TENSITRON, INC.®

Operating Instructions
LX-1 Series
Digital Tension Meter

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Sec 1. SAFETY.

WARNING: When using cordless, electronic instruments, always follow basic safety precautions to reduce the risk of fire, electric shock and personal injury.

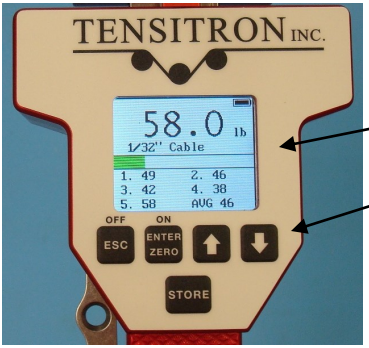
READ AND SAVE ALL INSTRUCTIONS FOR FUTURE USE. Before use, ensure all users read and understand this manual, as well as any labels packaged with or attached to the instrument.

1. **KNOW YOUR INSTRUMENT.** Read this manual carefully to learn your tension meter's applications and limitations, as well as the potential hazards associated with this type of instrument.
2. **AVOID DANGEROUS ENVIRONMENTS.** Do not use your instrument in the presence of explosive atmospheres (gaseous fumes, dust or flammable materials). Do not submerge your instrument in liquids.
3. **USE THE RIGHT TOOL OR INSTRUMENT.** Do not use this instrument to do a job for which it is not recommended.
4. **CHECK FOR DAMAGED PARTS.** Inspect instrument before use. Check for any binding of moving parts, improper mountings, broken parts and any other condition that may affect operation. Do not use a damaged instrument. Tag damaged instrument "DO NOT USE" until repaired. For repair, send instruments directly to Tensitron, Inc.
5. **GUARD AGAINST ELECTRIC SHOCK.**
6. **MAINTAIN INSTRUMENT CAREFULLY.** Keep handles dry, clean and free from oil and grease. Do not lubricate. All roller bearings are sealed.
7. **DO NOT USE INSTRUMENT** if it has received a sharp blow, been dropped or damaged in any way. Do not disassemble. Incorrect reassembly may result in damage to the instrument, risk of electric shock and fire. If instrument is damaged return it to Tensitron, Inc. for repair.
8. **STANDARD POWER SUPPLY** is rated for input voltages between 100 – 240 VAC.
9. **TEMPERATURE:** Normal operating temperature range of the instrument is between 32° F and 120° F. If these values are exceeded, then battery charge/ discharge rates will decline. However, this could be offset by using the power supply. Charging in direct sunlight or near a heat source will not produce a full charge and may permanently damage battery pack.
10. **UNPLUG CHARGER** when not in use.
11. **STORE INSTRUMENT AND CHARGER** in a cool, dry place. Do not store where temperatures may exceed 158° F or fall below -20° F.
12. **WARNING:** Only use battery pack assemblies provided by Tensitron, Inc. with your meter (P/N: LX-15-BATT). Other types of batteries may explode, causing personal injury and damage.

Sec. 2. CHARGING INSTRUMENT BATTERIES.

1. Connect power supply cable to instrument.
2. Plug the power supply into a power source with input voltages between 100 – 240 VAC.
3. Full charge of battery assembly requires several hours of charging.
4. Battery pack assembly cannot be overcharged, however instrument will remain on while connected to its power supply.
5. Fully-charged battery assemblies will operate approx. 6 hours +/- 20% depending upon usage.
6. Battery charge level is indicated in the upper, right-hand corner of the display.

Sec. 3. OPERATION: QUICK START.

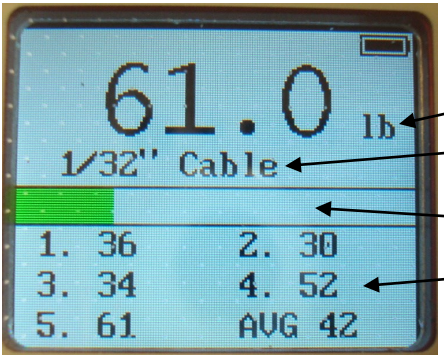


Instrument Operation Panel

Display

Operation Buttons:
- Off / Escape
- On / Enter / Zero
- Arrow Up
- Arrow Down
- Store

Figure 1

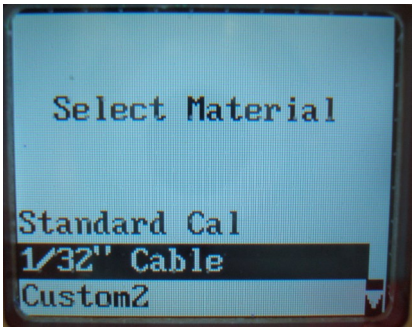


Display Details

- Battery Charge Level
- Selectable Tension in Kg, daN, Lbs.
- Select Cable Size – Instrument automatically adjusts calibration
- Set Point Display
- Store and Display up to 5 separate tension measurements and their average.

Figure 2

1. **POWER UNIT ON** by pressing **ON** button. Main display will indicate: **Tension** (in Lbs, daN or KG), **Material** (with the description of calibration/cable selected), along with five stored tension readings and their average. *Figure 1 and Figure 2*
2. **NAVIGATION:** Use either the up (↑) or down (↓) arrows to move between screens. To make or enter a selection press the Enter button. To exit a setting press the Escape (ESC) button.
3. **DATA LOGGING:** Press the **STORE** button to store and display up to five separate tension readings along with the average of these values. To clear the data displayed on the Main Screen, press and hold the **STORE** button or power the instrument off. For additional information on logging and viewing data refer to Sec 4.9.
4. **READING OF TENSION.** Variations in materials and cable diameters affect tension readings. It is essential to select the correct material and size before use, or tension values may be incorrect.
5. **TENSION UNITS.** Use either the up (↑) or down (↓) arrows to scroll to **TENSION UNITS** and then press ENTER. Next, select from: **Kg, daN, or Lbs** and ENTER selection.

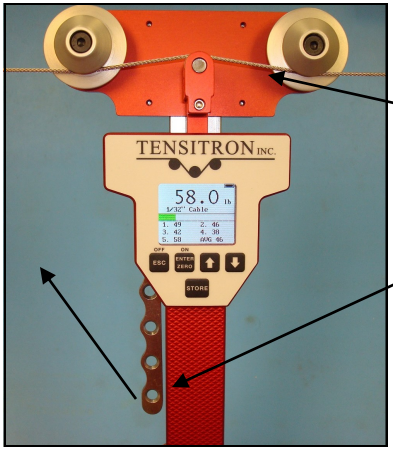


Select Material Screen

Select Material Size – Instrument automatically adjusts calibration

Figure 3

6. **SELECT MATERIAL.** Use either the up (↑) or down (↓) arrows to scroll to **SELECT MATERIAL** and then press ENTER**.** Next scroll through the various cable descriptions until the correct cable size is highlighted and then press ENTER. Note: Your main display will indicate the cable size selected. If your specific material is not listed, follow the calibration procedure included at the end of these instructions, or send a 15' sample of your material/cable and the instrument to Tensitron to have it added to the menu. *Figure 3*
7. **ZERO INSTRUMENT**. Hold the instrument in the attitude your reading will be taken in before you engage it to the tensioned material/cable and press **ZERO**.



Instrument engaged onto cable.

Note the routing of the Cable.

Rotate engagement lever away from handle to open.

Once cable is properly routed, gently squeeze lever back toward handle until it locks into the engaged position, parallel to the instrument handle.

Figure 4

8. **ENGAGE INSTRUMENT ONTO MATERIAL** by first rotating the engagement lever away from the instrument, raising the outer cable contact guides. Next, route your material/cable so that it runs beneath the outer cable contact guides and over (on top of) the center contact point (sensor). Then rotate/squeeze the engagement lever shut until it locks into position, parallel with the instrument handle. Note tension reading. *Figure 4*

Do not exceed instrument's maximum tension range or damage will occur.

Sec. 4. ADDITIONAL TECHNICAL INFORMATION.

1. **LCD REFRESH RATES**. To either speed up or slow down the instrument's LCD refresh rates, scroll to **SETUP** and press ENTER. Next, scroll to **LCD REFRESH RATE,** press ENTER, then select and enter your preference (1, 2 or 5 Hz).
2. **CUSTOM NAMES**. Custom Calibrations, listed as Custom 0 – 9, can be re-named so the Main Display indicates the name for your selection. Scroll to **SETUP** and press ENTER. Next, scroll to **CUSTOM NAMES** and press ENTER. Next, scroll to the description you wish to rename and then press ENTER. Use either the up (↑) or down (↓) arrows to select the first character of your custom name and then press ENTER. Follow the same procedure for each sequential character or space for your new description. Continue pressing ENTER until all spaces in the description have entered values, including the blank spaces. Once your custom name has been entered you will be automatically returned to the **SETUP** screen.
3. **RE-CAL TENSION** is used to program calibrations into the instrument. It is not used for checking accuracy. To verify accuracy refer to

"How to check the accuracy of an LX-1 series, digital tension meter" on page 14.

4. **AUDIO**. Scroll to **SETUP** and press ENTER. Next scroll to **AUDIO** and press ENTER and then make and enter your preference. (Beep ON or OFF)
5. **BACKLIGHT.** This feature is used to adjust the visual intensity of the LCD screen. Scroll to **SETUP** and press ENTER. Next, scroll to **BACKLIGHT** and press ENTER and then make and enter your preference. (Low, Medium or Full Intensity)

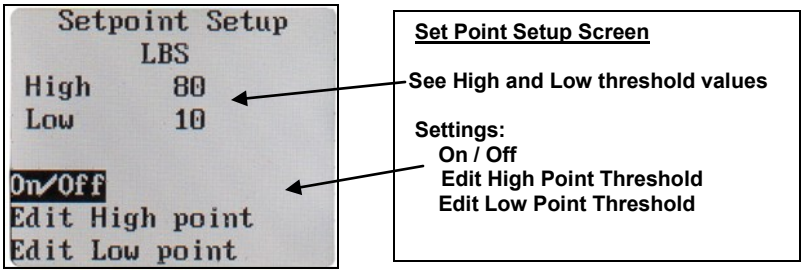


Figure 5

6. **SETPOINT MENU**. This feature allows a graphical representation of the applied tension to be displayed on the main display beneath the tension units. A colored bar will advance and retract in conjunction with increasing or decreasing tension values. Additionally the user can define their safe-operating-tension range, which will then display in green. Values under this operating range will display in amber and tensions above the safe operating range will indicate in red. *Figure 2*
7. **TURNING ON AND ADJUSTING SETPOINT MENU**. Scroll to **SETUP** and press ENTER. Next, scroll to **SETPOINT MENU** and press ENTER**.** Follow and enter the prompts to turn this feature on or off, as well as to edit your high and low values. *Figure 5*
8. **VERSION**. Scroll to **SETUP** and press ENTER. Next, scroll to **VERSION** and press ENTER to view instrument Model Number and software version.
9. **DATA LOGGING**. Each time the instrument's **STORE** key is pressed, cable tension data will be stored for later review. To view this logged data, scroll to **DATA LOGGING** and press ENTER**.** Then scroll to **VIEW DATA LOG** and press ENTER. To clear stored data, scroll to **CLEAR SINGLE PT LOG**, press ENTER and follow the prompts.

AVAILABLE OPTIONS FOR ALL INSTRUMENTS

- **A** Analog Output option. 0-5 VDC or 4-20 mA with Software-definable ending sequences. Provided with 10' cable. Data outputted at 40 Hz. *(See separate instructions.)*

- **E** RS-232 Serial Output option. Provided with 10' cable to interface with your receiving device. Select data sampling rate from 1, 2 or 5 Hz. *(See separate instructions.)*

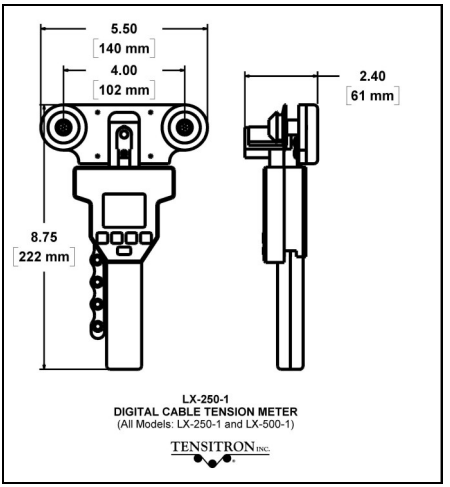
Instruments can be configured with any or all of these options.

SPECIFICATIONS:

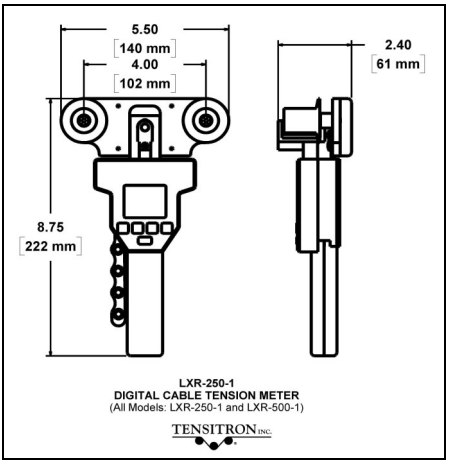
- Approximate weight is 1-1/2 lb (weight varies depending upon instrument configuration).
- Re-chargeable NIMH battery with power supply provided. Approximately 6 hours of operation per battery charge, depending upon backlighting intensity and usage.
- Automatic shutoff after 10 minutes of non-use.
- Power Supply operates with input voltages from 100 – 240V and includes several interchangeable "adaptors" allowing use with European, US, Australian, and other plug configurations.
- Instruments may be operated continuously while connected to power supply.
- Durable, lightweight carrying case with protective foam inserts.
- CE Certification complying with heavy, industrial immunity standards.
- FCC Certification compliant with Class A limits of FCC Part 15 and ICES-003.

STANDARD INSTRUMENTS

MODEL	RANGE	RESOLUTION
LX-250-1	5-250 LBS	0.5 LB
LX-500-1	25-500 LBS	1.0 LB
LXR-250-1	5-250 LBS	0.5 LB
LXR-500-1	25-500 LBS	1.0 LB

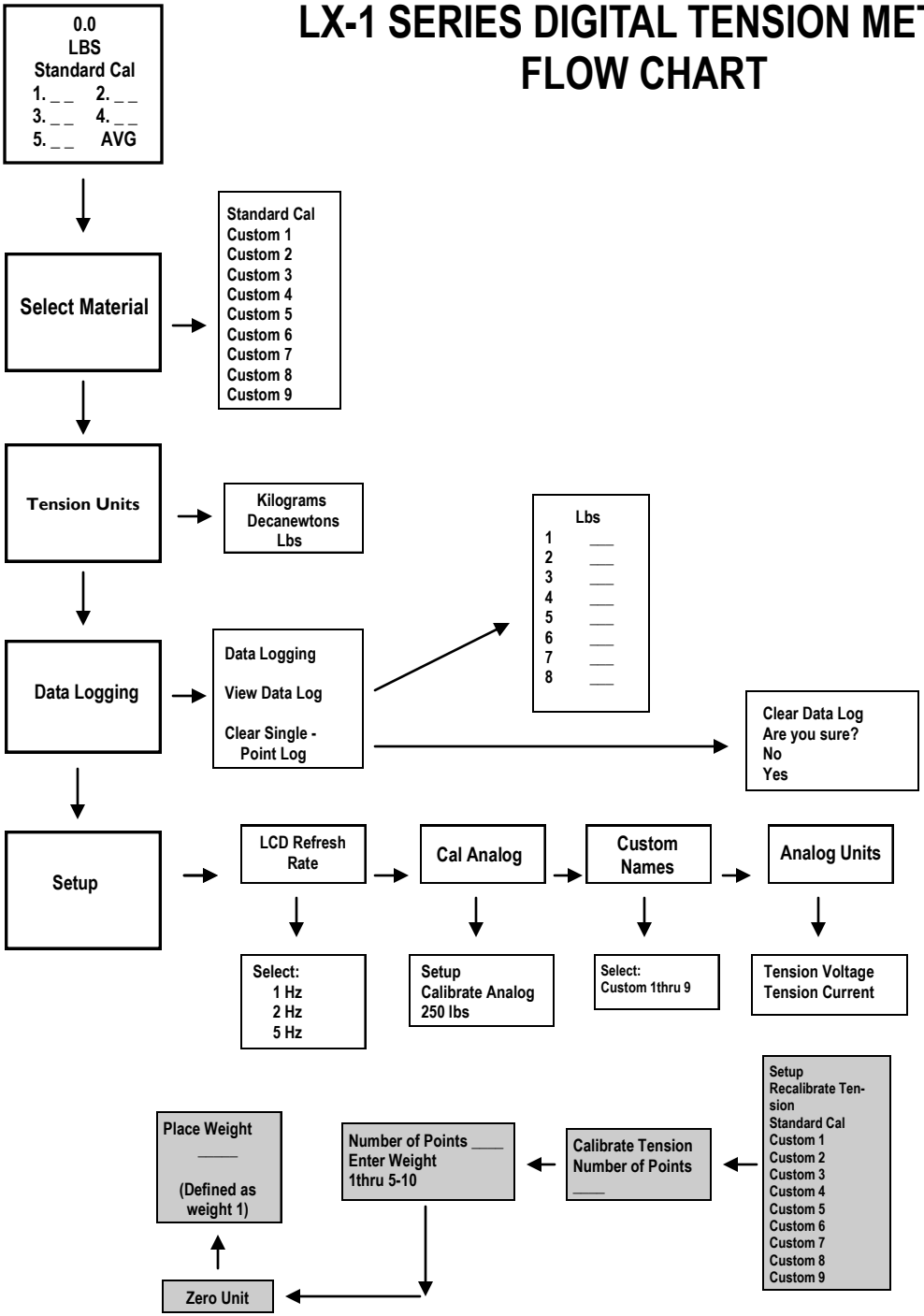


LX-1 Series



LXR-1

LX-1 SERIES DIGITAL TENSION METE
FLOW CHART



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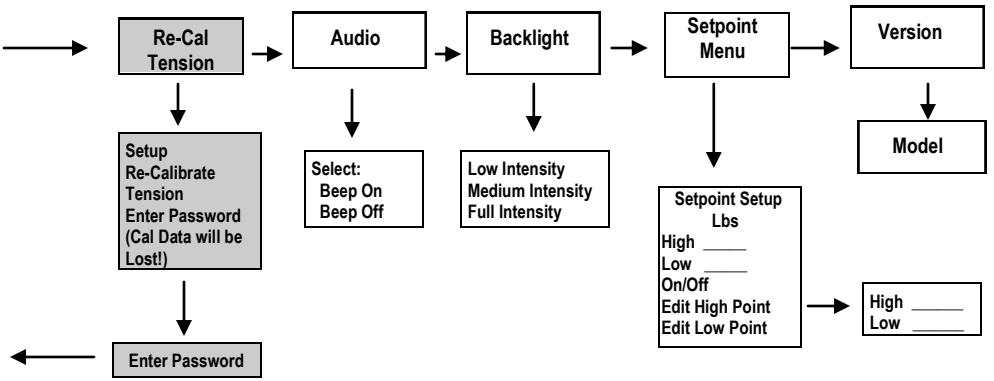
Use and ↑ and ↓ keys to navigate main screens



FEATURES

- Large, easy to read, color graphic display with adjustable backlighting.

- Display shows Tension, Battery Charge Level, Material Size Selected and user definable tension Set Points.

- Push the STORE button to activate the Memory Function to store and display up to five separate tension readings plus the average value (AVG) of these stored readings.

- Select tension value to indicate either in Lb, Kg or daN.

- Accuracy is +/- 2% full-scale for all menu-selectable calibrations. Accuracy for custom calibrations is material specific.

- Up to ten calibrations can be programmed into the instrument.
  (All calibrations are password protected to provide due diligence against unauthorized changes.)

- Adjustable LCD refresh rates allow for stable digital readings.

- All models are typically available from stock.

- All models are factory calibrated and ready for use.

- Includes easy to use, cable diameter gage to accurately determine correct cable size.

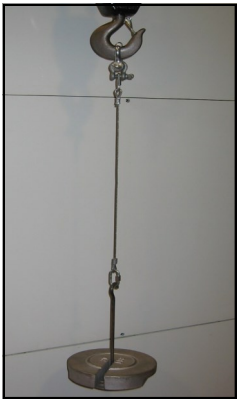
- All calibration values are traceable to National Standards. Calibration certificate is included.

Fig 6

Proper Engagement of Instrument to Cable

Engage the instrument onto the cable by first rotating the engagement lever away from the instrument, raising the outer cable contact guides. Next route your material/cable so that it runs beneath the outer cable contact guides and over (on top) of the center contact point (sensor). Then rotate/squeeze the lever shut until it locks into position parallel with the instrument handle. View the tension reading. In this example the tension is 58.0 lb. *Fig 6.*

How to check the accuracy of an ACX-Series Digital Aircraft Cable Tension Meter



To verify the accuracy of your instrument, check the tension on a sample length of material by suspending known weights from the opposite end. *Fig 7.*

Fig 7 Simulating Material Tension

- KEEP IT SIMPLE. Only simulate tensions using free-hanging weights on correctly-sized cable material. Never use any device that attempts to convert rotational torque values into tension loads, as these types of systems are highly inaccurate.

- Additionally, this instrument must be routinely checked for accuracy using traceable weights as these types of systems are also highly inaccurate and generally do not meet the minimum repeatable accuracy standards required by ISO-17025.

- Confirm the material you're working with is the same size selected in your LX's display.

- Before engaging the LX instrument onto the material, hold it in the same attitude you'll be taking the readings in and press the "Enter" / "Zero" button. This will eliminate any small tare effects.

FOR BEST RESULTS ALWAYS TAKE SEVERAL READINGS OF THE MATERIAL TENSION BY DISENGAGING AND THEN RE-ENGAGING THE INSTRUMENT FROM THE MATERIAL ITSELF.

Verify the tension value. For example, if your suspended weight is 100 lbs, and you are using an LX-250-1, your instrument should also indicate 100 lbs +/- 5.0 lb once properly engaged to the material. This procedure confirms the instrument's accuracy and it is now ready for use.

Note: Full-scale accuracy is +/- 2% for all menu selectable calibrations. Accuracy for custom calibrations is material specific.

Thus an instrument with a full-scale range of 250 Lbs has +/- 5.0 Lbs full-scale accuracy. An instrument with a full-scale range of 500 Lbs has +/- 10.0 Lbs accuracy.

- Should you have additional questions, please contact Tensitron for help. Before beginning this next procedure, verify that your cable is within tolerance and not out of round. For optimum accuracy use weights traceable to National Standards.

How To Program a Custom, 5-10 Point Linearization Calibration

IMPORTANT: This feature should only be used by a calibration facility using certified and traceable dead weights. Do not use this feature for a simple accuracy check.

* If you want to verify or check the accuracy to a cable go to: "How to Check Accuracy" on page 14.

*When performing a multi-point linearization calibration, keep it simple. Only simulate tensions using traceable, free hanging dead weights on correctly sized cables which are dimensionally within tolerance (+/- .003"). Never use any device which attempts to convert rotational (torque) values into tension loads, as these types of systems are highly inaccurate. Additionally any load cell system must be routinely checked for accuracy using traceable dead weights as these types of systems are also highly inaccurate and generally do not meet the minimum repeatable accuracy standards required by ISO-17025. For best accuracy always use free hanging dead weights on a single length of cable.

When calibrating LX-Series instruments tension values must be entered in Lbs. Note: If your dead weight standards are in Kilograms, convert their values into Lbs: 1 KG = 2.2046 Lbs

1. Scroll to **SETUP** and press ENTER. Next, scroll to **RE-CAL TENSION** and press ENTER. The screen will now display: **SETUP, RE-CALIBRATE TENSION, ENTER PASSWORD, CAL DATA WILL BE LOST!**

2. Password. To proceed with this re-calibration you must enter the following sequence of key strokes: Press **ENTER** once, then press the **UP** arrow once, and then finally the **ENTER** button once again. These three inputs: **ENTER, UP, ENTER** are the password, which cannot be changed.

3. The display now indicates: **SETUP, RE-CALIBRATE TENSION** with a list of the calibration names and custom names that have been programmed into the instrument. Scroll to the description you wish to recalibrate, highlight it and then press **ENTER**.

4. The next screen will indicate: **CALIBRATE TENSION, NUMBER OF POINTS.** Using the up (↑) or down (↓) arrows select the number of cal points you will be tensioning the cable to, the minimum of which is 5 points (zero is a calibration point and already set so you will need to define a minimum of 4 increasing tension values such as: 50, 100, 150 and 200). If necessary you can adjust the number of calibration, or weight points up to 10 points, or another value over 5. If 10 cal points were selected the entries could look something like this: 10, 20, 30, 40, 50, 60, 70, 80, 90.

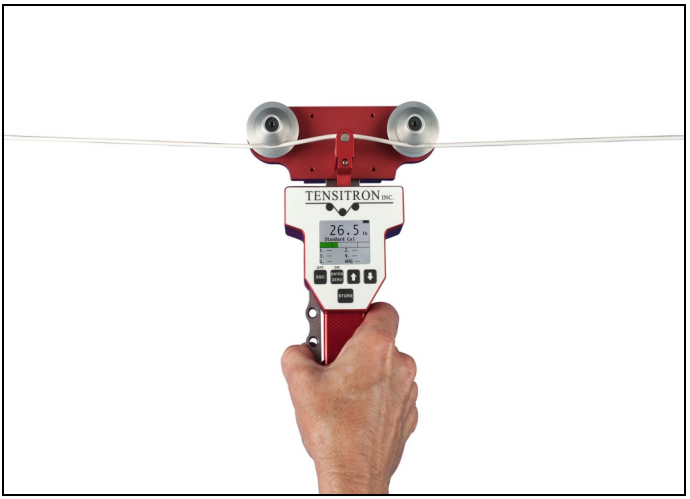
5. **ENTER WEIGHT**. After selecting the number of calibration points you'll need to define these weight values. Using the up (↑) or down (↓) arrows, select your first tension, or weight cal-point and then press **ENTER.** *Note: Do not use 0 (zero) as this value is already programed into the instrument*. Next, use the up or down arrows to select your **Weight 2** value making sure that the value entered is greater than the previous entry in **weight 1**. Next, select increasing weight values for the additional weight points but not exceeding the maximum tension range of the instrument.

6. CALIBRATE TENSION. Next you will calibrate the instrument using the weight values you previously selected. To properly simulate these tensions, suspend a single length of your cable from above and add or suspend known weights onto the cable in the values you've previously selected, when prompted.

a. **CALIBRATE TENSION, NUMBER OF POINTS __, ZERO UNIT**. Without any cable engaged to the instrument hold it in the attitude you will be taking the reading in and press **ENTER** to zero the unit. Next the display will prompt you to suspend the weight value you previously selected in step 5. If, for example you selected 50 lbs for your first weight value the instrument will indicate: **PLACE WEIGHT 50.**
b. Suspend the exact weight value from your cable that you've previously selected (in this example it would be 50 Lbs).
c. Next, engage the instrument to your tensioned cable and then press **ENTER** once the reading has stabilized.
d. Repeat steps b. and c. for the remaining number of weight points by suspending additional weights onto your cable in the values previously selected and entering these readings.
e. Once the last weight value has been entered, the instrument will return to the **SETUP** menu. Next, press the **ESCAPE** key to return to the main display.

f. The main display will now indicate the cable/material description that you have just finished calibrating. If the material name on the display is not the material you just recalibrated, you have reprogrammed the incorrect description. If this happens you will need to recalibrate both the material indicated on the display along with the material you thought you were calibrating.

g. After completing a calibration always recheck the values. Refer to “How to Check Accuracy” on page 14 for additional information.



The LX-1 models of Digital Instruments are used to measure tension(s) on slightly larger, flexible cables, wires, and filaments where your expected tensions range from 5 - 250 Lbs, or 25-500 Lbs. The standard calibration is to 1/16" cable.

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