

11.00 WARRANTY

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1.00 INTRODUCTION

The CHECK•LINE® DTMX 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, rigidities, gravity and other critical parameters. The DTMX is powered by four AA batteries and is supplied in a rugged, die-cast aluminum housing.

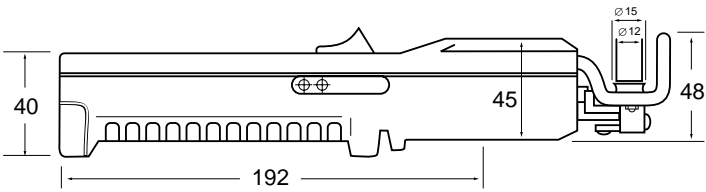
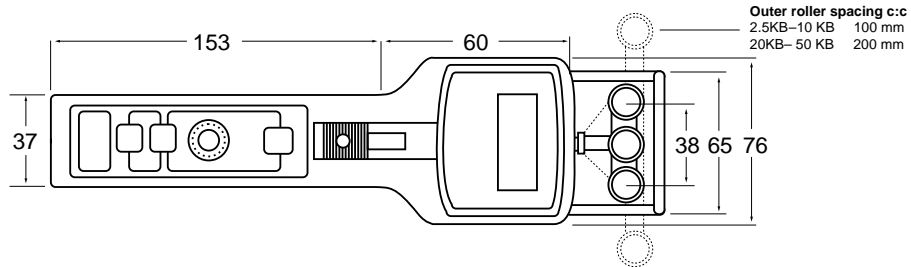
The DTMX takes 62 tension measurements per second and displays the average of these measurements over a user-selected interval of 0.5, 1, 2 or 4 seconds, the Display Update Rate. This permits the user to determine the extent of averaging (or damping) required to "stabilize" the tension readings, making 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 data logging system is provided which permits storage of 100 individual data points plus *maximum*, *minimum*, *peak*, *average* and *standard deviation* values. The recorded data and statistics can be recalled to the display for viewing, downloaded to the battery-powered P-40 Printer (or other serial printer) or downloaded to a Personal Computer. The DTMX can also be mounted in-line for extended periods using the threaded mounting holes on the rear side of the housing. For long term analysis, an AC adapter can be connected. The DTMX can be connected to a Chart Recorder (or other recording device) using its 0-1 VDC analog output. For those familiar with RS-232 communication, the DTMX can also be "polled" from a Host Computer.

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 Capacity	100 values plus maximum, minimum, average, peak, standard deviation and memory location
Memory Operation	<u>Continuous Mode</u> : automatic storage of each displayed value until memory is full <u>On-Demand Mode</u> : displayed value is stored when STORE key is pressed
Overrange Indicator	Value will blink on/off, then "FFFF"
Field Calibration Adjustment	± 7 steps, 1.5% per step
Serial Output	RS-232C (4800 baud, 8-bit word length, no parity, 2 stop bits)
Analog Output	0-1 VDC, proportional to tension range
Frequency Response	(Analog Output) 16 msec (62.5 Hz)
Battery Type	Four (4) 1.5 V AA (included)
Battery Life	20 hours, continuous use
AC Adapter (optional)	6 VDC @ 300 mA, for continuous in-line use. Powered by 115 VAC
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, output connector and operating instruction guide, all in a fitted, hard-plastic carrying case
Warranty	One year

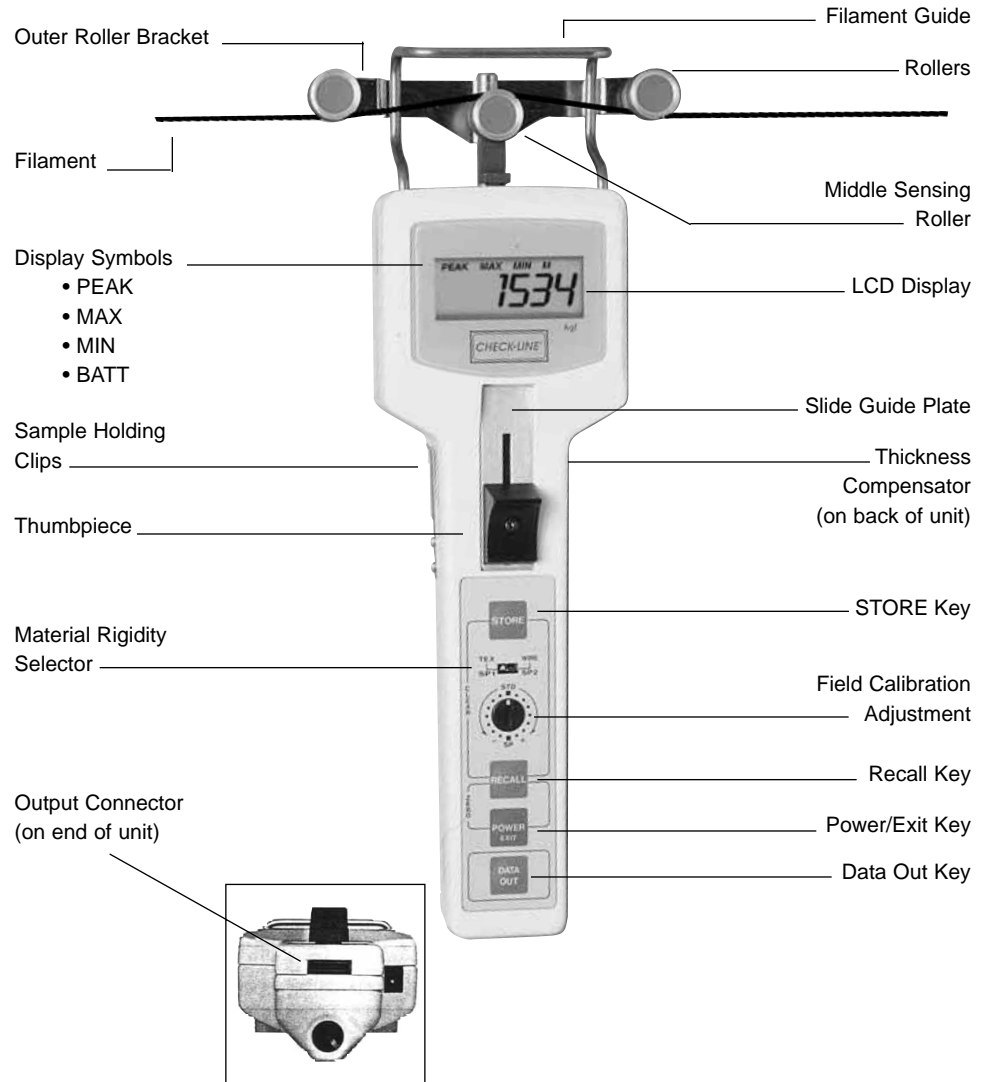
10.00 SPECIFICATIONS



All dimensions in mm

Model Data								
Model	DTMX-200	DTMX-500	DTMX-1K	DTMX-2K	DTMX- 2.5KB	DTMX-5KB	DTMX-10KB	DTMX-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
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

2.00 DTMX 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) Starts/Stops automatic recording of values into memory (Continuous Data Logging Model). Loads displayed value into memory (On-Demand Data Logging Model).
RECALL	<ul style="list-style-type: none"> Enters Recall Mode to review statistics and recorded Data. <ul style="list-style-type: none"> In recall mode, changes display from LAST → MAX → MIN → PEAK → LAST → MAX etc. When in Data Logging Mode: changes display from LAST → MAX → MIN → PEAK. → AVERAGE → STANDARD DEVIATION → DATA #1 → DATA #2 → DATA #3 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 statistics and data.
DATA OUT	<ul style="list-style-type: none"> Initiates downloading of data.
STORE + RECALL	<ul style="list-style-type: none"> Clears all data in Basic Memory and Extended 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").

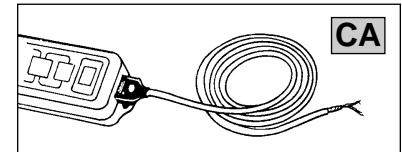
3.10 Auxiliary Functions

Key	Description of Functions
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.
POWER EXIT + DATA OUT	<ul style="list-style-type: none"> Changes from Tension Measurement Mode into Thickness Measuring Mode when both keys are pressed and held for four or more seconds.
STORE	<ul style="list-style-type: none"> Exits Material Thickness Mode and returns to Tension Measuring Mode.

* 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.

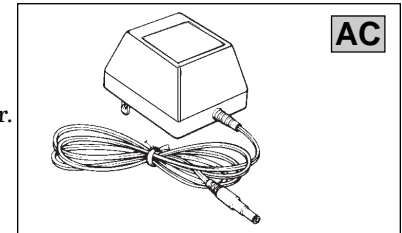
9.55 Analog Cable

The CA cable is for connection to chart recorders or other recording devices. It is supplied with bare leads for easy connection to a wide variety of devices.



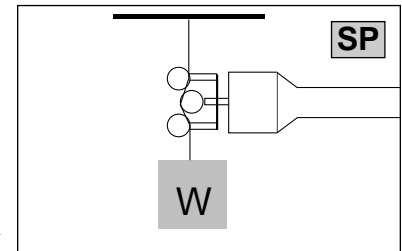
9.56 AC Adapter.

This adapter is for use during long-term, on-line measurements to save battery power. It connects to 115 VAC power sources.



9.57 Special Calibration

If the standard Factory Calibration and the Field Calibration Adjustment does not provide the desired accuracy, a Special Calibration can be ordered. Up to two Special Calibrations can be provided (SP1 and SP2). A 10' sample of the process material(s) must be provided for calibration purposes.

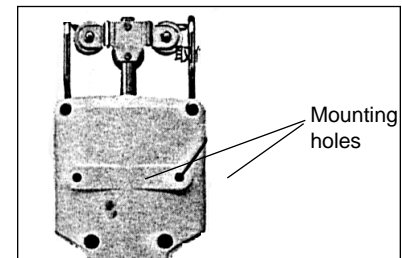


9.60 On-Line Mounting Holes

The DTMX 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.)



9.50 Options

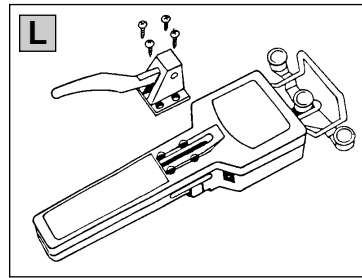
9.51 Ultra-High Speed Roller Assemblies

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



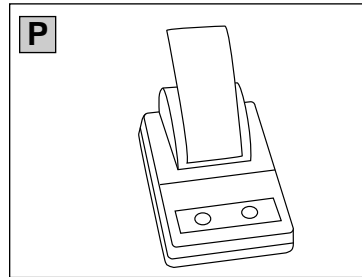
9.52 Lever

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



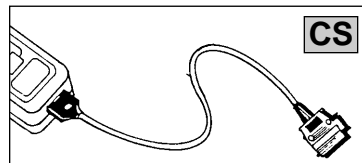
9.53 Portable Printer

The P-DTMX battery-powered, portable printer uses rechargeable batteries. It is supplied with a 10 ft. connection cable, one roll of paper and a 115 VAC charger.



9.54 Serial Cable

The CS cable is for connection to Personal Computers. The 10 ft. cable is supplied with DB9 and DB25 Serial connectors.



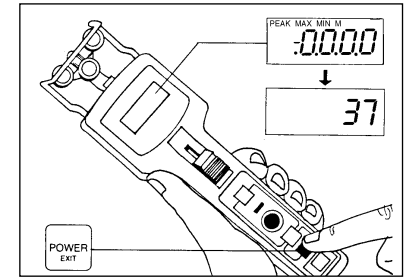
4.00 QUICK START INSTRUCTIONS

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. **Thickness Compensator is not used on the DTMX-200 Model.**
2. Set the **Material Rigidity Selector** to "TEX" or "WIRE"
3. Set the **Field Calibration Adjustment** to "STD"

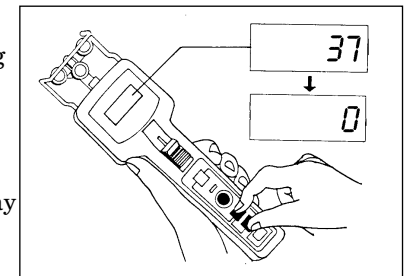
4.20 Operation

1. Turn the unit on by pressing the **POWER EXIT** 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).

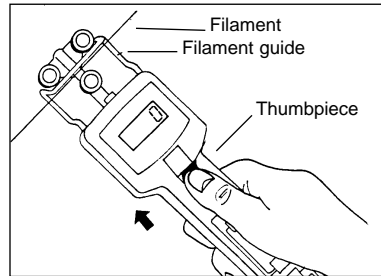


2. Position the DTMX into the measuring position and perform a Gravity Correction procedure (Zero):

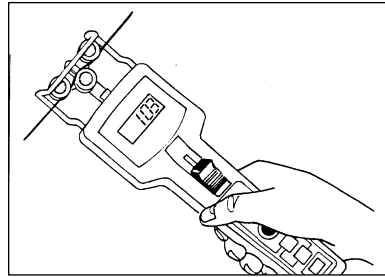
Press the **RECALL** and **POWER EXIT** keys simultaneously, and hold until the display shows "0" or "0.0".



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

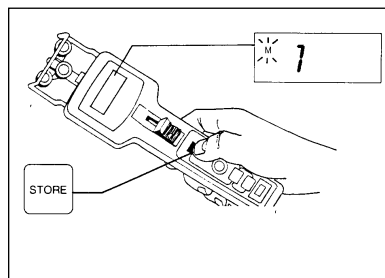


4. Release the Thumbpiece SLOWLY until it returns to its original position. **Do not let it snap back as this could effect the calibration and damage the instrument.** The display will begin to show tension readings.



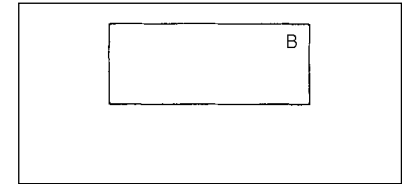
5. Press the **STORE** key to start and stop the Standard Memory system.

The “M” indicator will blink on and off indicating that the memory is active and up to 100 readings will be stored *continuously* or *on-demand*, as indicated in Sections 6.10, 6.30 and 6.40.



9.23 Low Battery

When the “B” indicator appears on the display, the batteries are low. If data is stored in memory, download it before replacing batteries as the data will be lost when the batteries are removed.



9.30 Standard Deviation & Average Formulas

The formula indicated is used to calculate the Standard Deviations & Average of all the data stored in the Extended Memory when the DTMX is configured for:

- On-Demand Data Logging Mode
- Continuous Data Logging Mode

Standard Deviation Value

$$\sqrt{\frac{\sum (X_i - \bar{X})^2}{n-1}}$$

Average Value

$$\frac{\sum X_i}{n}$$

9.40 Changing Units of Measure

The DTMX is supplied with the Units of Measure set for Grams (g) or Kilograms (Kg) depending upon the selected range. The units can be changed to Pounds (lb) or Ounces (oz) by pressing the

POWER EXIT + **STORE** keys simultaneously.


Changing Units of Measure


POWER EXIT + **STORE** Press both keys simultaneously

Units	Indicator
Grams	gf (momentarily)
Kilograms	Kgf (momentarily)
Pounds	lb (continuously)
Ounces	oz (continuously)

9.00 GENERAL NOTES

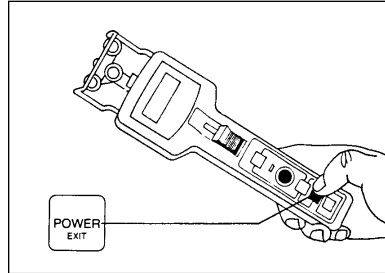
9.10 Turning Power On/Off

Turn Power On: Press  key

Turn Power Off: Press and hold the  key for five (5) seconds

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

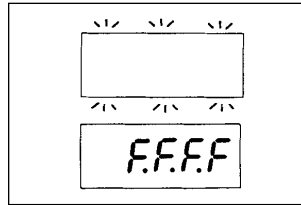
- Memory Mode configured for Standard - NAPO (No Auto Power Off)
- When AC Adapter is used
- While logging data in Continuous Data Logging Memory Mode (unit will power off when memory is full)
- While downloading data



9.20 LCD Display Indications and Error Codes

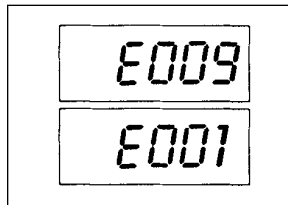
9.21 Over Range Display


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.

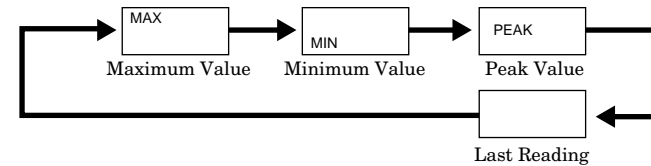
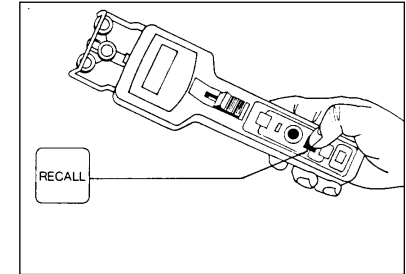



9.22 Error Codes


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 data 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  key repeatedly to review the data stored in memory.



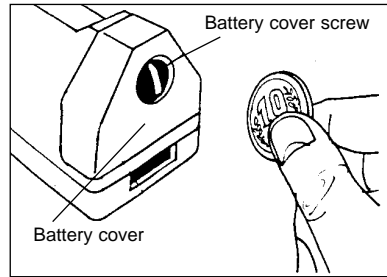
Press the  key at any time to exit Recall Mode.

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

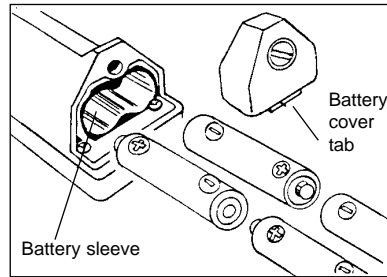
5.00 SETUP

5.10 Installing/Replacing Batteries

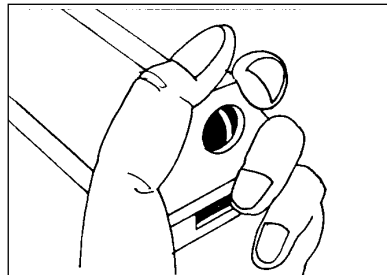
1. Using a slotted screwdriver or coin, loosen the battery cover screw located at the end of the unit by turning the screw counterclockwise.



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.



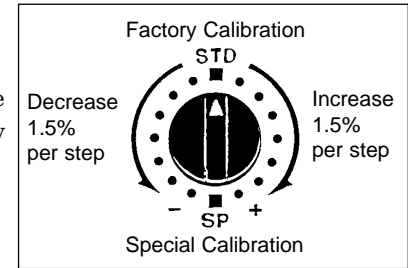
3. Replace battery cover by first inserting the tab of the cover into the slot of the housing and pressing the cover into place. Tighten the screw by turning it clockwise.



NOTE: If battery cover will not close, confirm that the batteries are inserted in the proper orientation. Refer to step 2 above.

8.20 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 DTMX can be increased further by ordering a Special Calibration using a calibration sample supplied by the user. Refer to Special Calibration, Section 8.30.

8.30 Special Calibration

If the standard Factory Calibration and the Field Calibration Adjustment does not provide the desired accuracy, a Special Calibration can be ordered. Up to two Special Calibrations can be provided (SP1 and SP2). A 10' sample of the process material(s) must be provided for calibration purposes.

8.31 To Set DTMX For Special Calibration #1 (SP1)

1. Set Material Rigidity Selector to "TEX"
2. Set Field Calibration Adjustment to "SP"

8.32 To Set DTMX For Special Calibration #2 (SP2)

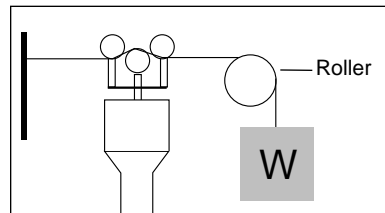
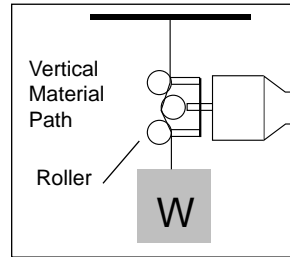
1. Set Material Rigidity Selector to "WIRE"
2. Set Field Calibration Adjustment to "SP"

8.10 Checking Calibration

It is important to check the calibration of the DTMX 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.

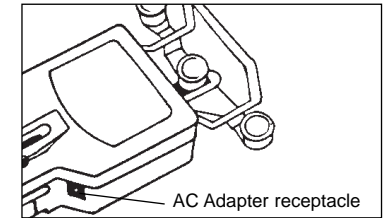
To check the calibration:

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 application
2. Setup DTMX by inserting sample into Thickness Compensator, setting Material Rigidity Selector and performing a Gravity Correction (Zero) if using a horizontal material path. Refer to Quick Start Instructions, Section 4.0.
3. The DTMX should display a value equal to (or within quoted accuracy specification) of the known Weight “W”. If not, refer to Field Calibration Adjustment, Section 8.20.



5.20 Using AC-Adapter

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

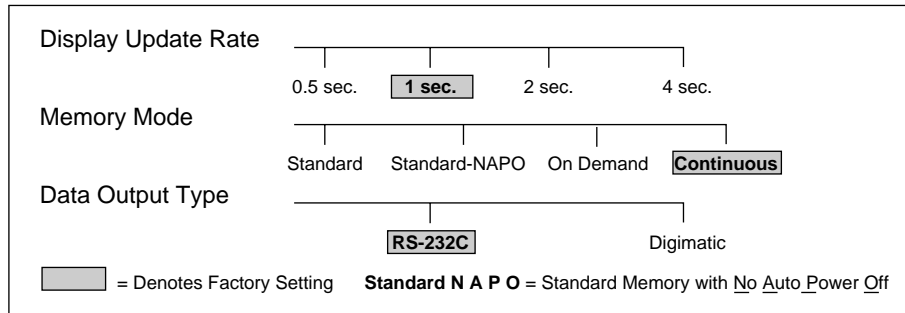


Note:

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

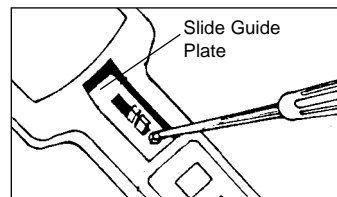
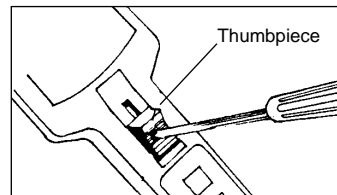
The DTMX is supplied with six (6) dip switches permitting the user to select desired *Display Update Rate*, *Memory Mode* and *Data Output Type* as detailed below.



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 DTMX power off by pressing and holding the  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.



8.00 CALIBRATION

The DTMX 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 *material rigidity*, *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 8.20) or return the gauge to the factory for optional Special Calibration.

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

Factory Calibration Standard Materials		
Model	* Textile (mm)	** Wire (mm)
DTMX-200	0.10	0.16
DTMX-500	0.10 and 0.20	0.16 and 0.26
DTMX-1K	0.20 and 0.40	0.26 and 0.40
DTMX-2K	0.40 and 0.70	0.40 and 0.70
DTMX-2.5KB	0.40 and 0.70	0.40 and 0.60
DTMX-5KB	0.60 and 1.20	0.60 and 1.00
DTMX-10KB	0.80 and 1.40	1.00 and 1.20
DTMX-20KB	Customer Sample	Customer Sample
DTMX-50KB	Customer Sample	Customer Sample

* Monofilament is used for TEXTILE Calibration
 ** Soft annealed copper wire is used for WIRE Calibration

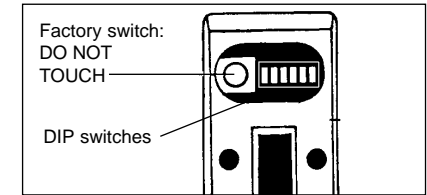
7.51 Signal Characteristics

Signal	Baud Rate	Word Length	Parity	Stop Bits	EOL Delimiter
RS-232C	4800	8-bit	None	2-bits	CR + LF

7.52 Data Format

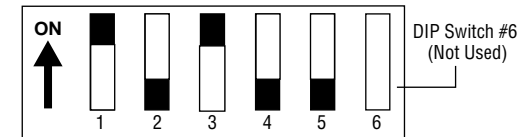
1	2	3	4	5	6	7	8	9	10	11	12	13
	S	T	A	T	I	S	T	I	C	S	CR	LF
CR	LF											
U	N	I	T	S						g	CR	LF
D	A	T	A					x	x	x	CR	LF
M	A	X						x	x	x	CR	LF
M	I	N						x	x	x	CR	LF
P	E	A	K					x	x	x	CR	LF
A	V	G						x	x	x	CR	LF
D	E	V						x	•	x	CR	LF
CR	LF											
	D	A	T	A							CR	LF
		1						x	x	x	CR	LF
		1	2					x	x	x	CR	LF
1	0	0						x	x	x	CR	LF
	*	*		E	N	D		*	*		CR	LF

4. 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.



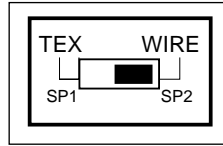
Display Update Rate	DIP-1	DIP-2
0.5 sec	OFF	OFF
1.0 sec	ON	OFF
2.0 sec	OFF	ON
4.0 sec	ON	ON

Data Output	DIP-5
RS-232C	OFF
Digimatic	ON

Memory Mode	DIP-3	DIP-4	Data Stored in Memory
Standard Memory	OFF	OFF	MIN, MAX, PEAK
Standard Memory Without Auto-Power Off	ON	ON	MIN, MAX, PEAK
Extended Memory (Continuous Mode) automatically entered	ON	OFF	MIN, MAX, PEAK, AVG, STD. DEV. plus 100 data points
Extended Memory (On-Demand Mode)	OFF	ON	MIN, MAX, AVG, STD. DEV. plus 100 data points

5.40 Material Rigidity Selector

The Material Rigidity Selector permits the user to set the DTMX for use on Textiles or Wires. It is used in the computer calibration formulas to provide the highest measurement accuracy. If using a process material other than a Textile or Wire, choose the setting which best matches the rigidity (stiffness) of the process material. If uncertain which setting is best, check the calibration in each position and choose the one providing the best accuracy. Refer to Checking Calibration, Section 8.10.



The Material Rigidity Selector is also used to select a *special calibration* (SP1 or SP2) which is optionally available. Refer to Special Calibration, Sec. 8.30.

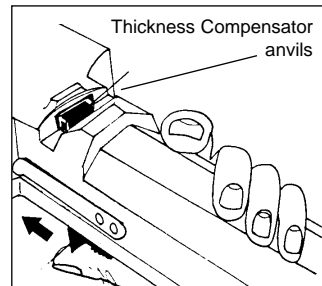
5.50 Thickness Compensator

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 DTMX 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.

NOTE: 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 DTMX-200 because the range of material diameters used with this model is inconsequential.



7.41 Printer Setup Data

Signal	Baud Rate	Word Length	Parity	Stop Bits	EOL Delimiter
RS-232C	4800	8-bit	None	2-bits	CR + LF

7.42 Printer Setup Data

STATISTICS	
UNITS	g
DATA	12
MAX	154.2
MIN	101.5
AVG	137.7
DEV	13.77
DATA	
1	101.5
2	120.7
3	140.7
4	133.9
5	135.2
6	136.8
7	140.5
8	146.4
9	147.4
10	146.4
11	148.6
12	154.2
** END **	


*On-Demand
Data Logging Mode*

STATISTICS	
UNITS	g
DATA	12
MAX	154.2
MIN	101.5
PEAK	157.5
AVG	137.7
DEV	13.77
DATA	
1	101.5
2	120.7
3	140.7
4	133.9
5	135.2
6	136.8
7	140.5
8	146.4
9	147.4
10	146.4
11	148.6
12	154.2
** END **	

*Continuous
Data Logging Mode*

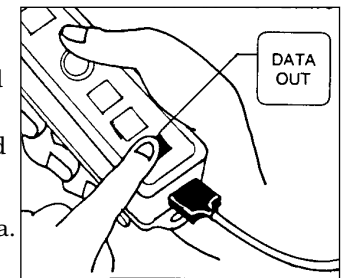
7.50 Serial Output — Computer

The DTMX can be connected to Personal Computers or other serial recording devices for downloading the recorded data and all calculated statistics. Additionally, a user can request a data point from a Host Computer (Poll Command) and perform a Zero ("Tare"). See below for details.

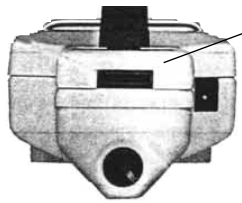
Press the  key to download recorded data.

Remote Host Computer Commands (Poll)

Request Data Point "D" (ASCII capital letter "D")
Zero "Z" (ASCII capital letter "Z")



7.20 Output Connector Pin Outs



10-Pin Output Connector

1	RXD	RS-232C
2	TXD	
3	CTS	
4	RTS	Digimatic
5	REQ	
6	READY	
7	CLK	Analog
8	DATA	
9	Signal 0-1VDC	
10	GND	

7.30 Analog Output


The analog output permits users to connect the DTMX to Chart Recorders and other analog recording devices for trending and other data recording purposes. The analog output is continuously updated at all times and does not have to be turned on or off.

Signal Type	0-1 VDC
D-to-A Converter	12 bit
Frequency Response	16 msec (62.5 Hz)
Impedance	2 K Ohm (minimum)

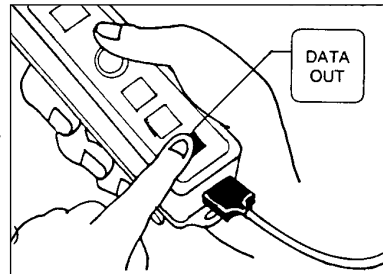
Pin #	Function
9 ...	Signal (0-1) VDC
10 ...	Ground

7.40 Serial Output — Printer

The DTMX can be connected to the CHECK•LINE P-DTMX battery-powered printer (or other serial printer) for downloading the recorded data and all calculated statistics.

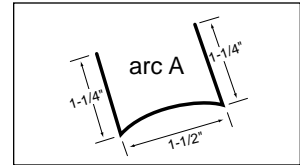
Press the  key to print recorded data.

Note: When the CHECK•LINE P-DTMX is ordered, no printer setup is required.



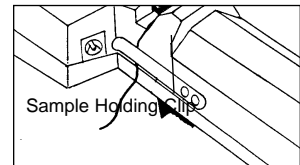
5.51 Preparing Sample For Thickness Compensator

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.



5.52 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.

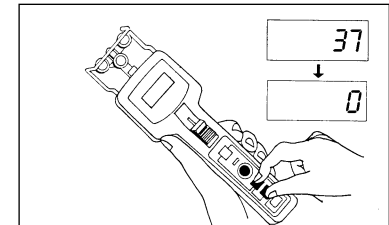


NOTE: In lieu of a sample, an equivalent shim can be inserted into the Thickness Compensator as long as its compressed thickness is the same as the process material. The shim should be secured using a spray adhesive on one side, so it will not fall out each time the Thumbpiece is pushed forward.

5.60 Gravity Correction Procedure (ZERO)

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


Hold the instrument in the measuring position and press the  and  keys simultaneously. The display will show zero. The DTMX is now ready for use.



6.00 BUILT-IN MEMORY SYSTEM

The DTMX Built-In Memory system can be configured to operate in one of the following modes: *Standard Memory*, *Standard Memory With No Auto Power Off*, *On-Demand Data Logging* and *Continuous Data Logging*. The latter two are part of the Extended Memory. Data recorded in the Standard Memory or the Extended Memory can be recalled to the LCD Display for viewing or downloaded to a printer or PC. To set the Memory Mode, refer to Configuring Dip Switches, Section 5.30.

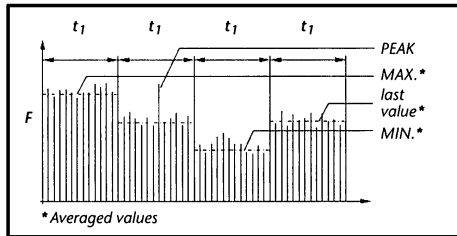
6.10 Standard Memory Mode

The DTMX 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  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

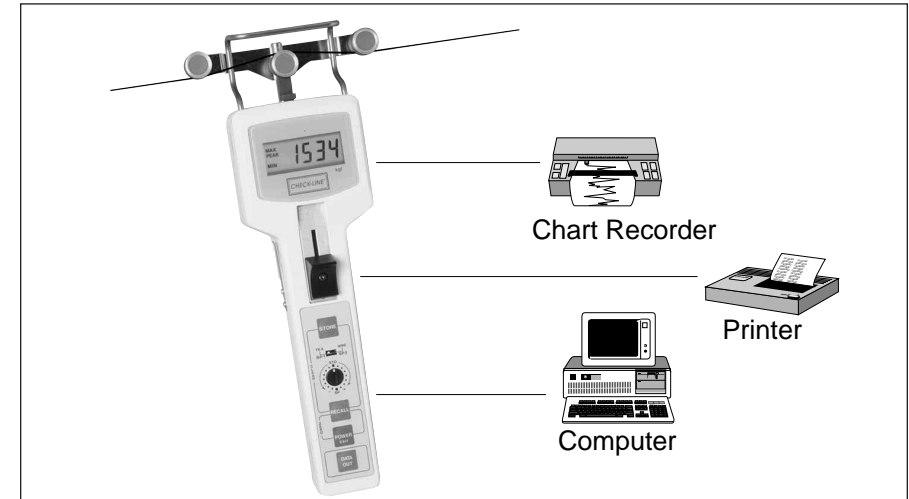


Note: The "M" indicator on the LCD display will flash on and off, indicating that the Standard Memory system is activated.

To Start/Stop measuring interval for Standard Memory, press 

7.00 DOWNLOADING DATA

When configured for either *Continuous Data Logging Memory Mode* or *On-Demand Data Logging Memory Mode*, the recorded data can be downloaded for record-keeping purposes using the DTMX Serial and Analog outputs.



7.10 Output Cables

The DTMX is supplied with a special 10-pin high-density connector for downloading data. A mating connector is provided for user-supplied cables or with the following optionally available cables:

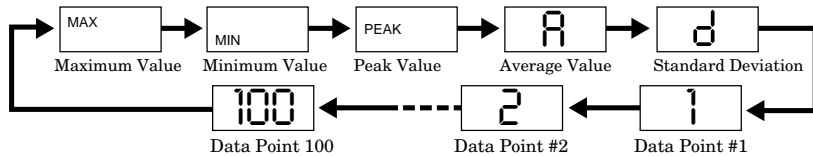
- **CS-DTMX:** Serial Cable (10' length) for connection to PC's or other serial recording devices. It is supplied with a DB9 serial connector and a DB9/25 adapter.
- **CA-DTMX:** Analog Cable (10' length) for connection to Chart Recorders or other analog recording devices including PC's with Analog-to-Digital Converter cards. It is supplied with two bare leads.

6.41 Viewing Data In Continuous Data Logging Mode

To view data stored in the Extended Memory press the **RECALL** key

The following will be displayed when the **RECALL** key is pressed repeatedly.

Action	Display Will Show	LCD Indicator
Press RECALL key	Maximum Value	MAX
Press RECALL key	Minimum Value	MIN
Press RECALL key	Peak Value	" P "
Press RECALL key	Average Value	" A "
Press RECALL key	Standard Deviation	" d "
Press RECALL key	Date Point #1	" 1 "
Press RECALL key	Date Point #2	" 2 "
⋮	⋮	⋮
Press RECALL key	Date Point #100	" 100 "



Each time the key is pressed the displayed value will change.

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

6.42 To Clear All Data Stored In The Extended Memory.

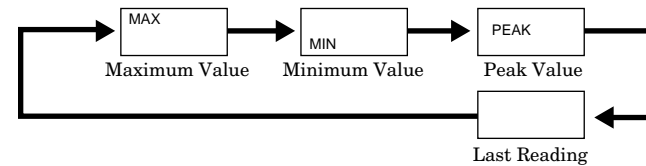
Press the **STORE** key and the **RECALL** key simultaneously.

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 with 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.

6.30 On-Demand Data Logging Mode

When configured for *On-Demand Data Logging Mode*, up to 100 data points can be stored in memory along with the calculated *average* and *standard deviation* of the stored values. Each data point can be manually entered into memory.

When the key is pressed the currently displayed tension reading will be stored into memory and the memory location (a number from 1 to 100) will momentarily flash on the display.

To Store a Data Point in memory, press the key.

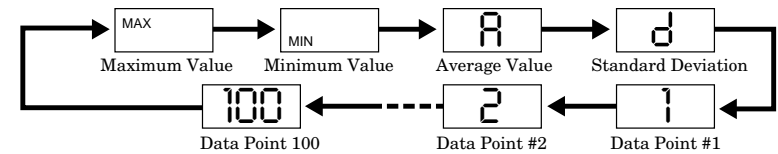
Note: The first time the key is pressed the “M” indicator will flash on and off on the LCD display. When the memory is full (100 data points in memory), the “M” indicator will stop flashing and remain on the display.

6.31 Viewing Data Stored In On-Demand Data Logging Mode

To view data stored in Extended Memory press the key.

The following will be displayed when the 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	Average Value	“ A ”
Press RECALL key	Standard Deviation	“ d ”
Press RECALL key	Date Point #1	“ 1 ”
Press RECALL key	Data Point #2	“ 2 ”
⋮	⋮	⋮
Press RECALL key	Data Point #100	“ 100 ”



Press the key at any time to exit the Recall Mode.

6.32 To Clear All Data Stored In The Extended Memory.

Press the key and the key simultaneously.

6.40 Continuous Data Logging Memory Mode

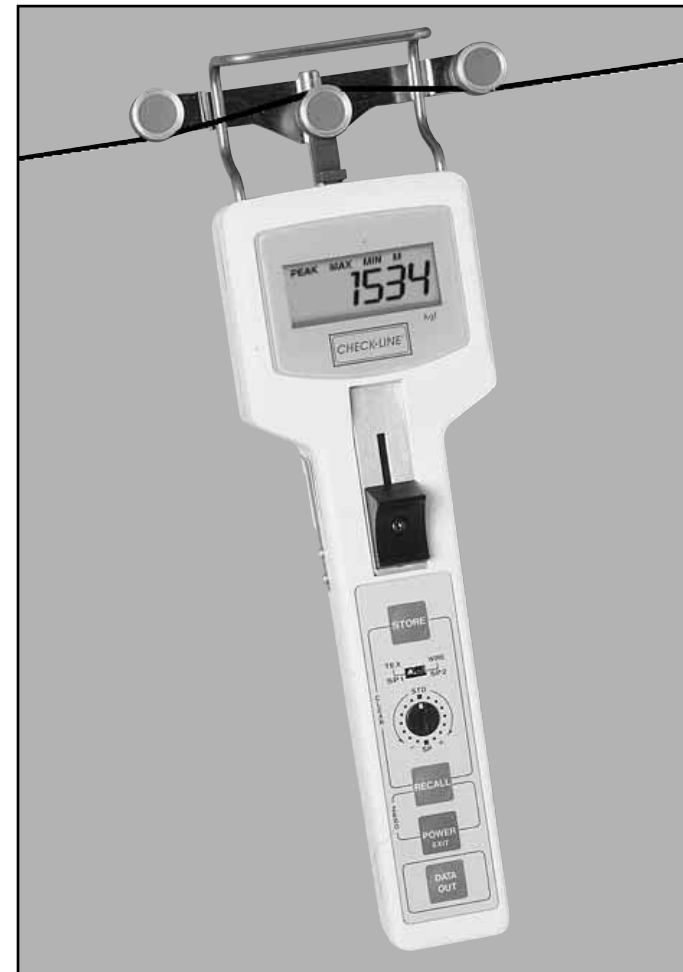
When configured for *Continuous Data Logging Mode*, up to 100 data points can be stored in memory along with the calculated average, peak and standard deviation values of the data stored in memory. Each displayed value is automatically entered into memory at a rate equal to the selected Display Update Rate of 0.5, 1, 2 or 4 seconds.

When the key is pressed the “M” indicator on the LCD Display will begin to flash indicating that each displayed value is being automatically stored in memory. The indicator will continue to flash until the key is pressed again to stop the automatic storage or until the memory is full. The indicator will stop flashing and remain on the display.

To start or stop the automatic storage of each displayed tension value into memory, press the key.

Digital TENSION METER

Model DTMX



OPERATING MANUAL