

INSTRUCTION MANUAL
VFD AUTOMATIC CONTROL

COMPRESSION TESTING MACHINE

MN-VFD.24.1

WWW.FORNEYONLINE.COM

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SUPPORT & CONTACT INFORMATION

Support Ticket:

The fastest way to get technical help is through our support ticketing system. Click this link to complete the form and our support team will get you answers ASAP:

<https://forneyonline.com/customer-service/>

General Phone Support:

We still believe in service defined by a helpful voice at the other end of the phone. Our technical team is available for unlimited general product support inquiries on all the equipment we manufacture. Reach us via phone or email: Monday – Friday 8:00 AM to 5:00 PM Eastern

Phone: 724-346-7400 | Toll-Free: 800-367-6397

We offer unlimited Remote Technical Support for all Forney Testing Machines during the two-year warranty period. Please have your machine model and serial number available. After that period, we continue to offer General Phone Support, but Remote Technical Support invoices at \$150 per occurrence.

For ForneyVault® subscribers, post warranty remote technical support fees are waived for the life of your subscription.

Explore Our Knowledge Base:

Browse our knowledge base for informative articles to help you use, maintain, and troubleshoot Forney testing machines: <https://knowledge.forneyonline.com/>

FORNEYVAULT - Essential Concrete Testing Platform

Make your machine smart – enable two-way data communication by accessing information and making it available for the testing process. Connect your machine seamlessly to LIMS packages, QC software and other third-party software participating on the ForneyVault platform. ForneyVault enabled machines help control the workload, and make your technicians smarter and more productive, with fewer costly errors.

A smart machine can:

- Enable intelligent workflows
- Enable Bar Code Scanning capability to identify the specimen to be tested
- Validate specimen geometry
- Calculate proper preload settings – based on actual and/or expected strength
- Calibration Monitor provides notification of impending calibration requirements
- Discard Dashboard provides context enabled specimen management for untested specimen disposal
- decisions.
- Notify you that a correction factor should be used
- Notify you of individual low breaks
- Notify you of excessive variance among several specimens



Learn more @ [ForneyVault.com](https://www.forneyvault.com)

Get More Out of Your Materials Testing Lab

WARNINGS / CAUTIONS

ONLY QUALIFIED PERSONNEL MAY OPERATE EQUIPMENT TAKING NOTE OF THE FOLLOWING

MOVING PARTS CAN CRUSH AND CUT – Keep hands clear of moving parts while operating machinery!

WEAR SAFETY GLASSES WHILE OPERATING EQUIPMENT – Always wear safety glasses while operating machinery!



FORNEYLINK TOUCHSCREEN INTERFACE



ForneyLink™ Touchscreen Interface is a powerful device which enables setup of testing protocol, real-time display of test data, and post-test data transfer.

The operator can navigate options for:

- Test Run
- Test Setup
- Machine Setup
- Calibration
- Reporting and Data Transfer
- Diagnostics

Provides simultaneous display of force, stress, and rate of load and displays a real-time graph of Load vs. Time, or Stress vs. Strain.

Paired with other Forney products, such as ForneyVault™, it can offer secure automatic cloud data management or fully integrate with most existing Lab Information Management Systems (LIMS). Please contact Forney for more information.

ForneyLink™ is equipped standard with WIFI, USB inputs, and (2) LAN ports. The power switch is located in the lower corner. Always turn off the ForneyLink™ system by momentarily pushing the power switch. This will initiate the operating system to shut down and prevent data loss or file corruption. Once the shutdown process has completed, the PWR LED will extinguish and line power can be disconnected. If being installed in an area with poor power reliability, Forney recommends the use on an uninterruptable power supply. (UPS)

FORNEYLINK TOUCHSCREEN INSTALLATION

Mounting the ForneyLink Touchscreen

1. For security, the ForneyLink is shipped separately and will need mounted to the test machine.
2. Unbox ForneyLink. It is recommended to save the box for the touchscreen as it is custom designed for shipping the ForneyLink if it needs servicing.



3. Remove the screws, washers and lock washers from the back of the ForneyLink and set aside.
4. Line up the touchscreen with the mounting bracket. There are two sets of four screw holes on the mounting bracket. The touchscreen utilizes the inner set of holes.

5. Put one screw in to hold the touchscreen. Finger tighten this screw. Once one screw is holding the touchscreen, align and finger tighten the remaining three screws.



6. Once all screws are in place, tighten all screws. Care should be exercised to not over-tighten.



7. Connect the power plug, round load signal cable and VFD cable DB9 connector to their respective ports on the ForneyLink. Tighten the screws on the DB9 with a screwdriver so they are snug, but do not over-tighten these screws.



8. If your machine has additional USB connections for factory-installed options such as MOE, it is important to note that only the blue, USB 3.0 connector should be plugged into the blue USB 3.0 port on the ForneyLink. You can connect other connectors to any available USB ports on the ForneyLink, except for the blue, USB 3.0 port.

Connections & Set-up

To complete machine installation, perform the following tasks:

1. Most integrated VFD machines involve one hydraulic connection to the main ram that is already completed at the factory. If the machine is an optional dual frame type, one additional hydraulic connection will need connected from the other frame to the AB valve below the pump assembly.
2. Integrated VFD machines have an over-travel limit protection switch preinstalled from the factory. If the machine is an optional dual frame model, a twist lock connector is included to connect the preinstalled switch from the additional frame. Shown below is the female connector already wired to the VFD control panel. The male connector is shipped with the machine and needs to be wired to the limit switch. Make sure to also check the over-travel protection is turned on in the Forney software.



3. Install any other electronic devices ordered if applicable (i.e. LDTs, position sensors, etc.)
4. Once all hydraulic connections have been made, check the reservoir for hydraulic fluid. Machines are typically shipped with hydraulic oil, but add hydraulic fluid to reservoir if necessary. Fluid type is the readily available **Dexron III or VI automatic transmission fluid**. A full reading is 2" below the top of the reservoir with the machine fully retracted.
5. Connect power to the machine by plugging in the standard wall plug. Check the stamped metal ID nameplate for voltage requirements.

NOTE: GFCI protected outlets should not be used. Nuisance tripping may occur due to the high frequency switching of the VFD drive.

MACHINE CONTROL SYSTEM OVERVIEW

Overview

There are two major components that make up the control system of this machine: the ForneyLink touch-panel and the Variable Frequency Drive (VFD). The ForneyLink allows you to set up and run the machine, as well as view, analyze, and export test data. The touch-panel design allows for intuitive setup and use of the machine. The VFD controls the motor speed allowing very efficient use of hydraulic power.

Startup

When the machine is plugged in power is supplied to many of the components. If the machine will be off for a long period of time, for example a few weeks or more, it is recommended to unplug the machine.

The ForneyLink has a power button in the bottom left corner that is used to turn it on or off. Once power is applied to the ForneyLink, a booting sequence is started and will last about 30 seconds to two minutes. When the booting is complete, the ForneyLink will finish by loading the FORNEY automatic software package.

To turn the ForneyLink off, momentarily push the power switch. This will initiate the operating system to shut down and prevent data loss or file corruption. Once the shutdown process has completed, the PWR LED will extinguish and line power can be disconnected. The system is designed to let power remain on the other components. If the system will be off for a long period of time, it is acceptable to unplug the machine after the above shutdown procedure.

Emergency Stop (E-Stop)

This button is a safety feature of the machine. If something unexpected happens while the machine is running, the E-Stop button can be pressed. Pressing this button removes all output power from the system. This means that the hydraulic pump motor will stop, and all controls and solenoids will return to their default positions. This button should be used in emergency situations to kill hydraulic power on the machine. The button “locks” after being pressed and must be twisted to be reset. Tripping the E-Stop is recommended during routine maintenance or service of the system, for example changing hydraulic oil.

After the emergency condition has been addressed, the E-Stop button can be reset. The diagnostics screen will report when the E-Stop is activated by turning red. It may be necessary to press the RESET DRIVE button on the diagnostics screen to resume testing after an E-Stop condition.

The following sections describe the operation of the ForneyLink touchscreen with standard software installed. If your machine is equipped with ForneyVault[®], the basic operation will be the same but you will notice many additional features.

Please contact Forney to learn more about these features.

CONTROL SYSTEM | MAIN / TEST RUN SCREEN

The “Main/Test Run” screen is the base screen where testing is performed. It provides access to setup, calibration, diagnostics, and reporting.

The screenshot displays the Main/Test Run screen with the following elements:

- Left Column:** Jog Advance, Retract, Show Graph, Start Test, Stop Test buttons.
- Top Center:** This Specimen: 3
- Center:** Load: 0 lbf, Stress: 0 psi, Max Load: 0 lbf, Max Stress: [] psi, Ramp Rate: [] psi/s
- Right Column (Cylinder):** DiamAvg: 4 in, LengthAvg: 8 in, Age: 28 days, Weight: 0 lb, Density: 0 lb/ft³, Corr. Factor: 1
- Right Column (Compression):** Preload: 500 psi, Ramp Rate: 35 psi/s, Break Pct.: 50 %, Test Stop: None, Ask for Break Type?
- Bottom Bar:** 1:11:43 PM 9/30/2022, English, Diagnostics, User Info, Verify Calibration 9/30/2022, Machine Setup, Generate Report Transfer

ForneyLink On-Screen Buttons

Jog Advance – This allows the user to jog advance the main ram. The ram only moves while the button is being pressed. Therefore, the button must be held to advance. Releasing the button will stop the advance and hold the ram in position. The button is green while being pressed and yellow when holding.

Retract – This allows the user to retract (dump hydraulic pressure). Pressing the button will open the valve and dump all system pressure. It does not need to be held – a single press dumps the system.

Start Test – When a test is ready, press this button to start the test. During Preload, this button will be yellow. When a test is running, this button will be green.

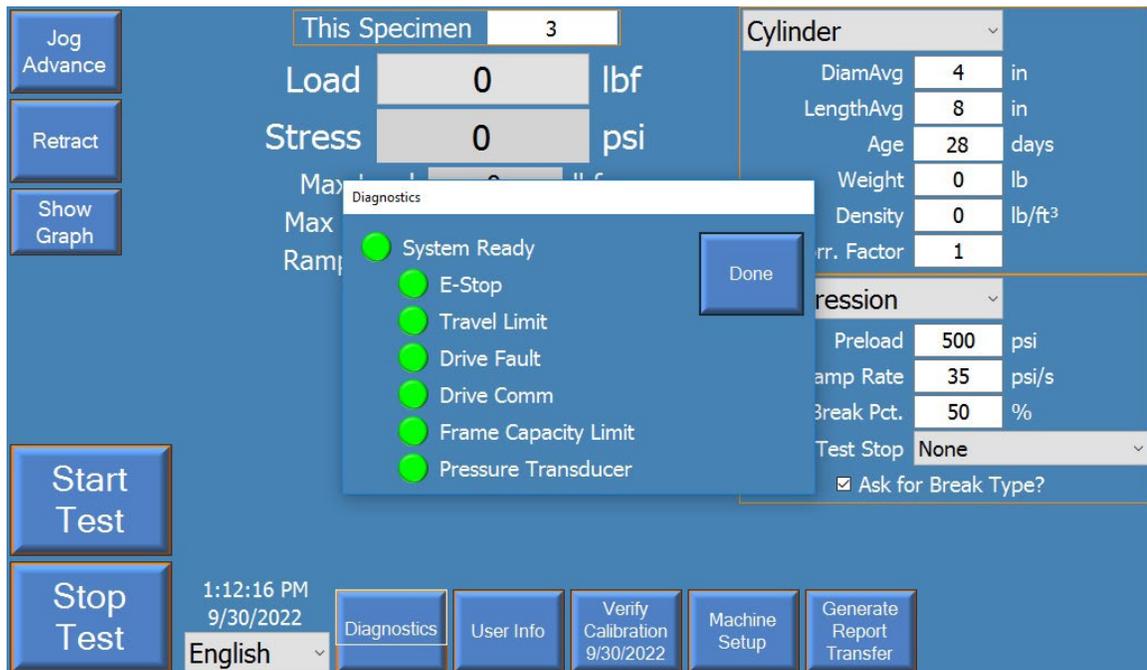
Stop Test – During preload, a running test, or while paused, the **Stop Test** button can be pressed to stop the test. Pressing the button will stop the motor and open the dump valve to dump all system pressure.

Load – Displays active load. Also allows user to tare or zero the system load/stress. Press on the active load to tare.

Show Graph – Shows a graph of the test when pressed. Button changes to “**Hide Graph**” when a graph is displayed. Press the button to close the graph in this state.

Diagnostics – Allows a user to see the status of the E-Stop button, the VFD Drive, the pressure transducer, and the over-travel limit switch. The diagnostic button will show red if there is a problem or activated item. Pressing the button brings up the screen below. A green indicator means the item is ready, while a red indicator means that the item is in a fault condition. You need to resolve any faults to achieve a green “System Ready” before you can proceed with testing.

The diagnostics screen for your system may have additional items to accommodate special features such as MOE, secondary frame or displacement.



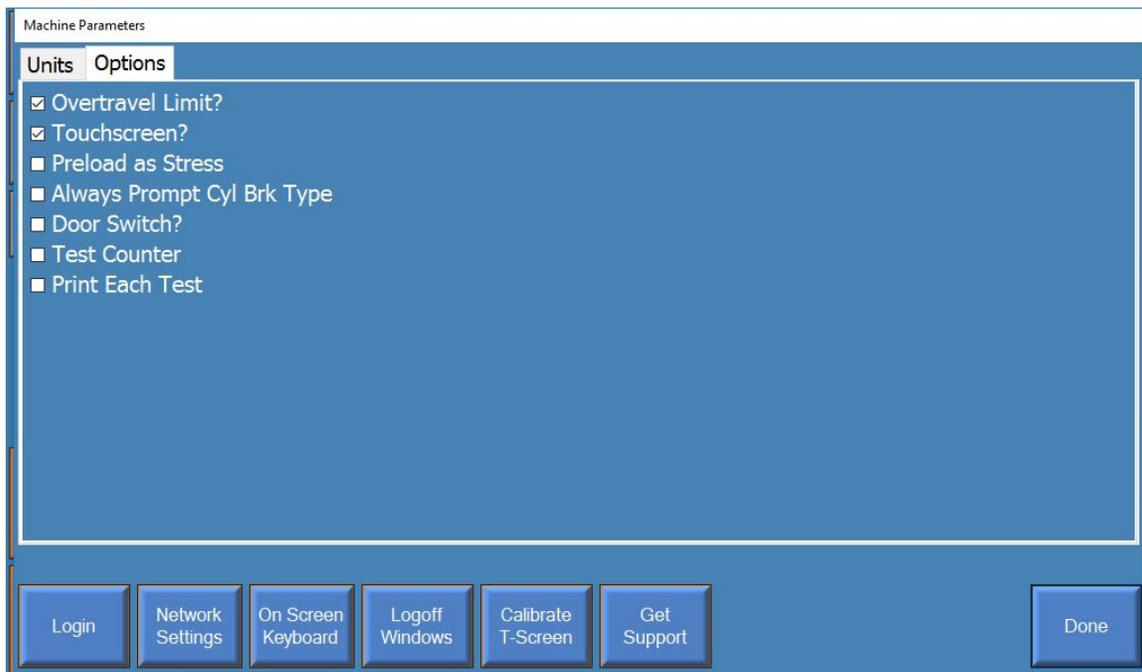
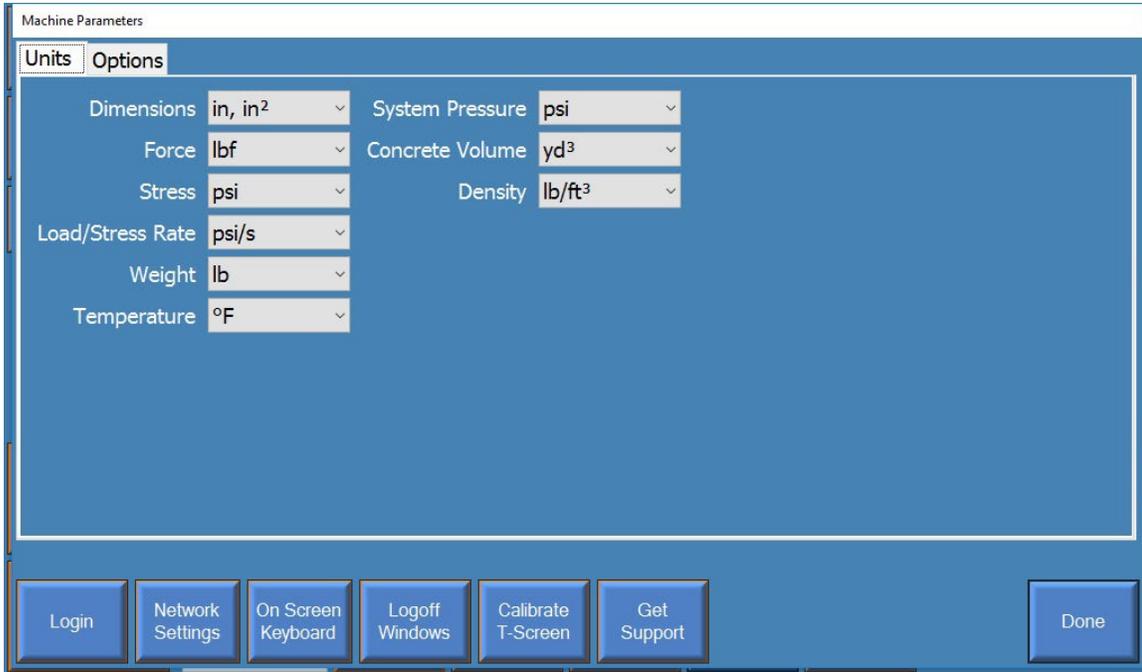
User Info – Allows the user to enter and store various name, company, address, and other reporting information.

The screenshot displays the 'User Information' dialog box within a software interface. The dialog box is titled 'User Information' and contains the following fields and values:

- Machine Owner:
 - Name: Forney
 - Company: Forney, LP
 - Address1: 2050 Jackson's Pointe Court
 - Address2: (empty)
 - City: Zelienople
 - State: PA
 - ZIP: 16063
 - Phone: 724-346-7400
 - URL: <https://forneyonline.com/>

A virtual keyboard is overlaid on the right side of the dialog box, featuring keys for letters, numbers, and symbols. The background interface includes a 'Jog Advance' button, a 'Load' field with '-526 lbf', a 'Diameter' field with '4 in', and a 'Cylinder' dropdown menu. At the bottom, there is a 'Stop Test' button and a row of navigation buttons: 'Diagnostics', 'User Info', 'Verify Calibration 9/29/2022', 'Machine Setup', and 'Generate Report Transfer'. A date field shows '9/30/2022' and a language dropdown is set to 'English'.

Machine Setup – This brings up a screen that contains various units of measure and machine options. A user can toggle on/off the checkbox for either the touchscreen or the Overtravel limit switch detection. It is strongly recommended to leave the Overtravel limit switch detection on if the frame is equipped with the device.



Verify Calibration – This button allows access to the verification and calibration screens. Calibrating and verifying the machine allows accuracy exceeding ASTM E4 requirements. This menu is discussed in detail in the Calibration section.

Generate Report/Transfer – This button is used to reprint specimen reports, create summary reports, and transfer data files to an external USB flash drive.

Display Fields

Load – This is the current live load measured at the machine’s main ram. This is a calculated value based on the hydraulic pressure at the ram, and the diameter of the ram. This value can be reset at any time (press live value to tare), other than when a test is running. Resetting the value allows for compensation for materials placed on the ram that do not exert force on the test specimen.

Stress – This is the current live stress measured at the machine’s main ram. This is a calculated value based on the calculated load and the surface area of the specimen (or other method per applicable ASTM or other standard). Other than when a test is running, this value can be reset at any time by pressing the live Load value. Resetting the value allows for compensation for materials placed on the ram that do not exert force on the test specimen.

Max Load – This is the peak load encountered by the specimen since it was last reset. This value is reset at the beginning of every test.

Max Stress – This is the peak stress encountered by the specimen since it was last reset. This value is reset at the beginning of every test.

Ramp Rate – This is a display of the current ramp rate during a test.

This Specimen – The ID for the currently running test, or the last completed test. This must be an integer on standard machines. ForneyVault® enabled machines have many more options for data storage hierarchy including projects and locations, samples, sets, etc. Please contact Forney to learn more. To change the ID, press on this field.

Specimen Setup

SPECIMEN DROP-DOWN BOX – Select the specimen/test type to be run. This allows access to various specimen setup input parameters. Care should be taken when entering the dimensions as specimen stress is calculated from this parameter.

TEST DROP-DOWN BOX – Select the test to be run. For most machines, the only test available will be compression. However, machines that have additional options, such as MOE will have additional test types, depending on the specimen type selected.

Care should also be taken when entering the following three important setup parameters:

1. **Break %** = Percentage threshold of the peak load used to detect a specimen break. For example, if the Break % is set at 70%, and the system maximum load is 100,000 lbs., a drop to 70,000 lbs. or less would trigger break detection. (70% or below max load of 100,000 lbs.)

Care must be exercised if this setting is set too high or too low. For example, if 95% was selected, the system may stop the test when a chip breaks off a corner. Full breaking stress may never be reached. Alternatively, if the percent is too low, the system may never detect breakage and thus not stop and retract at the end of a test. Forney recommends a Break % from 50% to 70% for most applications.

2. **Ramp** = Ramp rate desired. This value should be set based on testing standard.
3. **Preload** = Load threshold in which to perform rapid advance to, before controlling at the desired Ramp rate. This value is the load before data collection begins. During **Preload**, no break detection is applied. It is important to select a **Preload** value that is high enough so that break detection is not activated prematurely. In most applications **Preload**, should not be set lower than 1% of a testing machine's capacity. Note: ASMT C39 allows a fast advance up to 50% of the anticipated break strength before controlling at 35psi/s.
4. **Test Stop** = This option allows the operator to stop the test at a pre-determined load or stress rather than breaking the specimen. It is not used for most testing.

Other parameters:

Correction Factor – Per ASTM C39, only used for specimens that are not standard diameter vs length. When activated, the correction factor is applied to displayed values. A value of 1 should be used when diameter vs. length does not require applying a Correction Factor.

Break Type – Used to store the break type according to ASTM C39. When the checkbox “Ask for Break Type?” is selected the system will prompt the user to choose the break type at the end of each test

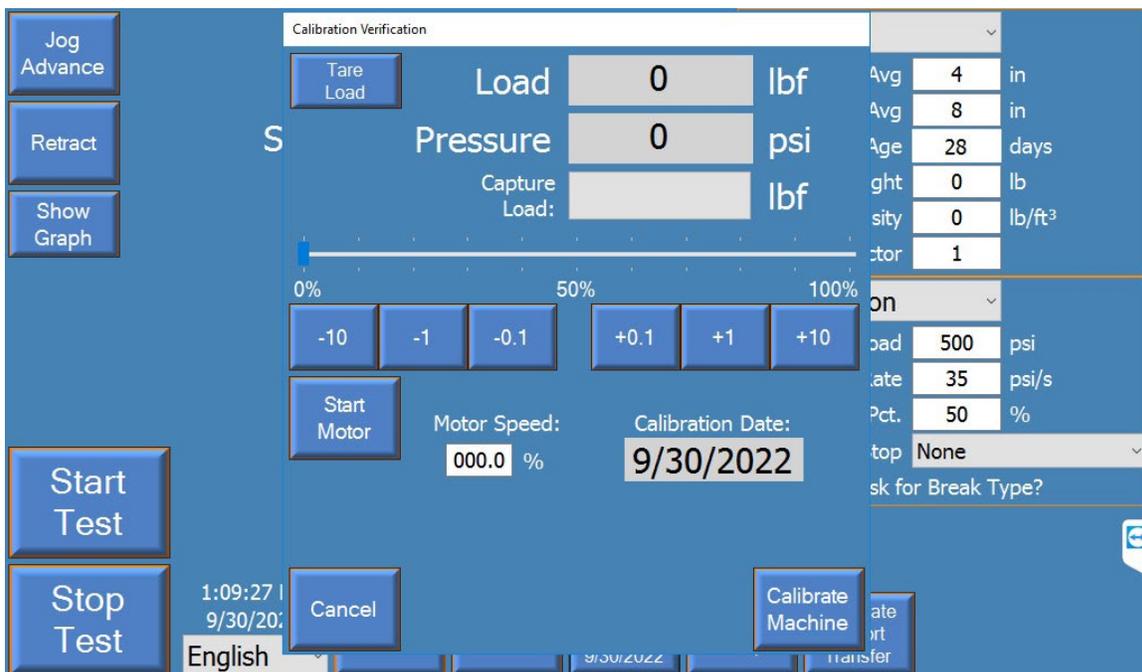
Note: ForneyVault® enabled machines automatically get all specimen setup information as entered when the specimen was created in either the lab information management system or via ForneyTools, the ForneyVault® web interface.

CALIBRATION AND VERIFICATION

Before the machine can be used, it must be properly calibrated and verified. While FORNEY machines are always factory calibrated and verified, ASTM E4 requires the machine to be verified in its final location. Verification is completed on the “Verify Calibration” screen. If necessary, calibration is performed by pressing the Calibrate Machine button on the verification screen. Please note the user must have the proper password to calibrate the machine. Please contact FORNEY technical support for the proper password.

The Load Display, Tare Load Button, Capture Load Button, Motor Speed %, Start/Stop Motor and Quick Adjust Buttons, are all used during verification.

The general process for verification is to apply load to an ASTM E74 certified load cell and verify the applied load matches the load on the machine indicator. The Capture Load button is pressed while watching the load cell to allow easy precise capture of load. The motor speed is adjusted identically to the following calibration section. Follow all regulations for verification as outlined in the most current version of ASTM E4 otherwise. Even if no adjustment to the calibration is necessary, the calibrator should still enter the calibration screen and press “Done” to update the calibration date.



The calibration procedure is to capture hydraulic pressure values at known load values. Choose 5 data points with the first always being zero. The calibrator should first go through and enter load values, shown in pounds force (lbf) below, before starting. The calibrator will then go through loading the system using the slider and/or quick adjust buttons applying load to the system to reach the load values. When the system is loaded to the appropriate points, the point button is pressed, which sets a psi value for that point, thus calibrating the system. The system allows for fine adjustment and for going back in and adjusting each point up or down as needed.

Point	psi	lbf
1	0	0
2	1,768.39	50,000
3	4,420.97	125,000
4	8,841.94	250,000
5	28,294.21	800,000

The **Load/Pressure Display, Motor Speed %, Calibration Slider, Start/Stop Motor, Quick Adjust Buttons, and Point Buttons** are all used during calibration.

The calibration slider and/or quick adjust buttons are used to jog the motor and advance the piston, thus building pressure.

All calibration points must have values. Each calibration point must be greater than the previous calibration point for both pressure and load. The number of points used is determined by calibration requirements for the tests performed. It is acceptable to use fewer than five points, but the unused point(s) must have values higher than the calibrated range. In the example above, four points are used to calibrate a 250,000 lbf machine. The fifth point is chosen above 250,000 lbs. and maximum system pressure.

Load Calibration:

The calibrator will need an ASTM E74 certified load cell/readout to measure actual load while running the machine.

1. Load appropriate load cell for calibration range, allowing proper warm-up to manufacturer recommendations.
2. Select force values for the five points used during calibration by pressing the boxes along the right side of the screen. This brings up a keypad to allow the operator to set the force values desired. The five force values used in the screenshot are 0 lbf, 50,000 lbf, 125,000 lbf, 250,000 lbf, and 800,000 lbf.
3. Press the start motor button (it will change to green when it is active).
4. Use either the slider bar or the quick buttons to change the motor speed %. The higher the motor speed %, the quicker the rate of loading. The lower the motor speed %, the slower the rate of loading.
5. Advance until you are 1/16" from touching the load cell and press the point 1 button. This will set the pressure for the first (zero) reading.
6. Advance until approaching the second load point and then slow the system using the fine adjust buttons. Moving slowly towards the next point, press the point 2 button just as the load reaches the desired force to set a pressure (psi) value for point 2.
7. Repeat this process until you have stored points for all calibration points. If using fewer than five points, make sure to assign logical pressure values to the load values outside of the calibrated range.
8. Press the Stop Motor button to retract the system.
9. Exit out to the verification test screen to verify the calibration is valid per applicable standards.
10. The "Capture Load" button will take a snapshot of the live load during verification loading. To use, slow the machine during your verification readings and press this button while watching the load cell to get a snap shot of the load. This is convenient for a single operator to get accurate verification readings.

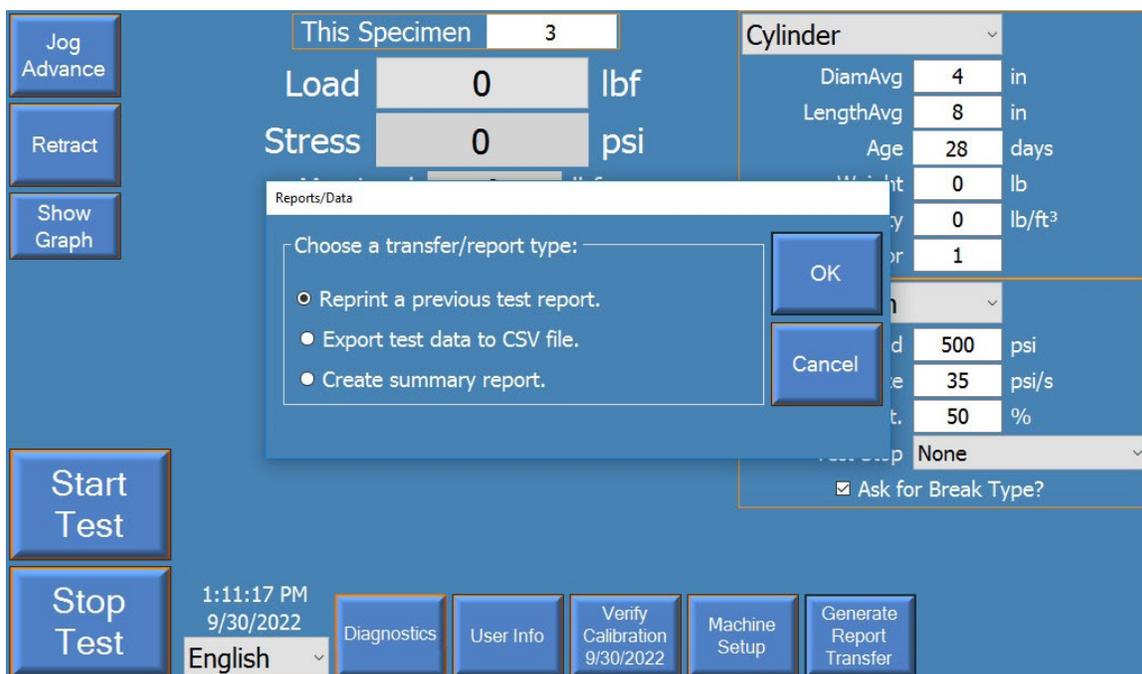
11. Once verification is complete, write down the constants or take a photo of the screen. In the event of system failure, these values can be restored without requiring recalibration.
12. Exit back to the main screen.

DATA LOGGING

Standard functionality includes data collection by the ForneyLink HMI for printing and transfer.

Data from optional extensometer and compressometer displacement transducers are also collected by the HMI. This data is captured with the same timestamp as the load data.

Press the Generate Report/Transfer button to manage logged data. Two data sets are stored on the machine. The summary data has summary information about the test performed, like peak break info, the test ID, and some basic specimen information. The second data set is the test data and contains the force-vs-time information for the complete test(s).



To retrieve test data or summary reports, an external USB drive, such as a USB thumb or USB flash drive must be attached to the touchscreen.

To generate a summary report, press the 'Create summary report' button and then select one or more stored summary data files for your report. Press the 'Generate Report/Transfer' button to generate the report.

Select Reprint a previous test report and then select the proper test ID to reprint a test report.

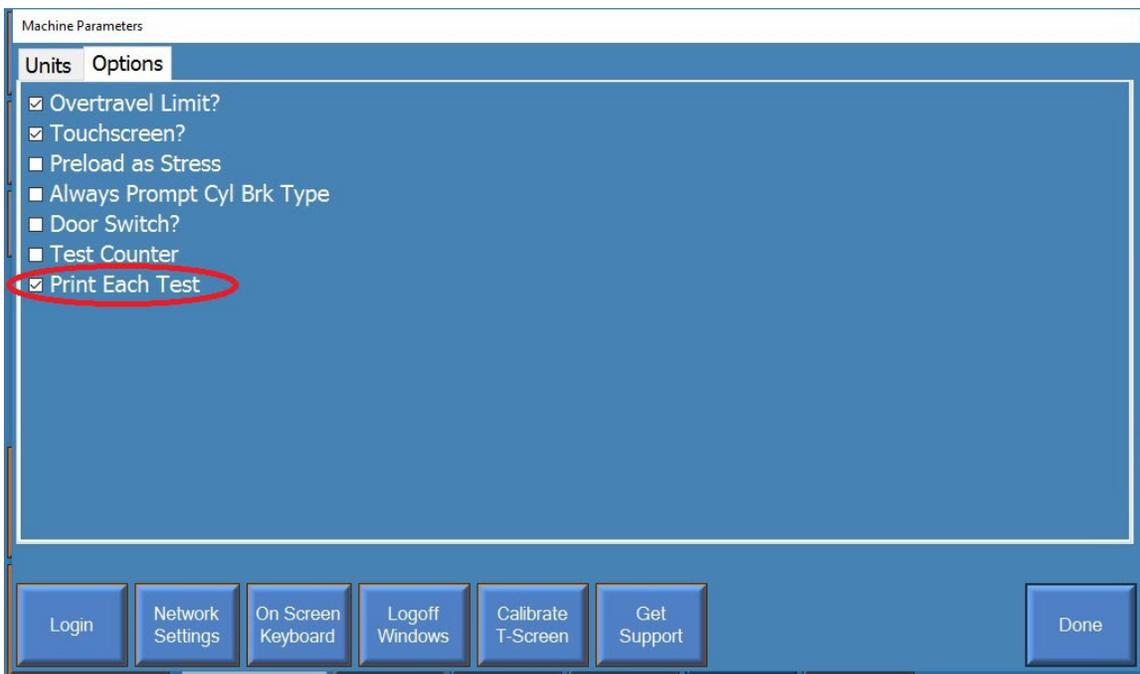
To retrieve detailed test data for a specimen, select "Export test data to CSV file." A CSV file or Comma-separated value file is a standard file that are standard with a wide variety of applications, such as Microsoft Excel.

PRINTING

The system can be configured to print every test report. Most printers will be automatically setup by the operating system when connected. Some printer drivers will require remote assistance from Forney to install.

Please contact FORNEY Technical Support if your printer requires advanced setup.

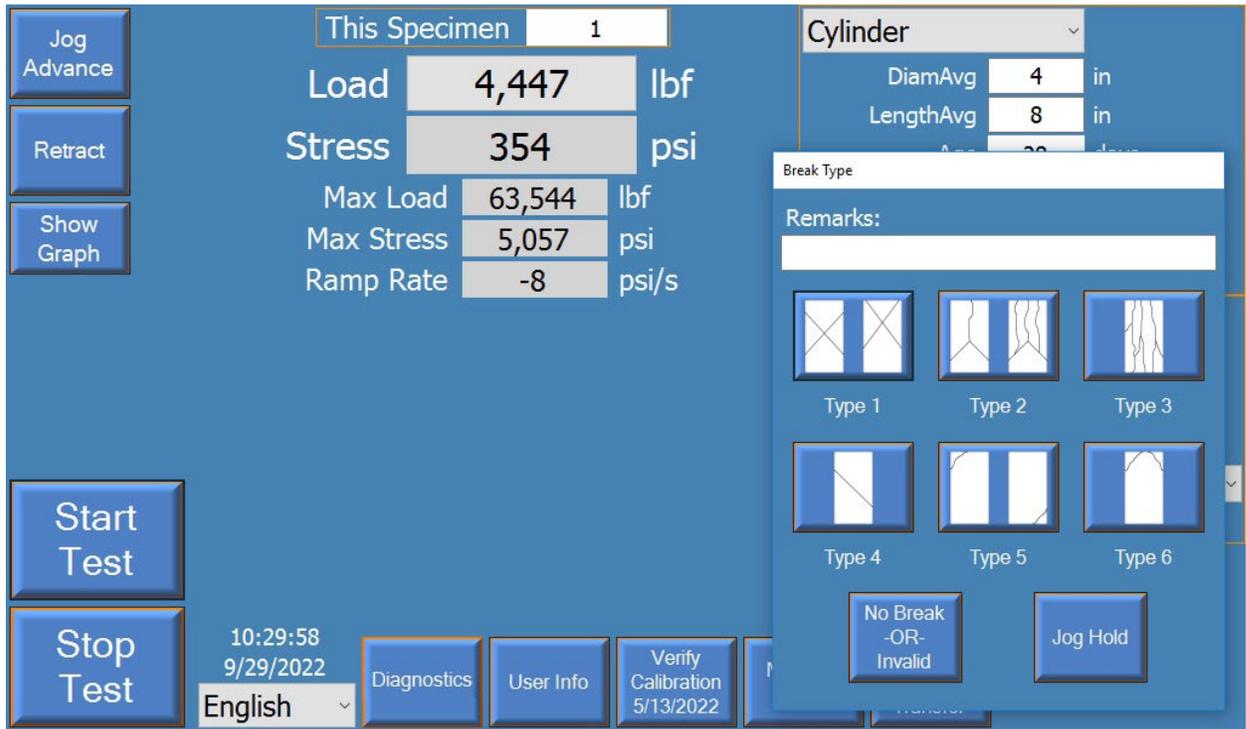
The “Print Each Test” checkbox is found on the Options tab of Machine Setup. Select the checkbox to print each test.



QUICK GUIDE TO RUNNING A COMPRESSION TEST

1. Always be aware of the **E-STOP button** location prior to operating the automatic machine. This is a red button, clearly marked on the console of the machine. If at any time, you need stop system due to unsafe conditions, press the **E-STOP button**.
2. Turn on power to machine (if not already running) and wait for the system to power up.
3. Check specimen/test type in the upper right corner, change to desired specimen if needed. Make sure to check the specimen dimensions and set the **RAMP RATE, BREAK PERCENT, and PRELOAD**.
4. Load specimen in machine according to applicable standards.
5. Hold the 'Jog Advance' button to advance the system for specimen centering/block seating procedures. Jog until there is a small gap between the platen and the specimen.
6. Press the active load value to tare and perform centering block seating procedures per applicable standards.
7. Hold the 'Jog Advance' button to apply between 1% and 10% of anticipated load on the specimen. Release 'Jog Advance' button and perform perpendicularity/alignment checks per applicable standards.
8. Press the start test button if satisfied with checks. If not satisfied, press 'Retract' button and repeat from step 5.
9. The machine will rapid advance to the preload amount, then switch to the preset ramp rate for the remainder of the test. The machine will stop and retract when a drop in load according to the Break Percentage is reached.

10. Select the ASTM C39 break type as shown in the screenshot below:

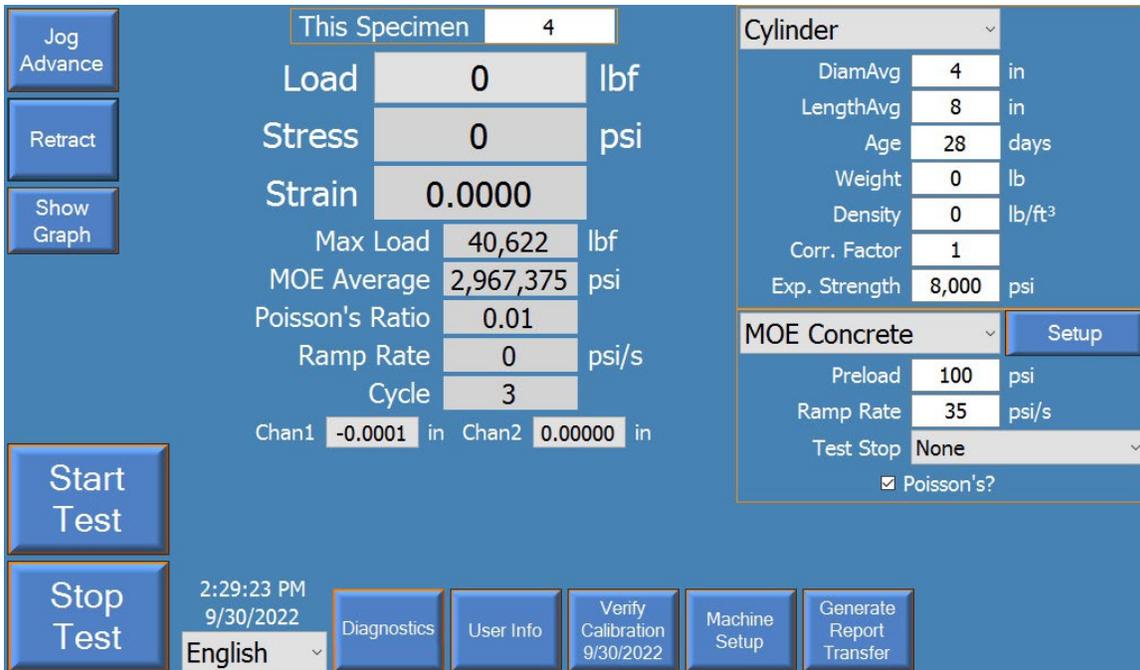


11. Record the Load at Break, or Stress at Break as desired, or simply move on to the next test if the data-logged results or ForneyVault® are used.
12. Clean out any debris from the broken specimen and repeat from step four to continue testing the same specimen type.

MODULUS OF ELASTICITY (MOE) TESTING

(If equipped)

Modulus of Elasticity (MOE) testing can be selected from the specimen type drop-down menu on the main screen if optional equipment was factory installed on the machine. Before you can start an MOE test you must break a companion specimen in standard compression mode to get the strength of the specimens. This strength is then entered in the “Exp. Strength.” field. Once a non-zero value is entered, the operator can proceed with setup and testing.



The remaining parameters to setup are:

DiamAvg = specimen diameter

LengthAvg = specimen length

Age = specimen age

Weight = specimen weight

Ramp Rate = rate of stress applied

Preload = amount of load to apply before starting controlled ramp rate

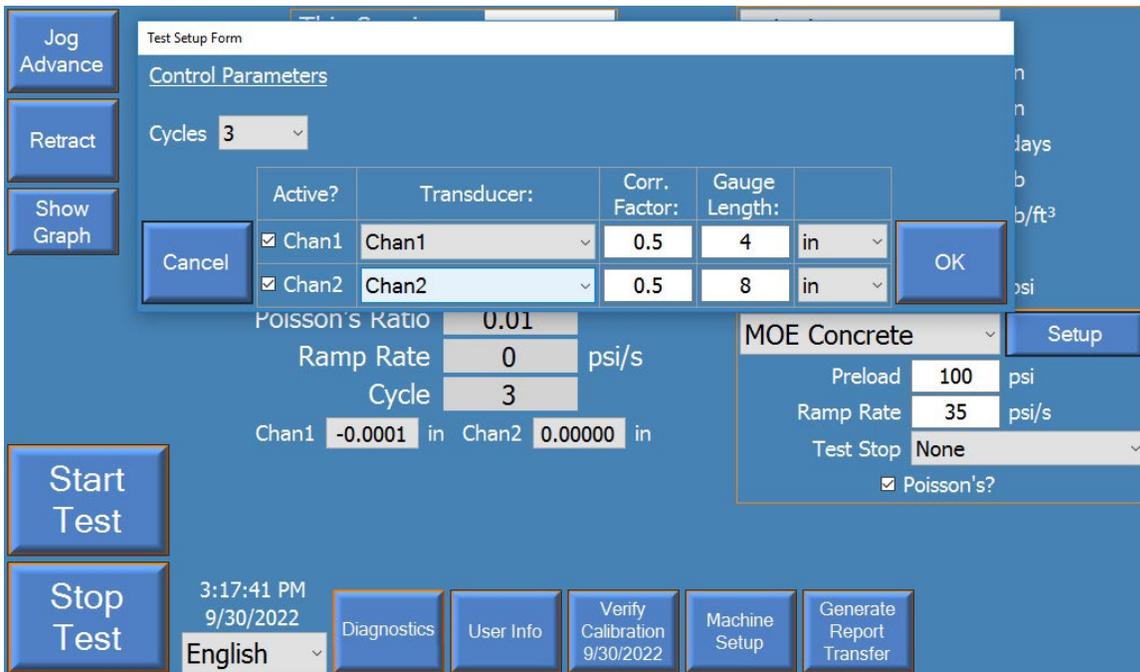
Exp. Strength. = break strength of the companion specimen (discussed above)

Correction Factor = $e_r / (e_r + e_g)$, dimensional constant per ASTM C-469 (via the “Setup” button)

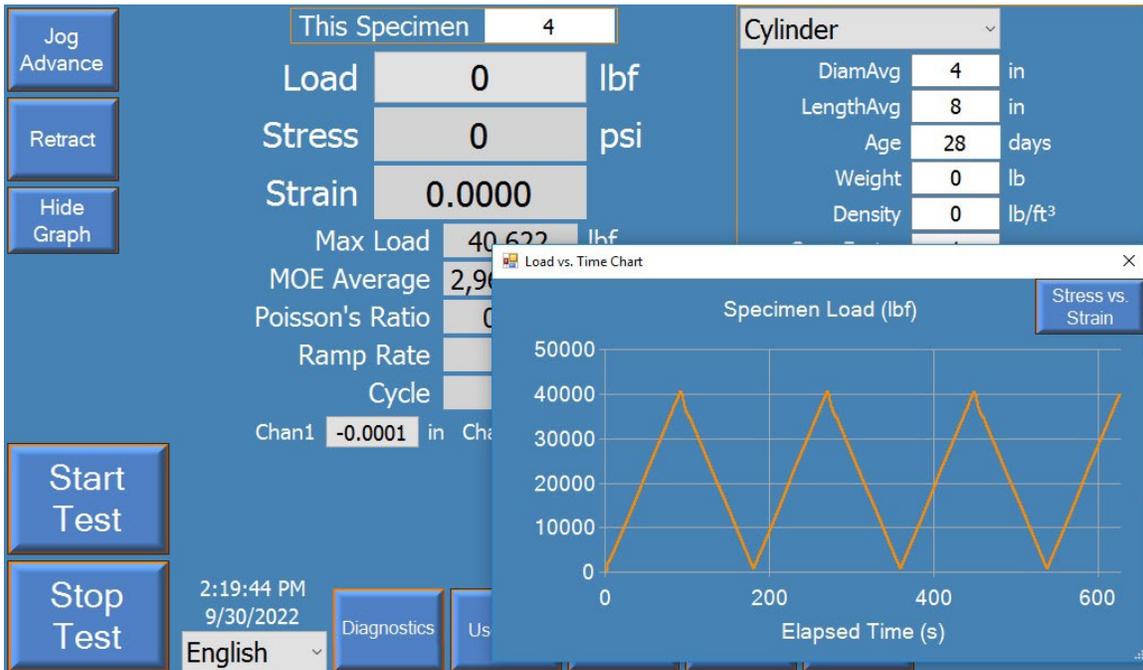
During testing you can either watch the normal display or select the show graph option to look at load vs time or strain vs time. While the test is applying load, the system will show positive ramp rate. When the system is unloading, it will display a negative ramp rate.

Pressing the 'Setup' button (next to LVDT) will allow the user to input the correction factor and gauge length.

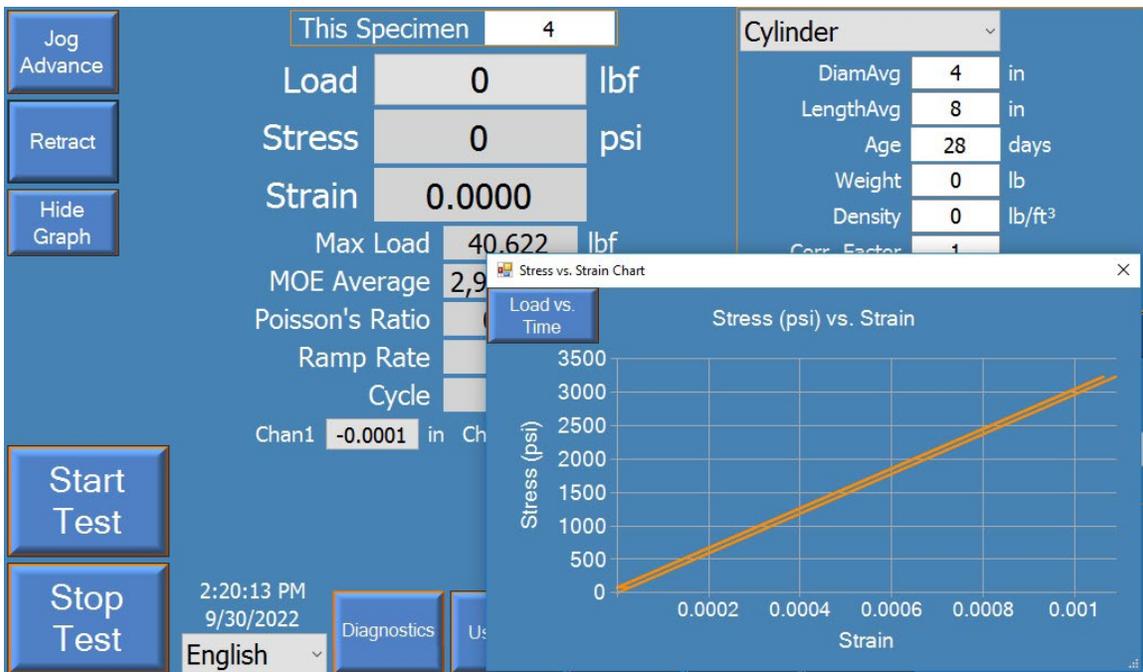
Note: A Modulus/Poisson's (-MP) machine setup is shown. If your machine is Modulus only (-M) there is only one channel.



An example load vs time graph is shown during the test by pressing the 'show graph' button:



By pressing the 'Stress vs Strain' button, you can look at the stress vs strain graph:



Once the test completes, the MOE value is displayed:

The screenshot displays a software interface for a testing machine. The main area shows specimen information and test results. On the left, there are control buttons for 'Jog Advance', 'Retract', and 'Show Graph'. Below these are 'Start Test' and 'Stop Test' buttons. The top center shows 'This Specimen' as 4. The test results are displayed in a table-like format:

Load	0	lbf
Stress	0	psi
Strain	0.0000	
Max Load	40,622	lbf
MOE Average	2,967,375	psi
Poisson's Ratio	0.01	
Ramp Rate	0	psi/s
Cycle	3	
Chan1	-0.0001	in
Chan2	0.00000	in

On the right side, there is a 'Cylinder' dropdown menu and a table of specimen properties:

DiamAvg	4	in
LengthAvg	8	in
Age	28	days
Weight	0	lb
Density	0	lb/ft ³
Corr. Factor	1	
Exp. Strength	8,000	psi

Below this is an 'MOE Concrete' dropdown menu with a 'Setup' button. The MOE Concrete settings are:

Preload	100	psi
Ramp Rate	35	psi/s
Test Stop	None	

There is a checked checkbox for 'Poisson's?'. At the bottom, there is a status bar showing the time '2:20:36 PM' and date '9/30/2022', a language dropdown set to 'English', and several utility buttons: 'Diagnostics', 'User Info', 'Verify Calibration 9/30/2022', 'Machine Setup', and 'Generate Report Transfer'.

OPTIONAL MACHINE CONFIGURATIONS

Many optional machine configurations are available for Forney VFD machines. The common options include Dual Frame machines, Dual Range machines, and ram displacement measurement (for speed control).

Dual Range machines allow selection of either a low or high range by pressing the button on the main screen. **Dual Frame machines** have a two-step process to change the frame selected. The operator must move the AB valve to the opposite position and also press the button on the main screen for primary frame or secondary frame.

The screenshot displays the main control interface for a Forney VFD machine. It features several control buttons on the left: 'Jog Advance', 'Retract', 'Show Graph', 'Start Test', and 'Stop Test'. The central area shows test parameters for 'This Specimen 3': Load (0 lbf), Stress (0 psi), Max Load (0 lbf), Max Stress (psi), and Ramp Rate (psi/s). On the right, there are two configuration panels: 'Cylinder' and 'Compression'. The 'Cylinder' panel includes fields for DiamAvg (4 in), LengthAvg (8 in), Age (28 days), Weight (0 lb), Density (0 lb/ft³), and Corr. Factor (1). The 'Compression' panel includes Preload (500 psi), Ramp Rate (35 psi/s), Break Pct. (50 %), and Test Stop (None). At the bottom, there is a status bar with a clock (1:16:58 PM 9/30/2022), a language dropdown (English), and a 'Primary Frame Active' button circled in red. Other bottom buttons include 'Diagnostics', 'User Info', 'Verify Calibration 9/30/2022', 'Machine Setup', and 'Generate Report Transfer'.

Machines with the **Displacement option** have the ability to measure the movement of the ram. This gives a user the ability to select a speed at which a test occurs rather than just a loading or stress rate.

Forney also offers many optional software packages for running customized test types that are not included with the base software package. These include proppant tests, specialized flexural tests like ASTM C1609, punch penetration tests, as well as cyclic and segmented tests. Please contact Forney for more details or to discuss your own custom test requirement.