

11.0 WARRANTY

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TABLE OF CONTENTS

1.0 Introduction	2
2.0 Overview	3
2.1 Operating Elements	
2.2 Installing And Replacing The Battery	
2.3 Turning The Power On and Off	
2.4 Reversing The Display	
2.5 Selecting The Unit Of Measure	
2.6 Zero Adjustment of the Measuring Position	
3.0 Removing and Re-Mounting The Filament Guide	6
4.0 Taking A Measurement	7
4.1 Inserting The Process Material	
4.2 Measuring	
4.3 Removing The Process Material	
5.0 Damping Mode	8
5.1 Switching On The Damping Mode	
5.2 Switching Off The Damping Mode	
5.3 Changing the Damping Factor	
6.0 Storing and Recalling Tension Values	9
6.1 Storing Tension Values	
6.2 Recalling Tension Values	
6.3 Clearing Values Stored In Memory	
6.4 Memory HOLD Function	
6.5 Error Messages	
7.0 Static Verification of Measuring Accuracy	12
8.0 Calibration	13
8.1 Dynamic Calibration	
8.2 Static Calibration	
8.3 Error Messages	
8.4 Restoring Factory Defaults	
9.0 Specifications	17
10.0 Appendix - Replacing the Rollers / Ceramic Pins	18
11.0 Warranty	20

1.0 INTRODUCTION

Three long, closely-spaced slender shafts with precision guide rollers or pins at their ends combine with the latest in microprocessor technology to make this instrument top choice for all limited-access, tension measuring applications.

Store up to 4000 displayed tension values in memory and statistics (Last, AVG, MIN, MAX, MIN-PEAK, MAX-PEAK), which can be transmitted using the serial output port.

Choice of miniature, high speed rollers for filament speeds up to 2000 m/min or non-rotating, ceramic pins for speeds to 6000 m/min. Uses part number ETMX or ETMPX to designate model with ceramic pins.

Available Models - The standard series is also available with the following modifications. (Special calibration using customer supplied material.)

Model	Tension Ranges cN	*Measuring Head Width mm	Calibration with running filament
ETMB-100	0.5 - 100.0	24	PA: 0.20 mm Ø
ETMB-200	1 - 200	24	PA: 0.20 mm Ø
ETMB-500	1 - 500	24	PA: 0.20 mm Ø
ETMPB-100	0.5 - 100.0	24	PA: 0.20 mm Ø
ETMPB-200	1 - 200	24	PA: 0.20 mm Ø
ETMPB-500	1 - 500	24	PA: 0.20 mm Ø

1.1 Unpacking

Unpack the tension meter and inspect it for any shipping damage. Notice of defect must be filed immediately, at the latest, within 10 days of receipt of the goods.

Delivery includes:

- 1 Tension meter
- 1 AC-adapter with 3 country-specific adapters (EU/USA/UK)
- 1 Open end-wrench (4mm jaw width)
- 1 Screwdriver (1.5mm blade width)
- 1 Operating Instructions
- 1 Carrying case

3. Unscrew and remove the **GUIDE ROLLERS** (2) using the supplied open-end wrench (4mm jaw width).

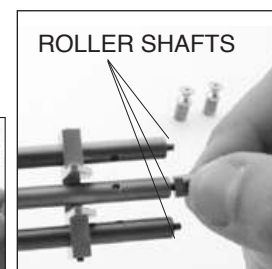
Note: Should any of the three threaded studs be damaged, replace it with one of the threaded studs supplied with the new rollers.

4. Carefully screw the new **GUIDE ROLLERS** onto the **ROLLER SHAFTS**.

5. Carefully tighten the new rollers with the open end wrench until hand tight.

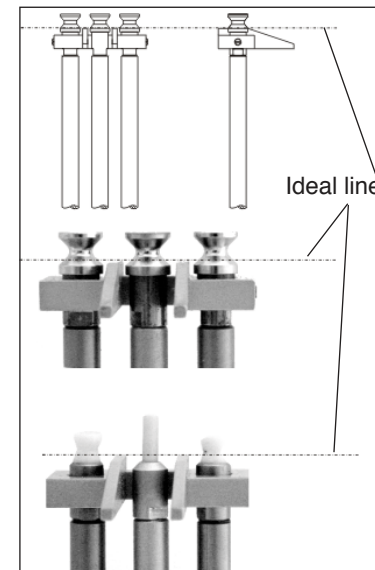
Note: When loosening or tightening the rollers, steady the roller bolt with the supplied screwdriver to prevent the **ROLLER SHAFTS** from being twisted off.

6. Slide the **FILAMENT GUIDE** up the roller shafts in the direction of the arrow.



7. Push the **FILAMENT GUIDE** upwards far enough to ensure that the rollers do not rub against the **FILAMENT GUIDE** and that the process material can slide unhindered from the **FILAMENT GUIDE** into the roller grooves.

8. Tighten the **SETSCREWS** (2) with the supplied screwdriver (1.5mm blade).



10.0 APPENDIX - REPLACING THE ROLLERS/CERAMIC PINS

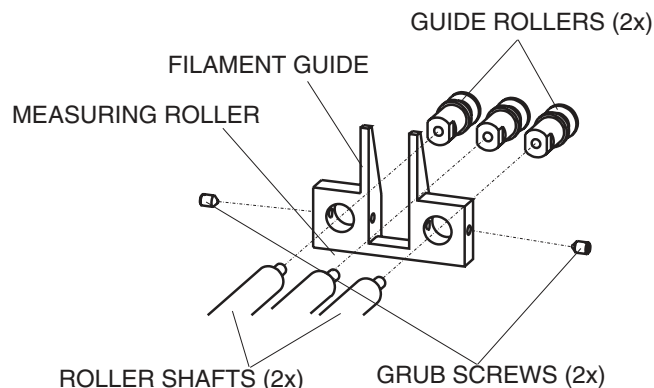
You should regularly inspect the rollers to assure that they are running easily and smoothly. You can replace the rollers yourself, as necessary, by following the directions in this section. Please indicate the tension meter model and the serial number (given on the rear side of the tension meter) in your spare-parts order.

Model ID

Model: 03/04
ETMB-100
400 - 88888

Serial number

NOTE: Replacing rollers with ceramic pins or ceramic pins with rollers can only be performed at the manufacturer's facility.



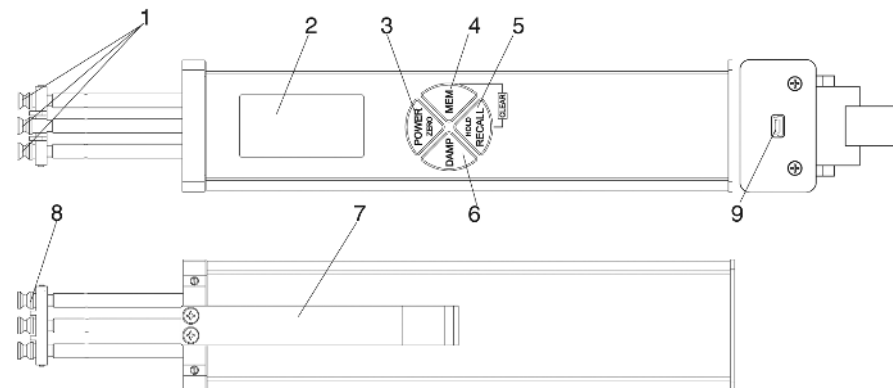
Procedure

1. Remove the **FILAMENT GUIDE** by loosening the **SETSCREWS** (2) using the supplied screwdriver (1.5m blade width).
2. Slide the **FILAMENT GUIDE** down the **ROLLER SHAFTS** in the direction of the arrow.




2.0 OVERVIEW

2.1 Operating Elements



- | | |
|---------------------------|--|
| 1 ROLLERS or ceramic pins | 6 DAMP key |
| 2 DISPLAY | 7 LEVER |
| 3 POWER / ZERO key | 8 FILAMENT GUIDE |
| 4 MEM key | 9 USB output (for connecting the AC adapter) |
| 5 RECALL / HOLD key | |


2.2 Battery Management & Charging

The tension meter has a built-in rechargeable LiPo battery, which has been charged at the factory. The tension meter can only be switched on if the battery has enough charge. If the instrument does not power up or if the battery level indicator shows only one bar  after power-up the battery needs to be recharged.

NOTE: To ensure maximum battery life, avoid discharging it completely or charging it frequently for short periods. The battery should not be stored for a prolonged time when empty. After a maximum storage period of one year, the battery has to be recharged.

Charging the Battery

NOTE: The battery must be charged at a temperature between +5 °C and +45 °C. Before connecting the AC adapter, verify that the supply voltage is correct (100 V – 240 V). Electromatic provides no warranty or liability for damage resulting from the use of AC adapters from other manufacturers.

To charge the battery, connect the cable of the AC adapter to the USB output. When the battery is fully charged, the battery level indicator will show 3 bars . The charging time is approx. 3 ½ hours. Battery overcharging is not possible.

2.3 Turning the Power On and Off

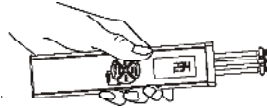
Power On: Press the **POWER** key until the **DISPLAY** momentarily shows the tension range and the software version, e.g. E 1.0, followed by random values or "0."

Auto Power Off: The tension meter switches off automatically after 3 minutes of non-use.

Manual Switch-Off: Press the **POWER** key for 5 seconds.

2.4 Reversing the Display

When you shift the tension meter from the right to the left hand, you can rotate the readings on the **DISPLAY** by 180°.



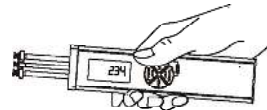
Measuring with the left hand:

If you would like to use the left hand for measuring, you should reverse the readings on the **DISPLAY** to make them easier to read.

1. Tension meter switched off as described in Chapter 3.3.3.
2. Press and hold the **DAMP** and **POWER** keys until the **DISPLAY** shows the readings the other way around.

Measuring with the right hand:

1. Tension meter switched off as described above
2. Press and hold the **DAMP** and **POWER** keys until the **DISPLAY** shows the readings in the default (right-handed) orientation.



2.5 Selecting the Unit of Measure

You can set the ETMB to the cN or g unit of measure, depending on the required tension range. The default setting is cN.

1. Tension meter switched off as described above
2. Press and hold the **RECALL** and **POWER** keys until the new unit of measure



is indicated on the **DISPLAY**.

9.0 SPECIFICATIONS

Calibration	According to factory procedure
Units of Measure	cN / g, user selectable
Accuracy	± 1% FS* ± 1 digit (typical ± 0.5% FS*)
Overrange	10% FS*, without accuracy guarantee
Overload Protection	200% FS*
Measuring Principle	Strain gauge bridge
Meas. Roller Deflection	0.5 mm, max.
Signal Processing	Digital, 24 bit A/D converter
Damping	Adjustable electronic (averaging)
Meas. Frequency	Approx. 1 kHz internal
Display Update Rate	2x per sec.
Display	4-digit LCD, 11 mm high
Memory	Average, last value, maximum, minimum, MAX _{PEAK} , MIN _{PEAK}
Temperature Coefficient	Gain: less than ± 0.01% FS*/°C
Converter Frequency	30 Hz
Temperature Range	10 - 45° C
Air Humidity	85% RH, max.
Auto Power Off	Automatic after approx. 3 min. of non-use
Power Supply	LiPo accumulator (60 h continuous use, 3 ½ h charging time) and AC adapter 100 ... 240 V AC with country-specific adapters (EU/USA/UK)
Housing Material	Aluminium profile with plastic outer casing (PVC)
Housing Dimensions	197 mm x 58 mm x 47 mm (L x W x H)
Weight (net /gross)	Approx. 340 g / 1250 g

*FS = Full Scale

ETMB Guide Rollers:

V - grooved	Line Speed m/min max.	Roller Material
Standard	2000	Aluminium hard chromed

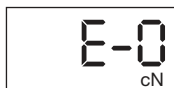
ETMPB Guide Pins:

V - grooved	Line Speed m/min max.	Pin Material
Standard	6000	Oxide ceramic

8.3 Restoring Factory Calibration

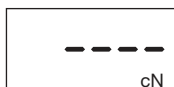
You can restore the factory calibration at any time with the following procedure:

1. Switch off the tension meter.
2. Press and hold the **MEM** and **POWER** keys until the Display shows E-0 cN .
3. Release first the **POWER** key and then the **MEM** key.
4. Press and hold the **DAMP** and **RECALL** keys, then additionally press and hold **MEM** until the Display shows - - - cN .



The factory calibration is restored.

5. Release the **DAMP**, **RECALL** and **MEM** keys.
6. Press the **POWER** key. The instrument switches off.



2.6 Zero Adjustment of the Measuring Position (Auto Zero)

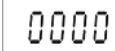

A Zero Adjustment is automatically carried out for the current measuring position.



A Zero Adjustment must be carried out whenever the tension meter does not display “0” in measuring position. The process material must not yet be inserted!

Procedure:

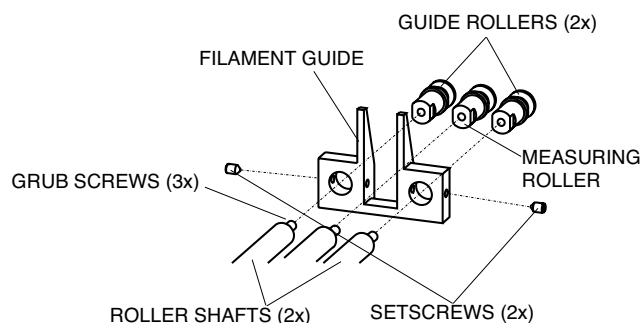
1. Switch on the tension meter as described in Sec 2.3.
2. Select the unit of measure as described in Sec 2.5.
Do not insert the process material.
3. Hold the tension meter in the desired measuring position. Be careful to hold the instrument absolutely steady.
4. Press the **POWER** key.

The DISPLAY momentarily shows  and then switches to .

The tension meter is now adjusted for the new material path and is ready to measure.

3.0 REMOVING AND REMOUNTING THE FILAMENT GUIDE

The tension meter is supplied with a **FILAMENT GUIDE** for fast and easy material acquisition. For application in hard-to-reach areas with limited access space, you can remove the **FILAMENT GUIDE**.

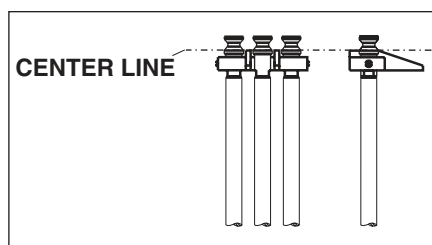


Removal Procedure

1. Loosen the **SETSCREWS** (2x) with the supplied screwdriver (1.5 mm blade).
2. Unscrew and remove the **GUIDE ROLLERS** (2x) with the supplied open end wrench (jaw width 4 mm).
3. Slip the **FILAMENT GUIDE** off the **ROLLER SHAFTS**.
4. Screw the **GUIDE ROLLERS** (2x) back onto the **ROLLER SHAFTS** and carefully tighten using the supplied open end wrench (jaw width 4 mm) until hand-tight.

Remounting Procedure

1. Unscrew and remove the **GUIDE ROLLERS** (2x) with the supplied open end wrench jaw width 4 mm).
2. Slip the filament guide on to the **ROLLER SHAFTS**.
3. Screw the **GUIDE ROLLERS** (2x) back on to the **ROLLER SHAFTS** and carefully tighten them using the supplied open end wrench (jaw width 4 mm) until hand-tight.
4. Push the **FILAMENT GUIDE** forward far enough to ensure that the rollers do not rub against the **FILAMENT GUIDE** and that the process material can slide unhindered from the **FILAMENT GUIDE** into the roller grooves (fig. CENTER LINE).
5. Carefully tighten the **SETSCREWS** (2x) with the supplied screwdriver (blade width 1.5 mm) until hand-tight.



3rd calibration point:

1. Repeat steps 1 through 4 from the preceding procedure using a weight which corresponds to 70% of the tension range
2. Press the **RECALL** key. As long as the **RECALL** key is depressed, the **DISPLAY** shows a decimal value which is higher than the second decimal value, e.g., 8000. This decimal value may vary from instrument to instrument. Write down the value.
3. Release the **RECALL** key when the value shown on the **DISPLAY** is stable (the reading might fluctuate greatly). The **DISPLAY** shows E 100

8000

E 100

4th calibration point:

1. Repeat steps 1 through 4 from the preceding procedure using a weight which corresponds to 100% of the tension range
2. Press the **RECALL** key. As long as the **RECALL** key is depressed, the **DISPLAY** shows a decimal value which is higher than the third decimal value, e.g., 9500. This decimal value may vary from instrument to instrument. Write down the value
3. Release the **RECALL** key when the value shown on the **DISPLAY** is stable (the reading might fluctuate greatly).
4. Press and then release the **RECALL** key. the **DISPLAY** switches off after approximately 1 second. The new calibration is stored.
5. Press the **POWER** key. the instrument switches off.
6. Verify the new calibration, following the directions in Sec. 7.0 If this procedure shows a deviation, you can recalibrate the tension meter again or restore the factory calibration as described in Sec. 8.3.

9500



If the verification of the calibration according Sec.7.0 shows a deviation beyond the allowable tolerance and a reliable operation is no longer allowed, the instrument has to be returned to Electromatic for factory recalibration.

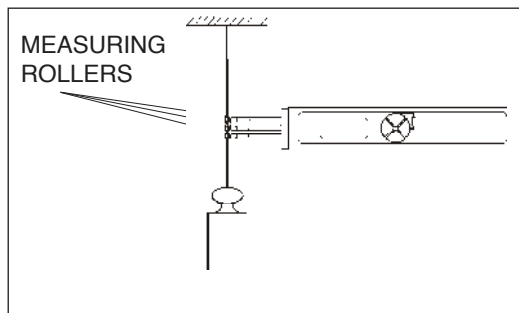
2. Release the **RECALL** key when the value shown on the Display is fairly stable (the reading might fluctuate greatly).

3. The Display shows E -10

E -10

1st calibration point:

1. Hang a weight which corresponds to 10% of the tension range from the measured material, vertically, as shown.
2. Press the **LEVER** down all the way. Thread the **PROCESS MATERIAL** through the **MEASURING** and **GUIDE ROLLERS**. Slowly release pressure on the **LEVER** until the **GUIDE ROLLERS** return to their original position.
3. Before starting the calibration, move the instrument slowly up and down to compensate for possible mechanical friction losses and thus ensure repeatability of the measurements.



4. Press the **RECALL** key. As long as the **RECALL** key is depressed, the **DISPLAY** shows a decimal value which is higher than the first decimal value, e.g., 3500. This decimal value may vary from instrument to instrument. Write down the value

3500

5. Release the **RECALL** key when the value shown on the **DISPLAY** is stable (the reading might fluctuate greatly). The **DISPLAY** shows

E -40

2nd calibration point:

1. Repeat steps 1 through 4 above using a weight which corresponds to 40% of the tension range
2. Press the **RECALL** key. As long as the **RECALL** key is depressed, the **DISPLAY** shows a decimal value which is higher than the second decimal value, e.g., 6000. This decimal value may vary from instrument to instrument. Write down the value

6000

3. Release the **RECALL** key when the value shown on the **DISPLAY** is stable (the reading might fluctuate greatly). The **DISPLAY** shows E -70

E -70

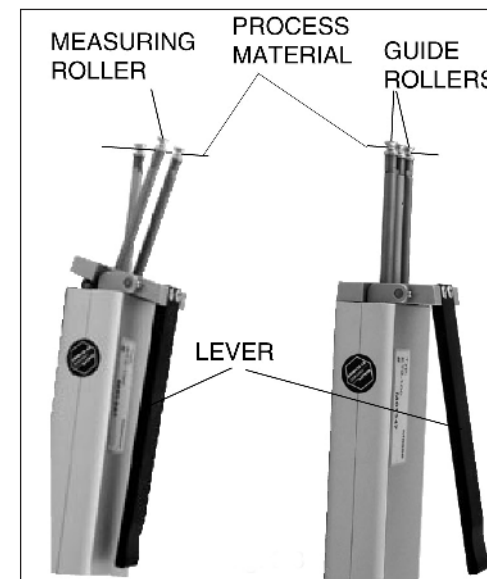
4.0 TAKING A MEASUREMENT

NOTE: Before taking a measurement, be sure that the correct unit of measurement (g or cN) has been selected and a zero adjustment has been performed.

4.1 Inserting the process material

1. Press the **LEVER** to tilt the outer **GUIDE ROLLERS** sideways.
2. Thread the **PROCESS MATERIAL** through the **MEASURING** and **GUIDE ROLLERS** (filament guide).
3. Slowly release pressure on the **LEVER** until the **GUIDE ROLLERS** return to their original position.

NOTE: It is important to assure that the **PROCESS MATERIAL** runs smoothly between the **MEASURING** and **GUIDE ROLLERS**.



4.2 Measuring the process material

The **DISPLAY** now shows the measured tension values. Error messages which might be displayed are described in Sec. 6.5.

4.3 Removing the process material

1. Press the **LEVER** and remove the **PROCESS MATERIAL**.
2. Slowly release pressure on the **LEVER** until the **GUIDE ROLLERS** return to their original position.

5.0 DAMPING MODE

The tension meter is equipped with an electronic damping that ensures steady readings when tension fluctuates. This is achieved by averaging the measured values at the preset update rate.

5.1 Switching On the Damping Mode

NOTE: Before switching on the damping mode, it is recommended that you measure the first values without damping enabled.

1. Insert process material as described in section 4.1.
2. Press and hold the **DAMP** key. The display shows the currently set damping factor.
3. Release the **DAMP** key. The display shows **DAMP** below the currently measured value.

22.1
D cN

5.2 Switching Off the Damping Mode

1. Press and release the **DAMP** key. If display shows only the currently measured value, damping is off.

22.1
cN

5.3 Changing the Damping Factor

The tension meter is factory preset to a damping factor of 12. The tension values are thereby averaged for the display in the following way:

$$\frac{12 \text{ old values} + 4 \text{ new values}}{16}$$

The damping factor can be modified in 15 steps from 01 = low damping:

$$\frac{1 \text{ old value} + 15 \text{ new values}}{16}$$

to 15 = high damping:

$$\frac{15 \text{ old values} + 1 \text{ new value}}{16}$$

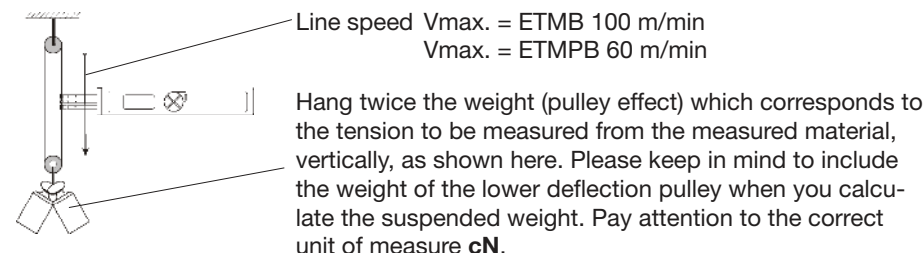
1. Switch on the tension meter
2. Press and hold the **DAMP** key. The Display shows the set damping factor.
3. You can now increase the damping factor by pressing the **MEM** key and decrease it by pressing the **RECALL** key.
4. Release the **DAMP** key to return to the measuring mode.

NOTE: The selected damping factor remains stored in memory even after the gauge is turned off.

8.0 CALIBRATION

8.1 Dynamic Calibration of the ETX

All tension meters are calibrated with standard materials—such as polyamide monofilament (PA)—according to the factory procedure. The diameters are given in section 1.0. In 95% of all industrial applications, the factory calibration has been proven to provide the best results and is used for comparative purposes. The basic setup for a dynamic calibration is shown below.



NOTE: The gauge has been calibrated dynamically according to factory procedure. Therefore, differences may occur between static and dynamic readings.

8.2 Static Calibration

NOTE: The tension meter is factory calibrated for a vertical material path. Recalibration thus also has to be carried out with a vertical material path.

Before beginning:

Acquire one cN weight each (or several weights adding up to the required value), corresponding to 10%, 40%, 70% and 100% of the tension range. Make sure the tension meter is switched off and that no process material is inserted between the rollers.

To select the calibration mode:

1. Press and hold the **MEM** and **POWER** keys until the Display shows E -0
2. Release first the **POWER** key and then the **MEM** key.

E -0

To calibrate the zero point:

1. Press the **RECALL** key. As long as the **RECALL** key is depressed, the Display shows a random decimal value between -2000 and 2000, e.g. 800 cN. This decimal value may vary from instrument to instrument. Write down the decimal value.

800

NOTE: If the value is outside this range, calibration cannot be guaranteed.

7.0 STATIC VERIFICATION OF MEASURING ACCURACY

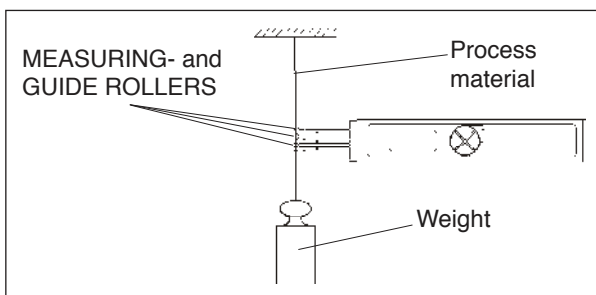
All tension meters are calibrated with standard materials—such as polyamide monofilament (PA)—according to the factory procedure. The diameters are given in section 1.0. Any difference in process material size and rigidity from the standard material may cause a deviation of the accuracy.

In 95% of all industrial applications, the factory calibration has been proven to provide the best results and is used for comparative purposes.

NOTE: Before beginning, make sure that the tension meter is factory calibrated for a vertical material path. The required reference weight is available.

Verification procedure:

1. Switch on the tension meter.
2. Hang a weight which corresponds to the tension to be measured from the measured material, vertically, as shown.



NOTE: Pay attention to the correct unit of measure cN or g (gram).

3. Press the **LEVER** down all the way down and thread the process material through the **MEASURING** and **GUIDE ROLLERS** as described in section 4.1, then slowly release pressure on the **LEVER** until the **GUIDE ROLLERS** return to their original position.
4. Before verifying the calibration, move the instrument slowly up and down to compensate for possible mechanical friction losses and thus ensure repeatability of the measurements.
5. The tension value shown on the Display should be equal to the value of the suspended weight (pay attention to the measuring units).

If this procedure shows a deviation, you can recalibrate the instrument following the directions in Sec 8.0

6.0 STORING AND RECALLING TENSION VALUES

The tension meter features a data logger which stores the following data obtained during a measuring period:

Average value
Last value
Maximum value (MAX),
Minimum value (MIN),
Minimum peak value (MIN PEAK)
Maximum peak value (MAX PEAK)

NOTE: The measured data remain stored in the ETMB memory even after the instrument is switched off.

6.1 Storing Tension Values

NOTE: The stored tension values remain stored in the ETMB memory even after the instrument is switched off.

1. Turn off the tension meter.
2. Insert the process material.
3. Press the **MEM** key to start the measuring period.

While the tension data are stored, the **MEM** indicator blinks on the **DISPLAY** and the currently measured value is displayed.



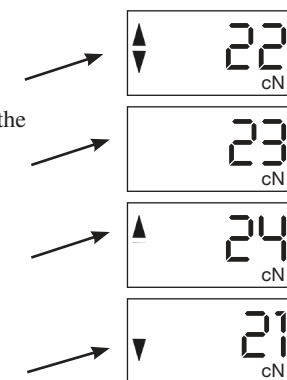
When you want to end the measuring period, press the **MEM** key once again. Data logging is stopped. The **DISPLAY** shows **MEM** and the current reading.

6.2 Recalling Stored Tension Values

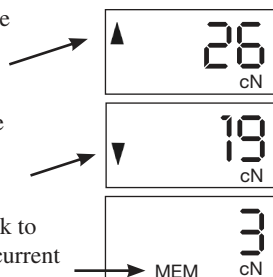
1. Be sure that the tension meter is **ON**.

NOTE: You can end recall at anytime by pressing the **POWER** key.

2. Press the **RECALL** key. The display blinks, showing the **average** value of the measuring period and the indicated symbol.
3. Press the **RECALL** key. The display blinks, showing the **last** value of the measuring period (no symbol).
4. Press the **RECALL** key. The display blinks, showing the **maximum** value of the measuring period and the indicated symbol.
5. Press the **RECALL** key. The display blinks, showing the **minimum** value of the measuring period and the indicated symbol.



6. Press the **RECALL** key. The display blinks, showing the maximum peak value of the measuring period and the indicated symbol.
7. Press the **RECALL** key. The display blinks, showing the maximum peak value of the measuring period and the indicated symbol.
8. Press the **RECALL** key. The tension meter switches back to the measuring mode. The display shows **MEM** and the current reading.

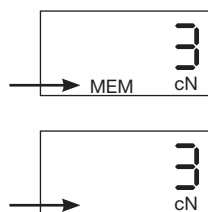


The tension meter is ready for a new measuring period.

6.3 Clearing Tension Values Stored In Memory

If values are stored in the tension meter memory, the **DISPLAY** shows with the **MEM** indicator.

1. To clear the memory, simultaneously press the **MEM** and **RECALL** keys. The **MEM** indicator disappears and all values stored in memory are deleted.



6.4 Memory Function HOLD

When the tension meter memory is empty, you can retain the last reading on the Display by using the memory function **HOLD**.

To retain the last reading:

Press the **RECALL / HOLD** key once for about 1 second. The Display shows the last reading and the “:” colon symbol.



To switch back to measuring mode:

Press the **RECALL / HOLD** key once for about 1 second. The tension meter switches back to measuring mode.

6.5 Error Messages

1. The Display shows **EEE**. The upper limit of the tension range was exceeded by more than 10%. Reduce the line tension.

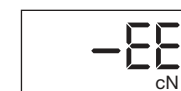


OR

AUTO ZERO is no longer possible.

Recalibrate the instrument following the directions in Sec. 8.0.

2. The Display shows **-E.E**. The lower limit of the tension range has fallen below by more than 10%. Properly insert the process material.



OR

AUTO ZERO is no longer possible.

Recalibrate the instrument following the directions in Sec. 8.0.

Tension Meters

ETMB-ETMPB



Operating Manual



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