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## 9.0 WARRANTY

The manufacturer 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 the manufacturer's option, except where unauthorized repair, disassembly, tampering, abuse or misapplication has taken place, as determined by the manufacturer. All returns for warranty or non-warranty repairs and/or replacement must be authorized by the manufacturer, 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.

Every precaution has been taken in the preparation of this manual. The manufacturer, 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.

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The device must not be operated in potentially explosive areas and must not come into contact with aggressive substances.

Tensions that exceed the tension range of the instrument by more than 100% may cause permanent damage to the measuring spring and must be avoided under any circumstances.

## 1.0 INTRODUCTION

The CHECK•LINE® models ZEF and ZED tension meters employ a strain gauge system for accurately measuring the running line tensions on a wide variety of yarns, fibers and fine wires. Its trigger-operated roller shifting mechanism makes it easy to acquire the running material. Single-button automatic zero permits operation in any orientation while maintaining the highest accuracy.

### 1.1 Available models

Model	Tension Range cN	*Measuring Head Width mm	Calibration Material
ZEF-50	0.5 - 50.0	43	PA: 0.12 mm Ø
ZEF-100	0.5 - 100.0	43	PA: 0.12 mm Ø
ZEF-200	1 - 200	43	PA: 0.12 mm Ø
ZED-200	1 - 200	63	PA: 0.20 mm Ø
ZED-500	1 - 500	63	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 significantly from the 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

### 1.2 Unpacking

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

### 1.3 Complete Kit

The gauge is supplied as a complete kit, including:

- Tension meter,
- AC-adpater with three, country-specific adapters (EU/USA/UK),
- Operating instructions,
- Carrying case



## 8.3 ZED Guide Rollers

V-Grooved	Line Speed max. m/min	Roller Material
Standard	2000	Hardcoated Aluminum
Code K	3500	Hardcoated Aluminum
Code H	5000	Aluminum plasmabeschichtet
Code T	450	Plastic (POM) black
Code W	450	Nickel plated steel

## 8.4 Service and Maintenance

The tension meter is easy to maintain. Depending on operating time and load, the tension meter should be checked as described in section 6.0. The use of other test methods than the procedure described in section 6.0 may cause deviating measuring results. When cleaning, do not use aggressive solvents such as trichlorethylene.

## 8.5 Rollers

You should regularly inspect the rollers to assure that they are running easily and smoothly. You can replace the rollers yourself, as necessary. In such a case, please indicate the tension meter model and the serial number (given on the rear side of the tension meter) in your order. For example:

**Model:** ZEF-100 / ZED-500 (given on rear side of tension meter)  
**Serial number:** 800 - 888888 (given on rear side of tension meter)

*Standard rollers:*

**Model number** ZEF: R50005  
**Delivery** 1 set (3 pcs.) of spare rollers 900 m/min with mounting tool

*Standard rollers*

**Model number** ZED: R50004  
**Delivery** 1 set (3 pcs.) of spare rollers 2000 m/min with mounting tool

or

**Model** ZEF-100-K / ZED-500-K (given on rear side of tension meter)  
**Serial number** Z 800 - 8888888 (given on rear side of tension meter)

*Code K rollers*

**Model number** ZEF: R50006  
**Model number** ZED: R50003  
**Delivery** 1 set (3 pcs.) of spare rollers 2000 m/min with mounting tool

*Code K rollers*

**Model number** ZED: R50003  
**Delivery:** 1 set (3 pcs.) of spare rollers 3500 m/min with mounting tool

## 8.0 SPECIFICATIONS

### 8.1 Gauge

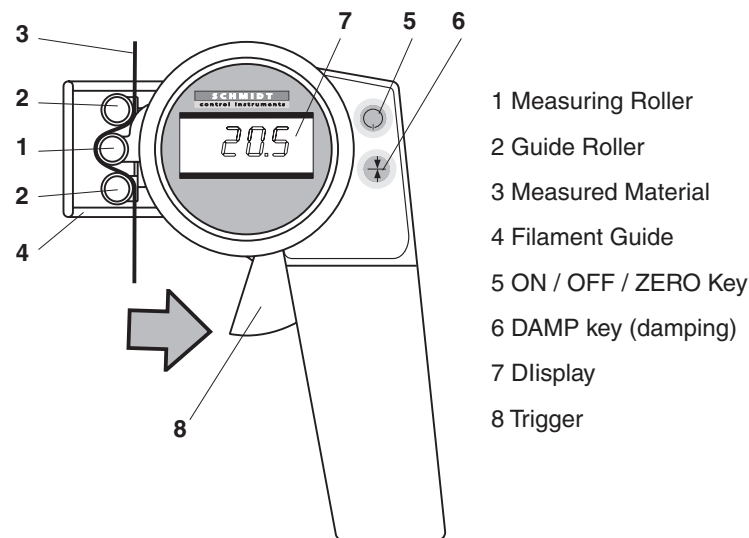
<b>Calibration</b>	According to Electromatic factory procedure
<b>Accuracy</b>	$\pm 1\% \text{ FS}^* \pm 1 \text{ digit}$ (typical $\pm 0.5\% \text{ FS}^*$ )
<b>Overrange</b>	10% FS*, without accuracy guarantee
<b>Overload Protection</b>	200% FS*
<b>Measuring Principle</b>	Strain gauge bridge
<b>Meas. Roller Deflection</b>	0.5 mm, max.
<b>Signal Processing</b>	Digital, 12 bit A/D converter
<b>Damping</b>	Selectable electronic damping (moving averaging)
<b>Measuring Frequency</b>	Approx. 5 kHz internally
<b>Display Update Rate</b>	2 times per sec.
<b>Display</b>	3-digit LCD, 11 mm high
<b>Model</b>	ZEF-50, ZEF-100: 3.5-digit LCD
<b>Temperature Coefficient</b>	Gain: less than $\pm 0.01\% \text{ FS}^*/^\circ\text{C}$
<b>Auto Power Off</b>	Automatically after approx. 3 min. of non-use
<b>Power Supply</b>	LiPo accumulator (80 hours continuous use, 3½ hour charging time) and AC adapter 110 to 240 V AC with country-specific adapters (EU/USA/UK)
<b>Temperature Range</b>	50 to 113 °F (10° to 45° C)
<b>Air Humidity</b>	85% RH, max.
<b>Housing Material</b>	Plastic (POM)
<b>Dimensions (L x W x H)</b>	6.18" x 3.35" x 1.26" (157 x 85 x 32mm)
<b>Weight net (gross)</b>	Approx. 7.05 oz./ 200 g (approx. 1.32 lbs./600 g)

\*FS = Full Scale


### 8.2 ZEF Guide Rollers

V-Grooved	Line Speed max. m/min	Roller Material
Standard	900	Hardcoated Aluminum
Code K	2000	Hardcoated Aluminum
Code T	450	Plastic (POM) black
Code W	450	Nickel plated steel


## 2.0 SET-UP



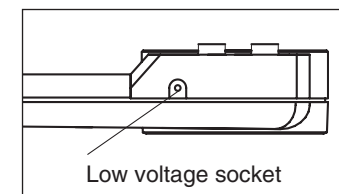
### 2.1 Battery Management

The tension meter comes with a built-in rechargeable LiPo battery, which has been charged at the factory. The tension meter can only be switched on if the battery is still working, i.e. if the battery has enough charge. If the instrument does not power up or if the battery level indicator shows only one bar  after turning the gauge on 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.

**To charge the battery,** connect the cable of the AC adapter to the low voltage socket. When the battery is fully charged, the battery level indicator will show three bars . The charging time is approximately 3 ½ hours.


**NOTE:** The battery can only be charged at a temperature between +5 °C and +45 °C. Before you connect the AC adapter, verify that the supply voltage is correct (110V – 240V). Electromatic provides no warranty or liability for any damage resulting from the use of AC adapters from other manufacturers.



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## 2.2 Turning the power ON and OFF ( )



1. Press the **ON/OFF** key. The display shows all symbols, then momentarily shows the tension range and the software version. When the display shows , the tension meter is ready to operate.
2. **Auto Power Off:** The tension meter switches off automatically after three minutes of non-use.
3. **Manual Switch Off:** Press and hold the **ON/OFF** key for five seconds

## 2.3 Zero adjustment of the measuring position (Auto Zero)

Zero adjustment is automatically carried out for the current measuring position.

**NOTE:** 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!

### Zero Adjustment procedure

1. Turn on the tension meter as described above.
2. Hold the tension meter in the desired measuring position. Be careful to hold the instrument absolutely steady.
3. Press the **ON/OFF/ZERO** key.
4. The display momentarily shows  and then switches to .



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

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## 7.0 RESTORING THE FACTORY CALIBRATION

You can restore the factory calibration anytime with the following procedure:

1. Turn off the tension meter.
2. Press the **DAMP** key until the display shows a decimal value, then press additional the **OFF/ON** key. Keep the keys depressed for about 6 seconds until the display shows .
3. Release first the **OFF/ON** key and then the **DAMP** key.
4. Press and hold the **DAMP** and **OFF/ON** keys again. Keep the keys depressed until the display shows  for about 1 sec. and the tension meter switches off.

The factory calibration has been restored.

### 7.1 Verification Intervals

The question of finding the right frequency of calibration accuracy verification depends on several different factors:

- Operating time and load of the tension meter
- Tolerance band defined by the customer
- Changes of the tolerance band compared to previous verifications of calibration

Therefore, the interval between verifications must be determined by the user's Quality Assurance Department based on the user's experience. Assuming normal operating time and load as well as careful handling of the tension meter, we recommend a verification interval of 1 year.



*It is essential that the THUMBPIECE return slowly to its initial position. Any uncontrolled snap-back may affect calibration and may also damage the instrument.*

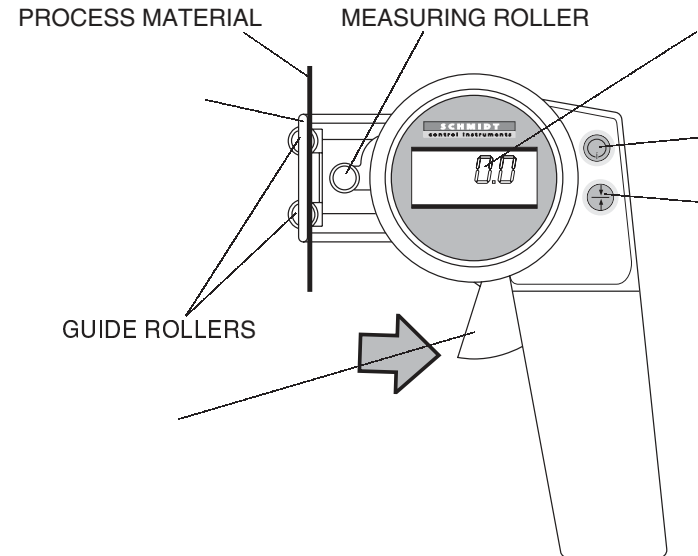
5. Press the **DAMP** key. As long as the **DAMP** key is depressed, the display shows a decimal value which is higher the third decimal value, e.g. 2200.

**NOTE:** This decimal value may vary from instrument to instrument.

6. Press and release the **DAMP** key. The tension meter then switches off after approx one sec. The new calibration has been stored.

The new calibration should be verified following the directions in section 5.0. If this procedure shows a deviation, you can recalibrate the tension meter again or restore the factory calibration as described in sections 6.0 and 7.0. If the verification of the calibration according to section 5.0 shows a deviation beyond the allowable tolerance and a reliable operation is no longer possible, the instrument has to be returned to the Electromatic Equipment Company for factory recalibration.

## 3.0 OPERATING PROCEDURE



### 3.1 Start-up

1. Turn on the power by pressing the **ON/OFF** key.
2. Perform a **ZERO ADJUSTMENT** if necessary, see section 2.3.
3. Adjust the **DAMPING FACTOR** if necessary, see section 4.2.

### 3.2 Inserting the process material

1. Push the **THUMBPIECE** as far as it will go in the direction of the arrow to extend the **GUIDE ROLLERS**.
2. Capture the **PROCESS MATERIAL** with the **FILAMENT GUIDE**.
3. Slowly release pressure on the **THUMBPIECE** until the **GUIDE ROLLERS** return to their original positions.

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



*It is essential that the THUMBPIECE return slowly to its initial position. Any uncontrolled snap-back may affect calibration and may also damage the instrument.*

### 3.3 Measuring the process material:

The display now shows the measured tension values. Error messages which might be displayed are described in section 3.5.

### 3.4 Removing the process material

1. Push the THUMBPIECE as far as it will go in the direction of the arrow.
2. With the GUIDE ROLLERS extended, move the instrument away from the PROCESS MATERIAL.
3. Slowly release pressure on the THUMBPIECE until the outer rollers return to their original positions.

### 3.5 Error Messages

The display shows



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 section 2.3**

The display shows




The tension is more than 10% below the lower tension limit


**Remove the tension material and re-insert it properly.**

OR

AUTO ZERO is no longer possible.

**Recalibrate the instrument following the directions in section 2.3**

5. Press the **DAMP** key. As long as the **DAMP** key is depressed, the DISPLAY shows a decimal value higher than the first decimal value (zero point calibration), e.g. . This decimal value may vary from instrument to instrument.
6. Release the **DAMP** key when the value shown on the display is stable (the reading may fluctuate slightly).


The display shows .

### 2nd calibration point

1. Hang a WEIGHT which corresponds to 50% of the tension range from the PROCESS MATERIAL, vertically, as shown on page 9.
2. Push the THUMBPIECE as far as it will go in the direction of the arrow.
3. Thread the PROCESS MATERIAL between the GUIDE ROLLERS and MEASURING ROLLER as shown on page 9.
4. Slowly release pressure on the THUMBPIECE until the GUIDE ROLLERS return to their original positions.



*It is essential that the THUMBPIECE return slowly to its initial position. Any uncontrolled snap-back may affect calibration and may also damage the instrument.*

5. Press the **DAMP** key. As long as the **DAMP** key is depressed, the display shows a decimal value that is higher than the second decimal value, e.g. . This decimal value may vary from instrument to instrument.
6. Release the **DAMP** key when the value shown on the display is stable (the reading may fluctuate slightly).

The display shows .


### 3rd calibration

1. Hang a WEIGHT which corresponds to 90% of the tension range from the PROCESS MATERIAL, vertically, as shown on page 9.
2. Push the THUMBPIECE as far as it will go in the direction of the arrow.
3. Thread the PROCESS MATERIAL between the GUIDE ROLLERS and MEASURING ROLLER as shown on page 9.
4. Slowly release pressure on the THUMBPIECE until the GUIDE ROLLERS return to their original positions.

## 6.0 STATIC CALIBRATION OF THE ZE

- NOTES:**
- The tension meter is factory calibrated for a vertical material path. Recalibration must also be carried out with a vertical material path.
  - One cN weight each, corresponding to 10%, 50% and 90% of the tension range must be provided.
  - No PROCESS MATERIAL inserted.
  - Tension meter switched off.

### To select the calibration mode

- Press and hold the **DAMP** and **OFF/ON** keys. Release the **OFF/ON** key after one second. Keep the **DAMP** key depressed for about 6 seconds until the display shows .
- Release the **DAMP** key.


### To calibrate the zero point:

- Press the **DAMP** key. As long as the **DAMP** key is depressed, the display shows a random decimal value between -2000 and 2000, e.g. .

This decimal value may vary from instrument to instrument.

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

- Release the **DAMP** key when the value shown on the display is fairly stable (the reading may fluctuate slightly).

The display shows .

### 1st calibration point

- Hang a WEIGHT which corresponds to 10% of the tension range from the PROCESS MATERIAL, vertically, as shown on page 9. The WEIGHT must not swing!
- Push the THUMBPIECE as far as it will go in the direction of the arrow.
- Thread the PROCESS MATERIAL between the GUIDE ROLLERS and MEASURING ROLLER as shown on page 9.
- Slowly release pressure on the THUMBPIECE until the GUIDE ROLLERS return to their original positions.



*It is essential that the THUMBPIECE return slowly to its initial position. Any uncontrolled snap-back may affect calibration and may also damage the instrument.*

## 4.0 USING THE DAMPING MODE

### 4.1 Switching the Damping Mode ON and OFF

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

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

- Process material inserted as described in section 3.0.
- The display has shown the first tension values.


### To switch on damping

- Press the **DAMP** key. The display shows the set damping factor.
- Release the **DAMP** key.

The display shows  **DAMP** below the currently measured value.

### To switch off damping

- Press the **DAMP** key.

The display shows  only the currently measured value.

### 4.2 Changing the Damping Factor

The tension meter is factory preset to a factor of 7. The tension values are thereby averaged for the display in the following way:

$$\frac{7 \text{ old values} + 9 \text{ new values}}{16}$$

The damping factor can be modified in 15 steps from 1 = low damping:

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

to 15 = high damping:

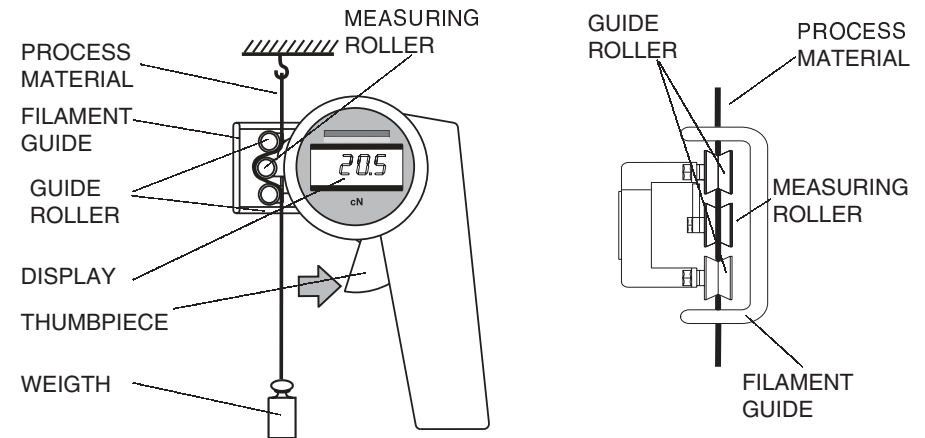
$$\frac{15 \text{ old values} + 1 \text{ new value}}{16}$$

### To change the damping factor

1. Press the **DAMP** key. The display shows the set damping factor.
2. Press the **ON/OFF** key to change the Damping Factor. Each time the **ON/OFF** key is pressed the Damping Factor will change.
3. Release the **DAMP** key. The tension meter switches back to measuring mode.

## 5.0 STATIC VERIFICATION OF MEASURING ACCURACY

All tension meters are calibrated with standard materials—such as polyamide monofilament (PA)—according to the Electromatic factory procedure. The diameters are given in the chart on page 2. 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 SCHMIDT calibration has been proven to provide the best results and is used for comparative purposes. The tension meter is factory calibrated for a vertical material path as shown below.



1. Hang a **WEIGHT** which corresponds to the tension to be measured (pay attention to the correct unit of measure) from the **PROCESS MATERIAL**, vertically, as shown above.
2. Push the **THUMBPIECE** as far as it will go in the direction of the arrow.
3. Thread the **PROCESS MATERIAL** between the **GUIDE ROLLERS** and **MEASURING ROLLER** as shown above.
4. Slowly release pressure on the thumbpiece until the **GUIDE ROLLERS** return to their original positions.



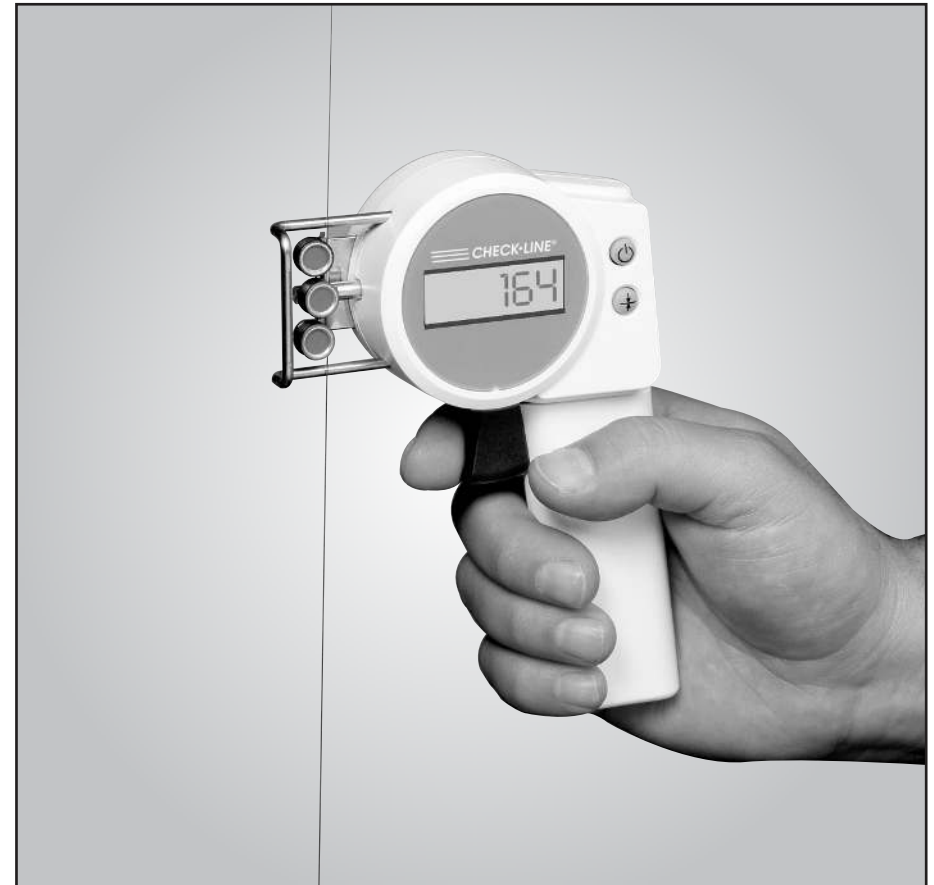
*It is essential that the **THUMBPIECE** return slowly to its initial position. Any uncontrolled snap-back may affect calibration and may also damage the instrument.*

5. The tension value shown on the display should be equal to the value of the suspended weight. If this procedure shows a deviation, you can recalibrate the instrument following the directions in section 6.0



# Tension Meters

## Z Series



## Operating Manual