

Digital TENSION METER

Model DTMB



OPERATING MANUAL

10.00 WARRANTY

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1.00 INTRODUCTION

The CHECK•LINE® DTMB Digital Tension Meter is a hand-held device which accurately measures the running as well as static tensions of a wide variety of process materials including yarns, fibers, wires, optical fibers, etc. It employs the "three-roller principle" of tension measurement where the outer two reference rollers are fixed to create a known angle of wrap over the middle sensing roller. The middle roller is part of a precision strain gauge sensing system which accurately measures the resulting force on the roller. This value is converted into a highly accurate and repeatable tension value using proprietary computer calibration formulas which correct for different material diameters, gravity and other critical parameters. The DTMB is powered by four AA batteries and is supplied in a rugged, die-cast aluminum housing.

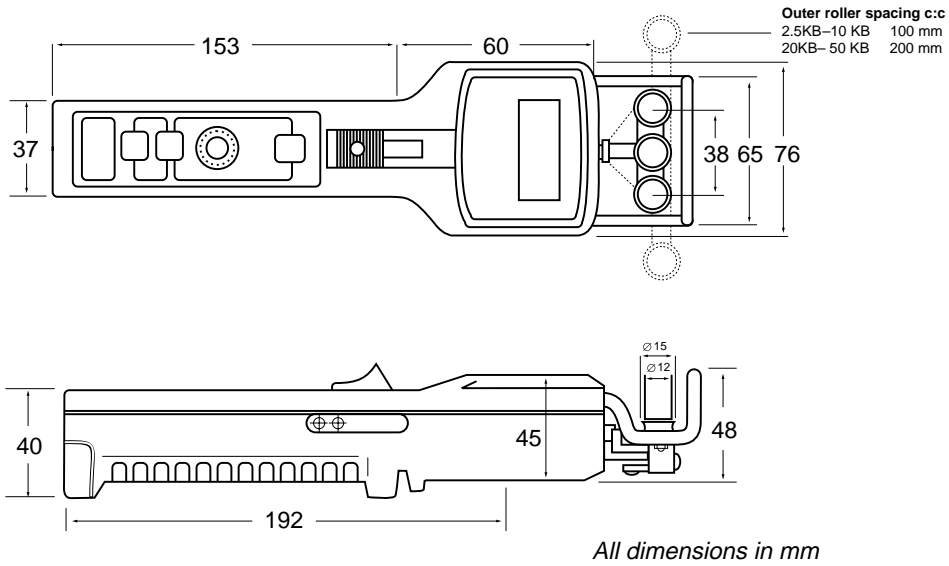
The DTMB takes 62 tension measurements per second and displays the average of these measurements over a user-selected interval of 0.5, 1, 2 or 4 seconds, the Display Update Rate. This permits the user to determine the extent of averaging (or damping) required to "stabilize" the tension readings, making them much easier to read and eliminating the undesirable "bouncing needle" condition found on most mechanical tension meters. To set or change the Display Update Rate, refer to Configuring Dip Switch Settings, Section 5.30.

A built-in memory system is provided which permits storage of the *maximum*, *minimum* and *peak* values occurring during a measuring interval. These values can be recalled to the display for viewing.

Specifications

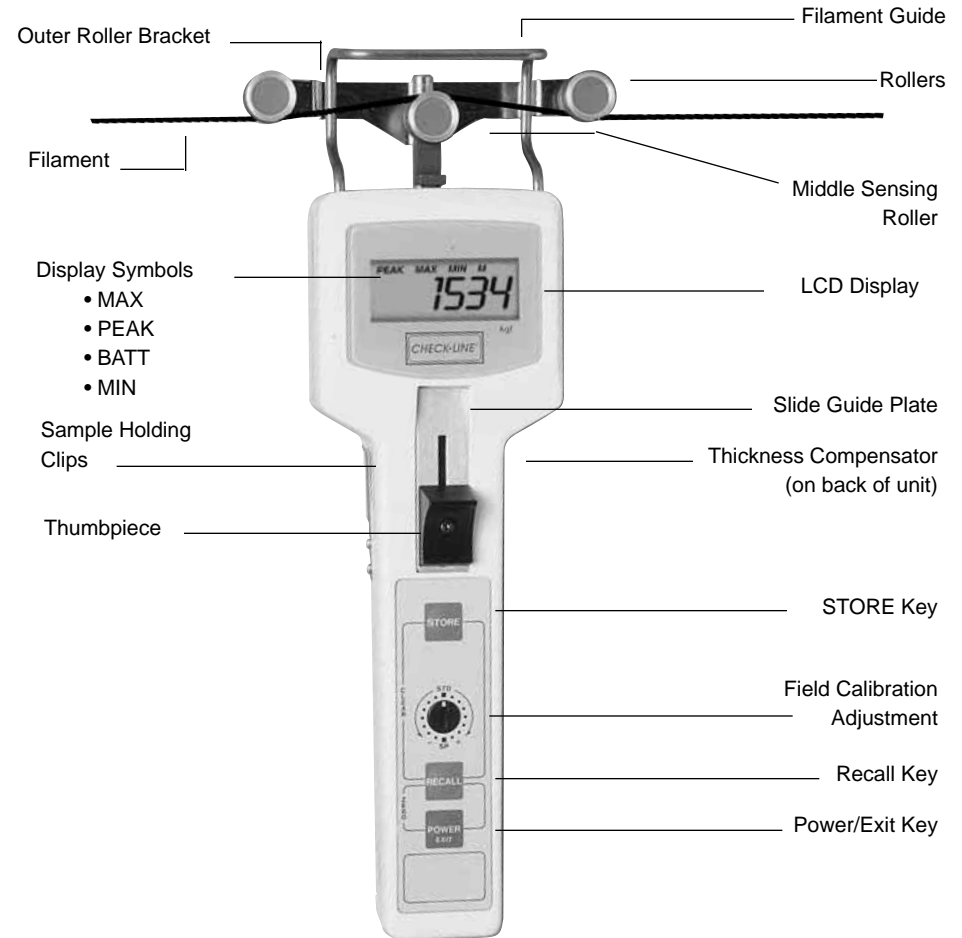
Measuring Principle	Strain gauge
Measuring Frequency	16 msec (62.5 samples/sec)
Deflection of Sensing Roller (max.)	0.2 mm
Overload Capacity	200% of Full Scale
Temperature Coefficient	<u>Zero</u> : less than $\pm 0.3\%$ FS/ $^{\circ}$ C <u>Span</u> : less than $\pm 0.01\%$ FS/ $^{\circ}$ C
Display	4-Digit LCD, 12 mm high
Display Update Rate	0.5, 1.0, 2.0 or 4.0 seconds, dip-switch selectable
Memory System	Last, maximum, minimum and peak values
Overrange Indicator	Value will blink on/off, then "FFFF"
Field Calibration Adjustment	± 7 steps, 1.5% per step
Battery Type	Four (4) 1.5 V AA (included)
Battery Life	20 hours, continuous use
Auto Power Off	After 2 minutes of non-use
Roller Material (standard) (optional)	Hard-coated Aluminum Hardened Steel (ST), Ceramic (CE), Plastic (PL)
Maximum Speed (standard) (optional)	2000 m/min 5000 m/min
Housing	Die-cast Aluminum
Dimensions	2.95" W x 10.83" H x 1.77" D (75 x 275 x 45 mm)
Weight (approximate)	1.43 lbs. (650 g)
Operating Temperature	32 to 132 $^{\circ}$ F (0 to 45 $^{\circ}$ C)
Accessories Included	4 AA batteries and operating instruction guide, all in a fitted, hard-plastic carrying case
Warranty	One year

10.00 SPECIFICATIONS



Model Data									
Model	DTMB-200	DTMB-500	DTMB-1K	DTMB-2K	DTMB- 2.5KB	DTMB-5KB	DTMB-10KB	DTMB-20KB	DTMB-20KB
Tension Range (grams)	0.1-200.0	0.1-500.0	50-1000	200-2000	250-2500	500-5000	1.00-10.00 Kg	2.00-20.00 Kg	50 KB
Accuracy	± 1.0% or better		± 1.5% or better						
Outer Roller Dist. (c:c)	38 mm	38 mm	38 mm	38 mm	100 mm	100 mm	100 mm	200 mm	200 mm

2.00 DTMB OVERVIEW



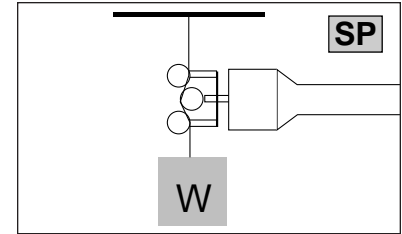
3.00 DESCRIPTION OF MEMBRANE KEY FUNCTIONS

Key	Description of Functions
STORE	<ul style="list-style-type: none"> Starts/Stops scanning for Max/Min/Peak values. (Standard Memory)
RECALL	<ul style="list-style-type: none"> Enters Recall Mode to review statistics and recorded Data. In recall mode, changes display from LAST → MAX → MIN → PEAK → LAST → MAX etc.
POWER EXIT	<ul style="list-style-type: none"> Turns power on. Turns power off if pressed and held for 5 or more seconds. Exits from Recall Mode when reviewing data.
STORE + RECALL	<ul style="list-style-type: none"> Clears all data in Basic Memory ("CCCC" momentarily shown on display).
RECALL + POWER EXIT	<ul style="list-style-type: none"> Zeros gauge ("Tare") for use in any orientation ("Gravity Correction").
POWER EXIT + STORE*	<ul style="list-style-type: none"> Changes units of measure from grams (or Kg) to pounds (or ounces) and back again each time this key combination is pressed.

* When the units of measure are changed to grams, the "gf" indicator will momentarily flash on and then turn off. Otherwise the "lb." or "oz" indicators will be shown.

8.34 Special Calibration

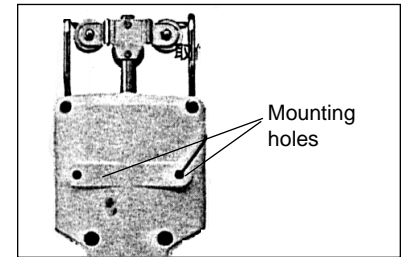
If the standard Factory Calibration and the Field Calibration Adjustment does not provide the desired accuracy, a Special Calibration can be ordered. A 10' sample of the process material must be provided for calibration purposes.



8.40 On-Line Mounting Holes

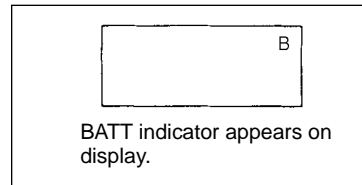
The DTMB is supplied with two threaded holes for on-line mounting in a fixed position when performing measurements over an extended period.

Thread Size M5 (metric)
Thread Depth 7.5 mm (max.)



8.23 Low Battery

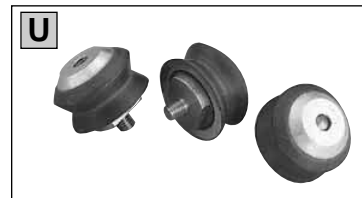
When the BATT indicator appears on the display, the batteries are low. Data will be lost when the batteries are removed.



8.30 Options

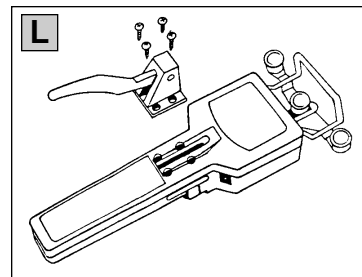
8.31 Ultra-High Speed Roller Assemblies

For line speeds up to 5,000 m/min., specify “U” roller guides.



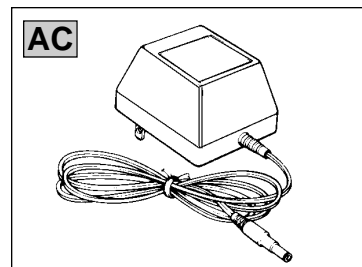
8.32 Lever

For high tension ranges, specify an “L” Lever attachment to make it easier to push the outer rollers forward for material acquisition.



8.33 AC Adapter.

Use this adapter during long-term, on-line measurements to save battery power. Connects to 115 VAC power sources.



4.00 QUICK START INSTRUCTIONS


4.10 Setup

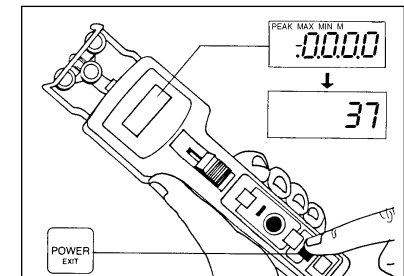
1. Insert a sample of the process material into the Thickness Compensator and secure the ends of the sample under the Sample Holding Clips on each side of the unit.

Note: Thickness Compensator is not used on the DTMB-200 Model.



2. Set the **Field Calibration Adjustment** to "STD"

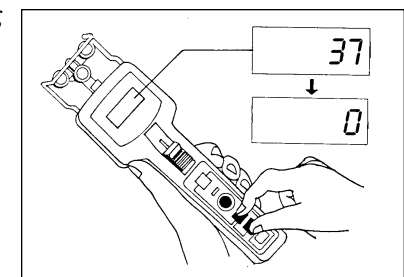
4.20 Operation

1. Turn the unit on by pressing the  key. Display should show zero when unit is in measuring position. If the gauge displays zero go to Step 3, otherwise perform a Gravity Correction Procedure (Step 2).

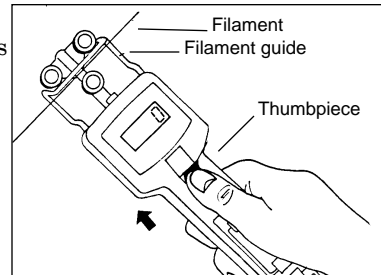


2. Position the DTMB into the measuring position and perform a Gravity Correction procedure (Zero):

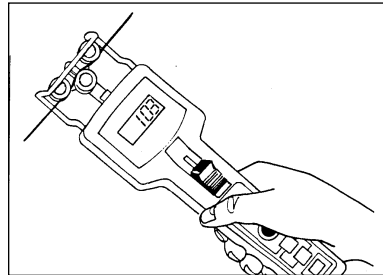
Press the  and  keys simultaneously, and hold until the display shows “0” or “0.0”.



3. Open the 3-roller system by pushing the Thumbpiece forward until the outer rollers extend beyond the Filament Guide. Position the DTMB so that the process material contacts the Filament Guide and passes between the outer rollers and the middle sensing roller.

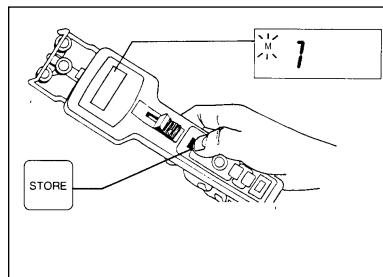


4. Release the Thumbpiece SLOWLY until it returns to its original position. **Do not let it snap back as this could effect the calibration and damage the instrument.** The display will begin to show tension readings.



5. Press the **STORE** key to start and stop the Measuring Interval.

The M indicator will blink on and off indicating that the memory is active. Refer to Built-In Memory, Section 6.00.



8.00 GENERAL NOTES

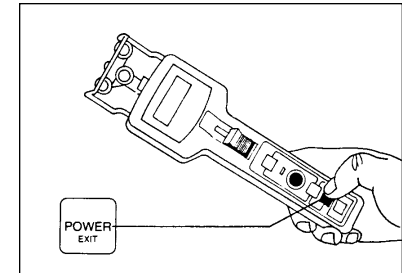
8.10 Turning Power On/Off

Turn Power On: Press **POWER EXIT** key

Turn Power Off: Press and the **POWER EXIT** key for five (5) seconds

Note: DTMB will power off automatically after 90 seconds of inactivity, except for the following instances:

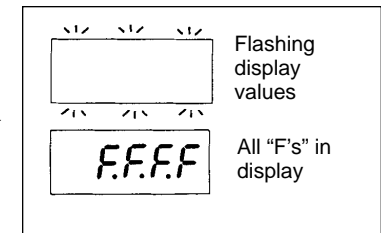
- Memory Mode configured for Standard - NAPO (No Auto Power Off)
- When AC Adapter is used



8.20 LCD Display Indications and Codes

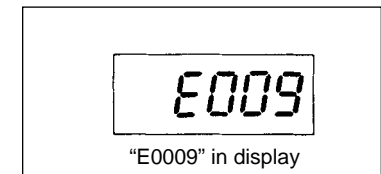
8.21 Over Range Display

When a displayed value is flashing on & off, this indicates that this reading is higher than the maximum range of the unit. The accuracy of the flashing value is not guaranteed. When all F's are displayed, this indicates that the current value greatly exceeds the maximum range of the unit.



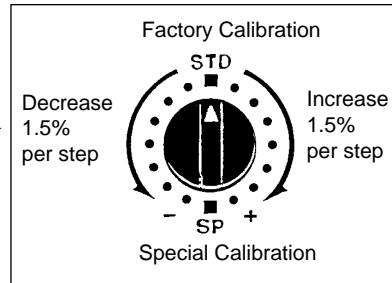
8.22 EProm Error

When this code is displayed, the EProm is not responding properly. Try turning the power off and then on again. Try this a few times. If code will not clear, contact factory.



7.20 Field Calibration Adjustment

The Field Calibration Adjustment permits the end user to "shift" the calibration curve to provide better accuracy when the Factory Standard Calibration is not suitable. Each step on the Field Calibration Adjustment will increase (clockwise) or decrease (counterclockwise) the displayed value by 1.5%.



Increase: [7 steps] x [1.5% per step] = +10.5%

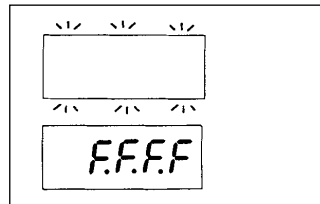
Decrease: [7 steps] x [1.5% per step] = -10.5%

If a Field Adjustment Calibration is not adequate, the accuracy of the DTMB can be increased further by ordering a Special Calibration using a calibration sample supplied by the user. Refer to Special Calibration, Section 7.30.

7.20 LCD Display Indications and Error Codes

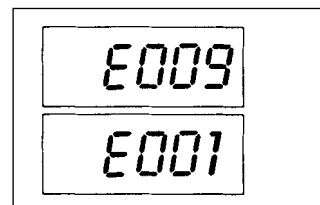
7.21 Over Range Display

When a displayed value is flashing on & off, this indicates that this reading is higher than the maximum range of the unit. The accuracy of the flashing value is not guaranteed. When all F's are displayed, this indicates that the current value greatly exceeds the maximum range of the unit.

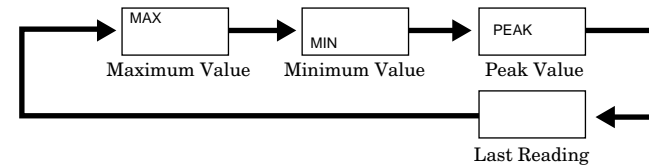
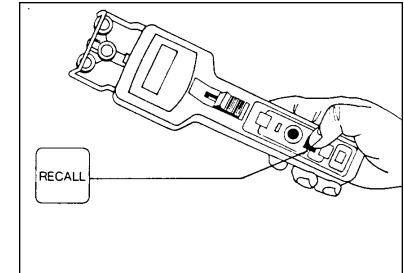


7.22 Error Codes

If the Error Code "E009" is displayed, try turning the power on and off a few times to clear it. If it does not clear, contact the factory. If the Error Code "E001" is displayed, the user is attempting to store date with units (g or lb.) different than those values already stored in memory. Clear the data stored in memory and start again.



6. Press the **RECALL** key repeatedly to review the data stored in memory.



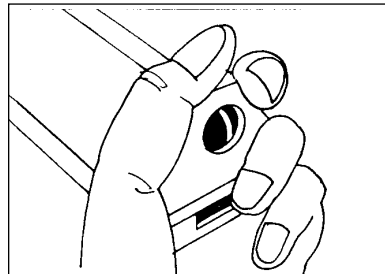
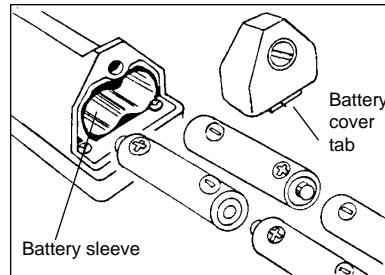
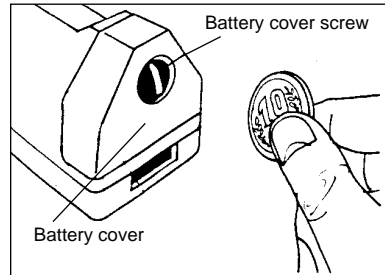
Press the **POWER EXIT** key at any time to exit Recall Mode.

The DTMB will automatically power off after 90 seconds of inactivity. To manually turn off the power, press and hold the **POWER EXIT** key for 5 seconds.

5.00 SETUP

5.10 Installing/Replacing Batteries

1. Using a slotted screwdriver or coin, loosen the battery cover screw located at the end of the unit by turning the screw counterclockwise.
2. Insert four (4) AA , 1.5 volt alkaline batteries into the battery sleeve. Insert them in the direction indicated on the top of the sleeve. Use of NiCad rechargeable batteries is not recommended.
3. Replace battery cover by first inserting the tab of the cover into the slot of the housing and pressing the cover into place. Tighten the screw by turning it clockwise.



NOTES:

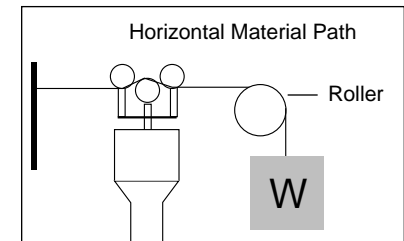
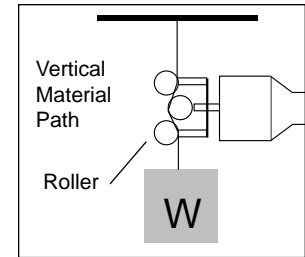
1. If battery cover will not close, confirm that the batteries are inserted in the proper orientation. Refer to step 2 above.
2. After replacing the battery, make sure the proper units of measure are selected.

7.10 Checking Calibration

It is important to check the calibration of the DTMB frequently to insure that the gauge continues to perform within factory specifications. Implementing a periodic calibration check will help identify when (and if) the gauge goes out of calibration due to unreported damage, overload, or other unknown reason.

To check the calibration:

1. Suspend a known weight “W” from the process material in either a vertical or horizontal direction, best simulating the orientation that will be used during actual measurement. Fix the process material at one end. When fixing the process material horizontally, use a roller (or other free-rotating guide) prior to fixing the known weight. Refer to sketches. Select a weight within the expected operating tension range of the the application
2. Setup DTMB by inserting sample into Thickness Compensator and performing a Gravity Correction (Zero) if using a horizontal material path. Refer to QuickStart Instructions, Section 4.0.
3. The DTMB should display a value equal to (or within quoted accuracy specification) of the known Weight “W”. If not, refer to Field Calibration Adjustment, Section 7.20.



7.00 CALIBRATION

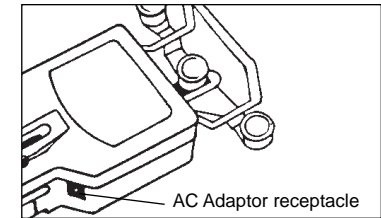
The DTMB is factory calibrated by taking a series of measurements with known weight standards suspended from Factory Calibration Standard Materials. The built-in microprocessor uses this calibration data with a complex formula to calculate a calibration curve which takes into account the *material thickness* and *orientation of use*. The factory calibration works well in most cases. However, if the process material to be measured differs significantly from the Factory Calibration Standard Materials (see table below) or if the application requires the highest accuracy possible, perform a *Field Calibration Adjustment* (refer to Section 7.20) or return the gauge to the factory for an optional Special Calibration.

Note: When ordering a Special Calibration, please supply a 10' sample of the process material for calibration purposes.

Model	Monofilament (mm)
DTMB-200	0.10
DTMB-500	0.10 and 0.20
DTMB-1K	0.20 and 0.40
DTMB-2KB	0.40 and 0.70
DTMB-2.5K	0.40 and 0.70
DTMB-5KB	0.60 and 1.20
DTMB-10KB	0.80 and 1.40
DTMB-20 KB	Customer supplied sample
DTMB-50 KB	Customer supplied sample

5.20 Using AC-Adapter

The optional AC-DTMX AC Adapter can be used as an alternative to batteries. Plug one end of the adapter into an appropriate AC outlet and the other end into the receptacle located on the side of the DTMB.

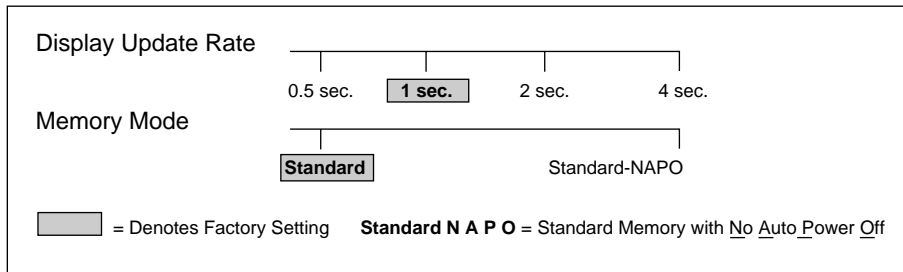


NOTES:

1. When using the AC Adapter, **do not remove the batteries** as they are used to save the data in memory when the power is turned off.
2. If the units of measure were changed while the AC Adapter was in use, the units of measure will revert back to the one's selected prior to the change.

5.30 Configuring Dip Switches

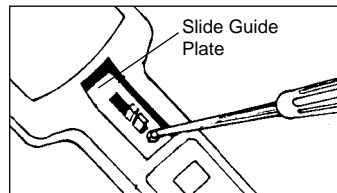
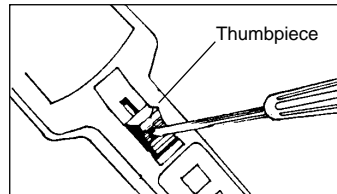
The DTMB is supplied with six (6) dip switches permitting the user to select desired *Display Update Rate* and *Memory Mode* as detailed below.



To access the dip switches, the Thumbpiece and Slide Guide Plate must be removed. Refer to access instructions below.

5.31 Accessing The Dip Switch Block

1. Turn the DTMB power off by pressing and holding the **POWER EXIT** key for five (5) or more seconds. The display will go blank.
2. Using a small Phillips screwdriver, remove the screw in the center of the Thumbpiece. Remove the Thumbpiece and screw. The Slide Guide Plate and screw will be visible.
3. Using a small Phillips screwdriver, remove the screw at the bottom of the Slide Guide Plate and remove plate.

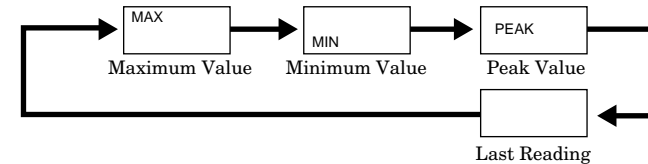


6.11 Viewing Data in Standard Memory

To view data stored in Standard Memory, press the **RECALL** key.

The following will be displayed when the **RECALL** key is pressed repeatedly. Each time the key is pressed the displayed value will change.

Action	Display Will Show	LCD Indicator
Press RECALL key	Maximum Value	MAX
Press RECALL key	Minimum Value	MIN
Press RECALL key	Peak Value	PEAK
Press RECALL key	Last Reading	none



Press the **POWER EXIT** key at any time to exit the Recall Mode.

6.12 To Clear All Data Stored in the Standard Memory

Press the **STORE** key and the **RECALL** key simultaneously

6.20 Standard Memory with No Auto Power Off (Standard - NAPO)

This memory mode is identical to the Standard Memory Mode detailed above, except that when configured in this mode the power will not turn off automatically after 90 seconds of inactivity.

6.00 BUILT-IN MEMORY SYSTEM

The DTMB Built-In Memory System can be configured to operate in one of two modes: *Standard Memory* or *Standard Memory With No Auto Power Off*. The data stored in the Standard Memory can be recalled to the display for viewing.

6.10 Standard Memory Mode

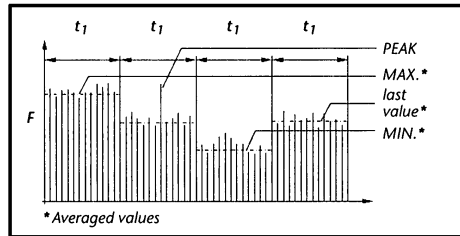
The DTMB takes 62 tension measurements per second and displays the average of these measurements over a user-selected Display Update Rate of 0.5, 1, 2 or 4 seconds. The Standard Memory system checks each displayed value and retains the Maximum, Minimum and Peak tension values which occurred during the *Measuring Interval*. The *Measuring Interval* is started and stopped by pressing the STORE key.

Maximum Value: highest displayed value during measuring interval

Minimum Value: lowest displayed value during measuring interval

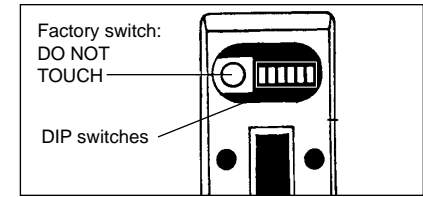
Peak Value: highest transient value of all of the measurements used to calculate each displayed value

Note: The “M” indicator on the LCD display will flash on and off, indicating that the Standard Memory system is activated.



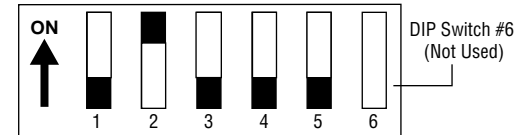
To Start/Stop measuring interval for Standard Memory, press STORE key.

- The Dip Switch Block will be located at the top of the opening after removing the Slide Guide Plate.



5.32 Setting Dip Switches

Using a small slotted screwdriver or other pointed tool, slide each of the five (5) Dip Switches into the ON (up) or OFF (down) position as indicated in the illustration below for the desired setting. Dip Switch #6 is not used.



Display Update Rate	DIP-1	DIP-2	DIP-3	DIP-4
0.5 sec	ON	OFF	OFF	OFF
1.0 sec	OFF	ON	OFF	OFF
2.0 sec	OFF	OFF	ON	OFF
4.0 sec	OFF	OFF	OFF	ON

Memory Mode	DIP-5	Data Stored in Memory
Standard Memory	OFF	MIN, MAX, PEAK
Standard Memory Without Auto-Power Off	ON	MIN, MAX, PEAK

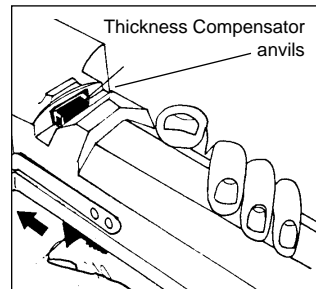
5.40 Thickness Compensator

When using the "three-roller" principle of tension measurement, an increase in material diameter will result in an increased tension reading even when the line tensions are unchanged. The DTMB is supplied with a proprietary Thickness Compensation system which automatically shifts the outer rollers to compensate for this effect. Additionally, the Thickness Compensator measures the material diameter with an accuracy of 0.01 mm (0.0004 ") for use as a factor in the computer calibration formula.

The Thickness Compensator is located on the back of the instrument. When the Thumbpiece is pushed forward, two metal plates (anvils) will separate creating a slot for insertion of the material sample.

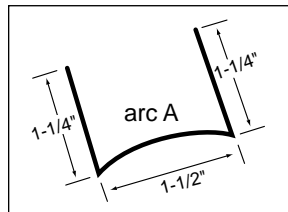
NOTES:

1. Some monofilaments, wires and other difficult-to-bend samples will need special preparation prior to insertion into the Thickness Compensator. See Preparing Sample for Thickness Compensator.
2. It is unnecessary to use the Thickness Compensator on the DTMB-200 because the range of material diameters used with this model is inconsequential.



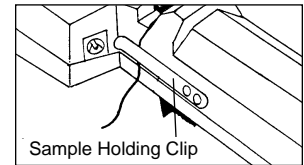
5.41 Preparing Sample For Thickness Compensator

When using monofilament, wire or other difficult-to-bend materials, the sample must be prepared properly before inserting into the Thickness Compensator. Using the pliers supplied, bend the sample as noted in the sketch. For monofilaments, maintain arc "A" as shown, so sample bends into anvils.



5.42 Inserting Sample Into Thickness Compensator

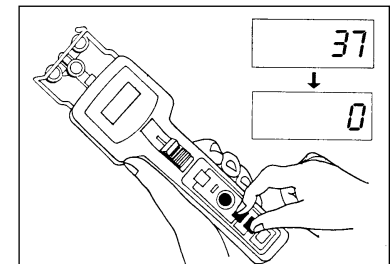
Push the Thumbpiece forward to separate the two anvils. Insert the sample into the slot and slowly release the Thumbpiece back to its resting position. The material sample should be secured between the two anvils. Place the ends of the sample under the Sample Holding Clips located on each side of the unit. If the ends stick up bend them back so they will not present a safety hazard.



NOTE: In lieu of a sample, an equivalent shim can be inserted into the Thickness Compensator as long as its compressed thickness is the same as the process material. The shim should be secured using a spray adhesive on one side, so it will not fall out each time the Thumbpiece is pushed forward.

5.50 Gravity Correction Procedure (ZERO)

The DTMB is factory calibrated for use in the right-handed, horizontal position (vertical material path) with the rollers aligned vertically. When using the DTMB in any other orientation, a *Gravity Correction Procedure (Zero)* should be performed.



Hold the instrument in the measuring position and press the **RECALL** and **POWER EXIT** keys simultaneously. The display will show zero.

The DTMB is now ready for use.