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**NOTES**

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## 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 ETPMX 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
ETMX-100	0.5 - 100.0	24	PA: 0.20 mm Ø
ETMX-200	1 - 200	24	PA: 0.20 mm Ø
ETMX-500	1 - 500	24	PA: 0.20 mm Ø
ETMPX-100	0.5 - 100.0	24	PA: 0.20 mm Ø
ETMPX-200	1 - 200	24	PA: 0.20 mm Ø
ETMPX-500	1 - 500	24	PA: 0.20 mm Ø

\* Outer distance between outside guide rollers / pins

\*\* Suitable for 95% of all applications. PA = Polyamide Monofilament.

If the material to be measured differs significant from the factory calibration material in diameter, rigidity, shape, etc., we recommend calibration using customer supplied material. For this purpose a material sample of about 5 m should be supplied. International unit of tensile force: 1 cN = 1.02 g = 0.01 N

ETX: Calibration with approx. 100 m/min

ETPX: Calibration with approx. 60 m/min

### 1.1 Unpacking

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

#### Delivery includes:

- |   |  |
|---|--|
| 1 Tension meter   | 1 ETX-P2: TENSION INSPECT software (Win 95 or higher) for viewing and storing the measured data on a PC. |
| 1 AC-adapter with 3 country-specific adapters (EU/USA/UK) | 1 Carrying case  |
| 1 Open end wrench (4 mm jaw width)                        |  |
| 1 Screwdriver (1.5 mm blade width)                        |  |
| 1 USB cable   |  |
| 1 Operating Instructions                                  |  |

## WARRANTY

ELECTROMATIC Equipment Co., Inc. (ELECTROMATIC) warrants to the original purchaser that this product is of merchantable quality and confirms in kind and quality with the descriptions and specifications thereof. Product failure or malfunction arising out of any defect in workmanship or material in the product existing at the time of delivery thereof which manifests itself within one year from the sale of such product, shall be remedied by repair or replacement of such product, at ELECTROMATIC's option, except where unauthorized repair, disassembly, tampering, abuse or misapplication has taken place, as determined by ELECTROMATIC. All returns for warranty or non-warranty repairs and/or replacement must be authorized by ELECTROMATIC, in advance, with all repacking and shipping expenses to the address below to be borne by the purchaser.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE WARRANTY OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE OR APPLICATION. ELECTROMATIC SHALL NOT BE RESPONSIBLE NOR LIABLE FOR ANY CONSEQUENTIAL DAMAGE, OF ANY KIND OR NATURE, RESULTING FROM THE USE OF SUPPLIED EQUIPMENT, WHETHER SUCH DAMAGE OCCURS OR IS DISCOVERED BEFORE, UPON OR AFTER REPLACEMENT OR REPAIR, AND WHETHER OR NOT SUCH DAMAGE IS CAUSED BY MANUFACTURER'S OR SUPPLIER'S NEGLIGENCE WITHIN ONE YEAR FROM INVOICE DATE.

Some State jurisdictions or States do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation may not apply to you. The duration of any implied warranty, including, without limitation, fitness for any particular purpose and merchantability with respect to this product, is limited to the duration of the foregoing warranty. Some states do not allow limitations on how long an implied warranty lasts but, notwithstanding, this warranty, in the absence of such limitations, shall extend for one year from the date of invoice.

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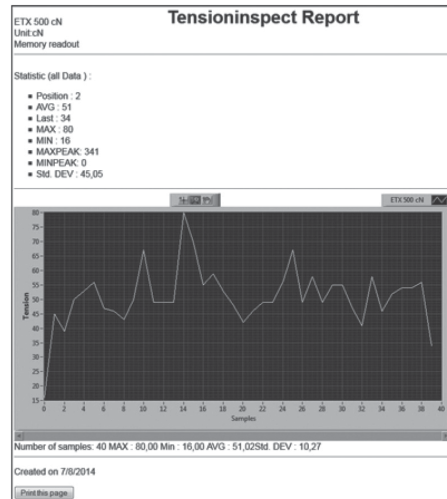
Every precaution has been taken in the preparation of this manual. Electromatic Equipment Co., Inc., assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of information contained herein. Any brand or product names mentioned herein are used for identification purposes only, and are trademarks or registered trademarks of their respective holders.

### 3.9 Print and data transfer

#### Print:

1. Click the **GENERATE** button to open the print review.
2. Click the **PRINT THIS PAGE** button to open the printer setup box.

The print-out includes the statistical data of the series of measurements and the current displayed graph.



#### Data transfer:

The **EXPORT SCREEN TO EXCEL** button copies the readings of the desired series of measurements to an Excel file (reading, date, time). With the infixed readings, a graph can be created in the Excel file.

### 3.10 Save the readings

#### Save:

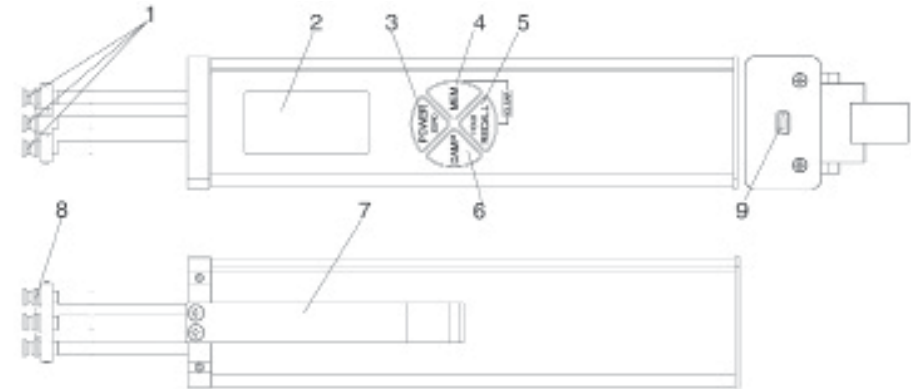
With the button **SAVE** stored values (statistics and series of measurements) of the connected tension meter can be downloaded and stored as CSV file. Te individual series of measurement can be selected.



Readings which have be downladed and be stored as CSV file cannot be related to Tension Inspect 3


## 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 INTERFACE      |
| 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 low USB output. The battery can also be charged by connecting the USB cable to a PC. 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.

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### 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°.

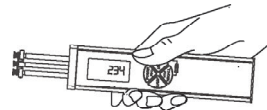
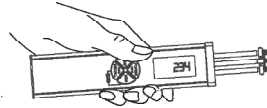
#### Measuring with the left hand:

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 above.
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 ETMX 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.

#### To select the unit of measure:

2. Press and hold the **RECALL** and **POWER** keys until the new unit of measure



is indicated on the DISPLAY.

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### 3.7 Download the tension data from the ETX (ETPX) to the PC

Requirements:

- Tension meter connected to the PC
- Tension meter switched on.

#### To download the tension data:

1. Click the **READ** button. The tension data stored in the tension meter are read into the PC.

#### Tension value display:

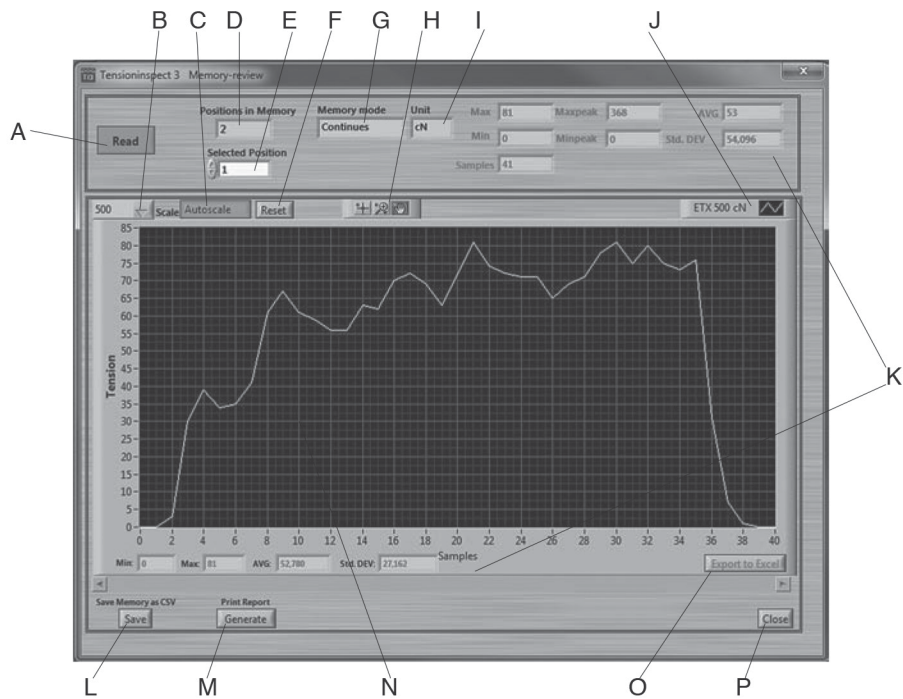
<b>TENSION</b>	Graph of the displayed series of measurements
<b>STATISTICS</b>	Statistical data of the displayed series of measurements

### 3.8 Graph adjustments

<b>SCALE</b>	Manual scaling of the Y-axis which starts at „zero“. This feature can be activated by pressing <b>RESET</b> .
<b>AUTOSCALE</b>	Automatic scaling of the Y-axis depending to the displayed readings of the diagram.
<b>RESET</b>	Activates the scaling, which is set in the pop-up <b>SCALE</b> .
<b>ZOOM</b>	A big number of zoom features can be selected to enlarge a selected frame of the diagram.



The button **ZOOM** and **RESET** work only if **AUTOSCALE** is not activated.



A	Button	READ	Section 3.7
B	Choice box	SCALE	Section 3.8
C	Button	AUTOSCALE	Section 3.8
D	Display	POSITION IN MEMORY	Number of saved series of measurement
E	Choice box	SELECTED POSITION	Selected series of measurement
F	Button	RESET	Section 3.8
G	Display	MEMORY MODE	Used memory mode during the measuring
H	Button	ZOOM	Section 3.8
I	Display	UNIT	measuring unit of the readings
J	Display	DEVICE TYPE	Display the connected unit
K	Display	STATISTICS	Statistical data of the displayed series of measurement
L	Button	SAVE	Section 3.10
M	Button	GENERATE	Section 3.9
N	Display	TENSION	Readings as graph
O	Button	EXPORT TO EXCEL	Section 3.9
P	Button	CLOSE	Close MEMORY-REVIEW

## 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.

# Tension Meters

## ETMX-ETMPX

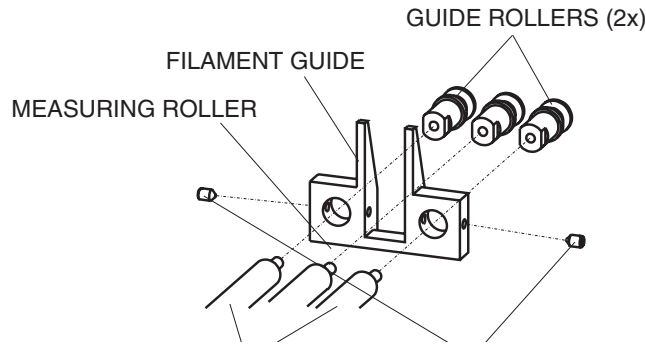


### Operating Manual



### 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**.

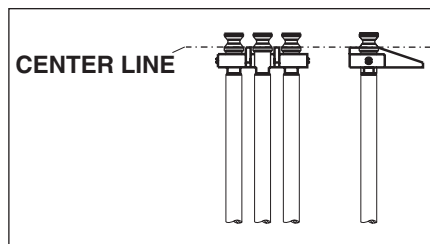


#### Removal Procedure

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.

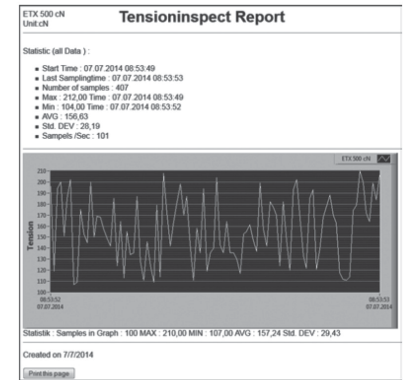


### 3.4 Printing and Data Transfer

#### Print:

1. Click the **GENERATE** button to open the print preview.
2. Click the **PRINT THIS PAGE** button to open the printer setup box.

The print-out includes the statistical data of the series of measurements, the current displayed graph and the statistical values of the graph.



#### Data transfer:

1. The **EXPORT SCREEN TO EXCEL** button copies the readings, which are displayed at the graph to an excel file (reading, date, time). With the infixed readings, a graph can be created in the Excel file.

### 3.5 Save and load the readings

#### Save:

1. The statistical data, as well as the single readings of a measuring can be saved after the measuring ends as CSV file, by clicking the the **SAVE** button.

#### Load:

1. Click the **LOAD** button and open the required file. The statistical data of the saved measuring, the graph and the statistical data of the graph are displayed in Tension Inspect 3



It is possible to add readings to an existing file. In this case open the file and start a new series of measurements. The new readings will be added in the diagram. After this store the complete CSV file again. If any readings are in the internal memory before opening the existing file, the internal memory will be overwritten.

### 3.6 The **READ** button (Available only for ETX and ETPX)

With the **TENSION INSPECT 3** program you can download all the tension data stored in the memory of the connected tension meter.

#### Start the **DOWNLOAD**

1. Click the **READ** button.  
The **MEMORY-REVIEW** window opens.

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### 3.2 Starting and Stopping the Tension Value Display

**NOTE:** Before beginning, click the **CLEAR GRAPH** button to clear all readings shown in the **TENSION** display, if any.

#### Start:

1. Click the red **START STOP** button to activate the display of tension values. The button color changes to red (function enabled).

#### Tension value display:

TENSION display	Current graph
TENSION display	Current digital value
STATISTICS display	Continuously updated statistics
STATISTICS DIAGRAM display	Continuously updated statistics of readings shown in the graph

#### Stop:

1. Click the now red **START STOP** button.  
The display of the tension values stops. The button color changes back to green (function disabled).

### 3.3 Graph adjustments

SCALE	The maximal tension value of the diagram can be adjusted (Y-axis, starts at „zero).
AUTO	Automatic scaling of the Y-axis depending on the measured tension values.
RESET	Change of scaling from mode <b>AUTO</b> to <b>SCALE</b>
READINGS ON SCREEN	To set the number of readings to be shown in the diagram (Timescale) (X-axis). The scroll bar turns to red, if more readings are selected for the diagram than measured.
TIMESHIFTBUFFER	Indicates in % the fill level of the memory. The maximal numbers of readings will be set in the <b>SETUP</b> .
TIMESHIFT	To select the timeframe of a series of measurements, that should be displayed in the diagram. If the setup Value of <b>READINGS ON SCREEN</b> bigger or equal to the recorded readings, the scroll bar can not be moved.

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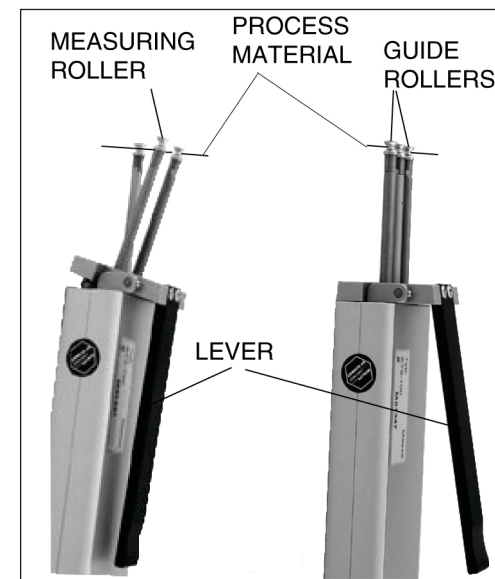
## 4.0 TAKING A MEASUREMENT

**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.7.7.

### 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 Sec. 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.



### 5.2 Switching Off the Damping Mode

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



### 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 damping factor stays stored in memory even after the gauge is turned off.

15	Button	LOAD	Section 3.4
16	Display	STATISTICS DIAGRAM	Display the statistical values, shown currently at the graph.
17	Button	CLEAR ALL DATA	Clear all measuring values
18	Display	READINGS ON SCREEN	To adjust the number of measuring values, shown at the display
19	Display	TENSION	Readings as graph
20	Button	GENERATE	Section 3.3
21	Button	EXPORT SCREEN	Section 3.3
22	Button	EXIT	Close Tension Inspect 3

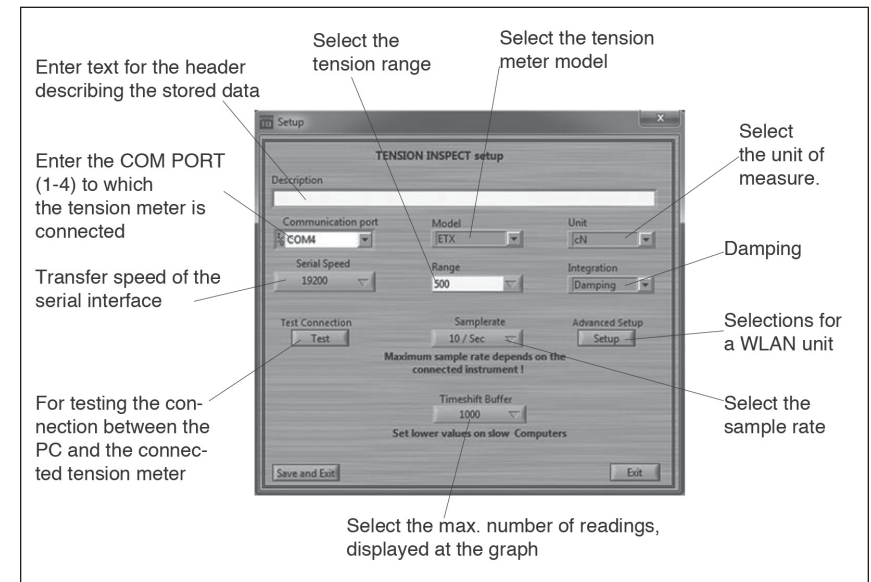
### 3.1 Basic Settings

**NOTE:** The tension meter to be used must be connected to the PC.

To edit the settings:

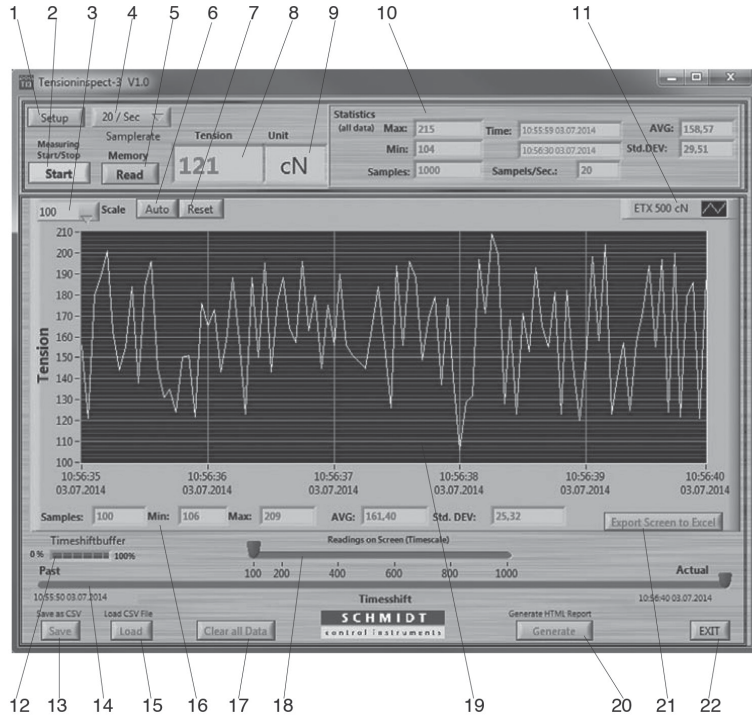
1. Click the **SETUP** button. The setup dialog box opens. You can now either keep the default values preset in the input boxes or customize them for your specific requirements.

The figure below shows the factory-preset defaults for a tension meter model ETX-500.



### 3.0 USING TENSION INSPECT

1. Double click the **TENSION INSPECT ICON**  to start the program.



- |               |                 |  |
|---------------|-----------------|--|
| 01 Button     | SETUP           | Section 3.1                                      |
| 02 Button     | START/STOP      | Section 3.2                                      |
| 03 Choice box | SCALE           | Section 3.3                                      |
| 04 Choice box | SAMPLERATE      | Select the sampling rate                         |
| 05 Button     | READ            | Section 3.5                                      |
| 06 Button     | AUTO            | Section 3.3                                      |
| 07 Button     | RESET           | Section 3.3                                      |
| 08 Display    | TENSION         | Current reading                                  |
| 09 Display    | UNIT            | Unit of measure of the readings                  |
| 10 Display    | STATISTICS      | Display of statistical values of the measurement |
| 11 Display    | DEVICE TYPE     | Display the connected unit                       |
| 12 Display    | TIMESHIFTBUFFER | Section 3.3                                      |
| 13 Button     | SAVE            | Section 3.4                                      |
| 14 Display    | TIMESHIFT       | Section 3.3                                      |

### 6.0 MEMORY MODE

The tension meter features a data logger with a memory capacity for up to 4000 readings, with which you can store different measuring periods at one or more machine positions.

Memory Mode	S	C	L	F
Meas. periods, max.	255	255	255	255
Readings, max.	-	4000	4000	4000
Max. no. of readings per position	-	Any	10	Any
Statistics	Yes	Yes	Yes	Yes
Save readings	-	Yes	Yes	Yes

The readings are saved 2x per second, synchronously with the display update rate, in all memory modes except the “F” mode in which they are saved 100x per second. All saved readings and statistics can be shown on the display or transmitted to a PC (e.g. for further processing in Excel). The memory can be allocated to different measuring periods, depending on the memory mode.

#### Memory mode “S” STANDARD (default):

The following values of a measuring period are calculated and saved at a rate of 2 readings per second:

- Average value,
  - Last value,
  - Maximum value (MAX),
  - Minimum value (MIN),
  - Minimum peak value (MIN PEAK)
  - Maximum peak value (MAX PEAK)
- Individual readings are not saved.

You can save up to 255 measuring periods.

#### Memory mode “C” CONTINUOUS:

The following values of a measuring period are calculated and all readings are additionally saved at a rate of 2 readings per second:

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

You can save up to 4000 readings, split up into up to 255 measuring periods.

#### Memory mode “L” LIMIT:

The following values of a measuring period are calculated and 10 readings are additionally saved at a rate of 2 readings per second:

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

You can save up to 255 measuring periods with 10 readings each.

#### Memory mode “F” FAST:

The following values of a measuring period are calculated and all readings are additionally saved at a rate of 100 readings per second:

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

You can save up to 4000 readings, split up into up to 255 measuring periods.

**NOTE:** The selected memory mode remains stored in memory even after the instrument is switched off.

## 6.1 Memory Mode Selection

1. Switch on the tension meter
2. Clear the memory by simultaneously pressing the **MEM** and **RECALL** keys.
3. Press and hold the **MEM** key.

The DISPLAY shows “S”. This is the **Standard Memory Mode** (default). Press the **DAMP** or **RECALL** to display the other memory modes.



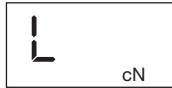
### Memory mode C (CONTINUOUS):

If the DISPLAY shows C, the LIMIT memory mode is set.



### Memory mode L (LIMIT):

If the DISPLAY shows L, the LIMIT memory mode is set.



### Memory mode F (FAST):

If the DISPLAY shows F, the FAST memory mode is set.



When you have selected the desired memory mode, you can release the MEM key. The selected memory mode is now active and the tension meter switches back to measuring mode.

**NOTE:** The selected memory mode remains stored in the memory even after the instrument is switched off.

## 6.2 Data Logging in Mode S (Standard)

1. Turn on the tension meter.
2. Memory Mode S set as described in Sec. 6.1.
3. Insert process material and begin measuring as described in section 4.0.

### To Start Data Logging:

1. Press and hold the **MEM** key until the DISPLAY shows the memory mode “S” and the current memory number.
2. Release the **MEM** key. The tension meter starts logging the data. While the tension data are stored, the **MEM** indicator blinks on the DISPLAY and the currently measured value is displayed.



# TensionInspect 3 Software

## 1.0 SYSTEM REQUIREMENTS

Computer: PC

Operating System: Windows XP and higher (32 / 64 Bit)

Hard Disk Space: Approx. 200 MB

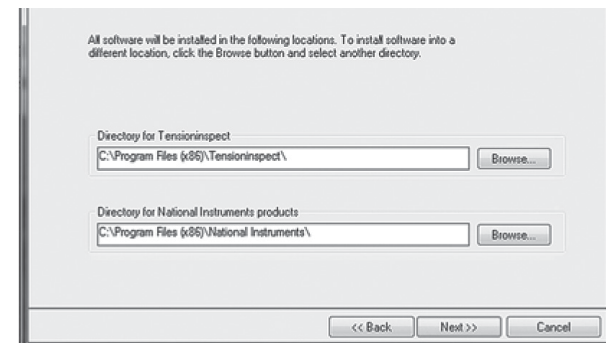
Installation: CD-ROM drive

## 2.0 INSTALLING TENSION INSPECT



To be able to restore the original files in case problems occur after the installation, you should make a backup of your hard disk contents before you start installing.

1. Insert the CD-ROM with the Tension Inspect 3 program into the CD-ROM drive.
2. Start the installation process by double-clicking the application file.
3. Follow the instructions on the screen, to install the software Tension Inspect 3 and the corresponding USB driver.
4. At the end, click the **RESTART NOW** button, to finish the installation process.



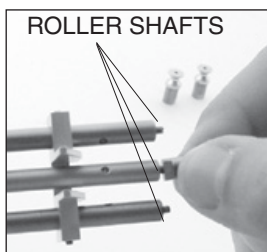
- Unscrew and remove the **GUIDE ROLLERS** (2) using the supplied open-end wrench (4mm jaw width).

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

- Carefully screw the new **GUIDE ROLLERS** onto the **ROLLER SHAFTS**.
- Carefully tighten the new rollers with the open end wrench until hand tight.

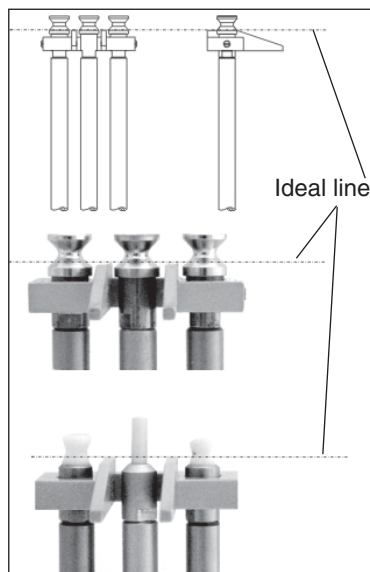
**Note:** When loosening or tightening the rollers, steady the roller bolt with the supplied screwdriver to prevent the **ROLLER SHAFTS** from being twisted off.

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



- 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.

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



### To Stop Data Logging:

- When you want to stop data logging, press the **MEM** key once again. The statistical values are calculated from the logged tension data and stored in the following order:

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

The **MEM** indicator is frozen on the display and the current reading is displayed. The tension meter has changed back to measuring mode.



### To Save The Next Measuring Period:

- Press the **MEM** key again. The **DISPLAY** shows the memory mode **"S"** and the next memory number.



### 6.3 Data Logging in Mode C (Continuous)

- Turn on the tension meter.
- Memory Mode C set as described in Sec. 6.1
- Insert process material and begin measuring as described in Sec.4.0.

### To Start Data Logging:

- Press and hold the **MEM** key until the **DISPLAY** shows the memory mode **"C"** and the current memory number.
- Release the **MEM** key. The tension meter starts logging the data.



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



### To Stop Data Logging:

- To stop data logging, press the **MEM** key once again. The statistical values are calculated and stored in the following order:

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

Tension Value - 1 -  
 Tension Value - 2 -

↓  
 Tension Value - N - (up to 4000 tension values in up to 255 measuring periods)

The **MEM** Mem indicator is frozen on the DISPLAY and the current reading is displayed. The tension meter has changed back to measuring mode.



**To Save The Next Measuring Period:**

1. Press the **MEM** key again. The DISPLAY shows the memory mode “**C**” and the next memory number.



**6.4 Data Logging in Mode L (Limit)**

1. Turn on the tension meter.
2. Memory Mode C set as described in Sec. 6.1
3. Insert process material and begin measuring as described in Sec. 4.0.

**To Start Data Logging:**

1. Press and hold the **MEM** key until the DISPLAY shows the memory mode “**L**” and the current memory number.
2. Release the **MEM** key. The tension meter starts logging the data.



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



**To Stop Data Logging:**

1. To stop data logging, press the **MEM** key once again. The statistical values are calculated and stored in the following order:

- Average value
- Last value
- Maximum value (MAX)
- Minimum value (MIN)
- Minimum peak value (MIN PEAK)
- Maximum peak value (MAX PEAK)
- Tension Value - 1 -
- Tension Value - 2 -



Tension Value - 10 - (up to 10 tension values in up to 255 measuring periods.)

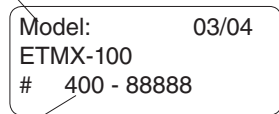
The **MEM** indicator is frozen on the DISPLAY and the current reading is displayed. The tension meter has changed back to measuring mode.



**12.0 APPENDIX B - REPLACING THE ROLLERS/CERAMIC PINS**

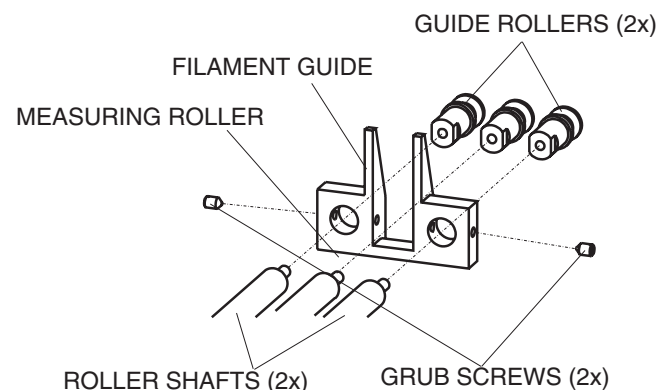
You should regularly inspect the rollers to assure that they are running easily and smoothly. You can replace the rollers yourself, as necessary, by following the directions in this section. Please indicate the tension meter model and the serial number (given on the rear side of the tension meter) in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

Model ID



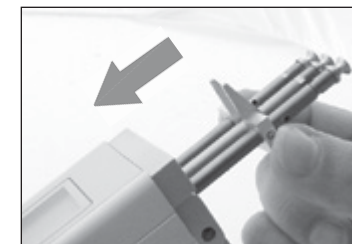
Serial number

**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.





## 11.0 SPECIFICATIONS

<b>Calibration</b>	According to SCHMIDT factory procedure
<b>Units of Measure</b>	cN / g, user selectable
<b>Accuracy</b>	± 1% FS* ± 1 digit (typical ± 0.5% FS*)
<b>Overrange</b>	10% FS*, without accuracy guarantee
<b>Overload Protection</b>	200% FS*
<b>Measuring Principle:</b>	Strain gauge bridge
<b>Meas. Roller Deflection</b>	0.5 mm, max
<b>Signal Processing</b>	Digital, 16 bit A/D converter
<b>Damping</b>	Adjustable electrical (averaging)
<b>Measuring Frequency</b>	Approx. 5 kHz internal
<b>Display Update Rate:</b>	2x per second
<b>Display</b>	4-digit LCD, height of digit 11 mm
<b>Memory</b>	Average, last value, maximum, minimum, MAX <sub>PEAK</sub> , MIN <sub>PEAK</sub>
<b>Memory Modes:</b>	4 - for up to 4000 readings
<b>Communication frequency</b>	1 to max. 100 readings/sec
<b>Temperature Coefficient</b>	Gain: less than ± 0.01% FS*/°C
<b>Digital Output Signal</b>	USB (Software Tension Inspect > 50 Measuring values/sec.)
<b>Temperature Range</b>	10 to 45° C
<b>Air Humidity</b>	85% RH, max.
<b>Auto Power Off</b>	Automatical after approx. 3 min. of non-use
<b>Power Supply</b>	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)
<b>Housing Material</b>	Aluminium profile with plastic outer casing (PVC)
<b>Housing Dimensions</b>	197 mm x 58 mm x 47 mm (L x W x H)
<b>Weight (net /gross):</b>	Approx. 340 g / 1250 g

\*FS = Full Scale

### ETMX Guide Rollers:

V-Groove	Line Speed m/min ... max.	Roller Material	ETMPX Guide Roller V-Groove	Line Speed m/min ... max.	Roller Material
Standard	2000	Hardcoated aluminium	Standard	6000	Oxide ceramic

### To Save The Next Measuring Period:

1. Press the **MEM** key again. The DISPLAY shows the memory mode “S” and the next memory number.



### 6.5 Data Logging in Mode F (Fast)

1. Turn on the tension meter.
2. Memory Mode C set as described in Sec. 6.1
3. Insert process material and begin measuring as described in Sec.4.0.

### To Start Data Logging:

1. Press and hold the **MEM** key until the DISPLAY shows the memory mode “F” and the current memory number.
2. Release the **MEM** key. The tension meter starts logging the data at a rate of 100 readings per second.



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

### To Stop Data Logging:

1. To stop data logging, press the **MEM** key once again. The statistical values are calculated and stored in the following order:

Average value  
Last value  
Maximum value (MAX)  
Minimum value (MIN)  
Minimum peak value (MIN PEAK)  
Maximum peak value (MAX PEAK)  
Tension Value - 1 -  
Tension Value - 2 -

Tension Value - N - up to 4000 tension values in up to 255 measuring periods.

The **MEM** indicator is frozen on the DISPLAY and the current reading is displayed. The tension meter has changed back to measuring mode.



### To Save The Next Measuring Period:

1. Press the **MEM** key again. The DISPLAY shows the memory mode “F” and the next memory number.









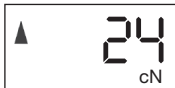






## 7.0 RECALLING TENSION VALUES STORED IN MEMORY

Using the Tension Inspect software, you can easily and accurately evaluate the stored tension values and export them to an Excel spreadsheet.

### 7.1 Recalling Stored Values in Mode S (Standard)

1. Turn on the tension meter and press the **RECALL** key. You can exit recall at any time by pressing the **POWER** key.

Memory Mode STANDARD							
Pos:	1	Pos:	2	Pos:	3	Pos:	4
AVG:	22.0	AVG:	12.0	AVG:	12.0	AVG:	12.0
Last:	23.0	Last:	22.1	Last:	22.1	Last:	22.1
MAX:	24.0	MAX:	22.1	MAX:	22.1	MAX:	22.1
MIN:	21.0	MIN:	5.4	MIN:	5.4	MIN:	5.4
PEAK <sub>MAX</sub> :	26.0	PEAK <sub>MAX</sub> :	28.1	PEAK <sub>MAX</sub> :	28.1	PEAK <sub>MAX</sub> :	28.1
PEAK <sub>MIN</sub> :	19.0	PEAK <sub>MIN</sub> :	1.8	PEAK <sub>MIN</sub> :	1.8	PEAK <sub>MIN</sub> :	1.8

2. The DISPLAY blinks showing the **average value** (AVG) of the first measuring period (POS: 1) and the  symbol. 
3. Press the **RECALL** key. The DISPLAY blinks, showing the **last value** (LAST) of the measuring period. 
4. Press the **RECALL** key. The DISPLAY blinks, showing the **maximum value** (MAX) or the measuring period and the  symbol. 
5. Press the **RECALL** key. The DISPLAY blinks, showing the **minimum value** (MAX) of the measuring period and the  symbol. 
6. Press the **RECALL** key. The DISPLAY blinks, showing the **maximum peak value** (PEAKMAX) of the measuring period and the  symbol. 
7. Press the **RECALL** key. The DISPLAY blinks, showing the **minimum peak value** (PEAKMIN) of the measuring period, the PEAK indicator and the  symbol. 
8. Press the **RECALL** key. The next measuring period (POS: 2) is shown on the DISPLAY, starting with the average value (AVG).

### 9.3 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.



## 10.0 WINDOWS TERMINAL PROGRAM

The measured values and the memory contents can be transmitted over the USB interface to a personal computer.

For data transfer to the PC, you will need a USB driver. If no matching driver is installed on your PC, the Windows Found New Hardware Wizard appears when you connect the unit to the computer for the first time. Follow the wizard steps. Specify the location of the driver on the supplied CD-ROM. You will find the driver in the "Treiber" folder.

You can connect the computer to the INTERFACE of the ETX by using the EK-0662 special cable which is included in delivery.

#### Requirements:

A communication program, such as Terminal or HyperTerminal (provided on MS Windows Version 3.0 or later), must be installed and configured on the computer.

#### Commands for communication with a PC (polling)

ASCII Code	Function	Description
s	transmission	Transmission of the undamped reading.
d	Send	Transmit current reading to PC once.
r	Output	Output the memory contents to the PC.

### 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.

8000

3. Release the **RECALL** key when the value shown on the DISPLAY is stable (the reading might fluctuate greatly). The DISPLAY shows E 100.

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. 8.0 If this procedure shows a deviation, you can recalibrate the tension meter again or restore the factory calibration as described in Sec. 9.3.

9500



If the verification of the calibration according Sec.8.0 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.

## 7.2 Recalling Stored Values in Mode C (Continuous)

1. Turn on the tension meter and press the **RECALL** key, You can exit recall at any time by pressing the **POWER** key.

Memory Mode CONTINUOUS							
Pos:	1	Pos:	2	Pos:	3	Pos:	4
AVG:	22.0	AVG:	12.0	AVG:	12.0	AVG:	12.0
Last:	23.0	Last:	22.1	Last:	22.1	Last:	22.1
MAX:	24.0	MAX:	22.1	MAX:	22.1	MAX:	22.1
MIN:	21.0	MIN:	5.4	MIN:	5.4	MIN:	5.4
PEAK <sub>MAX</sub> :	26.0	PEAK <sub>MAX</sub> :	28.1	PEAK <sub>MAX</sub> :	28.1	PEAK <sub>MAX</sub> :	28.1
PEAK <sub>MIN</sub> :	19.0	PEAK <sub>MIN</sub> :	1.8	PEAK <sub>MIN</sub> :	1.8	PEAK <sub>MIN</sub> :	1.8
	10.8		14.2		14.1		15.4
	10.0		19.4		11.2		18.3
	7.3		22.9		8.9		17.5
	6.1		17.3		10.2		7.8
	↓		↓		↓		↓
	n		n		n		n

2. The display blinks showing the **average value** (AVG) of the first measuring period (POS: 1) and the symbol.
3. Press the **RECALL** key. The DISPLAY blinks, showing the **last value** (LAST) of the measuring period.
4. Press the **RECALL** key. The DISPLAY blinks, showing the **maximum value** (MAX) or the measuring period and the symbol.
5. Press the **RECALL** key. The DISPLAY blinks, showing the **minimum value** (MAX) of the measuring period and the symbol.
6. Press the **RECALL** key. The DISPLAY blinks, showing the **maximum peak value** (PEAKMAX) of the measuring period and the symbol.
7. Press the **RECALL** key. The DISPLAY blinks, showing the **minimum peak value** (PEAKMIN) of the measuring period, the PEAK indicator and the symbol.
8. Press the **RECALL** key. The measured values no. 1 — n of the first measuring period can be recalled.
9. Press the **RECALL** key. The next measuring period (POS: 2) is shown on the DISPLAY, starting with the **average value** (AVG).

### 7.3 Recalling Stored Values in Mode L (Limit)

1. Turn on the tension meter and press the **RECALL** key. You can exit recall at any time by pressing the **POWER** key.

Memory Mode LIMIT								
Pos:	1	Pos:	2	Pos:	3	Pos:	4	
↕	AVG:	22.0	AVG:	12.0	AVG:	12.0	AVG:	12.0
	Last:	23.0	Last:	22.1	Last:	22.1	Last:	22.1
▲	MAX:	24.0	MAX:	22.1	MAX:	22.1	MAX:	22.1
▼	MIN:	21.0	MIN:	5.4	MIN:	5.4	MIN:	5.4
▲ <sub>Peak</sub>	PEAK <sub>MAX</sub> :	26.0	PEAK <sub>MAX</sub> :	28.1	PEAK <sub>MAX</sub> :	28.1	PEAK <sub>MAX</sub> :	28.1
▼ <sub>Peak</sub>	PEAK <sub>MIN</sub> :	19.0	PEAK <sub>MIN</sub> :	1.8	PEAK <sub>MIN</sub> :	1.8	PEAK <sub>MIN</sub> :	1.8
		10.8		14.2		14.1		15.4
		10.0		19.4		11.2		18.3
		7.3		22.9		8.9		17.5
		6.1		17.3		10.2		7.8
	↓		↓		↓		↓	
	n		10		10		10	

2. The DISPLAY blinks showing the **average value** (AVG) of the first measuring period (POS: 1) and the symbol.



3. Press the **RECALL** key. The DISPLAY blinks, showing the **last value** (LAST) of the measuring period.



4. Press the **RECALL** key. The DISPLAY blinks, showing the **maximum value** (MAX) or the measuring period and the ▲ symbol.



5. Press the **RECALL** key. The DISPLAY blinks, showing the **minimum value** (MAX) of the measuring period and the ▼ symbol.



6. Press the **RECALL** key. The DISPLAY blinks, showing the **maximum peak value** (PEAKMAX) of the measuring period and the ▲ symbol.



7. Press the **RECALL** key. The DISPLAY blinks, showing the **minimum peak value** (PEAKMIN) of the measuring period, the PEAK indicator and the ▼ symbol.

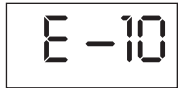


8. Press the **RECALL** key. The measured values no. 1 — n of the first measuring period can be recalled.

9. Press the **RECALL** key. The next measuring period (POS: 2) is shown on the DISPLAY, starting with the **average value** (AVG).

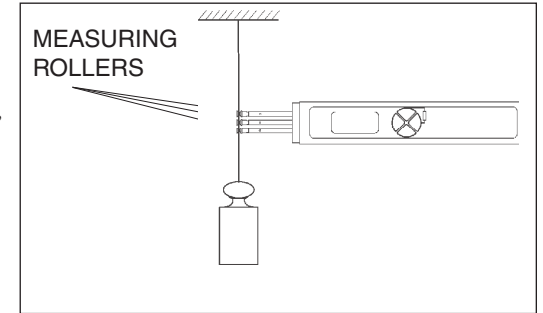
2. Release the **RECALL** key when the value shown on the Display is fairly stable (the reading might fluctuate greatly).

3. The DISPLAY shows E -10.



#### 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**.

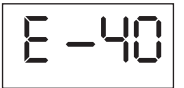
Slowly release pressure on the **LEVER** until the **GUIDE ROLLERS** return to their original position.

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.



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



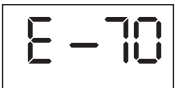
#### 2nd calibration point:

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.



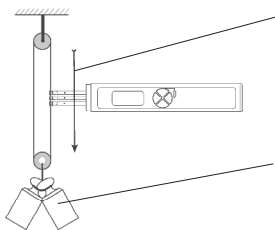
3. Release the **RECALL** key when the value shown on the DISPLAY is stable (the reading might fluctuate greatly). The DISPLAY shows E -70.



## 9.0 CALIBRATION

### 9.1 Dynamic Calibration of the ETMX

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.



Line speed  $V_{max.} = ETMX$  100 m/min  
 $V_{max.} = ETMXP$  60 m/min

Hang twice the weight (pulley effect) which corresponds to the tension to be measured from the measured material, vertically, as shown here. Please keep in mind to include the weight of the lower deflection pulley when you calculate the suspended weight. Pay attention to the correct unit of measure cN.

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

### 9.2 Static Calibration

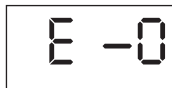
**NOTE:** The tension meter is factory calibrated for a vertical material path. Recalibration thus also has to be carried out with a vertical material path.

#### 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:

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



#### To calibrate the zero point:

- 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.



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

## 7.4 Recalling Stored Values in Mode F (Fast)

- Turn on the tension meter and press the **RECALL** key. You can exit recall at any time by pressing the **POWER** key.

Memory Mode FAST								
Pos:	1	Pos:	2	Pos:	3	Pos:	4	
▲	AVG:	22.0	AVG:	12.0	AVG:	12.0	AVG:	12.0
	Last:	23.0	Last:	22.1	Last:	22.1	Last:	22.1
▲	MAX:	24.0	MAX:	22.1	MAX:	22.1	MAX:	22.1
▼	MIN:	21.0	MIN:	5.4	MIN:	5.4	MIN:	5.4
▲ Peak	PEAK <sub>MAX</sub> :	26.0	PEAK <sub>MAX</sub> :	28.1	PEAK <sub>MAX</sub> :	28.1	PEAK <sub>MAX</sub> :	28.1
▼ Peak	PEAK <sub>MIN</sub> :	19.0	PEAK <sub>MIN</sub> :	1.8	PEAK <sub>MIN</sub> :	1.8	PEAK <sub>MIN</sub> :	1.8
		10.8		14.2		14.1		15.4
		10.0		19.4		11.2		18.3
		7.3		22.9		8.9		17.5
		6.1		17.3		10.2		7.8
		↓		↓		↓		↓
		n		n		n		n

- The DISPLAY blinks showing the **average value** (AVG) of the first measuring period (POS: 1) and the ▲ symbol.



- Press the **RECALL** key. The DISPLAY blinks, showing the **last value** (LAST) of the measuring period.



- Press the **RECALL** key. The DISPLAY blinks, showing the **maximum value** (MAX) or the measuring period and the ▲ symbol.



- Press the **RECALL** key. The DISPLAY blinks, showing the **minimum value** (MAX) of the measuring period and the ▼ symbol.



- Press the **RECALL** key. The DISPLAY blinks, showing the **maximum peak value** (PEAKMAX) of the measuring period and the ▲ symbol.



- Press the **RECALL** key. The DISPLAY blinks, showing the **minimum peak value** (PEAKMIN) of the measuring period, the PEAK indicator and the ▼ symbol.



- Press the **RECALL** key. The measured values no. 1 — n of the first measuring period can be recalled.

- Press the **RECALL** key. The next measuring period (POS: 2) is shown on the DISPLAY, starting with the **average value** (AVG).

## 7.5 Clearing the Memory

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



### To clear the memory:

Simultaneously press the **MEM** and **RECALL** keys. The mem indicator disappears from the DISPLAY and all values stored in the memory have been deleted.

## 7.6 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.

## 7.7 Error Messages

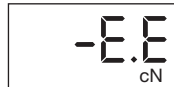
1. The DISPLAY shows EEE. The upper limit of the tension range was exceeded by more than 10%. Reduce the line tension.

OR

AUTO ZERO is no longer possible. Recalibrate the instrument following the directions in Sec. 9.0.



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



## 8.0 STATIC VERIFICATION OF MEASURING ACCURACY

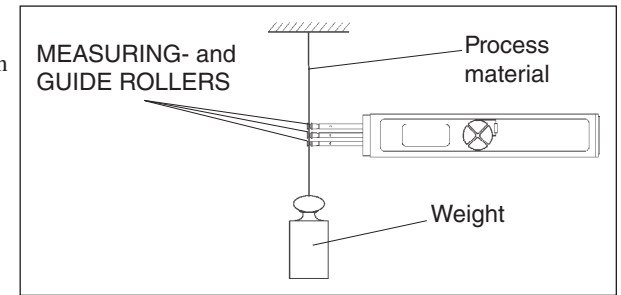
All tension meters are calibrated with standard materials—such as polyamide monofilament (PA)—according to the factory procedure. The diameters are given in section 1.0. Any difference in process material size and rigidity from the standard material may cause a deviation of the accuracy.

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 9.0.

**NOTE** The tension meter has been calibrated dynamically according to the factory procedure. therefore, differences may occur between static and dynamic readings.