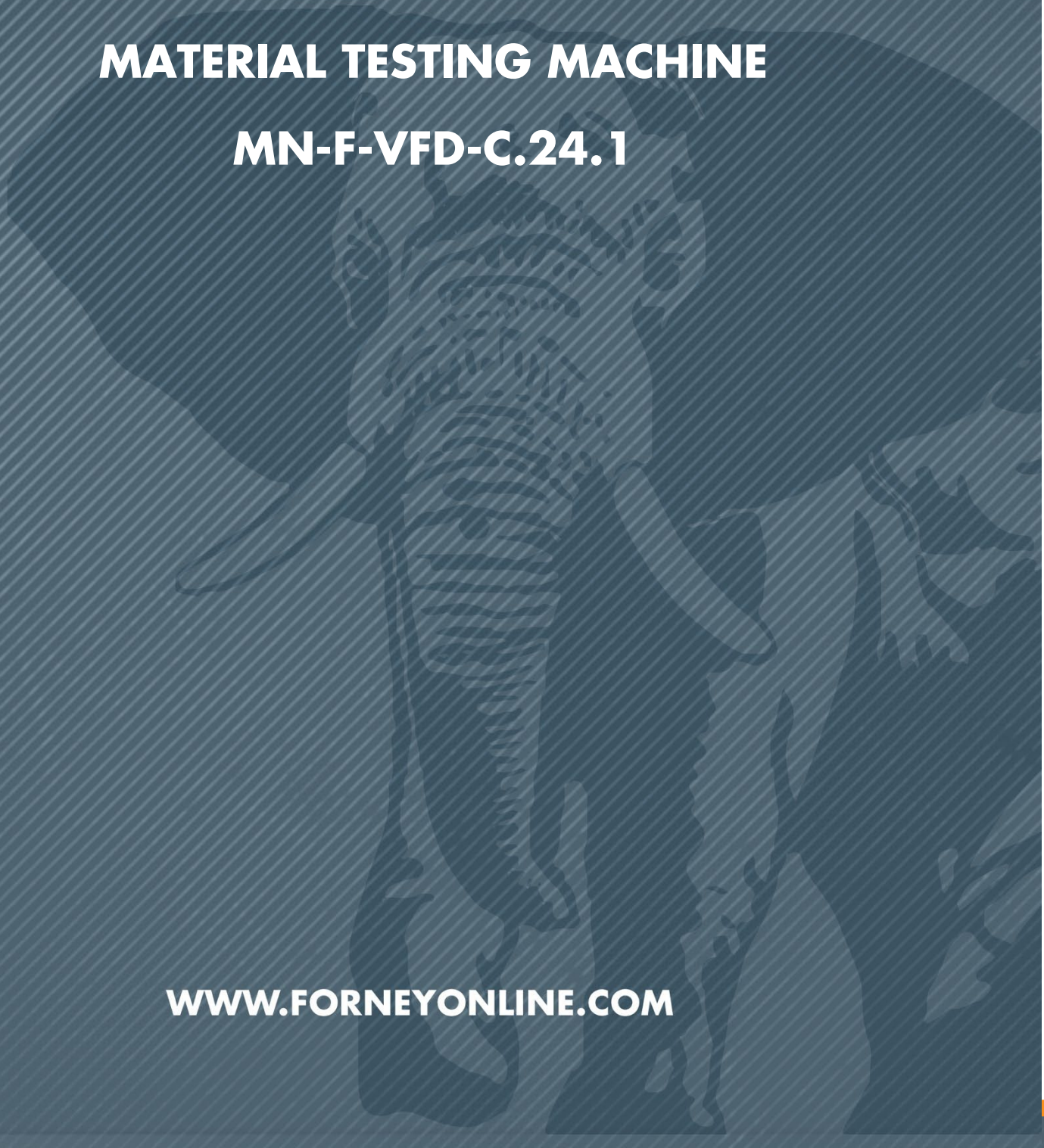
INSTRUCTION MANUAL

VFD AUTOMATIC RETROPAK

MATERIAL TESTING MACHINE

MN-F-VFD-C.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 tickeblue portting 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 inquires 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

Get More Out of Your Materials Testing Lab

WARRANTY POLICY

SALES TERMS AND CONDITIONS

1. **Definitions:** As used in these Terms and Conditions, "Machinery" means any equipment, material, product, motor, article or item quoted or sold by or through Forney and/or listed on any document attached hereto or prepared in connection herewith. "Forney" means Forney, its affiliates and any entity for whom Forney acts as agent in connection with the sale of Machinery. "Purchaser" means all persons and entities acquiring Machinery from or through Forney.

2. **Offer and Acceptance:** These Terms and Conditions constitute an offer to sell Machinery and/or services which may be accepted only in accordance with these Terms and Conditions and without modification, addition, deletion or alteration. In the event that any correspondence, form documents (e.g., purchase order or acknowledgment forms) or sale terms submitted by or on behalf of Purchaser contain terms in addition to or different from those set forth herein, those additional or different terms are hereby rejected. Forney's willingness to contract with Purchaser is expressly conditioned on Purchaser's acceptance of the terms set forth below, which shall be deemed to constitute a counter-offer to any conflicting terms submitted by Purchaser.

3. **Duration of Offer:** Any quotations or offers extended by Forney are subject to immediate acceptance and prior sale. Forney reserves the right to withdraw, change or alter any quotation or offer submitted by it at any time prior to written acceptance.

4. **Delivery and Delay:** The shipping date or dates that may be set forth in any correspondence or document from Forney are approximate only and Forney shall not be liable for failure to deliver, delay in delivery or any other hindrance of performance occasioned by causes beyond Forney's control including, without limitation, strikes, labor shortages, labor stoppages, lockouts or other labor troubles, material shortages, fires, riots, floods, embargoes, war or other outbreak of hostilities, acts of God, inability to obtain shipping space, machinery breakdown, delays of carriers or suppliers, governmental acts and regulations and actions by Purchaser. In the event of such delay or hindrance, Forney shall be entitled to an extension of time commensurate with the delay or hindrance. Unless expressly agreed to the contrary by Forney in writing, all sales of Machinery by Forney are made "as is, where is" and shipped F.O.B. point of shipment; all risks of loss or damage in transit shall be borne exclusively by Purchaser; and all deliveries of Machinery to a common carrier or licensed trucker shall constitute delivery to Purchaser. Unless expressly agreed to the contrary by Forney in writing, Purchaser shall be solely and exclusively responsible for all costs and risks of loss or damage associated with the loading, shipment, transport, unloading, assembly and installation of all Machinery acquired from Forney. FORNEY SHALL NOT BE LIABLE FOR ANY DAMAGES ATTRIBUTABLE TO DELAYED SHIPMENT OR LATE DELIVERY INCLUDING, WITHOUT LIMITATION, INDIRECT, SPECIAL, INCIDENTAL OR

CONSEQUENTIAL DAMAGES RELATING THERETO.

5. **Cancellation by Purchaser:** Upon cancellation by Purchaser of all or any part of a Purchase Order or other commitment to purchase from Forney, liquidated damages shall be payable by Purchaser as follows: Full cost to Forney of (i) all amounts expended or committed by Forney to acquire the Machinery ordered by Purchaser and to assemble the Machinery for shipment; (ii) all work in process relating to Purchaser's order; (iii) all equipment costs incurred by Forney in connection with Purchaser's order, including commitments made for the use of such equipment; (iv) all engineering, travel and rental costs incurred as a result of Purchaser's order; and (v) an amount equal to 30% of the aggregate of (i), (ii), (iii) and (iv) above for administrative overhead.

6. **Transportation and Insurance Charges:** Except as may be specifically agreed to in writing by Forney, Forney shall not be responsible for freight, transportation, insurance, shipping, storage, handling, demurrage or similar charges. If such charges are by the terms of any quotation or offer extended by Forney included in the price of the Machinery, any increase in the applicable rates which becomes effective after the date of Forney's quotation or order shall be to the account of Purchaser.

7. **Taxes and Permits:** All sales, excise, gross receipts, value added or similar taxes, whether presently in force or hereafter enacted, shall be deemed extra charges and Purchaser agrees to pay the same at applicable rates. All licenses and permits, whether federal, state, local or those of a foreign government shall be obtained by Purchaser at Purchaser's expense. Purchaser shall be solely and exclusively responsible for all trade tariffs, import/export permits, charges and taxes, customs duties, stamp duties, registration fees, clearances and other consents arising from or connected with the purchase of any Machinery being acquired from Forney.

8. **Spare Parts:** Spare parts are not included in any quotation or offer of Forney unless expressly provided for in writing. At the request of Purchaser, spare parts shall be quoted separately, if available to Forney.

9. **Installment Delivery:** Forney reserves the right to deliver the Machinery in installments. Delay in the delivery of any installment shall not relieve Purchaser of its obligation to accept remaining deliveries of Machinery.

10. **Change Orders:** In the event that Purchaser desires to alter any Purchase Order previously submitted, Purchaser shall submit to Forney a written change order which shall become effective only upon written acceptance by an authorized officer of Forney.

11. **Modifications:** No modifications to these Terms and Conditions shall be effective unless agreed to in writing by an authorized officer of Forney. Any attempt to modify these Terms and Conditions by an instrument or form not executed by an authorized officer of Forney shall be ineffective.

12. **Governing Law:** The transaction between Forney and Purchaser contemplated by any quotation or Purchase Order shall be governed by and construed in accordance with the laws of the Commonwealth of Pennsylvania. All matters dealt with by any quotation or Purchase Order to which Forney is a party shall be governed by the Uniform Commercial Code, as in force in the Commonwealth of Pennsylvania on the effective date of the acceptance of the quotation or Purchase Order by Purchaser. In no event shall provisions of the United Nations Convention on Contracts for the International Sale of Goods apply to or govern the provisions of any agreement involving the sale of Machinery by Forney.

13. **Terms of Payment:** Unless Forney has specifically agreed to the contrary in writing, fifty (50) percent of the purchase price shall be paid by Purchaser immediately after Purchaser's acceptance of Forney's quotation or offer; and the remaining fifty (50) percent must be received by Forney prior to shipment of the Machinery. In the event that payment is not received when due, an interest charge of 1-1/2% per month will be charged on the overdue amount.

14. **Return Privilege:** Subject to the following provisions of this paragraph 14, any Machinery that is purchased from Forney's inventory "as is, where is" may be returned freight prepaid within 15 days of initial receipt for a refund of the purchase price if (i) the Machinery fails to conform to Forney's description in a respect material to its operation, and (ii) Forney has been informed in advance of the alleged nonconformity and has authorized the return in writing. Subject to paragraph 16 below, if applicable, the foregoing shall be the sole and exclusive remedy with respect to any issue or claim arising from any Machinery sold by Forney and shall not apply if the Machinery has been (i) damaged by Purchaser or subjected to misapplication, neglect or abnormal conditions of operation, (ii) damaged in transit, or (iii) sold directly from auctions, private users' plants, or any other sale or trade other than from Forney's stock. All returns shall be subject to a twenty-five percent (25%) restocking charge.

15. **Compliance with Safety Regulations:** In the event Forney performs installation or engineering services at the facility of Purchaser, Purchaser shall be solely and exclusively responsible for ensuring that working conditions at Purchaser's facility comply with all applicable federal, state and local safety rules and regulations, including but not limited to those promulgated under the Occupational Safety and Health Act of 1970 (collectively, the "Safety Regulations"). Purchaser shall be liable for all fines and penalties of whatsoever kind or nature in the event that said working conditions do not comply with such Safety Regulations. It is the duty of Purchaser to inspect all Machinery purchased from Forney, to provide proper safety devices to safeguard the operators from harm and to ensure compliance with all applicable Safety Regulations. Forney makes no representations or warranties that any Machinery sold by it complies with the Safety Regulations and specifically disclaims any liabilities arising from noncompliance.

16. **Forney F, FHS and LT Series Testing Machines Limited Warranty:** With respect to Testing

Machines that have been manufactured by Forney only, and not with respect to any other Machinery quoted or sold by Forney or its affiliates, Forney warrants to Purchaser that for a period of two (2) years from the date of shipment, the Machinery will be substantially free of defects in materials and workmanship. In the event such Machinery is found to have a material defect in materials or workmanship, Forney shall remedy said defect by exercising one of the following three options, the choice of which shall be exclusively that of Forney. The options are: (a) Return of the Machinery to Forney for a refund of the purchase price paid by Purchaser; (b) Return of the Machinery to Forney for rebuilding by Forney, provided that Forney will rebuild the Machinery during regular working hours and will not be responsible for overtime or special rates; or (c) Replacement of the Machinery or components. Forney shall not be responsible for paying overtime or special rates to rebuild the Machinery. In the event that the option initially selected by Forney is not effective in remedying the defect, Forney retains the right to select either or both of the remaining options. Purchaser's damages for any breach by Forney of its obligations to remedy defects pursuant to this Paragraph 16 shall not exceed the cost of such remedial effort.

17. **Other Forney Manufactured Items Limited Warranty:** With respect to other items that have been manufactured by Forney only, and not with respect to any other Machinery quoted or sold by Forney or its affiliates, Forney warrants to Purchaser that for a period of (90) days from the date of shipment, the Machinery will be substantially free of defects in materials and workmanship. In the event such Machinery is found to have a material defect in materials or workmanship, Forney shall remedy said defect by exercising one of the following three options, the choice of which shall be exclusively that of Forney. The options are: (a) Return of the Machinery to Forney for a refund of the purchase price paid by Purchaser; (b) Return of the Machinery to Forney for rebuilding by Forney, provided that Forney will rebuild the Machinery during regular working hours and will not be responsible for overtime or special rates; or (c) Replacement of the Machinery. Forney shall not be responsible for paying overtime or special rates to rebuild the Machinery. In the event that the option initially selected by Forney is not effective in remedying the defect, Forney retains the right to select either or both of the remaining options. Purchaser's damages for any breach by Forney of its obligations to remedy defects pursuant to this Paragraph 17 shall not exceed the cost of such remedial effort.

18. **Items not manufactured by Forney Limited Warranty:** With respect to items that have not been manufactured by Forney, and not with respect to any other Machinery quoted or sold by Forney or its affiliates, Forney will pass on to the customer the benefit of any warranty Forney received from the original equipment manufacturer.

    a. In order to obligate Forney under this Limited Warranty, Purchaser must notify Forney in writing within ten (10) days of the appearance of the defect, provide full details concerning the defect, and discontinue use of the Machinery. Upon receipt of this information, Forney will provide service instructions or shipping instructions. If shipping instructions are provided by Forney, Purchaser shall send the Machinery in accordance with those instructions and with freight charges prepaid by Purchaser.

If Forney determines that repairs are warranted under the terms of this Limited Warranty because of defects, Forney will provide repair services at its place of business and the cost of such repair services and return freight charges will be paid by Forney; provided, however, that Forney may instead refund the purchase price in lieu of making such repairs. If Forney determines that the alleged defects are not covered by this Limited Warranty, the cost of its repair services and return freight charges will be paid by Purchaser. This Limited Warranty shall not apply if the Machinery has been assembled, installed, used, altered or handled in a manner contrary to any written instructions provided with the Machinery or if the Machinery has otherwise been subjected to misuse, neglect or abnormal conditions of operation.

19. **Machine Safety and Indemnification:** By accepting a quotation or "Offer to Sell" from Forney, Purchaser acknowledges and agrees that Forney has made no representations or warranties concerning the safety of the Machinery being sold, either on its own behalf or for anyone possessing an interest in the Machinery. Purchaser further acknowledges and agrees that Machinery sold by Forney may not include necessary safety equipment to permit safe operation or to comply with local, state, Federal, industry and/or other applicable Safety Standards or requirements. Before placing the Machinery in use, Purchaser agrees to utilize such safety equipment and give operators such instructions and/or warnings as may be necessary to permit safe operation and to comply with all local, state, federal, industry and/or other applicable Safety Standards, requirements and regulations. Purchaser further agrees to indemnify and hold Forney harmless from and against any and all claims and liabilities which may be incurred by Forney, including any and all costs and attorney fees, based in whole or in part on the failure to comply with applicable Safety Standards and/or the failure to provide safety equipment, instructions and/or warnings necessary to operate the Machinery safely.

20. **Warranties and Remedies Exclusive; Further Warranties and Remedies Disclaimed**: EXCEPT FOR THE LIMITED WARRANTY PROVIDED PURSUANT TO PARAGRAPH 16 THROUGH 19 ABOVE, FORNEY MAKES NO REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, WRITTEN OR ORAL, WITH RESPECT TO THE CONDITION, PERFORMANCE OR SHIPMENT OF ANY MACHINERY SOLD BY IT OR ANY COMPONENTS THEREOF, WHETHER OR NOT THE MACHINERY OR COMPONENTS HAVE BEEN REBUILT, ENGINEERED OR DESIGNED IN WHOLE OR IN PART BY FORNEY OR ANY AFFILIATE OF FORNEY. FORNEY SPECIFICALLY DISCLAIMS, AND PURCHASER HEREBY WAIVES, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. It is specifically understood and agreed that except to the extent provided in paragraph 16 through 19 above, Forney shall have no liability, whether claimed in contract, equity, tort (including negligence) or otherwise, for or resulting from defaults in workmanship or materials or failure of performance of any Machinery sold by it.

21. **Limitation of Liability:** Forney shall not be liable for any special, incidental, indirect or consequential damages, or for any equivalent proximate damages, arising out of or connected with any Machinery sold or services provided by it, regardless of whether any

such liability shall be claimed in contract, equity, tort (including negligence) or otherwise. By way of example of the foregoing limitation of liability, but without limiting in any manner its scope or application, Forney shall not be liable for all or any part of any of the following, no matter how claimed, computed or characterized:

a. Loss of profits or revenue, loss of return on investment, cost of capital, loss of operating time or production, loss or reduction of use or value of any facilities or replacement products, or increased costs of operation or maintenance; (b) damages incurred in the unloading, assembly or installation of the Machinery; (c) damages relating to the operation of the Machinery or to any products manufactured in whole or in part with the use of the Machinery; or (d) interruption of business. The limitation of liability contained in this Paragraph 21 shall be effective without regard to Forney's performance or failure or delay of performance under any other terms and conditions, including those contained in Paragraph 16 through 19 hereof.

22. **Indemnification:** In consideration of Forney's agreeing to sell items of Machinery to Purchaser and/or to provide services to Purchaser, and intending to be legally bound hereby, Purchaser covenants and agrees to indemnify and hold Forney and its affiliates harmless from and against any and all claims, demands, actions, causes of action, damages, costs and expenses, including attorney's fees, which arise directly or indirectly from Forney's sale of Machinery and/or services to Purchaser. Without limitation as to the foregoing, Purchaser's indemnity shall encompass and include any and all incidental, special, direct, indirect and consequential damages incurred by it including, without limitation, lost profits, damage to reputation, injury to persons (including death) and damage to property.

23. **Dispute Resolution and Venue:** The sole and exclusive means of resolving any dispute which may arise from Forney's sale of Machinery and/or services to Purchaser shall be the submission of such dispute to arbitration under the auspices of the American Arbitration Association in Pittsburgh, Pennsylvania.

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!

INSTALLATION PROCEDURES

Inspection

Upon receiving shipment of your new machine, before uncrating or unpacking, inspect the crates/boxes for signs of freight/handling damage.

If container shows visible signs of damage, please note damage to freight carrier at time of delivery. If severe damage to package or machine is discovered during delivery, refuse delivery due to freight damage.

Uncrating

To properly uncrate your new Forney Testing Machine, follow these steps:

- Remove metal straps around crate/box with suitable cutters (shears) if banded.
- Remove top of box/crate.
- Remove wooden braces on the top and sides of the machine if braced.
- If crated, remove the sides of the crate, if boxed, remove the entire box.
- If accessories are included, unband/unbrace and remove accessories.
- Cut all remaining bands, remove all wooden braces on pallet.
- Machine can now be removed from pallet.
- Locate the packing list and check parts and units against the packing list to make sure the shipment is complete.

Machine Location

It is recommended that the machine be located in an area where the atmosphere is free from acidic or contaminating fumes, which could possibly accelerate corrosion to, machined surfaces or electrical contacts.

The machine should be located in a temperature-controlled indoor environment where humidity or condensation is within the following limits:

Temperature Range = 41F (5C) to 104F (40C)
Recommended Humidity = 30% to 70% RH

For proper operation, all machines should be accurately leveled and secured to the floor with anchor bolts. This is especially important when testing high strength concrete or utilizing pad caps. Forney recommends ½" diameter anchor bolts.

The machine should be positioned allowing sufficient space at the side and rear for calibration or servicing working space.

A dedicated electric outlet is recommended to help insure that proper electric is provided to the unit. Please check stamped identification plate for voltage and current requirements.

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

CLEANING

To protect your new testing machine during shipping and through extended periods of exposure to the elements; a rust-preventative has been applied to the external surfaces of the machine.

After positioning/installing your machine, and prior to making the hydraulic connections, the rust inhibitor can be removed.

1) Dampen a clean, dry cloth with a suitable, safety solvent.
   i.e. CRC Quick Clean or similar (use rubber gloves)
   NOTE: Do not soak cloth or rub painted surfaces vigorously, as the solvent may attack the paint.
2) Gently wipe the surfaces until tackiness is gone, gently wipe with a dry cloth.

To reduce particle contamination after testing, a dry wipe down should be done.

Solvent need not be used unless an accumulation of particles is present, and otherwise hard to remove.

CALIBRATION

In accordance with ASTM E-4, testing machines are calibrated and verified annually. All Forney testing machines are calibrated at the factory following the guidelines of the most current revision of ASTM E-4.

During the calibration, all safety devices and accuracy adjustments are pre-set to give maximum performance and safe operation. Details of adjustment procedures are described in the Machine Control Section of this manual.

Even though the machines are completely serviced and calibrated at the factory, ASTM requires that machines be calibrated after transportation and final installation to ensure the calibration constants are accurate in the new environment.

ON-SITE CALIBRATION – A complete on-site calibration service is available from Forney through our Authorized Service Providers. Forney recommends the use of their Factory-Trained Authorized Service Providers for all calibration services. These Representatives are trained to perform ASTM E-4 calibration procedures, with instruments conforming to ASTM E-74 standards. They are also qualified to perform various preventative maintenance procedures. Procedures, which combined with annual calibration, will greatly reduce the possibility of down-time of your machine.

Please contact FORNEY Technical Support for a list of Authorized Service Providers.

SAFETY FEATURES

Safety features are incorporated to protect both operator and testing machine:

- The hydraulic power unit utilizes an adjustable high-pressure relief valve which protects the testing machine from becoming overloaded. This is factory preset and typically does not require any adjustment in the field. Please contact Forney support if the relief valve requires adjustment.

PREVENTIVE MAINTENANCE

Keeping this unit clean and the oil free of dirt will increase the life of the pump, valve(s), and other hydraulic components. The oil reservoir has been filled prior to shipment with Dexron III Automatic Transmission Fluid. Oil capacity is approximately 2 gallons.

Testing accessories should be cleaned as needed. Spherical discs and seats should be disassembled, cleaned, and lubricated periodically with a light lubricant such as Dexron III ATF or spray lubricants. Do not use heavy lubricants, such as grease, as dust and debris will collect in it and prevent the unit from rotating properly.

The reservoir should be drained and replenished with clean oil at least once a year. The frequency of the oil change will depend greatly on the general working conditions, hours of use, and the overall cleanliness and care given to the system.

NOTE: The following operations should be performed with the power off and the piston retracted to effectively determine fluid level.

Checking & Maintaining the Oil Level

1. After locating the pump & motor assembly, find the fill plug on the top of the reservoir cover plate.
2. Check the oil level in the reservoir by removing the fill plug and inserting a dipstick in the reservoir. The system is full when the technician observes a reading 2 inches below the top of the tank when fully retracted. Overfilling may cause performance issues, leaking, and/or damage to the pump, motor, or valve(s).
3. When it is necessary to add oil to the reservoir, remove the cap and fill the reservoir to the proper level with Dexron III or VI Automatic Transmission Fluid (ATF). The reservoir capacity is about 2 gallons.

Draining & Cleaning the System

1. Disconnect the power and ensure the piston is retracted.
2. Thoroughly clean the pump exterior.
3. Disconnect the high-pressure line and set it in a clean bucket.
4. Remove the solenoid from the valve cartridge by unthreading the cap and then sliding it upward off of the valve.
5. If your system has a transducer attached to the high-pressure line, disconnect by unscrewing the signal cable
6. With all attachments now disconnected, remove the four bolts holding the reservoir to the shelf.
7. Remove the screws along the top plate of the reservoir.
8. Lift off the motor, top plate, and pumps as one unit and carefully rest the unit on its side on clean rags to soak up excess hydraulic fluid.
9. Check and clean the filter screen on the intake of the pump assembly at this time. A soft brush can remove any build up on the screen.
10. Drain the fluid from the reservoir.
11. Using a clean lint free cloth, wipe out any remaining fluid and debris from the bottom of the tank.
12. Once complete, partially fill the tank with approximately one gallon of clean fluid.
13. Reassemble the top assembly to the reservoir changing the gasket if necessary.

How to Fill the Reservoir with Hydraulic Oil

1. On the back, top side of the reservoir, locate the plastic screw-in-plug. This is the fill hole for hydraulic oil. Clean the area around the plug to remove all dust and grit before removing the screw-in-plug. Any foreign particles in the oil could damage pump surfaces resulting in loss of performance.
2. Insert a clean funnel with filter.

3. Fill the reservoir with new Dexron III Automatic Transmission Fluid to approximately 2” below the top plate of the reservoir. Do not overfill as this can cause poor performance, leaking, and possibly damage to the system.
4. Replace the plug.

Test the system. Sometimes multiple starts and stops are needed to prime the pump following service.

Bleeding Air from The System

Upon initial startup, air can accumulate within the hydraulic system. The trapped air can cause the system to advance slowly or surge and make the motor become noisy. To remove the trapped air, try the following steps.

1. With oil in the unit and the machine ready to operate under zero load, advance the piston about 2” of travel and then retract to the starting position. This should be done several times to work the air out of the system. If this does not remove all trapped air, you can perform step #2.
2. With oil in the unit and the machine ready to operate under zero load, loosen a couple of turns, but do not remove, a hose fitting that is situated higher than the rest of the hose fittings in the system. Run the pump until a steady flow of oil, free of air bubbles is observed. Re-Tighten the fitting.

Replacement Parts

Please refer to the model and serial number of your testing machine when ordering parts. This information can be found on the metal information tag of the testing machine typically affixed to the upper left side of the frame.

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.

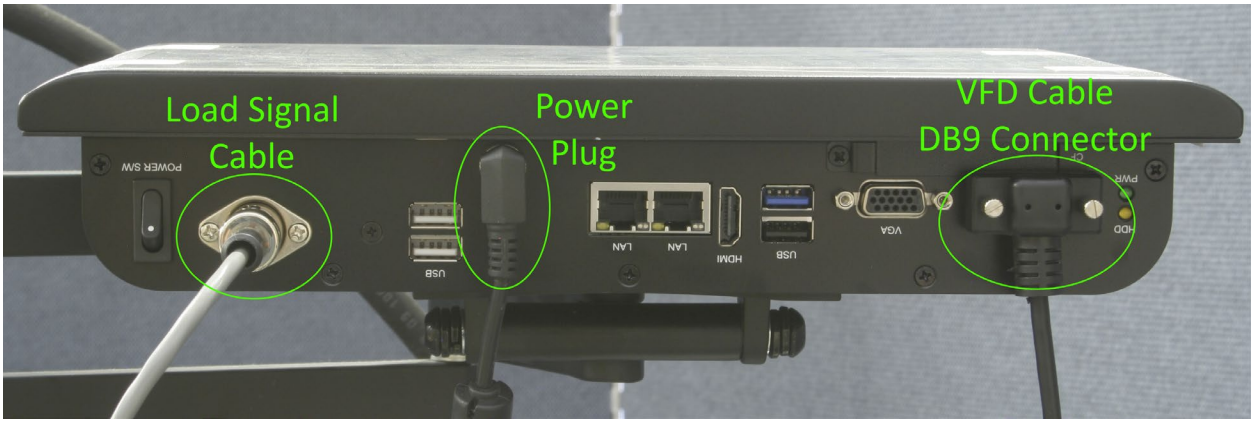
3. Remove the screws, washers and lock washers from the back of the ForneyLink and set aside.

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 machines involve one hydraulic connection to the main ram. Using wrenches, remove the existing hydraulic hose and install the new hose to the main ram. Then, tighten the hydraulic swivel fitting near the pump to the hydraulic hose. If the machine is an optional dual frame type, one additional hydraulic connection will need connected from the other frame to the AB valve mounted on the aluminum post.

Figure 1

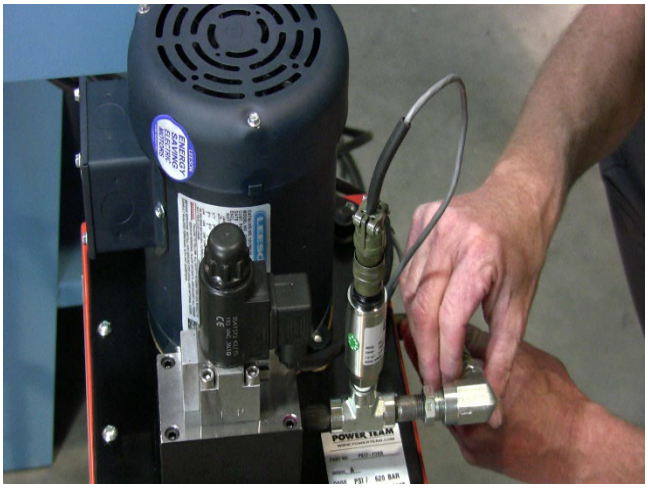


Figure 2

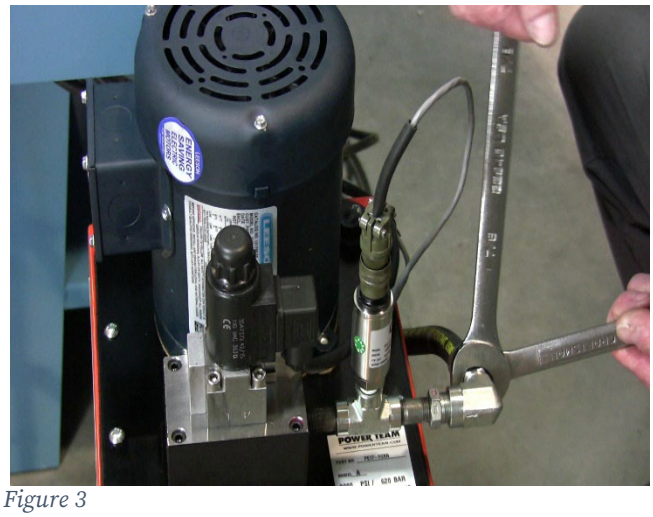
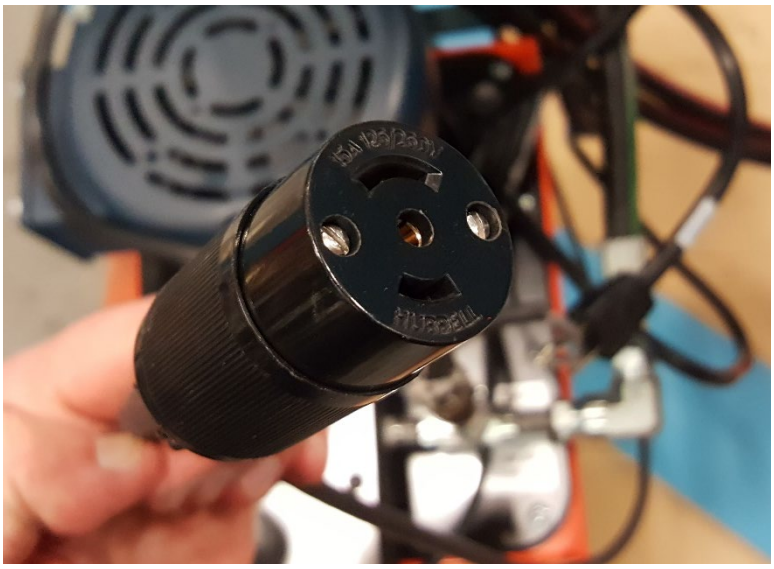


Figure 3

2. If the frame is equipped with an over-travel limit protection device, we recommend using this device with the new system. A twist lock connector is included to easily accommodate this connection. The female connector comes pre-wired to the VFD control panel. The male connector is shipped loose and requires wiring to the limit switch. Most mechanical switches do not require polarity. 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.

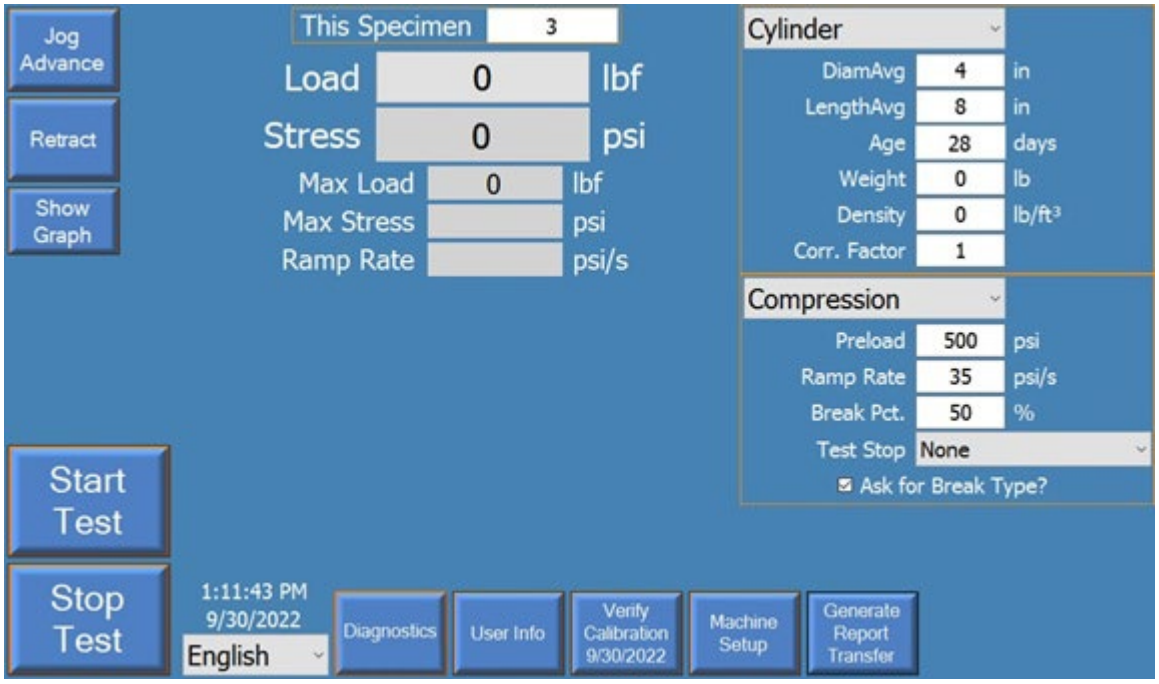
After the emergency condition has been addressed, the E-Stop button can be reset. The diagnostics screen will report when the E-Stop is activated by turning red. It may be necessary to press the RESET DRIVE button on the diagnostics screen to resume testing after an E-Stop condition.

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.



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.

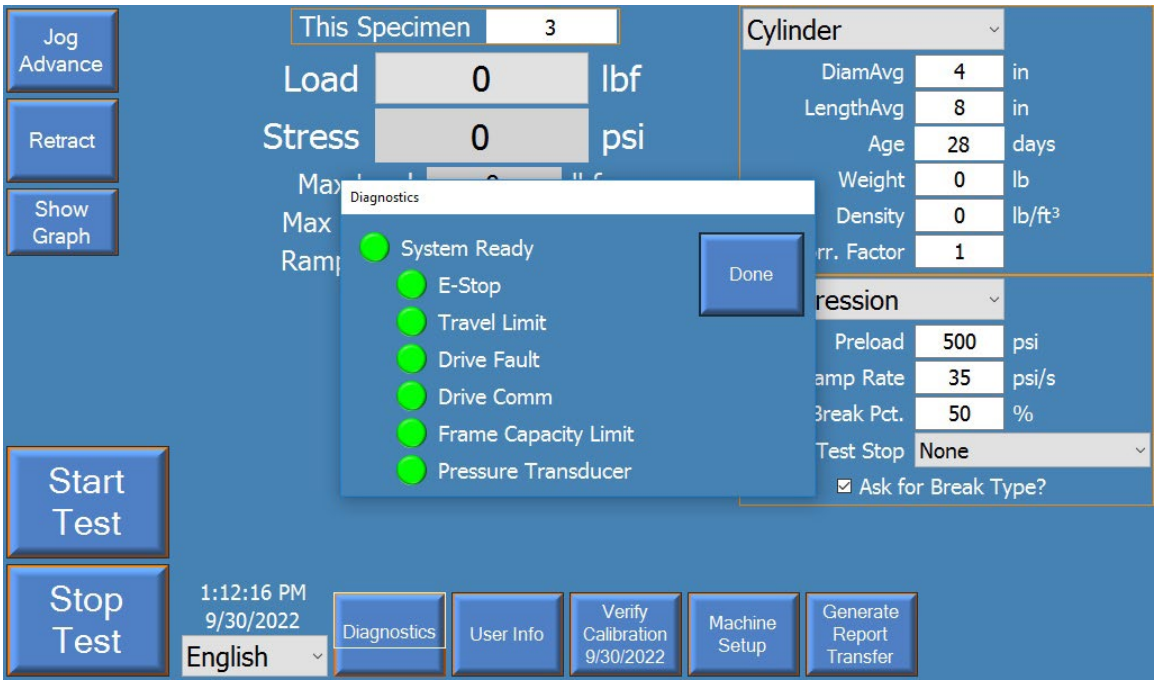
Stop Test – During preload, a running test, or while paused, the ***Stop Test*** button can be pressed to stop the test. Pressing the button will stop the motor and open the dump valve to dump all system pressure.

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

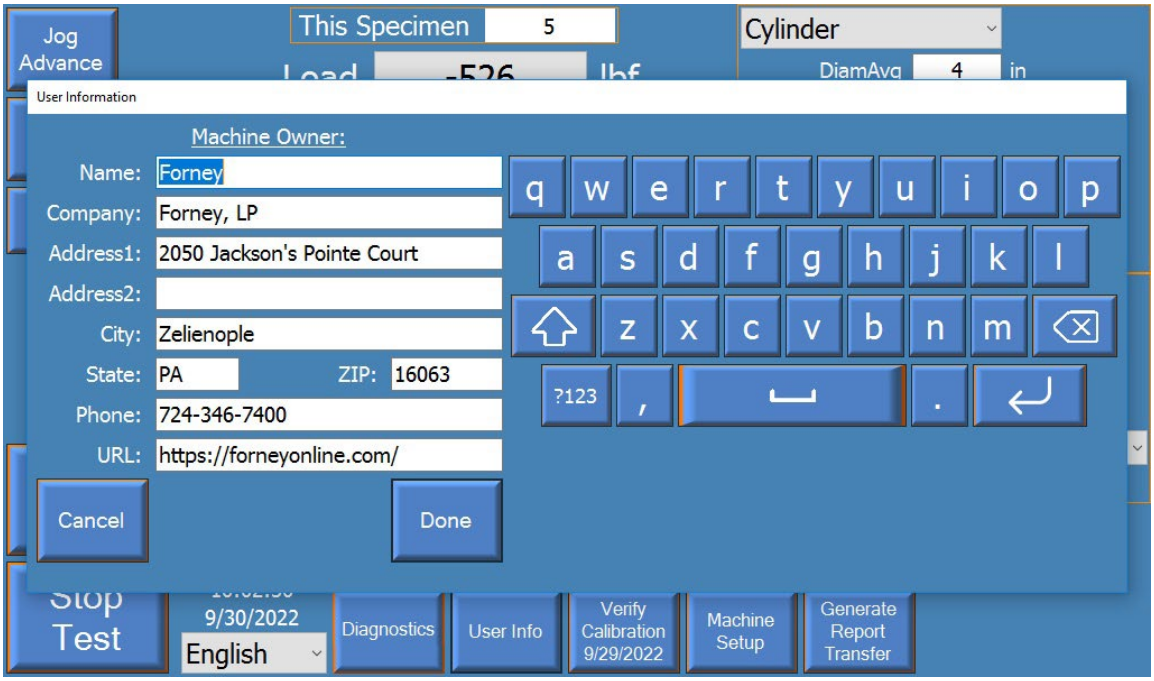
Show Graph – Shows a graph of the test when pressed. Button changes to "**Hide Graph**" when a graph is displayed. Press the button to close the graph in this state.

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.

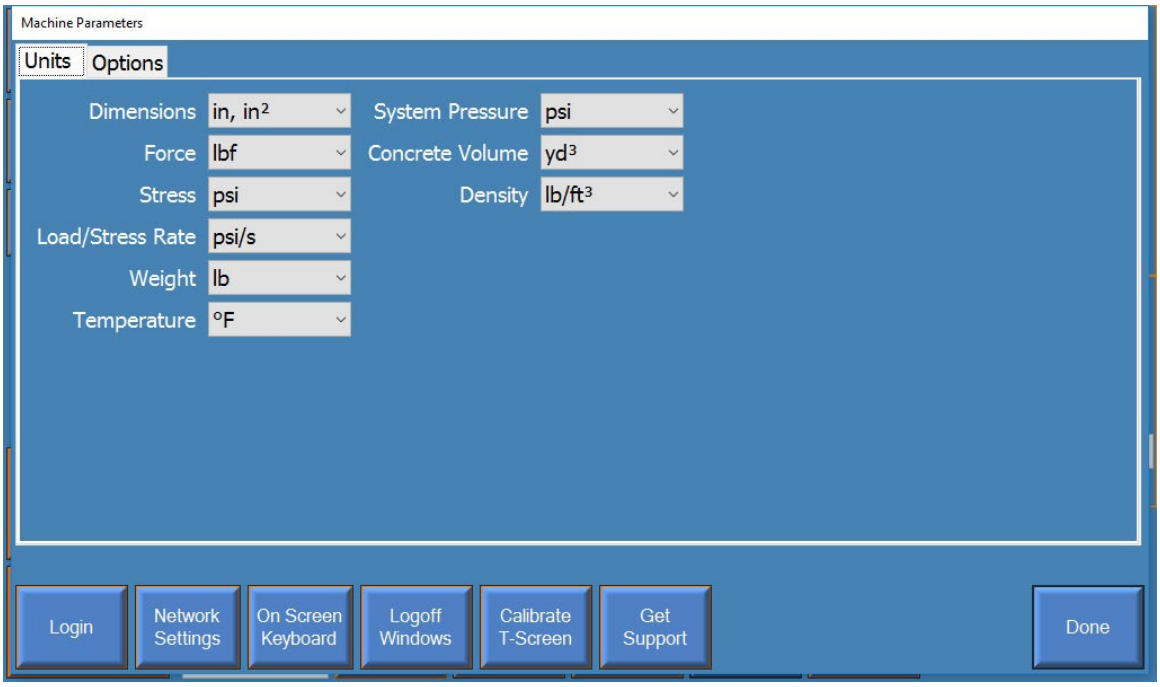
The diagnostics screen for your system may have additional items to accommodate special features such as MOE, secondary frame or displacement.

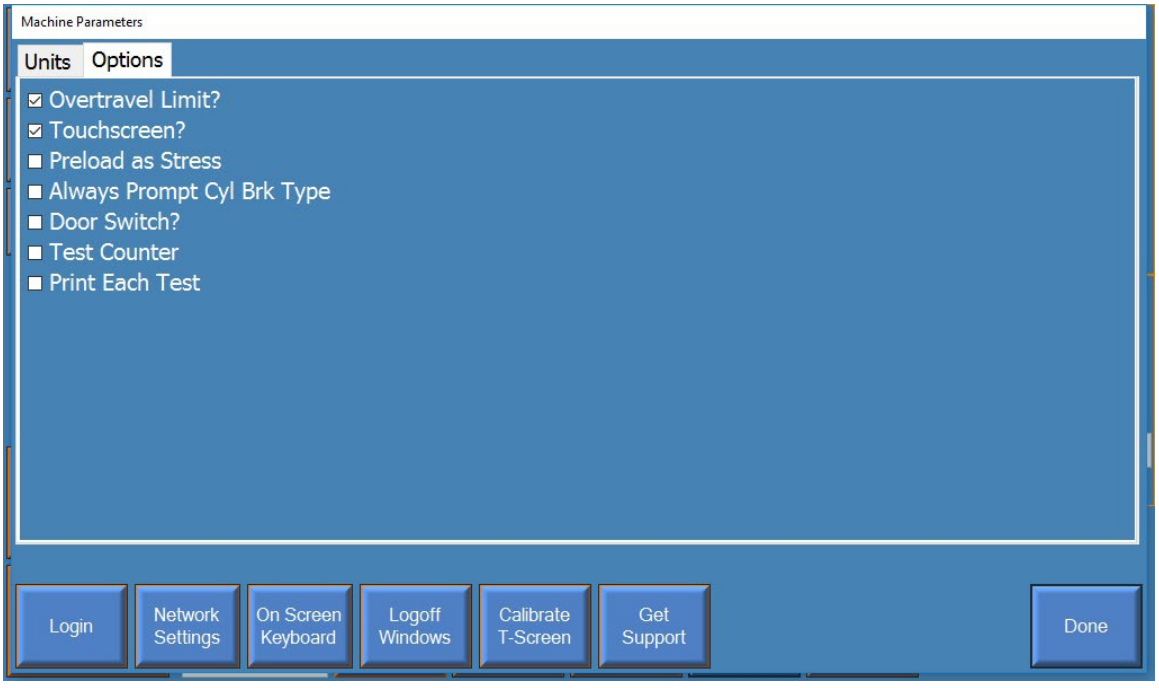


User Info – Allows the user to enter and store various name, company, address, and other reporting information.



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

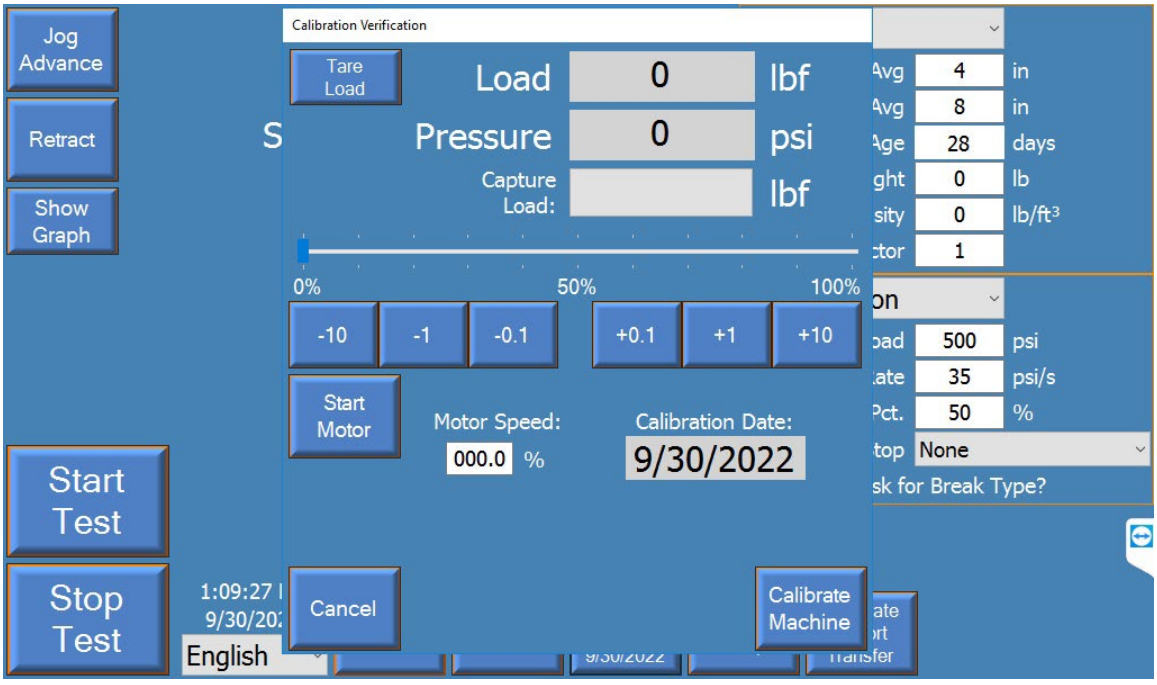
Note: ForneyVault® enabled machines automatically get all specimen setup information as entered when the specimen was created in either the lab information management system or via ForneyTools, the ForneyVault® web interface.

CALIBRATION AND VERIFICATION

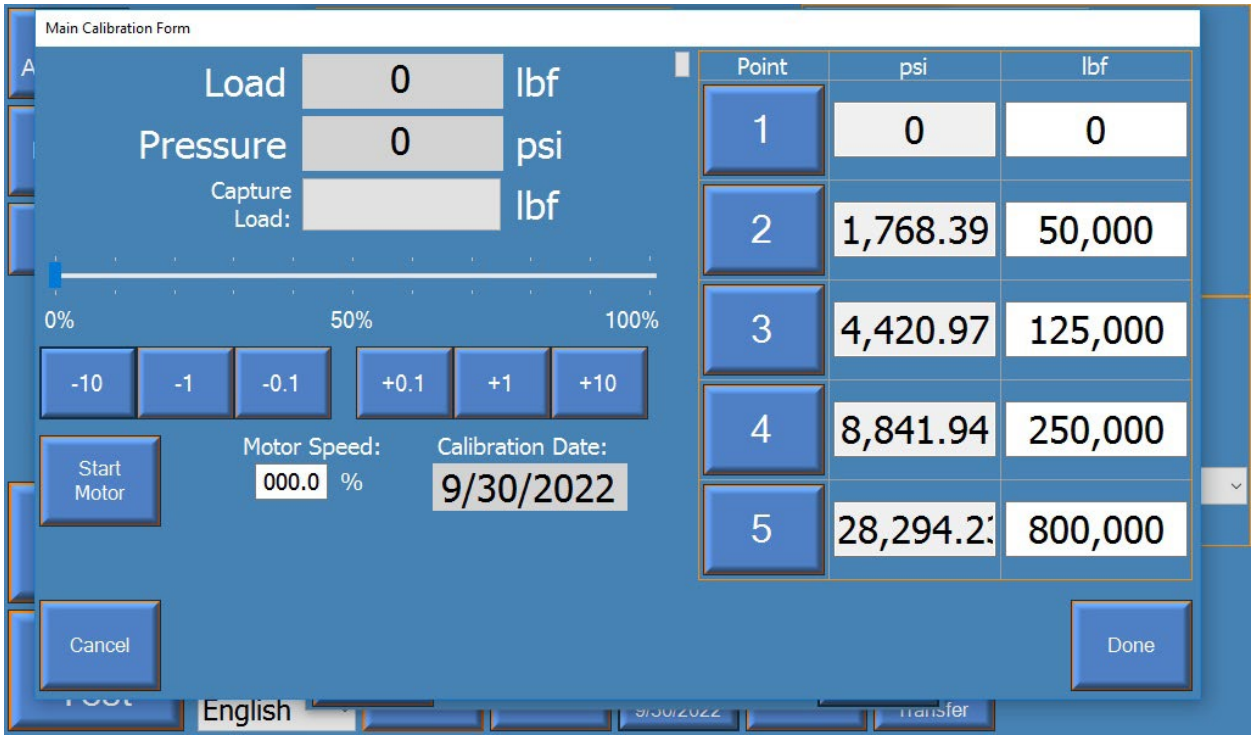
Before the machine can be used, it must be properly calibrated and verified. While FORNEY machines are always factory calibrated and verified, ASTM E4 requires the machine to be verified in its final location. Verification is completed on the "Verify Calibration" screen. If necessary, calibration is 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.



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.

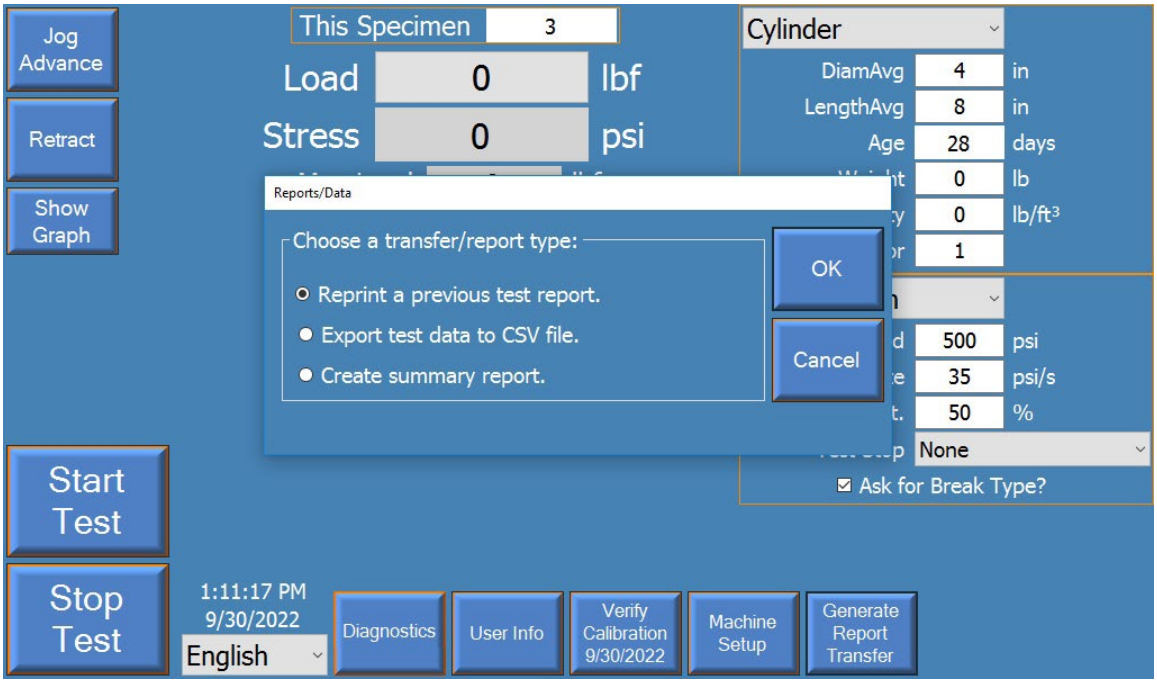
11. Once verification is complete, write down the constants or take a photo of the screen. In the event of system failure, these values can be restored without requiring recalibration.
12. Exit back to the main screen.

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.

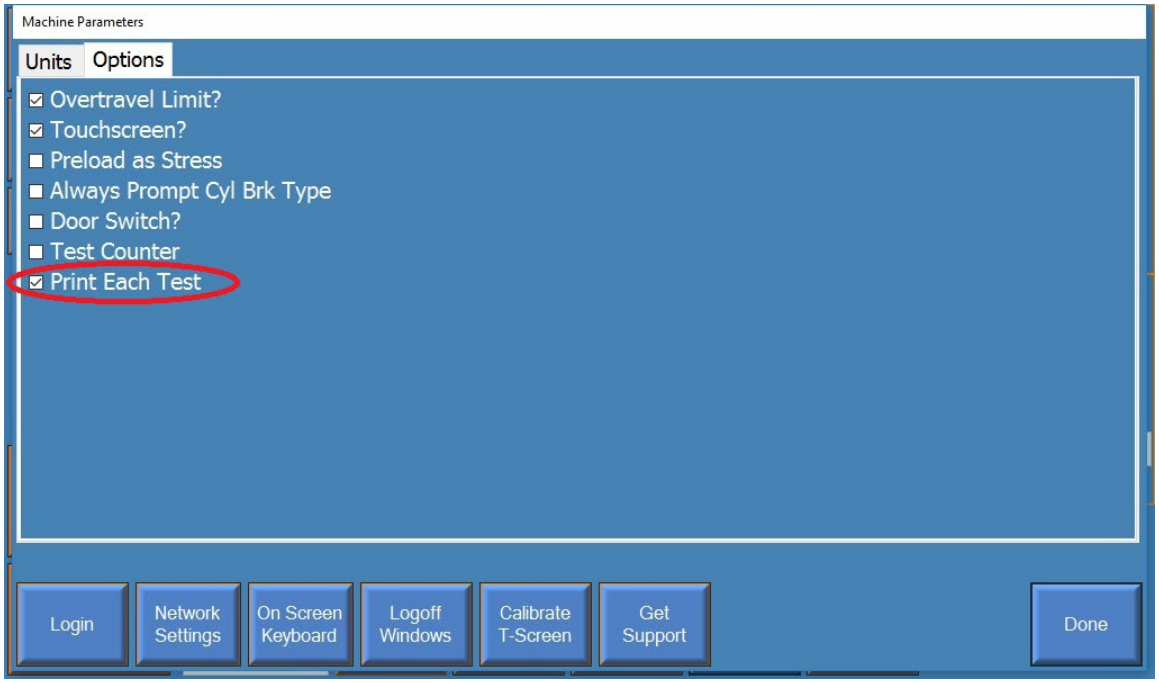
To retrieve detailed test data for a specimen, select "Export test data to CSV file." A CSV file or Comma-separated vale file is a standard file that are standard with a wide variety of applications, such as Microsoft Excel.

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.

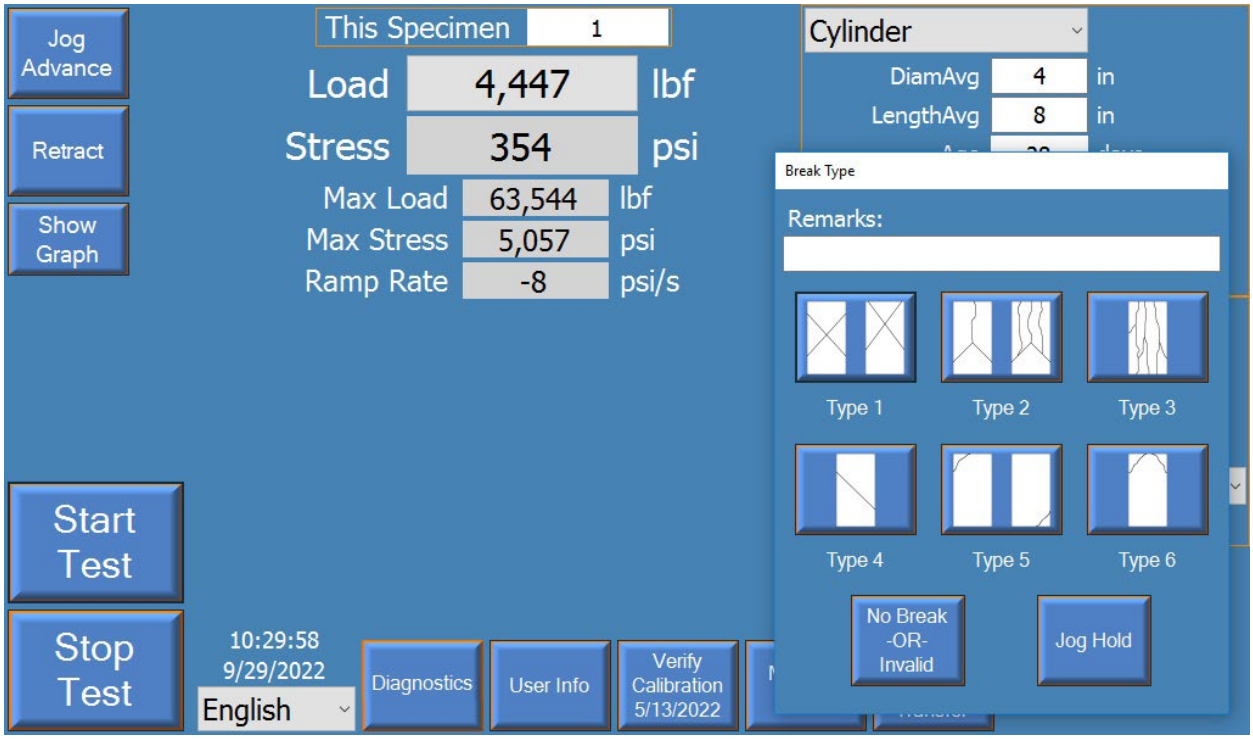
6. Press the active load value to tare and perform centering block seating procedures per applicable standards.

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:



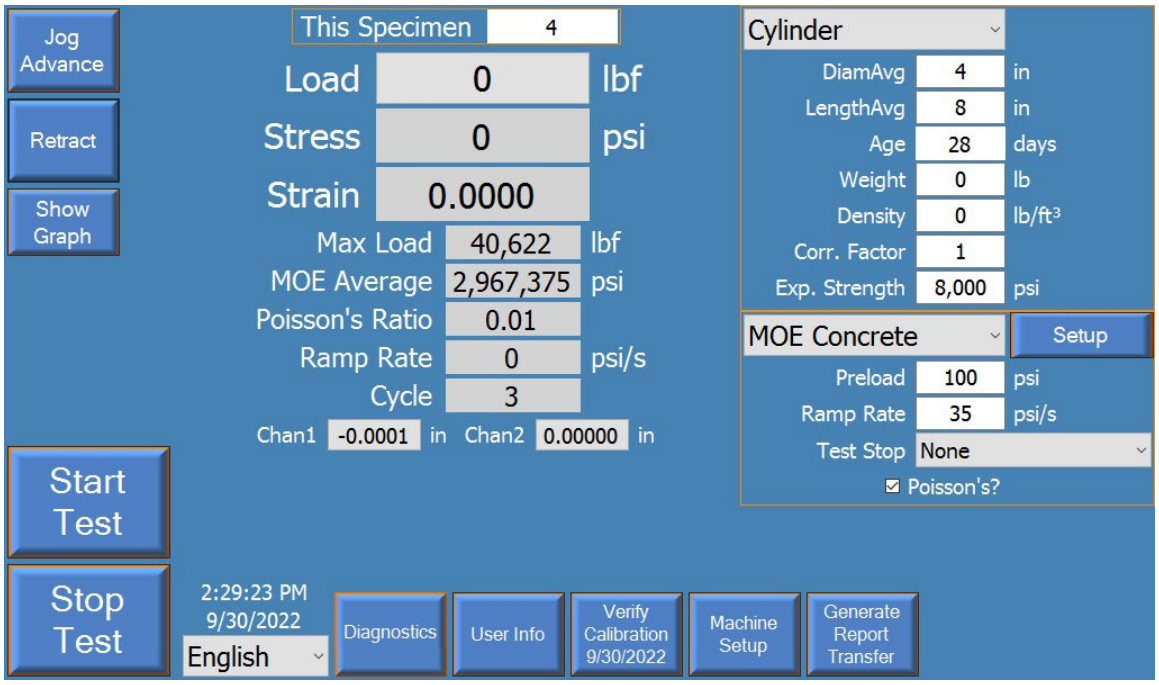
11. Record the Load at Break, or Stress at Break as desired, or simply move on to the next test if the data-logged results or ForneyVault® are used.

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.



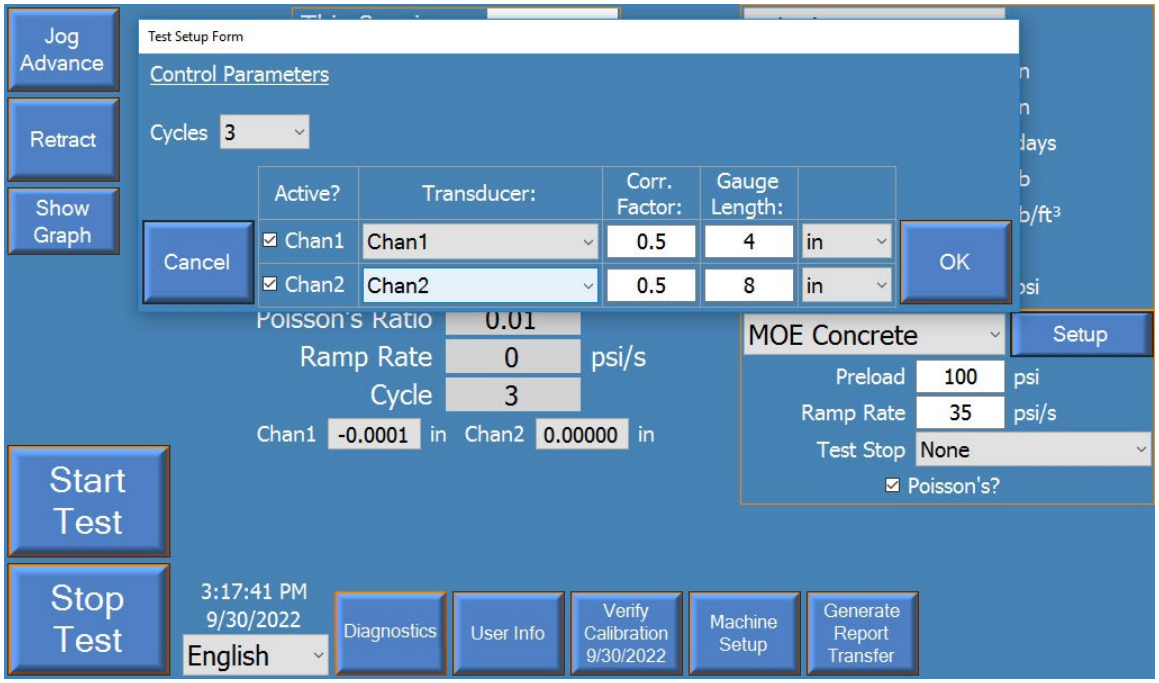
The remaining parameters to setup are:

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)

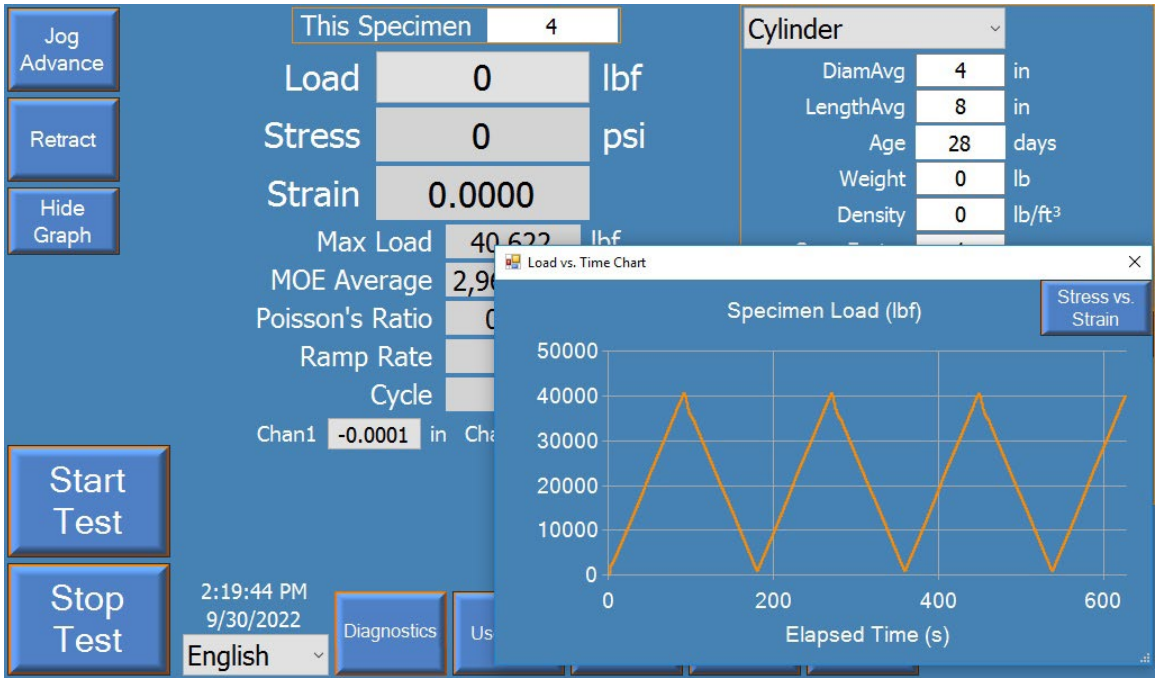
During testing you can either watch the normal display or select the show graph option to look at load vs time or strain vs time. While the test is applying load, the system will show positive ramp rate. When the system is unloading, it will display a negative ramp rate.

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

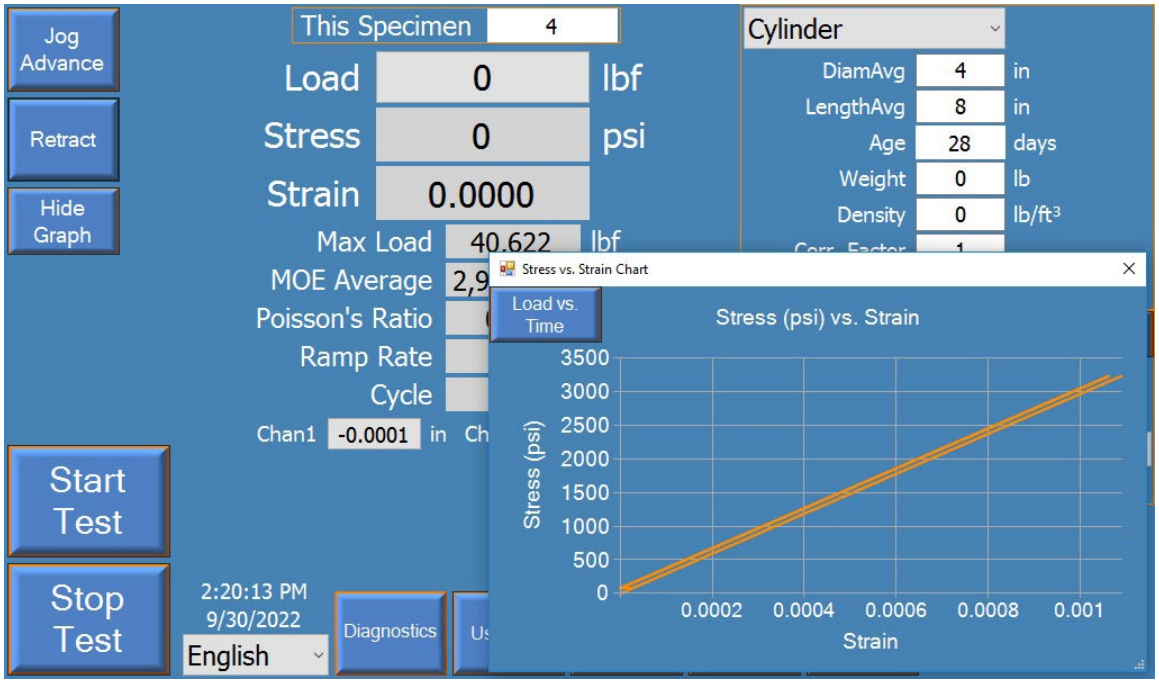
Note: A Modulus/Poisson's (-MP) machine setup is shown. If your machine is Modulus only (-M) there is only one channel.



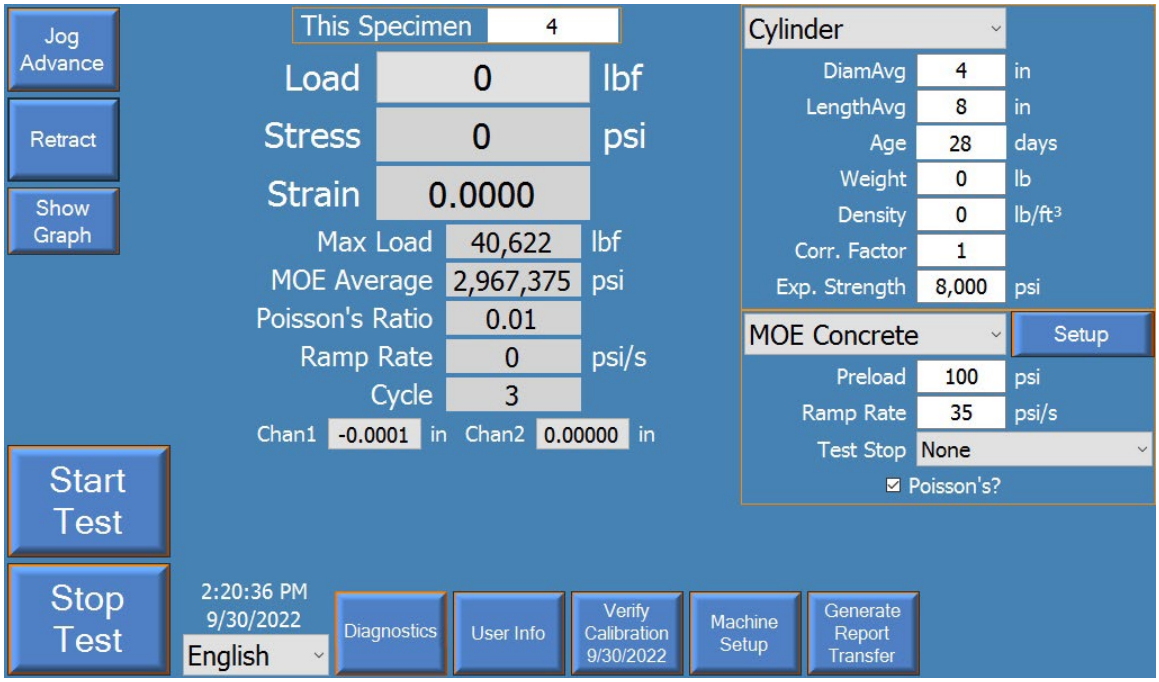
An example load vs time graph is shown during the test by pressing the ‘show graph’ button:



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



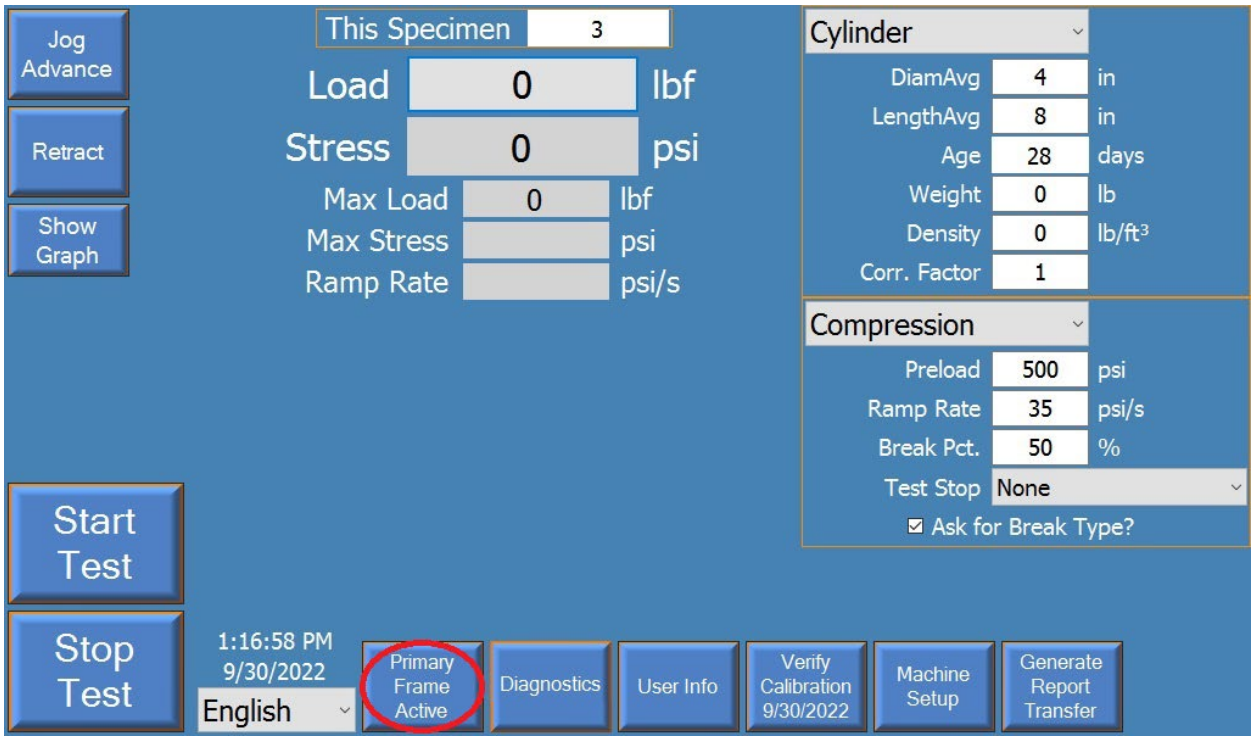
Once the test completes, the MOE value is displayed:



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.



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.

NOTES: