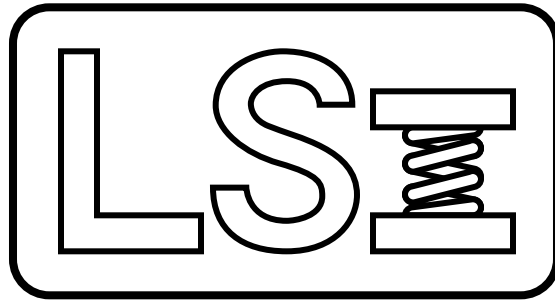


Larson Systems Inc.



*ECT / CDHT / FDHT / DHT
User Manual*



April, 2003
Part No. 060-1000-025J

LARSON SYSTEMS INC.

User Manual for

ECT - Electronic Compression Tester
CDHT - Compression Digital Hand Tester
FDHT - Force Digital Hand Tester
DHT - Digital Hand Tester

Current for Software Version 4

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This manual could contain technical inaccuracies or typographical errors. Changes are periodically made to the information herein. These changes will be incorporated in new editions of the manual

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1.0 About your Tester

1.1 Description - What it can do

Your LARSON Hand Tester is a manually operated Force / Length Tester: it is designed to be portable and easy to use for In-Process Control measurements right on the factory floor. The LARSON Hand Tester is light weight (about 22 lb) and battery powered (optional on some models); hence, mobile for use wherever needed. The LARSON Hand Tester uses LCD readouts for easy viewing of highly accurate length and force measurements. The length measurement units can be selected to read in inches or millimeters while force measurement is selectable to read in pounds, kilograms, or Newtons. The LARSON Hand Tester measures flexible items in either compression or tension. Although low in cost, the LARSON Hand Tester features a high degree of built-in precision and accuracy to assure excellent repeatability and reproducibility.

All of the LARSON Hand Testers have DEFLECTION COMPENSATION for load cell and frame deflection. Because the testers have compensation with Integrated force and length measurements, the length reads accurately at any force. This eliminates the need to use look up tables to correct for the displayed length error. LARSON Hand Tester's length reading is accurate as displayed.

The Testers are made with rugged cast aluminum and steel frames and instrumented with Larson's precision load cell for force, glass scale for length and Larson's proprietary Precision Electronics for analysis and display of exact measurements.

RS 232 output (optional on some models) can be sent to computer, datalogger or printer for accurate transmission of data for further analysis.

LARSON Hand Tester Features:

- Automatic displays of length and force. (except FDHT which is Force only)
- Sixteen digit, LCD force display (including low battery indication).
- Push button force zeroing.
- **Load cell deflection compensation**
- Optional high resolution force for 10X resolution and accuracy.
- A length lock for holding the unit at a given position for ease of measurement.
- 100% factory set overload protection for the load cell.
- Two inch diameter load platforms with a 5/16-18 threaded center for using optional tension hooks or for mounting special fixtures.
- LSI supplied 6V battery charger.
- Peak capture capability.

1.1.1 Individual Tester Features and Options



ECT Features:

- Force Capacities of 110 and 750 lb.
- 5" stroke (travel) and 5" range measurement (between the platforms).
- Compression testing



CDHT Features

- Force Capacities of 10, 110 and 750 lb.
- 6" stroke (travel) and 6" range measurement (between the platforms).
- Compression testing



FDHT Features:

- Force Capacities of 110 and 750 lb.
- 7" stroke (travel) and 18" range measurement (between the platforms).
- Compression or Extension testing (with optional hooks or accessories)



DHT Features:

- Force Capacities of 2, 10, 110 and 750 lb.
- 6" stroke (travel) and 12" range measurement (between the platforms).
- Two micro-adjust length stop screws to simplify and speed up repetitive measurements.
- Long life Ni-Cd battery good for 8+ hours of operation between charges.
- Compression or Extension testing (with optional hooks or accessories)

ECT Options:

- High Resolution Force 0-100% of FS.
- High Resolution Length (.001")
- Single micro-adjust length stop screw to simplify and speed up repetitive measurements.
- Long life Ni-Cd battery good for 8+ hours of operation between charges.
- RS 232 output
- 220VAC 50 hz power supply

CDHT Options:

- High resolution force for more accurate load measurements at low loads. 10X resolution from 0-20% of FS.
- Digital Length Precision Upgrade (.0005" resolution)
- Micro Length Adjust
- Micro Length Adjust with built in stops
- Two micro-adjust length stop screws to simplify and speed up repetitive measurements.
- Long life Ni-Cd battery good for 8+ hours of operation between charges.
- RS 232 output
- 220VAC 50 hz power supply

FDHT Options:

- High resolution force for more accurate load measurements at low loads. 10X resolution from 0-20% of FS.
- Quick Release Range Adjust Handles
- Long life Ni-Cd battery good for 8+ hours of operation between charges.
- Micro Length Adjust
- Micro Length Adjust with built in stops
- Extended Range Rods to 36"
- Extended Range Rods to 48"
- RS 232 output
- 220VAC 50 hz power supply

DHT Options:

- High resolution force for more accurate load measurements at low loads. 10X resolution from 0-20% of FS.
- Digital Length Precision Upgrade (.0005" resolution)
- Quick Release Range Adjust Handles
- Micro Length Adjust
- Micro Length Adjust with built in stops
- Extended Range Rods to 18"
- Extended Range Rods to 36"
- Extended Range Rods to 48"
- RS 232 output
- 220VAC 50 hz power supply

1.2 Safety and Use Considerations

Remember that a compressed or extended spring has stored potential energy proportional to the spring constant. Use care and release this energy in a controlled manner to avoid possible injury.

Before using your tester, read this manual to gain an understanding of its proper operation to measure force / length relationships of an object and observe the following important operating considerations.

- Do not apply more force than the tester is designed for - the tester has overload stops to protect it to twice the rated capacity. Force readings are not accurate above the rated limit.
- Be sure the operating location is clean and dry and all springs to be tested are free of oil and contaminants.
- Wear appropriate eye protection.
- Use appropriate fixturing to prevent springs from flying out due to buckling under load.
- Keep your equipment away from any source of liquid.
- Keep these instructions for handy reference.
- Follow all instructions and warnings concerned with the use of the Larson Hand Tester.

1.3 Specifications (All models)

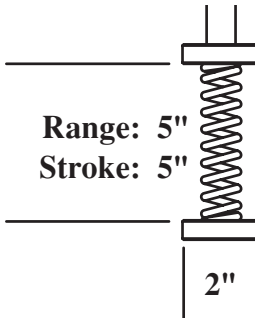
Actuation	Manual handle
Dimensions	8 X 12 X 22"
Weight	Approx. 22 lb
Operating temperature range	60-100° F
Power requirement	100-135VAC 60 hz (Optional 210-250 VAC 50 hz)
Deflection	0.001 max
Parallelism	0.001 TIR (Total Indicator Reading)

1.3.1 ECT

Compression capability only

ECT - Force Specifications		
Capacity	Standard Resolution	High Resolution*
110 lb	0.1 lb	0.05 lb
50 kg	0.05 kg	0.02 kg
489 N	0.5 N	0.2 N
750 lb	1 lb	0.5 lb
340 kg	0.5 kg	0.2 kg
3,336 N	5 N	2 N
Accuracy = \pm Resolution x 2 *Requires 050-1000-0012-00		

ECT - Length Specifications				
Capacity	Standard Resolution		High Resolution*	
	Resolution	Accuracy (\pm)	Resolution	Accuracy (\pm)
110 & 750 lb	0.005 in	0.01 in	0.001 in	0.005 in
	0.1 mm	0.2 mm	0.02 mm	0.1 mm
*Requires 050-1000-0013-00				

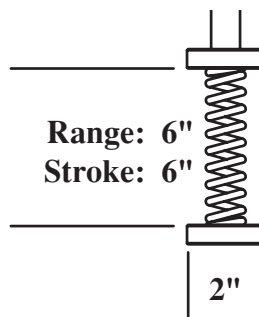


1.3.2 CDHT

Compression capability only

CDHT - Force Specifications		
Capacity	Resolution	
	— 0-20% FS*	0-100% FS 20-100% FS*
10 lb	0.0005 lb	0.005 lb
4.6 kg	0.2 g	2 g
44.5 N	0.002 N	0.02 N
110 lb	0.005 lb	0.05 lb
50 kg	0.002 kg	0.02 kg
489 N	0.02 N	0.2 N
750 lb	0.05 lb	0.5 lb
340 kg	0.02 kg	0.2 kg
3,336 N	0.2 N	2 N
Accuracy = \pm Resolution *Requires 050-0000-0107-00		

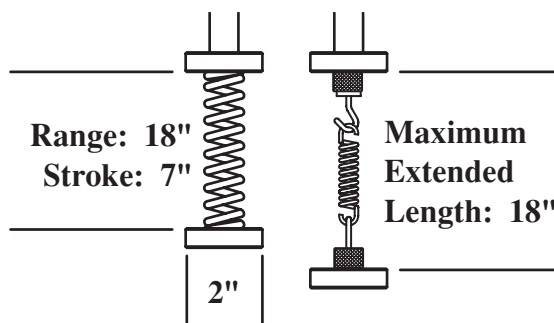
CDHT - Length Specifications				
Capacity	Standard Resolution		High Resolution*	
	Resolution	Accuracy (\pm)	Resolution	Accuracy (\pm)
10 & 110 lb	0.001 in	0.002 in	0.0005 in	0.001 in
	0.02 mm	0.04 mm	0.01 mm	0.02 mm
750 lb	0.001 in	0.005 in	0.0005 in	0.002 in
	0.02 mm	0.1 mm	0.01 mm	0.04 mm
*Requires 025-0000-0488-00				



1.3.3 FDHT

Compression / extension capability

FDHT - Force Specifications		
Capacity	Resolution	
	— 0-20% FS*	0-100% FS 20-100% FS*
110 lb	0.005 lb	0.05 lb
50 kg	0.002 kg	0.02 kg
489 N	0.02 N	0.2 N
750 lb	0.05 lb	0.5 lb
340 kg	0.02 kg	0.2 kg
3,336 N	0.2 N	2 N
Accuracy = \pm Resolution		
*Requires 050-0000-0107-00		

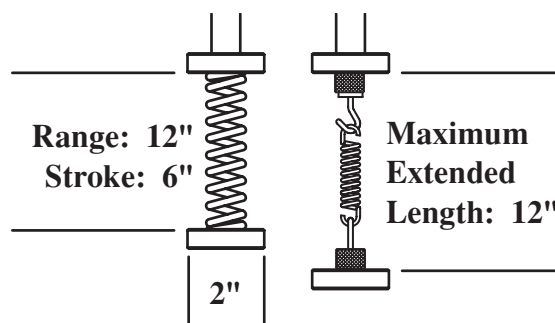


1.3.4 DHT

Compression / extension capability

DHT - Force Specifications		
Capacity	Resolution	
	— 0-20% FS*	0-100% FS 20-100% FS*
2 lb	0.00005 lb	0.0005 lb
907 g	0.02 g	0.2 g
8.9 N	0.0002 N	0.002 N
10 lb	0.0005 lb	0.005 lb
4.6 kg	0.2 g	2 g
44.5 N	0.002 N	0.02 N
110 lb	0.005 lb	0.05 lb
50 kg	0.002 kg	0.02 kg
489 N	0.02 N	0.2 N
750 lb	0.05 lb	0.5 lb
340 kg	0.02 kg	0.2 kg
3,336 N	0.2 N	2 N
Accuracy = \pm Resolution		
*Requires 050-0000-0107-00		

DHT - Length Specifications				
Capacity	Standard Resolution		High Resolution*	
	Resolution	Accuracy (\pm)	Resolution	Accuracy (\pm)
2, 10 & 110 lb	0.001 in	0.002 in	0.0005 in	0.001 in
	0.02 mm	0.04 mm	0.01 mm	0.02 mm
750 lb	0.001 in	0.002 in	0.0005 in	0.002 in
	0.02 mm	0.04 mm	0.01 mm	0.05 mm
*Requires 025-0000-0488-00				



2.0 Setting Up Your Tester

2.1 Unpacking

Lay the shipping box on its side and pull out the two styrofoam pieces that encase the tester. Check to make sure that you have the following items as shown in Figure 1.

*** SAVE PACKAGING TO RETURN TESTER TO LSI FOR CALIBRATION ***

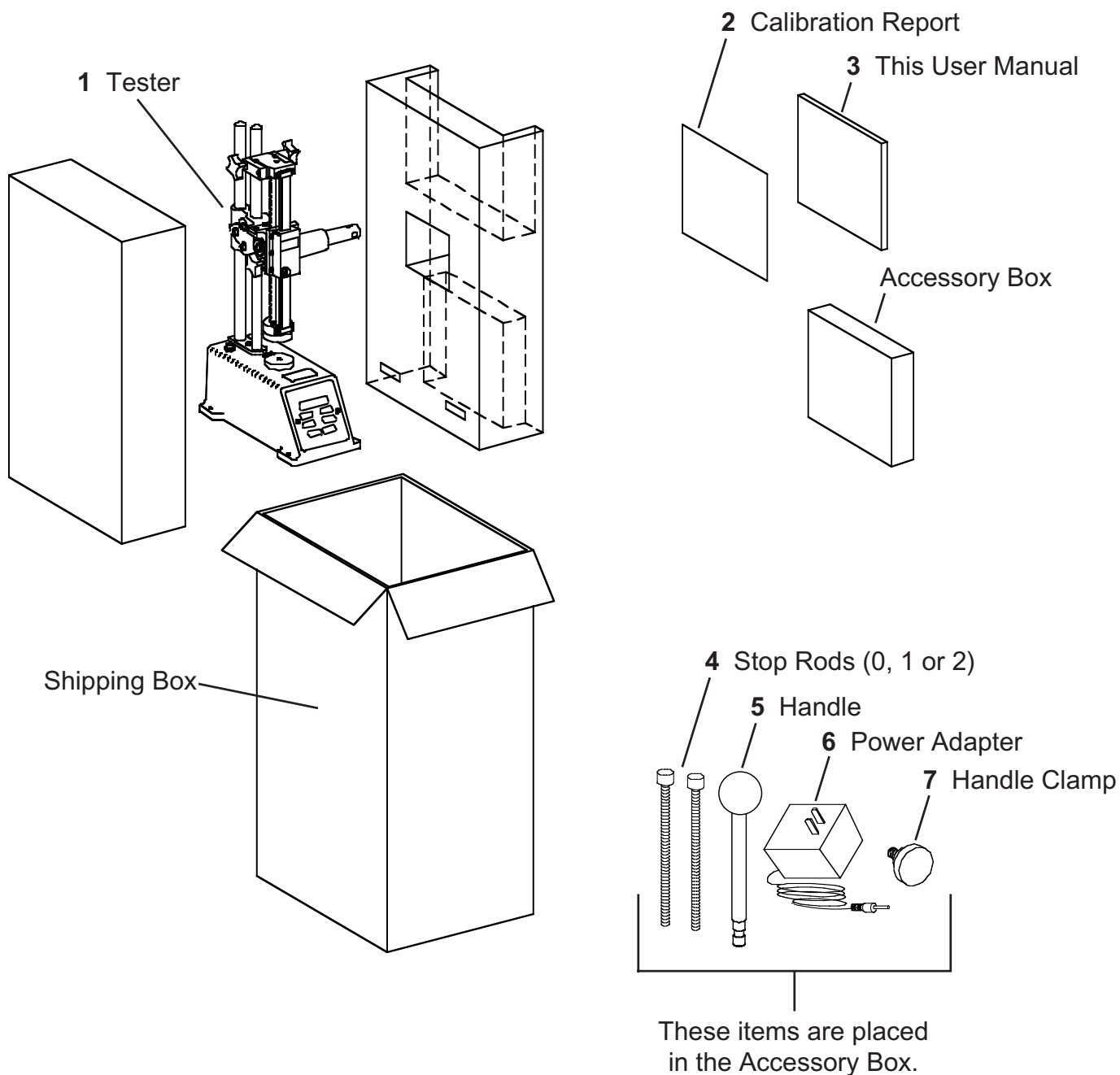


Figure 1
Unpacking
6

2.2 Installation

Observe the considerations outlined in Section 1-2 when selecting a work station for operating the tester.

- Place the tester on a level and stable work area where the operator can perform compression and tensile testing in a comfortable manner; i.e., lower platform is at a height to allow ease in loading, testing and removing testable items and the displays are easy to see and read.
- Insert the Handle Rod for applying test force and note that this handle can easily be removed and reinstalled at 90 degree increments for convenience in testing.
- Insert the Stop Rods from the top of clamping member leaving rods protruding sufficiently to permit free platform movement.
- Use black knobs to tighten stop Clamps around Stop Rods as required.
- The platform lock on the lower left (facing tester) is for use to lock the upper platform at a desired set position.
- The range adjust locks, lock the upper assembly at any desired position on the two 12 in. support rods.
- The overload screws on top of the tester base are factory set for overload protection.

NOTE: Tampering with these set screws voids tester warranty.

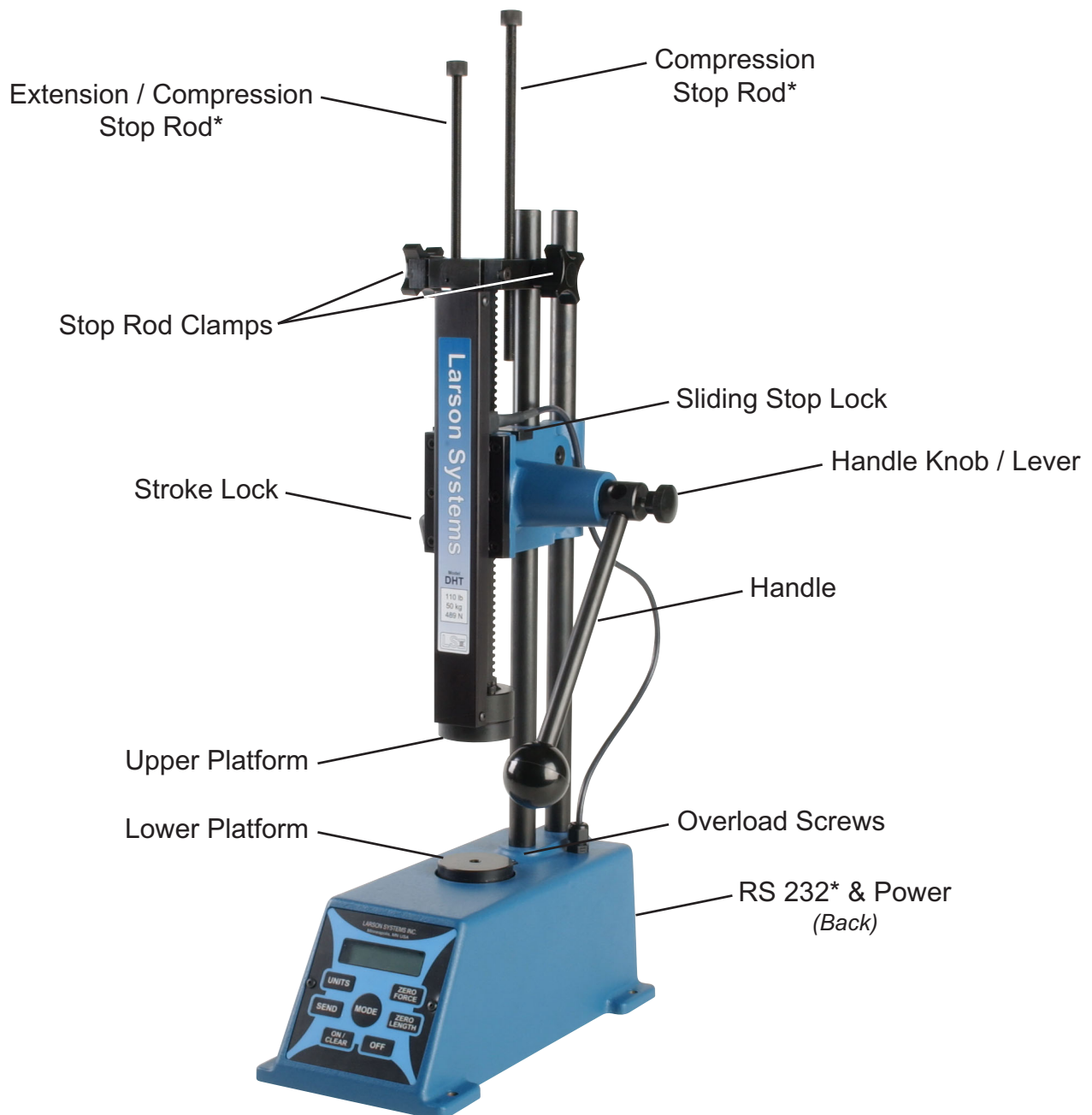


Figure 2
Tester Setup

**Optional on some models*

3.0 How to Operate Your Tester

3.1 Features

3.1.1 Power On

Press On/Clear

The tester will respond by lighting and first displaying:



Next it will display:



The first line is the model designation, force capacity, /H is high resolution force and software revision, the second line is the length resolution.

Next it will display:



The force display should show zero or a small reading. Press Zero Length to activate the length reading.

3.1.2 Power Off

Note ! Turn off the tester when not in use to conserve battery life. Press off. The display should show blank.

3.1.3 Selecting Measurement Units

Press Units to change the measuring units. Choices include: in/lb, mm/N, in/oz, mm/g and in/kg (in/g).

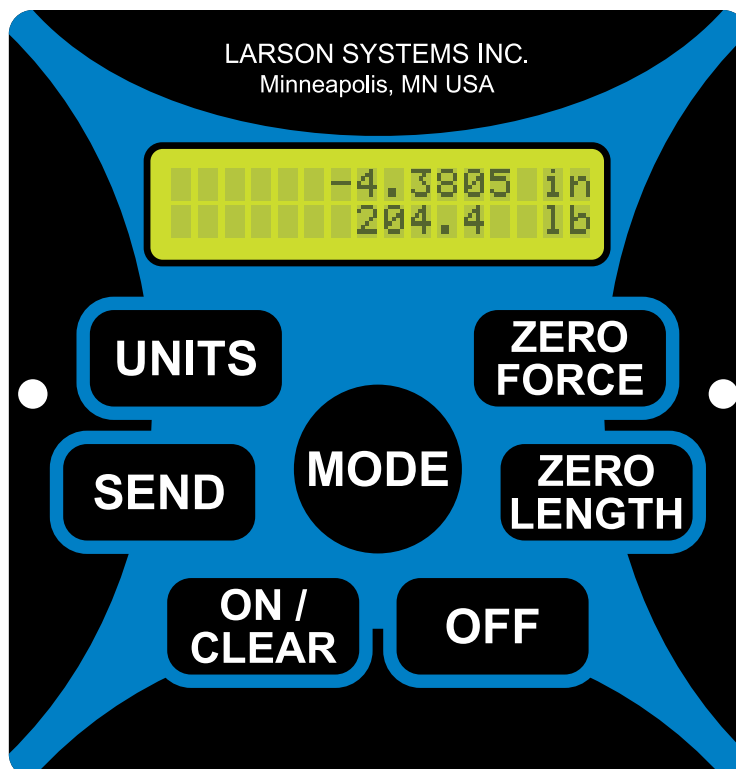


Figure 3
Force Display
8

3.1.4 Force and Length Zeroing (Initialization)

The force and length displays must be zeroed at a reference point. The normal reference for force is with the platforms apart with nothing on the platforms or with the specimen spring on the lower platform. The normal reference for length is with the platforms together or the hooks interlocked. To accomplish this initialization, make sure the stop rods permit free travel of the upper platform and proceed as follows:

Compression

- After power up, move the upper platform fully up and press zero force so the force display reads zero.
- Move the upper platform to a position which touches the Lower Platform exerting a load of about 10 to 30 % of the testers full scale.
- Press the Zero Length button to zero the Length Display.

Extension

- Install extension hooks as shown in Figure 6.
- Verify that the upper platform is at a position where Upper Hook interlocks with the lower hook, exerting a load of about 10 to 30% of the testers full scale.
- Momentarily depress the Zero Length button to zero the Length Display.

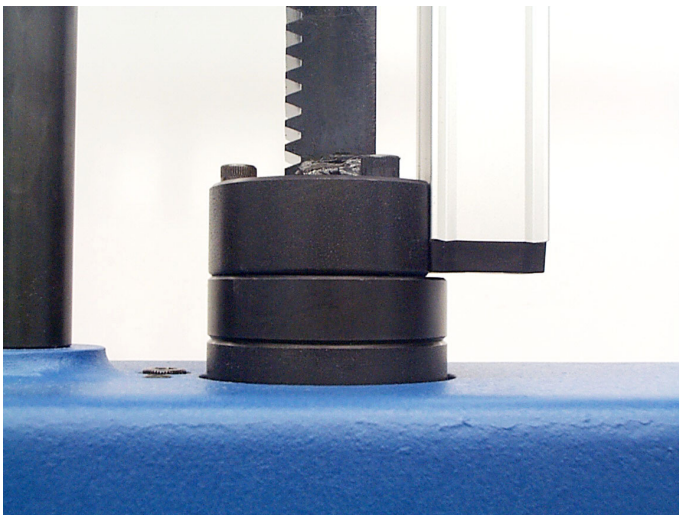


Figure 4
Compression Zeroing

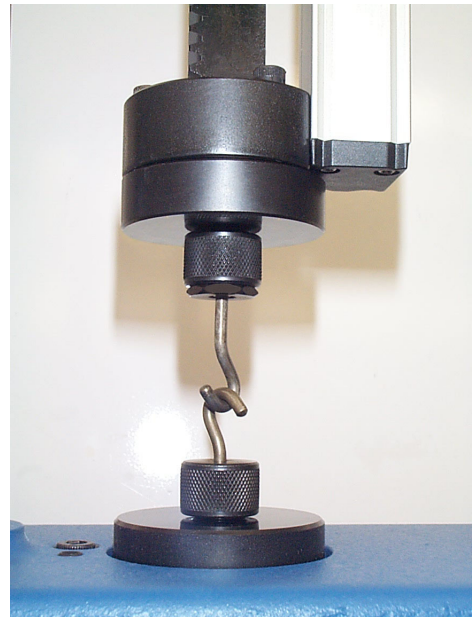


Figure 5
Extension Zeroing

3.1.5 Test Modes

Normal Tracking Mode

In the normal tracking mode the tester displays the current length and force.

Peak Force Mode

In the peak mode the tester remembers and displays the largest force that has occurred since entering the peak mode. The tester samples the force 4000 times each second, so forces of very short duration can be measured accurately.

Press the Mode button until the display shows "PK" causing the tester to enter the peak mode.

To reset the peak display, press the On/Clear button. If the display does not return to zero or near zero, press the Mode button to exit the peak mode. Pressing the Zero force button in the normal tracking mode will then cause the display to zero out. Return to the Peak mode and proceed.

Shunt Calibration Mode

This mode can be used to verify the accuracy of the force readings. This mode electrically simulates a load. Comparing the displayed value to the calibration report will verify the accuracy of the tester.

Press the Mode button until the display shows "SHN" causing the tester to enter the Shunt Mode. The force display in the normal tracking mode should read Zero.

3.1.7 Optional RS 232 Interface

Pressing the send button sends the current displayed force and length to the RS 232 port, which can be connected to a Larson supplied cable and printer, a computer via Larson's UTM Manager, or to a customer supplied data logger. Standard communication protocol is as follows: 9600 Baud, 1 start bit, 8 data bits, 1 stop bit. The DHT will not receive data when connected to a computer port.

Pinout
3 TXD
4 CTS
5 RTS
7 GND
9 +5V
11 CTS

Larson has available a RS 232 to Parallel Printer Cable / Adapter to allow printing directly to a parallel printer (PN 025-0000-458)

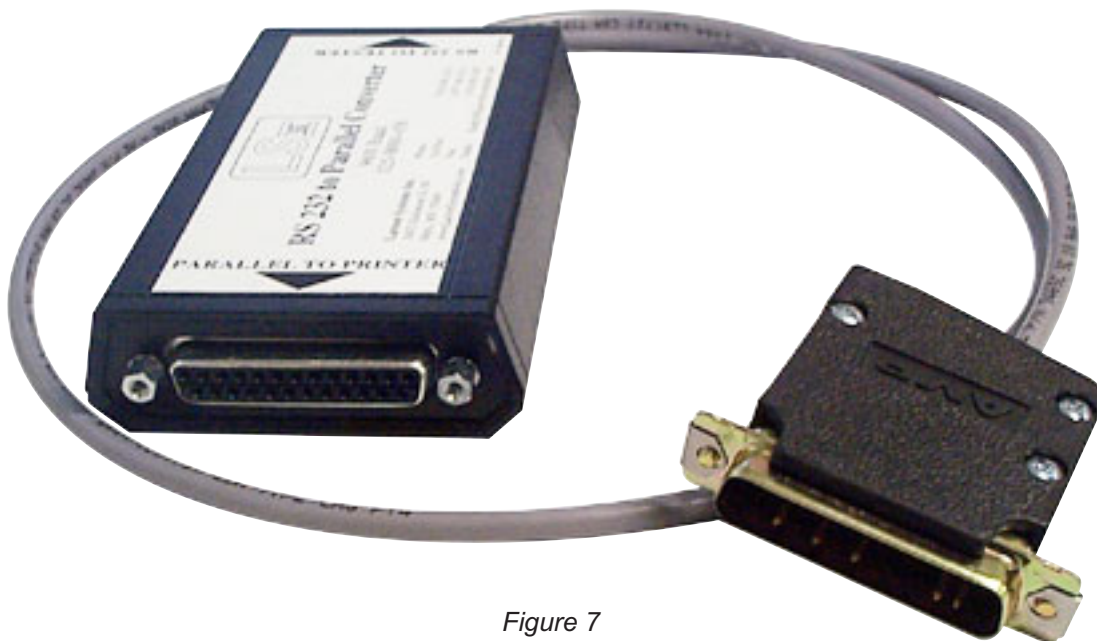


Figure 7
Parallel Printer Cable / Adapter

3.2 Optional High Resolution Force

The tester automatically displays 10X normal resolution improving resolution and accuracy at all force levels.

3.3 Length Lock

The length lock shown in Figure 8 locks the upper platform under load at any selected position in the length range. Using this feature simplifies setting the length stops and promotes accurate repetitive testing at two different lengths. The length lock is usable at forces up to 300 lb.

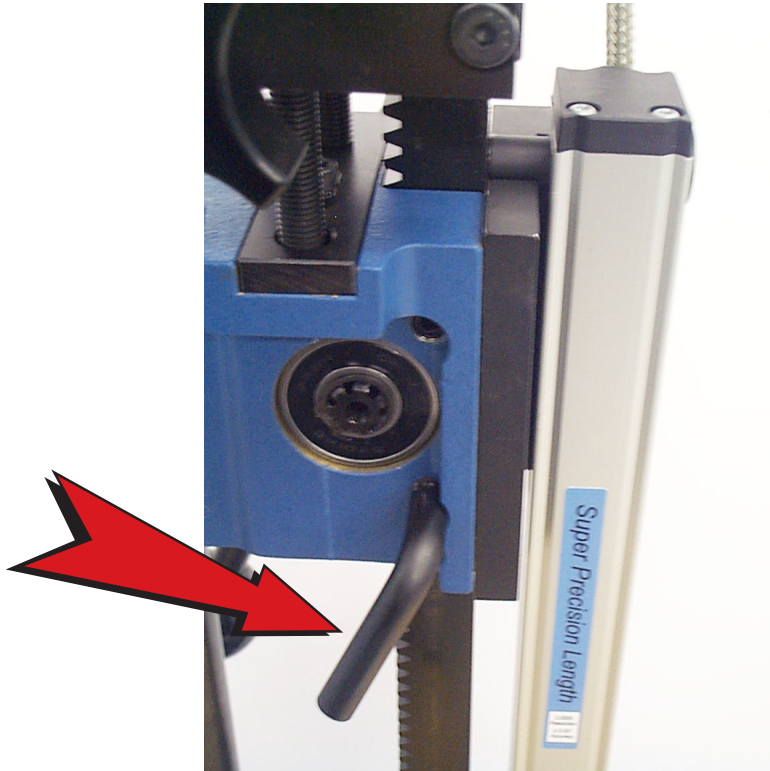


Figure 8
Length Lock

3.4 Setting Micro-Adjust Length Stops

Repetitive testing at one or two specified lengths is made simple through use of the Micro-Adjust system which consists of two threaded stop rods, a dual clamping top support and a sliding stop block.

Features:

- Loosening the clamping knob a fraction of a turn permits hand rotation of the threaded stop rod for fine positioning
- Loosening the clamping knob several turns frees the rod for large platform adjustment;
- Positive stop locking requires only light clamping force, because of the rod thread engagement.

Compression Stops

- Place your spring on the lower platform.
- Determine the two specified lengths for measurement.
- Move the sliding stop block fully to the left (figure 9)
- Set the left stop rod to the longer test length and tighten the left stop rod clamp.
- Move the sliding stop block to the right.
- Set the right stop rod to the shorter test length and tighten the right stop rod clamp.
- Check that the displayed lengths are correct and adjust as necessary.



Figure 9
Left Compression Stop Rod Example

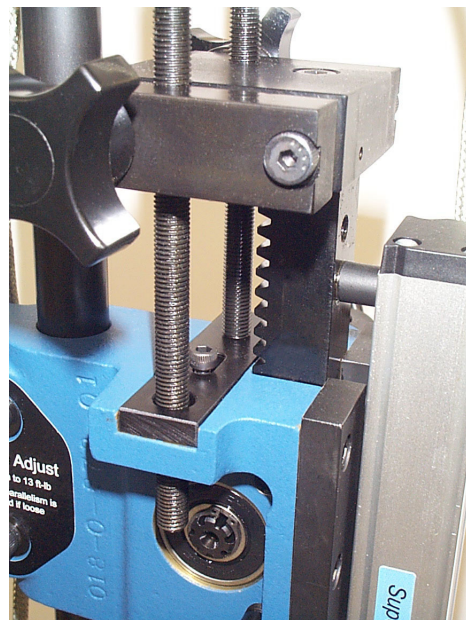


Figure 10
Right Compression Stop Rod Example

Extension Stop

- Place your spring on the extension hooks
- Determine the specified length for measurement.
- Loosen the right clamping knob and remove the right stop rod.
- Loosen the left clamping knob and remove and reinsert the extension rod in the reverse direction - through the sliding stop block, head down (figure 11)
- Set the left stop rod to the extension test length and tighten the left stop rod clamp.
- Check that the displayed length is correct and adjust as necessary.

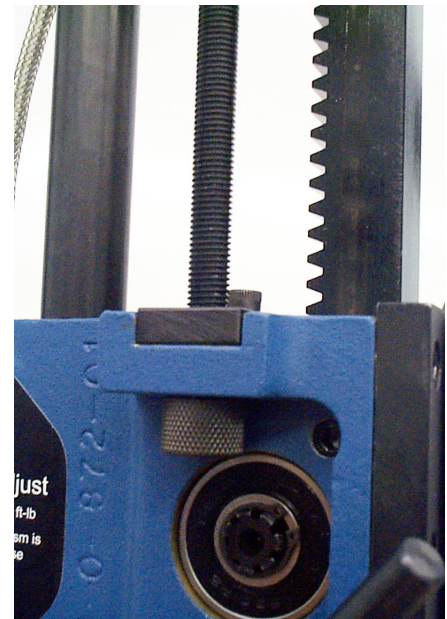
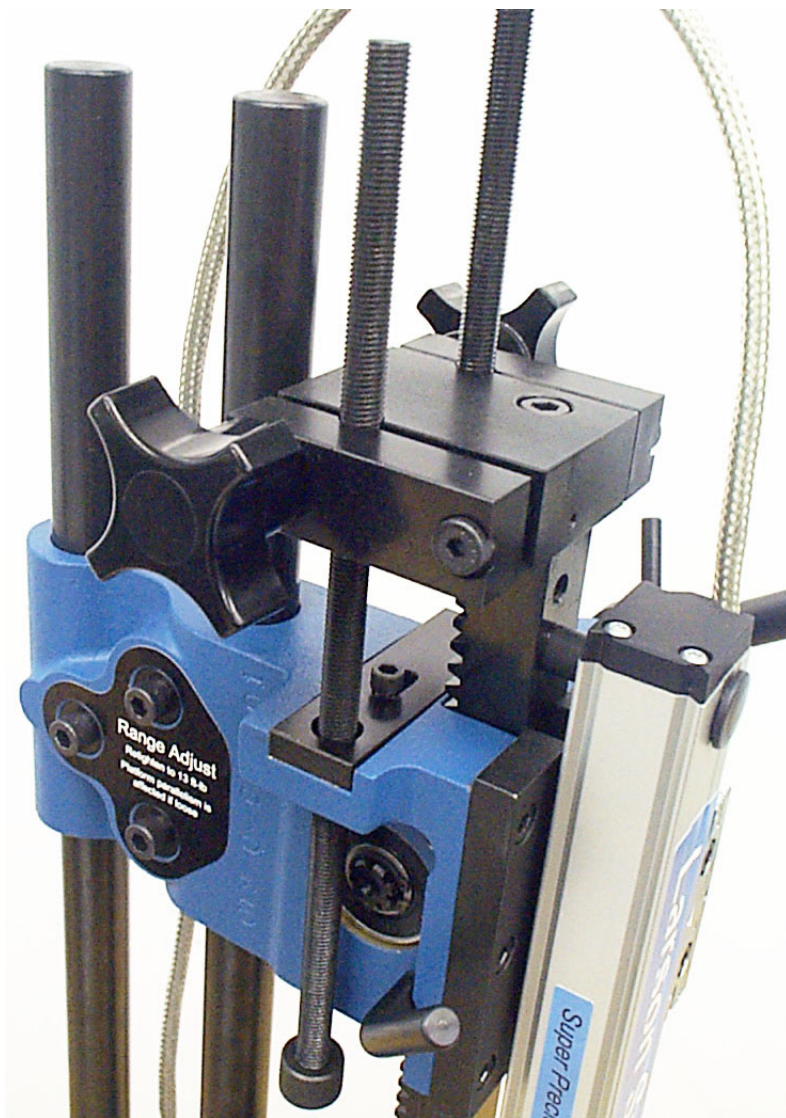


Figure 11
Extension Stop Rod Examples

4.0 Tester Calibration

4.0.1 Need for Calibration

The Larson hand tester is a precision measuring device that will require periodic calibration. The Tester should be recalibrated on an annual basis or when force or length readings and or linearity appears suspect.

4.0.2 Calibration Options

Larson Systems offers two calibration options. Usually the most economical option is Factory Calibration. The tester can be returned in original packaging to Larson Systems factory for calibration. Usual turnaround is less than one week.

Larson Systems also offers calibration at your site for customers that prefer this convenience. Service is often grouped with other customers in your area for economy.

Contact Larson Systems Service Calibration for further information (763-780-2131).

4.0.3 Required Calibration Equipment

Force Calibration

Calibration requires NIST traceable certified weights or NIST traceable certified load cells. Weights should be available to test at ten equally spaced load points. Load cell displays should have resolution that equals or is smaller than the tester resolution. Because of limited space on the platform for weights, the larger capacity testers must be calibrated with a NIST traceable certified load cell.

Length Calibration

Calibration requires NIST traceable gage blocks, in increments to test at ten equally spaced lengths and indicator, LSI PN 025-0000-202.

4.1 Force Calibration

4.1.1 Offset Adjustment

Pressing the Zero Force button will zero and tare load or drift up to maximum force of the tester.

4.1.2 Verifying Force Calibration

1. Starting with the tester off, press **on** to turn on the tester. Allow to remain on for 30 minutes before making any adjustments.
2. Move the upper platform to its maximum up position.
3. Press **force zero** to obtain exactly zero on the display.
4. Apply loads in an ascending order in ten equal increments and record the results.
5. Reapply loads at least 3 times to establish repeatability.
6. Evaluate results. Error at each load increment must be less than the accuracy listed in section 1.3. Proceed to section 4.1.3, Adjustment, if it is not possible to achieve the accuracy limits listed in section 1.3.

4.1.3 Force Adjustment

1. Turn tester off. Remove two screws holding the Force Display cover plate to the tester base and remove cover assembly, allow cables to remain connected. Note! Be careful during this step and the following so that the PC board does not touch the tester base.
2. Move the cover plate to a position where it is still connected to the tester but allows access to the two adjustable potentiometers shown in Figure 13.
3. Press and hold **mode** then press **on/clear** to turn on the Force Display. Hold **mode** until Larson Systems has been displayed. Display will show CAL in left hand side of display. Allow to remain on for 30 minutes before making any adjustments.
4. Move the upper platform to its maximum Up position.
5. With no weight on platform, adjust the force zero potentiometer (P21) so that the display reads zero.
6. Press the force zero to obtain exactly zero on the display.
7. Apply approximately 85% full scale load to the tester and adjust the force full scale potentiometer (P1) to read correctly.
8. Apply loads in an ascending order in ten equal increments and record the results.
9. Repeat three times to demonstrate repeatability.

10. Evaluate results, error at each load increment must be less than the accuracy listed in section 1.3 and the largest positive error should match the largest negative error. Repeat steps 6 to 9 until results are acceptable. Return to Larson Systems for service if it is not possible to achieve the accuracy limits listed in section 1.3.
11. Replace force display and screws.

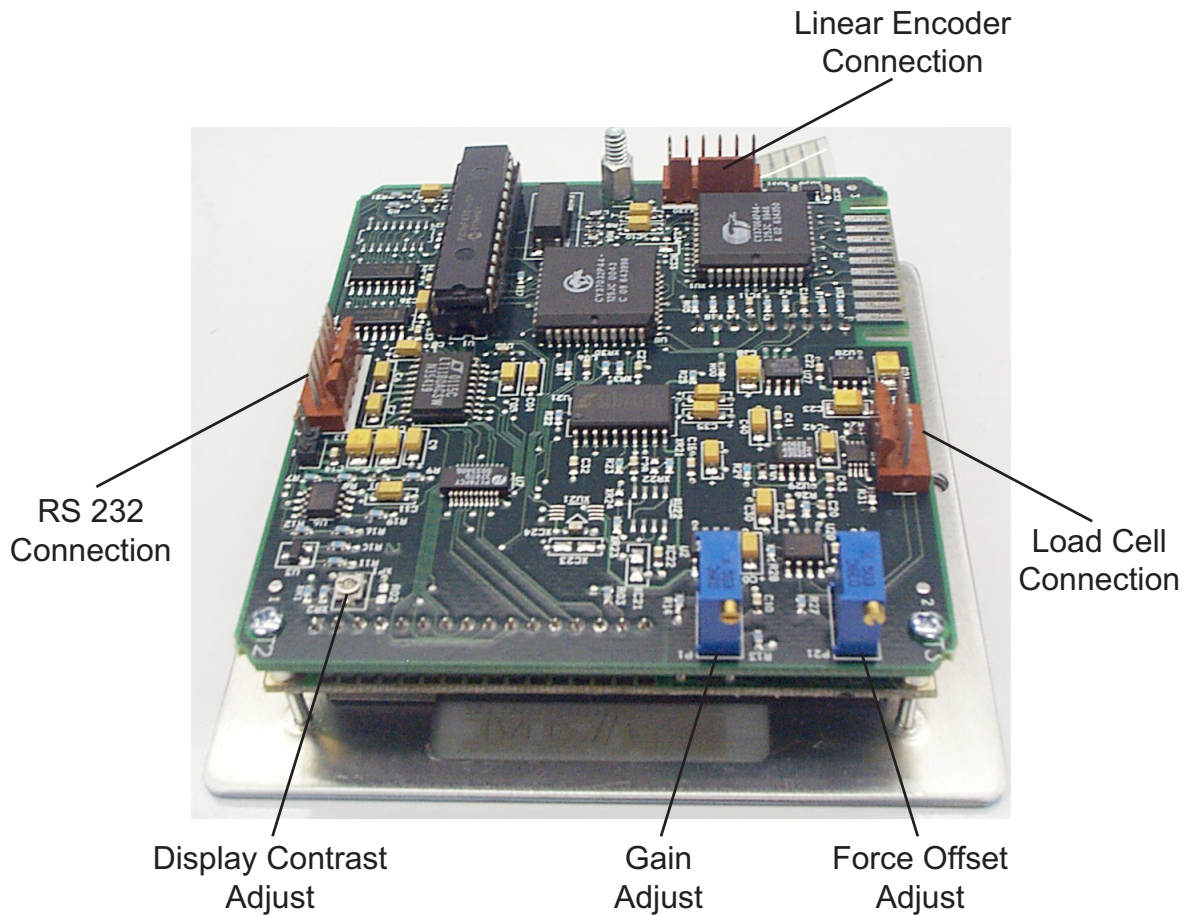


Figure 12
Faceplate Electronics Board

4.2 Platform Parallelism

4.2.1 Verifying Platform Parallelism

1. Move the upper assembly to an appropriate height. Tighten the range adjust screws to 13 ft-lb.
2. Place the dial indicator (Larson Part Number 025-0000-202) on the lower platform. Move the upper platform to an appropriate height.
3. Check the TIR of the indicator over the full area of the upper platform.
4. Relocate the upper assembly and repeat the process.
5. Evaluate results. TIR Error section 1.3. Proceed to section 5.2.2, Adjustment, if it is not possible to achieve the accuracy limits listed in section 1.3.

4.2.2 Platform Parallelism Adjustment

1. Remove the three screws retaining the upper platform and remove or replace shims as necessary to correct parallelism. Torque the screws to 67 in-lb.
2. Recheck the parallelism, repeat as necessary.

4.3 Deflection Compensation

4.3.1 Verifying Deflection Compensation

1. Starting with the tester off, press **on/clear** to turn on the Tester.

Compression deflection

2. Bring the platforms together, apply a load of 20 to 30% of the tester full scale and press **zero length**.
3. Place a .1 gage block crossways on the lower platform. Bring the platforms together. Apply a 5%FS compression load on the tester. Record the length reading, Increase the load to 95% FS and record the reading. The display's should match within the tolerance specified in section 1.3.

Extension deflection

4. Install hook set, Interlock the hooks and apply a 20 to 30% FS load. Press **zero length**.
5. Apply a 5%FS extension load on the tester. Record the length reading, Increase the load to 95% FS and record the reading. The display's should match within the tolerance specified in section 1.3.

4.3.2 Deflection Compensation Adjustment

1. With the tester off, press and hold **mode** then press **on/clear** to turn on the Force Display. Hold **mode** until Larson Systems has been displayed. Display will show CAL in left hand side of display.

Compression Deflection

2. Press Mode to display PDF (positive deflection force) on the left side of the display.
3. Bring the platforms together, apply a load of 20 to 30% of the testers full scale and press **zero length**.
3. Place a .1 gage block crossways on the lower platform. Bring the platforms together. Apply a 5%FS compression load on the tester. Record the length reading, Increase the load to 95% FS and record the reading.
4. Press **send** to increase the 95% FS reading until it matches the 5% FS reading. Press **on/clear** to decrease the 95% FS reading until it matches the 5% FS reading.

Extension deflection

5. Press Mode to display NDF (negative deflection force) on the left side of the display.
4. Install hook set, Interlock the hooks and apply a 20 to 30% FS load. Press **zero length**.
5. Apply a 5%FS extension load on the tester. Record the length reading, Increase the load to 95% FS and record the reading.
6. Press **send** to decrease the 95% FS reading until it matches the 5% FS reading. Press **on/clear** to increase the 95% FS reading until it matches the 5% FS reading.

4.4 Length Calibration

4.4.1 Verifying Length Calibration

1. Starting with the tester off, press **on/clear** to turn on the tester.
2. Bring the platforms together, apply a load of 20 to 30% of the tester full scale and press **zero length**.
3. Place a .1 gage block crossways on the lower platform. Bring the platforms together. Apply a 20 to 30%FS compression load on the tester. Record the length reading,
4. Apply gage blocks in an ascending order in ten equal increments and record the results.
6. Evaluate results. Error at each load increment must be less than the accuracy listed in section 1.3. Proceed to section 5.4.2, Adjustment, if it is not possible to achieve the accuracy limits listed in section 1.3.

4.4.2 Length Adjustment

1. With the tester off, press and hold **mode** then press **on/clear** to turn on the Force Display. Hold **mode** until Larson Systems has been displayed. Display will show CAL in left hand side of display.
2. Press Mode to display LEN (length) on the left side of the display.
3. Bring the platforms together, apply a load of 20 to 30% of the testers full scale and press **zero length**.
4. Place a gage block that is near the maximum length of the tester, crossways on the lower platform. Bring the platforms together. Apply a load of 20 to 30% of the testers full scale. Record the length reading.
5. Press **send** to increase the displayed length until it matches the gage block length. Press **on/clear** to decrease the displayed length until it matches gage block length.

5.0 Warranty Information

Larson Systems Inc. warrants the Larson Hand tester to be free from defects in material and workmanship for a period of **twelve months** from the date of purchase.

This warranty covers all parts. It applies only to testers and accessories which have been installed and operated in accordance with instructions in our operating manual, have not been tampered with in any way, misused, suffered damage through accident, neglect, or conditions beyond our control and have been serviced only by authorized personnel.

Larson Systems Inc. is not responsible for loss in operating performance due to environmental conditions, such as humidity, dust, corrosive chemicals, deposition of oil or other foreign matter, spillage, or other conditions beyond our control.

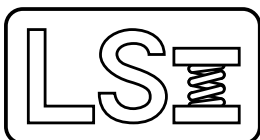
There are no other warranties expressed or implied, and Larson Systems Inc. shall not be liable under any circumstances for incidental or consequential damage.

Procedure for warranty service

1. Request an RMA number from Larson Systems Inc.
2. Ship the tester freight prepaid to:
Larson Systems Inc.
10073 Baltimore St. NE
Minneapolis, MN 55449-4425

Any shipment sent freight collect will be rejected.

3. Warranty determination will be made at the factory. Warranty service will be processed promptly.
4. The tester will be returned freight collect per LSI's current shipping procedures.



Larson Systems Inc.
10073 Baltimore St. NE
Minneapolis, MN 55449-4425
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1-877-780-2131
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