



**Operating Instructions
CX-1 Series
Digital Cable 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.
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.

WARNING: Only use battery pack assemblies provided by Tensitron, Inc. with your meter (P/N: CX-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.

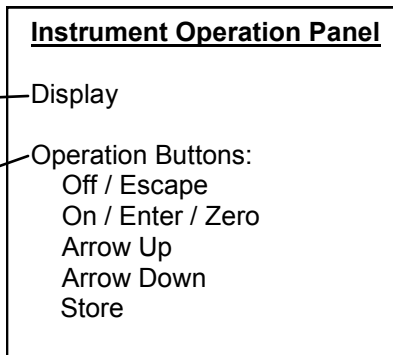


Figure 1

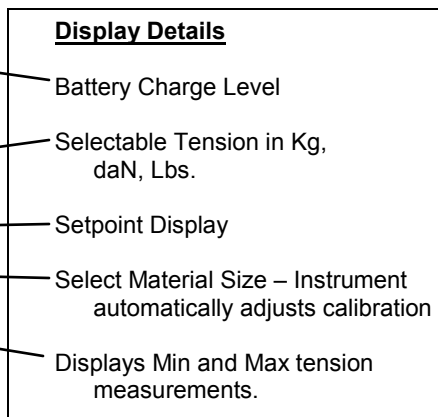


Figure 2

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 minimum and maximum readings.
2. **NAVIGATION.** Use either the up (↑) or down (↓) arrows to move between screens. To make or enter a selection press the **ENTER** key. To exit a setting press the Escape (ESC) button.
3. **DATA LOGGING.** Use this feature to store individual tension values by depressing the **STORE** key. For additional information on logging and viewing data refer to Sec 4.9.
4. **READING OF TENSION.** Variations in materials, thicknesses and widths affect tension readings. It is essential to select the correct material and size before use, or tension values may be incorrect.
5. **TENSION UNITS.** Using either the up (↑) or down (↓) arrows, scroll to **TENSION UNITS** and then press **ENTER**. Next, select from: **Kilograms, daN, or LBS** and **ENTER** selection.

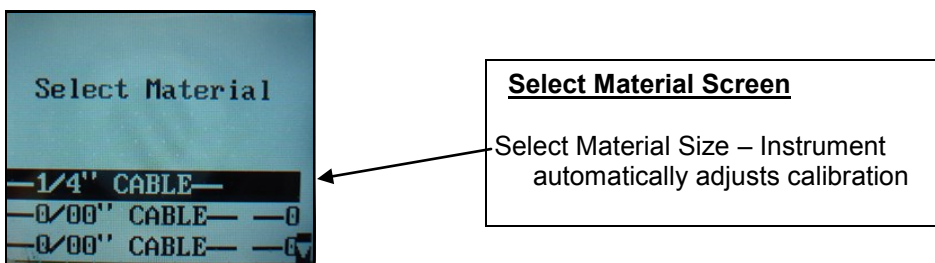
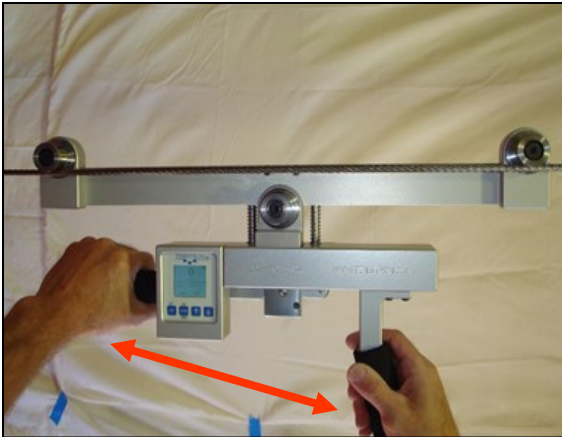


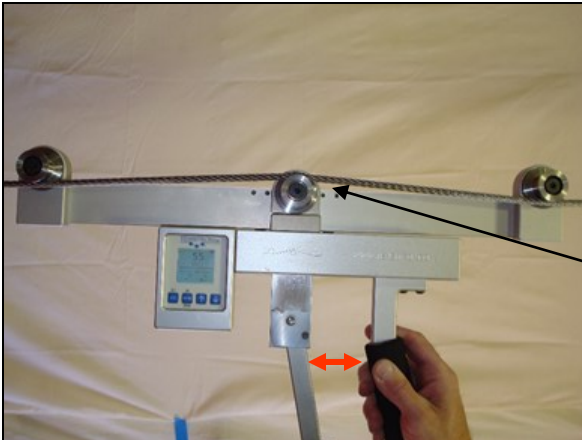
Figure 3

6. **SELECT MATERIAL.** Using either the up (↑) or down (↓) arrows, scroll to **SELECT MATERIAL** and then press **ENTER**. Next scroll through the various descriptions until the correct material description and/or size is highlighted and then press **ENTER**. Note: Your main display will indicate the material 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.
7. **ZERO INSTRUMENT.** Hold the instrument in the attitude your reading will be taken in before you engage it to the tensioned material and press **ZERO**.
8. **ENGAGE INSTRUMENT ONTO THE TENSIONED CABLE** by first rotating the engagement lever so that its orientation runs parallel with the instrument body. Next, position the outer rollers over the tensioned material so that the material runs under them and over the top, center roller (sensor). Next, rotate the engagement lever down so that it locks into position parallel with the stationary instrument handle and then note the tension reading on your display. **Do not exceed the maximum tension range of the instrument or damage will occur.**



Instrument engaged onto material
and in **OPEN** position.

Figure 4a



Instrument engaged onto
material and in **CLOSED** position.

Note the routing of the cable (under
the outer guide pins and over the
center element.)

Figure 4b

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 RATES** and press **ENTER** and then select and enter your preference (1, 2 or 5 Hz).
2. **CUSTOM NAMES.** Custom Calibrations, listed as Custom 0 – 9, can be renamed so that the Main Display indicates your name for the 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**. Then using the up or down arrows select the number, letter or character for the beginning of your new name and then press **ENTER**. Follow the same procedure for each sequential letter or space for your new

description. Continue pressing **ENTER** until all spaces in the description have entered values, including the blank spaces. Once your new name has been entered you will automatically be 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 CX-1 series, digital cable tension meter" on page 13.
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)
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 operating range will indicate in red.

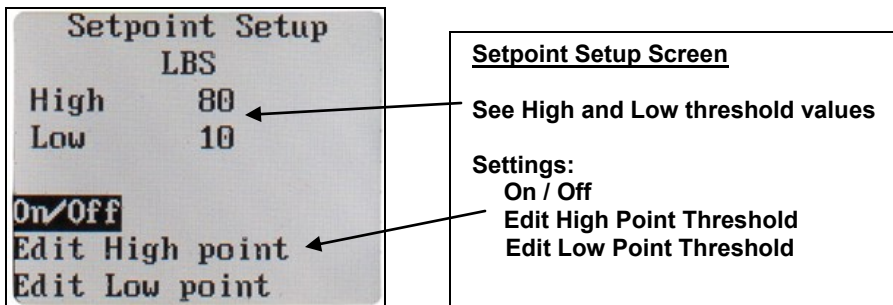
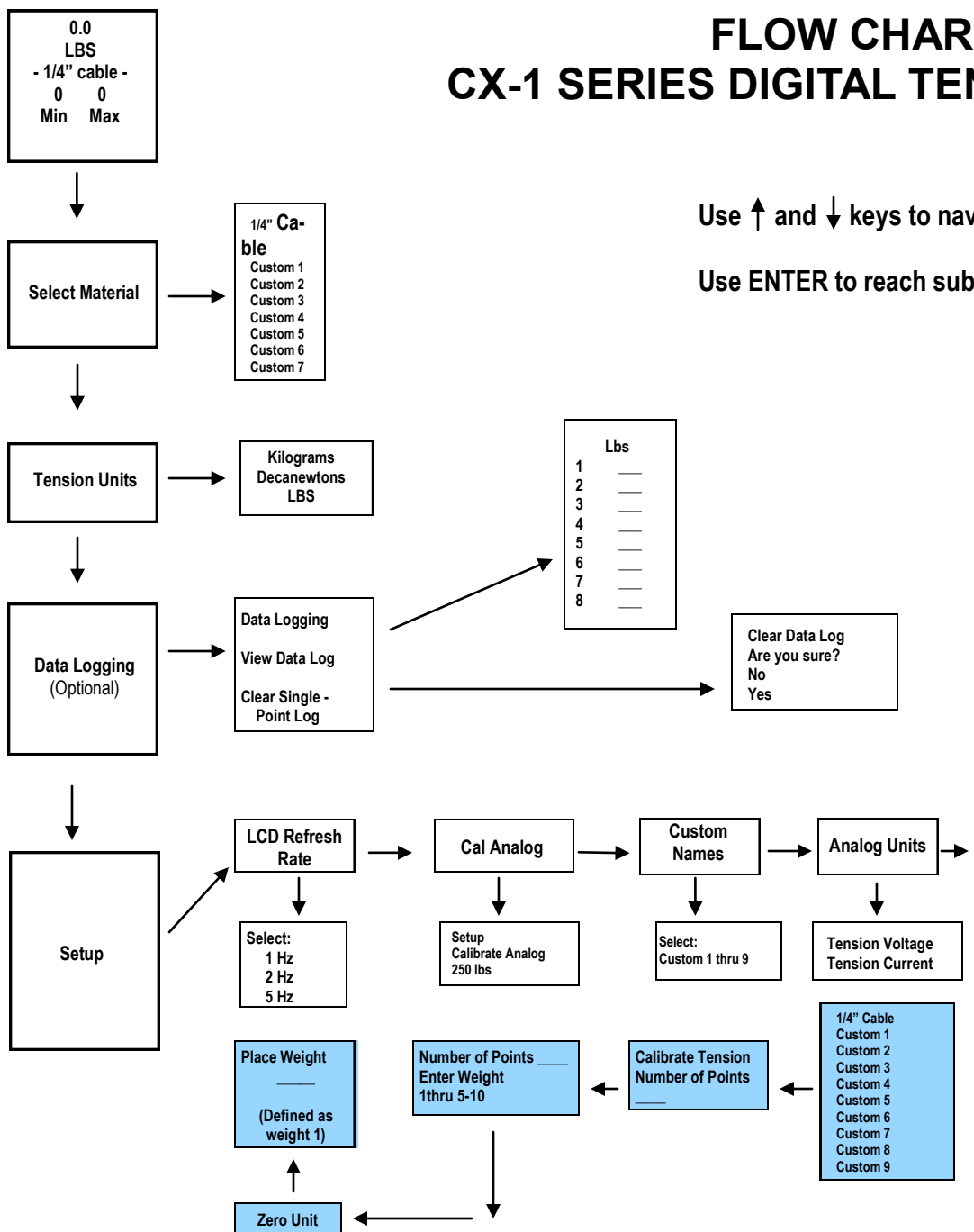
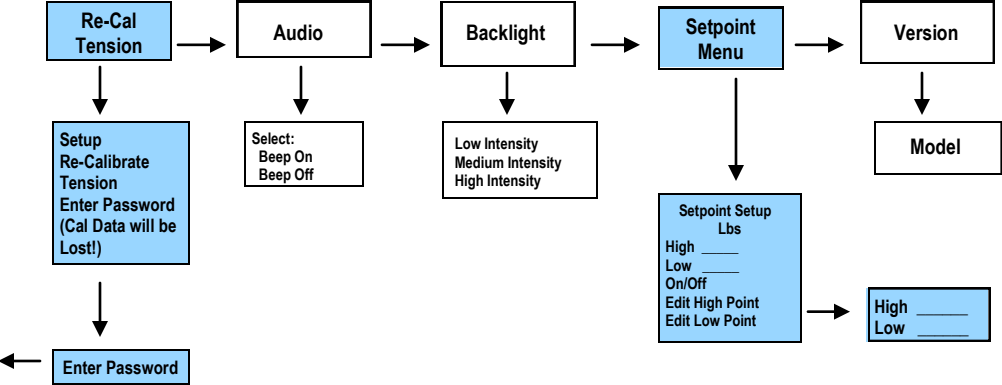


Figure 5

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.
8. **VERSION**. Scroll to **SETUP** and press **ENTER**. Next, scroll to **VERSION** and press **ENTER** to see instrument Model Number and software version.

FLOW CHART CX-1 SERIES DIGITAL TENS





9. **DATA LOGGING.** This standard feature allows either continuous data collection or single point data entries. To make the selection Scroll to **DATA LOGGING** and press **ENTER**. Next scroll to **SELECT MODE** and press **ENTER**. Then select either **CONTINUOUS** or **SINGLE POINT** and press **ENTER**.
- CONTINUOUS.** Once CONTINUOUS has been entered, select and enter both the **LOGGING RATE**, adjustable from 1Hz up to 100 Hz, and the **DURATION** for the time period the data will be collected in.
 - LOGGING CONTINUOUS DATA.** When you are ready to both log and to stop logging data go to the instrument's main screen and press the **STORE** key.
 - SINGLE POINT.** Each time the instrument's **STORE** key is depressed it will log single point entries into its memory for later viewing. To view either CONTINUOUS or SINGLE POINT data scroll to **VIEW DATA LOG** and press **ENTER**.
 - CLEAR SINGLE POINT LOG.** To clear the single point log entries scroll to **CLEAR SINGLE PT LOG** and press **ENTER**. Next follow the prompts to clear the data log.
 - CLEARING CONTINUOUS DATA.** Collected data will remain in memory until overwritten with new data.

STANDARD INSTRUMENTS

AVAILABLE OPTIONS FOR ALL INSTRUMENTS

Note: Add option designator to the end of the part number. (For example, a Model CX-2000-1E denotes a standard, CX-2000-1 with the optional RS-232, serial output function installed).

- **–A Analog Output option.** 0-5 VDC or 4-20 mA with software definable ending sequences. Provided with 10' cable. Data output at 40 Hz.
- **–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.

Instruments can be configured with either or both of these options.

MODEL	RANGE	RESOLUTION
CX-1000-1	50 - 1,000 lb	5 lb
CX-2000-1	100 - 2,000 lb	10 lb

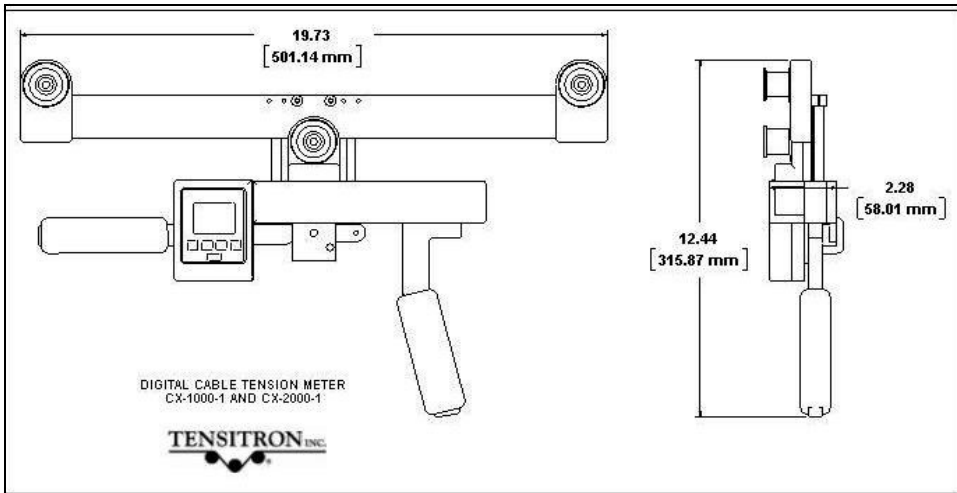


Figure 6



Figure 7

SPECIFICATIONS:

- Approximate weight is 7 lbs. (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.
- Power Supply operates with input voltages from 100 – 240V and includes several, interchangeable adaptors allowing use with European, US, Australian, and other plug configurations.
- Automatic shutoff after 10 minutes of non-use.
- 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.

FEATURES:

- Large, easy to read, color graphic display with adjustable backlighting.
- Display shows Tension, Battery Charge Level, name of Calibration selected, and minimum and maximum tension values.
- Select material size from the menu. Instrument automatically adjusts calibration to the correct setting.
- Up to 10 calibrations can be programmed into instrument. (All calibrations are password protected to provide due diligence against unauthorized changes).
- Adjustable LCD refresh rates allow for stable, digital readings.
- All models typically available from stock.
- All models factory calibrated and ready for use.
- All calibration values traceable to National Standards. Calibration certificate included.

How to check the accuracy of a CX-1-Series Digital Aircraft Cable Tension Meter

- To verify the accuracy of your instrument, check the tension of a sample length of your material by suspending known weights from the opposite end. Figure 8.



Free Hanging Weight on a single length of cable to simulate tension.

Figure 8

- **KEEP IT SIMPLE.** Only simulate tensions using free-hanging weights on correctly-sized material. Never use any device that 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 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 suspended onto a single length of your material.

**NEVER SIMULATE TENSION LOADS ON THESE INSTRUMENTS
BY USING A CALIBRATION BAR!**



Micrometer for measuring material thickness and diameter.

Figure 9

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

Verify the tension value. For example, if your suspended weight is 100 Lbs your instrument should also indicate 100 Lbs once properly engaged to the cable. 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.

For an instrument with a full-scale range of 2,000 Lbs this translates into +/- 40 Lbs and for an instrument with a full-scale range of 1,000 Lbs, accuracy is +/- 20 Lbs.

- 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, or 5-10 Point Multi-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 13.***

- **When calibrating these 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 the **ENTER** button once, then press the **UP** arrow once, and then press the **ENTER** button once more. 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 calibration points you will be tensioning the material 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: 250, 500, 750 and 1000). 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: 100, 200, 300, 400, 500, 600, 700, 800, 900.

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 programmed 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 material from above and add or suspend known weights onto the material 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 100 lbs for your first weight value the instrument will indicate: **PLACE WEIGHT 100.**
- b. Suspend the exact weight value from your material that you've previously selected (in this example it would be 100 Lbs).
- c. Next, engage the instrument to your tensioned material 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 to your material in the values previously selected and entering these readings.
- e. Once the last weight value has been entered, the instrument will return to the **SET-UP** menu. Next, press the **ESCAPE** key to return to the main display.
- f. The main display will now indicate the material description that you have just finished calibrating. If the name on the display is not the material you just recalibrated, you have re-programmed 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 13 for additional information.



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