. This is measured from when the test start condition is met.

  Percent Drop of Maximum Deviator Stress - When the deviator stress drops by the specified amount.

  User Stop - If you want to manually stop the test.

  Conidtion - Select Greater Than, Less Than, Time Delay, Distance (Up/Forward), or Distance (Down/Reverse).

  Greater Than or Less Than

  Device - Device the stop condition will occure on.
  Input - Input on the device the stop condition will occure.
  Value - when the device and input selected are greater than or less than this value the test will stop.

  Time Delay

  Value - time (HH:MM:SS:m) to delay before the test will stop. This is time from when the test start condition is met.

  Distance (Up/Forward) or Distance (Down/Reverse)

  Device - Device the stop condition will occure on.
  Input - Input on the device the stop condition will occure.
  Value - when the device and input selected have travelled this value the test will stop. This is the distance from when the test start condition is met.

- Motor Parameters

  Motor Type - Computer Controlled or None. Select none if you are not using a motor or if you are not using a Humboldt motor.

  Computer Controlled

  Device - Device that the motor exists on. NOTE: Only Humboldt hardware containing a motor can be controlled.

Value - speed in in/min or mm/min. When the test is activated, the motor will start, the motor will continue running throughout the entire test untill the stop condition is met.

Suggested Test Setups

- Consolidation Test

  Test Channels - Select a displacement channel.
  Logging Type - Typically a timer interval or time table.
  Trigger Condition - Slightly larger than current displacment value.
  Stop Condition - User Stop.
  Motor - None

- Direct Shear Test

  Consolidation Phase

  Test Channels - Select a displacement channel.
  Logging Type - Typically a time interval or time table.
  Trigger Condition - Slightly larger than current displacment value.
  Stop Condition - User Stop.
  Motor - None

  Shear Phase

  Test Channels - select force, horizontal deformation, and vertical deformation device.
  Logging Type - Distance interval.
  Trigger Condition - Anything larger than current horizontal deformation.
  Stop Condition - Distance using horizontal deformation.
  Motor - Use.

- Marshall Test

  » DO NOT perform a Marshall Test with the user defined test. Data needs to be read to quickly. It is recommended that you purchase the Marshall Test (HM-3005SW) software module.

- CBR/LBR Test

  Test Channels - Select a load and displacement channel.
  Logging Type - Distance interval of every 0.025 inch or 0.635 mm
  Trigger Condition - Current Load + 10 lbs or 0.0044 kn
  Stop Condition - Distance travel of 0.5 inch or 12.7 mm
  Motor Condition - Set speed according to standard.

- Unconfined Compression Test

  Test Channels - Select a load and displacement channel.
  Logging Type - Typically a time interval.
  Trigger Condition - Slightly larger than current displacment value.
  Stop Condition - No specification.
  Motor - Use

- Unconsolidated Undrained Triaxial Test

  Test Channels - Select a load and displacement channel.
  Logging Type - Typically a time interval.
  Trigger Condition - Slightly larger than current displacment value.
  Stop Condition - No specification.
  Motor - Use

- Consolidated Undrained Triaxial Test

  Test Channels - Select a load, displacement, and pressure channel.
  Logging Type - Typically a time interval.
  Trigger Condition - Slightly larger than current displacment value.
  Stop Condition - No specification.
  Motor - Use

7.15.3 User Defined Graphs

The User Defined tests lets you setup up to four different graphs for a test. Only one graph can be viewed at a time, and the graphs parameters for all four graphs are stored and loaded the next time you open that User Defined test. Graphs viewed in the User Defined test are not exported to Excel, if you would like more comprehensive graphs call Humboldt about purchasing test modules.

Setting Up a Graph

1. Locate the plot you would like to setup in the project navigation pane (Plot 1 ... Plot 4).
2. Select what you would like the X-Axis to represent. If you have not already clicked on the plot, the plot you are setting up will be shown. Both X-Axis and Y-Axis need to be set to see a graph correctly.

   Linear Time - Elapsed Time from tabulated data.
   Logarithmic Time - Logarithmic representaion of Elapsed Time from tabulated data.
   Square Time- Square root of Elapsed Time from tabulated data.

   Instrument 1..4 Selections - Will let you graph with any of the instruments selected in the test setup. Only items tested with will be graphed.

3. Select what you would like the Y-Axis to represent.

   Linear Time - Elapsed Time from tabulated data.

   Instrument 1..4 Selections - Will let you graph with any of the instruments selected in the test setup. Only items tested with will be graphed.

Humboldt Material Testing Software Manual

Part VIII

8 Appendix A: EPROM Replacement

8.1 Front Panel EPROM Replacement

Follow these steps to replace the EPROM in your machine.

Step 1: Turn off power to machine.

Step 2: Unplug power cable from machine or outlet.

Step 3: If you are using a HM-3000 or HM-2560, unscrew front panel (Figure 1). Anything else will be in plastic housing and the top cover can be taken off using a screwdriver to depress the clips on the sides (Figure 2).

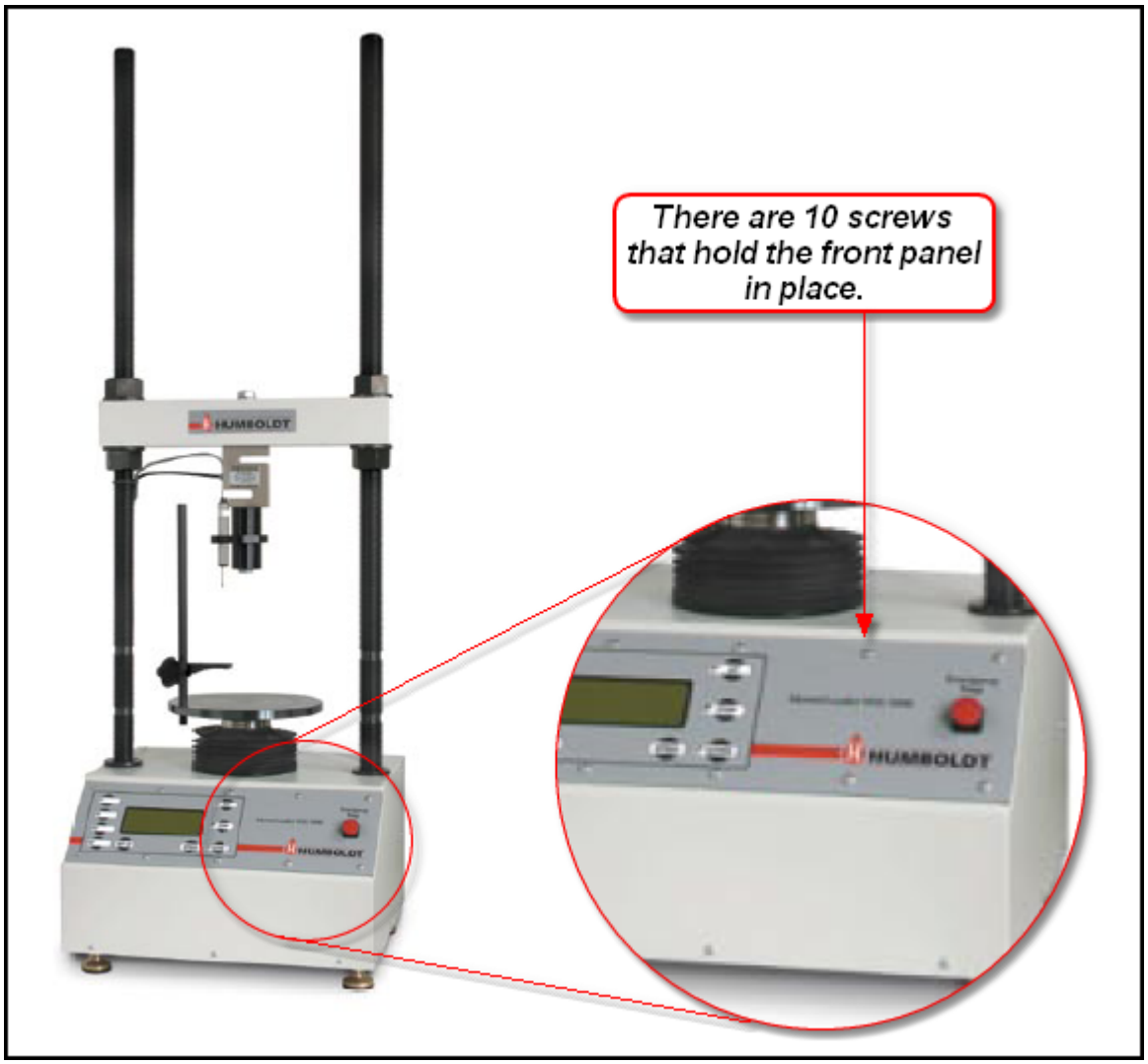


Figure 1: Finding the screws on the front panel of a HM-3000 MasterLoader.

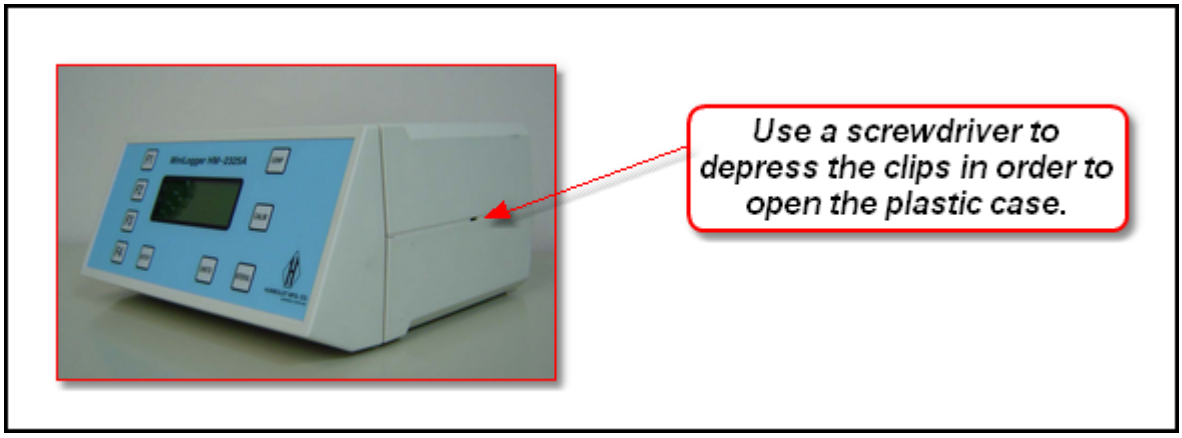


Figure 2: Finding the clips on the side of a HM-2325A MiniLogger.

Step 4: Set the front panel facing down (so that the circuit board is facing upwards). Find the blue socket and press the tabs outward to release the EPROM.

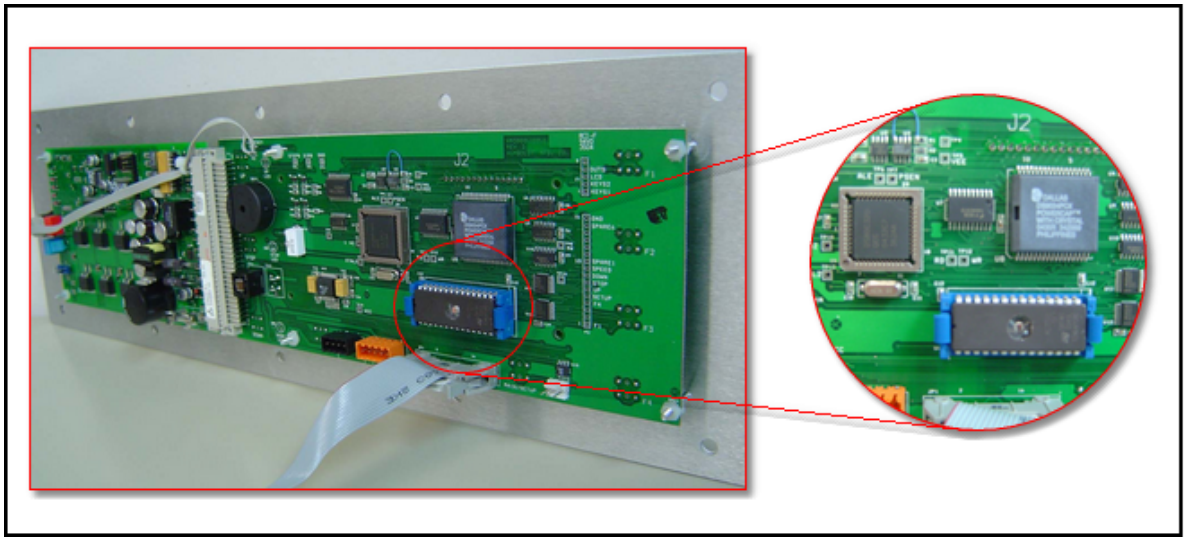


Figure 3: Finding the EPROM. (HM-3000 panel shown above)

Step 5: Pull the old EPROM out, noting the orientation of pin 1. Pin 1 side of EPROM will have a groove on one side of chip.

Step 6: Install new EPROM making sure that the groove indentation on the chip is pointing in the same direction as the pin 1 indicator on the board. The pin 1 indicator will be a number 1 printed on the circuit board.

Step 7: Press the chip into the socket making sure not to bend any pins.

Step 8: Replace the front panel by screwing it back on, then plug in the power cord and turn the machine on.

» **You have now successfully replaced the EPROM.**

8.2 Back Panel Processor Replacement

Follow these steps to replace the back panel chip in your machine.

» **CAUTION: Replacing the back panel processor will cause your calibrations on all channels to be lost. Be sure your calibrations are stored in the HMTS software; if they are not, retrieve your calibrations into the HMTS software. If your hardware is not connected to a PC, you will need to contact Humboldt Scientific, Inc. about calibration or have the channels recalibrated by a qualified person.**

Step 1: Turn off power to machine.

Step 2: Unplug power cable from machine or outlet.

Step 3: If you are using a HM-3000 or HM-2560, unscrew back panel. Six screws will need to be removed. Anything else will be in plastic housing and the top cover can be taken off using a screwdriver to depress the clips on the sides (Figure 1).

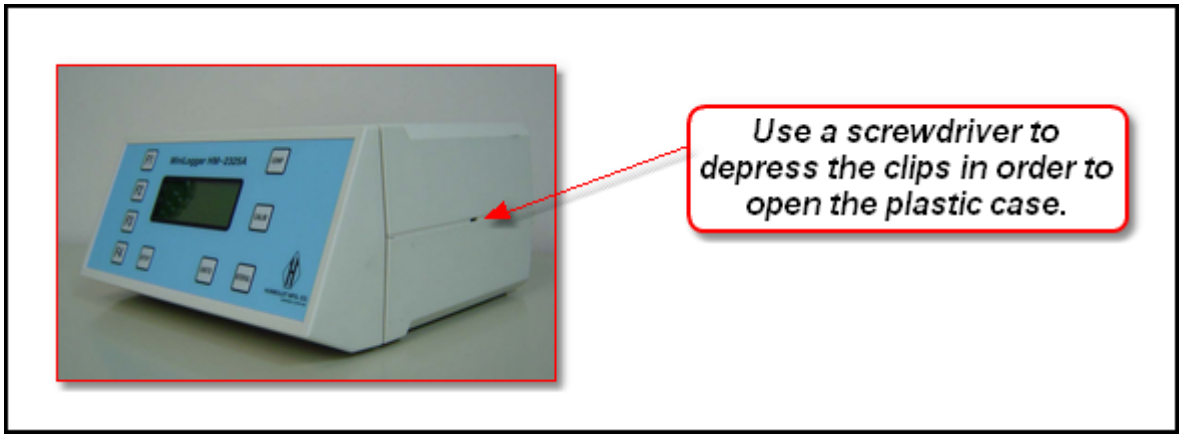


Figure 1: Finding the clips on the side of a HM-2325A MiniLogger.

Step 4: Set the back panel facing down (so that the circuit board is facing upwards). You will need to remove the ribbon cable connected to the back panel. Depress both latches on either side of the ribbon cable socket, this will allow the ribbon cable to be removed.

CAUTION: Please make sure that the processor you received from Humboldt matches the same type of processor that is currently in your system. If you received a processor of type AT89S8253 and your machine has a processor of AT89S8252 or vice-versa, do not install the new processor. Please contact Humboldt Scientific (1-800-537-4183) for a different processor.

Step 5: Find the square socket and using the chip puller provided by humboldt, pull the processor from its socket. You will see in the socket on the board that there are two rectangular slots, the puller teeth will be inserted into these rectangular slots (Figure 2). Push the puller in, squeeze the tool while pulling out, and the processor should come out.

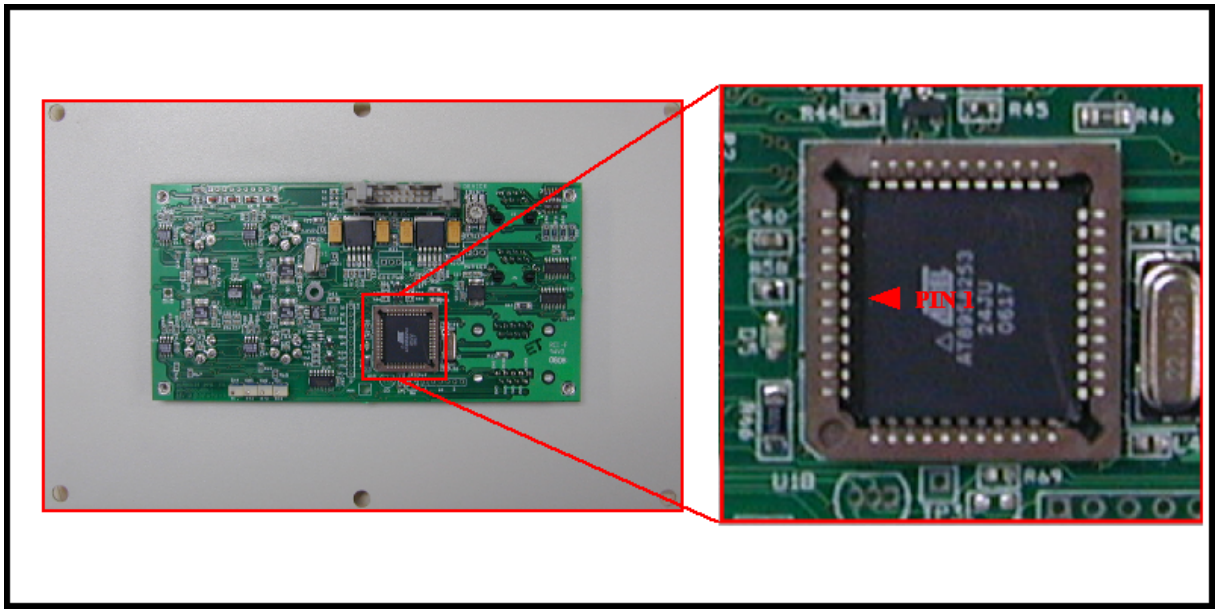


Figure 2: Finding the processor. (HM-3000 back panel shown above)

Step 6: Pin 1 of the new processor will be circular indention on the beveled edge of the processor. (Figure 3).

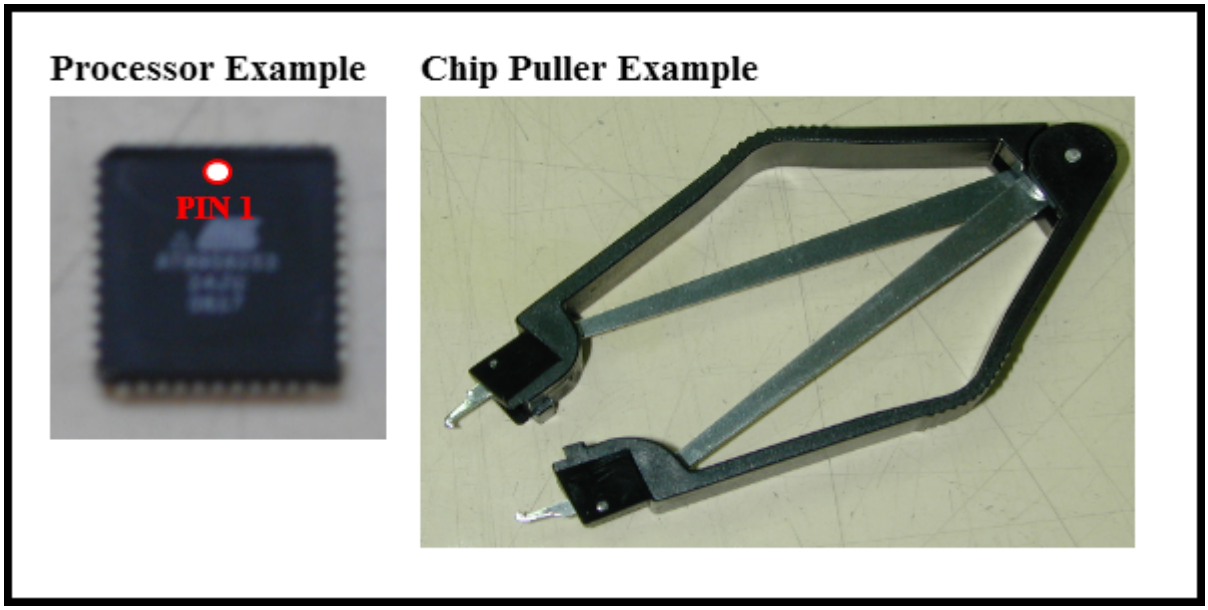


*Figure 3: E*xample of processor and puller.

Step 7: If you look at the socket you pulled the processor from, you will see a small triangle in the socket. This triangle represents pin 1 of the socket. Install the new processor so the circle mentioned in step 6 aligns with the triangle (Figure 2 and Figure 3). If you can't find the triangle symbol in the socket, install the new processor with the angled corner of the processor aligned with angle corner of the socket.

Step 8: Press the processor into the socket.

Step 9: If the ribbon cable was removed, reconnect that. Replace the back panel by screwing it back on, then plug the power cable back into the machine.

Step 10: Turn the machine back on, you should hear the startup beeps.

Step 11: Turn off the machine, hold the F4 button down. Keep holding the F4 button down while you turn on the power. You will here four quick beeps, you can now let go of the F4 button. Next you will here four more beeps which are the normal startup beeps.

Step 12: Next you need to start the HMTS software. Using the calibration managment tool, transfer your calibrations back to the hardware.

» **You have now successfully replaced the back panel chip.**

» **NOTE: PLEASE RETURN THE PULLER, IF NOT RETURNED YOU WILL BE**

CHARGED FOR THE TOOL.

Index

- A -

- B -

- C -

- D -

- E -

- F -

- G -

- H -

- I -

- L -

- M -

- N -

- O -

- P -

- R -

- S -

- T -

- U -

- V -

- W -

Thank you for using Humboldt Material Testing Software in conjunction with your Humboldt product(s). If you have any questions or suggestions regarding this manual, please feel free to call Humboldt Scientific, Inc. at (800) 537-4183.

Humboldt Scientific, Inc.
551-D Pylon Drive
Raleigh, North Carolina 27606
USA