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DTMB & DTMX

Calibration Instructions

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INDEX

1.0 OVERVIEW

The CHECK•LINE® DTMB and DTMX Digital Tension Meters are factory calibrated using the materials listed in the Calibration section of the Operating Instruction Guide. The DTMB models are factory calibrated using two monofilament samples with different diameters, and the DTMX models are calibrated with two monofilament samples and two bare copper wire samples. A *Special Calibration* can be easily performed by the user using a customer supplied sample of the process material to obtain the highest accuracy in specific applications.

DTMB and DTMX models are calibrated using three (3) calibration points, normally at 20%, 50% and 100% of the full scale tension range of the instrument. These "calibration points" can be adjusted up or down in 10% increments to "fine-tune" the calibration if desired. During the calibration procedure, the user will be prompted to suspend a series of known weights equal to the displayed percentages. The calibration steps are first performed for the "thin" sample (smaller diameter) and then repeated for the "thick" sample (larger diameter). **The weights suspended from the process material must be in centinewton (cN) units or the equivalent weight in grams (refer to the cN-to Gram Conversion Chart in the Appendix).**

When performing the calibration, the process material should be suspended from the Calibration Test Stand in a vertical orientation as indicated in the illustration on page 3. The vertical calibration will still be accurate even when measuring tensions on a horizontal running material as long as a Gravity Correction Procedure is performed to compensate for the change in the position of the instrument. This procedure is described in section 5 of the Operating Instruction Guide.

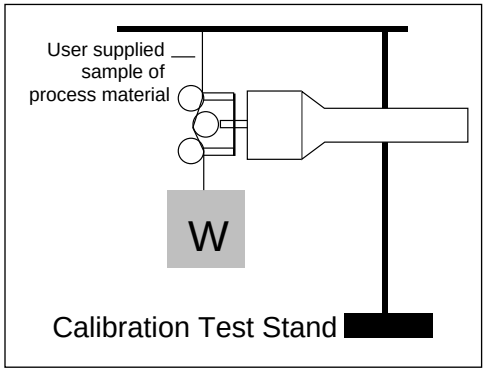
The user can perform the calibration using a single sample or with two different samples varying significantly in diameter or material rigidity. It is recommended that two samples be used when the tension meter will be used on a variety of different process materials varying in diameter and/or rigidity. The microprocessor performs an analysis on the calibration data from the two samples to provide the best possible accuracy over the range of process materials.

After completing the *Special Calibratio*n, the accuracy of the calibration should be verified. It is important to note that the values will be displayed in grams (or pounds) not cN units, even though they are used for the calibration. Therefore, gram weights should be used for calibration verification (or refer to the CN-to-Gram Conversion Chart in the Appendix).

2.0 SETUP FOR CALIBRATION

The following materials will be necessary to perform a special calibration:

1. Calibration Test Stand
2. Set of hook weights calibrated in cN units (or grams)
3. Sample of process material
4. 3mm rigid shim or drill bit
5. Tension Meter
6. Small Phillips screwdriver



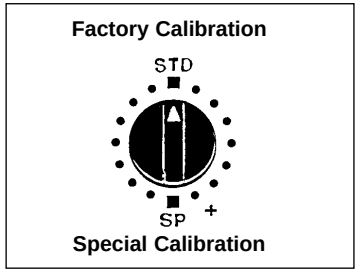
Note: When combining gram weights to equal cN values for calibration, the conversion from cN to grams is ... 1 cN = 1.02 grams (see conversion chart in Appendix)

Examples

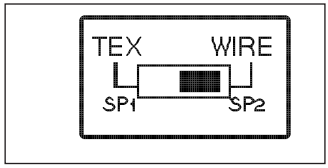
20 cN = 23.4 grams **1000 cN** = 1020 grams

3.0 CALIBRATION PROCEDURE

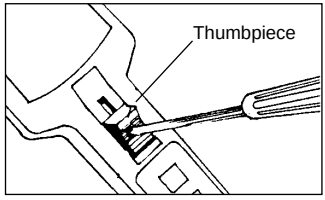
When performing a special calibration, the factory calibration data can be retained by performing the new *Special Calibratio*n with the Field Calibration Adjustment Switch rotated to the "SP" position. If the switch is left in the "STD" position the *Special Calibration* data will overwrite (erase) the factory calibration data. In this case the"SP" position can be used for a 2nd *special calibration* if desired.



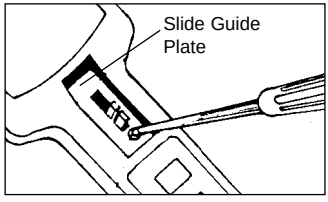
When calibrating DTMX models, the Rigidity Selector Switch can be moved into the "SP1" or "SP2" position in conjunction with the "STD" or "SP" setting of the Field Calibration Adjustment Switch. This allows up to two (2) special calibrations to be stored while retaining the factory calibration data or up to four (4) special calibrations when overwriting the factory calibration data.



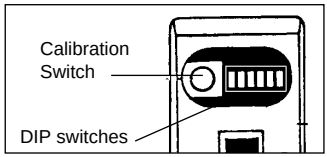
1. Using a small Phillips screwdriver, remove the screw in the center of the Thumbpiece. Remove the Thumbpiece and screw. The Slide Guide Plate and screw will be visible.



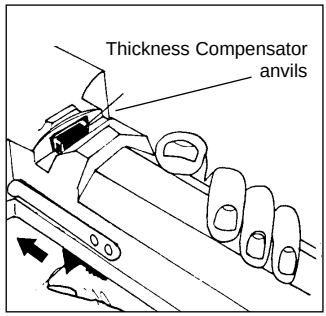
2. Remove the screw at the bottom of the Slide Guide Plate and remove the plate. Re-install the Thumbpiece as it will be helpful when extending the outer rollers to acquire the sample.



3. The Calibration Switch will be located under the Slide Guide Plate, next to the Dip Switch Block.



4. Open the three roller system and insert a sample of the same material that is suspended from the Test Stand between the Thickness Compensator anvils and secure under the clips. Release the Thumbpiece slowly.



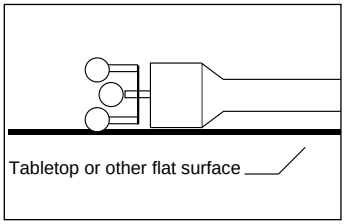
5. Power the unit on by pressing the POWER switch.

6. Press and hold the Calibration Switch using a screwdriver or similar device for approximately four (4) seconds. The display will show “CA 1”.

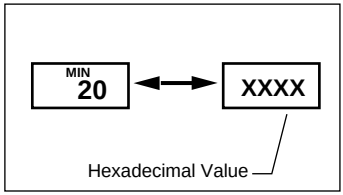
7. Press the STORE key to enter the Calibration Mode. A hexadecimal value will be displayed.

8. Place the instrument on a flat surface as illustrated without any sample threaded between the Rollers.

Press the STORE key when the display is stabilized to record the original position of the sensing roller.



9. The display will begin flashing “20” (meaning 20% of full scale) alternating with a hexadecimal value. The “MIN” indicator will also flash on and off.



Note: The 20% of full scale calibration point can be increased or decreased in 10% increments by rotating the Field Calibration Adjustment Switch. The new selected value (0, 10, 30%) will be displayed.

10. Suspend a weight equal to 20% (or selected percentage) of the full scale tension range from the end of the process material. Refer to the table below to determine the appropriate cN or gram weight based on the model being calibrated.

20% of Full Scale Tension Range By Model							
200	500	1K	2K	2.5 KB	5 KB	10 KB	20 KB
40 cN	100 cN	200 cN	400 cN	500 cN	1000 cN	2000 cN	4000 cN
41 g	102 g	204 g	408 g	510 g	1020 g	2040 g	4080 g

11. Push the Thumbpiece forward to extend the outer rollers and acquire the process material with the selected weight attached. The display will show a new hexadecimal value.

12. Press the STORE key to record this calibration point in memory.

13. The display will now flash "50" (meaning 50% of full scale) alternating with a hexadecimal value. The "MAX" and "MIN" indicators will also flash on and off. The 50% value can be increased or decreased in 10% increments as desired by rotating the Field Adjustment Calibration Switch.

14. Remove the Instrument from the process material.

15. Suspend a weight equal to 50% of the full scale tension range from the process material in either grams or cN.

50% of Full Scale Tension Range By Model							
200	500	1K	2K	2.5 KB	5 KB	10 KB	20 KB
100 cN	250 cN	500 cN	1000 cN	1250 cN	2500 cN	5000 cN	10000 cN
204 g	255 g	510 g	1020 g	1275 g	2550 g	5100 g	10200 g

16. Push the Thumbpiece forward to extend the outer rollers and acquire the process material with the new 50% weight attached. The display will show a new hexadecimal value.

17. Press the STORE key to record this calibration point in memory.

18. The display will now flash “100” (meaning 100% of full scale) alternating with a hexadecimal value The “MAX” indicators will also flash on and off. The 100% value can be decreased in 10% increments as desired by rotating the Field Adjustment Calibration Switch.

19. Remove the instrument from the process material.

20. Suspend a weight equal to 100% of the full scale tension range from the process material.

100% of Full Scale Tension Range By Model							
200	500	1K	2K	2.5 KB	5 KB	10 KB	20 KB
200 cN	500 cN	1000 cN	2000 cN	2500 cN	5000 cN	10000 cN	20000 cN
204 g	510 g	1020 g	2040 g	2550 g	5100 g	10200 g	20400 g

21. Push the Thumbpiece forward to extend the outer rollers and acquire the process material with the new 100% weight attached. The display will show a new hexadecimal value.

22. Press the STORE key to record this calibration point in memory.

23. Remove the instrument from the process material.

3.1 Calibrating Sample In The Thickness Compensator

Next, the thickness of the sample used in the Thickness Compensator during calibration must be stored in memory. Proceed as follows:

24. The display shows the hexadecimal value of the sample in the Thickness Compensator. The “PEAK” indicator will flash on and off.

25. Press the STORE key to record this value in memory. The display will flash “.20” alternating with a hexadecimal value. The “MIN” indicator will flash on and off.

If you choose to calibrate the instrument with a single sample only ("thin"), the calibration is now complete. Press the POWER/EXIT key to exit the Calibration Mode.

**To continue the calibration for the 2nd "thick" material (larger diameter or more rigid), insert a sample between the Thickness Compensator anvils and proceed as detailed in steps 9 thru 25 above. The presence of two arrows before the first numeral indicates that the second sample ("thick") is now being calibrated (example: 

).**

3.2 Calibrating The Thickness Compensator

26. Press and hold the Calibration Switch approx. 4 seconds until "CA 1" is displayed.

27. Press the RECALL key to enter Thickness Calibration Mode.

28. The display will show a hexadecimal value and the "PEAK" and "MIN" indicators will flash.

29. With no sample in the Thickness Compensator press the STORE key. The display should show a value of "0" (or nearly zero) and the "MAX" and "PEAK" indicators will flash on and off.

30. Insert a 3 mm standard sample (i.e. 3 mm drill bit or 3 mm rigid shim) between the Thickness Compensator anvils. The display will now show a hexadecimal value.

31. Press the STORE key to record this value in memory. The display should show a value of "0" (or nearly zero). Remove the 3 mm rigid shim.

All calibration data is now downloaded into the microprocessor and the special calibration is complete. Verify the calibration using gram weights.

4.0 VERIFYING CALIBRATION

When the calibration procedure is complete you can verify the accuracy by performing a calibration verification. Suspend a series of known weights in grams (or pounds) from the selected process materials and confirm that the instrument is displaying the tension values within the required accuracy range. A sample of the process material should be inserted into the Thickness Compensator.

If it is determined that the resulting accuracy is not acceptable, the calibration procedure can be repeated using different calibration points instead of 20%, 50% and 100%. This procedure may have to be repeated several times using different calibration points until the desired accuracy is obtained.

5.0 APPENDIX

cN-to-Gram Conversion Charts

DTM-200		
% Full Scale	cN	Grams
10	20	**20.4**
20	40	**40.8**
30	60	**61.2**
40	80	**81.6**
50	100	**102.0**
60	120	**122.4**
70	140	**142.8**
80	160	**163.2**
90	180	**183.6**
100	200	**204.0**

DTM-1K		
% Full Scale	cN	Grams
10	100	**102.0**
20	200	**204.0**
30	300	**306.0**
40	400	**408.0**
50	500	**510.0**
60	600	**612.0**
70	700	**714.0**
80	800	**816.0**
90	900	**918.0**
100	1,000	**1,020.0**

DTM-500		
% Full Scale	cN	Grams
10	50	**51.0**
20	100	**102.0**
30	150	**153.0**
40	200	**204.0**
50	250	**255.0**
60	300	**306.0**
70	350	**357.0**
80	400	**408.0**
90	450	**459.0**
100	500	**510.0**

DTM-2K		
% Full Scale	cN	Grams
10	200	**208.0**
20	400	**408.0**
30	600	**612.0**
40	800	**816.0**
50	1,000	**1,020.0**
60	1,200	**1,224.0**
70	1,400	**1,428.0**
80	1,600	**1,632.0**
90	1,800	**1,836.0**
100	20,000	**2,040.0**

cN-to-Gram Conversion Charts

DTM-2.5 KB		
% Full Scale	cN	Grams
10	250	**255.0**
20	500	**510.0**
30	750	**765.0**
40	1,000	**1,020.0**
50	1,250	**1,275.0**
60	1,500	**1,530.0**
70	1,750	**1,785.0**
80	2,000	**2,040.0**
90	2,250	**2,295.0**
100	2,500	**2,550.0**

DTM-10KB		
% Full Scale	cN	Grams
10	1,000	**1,020.0**
20	2,000	**2,040.0**
30	3,000	**3,060.0**
40	4,000	**4,080.0**
50	5,000	**5,100.0**
60	6,000	**6,120.0**
70	7,000	**7,140.0**
80	8,000	**8,160.0**
90	9,000	**9,180.0**
100	10,000	**10,200.0**

DTM-5 KB		
% Full Scale	cN	Grams
10	500	**510.0**
20	1,000	**1,020.0**
30	1,500	**1,530.0**
40	2,000	**2,040.0**
50	2,500	**2,550.0**
60	3,000	**3,060.0**
70	3,500	**3,570.0**
80	4,000	**4,080.0**
90	4,500	**4,590.0**
100	5,000	**5,100.0**

DTM-20KB		
% Full Scale	cN	Grams
10	2,000	**2,040.0**
20	4,000	**4,080.0**
30	6,000	**6,120.0**
40	8,000	**8,160.0**
50	10,000	**10,200.0**
60	12,000	**12,240.0**
70	14,000	**14,280.0**
80	16,000	**16,320.0**
90	18,000	**18,360.0**
100	20,0000	**20,400.0**

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