L3 Series Software
for Material Testing

Creating a Test

Starrett®
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Athol, MA 01331
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MODEL: MLC-50K S/N: 459447A
CAPACITY: 50 kN OUTPUT: 4.227 mV/V

Reliant
Extensometry.com
SN: R2062
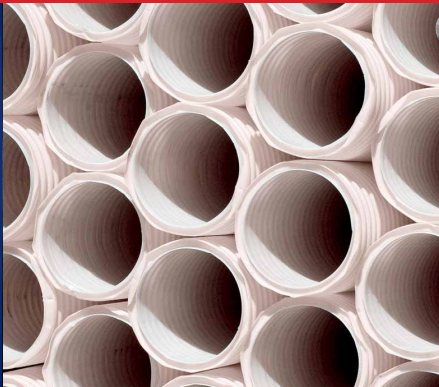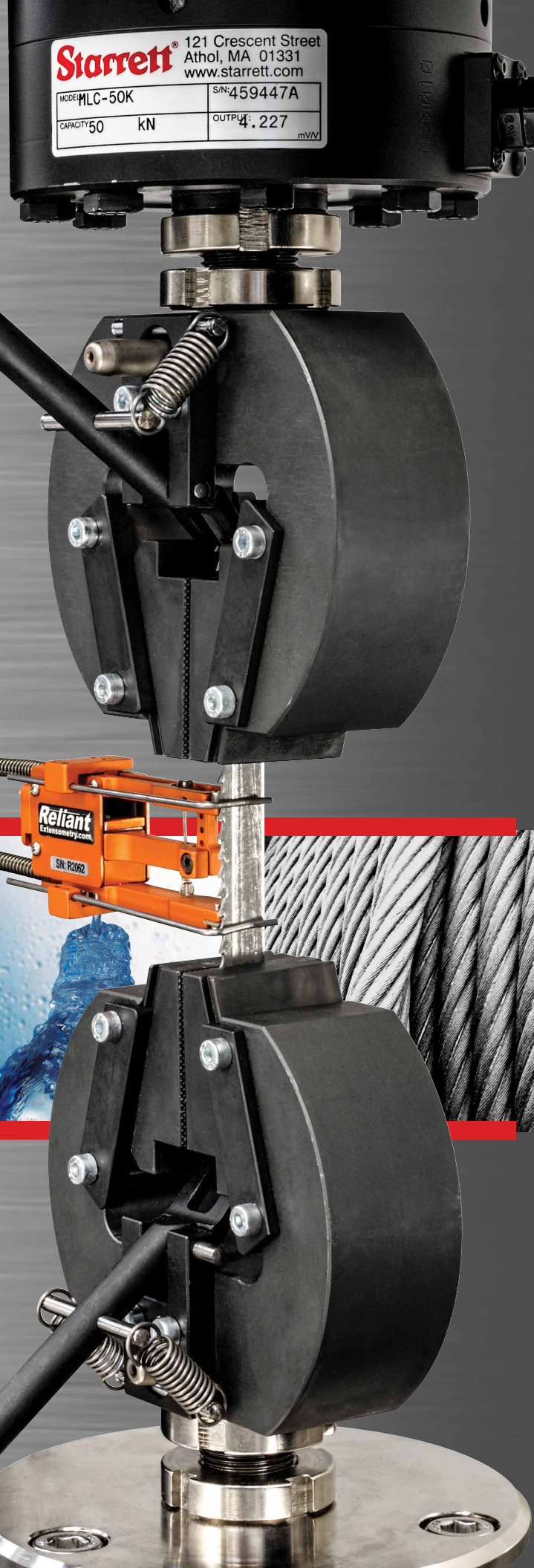
Starrett®

The Better Solution

Table of Contents

3.0 Creating an L3 Test Setup

All L3 test setups have four basic sections:

- Pre Test
- Test
- Data
- Post Test

Each of these sections have a variety of options that you can use to create a simple single step test or a sophisticated multiple step test.

This section will describe each of the options within the four basic sections of an L3 test setup.

3.1 Using the L3 Test Builder Application

The L3 Test Builder application is the primary method used to create an L3 test setup. The L3 Test Builder is a graphical test authoring application where you create your test by defining four sections of a test: Pre Test, Test, Data and Post Test.

When you create a New Test, you select the New Test symbol from the Home view. This launches a new test setup. The setup shows Pre Test, Data and Post Test. The Test step is not shown because you will need to create that section using the Test step tools.
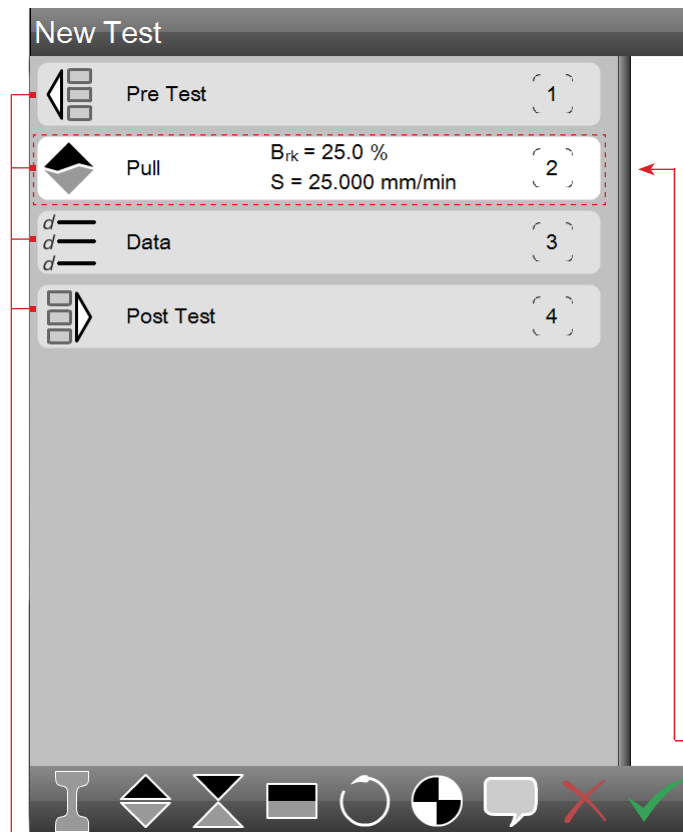
L3 Test Builder
Example test setup shows four common sections to all L3 test setups

Shown are four sections to the test setup called My Break Test:

- *Pre Test section*
- *Test section*
- *Data section*
- *Post Test section*

When you create a New Test, the Test section is not displayed because it needs to be created using the graphical test steps.

Test setups used to create the Test section.
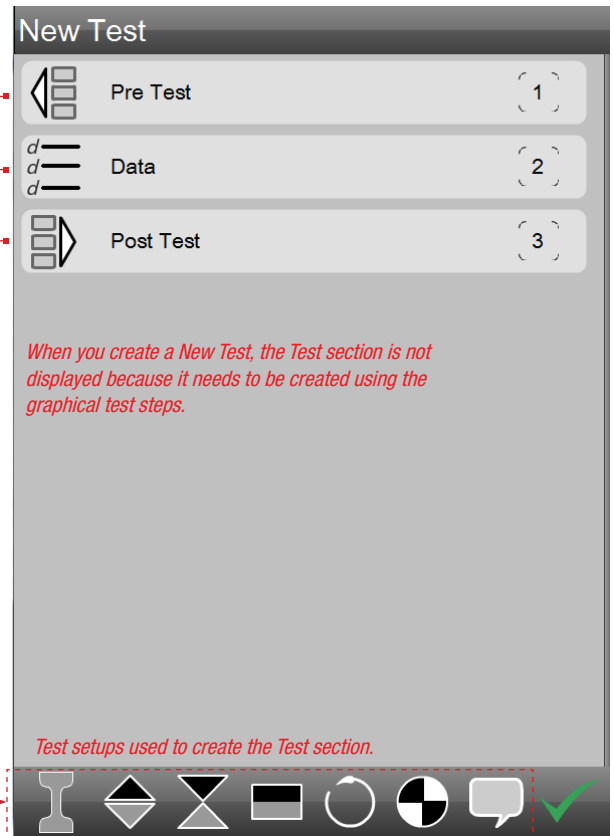
L3 Test Builder
When New Test is selected, the Test section is not created yet

3.2   Pre Test Step

The Pre Test step is where you define key aspects of your test setup that take place before the test sequence actually begins. The Pre Test step has two basic option sets: Standard and Format.
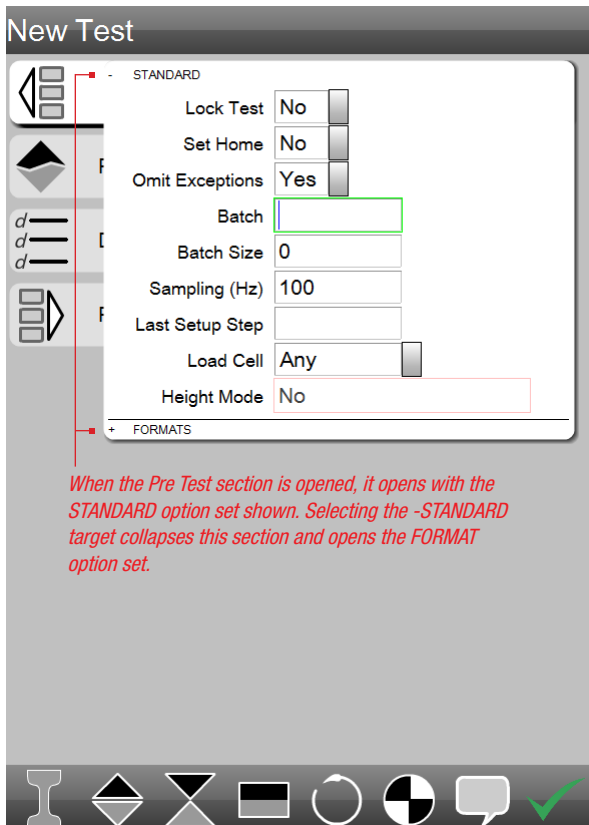
When the Pre Test section is opened, it opens with the STANDARD option set shown. Selecting the -STANDARD target collapses this section and opens the FORMAT option set.

L3 Test Builder - PRE TEST section
Features two options sets: Standard and Format

3.2.1   Standard Options

The Standard Pre Test options are the commonly used options that you configure for your test setup. The Standard options represent basic "rules" of how the test setup will perform and what happens when key actions occur. The Standard Pre Test options are discussed in detail in the following sections.

3.2.1.1   Lock Test

The Lock Test option is used to lock the test setup so that only authorized users have the ability to make changes to this test setup. The Security Setting in the L3 Main menu allows you to specify the authorizations/privileges for each user of your system. If the user has the privilege to Lock a test, then that user may specify Lock Test when creating a test setup.

The default for Lock Test is NO. This means that the test setup is not locked and maybe edited, copied, deleted or renamed.

If the Lock Test option is YES, the creator of the test setup has locked the test setup- no one other than those with secure authorization are allowed to edit, copy, delete or rename this test. When a test setup is locked, a lock symbol appears next to the test setup name in the Home menu.

NOTE
When a test setup is locked, it cannot be edited, copied, deleted or renamed unless the user has the proper security authorization.
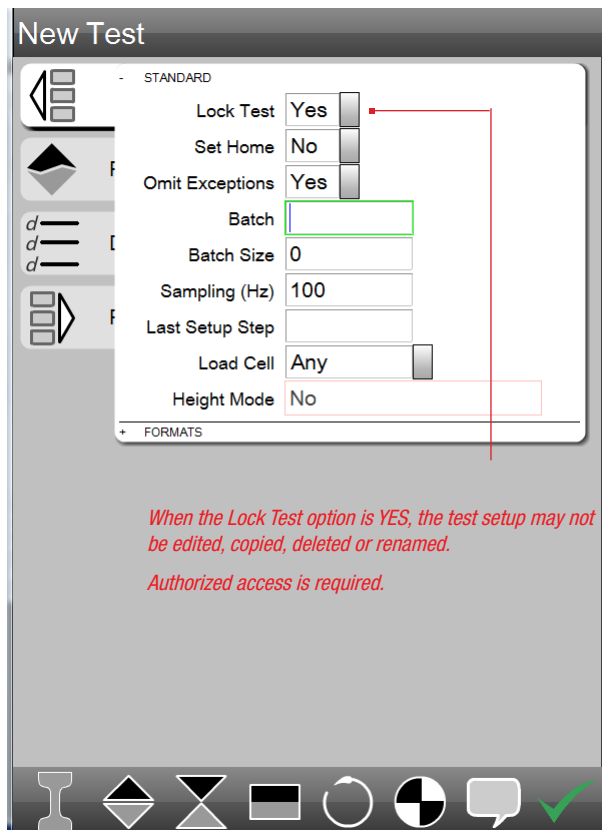
When the Lock Test option is YES, the test setup may not be edited, copied, deleted or renamed.

Authorized access is required.

L3 Test Builder - PRE TEST section
Lock Test = Yes restricts editing to this test setup to authorized users

Break Test A-123

| L | ⬦ 0.20 | N |
| D | 0.000 | mm |

A lock symbol appears next to any test setup that has the Lock Option = Yes in the Pre Test options.

A locked test may be performed, however, the user is restricted from editing, copying, deleting or renaming the test setup.

Tests

Break Test A-123 🔒

That test is locked; you cannot edit, copy, or delete it unless you have the proper access rights.

(press anywhere to continue)

Data Views.

If the user attempts to edit, copy, rename or delete the selected test, a warning message appears.

L3 Home view
Shows all test setups in the Test directory. Tests identified with Lock symbol cannot be edited

3.2.1.2 Set Home

Home is the crosshead position where you want your test to start at. When Set Home = YES, the position where the crosshead is at when the Start Test push button is pressed is the Home position. Load and Distance are measured from this position.

If you prefer to Set Home manually using the Set Home target, the Set Home option should be NO. This requires the user to manually press the Set Home target before selecting Start Test.

CAUTION
Use caution when using automatic Home positioning when the Set Home option is YES.

L3 Controller view
Manually Set Home by pressing Set Home target

When Set Home = No, the user must automatically set Home by pressing the Set Home target BEFORE selecting Start Test.

When Set Home = Yes, the crosshead position when the Start Test push button is pressed, is the Home position. Load and Distance are measured from this position.

L3 Test Builder - PRE TEST section
Set Home = Yes automatically sets Home when the Start Test function is invoked

3.2.1.3 Omit Exceptions

Exceptions are used in the individual test steps. Exceptions are protection mechanisms. An exception is an event, that when it occurs, causes the test run to automatically abort. For example, if you were performing a break test, you might want to include an exception based on distance. When the distance = x, stop the test because the break should have occurred before this distance was achieved.

When an exception occurs, the test is aborted. No results are calculated and the run is identified in Red as an invalid test. When Omit Exceptions = YES, we omit all data for the invalid test- no data is saved.

In some situations, it may be desirable to save the data for a test that was ended due to an exception. In these situations, the Omit Exceptions function is used and the option is changed to NO. When Omit Exceptions = NO, we do not omit the data. Rather, we save the data until the test was aborted.

NOTE
Data is saved when the Export Raw option is Yes. If this option is No, no data is exported.
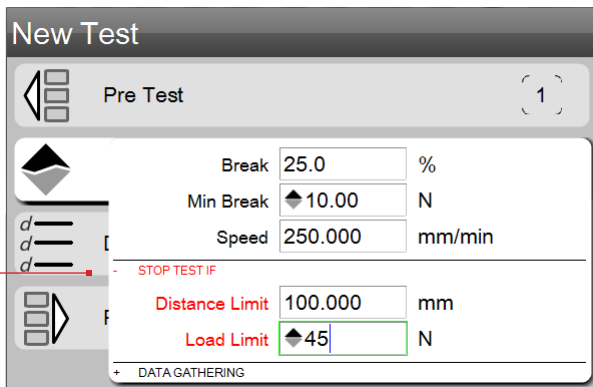
L3 Test Builder - Exception
An Exception is used to denote when to terminate a test

Selecting the STOP IF function presents you with options for terminating a test. In the example, the break step will terminate if the Distance Limit of 100mm or the Load Limit of 45N are achieved before the sample breaks.
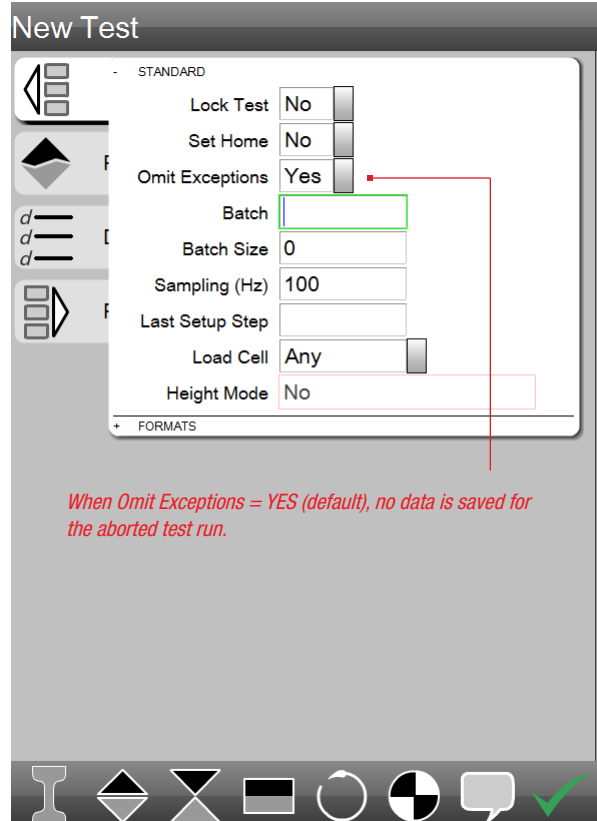
When Omit Exceptions = YES (default), no data is saved for the aborted test run.

L3 Test Builder - Pre Test Omit Exception
When YES, no data is collected for this run
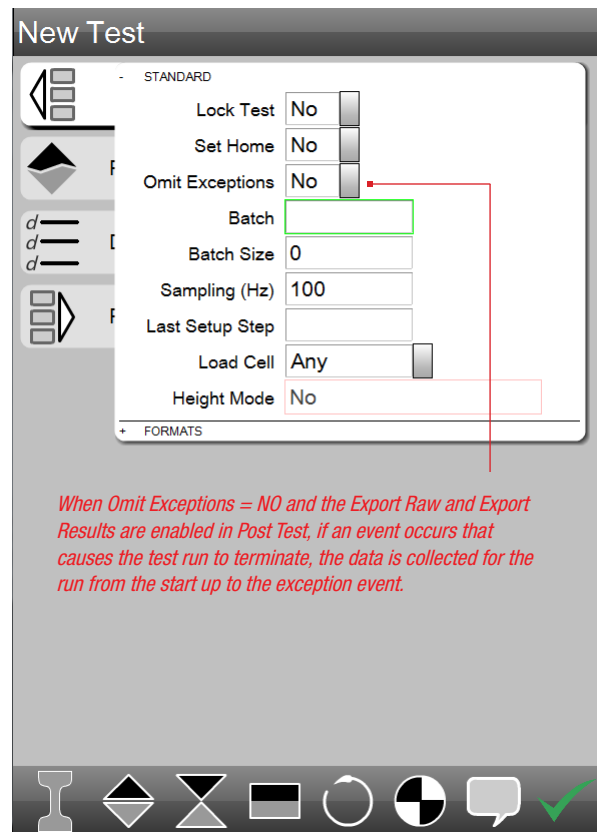
When Omit Exceptions = NO and the Export Raw and Export Results are enabled in Post Test, if an event occurs that causes the test run to terminate, the data is collected for the run from the start up to the exception event.

L3 Test Builder - Pre Test Omit Exception
When NO, data and results may be available up to when the event occurred

3.2.1.4 Batch Name

The Pre Test step lets you create a batch for your test runs. A batch may be used to categorize the test runs within a test setup. For example, you may have a common test setup, but you want to test a batch of samples coming from different lots. You can distinguish one lot from the other by using a Batch Name for each lot.

3.2.1.5 Batch Size

When you use a batch, you can specify the number of test runs you are going to perform within the batch. So, if you have a lot, you may need to test each of 10 samples for that lot. Your Batch Size will be identified as 10.

During your testing, once you complete test run 10, the L3 software will ask if you want to continue with the current batch, which means you can add additional runs to the Batch, or you can decide to complete that lot and begin a new batch. If you decide to create a new batch, the name of the existing batch will be used with a suffix number 1. You may change the name of your Batch name if you wish.
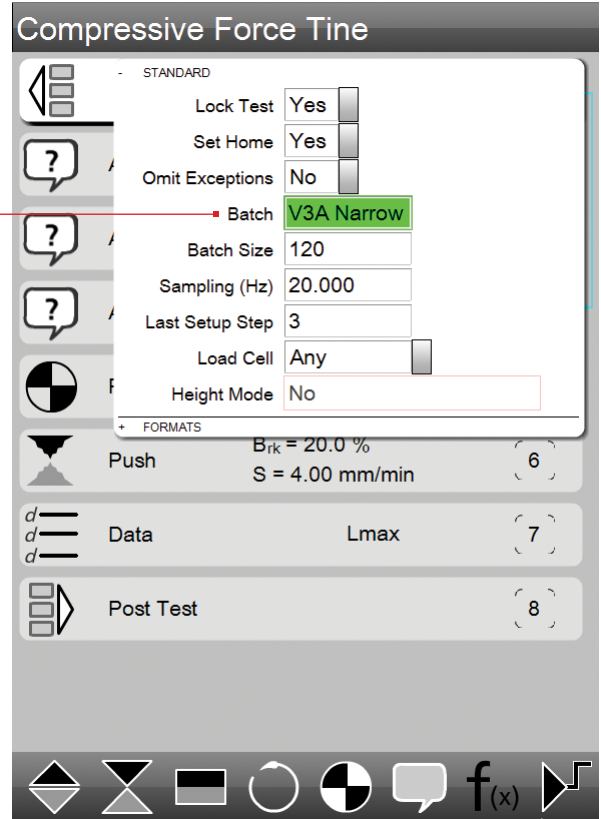
L3 Builder - Pre Test Batch setup
Enter your Batch Name and Batch Size

The Batch Name is identified above each test run in the Runs List.

L3 Graph view
Shows how the Batch Name is used in the Runs List

3.2.1.6 Sampling Rate (Hz)

The Sampling Rate (Hz) option is the number of data points acquire during the test run per second. The factory default is 100 samples per second, which is approximately three to five times more data than systems that sample via RS232.

The Sampling Rate (Hz) option may be any value between 0.001 and 2000. Enter the value you require in the text block.

NOTE
The maximum duration for a test run is 48 hours. This applies to Hold and Cyclic steps. Adjusting the sampling rate to 0.5Hz will allow for a 48 hour test.

NOTE
The greater the sampling rate number the more susceptible the test run is to noise. So a higher number won't necessarily provide you with better results. High sampling rates are useful in detecting maximum points, but this can be susceptible to noise.

NOTE
If you are attempting to correlate new data from your L2 Plus system with data from an older machine that used RS232 or that had a lower sampling rate, you should set the Sampling Rate (Hz) to a lower number, e.g. 20. You can then compare and correlate. Modify the rate until you're historical data and new data correlate.

NOTE
The maximum number of data points that may be acquired for a test run is 100,000. Adjust your Sampling Rate to the desired duration while maintaining the limit on the number of data points acquired for your test.

3.2.1.7 Last Setup Step

The Last Setup Step option is useful when you are performing the same test setup on multiple samples or parts (a "batch" of parts). The ASK step may be used (at the beginning of the test setup) to ask questions that only need to be answered once, such as "Operator Name" or "Fixture ID". These ASK steps will be skipped on the second and subsequent runs of the test if the Last Setup Step is set to the first step after them.
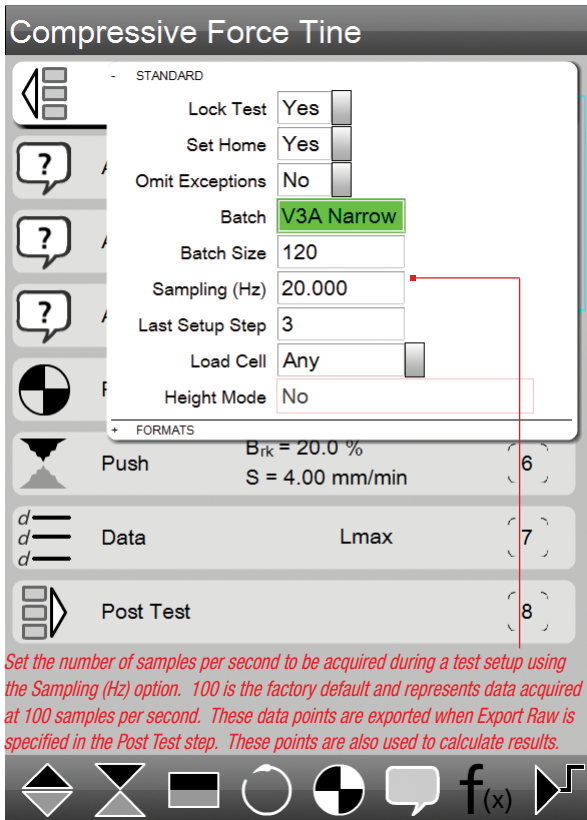
Set the number of samples per second to be acquired during a test setup using the Sampling (Hz) option. 100 is the factory default and represents data acquired at 100 samples per second. These data points are exported when Export Raw is specified in the Post Test step. These points are also used to calculate results.

L3 Test Builder - Pre Test Data Sampling (Hz)
This test has a Sampling Rate of 20 samples per second
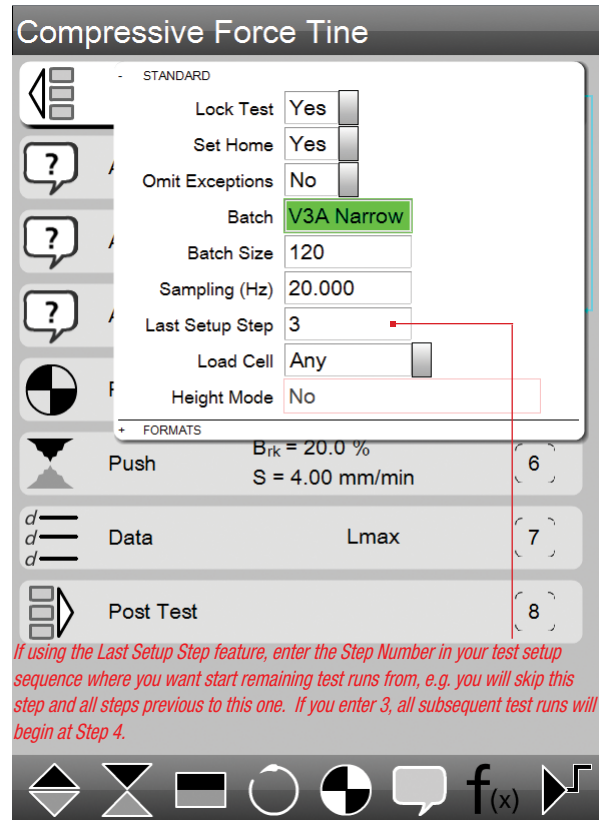
If using the Last Setup Step feature, enter the Step Number in your test setup sequence where you want start remaining test runs from, e.g. you will skip this step and all steps previous to this one. If you enter 3, all subsequent test runs will begin at Step 4.

L3 Test Builder - Pre Test Last Batch Step
Enter the Step number that you want all subsequent test runs to start from

Compressive Force Tine

L ♦ 0.00 N
D 0.00 mm *At limit*

Set Home | Start Test | Return Home

L$_{max}$ ⚡184.67 N

The Batch ID V3 Narrow Sample is active and displaying Run #2 results.

Batch	Run	Describe	Lot	Tine	Date	Comment
V4 PM 340 T77	1 .. 120	0.000000000000	0.0000000000	0.000000	12/3/14	...
V4 PM 340 T77 1	1 .. 120	0.000000000000	0.0000000000	0.000000	12/3/14	...
V3 Narrow Sample	1	Control Tine Force Test	Unknown. Sam	RF	11/5/14	
V3 Narrow Sample	2	Control Tine Force Test	Unknown. Sam	RB	11/5/14	
V3 Narrow Sample	3	Control Tine Force Test	Unknown. Sam	LF	11/5/14	
V3 Narrow Sample	4	Control Tine Force Test	Unknown. Sam	LB	11/5/14	
V3 Narrow Sample	6	Control Tine Force Test	Unknown. Sam	RF	11/5/14	
V3 Narrow Sample	7	Control Tine Force Test	Unknown. Sam	RB	11/5/14	
V3 Narrow Sample	8	Control Tine Force Test	Unknown. Sam	LF	11/5/14	
V3 Narrow Sample	9	Control Tine Force Test	Unknown. Sam	LB	11/5/14	
V3 Narrow Sample	10	Control Tine Force Test	Unknown. Sam	RF	11/5/14	
V3 Narrow Sample	11	Control Tine Force Test	Unknown. Sam	RF	11/5/14	
V3 Narrow Sample	13	Control Tine Force Test	Unknown. Sam	RF	11/5/14	
V3 Narrow Sample	14	Control Tine Force Test	Unknown. Sam	RB	11/5/14	
V3 Narrow Sample	15	Control Tine Force Test	Unknown. Sam	LF	11/5/14	
V3 Narrow Sample	16	Control Tine Force Test	Unknown. Sam	LB	11/5/14	
V3 Narrow Sample	17	Control Tine Force Test	Unknown. Sam	LF	11/5/14	
V3 Narrow Sample	18	Control Tine Force Test	Unknown. Sam	LB	11/5/14	

Test 2 of 120 for V3 Narrow Sample.

L3 Data View
Displays each Run of the Batch on a separate row

My Break Test

L ⚡1.44 N
D 0.000 mm

Set Home | Start Test | Return Home

L x D | L x T | D x T

When using a Batch, the Batch ID appears above the test Run Number.

BL-A4455 1
BL-A4455 2
BL-A4455 3
BL-A4455 4

The Batch is complete. Do you want to start a new Batch?

Resume Batch | **New Batch**

If you want to continue to test by adding another sample, select the Resume Batch target.

If you want to finish this Batch and begin a new Batch, select the New Batch target.

Test 4 of 4 for BL-A4455 is complete.
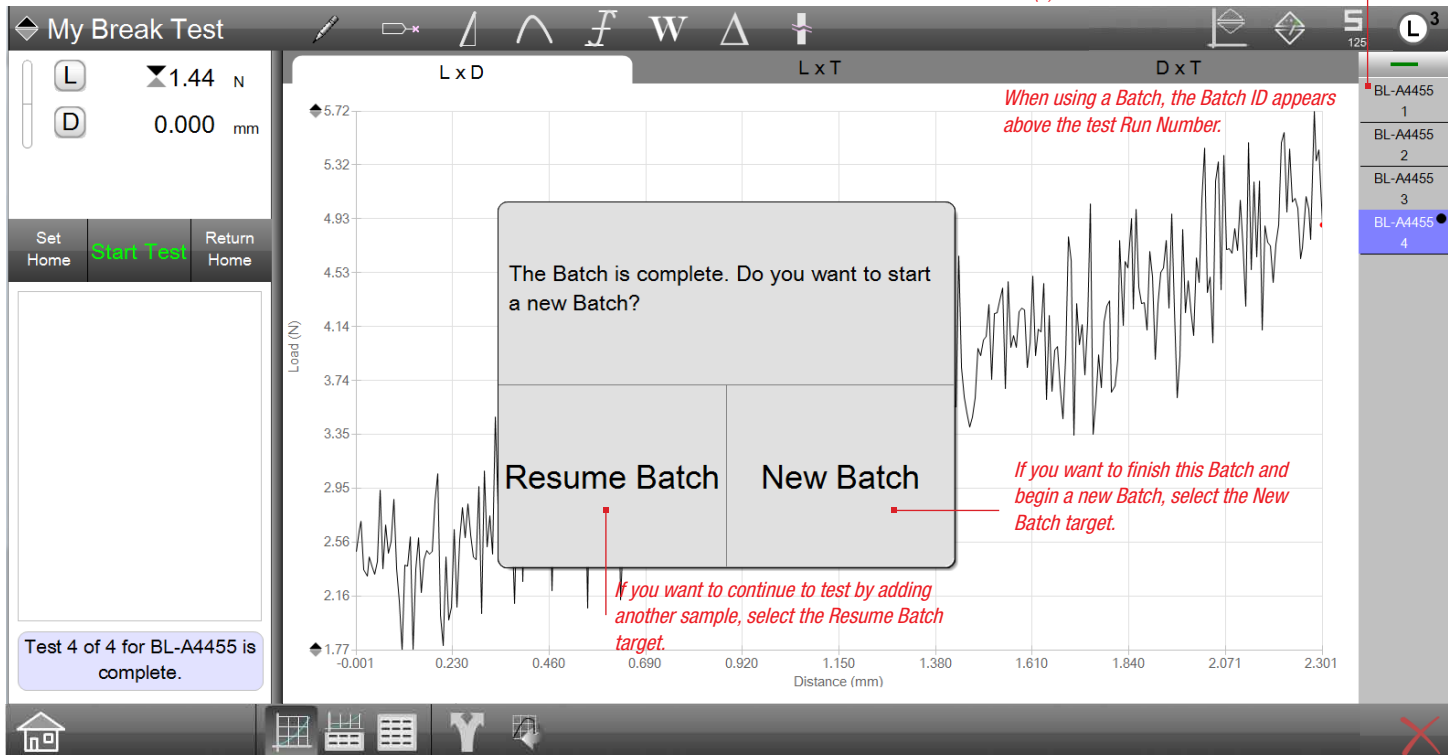
L3 Plus Full Graph View
Displays the graph of a selected Run. When a Batch is completed, a messaged asked whether to Resume or create a New Batch

3.2.1.8 Load Cell

The Load Cell option allows you to select which load cell sensor model and capacity is to be used for your test setup. All load cell sensors are TEDs compatible. This means that they comply with IEEE 1451 and that the sensor will self-identify their model number, capacity and other key characteristics when they are connected to your Starrett testing frame. By specifying the load cell model, you can ensure that your test is always performed using the same sensor model and capacity. If you specify a Load Cell, the test will only be allowed to perform if that load cell is connected to your system.

This is an optional field that may be left blank. The default is ANY, which means any load cell sensor may be used for this test setup.

3.2.1.9 Height Mode

The L3 system has two operating modes: Normal and Height mode. You must specify the mode prior to creating your test setup. Height mode is used when your testing involves going to a height limit measured from the bottom of the sample. When using Height mode, the system automatically finds the datum using a height datum routine. Height mode is useful when testing springs or other samples where height is an important measurement point.

When the system is in Height mode, the Height Mode indicator will read YES. When in Normal Mode, the indicator will display NO.
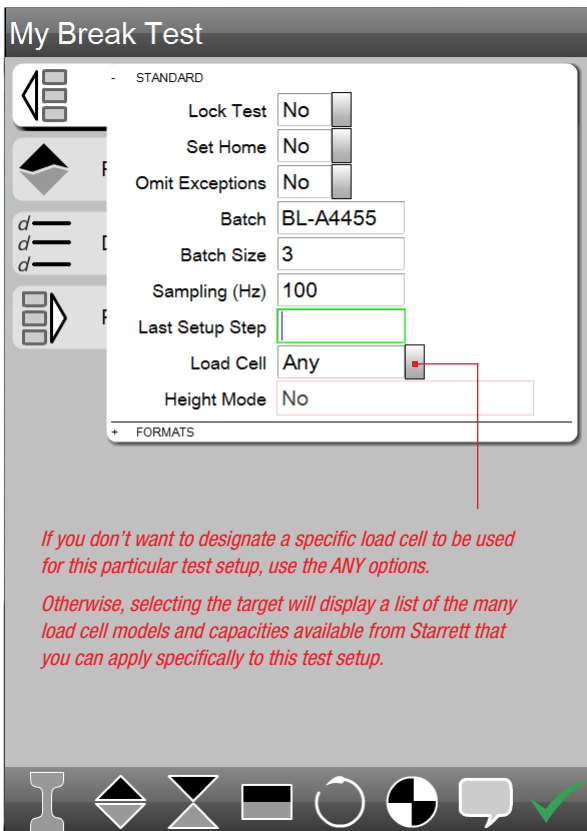
If you don't want to designate a specific load cell to be used for this particular test setup, use the ANY options.

Otherwise, selecting the target will display a list of the many load cell models and capacities available from Starrett that you can apply specifically to this test setup.

L3 Test Builder - Pre Test Load Cell
You may select a specific load cell that is required to perform this test setup

Height Mode is an indication only. It tells you what mode the system is currently in.

When Height Mode = NO, the system is in Normal Mode.

When Height Mode = YES, the system is in Height mode.

L3 Test Builder - Pre Test Load Cell
You may select a specific load cell that is required to perform this test setup
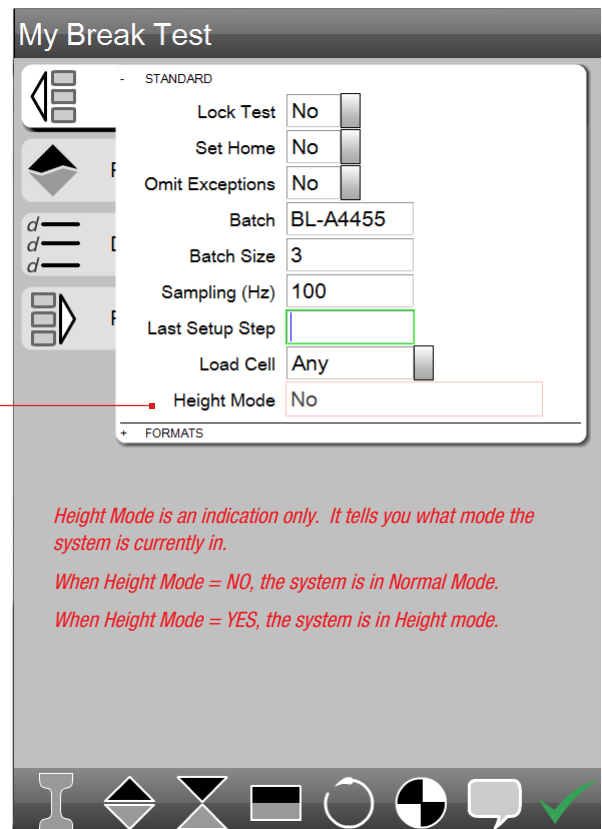
L3 Test Mode- HEIGHT Mode

When Height Mode = NO, the system is in Normal Mode.

L3 Test Mode- NORMAL Mode

3.2.2 Formats Options

The Formats options within Pre Test is where you specify the units of measure that will be used. Each unit of measure type is also defined by how many decimals to display.

There are two categories of available units: SI/Metric and US/Imperial. Use the Desktop Settings function to choose which unit of measure type you want to use with your system.

The available units of measures are shown.

Unit of Measure	SI/Metric Set	US/Imperial Set
Load	N kgf	lbf
Distance	mm cm	in
Stress	Mpa Gpa N/cm² Kgf/mm² Kgf/cm²	PSI
Strain	Null %	Null %
Work	mJ/mm³ kJ/mm³ J/mm3 mJ/cm³ kJ/cm³ J/cm³	inch-lb/in³
Rate Time	Seconds Minutes	Seconds Minutes

L3 Units of Measure
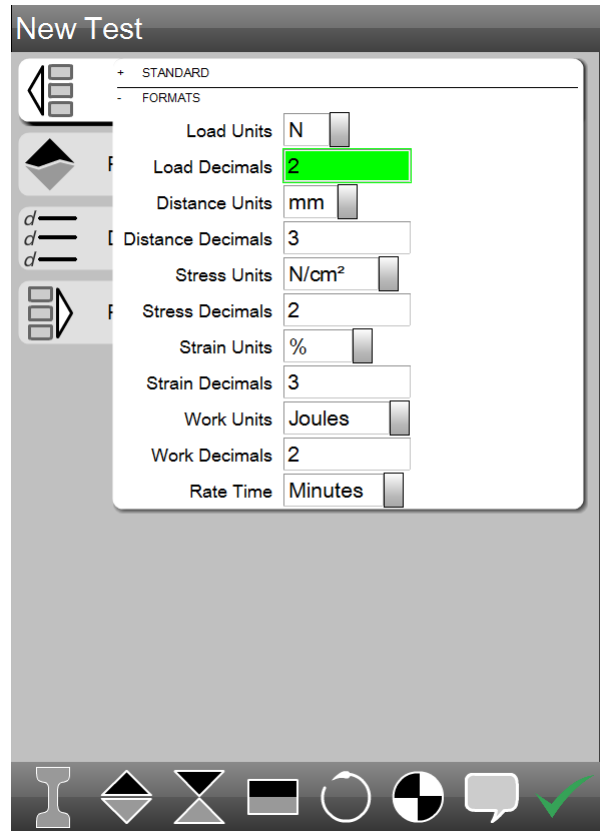
L3 Test Builder - Pre Test Formats Options
Specify Units and Display resolutions

L3 Test Builder - DISPLAY FORMATS
Use to specify global unit of measure sets, units and other display formats

3.3 Test Step

The Test step is where you create the sequence of movements that control the crosshead speed, direction and which are used to perform the test in the manner you require.

All steps within your test setup have a reference number. The reference number is the sequence in which the step takes place. The step reference is also used with scoping and helps identify how functions or formulas are to be performed within a test and between identified steps.

All test setups are a combination of steps. Steps are performed in sequential order. The Pre Test step is always step 1 whether or not any Pre Test options are used.

When you create a new test setup, the Pre Test is always step 1. The Data step is step 2 and the Post Test is step 3. However, a test cannot be performed until you add a movement step, therefore, a move step is inserted based on the type of test you want to perform. The move step is always added after step 1 (Pre Test) or step 2 (Sample) if a sample is used. Once a step is added, in this case a move step, the subsequent steps are incremented, e.g. step 2 (Data) becomes step 3. Steps continue to be incremented downward as more steps are added to your setup.

NOTE
All steps within a setup have a unique reference number. Pre Test is always step 1.

Step references are also displayed during the test in the status message. During your test, the status message will display the test step being performed. Once your test is completed, the message will read "Test is complete."

The individual step types are displayed at the bottom of the setup view. The test step types are:

- Sample Definition Step
- Tensile Steps
- Compression Steps
- Hold Steps
- Cyclic Steps
- Ask Steps
- Datum Steps

All test steps are described in the following paragraphs.
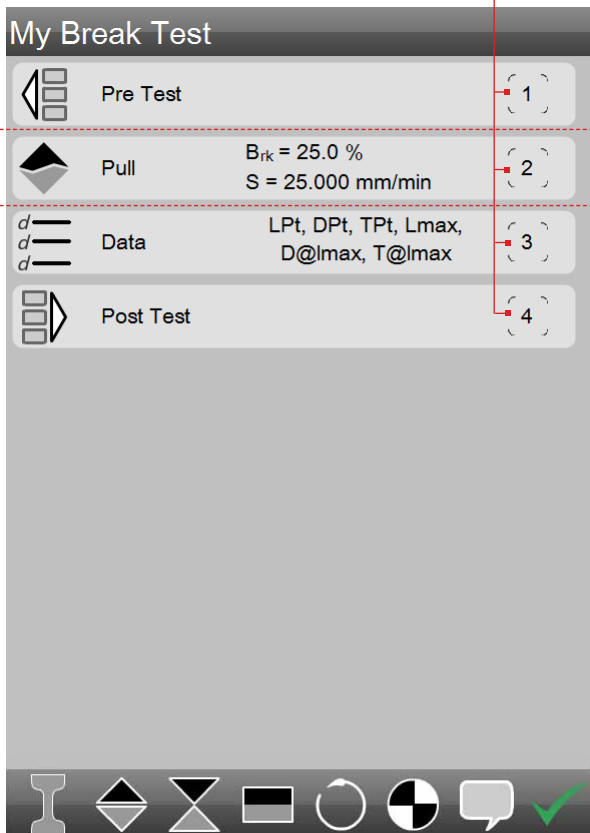
L3 Test Builder - Test Stage
Shows a single step test setup
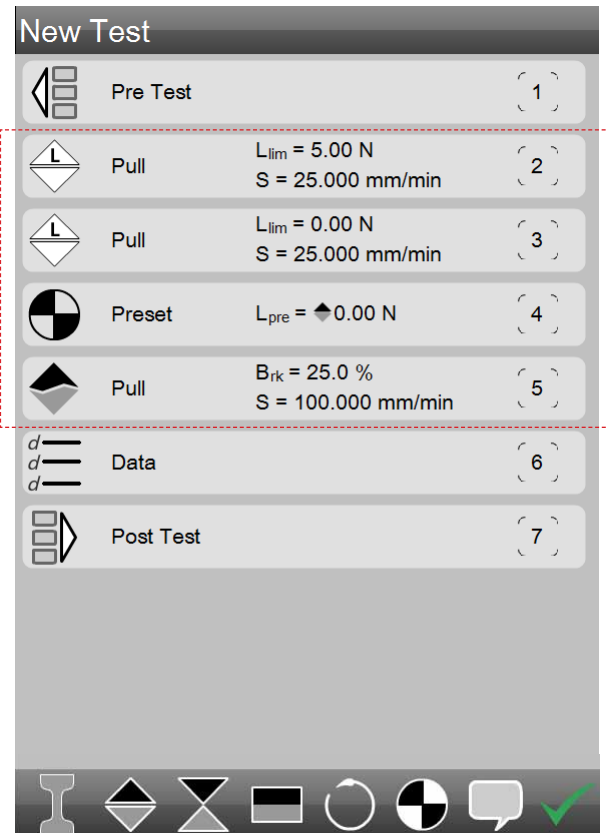
L3 Test Builder - Test Stage
You may have multiple steps with a test setup

3.3.1   Sample Definition Step

When you want measurement using Stress or Strain, the Sample Definition step MUST be used.

NOTE
You must use the Sample Definition step in order to measure stress or strain.

The Sample Definition step is used to specify the sample under test, specifically its shape and area. Stress and strain require the sample area.

When the Sample Definition step is used, the graphing options are:

- Stress x Strain (σ x ϵ)
- Stress x Time (σ x T)
- Strain x Time (ϵ x T)

NOTE
If the Sample Definition step is not used, the graphing options are restricted to:

- Load x Distance (L x D)
- Load x Time (L x T)
- Distance x Time (D x T)
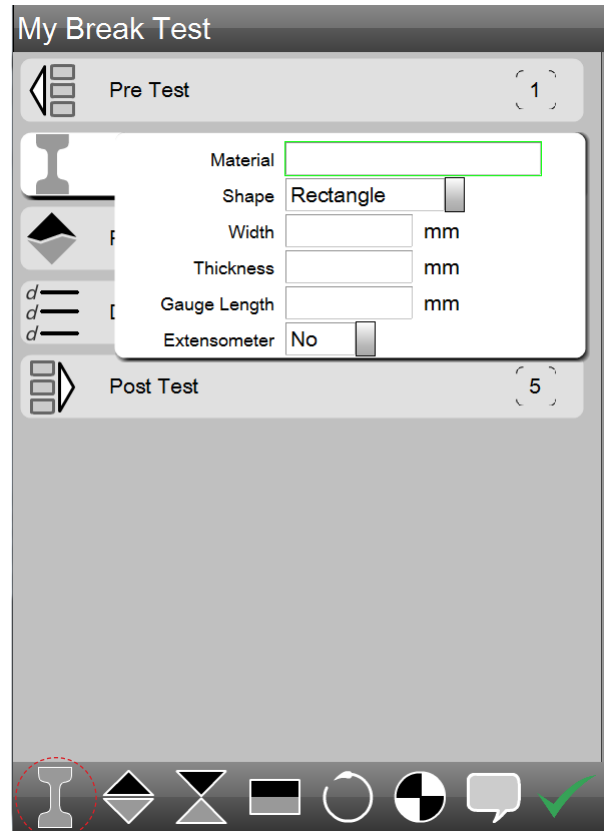
L3 Test Builder - Test Stage
Use the Sample Definition Step for Stress-Strain testing

Stress x Strain Graph · Stress x Time Graph · Strain x Time Graph

L3 Graph Formats for Stress-Strain Analysis
Use the Sample Definition Step for Stress-Strain testing

Load x Distance Graph · Load x Time Graph · Distance x Time Graph
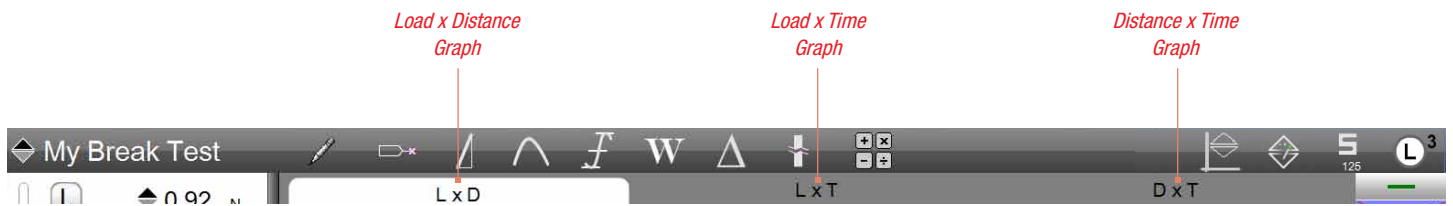
L3 Graph Formats for Load-Distance Analysis
Do NOT use the Sample Definition Step for Load-Distance testing

3.3.1.1 Material Identification

You may enter an identification for your sample using the Material text entry box. The material ID may be up to 12 characters in length.

NOTE
The material ID may be displayed in data table results.
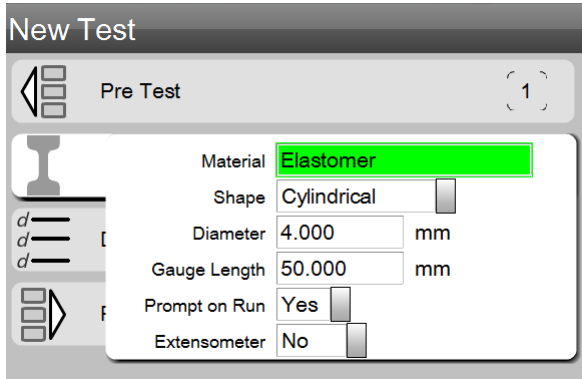
L3 Test Builder - Sample Definition Step
Material Identification

3.3.1.2 Sample Shape

You may specify your sample's shape using the drop down list. Shape options are:

- Rectangular
- Cylindrical
- Round Tubular
- Irregular

The Rectangular shape can be used for dog bones or other common sample formats that have a Width, Thickness and Gauge Length.

The Cylindrical shape can be used for wire, filament, dumb bells or other common sample formats that have a Diameter and Gauge Length.

The Round Tubular shape can be used for hollow tubing shaped material. This shape can be defined by the Outer Diameters, Wall Thickness and Gauge Length.

The Irregular shape can be specified where you know the area of the sample being testing.

L3 Test Builder - Sample Definition Step
Rectangular Shape - Dog Bones
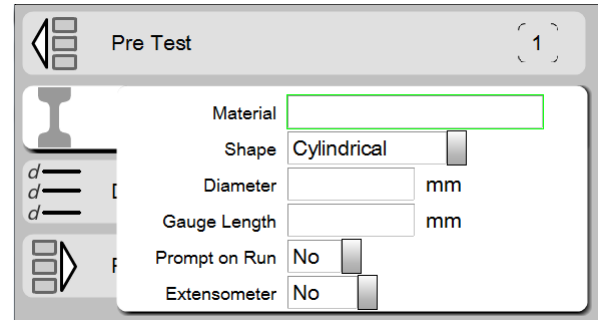
L3 Test Builder - Sample Definition Step
Cylindrical Shape - Dumb Bells
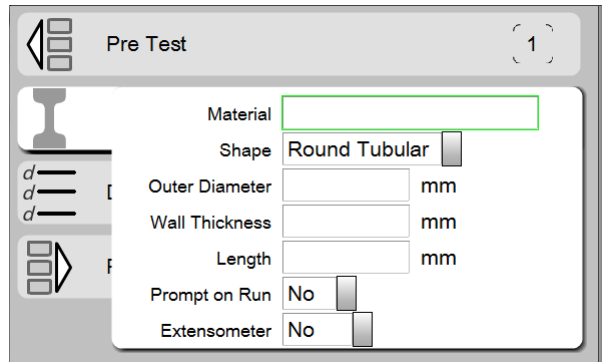
L3 Test Builder - Sample Definition Step
Round Tubular Shape - Tubular materials
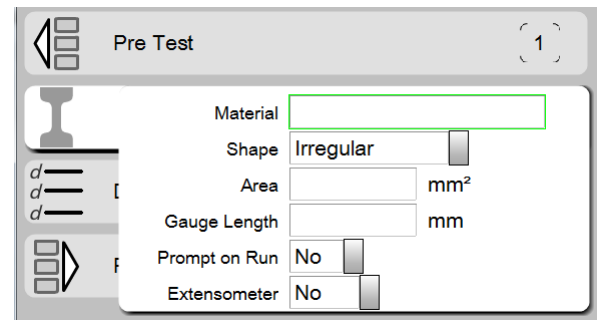
L3 Test Builder - Sample Definition Step
Irregular Shape - When you know the area

3.3.1.3 Prompt On Run

The Prompt On Run option allows you to revise your sample dimensions prior to each test run. If you measure each individual sample's dimension prior to a test, use the Prompt On Run = Yes.

When the Prompt On Run = Yes, a dialog box will display showing the associated dimension attributes for the type of Shape your are testing. You can then measure each individual sample and edit its dimensions.

If all of your samples have the exact dimensions, the Prompt On Run can be set to No. When the Prompt On Run = No, no dialog is displayed so no adjustment can be made for an individual sample.

NOTE
Connect your micrometer via USB to your L3 System and your measurement can automatically populate the active sample dimension field.

When Prompt On Run=Yes, you can edit your sample's dimensions prior to each test run.
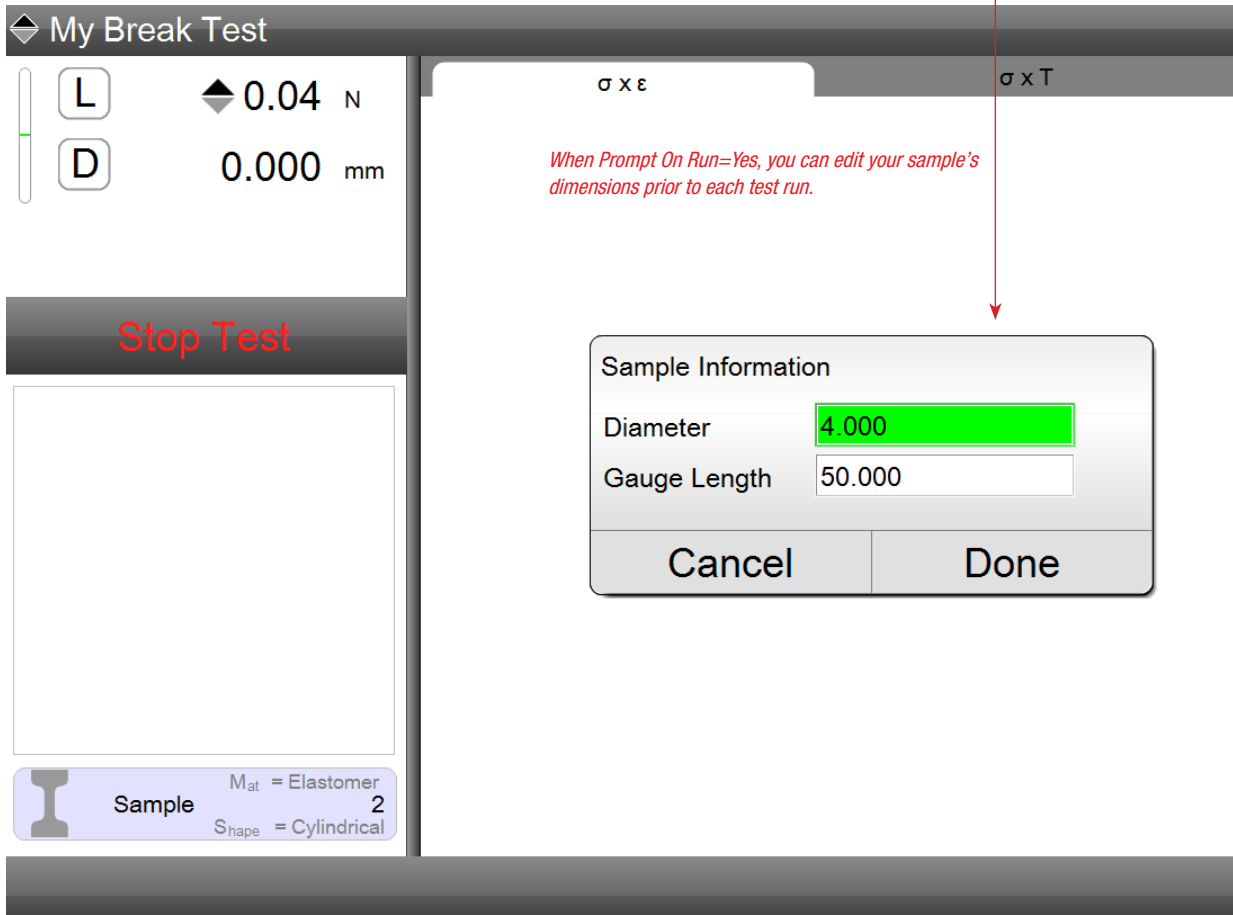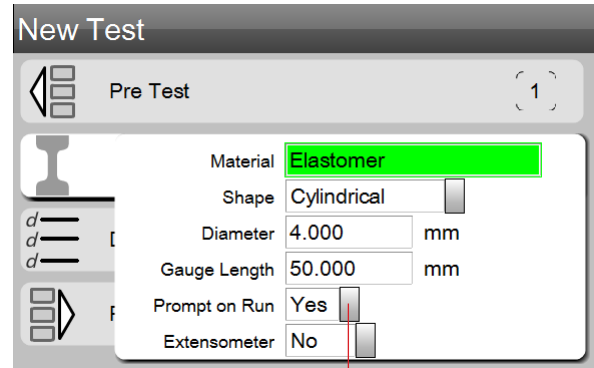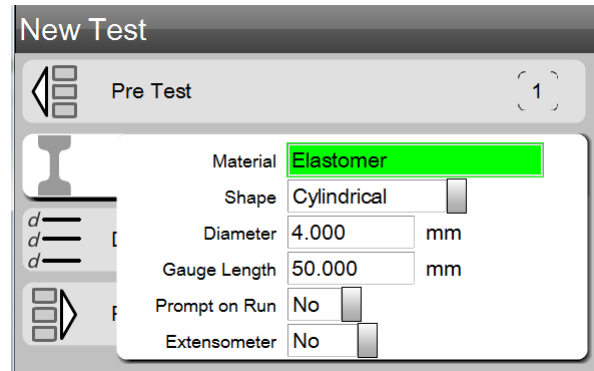
L3 Test Run- Sample Definition Prompt On Run = Yes
Revise your sample's dimensions prior to the test run

3.3.1.4 Using an Extensometer

Your L3 System may use up to two (2) extensometers. Extensometers connect to the back of the MMS or MMD test frame.

Starrett supports Epsilon Technologies and Reliant Technologies extensometers. When these extensometers are connected, your L3 System will automatically sense the type and model extensometer connected including key characteristics such as Gauge Length, Measuring Range, Linearity, etc.

When an extensometer is selected, a symbol appears on the L3 Header display. Select this symbol to view the extensometer's characteristics. Listed beneath the symbol is the extensometer's measuring range.

When an extensometer is used, a symbol "E" is displayed along with the standard "L" (Load) and "D" (Distance) in the Controller view. The values displayed during a test for "E" represent the sample's elongation measurement.

When an extensometer is used, the Start/Stop function will also include a PAUSE function. During an active test run, you may select the Stop target to "pause" the test for the purposes of removing the extensometer prior to the sample breaking in order to protect the extensometer from damage. Once the Extensometer is removed, you may press the Stop Test PLAY function to resume the crosshead movement.

L3 Test Builder - Sample Definition Step
An Epsilon Extensometer used on an L3 System

Select ANY, and any extensometer, that is connected to your L3 System, will be accepted and allow your test setup to perform.
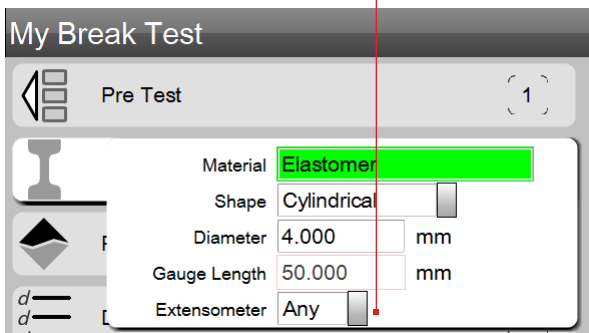
Select EXACT, and the extensometer that is connected to your L3 System during the test setup is selected. The test run will not perform unless this "exact" extensometer is connected.
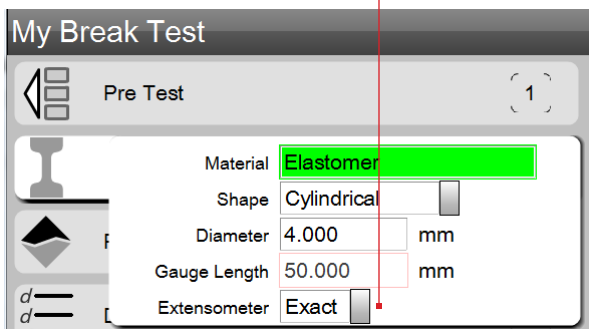
L3 Test with an Extensometer
Select Exact to specify an exact model extensometer
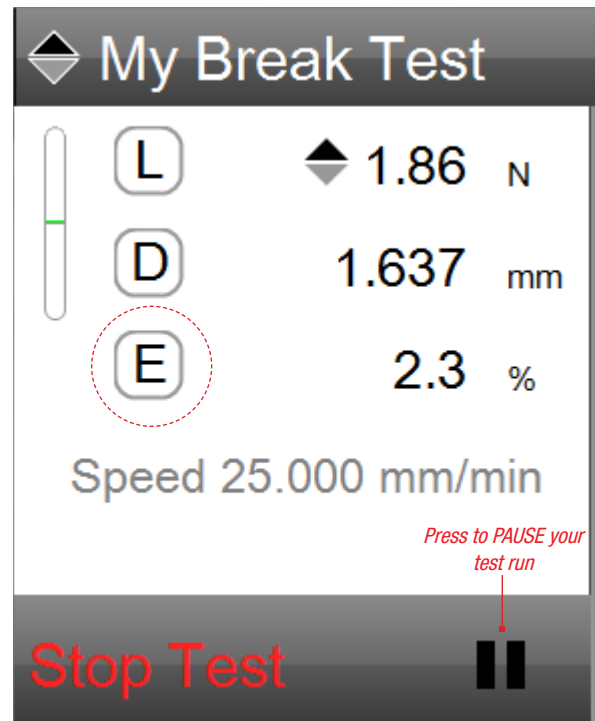
Press to PAUSE your test run

Press to PLAY or resume your paused test run

L3 Test with an Extensometer connected
Press Stop Test to Pause and Resume (Play) a test run

3.3.2 Tensile Steps

Break and input tension steps always move the crosshead upwards. Tension movements are "pull" movements. L3 Series supports four types of tension steps: Load, Distance, Break and Load Rate. You may have multiple tension steps within a test setup.

3.3.2.1 Tensile to Load Step

The Tension Load Limit move causes the crosshead to typically move upward until it meets a load setpoint. You define the load target (setpoint), which is measured by the load cell sensor during your test. When this load is measured, the step concludes on to the next step or if no additional steps is in your sequence, the test ends.

• Select the Tension symbol

• Select the Tension Load symbol

• Enter your Load Target and Test Speed

NOTE
Each test step may have an individual Test Speed.

NOTE
If you have two load targets with the first target at 100N and the second target at 50N, the crosshead will move to 100N (upward) and then move to 50N (downward).

These are the Exceptions for this step. An exception is an event. An exception stops the test. Exceptions are optional, but are recommended.

Distance Limit - If the crosshead moves this distance and the Load Limit has not be achieved, the test will stop.

Break % - If the sample breaks the test will stop. A break is defined as when the load drops by this percentage value after a Minimum Load has been achieved and there is a maximum load measured.

Min Break - This is the minimum load that must first be achieved before the system begins to look for a Break % drop in load.

Enter the target Load Limit. This step will conclude when this load is achieved.

Enter the Speed. This is the velocity the crosshead will move at to the Limit.

Pull to the Home position

Pull to a Load Limit

Pull to a Distance Limit

Pull to a Break Limit

Pull at a Load Rate to a Load Limit

L3 Test Builder - Tensile Step types

When Collect Data = Yes, the individual data points for this test step are acquired and saved for exporting.

When Collect Data = No, no data points are collected or saved. The step is just a "goto" without any data collected.

L3 Test Builder - Tensile Load Limit
Moves the crosshead until a Load is achieved

3.3.2.2 Tensile to Distance Step

The Tension Distance Limit move causes the crosshead to move upward until it meets a distance setpoint. You define the distance target (setpoint), which is measured by the encoder during your test. Once this distance is achieved, the test or the step is completed.

- Select the Tension symbol
- Select the Tension Distance symbol
- Enter your Distance Target and Test Speed

NOTE
Each test step may have an individual Test Speed.

These are the Exceptions for this step. An exception is an event. An exception stops the test. Exceptions are optional, but are recommended.

Load Limit - If the crosshead moves and the measured load equals this limit, the crosshead will stop.

Break % - If the sample breaks the test will stop. A break is defined as when the load drops by this percentage value after a Minimum Load has been achieved and there is a maximum load measured.

Min Break - This is the minimum load that must first be achieved before the system begins to look for a Break % drop in load.

Enter the target Distance Limit. This step will conclude when this load is achieved.

Enter the Speed. This is the velocity the crosshead will move at to the Limit.

L3 Test Builder - Tensile Step types

When Collect Data = Yes, the individual data points for this test step are acquired and saved for exporting.

When Collect Data = No, no data points are collected or saved. The step is just a "goto" without any data collected.

L3 Test Builder - Tensile Distance Limit
Moves the crosshead until a Distance is achieved from Home

3.3.2.3 Tensile to Break Step

During a break test, the sample is pulled until the measured load drops by a % from the maximum load after a minimum load setpoint is achieved. This indicates a break event.

When you configure a break test, you specify the Break %. This is the percentage drop in load from a measured maximum load. For example, if the measured peak load is 100 lbf, and the Break % = 20%, the break load = 80 lbf.

The Minimum Break is the measured load that must first be achieved before the system starts looking for the break event. The minimum break protects against false break events in samples that exhibit significant load changes when under stress, e.g. peel tests.

- Select the Tension symbol
- Select the Tension Break symbol
- Enter your Break % (percentage drop from the peak load)
- Enter the Minimum Break value
- Enter the Test Speed

NOTE

All break tests use the % Drop algorithm to define a sample break for the purposes of completing a test setup. A Rate algorithm is available to determine a break measurement using the Graphic Analysis tools.

These are the Exceptions for this step. An exception is an event. An exception stops the test. Exceptions are optional, but are recommended.
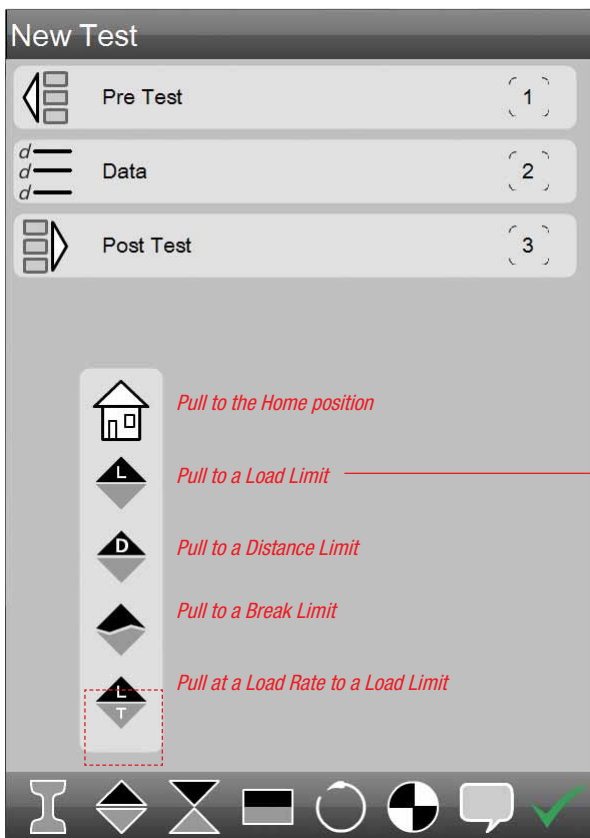
Distance Limit - If the crosshead moves this distance and the Load Limit has not be achieved, the test will stop.

Load Limit - If the crosshead moves and the measured load equals this limit, the crosshead will stop.

Enter the load (Min Break) which is the starting load- where the search for a drop in load shall begin.

Enter % drop in load value. Measured from the maximum load achieved.

Enter the Speed. This is the velocity the crosshead will move at to the Limit.

L3 Test Builder - Tensile Step types

When Collect Data = Yes, the individual data points for this test step are acquired and saved for exporting.

When Collect Data = No, no data points are collected or saved. The step is just a "goto" without any data collected.

L3 Test Builder - Tensile Break Limit
Moves the crosshead until a Break is achieved

3.3.2.4 Tensile Load Rate

Load Rate control is an advanced test method where a limit is defined as "getting to a load setpoint in a specified rate of time".

For example, you may configure a tensile step where you want the crosshead to go to a setpoint of 15 lbf in 5 seconds.

First, specify the tensile load rate step.

Next, enter the target load of 15 lbf.

Lastly, since our rate is based on minutes, we convert 5 seconds to minutes or 1/12 minutes. So, to get to 15 lbf in 5 seconds we multiply 15 x 12 = 180 to establish a rate of 180 lbf/minute.

These are the Exceptions for this step. An exception is an event. An exception stops the test. Exceptions are optional, but are recommended.
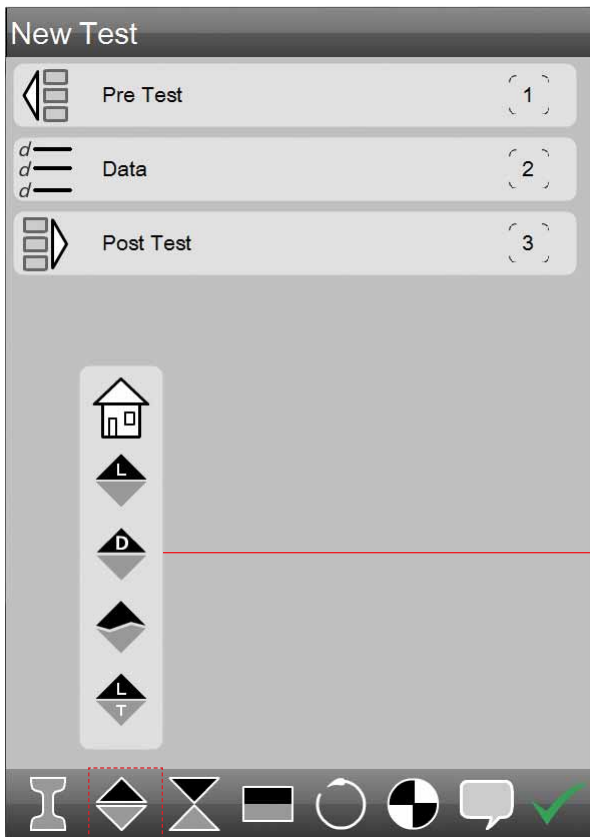
Distance Limit - If the crosshead moves, and the measured distance equals this limit, the crosshead will stop.

Break % - If the sample breaks the test will stop. A break is defined as when the load drops by this percentage value after a Minimum Load has been achieved and there is a maximum load measured.
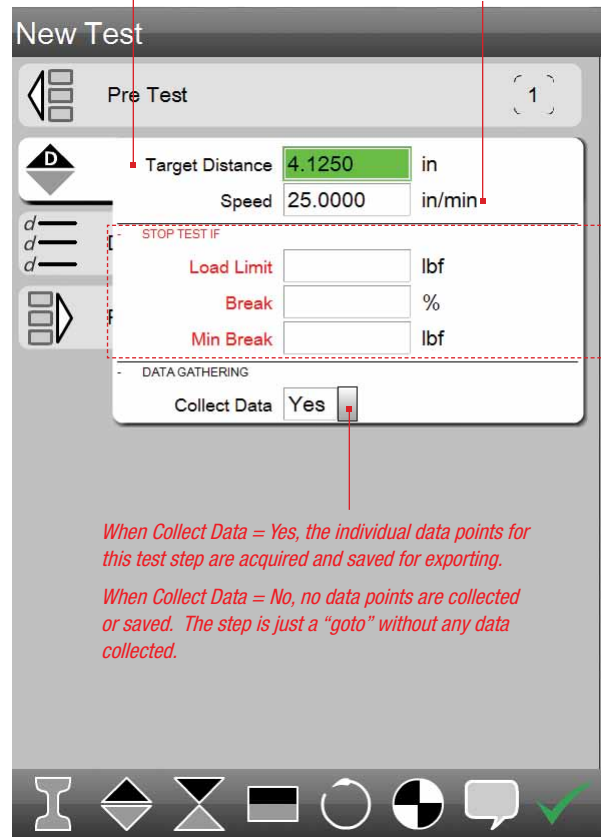
Min Break - This is the minimum load that must first be achieved before the system begins to look for a Break % drop in load.

Enter the target Load Limit. This step will conclude when this load is achieved.

Enter the Rate. This is the velocity the crosshead will move at to the Limit.

When Collect Data = Yes, the individual data points for this test step are acquired and saved for exporting.

When Collect Data = No, no data points are collected or saved. The step is just a "goto" without any data collected.

L3 Test Builder - Tensile Step Types

L3 Test Builder - Tensile Step Types
Moves to a Load target at a specified Rate based on Load/minute

3.3.2.5 Tensile to Home Step

The Tensile to Home position requires that you establish a Home position prior to starting your test. This can be done simply by pressing the Set Home target or by establishing Home automatically when you start the test by configuring the Pre Test Set Home option to Yes.

This step will move the crosshead to the established Home position.

These are the Exceptions for this step. An exception is an event. An exception stops the test. Exceptions are optional, but are recommended.
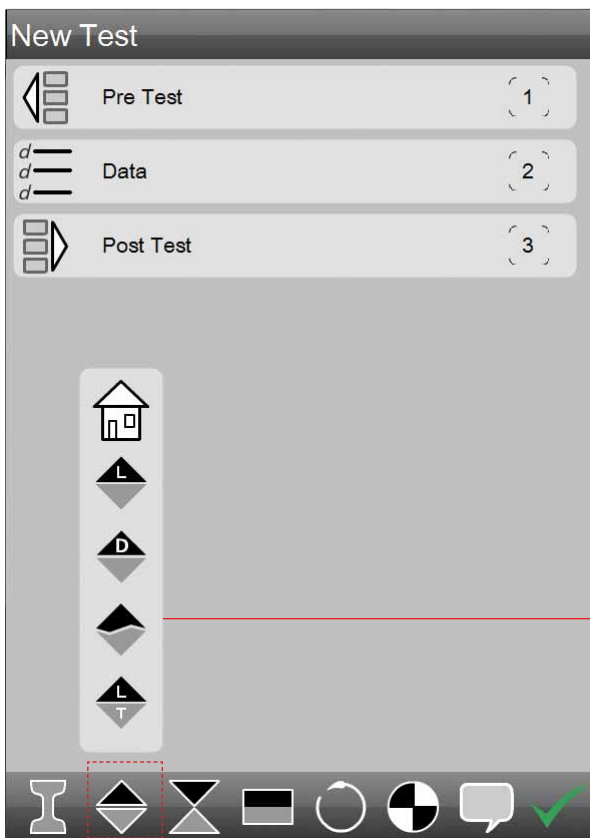
Load Limit - If the crosshead moves and the measured load equals this limit, the crosshead will stop.

Min Break - This is the minimum load that must first be achieved before the system begins to look for a Break % drop in load.

Enter the Speed. This is the velocity the crosshead will move at to the Home position.

L3 Test Builder - Tensile Step types

L3 Test Builder - Go to Home
Moves the crosshead to the established Home position

When Collect Data = Yes, the individual data points for this test step are acquired and saved for exporting.

When Collect Data = No, no data points are collected or saved. The step is just a "goto" without any data collected.

3.3.3   Compression Steps

Compression steps move the crosshead in an downward direction. Compression movements are "push" movements. Your L3 Series supports three types of compression steps: Load, Distance and Break/Rupture and Load Rate. You may have multiple compression steps within a test setup.

3.3.3.1   Compress to Load Step

The Compression Load Limit move causes the crosshead to move downward until it meets a load setpoint. You define the load target (setpoint), which is measured by the load cell sensor during your test. Once this load is achieved, the test or the step is completed.

• Select the Compression symbol

• Select the Compression Load symbol

• Enter your Load Target and Test Speed

These are the Exceptions for this step. An exception is an event. An exception stops the test. Exceptions are optional, but are recommended.
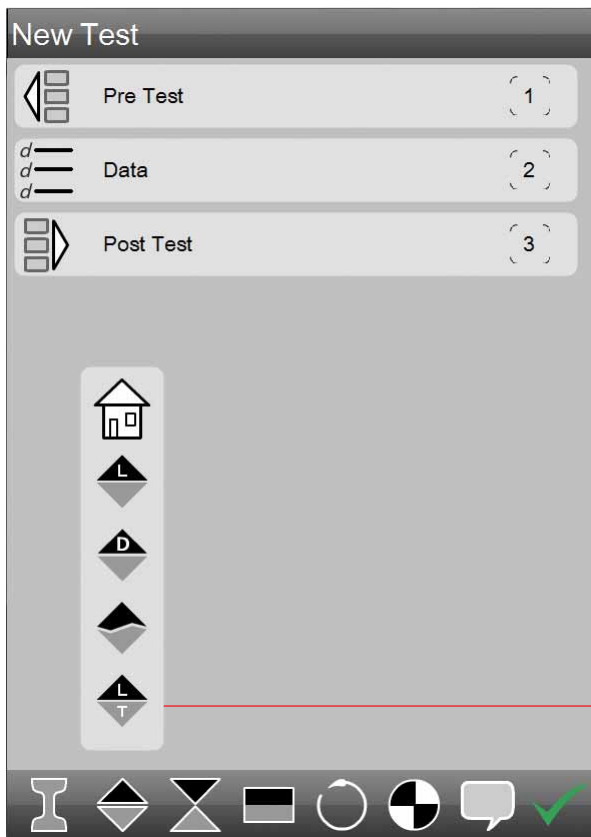
Distance Limit - If the crosshead moves this distance and the Load Limit has not be achieved, the test will stop.

Break % - If the sample breaks the test will stop. A break is defined as when the load drops by this percentage value after a Minimum Load has been achieved and there is a maximum load measured.
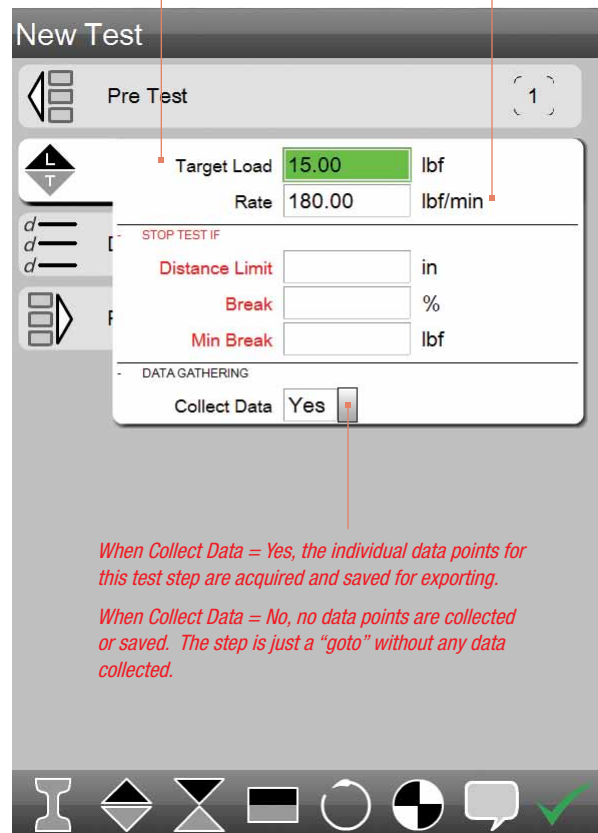
Min Break - This is the minimum load that must first be achieved before the system begins to look for a Break % drop in load.

Enter the target Load Limit. This step will conclude when this load is achieved.

Enter the Speed. This is the velocity the crosshead will move at to the Limit.

Pull to the Home position

Pull to a Load Limit

Pull to a Distance Limit

Pull to a Break Limit

Pull at a Load Rate to a Load Limit

When Collect Data = Yes, the individual data points for this test step are acquired and saved for exporting.

When Collect Data = No, no data points are collected or saved. The step is just a "goto" without any data collected.

L3 Test Builder - Compression Step types

L3 Test Builder - Tensile Load Limit
Moves the crosshead until a Load is achieved

3.3.3.2 Compress to Distance Step

The Compression Distance Limit move causes the crosshead to move downward until it meets a distance setpoint. You define the distance target (setpoint), which is measured by the encoder during your test. Once this distance is achieved, the test or the step is completed.

• Select the Compression symbol

• Select the Compression Distance symbol
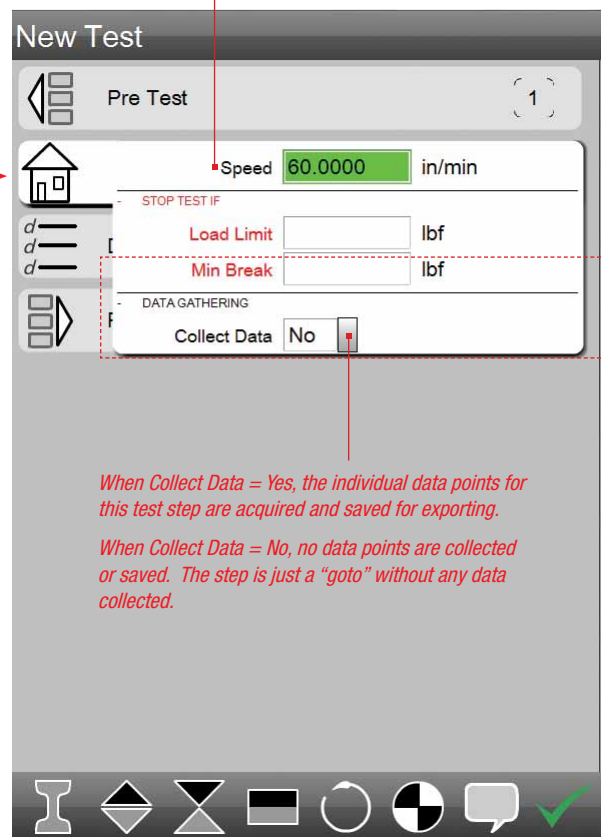
• Enter your Distance Target and Test Speed

These are the Exceptions for this step. An exception is an event. An exception stops the test. Exceptions are optional, but are recommended.

Load Limit - If the crosshead moves to this Load and the Distance Limit has not be achieved, the test will stop.

Break % - If the sample breaks the test will stop. A break is defined as when the load drops by this percentage value after a Minimum Load has been achieved and there is a maximum load measured.

Min Break - This is the minimum load that must first be achieved before the system begins to look for a Break % drop in load.

Enter the target Distance Limit. This step will conclude when this distance is achieved.

Enter the Speed. This is the velocity the crosshead will move at to the Limit.
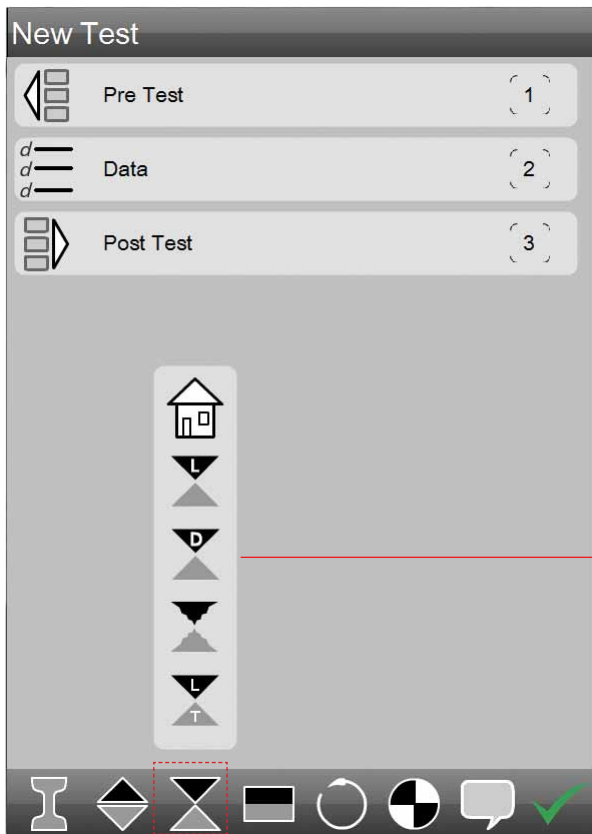
L3 Test Builder - Compression Step types

L3 Test Builder - Compression Distance Limit Moves the crosshead until a Distance is achieved
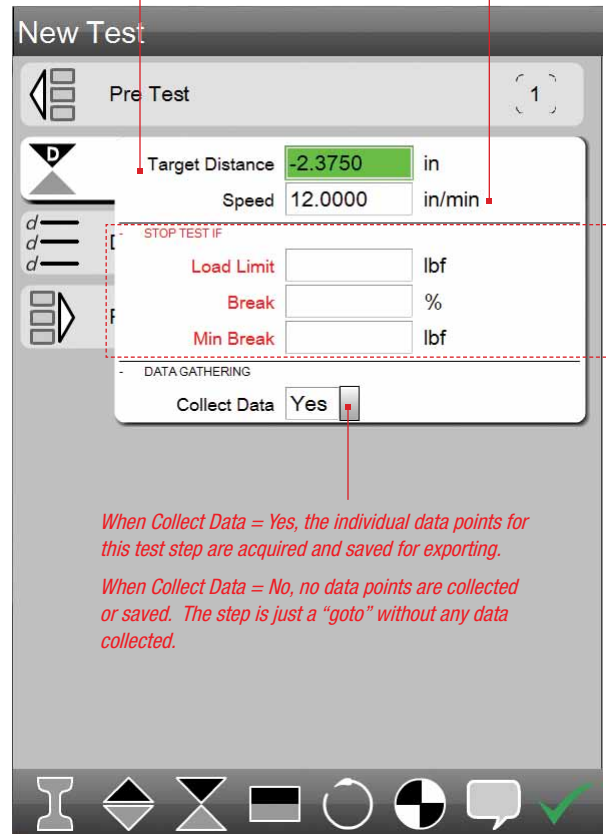
When Collect Data = Yes, the individual data points for this test step are acquired and saved for exporting.

When Collect Data = No, no data points are collected or saved. The step is just a "goto" without any data collected.

3.3.3.3 Compress to Break Step

During a break test, the sample is pulled until the measured load drops by a % from the maximum load after a minimum load setpoint is achieved. This indicates a break event.

When you configure a break test, you specify the Break %. This is the percentage drop in load from a measured maximum load. For example, if the measured peak load is 100 lbf, and the Break % = 20%, the break load = 80 lbf.

The Minimum Break is the measured load that must first be achieved before the system starts looking for the break event. The minimum break protects against false break events in samples that exhibit significant load changes when under stress, e.g. puncture and insertion tests.

- Select the Compression symbol
- Select the Compression Break symbol
- Enter your Break % (percentage drop from the peak load)
- Enter the Minimum Break value
- Enter the Test Speed

These are the Exceptions for this step. An exception is an event. An exception stops the test. Exceptions are optional, but are recommended.

Distance Limit - If the crosshead moves this distance and the Load Limit has not be achieved, the test will stop.

Load Limit - If the crosshead moves and the measured load equals this limit, the crosshead will stop.

Enter the load (Min Break) which is the starting load- where the search for a drop in load shall begin.

Enter % drop in load value. Measured from the maximum load achieved.

Enter the Speed. This is the velocity the crosshead will move at to the Limit.

L3 Test Builder - Compression Step types

When Collect Data = Yes, the individual data points for this test step are acquired and saved for exporting.

When Collect Data = No, no data points are collected or saved. The step is just a "goto" without any data collected.

L3 Test Builder - Compression Break Limit
Moves the crosshead until a Break is achieved

3.3.3.4 Compress at Load Rate

Load Rate control is an advanced test method where a limit is defined as "getting to a load setpoint in a specified rate of time".

For example, you may configure a tensile step where you want the crosshead to go to a setpoint of 15 lbf in 5 seconds.

First, specify the tensile load rate step.

Next, enter the target load of 15 lbf.

Lastly, since our rate is based on minutes, we convert 5 seconds to minutes or 1/12 minutes. So, to get to 15 lbf in 5 seconds we multiply

15 x 12 = 180 to establish a rate of 180 lbf/minute.

These are the Exceptions for this step. An exception is an event. An exception stops the test. Exceptions are optional, but are recommended.

*Distance Limit - If the crosshead moves, and the measured distance equals this limit, the crosshead will stop.*

Break % - If the sample breaks the test will stop. A break is defined as when the load drops by this percentage value after a Minimum Load has been achieved and there is a maximum load measured.

Min Break - This is the minimum load that must first be achieved before the system begins to look for a Break % drop in load.

Enter the target Load Limit. This step will conclude when this load is achieved.

Enter the Rate. This is the velocity the crosshead will move at to the Limit.

L3 Test Builder - Compression Step types

L3 Test Builder - Tensile Step Types
Moves to a Load target at a specified Rate based on Load/minute

When Collect Data = Yes, the individual data points for this test step are acquired and saved for exporting.

When Collect Data = No, no data points are collected or saved. The step is just a "goto" without any data collected.

3.3.3.5 Compress to Home Step

The Compress to Home position requires that you establish a Home position prior to starting your test. This can be done simply by pressing the Set Home target or by establishing Home automatically when you start the test by configuring the Pre Test Set Home option to Yes.

This step will move the crosshead to the established Home position.

These are the Exceptions for this step. An exception is an event. An exception stops the test. Exceptions are optional, but are recommended.

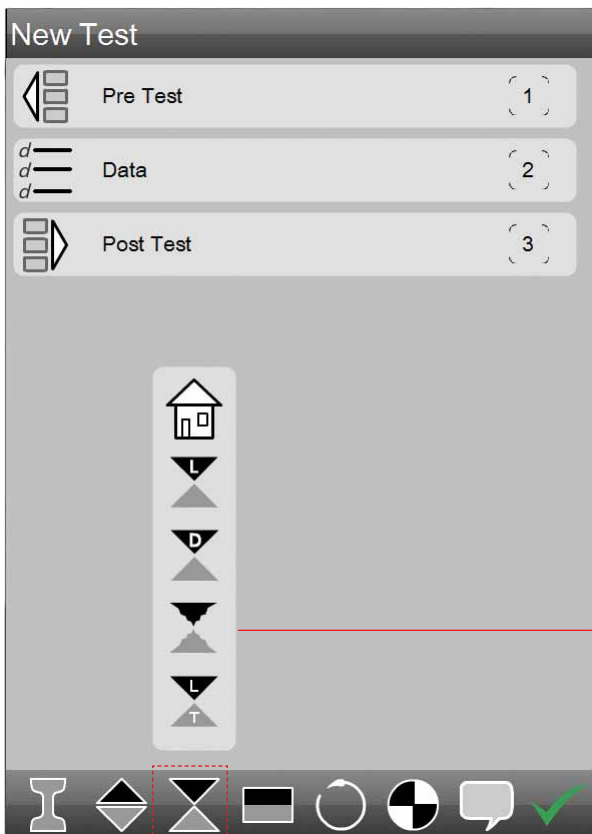*Load Limit - If the crosshead moves and the measured load equals this limit, the crosshead will stop.*

Min Break - This is the minimum load that must first be achieved before the system begins to look for a Break % drop in load.

Enter the Speed. This is the velocity the crosshead will move at to the Home position.

New Test	
Pre Test	1
Data	2
Post Test	3

New Test	
Pre Test	1
Speed	60.0000 in/min

STOP TEST IF
Load Limit _____ lbf
Min Break _____ lbf

DATA GATHERING
Collect Data No

When Collect Data = Yes, the individual data points for this test step are acquired and saved for exporting.

When Collect Data = No, no data points are collected or saved. The step is just a "goto" without any data collected.

L3 Test Builder - Compression Step types

L3 Test Builder - Go to Home
Moves the crosshead to the established Home position

3.3.4   Hold Steps

You can perform constant load or constant distance tests using the Hold step. Creep and relaxation are typical applications that use a hold function.

NOTE
The maximum duration for a test is 48 hours.

NOTE
The maximum number of data points for a test is 100,000. Adjust the Sampling Rate (Hz) accordingly for your test.

3.3.4.1   Hold at Load Step

When you want to hold a load, first create your step with a load variable; either a tension or compression load. Next, select the Load Hold step. Then specify the duration for your hold period. The maximum allowable hold duration is 48 hours (depending on test frame used).

• Select the test mode- either Tension or Compression

• Enter the Load Limit (target)

• Enter the Test Speed

• Select the Hold symbol

• Select the Load Hold symbol

• Enter the Hold Duration value

Step Exceptions- use when you want the test to abort if one of these events occur.

Travel Limit exception- stop if the crosshead goes to this distance during the hold period.

Break exception- stop if a break event occurs. The Break % is the percentage drop in load from a highest load point.

Minimum break is used with a Break exception. This is the load that must be measured before looking for a break event.

The step preceding the Hold step will be the setpoint. Since the load limit is 250N and the hold duration may be set for up to 172,800 seconds, the system will hold the sample at a constant load for 48 hours (172,800 sec).

Distance Hold step- go to a distance value and hold for a specified duration.

Load Hold step- go to a load value and hold for a specified duration.
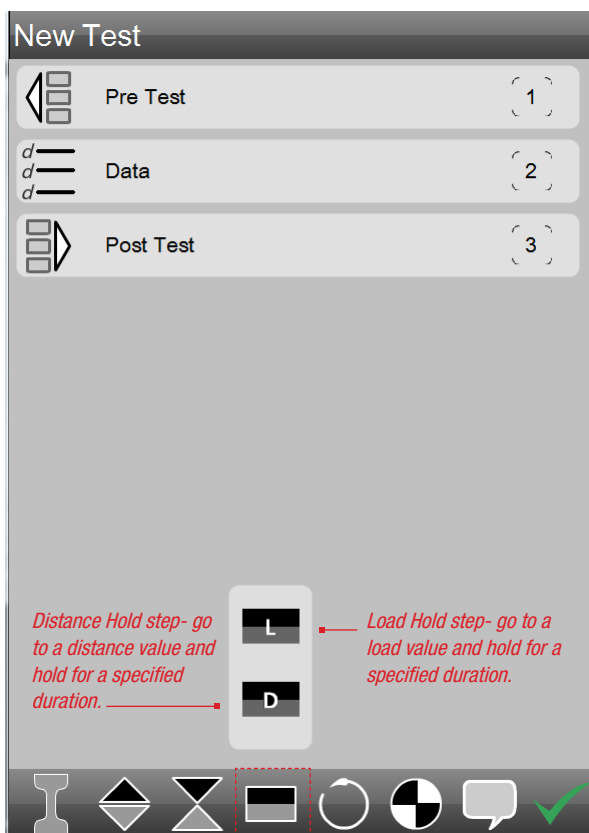
L3 Test Builder - Hold Step types
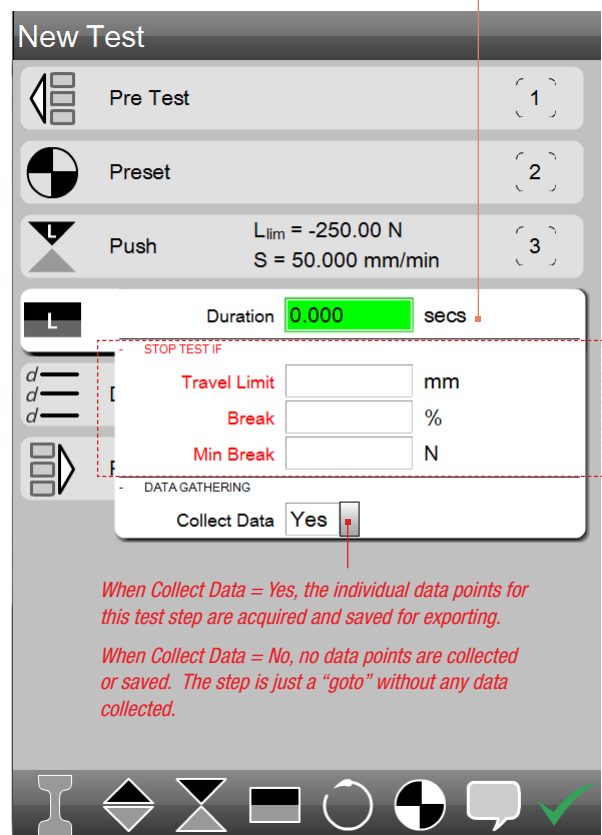
When Collect Data = Yes, the individual data points for this test step are acquired and saved for exporting.

When Collect Data = No, no data points are collected or saved. The step is just a "goto" without any data collected.

L3 Test Builder - Hold at Load
Holds the crosshead at the target load for a specified time duration

3.3.4.2 Hold at Distance Step

YYou may hold the crosshead at a Distance target to determine the effects the hold time has on the sample's load characteristic. The Distance Hold is performed together with an associated tension or compress to distance step. The maximum hold duration of 48 hours at full load capacity can be performed on any Starrett test frame with no cool down period required between hold steps.

• Select the test mode- either Tension or Compression

• Enter the Distance Limit (target)

• Enter the Test Speed

• Select the Hold symbol

• Select the Distance Hold symbol

Enter the Hold Duration value

Step Exceptions- use when you want the test to abort if one of these events occur.

Break exception- stop if a break event occurs. The Break % is the percentage drop in load from a highest load point.

Minimum break is used with a Break exception. This is the load that must be measured before looking for a break event.

The step preceding the Hold step will be the setpoint. Since the load limit is 250N and the hold duration is 15 minutes, the system will hold the sample at a constant load, at this Distance, for 15 minutes.

New Test

◁	Pre Test	1
⬤	Preset	2
⏳	Push L_{lim} = -250.00 N S = 50.000 mm/min	3

| D | Duration | 15:00.000 | secs |

STOP TEST IF
Break _____ %
Min Break _____ N

DATA GATHERING
Collect Data Yes

When Collect Data = Yes, the individual data points for this test step are acquired and saved for exporting.

When Collect Data = No, no data points are collected or saved. The step is just a "goto" without any data collected.

L3 Test Builder - Hold at Load
Holds the crosshead at the target load for a specified time duration

3.3.5   Cycle Steps

L3 Series can be used to perform cyclic testing. Cyclic tests occur between multiple steps where the actions of these steps are repeated either by a number of counts or by using a time period.

NOTE
The maximum duration for a test is 48 hours.

NOTE
The maximum number of data points for a test is 100,000. Adjust the Sampling Rate (Hz) accordingly for your test.

NOTE
There is no need to have a cool down period when cycle testing with Starrett test frames.

NOTE
You do not need to reduce your load capacity testing when performing cycle steps using Starrett test frames due to duty cycle limitations. You may cycle at full load capacity for up to 1000 cycles for 48 hours.

3.3.5.1 Cycle for Count Step

When you cycle within a test, you must specify the step where you want your cycle to begin. You then specify the number of times you want the cycle to be performed. The minimum cycle count = 2. The maximum cycle count = 1000.

NOTE
The maximum number of cycles is 1000.

Typically, you will have at least two steps that you wish to cycle between, but you may have a series of steps that you can cycle. When multiple steps are cycled, you specify the first step and then all steps starting with the first step and the last step prior to the cycle move step will be performed.

- Select the Cycle symbol
- Select the Cycle Count symbol
- Select the first step where the cycle will begin
- Specify the number of counts that the cycle shall be performed

This test setup with cycle three (3) times beginning with step 3 (Push to 250N) and finishing with step 3 (Push to 100N).
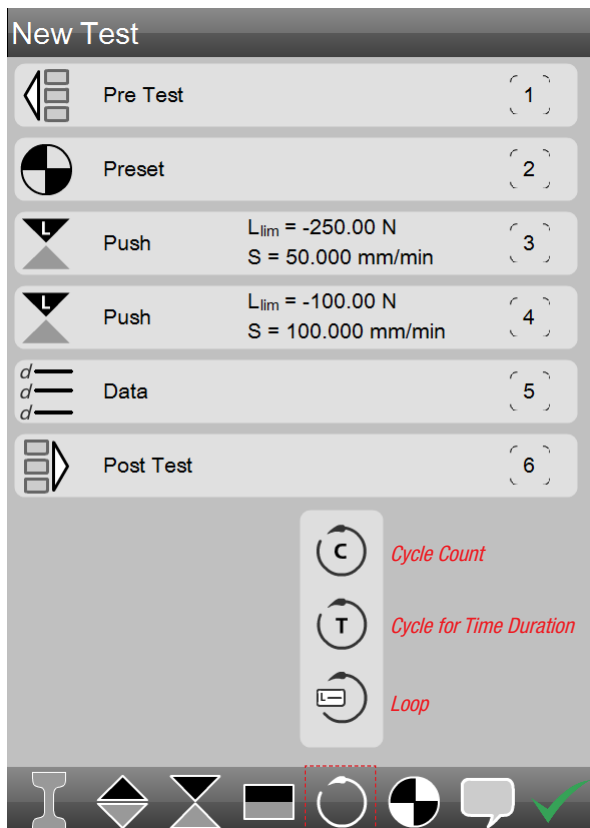
L3 Test Builder - Cycle Steps
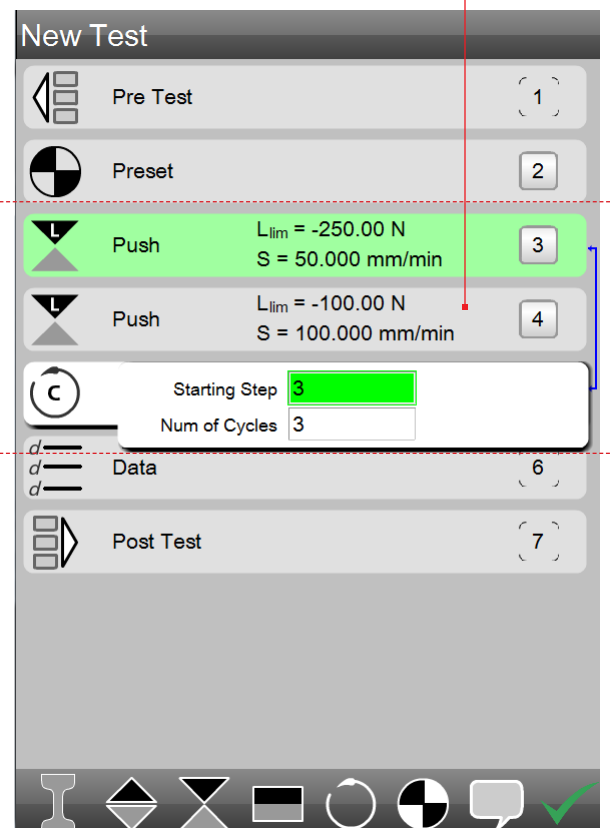
L3 Test Builder - Cycle Count Step
Cycles selected steps for a number of cycles (counts)

3.3.5.2 Cycle for Duration Step

Instead for cycling your steps based on a count, you can cycle based on time. You may set a cycle time duration for up to 24 hours. You enter time using hours, minutes or seconds. If you want a 30 minute cycle time, you would enter the number 1800 (30 min x 60 sec = 1800 sec) or enter 30:0.0.

• Select the Cycle symbol

• Select the Cycle Time symbol

• Select the first step where the cycle will begin

• Specify the Time Duration (in seconds) the cycle shall be performed

NOTE
When you enter the Duration time, always enter using seconds.

NOTE
The maximum duration for a test is 48 hours.

NOTE
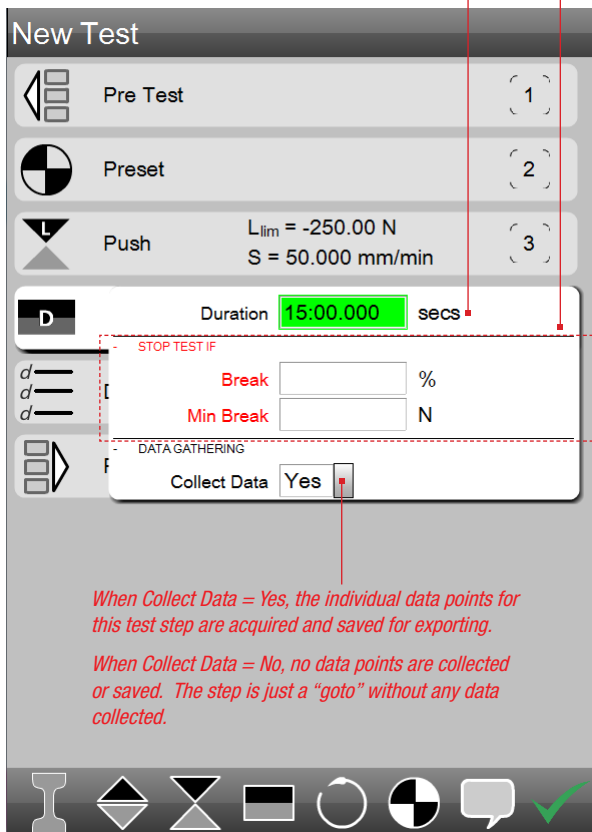The maximum number of data points for a test is 100,000. Adjust the Sampling Rate (Hz) accordingly for your test.

Enter the time as a whole number in seconds, minutes or hours.
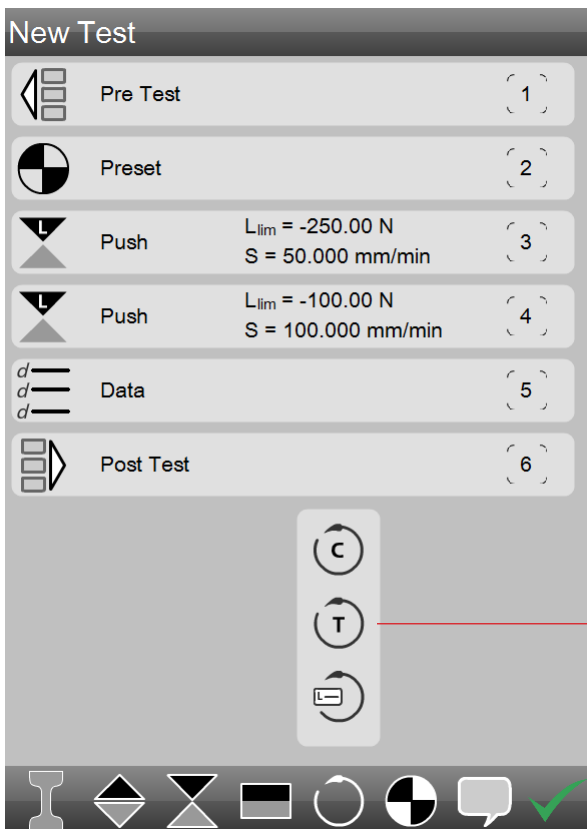
L3 Test Builder - Cycle Steps
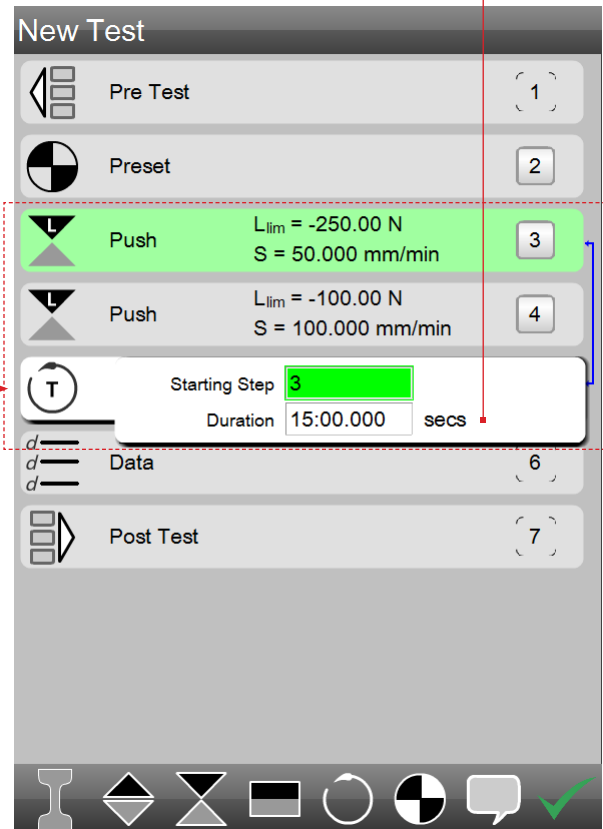
L3 Test Builder - Cycle Time Step
Cycles selected steps for a time duration

3.3.5.3 Cycle for Loop Step

When you use either Cycle Count or Cycle Time, you get a single result for the cycle. However, with a Loop step, you get a result for each step. If a step is repeated three (3) times, you will get three independent results recorded as individual Runs.

CAUTION
Using a Loop step with a Cycle step in a test is NOT PERMITTED.

Notice in the Loop type of cycle, the Data step is also included in the cycle set. This is because with a loop test, you will get a separate test run with coefficients for each cycle.

In this example, the Number of Loops = 10. This means when this test has finished, there will be ten (10) separate test runs- each having its own measured results.
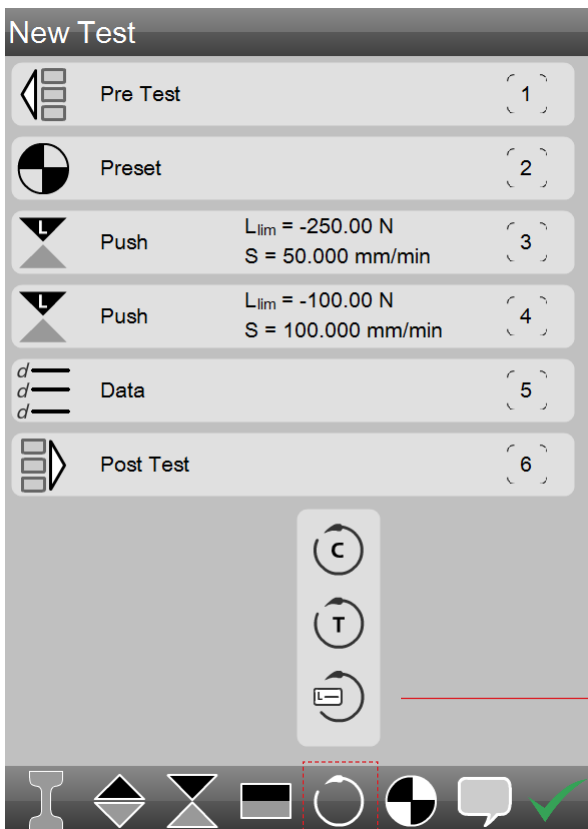
New Test

	Pre Test		1
	Preset		2
	Push	L_{lim} = -250.00 N S = 50.000 mm/min	3
	Push	L_{lim} = -100.00 N S = 100.000 mm/min	4
	Data		5
	Post Test		6

L3 Test Builder - Cycle Steps

New Test

	Pre Test		1
	Preset		2
	Push	L_{lim} = -250.00 N S = 50.000 mm/min	3
	Push	L_{lim} = -100.00 N S = 100.000 mm/min	4
	Data		5
	Starting Step	3	
	Num of Loops	10	
	Post Test		7
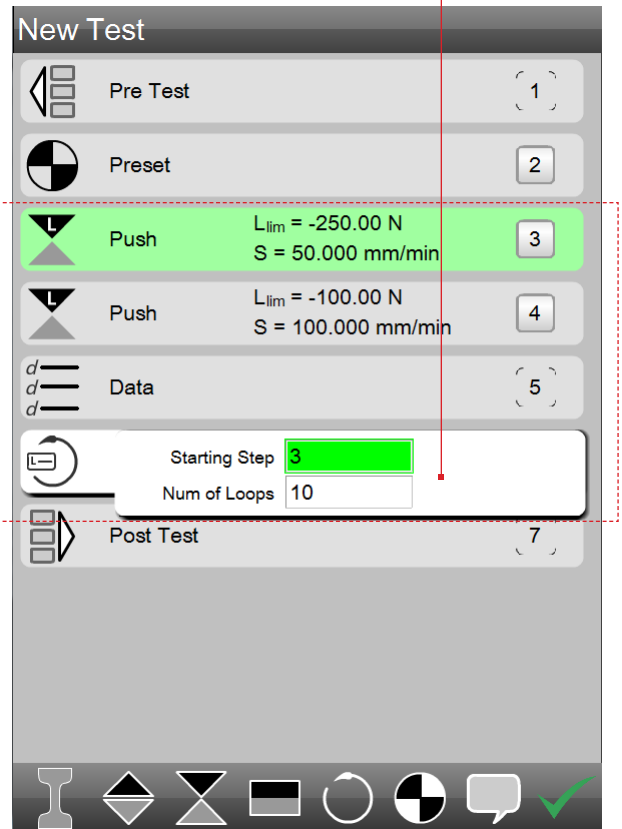
L3 Test Builder - Cycle Time Step
Cycles selected steps for a time duration

3.3.6   Datum Step

You may datum as part or your test. The primary datum is referred to as Datum #0. A second datum (available only during a test) is referred to as Datum #1. The Datum step sets a datum according to the position and load at the moment the Datum step is executed during a test. The distance and/or load may be preset to display a zero or non-zero value at the time.

You may use a second datum for load or position during a test for more complex applications. For example, Datum #1 may be used to determine the distance that corresponds to a creep rate.

• Pull to a load.

• Datum (set the datum to Datum #1) and zero the distance.

• Hold for 10 minutes.

The distance reported at the end of the Hold step is creep over 10 minutes.
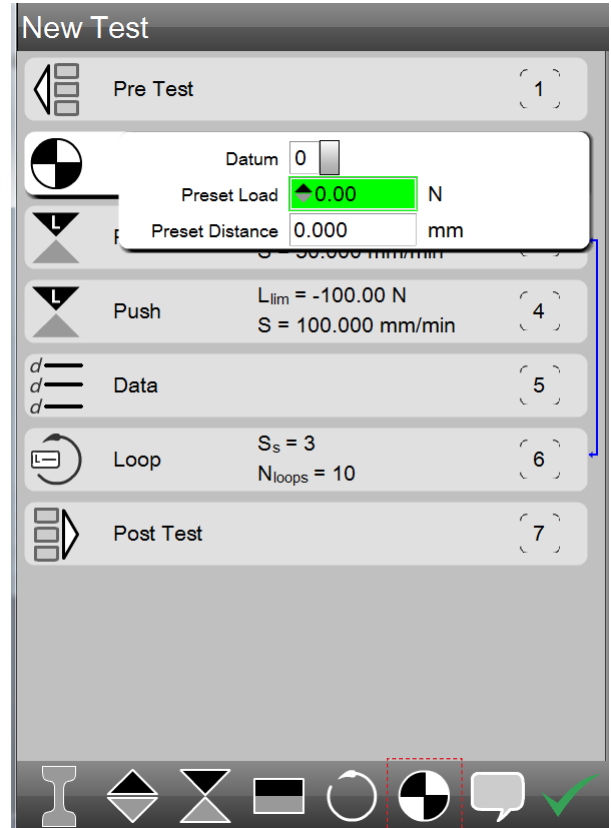
L3 Test Builder - Datum Step
Use a datum to zero Load and Distance prior to test

3.3.7 Prompt Steps

There are two forms of prompts available for your L3 test setup.

- Ask Prompt
- Tell Prompt

The Ask prompt requires a response from the operator.

The Tell prompt alerts the operator and requires no response from the operator.

3.3.7.1 Ask Step

The Ask step is used to add a question that requires the operator to respond. Questions should always be short and require a single or few word response. The maximum number of characters, including spaces, for your question is 100.

The response is limited to a maximum number of characters, including spaces, to 16. Use the Ask coefficient to display the answer to your question.
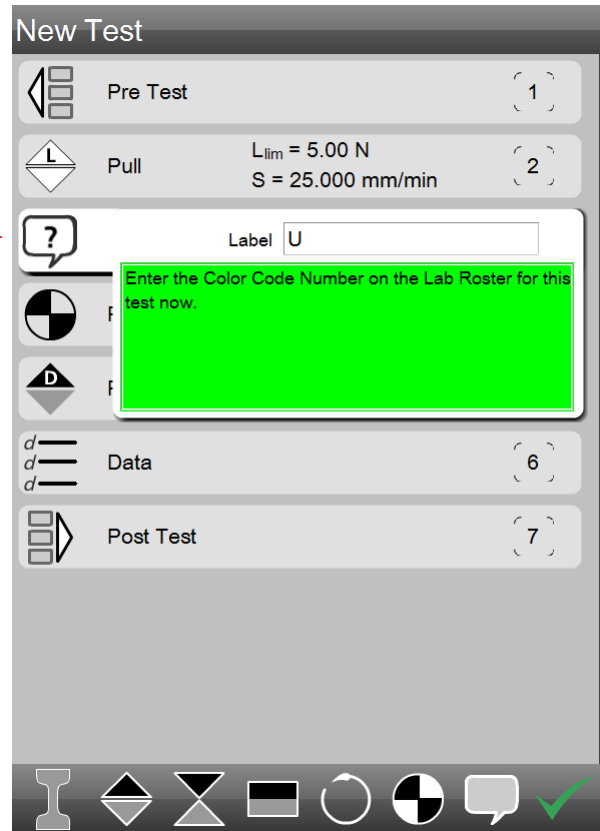
L3 Test Builder - Ask Step
Requires an operator response
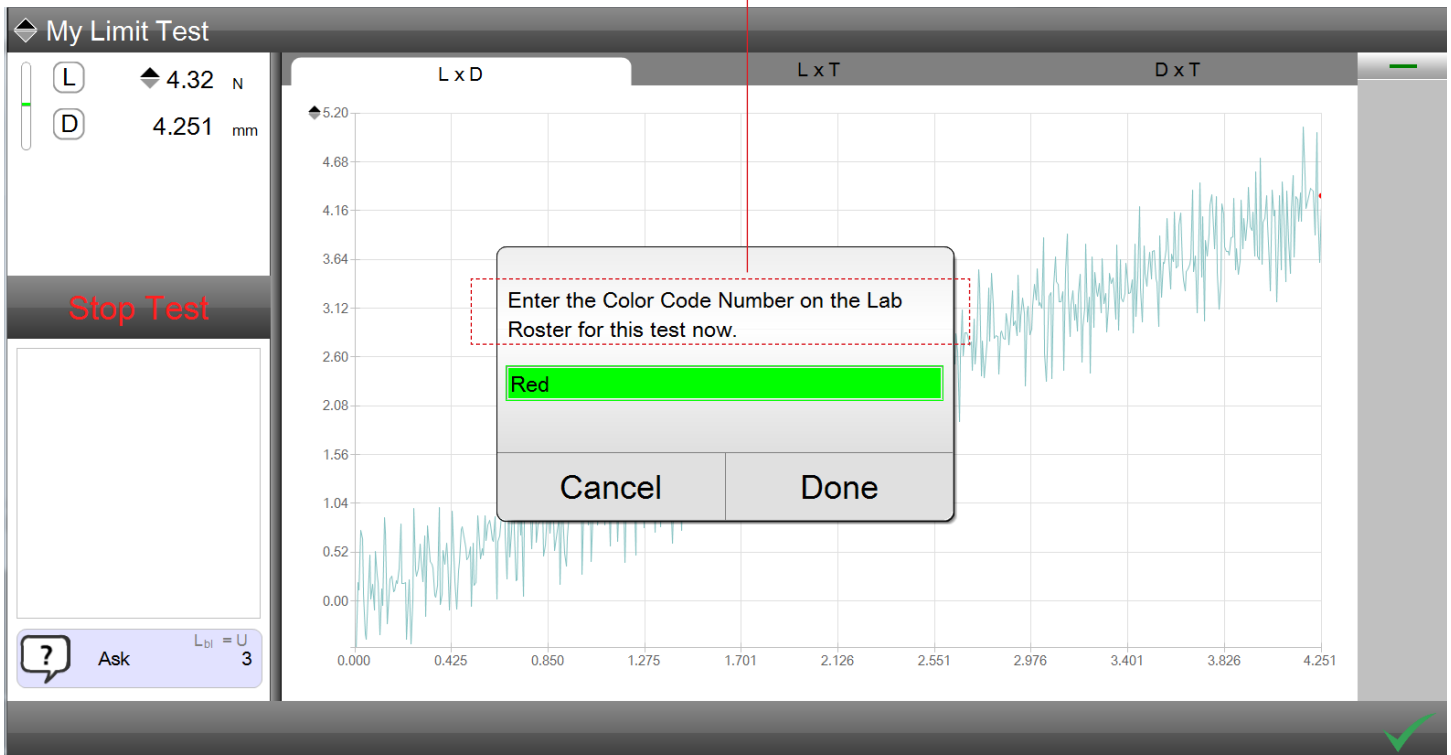
L3 Test
An ASK prompt is displayed requiring the operator to answer

3.3.7.2 Tell Step

The Tell Step is a message displayed for the user. Prompts can be used as reminders to the operator or used to give the user instructions during the test procedure.

NOTE
A prompt does not require an operator response.

When a prompt is used, you have the option to specify how long (duration) the prompt is to be displayed during your test procedure.

A prompt may have up to 100 characters (including spaces). The prompt duration (length of time displayed) may be up to 8 hrs. A step does not complete until the prompt has been displayed for its full duration or the user selects the check mark.

My Limit Test

Pre Test 1

Duration 10.000 secs

Check to make sure sample is aligned properly in test fixture.

Pull D_{lim} = 125.000 mm
S = 50.000 mm/min 5

Data 6

Post Test 7

L3 Test Builder - Prompt Step

My Limit Test

L ▲ 0.00 N
D 0.000 mm

L x D   L x T   D x T

Stop Test

Results for last run

Prompt time duration setting.

user
12/3/2013

D_{ur} = 10.000 S.s

Tell 2
6.942

Check to make sure sample is aligned properly in test fixture.

Elapsed time remaining for prompt.

Or, operator can simple press the dialog to finish prompt .

L3 Prompt
Displays message to operator

3.3.8 Using Coefficients in Test Steps

Coefficients (results) from test steps may be used as inputs in other steps within your test setup. If a result from a step is to be used as an input, the step suppling the result must occur BEFORE the test step that will use the result.

NOTE
A result from a step may be used as an input in another test provided the result occurs BEFORE the input step.

3.3.8.1 Using Prompt Coefficients

You may use the answer to an Ask step as the input to a step that comes after the Ask step.

In this example, the test speed for the go to Load step is going to be changed by the operator in increments of 10% beginning with a starting test speed of 10 in/min. An Ask step is used that preceeds the go to Load step. During the Ask step, the operator enters the new test speed for the load step.

New Test

Pre Test 1

Preset $L_{pre} = ▲0.00$ N $D_{pre} = 0.000$ mm 2

Label Speed

Enter the test speed.

The operator enters a value in response to the ASK step. The value entered uses the units of measure already setup for speed, e.g. mm/min for this test setup.

L2 Plus Test Builder - Prompt Step
Operator will enter the Speed required for a Go To Load step

New Test

Pre Test 1

Preset $L_{pre} = ▲0.00$ N $D_{pre} = 0.000$ mm 2

Ask $L_{bl} = $ Speed 3

Target Load ▲100.00 N
Speed Speed

+ STOP TEST IF
+ DATA GATHERING

L2 Plus Test Builder - Prompt Step
The Speed value will come from the ASK Step labeled Speed

◆ Ask Speed Test

L ▲11.11 N
D 11.030 mm
Speed 25.000 mm/min
Stop Test

L x D   L x T   D x T

The operator enters a value in response to the ASK step. The value entered uses the units of measure already setup for speed, e.g. mm/min for this test setup.

The value the operator enters is read by the go to Load target step of 100N.

The operator entered the value 25, e.g. 25 mm/min. The crosshead will move at this velocity until the load target of 100N is reached.

On the next test run, the operator may change the Ask response to 50. The next test run will perform at a velocity of 50 mm/min.

$L_{lim} = 100.00$ N
Pull 4
S = Speed

L3 Test Run Full Graph
Test Speed is set from a Previous ASK step answer

3.3.8.2   Using Formula Coefficients

Before the results of a formula can be used as an input to another step, you must first perform a run where you have coefficients on which to use a formula. Consequently, a formula result cannot be used unless you have performed a run; obtained coefficients; and calculated a result based on a formula that uses those coefficients. The result of your formula may then be used as an input. All coefficients used in the formula must occur before the step using the formula result.

In this example we are using the result of a formula as the input for the Area of an Irregular Shape (Pentagonal wire).

The formula for the cross-sectional area is:

$$Area = x^2(0.72654)$$

Where x = length of pentagon side

A formula is used to find a result (Area) that is used as the input for the Sample Definition Step 5.

The formula uses the Side result from Ask Step 3 as "x". This value is squared and multiplied by a constant 0.72654.

The Gauge Length, in the Sample Definition Step 5 is from the operator response to Ask Step 2.
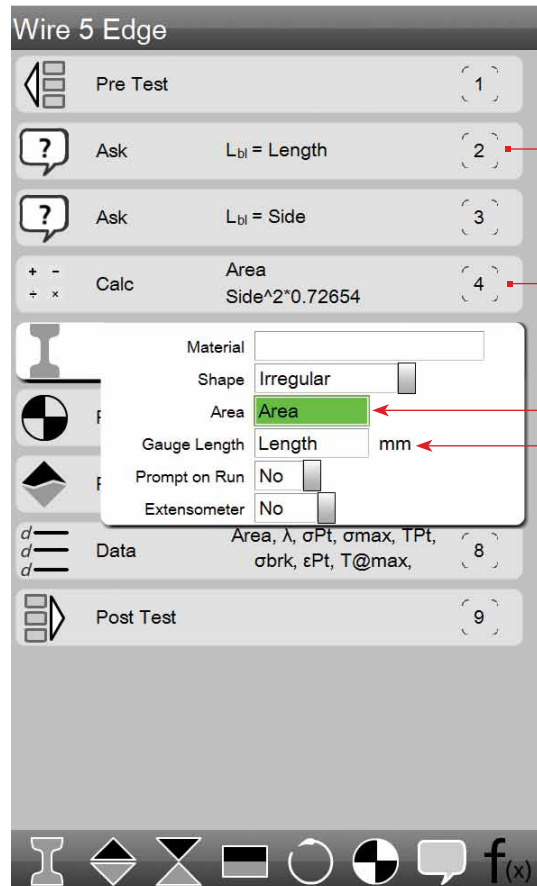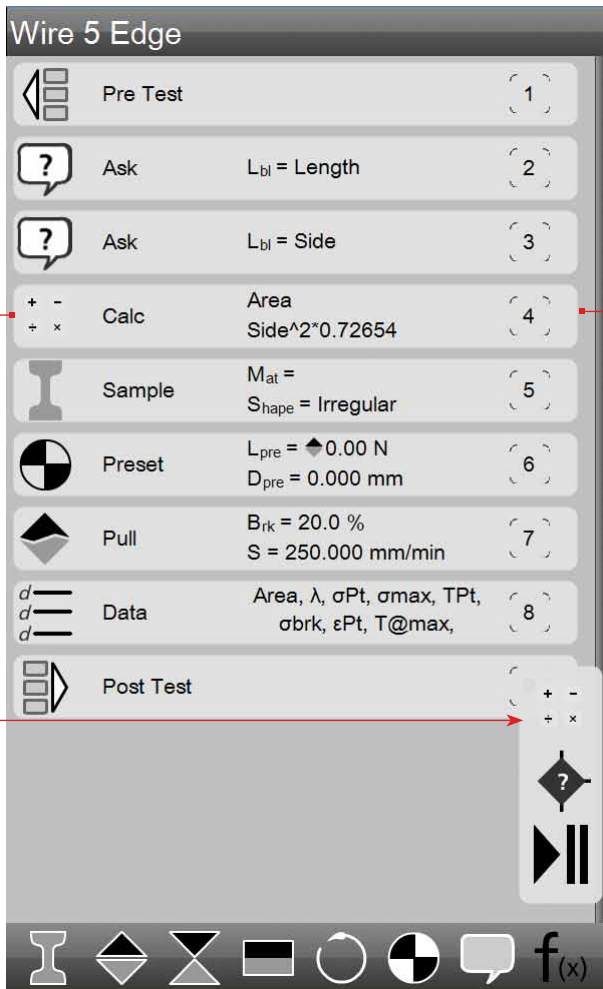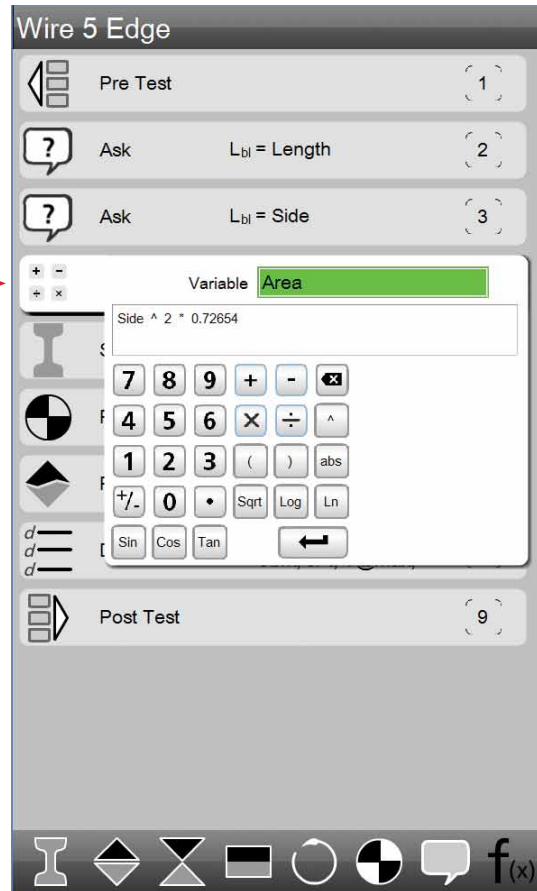
L3 Test Builder
Shows Formula Step used as Input to Sample Area Step #5

Wire 5 Edge

L ⊻ 0.80 N
D 6.294 mm

Set Home | Start Test | Return Home

A_{rea} 2.906
λ 1234.72 Mpa
σ_{Pt} 8.80 Mpa
σ_{max} 19.94 Mpa
σ_{brk} 17.55 Mpa
ε_{Pt} 0.719 %
$\varepsilon_{@max}$ 4.519 %
$\varepsilon_{@brk}$ 5.975 %

The Test has finished running!

Tabs: σ x ε | σ x T | ε x T

Graph annotations:
σ_{max} 19.94 / $\varepsilon_{@max}$ 4.519
σ_{brk} 17.55 / $\varepsilon_{@brk}$ 5.975
σ_{Pt} 8.80 / ε_{Pt} 0.719
λ 1234.72

Run	Length	Side	λ Mpa	σ_{Pt} Mpa	ε_{Pt} %	σ_{max} Mpa	$\varepsilon_{@max}$ %	σ_{brk} Mpa	$\varepsilon_{@brk}$ %	+
1	100.000	2	2786.64	20.04	0.719	56.78	6.267	49.97	8.721	
2	100.000	2	1121.62	7.99	0.719	19.79	4.941	17.41	6.967	
3	100.000	2	1234.72	8.80	0.719	19.94	4.519	17.55	5.975	

L3 Test Run Split View
Shows results after using a formula step for Area

3.4   Data Step

The Data step is used to define the results you want to measure and report.

You may specify the coefficients (results) you want using the Data step prior to performing the test. Alternatively, you can defer specifying the coefficients you want until after the test run is complete and your graph trace is created. Then, using the Graphic Analysis tools, you can make your measurements on the graph, which automatically creates your coefficients.

NOTE
The Graph Analysis tools are used to create a coefficient.

L3 Test Builder - Data Step

Use the Graph Analysis Tools to measure and display results.

σ_{max} 64.84 Mpa
σ_{brk} 53.82 Mpa
σ_Δ -11.02 Mpa
$\varepsilon_{@max}$ 6.368 %
$\varepsilon_{@brk}$ 11.397 %
ε_Δ 5.030 %
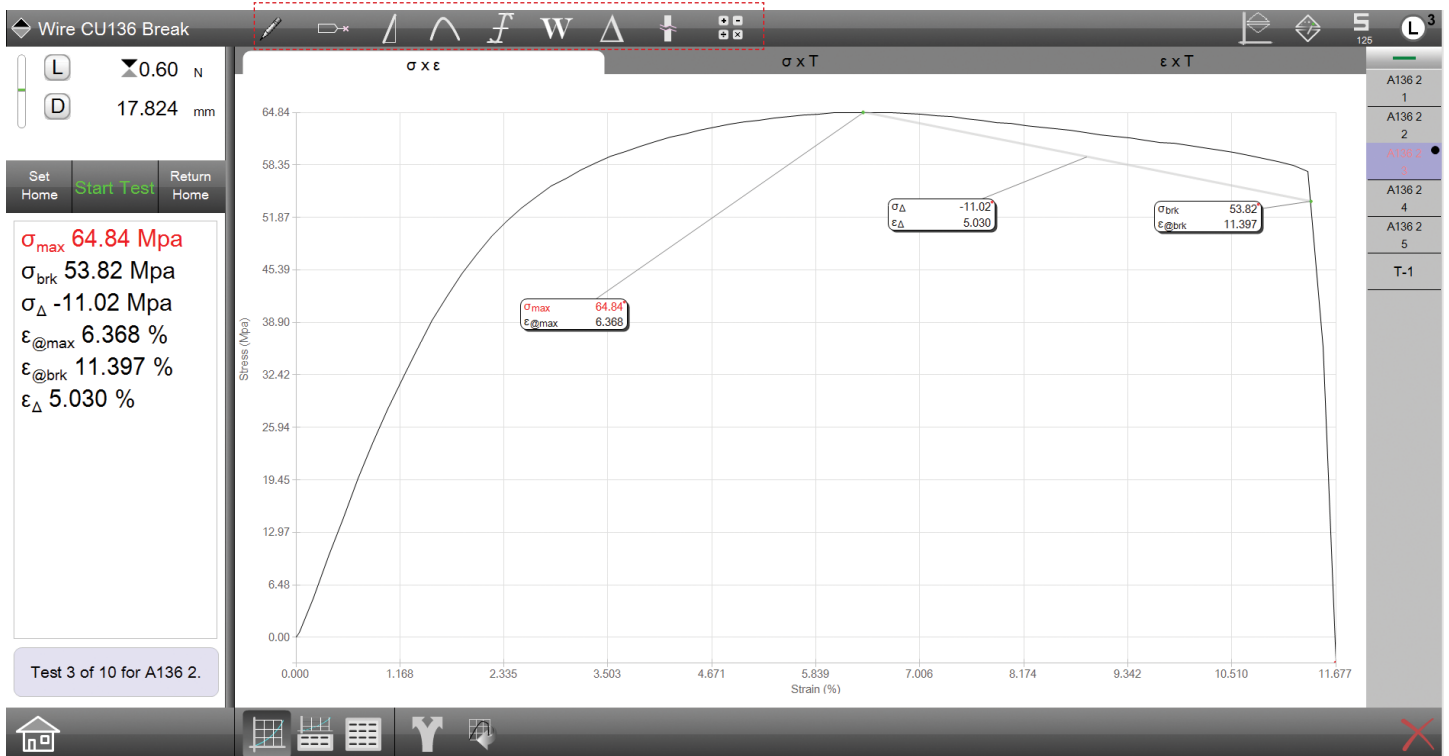
L3 Full Graph view
Displaying measured results (coefficients) with their markers indicating the values

3.4.1 Coefficient Definition

The term coefficient is used to represent a result. The result may be configured prior to the test in the Data step, or the result may be determined using the graph of your test and the associated analysis tools.

NOTE
A coefficient is a result.

L3 Data Definition menu for a Load Point

3.4.1.1 Coefficient Types

Coefficients are categorized into types according to their ability to measure a particular trait of your test result. These types also help you find the particular measurement result you are looking for.

Every coefficient has a Data Definition menu that permits you to customize the coefficient so you get the exact measurement result you need.

NOTE
The Data Definition view for a coefficient displays "coefficient sets". Included are the associated coefficients for a particular type. For example, for Maximum Load, also displayed in a separate tab is the coefficient for Distance @ Maximum Load and the coefficient for Time @ Maximum Load.

Coefficient types are listed in the following table.

Type	Function
Point	Load or Stress
	Distance or Strain
	Time
Modulus/Slope	Slope Intersect
	Elastic Modulus Fit (Automatic)
	Tangent Modulus
	Two Point (Chord) Modulus
	Maximum Slope
Peak/Valley	Maximum Peak
	Maximum Valley
	Minimum Peak
	Minimum Valley
	Number of Peaks (Count)
	Number of Valleys (Count)
	Average of Peaks
	Average of Valleys
Minimum/Maximum/Average	Minimum Load or Stress
	Maximum Load or Stress
	Average Load or Stress
	Minimum Distance or Strain
	Maximum Distance or Strain
	Average Distance or Strain
Work/Energy	Work
	Hysteresis
	Resilience
	Hysteresis Loss
Delta	Delta Load or Stress
	Delta Distance or Strain
	Creep- Load or Stress
	Creep- Distance Or Strain
	Relaxation- Load or Stress
	Relaxation- Distance or Strain
Break/Rupture	Break %Drop- Load or Stress
	Break %Drop- Distance or Strain
	Break Rate- Load or Stress
	Break Rate- Distance or Strain

3.4.1.2 Coefficient Naming

Coefficient names are abbreviations for what the result represents. For example, the coefficient name for Maximum Load is Lmax.

The coefficient name for the first Load point with a test run is LPt and if a second point for Load is measured, it will have the coefficient name of LPt2. Any additional Load points will be identified using 3,4,5, etc.

NOTE
Coefficient names may be up to 8 characters in length using alpha, numeric and space characters.

The tab is used to select the active coefficient. Lmax is shown as the active coefficient for editing.

Coefficients have default names.

You may rename the coefficient using up to 8 character spaces.

L3 Data Definition menu
Rename your coefficient

3.4.1.3 Display Coefficient Where Options

Coefficients can be display in the following views:

- Result view
- Full Graph view
- Data view
- Split Graph view

You specify where you want your coefficient to display using the WHERE function in the Data Definition.

Display on Result view
Select the Result symbol in the Data Definition menu for the displayed coefficient. This coefficient will display on the Results view.

Display on Data views
Select the Data symbol in the Data Definition menu for the displayed coefficient. This coefficient will display on the Data view and in the Split Graph view.

Display on a Graph
Select the Graph symbol in the Data Definition menu for the displayed coefficient. This coefficient will display on the Full Graph and the Split Graph views.

Pin Marker
When selected, the pin symbol causes the marker that displays the coefficient on the graph views to automatically be positioned. The marker is positioned in a "best fit location" so not to obscure other markers or the graph trace.
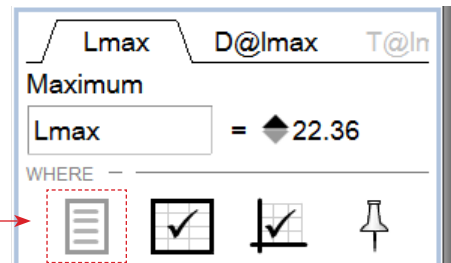
Display on Results View

Display on Data Views

Display on Graph Views

This shows coefficient Lmax displayed in Results view.

If the WHERE function for the Results view is "unchecked", the Lmax coefficient is NOT displayed (see the adjacent view). Lmax is not displayed.
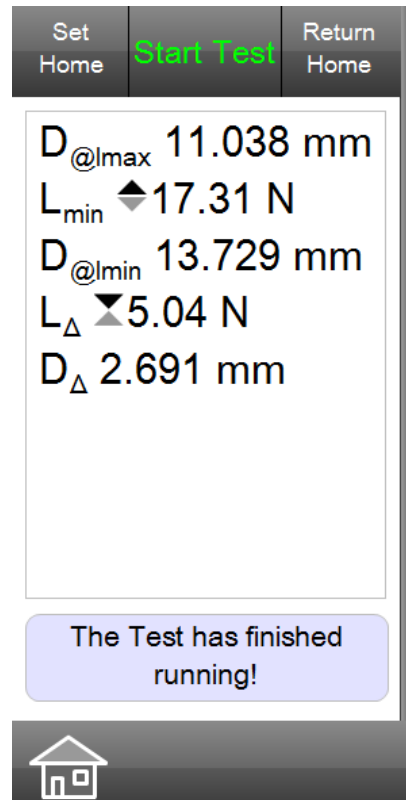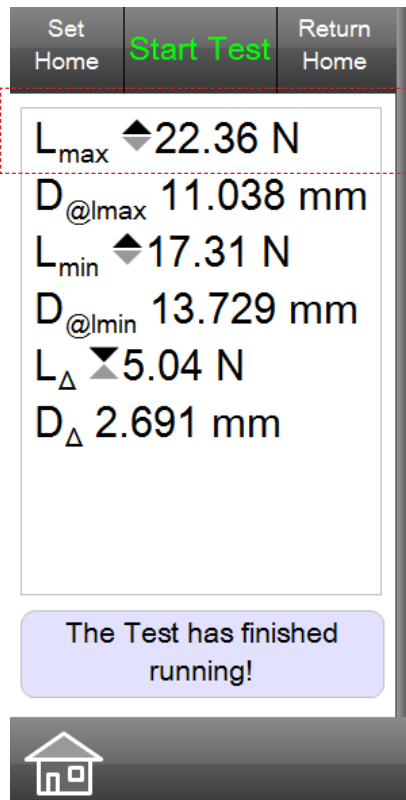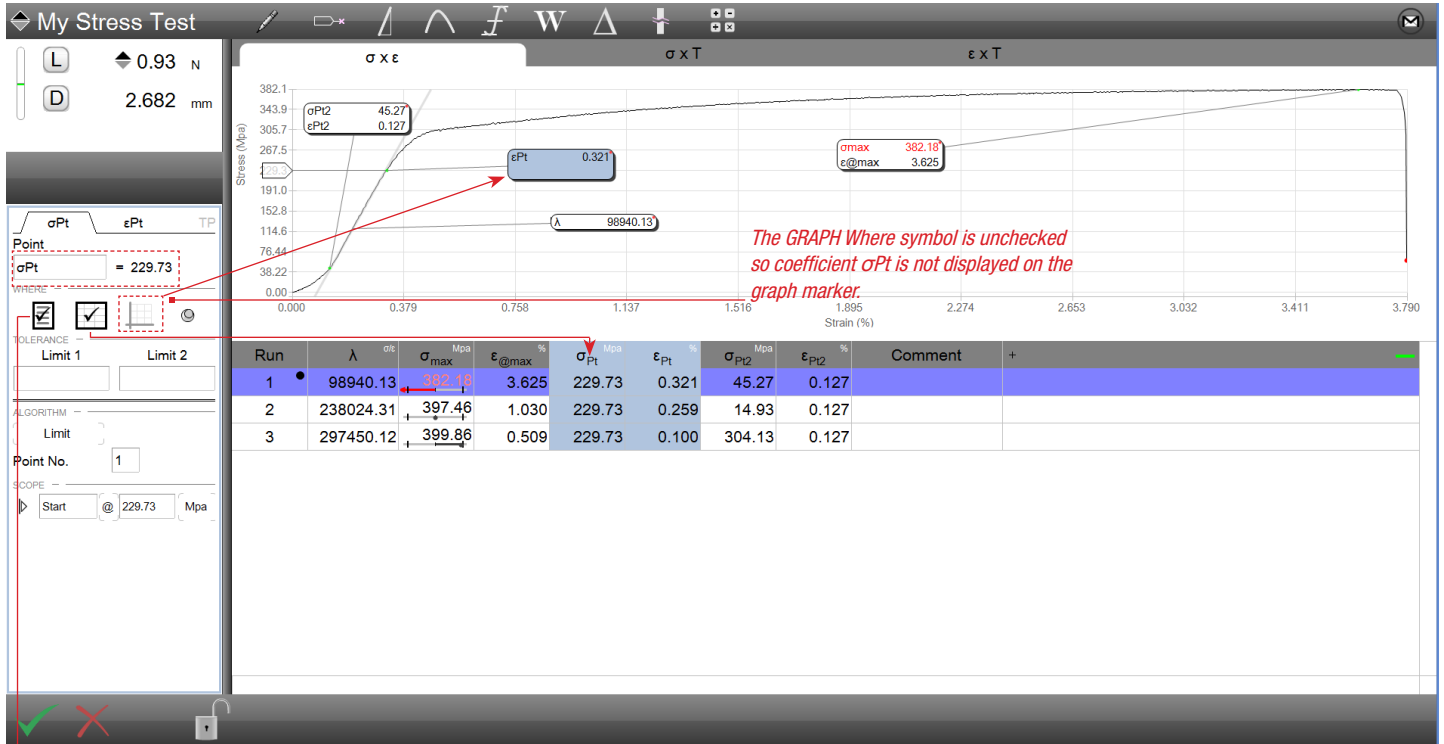
L3 Split Graph Data view
Shows coefficient σPt not being displayed in the graph marker
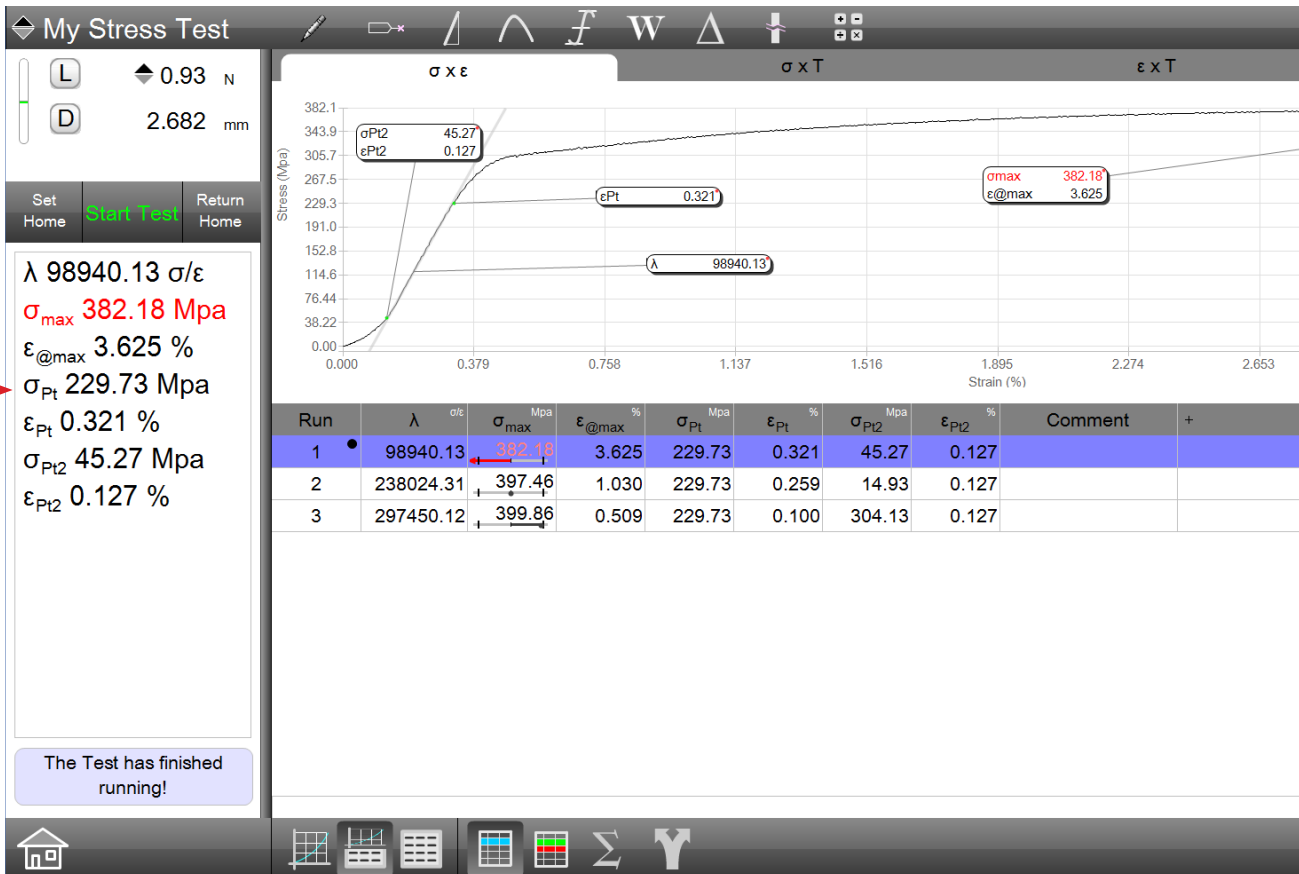
L3 Split Graph Data view with Results
Shows coefficient σPt being displayed in the Result view

3.4.1.4 Applying a Tolerance to a Coefficient

You may use the Tolerance option to establish a "pass or fail" metric for each coefficient.

When you set a Tolerance, you create a range within your data. When the coefficient is located within this range, the coefficient is viewed as a "pass" and displays in black text.

A "failed" result will display in red wherever the coefficient is displayed denoting that the result is "outside" the tolerance range.

NOTE
When a tolerance range is created, any result that equals the limits of the range or that reside within the range established by the two limits is views as a "pass" and displays in black text.

You set a tolerance range by entering the values for the Limit 1 and Limit 2. These values use the units of measure for the coefficient that is being defined.

NOTE
When using limits, the limit values are considered "pass" results. If the result equals the limit value, the result is a "pass" and the coefficient displays in black text.

When a tolerance is used, the Data view also displays a Tendency bar. The Tendency bar displays the coefficient and symbolizes where the result is relative to the tolerance- high side or low side of the tolerance limit range.

L3 Tolerance Setup
For coefficient σmax
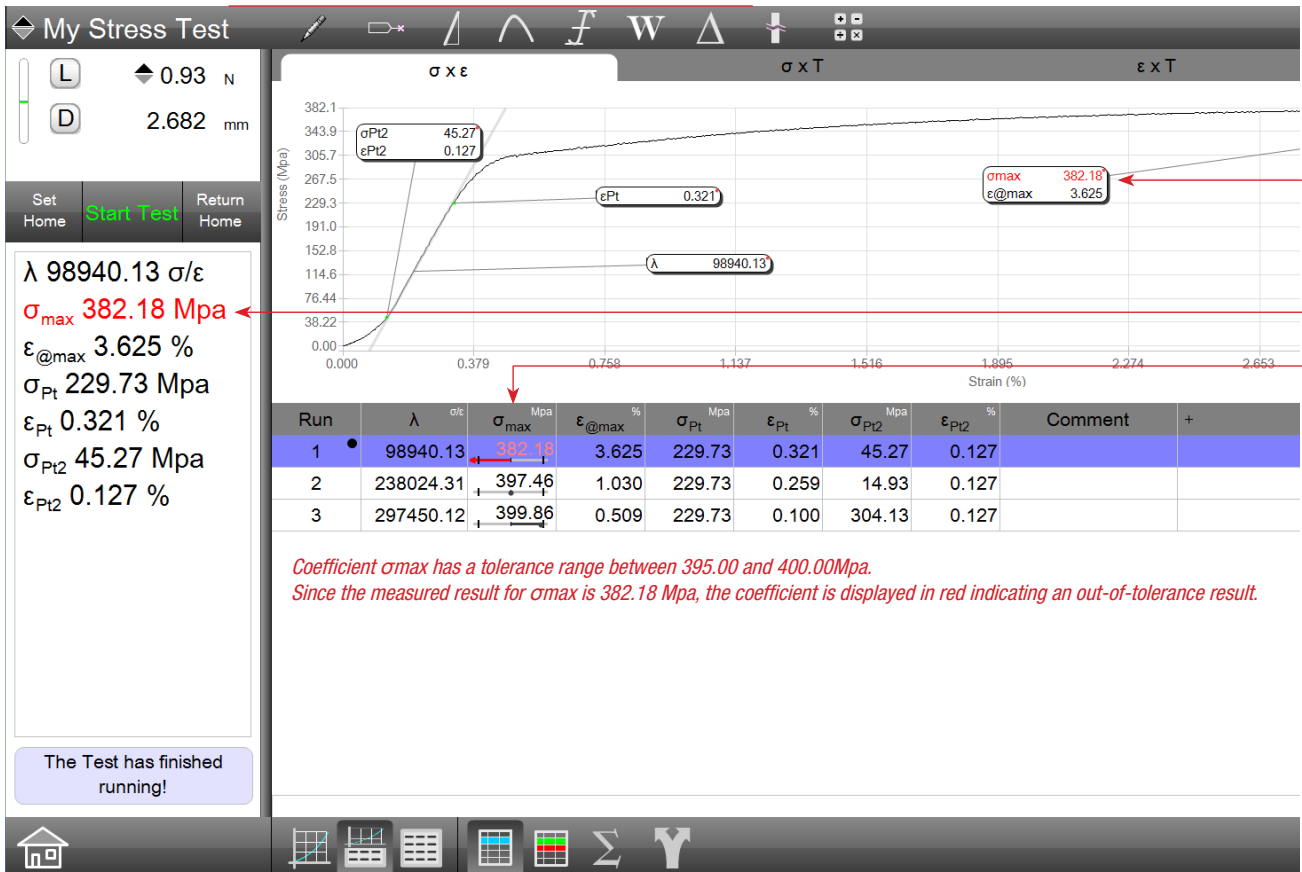
Coefficient σmax has a tolerance range between 395.00 and 400.00Mpa.
Since the measured result for σmax is 382.18 Mpa, the coefficient is displayed in red indicating an out-of-tolerance result.

L3 Tolerance Indication for Point σmax

3.4.1.5 Coefficient Algorithms

All coefficients have algorithms. The algorithm is the method used to calculate a result for that coefficient. Select the algorithm option box to scroll thru the various methods that are available for your coefficient.

Each coefficient and each algorithm available for that coefficient are described in detail in the following sections.

Algorithms are discussed in more detail in the following sections.

Data Type	Algorithm	Variable
AVERAGE	Average	Load or Stress
	Average	Distance or Strain
DELTA	Delta	Load or Stress
	Delta	Distance or Strain
MINIMUM	Minimum	Load or Stress
	Minimum	Distance or Strain
MAXIMUM	Maximum	Load or Stress
	Maximum	Distance or Strain
PEAK	Numbered	Load or Stress
	Numbered	Distance or Strain
	Minimum	Load or Stress
	Minimum	Distance or Strain
	Count	Load or Stress
	Count	Distance or Strain
	Average	Load or Stress
	Average	Distance or Strain
POINT	Limit	Load or Stress
	Limit	Distance or Strain
	Limit	Time
	Slope Intersect	Load or Stress
	Slope Intersect	Distance or Strain
SLOPE	Slope Fit	Load/Distance or Stress/Strain
	Maximum Slope	Load/Distance or Stress/Strain
	Slope Tangent	Load/Distance or Stress/Strain
	Slope Two Point	Load/Distance or Stress/Strain
VALLEY	Numbered	Load or Stress
	Numbered	Distance or Strain
	Minimum	Load or Stress
	Minimum	Distance or Strain
	Count	Load or Stress
	Count	Distance or Strain
	Average	Load or Stress
	Average	Distance or Strain
WORK	Work	Load/Distance or Stress/Strain

L3 Algorithm Types

3.4.1.6 Scoping a Coefficient

Scoping is the amount of data that you define that you want to use to determine your result. Scoping allows you to define the entire test data or a segment of the test data based on a Start, Finish, or another coefficient within your results.

Scoping is best performed as a post test data analysis feature where you can report results from within all of the raw data acquired for a step from your graph.

For example, suppose you create a test setup using a tension to distance step. Your distance limit is 10 inches. Normally, you would report the load at 10 inches using the Load (L) coefficient. During this test, the system acquired all of the time-based raw data for load and distance from the Start Test event to the End Test event (10 inch limit). Suppose you wanted to know the load at 250mS after the start of your test or 5 seconds from the end of the test? Suppose you wanted to know the load values at 2 inch, 4 inch, 6 inch or 8 inch? Suppose you wanted to know the distance at 5 lbf? Scoping can be used to answer each of these questions.

When a result or step is collecting data, the data is collected at the start of the result or step until the result's or step's conclusion. The data collected during a result or step forms an array of data: load/stress, distance/strain, and time.

Scoping has three operators that may be used:

Operator	Description
@	Use the @ sign to request the data at a specific location or reference.
+	The + sign uses the data AFTER this particular location or anchored reference.
-	The - sign uses the data BEFORE this particular location or anchored reference.

Scope Operators

When anchoring is used, you can measure a result using the + (after) or - (before) scoping operator. Anchoring is where you select an existing result on your graph trace for the purposes of measuring from this reference point. For example, you may want to measure the load, stress, distance or strain 100mS after the maximum tensile strength. Using scoping, you would first specify the maximum result using the Min/Max/Avg tool. Next, you would select the Point tool. When the Point tool is launched and the scope handle appears on the graph, you move the scope handle until it anchors to the maximum result. When anchoring occurs, the marker for the anchored result turns yellow in color. Then using the Data Definition menu for the new point target (100mS), you specify that using the + operator with a value of 100ms (0.01 S.s). The new marker for the point is generated and appears on the graph.
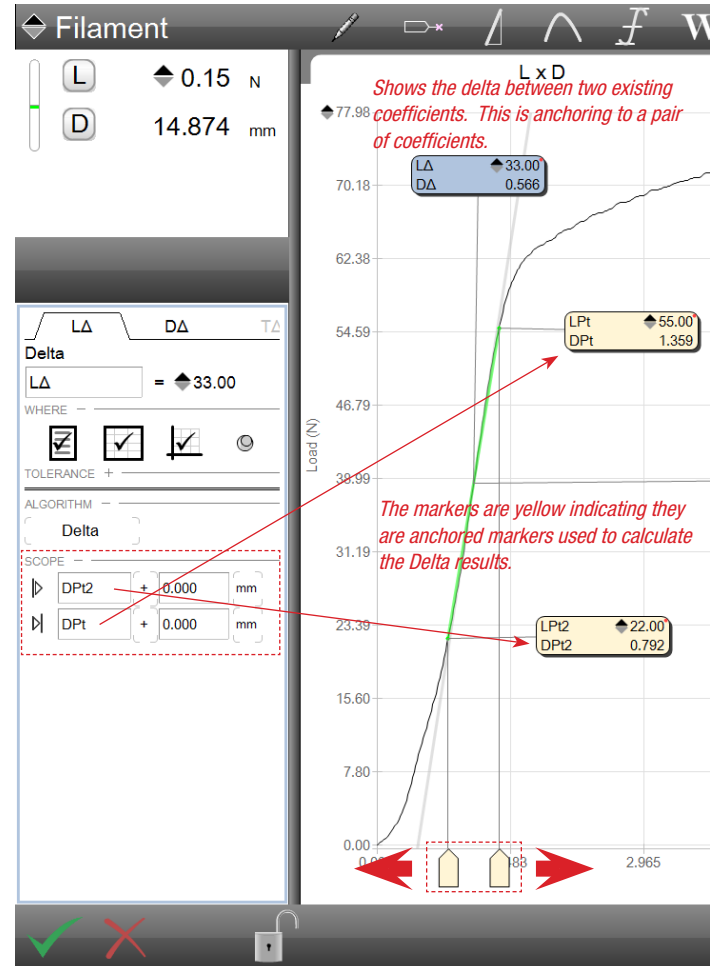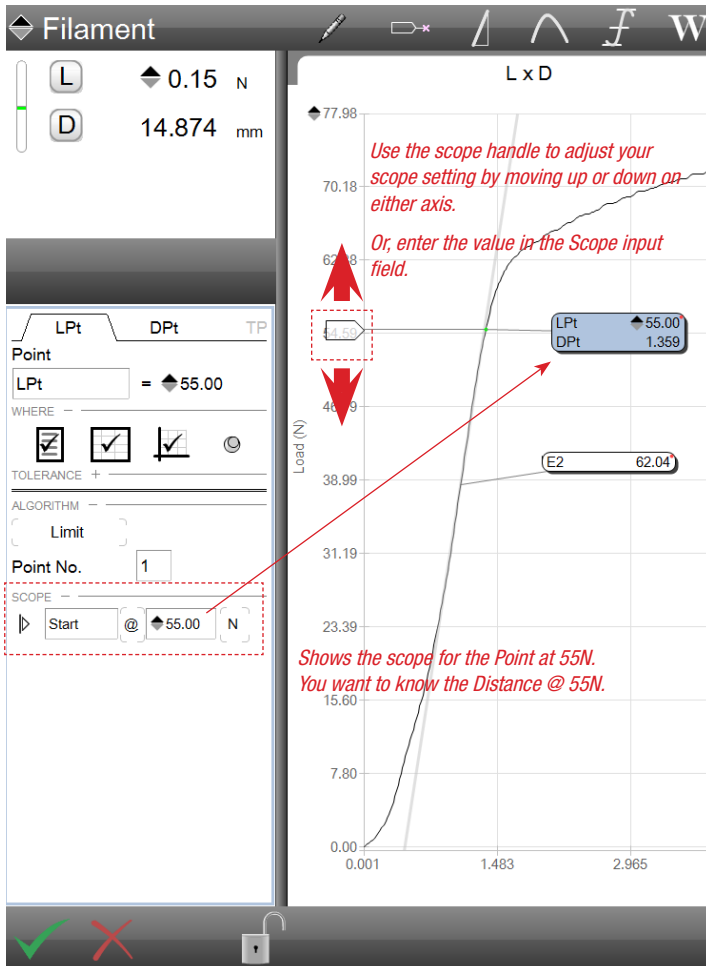
L3 Scoping Examples
Scope on a Point (left) and Scope using two existing Coefficients called anchors (right)

3.4.1.7 Locking a Coefficient

You may lock a coefficient using the Lock symbol. When you lock a coefficient, you prevent that coefficient from accidentally being deleted. When a coefficient is locked, the delete function (X) is removed and the marker is designed with a lock symbol.

To lock a coefficient, go to the Data Definition menu for the coefficient, select the coefficient to be locked and select the lock symbol.

To unlock a coefficient, go to the Data Definition menu for the coefficient that is locked and select the lock symbol.
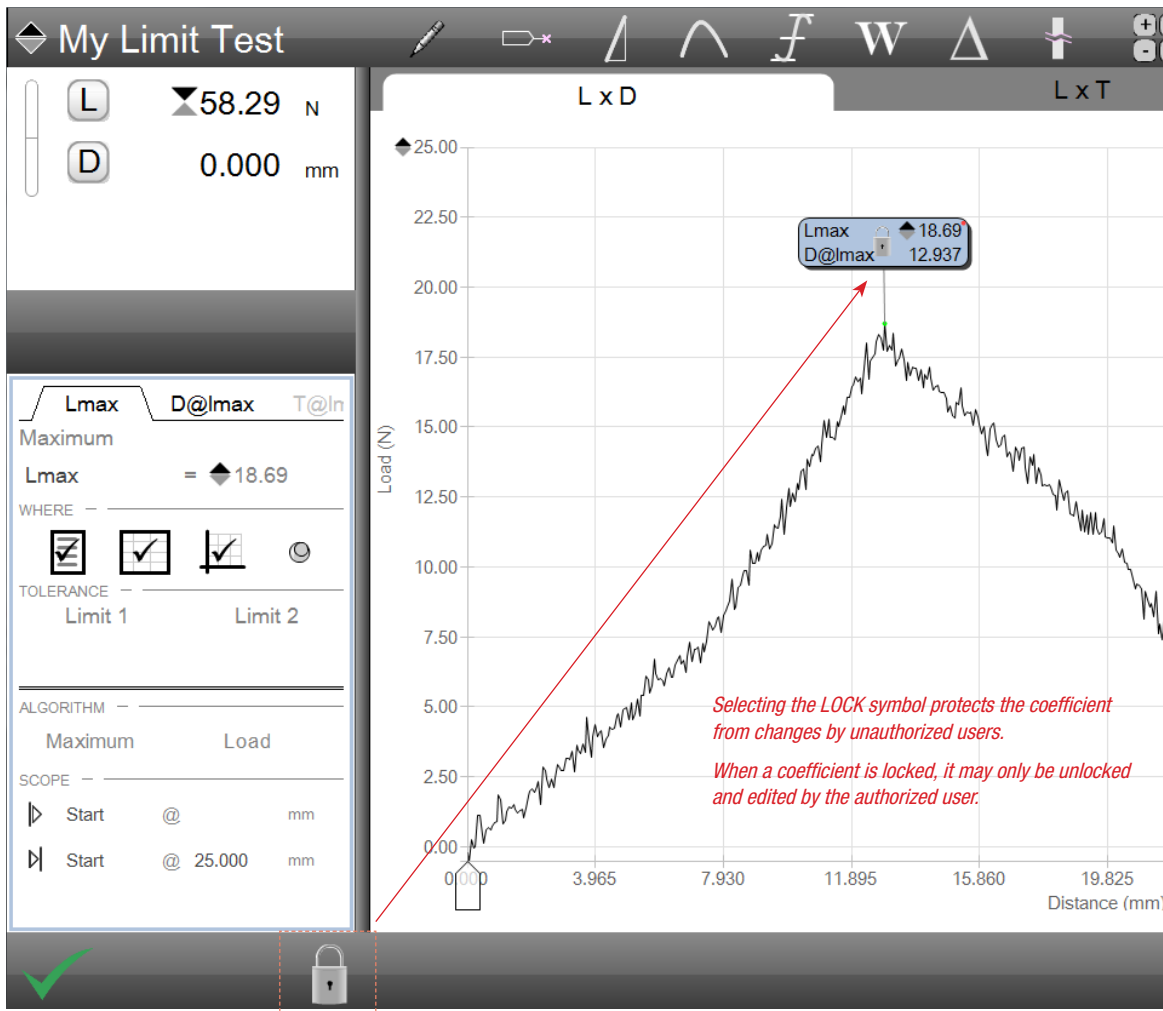
L3 Locked Coefficient

3.4.2 Point Coefficient

The Point coefficient is one of the most common coefficients used in L3. The Point coefficient lets you measure your data stream at a single point resolution.

The Point coefficient corresponds to the Point graph analysis tool. When this tool is used, you may obtain the measured result on a single point based on load, distance or time.

The Point coefficient has two algorithm choices: Limit and Slope Intersect.

Select the Algorithm option box to scroll through the available options for the Point coefficient.

3.4.2.1 Point Limit Coefficient

The Point Limit coefficient lets you measure a single data point on your graph or for your data stream at a single point resolution. The Limit-type algorithm is used when you want to find a point based on a limit, e.g., at a Load Limit, at a Distance Limit, at a Time Limit. The limit is defined by the user.

Associated with the Limit type algorithm is the Point No. (Number).

The Point No. is used to define the "incident" where the point occurs. For example, if the Point No. = 1, the coefficient is finding the first (#1) point where the coefficient appears on the graph trace.

If the Point No. = 8, the coefficient will find the 8th location where the defined limit appears on the graph trace. If there is no 8th location, the marker will display XXXXX for values.

When a positive number is used to find a point in the data stream, the search begins at the Start of the test- in the left-most part of the graph trace.

However, if you enter a Point No. = -1 (negative value), the data stream is analyzed from the right-most or Finished end of the test. Data is analyzed from right to left so the Point is identified as the first point from the end of the test.

Point Measuring Tools

- *Point Limit*
- *Slope Intersect Point*
- *Offset Yield (Stress-Strain)*

Because the POINT NO. is a positive number, the data is analyzed from left to right along the graph.

Find the 8th location where the load is 2.50N.

You may find the results based on Load, Distance or Time selecting the UNITS target.

L3 Point Limit Measurement
Find the 8th location on the trace where the load value is 2.50N
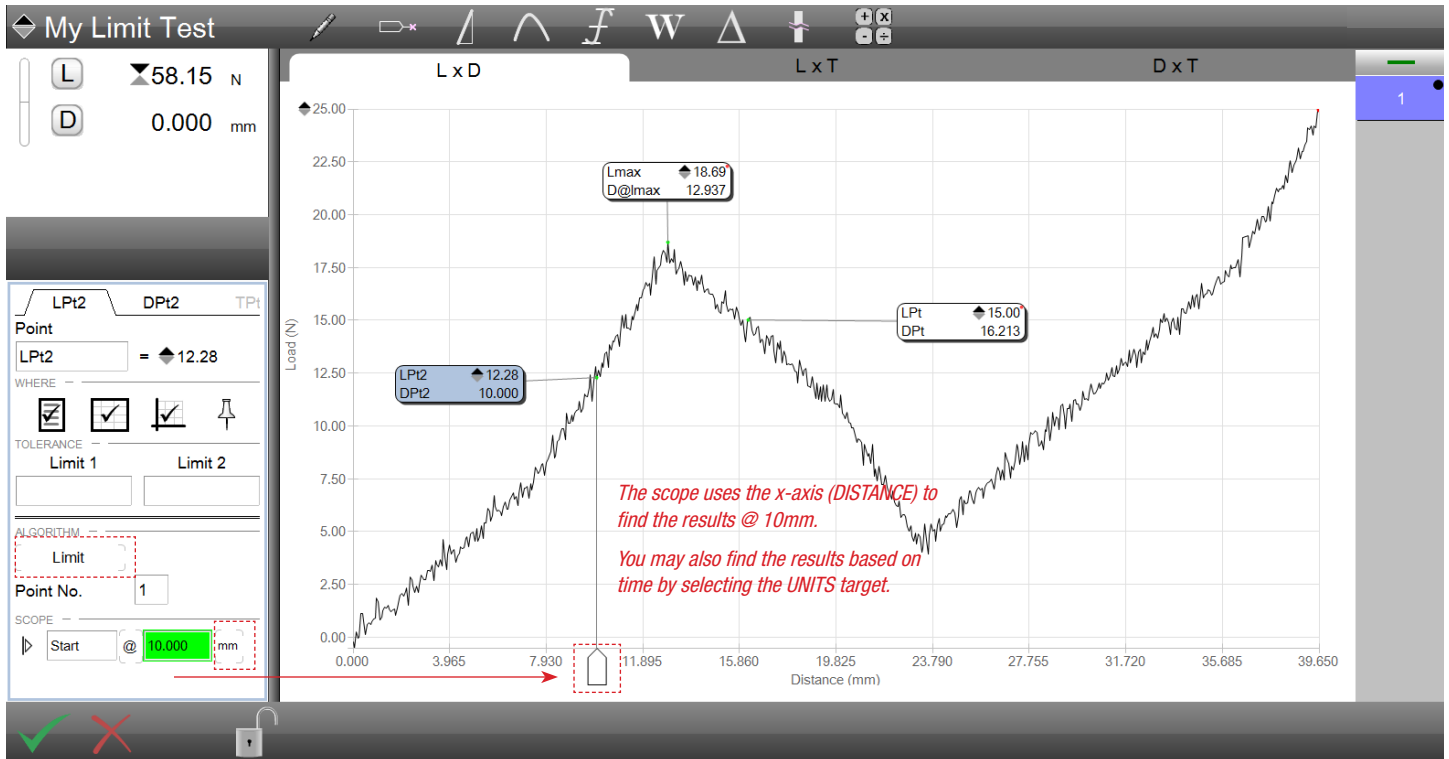
L3 Point Limit Measurement
Finding the results with a scope @ 10mm
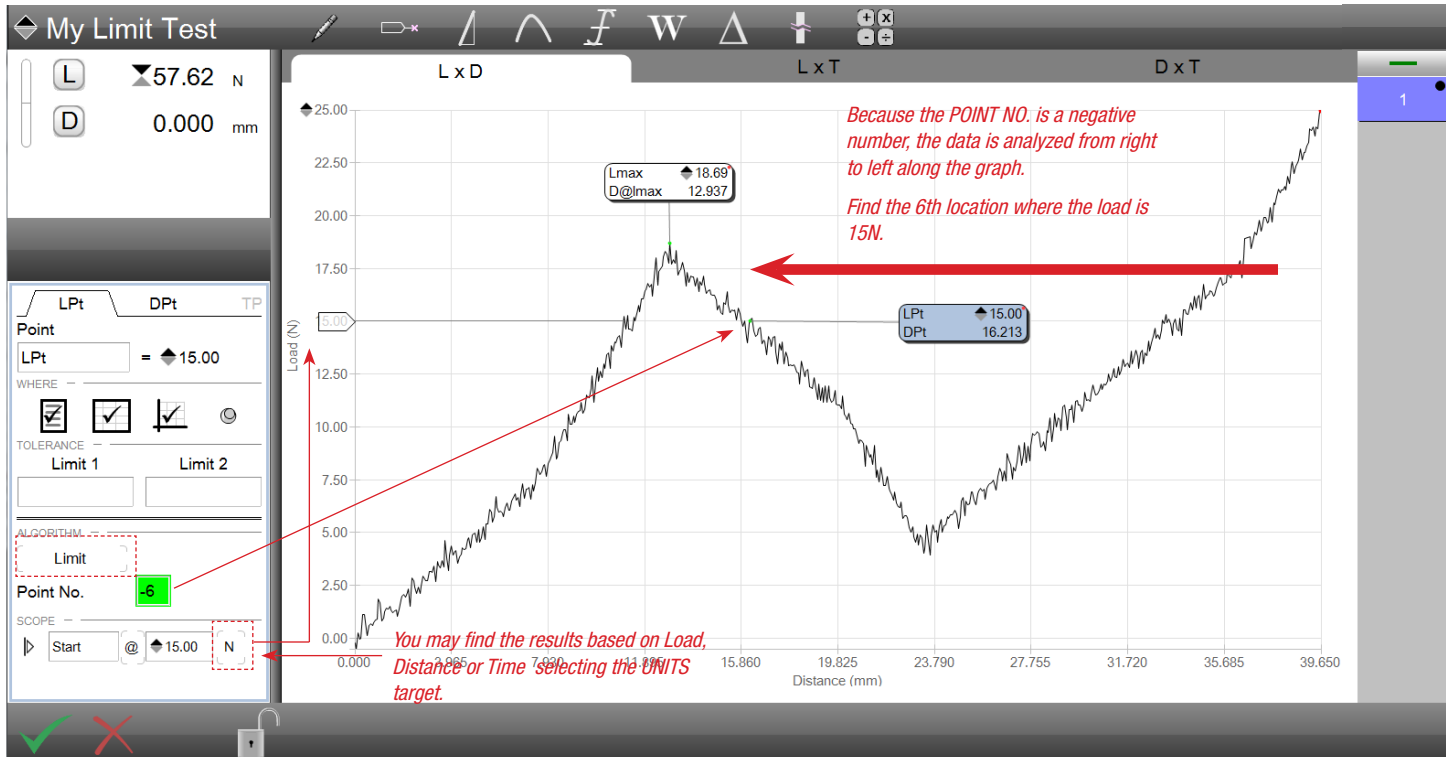
L3 Point Limit Measurement
Finding the results with a scope @ 15N using a negative Point No.

3.4.2.2 Point Slope Intersect Coefficient

The Point Slope Intersect uses the slope you have specified on your graph. The slope must be determined first before you can specify a point using the Slope Intersect algorithm.

Slope intersect can be used on an extension spring, as an example, to determine the initial tension of the spring.

NOTE
Find the slope first using the Slope tool, before measuring using the Slope Intersect point.

Point Measuring Tools

- *Point Limit*
- *Slope Intersect Point*
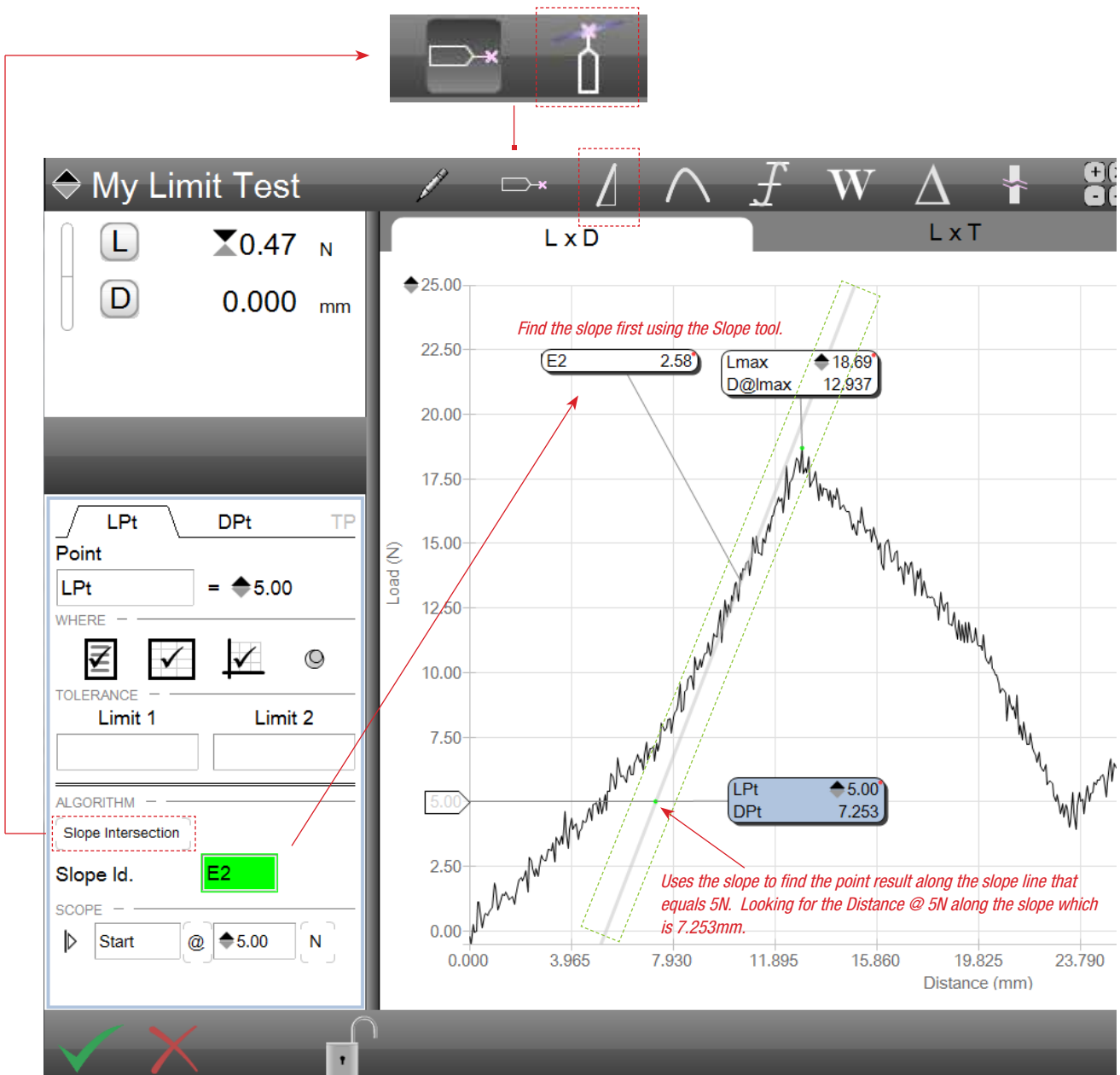
L3 Point Slope Intersect Measurement
Finding the results with a scope @ 5N along the slope line associated with coefficient E2

3.4.2.3   Offset Yield Point

The Offset Yield point is displayed when you have a Stress-Strain graph. It is not displayed for a Load-Distance graph.

The Offset Yield Point uses the slope you have specified on your graph. The slope must be determined first before you can specify a point using the Offset Yield algorithm.

NOTE
Find the elastic modulus first using the Slope tool, before measuring using the Offset Yield point.

NOTE
The Offset Yield point is available on Stress-Strain graphs only.

Point Measuring Tools for Stress-Strain

- *Point Limit*
- *Slope Intersect Point*
- *Offset Yield*
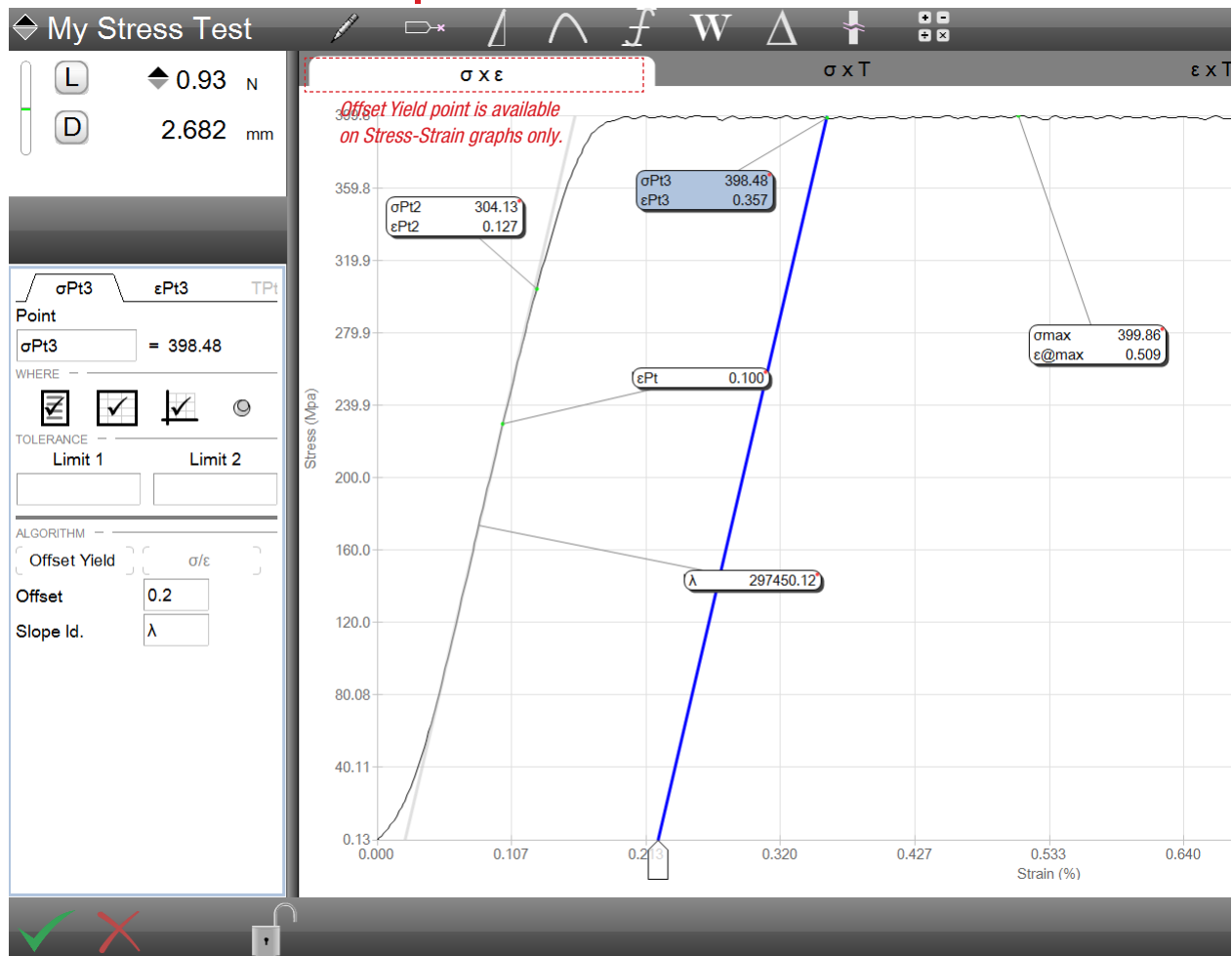
L3 Offset Yield Measurement
Finding the offset yield at 0.2% strain

3.4.3 Modulus/Slope Coefficient

Slope, also called Modulus in some industries, is used in load-distance applications in determining elastic or rate. The L3 Series software offers four methods for determining modulus/slope:

- Slope Fit (Automatic)
- Maximum Slope
- Slope Tangent
- Slope Two-Point (Segment Slope, Chord Slope, Secant Slope)

Each of these are described in the following sections.

Slope Measuring Tools

- *Slope Fit & Max Slope*
- *Slope Tangent*
- *Slope Two-Point (Chord Modulus)*

Finds the greatest slope using the Slope Fit algorithm at a scope starting at 0.037% strain and a finish at 0.140% strain.

The elastic modulus is 287303.75 Mpa.

The green line is the slope line.

The blue section on the line represents the data used to find the greatest slope.
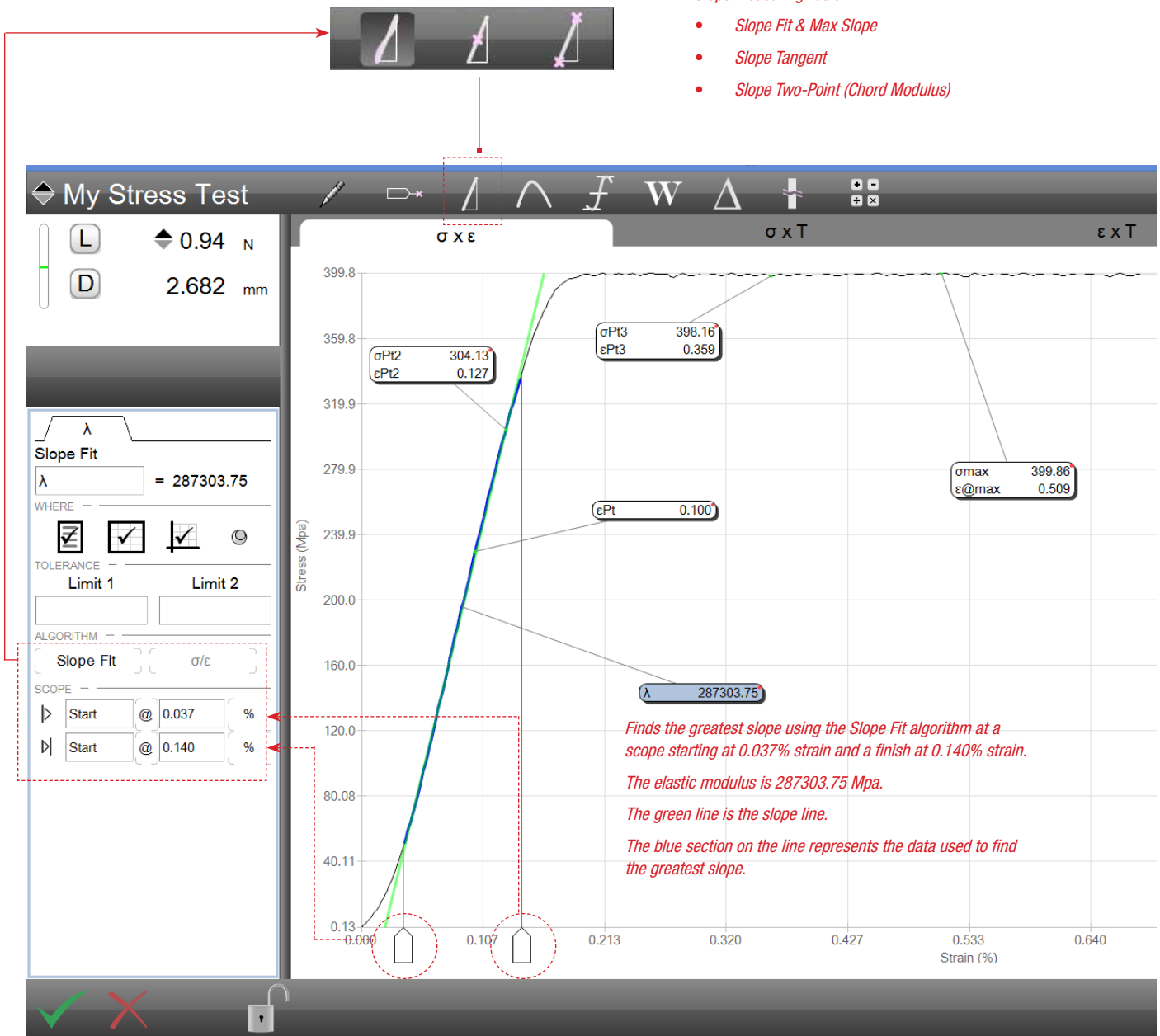
L3 Slope Fit Measurement
Finding the elastic modulus between strain values of 0.037% and 0.140%

3.4.3.1 Slope Fit (Automatic Modulus) Coefficient

The Slope Fit (Automatic Modulus) coefficient for modulus/slope is a quick method that finds the slope on your load-distance graph using an automatic algorithm.

This algorithm evaluates the data points along the curve and looks at a specified number of segments that together form a straight line segment or modulus.

When you use the Slope Fit algorithm, you first perform your test to obtain your graph. Next, select the Slope Fit algorithm. The scope handles appear at the x-axis and default to the Start and Finish of the test data. You can reposition the scope handles to a particular location on the graph in order to obtain the modulus for that specific line segment.

Slope Measuring Tools

- *Slope Fit & Max Slope*
- *Slope Tangent*
- *Slope Two-Point*

Finds the greatest slope using the Max Slope algorithm at a scope starting at 0.087% strain and finishing at the strain of 0.140%.

The elastic is 287303.75 Mpa.

The green line is the slope line.

The blue section on the line represents the data used to find the greatest slope.
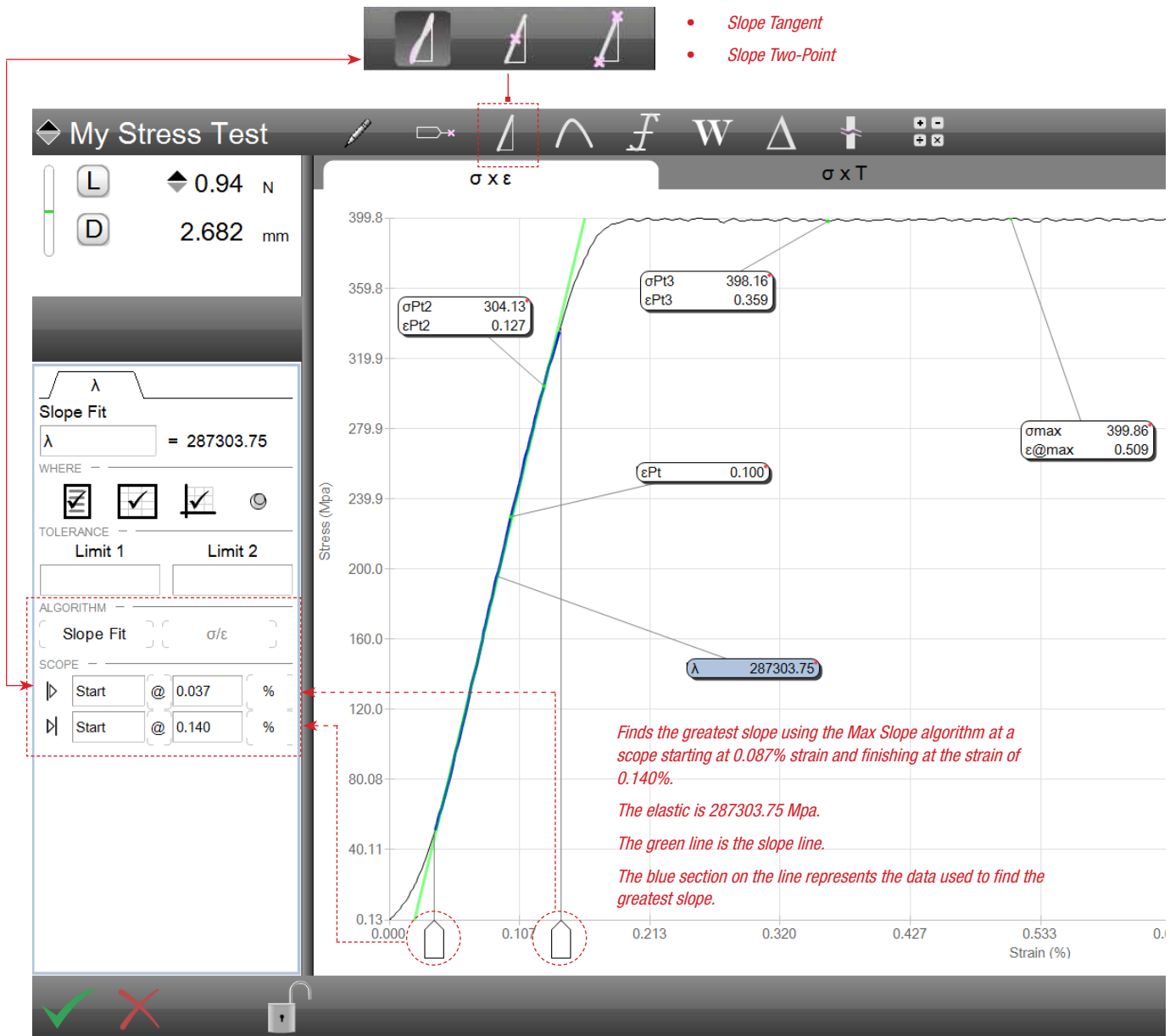
L3 Maximum Slope Measurement

3.4.3.2 Maximum Slope

The Maximum Slope uses the same tool as the Slope Fit algorithm. The Maximum Slope algorithm finds the slope using all of the data within the scope segment. The algorithm uses all of the data and looks for the maximum slope.

The Maximum Slope algorithm differs slightly from the Slope Fit. The Slope Fit uses multiple segments of data and looks for changes within a set number of these segments. The Maximum Slope looks at the data only and doesn't use segmented data.

Slope Measuring Tools

- *Slope Fit & Max Slope*
- *Slope Tangent*
- *Slope Two-Point*

Finds the greatest slope using the Max Slope algorithm at a scope starting at 0.087% strain and finishing at the strain of 0.140%.

The elastic is 298194.66 Mpa.

The green line is the slope line.

The blue section on the line represents the data used to find the greatest slope.
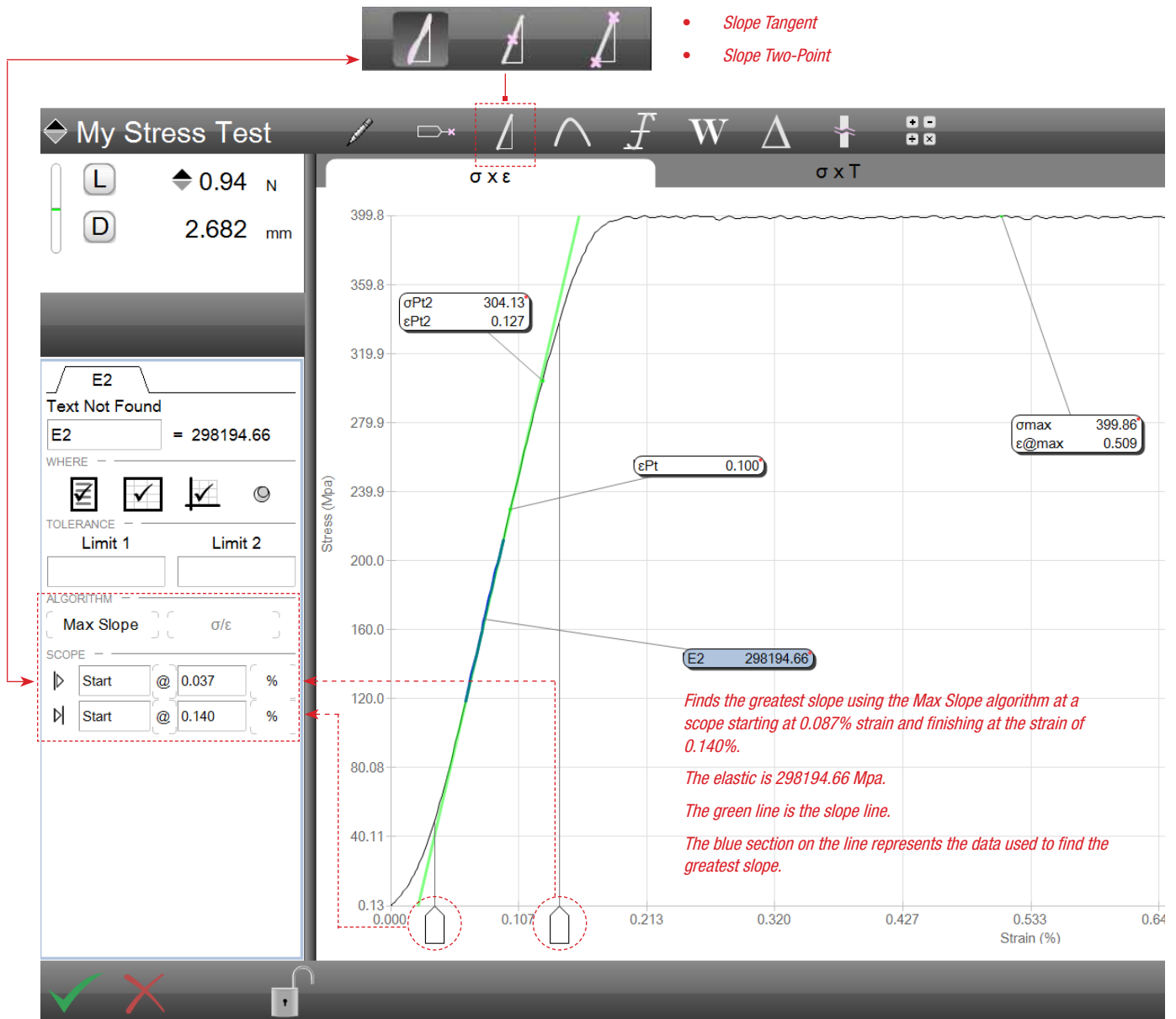
L3 Maximum Slope Measurement

3.4.3.3 Slope Tangent Coefficient

The tangent option lets you find the modulus/slope using a point on the graph and a line segment drawn that is tangent to this point.

And because you cannot draw a slope based on a single point, the tangent option includes an attribute called Leg Length.

The Leg Length value is the number of data points on either end of the point you specified. Using these extra data points, a line segment can effectively be drawn in order to create a tangent line segment and resulting modulus.

Slope Measuring Tools

- *Slope Fit & Max Slope*
- *Slope Tangent*
- *Slope Two-Point*

The σPt coefficient is yellow indicating it is an "anchored coefficient" that is being used to calculate another coefficient, e.g. elastic.

Finds the slope that uses a point (σPt). A line segment is created at this point that is 19 points in length (Leg Length).

The elastic is 290591.90 Mpa.

The green line is the slope line.
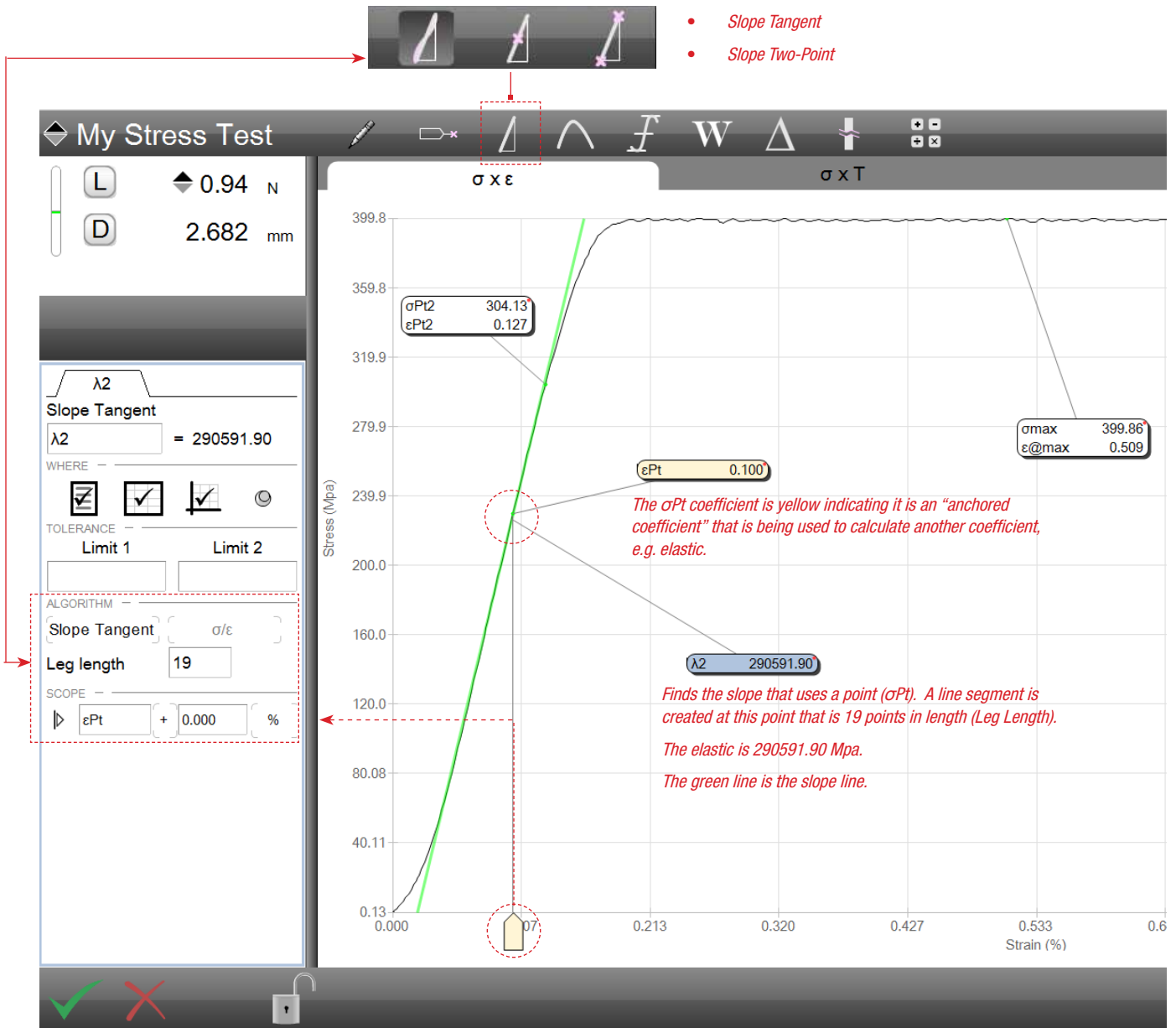
L3 Tangent Modulus Measurement

3.4.3.4 Slope Two Point Segment Coefficient

The two point modulus algorithm allows you to construct a modulus line between two points that you specify.

This method is often used and expressed as Chord modulus or Segment modulus where the line is constructed between two data points.

With the two point algorithm, you position the scope handles at the two points representing the Start and Finish positions for the modulus to be drawn between.

Slope Measuring Tools

- *Slope Fit & Max Slope*
- *Slope Tangent*
- *Slope Two-Point*

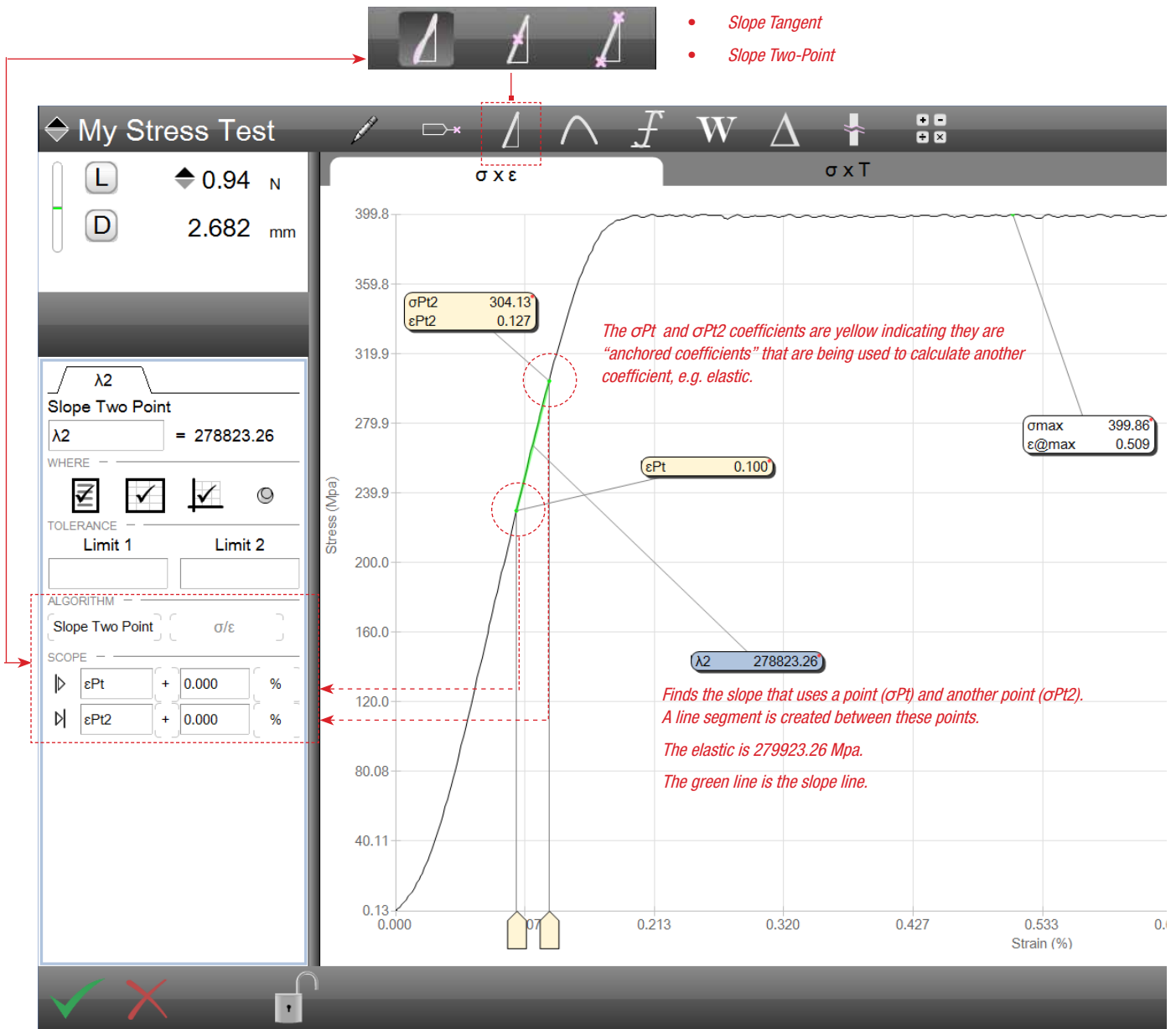*The σPt and σPt2 coefficients are yellow indicating they are "anchored coefficients" that are being used to calculate another coefficient, e.g. elastic.*

Finds the slope that uses a point (σPt) and another point (σPt2). A line segment is created between these points.

The elastic is 279923.26 Mpa.

The green line is the slope line.

L3 Chord Modulus Measurement

3.4.4 Peak & Valley Coefficients

The Peak & Valley coefficients are used with applications that exhibit a cyclic graph form, such as those found in peel and adhesive testing. The Peak & Valley measurements include finding the maximum peak or the minimum valley; the average of selected peaks/valleys; our just simply finding the number of peaks or valleys based on load sensitivity.

When Peak results are required, you will select above the graph curve. Selecting below the graph curve will deliver valley results.

Sensitivity is used to specify the region that defined a peak or valley. Sensitivity is associated with the load data and is represented as a percent value of the load data for the graph.
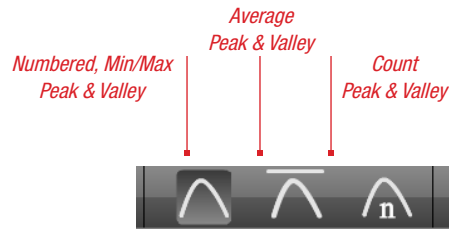
Sensitivity is a percent of the load where the measured load data on either side of the peak or valley are equal to or less than the Sensitivity setpoint. If the Sensitivity = 10, the data stream within the scope range is analyzed and the peak or valley is identified where the load on the incline side of the peak was 10 and the opposite side of the peak was also 10. If the incline side was 10 and the decline side was 9, the data segment would not qualify as a peak or a valley.

Sensitivity is used to evaluate a graph curve and identify the data points within the data stream that increase and decrease at the sensitivity value you are using or at a value greater than the specified sensitivity.

NOTE
Load Sensitivity is used to define what qualifies as a peak or a valley. The two sides of the peak or valley must be equal to or less than the Sensitivity setpoint.

Average Peak & Valley

Numbered, Min/Max Peak & Valley

Count Peak & Valley

L3 Peak Measurement on an adhesive test

The blue lines indicate the part of the graph that satisfy a 30.8 sensitivity. This means that this portion of the graph increased and decreased by a load percentage of 30.8 or more.

The maximum load is then indicated by the marker at 5.09N.
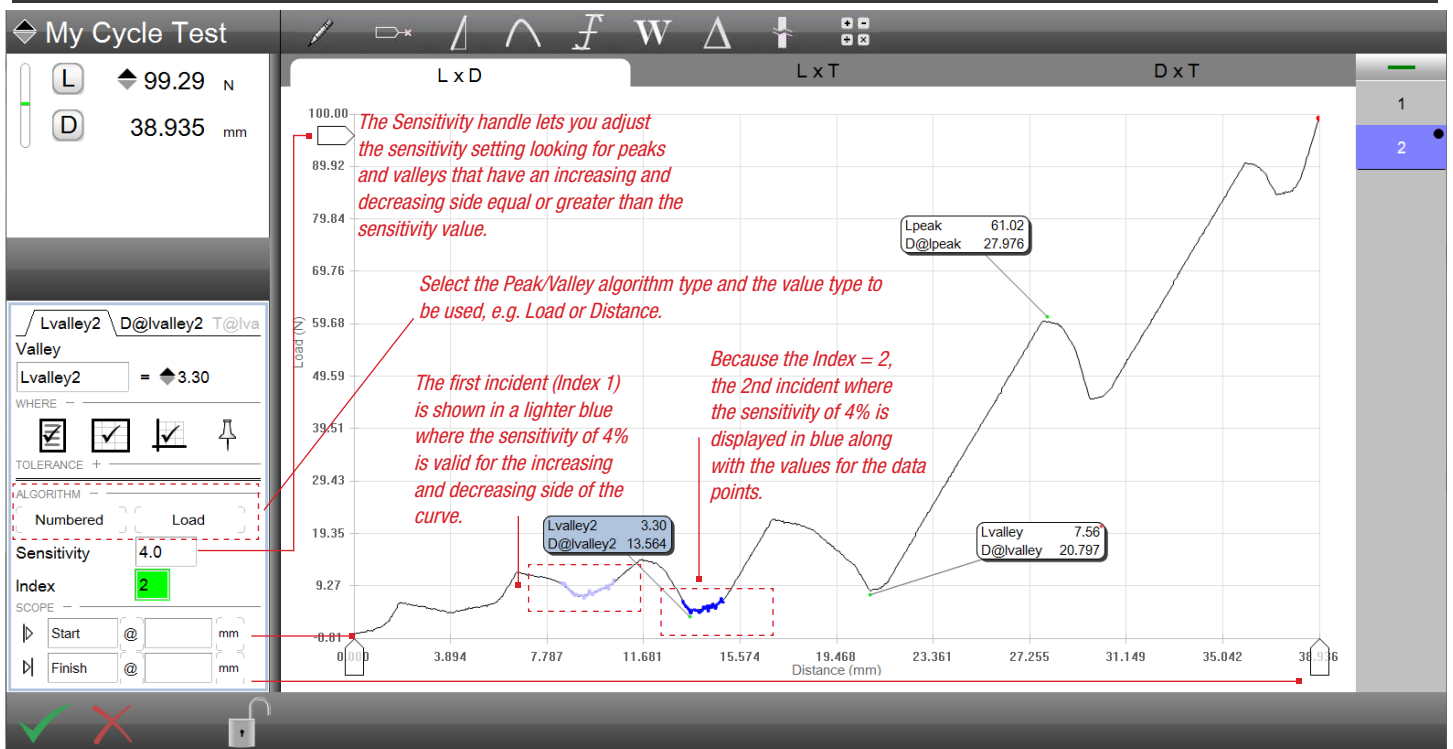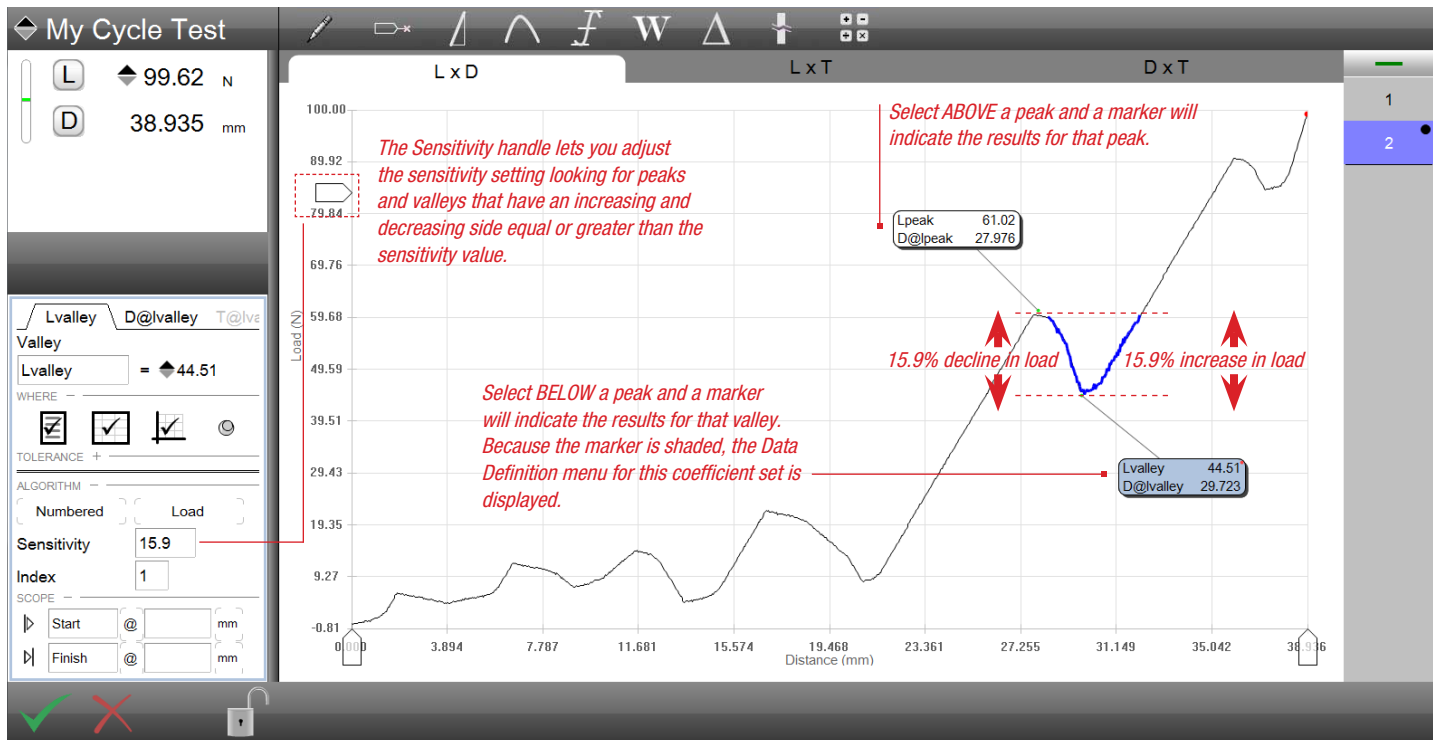
3.4.4.1 Numbered Peak/Valley Coefficient

The Numbered Peak/Valley coefficient reports the peak when you select above a peak on the graph or the valley when you select below a valley on the graph.

Use the sensitivity holder to move upward to reduce the sensitivity. When you decrease/increase the sensitivity the L3 Series software will find the peak or valley that meets the sensitivity setting and highlight that location on your graph in blue.
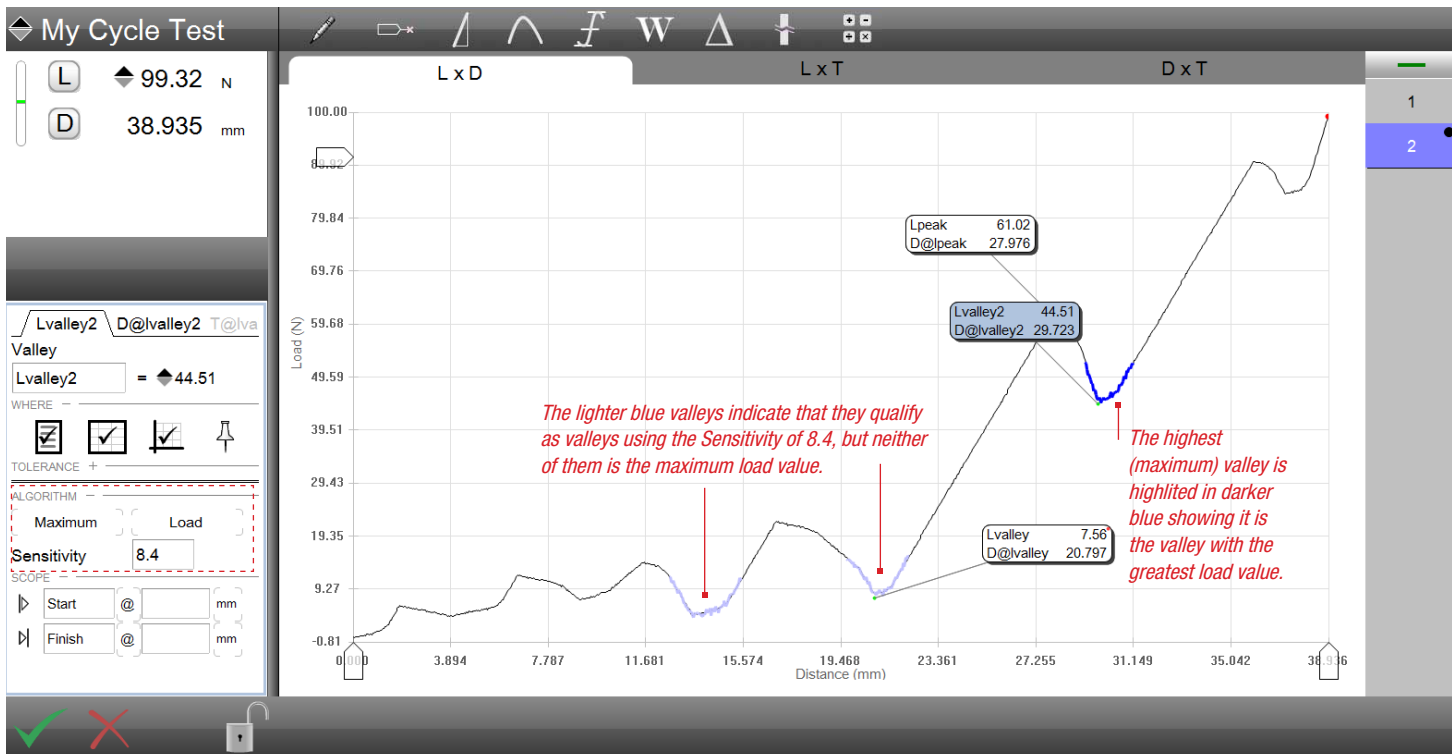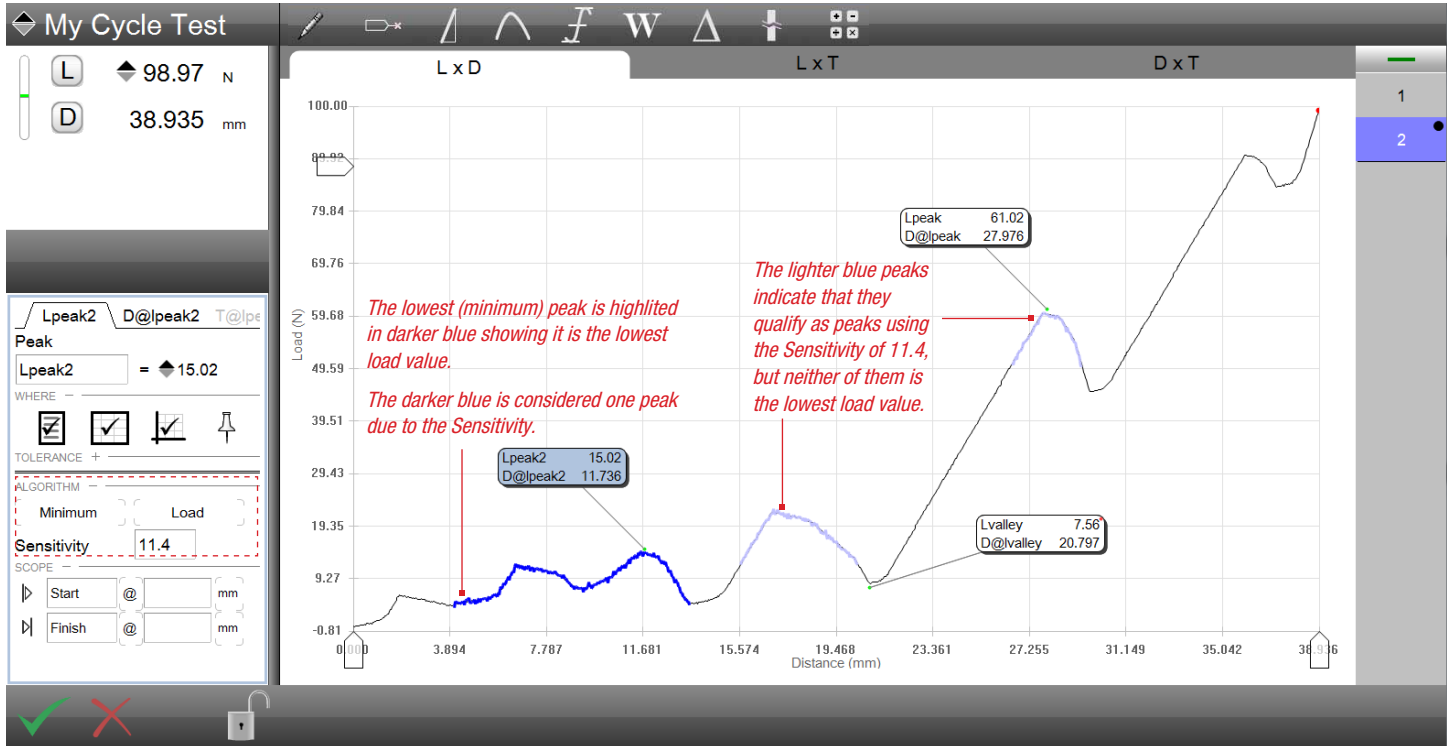

L3 Graph Peak & Valley
Shows a Numbered Valley with a Sensitivity of 4%

3.4.4.2 Peak/Valley Maximum/Minimum Coefficient

This algorithm for peaks & valleys finds all of the peaks or all of the valleys within the scope range you specify for your test that satisfy the sensitivity setting.

Selecting above the graph will display the Minimum results while selecting below the graph will display the Maximum results.

All peaks and all valleys are displayed when using this algorithm.

L3 Graph Peak & Valley
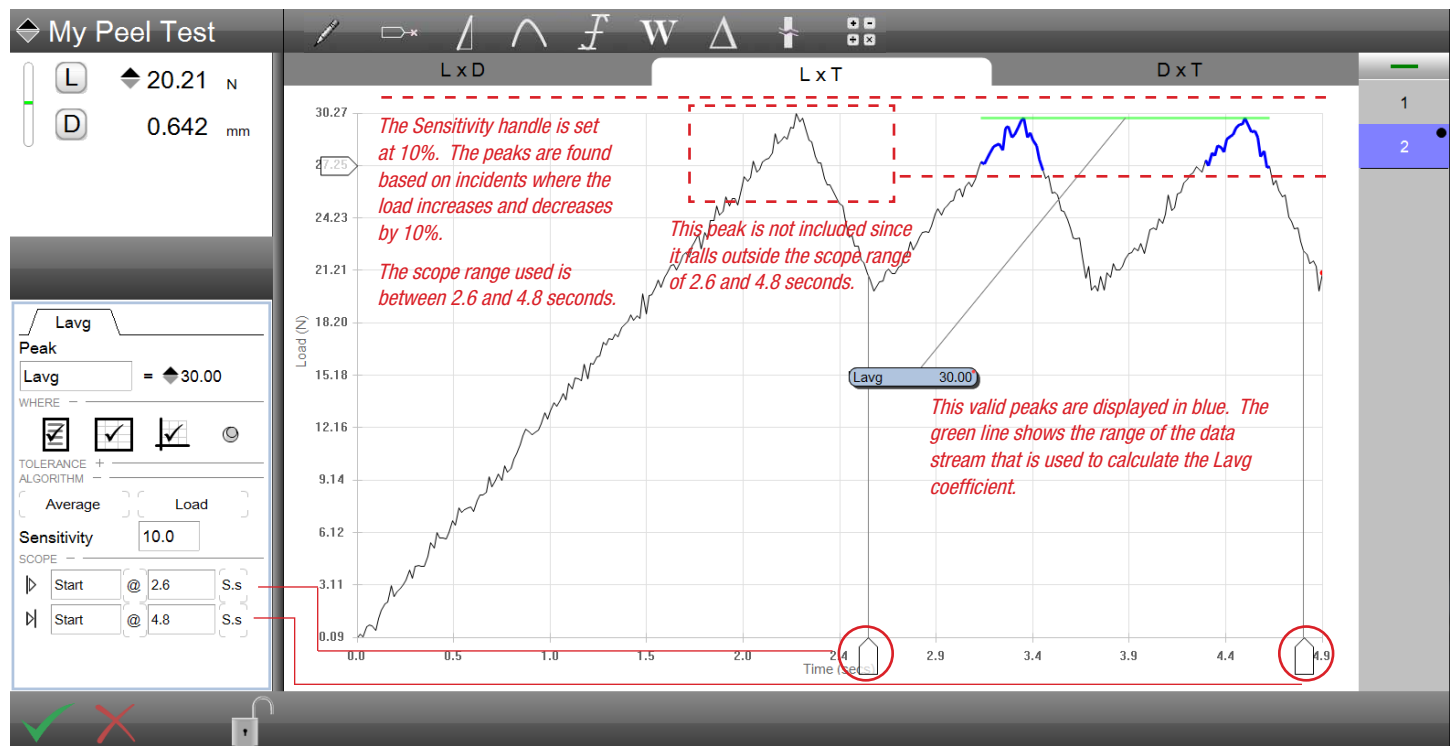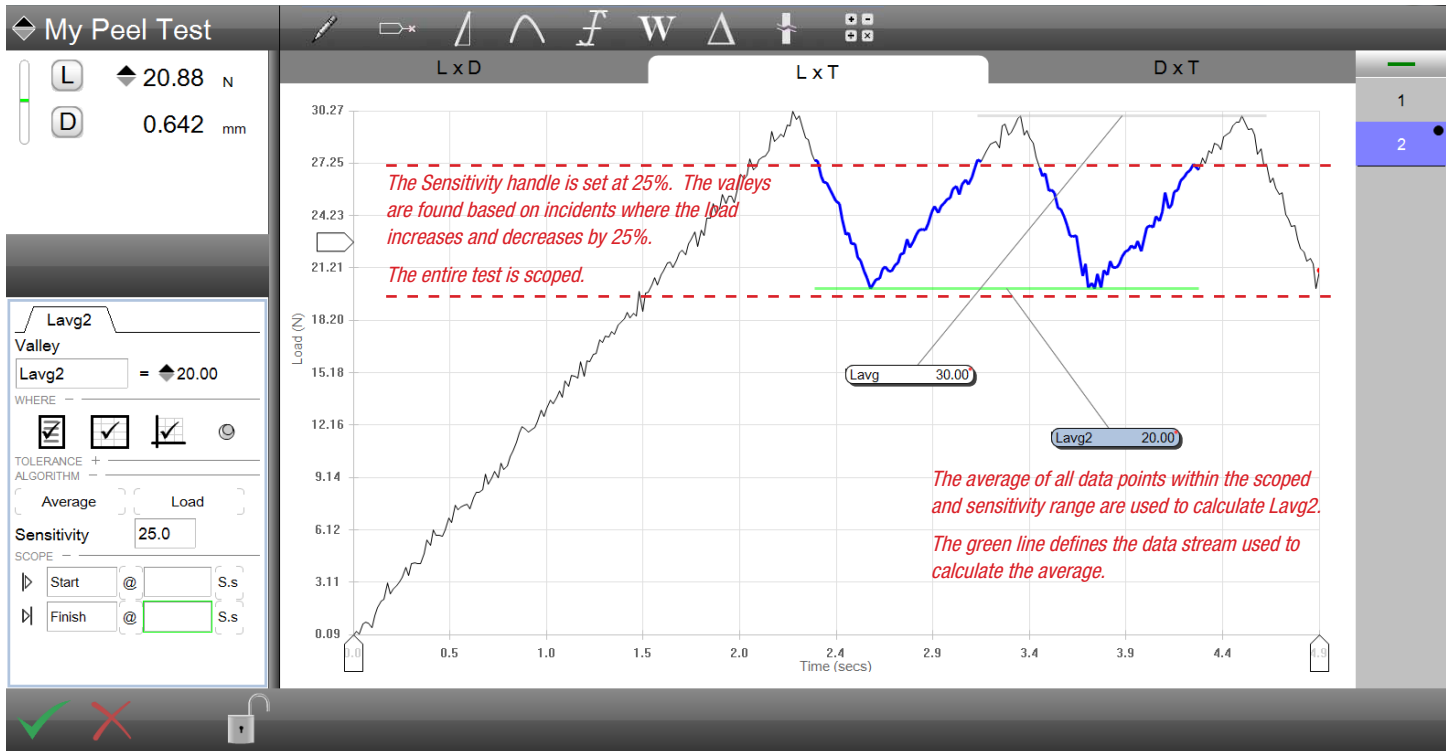*Shows Minimum and Maximum Peaks*

3.4.4.3 Peak/Valley Averaging Coefficient

The Averaging coefficient for peaks and valleys lets you find the average load, stress, distance or strain for all peaks and valleys or for peaks and valleys within a range.

For example, you may get the average load of all peaks within a peel test graph, or specify the average of selected peaks within the data stream of your test.

Above
L3 Peak & Valley test showing Average Valleys

Bottom
L3 Peak & Valley test showing Average Peaks

The Sensitivity handle is set at 25%. The valleys are found based on incidents where the load increases and decreases by 25%.

The entire test is scoped.

The average of all data points within the scoped and sensitivity range are used to calculate Lavg2.

The green line defines the data stream used to calculate the average.

The Sensitivity handle is set at 10%. The peaks are found based on incidents where the load increases and decreases by 10%.

The scope range used is between 2.6 and 4.8 seconds.

This peak is not included since it falls outside the scope range of 2.6 and 4.8 seconds.

This valid peaks are displayed in blue. The green line shows the range of the data stream that is used to calculate the Lavg coefficient.
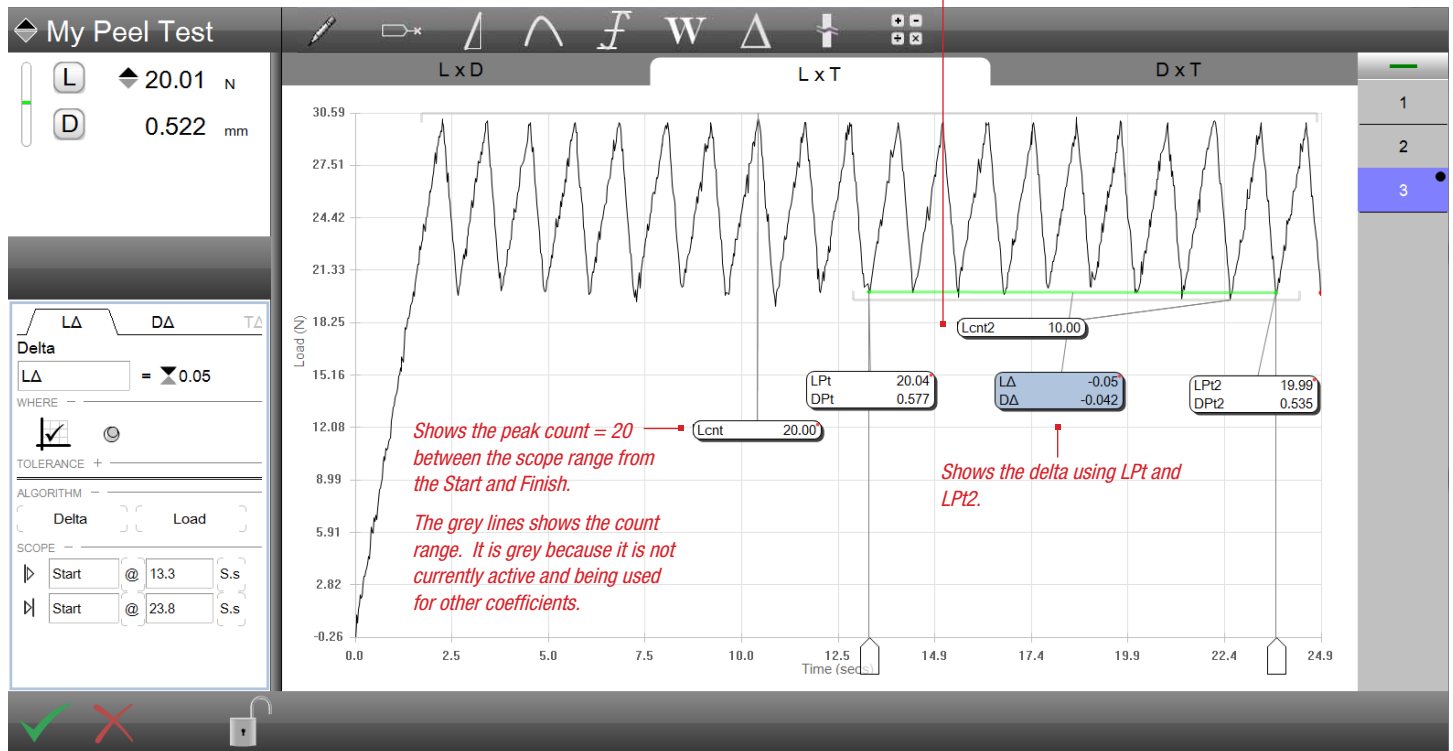
3.4.4.4 Peak/Valley Count Coefficient

The Count coefficient counts the number of peaks or valleys within your test or within your specified scope range.

Sensitivity is used to define what is classified as a peak or a valley.

You can use the peak or valley numbers as anchors to calculate delta or averages. For example, you may want to calculate the delta in load between the first peak and the 10th peak within your test range.
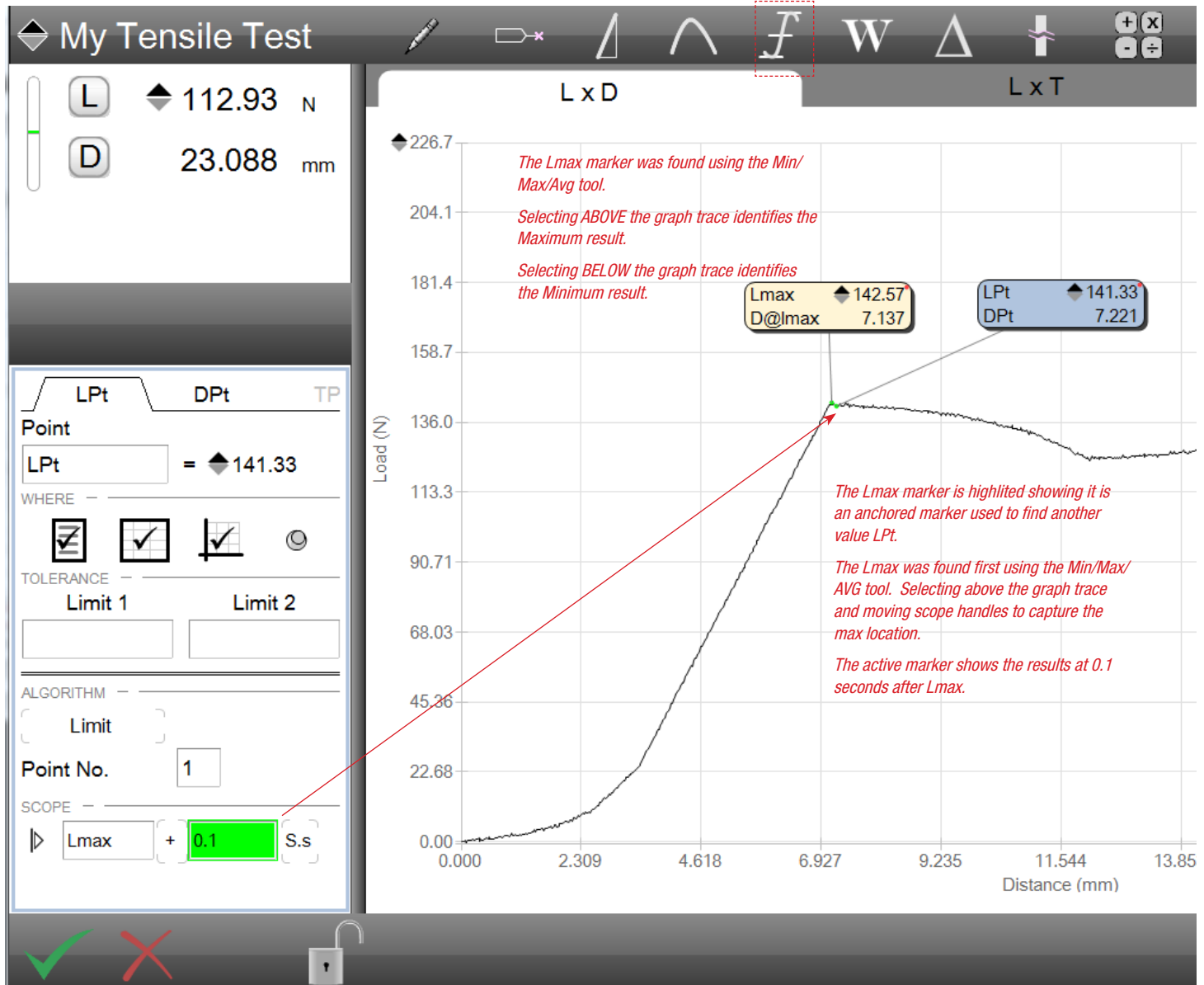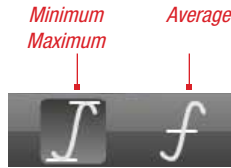

Shows the valley count = 10 between the scope range of 13.3 and 23.8 seconds.

The green lines shows the count range.

Shows the peak count = 20 between the scope range from the Start and Finish.

The grey lines shows the count range. It is grey because it is not currently active and being used for other coefficients.

Shows the delta using LPt and LPt2.

L3 Peak & Valley test showing Counts for the number of valleys in a scope range
Delta load is calculated between the first and last valley within the range

3.4.5 Minimum/Maximum/Averaging Coefficients

The Min/Max/Avg result is likely one of the most frequently used coefficients. It allows you to find the maximum values within a test or a range such as tensile strength or bulk strength.

And like the example shown below, the maximum or minimum values from this coefficient may be used as an anchor on which to determine other values within your data stream, such as the load or stress 100mS after the maximum load or stress.


Minimum
Maximum

Average

My Tensile Test

L x D

L x T

L ♦ 112.93 N

D 23.088 mm

The Lmax marker was found using the Min/Max/Avg tool.

Selecting ABOVE the graph trace identifies the Maximum result.

Selecting BELOW the graph trace identifies the Minimum result.

| Lmax | ♦142.57 |
| D@lmax | 7.137 |

| LPt | ♦141.33 |
| DPt | 7.221 |

LPt   DPt   TP

Point

LPt   = ♦141.33

WHERE —

TOLERANCE —

Limit 1   Limit 2

ALGORITHM —

Limit

Point No.   1

SCOPE —

▷ Lmax + 0.1 S.s

The Lmax marker is highlited showing it is an anchored marker used to find another value LPt.

The Lmax was found first using the Min/Max/AVG tool. Selecting above the graph trace and moving scope handles to capture the max location.

The active marker shows the results at 0.1 seconds after Lmax.

L3 Tensile test
Using Lmax marker, calculated the load at 1 second after the maximum

3.4.5.1 Minimum/Maximum Coefficients

The Min/Max algorithms find the minimum or maximum results for your test range. Your test range can be the entire test or a segment within your test that you scope.

To find the minimum result, select below the graph and a marker showing the Lmin is displayed with the associated Distance value.

To find the maximum result, select above the graph and a marker showing the Lmax is displayed with the associated Distance value.
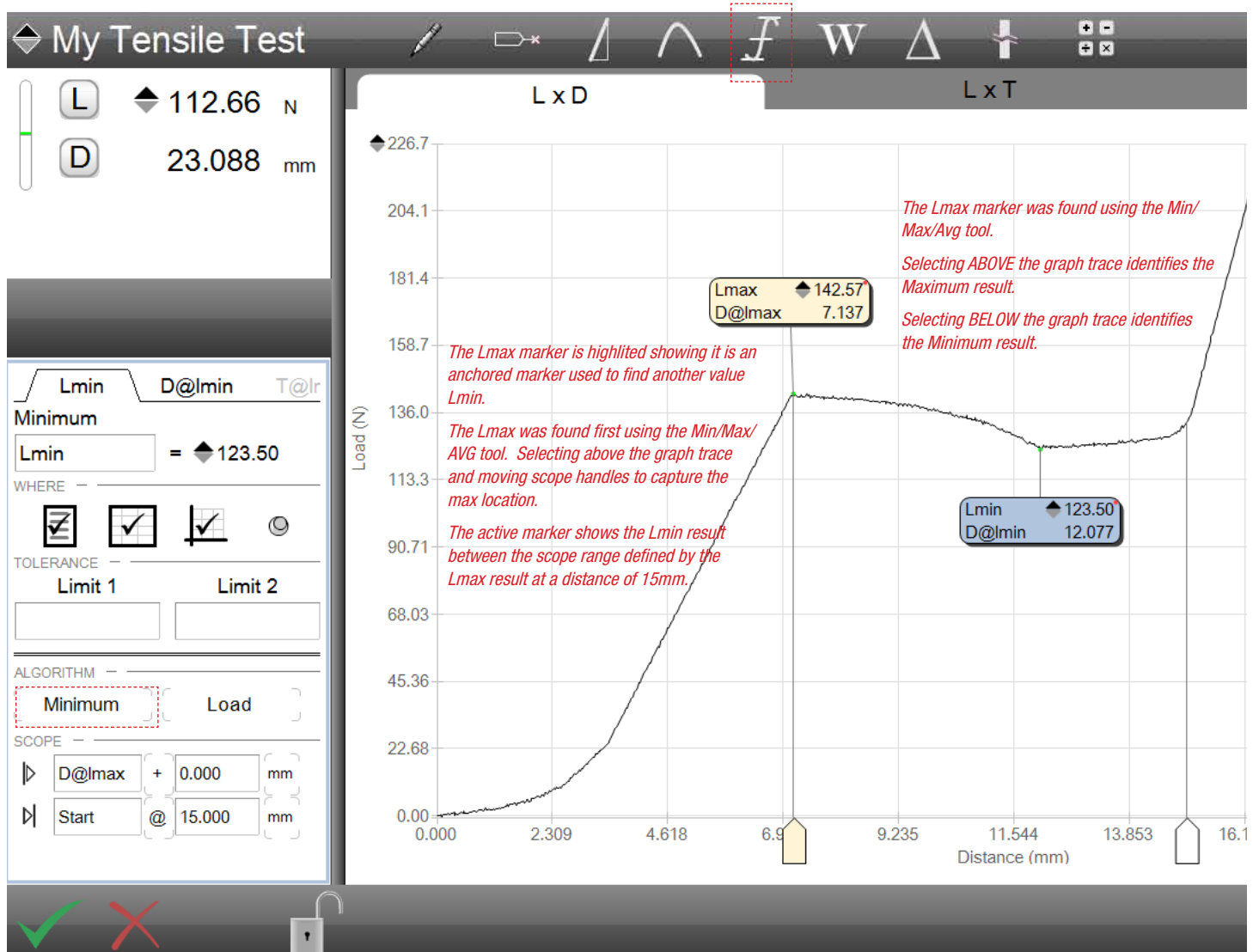
L3 Tensile test
The Lmin was found by selecting below the graph trace

3.4.5.2 Averaging Coefficient

The Average algorithm should be used on non-peak & valley graphs where you are interested in determining the average load, stress, strain and distance.

NOTE

Peak & Valley analysis has its own unique averaging tool.

When the Average algorithm is used, scope handles appear. These scope handles may appear as a single handle because they are presented initially one atop the other.

Moving the scope handle will present the other handle. A green line is drawn showing the portion of the data stream that is being used to calculate the average.

The average is calculated using all of the data points defined by your scope range.

The average load (Lavg) of 207.53N is calculated from all of the data points between the Lmax and Lmin markers. Both markers are highlited showing them as anchored to the Lavg marker.

A green line is displayed showing the range being used to calculate the average result.

The Start (first) scope position is the D@Lmax marker.

The Finish scope position is the D@Lmin marker.
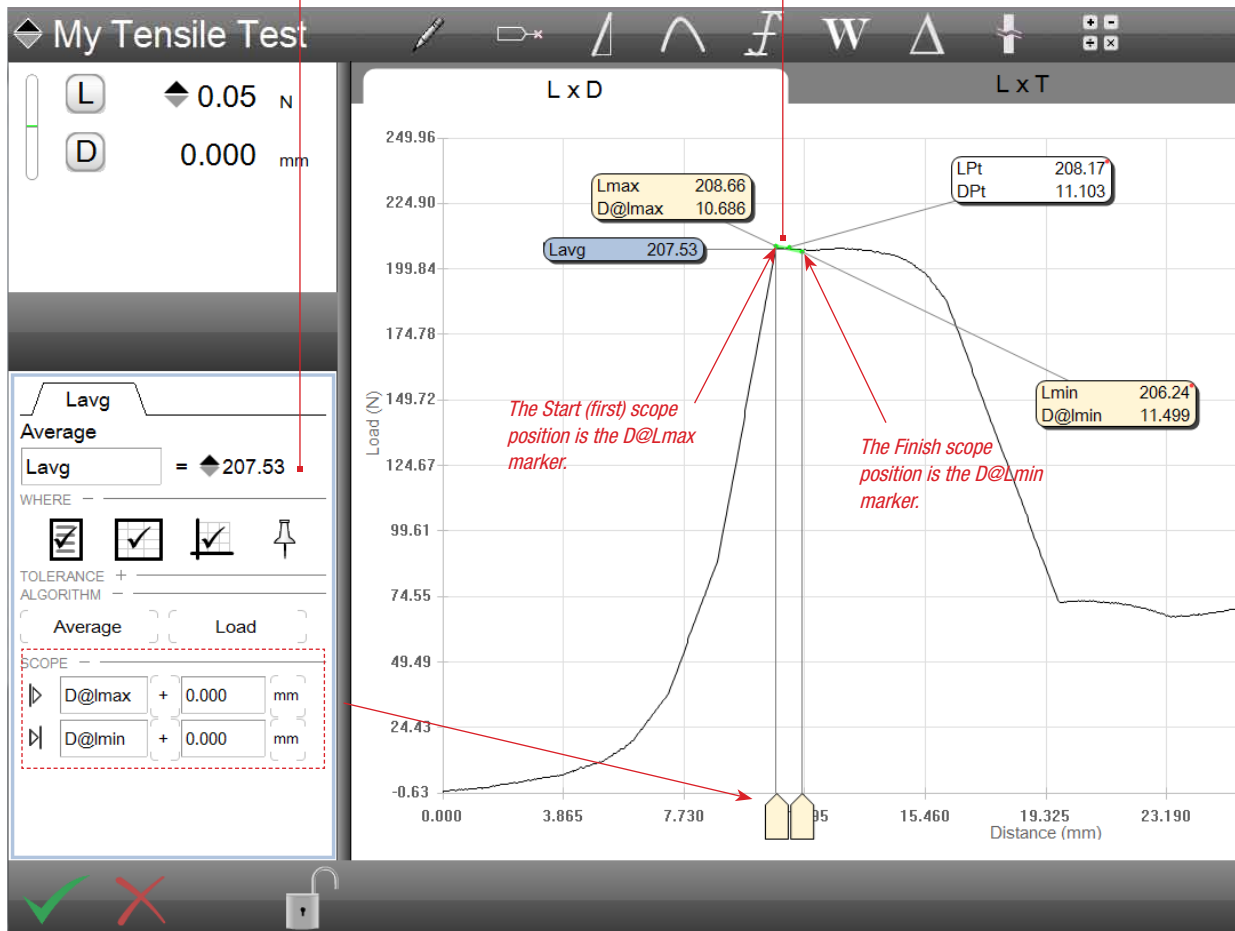
L3 Tensile test
Finding the Average load between D@Lmax and D@Lmin

3.4.6 Work Coefficient

Work or sometimes referred to as Energy is used to determine the resilience of a material.

Work is calculated as the area under the graph. The area may be calculated for the entire test range or to a scope range you specify.
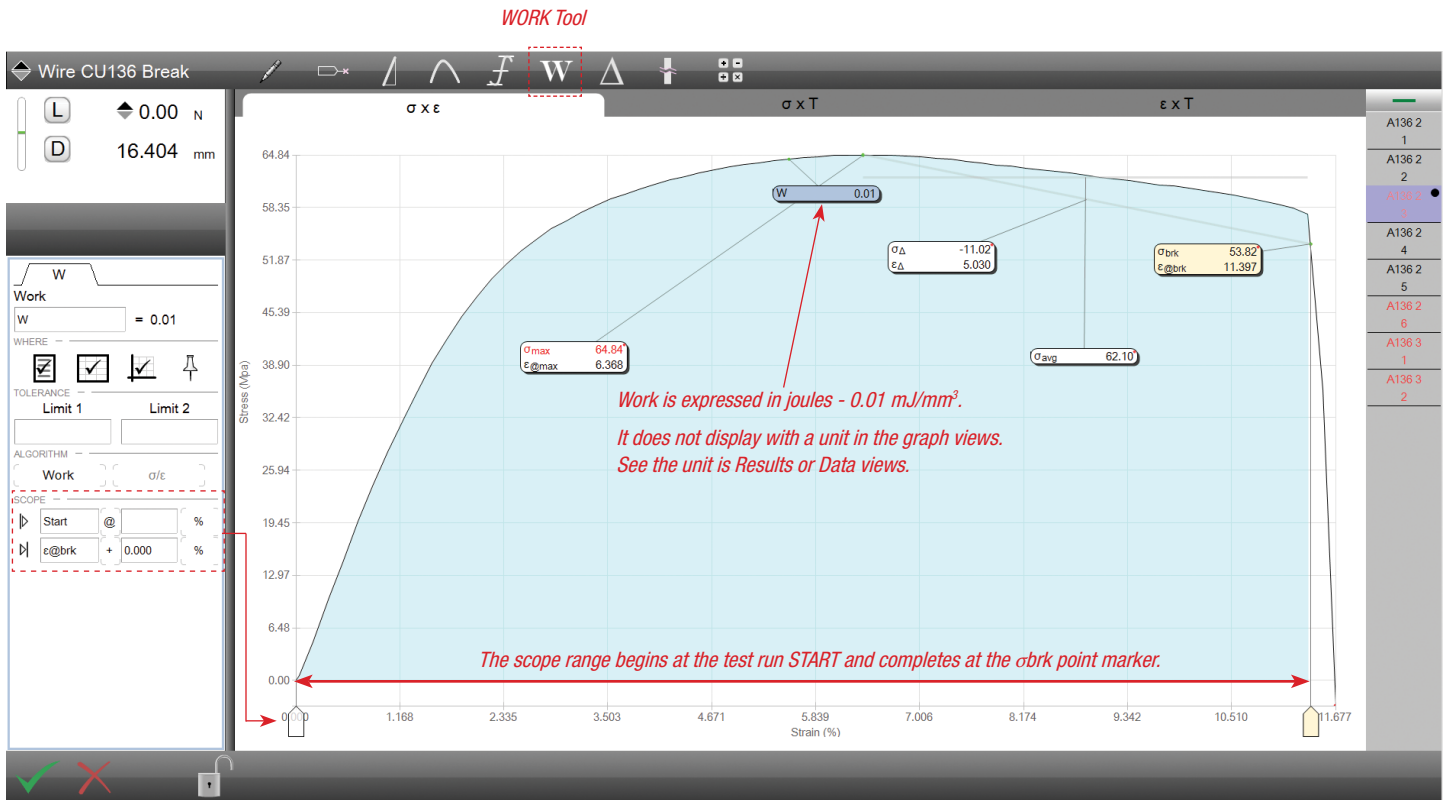
See page 13 for the units of measure available for Work.

Select the Work graph analysis tool. Next, select below the graph. Arrange the scope handles to the range you are interested. The area is displayed in blue.

NOTE
1 joule equals 1000 newtons millimeter

L3 Tensile test
Finding the Energy from the Start of the test to D@Lmin expressed as 0.61 joules

3.4.7 Delta Coefficient

The Delta coefficient is used to determine the differences between two values. This difference may be constructed from within a test using the scope range. Or, you may use the overlay feature and determine the differences between points on two separate graphs within the same test setup.

Select the Delta graph analysis tool. A green line is automatically drawn from the Start to Finish scope positions. Adjust the scope handles to the locations you want to determine the delta.

You can determine the delta between markers and between a marker and a point of the graph without a marker.

If using overlays, first specify the overlay function by pressing the single green bar above the Runs List. Next, select your two runs you want to compare.

Next, select the Overlay analysis tool, then use the Point tool to measure the delta along the two graphs.
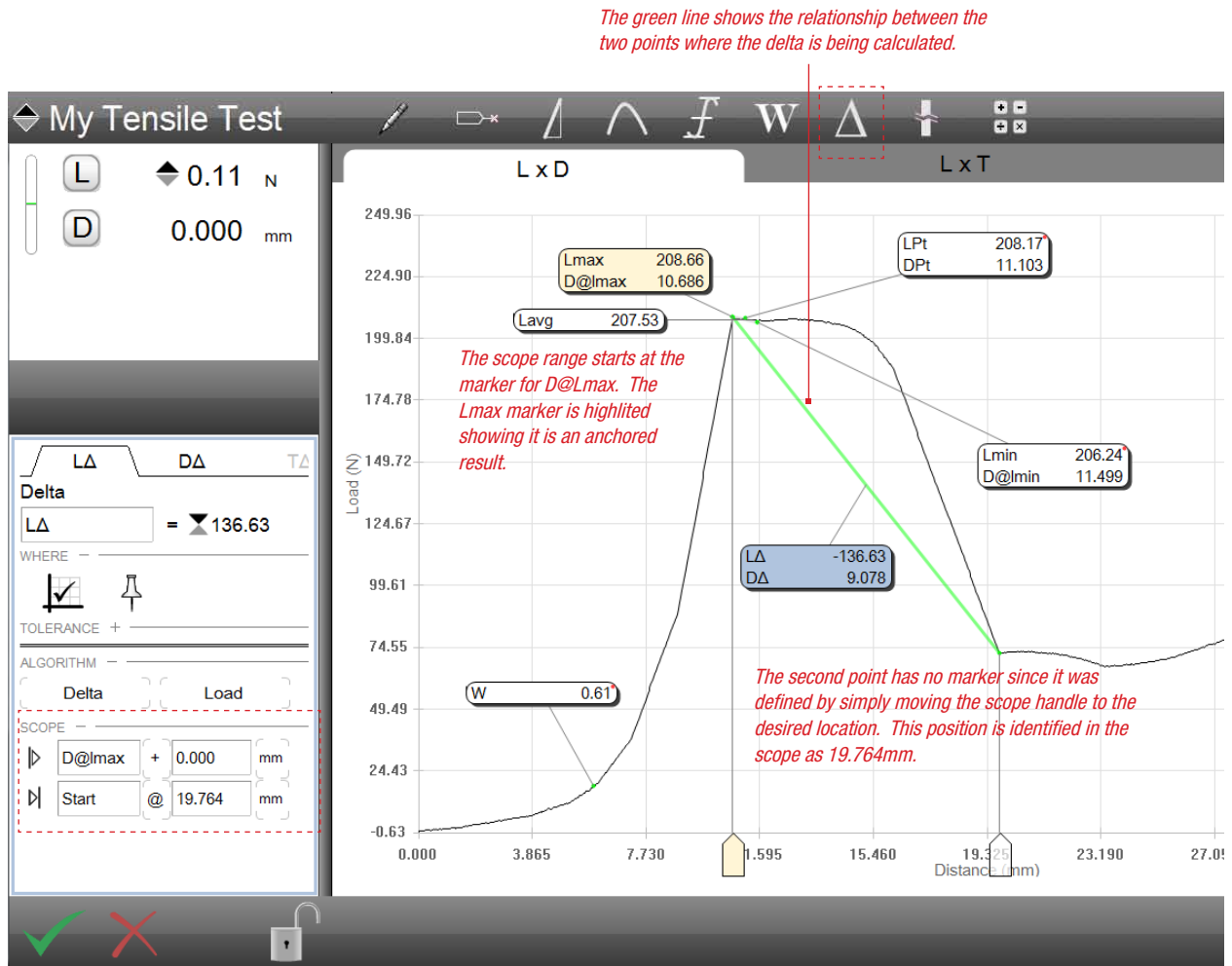
L3 Tensile test
Finding the Delta between marker D@Lmax and a point on the curve

3.4.8 Break Coefficient

The Break tool features two methods for identifying a material break: %Drop and Rate.

Break testing identifies when the material fractures or ruptures and provides a curve that can be used to identify the maximum stress, strain, load or distance prior to the break event.

Both forms for break identification may be used in either tensile or compressive directions.

3.4.8.1 Break %Drop Coefficient

The Drop % algorithm is the more commonly used method for determining a sample break.

This method first looks for the maximum stress or load. Once the maximum load is determined, the algorithm next looks for a % drop in load. So, if the maximum load was measured as 100N, and the load dropped to 80N, that is a 20% drop in load.

The % Drop method is used in the L3 test setup steps for both tensile and compressive limits. This terminates or completes a test run when the maximum load is measured and the load drops be the specified percent value.
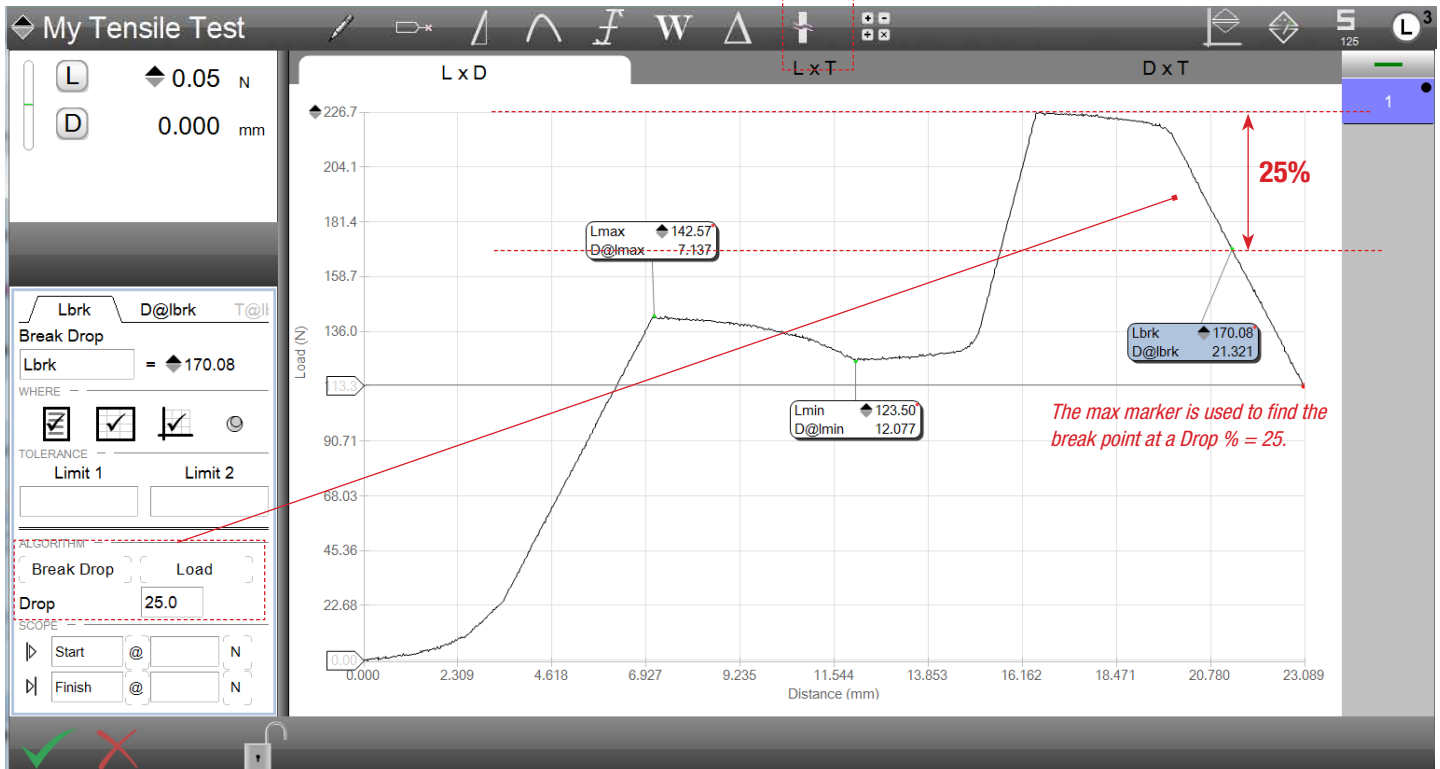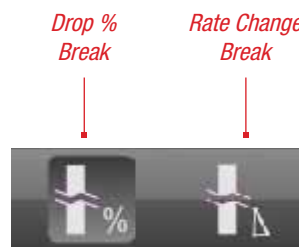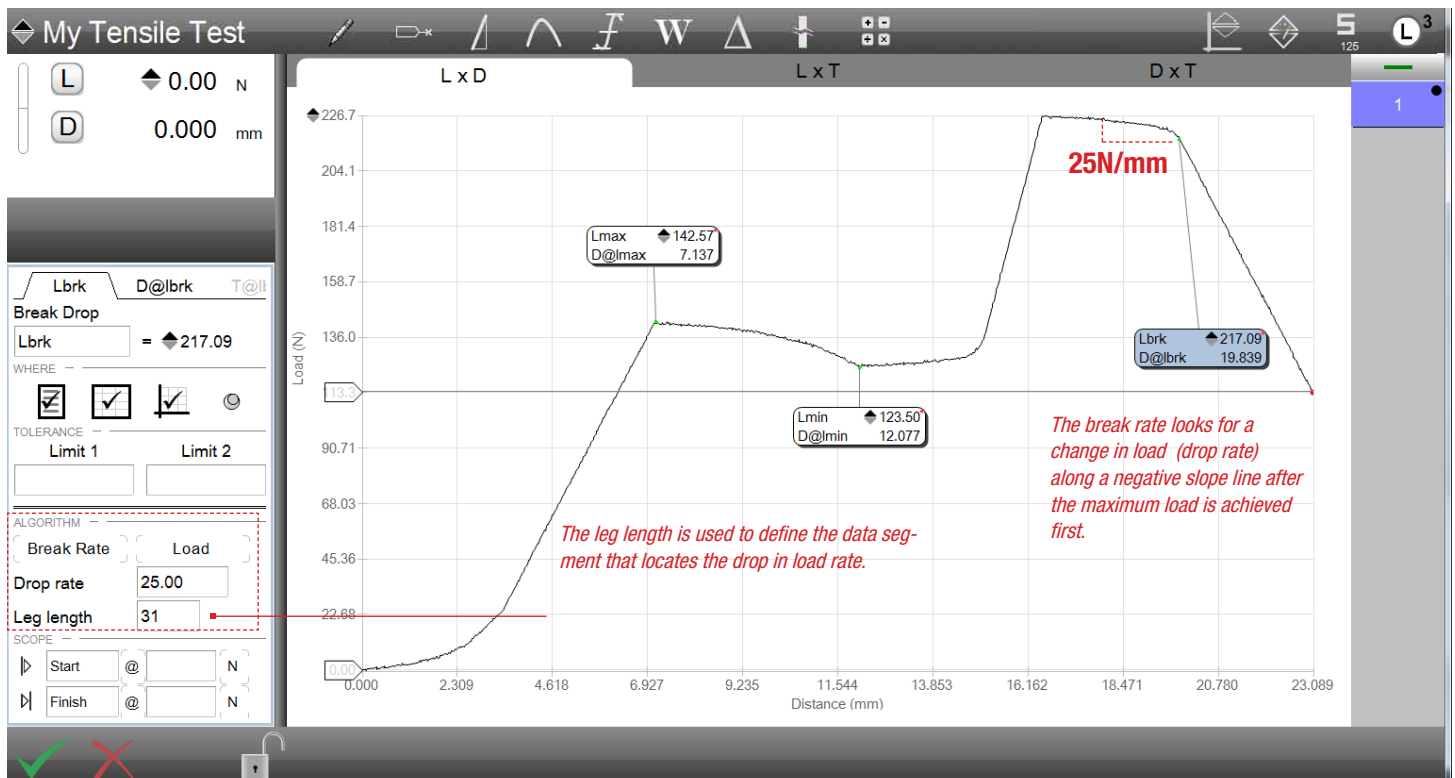

L3 Break Test
Using %Drop method for determining the break load

3.4.8.2 Break Rate Coefficient

The Break Rate algorithm looks at the slope along the stress-strain curve to determine the break point. Using a user-defined break rate, the algorithm first finds the maximum load point. After this point, the algorithm looks for the first occurrence where the break rate appears and marks that point as the break point.

The Break Rate is determined as the change in load divided by the change in distance. So, if the Break Rate is 25, the break result is the point in the data stream where the load rate changed at a rate of 25N/mm.

The Leg Length is used to help counter any noise issues along the graph trace. A Leg Length of 31 uses one point along the slope created by the Break Rate point and then 15 points on either side to create a slope line.

L3 Break Result
Shows Break point using Break Rate algorithm

3.5   Offline Test Creation

Test setups will appear in red text if the test was created on a system that is improperly licensed, or a system that is incompatible with your version of L3 software.

If a test setup is created on a computer that is not connected to a Starrett test frame, or if the test is created on an illegal computer with unlicensed software, the test setup will appear in the main test menu, but it cannot be opened.

NOTE
Test setups may only be created on a licensed computer for use with L3 software.

If a test is imported from an unlicensed L3 system, the test setup will display in red text.
The test cannot be opened unless the computer is licensed for L3 software.
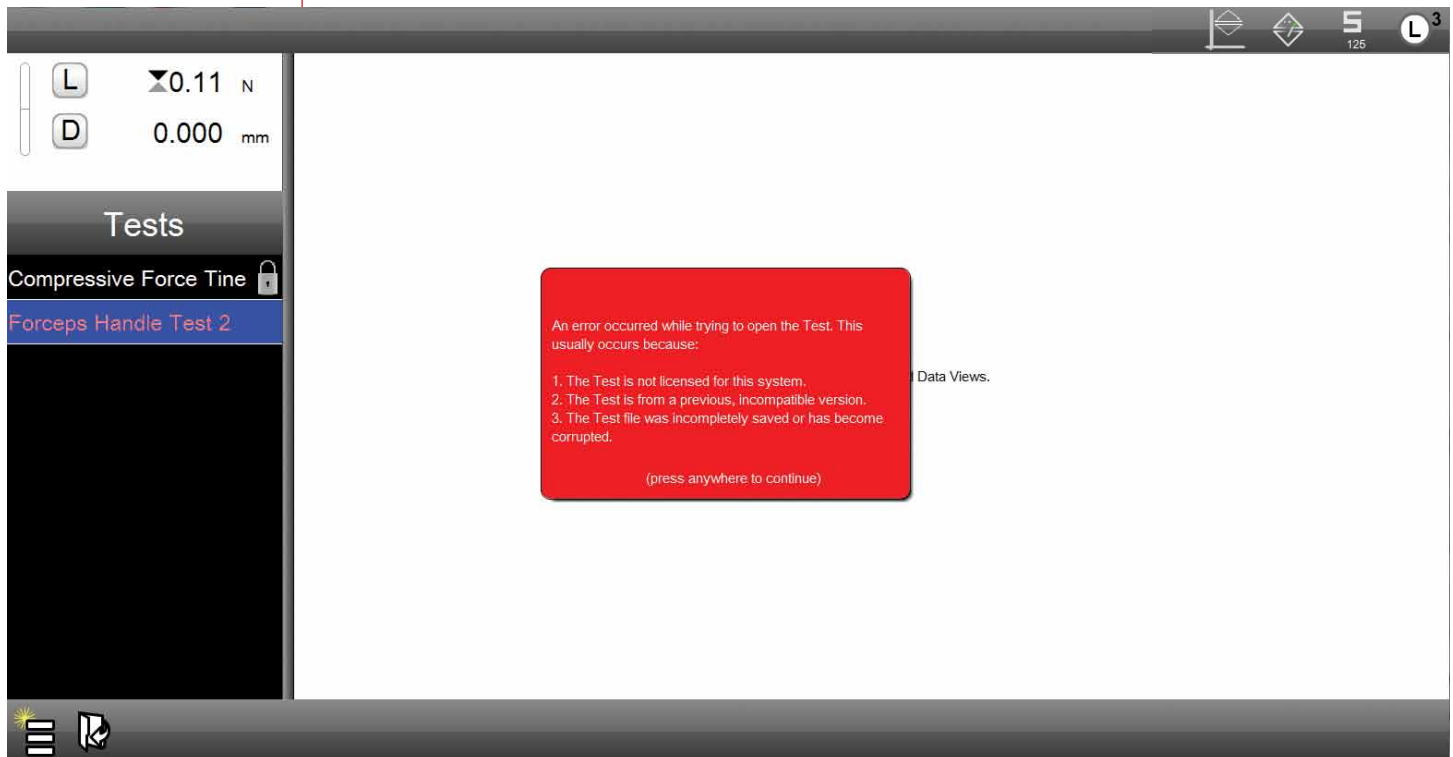
L3Test Setup Menu
Shows Unlicensed Test Setup

FORCE MEASUREMENT SOLUTIONS