TENSITRON INC.

OPERATING INSTRUCTIONS

Model: TX-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.

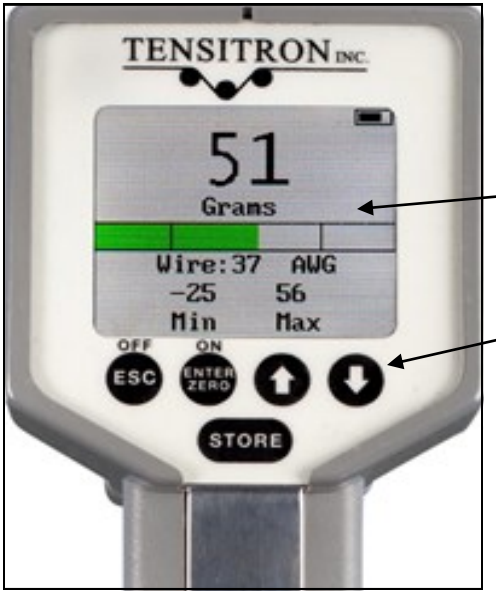
1. **KNOW YOUR INSTRUMENT.** Read this manual carefully to learn your tension meter's applications and limitations, as well as the potential hazards associated with this type of instrument.
2. **AVOID DANGEROUS ENVIRONMENTS.** Do not use your instrument in the presence of explosive atmospheres (gaseous 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.

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

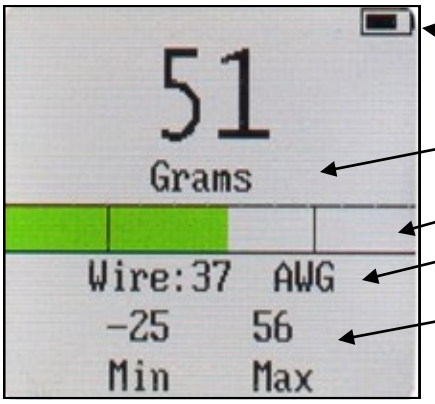


Instrument Operation Panel

Display

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

Figure 1



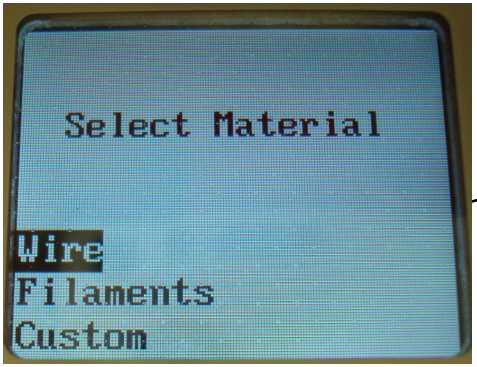
Display Details

- Battery Charge Level
- Selectable Tension in cN, N, Grams, or Lbs.
- Set Point Display
- Select material and then size – Instrument automatically adjusts calibration
- Store and Display Minimum and Maximum tension values.

Figure 2

1. **POWER UNIT ON** by pressing **ON** button. Main display will indicate: **Tension** (in Grams, Newtons, or LBS), **Material** (with the description of calibration/cable selected), along with the Minimum and Maximum tension values that have been stored in the instrument.

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) key.
3. **DATA LOGGING**. Use this feature to capture either single or continuous tension readings by depressing the **STORE** key. Refer to Sec. 4.13 later in this manual for additional information.
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.



Select Material Screen

Select material and then size – Instrument automatically adjusts calibration

Figure 3

5. **SELECT MATERIAL.** Using either the up or down arrows, scroll to **SELECT MATERIAL** and then press ENTER**.** Next select your material from: Wire, Filaments or Custom and press ENTER. Next select your material size (diameter) in AWG (for wires), Inches, mm or description for Custom entries and then ENTER your selection.
6. **TENSION UNITS.** Using either the up or down arrows, scroll to **TENSION UNITS** and then press **ENTER.** Next, select from: **Grams, Newtons** (**cN** for the Model TX-125-1 only)**, or LBS** and ENTER selection.
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**.

Continued on next page

8. **ENGAGE INSTRUMENT ONTO THE TENSIONED MATERIAL** by separating the rollers (squeeze the trigger assembly) and inserting your material between the fixed roller and the two rollers on the trigger assembly. Once the material is in line with the three rollers slowly release the trigger until it makes a full stop. Note tension reading. **Do not exceed the maximum tension range of the instrument or damage will occur.**

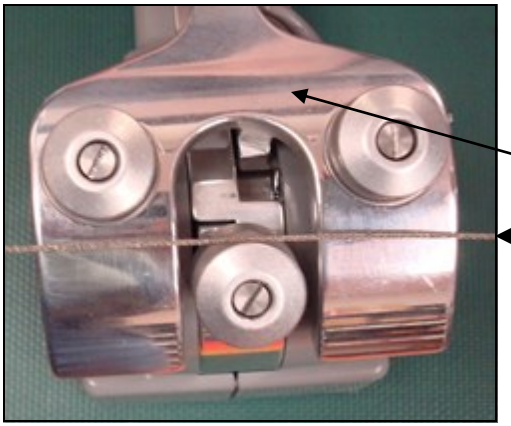


Figure 4

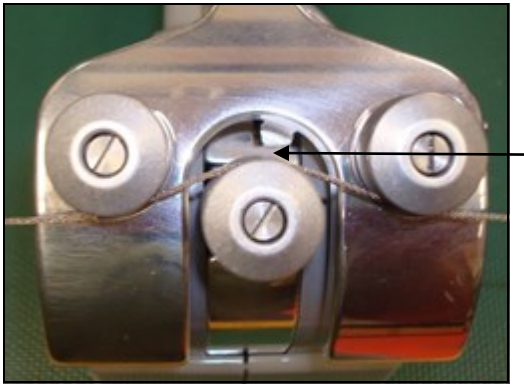


Figure 5

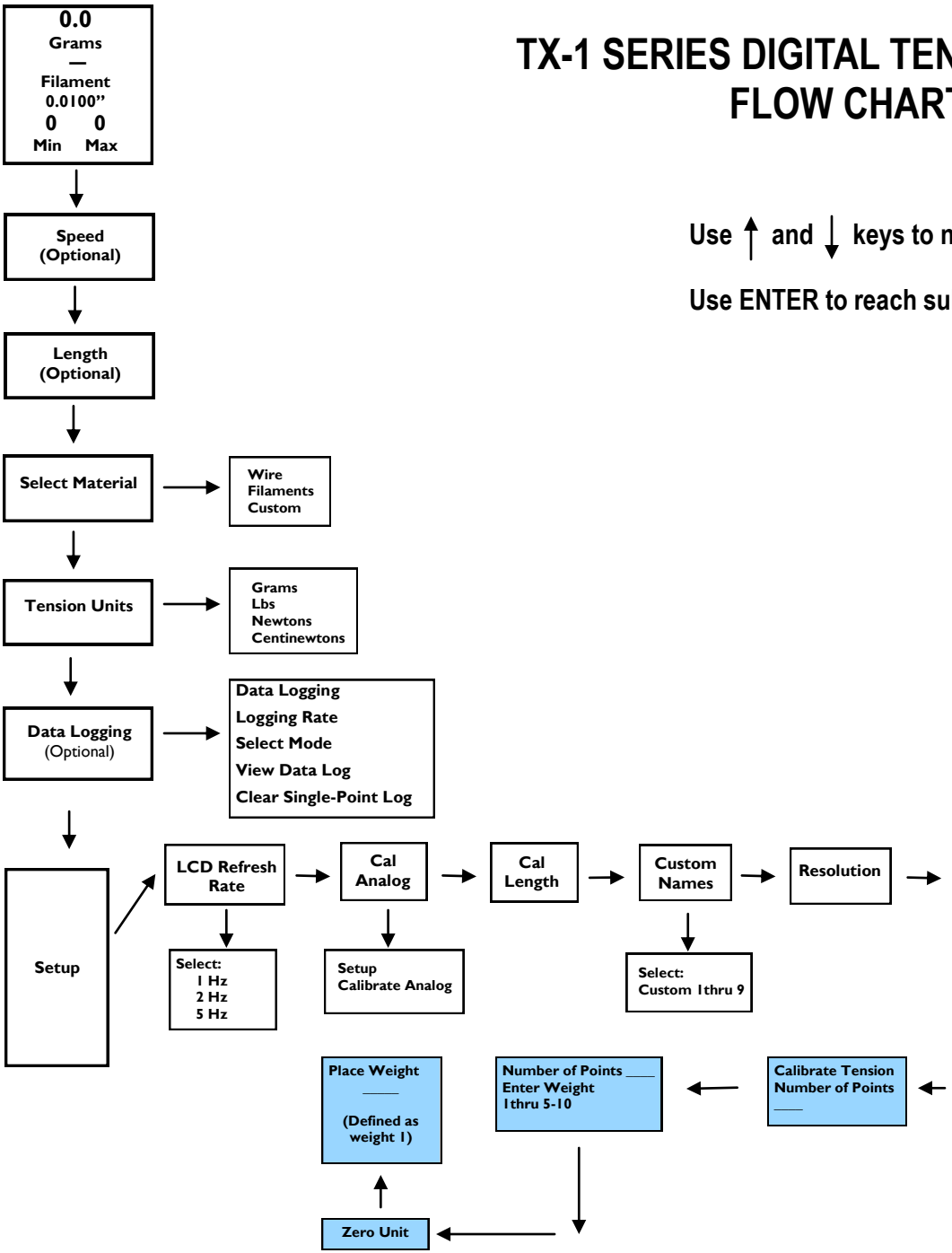
Sec. 4. ADDITIONAL TECHNICAL INFORMATION.

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** and press ENTER and then select and enter your preference (5 Hz + Serial, 1, 2 or 5 Hz).
2. **CAL ANALOG**. (*Optional feature).* Scroll to **SETUP** and press ENTER then scroll to **Cal Analog** and press ENTER. Using the up and down arrows adjust the display to indicate the value at which the instrument should output maximum Voltage or current. The press ENTER.
3. **CAL LENGTH**. (*Optional feature).* Scroll to **SETUP** and press ENTER, then scroll to **Cal Length** and press ENTER. Next, using a precise 20 foot length of your material (20.0') thread one end through the instrument's three rollers and slowly pull exactly 20.0' through the instrument, then press ENTER.
4. **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 be automatically be returned to the **SETUP** screen.
5. **RESOLUTION**. Scroll to **SETUP** and press ENTER. Next, scroll to **RESOLUTION** and press ENTER. Next scroll to and highlight your selection (1 or 5 Grams) and press ENTER.
6. **LENGTH UNITS** (*Optional feature).* Scroll to **SETUP** and press ENTER. Next scroll to **Length units** and press ENTER. Next, highlight you selection (Meters or Feet) and press ENTER.
7. **RE-CAL TENSION** is used to program calibrations into the instrument. It is not used for checking accuracy. More detail on this feature is shown later in this document.
8. **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)
9. **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)
10. **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.
11. **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.
12. **VERSION**. Scroll to **SETUP** and press ENTER. Next, scroll to **VERSION** and press ENTER to see instrument Model Number and software version.

TX-1 SERIES DIGITAL TENS
FLOW CHART

Use ↑ and ↓ keys to na

Use ENTER to reach sub

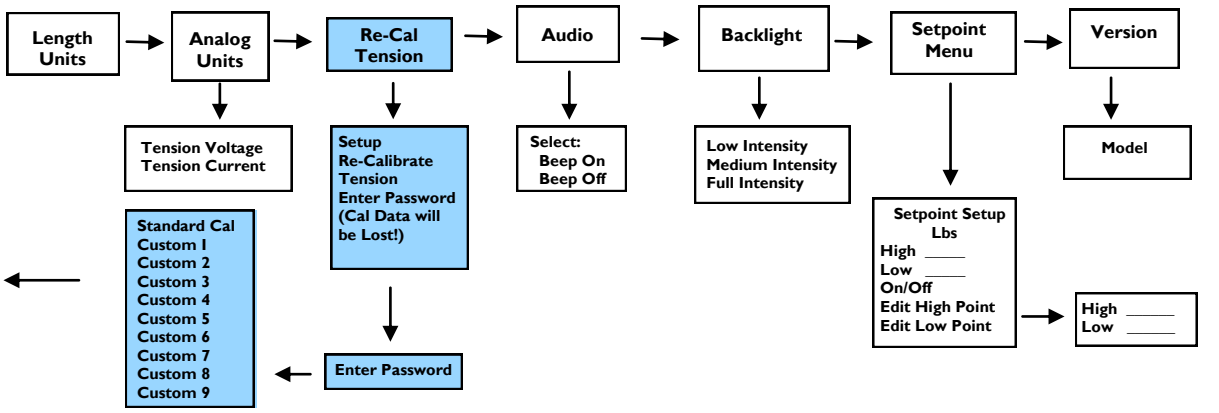


SION METER

TENSITRON INC.

vigate main screens

screens and ↑ and ↓ keys to make selections.



13. **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.
    a. **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. Up to 2,048 points can be stored.
    b. **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.
    c. **SINGLE POINT.** Each time the instrument's **STORE** key is depressed it will log single point entries into its memory for later viewing. Up to 128 single points can be stored.
    d. **VIEW DATA LOG**. To view either CONTINUOUS or SINGLE POINT data scroll to and ENTER **VIEW DATA LOG**.
    e. **CLEAR SINGLE POINT LOG**. To clear the single point log entries scroll to and ENTER **CLEAR SINGLE PT LOG**. Next follow the prompts to clear the data log.
    f. **CLEARING CONTINUOUS DATA**. Collected data will remain in memory until overwritten with new data.

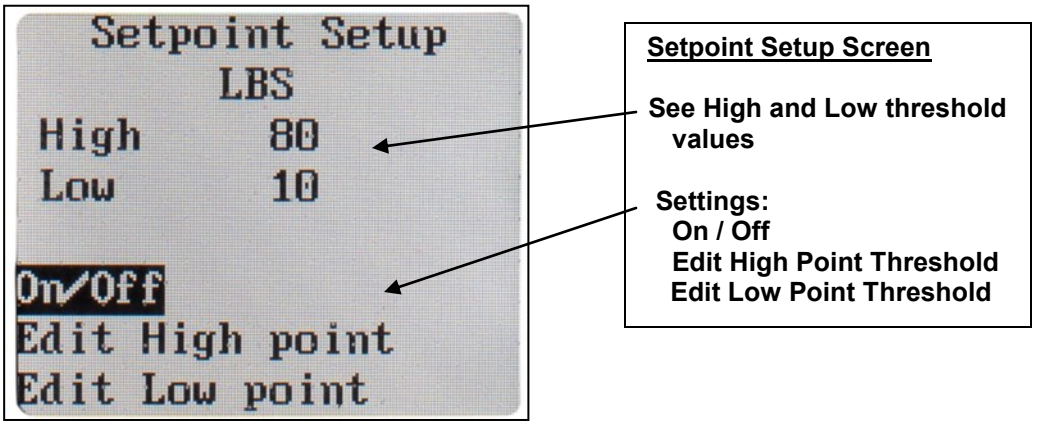


Figure 6

STANDARD INSTRUMENTS

MODEL	RANGE	RESOLUTION
TX-125-1	0-125 Grams	0.1 to 1 Grams
TX-1000-1	10-1000 Grams	1 to 5 Grams
TX-5000-1	50-5000 Grams	5 to 10 Grams

APPLICATION-SPECIFIC METER:

TX-5EDM-1, 50-5000 Grams - For use on EDM wires.

Figure 7

AVAILABLE OPTIONS FOR ALL INSTRUMENTS

Note: Add option-designator letter to the end of the Model Number. (For example, a Model TX-1000-1S denotes a standard TX-1000-1 with the optional Speed and Length function included.)

-**R** **Custom Roller option.** Choose from numerous sizes of cylindrical, flanged, or U-shaped rollers.
Note: For tapes, webs, and custom materials please provide thickness, width, or diameter with order.

-**S** **Speed and Length option.** Indicate real-time speed in FPM, or MPM. Maximum measurable speed is 9,999 FPM or 9,999 meters per minute, however line speeds in excess of 2,000 FPM are generally unsafe for hand-held applications. Read length of part run in feet or meters. Maximum length measuring up to 9,999 meters or feet.

–**A** **Analog Output option** for both speed and tension values. 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.

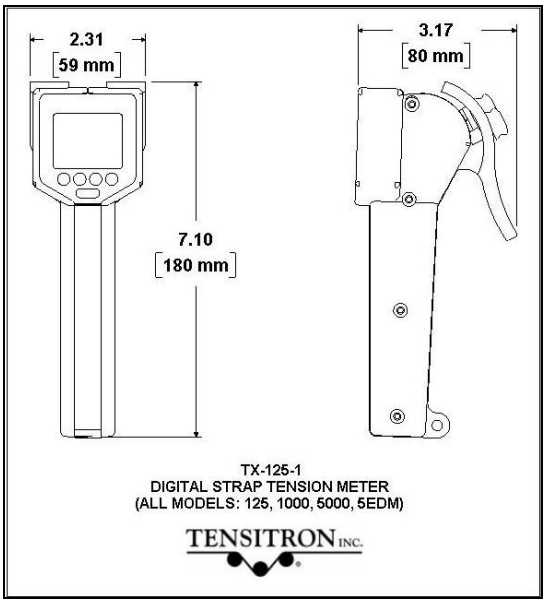


Figure 8

SPECIFICATIONS

- Approximate weight .75 lbs (14 oz), depending upon configuration.
- Re-chargeable NIMH battery assembly and power supply provided.
- Power Supply operates with input voltages from 100 – 240V and includes several, interchangeable adaptors allowing use with European, US, Australian, and other plug configurations.
- 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, and Cable Size Selected and user-definable tension Set Points.
- Push the STORE button to record either single point or continuous tension readings for later viewing.
- Select tension value to indicate either in Grams, Newtons, or LB.
- Accuracy is +/- 1% 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.

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.

***CHECKING ACCURACY.** If you simply want to verify the accuracy of your instrument simulate a tension load on your material by suspending known weights to a sample length of the same material and then, verify these values with the instrument. If, for example, a 100 gram weight is freely suspended from your material, your tension will be 100 grams and your instrument should indicate 100 grams. To correctly obtain readings, first zero your instrument in the attitude it will be used and then engage the instrument's three rollers onto the tensioned material. Never hang weights from only the center roller as this will overload the instrument and cause damage. Check several tension values to determine full-scale accuracy.*

***When calibrating these instruments tension values must be entered in grams.**

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 recalibration you must enter the following sequence of key strokes: Press **ENTER** once, then press the **UP** arrow once and then finally the **ENTER** button. 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 and down arrows select the number of cal points you will be tensioning your 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: 100, 250, 500 and 750). 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 cable in the values you've previously selected, when prompted.

a. **CALIBRATE TENSION, NUMBER OF POINTS __, ZERO UNIT**. Without any material 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 grams 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 grams).
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.

After completing a calibration always recheck the values.

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