

Operating Instructions



 *Tension Meter*

 *MST Series*

 *Model MST*

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1 Warranty and Liability

In principle, the supply of the device is subject to our “General Conditions of Sale and Delivery.” These have been provided to the operating company on conclusion of the contract, at the latest.

Warranty:

- SCHMIDT tension meters are warranted for 12 months.

Parts subject to wear, electronic components and measuring springs are not covered by the warranty. No warranty or liability will be accepted for bodily injury or property damage resulting from one or several of the following causes:

- Misuse or abuse of the device.
- Improper mounting, commissioning, operation and maintenance of the device (e.g. verification interval).
- Operation of the device if any safeguards are defective or if any safety and protection precautions are not properly installed or not operative.
- Failure to comply with the notices in the Operating Instructions regarding transport, storage, mounting, commissioning, operation, maintenance and setup of the device.
- Any unauthorized structural alteration of the device.
- Insufficient inspection of device components that are subject to wear.
- Opening the device or improper repair work.
- Disasters caused by the effects of foreign objects or by force majeure.

1.1 Notices within the Operating Instructions

The fundamental prerequisite for the safe handling of this device and its troublefree operation is the knowledge of the basic safety notices and safety instructions.

These Operating Instructions contain the most important notices for the safe operation of the device.

These Operating Instructions, in particular the safety notices, must be observed by any person who works with the device. In addition, the local valid rules and regulations for the prevention of accidents must be complied with.

The representations within the Operating Instructions are not true to scale.

The dimensions given are not binding.

General indications of direction, such as FRONT, REAR, RIGHT, LEFT apply when viewing the front of the device.

1.2 Responsibilities of the Operating Company

In compliance with the EC Directive 89/655/EEC, the operating company agrees to only permit persons to work with the device who:

- are familiar with the basic regulations on industrial safety and accident prevention and who have been trained in handling the device.
- have read and understood the chapter on safety and the warning notices in these Operating Instructions and have confirmed this with their signatures.
- are examined regularly on their safe and conscientious working method.

1.3 Responsibilities of the Personnel

All persons who work with the device agree to perform the following duties before starting work:

- to observe the basic regulations on industrial safety and accident prevention.
- to read the chapter on safety and the warning notices in these Operating Instructions and to confirm with their signatures that they have understood them.

1.4 Informal Safety Measures

The Operating Instructions must always be kept on hand where the device is operated. Apart from the Operating Instructions, the general and local valid regulations on accident prevention and environmental protection must be provided and complied with.

1.5 Training of the Personnel

Only trained and instructed personnel is permitted to work with the device. The responsibilities of the personnel must be clearly defined for mounting, commissioning, operation, setup, maintenance and repair. Trainees may only work with the device under the supervision of an experienced personnel

1.6 Intended Use

The device is intended exclusively to be used as a tension meter. Any other use or any use exceeding this intention will be regarded as misuse. Under no circumstances shall HANS SCHMIDT & Co GmbH be held liable for damage resulting from misuse.

The intended use also includes:

- Complying with all notices included in the Operating Instructions and observing all inspection and maintenance works.

1.7 Dangers in Handling the Device

The device was designed according to the state of the art and the approved safety standards. Nevertheless, its use may cause serious or fatal injury to the user or third persons, and/or an impairment of the device or of other material assets.

The device may only be applied:

- For its intended use in a faultless condition with regard to the safety requirements.
- Malfunctions that could impair safety must be remedied immediately.
- Personal protective equipment must be used according to the EC Directive 89/686/EEC.



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

1.8 Copyright

The copyright on these Operating Instructions remains with the company HANS SCHMIDT & Co GmbH.

These Operating Instructions are intended for the operating company and its personnel only. They contain instructions and notices that may only be reproduced on the prior written permission of

HANS SCHMIDT & Co GmbH

and under indication of the complete reference data. Violations will be prosecuted.

1.9 Declaration of Conformity, RoHs II and WEEE Registration

In compliance with the EU Directives 2004/108/EC and 2011/65/EU



HANS SCHMIDT & CO GmbH is registered in compliance with the German Electrical and Electronic Equipment Act (ElektroG) under WEEE Reg. No. DE 48092317.

2 Available Models

Model	Tension Range cN	*SCHMIDT Calibration Material
MST-500	1 - 500	PA: 0.20 mm Ø
MST-1000	1 - 1000	PA: 0.30 mm Ø
MST-2000	1 - 2000	PA: 0.50 mm Ø

* Suitable for 95% of all applications. PA = Polyamide Monofilament.
If the material to be measured differs significantly from the SCHMIDT 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

2.1 Specifications

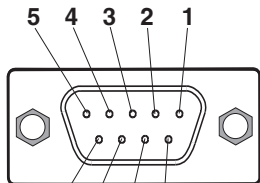
Calibration:	Acc. to SCHMIDT factory procedure with 0.2 mm Ø PA monofil
Accuracy:	$\pm 1\% \text{ FS}^* \pm 1 \text{ digit}$ (typically $\pm 0.5\% \text{ FS}^*$)
Overrange:	10% FS*, without accuracy guarantee
Overload Protection:	200% FS*
Measuring Principle:	Strain gauge bridge
Meas. Roller Deflection:	max. 0.5 mm
Signal Processing:	Digital, 16 bit A/D converter
Damping:	Adjustable electronically (averaging)
Meas. Frequency:	Approx. 5 kHz internally
Display Update Rate:	2x per sec.
Display:	4-digit LCD, 11 mm high
Memory:	Average, last value, maximum, minimum, MAX_{PEAK} , MIN_{PEAK}
Temperature Coefficient:	Gain: less than $\pm 0.01\% \text{ FS}^*/^\circ\text{C}$
Output Signal	Analog: 0 - 2 V DC (linearized), $R_{\text{load}} > 1 \text{ kW} \pm \text{approx. } 1\%$ Converter frequency 100 Hz Digital: RS-232 (19200, 8, N, 1)
Temperature Range:	10 - 45° C
Air Humidity:	85% RH, max.
Auto Power Off:	Automatically after approx. 3 min. of non-use
Power Supply:	9 V E block, e.g. long life 9 V lithium AC adapter 12 V, 500 mA
Housing Material:	Aluminium profile with plastic outer casing (PVC)
Housing Dimensions (incl. clamping device):	215 mm x 100 (140) mm x 120 mm (W x D x H)
Weight , tension meter:	1 kg
Weight , suction cup:	0.5 kg

*FS = Full Scale

Guide Rollers:

V-grooved	Line Speed m/min max.	Roller Material
Standard	2000	Hard-coated aluminium

2.2 Pin Assignment and Signals of the RS-232 Interface (9-Pin D-Sub Connector)



Signal	RS-232-C
Data Bit	8 bits
Stop Bit	1 bit
Parity	None
Baud Rate	19200

Pin Number	Signal	Description
1		Not assigned
2	TXD	TRANSMITTED DATA
3	RXD	RECEIVED DATA
4		Not assigned
5	GND	Ground
6		Not assigned
7	RTS	READY TO SEND
8		Not assigned
9	2 V DC	Analog signal

2.2.1 Connecting the Tension Meter



The requirements of the CE specification are only complied with if the tension meter is equipped and operated with connecting cables supplied by HANS SCHMIDT & Co GmbH. Certification to the CE specification does not extend to, and shall be invalid for any other combination. Under no circumstances shall HANS SCHMIDT & Co GmbH be held liable for any damage resulting from the use of non-SCHMIDT sensors or cables.

2.3 Optional Accessories

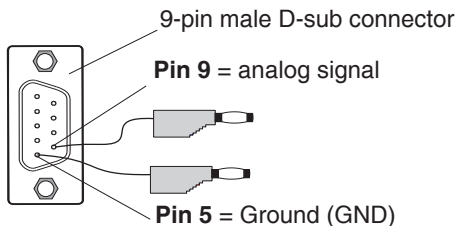
ETX-CA: Connecting cable for analog signal

ETX-CC: Digital connecting cable

SW-TI3: "TENSION INSPECT 3"

Software (Win XP or higher) for viewing and storing the measured data on a PC.

2.3.1 Pin Assignment of the Analog Cable (Option ETX-CA)



2.4 Delivery Includes

- Tension meter with 9 V long life battery
- 1 AC adapter 12 V, 500 mA
- 1 Operating Instructions
- 1 Stand

2.5 Unpacking

Unpack the tension meter 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.

3 Notices before Starting Measurement



Have you read and understood the Operating Instructions, in particular Chapter 1 “Basic Safety Notices”? You are not permitted to operate the instrument before doing so.

**Before working with the instrument you must put on your personal protective clothing, if necessary. For example, eye protectors, gloves, etc.
To avoid damage, do not move the center roller by hand.**

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.



The ID plate with the CE mark and the serial number as well as the calibration label (optional) and the SCHMIDT Quality Seal are provided at the rear side of the instrument.

3.1 Operating Elements

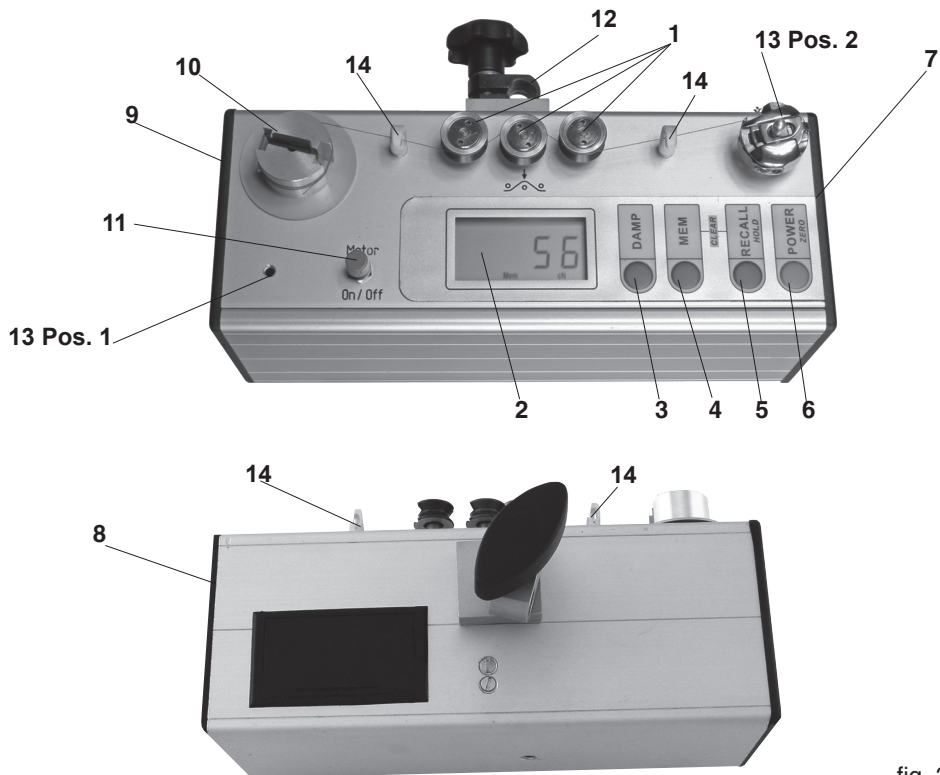




fig. 3.1b

- | | | | |
|---|-------------------|----|---------------------------------|
| 1 | ROLLERS | 8 | Battery compartment |
| 2 | DISPLAY | 9 | AC adapter connector |
| 3 | DAMP key | 10 | TAKE OFF ROLLER |
| 4 | MEM key | 11 | ON / OFF button |
| 5 | RECALL / HOLD key | 12 | Clamping device for suction cup |
| 6 | POWER / ZERO key | 13 | FIXTURE TO DETERMINE BOBIN CASE |
| 7 | Interface | 14 | CERAMIC EYES |

3.2 Battery Insertion

Before first use of your tension meter, you need to insert the battery. If the  symbol is

shown on the DISPLAY , the battery is low and must be replaced immediately. Operating the tension meter with a low battery may cause measurement errors.

To insert the battery:

- Open the BATTERY COMPARTMENT which is located on the rear side of the instrument.
- Insert a 9 V battery (E block) into the BATTERY COMPARTMENT. Please ensure proper polarity.
- Close the BATTERY COMPARTMENT.

1 • **Used batteries must be disposed of in compliance with local regulations. If the instrument will not be used for a longer period of time, the battery should be removed.**

3.2.1 Switch-On

Press the POWER key until all symbols are shown on the DISPLAY



When you release the key, the DISPLAY momentarily shows the tension range and the software version, e.g. E 1.0, followed by random values or "0".

3.2.2 Switch-Off

Auto power off:

The tension meter switches off automatically after approx. 3 minutes of non-use.

Manual switch-off:

- Press the POWER key for five seconds.

3.2.3 Setting the Display Backlight

Requirement:

Instrument switched off.

To set the backlight:

- Press and hold the DAMP - MEM and POWER keys (the display backlight menu opens).
The display shows the setting that was last used.
- Release the DAMP - MEM and POWER keys.
You can now choose the required setting:
- Press the RECALL key.
The display shows L - 0 for ,no backlight'.
- Press the RECALL key once again.
The display shows L - 1 for ,automatic backlight'. The display backlight shuts off after about 5 seconds of inactivity.
- Press the RECALL key once again.
The display shows L - 2 for ,permanent backlight'.
- Press the POWER key to save the selected setting.

3.2.4 Zero Adjustment of the Measuring Position (Auto Zero)

The instrument is factory calibrated for a vertical material path. Therefore, before starting measurement you need to carry out zero adjustment, as described below, each time the tension meter is switched on. This procedure is necessary to compensate for the weight of the measuring roller in the measuring position. The zero adjustment for the new measuring path only remains effective until the instrument is switched off.



Zero adjustment must be repeated whenever the material path is changed or the tension meter does not display "0". The process material must not yet be inserted!

Requirement:

- Tension meter switched on as described in Chapter 3.2.1.

To carry out zero adjustment:

- Place the MST in the desired measuring position.
- Press the POWER key 6.

The DISPLAY 2 momentarily shows  and then switches to .
The MST is now adjusted for the new material path and is ready to measure.

3.3 Operating Procedure

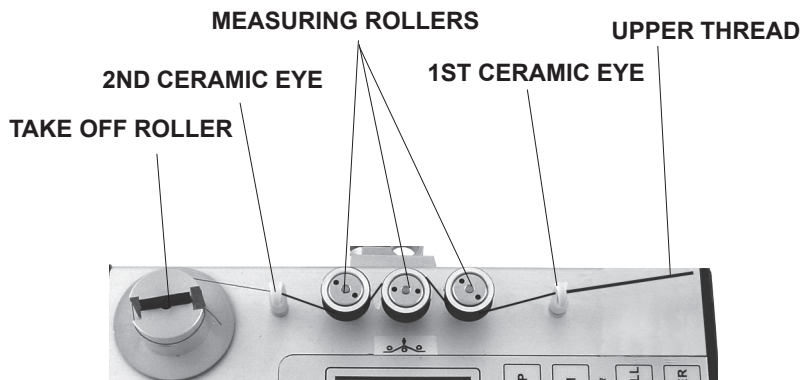
3.3.1 Measuring the Upper Tension

Requirements:

- Tension meter switched on as described in Chapter 3.2.1.
- Damping factor set, if necessary (Ch. 3.3.4)
- Zero adjustment carried out as described in Chapter 3.2.4.

To insert the process material:

- At the sewing machine, thread the upper thread all the way through to the take-up lever
- Thread the upper thread through the first CERAMIC EYE,
- and then through the MEASURING ROLLERS (see material path symbol on front side)
It is important to assure that the UPPER THREAD runs smoothly between the MEASURING ROLLERS.
- Thread the upper thread through the second CERAMIC EYE,
- and clamp it in the rubber groove of the motor-driven TAKE OFF ROLLER.



To measure the process material:

- Press the ON / OFF button to switch on the motor-driven TAKE OFF ROLLER.
The tension meter starts measuring.
- The DISPLAY shows the measured tension values.
You can simultaneously set the desired upper tension at the corresponding setscrew of the sewing machine.

If any error messages occur during measurement, please refer to Chapter 3.5 for details.

To remove the process material:

- Press the ON / OFF button to switch off the motor-driven TAKE OFF ROLLER.
- Remove the UPPER THREAD from the MEASURING ROLLERS and cut it off at the TAKE OFF ROLLER with the supplied scissors.

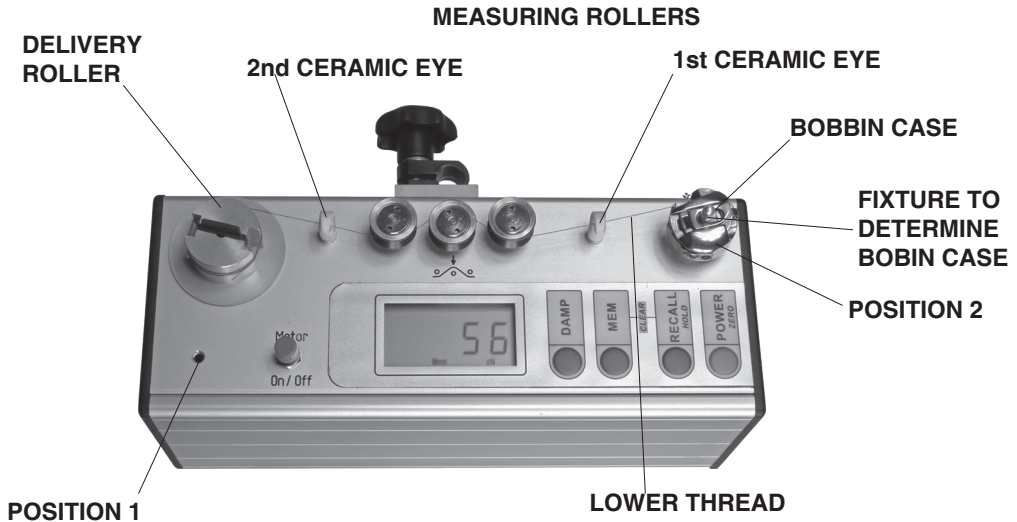
3.3.2 Measuring the Lower Tension

Requirements:

- FIXTURE TO DETERMINE BOBBIN CASE removed from POSITION 1 and screwed in at POSITION 2.
- Tension meter switched on as described in Chapter 3.2.1.
- Damping factor set, if necessary (Ch. 3.3.4)
- Zero adjustment carried out as described in Chapter 3.2.4.

To insert the process material:

- Slip the BOBBIN CASE with the full lower-thread bobbin onto the FIXTURE TO DETERMINE BOBBIN CASE- Properly insert the LOWER THREAD from the bobbin into the BOBBIN CASE.
- Thread the lower thread through the first ceramic eye,
- and then through the MEASURING ROLLERS (see material path symbol on front side). It is important to assure that the LOWER THREAD runs smoothly between the MEASURING ROLLERS.
- Thread the lower thread through the second CERAMIC EYE,
- and clamp it in the rubber groove of the TAKE OFF ROLLER.



To measure the process material:

- Press the ON / OFF button to switch on the motor-driven TAKE OFF ROLLER. The tension meter starts measuring.
- The DISPLAY shows the measured tension values. You can simultaneously set the desired lower tension at the corresponding setscrew of the BOBBIN CASE.

If any error messages occur during measurement, please refer to Chapter 3.5 for details.

To remove the process material:

- Press the ON / OFF button to switch off the motor-driven TAKE OFF ROLLER.
- Remove the LOWER THREAD from the MEASURING ROLLERS and cut it off at the TAKE OFF ROLLER with the supplied scissors.

3.3.3 Switching on Damping Mode

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

Requirements:

- Process material inserted as described in Chapter 3.3.
- 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 current reading.

To switch off damping:

- Press the DAMP key 3.

The DISPLAY shows  only the current reading.

3.3.4 Changing the Damping Factor

The tension meter is factory preset to a damping factor of 07. 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 01 = **low damping**:

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

to 15 = **high damping**


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

Requirement:

- Tension meter switched on as described in Chapter 3.2.1.

To change the damping factor:

- Press and hold the DAMP key.
The display shows the set damping factor.
You can now increase the damping factor with the MEM key and decrease it with the RECALL key.
- Release the DAMP key.
The tension meter switches back to measuring mode.

 **The selected damping factor remains stored in the MST memory even after the instrument is switched off.**

3.4 Memory Modes

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. 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	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

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.



The selected memory mode remains stored in the ETX memory even after the instrument is switched off.

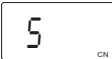
3.4.1 Memory Mode Selection

Requirements:

- Tension meter switched on as described in Chapter 3.2.1.
- Memory cleared by simultaneously pressing the MEM and RECALL keys.

To select the memory mode:

- Press and hold the MEM key.

The DISPLAY shows  **S**.

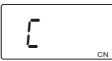
Press the DAMP or RECALL key to change the memory mode.

Memory mode “S” STANDARD (default):


The DISPLAY shows  **S**.

The STANDARD memory mode is set.

Memory mode “C” CONTINUOUS:

If the DISPLAY shows  **C**, the CONTINUOUS 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.

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

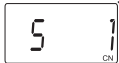
3.4.1.1 Data Logging in Mode “S” STANDARD

Requirements:

- Tension meter switched on as described in Chapter 3.2.1.
- **Memory mode “S” STANDARD** set as described in Chapter 3.4.1.
- Process material inserted as described in Chapter 3.3.

To save the first measuring period:


- Press and hold the MEM key until the



DISPLAY shows the memory mode “S” 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.




The logged tension values remain stored in the ETX memory even after the instrument is switched off.

To stop data logging:

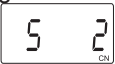
- When you want to end the measuring period, press the MEM key once again. The statistical values are calculated from the logged tension data and stored in the following order:

- 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.

You can save up to 255 measuring periods.

3.4.1.2 Data Logging in Mode “C” CONTINUOUS

Requirements:

- Tension meter switched on as described in Chapter 3.2.1.
- **Memory mode “C” CONTINUOUS** set as described in Chapter 3.4.1.
- Process material inserted as described in Chapter 3.3.

To save the first measuring period:


- 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.




The logged tension values remain stored in the ETX memory even after the instrument is switched off.

3.4.1.2 Data Logging in Mode “C” CONTINUOUS (Cont.)

To stop data logging:

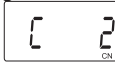
- When you want to end the measuring period, press the MEM key once again. The statistical values are calculated from the logged tension data and stored in the following order:

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

- Press the MEM key again.

The DISPLAY shows  the memory mode “C” and the next memory number.

You can save up to 255 measuring periods with a total of 4000 readings max.


3.4.1.3 Data Logging in Mode “L” LIMIT

Requirements:

- Tension meter switched on as described in Chapter 3.2.1.
- **Memory mode “L” LIMIT** set as described in Chapter 3.4.1.
- Process material inserted as described in Chapter 3.3.


To save the first measuring period:


- Press and hold the MEM key until the

DISPLAY shows  the memory mode “L” 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.

 **The logged tension values remain stored in the ETX memory even after the instrument is switched off.**


To stop data logging:

- When you want to end the measuring period, 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),


3.4.1.3 Data Logging in Mode “L” LIMIT (Cont.)

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.

To save the next measuring period:

- Press the MEM key again.

The DISPLAY shows  the memory mode “L” and the next memory number. You can save up to 255 measuring periods with up to 10 readings each.

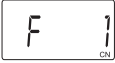
3.4.1.4 Data Logging in Mode “F” FAST

Requirements:

- Tension meter switched on as described in Chapter 3.2.1.
- **Memory mode “F” FAST** set as described in Chapter 3.4.1.
- Process material inserted as described in Chapter 3.3.

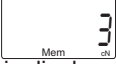
To save the first measuring period:

- Press and hold the MEM key until the

DISPLAY shows  the memory mode “F” and the current memory number.

- 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.




The logged tension values remain stored in the ETX memory even after the instrument is switched off.

To stop data logging:

- When you want to end the measuring period, 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).
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

3.4.1.4 Data Logging in Mode “F” FAST (Cont.)

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 “F” and the next memory number.

You can save up to 255 measuring periods with a total of 4000 readings max.

3.4.2 Recalling the Stored Tension Values

With the TENSION INSPECT software from SCHMIDT, you can easily and accurately evaluate the stored tension values and export them to an Excel sheet.

3.4.2.1 Recalling the Stored Tension Values in Mode “S” STANDARD

Requirement:



- Tension meter switched on as described in Chapter 3.2.1.

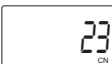
To recall the tension values:



- Press the RECALL key.

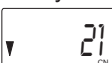

You can end recall any time by pressing the POWER key.



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 _{MAX} :	26.0	PEAK _{MAX} :	28.1	PEAK _{MAX} :	28.1	PEAK _{MAX} :	28.1
PEAK _{MIN} :	19.0	PEAK _{MIN} :	1.8	PEAK _{MIN} :	1.8	PEAK _{MIN} :	1.8

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)** of the measuring period and the  symbol.

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

- Press the RECALL key. The DISPLAY blinks, showing  the **maximum peak value (PEAK_{MAX})** of the measuring period, the PEAK indicator and the  symbol.

3.4.2.1 Recalling the Stored Tension Values in Mode “S” STANDARD (Cont.)

- Press the RECALL key. The DISPLAY blinks, showing  the **minimum peak value** (PEAK_{MIN}) of the measuring period, the PEAK indicator and the ▼ symbol.
- Press the RECALL key.
The next measuring period (POS: 2) is shown on the DISPLAY, starting with the **average value** (AVG).

3.4.2.2 Recalling the Stored Tension Values in Mode “C” CONTINUOUS Requirement:


- Tension meter switched on as described in Chapter 3.2.1.


To recall the tension values:


- Press the RECALL key.


You can end recall 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 _{MAX} :	26.0	PEAK _{MAX} :	28.1	PEAK _{MAX} :	28.1	PEAK _{MAX} :	28.1
PEAK _{MIN} :	19.0	PEAK _{MIN} :	1.8	PEAK _{MIN} :	1.8	PEAK _{MIN} :	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) of the measuring period and the ▲ symbol.

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

3.4.2.2 Recalling the Stored Tension Values in Mode “C” CONTINUOUS (Cont.)

- Press the RECALL key. The DISPLAY blinks, showing  the **maximum peak value** (PEAK_{MAX}) of the measuring period, the PEAK indicator and the ▲ symbol.
- Press the RECALL key. The DISPLAY blinks, showing  the **minimum peak value** (PEAK_{MIN}) 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).

3.4.2.3 Recalling the Stored Tension Values in Mode “L” LIMIT

Requirement:


- Tension meter switched on as described in Chapter 3.2.1.

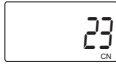
To recall the tension values:


- Press the RECALL key.

You can end recall 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
PEAK _{MAX} :	26.0	PEAK _{MAX} :	28.1	PEAK _{MAX} :	28.1	PEAK _{MAX} :	28.1
PEAK _{MIN} :	19.0	PEAK _{MIN} :	1.8	PEAK _{MIN} :	1.8	PEAK _{MIN} :	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

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) of the measuring period and the ▲ symbol.

3.4.2.3 Recalling the Stored Tension Values in Mode “L” LIMIT (Cont.)

- Press the RECALL key. The DISPLAY blinks, showing  the **minimum value (MIN)** of the measuring period and the ▼ symbol.
- Press the RECALL key. The DISPLAY blinks, showing  the **maximum peak value (PEAK_{MAX})** of the measuring period, the PEAK indicator and the ▲ symbol.
- Press the RECALL key. The DISPLAY blinks, showing  the **minimum peak value (PEAK_{MIN})** of the measuring period, the PEAK indicator and the ▼ symbol.
- Press the RECALL key. The measured values no. 1 — 10 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)**.

3.4.2.4 Recalling the Stored Tension Values in Mode “F” FAST Requirement:

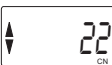
- Tension meter switched on as described in Chapter 3.2.1.

To recall the tension values:


- Press the RECALL key.


You can end recall any time by pressing the POWER key.

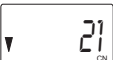
Memory Mode FAST ⇒ ⇒ ⇒ ⇒ ⇒ ⇒ ⇒ ⇒ ⇒ ⇒ ⇒ ⇒ ⇒ ⇒ ⇒ ⇒							
Pos:	1	Pos:	2	Pos:	3	Pos:	4
AVG:	22.0	AVG:	12.0	AVG:	12.0	AVG:	12.0
Last:	23.0	Last:	22.1	Last:	22.1	Last:	22.1
MAX:	24.0	MAX:	22.1	MAX:	22.1	MAX:	22.1
MIN:	21.0	MIN:	5.4	MIN:	5.4	MIN:	5.4
PEAK _{MAX} :	26.0	PEAK _{MAX} :	28.1	PEAK _{MAX} :	28.1	PEAK _{MAX} :	28.1
PEAK _{MIN} :	19.0	PEAK _{MIN} :	1.8	PEAK _{MIN} :	1.8	PEAK _{MIN} :	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.


3.4.2.4 Recalling the Stored Tension Values in Mode "F" FAST (Cont.)

- 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) of the measuring period and the ▲ symbol.

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

- Press the RECALL key. The DISPLAY blinks, showing  the **maximum peak value** (PEAK_{MAX}) of the measuring period, the PEAK indicator and the ▲ symbol.

- Press the RECALL key. The DISPLAY blinks, showing  the **minimum peak value** (PEAK_{MIN}) 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).

3.4.3 Clearing the ETX Memory

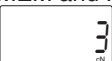
If values are stored in the ETX memory, the DISPLAY shows e.g.



with the MEM indicator.

To clear the memory:

- Simultaneously press the MEM and RECALL keys.

The DISPLAY shows e.g. ; all values stored in the memory have been deleted.

3.5.4 Memory Function HOLD

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

To retain the last reading:

- Press the RECALL / HOLD key once for about 1 second.

The DISPLAY shows the last reading  and the ":" colon symbol.

To switch back to measuring mode:

- Press the RECALL / HOLD key once for about 1 second.

The tension meter switches back to measuring mode.

3.5 Error Messages

Error message 1:



- The DISPLAY shows

The upper limit of the tension range was exceeded by more than 10%.

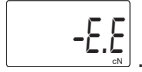
Reduce the line tension

OR

AUTO ZERO is no longer possible.

Recalibrate the instrument following the directions in Chapter 3.7.1.

Error message 2:



- The DISPLAY shows

The lower limit of the tension range was fallen below by more than 10%.

Properly insert the process material

OR

AUTO ZERO is no longer possible.

Recalibrate the instrument following the directions in Chapter 3.7.1.

Error message 3:



- The DISPLAY shows

The battery is low and must be replaced immediately. Operating the tension meter with a low battery may cause measurement errors.

3.6 Verification of Measuring Accuracy

All tension meters are calibrated with standard materials - such as polyamide monofilament (PA) - according to the SCHMIDT factory procedure. 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.

Requirements:

- The MST is factory calibrated for a vertical material path (fig. 3.6).
The verification of accuracy must also be carried out with a vertical material path. Tension meter switched on as described in Chapter 3.2.1.
- The required reference weight must be provided.
- Hang a weight which corresponds to the tension to be measured (pay attention to the correct unit of measure) from the measured material, vertically, as shown here. The weight must hang freely, therefore, place the instrument near the edge of the table, if necessary.

Verification procedure:

- Clamp the process material in the rubber groove of the motor-driven DELIVERY ROLLER and thread it through the MEASURING ROLLERS.
- The correct material path is indicated by the red material path symbol on the front of the tension meter.
- 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 Chapter 3.7.



fig 3.6

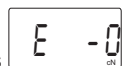
3.7 Calibration of the MST

Requirements:

- The MST is factory calibrated for a vertical material path (fig. 3.6.).
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 MEM and POWER keys until the DISPLAY shows
- Release first the POWER key and then the MEM key.



3.7 Calibration of the MST (Cont.)

To calibrate the zero point:

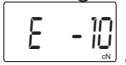
- Press the MEM key.
As long as the MEM key is depressed, the DISPLAY shows a random decimal value between 500 and 1200 e.g.

 800

This decimal value may vary from instrument to instrument.

Write down the decimal value.

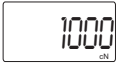
- Release the MEM key when the value shown on the DISPLAY is fairly stable (the reading might fluctuate greatly).

The display 2 shows  E - 10

1st calibration point:

- Hang a weight which corresponds to 10% of the tension range from the measured material, vertically, as shown in fig. 3.6.
 - Clamp the process material in the rubber groove of the motor-driven DELIVERY ROLLER and thread it through the MEASURING ROLLERS.
The correct material path is indicated by the red material path symbol on the front of the tension meter.
- a) Press the MEM key.

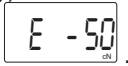
As long as the MEM key is depressed, the DISPLAY shows a decimal value which is

higher by approx. 200 than the first decimal value, e.g.  1000

This decimal value may vary from instrument to instrument.

Write down the decimal value.

- Release the MEM key when the value shown on the DISPLAY is stable (the reading might fluctuate greatly).

The DISPLAY shows  E - 50

If the display shows  E - 10 again, the value was not accepted.

Check the suspended weight and the material path between the MEASURING ROLLERS and repeat the procedure from step a.

2nd calibration point:

- Hang a weight which corresponds to 50% of the tension range from the measured material, vertically, as shown in fig. 3.6.
- Clamp the process material in the rubber groove of the motor-driven DELIVERY ROLLER and thread it through the MEASURING ROLLERS.
The correct material path is indicated by the red material path symbol on the front of the tension meter.




fig 3.6

3.7 Calibration of the MST (Cont.)

b) Press the MEM key 4.

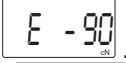
As long as the MEM key is depressed, the DISPLAY shows a decimal value which is higher by approx. 800 than the

second decimal value, e.g.  .

This decimal value may vary from instrument to instrument.

Write down the decimal value.

- Release the MEM key when the value shown on the DISPLAY is stable (the reading might fluctuate greatly).

The DISPLAY shows  .

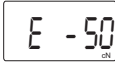
If the DISPLAY shows  again, the value was not accepted. Check the suspended weight and the material path between the measuring rollers and repeat the procedure from step b.



fig 3.6

3rd calibration point:

- Hang a weight which corresponds to 90% of the tension range from the measured material, vertically, as shown in fig. 3.6.
- Clamp the process material in the rubber groove of the motor-driven DELIVERY ROLLER and thread it through the MEASURING ROLLERS. The correct material path is indicated by the red material path symbol on the front of the tension meter.

c) Press the MEM key.

- Release the MEM key.

The DISPLAY shows  .

The new calibration has been stored.

If the DISPLAY shows  again, the value was not accepted.

Check the suspended weight and the material path between the measuring rollers and repeat the procedure from step c.

- Press the POWER key.

The tension meter switches off.

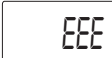
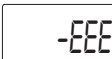
Verify the new calibration, following the directions in Chapter 3.6.

If this procedure shows a deviation, you can recalibrate the tension meter again or restore the factory calibration as described in Chapter 3.7.2.

If the verification of the calibration according to Chapter 3.6 shows a deviation beyond the allowable tolerance and a reliable operation is no longer allowed, the instrument has to be returned to **Hans Schmidt & Co GmbH** for factory recalibration. Please follow the shipping instructions given in Chapter 8.

3.7.1 Error Messages During Calibration

The following error messages might be displayed during the calibration of the tension meter:

- The DISPLAY shows  .
The weight suspended from the process material is too heavy.
- The DISPLAY shows  .
The weight suspended from the process material is too light.

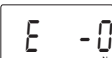
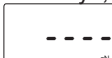
3.7.2 Restoring the Factory Calibration

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

Requirement:

- Tension meter switched off.

To restore factory calibration:

- Press and hold the MEM and POWER keys until the DISPLAY shows  .
- Release first the POWER key and then the MEM key.
- Press and hold the DAMP and RECALL keys, then additionally press and hold the MEM key until the DISPLAY shows  .
The factory calibration is restored.
- Release the DAMP, RECALL and MEM keys
- Press the POWER key.
The instrument switches off.

4 PC Communication (RS-232-C Interface)

4.1 WINDOWS Terminal Program

The measured values and the memory contents can be transmitted over the RS-232 interface to a personal computer. You can connect the computer to the connector of the MST by using the ET2-CC special cable which is available as an accessory. The pin assignment of the connector is described in Chapter 2.2.

Requirement:

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
D	Continuous transmission	Continuous transmission of readings. Press any key to stop transmission.
d	Send	Transmit current reading to PC once.
m	Save	Start logging of measured data. Stop data logging.
r	Output	Output the memory contents to the PC.
c	Clear memory	Delete the memory contents.
a	Damping ON / OFF	Switch damping on or off.
z	Zero	Carry out zero adjustment of the instrument.

4.2 TENSION INSPECT SW-T13

SCHMIDT software (Win XP or higher) for viewing and storing the measured data on a PC (optionally available).

5 Service and Maintenance

The tension meter is easy to maintain. Depending on operating time and load, the tension meter should be checked according to the locally valid regulations and conditions (as described in Chapter 3.6). The use of other test methods than the procedure described in Chapter 3.6 may cause deviating measuring results.

6 Cleaning

For cleaning the unit, do not use any



AGGRESSIVE SOLVENTS

such as trichloroethylene or similar chemicals.

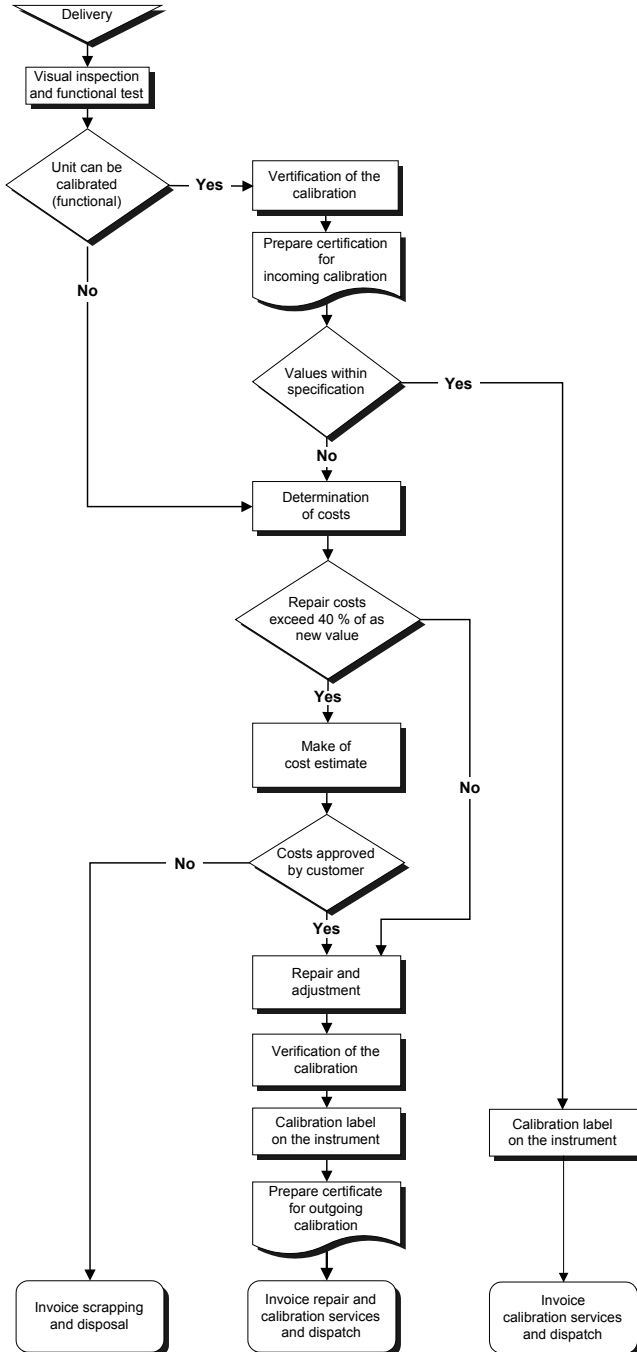


NO WARRANTY OR LIABILITY

shall be accepted for damage resulting from improper cleaning.

7 Verification of Calibration and Determination of Repair Costs

Flow chart for verifying the calibration of used tension meters, incoming and outgoing verification with Inspection Certificate 3.1 according to DIN EN 10204



8 Correspondence

Should you have any questions regarding the tension meter or Operating Instructions, or their use, please indicate above all the following details which are given on the ID plate:

- 1) The tension meter model
- 2) The serial number

9 Repairs

Shipping instructions:

We kindly ask for return free of charge for us, if possible by airmail parcel. All occurring charges, if any (such as freight, customs clearance, duty, etc.) will be billed to customer. For return from foreign countries, we ask you to include a proforma invoice with a low value for customs clearance only, e.g. 50 Euro, each and to advise the shipment in advance by fax or eMail.



To avoid unnecessary follow-up questions, and the resulting loss of time or possible misunderstandings, please return the tension meter with a detailed fault description to our service department. Please indicate in your order whether you require an Inspection Certificate 3.1 according to DIN EN 10204.