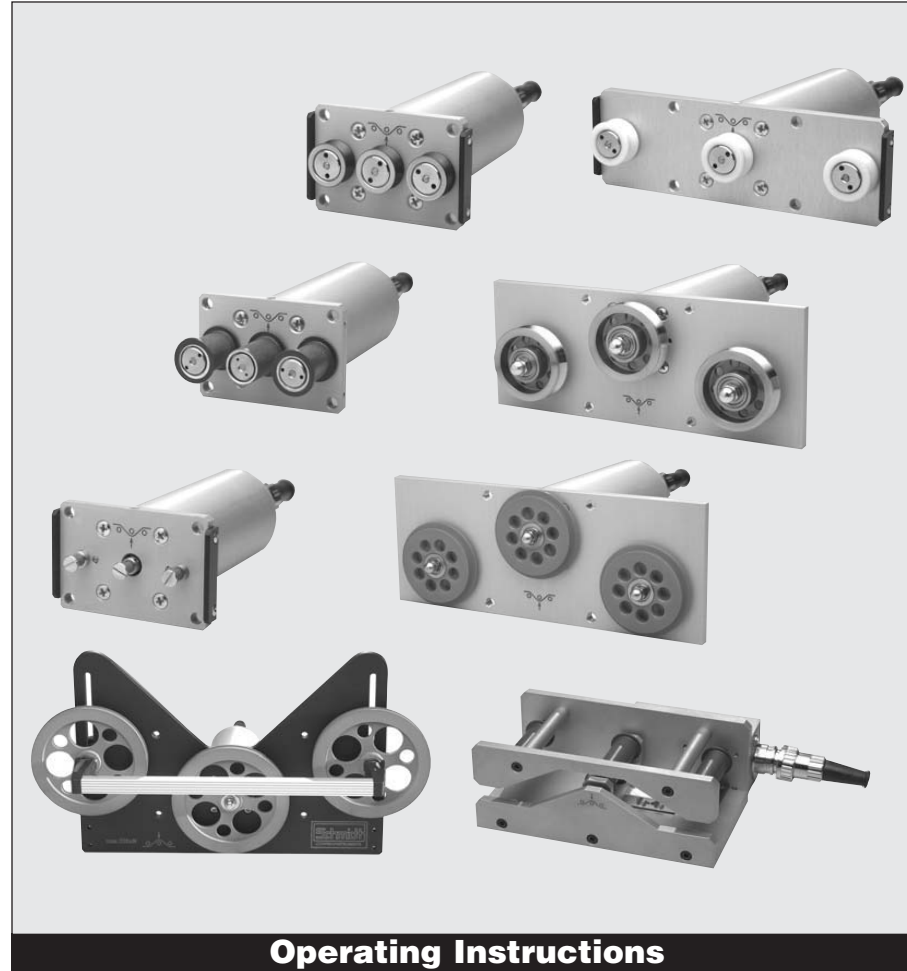


TENSION SENSORS



6.0 WARRANTY

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1.0 INTRODUCTION

These Operating Instructions refer to Model TE sensor; they are also applicable to the following models:

TP, TE-24, TE-22, TF, TERX, BTMS

1.1 Unpacking

When the sensor is delivered without a display and data analysis unit:

- 1 Diode connector, 8-pin
- 1 Operating Instructions

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

1.2 Optional Accessories

Option DC: Analog output 0 - 10 V DC

Option MA: Analog output 4 - 20 mA

5.6 TERX Models

| Model | Tension Ranges cN | *Measuring Head Width mm | Roller Widths |
|-----------|----------------------|-----------------------------|---------------|
| TERX-100 | 0 - 100 | 60 | 7, 10, 15, 20 |
| TERX-200 | 0 - 200 | 60 | 7, 10, 15, 20 |
| TERX-500 | 0 - 500 | 60 | 7, 10, 15, 20 |
| TERX-1000 | 0 - 1000 | 60 | 7, 10, 15, 20 |
| TERX-2000 | 0 - 2000 | 120 | 7, 10, 15, 20 |



TERX guide rollers:

| Guide Rollers | Line Speed m/min max. | Roller Material |
|---------------|--------------------------|--|
| Standard | 1000 | Hardcoated aluminium (Exception: 7 mm rollers are made of nickel-plated steel) |

5.7 BTMS Models

| Model | Tension Ranges cN | Roller Widths |
|-----------|----------------------|---------------------------------|
| BTMS-1000 | 0 - 1000 | 30, 36, 41, 50, 100 |
| BTMS-2000 | 0 - 2000 | 30, 36, 41, 50, 100 |
| BTMS-5000 | 0 - 5000 | 10, 15, 20, 30, 36, 41, 50, 100 |
| BTMS-10K | 0 - 10 daN | 10, 15, 20, 30, 36, 41, 50, 100 |
| BTMS-20K | 0 - 20 daN | 10, 15, 20, 30, 36, 41, 50, 100 |
| BTMS-50K | 0 - 50 daN | 10, 15, 20, 30, 36, 41, 50, 100 |



BTMS guide rollers:

| Guide Rollers | Line Speed m/min max. | Roller Material |
|---------------|--------------------------|----------------------|
| Standard | 1000 | Hardcoated aluminium |

5.4 TE-22 Models

| Model | Tension Ranges cN | *Measuring Head Width mm | **FACTORY Calibration Material |
|------------|----------------------|-----------------------------|-----------------------------------|
| TE-22-50 | 0 - 50 | 150 | PA: 0.12 mm Ø |
| TE-22-100 | 0 - 120 | 150 | PA: 0.12 mm Ø |
| TE-22-200 | 0 - 200 | 150 | PA: 0.12 mm Ø |
| TE-22-500 | 0 - 400 | 150 | PA: 0.20 mm Ø |
| TE-22-1000 | 0 - 1000 | 15 | PA: 0.30 mm Ø |

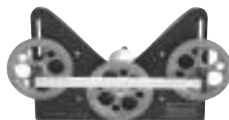


TSL guide rollers:

| V-grooved | Line Speed m/min max. | Roller Material |
|-----------|--------------------------|---|
| Standard | 4000 | Hardcoated aluminium (Nr. R12021) |
| Option T | 4000 | Plastic (PVC reed) (Same dimension as standard roller) |

5.5 TF Models

| Model | Tension Ranges cN | *Measuring Head Width mm | **FACTORY Calibration Material |
|---------|----------------------|-----------------------------|-----------------------------------|
| TF-100 | 0 - 120 | 270 | PA: 0.12 mm Ø |
| TF-200 | 0 - 200 | 270 | PA: 0.12 mm Ø |
| TF-500 | 0 - 400 | 270 | PA: 0.20 mm Ø |
| TF-1000 | 0 - 100 | 270 | PA: 0.30 mm Ø |
| TF-2000 | 0 - 200 | 270 | PA: 0.50 mm Ø |
| TF-5000 | 0 - 500 | 270 | PA: 0.80 mm Ø |



TSF guide rollers:

| V-grooved | Line Speed m/min max. | Roller Material |
|-----------|--------------------------|--------------------------------------|
| Standard | 5000 | Hardcoated aluminium (Nr. R12045) |

2.0 OPERATION



WARNING

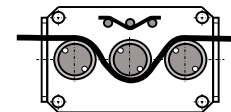
The device must not be operated in explosion hazard areas and must not come into contact with aggressive substances.

To avoid damage, do not move the center roller by hand.

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

2.1 First Installation

1. Install the sensor at the desired measuring location.
2. Connect the sensor with the supplied or existing display unit. The pin assignment of the 8-pin connector located on the rear side of the sensor is described in section 4.0.
3. If the material path is other than vertical or if the process material deviates significantly from the factory calibration material, you have to carry out zero and gain adjustment, as described in [section 2.3](#) and [2.4](#), before first installation.
3. Wait approx. 10 minutes for the sensor to warm up.
4. Thread the process material through the measuring rollers, following the thread acquisition symbol on the front of the sensor.



2.2 Internal Sensor Calibration

General Notes:

If the sensor was delivered together with a display unit, ZERO and GAIN adjustment should only be performed on the supplied display unit.

All tension meters are calibrated with standard materials—such as polyamide-monofilament (PA)—according to the factory procedure; the material path is vertical (Model BTMS horizontal).

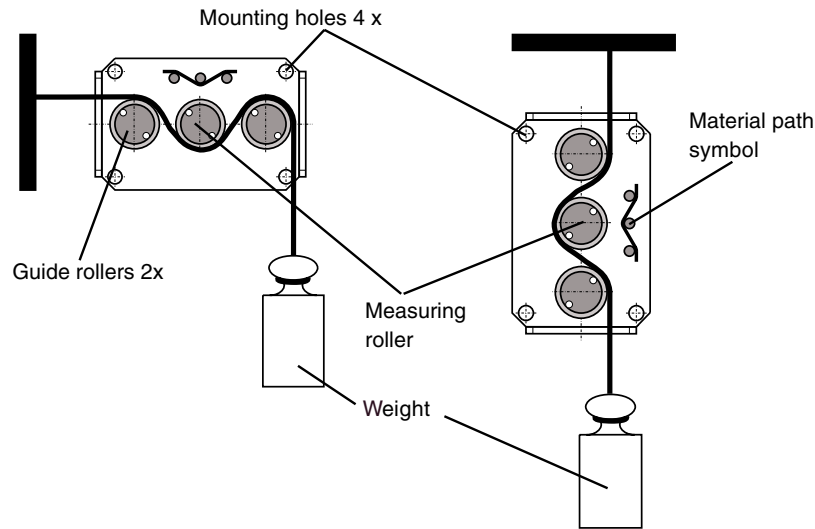
Any difference in process material size and rigidity from the standard material may cause a deviation of the accuracy.

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

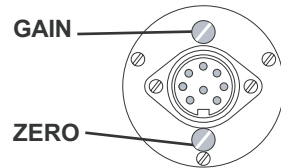
If required, you can operate the sensors with a material path other than vertical.

If the process material differ significantly in size, rigidity and shape we recommend special calibration using customer material. In the case of a material path other than vertical or special calibration using customer material you have to carry out static zero and gain adjustment once again as described in [Chapters 3.2.1](#) and [3.2.2](#).

2.3 ZERO Adjustment



1. Install the sensor at the measuring locations in the desired measuring position, using the provided mounting holes.
2. Remove the countersunk head screws (M2.5) ZERO and GAIN on the rear side of the sensor.
3. Wait approx. 10 minutes for the measuring head to warm up.
4. Thread the process material through the measuring rollers, following the thread acquisition symbol on the front of the sensor.



WARNING When threading the process material through the rollers, follow the material acquisition symbol on the front of the sensor. If force is applied to the middle sensing roller in the incorrect direction, damage could result.

- NOTE:** Since zero and gain adjustments are always performed statically the display values may differ under dynamic load.
5. Suspend a weight that corresponds to, for example, 10% of the tension range from the measured material (see diagram above).
 6. Connect a voltmeter to pins 1 and 7 of the connector provided on the rear side of the sensor. See section 4.0

5.2 TP Models

| Model | Tension Ranges cN | *Measuring Head Width mm | **FACTORY Calibration Material |
|--------|----------------------|-----------------------------|-----------------------------------|
| TP-50 | 0 - 50 | 64 | PA: 0.12 mm Ø |
| TP-100 | 0 - 120 | 64 | PA: 0.12 mm Ø |
| TP-200 | 0 - 200 | 64 | PA: 0.12 mm Ø |
| TP-500 | 0 - 400 | 64 | PA: 0.20 mm Ø |



TP guide pins:

| Guide Pins | Line Speed m/min max. | Pin Material |
|------------|--------------------------|-----------------------------------|
| Standard | 6000 | Oxide ceramic 4 mm Ø (Nr. R12056) |

5.3 TE-24 Models

| Model | Tension Ranges cN | *Measuring Head Width mm | **FACTORY Calibration Material |
|------------|----------------------|-----------------------------|---------------------------------------|
| TE-24-1000 | 0 - 1000 | 150 | PA: 0.30 mm Ø |
| TE-24-2000 | 0 - 2000 | 150 | PA: 0.50 mm Ø |
| TE-24-5000 | 0 - 5000 | 150 | PA: 0.80 mm Ø |
| TE-24-10K | 0 - 10 daN | 200 | PA: 1.00 mm Ø |
| TE-24-20K | 0 - 20 daN | 200 | PA: 1.50 mm Ø |
| TE-24-50K | 0 - 50 daN | 200 | Steelrope 1.50 mm Ø (7 x 7 x 0.20) |



TE-24 guide rollers:

| V-grooved | Line Speed max. m/min | Roller Material |
|------------------------|--------------------------|---------------------------------------|
| Standard | 4000 | Hardened steel roller (Nr. R10006) |
| U-grooved Option R1 | 4000 | Hardened steel roller (Radius R5) |

5.0 APPENDIX: AVAILABLE MODELS

In addition to the standard specifications listed below, the following custom modifications are also available:

- Special tension ranges
- Customized roller dimensions
- Special calibration using customer supplied material

5.1 TE Models

| Model | Tension Ranges cN | *Measuring Head Width mm | **FACTORY Calibration Material |
|---------|-------------------|--------------------------|---|
| TE-50 | 0 - 50 | 64 | PA: 0.12 mm Ø |
| TE-100 | 0 - 100 | 64 | PA: 0.12 mm Ø |
| TE-200 | 0 - 200 | 64 | PA: 0.12 mm Ø |
| TE-500 | 0 - 500 | 64 | PA: 0.20 mm Ø |
| TE-1000 | 0 - 1000 | 64 | PA: 0.30 mm Ø |
| TE-2000 | 0 - 2000 | 124 | PA: 0.50 mm Ø |
| TE-5000 | 0 - 5000 | 124 | PA: 0.80 mm Ø |
| TE-10K | 0 - 10 daN | 124 | PA: 1.00 mm Ø |
| TE-20K | 0 - 20 daN | 224 | PA: 1.50 mm Ø |
| TE-50K | 0 - 50 daN | 224 | Steel rope: 1.50 mm Ø (7 x 7 x 0.20) |



TE Guide Rollers

| V-grooved | Line Speed m/min max. | Roller Material |
|--------------------------------|-----------------------|---|
| Standard | 2000 | Hardcoated aluminium (Nr. R10008) |
| Option K | 3500 | Hardcoated aluminium |
| Option H | 5000 | Plasma-coated aluminium (for Model TE-100 and higher ranges) |
| Option T | 1000 | Plastic (POM) black |
| Option W | 1000 | Nickel-plated steel |
| Option ST | 1000 | Hardened steel |
| Option B | 1000 | Steel tempred, especially for measuring Tyrecord |
| Option CE | 1000 | Ceramic |
| Asymmetrical groove ASY | 1000 | Hardcoated aluminium (for Model TE-100 and higher ranges) |
| U-grooved Option U | 2000 | Hardcoated aluminium |

7. Insert a screw driver (with a point width of up to 1.9 mm) into the now accessible ZERO opening of the housing and adjust the potentiometer until the connected voltmeter shows a measured voltage of, for example:

Sensor Model TS -200:

Weight 20 cN = Display 0.100 V for the TS standard version

or

Weight 20 cN = Display 1.00 V for the TS version with 10 V output signal.



Do not tilt the screwdriver as this may damage the potentiometer.

WARNING

2.4 GAIN Adjustment

Requirement: ZERO adjustment (section 2.3) must be carried out first.

1. Thread the process material through the measuring rollers, following the thread acquisition symbol on the front of the sensor.
2. Suspend a weight that corresponds to, for example, 95% of the tension range from the measured material (see diagram on page 4).
3. Insert a screw driver (with a point width of up to 1,9 mm) into the now accessible GAIN opening of the housing (see diagram on page 4) and adjust the potentiometer until the connected voltmeter shows a measured voltage of, for example:

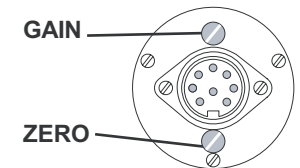
Sensor Model TS-200:

Weight 190 cN = Display .950 V for the TS standard version

or

Weight 190 cN = Display 9.50 V for the TS version with 10 V output signal.

4. Check the adjustment with a fresh portion of the process material and repeat the adjustments if required, following the direction in section 2.3 and 2.4.
5. Screw in the countersunk head screws ZERO and GAIN on the rear side of the sensor.



2.5 Checking the Adjustment

For general information, refer to section 2.2.


Requirements:

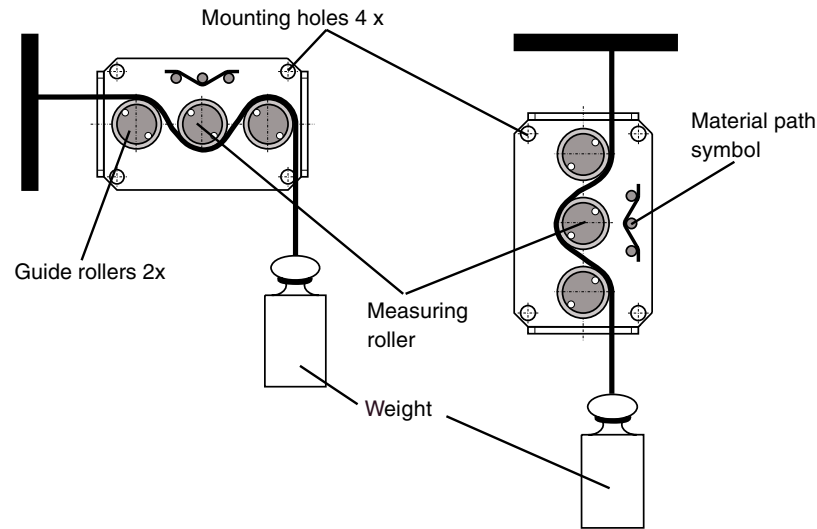
1. The sensors must be installed at the measuring location. Connect the sensor with the supplied or existing display unit.

NOTE: The pin assignment of the 8-pin connector located on the rear side of the sensor is described in section 4.0. Wait approx. 10 minutes for the sensor to warm up.

Checking procedure:

1. Thread the process material through the measuring rollers, following the red marking on the front of the sensor.

 **WARNING** When threading the process material through the rollers, follow the material acquisition symbol on the front of the sensor. If force is applied to the middle sensing roller in the incorrect direction, damage could result.



2. Suspend a weight that corresponds to the tension to be measured (pay attention to the correct unit of measure) from the measured material, vertically, as shown above. (Always use a fresh portion of the material to be measured.)
3. The tension value on the connected display unit should be equal to the value of the suspended weight. If this procedure shows a deviation beyond the allowable tolerance and a reliable operation is no longer allowed, the instrument has to be readjusted, following the directions in sections 2.3 and 2.4

3.0 SPECIFICATIONS

Calibration

According to factory procedure Suitable for 95% of applications. PA = Polyamide Monofilament. If the material to be measured differs significantly from the factory calibration material in diameter, rigidity, shape, etc., we recommend calibration using customer material. For this purpose, a material sample of at least 5 m should be supplied. International unit for tension force: 1 cN = 1.02 g = 0.01 N 1 daN = 1.02 kg = 10 N

Accuracy

Remainder of range and other calibration material

For 10% to 100% of range: $\pm 1\%$ full scale

$\pm 3\%$ full scale or better

Overload protection

100% of range

Measuring principle

Strain gauge bridge

Measuring roller deflection

0.5 mm, max.

Natural frequency of measuring spring

Approx. 500 Hz, depending on tension range

Signal processing

Analog

Temperature coefficient

Zero point: less than $\pm 0.05\%$ full scale / °C

Output signal

Option DC

Option MA

0 - 1 V DC Impedance: > 5 kOhm (standard) Option

0 - 10 V DC

4 - 20 mA

Damping (f g)

Standard: approx. 30 Hz (other values on request)

Temperature range

10 - 45 °C Air humidity: 85% RH, max.

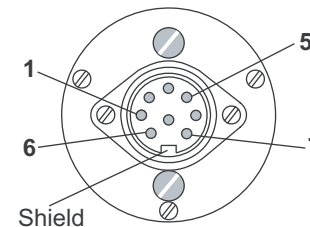
Power supply

Standard: 12 to 18 V DC (21mA) (regulated)

Housing

Aluminium

4.0 PIN ASSIGNMENTS



| Pin No. | Signal | Description |
|---------|-------------------------|------------------------|
| 1 | GND | Ground - analog signal |
| 2 | | Not assigned |
| 3 | | Not assigned |
| 4 | | Not assigned |
| 5 | +12 to 24 VDC regulated | Supply voltage |
| 6 | GND | Ground - analog signal |
| 7 | 0-1 VDC | |
| 8 | | Not assigned |