S2 Series
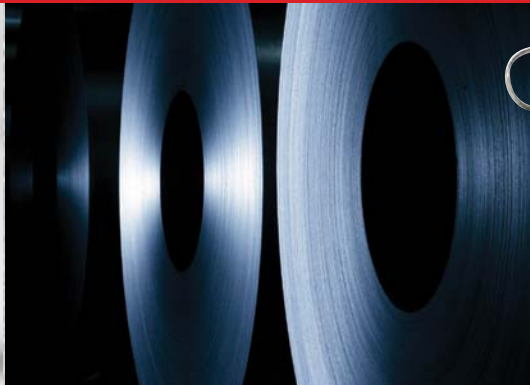## SMS Series Spring Testing System for Compression and Extension Springs

User's Guide

Starrett®

The Better Solution

Starrett®

Table of Contents

General Safety Precautions

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

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

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

• EN61010-1 Safety Requirements for Electrical Equipment

• EN61000-6-3 EMC Generic Emissions Standard

• EN61000-6-1 EMC Generic Immunity Standard

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

Warnings

The testing of springs is inherently dangerous.

Always make sure to properly secure the spring being tested. And always wear appropriate eye protection whenever testing any material that may fracture during a testing procedure.

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

Flying Debris

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

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

Electrical Hazard
• Disconnect equipment from the electrical power supply before removing any electrical safety covers.

• Disconnect power when replacing fuses.

• Never reconnect power while the covers are removed.

• Never operate the system with protective covers removed.

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

1.0 Introduction

Thank you and congratulations for selecting the Starrett SMS Series software for your spring measurement testing.

Your SMS testing system may be used for compression or extension spring testing and more. Your SMS testing system should be used with Starrett equipment and accessories only. For optimum performance, your SMS testing system should be maintained and serviced annually by an authorized Starrett representative.

SMS Series - Specifications				
Specification	SMS500	SMS1000	SMS2500	SMS5000
Load Capacity	500 N 112 lbf 50 kgf	1000 N 225 lbf 100 kgf	2500 N 560 lbf 250 kgf	5000 N 1124 lbf 500 kgf
Crosshead Travel	15 in 381 mm	30 in 762 mm	40 in 1016 mm	40 in 1016 mm
Test Speed Range	0.001 to 50 in/min 0.02 to 1270 mm/min			
Speed Accuracy	+/- 0.2% of set speed			
Distance Accuracy	Better than 0.02% (no load)			
Load Measurement Accuracy	FLC Sensors: +/- 0.1% Full Scale MLC Sensors: +/- 0.5% of reading. Meets or exceeds ASTM E4, ISO 7500/1			
Throat Depth	4.25 in (108 mm)			
Height	32 in (813 mm)	50 in (1270 mm)	62 in (1575 mm)	62 in (1575 mm)
Width	15 in (381mm)			
Depth	20.25 in (514 mm)			
Weight	135 lbs 61 kg	170 lbs 77 kg	195 lbs 88 kg	195 lbs 88 kg
Input Voltage	85 - 264 Vac			
Operating Temp	+50° to +100°F (+10° to +38°C)			
Storage Temp	-40° to +150°F (-40° to +66°C)			
Humidity	+10 to +90% Non-condensing			
CE Compliant	Yes	Yes	Yes	Yes

The Starrett SMS Series -
Single-column Spring Measurement Systems

SMS5000

1.1   System Description

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

Column

Crosshead

Load Cell Sensor

Top Test Fixture

L2 Controller

Bottom Test Fixture

Base Plate

Emergency Stop

Start/Stop Button

1.2   System Safety and Labeling

ISO and ANSI safety labels are affixed to Starrett equipment to alert users and operators of the equipment about warnings and cautions. System users should obey all warnings and cautions and should be trained on the safe operation of this equipment by an authorized Starrett representative.

Definition	Type	Description
Electrical Hazard	ISO	Indicates that an electrical hazard exists from high voltage or electrical current.
Electrical Hazard	ANSI	Indicates that an electrical hazard exists from high voltage or electrical current.
Electrical Fuse Warning	ISO	Indicates an electrical hazard exists. Advises to disconnect power before changing fuses and to use only factory specified fuse.
Electrical Fuse Warning	ANSI	Indicates an electrical hazard exists. Advises to disconnect power before changing fuses and using only factory specified fuse.
Rotating Machinery Hazard	ISO	Indicates that a rotating hazard exists. Keep clear of rotating parts. Do not operate with covers or leadscrew blinds removed.
Rotating Machinery Hazard	ANSI	Indicates that a rotating hazard exists. Keep clear of rotating parts. Do not operate with covers or leadscrew blinds removed.
Ground Stud	ISO	Indicates location of ground stud.

1.3   Product Support

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

2.0   Using the Spring Test Templates

Test templates are designed to let you create a test in as few as two steps. Your S2 software contains two (2) types of Spring Test Setups: Compression Spring Test and an Extension Spring Test.
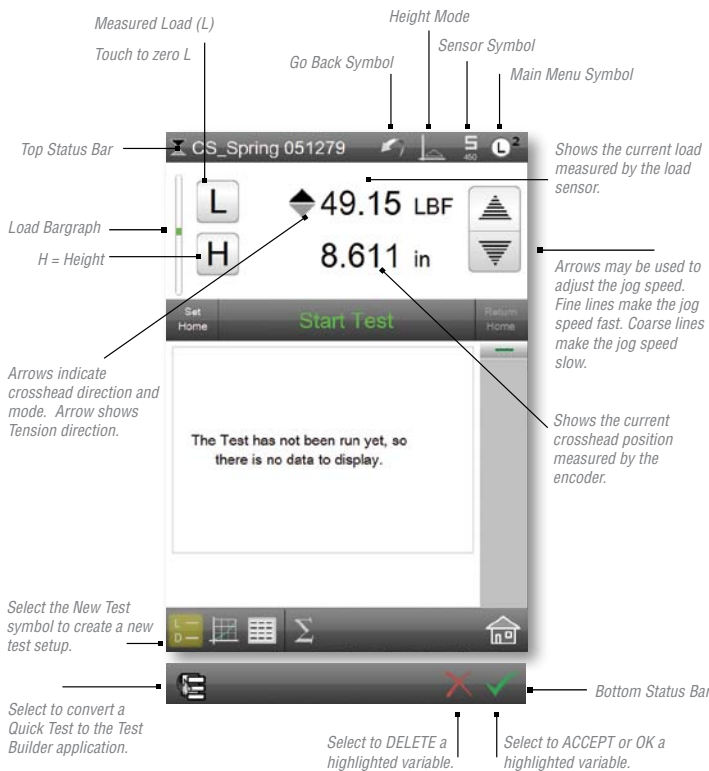
Use the Compression Spring Test with compression springs and belleville washers while performing testing in the compressive (down) direction.

Use the Extension Spring Test with extension springs while performing testing in the tensile (up) direction.

Test templates can be converted to the more advanced optional Test Builder application if added functions are required. Simply set up your test template as normal and then select the Convert to Test Builder icon. The Test Builder application must be ordered separately as an option.

2.1   Display Layout

Your L2 controller uses touch targets and symbols that correspond to key operating functions. These basic symbols and functions are shown in the diagram and discussed in the following paragraphs.

Measured Load (L)
Touch to zero L
Go Back Symbol
Height Mode
Sensor Symbol
Main Menu Symbol
Top Status Bar
Shows the current load measured by the load sensor.
Load Bargraph
H = Height
Arrows may be used to adjust the jog speed. Fine lines make the jog speed fast. Coarse lines make the jog speed slow.
Arrows indicate crosshead direction and mode. Arrow shows Tension direction.
Shows the current crosshead position measured by the encoder.
Select the New Test symbol to create a new test setup.
Select to convert a Quick Test to the Test Builder application.
Bottom Status Bar
Select to DELETE a highlighted variable.
Select to ACCEPT or OK a highlighted variable.

2.2   Bottom Status Bar

The bottom status bar displays various functions as icons that you touch to activate. The status bar is dynamic, so options appear based on the available functions for the display being shown.

2.3   Top Status Bar

The top status bar displays the test name (once configured) and includes symbols for key functions. These functions are discussed in the following paragraphs.
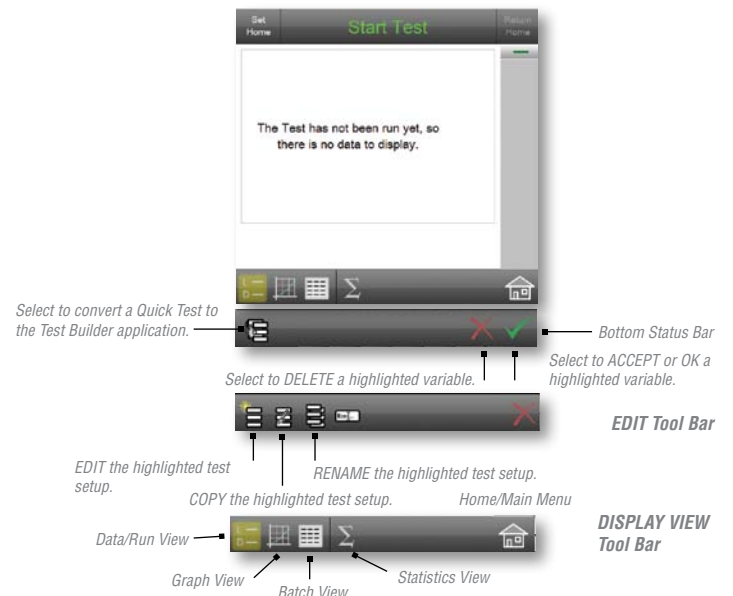
2.3.1   Go Back Symbol

The Go Back symbol is functional for certain applications where you have the ability to go back to where you were previously. Select this symbol to go back to the previous display or function. This symbol operates with selected functions only.

2.3.2   Height Mode Symbol

When the L2 Spring Test templates are used, the system is automatically placed in Height mode. Height mode (H) displays the crosshead position relative to an absolute datum. For example, if you wanted to measure the height of a spring and then compress the spring downward to a distance relative to the spring height, then you would use the Height mode. When Height mode is used, "H" displays the crosshead position relative to an absolute position.

2.3.3   Sensor Symbol

Select the Sensor symbol to view the connected load cells sensor's characteristics. During a test, the sensor will change color to let you know the sensor's operating capacity relative to its rated capacity. When the sensor is operating at 0-90%, the sensor icon is green; at 91-98% the icon is yellow; over 99%, the sensor is red indicating you should exercise extreme caution so as not to overload the sensor. Overloading the sensor can permanently damage the sensor, requiring replacement. Sensor colors correspond to the load bar graph.

Select to convert a Quick Test to the Test Builder application.
Bottom Status Bar
Select to ACCEPT or OK a highlighted variable.
Select to DELETE a highlighted variable.
EDIT Tool Bar
EDIT the highlighted test setup.
RENAME the highlighted test setup.
COPY the highlighted test setup.
Home/Main Menu
DISPLAY VIEW Tool Bar
Data/Run View
Graph View
Batch View
Statistics View

2.3.4 Main Menu

Select the Main Menu L2 symbol to access the main Settings menu. The print icon and On/Off functions are available here also.

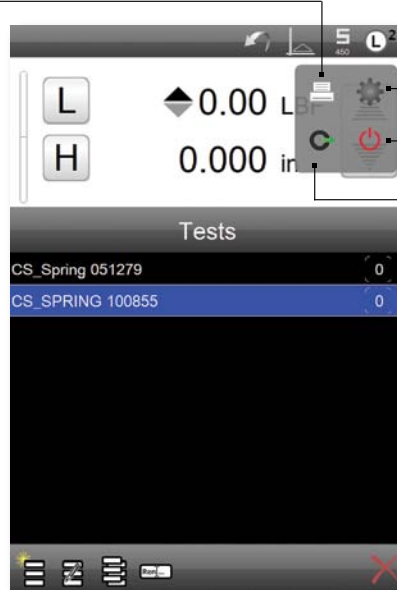*Select to Print.*

Printing can be done at these views:

- *Data View (DRO)*
- *Data Summary View*
- *Graph View*
- *Statistics View*

You may use the normal Print functions using your L2 Controller with a paired keyboard also., e.g. Print Screen.

See Section 11.0 Printing.

Select to go to Main Settings.

See Section 12.0 System Settings.

Select to turn OFF your S2 application.

Select to Log-In.

When security is used and users have passwords, use the Log-In to gain access to authorized functions. Functions are assigned by user.

See Section 12.4 Security Settings.

2.4 Bar Graph

The load bar graph shows the load being applied to the load sensor. When in tension mode, the bar graph fills from the center upward. Three colors are used to indicate the load sensor's status relative to the sensor's capacity: green means the load being measured by the load sensor is within 0% - 85% capacity; yellow means caution and the sensor is measuring between 86% - 100%; red means that the sensor has an applied load greater than the sensor's rated capacity. Immediate action is required to relieve the load or risk permanently damaging the sensor.

2.5 Load and Height Targets

Select the Load (L) or Height (H) targets to manually zero the measured value. When you zero Load, you are zeroing the measurement and not the actual load applied to the load sensor. You are taring out the load value. Load can still be applied to the load sensor even though the measured load reading is zero.

2.6 Jog Key Indicators

The two arrows are used to adjust the jog speed velocity. When the arrows have fine (narrow) lines, the manual jog key will operate at a fast velocity. However, when the arrows have coarse (thick) lines, the manual jog key will operate at a slow velocity.

Changing the jog key speed can be helpful when manually controlling the crosshead position. The slower the jog velocity the more precise you can be in positioning the crosshead.

You change the jog velocity by touching the arrows. The keys will toggle between fine and coarse lines (fast and slow speeds.)

Yellow means CAUTION. Your sensors are operating between 71-95% of its rated capacity.

Shows tension direction (Upward). Green indicates the sensors is operating within 0-70% of its rated capacity.

Shows sensor's rated capacity.
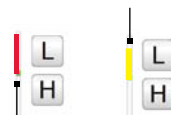
Red means STOP. Immediate action required! The sensors is operating at above 100% of its rated capacity. Further load and you risk permanent damage to your load sensor.

Touch the jog key symbols to change the default speeds on your mechanical jog switch.

When fine lines are displayed, the jog switch will operate at a FAST speed.

When coarse lines are displayed, the jog switch will operate at a SLOW speed.
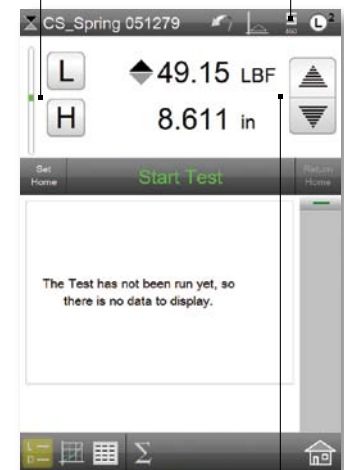
3.0   Spring Test Templates

This section will provide you with an overview of the Spring Test templates. There are two Spring Test templates:

• Compression Spring Test

• Extension Spring Test

3.1   Creating a New Test

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

1. Select the New Test Symbol to create a new test.

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

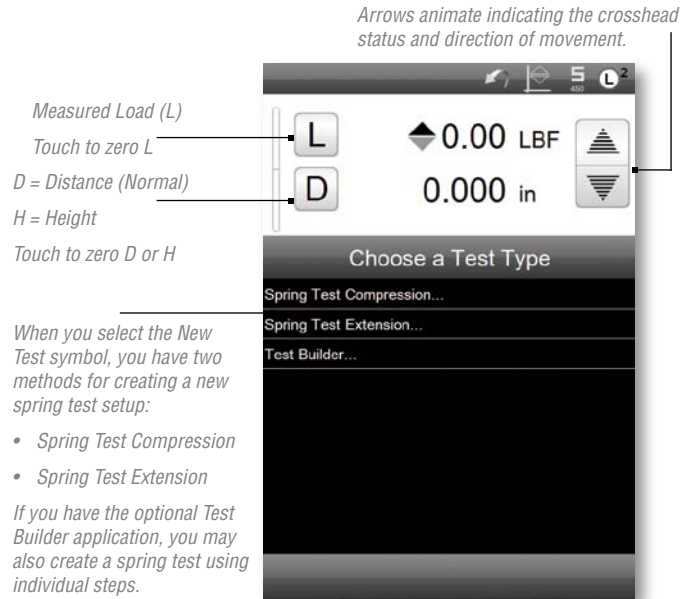• Spring Test Compression

• Spring Test Extension

• Test Builder

The **Spring Test Compression** is used to test compression springs and belleville washers. You can determine free length, spring rate and other results. Use this setup for testing in the compression (down) direction.

The **Spring Test Extension** is used to test extension springs. You can determine initial tension, free length, spring rate and other results. Use this setup for testing in the tension (upward) direction.

The **Test Builder** is an advanced application where you have total freedom to create the test method you desire.

Measured Load (L)

Touch to zero L

D = Distance (Normal)

H = Height

Touch to zero D or H

Shows the current load measured by the load sensor.

Arrows are dynamic indicating the crosshead status and direction of movement.

3.2   Selecting a Spring Template

The Spring Test Compression is used when you test a compression spring or Belleville washer or use the Spring Test Extension for extension spring testing.

Arrows animate indicating the crosshead status and direction of movement.

Measured Load (L)

Touch to zero L

D = Distance (Normal)

H = Height

Touch to zero D or H

When you select the New Test symbol, you have two methods for creating a new spring test setup:

• *Spring Test Compression*

• *Spring Test Extension*

If you have the optional Test Builder application, you may also create a spring test using individual steps.

Pre Test Options Menu

Data Options Menu

Post Test Options Menu

Test Options Menu

When you start a New Test, the Test Options Menu is automatically displayed first.

4.0   Pre Test Options

Use Pre Test options when you want the operator to perform functions prior to actually performing the spring test.

The following options are available with the Pre Test function:

• Settings
• User Prompt
• Precondition
• Datum
• Stop Precondition If

4.1   Settings

The Pre Test settings options are:

Lock Test when set to Yes, prevents an unauthorized user from making changes to the test setup. It also prevents the test setup from being deleted. The default value for Lock Test is No that allows you to make changes to the test setup once created.

1. Press the Lock Test touch target to select Yes or No.

Load Units let you specify the units of measure that represent your load result and load measurement. Available units of measure for load are N (newton), lbf (pound-force), kgf (kilogram-force), gf (gram-force) and ozf (ounce-force).

1. Press the Load Units touch target to select desired units for Load.

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

1. Press the Distance Units touch target to select desired units for Distance.

Set Home may be set to Yes or No. If Set Home is set to Yes, then the home position, which is the starting position for your crosshead prior to you selecting Start Test, is automatic. If the Set Home option is set to No, then the operator is required to manually select the Set Home touch target located to the left of the Start Test touch target.

SETTINGS Options

PROMPT Options

PRECONDITION Options

SET Datum Options
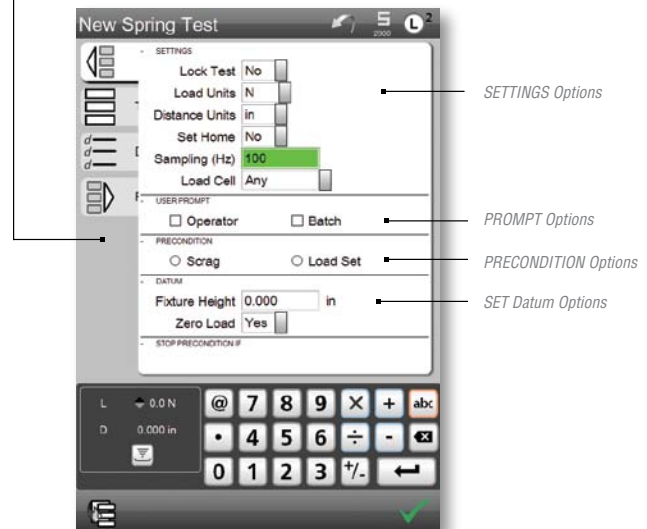
You should exercise caution when Set Home is set to Yes. Damage can occur to your load cell sensor if your Set Home position is incorrect and the crosshead automatically returns to an erroneous position once a test is completed.

• Press the Set Home touch target to select either Yes or No.

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

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

• Press the Sampling (Hz) touch target to change the numeric value.

• Use the numeric keypad to enter a new Sample rate value.

Use the touch targets to invoke changes, options and commands.

ALWAYS use the pad of your finger when using the touchscreen.

NEVER use finger nails, a stylus or any device having a hard or pointed surface. Hard, pointed objects will damage your L2 controller's display.

Adjust the number of samples per second that is appropriate for your testing.
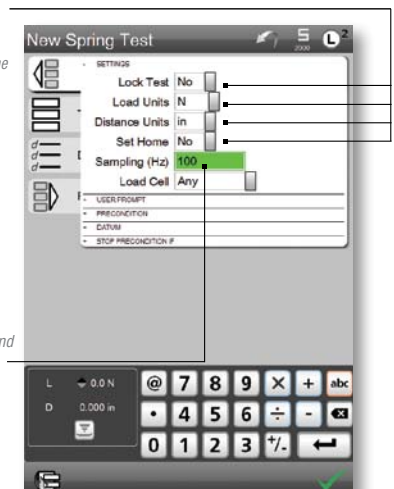
4.2   User Prompts

Pre Test settings include the ability to use prompting and are available in these options:

• Operator prompt

• Batch prompt

The **Operator** prompt requires the operator performing the test to enter their name when the start test touch target is selected. Use this prompt so that the name of the operator performing the test is recorded in the test data. The Operator prompt provides an audit trail for each test run by operator name. The Operator prompt default is Off (the combo box is not highlighted).

• Press Operator Prompt combo box to enable or disable.

The **Batch** prompt requires the operator performing the test to enter the name of the batch or the sample being tested before the test can be performed. When the Batch prompt is used, the operator is required to enter the name of the sample being tested before the test can be performed. The Batch prompt default is Off (the combo box is not highlighted).

• Press the Operator prompt combo box to enable or disable.

When the Operator prompt is enabled, the user will be asked for their name each time a Run is performed. This user information is reported in the Run's data.

When the Batch prompt is used, the user will be asked to enter a Batch Reference Number prior to each Run being performed. The Batch number is included in the Run's data.

Show is the dialog box that displays when the test starts and an Operator prompt is used.

The User must enter their name before the test can be performed.

4.3   Preconditions

Preconditions are pre test routines that may be performed to condition the spring prior to testing. During preconditioning, no data is collected.

There are two types of Preconditions that may be used for your spring test: Scragging and Load Set.

4.3.1   Scragging

Scragging is the process where you "exercise" the spring prior to testing and obtaining data for your spring. In a compression spring, you scrag or compress the spring to a Limit (load or height) typically for three (3) cycles or a Duration. Once the scragging is completed, the spring is "conditioned" and you test the spring and collect the data.

Specify the Limit type (Load or Height) and enter the limit value.

• Press the Limit target to toggle between Load Limit and Height Limit.

If the Limit type is Load, then you specify the amount of compressive load to which the spring will compress. In the example, the Load Limit is 20 N, and then return to zero.

If the Limit type is Height, then you specify the height of the compression from the datum position.
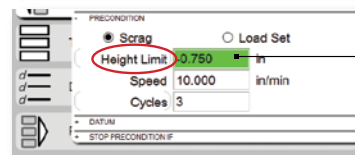
IMPORTANT

When a negative sign is used to denote compression (See Settings menu), you must enter a negative sign prior to your height value for a compression move.

If you want to "scrag" the spring prior to testing, select the Scrag radio button.
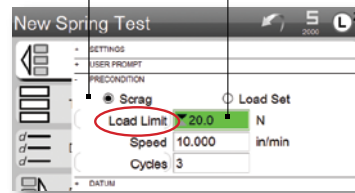
The brackets around the Load Limit indicate that the label is a touch target. The default limit type is Load. Enter the Load Limit value using the numeric keypad. Notice that arrows preceeding the numeric value indicate a compressive movement.

If you select the Limit label, then you can toggle between a Load Limit to a Height Limit. When a Height Limit is used, the spring will compress to a height based on the zero datum position.

IMPORTANT: When you use a Height Limit for a compressive direction, the value you enter MUST be a negative number.

Specify the Speed for your Scrag routine.

• Press the Speed target and enter the crosshead velocity for your Scrag routine.

Specify the Scrag Duration. The Duration may be either a number of cycles (from zero position to the Limit), or it may be a time duration.

• Press Cycle/Duration target to display Cycles. Enter the number of cycles you want to precondition, e.g. cycle between the zero position and the limit value for X cycles.

• Press Cycle/Duration target to display Duration. Enter the time duration you want to precondition, e.g. the period of time you want to cycle between the zero position and time limit. Time may be entered using seconds or use the decimal to enter minutes/seconds. For example, 1.30 equals 1 minute, 30 seconds or 01:30.
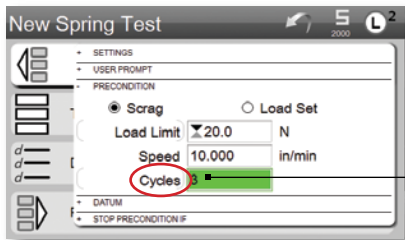
The brackets around the Cycles label indicate a touch target. Select the target to toggle between two types: Cycles and Duration.

When Cycles is displayed, enter the value that represents how many times the spring is compressed to the target limit and then returned to zero.
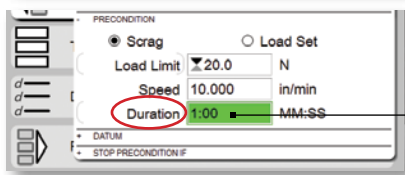
When Duration is displayed, enter the value that represents the time duration the spring is compressed to the target limit and then returned to zero.

4.3.2   Load Set

The Load Set Precondition is used to compress the spring to a load limit and then hold at that load for a time duration. It is a "constant load" routine where there is no cycling between the load limit and zero. The Load Set allows a single routine to load, hold and return-to-zero routine.

Note

The Load Set Precondition is not used with extension springs.

• Press the Load Set radio button to select the Load Set precondition type.

Specify the Load Limit, which is the load value to which the spring will be compressed to and held for the duration specified.

• Press the Load Limit and use the numeric keypad to enter the load limit value. Use a negative sign to represent a compression load value. Note the arrows preceding the numeric value to ensure the correct direction of load.

Specify the Speed, which is the velocity the crosshead will travel to the Load Limit value.

• Press the Speed target and enter the crosshead velocity for your Load Set routine, which is the velocity from the zero/home position to the load limit.

Specify the Duration, which is the amount of time the Load Limit will be held. Once this time period is reached, the spring will return to its zero position.

• Press the Duration target and enter the time duration you want to precondition, e.g. the period of time you want to hold at the Load Limit. Time may be entered using seconds or use the decimal to enter minutes/seconds. For example, 1.30 equals 1 minute, 30 seconds or 01:30.

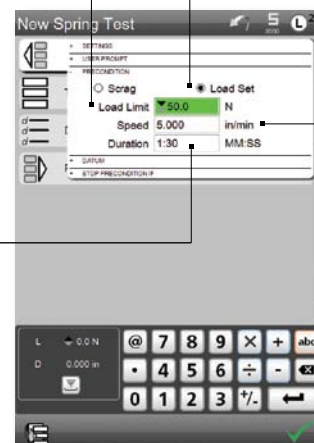*Enter the Load Limit value using the numeric keypad.*

The Load Limit is the load value that the spring is compressed to and held.

Select the Load Set type by touching the radio button.

Load Set precondition compresses the spring to a load limit and holds the spring at that load for a specified time duration.

The Speed is the velocity at which the crosshead will travel from the Home position to the Load Limit.

Enter the time Duration

*This is the amount of time to which the spring is compressed to the load limit.*

4.4   Datum

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

If you are using a special spring test fixture, then you can enter the fixture's height so that it is compensated when measuring the height of the spring.

Once the datum is determined, you have the option to zero the load (Yes) or not zero the load (No).
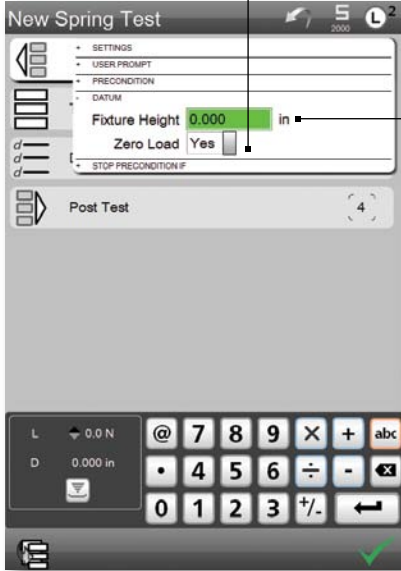
You can enter a custom fixture height when establishing a datum for your height measurements.

Enter the fixture height that is automatically compensated for during the datum procedure.
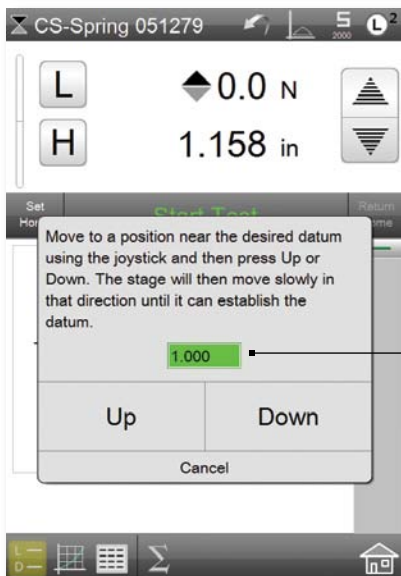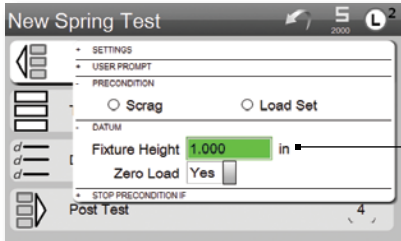
4.5   Stop Precondition If

The Stop Precondition If option lets you create rules that abort the precondition if a particular event occurs. For example, if you use the Scrag precondition, and the Load Limit option, there is an associated Stop Precondition If option called Maximum Height. This means that "if" during a precondition, the measured height is equal to the Maximum Height value established in your Stop Precondition If, then the test will abort. In other words, if you are compressing your spring during the precondition and the spring compresses to the Maximum Height "before" it reaches the Load Limit, you want the precondition and the test to stop.

Conversely, if your Scrag precondition uses a Height Limit, there is a comparable Maximum Load option in the Stop Precondition If section. The precondition will stop if during the precondition, the measured load equals the Maximum Load option before the Height Limit is achieved.

We recommend that you use the Stop Precondition If option whenever a Precondition option is used.
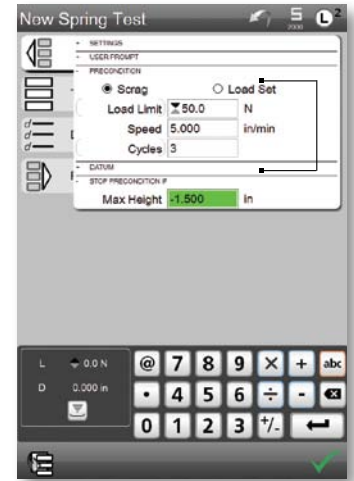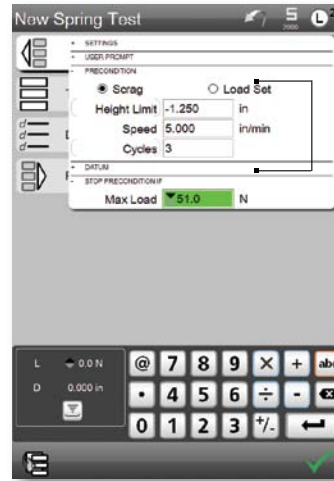
When Precondition is used, we recommend you also use the Stop Precondition If option.

If the Precondition uses a Height Limit, then the Stop Precondition If uses a Max Load Limit to stop the test.

If the Precondition uses a Load Limit, then the Stop Precondition If uses a Max Height Limit to stop the test.

Use the negative sign to represent compression when appropriate.

5.0   Test Options

The Test Step lets you measure the height of the spring (Free Length/Height) and test to a One or Two Point Limit (Load or Height).

5.1   Measure Height

To measure the free length/height of the spring, select the Measure Height radio button. The system will measure the length of the spring during the test. The spring length is determined when the spring is compressed and as the crosshead returns to the Home position. When the load measured is zero, the system determines the spring height at the zero load position.

• Press the Measure Height radio button to measure the spring's free length/height.

5.2   One (Single) Point Measurement

The One Point Measurement uses either a Target Load (Limit) or a Target Height. During the test procedure, if the Target Load is used, the spring is compressed to the load limit you specified at your specified crosshead velocity (speed).

• Press Target Load and enter the load limit using the numeric keypad. If your system is set up to use a negative sign for compression, then make sure to enter the load limit value as a negative number.

• Press the Speed target, and enter the crosshead velocity you want to use for your compression test.
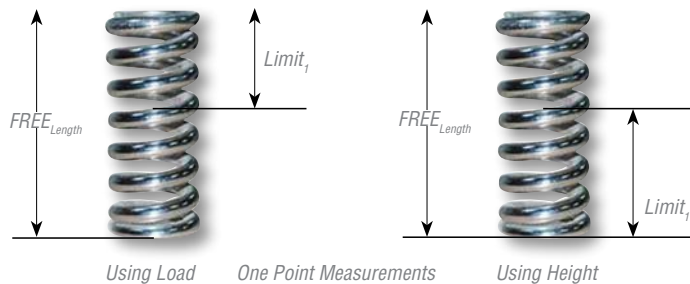
Touch the target to toggle between Target Load and Target Height. Enter your limit value using the numeric keypad. Use the appropriate sign to designate a compression movement. In our example, compression movements are designated with a negative sign.

Select the Measure Height radio button to measure the spring length/height during your test.

Select the One Point radio button test type when you want to use a single limit to determine your result.
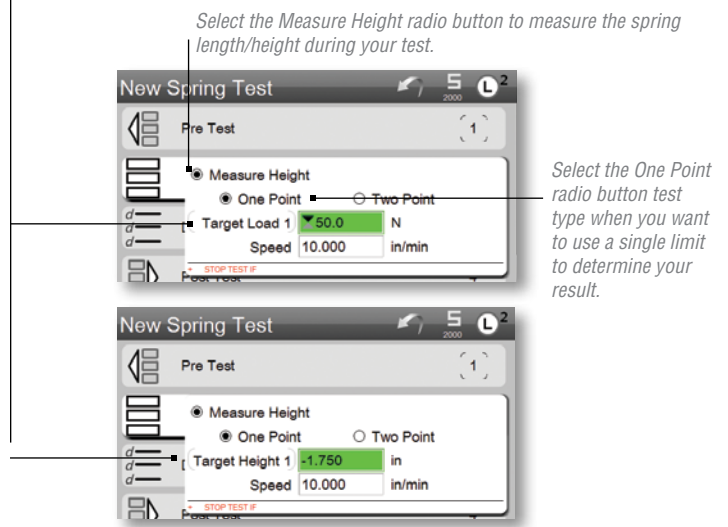
If the Target Height is used, then the spring is compressed to the height limit you specified at your specified crosshead velocity (speed).
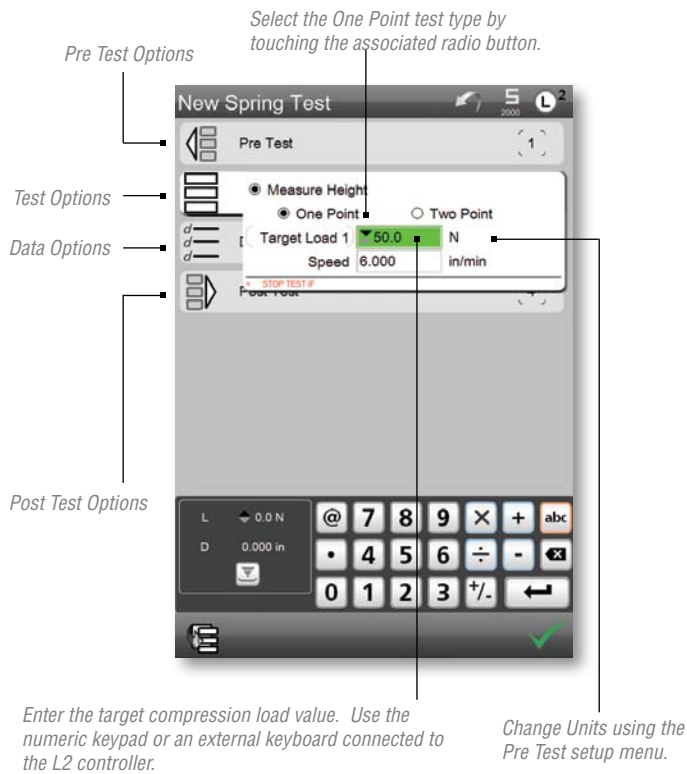
• Press Target Height and enter the height limit using the numeric keypad. If your system is set up to use a negative sign for compression, then make sure to enter the height limit value as a negative number.

• Press the Speed target and enter the crosshead velocity you want to use for your compression test.

$Limit_1$

$FREE_{Length}$

$FREE_{Length}$

$Limit_1$

Using Load   One Point Measurements   Using Height

5.2.1   Selecting Target Load Limit

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

• Select the Target Load 1.

• Enter the Target Load value.

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

Select the One Point test type by touching the associated radio button.

Pre Test Options

Test Options

Data Options

Post Test Options

Enter the target compression load value. Use the numeric keypad or an external keyboard connected to the L2 controller.

Change Units using the Pre Test setup menu.

5.2.2   Selecting Target Height Limit

If you prefer the One Point target to use height, press the bracketed Target Load and then Target Height displays.

The Target Height value is the spring height setpoint. You want the crosshead to push down your spring until the measured height reaches your specified Target Height value. Height units may be inches (in) or millimeters (mm). You may specify the units of measure for Load using the Pre Test Settings menu.

NOTE: When you use Height with a compression test, make sure that the sign for the Height value is correct. Typically, the Height value is a negative number.

• Select the Target Height 1.

• Enter the Target Height value.

When "brackets" appear around text, it signifies that the text is a touch target.

Touch the One Point radio button limit type and toggle between:

• Target Load 1

• Target Height 1

In our example, compression values use the negative sign. Therefore, when entering the height for compression, a negative value is entered.

5.2.3 Selecting Test Speed

The Speed value is your test speed, which is the velocity you want your crosshead to travel from the start of the test to the Target Load or Height set point. Speed units may be either in/min (inch per minute) or mm/min (millimeter per minute). You may specify the units of measure for speed using the Pre Test Settings menu.

• Enter your Speed value.

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

5.2.4 Using Exceptions

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

Exceptions are optional and they are not required for your Load limit test.

Use the Maximum Height exception to cause the test to be aborted should the crosshead travel to this height value.

Use the Maximum Load exception to cause the test to be aborted should the measured load be equal to this value.

Enter your Test Speed.

The velocity is based on the units of measure you have configured for your Height (either inch or millimeter)
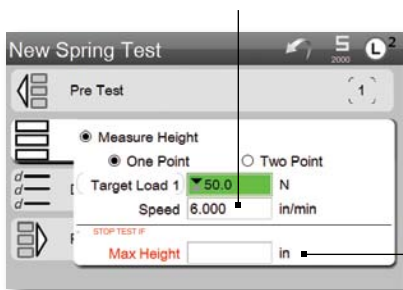
Use exceptions to stop a test if a negative event occurs that could compromise your test.

When your target is LOAD, the cexception attribute is HEIGHT.

You may set a height value that causes the test to stop. IF the height measured = Max Height, the test will abort.
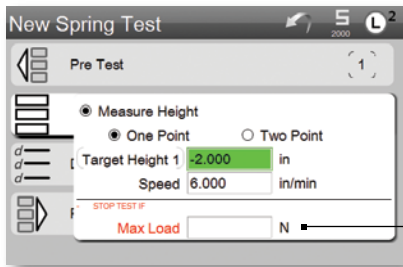
When your target is HEIGHT, the exception attribute is LOAD.

You may set a load value that causes the test to stop. IF the load measured = Max Load, the test will abort.

5.3 Two Point Measurement

The Two Point Measurement uses either two (2) Target Loads (Limits) or two (2) Target Heights. During the test procedure, if Target Loads are used, the spring is compressed to the higher load limit, then the lower load limit, you specified at your crosshead velocity (speed).

• Press the Target Load and enter the higher load limit (Load Limit 1) and then the lower load limit (Load Limit 2) using the numeric keypad. If your system is set up to use a negative sign for compression, then make sure to enter the limit value as a negative number.
• Press the Speed target, and enter the crosshead velocity you want to use for your compression test.

If the Target Height is used, the spring is compressed to the height limit you specified at your specified crosshead velocity (speed).

• Press the Target Height and enter the furthest height limit (Height Limit 1) and then the nearest height limit (Height Limit 2) using the numeric keypad. If your system is setup to use a negative sign for compression, make sure to enter the limit value as a negative number.
• Press the Speed target, and enter the crosshead velocity you want to use for your compression test.
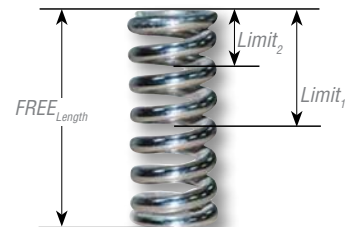
Two Point Measurement

Select the Two Point radio button when you want to test to two (2) points.

You may use either two Target Loads or two Target Heights. The first limit is always the greater value. If load is used, then the Target Load 1 is the greatest load limit value. If height is used, then the Target Height 1 is the furthest distance from the datum.
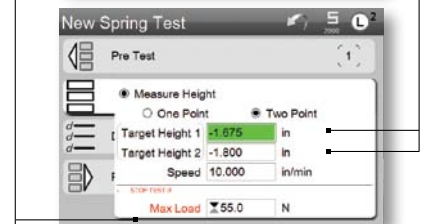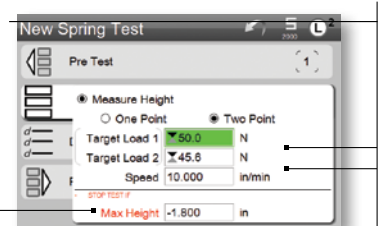
Use exceptions to abort the test if this particular condition occurs.

If the test uses Load Limits, then the Max Height exception should be used. If this Height is measured during the test, the test will abort.

If the test uses Height Limits, then the Max Load exception should be used. If this Load is measured during the test, the test will abort.

5.4   Extension Test Options

The Extension Spring Test is used to test extension springs. You can determine initial tension, free length, spring rate and other results. Use this setup for testing in the tension (upward) direction.

The Pre Test, Data and Post Test steps are identical to the Compression Test setup. Please see those sections for more information.

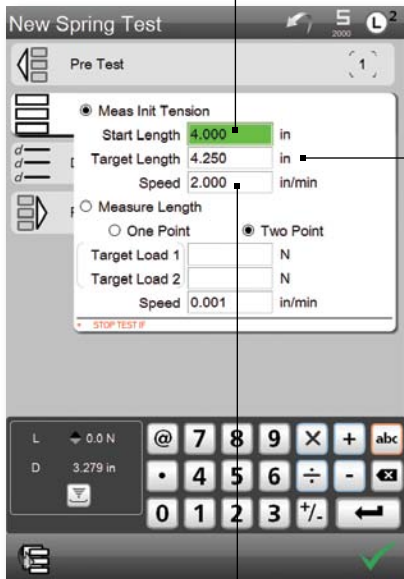### 5.4.1   Measure Initial Tension

The Measure Initial Tension option is a unique result of the Extension Spring test setup. The Initial Tension is the load measured at a point where all coils on the extension spring are no longer touching one another.

The **Start Length** is the extension spring's length with no load applied. This is the measurement from the inside edge of the spring's loops.

The **Target Length** is the spring's measured length where all coils are separated from one another.

The **Speed** is the velocity that the crosshead will move during the Measure Initial Tension procedure.

The Start Length represents the measured length between the loops on either end of your extension spring with no load applied.

The Target Length is the measured length of the spring when load is applied sufficiently to separate all coils from one another.

The Speed is the crosshead's velocity during the measurement of the Initial Tension.

6.0   Data Options

The Data Step is the next option in setting up your Spring test. The Data step is where you select the results to be measured, reported, and displayed. Results are categories and are called coefficients.
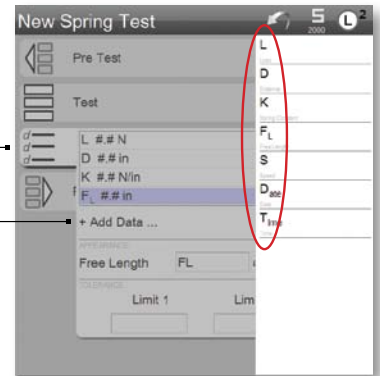
6.1   One Point Coefficients

The One Point Test automatically selects the Load (L) and Height/Distance (D) coefficients. It also calculates the Spring Constant (K) and, if Measure Height is selected, the Free Length (FL).

There are other coefficients available for this type of test. Select additional coefficients by touching the + Add Data... target.

There are four (4) default coefficients available when using the One Point test method:

- *L (Load Target)*
- *D (Height at Target)*
- *K (Spring Constant)*
- *FL (Free Length)*

To Add a coefficient, select the + Add Data target that displays the available coefficients for the test type you are configuring.


6.2   Two Point Coefficients

The Two Point Test automatically selects the Spring Rate (KSR) and, if Measure Height is selected, the Free Length (FL).

There are other coefficients available for this type of test. Select additional coefficients by pressing the + Add Data... target.

There are two (2) default coefficients available when using the Two Point test method:

- *KSR (Spring Rate)*
- *FL (Free Length)*

To Add a coefficient, select the + Add Data target to display the available coefficients for the test type you are configuring.
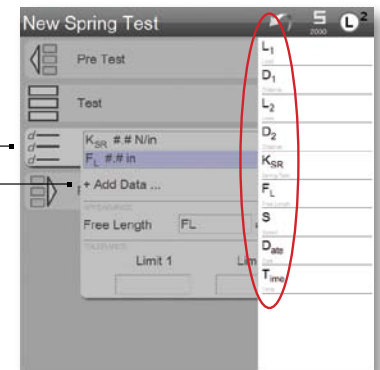
6.3   Formatting Coefficients

You have the option to format your coefficients, that is determine how the coefficient will appear on your L2 controller.

The Appearance menu is associated with the coefficient you select. You have the ability to select one of three different formats for your coefficient: large, medium, and small.

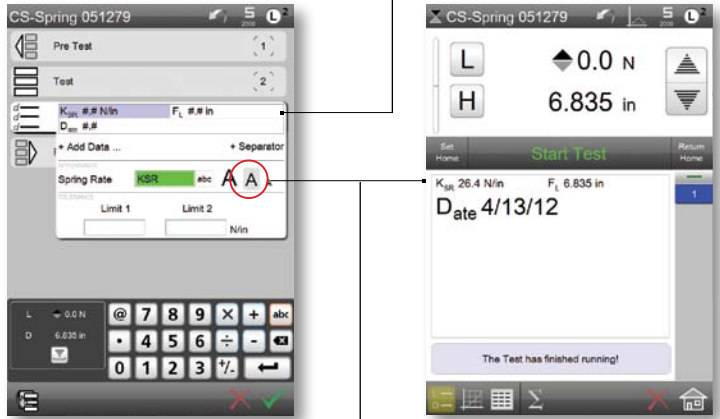Select the large "A" and the associated coefficient will be displayed in a large format occupying a single line.

Note when the coefficients are selected, when the large A is highlighted, the coefficients appear on a single line in the options menu.
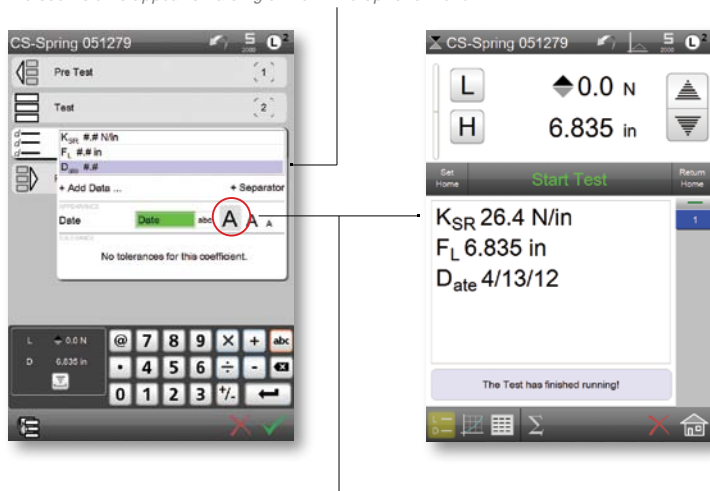
Select the "Large A" to display a result in large text and on a single line.

Select the middle "A" and the associated coefficient will be displayed in a smaller size than the large format, and the coefficient will fit the L2 controller display in a two-column format.

Note when the coefficients are selected, when the mid-size A is highlighted, the coefficients appear as a dual column format.

The KSR and FL coefficients are formatted using the mid-size A. These appear smaller and in a two-column format.

The Date remains formatted using the large A.

Select the small "A" and the associated coefficient will be displayed in the smallest format. Coefficients that use the smallest format will fit the L2 controller display in a three-column format.

When using the smallest A, the coefficients appear in a three-column format.
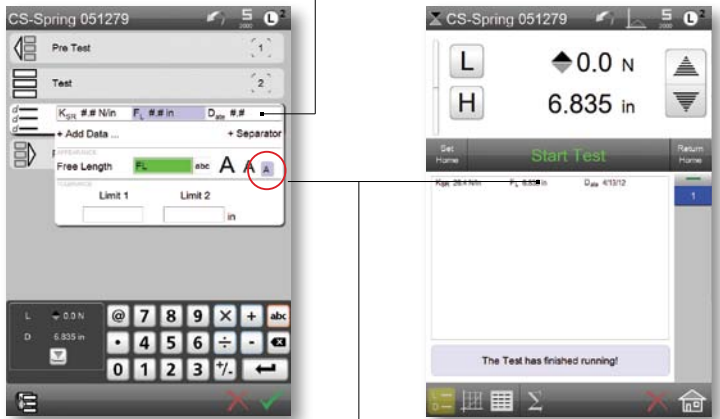
The KSR, FL and Date coefficients are formatted using the smallest A. These appear in the smallest size and in a three-column format.

6.3.1   Adding a Coefficient (+Add Data...)

The One Point and Two Point test methods are supplied with default coefficients; however, you can add coefficients by selecting them from the Data List. You access the Data List by selecting the + Add Data... touch target.

The coefficients available for the Spring test templates are:

• Load (L)
• Distance/Height (D)
• Spring Constant (K)
• Spring Rate (K_{SR})
• Free Length/Height (F_L)
• Speed (S)
• Date (D_{ate})
• Time (T_{ime})

The L (Load) coefficient will report the measured load result. In a One Point test, the Load (L) is a default coefficient that reports the load result at the limit. If using a Two Point test, you must select L1 (Load 1) and L2 (Load 2) if you want to report the load results for both limits.

The D (Height/Distance) coefficient will report the measured height/distance result. In a One Point test, the Height (D) is a default coefficient that reports the height result at the limit. If using a Two Point test, you must select D1 (Height 1) and D2 (Height 2) if you want to report the load results for both limits.

The K (Spring Constant) is a default coefficient for the One Point test only. The spring constant *K* is calculated as the change in height and the compression load.   The *K* spring constant is calculated as:

K = Fx / Hf - Hd

Where;

• *Fx* = applied compression load (Load Target 1)
• *Hf* = spring free height
• *Hd* = spring height at the compression load
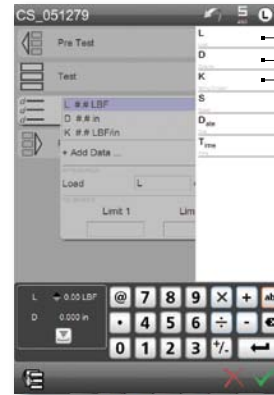
L represents Load. If a two position test is used, L1 and L2 coefficients are displayed.

D represents Distance or Height (H). D1 and D2 are displayed when using a two position test setup.

K represents Spring Constant for a one position test setup. If a two position test setup is used, KSR (Spring Rate) is listed.

The KSR (Spring Rate) is a default coefficient for the Two Point test only. The spring rate KSR is calculated as the change in height and the change in load.   The KSR spring rate is calculated as:

KSR = (L1 - L2) / (H1 - H2)

Where;

• *L1* = Greater Load Target 1
• *L2* = Lesser Load Target 2
• *H1* = Lowest Height at Target 1
• *H2* = Highest Height at Target 2

The FL (Free Length/Height) is the zero load position in a compression spring test. The spring is compressed and as the crosshead returns upward to the Home position, the spring height is determined when the load is zero.

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

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

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

• Press the + Add Data ... touch target to view the coefficient list of values for the Compression Spring test template.
• Press the remaining coefficients you would like reported on your test results.

6.3.2 Coefficient Appearance & Naming

You may rename your coefficients; however, the first character should be in regular text with any subsequent text in subscript.

Coefficient names are restricted to 8 characters.

- Select the coefficient you want to rename.
- Press the "abc" touch target next to the coefficient text block to launch the virtual QWERTY-style keyboard. Re-type the coefficient name. If you are using a wireless keyboard or USB keyboard connected to the L2 controller, then simply enter the new name.
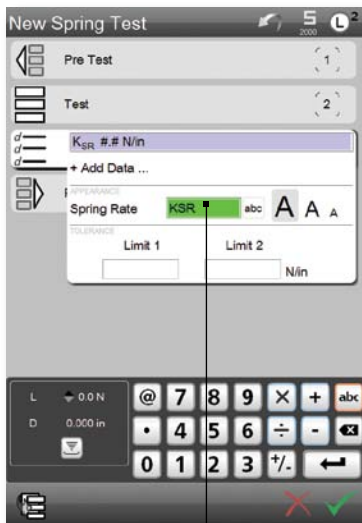
Select the coefficient to rename

Select the [abc] touch target to launch the virtual keyboard. Enter the new name.

6.3.3 Ordering Coefficients

You may organize your coefficients once they have been selected from the Data List. To organize the placement of your coefficients, simply touch the coefficient and hold until the coefficient shading is green, then drag the coefficient from the Data preview to the location you want the coefficient to appear on the Data View.

Select the coefficient to re-locate.

Touch and hold until the coefficient shading turns green in color.
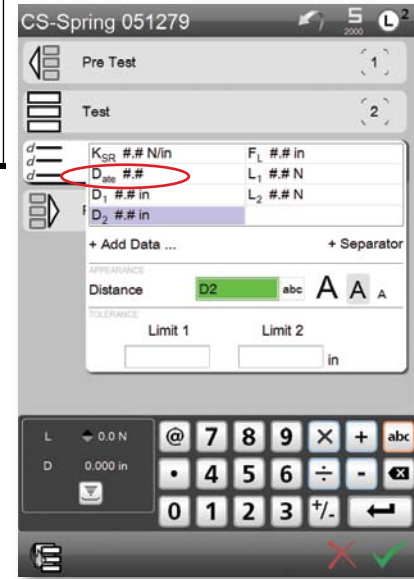
Drag and Drop the coefficient to the location you want it to appear in your Data View.
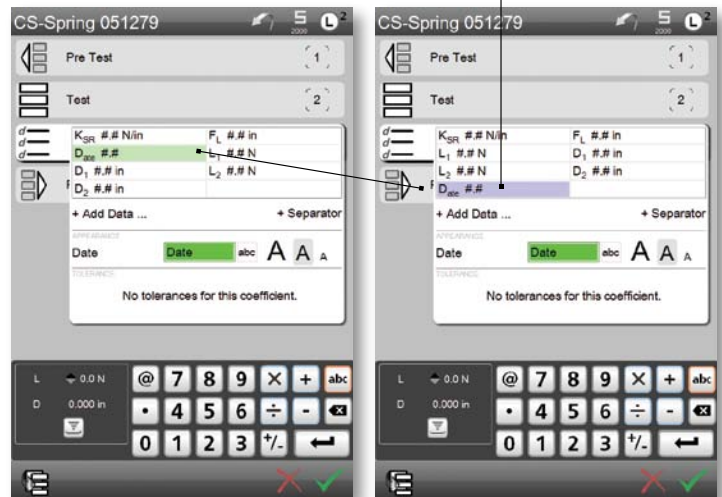
6.3.4 Hiding a Coefficient

You may have setups where you don't want the coefficient to appear on you Data View, but where you want to measure the value for a coefficient.

You may hide a coefficient using the Size function.

To hide a coefficient, select the coefficient, and then select the size function (A) until the A is no longer shaded. An outline will appear around the A indicating that the selected coefficient is now hidden.

Select the coefficient to hide on your Data View.

Select the sizing "A" until the shading changes. The A shading changes to an outline around the "A".

Now, in your Data View, the hidden coefficient (Date) does not appear.
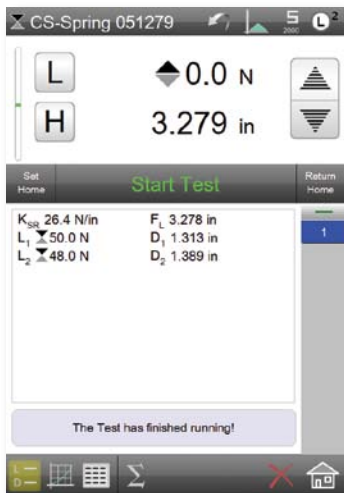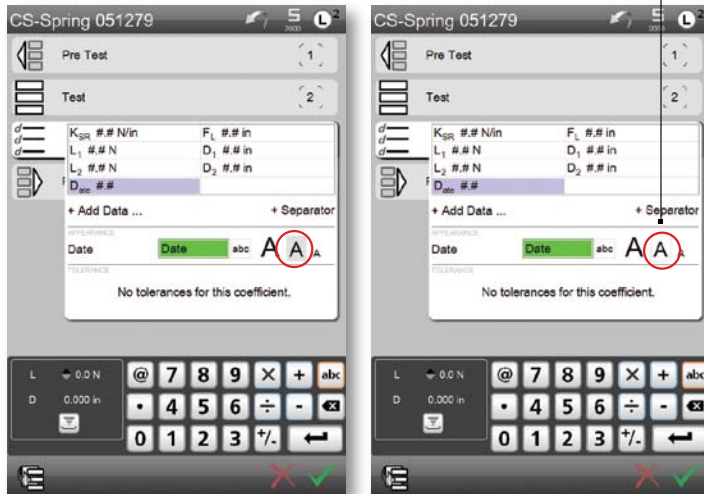
Data without separator.

6.3.5 Adding a Separator

A single line separator may be added to help distinguish data on your Data View.

To add a line separator, select the +Separator option. Once the Separator is added to your coefficient list, drag & drop to the location you want the separator to appear.
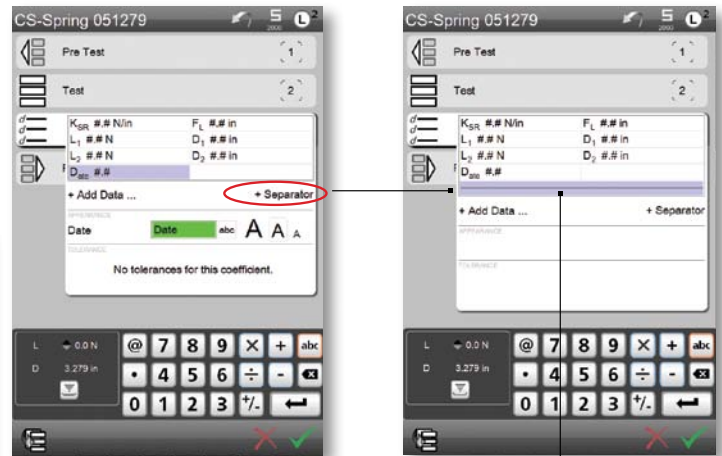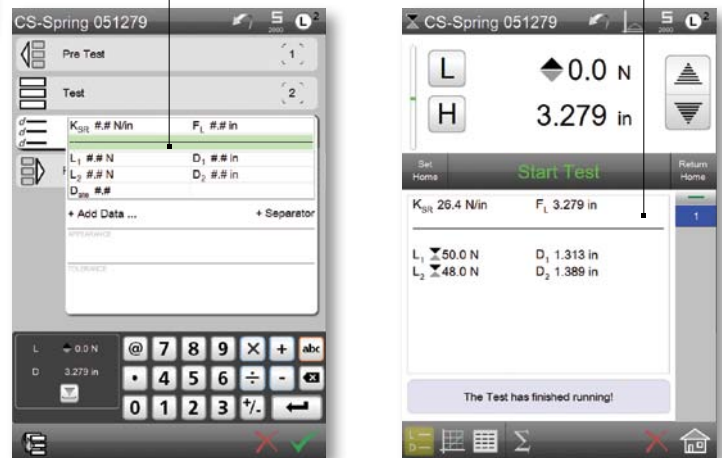

Select the +Separator to add a line separator to your coefficient list.

Select the separator line.

Drag & Drop the separator line to the location where you want it to appear in your Data View.

In the Data View, the line appears and separates your coefficient values.

6.3.6 Deleting a Coefficient

To remove a coefficient from your list, select the coefficient and then the delete symbol (X). The coefficient is permanently removed from your coefficient list.
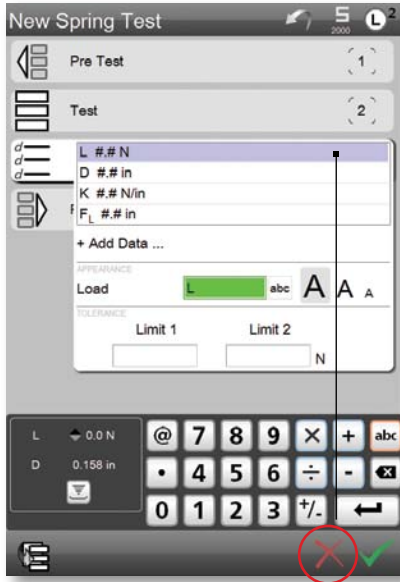
Select the coefficient you want to delete.

Once the coefficient is highlighted, select the delete (X) symbol to remove the coefficient.

6.4   Applying Tolerances

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

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

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

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

In our example, we are placing a tolerance on the Spring Constant (*K*).

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

- Select the coefficient you wish to tolerance.
- Enter the Limit 1 value that establishes one end of the range for your tolerance.
- Enter the Limit 2 value that establishes the other end of the range for your tolerance.

You may tolerance multiple coefficients for your test.

If any of the coefficient results fall outside the tolerance range, then the coefficient is displayed in red and the test is considered "failed".

Note that the Run number displays in red indicating a failed test.
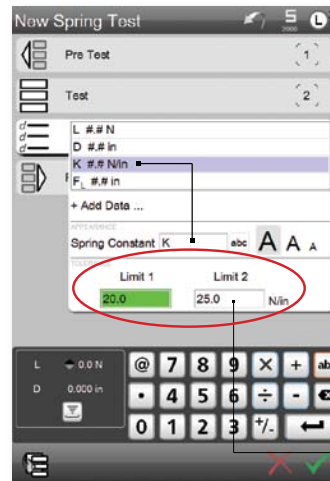
Select the coefficient K Spring Constant.

Enter the Tolerance Limits. If the result is equal to, or falls within the range created by Limit 1 and Limit 2, the coefficient is a "passed result" and displays in black text. If, however, the measured result is outside the range, the coefficient is a "failed result" and displays in red text.

Because our measured result for spring constant is 25.4 N/in, it falls outside the range and is therefore, a failed result.
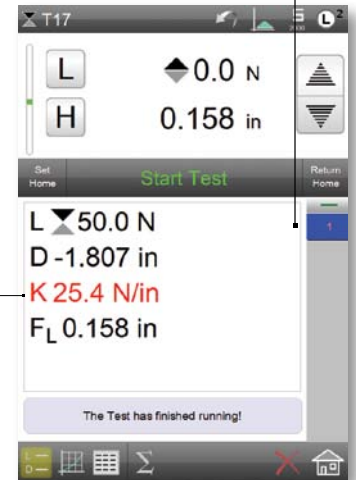
7.0   Post Test Options

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

7.1 Return Home Option

Use the Return Home option to automatically return the crosshead to the Home position once a test run is completed. When the option is Yes, the crosshead will automatically return to the Home position when the test is completed. When the option is No, the user will return to the Home position by selecting the Return Home touch target on the DRO view.

1.Press the Return Home target and change to Yes.
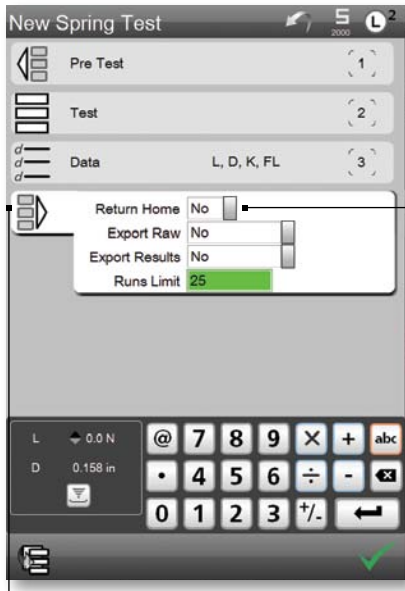
Use the Return Home function (change to Yes) to cause the crosshead to automatically return to the Home/Start position for a completed test.

Use the Post Test menu to specify what and how events happen at the completion of a test.

7.2 Export Raw Option

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

• Go to the Main Settings menu.

• Select File Locations.

• Select the Directory to where you want your data saved.

Once you have designated a file location, the user has two options on how to transmit the file to the location: Overwrite and Auto Number.

The **Overwrite** functionality is when the raw data overwrites the previous raw data. A file is transmitted to your directory: [Test Name]_Raw Data.

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

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

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

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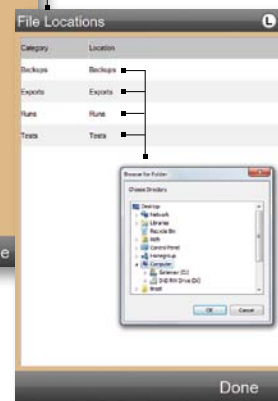

Use the File Locations setting to establish where files are automatically sent.

The Backup location stores setting information.

The Export location stores raw data files and results files in .csv format.

*The Runs location stores results files for individual Runs within a test setup.*

*The Tests location stores the test setups.*

Select the File Location Category, then select the link to the desired directory on your network.

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

• Go to the Main Settings menu.

• Select File Locations.

• Select the Directory to where you want your data saved.
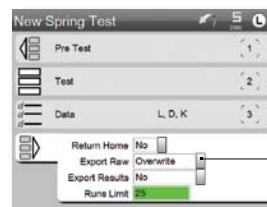
Select the Overwrite option when you want to save only one file. When Overwrite is selected, a new file is generated at the completion of a Run, and the former file is replaced or overwritten with the newest raw data .csv file.
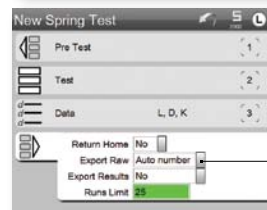
Select the Auto Number option when you want to save multiple files for each Run. When Auto Number is selected, a new file is generated at the completion of a Run. For example, if you have 10 Runs, you will have 10 Raw Data Files (one file for each Run) saved.

## 7.3 Export Results Option

You have four options for your Export Results function.

When Export Results is set to No, no results are exported at the completion of a test.

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

When Export Results is set to Overwrite, results are exported to a .csv file. With only one row of results. When a new test is completed, the data in the row is replaced with the new data.
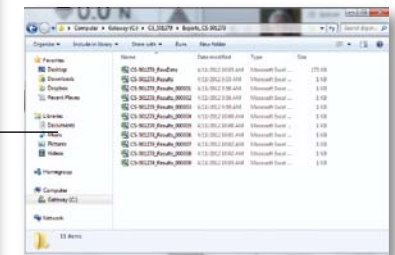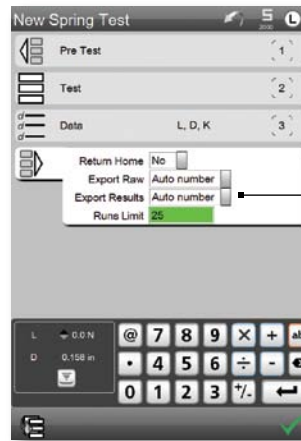
When Export Results is set to Auto Number, results are exported to a .csv file. Each test result creates a new file that is sequentially numbered for identification.
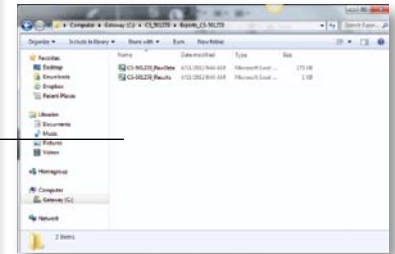
When Append is used, a new row in the file is added when a test run is completed.
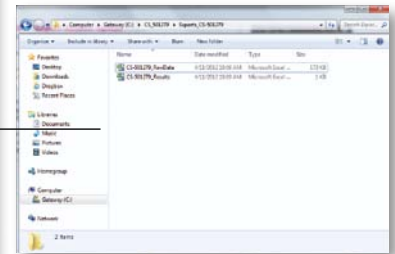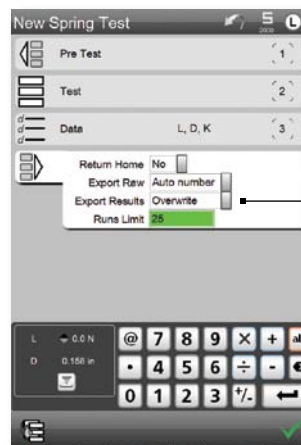
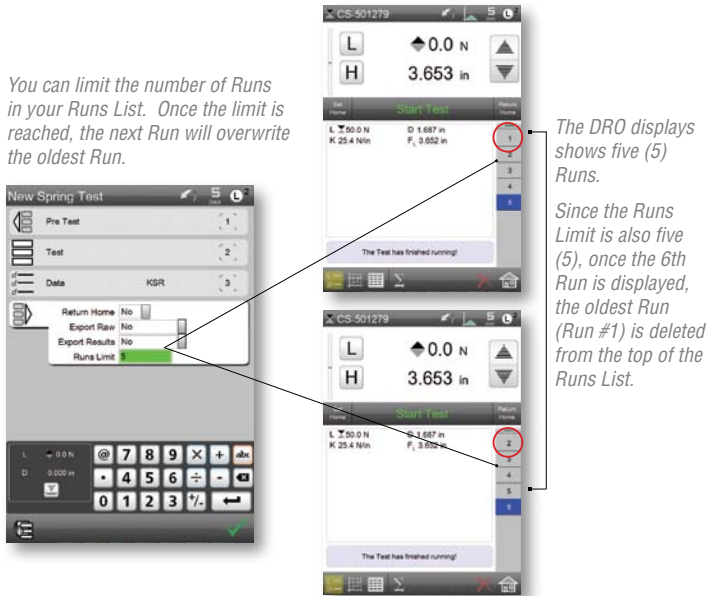When Overwrite is used, the file is replaced (overwritten) when a test is completed.

When Auto Number is used, a new file is created when a test is completed.

7.4   Runs Limit

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

When the Runs Limit is set to 5, each run will be shown with a sequential number that represents the Runs Number. When the sixth test is conducted, run #6 will display and run #1 will be permanently erased from the Runs list. Run #2 will now appear at the top of the Runs list.

You can limit the number of Runs in your Runs List. Once the limit is reached, the next Run will overwrite the oldest Run.

The DRO displays shows five (5) Runs.

Since the Runs Limit is also five (5), once the 6th Run is displayed, the oldest Run (Run #1) is deleted from the top of the Runs List.

8.0   Test Editing

You have a number of editing functions available on your Test Menu view: copy, delete, and convert to optional test builder for additional functionality.
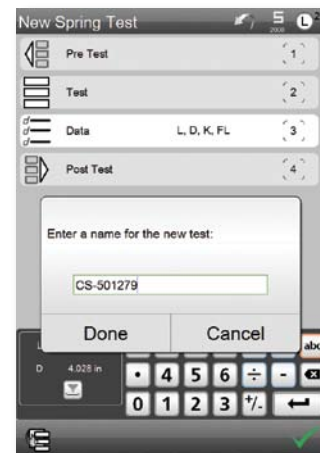
8.1   Naming Your Test

When you create your test, you need to name the test. Use the virtual keyboard on your L2 controller display or a keyboard connected to your system via USB or Bluetooth.

Test Names may be up to 16 characters in length.

To rename your test, do the following:

1. Open your test
2. Select the Rename symbol and a text block will appear for your current test name
3. Rename the test
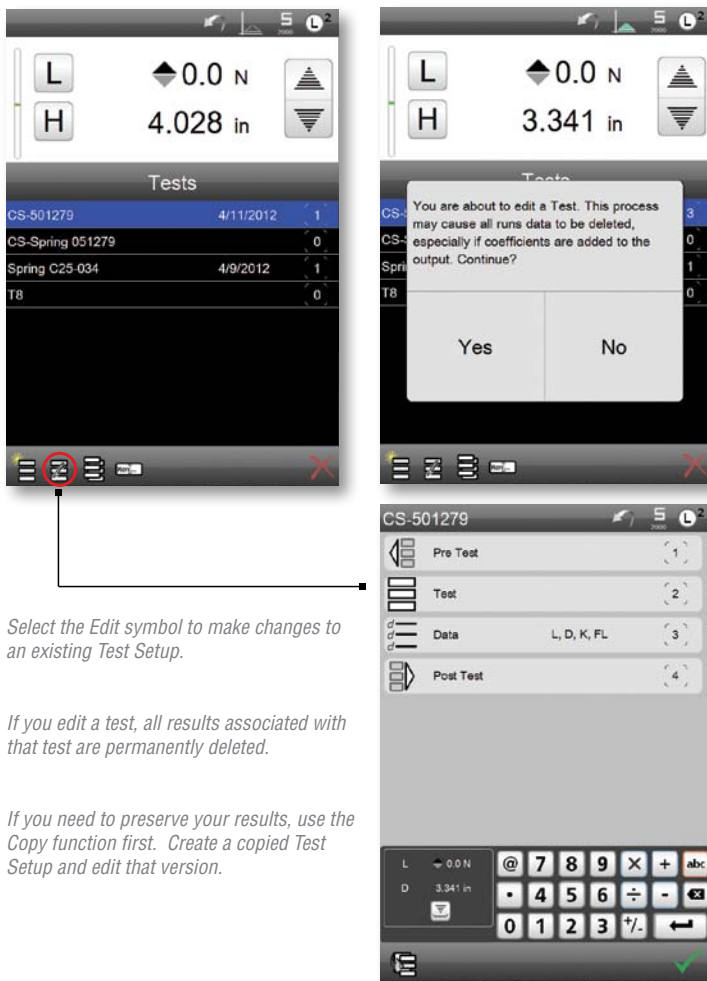4. Select the checkmark to save your changes

Use the Rename symbol to rename your test. Use a keyboard to enter the new name. A virtual keyboard is included in the L2 controller, or use a wireless keyboard or USB keyboard.
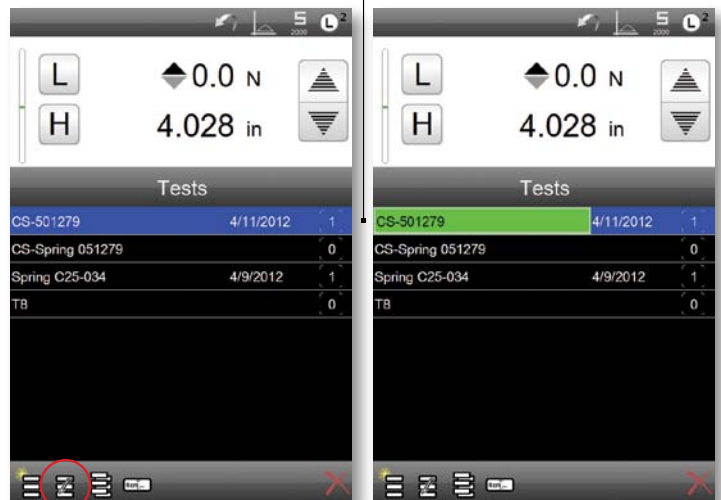
8.2 Editing Your Test

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

• Go to the Main Test Setup menu. Select the test setup to Edit.

• Select Yes on the Edit warning message display.

• Make necessary edits to any of the steps: Pre Test, Test, Data and Post Test.

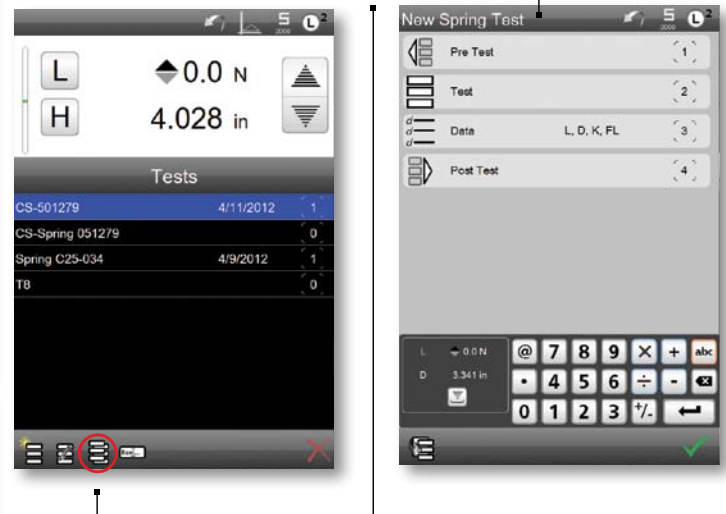• Select the checkmark to save your changes.

8.3 Copying Your Test

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

1.Go to the Main Test Setup menu.

2.Select the test setup you wish to Copy.

3.Select the Copy symbol.

A copy of the test you selected will display in the setup view. Make the necessary edits to the test setup.

• Rename your new test setup.

Since you have "copied" an existing test, the test setup from the original test is viewed without a Name. Once you make changes and save, you will be required to Name the test setup.

Select the Edit symbol to make changes to an existing Test Setup.

If you edit a test, all results associated with that test are permanently deleted.

If you need to preserve your results, use the Copy function first. Create a copied Test Setup and edit that version.

Use the Copy symbol to make a copy of an existing Test Setup. When you Copy a test setup, only the setup is copied and not the results.

8.4 Deleting Your Test

You delete a test by selecting the test for deletion from the main test setup menu. To delete your test, do the following:

1. Go to the Main Test Setup menu.

2. Select the test setup you wish to Delete.

3. Select the red "X" to Delete.
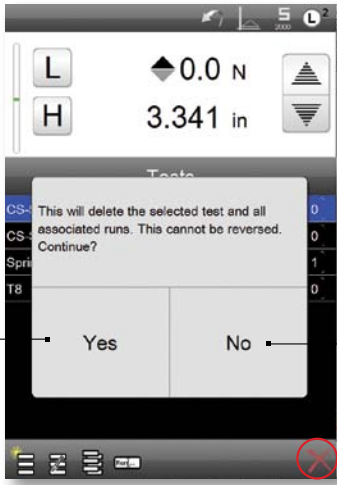
When you select Yes, you will permanently delete the test setup and all associated data.

If you do not want to delete the test, then select No.

Use the delete symbol (X) to permanently delete a Test Setup from your main Test Setup menu.

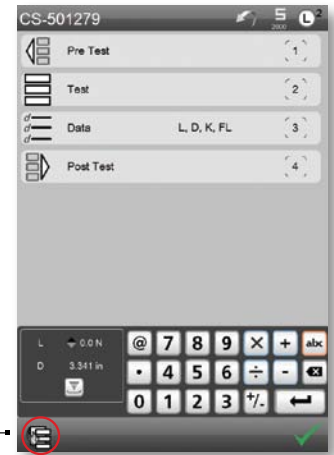## 8.5 Converting Your Test to the Optional Test Builder

The optional Test Builder is an advanced application available for use with your L2 controller. The Test Builder is a separate application that compliments the Compression Spring and Extension Spring test templates.

The Test Builder application lets you create a test setup without the use of a template. You create a test using stage movements and other types of stages including holds, cycles, etc.

You can create a spring test using either the compression or extension template and then convert the test setup to the Test Builder application allowing more flexibility and advanced testing features to be used.

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

For more information about using the Test Builder application, please read the *L2 Series Automation Builder User's Guide*.

Convert to the optional Test Builder application by pressing this symbol.

If you do not have the Test Builder application, then this symbol is greyed-out.
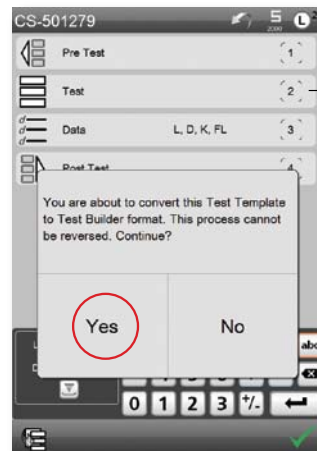
9.0   Operation

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

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

9.1   Test Menu

The main Test Menu lists all of the test setups that are saved in your L2 controller's memory. Select the test you wish to perform from this master list of test setups.
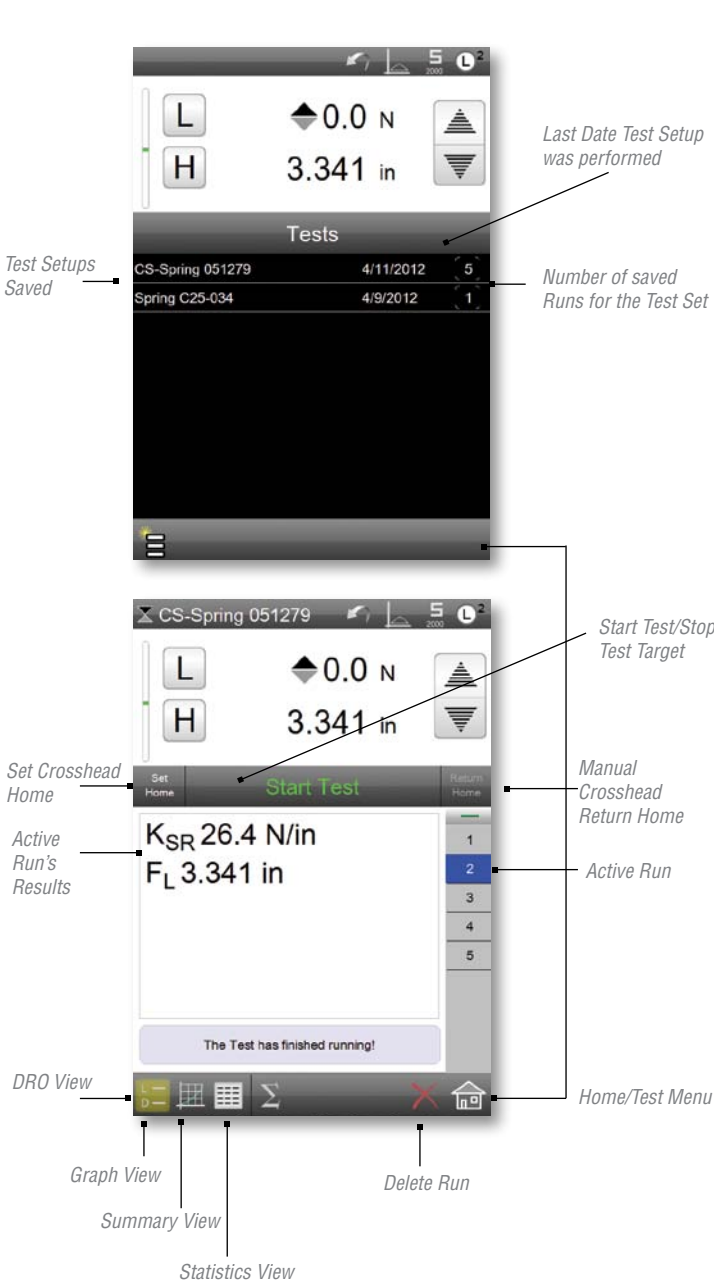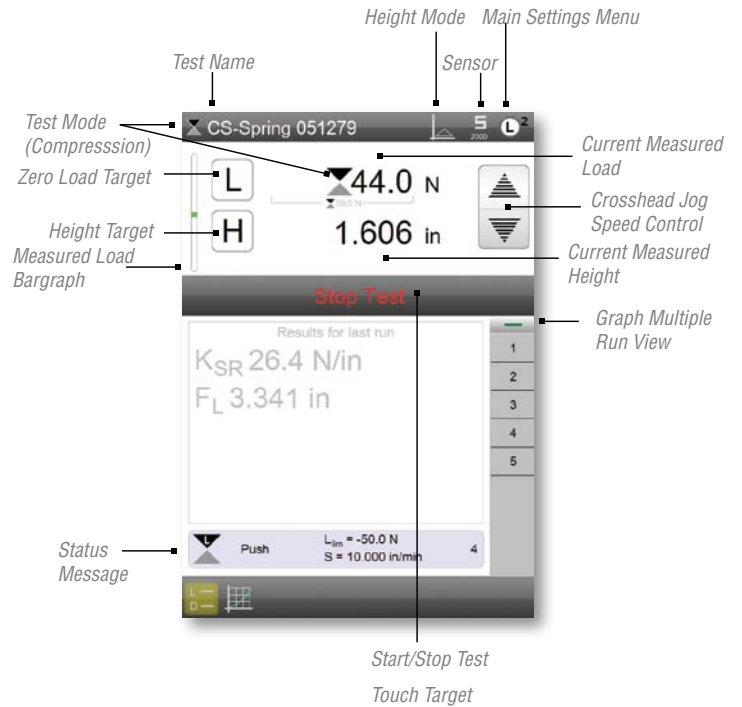
9.2   Data View

The Data view presents numerical information during the test and once the test is completed.

9.2.1   Viewing a Run

Runs are individual tests completed for your test setup. The Runs List shows each completed test and provides each test with a reference number called the Runs number.

You can view a run and the results by selecting the Run number. The result associated with the Run number is displayed.

Last Date Test Setup was performed

Test Setups Saved

Number of saved Runs for the Test Set

Start Test/Stop Test Target

Set Crosshead Home

Manual Crosshead Return Home

Active Run's Results

Active Run

DRO View

Home/Test Menu

Graph View

Delete Run

Summary View

Statistics View

Height Mode   Main Settings Menu

Test Name

Sensor

Test Mode (Compresssion)

Current Measured Load

Zero Load Target

Crosshead Jog Speed Control

Height Target

Measured Load Bargraph

Current Measured Height

Graph Multiple Run View

Status Message

Start/Stop Test Touch Target

9.2.2 Deleting a Run

You may delete a Run by selecting the run for deletion and then select the delete symbol (X).

Once a Run is deleted, it cannot be recalled and the results are not included in the test statistics.
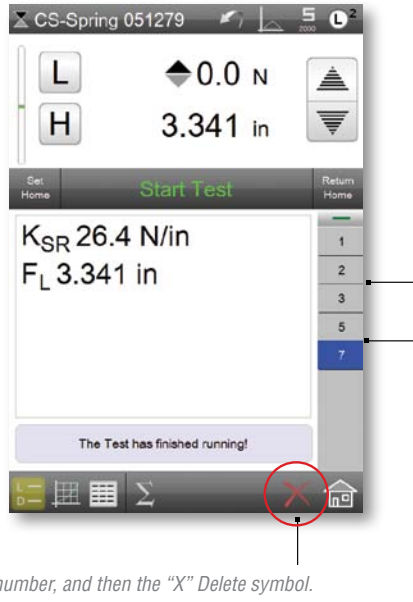
*Delete a Run by selecting the Run number, and then the "X" Delete symbol.*

When a Run is deleted, the Run number is removed from the Run List. Remaining Runs maintain their original Run number.

9.3 Graph View

You may view a result in a graphical format using the Graph view.

9.3.1 Changing the Axis

The default Graph view displays Load versus Distance. You may also display Load versus Time by selecting the Graph view symbol.
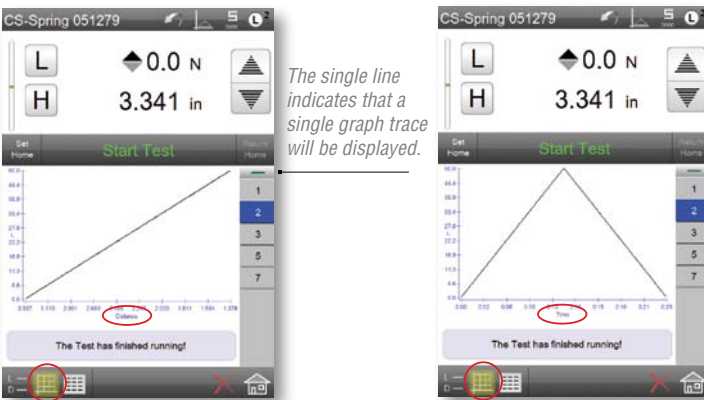

The single line indicates that a single graph trace will be displayed.

You may change the X-axis to represent either Distance (Height) or Time.

Select and Hold the Graph symbol to change the X-axis.

9.3.2 Using Graph Overlays

You can display multiple traces on a single graph as follows:

1. Select the Overlay target.
2. Select from the Run List the individual runs you wish to display in a graph format. The individual runs will highlight showing they are selected. The graph will populate with graph traces for each respective run. Each trace is color-keyed so that it references the associated run number. Up to six (6) Runs may be displayed collectively.
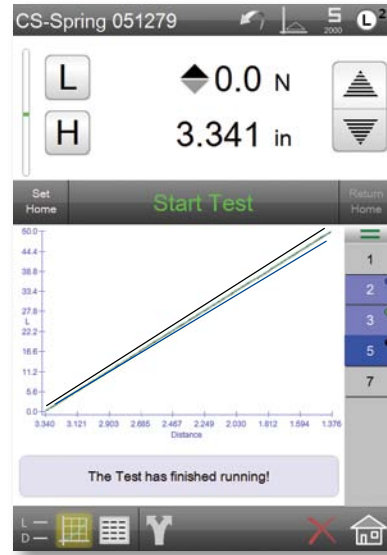
*The double line indicates that multiple traces for Runs that you select are being displayed.*

Select the Runs for which you want to display graph traces for. When multiple traces are displayed, a color is assigned to each Run to distinguish Runs from one another.

Up to five (5) Runs may be displayed simultaneously in an overlay view.

9.4 Summary View

The Summary view displays your test results for each Run for a test setup in a tabular format.

Select the Summary view symbol to display your results.
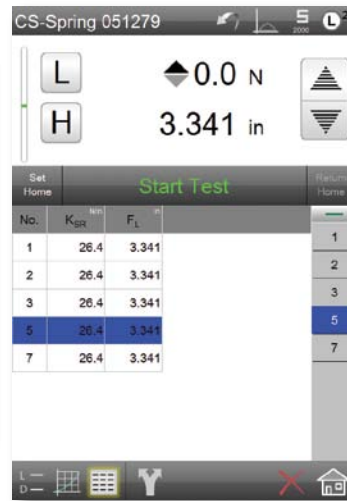
Since Run #5 and #6 were deleted, these Runs' results are no longer available in the Summary view.

Each row in the Summary view is associated with a Run listed.

Summary View

You can select the SHARE symbol to transmit the results data to the L2 controller's output.

9.5   Statistics View

The L2 controller provides you with basic statistics for all the valid Runs for a test setup. A deleted Run is not factored into the statistical calculations.

To view the Statistics for your test setup, you must be in the DRO view, and then select the Statistics symbol.

Shows the statistics for valid test Runs. In the example, there were a total of five Runs. One Run was deleted. All of the remaining Runs met the tolerance limit range.
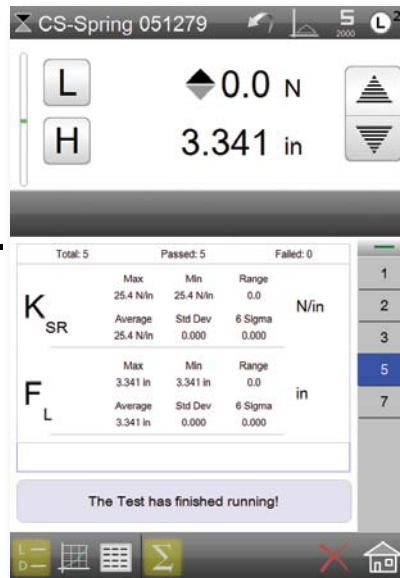
You access the Statistical view from the DRO view.

10.0   Performing Your Test

Once you have loaded your spring into the testing fixture, you can select the test setup from the Test Menu at the Home view. Prior to the test being able to start, you will need to establish the datum point so that your height measurements are accurate.

WARNING

The testing of springs is inherently dangerous.

Always make sure to properly secure the spring being tested. Always wear appropriate eye protection whenever testing any material that may fracture during a testing procedure.

10.1   Setting the Datum

Setting the datum establishes a reference zero height position. Your spring's length/height is measured based on your established datum.

An automatic datuming procedure is included with the spring test software.   Once your have affixed your testing fixtures, use the jog targets to position the top fixture as close as possible to the bottom fixture.

IMPORTANT

Be careful not to bring the top and bottom fixtures together causing a potential load cell overload condition.

Pressing the jog targets changes the jog speed from slow to fast. Fine lines on the jog targets indicate the jog speed is set for slow motion. Coarse lines indicate the jog targets are set for a fast speed. Use the fast jog to position the top fixture to a position that is "close to the bottom fixture".

- Pressing the jog target so that coarse lines are shown, indicating that the jog velocity is set to Fast.
- Use the jog pushbutton to move the crosshead to a position where the top and bottom fixture are in close proximity to one another, **BUT NOT TOUCHING**.
- Press the jog target so that fine lines are shown, indicating that the jog velocity is set to Slow.
- Use the jog pushbutton to move the crosshead to a position where the top and bottom fixture are in close proximity to one another, **BUT NOT TOUCHING**.
- Press the (H) Height target to initiate the datum procedure.

An automatic datuming can now take place.

*Note that prior to datuming, the Height is displayed as 0.000.*

The datum is unknown.

You can enter the Fixture Height or the known length of your extension spring in this entry block.

If you set up Fixture Height in the test setup, this height value is automatically poplulated and used to determine the datum.

Select Up for extension spring datuming.

Touch the Up target, the crosshead will move upward until the extension datum is determined automatically.
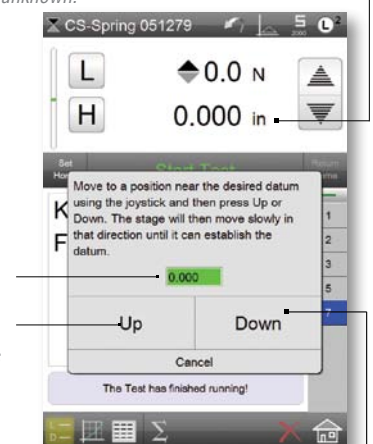

Select Down for compression spring datuming.

Touch the Down target and the crosshead will move downward until the top/bottom fixture touch and the datum is determined.

10.2   Accepting the Datum

The datum procedure is automatic. Once the datum is determined, the crosshead travel will stop.

• Press the jog target until the fine lines are displayed.

• Press the jog pushbutton to position the crosshead at a height that will allow you to affix the spring to the testing fixture (hook for extension or platen for compression). Note that the (H) Height indication is now reported by the L2 controller. This is the measured distance from the top fixture to the established datum that was just determined.
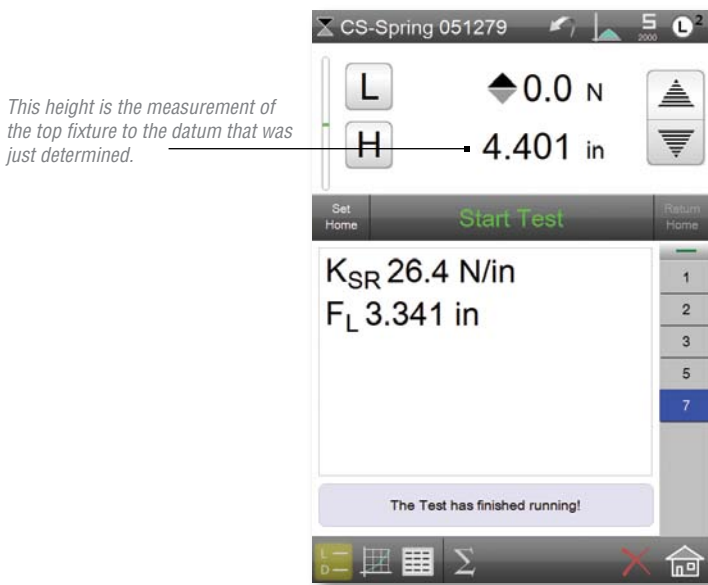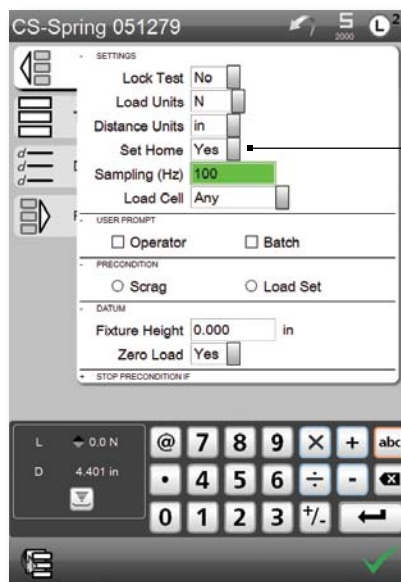
10.3   Set Home Position

When you Set Home you establish from where you want to start the test from. Usually, this is a position that allows ample room to load/unload your spring under test.

• Press the Set Home target to establish the Home position for your test.

Note

The Pre Test step includes the ability to automatically Set Home. When the Pre Test Set Home option is Yes, the Home position is automatic once the Start Test target is pressed.

This height is the measurement of the top fixture to the datum that was just determined.

Use the Pre Test Set Home option to automatically set the home position for your test once the Start Test target is pressed.

It is recommended that you routinely reset the datum, especially when you change test setups. If the test fixture changes, you should definitely re-datum the system.

Once the datum is established, you have the option to Accept the datum or Set the datum.

When you change tests, you will be asked to Accept or Set a new datum. If your fixture changes, you should Set a new datum. If, however, the fixture is the same, it may be appropriate to Accept the current datum.

It is recommended that you routinely reset the datum, especially when you change test setups. If the test fixture changes, then you should definitely re-datum the system.
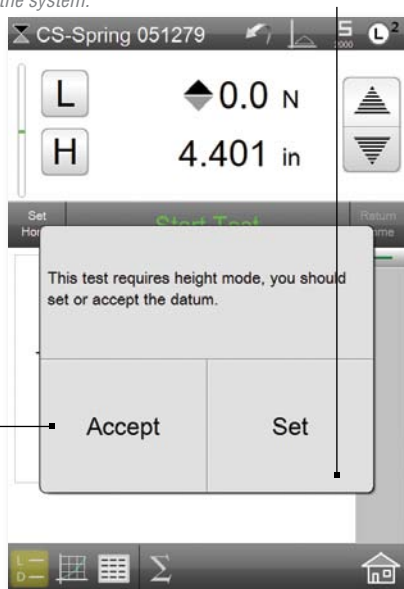
You can set the Home position manually prior to your test.

Select the Set Home target prior to pressing the Start Test.
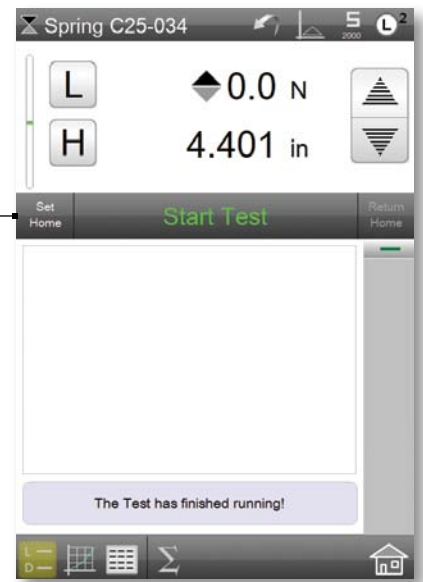
10.4 Start Your Test

Once the datum is determined and the Home position is established, you can start the test. Starrett recommends using the Start/Stop button to start/stop your test. When a test is active, the Start Test symbol changes to Stop Test.

10.5 Stop Your Test

Stop an active test by pressing the Stop Test target or using the Start/Stop pushbutton. Starrett recommends using the Start/Stop push button.


Starrett recommends that the Start/Stop pushbutton be used as the primary method for starting/stopping a test setup. Alternatively, users may Start or Stop a test using the Start Test and Stop Test touch targets.
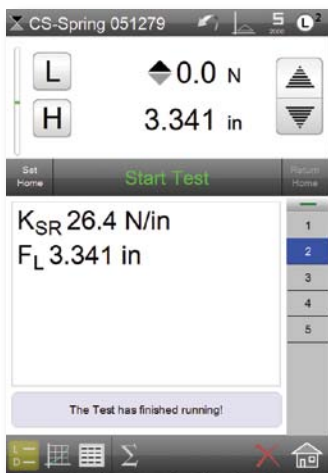
## 10.6 Observing Test Status Message

During a test, the status/message block provides you with information on the status of the test currently active and operating.
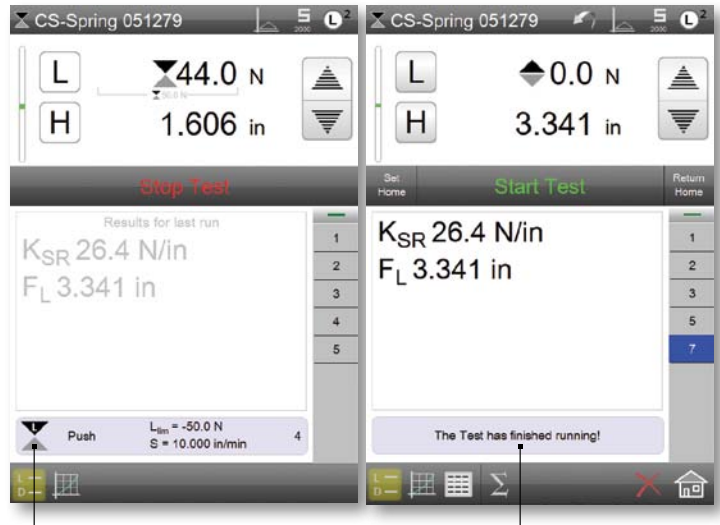

During a test, the status block supplies you with information on the steps within your test that are currently being performed. In this example, it shows that the system is compressing to a Load Limit target of 50N at a speed of 10 inches per minute. If cycling was used, the message line would also show the cycle count or cycle duration.

10.7   Return Home

When you manually Set Home, you can also manually set Return Home at the completion of your test. The Post Test step includes an option that automatically returns the crosshead to the Home position as well.
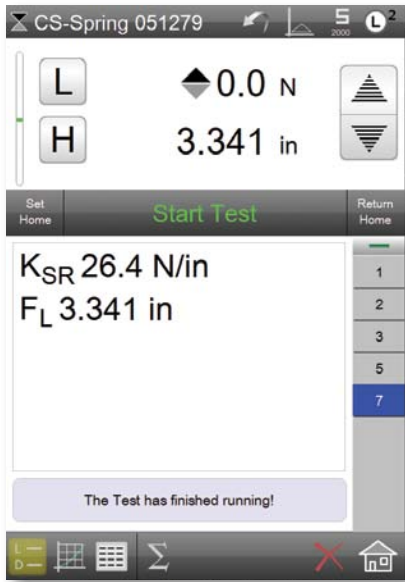
You can manually Return Home when you have previously manually Set Home. Press the Return Home target to return to the Home position.
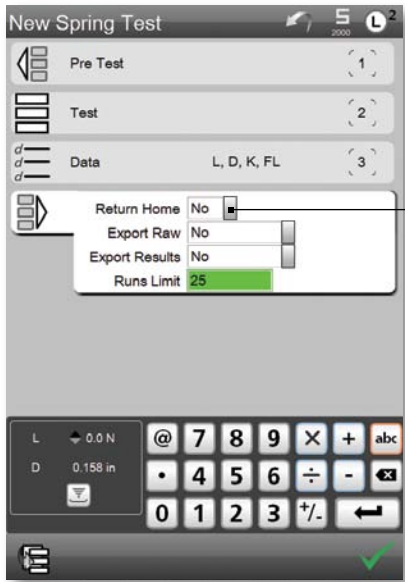

Use the Post Test Set Home option to automatically set the Return Home position for your test once the test is completed.

11.0   Printing

The L2 controller features four basic types of reports for printing: Data Label, Data Summary, Graph and Statistics. Your must print a report from the view currently being displayed.
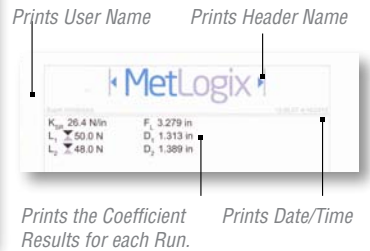
11.1   Data Label (DRO View)

The Data Label report is designed to be printed in a label format using a label printer. The Data Label prints the associated information you configured for a run within your test setup.
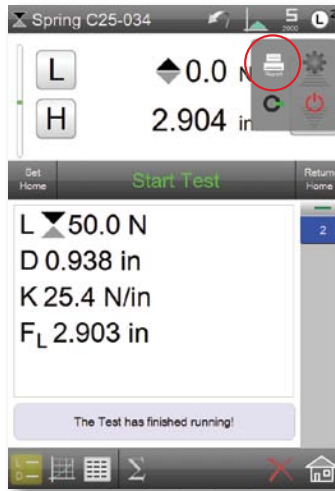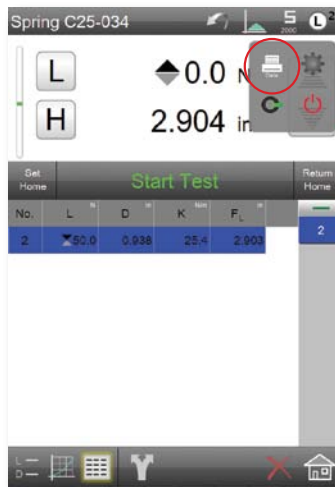

1. Select Data View.

2. Select L2 Main Menu.

3. Select PRINT symbol.

The report will print to the associated printer.

Prints User Name   Prints Header Name

Prints the Coefficient   Prints Date/Time
Results for each Run.

11.2   Data Summary (Batch View)

The Data Summary report prints in a landscape format. This is a batch report that prints the associated information you configured for all runs with your test setup. Each Run is reported as a single row within a spreadsheet-type layout.

1. Select Data Summary View.

2. Select L2 Main Menu.

3. Select PRINT symbol.

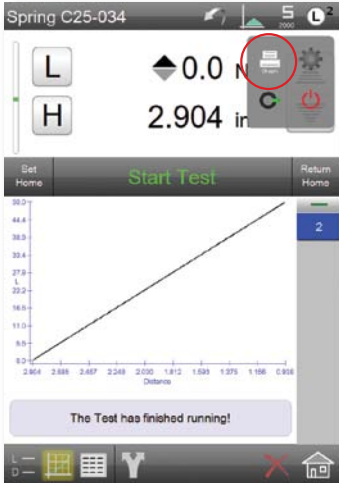*The report will print to the associated printer.*

Prints the Units of Measure per each Column Header
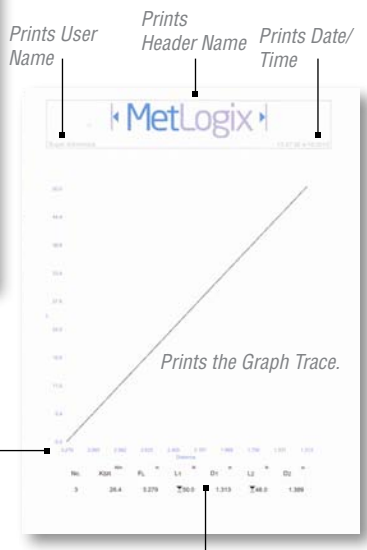
Prints the Coefficients as Column Headers

Prints the Coefficient Results for each Run within your Test. Since three (3) Runs were performed, it will print three sets of data for each Run.

11.3   Graph (Graph View)

You may print the graph using the print icon. From the Graph view, select the Print icon. You will get a portrait-style printout of the graph for an individual Run or an Overlay with up to six (6) Runs displayed collectively. When an Overlay is printed, the individual traces are printed in a unique color and referenced on the legend for identification back to its respective Run number.

1. Select Graph View.

2. Select L2 Main Menu.

3. Select PRINT symbol.

The report will print to the associated printer.

Prints User Name

Prints Header Name

Prints Date/ Time

Prints the Graph Trace.

Prints the Graph axis.

Prints the Graph for each Run. Prints the coefficients associated with the Graph in a table.

11.4 Statistics (Stats View)

You may print the Statistics View using the print icon. From the Statistics view, select the print icon. You will print the statistics for your individual run and the related statistics on the Run and the statistics for all Runs for that test.

1. Select Data View.

2. Select Statistics View.

3. Select L2 Main Menu.

4. Select PRINT symbol.

The report will print to the associated printer.
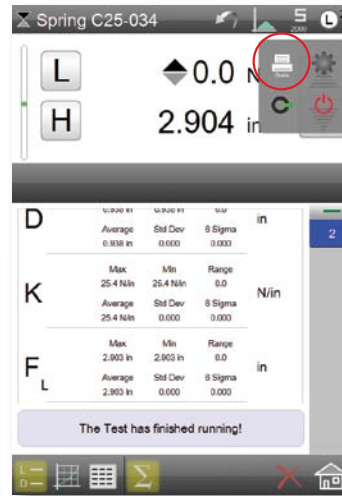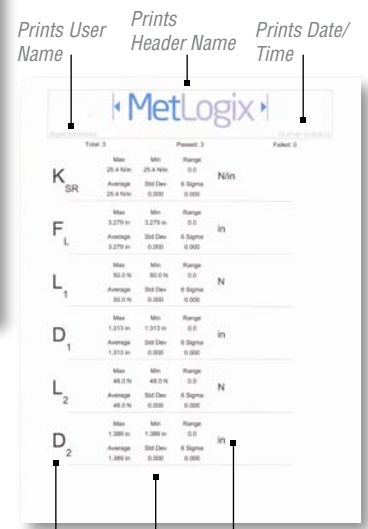
Prints User Name

Prints Header Name

Prints Date/ Time

Prints Coefficient

Prints Statistics

Prints Units of Measure

11.5 Changing Print Formats

Use the Main Settings - Printout function to set up your print Formats.

You may print your company logo onto your printouts

Select the location of your logo: right, center, left or none (No).

You select the location for your logo: header and/or footer

Save your bitmap image in your MetLogix directory and sub directory called LogosandBitmaps as:

- *HeaderLogo.bmp*
- *FooterLogo.bmp*

Select Yes, to include Header to your report printouts.

Select No, to print reports without a Header.

Maximum logo size recommended is 250x115 pixels.

Include User Name in header. Options are right, center, left and No.

Include Page Number in footer. Options are right, center, left and No.

Select Yes, to include a Column Header to your report printouts.

Select No, to print reports without column headers.

Select Yes, to include a Grid Lines to your graph printouts.

Select No, to exclude Grid Lines on your graph printouts.

Select Yes to add page numbers to your report formats.

You may have three (3) lines of header text.

Enter your header text into the text blocks.

Each header text may have up to 24 characters.

You may have one (1) line of Footer text.

Enter your Footer text into the text block.

Your Footer text may have up to 24 characters.

Select DONE to enable the Printout Settings you select.

12.0 System Settings

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

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

Select the L2 symbol to access System controls.

Select the Settings symbol to access the main System Settings options.

12.1 Contact Us Setting

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

12.2 Using About Setting

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

This functions makes a copy of the current mlxoptions. txt file. This file is used by MetLogix service personnel.

Use this function to upload new software options supplied by MetLogix, Inc.

Use this function to view the firmware revision for your L2 controller. Also used to upload new firmware software options.

Displays the current User Level of the operator.

12.3   Language Settings

When Language Settings is set to Yes, the user is abe to the designate the display language for your L2 controller. These languages are supported: English, Deutsch, Francais, Italiano, Espanol, Portugues, Russian, Chinese (simplified) and Chinese (Mandarin).

If the Language Settings is set to No, the user cannot change the display language.

Select the Language target that corresponds with the display language you want to use with your L2 Controller.

The current Language is identified with a green status indicator.

12.4   System Security

Your L2 controller has three levels of user security: Super Administrator, Supervisor or User.

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

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

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

All assigned users to a system have these configurable attributes:

• Display Name

• Password

• Maximum days a password is usable

• Account enabled

• Automatic login

All assigned users have these configurable access rights:

• Language Settings

• Display Formats

• File Locations

• Tests

• Coefficients

• IO Lines (for optional Automation Builder)

• Printouts

• Security Settings

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

Each user will have an individual and unique User Name.

The User Name may be a combination of alpha and numeric characters.

The User Name may be up to 16 characters in length.

The User Name will appear on the User List on the Login view.

Select the User Level: Super Administrator, Supervisor or User.

Each user may have a password. The password my be up to 16 characters in length.

Passwords may be set up to expire.

If this field is null, there is no expiration date.

Otherwise, enter a numeric value to indicate the number of days a password will remain active.

Use the Password Login view to gain access to the system.

Users may have their accounts enabled or disabled.
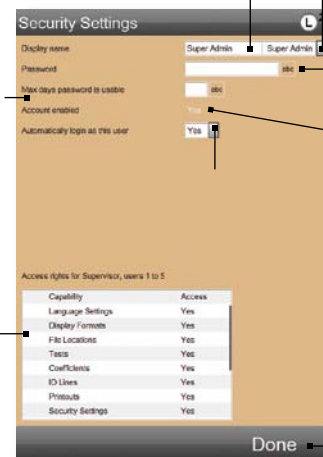
The Super Administrator level is always enabled.

The Supervisor and User levels may be disabled by selecting No.

Note: this view is for the Super Administrator which is why there is no option for Yes/No.

When the Access is Yes for a category, the user has the ability to make changes.
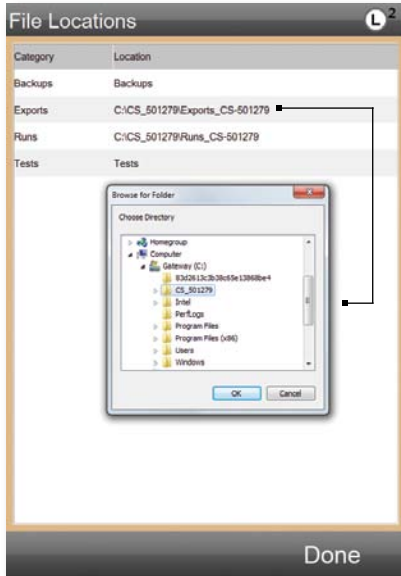
When the Access is No for a category, the user cannot make changes.

Select Done to enable the Settings you select.

12.5   File Locations

The File Locations setting lets you set up directories and locations to where files can be exported. Within the File Locations settings, you have the ability to set up and link directories for backups, exports, runs and test files.

Select the FILE Category.

Set the Directory (Location) where you want your files to be sent upon a test completion.

When no location is assigned, the default location is your C Drive.

Go to Computer.

Go to User.

Go to Public.

Go to Public Documents.

Go to MetLogix.

## 12.6   Using Corrections Setting

The Corrections setting is used by your authorized Starrett Dealer and by trained personnel in advanced service procedures for your system. Most of this section applies to corrections used in calibration.

For your spring test applications, it may be useful for you to use the Deflection Compensation options:

• Enable Deflection Compensation

• Deflection Distance

• Deflection Force

Your load string, comprised of your load cell sensor and testing fixture have inherent deflection when under load. This movement of the load string may affect the height measurements for your spring testing, therefore, you should use the deflection compensation option to compensate for this mechanical movement.

• Place your system into Normal mode by selecting the mode symbol. The test now displays Distance (D).

• Create a Load Limit test. Compress to a load value that equals the maximum load specification for the spring being tested. Use this value as your Load Limit.

• Set the Speed to a very low velocity, e.g. 0.01 in/min.

• Perform the test. Compress to the Load Limit value.

• Enter the Load Limit for your Deflection Force.

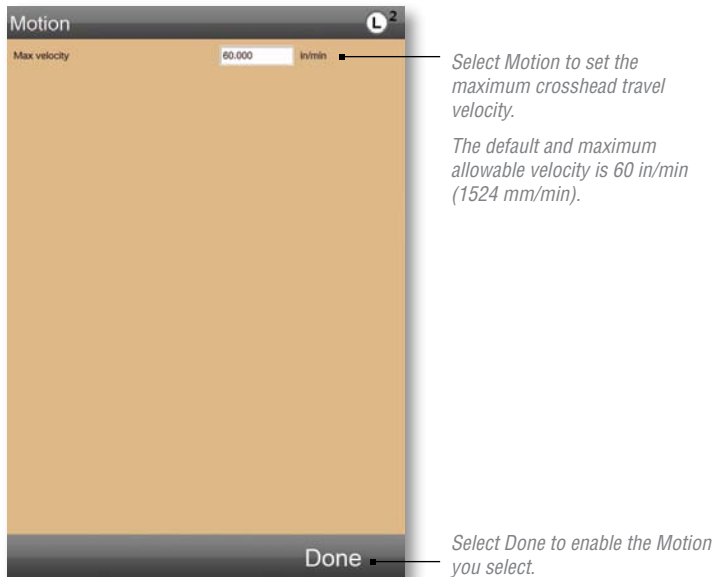• Enter the Distance at Load Limit for your Deflection Distance.
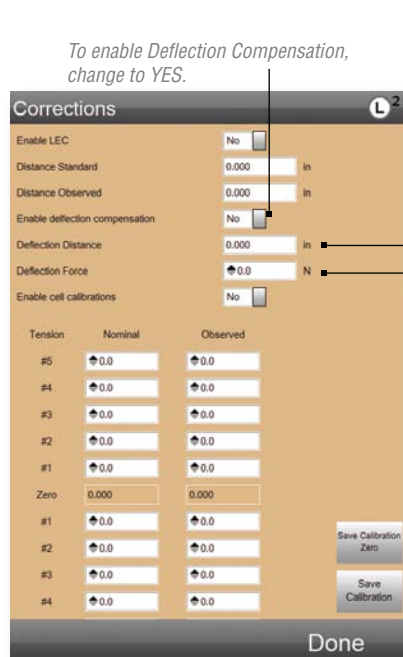
To enable Deflection Compensation, change to YES.

Enter the Deflection Distance (D) from your load limit test setup. Perform a Compression or Tension test with the load cell sensor and test fixture to be used for your spring test. Zero Load and Distance and measure the Distance (D) from your Home (zero) to the target load. The measured Distance is your Deflection Distance.

Enter the Deflection Distance (D) from your load limit test setup. Perform a Compression or Tension test with the load cell sensor and test fixture to be used for your spring test. Your target load should be a value equal to the highest load value used in your spring test. Use this load target value as the Deflection Force value.

12.7   Using Motion Setting

The Motion setting is used to set the maximum velocity for crosshead travel.

Select Motion to set the maximum crosshead travel velocity.

The default and maximum allowable velocity is 60 in/min (1524 mm/min).

Select Done to enable the Motion you select.

12.8   Loads Setting

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

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

The *Pinch* load setting is a safety feature for your Starrett system. When Pinch load is enabled, the load you set for Pinch load will stop crosshead movement when your system is operated manually and in the compression direction. Its purpose is to prevent someone from pinching their hands/fingers accidentally. You may have a load up to 15 lbf (66N) as your pinch load. If during a manual movement in the downward position, the load sensor measures 15 lbf (66N), then the crosshead will automatically stop.

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

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

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

Your options are Compression or Tension.

When set at Compression, the load result value is expressed as a negative number.

Use to protect your grip/fixture from damage due to overloading.

Set the maximum load for your fixture.

If this load is met, the test will abort.

This load cannot be changed.

The Frame load capacity is automatically recognized by your L2 Controller.

This is the maximum testing load to which the test frame is rated.

You may specify the load cell model to be used with your testing system.

Select the model from the list of values.

Your connected load cell sensor is automatically recognized by the system.
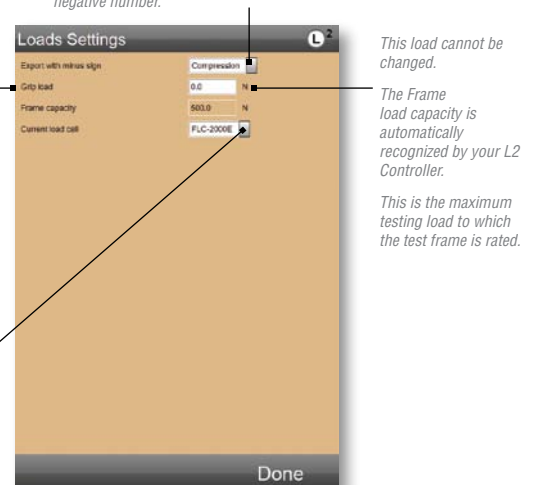
12.9   Tests

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

When the Unlocked Tests option is set to Yes, the user has the ability to edit, copy and delete a test setup. If the option is set to No, then the user cannot edit, copy or delete a setup.

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

When Allow Runs to be Deleted is set to Yes, the user may delete a Run. If the option is set to No, then the user may not delete a Run.

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

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

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

*Use to set limits on who can make revisions to locked and unlocked test setups.*

The user who creates a test setup can "lock" the test to prevent unauthorized changes.

Security access privileges provide additional access restrictions to making test revisions.

When these options are set to Yes, you have the ability to make test revisions.

The next test number lets you specify the number reference for your test used with the Test Number Prefix.

In our example, the next test name would be T1.
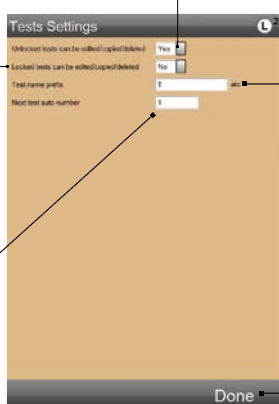
You can set up a test prefix name for your test setups. These can be by user, by manufacturing center, by batch ID, etc. The prefix allows you to add your own unique naming conventions for your test setups.

The Test name prefix may be up to 10 characters in length.

Select Done to enable the Test Settings you select.

12.10   Coefficients

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

You may rename a coefficient using up to 8 characters.

*Use the Coefficient Settings view to change how a coefficient is displayed.*

For example, the default coefficient name for Load uses the L character.

If you select the Load coefficient and select the [abc] target next to the Load coefficient block (which displays L), you can change the name. We changed the coefficient from L to Load.

The coefficient for Load will now display Load instead of L.

12.11 Using Desktop Setting

The Desktop setting is used to display certain functions such as the keyboard target that when pressed launches the virtual keyboard. These functions help with software navigation.
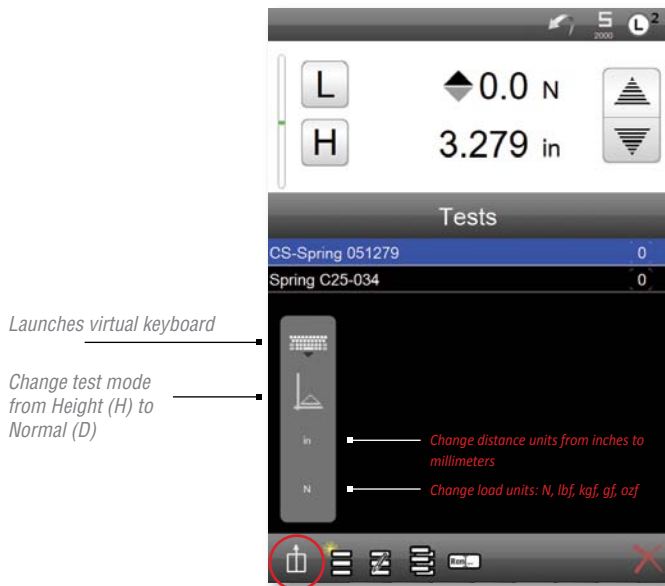
Launches virtual keyboard

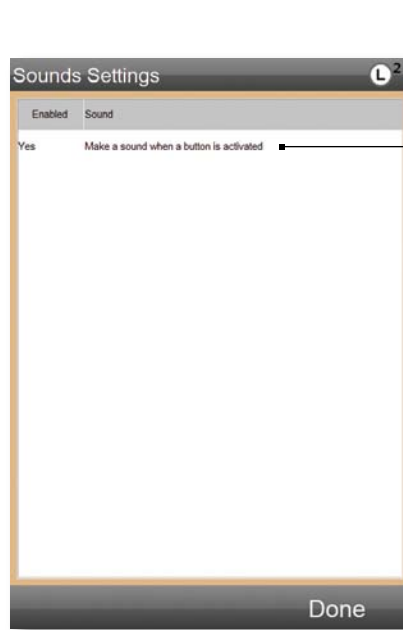*Change test mode from Height (H) to Normal (D)*

Change distance units from inches to millimeters

Change load units: N, lbf, kgf, gf, ozf

Special Desktop icon. Press to launch options list.

12.13 Using Sound Setting

The Sounds setting is used to link a sound file (.wav) to a keyboard action.

*Use the Sound function to establish a audible feedback of your keyboard/touch activity.*

Save a .wav file to your MetLogix L2 directory.

Selecting Yes will automatically link to this .wav file.

Select No if no audible feedback is preferred.

12.12 Using Display Formats Setting

The Display Formats setting is used to set up your global units of measure for load, distance/height and speed.
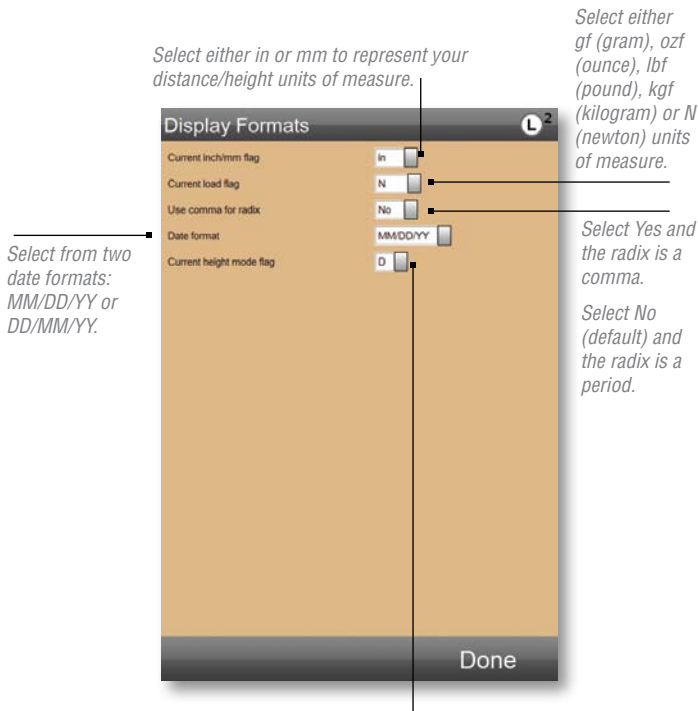
Select either in or mm to represent your distance/height units of measure.

Select either gf (gram), ozf (ounce), lbf (pound), kgf (kilogram) or N (newton) units of measure.

Select from two date formats: MM/DD/YY or DD/MM/YY.

Select Yes and the radix is a comma.

Select No (default) and the radix is a period.

When using Height mode, you may indicate height using the label H (height) or D (distance).

FORCE MEASUREMENT

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Form 977   09/12   PDF