

L2 Series Software for Force Measurement

Quick Test Applications



Starrett®

The Better Solution



Starrett®
FMS500



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General Safety Precautions

Force measurement systems are potentially hazardous. Prior to operating your testing system, Starrett recommends that you read and understand the instruction manuals for your system and components and that you receive training on the proper use of this equipment from your authorized Starrett representative.

Observe all warnings and cautions identified in this manual for your equipment. A warning identifies a function that may lead to injury or death. A caution identifies a hazard that may lead to damage to equipment or loss of data.

Starrett products, to the best of our knowledge, comply with various national and international safety standards as they apply to material and force measurement testing. This Starrett product has been tested and found to comply with the following recognized standards:

- EN61010-1 Safety Requirements for Electrical Equipment
- EN61000-6-3 EMC Generic Emissions Standard
- EN61000-6-1 EMC Generic Immunity Standard

Starrett also certifies that this product complies with all relevant EU directives and carries the CE mark.

Warnings

Emergency Stop Switch

Press the emergency stop button whenever you feel there is an unsafe condition during a test. The emergency stop button removes power to the motor drive system causing the crosshead to stop.

Flying Debris

Eye protection, protective clothing and splinter/safety shields should be used whenever any possibility exists of a hazard from the failure of a sample, assembly or structure under test. Due to the wide range of materials that may be tested and that may result in a failure which may cause bodily injury, the precautions and preventative methods taken prior to testing is entirely the responsibility of the owner and the user of the equipment.

Crush Hazard

Always use caution when installing or removing apparatus and your sample material between the frame's crosshead and the base. A potential pinch/crush hazard exists. Keep clear of the testing fixture, and particularly the jaw faces at all times. Keep clear of the crosshead during movement. If available, always make sure the Pinch Load feature is enabled. This will stop inadvertent crosshead operation if in manual mode. Always ensure that other personnel cannot operate the system while you are working within the test fixture area.

Electrical Hazard

Disconnect equipment from the electrical power supply before removing any electrical safety covers. Disconnect power when replacing fuses. Never reconnect power while the covers are removed. Never operate the system with protective covers removed.

Rotating Machinery Hazard

Always disconnect power before removing covers that protect the user from the internal rotating mechanisms. If maintenance to the drive mechanism is required, and power is needed to perform maintenance to the drive system, maintenance should be performed by an authorized Starrett representative who has received factory training on performing such procedures.

Load Sensor Minimum Deadband

Your FMS System uses FLC Series load cell sensors. Starrett recommends using these sensors per ASTM E4, therefore, the sensors should not be used for measurements less than 2% of the sensor's rated full scale capacity.

FLC Sensors are electronic precision instruments. Starrett recommends a warm-up period of 5 minutes prior to use.

1.0 Introduction

Thank you and congratulations for selecting the Starrett FMS Series for your force measurement testing.

Your FMS testing system may be used for tension and compression testing including specific test methods such as peak, break, constant hold, flexural, shear, peel, coefficient of friction and more. Your FMS testing system should be used with Starrett equipment and accessories only. And for optimum performance, your FMS testing system should be maintained and serviced annually by an authorized Starrett representative.

1.1 System Description

Your Starrett FMS Series system consists of the testing frame, L2 digital controller, load cell sensors and test fixtures. Together, these components provide you with a full-featured testing system for most force measurement testing applications.

1.2 Product Support

If you require product support for your Starrett system, contact your authorized Starrett representative. Authorized Starrett representatives are listed on our website at www.starrett.com. In the event that your Starrett representative may not be able to assist you, contact Starrett at one of our many international sales offices. Our sales offices are listed on our website at www.starrett.com.



The Starrett FMS Series - Single-column Force Measurement Systems

2.0 Test Setup Methods

Quick Test templates are supplied standard on your L2 Controller and are designed to let you create a test in as few as two steps.

Your L2 software contains three (3) types of Quick Test Setups: Load Limit Quick Test, Distance Limit Quick Test and Break Quick Test.

Quick Tests can be converted to the more advanced Test Builder application if added functions are required. Simply setup your Quick Test as normal, and then select the Convert to Test Builder icon.

2.1 Quick Test - Load Limit

The Quick Test - Load Limit setup lets you create a load limit test by specifying the limit value and the test speed. Your test will conclude when the load limit is achieved. This test is generally used when you are interested in determining the amount of deflection/extension the sample exhibits while being pulled or pushed to a load setpoint.

2.2 Quick Test - Distance Limit

The Quick Test - Distance Limit setup lets you create a distance limit test by specifying the limit value and the test speed. Your test will conclude when the distance limit is achieved. This test is generally used when you are interested in determining the amount of load the sample exhibits while being pulled or pushed to a distance setpoint.

2.3 Quick Test - Break Limit

The Quick Test - Break Limit setup lets you create a break test by specifying the break value and the test speed. Your test will conclude when the load drops by a percentage from a previously measured peak load. For example, if the user sets a Break % of 10%, the system will continuously measure the load value. When the load drops by 10% from a previously measured peak value, the data point associated with this drop in load is characterized as the “break point” for the sample under test. This test is generally used when you are interested in determining the break characteristics of the sample while being pulled or pushed.

2.4 Test Builder Application

The Test Builder is another test setup application supplied standard with your L2 Controller. The Test Builder is used when more advanced testing is required or where you may want more flexibility in your testing. The Test Builder is discussed in a separate User’s Guide and is referenced only in this document.

3.0 Using Quick Test Setup Method

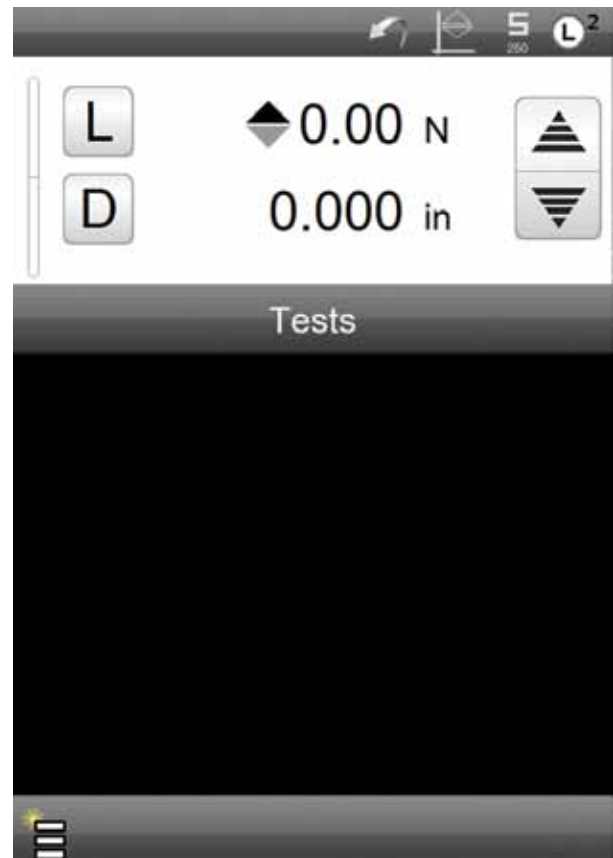
There are three types of Quick Test Setups: Load Limit, Distance Limit and Break Limit. Quick Tests are designed to be configured in as few as two steps. Quick Tests are basic test methods optimized for easy setup and implementation.

3.1 Creating a Quick Test

You create a new test by selecting the New Test symbol. The New Test symbol is always located at the Home view.

The Home view displays the Menu for New Tests. You have four New Test options:

- Load Test... (Quick Test)
- Distance Test... (Quick Test)
- Break Test... (Quick Test)
- Test Builder



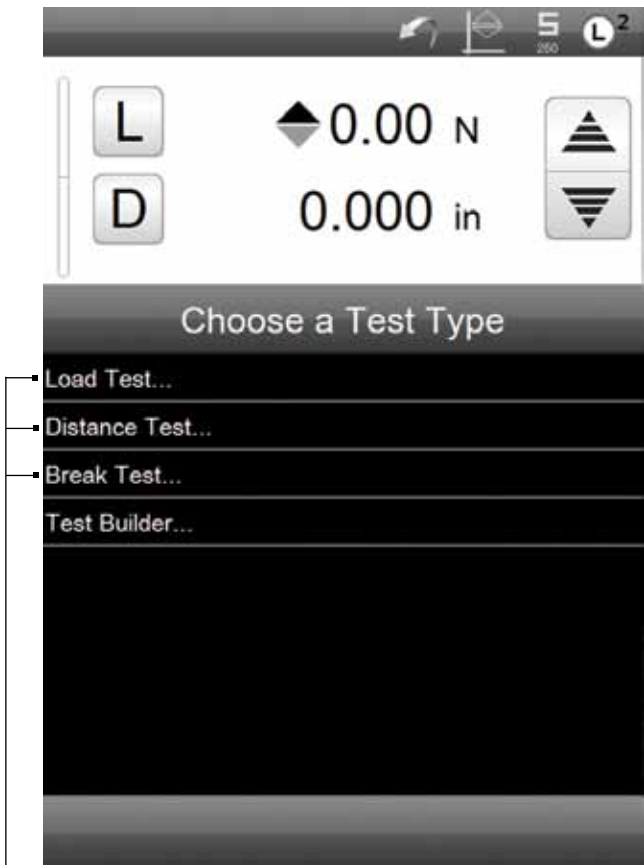
New Test Symbol

3.2 Quick Test Setup Options

All Quick Tests are comprised of four steps: Pre Test, Test, Data and Post Test. The Pre and Post Test steps are common to all Quick Test types. The Test and Data steps vary depending on the type of test being created.

3.2.1 Pre Test Options

The Pre Test step provides you with options that may be performed before the test is actually conducted. Pre Test options are discussed in detail in Section 4.0.



Home View

Quick Test Methods

3.2.2 Test Options

The Test step let's you select the testing options available for your specific test type. Options will vary depending on whether the test type is a Load Limit, Distance Limit or Break Limit. The Test step is where you configure how the test will be performed- the type of test (tensile or compressive); limit setpoints, test speed, etc.

3.2.3 Data Options

The Data step let's you select the results you want reported at the completion of your test. Results are reported as coefficients with symbols and abbreviations that specify the data type being reported. Table 3.1 shows the individual data types or coefficients available for each Quick Test. Each Quick Test has default coefficients that we have already selected for you.

Load Limit Quick Test	Distance Limit Quick Test	Break Limit Quick Test
Load (default)	Load (default)	Peak Load (default)
Distance (default)	Distance (default)	Distance @ Peak (default)
Speed	Speed	Break Load (default)
Date	Date	Distance @ Break Load
Time	Time	Speed
		Date
		Time

Table 3.1
Quick Test Data/Coefficients

3.2.4 Post Test Options

The Post Test step provides you with options that may be performed after the test is completed. Post Test options are discussed in detail in Section 5.0.

4.0 Pre Test Setup

The Pre Test step provides you with options that may be performed before the test is actually conducted. The Pre Test options are common to the Load, Distance and Break types of Quick Tests.

The Pre Test step consists of three sections: Settings, User Prompts and Set Datum.

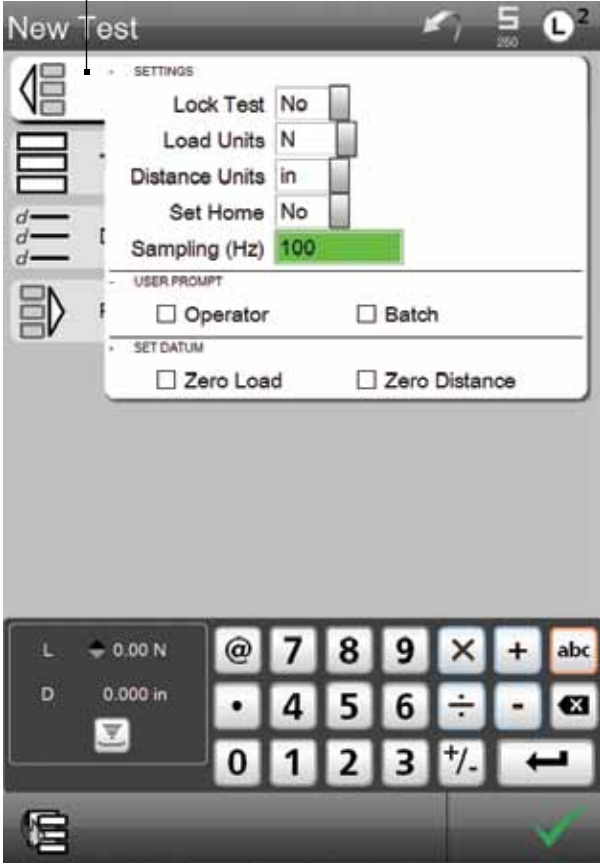
The following sections describe each option available in the Pre Test step for your Quick Tests.

Select the “+” target to expand the list of options for each section.



Pre Test View (Collapsed)

Select the “-” target to collapse the list of options for each section.



Pre Test View (Expanded)

4.1 Settings Options

The Pre Test Settings options are common to all Quick Test methods. Each option is described in the following sections.

4.1.1 Lock Test Option

When the Lock Test option is set to YES, an unauthorized user is prevented from making changes to the test setup. This option also prevents the test setup from being deleted. The default value for Lock Test is NO. NO means that you can make changes to the test setup once it has been created.

4.1.2 Load Units Option

Load Units let you specify the units of measure that represent your load result and load measurement. Available units of measure for load are N (newton), LBF (pound-force), KGF (kilogram-force), GF (gram-force) and OZF (ounce-force).

4.1.3 Distance Units Option

Distance Units let you specify the units of measure that represent your distance result and distance measurement. Available units of measure for distance are IN (inch) and mm (millimeter).

4.1.4 Set Home Option

Set Home may be YES or NO. If Set Home = YES, the home position, which is the starting position for your crosshead prior to you selecting START TEST, is automatic. If the Set Home option = NO, the operator is required to manually select the SET HOME touch target located to the left of the START TEST touch target.

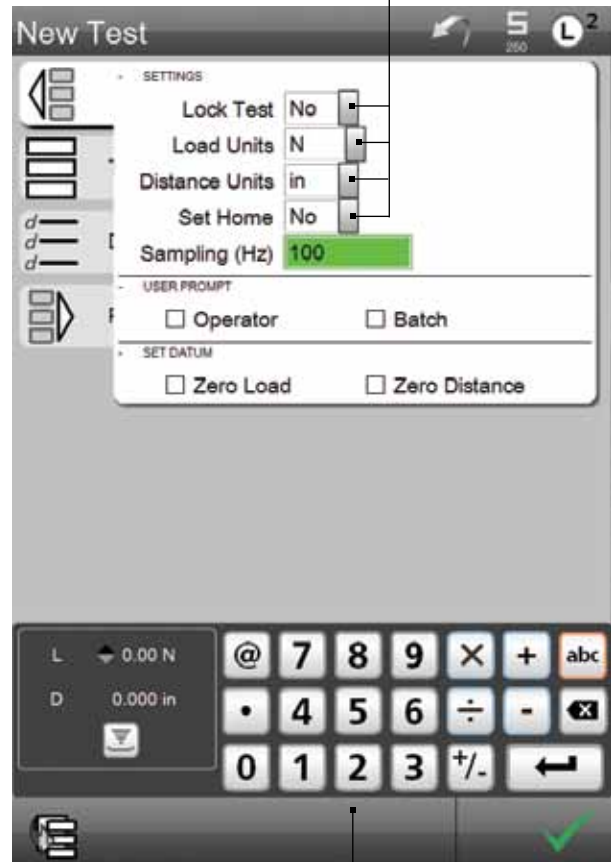
You should exercise caution when using Set Home = YES. Damage can occur to your load cell sensor if your Set Home position is incorrect and the crosshead automatically returns to an erroneous position once a test is completed.

4.1.5 Sampling Rate (Hz) Option

Your FMS Series system has a maximum rated Sampling (Hz) rate of 1000 samples per second (that's a lot of data). The factory setting is 100 Hz and is usually more than sufficient for capturing peak load, etc.

If you need a higher sampling rate, you can change the rate using the numeric keypad.

Select the "touch targets" to select the options for each Setting type.



Use the numeric keypad or your traditional keypad to change the numerical sampling rate. A wireless keyboard can be easily "paired" to your L2 Controller.

4.2 User Prompt Options

Pre Test settings include the ability to use prompting. Two prompts are available:

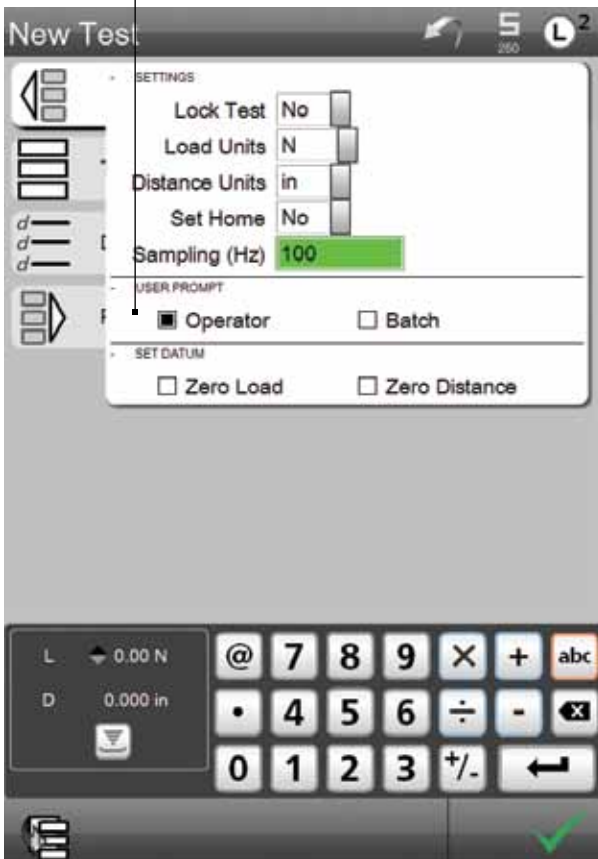
- Operator Prompt
- Batch Prompt

4.2.1 Operator Prompt

The Operator Prompt requires the operator performing the test to enter their name when the START TEST touch target is touched. Use this prompt so that the name of the operator performing the test is recorded in the test data.

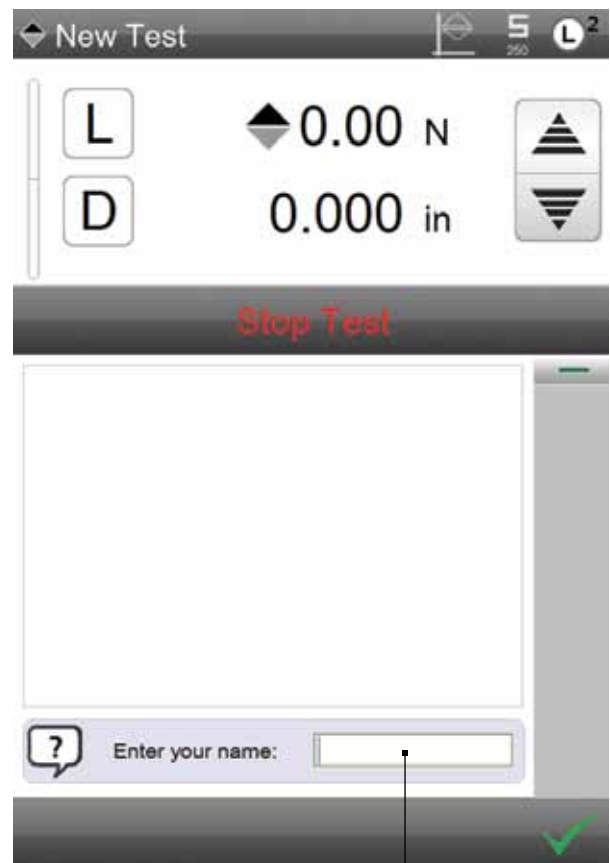
The Operator Prompt provides an audit trail for each test run by operator name. The Operator Prompt default is OFF (the combo box is not highlighted).

To enable a prompt, touch the combo box. A filled box means the prompt is enabled.

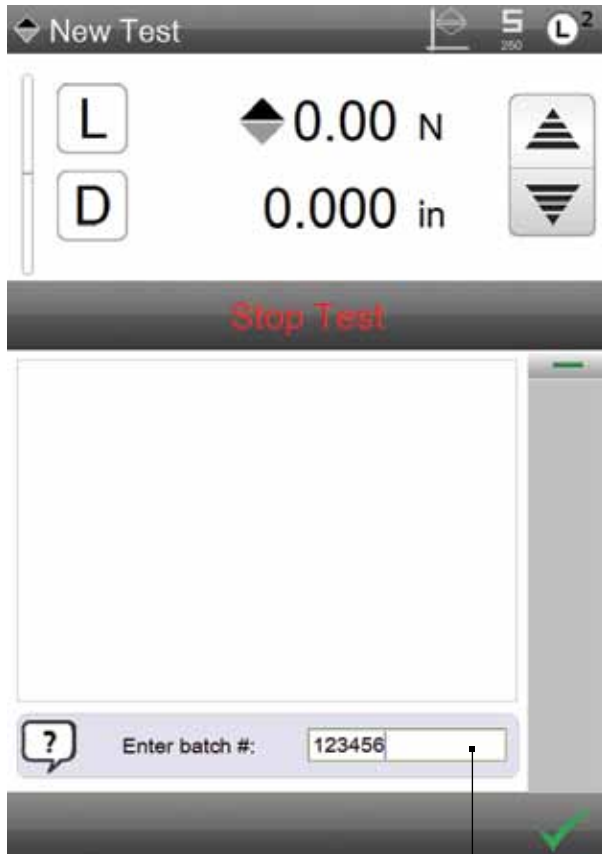


4.2.2 Batch Prompt

The Batch Prompt requires the operator performing the test to enter the name of the batch or the sample being tested. When the Batch Prompt is used, the operator is required to enter the name of the sample being tested prior to the test being able to be performed. The Batch Prompt default is OFF (the combo box is not highlighted).



An operator prompt appears when enabled. The operator is required to enter their name before the test is allowed to be performed.



When a Batch Prompt is used, a prompt will display and the operator is required to enter a batch number. The operator enters the number and selects the check mark. This will cause the test to START.

4.3 Set Datum Option

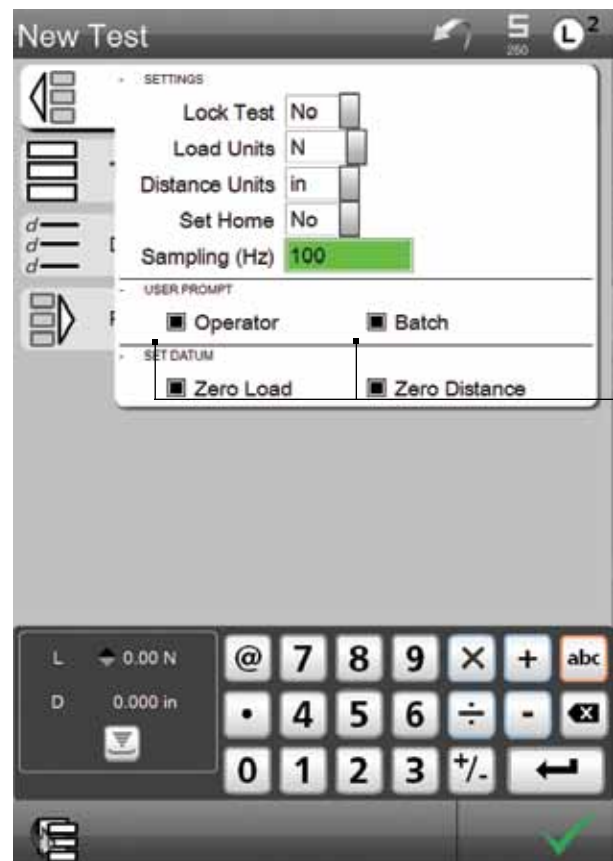
The Set Datum option lets you configure your test setup to automatically zero the Load and/or Distance after the Pre Test.

4.3.1 Zero Load

If you select the combo box for Zero Load, the load measurement in the display is automatically set to a 0 value at the completion of the pre test step.

4.3.2 Zero Distance

If you also select the combo box for the Zero Distance, your distance measurement in the display is automatically set to a 0 value at the completion of the pre test step.



You may set zero on Load and Distance using the Set Datum option. Select the combo box to enable these features. When selected, the Load and/or Distance will automatically zero once the START TEST target is pressed.

5.0 Post Test Setup

The Post Test options provide you with functions that are typically performed once a test run has completed. You may setup some, all or none of these options for your test setup. Like all options, Post Test options may also be added later using the Edit test function.

These Post Test options are common to all Quick Test methods.

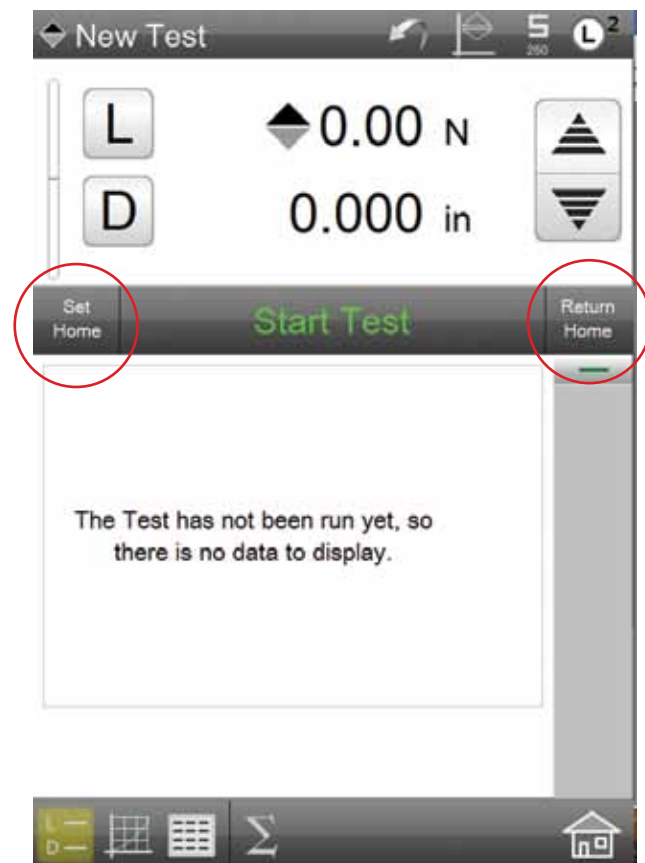
If the RETURN HOME option is ON, the SET HOME position is automatic once the START TEST target is pressed. At the completion of the Run, the crosshead will automatically return to the established HOME position.



5.1 Return to Home Option

Use the Return Home option to automatically return the crosshead to the Home position once a test run is completed. When the option is YES, the crosshead will automatically return to the Home position when the test is completed.

When the option is NO, the user will return to the Home position by selecting the SET HOME and the RETURN HOME touch targets on the DRO view.



If the RETURN HOME option is OFF, the operator must first SET HOME. Then you may perform the test. When you select the RETURN HOME target, the crosshead will return to the Start position where SET HOME was pressed.

5.2 Export Raw Option

When the Export Raw option = YES, the raw data points for the completed test will be saved as a .csv file and saved to a directory that you designate in the Main Settings option.

The directory may be anywhere on a network where your FMS System resides.

The Export Raw has three options: No, Overwrite and Auto Number.

When set to NO, no raw data is saved for the test Run.

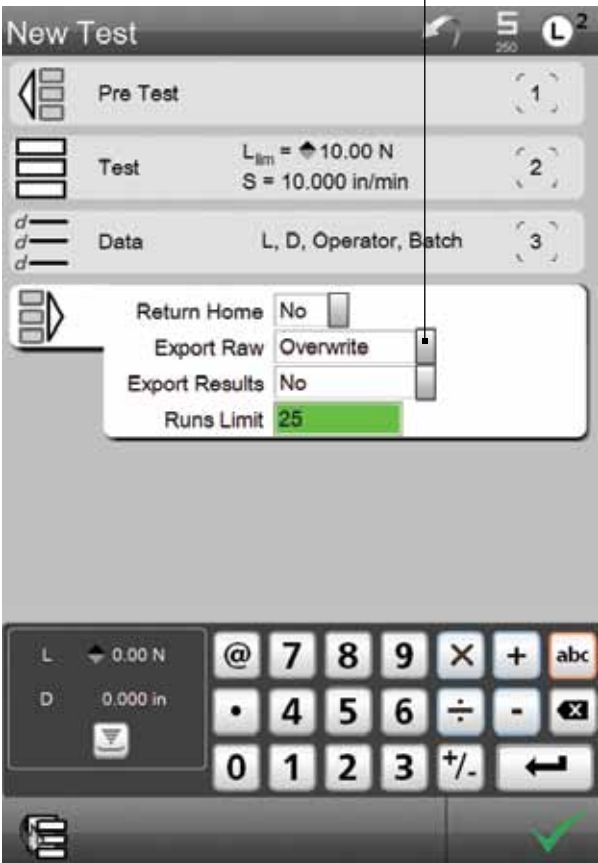
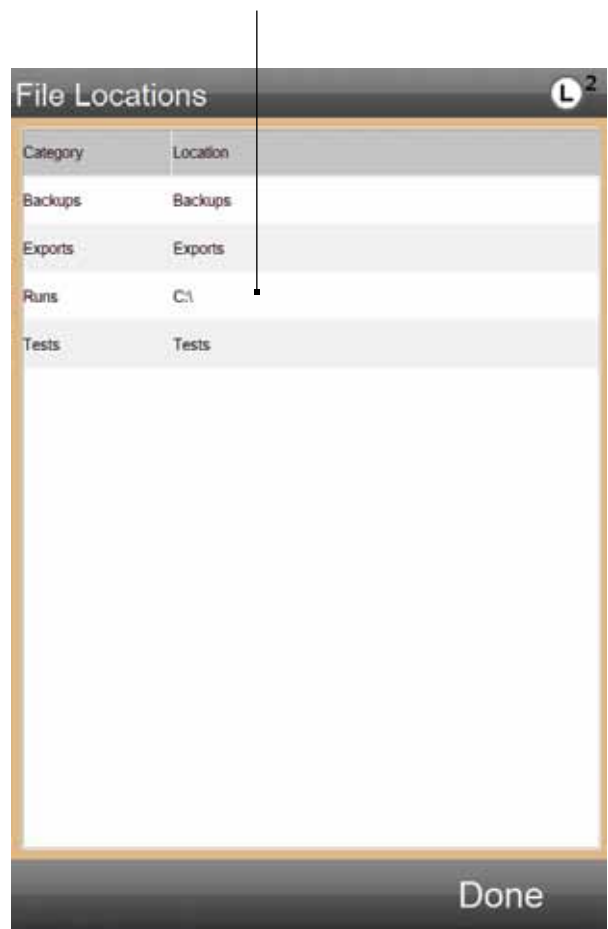
Overwrite means that the raw data overwrites the previous raw data. A file is transmitted to your directory: [Test Name]_Raw Data.

The Raw Data file displays the Step Number, Time, Load, Units of Load, Distance, Units of Distance, Velocity, Velocity Units and Status for all data points. The number of data points (or rows on your table) correspond to the sampling rate and the duration of your test.

The Results file displays the Test ID, Run Number, Load, Units of Load, Distance and Units of Distance.

Use the Main Settings function and select FILE LOCATIONS to designate a directory where you want your Raw Data Export to be saved to. Once the test Run is completed, a .csv file is created and saved to your designated directory.

When the OVERWRITE option is selected, a new .csv file is created for the test Run. The file “overwrites” the previous file’s data.



Auto Number means that a new file is created for each test run and each export. The files are sequentially numbered when Auto Number is used.

The Raw Data files displays the Step Number, Time, Load, Units of Load, Distance, Units of Distance, Velocity, Velocity Units and Status for all data points. The number of data points (or rows on your table) correspond to the sampling rate and the duration of your test. Each test run has its own separate file. The file is designated as [Test Name]_RawData_000001. Each test run is numbered sequentially.

The Results file displays the Test ID, Run Number, Load, Units of Load, Distance and Units of Distance. A new row is created for each test run when Auto Number is used.

5.3 Export Results Option

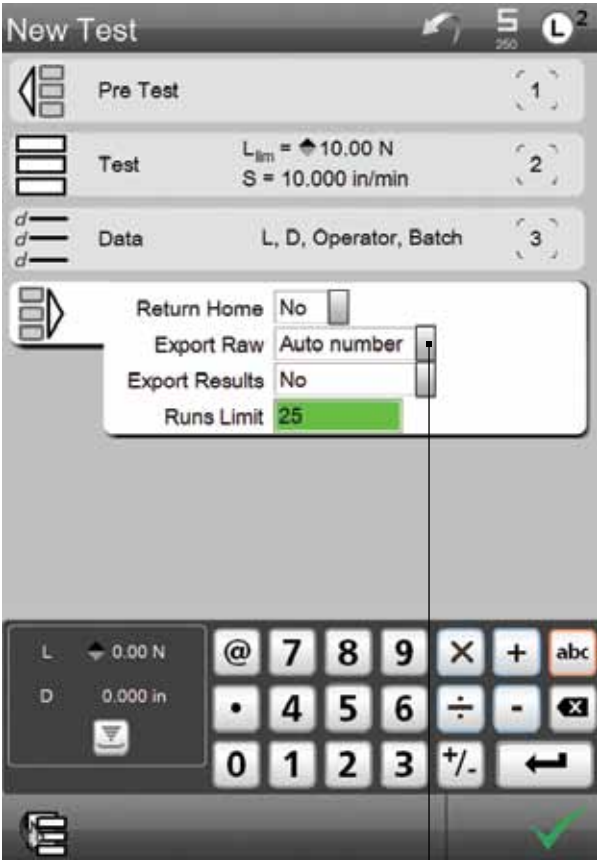
You have four options for your Export Results function.

When Export Results = NO, no results are exported at the completion of a test.

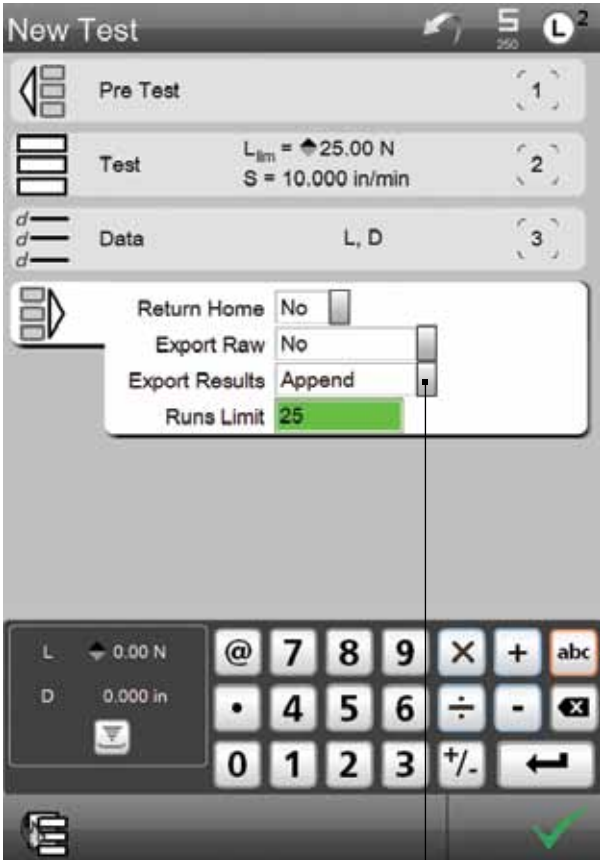
When Export Results = APPEND, results are exported to a .csv file within the Directory you established prior to your test. There is a single file and each result is appended to the file as a new row.

When Export Results = OVERWRITE, results are exported to a .csv file. There is a single file and there is only one row of results. When a new test is completed, the data in the row is replaced with the new data.

When Export Results = AUTO NUMBER, results are exported to a .csv file. Each test result creates a new file and each new file is sequentially numbered for identification.



When the AUTO NUMBER option is selected, a new .csv file is created for the test Run. A new .csv file is created for each test Run in the batch. If you performed ten test Runs, then ten files are created with the raw data for each Run.



When the APPEND option is selected, a new row of results data is added to a single Export Results file.

5.4 Runs Limit

The Runs Limit is the number of test runs that will appear on the Data View until the runs are overwritten. Setting the Runs Limit is a data management function.

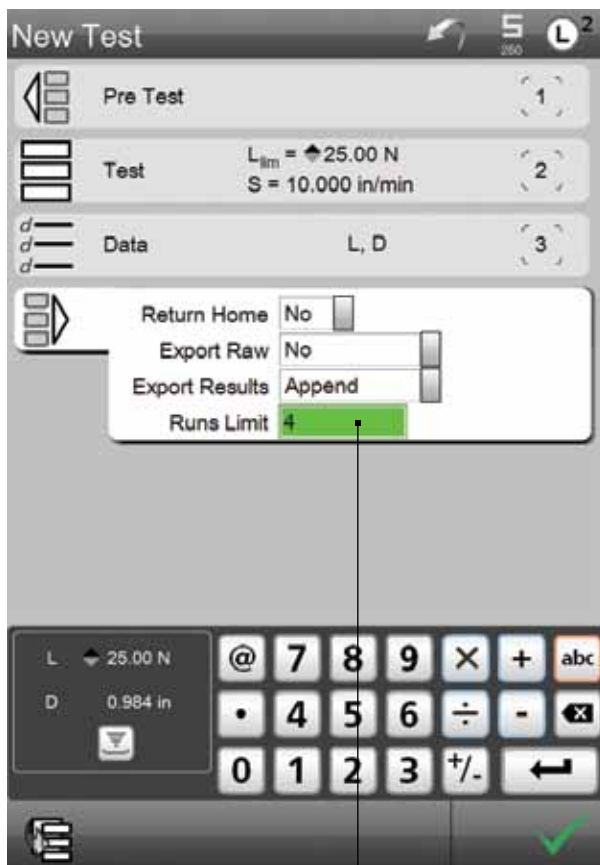
When the Runs Limit = 3, each run will be shown with a sequential number that represents the Runs Number. When the 4th test is conducted, Run #4 will display and Run #1 will be permanently erased from the Runs List.

When the RUNS LIMIT number is exceeded the oldest RUN is permanently erased and replaced by the newest test Run.

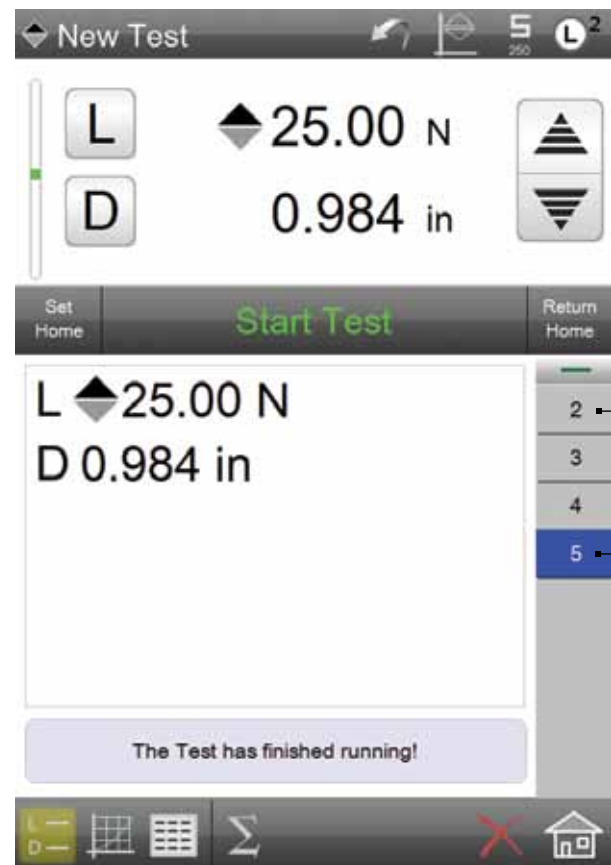
In our example, since the Runs Limit is 4, only four Runs will ever be shown in the Runs List.

The oldest Run will be replaced as a new Run is performed.

The Run number sequence will remain however.



The RUNS LIMIT can be set to limit the number of Runs that are displayed on the Data View.



6.0 Test Setups

The Test Setups are the options associated with the different types of Quick Tests that determine how the test will operate.

This section will describe the Test options for each type of Quick Test: Load Limit, Distance Limit, and Break Limit.

6.1 Load Limit Test Setup

The Load Limit Quick Test is used when you want a test to begin and reach a conclusion when a target load setpoint is reached.

The Load Limit Quick Test reports the Distance value at the Load Limit.

When you launch the Load Quick Test, the view automatically starts with the Test Options menu.

The Test Options menu has three basic attributes:

- Type (also referred to as Test Mode)
- Target Load (also referred to as the Load Limit or Load Setpoint)
- Speed (Test Speed)

6.1.1 Test Type

The Test Option launches with the Type = Tension. Tension means you want to perform a Pull test, e.g. you want the crosshead to move in an upward direction.

If you want to perform a Compression test (also called a Push test), change the Type to Compression.

6.1.2 Target Load

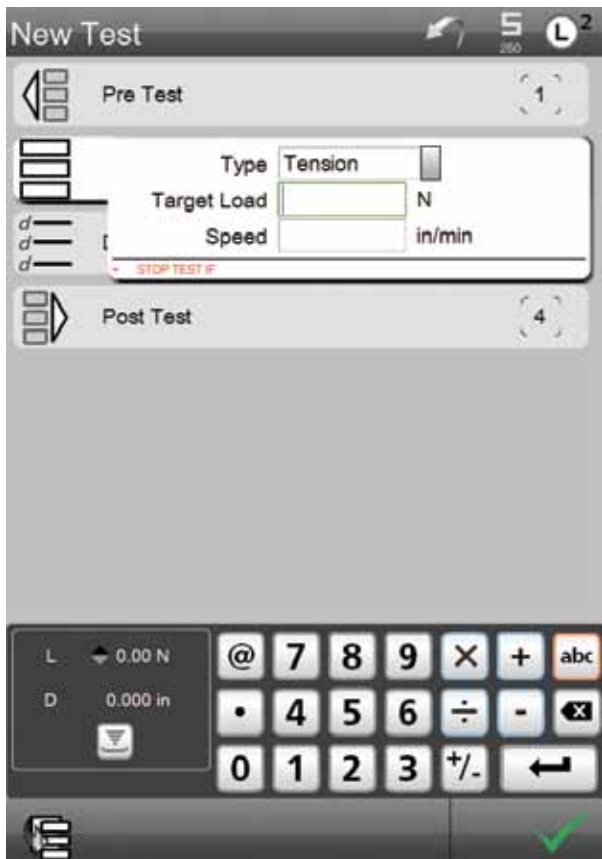
The Target Load value is the load limit setpoint. You want the crosshead to pull your sample until the measured load = your specified Target Load value. Load units may be newtons (N), pounds-force (lbf), kilogram-force(kgf) and for lighter load sensors additionally gram-force (gf) and ounce-force (ozf). You may specify the units of measure for Load using the Pre Test options.

Enter numerical data using the keypad at the bottom of the display. You may also use a USB key that is connected to your L2 Controller or a wireless keyboard that is paired to your L2 Controller.

6.1.3 Test Speed

The Speed value is your test speed. This is the velocity you want your crosshead to travel at from when you start your test to your Target Load setpoint. Speed units may be either in/min (inch per minute) or mm/min (millimeter per minute). You may specify the units of measure for speed using the Pre Test options.

All FMS Series systems have a speed range from 0.001 to 50.0 inch per minute (0.02 to 1270 mm per minute).



6.1.4 Using Load Conditions

Conditions are events that, when used, can cause your test to abort prior to completion. Conditions are used to protect against overload and over travel situations that can damage your equipment.

Conditions are optional. They are not required for your Load limit test.

6.1.4.1 Distance Limit

Use the Distance Limit to cause the test to be aborted should the crosshead travel to this distance value.

6.1.4.2 Break %

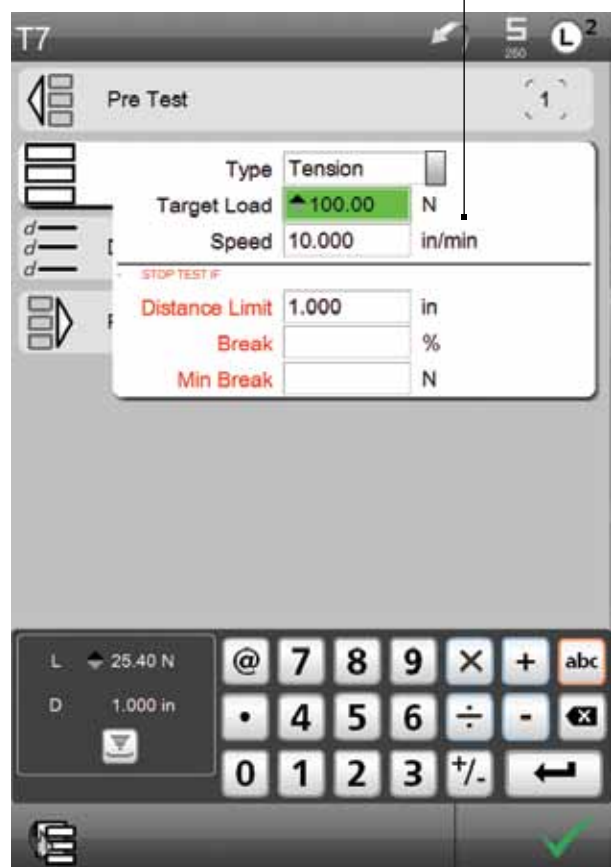
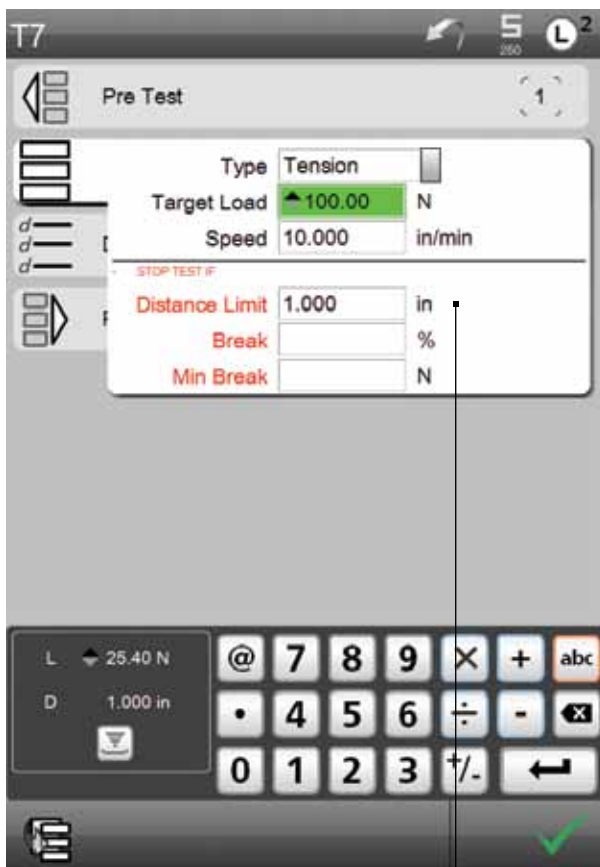
Break % is used if you want to abort a test should your sample break. The Break % represents the percentage drop in the measured load during the test from a higher value. For example, if you enter a Break % = 10, a test would abort if during the test, a measured load value of 100N dropped by 10% (to 90N). This sudden drop would indicate a sample break.

6.1.4.3 Minimum Break

Min Break represents the minimum break value when you use the Break % option. The minimum break is the load value that you must first achieve before the system begins to look for a drop in load. For example, some samples exhibit a high degree of load fluctuation when the test first starts. The minimum break states that the test must first exceed this minimum break value, THEN begin looking for the drop in load (Break %).

During the test Run, the crosshead moved 1.000 inch. Because the Distance Limit Condition is 1.000 inch, the test is aborted.

A message alerts the operator to the reason.



A Distance Limit condition will abort the test if the condition occurs. In this example, the Distance Limit = 1.000 inch.

You also have the option to set a condition based on a break event.

6.1.5 Data Options

The Data options step is where you specify what results you want reported and how you want your results formatted on individual display views.

Individual Data results are also called coefficients. Coefficients are displayed in an abbreviated format. Table 6.1 shows the available coefficients for the Load Limit Quick Test.

Load Limit Quick Test	Coefficient
Load (default)	L
Distance (default)	D
Speed	S
Date	Date
Time	Time

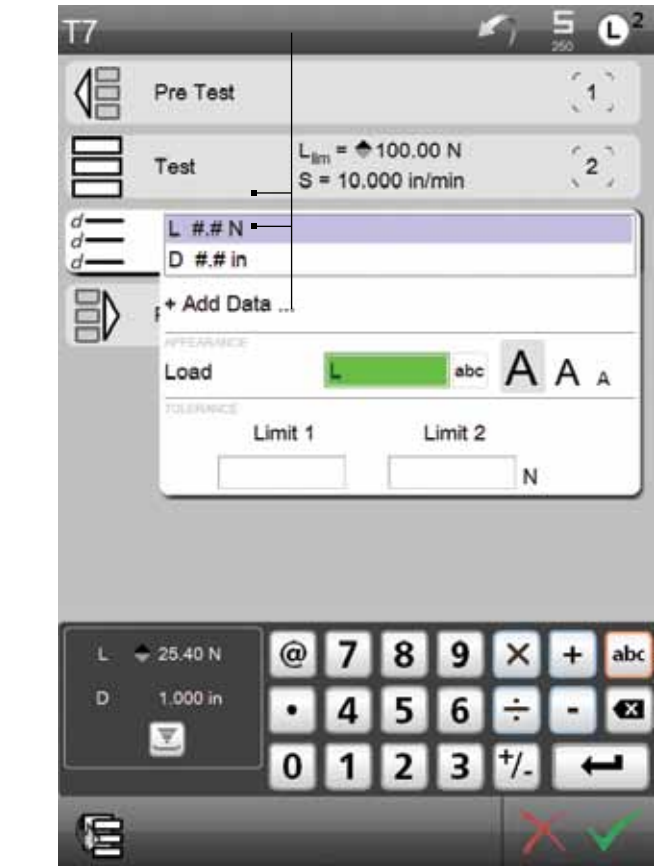
Table 6.1

Load Limit Quick Test Data/Coefficients

6.1.5.1 Load Limit Data

The Load Limit Quick Test assigns the default coefficients for Load (L) and Distance (D). Both results will be reported at the completion of a test Run.

The default coefficients for the Load Limit Quick Test are Load (L) and Distance (D). These coefficients are displayed with the associated units of measure.



6.1.5.2 Adding Data

While the Load test template automatically assigns both the Load (L) and Distance (D) coefficient, there are other coefficients available to you for reporting.

The other coefficients available for your Load test template are:

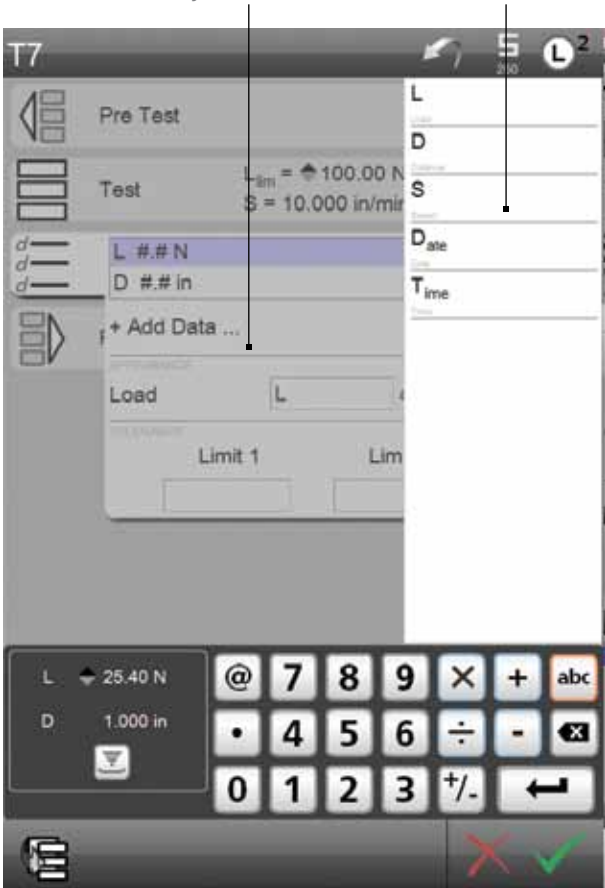
- Speed (S)
- Date (D_{ate})
- Time (T_{ime})

The S (Speed) coefficient will report the test speed used for your test.

The D_{ate} (Date) coefficient will report the date the test was performed. You may format the date using the main Settings menu (Display Formats). Date may be formatted in either MM/DD/YY or DD/MM/YY format.

The T_{ime} (Time) coefficient will report the time the test was performed.

Select the + Add Data... target to launch the Data Menu for your Load Limit Quick Test. Select the coefficient you want to add from the list.



6.1.5.3 Formatting Data

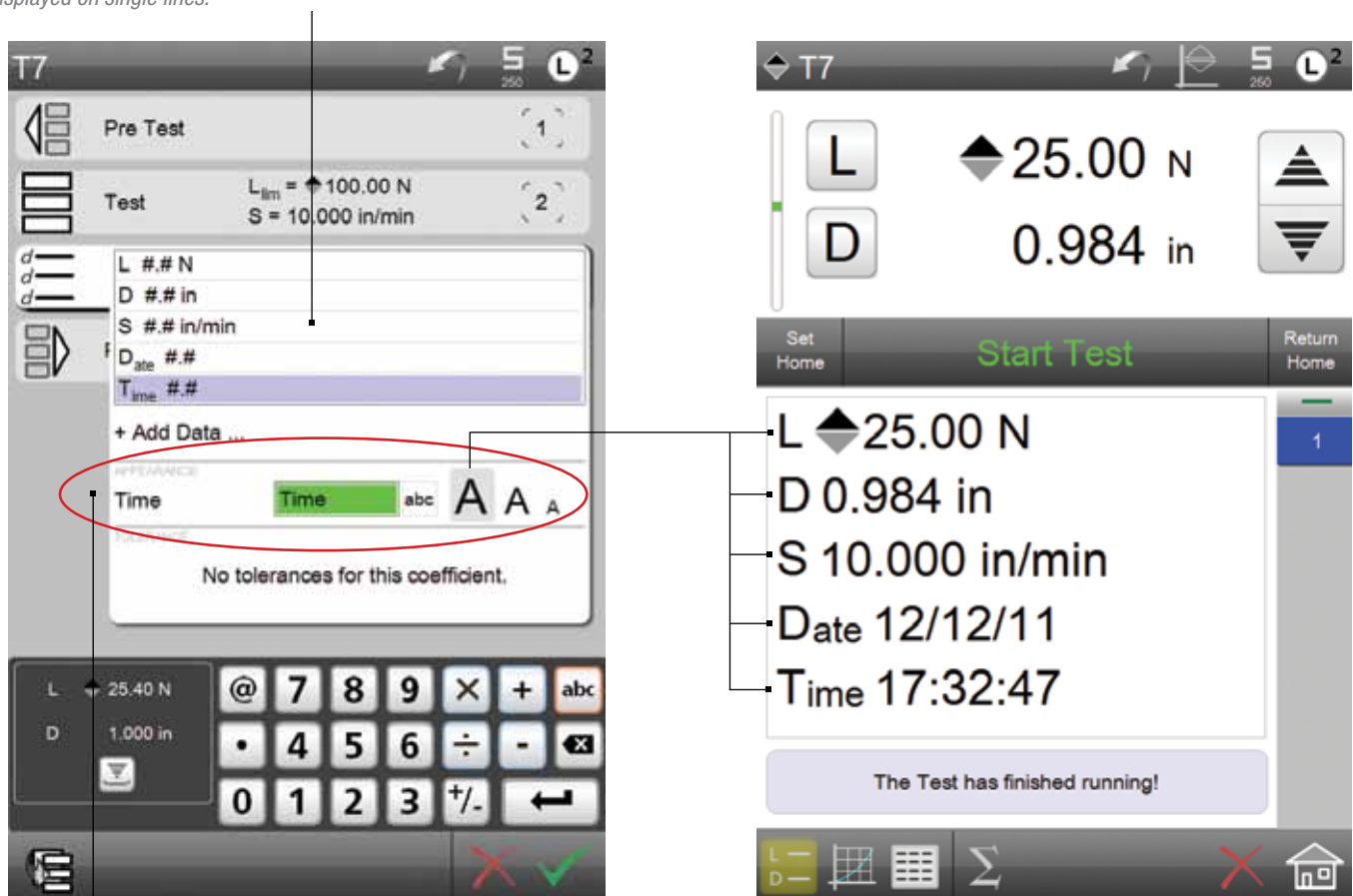
You have the option to format your coefficients. Formatting determines how you want the coefficient to appear on your L2 Controller.

The Appearance menu is associated with the coefficient you select. You have the ability to select one of three different formats for your coefficient.

Select the large “A” and the associated coefficient will be displayed in a large format occupying a single line.

Your coefficients are displayed on the Data menu in the format you select.

In our example, all coefficients are shown in the large format and displayed on single lines.



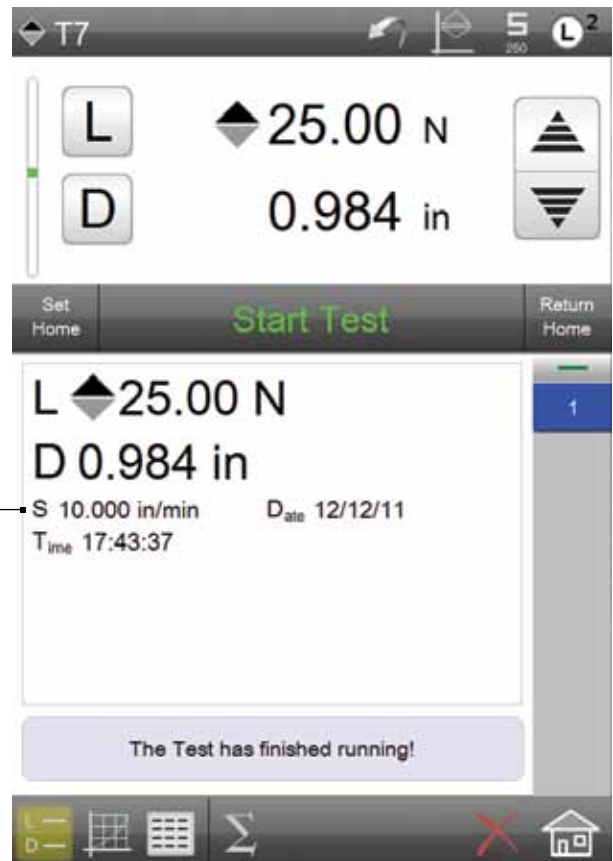
The Formatting options let you Rename your coefficient and format the size of the coefficient on the Data View.

The “large” format displays a coefficient on a single line, in a single column, and in the largest text size.

Select the middle “A” and the associated coefficient will be displayed in a smaller size than the large format, plus the coefficient will fit the L2 Controller display in a 2-column format.

Your coefficients are displayed on the Data menu in the format you select.

In our example, the L and D coefficients are in large, single column format while the S, D and T coefficients are in the medium, two-column format.

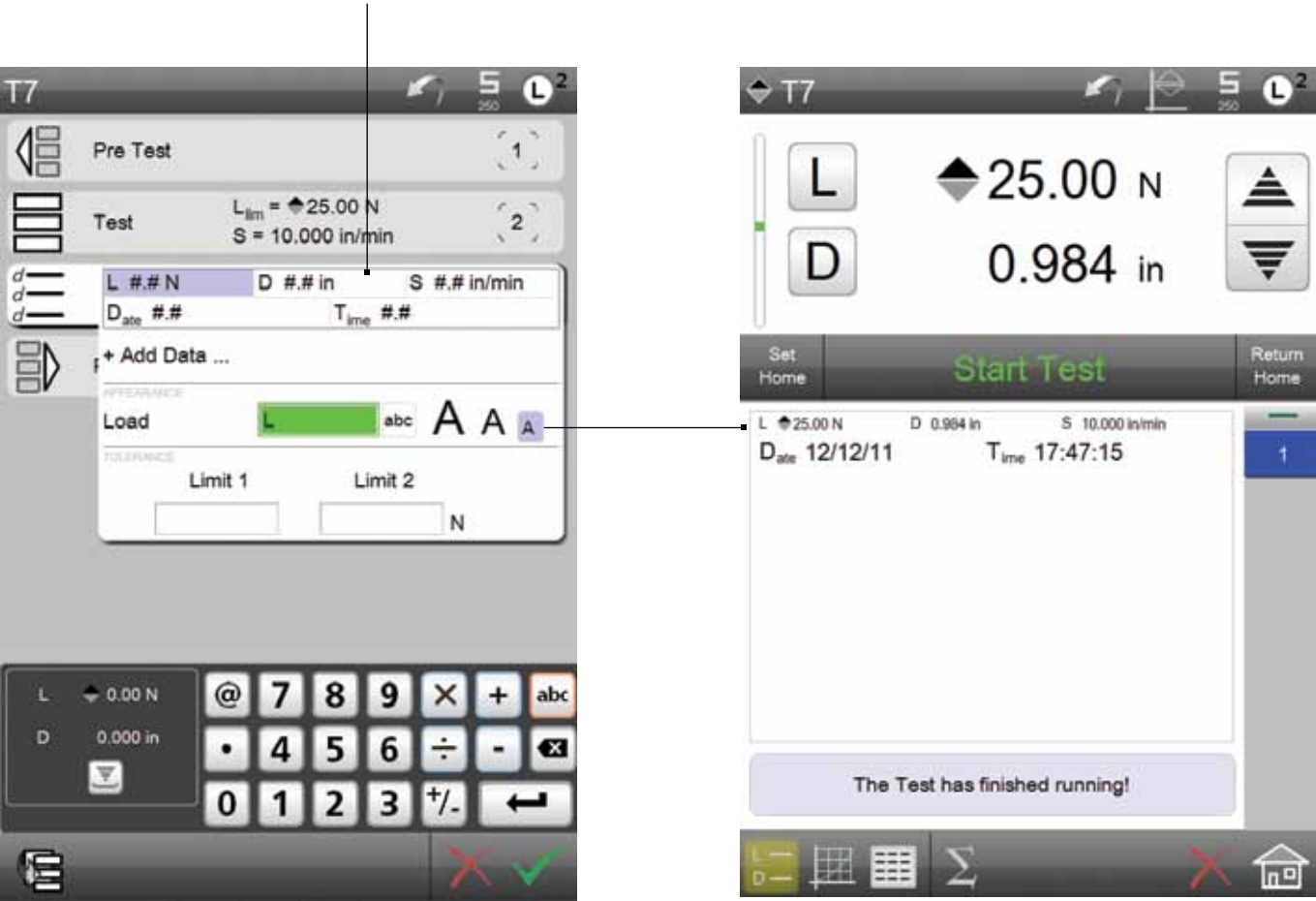


The “medium” format displays a coefficient on a single line, in a two-column, and in the medium text size.

You can mix and match formats. Our example shows the L and D coefficients in the “large” format and the S, D and T coefficients in the “medium” format.

Select the small “A” and the associated coefficient will be displayed in the smallest format. Coefficients that use the smallest format will fit the L2 Controller display in a 3-column format.

The “small” format displays a coefficient on a single line, in a three-column format, and in the smallest text size.



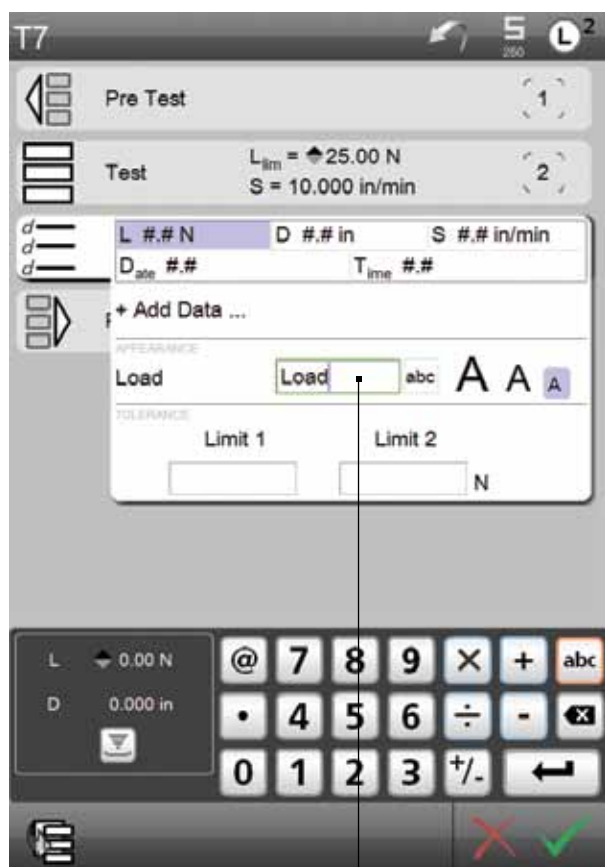
6.1.5.4 Renaming Data

You may rename your coefficients. Coefficients, however, always have the first character in regular text with any subsequent text in subscript.

Coefficient names are restricted to 8 characters.

You may rename a coefficient during the formatting procedure from the +Add Data... menu, or you may assign a global name for a coefficient using the Main Settings Menu.

Use the Main Settings Menu and the Coefficient Settings Menu to make a global Renaming of a coefficient. When the Coefficient Settings Menu is used to rename a coefficient, the coefficient's name will always be displayed on all setups.



You have two ways to Rename a coefficient. You may rename the coefficient at the Data Menu. Select your coefficient and rename the coefficient within the text block. Names are restricted to 8 characters and may NOT contain punctuation or symbol characters such as < > ? , . / ". Use alphabetical or numeric characters only.

When the coefficient is named at the Data Menu, the coefficient's name change is only effective on that coefficient in that particular test. It is not a global name change.

6.1.5.5 Tolerances

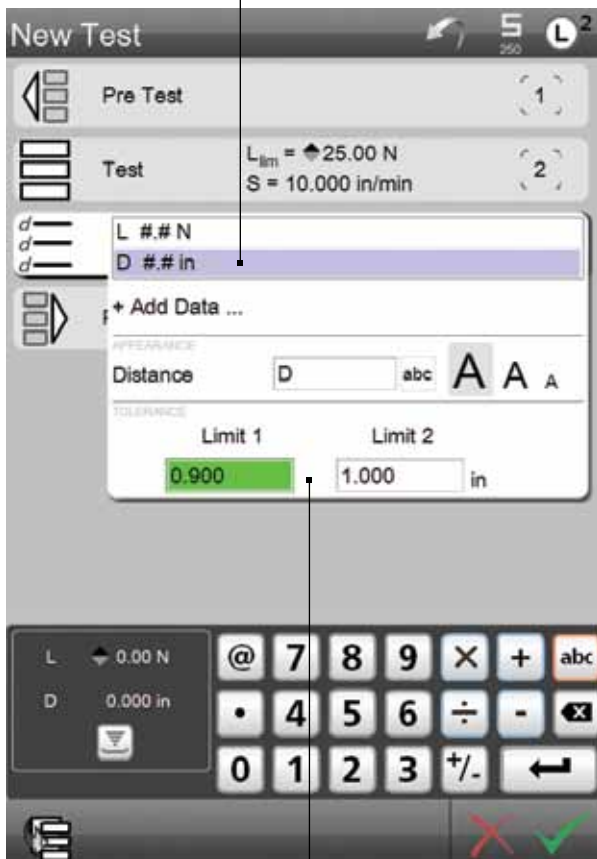
You may use a tolerance to setup a “Pass/Fail” result on a coefficient.

A tolerance is setup using two tolerance limits. Limit 1 can represent either the high or low value. Limit 2 represents to corresponding opposite limit value.

If a tolerance is used, a result will appear in red text if the result value is outside the range created by the Limit 1 and Limit 2 values.

If the results is equal to or falls within the two limit values, the result is displayed in black text.

Choose the coefficient from your list, then enter the Limit 1 and Limit 2 values that represent your Tolerance range.



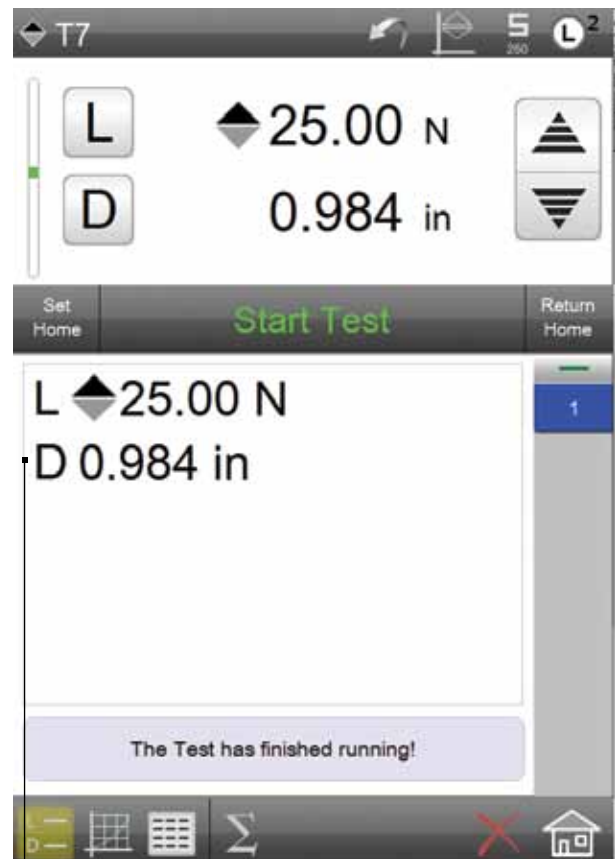
You can establish a Tolerance for a coefficient to establish a “pass” or “fail” result.

Enter the Lower and Upper Limit values for your Tolerance range. If the result equals or falls within your Limit Range, the result will be considered a “passed” result.

In our example, both the Load (L) and Distance (D) coefficients may be tolerated.

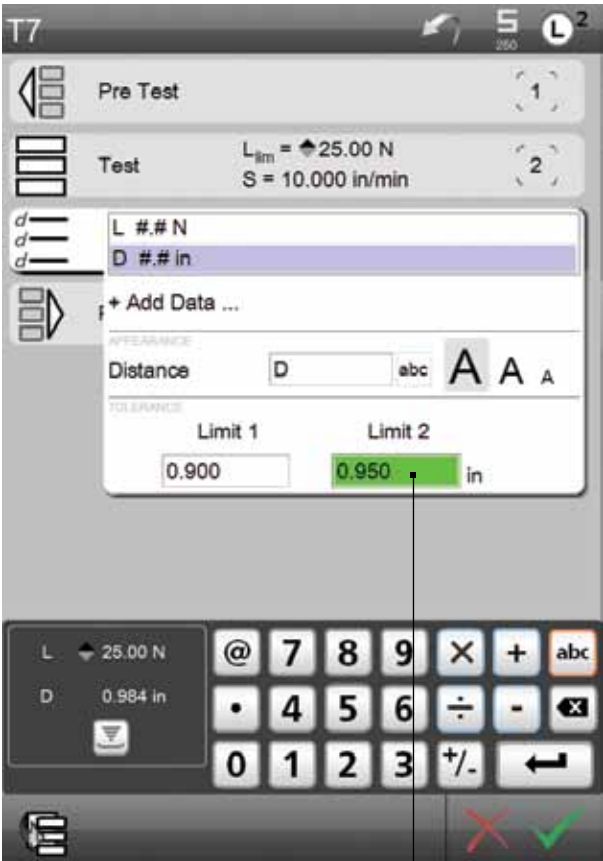
Not all coefficients can have a tolerance. If no tolerance is available for a coefficient, the Limit 1 and Limit 2 entry blocks are not displayed. Additionally, the L2 Controller will display “No tolerance for this coefficient.”

The Run Number is displayed in BLACK to indicate a “passed” result.



A “passed” result will display in BLACK text.

The Run Number is also displayed in RED to indicate a “failed” Run.



In our example, we adjusted the Limit 2 value.

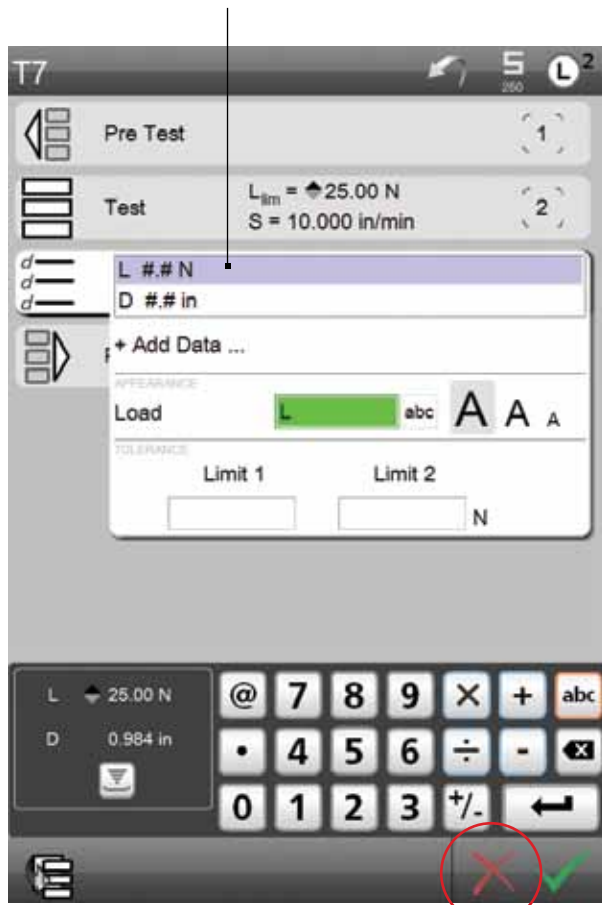


The D result is greater than the Tolerance range, therefore, the result is a “failed” result. The coefficient is displayed in RED to indicate a failed result.

6.1.5.6 Deleting Data

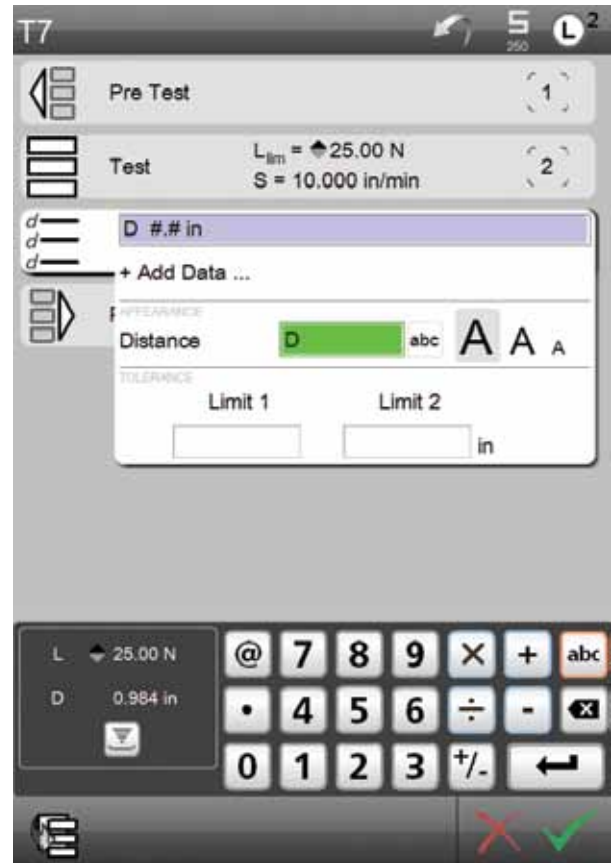
You can delete a coefficient from your Data List. Select the coefficient you wish to delete. When the coefficient is highlighted, select the "X" target to delete. The coefficient is removed from the Data List and will no longer be displayed in the Data View, Data Summary View or Graph.

Select the coefficient from the Data List you wish to delete.



The highlighted coefficient is deleted once the "X" target is pressed.

The L coefficient is removed from the Data List.



The L coefficient is no longer reported.

6.2 Distance Limit Test Setup

The Distance Limit Quick Test is used when you want a test to begin and reach a conclusion when a target distance setpoint is reached.

The Distance Limit Quick Test reports the Load value at the Distance Limit.

When you launch the Distance Quick Test, the view automatically starts with the Test Options menu.

The Test Options menu has three basic attributes:

- Type (also referred to as Test Mode)
- Target Distance (also referred to as the Distance Limit or Distance Setpoint)
- Speed (Test Speed)

6.2.1 Test Type

The Test Option launches with the Type = Tension. Tension means you want to perform a Pull test, e.g. you want the crosshead to move in an upward direction.

If you want to perform a Compression test (also called a Push test), change the Type to Compression.

6.2.2 Target Distance

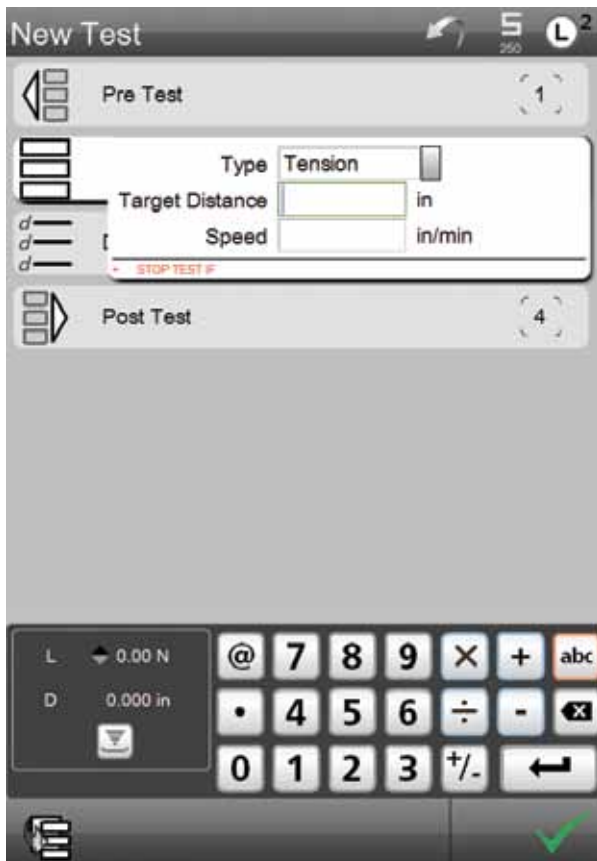
The Target Distance value is the distance limit setpoint. You want the crosshead to pull your sample until the measured distance = your specified Target Distance value. Distance units may be inches (in) or millimeters (mm). You may specify the units of measure for Distance using the Pre Test options.

Enter numerical data using the keypad at the bottom of the display. You may also use a USB keyboard that is connected to your L2 Controller or a wireless keyboard that is paired to your L2 Controller.

6.2.3 Test Speed

The Speed value is your test speed. This is the velocity you want your crosshead to travel at from when you start your test to your Target Load setpoint. Speed units may be either in/min (inch per minute) or mm/min (millimeter per minute). You may specify the units of measure for speed using the Pre Test options.

All FMS Series systems have a speed range from 0.001 to 50.0 inch per minute (0.02 to 1270 mm per minute).



6.2.4 Using Distance Conditions

Conditions are events that, when used, can cause your test to abort prior to completion. Conditions are used to protect against overload and over travel situations that can damage your equipment.

Conditions are optional. They are not required for your Distance limit test.

6.2.4.1 Load Limit

Use the Load Limit to cause the test to be aborted should the measured load reach this limit. If the measured load reaches the Load Limit value, the crosshead will stop and the test will be aborted.

6.2.4.2 Break %

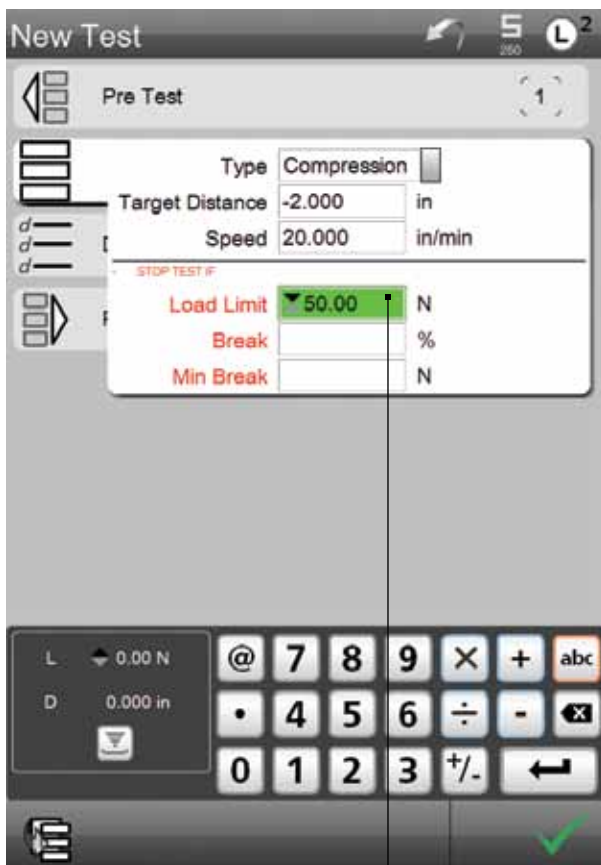
Break % is used if you want to abort a test should your sample break. The Break % represents the percentage drop in the measured load during the test from a higher value. For example, if you enter a Break % = 10, a test would abort if during the test, a measured load value of 100N dropped by 10% (to 90N). This sudden drop would indicate a sample break.

6.2.4.3 Minimum Break

Min Break represents the minimum break value when you use the Break % option. The minimum break is the load value that you must first achieve before the system begins to look for a drop in load. For example, some samples exhibit a high degree of load fluctuation when the test first starts. The minimum break states that the test must first exceed this minimum break value, THEN begin looking for the drop in load (Break %).

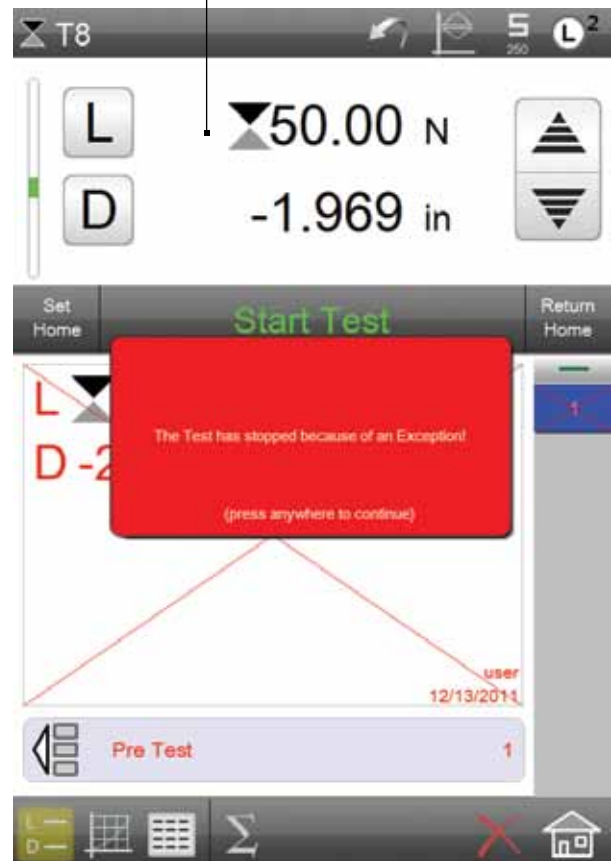
During the test Run, the measured load reached 50N. Because the Load Limit Condition is 50N, the test is aborted.

A message alerts the operator to the reason.



A Load Limit condition will abort the test if the condition occurs. In this example, the Load Limit = 50 N.

You also have the option to set a condition based on a break event.



6.2.5 Data Options

The Data options step is where you specify what results you want reported and how you want your results formatted on individual display views.

Individual Data results are also called coefficients. Coefficients are displayed in an abbreviated format. Table 6.2 shows the available coefficients for the Distance Limit Quick Test.

Distance Limit Quick Test	Coefficient
Load (default)	L
Distance (default)	D
Speed	S
Date	Date
Time	Time

Table 6.2
Distance Limit Quick Test Data/Coefficients

6.2.5.1 Distance Limit Data

The Distance Limit Quick Test assigns the default coefficients for Load (L) and Distance (D). Both results will be reported at the completion of a test Run.

6.2.5.2 Adding Data

While the Distance test template automatically assigns both the Load (L) and Distance (D) coefficient, there are other coefficients available to you for reporting.

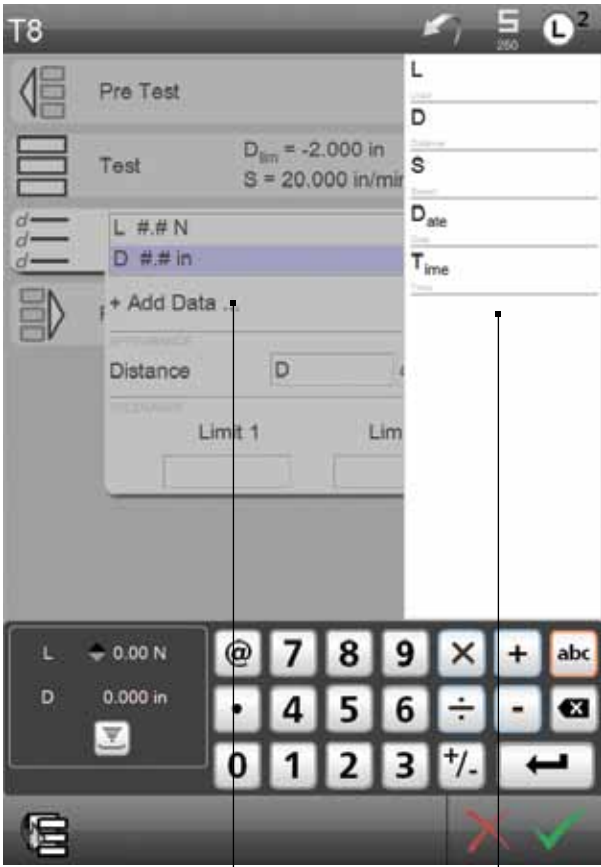
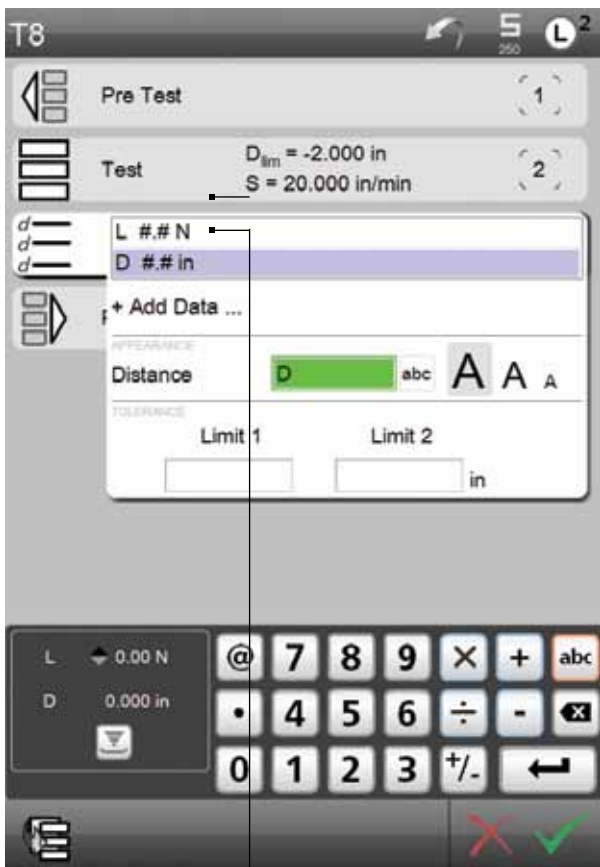
The other coefficients available for your Distance test template are:

- Speed (S)
- Date (Date)
- Time (Time)

The S (Speed) coefficient will report the test speed used for your test.

The D_{ate} (Date) coefficient will report the date the test was performed. You may format the date using the main Settings menu (Display Formats). Date may be formatted in either MM/DD/YY or DD/MM/YY format.

The T_{ime} (Time) coefficient will report the time the test was performed.



The default coefficients for the Distance Limit Quick Test are Load (L) and Distance (D). These coefficients are displayed with the associated units of measure.

Select the + Add Data... target to launch the Data Menu for your Distance Limit Quick Test. Select the coefficient you want to add from the list.

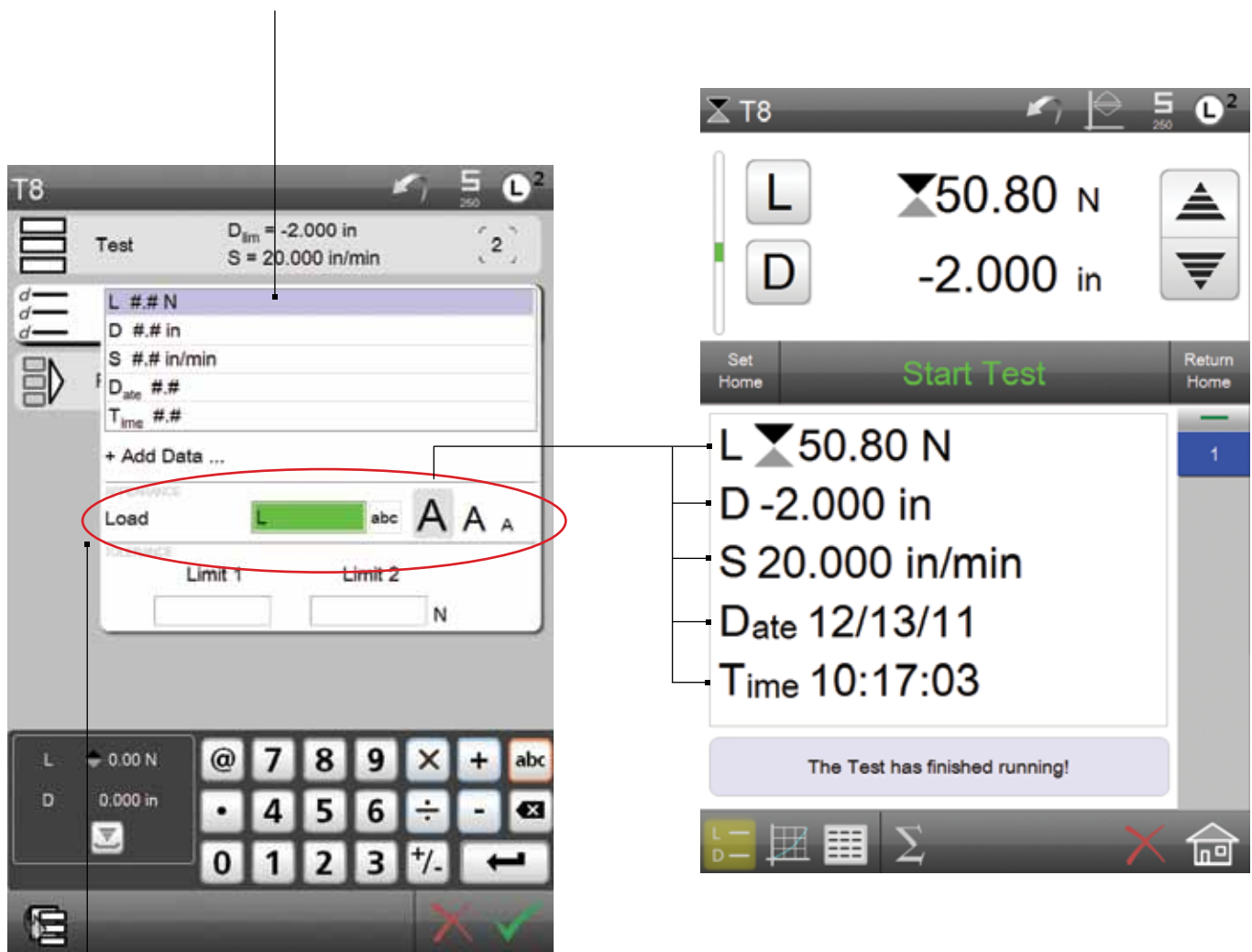
6.2.5.3 Formatting Data

You have the option to format your coefficients. Formatting determines how you want the coefficient to appear on your L2 Controller.

The Appearance menu is associated with the coefficient you select. You have the ability to select one of three different formats for your coefficient.

*Your coefficients are displayed on the Data menu in the format you select.
In our example, all coefficients are shown in the large format and displayed on single lines.*

Select the large "A" and the associated coefficient will be displayed in a large format occupying a single line.

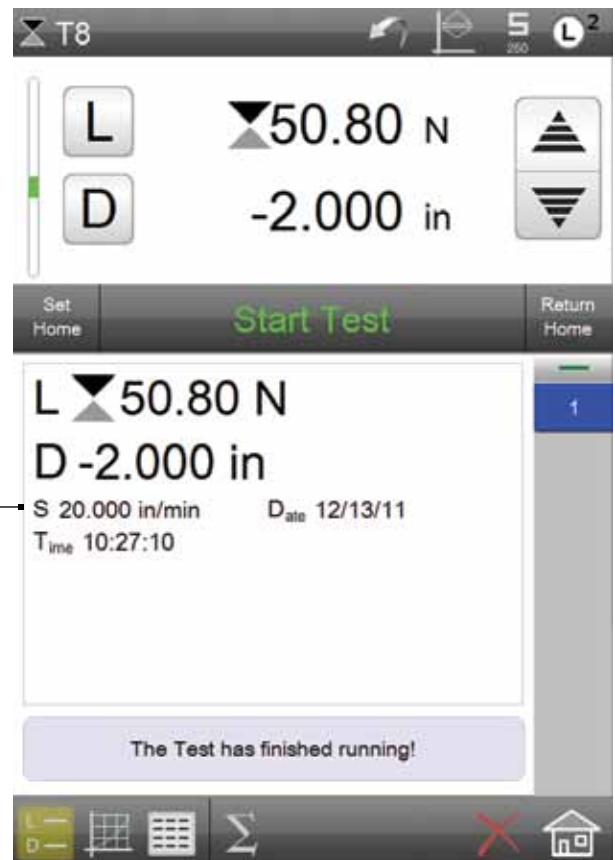
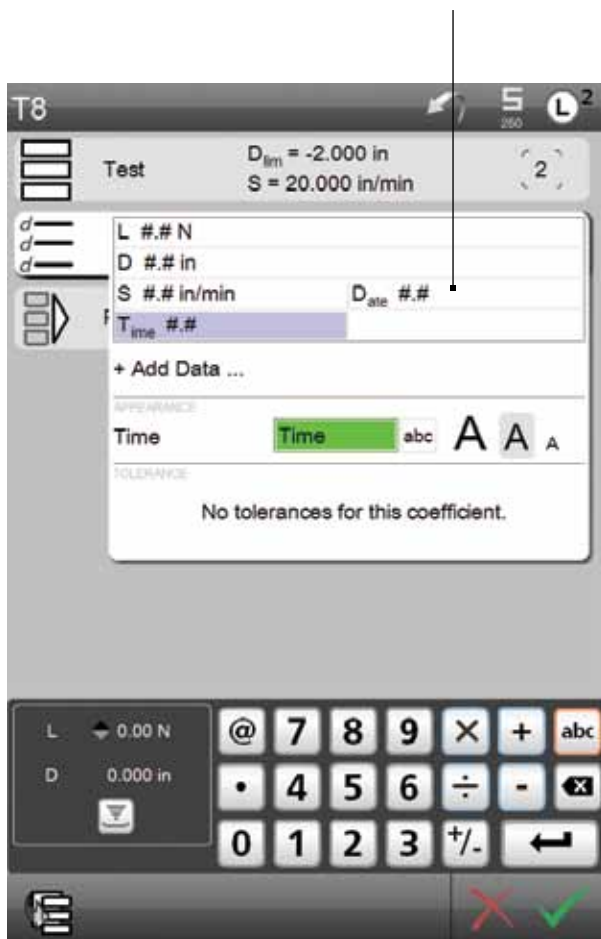


The Formatting options let you Rename your coefficient and format the size of the coefficient on the Data View.

The "large" format displays a coefficient on a single line, in a single column, and in the largest text size.

Select the middle “A” and the associated coefficient will be displayed in a smaller size than the large format, plus the coefficient will fit the L2 Controller display in a 2-column format.

Your coefficients are displayed on the Data menu in the format you select. In our example, the L and D coefficients are in large, single column format while the S, D and T coefficients are in the medium, two-column format.

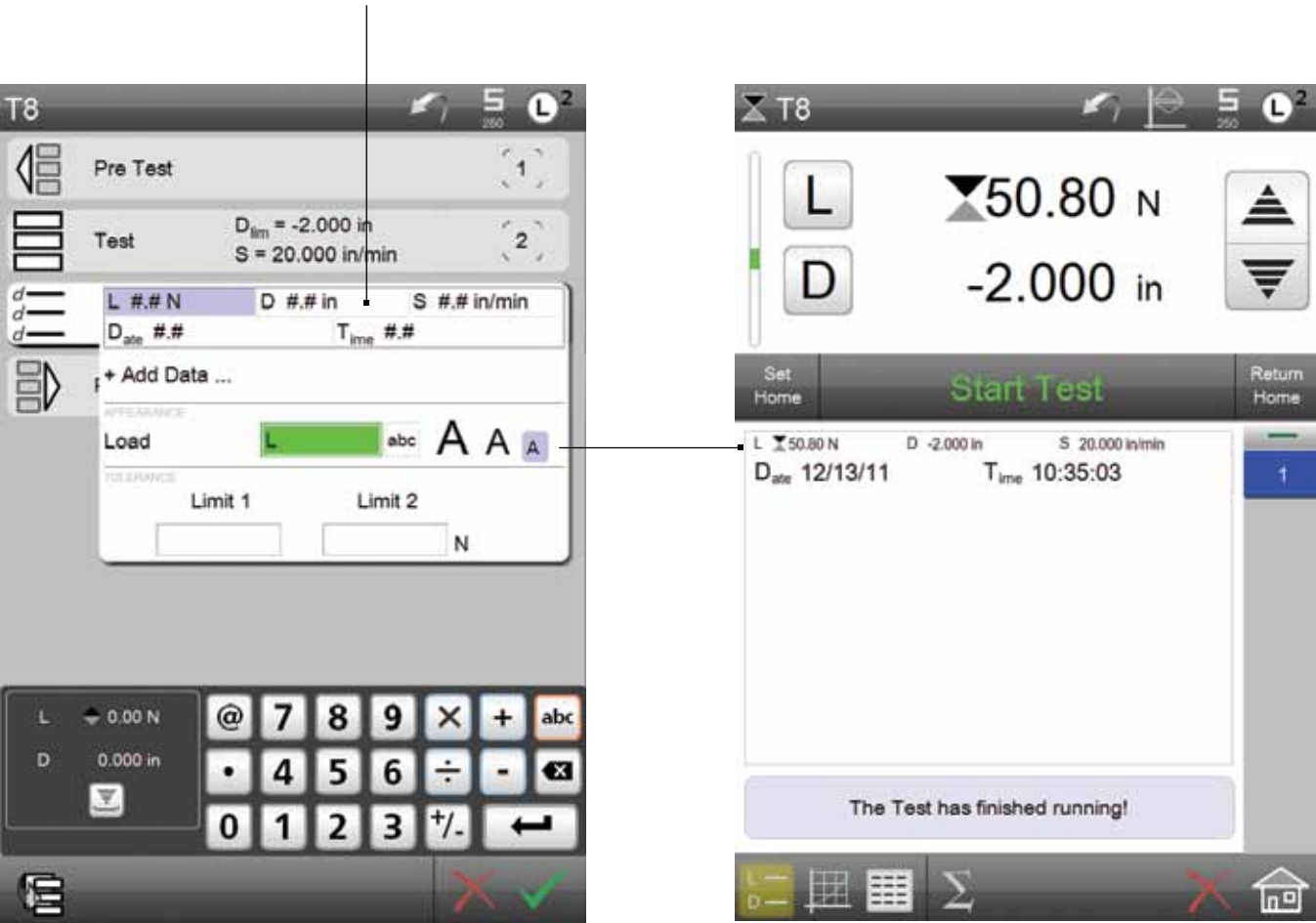


The “medium” format displays a coefficient on a single line, in a two-column, and in the medium text size.

You can mix and match formats. Our example shows the L and D coefficients in the “large” format and the S, D and T coefficients in the “medium” format.

Select the small “A” and the associated coefficient will be displayed in the smallest format. Coefficients that use the smallest format will fit the L2 Controller display in a 3-column format.

The “small” format displays a coefficient on a single line, in a three-column format, and in the smallest text size.



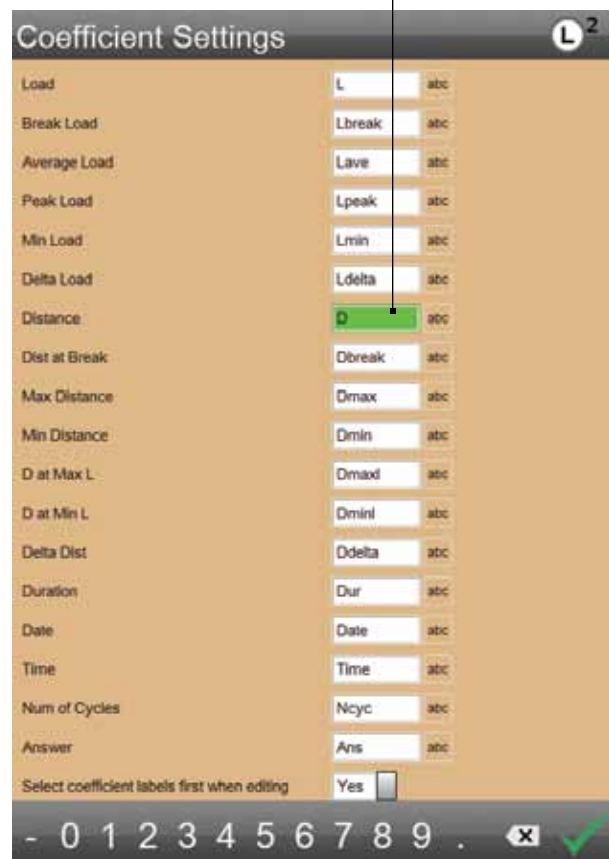
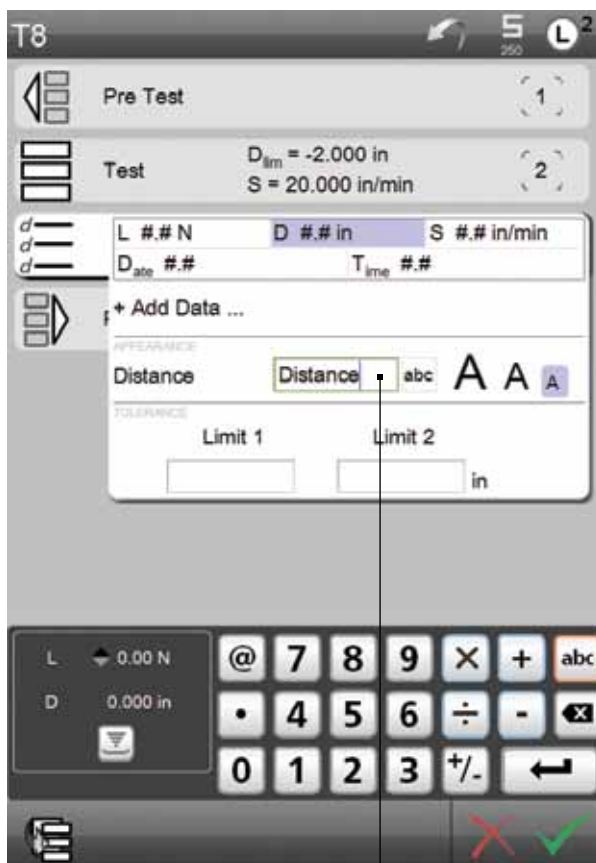
6.2.5.4 Renaming Data

You may rename your coefficients. Coefficients, however, always have the first character in regular text with any subsequent text in subscript.

Coefficient names are restricted to 8 characters.

You may rename a coefficient during the formatting procedure from the +Add Data... menu, or you may assign a global name for a coefficient using the Main Settings Menu.

Use the Main Settings Menu and the Coefficient Settings Menu to make a global Renaming of a coefficient. When the Coefficient Settings Menu is used to rename a coefficient, the coefficient's name will always be displayed on all setups.



You have two ways to Rename a coefficient. You may rename the coefficient at the Data Menu. Select your coefficient and rename the coefficient within the text block. Names are restricted to 8 characters and may NOT contain punctuation or symbol characters such as < > ? , . / ". Use alphabetical or numeric characters only.

When the coefficient is named at the Data Menu, the coefficient's name change is only effective on that coefficient in that particular test. It is not a global name change.

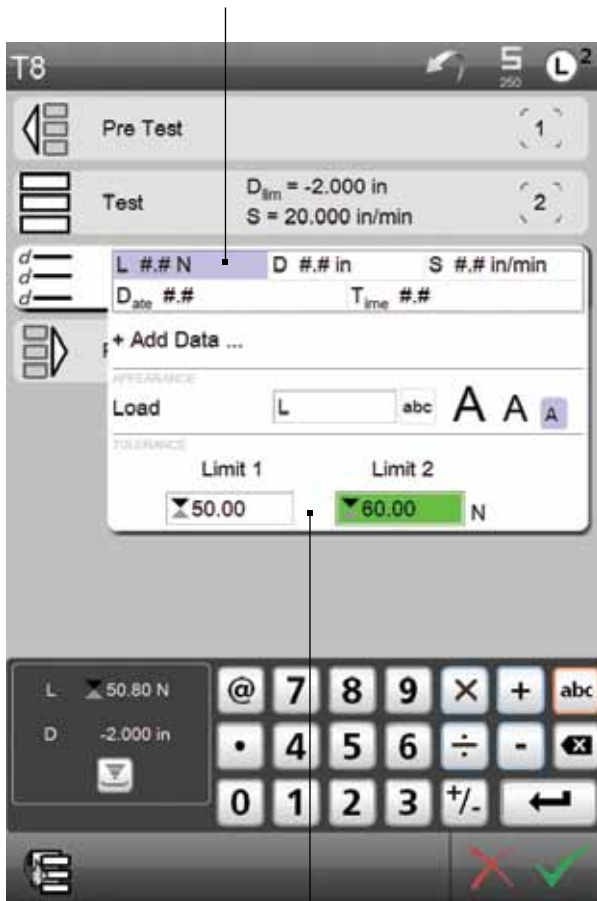
6.2.5.5 Tolerances

You may use a tolerance to setup a “Pass/Fail” result on a coefficient.

A tolerance is setup using two tolerance limits. Limit 1 can represent either the high or low value. Limit 2 represents to corresponding opposite limit value.

If a tolerance is used, a result will appear in red text if the result value is outside the range created by the Limit 1 and Limit 2 values.

Choose the coefficient from your list, then enter the Limit 1 and Limit 2 values that represent your Tolerance range.



You can establish a Tolerance for a coefficient to establish a “pass” or “fail” result.

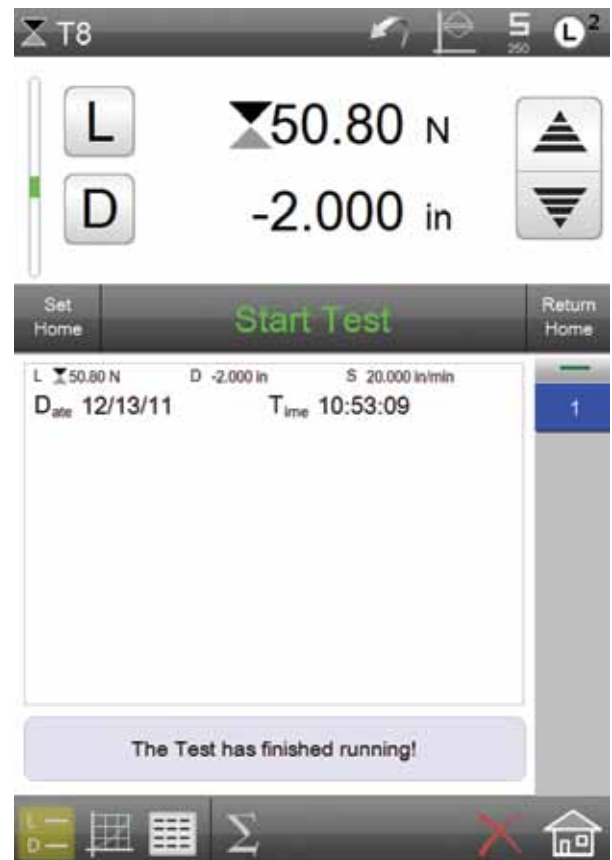
Enter the Lower and Upper Limit values for your Tolerance range. If the result equals or falls within your Limit Range, the result will be considered a “passed” result.

If the results is equal to or falls within the two limit values, the result is displayed in black text.

In our example, both the Load (L) and Distance (D) coefficients may be tolerated.

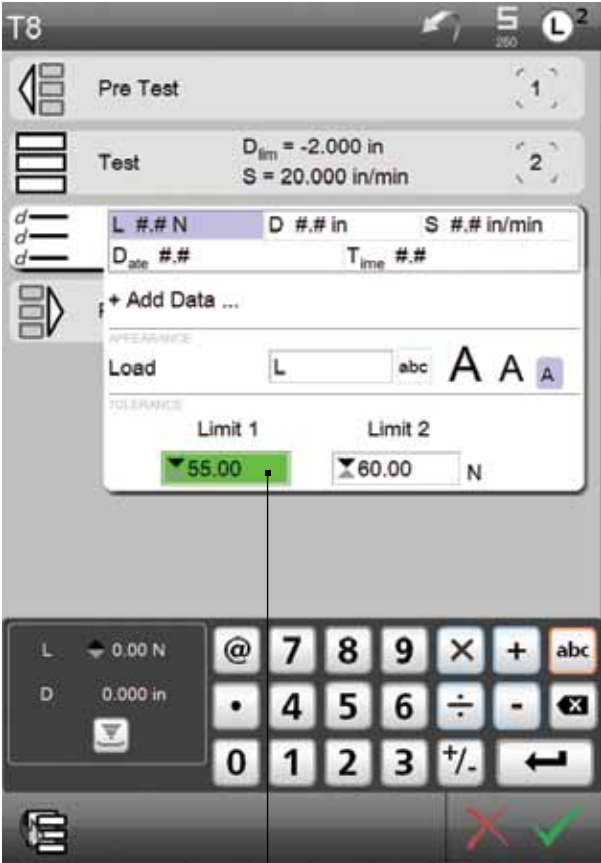
Not all coefficients can have a tolerance. If no tolerance is available for a coefficient, the Limit 1 and Limit 2 entry blocks are not displayed. Additionally, the L2 Controller will display “No tolerance for this coefficient.”

The Run Number is displayed in BLACK to indicated a “passed” result.

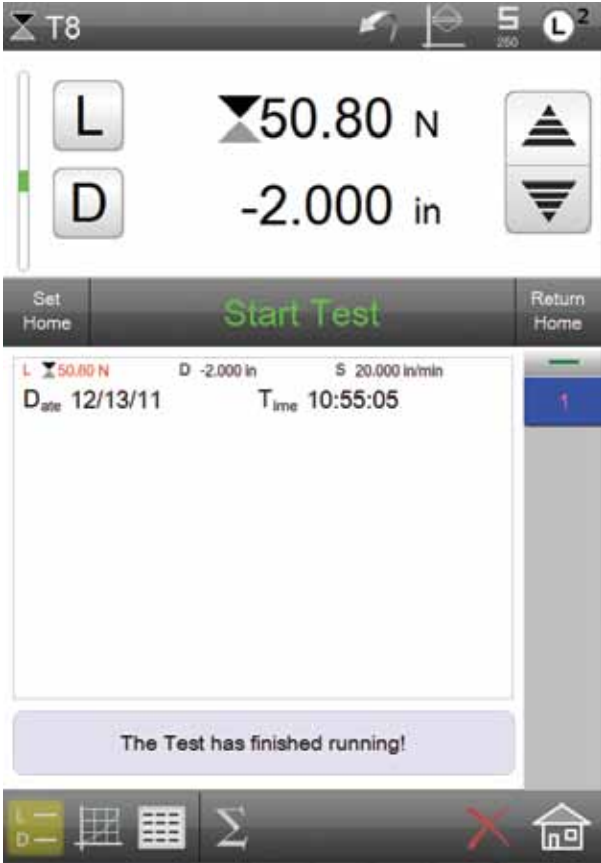


A “passed” result will display in BLACK text.

The Run Number is also displayed in RED to indicate a “failed” Run.



In our example, we adjusted the Limit 1 value.



The L result is less than the Tolerance range, therefore, the result is a “failed” result. The coefficient is displayed in RED to indicate a failed result.

6.2.5.6 Deleting Data

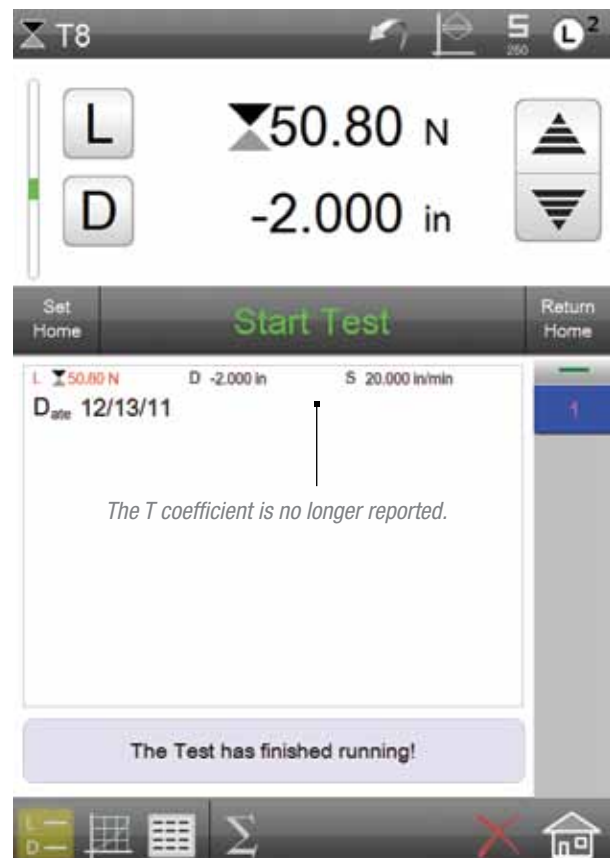
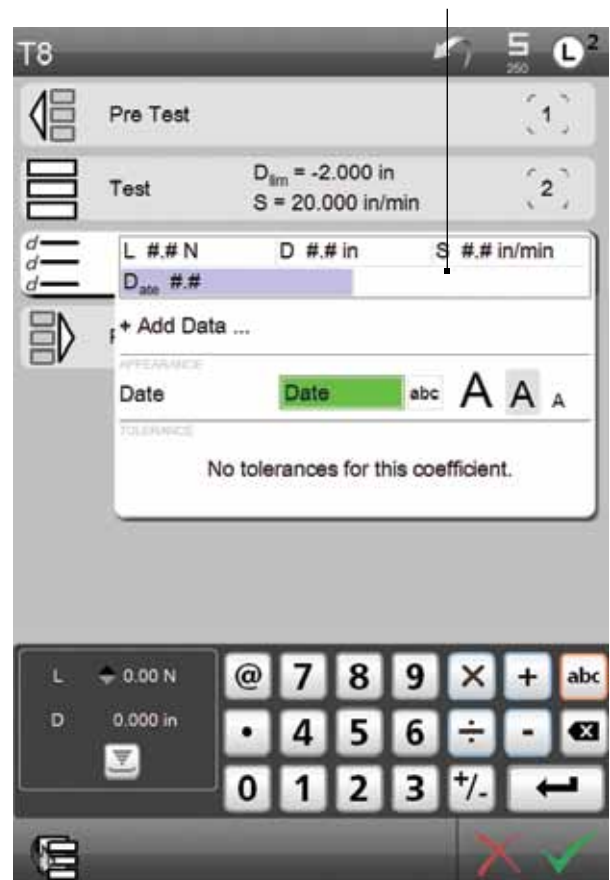
You can delete a coefficient from your Data List. Select the coefficient you wish to delete. When the coefficient is highlighted, select the "X" target to delete. The coefficient is removed from the Data List and will no longer be displayed in the Data View, Data Summary View or Graph.

Select the coefficient from the Data List you wish to delete.



The highlighted coefficient is deleted once the "X" target is pressed.

The T coefficient is removed from the Data List.



The T coefficient is no longer reported.

6.3 Break Limit Test Setup

The Break Limit Quick Test is used when you want a test to begin and reach a conclusion when your sample breaks or ruptures.

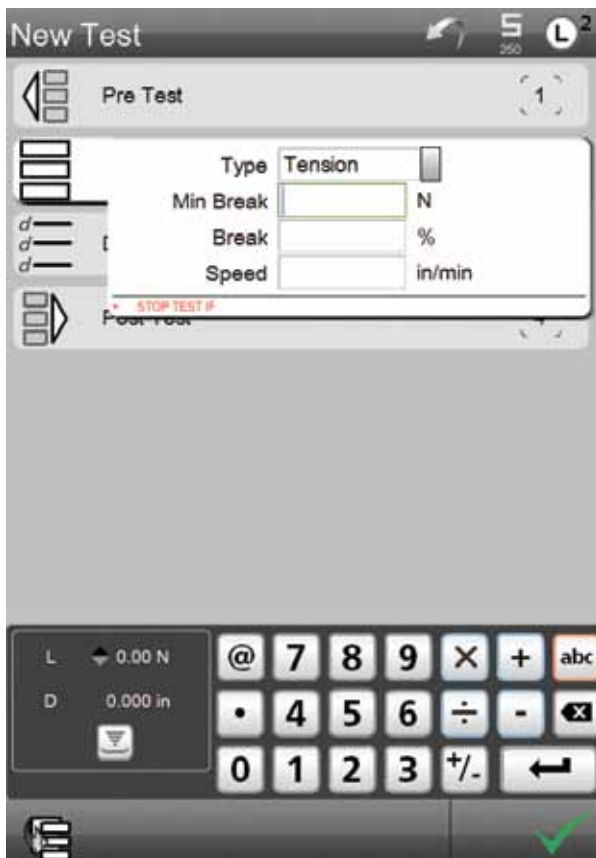
The L2 Controller determines a break using the Peak Load. A break is defined as a % Drop in the measured load from the Peak Load. For example, you specify the % Drop value as 10% meaning that a break is defined when the measure load drops by 10% from a previously measured peak load.

The Break Limit Quick Test reports the Peak Load, Break Load and Distance at Break Load.

When you launch the Break Quick Test, the view automatically starts with the Test Options menu.

The Test Options menu has three basic attributes:

- Type (also referred to as Test Mode)
- Target Distance (also referred to as the Distance Limit or Distance Setpoint)
- Speed (Test Speed)



6.3.1 Test Type

The Test Option launches with the Type = Tension. Tension means you want to perform a Pull test, e.g. you want the crosshead to move in an upward direction.

If you want to perform a Compression test (also called a Rupture test), change the Type to Compression.

6.3.2 Minimum Break Load

The Minimum Break Load is a precondition step. This is the load that must first be measured before the L2 Controller begins to look for a Peak Load and a % Drop from Peak Load. The Minimum Break Load must always occur before the Peak Load otherwise a break will never be determined.

The Minimum Break Load is used to counter samples that exhibit a high degree of noise in their load characteristic. This noise can result in a “noisy” load measurement where the load drastically swings from high to low values. This normally occurs at the initial stages of a sample being pulled/pushed to a break.

6.3.3 Break %

The Break % is the percentage drop in load from the measured peak value. If the Break % = 5%, the break occurs when the measured load is a 5% drop from the measured Peak Load. If the Break % = 25%, the break occurs when the measured load is a 25% drop from the measured Peak Load.

6.3.4 Test Speed

The Speed value is your test speed. This is the velocity you want your crosshead to travel at from when you start your test to your Target Load setpoint. Speed units may be either in/min (inch per minute) or mm/min (millimeter per minute). You may specify the units of measure for speed using the Pre Test options.

All FMS Series systems have a speed range from 0.001 to 50.0 inch per minute (0.02 to 1270 mm per minute).

6.3.5 Using Break Conditions

Conditions are events that, when used, can cause your test to abort prior to completion. Conditions are used to protect against overload and over travel situations that can damage your equipment.

Conditions are optional. They are not required for your Distance limit test.

6.3.5.1 Load Limit

Use the Load Limit to cause the test to be aborted should the measured load reach this limit. If the measured load reaches the Load Limit value, the crosshead will stop and the test will be aborted.

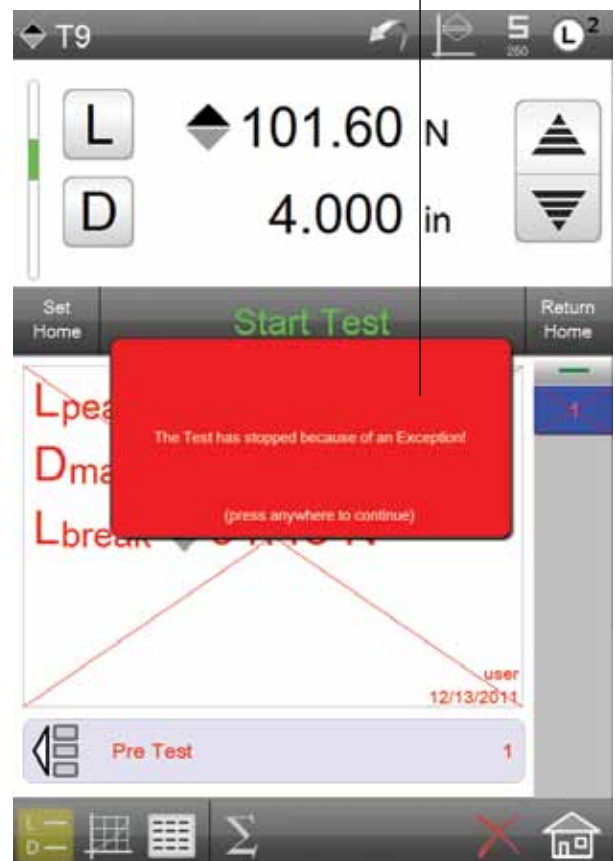
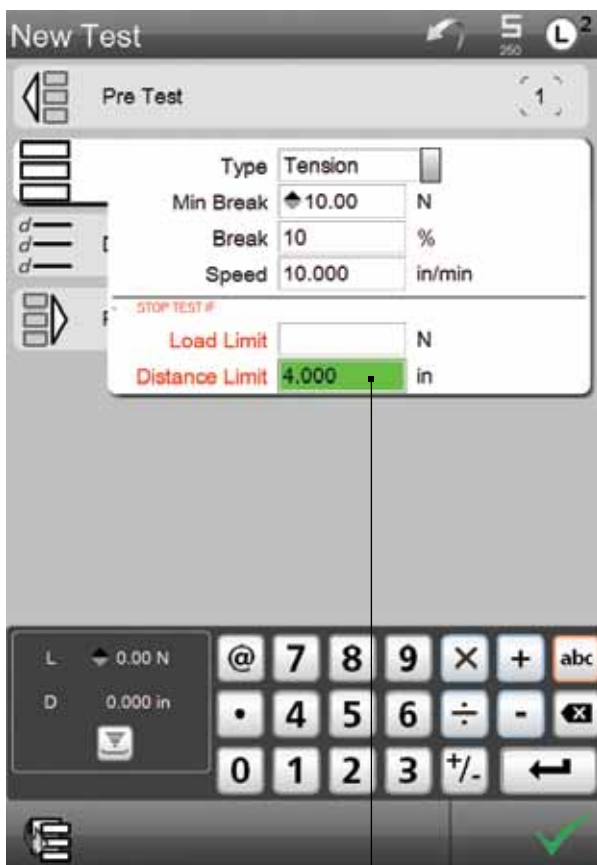
6.3.5.2 Distance Limit

Use the Distance Limit to cause the test to be aborted should the measured distance reach this limit. If the measured distance reaches the Distance Limit value, the crosshead will stop and the test will be aborted.

During the test Run, the measured distance reached 4.000 in.

Because the Distance Limit Condition is 4.000 in, the test is aborted.

A message alerts the operator to the reason.



A Distance Limit condition will abort the test if the condition occurs. In this example, the Distance Limit = 4.000 inches

You also have the option to set a condition based on a Load Limit.

6.3.6 Data Options

The Data options step is where you specify what results you want reported and how you want your results formatted on individual display views.

Individual Data results are also called coefficients. Coefficients are displayed in an abbreviated format. Table 6.3 shows the available coefficients for the Distance Limit Quick Test.

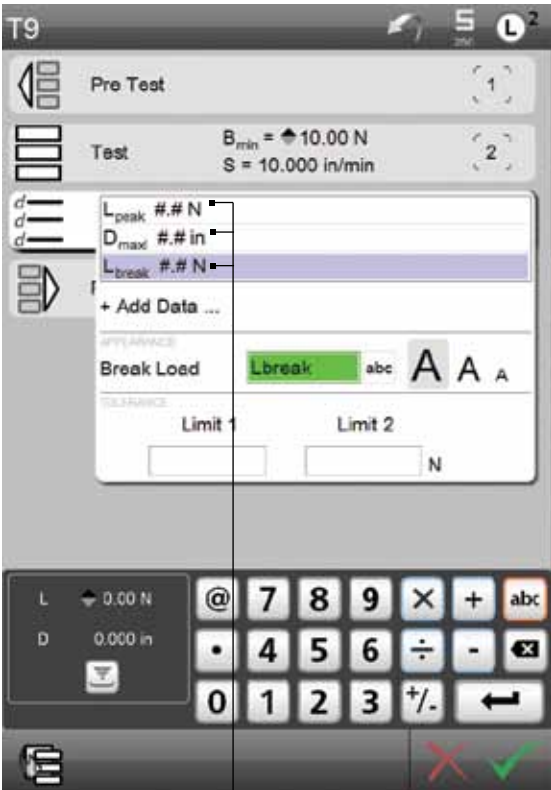
Distance Limit Quick Test	Coefficient
Peak Load (default)	Lpeak
Distance at Peak Load (default)	Dmaxl
Break Load (default)	Lbreak
Distance at Break Load	Dbreak
Speed	S
Date	Date
Time	Time

Table 6.3

Break Limit Quick Test Data/Coefficients

6.3.6.1 Break Limit Data

The Break Limit Quick Test assigns the default coefficients for Peak Load (Lpeak), Distance at Peak Load (Dmaxl) and Break Load (Lbreak). All results will be reported at the completion of a test Run.



The default coefficients for the Break Limit Quick Test are PeakLoad (Lpeak), Distance at Peak Load (Dmaxl) and Break Load (Lbreak). These coefficients are displayed with the associated units of measure.

6.3.6.2 Adding Data

While the Break test template automatically assigns the Peak Load (Lpeak), Distance at Peak Load (Dmaxl), and Break Load (Lbreak) coefficients, there are other coefficients available to you for reporting.

The other coefficients available for your Break test template are:

- Distance at Break Load (Dbreak)
- Speed (S)
- Date (Date)
- Time (Time)

The Dbreak (Distance at Break Load) coefficient will report the crosshead's distance at the break load data point. The Dbreak coefficient is reported as either inches or millimeters depending on the units of measure you have specified for all distance measurements.

The Date (Date) coefficient will report the date the test was performed. You may format the date using the main Settings menu (Display Formats). Date may be formatted in either MM/DD/YY or DD/MM/YY format.

The Time (Time) coefficient will report the time the test was performed.



Select the + Add Data... target to launch the Data Menu for your Break Limit Quick Test. Select the coefficient you want to add from the list.

6.3.6.3 Formatting Data

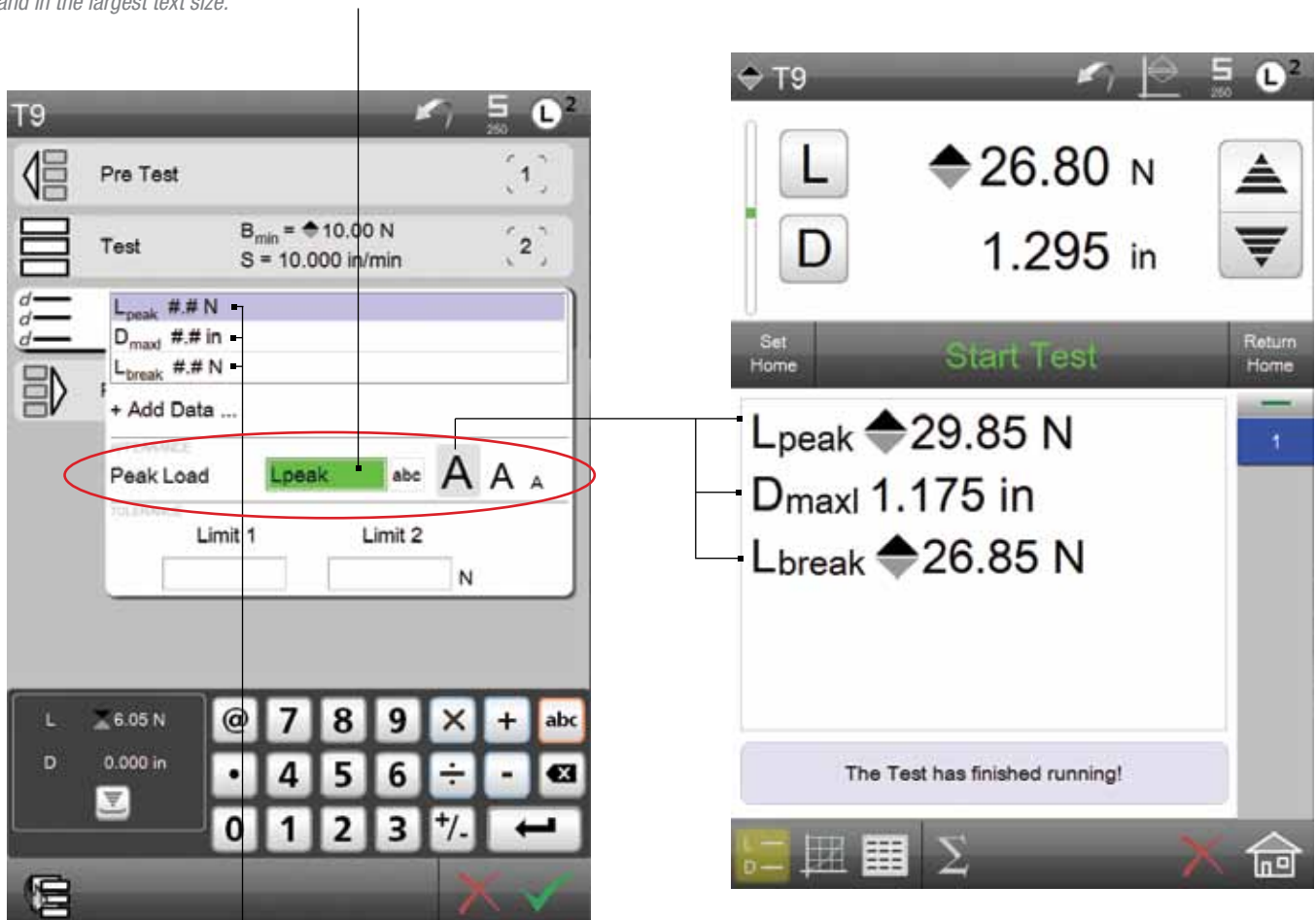
You have the option to format your coefficients. Formatting determines how you want the coefficient to appear on your L2 Controller.

The Appearance menu is associated with the coefficient you select. You have the ability to select one of three different formats for your coefficient.

The Formatting options let you Rename your coefficient and format the size of the coefficient on the Data View.

The “large” format displays a coefficient on a single line, in a single column, and in the largest text size.

Select the large “A” and the associated coefficient will be displayed in a large format occupying a single line.

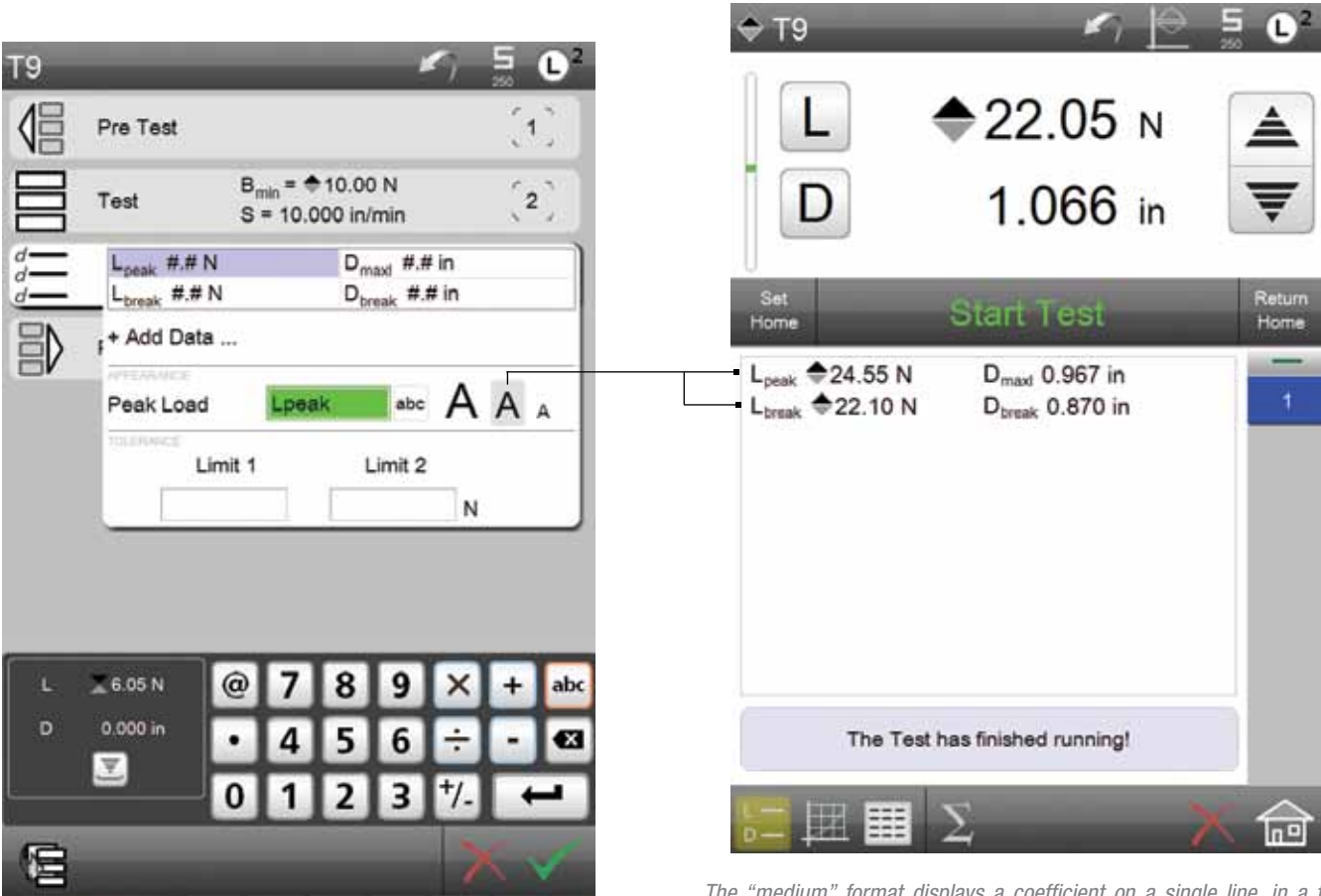


Your coefficients are displayed on the Data menu in the format you select.

In our example, all coefficients are shown in the large format and displayed on single lines.

Select the middle “A” and the associated coefficient will be displayed in a smaller size than the large format, plus the coefficient will fit the L2 Controller display in a 2-column format.

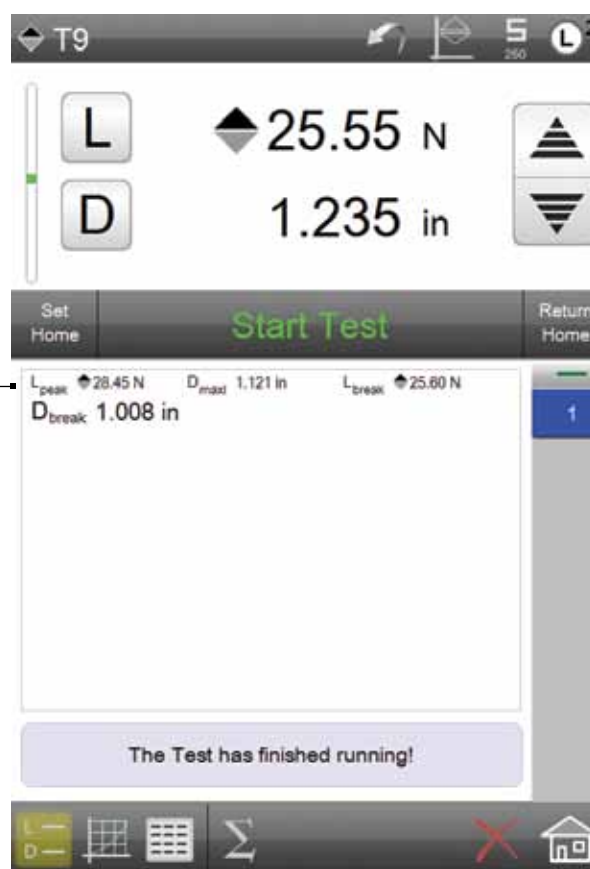
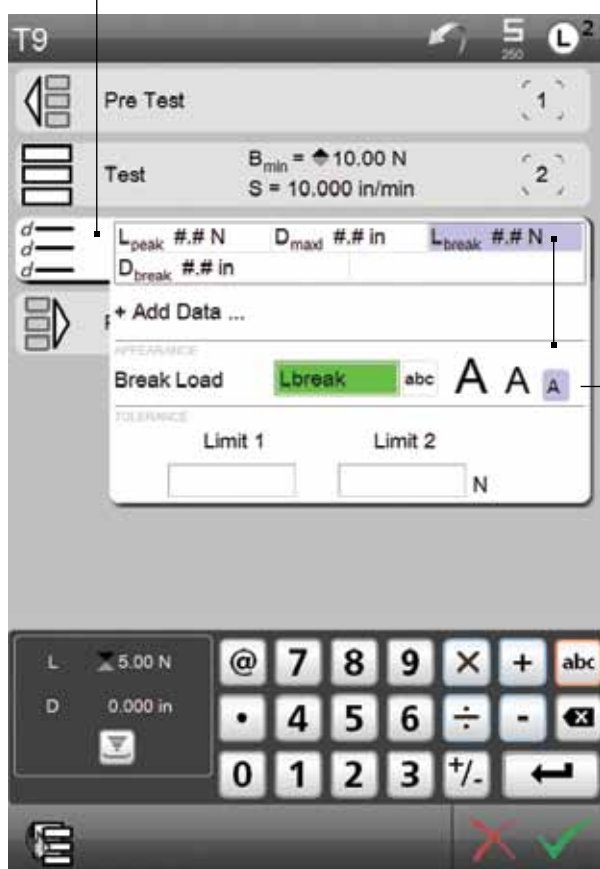
Your coefficients are displayed on the Data menu in the format you select.
In our example, we changed all the default coefficients to the medium size. Note the coefficients are listed in a 2-column format.



The “medium” format displays a coefficient on a single line, in a two-column format, and in the medium text size.

Select the small “A” and the associated coefficient will be displayed in the smallest format. Coefficients that use the smallest format will fit the L2 Controller display in a 3-column format.

The “small” format displays a coefficient on a single line, in a three-column format, and in the smallest text size.



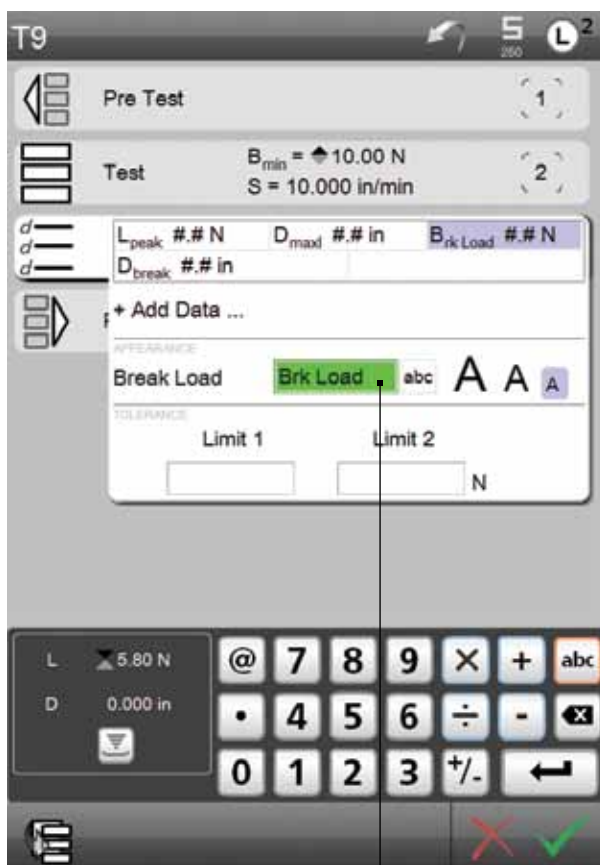
6.3.6.4 Renaming Data

You may rename your coefficients. Coefficients, however, always have the first character in regular text with any subsequent text in subscript.

Coefficient names are restricted to 8 characters.

You may rename a coefficient during the formatting procedure from the +Add Data... menu, or you may assign a global name for a coefficient using the Main Settings Menu.

Use the Main Settings Menu and the Coefficient Settings Menu to make a global Renaming of a coefficient. When the Coefficient Settings Menu is used to rename a coefficient, the coefficient's name will always be displayed on all setups.



You have two ways to Rename a coefficient. You may rename the coefficient at the Data Menu. Select your coefficient and rename the coefficient within the text block. Names are restricted to 8 characters and may NOT contain punctuation or symbol characters such as < > ? , . / ". Use alphabetical or numeric characters only.

When the coefficient is named at the Data Menu, the coefficient's name change is only effective on that coefficient in that particular test. It is not a global name change.

6.3.6.5 Tolerances

You may use a tolerance to setup a “Pass/Fail” result on a coefficient.

A tolerance is setup using two tolerance limits. Limit 1 can represent either the high or low value. Limit 2 represents to corresponding opposite limit value.

If a tolerance is used, a result will appear in red text if the result value is outside the range created by the Limit 1 and Limit 2 values.

If the result is equal to or falls within the two limit values, the result is displayed in black text.

In our example, the Peak Load (L_{peak}), Distance at Peak Load (D_{maxl}), and Break Load (L_{break}) coefficients may be tolerated.

Not all coefficients can have a tolerance. If no tolerance is available for a coefficient, the Limit 1 and Limit 2 entry blocks are not displayed. Additionally, the L2 Controller will display “No tolerance for this coefficient.”

Choose the coefficient from your list, then enter the Limit 1 and Limit 2 values that represent your Tolerance range.



You can establish a Tolerance for a coefficient to establish a “pass” or “fail” result.

Enter the Lower and Upper Limit values for your Tolerance range. If the result equals or falls within your Limit Range, the result will be considered a “passed” result.

The Run Number is displayed in BLACK to indicated a “passed” result.

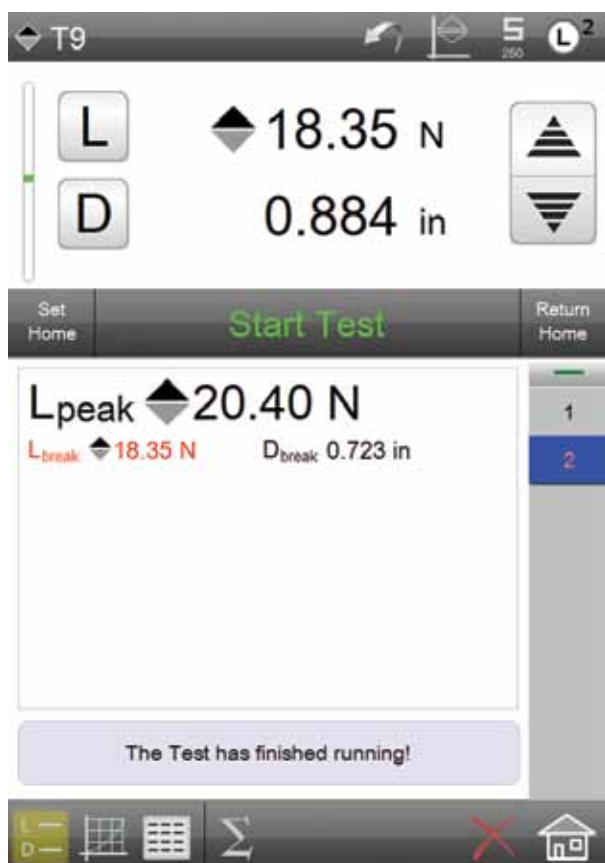


A “passed” result will display in BLACK text.

6.3.6.6 Deleting Data

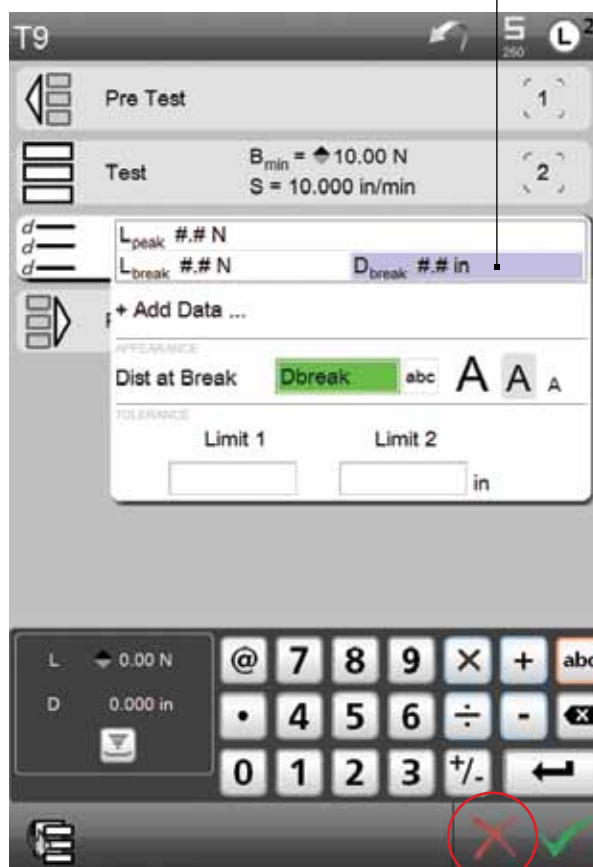
You can delete a coefficient from your Data List. Select the coefficient you wish to delete. When the coefficient is highlighted, select the “X” target to delete. The coefficient is removed from the Data List and will no longer be displayed in the Data View, Data Summary View or Graph.

The Lbreak result is less than the Tolerance range, therefore, the result is a “failed” result. The coefficient is displayed in RED to indicate a failed result.



The Run Number is also displayed in RED to indicate a “failed” Run.

Select the coefficient from the Data List you wish to delete.



The highlighted coefficient is deleted once the “X” target is pressed.

7.0 Naming Your Test Setup

When you create your test, your L2 software will ask you to name the test. Use the virtual keyboard on your L2 Controller display or use a keyboard connected to your system via USB or Bluetooth.

Test Names may be up to 16 characters in length.

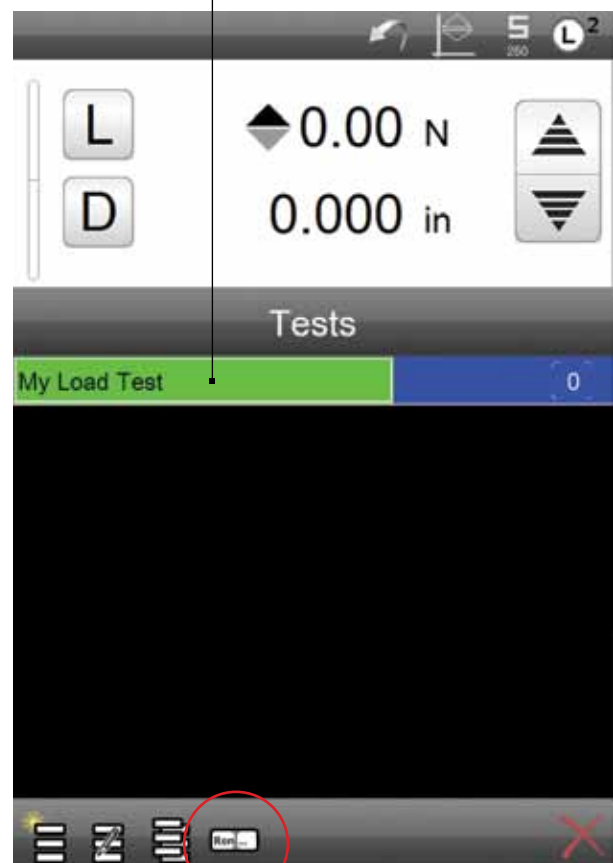
You may also use the Rename symbol to rename your test. Open your test, select the Rename symbol and a text block will appear for your current test name. You can then rename the test.

The existing test name is highlighted when the Rename function is selected. This allows you to enter a new name.



Once you complete the test setup, the final step is naming your test. The test name may be up to 16 character. You may use alphabetical or numeric characters only.

Enter the name and select Done.



You may rename a test setup using the Rename function

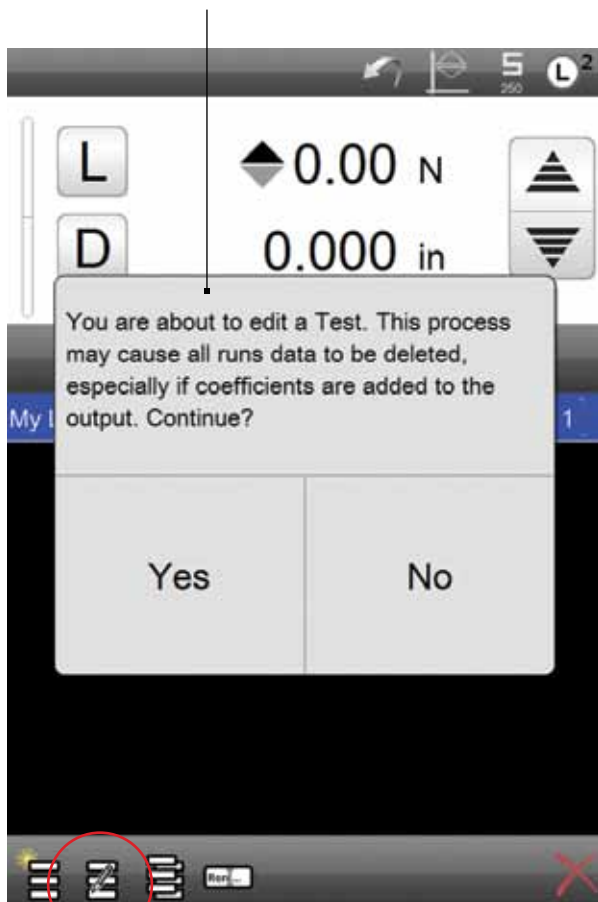
Select the test. Select the Rename target. Enter the new test name.

7.1 Editing Your Test Setup

If you find it necessary to make changes to your test setup, you can Edit your test. When you edit a test, you are changing the test setup, therefore, the test runs and data associated with the original test setup are not saved. If you need to save this information, use the COPY TEST function to save your original and to duplicate a copy of your original test setup. You can then Edit this test setup.

Whenever you Edit a test setup, any Run data for the existing test will be permanently erased.

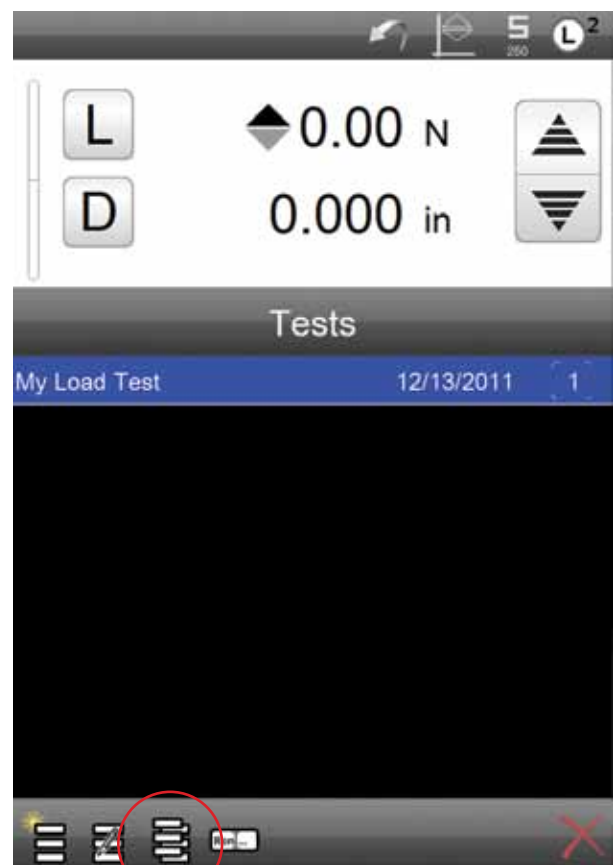
If you need to retain the data for an existing test, either copy the test setup or save the data to a file using the Export Results or Export Raw functions.



Use the Edit function to edit a test setup.
Select the test. Select the Edit target.

7.2 Copying Your Test Setup

Copy your test to save an original test setup before you edit, or to create a new test setup with the basic settings from the original test setup.



Use the Copy function to edit a test setup.
Select the test. Select the Copy target. The new test setup will open at the Test step. From there, you can make any necessary changes.
You will be required to rename the new test setup.

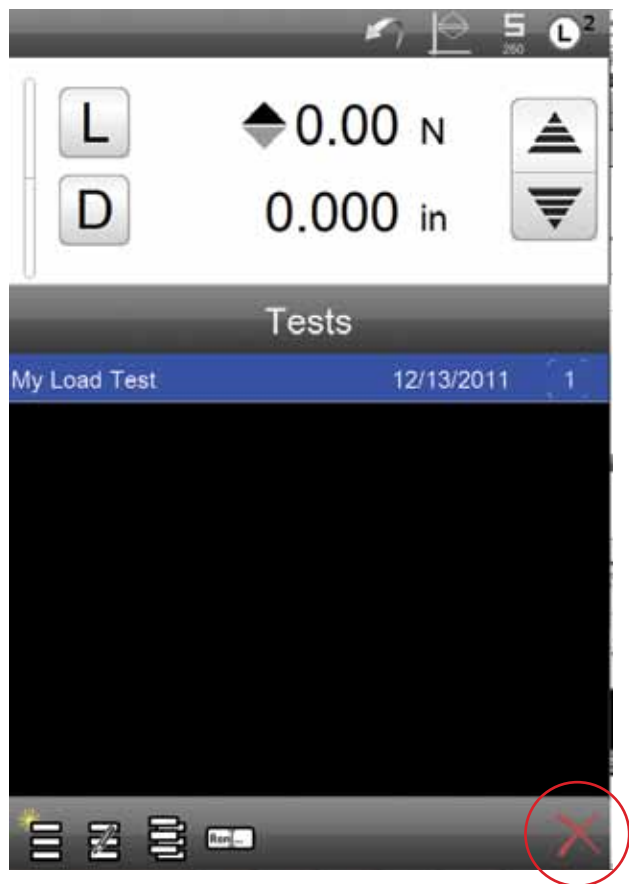
7.3 Deleting Your Test Setup

You delete a test by selecting the test for deletion from the main test setup menu.

You cannot recall a deleted test, therefore, exercise caution when selecting a test setup for deletion.

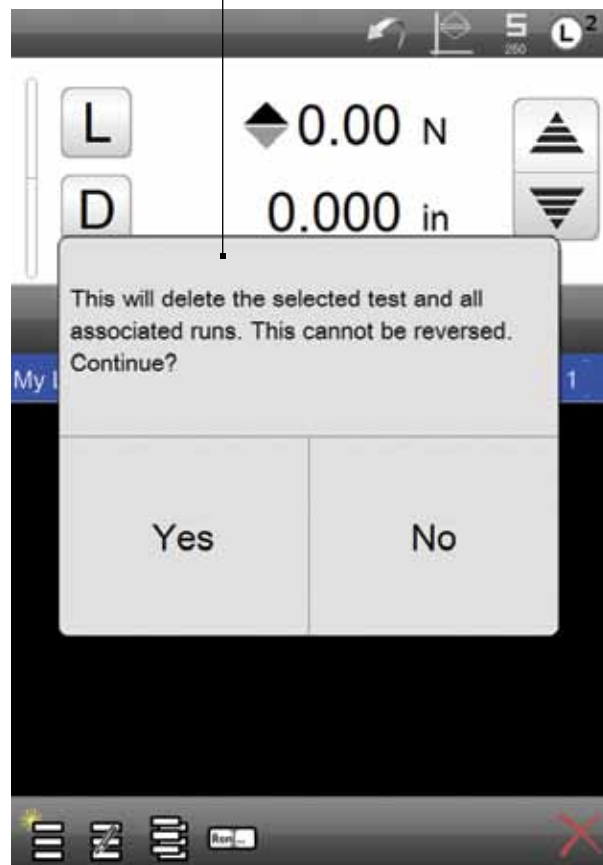
Once a test setup is deleted, all setup information and any data associated with the test setup is deleted permanently.

A warning message is displayed and requires the user to select YES in order to complete the deletion process.



Select the test setup for deletion from the Main Test Menu.

Select the "X" to delete the test setup.



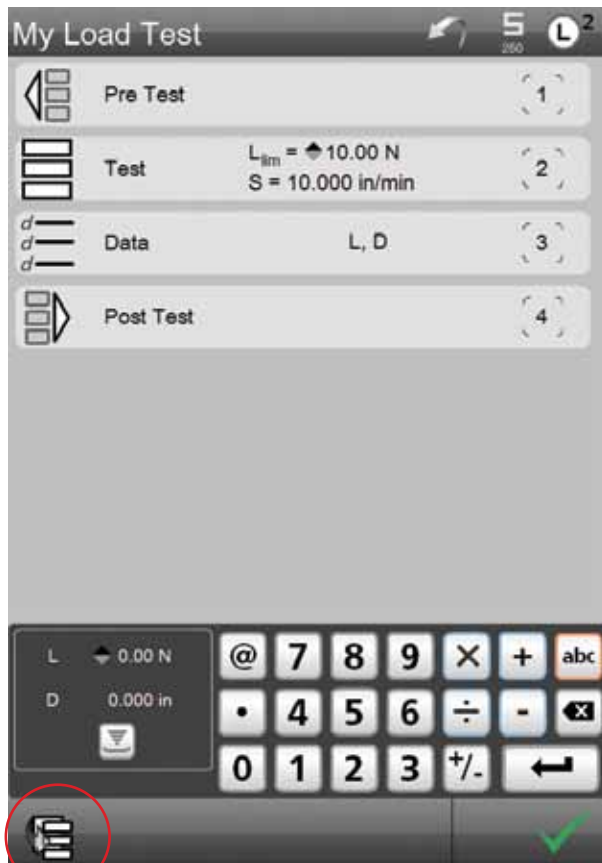
7.4 Converting Your Quick Test to the Test Builder

The Test Builder is an advanced application supplied with your L2 controller. The Test Builder application lets you create a test setup without the use of a template. You create a test using stage movements and other types of stage types including holds, cycles, etc.

Once your load test that you created using the Load Test template is converted to the Test Builder application, you cannot return the test back to the Load Test template setup.

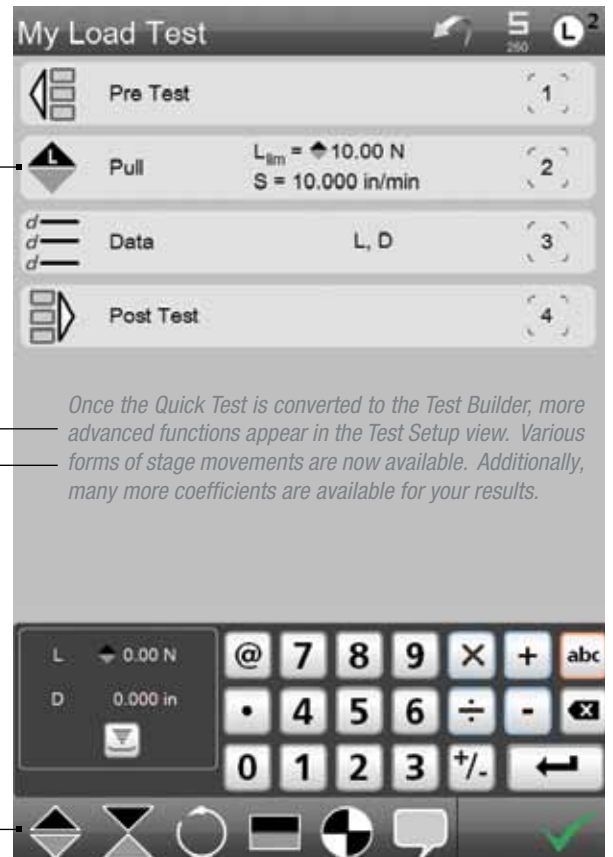
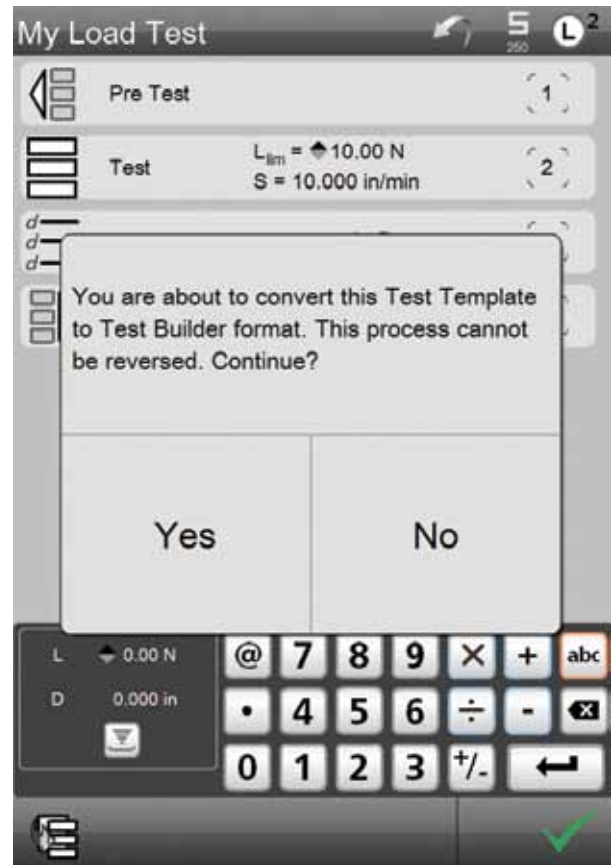
Starrett recommends you make a copy of your load test that you created using the Load Test template first. Then convert that copy of the test setup to the Test Builder.

For more information about using the Test Builder application, please read the Test Builder User Guide.



The Test Builder application allows you to create a more sophisticated test with advanced testing functions and additional testing and measurement features.

From a Quick Test Setup View, select the Convert to Test Builder target.



Once the Quick Test is converted to the Test Builder, more advanced functions appear in the Test Setup view. Various forms of stage movements are now available. Additionally, many more coefficients are available for your results.

8.0 L2 Operation

This section will provide you with an overview of your Starrett force testing system operation using the L2 controller.

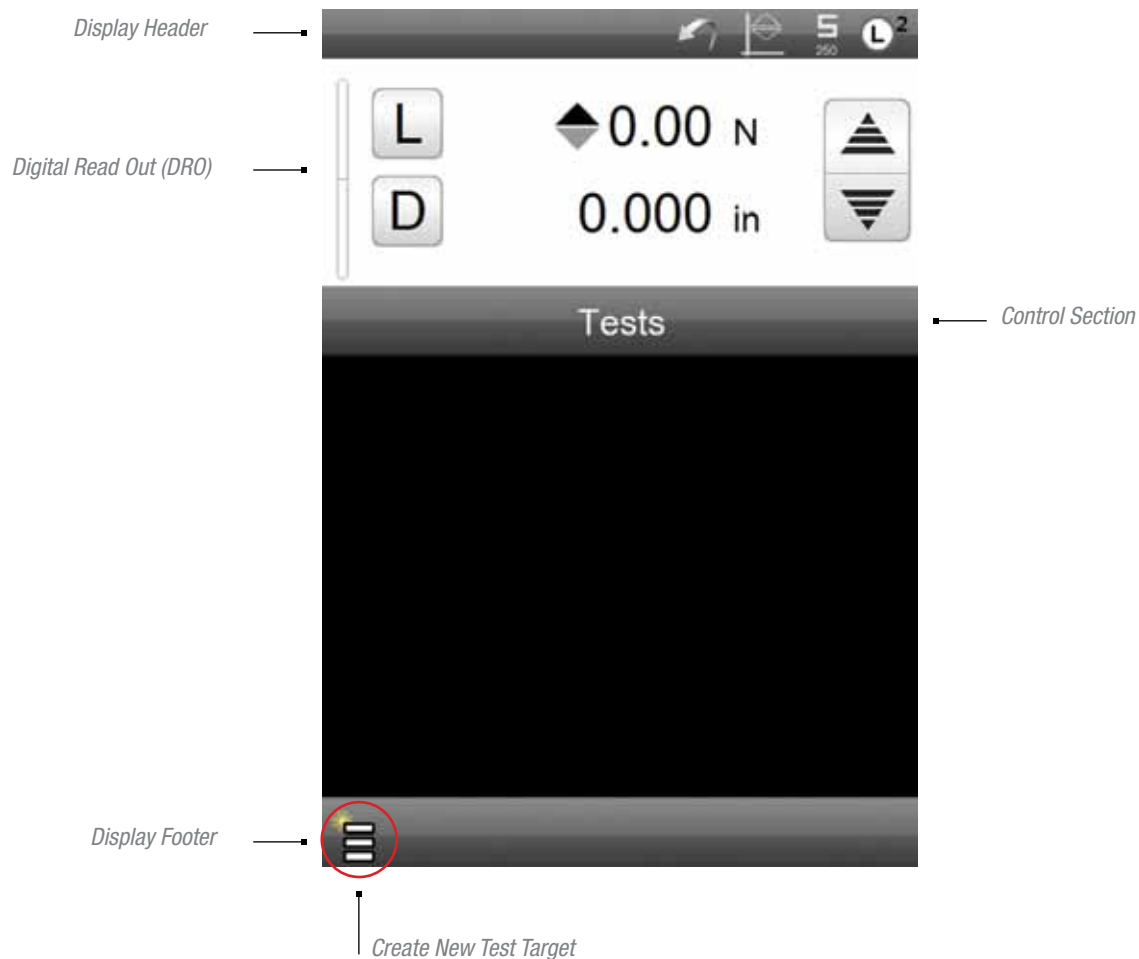
Starrett recommends that you receive training on the safe operation of your force measurement system from your authorized Starrett representative prior to use.

8.1 Display Views

The following sections will describe the many display views used or available to you during normal L2 Controller operation.

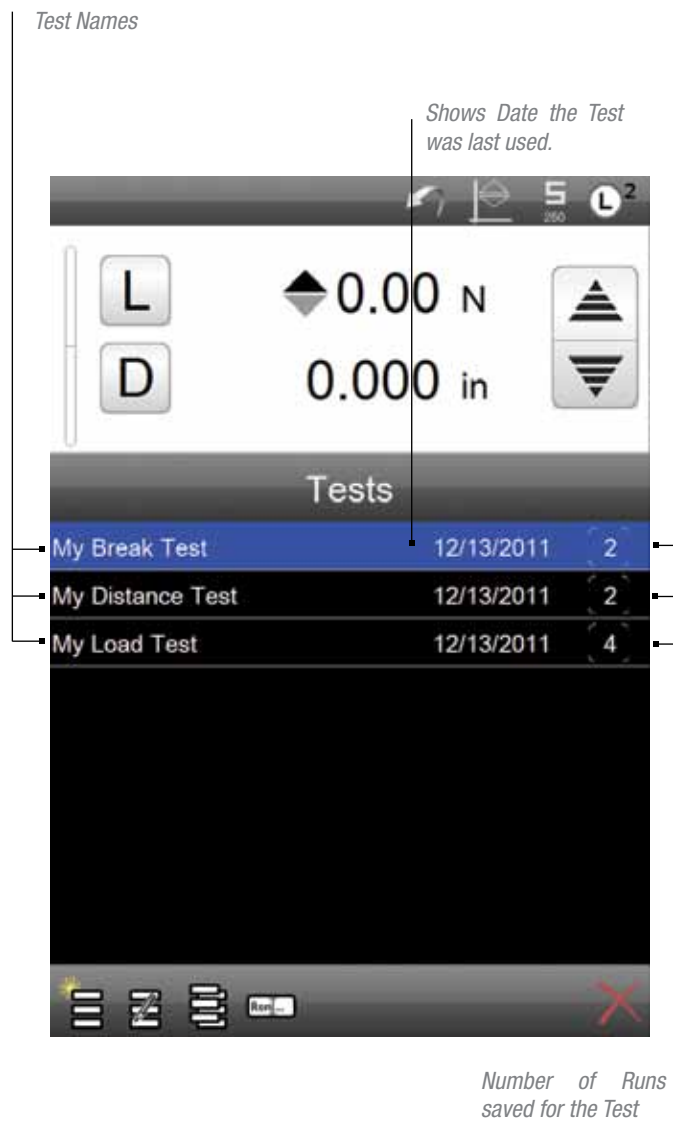
8.1.1 New Test View

When you first launch the L2 Controller, the first display is the New Test view.



8.1.2 Test Menu View

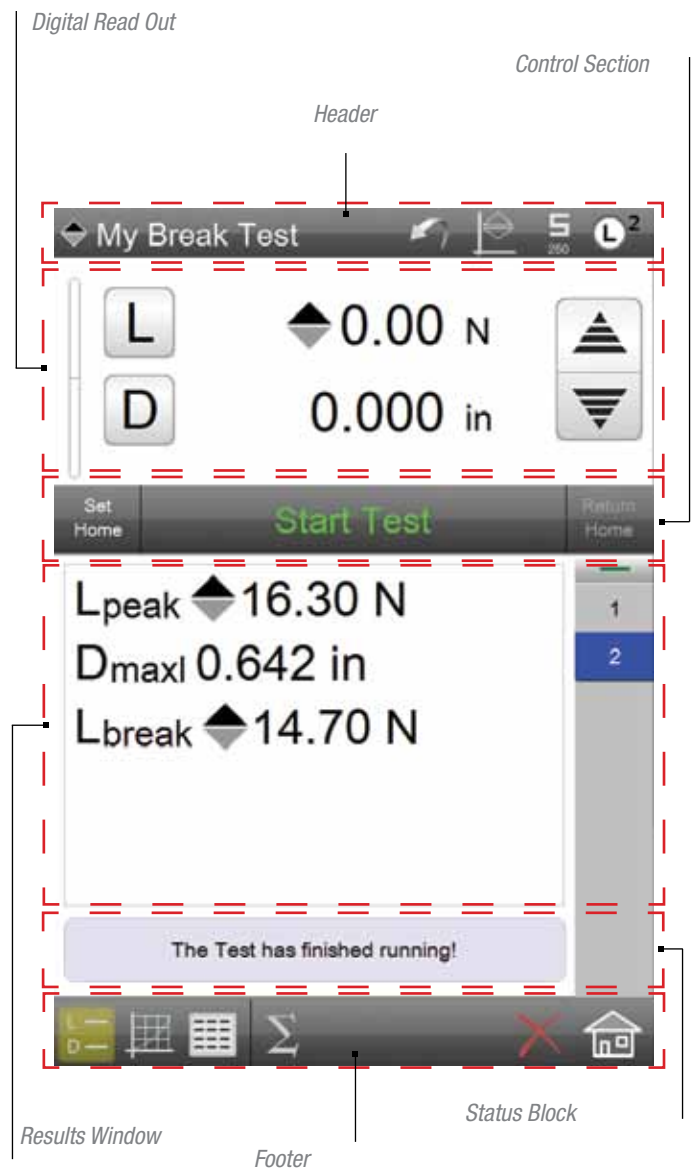
The Test Menu lists the Test Names that are saved on your L2 Controller for use. The Test Name and the last date the test was used are displayed. Additionally, the Test Name shows the number of test Runs for each test.



8.1.3 Data View

The Data View is the default operating display for all test setups. The Data View is the most used operating display. The Data View is comprised of the following sections:

- Header
- Digital Read Out
- Control Section
- Results Window
- Status Block
- Footer



8.1.3.1 Display Header

All views have a Display Header. The header contains the following attributes:

- Test Name
- Test Model
- Back Symbol
- Test Mode
- Sensor Status
- Main L2 Menu

The Test Name is displayed with the symbol showing the Test Type. The Test Name may be up to 16 characters. The Test Name may be constructed using alphabetic or numeric characters only. Punctuation characters and symbols may not be used.

The Back Arrow symbol is used in two L2 Controller functions only. The Back Arrow is used to:

- It allows you to move from the Test Menu View to the New Test View, or
- to abort a test setup.

Your FMS System may be operated in either Normal Model or Height Mode. When in Normal Mode, the L2 Controller displays crosshead position as Distance. The Distance (D) measurement is relative to a user-specified datum position.

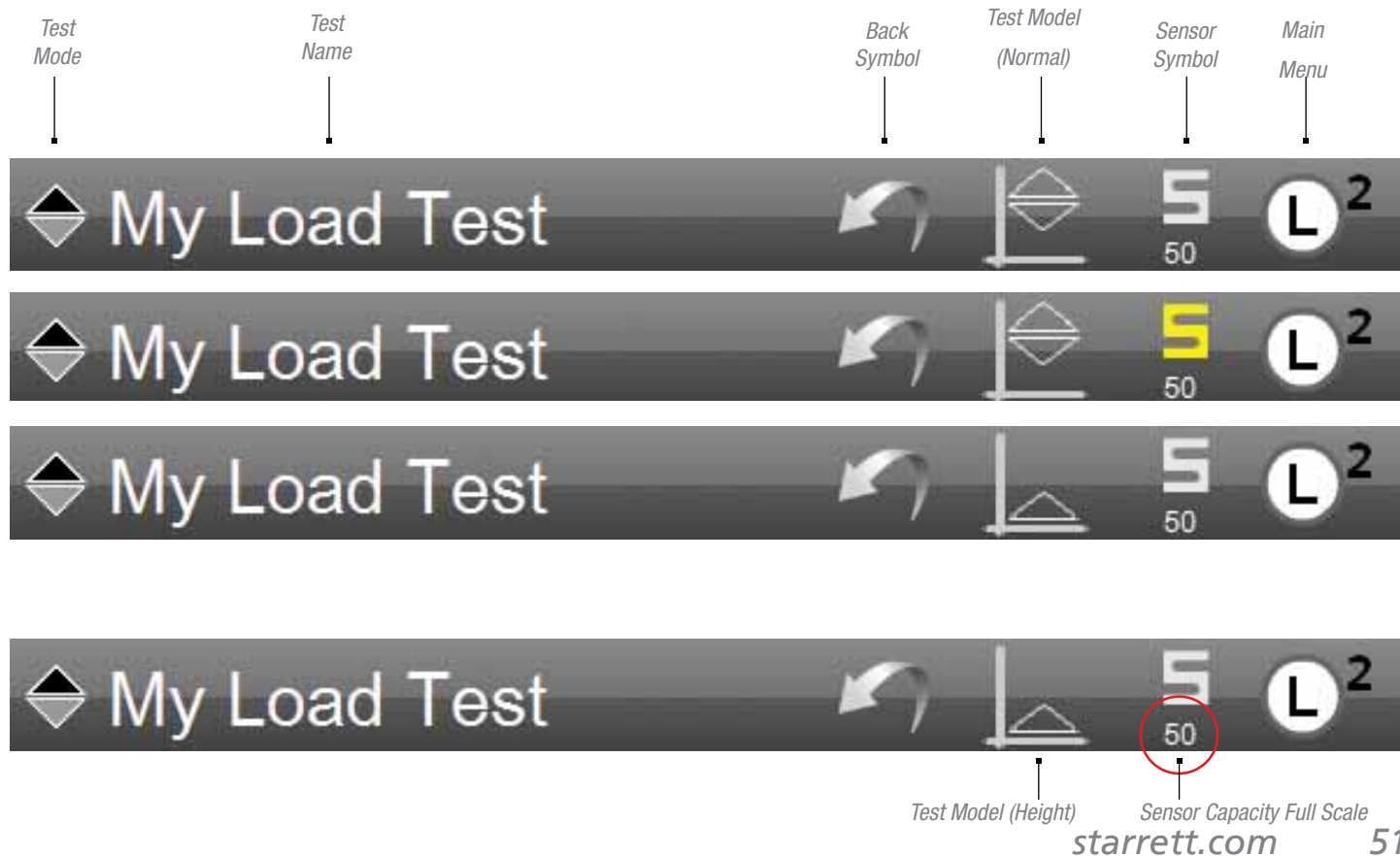
The Height Mode establishes the crosshead head based on an auto-datuming routine. Height mode is commonly used for tests on springs where the free length of the spring needs to be determined in order to determine spring rate.

You may switch between Normal Mode and Height Mode by pressing the Test Model symbol.

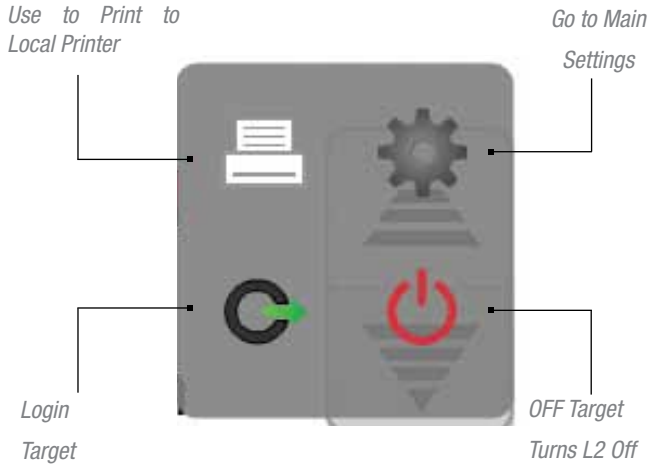
The Sensor symbol identifies the sensor capacity of the load cell that is connected to your FMS frame. Listed below the sensor symbol is the sensor's load capacity in the current units of measure.

The FLC sensors used with the FMS System are TEDS-compatible. They are automatically recognized by the system once the sensor is connected to the frame. Press the Sensor symbol to view the sensor's serial number, calibration status and overload history.

The Sensor symbol also uses the same color status indication as the bar graph. Green, Yellow and Red are used to represent the sensor's currently measured load based on the sensor's rated capacity.



The L2 Main Menu is used to gain access to the System Settings. It also is used to access the Print function for printing reports. The L2 Main Menu also has the On/Off function.



The Load Bar Graph displays the measured load in a graphical format. The bar graph fills from the center (zero) position. Tensile loads fill the bar graph from the center upward, while compressive loads fill the bar graph from the center downward.

The bar graph uses color to indicate the percentage of load being applied to the load cell sensor relative to the sensor's rated load capacity. The bar graph will display green when the measured load is 0 to 75% of the sensor's rated capacity. The bar graph will display yellow when the measured load is 76% to 90%. The bar graph displays red when the measured load is over 90%.

Caution should be exercised when the bar graph is displaying yellow. This indicates that you are operating at the upper range of the load sensor, which is perfectly acceptable.

The red color indicates that you are operating at the extreme high end of the sensor's capacity. You should exercise extreme caution in order to not overload the load cell sensor.

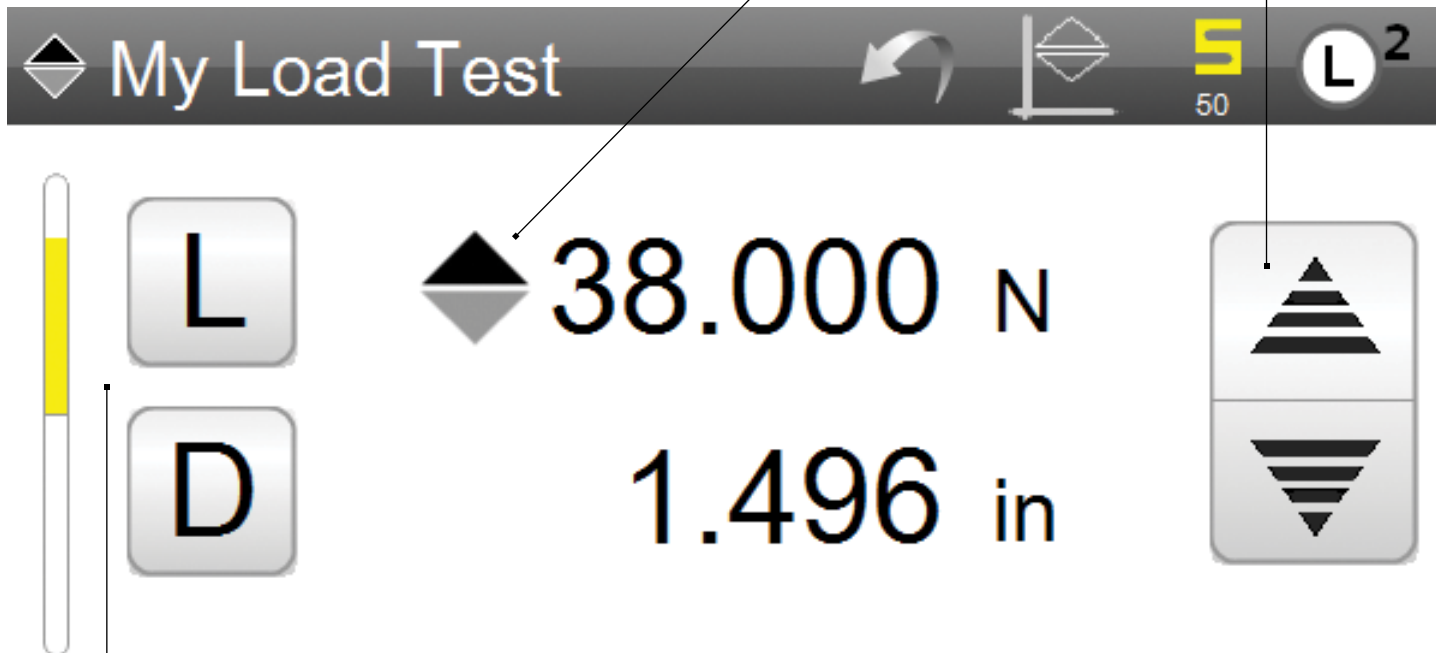
8.1.3.2 DRO Section

The DRO (Digital Read Out) section of the display shows active measurements for load and distance/height. The DRO section contains the following attributes:

- Load Bar Graph
- Load Target, Mode Symbol and Measurement
- Distance or Height Target, Mode Symbol and Measurement
- Status Indicators

Shows the test mode (Tension) and the direction of crosshead travel.

Crosshead status arrows animate when the crosshead is moving and shows the direction of travel.



The Load (L) and Distance (D) targets. Press to zero the measured value being displayed.

The Load (L) target is used to indicate the current measured load coming from the connected load cell sensor. Shown in front of the Load target is the mode indicator arrow which indicate either tension (pull) or compression (push). The measured load is displayed to the resolution for the individual sensor (10,000:1) and the units of measure is also displayed.

If you press the Load (L) target, the measured load is zeroed.

The Distance (D) target or Height (H) target when in Height mode, is used to indicate the current crosshead position as measured by the FMS frame's internal encoder. Associated with the measured distance is the unit of measure, which may be either inches (IN) or millimeters (MM).

If you press the Distance (D) or Height (H) target, the measured distance or height value is zeroed.

The two arrow symbols are used to indicate crosshead motion status. When the crosshead is actively moving, the arrows will animate showing the direction the crosshead is moving. Very slow crosshead travel is not immediately visible, therefore, this animation will help you recognize that the crosshead is active and in motion.

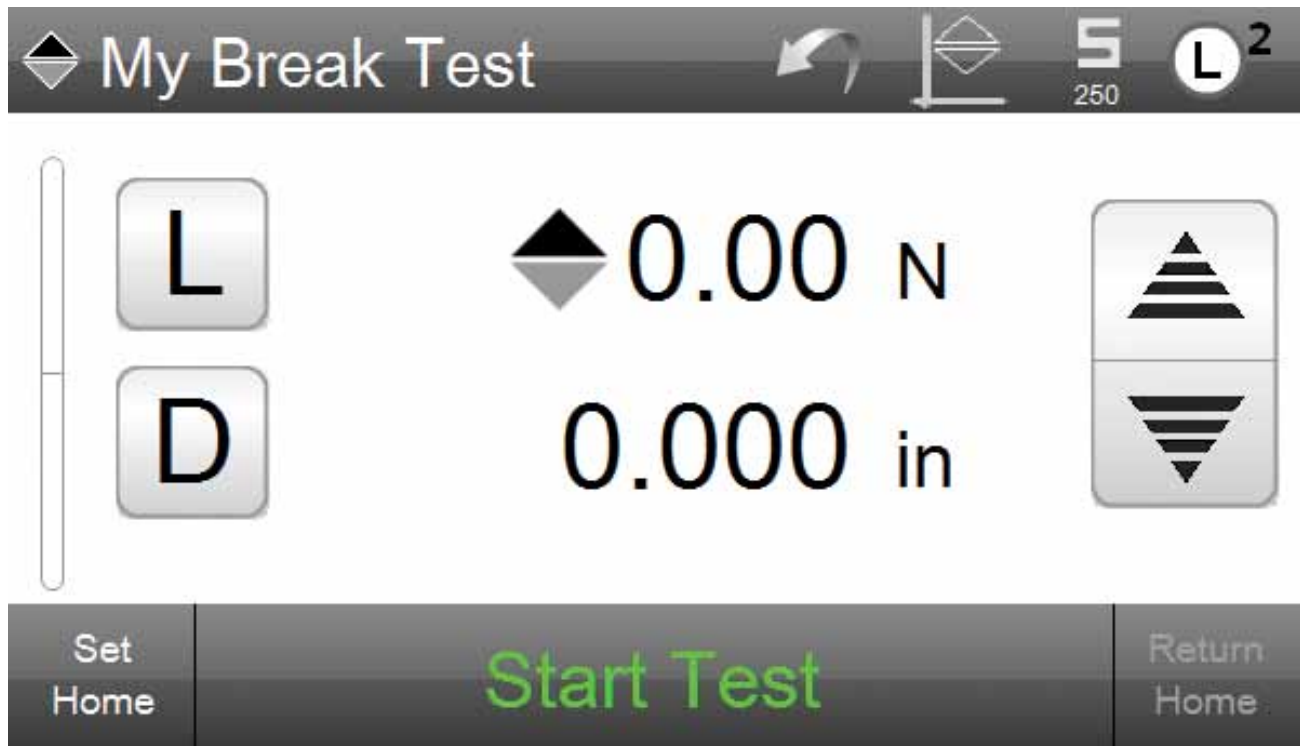
8.1.3.3 Control Section

The Control section is used during test operation to Start at test and Stop a test. The recommended method for Starting and Stopping a test is via the Start/Stop pushbutton on your FMS system's granite base.

The Control section also features the SET HOME and RETURN HOME targets. Both of these targets let you manually set the Home position prior to performing the test. The Home position is where the crosshead resides on the column prior to the Start test being performed. When the SET HOME target is pressed and after the test is concluded, you can press the RETURN HOME target. This will automatically return the crosshead to the established HOME position.

The SET HOME function is available in your Pre Test step. When enabled, the Home position is automatically established when the Start test push button is depressed.

The RETURN HOME function is available in the Post Test step. When enabled, the crosshead will automatically return to the Home position once the test concludes.



Press the SET HOME target to manually set the test Home position.

When the SET HOME function is used (manually), at the completion of the test, you may return the crosshead to the Home position by pressing the RETURN HOME target.

8.1.3.4 Results Section

The Results section displays your results for your selected coefficients. This section displays the value and units of measure for each selected coefficient.

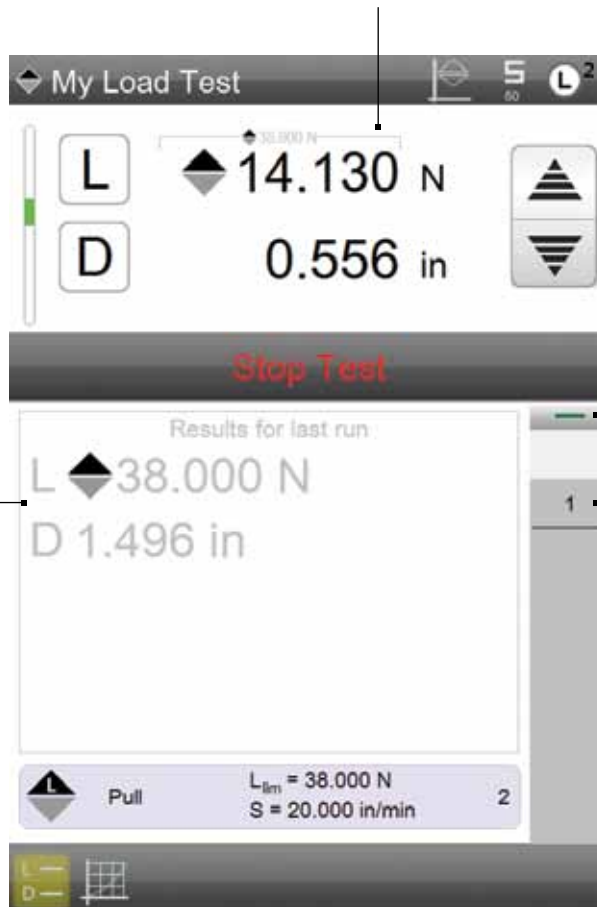
If tolerances are used, results that are “outside” the tolerance, display in RED to indicate a “failed” result.

The Results section also displays the Runs List. Each Run is numerically listed. You may select the Run number to view the results for that particular Run.

When the Graph view is being used, the Overlay function can be used to overlay traces for up to five (5) Runs on a single graph for comparison purposes.

The Result section also displays the test status in the Status Block. During runtime, the Status Block will indicate the step being performed and the current status of the test.

During an active RUN, the Limit setpoint is displayed. In this example the tension load limit of 38N is shown above the currently measured load of 14.130N.



The Overlay target is used during the Graph View. This allows you to select multiple RUNS for graphing together.

The Data View shows the results from the previous test RUN (Run 1).

The Runs List shows the current number of Runs performed. In this example, we are running Run 2. Run 1 is listed.

The Status Block reports the current step being performed for the test setup. Shown is the test direction (tension/pull), the Load Limit (38.000N) and the Test Speed (20.000 in/min). The Step Number (2) is also displayed.

This symbol represents the Data View. It is highlighted to show that you are viewing the Data View format.

The other symbol represents the Graph View. You may also perform a test Run while in the Graph View.

8.1.3.5 Graph View

The Graph View may be used while a test Run is being performed. The Graph View displays a graphical representation of the measured values using a histogram.

The Graph View displays Load versus Distance or Load versus Time. You can change views by depressing the Graph View symbol.

During the first test Run, the graph will automatically determine the X- and Y-axis graduations during the test.

When the OVERLAY function is used, the graph will place a trace for up to five (5) Runs on a single histogram. Each trace is color coded to match the individual RUN.

Press the OVERLAY target. If you press once and the double green line shows, you can then individually select the RUN number you want on your graph.

If you select the target and press and HOLD, all of the RUNS will be overlaid onto your graph. The maximum number of traces is five (5) per a single graph.

Shows the currently active View (Graph View)

Exports Raw Data for this RUN in a .csv file format

Deletes the highlighted RUN

Deletes the highlighted RUN

Go to Data View

Go to Data Summary View

Go to Home View

8.1.3.6 Data Summary View

The Data Summary View is a batch report for an entire test setup. The Data Summary View looks like a spreadsheet. Each row of information corresponds to a RUN within the test (batch).

The Title Row shows the various titles, which include the coefficients and their units of measure.

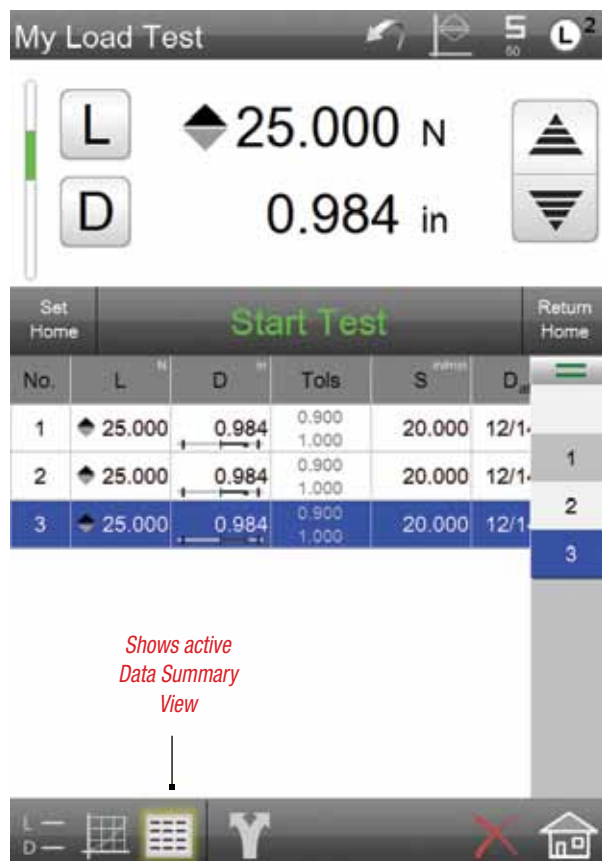
If Tolerances are used, a “tendency graph” is shown depicting the actual result on a line graph relative to the Limit 1 and Limit 2 range. Results that fall outside the tolerance range are displayed in RED text.

The Shared function is listed in the footer. Selecting this function will create and send a .csv file of the Raw Data for a result.

The Title Row shows the Run No., coefficient results with units of measure and tolerance limits (if used).

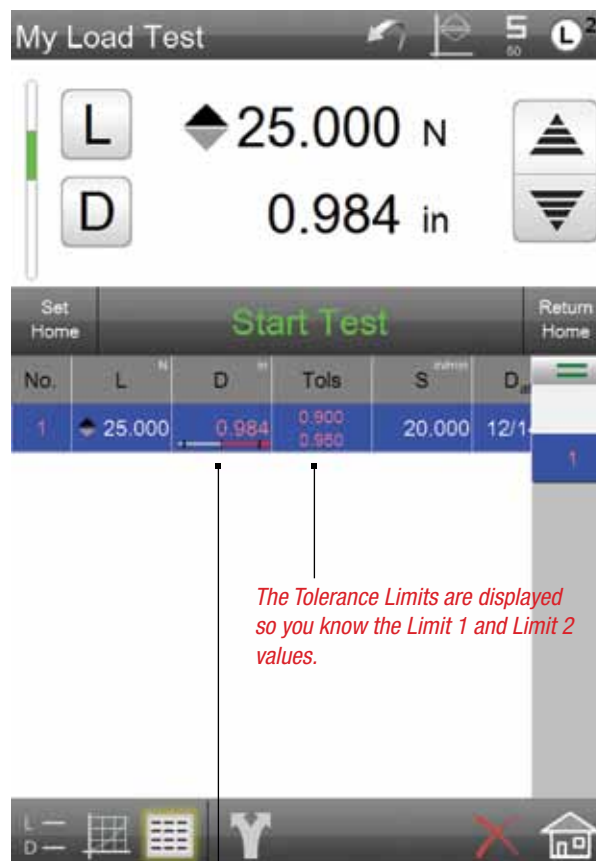
The highlighted (blue) row corresponds to the highlighted Run number in the Runs List.

When an “out-of-tolerance” condition occurred, the RUN displays RED indicating a “failed” result.



Shows active
Data Summary
View

Exports Raw Data for this RUN
in a .csv file format



The Tolerance Limits are displayed
so you know the Limit 1 and Limit 2
values.

When tolerance is used, a Tendency graph
is used to depict how the measured result
compares to the limit range you had established
for Limit 1 and Limit 2.

Our example shows that we exceeded the Limit
2 (Upper) tolerance.

8.1.3.7 Statistics View

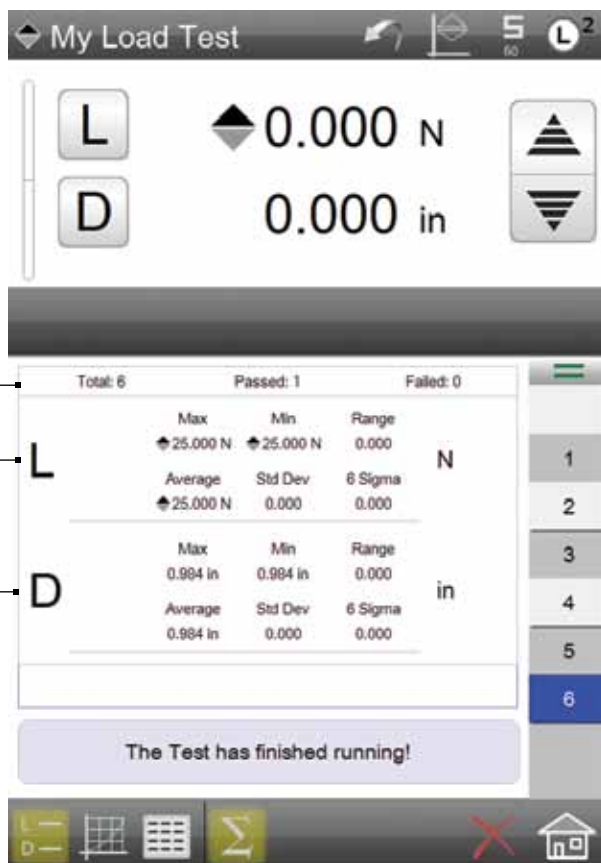
The Statistics View calculates basic statistics for the batch (all RUNS for a test). The Statistics View calculates:

- Total Runs
- Runs “passed”
- Runs “failed”

For each coefficient, the Statistics Views displays:

- Maximum Value
- Minimum Value
- Range
- Average
- Standard Deviation
- Six Sigma

The Statistics View header shows the number of RUNS, whether they passed or failed based on your tolerance settings.



Shows active Statistics View accessed via Data View

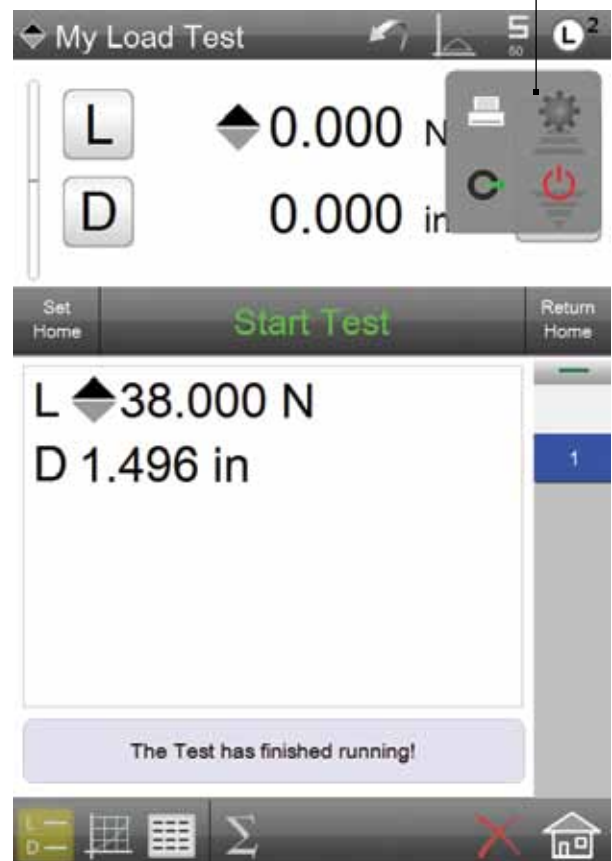
The Statistics View shows the statistics for each coefficient selected within a test setup.

9.0 System Settings

The main System Settings menu is used to set the global settings for your L2 Controller. The main System Settings menu is normally reserved for users with Super Administrator or Supervisor authorization and access.

This section will describe the primary system settings options for your L2 Controller.

From the L2 Menu, select the SETTINGS symbol to launch the SETTINGS options.



9.1 Contact Information

The Contact Information is an optional setting for your Starrett Dealer to complete. This will provide you with contact information should you require service or technical assistance.

9.2 About

The About setting tells you information about your L2 Controller and software. This setting displays software information including the revision level, revision date and lists any options included with your software.

The ABOUT Setting tells you information about your L2 Controller, including software revision date.

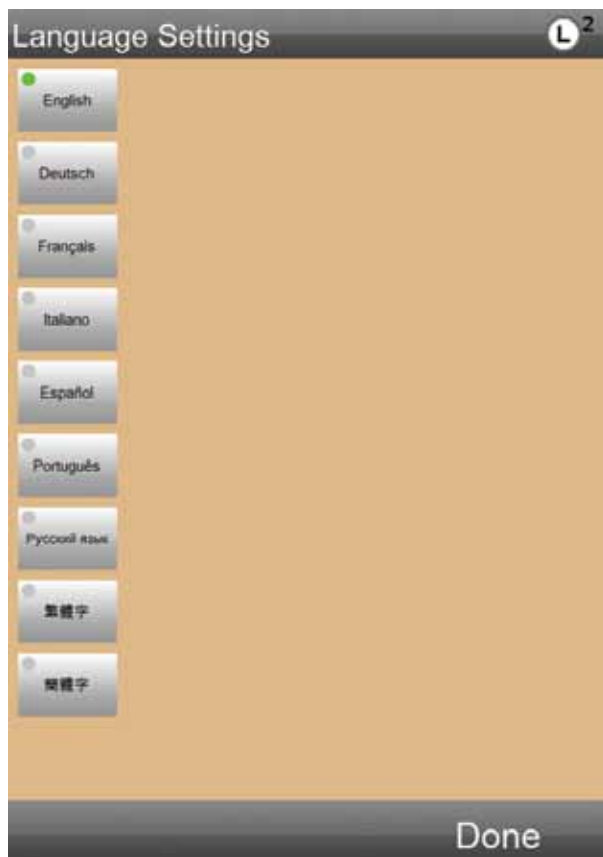
L2 System Settings options



9.3 Languages

When Language Settings = YES, the user has access to the setting that lets you designate the display language for your L2 controller. These languages are supported: English, Deutsch, Français, Italiano, Español, Portugues, Russian, Chinese (simplified) and Chinese (Mandarin).

If the Language Settings = NO, the user cannot change the display language.



ENGLISH is the default display language.

Select the desired language for your location. Language settings remain in their associated format.

9.4 Security

Your L2 controller has three levels of user security. These are:

- Super Administrator
- Supervisor
- User

The Super Administrator is the highest level of authorization. This level has total access to all system functions.

The Supervisor is normally a level below the Super Administrator. Only the Super Administrator can assign the “access rights” to the Supervisor. You may have multiple Supervisors for an L2 controller.

The User level is generally used for the operator with restrictive access to only the functions the operator needs to perform in their normal duties.

All assigned users to a system have these configurable attributes:

- Display Name
- Password
- Max days a password is usable
- Account enabled
- Automatically login as this user

All assigned users have these configurable access rights:

- Language Settings
- Display Formats
- File Locations
- Tests
- Coefficients
- IO Lines
- Printouts
- Security Settings

Access rights are either YES or NO and listed in the Access column. To change the access rights, select the Yes or No status.

Security Settings

L2

Display name

Super Admin

Super Admin

Password

abc

Max days password is usable

abc

Account enabled

Yes

Automatically login as this user

Yes

Access rights for Supervisor, users 1 to 5

Capability	Access
Language Settings	Yes
Display Formats	Yes
File Locations	Yes
Tests	Yes
Coefficients	Yes
IO Lines	Yes
Printouts	Yes
Security Settings	Yes

Done

Security Settings

L2

Display name

Supervisor

Supervisor

Password

abc

Max days password is usable

abc

Account enabled

Yes

Automatically login as this user

No

Access rights for Supervisor, users 1 to 5

Capability	Access
Language Settings	Yes
Display Formats	Yes
File Locations	Yes
Tests	Yes
Coefficients	Yes
IO Lines	Yes
Printouts	Yes
Security Settings	Yes

Done

The Supervisors can assign Users their access “rights”.

The Super Administrator has complete access to all System Settings
The Super Administrator can assign Supervisors and Users their access “rights”.

Security Settings L²

Display name: User 5 User 5

Password: abc

Max days password is usable: abc

Account enabled: No ☐

Automatically login as this user: No ☐

Access rights for User 5

Capability	Access
Language Settings	Yes
Display Formats	Yes
File Locations	Yes
Tests	Yes
Coefficients	Yes
IO Lines	Yes
Printouts	Yes
Security Settings	Yes

Done

Security Settings L²

Display name: User 5 User 5

Password: abc

Max days password is usable: abc

Account enabled: Yes ☒

Automatically login as this user: No ☐

Access rights for User 5

Capability	Access
Language Settings	No <input type="checkbox"/>
Display Formats	No <input type="checkbox"/>
File Locations	No <input type="checkbox"/>
Tests	Yes <input checked="" type="checkbox"/>
Coefficients	No <input type="checkbox"/>
IO Lines	No <input type="checkbox"/>
Printouts	Yes <input checked="" type="checkbox"/>
Security Settings	Yes <input checked="" type="checkbox"/>

Done

You may set the number of days to require a "forced" new Password.

Each User may have a Password constructed using alphabetical and numeric characters. No symbols or punctuations permitted

Passwords may be up to 16 characters in length.

Turn Security "rights" on/off using YES (on) or NO (off).

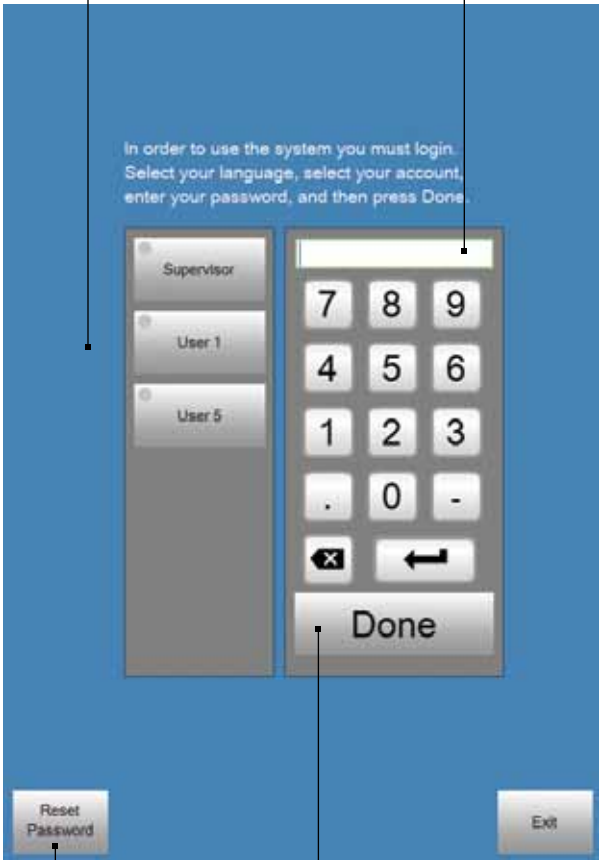
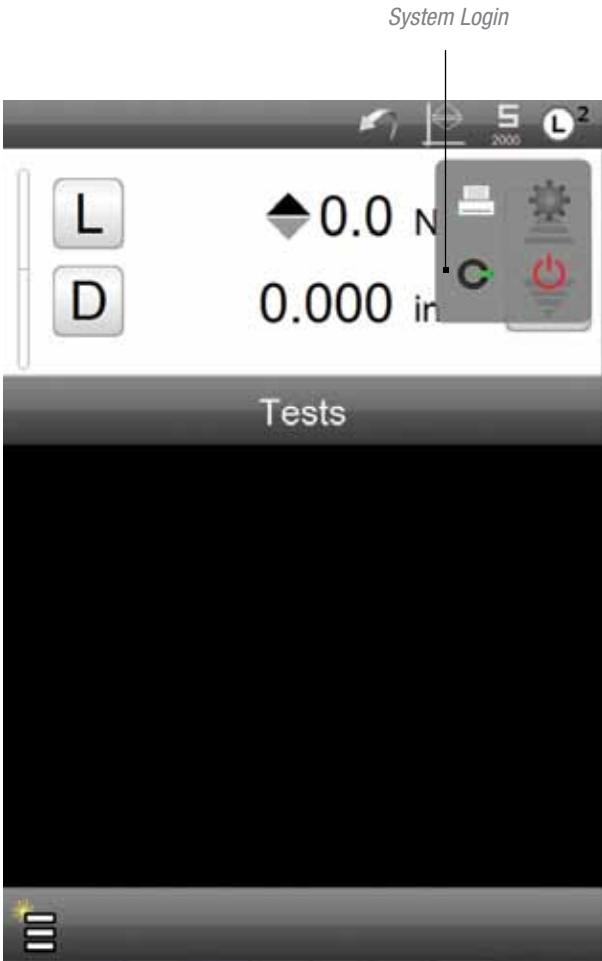
You may assign "rights" to up to five (5) User levels.

9.5 System Login

Users may login to the L2 Controller using the login symbol. When passwords are used, the user will be required to enter their password in order to launch the L2 software.

The authorized users for the system, setup by the Supervisor or Super Administrator, are listed. Select your access name from the list.

Enter your Password to launch the L2 software. Use the numeric keypad and/or a wireless keyboard that is paired to your L2 Controller.



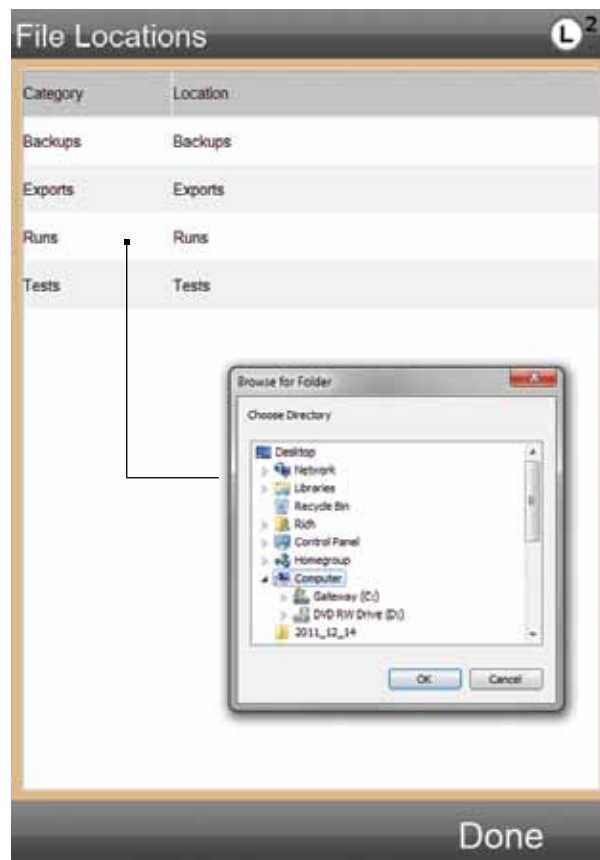
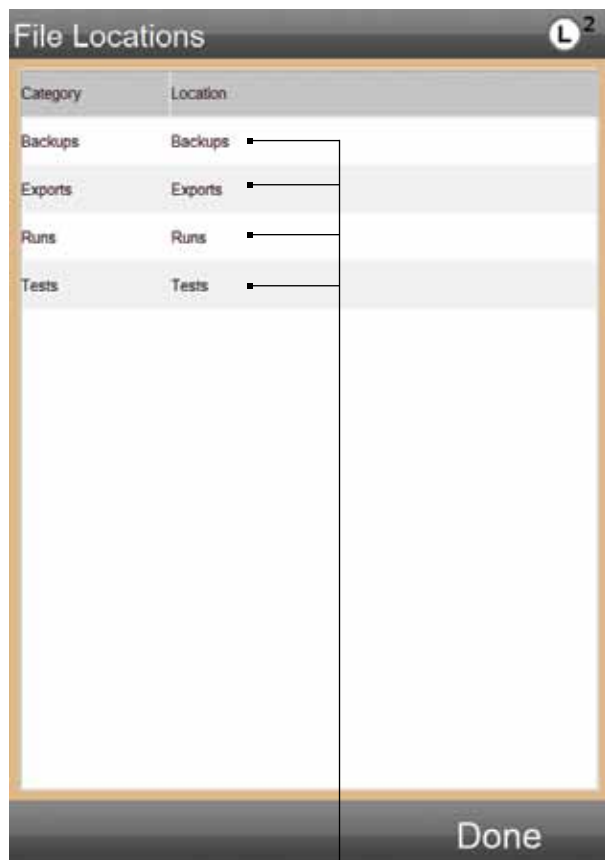
Use this touch target to reset your password.

Select DONE to launch the L2 software.

9.6 File Locations

When File Locations = YES, the user is allowed to setup directories and locations where files can be exported to. Within the File Locations settings, you have the ability to setup and link directories for backups, exports, runs and test files.

If the File Locations = NO, the user cannot assign a file location.



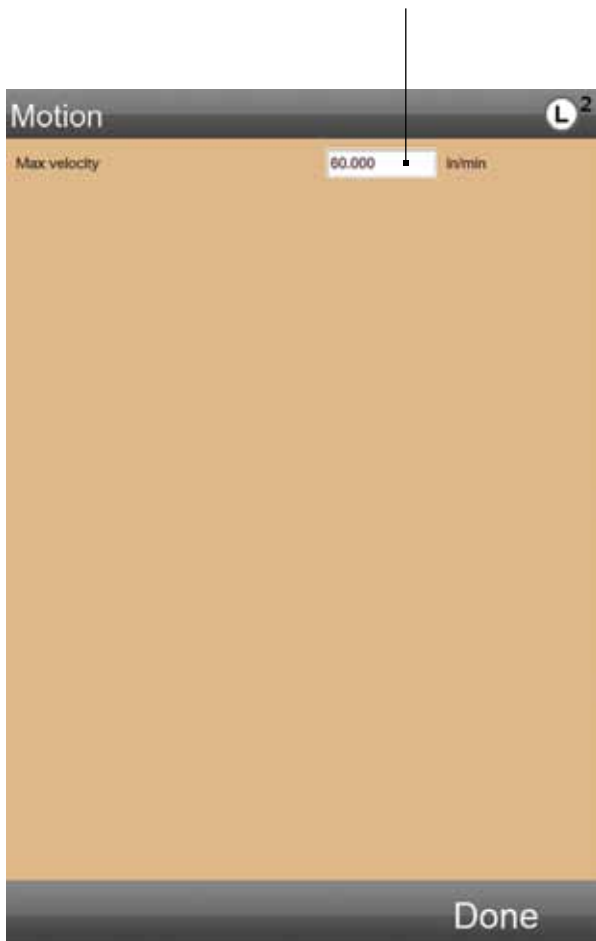
Select the File Type to assign a file directory. Once the directory is assigned, all files will be sent to that directory for archiving or use by other applications or personnel on a network.

9.7 Motion

The Motion setting lets you change the maximum velocity of your FMS frame. The maximum velocity is 60 inches per minute (1525 mm per minute). This velocity is not used for testing. The maximum allowed test speed is 50 inches per minute (1270mm per minute). The maximum velocity is used for the fast jog switch- the crosshead will move at the maximum velocity when the jog switch is pressed and held in position.

The maximum velocity for all FMS frames is 60 inches per minute. The maximum test speed velocity is 50 inches per minute.

When you set the velocity, you are setting the maximum velocity used when the jog switch is pressed and held, e.g. the rate of speed the crosshead can travel when not being used to testing, e.g. return speed.



The Grip Load is used to protect your gripping fixture from damage due to overloading. Set the Grip Load to a load capacity that is less than the capacity of the gripping fixture. If this load is achieved, the crosshead will stop and the test will abort.

9.8 Loads

The Load Settings lets you establish various load measurement attributes and safety options.

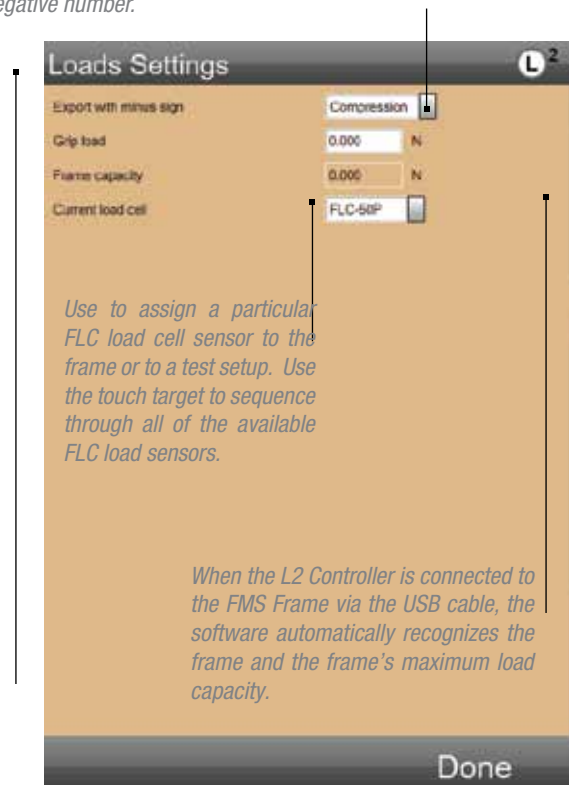
The Export with minus sign is used to designate a sign with either your compression or tension measurement in order to distinguish the two different types of loads. Generally, compression is displayed as a “negative” number.

The Grip load setting provides you with the ability to enter the load capacity for your testing fixtures. At times you may use a test fixture with a much lower load capacity than your sensor’s load capacity. Setting a Grip load will protect your test fixture. If this load is measured, the test will abort.

The Frame capacity is automatic. All Starrett testing frames are self-identifying by your L2 controller. The load capacity of the frame is automatically recognized and saved in the L2 controller. The frame capacity dictates and controls the maximum measurable load for your system.

The Current load cell is automatic. All Starrett load cell sensors are TEDS compliant to IEEE 1451. The sensor plugged into your Starrett load frame is self-identifying and the sensor’s characteristics are automatically recognized by your L2 controller. Load sensor deflection, for example, is automatically compensated for.

Use to assign a “sign” to either tension or compression. Normally, compression is a negative number.



Use to assign a particular FLC load cell sensor to the frame or to a test setup. Use the touch target to sequence through all of the available FLC load sensors.

When the L2 Controller is connected to the FMS Frame via the USB cable, the software automatically recognizes the frame and the frame’s maximum load capacity.

9.8 Calibration

The Calibration section is reserved for authorized personnel involved with calibrating the FMS system and associated load cell sensors.

9.10 Tests

The Tests Setting allow you to establish rules for how tests are created, edited, labeled and displayed.

When the Unlocked Tests option = YES, the user has the ability to edit, copy and delete a test setup. If the option = NO, the user cannot edit, copy or delete a setup.

When the option for Locked Tests = YES, an authorized user, normally a Supervisor or Administrator level, may edit, copy or delete a test setup. If the option = NO, the user cannot edit, copy or delete a setup.

When Allow Runs to be Deleted = YES, the user may delete a Run. If the option = NO, the user may not delete a Run.

You have the option to create a common Prefix Name for your tests. A Prefix Name may be the Supervisor who created the test; the facility where the test is to be performed; a Batch ID, etc. You may use up to ten (10) characters.

The Next Test Auto Number option lets you specify a numbering sequence for your test setups. The number you enter is the beginning number of the sequence. If the number is 1, the default test name for your newly created test setup is your Prefix Name and the number 1. If the number was 200, a newly created test setup is your Prefix name and the number 200. The next new test you setup would have the default name Prefix 201, etc. As tests are added to your system, the Next Test Auto Number represents the number of test that have been created.

The Graphing Points lets you determine the resolution of your graph trace. The default is 100 points. This means that 100 points from your data array for your Run will be used to display the trace on your graph. Using the crosshair tool, you can access all 100 points. You may have up to 1000 points for a graph trace. The greater number of points, the higher the graph resolution.

If set to YES, the user may make changes to unlocked test setups. Tests that are locked via the Security Settings cannot be modified or copied.

If set to YES, the user may make changes to locked test setups.

Tests Settings

Unlocked tests can be edited/copied/deleted Yes ☐

Locked tests can be edited/copied/deleted No ☐

Test name prefix T abc

Next test auto-number 3

Done

This lets you use a default name prefix when you create a test setup. For example you may want to use the name of the person who created the test setup, or the facility where the test is being performed or some other naming convention that helps identify the test setup author.

You may specify a test setup numbering sequence by specifying the next number to be used in auto-numbering.

9.11 Coefficients

The Coefficients Settings is a location where you have the option to change how a coefficient is reported and labeled. All coefficients have their own unique label, e.g. Load = L. You may, however, change the global label for Load if you wish. For example you may change Load to “Load” instead of L. Or you may change Peak Load from Lpeak to “Peak”.

You may rename a coefficient using up to 8 characters.

The COEFFICIENT SETTINGS shows all of the available coefficients for your L2 Controller. Most of the coefficients are only available using the Test Builder Application.

Load (L), Distance (D), Peak Load (Lpeak), Distance at Peak Load (Dmaxl), Break Load (Lbreak), Distance at Break (Dbreak), Time (Time) and Date (Date) are used on the Quick Tests. The other coefficients are NOT available for use on a Quick Test.

Coefficient Settings

L²

Load	<input type="text" value="L"/>	<input type="button" value="abc"/>
Break Load	<input type="text" value="Lbreak"/>	<input type="button" value="abc"/>
Average Load	<input type="text" value="Lave"/>	<input type="button" value="abc"/>
Peak Load	<input type="text" value="Lpeak"/>	<input type="button" value="abc"/>
Min Load	<input type="text" value="Lmin"/>	<input type="button" value="abc"/>
Delta Load	<input type="text" value="Ldelta"/>	<input type="button" value="abc"/>
Distance	<input type="text" value="D"/>	<input type="button" value="abc"/>
Dist at Break	<input type="text" value="Dbreak"/>	<input type="button" value="abc"/>
Max Distance	<input type="text" value="Dmax"/>	<input type="button" value="abc"/>
Min Distance	<input type="text" value="Dmin"/>	<input type="button" value="abc"/>
D at Max L	<input type="text" value="Dmaxd"/>	<input type="button" value="abc"/>
D at Min L	<input type="text" value="Dmind"/>	<input type="button" value="abc"/>
Delta Dist	<input type="text" value="Ddelta"/>	<input type="button" value="abc"/>
Duration	<input type="text" value="Dur"/>	<input type="button" value="abc"/>
Date	<input type="text" value="Date"/>	<input type="button" value="abc"/>
Time	<input type="text" value="Time"/>	<input type="button" value="abc"/>
Num of Cycles	<input type="text" value="Ncyc"/>	<input type="button" value="abc"/>
Answer	<input type="text" value="Ans"/>	<input type="button" value="abc"/>
Select coefficient labels first when editing	<input type="checkbox"/>	

Done

You may **RENAME** any coefficient. When you rename a coefficient at the **COEFFICIENT SETTING** view, the coefficient's name changes globally throughout the system.

9.12 Desktop

The Desktop Settings provide you with options for displaying extra symbols that help you making changes to common attributes. A special Desktop icon is displayed in the footer. Select this icon to reveal the Desktop settings options:

- Display inch/mm button
- Display load units button
- Display keyboard button
- Display height mode button
- Height of list items
- Shutdown computer on Exit

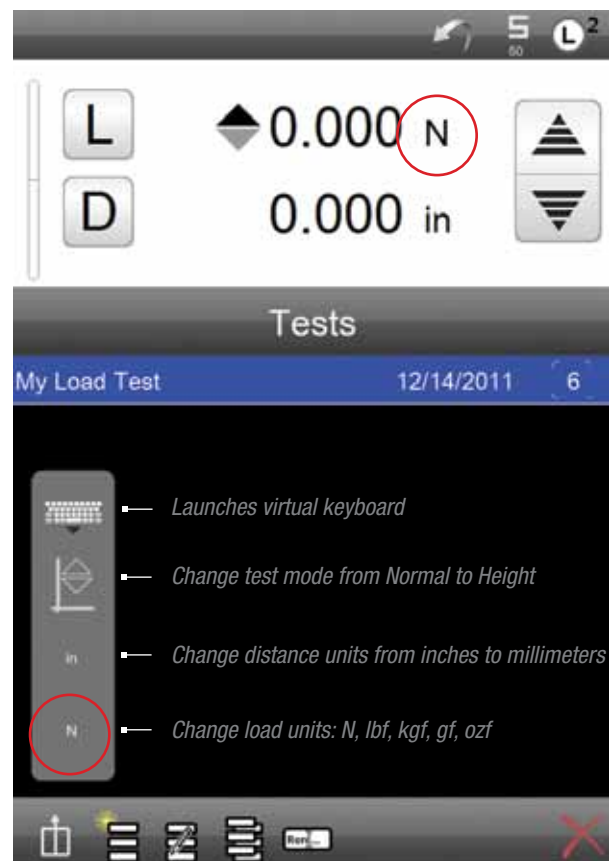
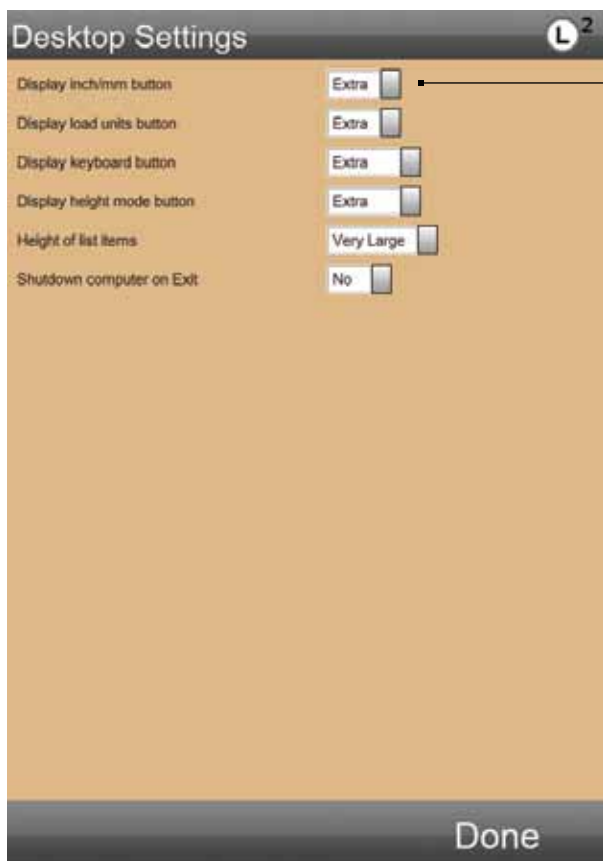
When the Display inch/mm button is set to Extra, you can change the distance units of measurement from your Test Menu view. Normal default is NO.

When the Display load units button is set to Extra, you can change the load units of measure from your Test Menu view. Normal default is NO.

When the keyboard button is set to Extra, the keyboard icon is displayed. Touch the keyboard display to launch the virtual keyboard for making alpha-numeric entries.

When the height mode button is set to Desktop, the height mode icon is displayed in the header.

The height of list items may be set to Very Large, Large, Medium or Small. This defines the size of your lists.



Special Desktop icon. Press to launch options list.

9.13 Display Formats

Use the Display Formats settings to globally establish your units of measure for distance, load, radix, data and height mode.

Set the units of measure for Load to either N (newtons), lbf (pound-force), kgf (kilogram-force), gf (gram-force) or ozf (ounce-force)

Set the units of measure for Distance to either in (inches) or mm (millimeters)

Current inch/mm flag: in

Current load flag: N

Use comma for radix: No

Date format: MM/DD/YY

Current height mode flag: D

The radix may be either a period (.) or comma (,)

Display the Date as either MM/DD/YY or DD/MM/YY

Display the Height target as either D or H

Done

9.14 Sounds

When Sound is enabled, an audible feedback sound is used on every touch of your L2 Controller. If you disable, there is no sound when you touch a target on your L2 Controller.

When the Sound feature is set to YES, an audible "beep" will be heard when you touch a target on the L2 Controller.

If you don't want any sound, turn the feature to NO.

Enabled	Sound
Yes	Make a sound when a button is activated

Done

10.0 Reports

Your L2 Controller supports four (4) different standard reports. Reports are generated from each of the four major display views: Data View, Data Summary View, Graph and Statistics.

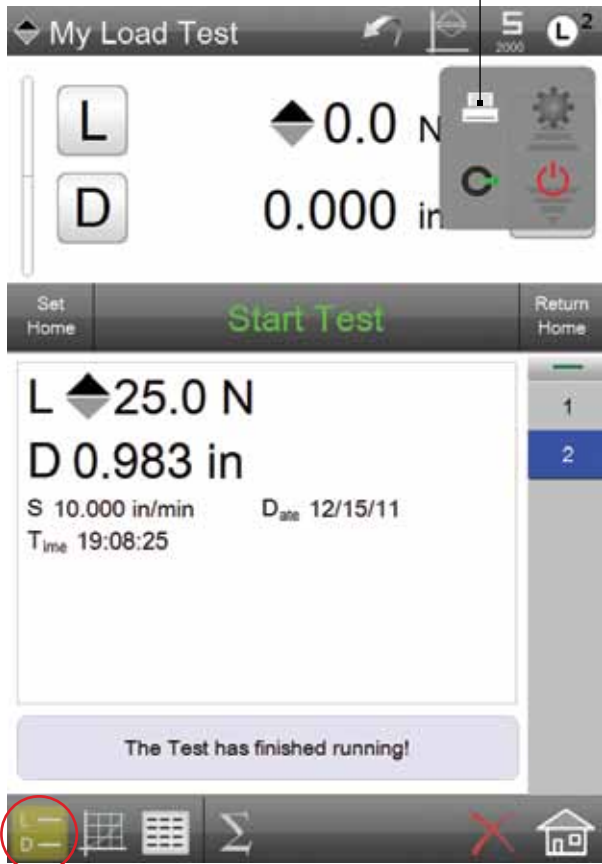
Your FMS system and L2 Controller can print to most printer models using a USB or wireless connection. Label printers may also be used.

10.1 Run Report

The Run Report derives from the Data View. This report is formatted as a label but can also be printed in portrait style on a standard letter-size document.

The Run Report shows result information from a single test Run. The information displayed comes directly from the Data View.

- Select Data View.
- Select L2 Main Menu.
- Select PRINT symbol.
- The report will print to the associated printer.



10.2 Batch Report

The Batch Report derives from the Data Summary View. It prints as a spreadsheet-style report displaying the results information for each test Run for a batch.

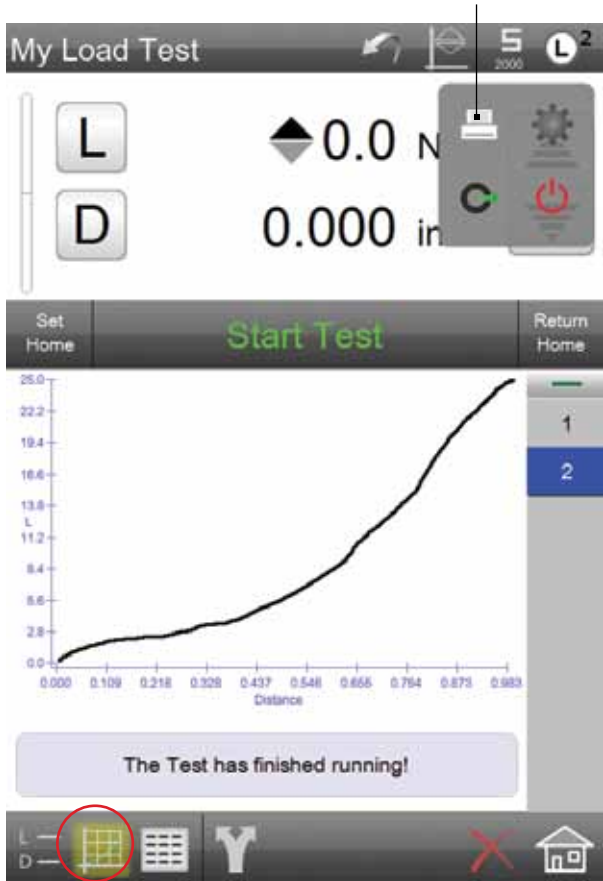
- Select Data Summary View.
- Select L2 Main Menu.
- Select PRINT symbol.
- The report will print to the associated printer.



10.3 Graph Report

The Graph Report prints the graph and the results information associated with the graph.

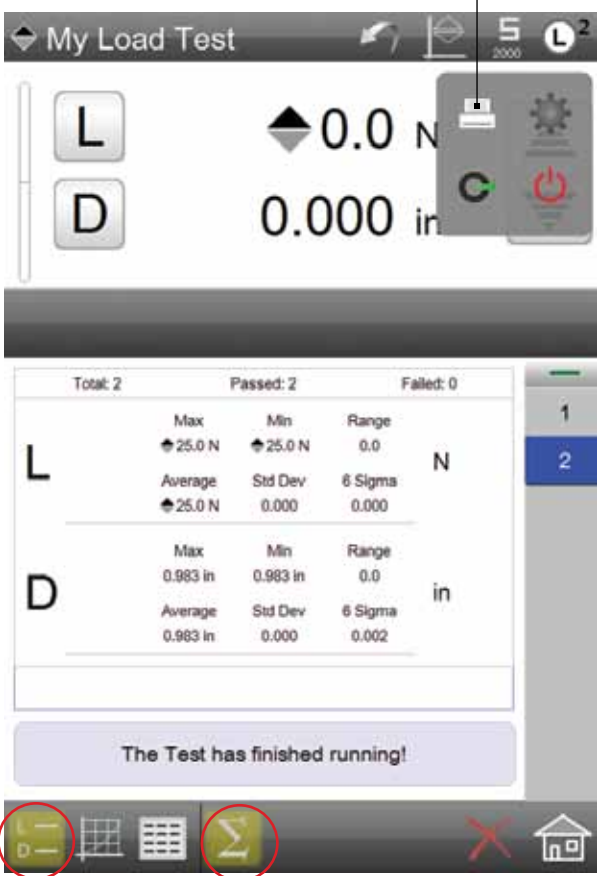
- Select Graph View.
- Select L2 Main Menu.
- Select PRINT symbol.
- The report will print to the associated printer.



10.4 Statistics Reports

The Statistics View prints the information from this view. It includes the number of passed, failed and total Runs. It also prints the statistics for each of the coefficients for your test setup.

- Select Data View.
- Select Statistics View.
- Select L2 Main Menu.
- Select PRINT symbol.
- The report will print to the associated printer.





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