

Tension Sensors

TS2 Series



TS2



TS2P



TS2B



TS2H



TS2L

Operating Manual

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WARNING



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

1.0 INTRODUCTION

The TS2 Series of universal tension sensor accurately measure the running tension of wires, cables, yarns, fibers and similar process material.

2.1 Delivery

- Sensor (1)
- Operating Instructions (1)

2.2 Unpacking

Unpack the instrument 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.

2.3 Model and Serial Numbers

The model number, serial number and calibration label (option) are provided on the cylindrical portion of the sensor.

TS2-1K	+	ASY	=	TS2-1K-ASY
Model with tension range		Code for guide rollers (<i>if not standard</i>)		Complete Model No.

2.0 AVAILABLE MODELS

2.1 TS2 Models



Model	Tension Ranges [g]	*Measuring Head Width [mm]	**Factory Calibration Material
TS2-50	0 - 50	64	PA: 0.12 mm Ø
TS2-100	0 - 100	64	PA: 0.12 mm Ø
TS2-200	0 - 200	64	PA: 0.12 mm Ø
TS2-500	0 - 500	64	PA: 0.20 mm Ø
TS2-1K	0 - 1000	64	PA: 0.30 mm Ø
TS2-2K	0 - 2000	124	PA: 0.50 mm Ø
TS2-5K	0 - 5000	124	PA: 0.80 mm Ø
TS2-10K	0 - 10 Kg	124	PA: 1.00 mm Ø
TS2-20K	0 - 20 Kg	224	PA: 1.50 mm Ø
TS2-50K	0 - 50 Kg	224	Steel rope: 1.5mm Ø (7 x 7 x 0.20)

TS2 Guide Rollers

V-Groove	Line Speed [m/min ... max.]	Roller Material
Standard	2000	Hardcoated aluminium
Code K	3500	Hardcoated aluminium
Code H	5000	Plasma-coated aluminium (TS2-100 and higher ranges)
Code T	1000	Plastic (POM) black
Code W	1000	Nickel-plated steel
Code ST	1000	Hardened steel
Code B	1000	Tempered steel, specially for measuring tire cord
Code CE1	1000	Ceramic
Asymmetrical Groove Code ASY	1000	Hardcoated aluminium (TS2-500 and higher ranges)
Code ASYB	1000	Tempered Steel (TS2-500 and higher ranges)
U-Groove Code U	2000	Hardcoated aluminium (TS2-500 and higher ranges)

* Depending on model, either width of filament guide or outer distance between outside guide rollers.

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

Should the process material differ significant from the factory calibration material in size, rigidity or shape, we recommend special calibration using customer supplied material.

International unit of tensile force:

$$\begin{array}{lcl} 1 \text{ g} & = & 1.02 \text{ g} \\ 1 \text{ Kg} & = & 1.02 \text{ kg} \end{array} \quad \begin{array}{lcl} = & & = \\ = & & = \end{array} \quad \begin{array}{l} 0.01 \text{ N} \\ 10.00 \text{ N} \end{array}$$

2.2 TS2P Models



Model	Tension Ranges [g]	*Measuring Head Width [mm]	**Factory Calibration Material
TS2P-50	0 - 50	64	PA: 0.12 mm Ø
TS2P-100	0 - 100	64	PA: 0.12 mm Ø
TS2P-200	0 - 200	64	PA: 0.12 mm Ø
TS2P-500	0 - 500	64	PA: 0.20 mm Ø
TS2P-1K	0 - 1000	64	PA: 0.30 mm Ø

TS2P Guide Rollers

Ceramic Pins	Line Speed [m/min ... max.]	Pin Material
Standard	2000	Oxid ceramic 5.2 mm Ø

2.3 TS2H Models



Model	Tension Ranges [g]	*Measuring Head Width [mm]	**Factory Calibration Material
TS2H-1K	0 - 1000	150	PA: 0.30 mm Ø
TS2H-2K	0 - 2000	150	PA: 0.50 mm Ø
TS2H-5K	0 - 5000	150	PA: 0.80 mm Ø
TS2H-10K	0 - 10 Kg	200	PA: 1.00 mm Ø
TS2H-20K	0 - 20 Kg	240	PA: 1.50 mm Ø
TS2H-50K	0 - 50 Kg	240	Steel rope: 1.5mm Ø (7 x 7 x 0.20)

TS2H Guide Rollers

V-Groove	Line Speed [m/min ... max.]	Roller Material
Standard	4000	Hardened-steel roller
U-Groove Code R1	4000	Hardened-steel roller (radius 5)

2.4 TS2L Models



Model	Tension Ranges [g]	*Measuring Head Width [mm]	**Factory Calibration Material
TS2L-50	0 - 50	150	PA: 0.12 mm Ø
TS2L-100	0 - 100	150	PA: 0.12 mm Ø
TS2L-200	0 - 200	150	PA: 0.12 mm Ø
TS2L-500	0 - 500	150	PA: 0.20 mm Ø
TS2L-1K	0 - 1000	150	PA: 0.30 mm Ø

TS2L Guide Rollers

V-Groove	Line Speed [m/min ... max.]	Roller Material
Standard	4000	Hardcoated aluminium
Code T	4000	Plastic (PVC red) (same dimensions as standard roller)

2.5 T2B Models



Model	Tension Ranges [g]	*Measuring Head Width [mm]	Roller Widths [mm]
TS2B-100	0 - 100	60	7, 10, 15, 20
TS2B-200	0 - 200	60	7, 10, 15, 20
TS2B-500	0 - 500	60	7, 10, 15, 20
TS2B-1K	0 - 1000	60	7, 10, 15, 20
TS2B-2K	0 - 2000	120	7, 10, 15, 20
TS2B-5K	0 - 5000	120	7, 10

TS2B1 Guide Rollers

V-Groove	Line Speed [m/min ... max.]	Roller Material
Standard	1000	Hardcoated aluminium (exception: 7 mm rollers are made of nickel-plated steel)

* Depending on model, either width of filament guide or outer distance between outside guide rollers.

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

Should the process material differ significant from the factory calibration material in size, rigidity or shape, we recommend special calibration using customer supplied material.

International unit of tensile force:

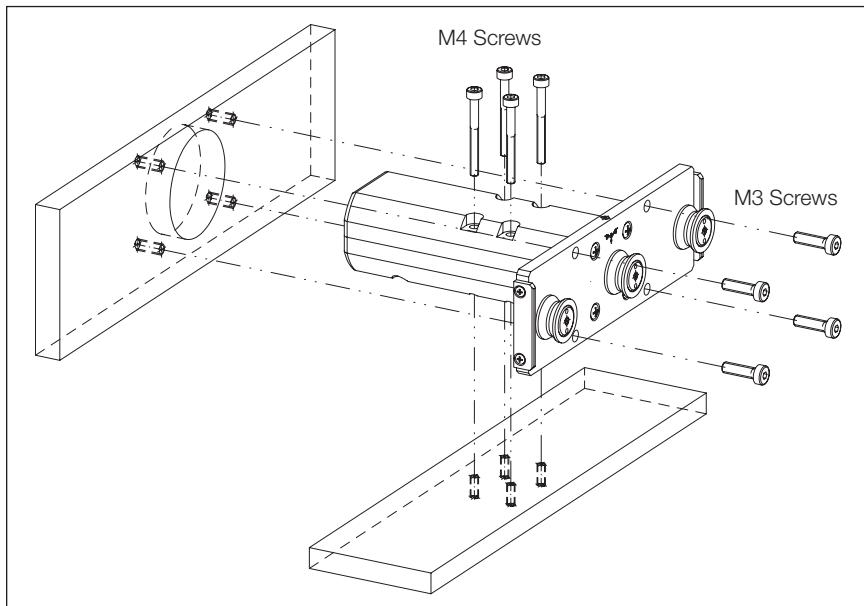
$$\begin{array}{lll} 1 \text{ g} & = & 1.02 \text{ g} \\ & & = 0.01 \text{ N} \\ 1 \text{ Kg} & = & 1.02 \text{ kg} \\ & & = 10.00 \text{ N} \end{array}$$

3.0 OPERATING PROCEDURES

3.1 Mounting Arrangements

TS2 Series sensors can be mounted in different ways:

- Mounting by using the frontplate on a cylindrical hole (cut out 38.5 - 40 mm Ø)
- Mounting on a flat platform



3.2 Connector Assignment

NOTE: To assure immunity to random noise, the measuring head must be installed so that it is insulated from ground (GND). The shield of the connecting cable must be connected to the metal housing of the connecting plug.

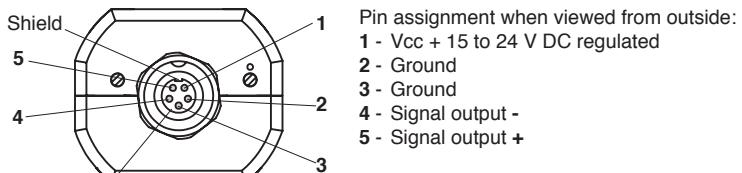
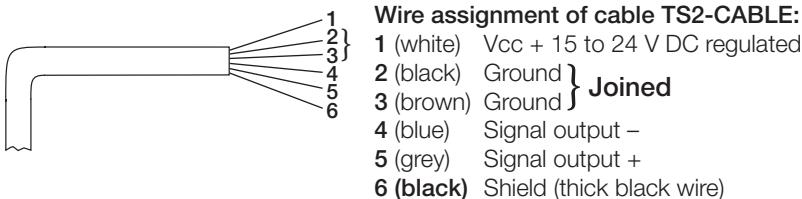


fig. 2.3a

Female socket M9 (series 712 - company Binder)



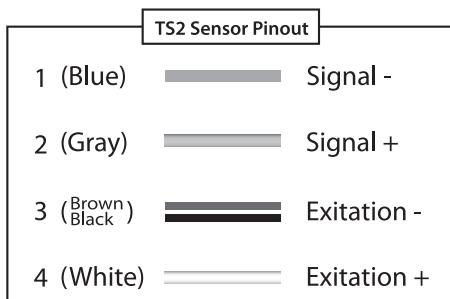
3.3 Options

Code **DC** Analog output 0 - 10 V DC

Code **MA** Analog output 4 - 20 mA

3.4 Initial Setup

- Install the sensor at the desired measuring location.
- Connect the sensor to the supplied or existing display unit. The pin assignment of the 5-pin connector located on the rear side of the sensor is described in section 3.2.
- If the material path is other than vertical or if the process material deviates significantly from the factory calibration material, you need to carry out ZERO Adjustment and GAIN Adjustment as described in sections 4.1 and 4.2 before starting measurement.
- Allow approx. 10 minutes for thermal stabilization of the sensor.
- Thread the process material through the measuring and guide rollers, following the material path symbol on the front of the sensor.



4.0 INTERNAL ADJUSTMENT OF THE SENSORS

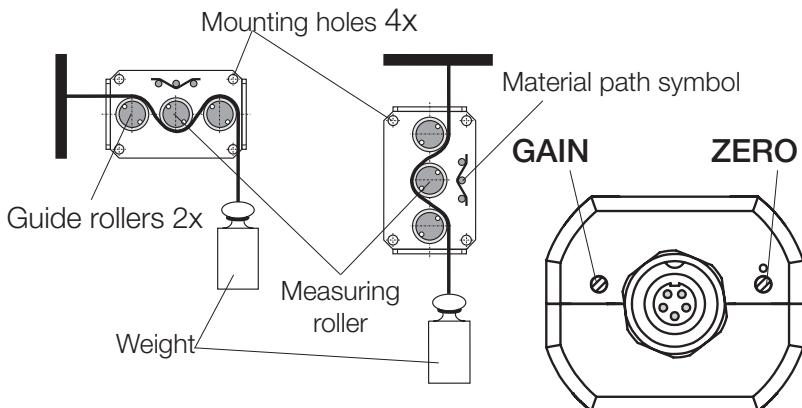
If the sensor has been delivered with a display unit, the ZERO and GAIN adjustments should only be carried out with the supplied display unit.

All tension meters are calibrated with standard material, such as polyamide monofilament (PA), according to the factory procedure; the material path is vertical. 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 also operate the sensors with a material path other than vertical. Should the process material differ significantly from the factory calibration material in size, rigidity or shape, we recommend special calibration using customer supplied material. If the material path is other than vertical or if the process material deviates significantly from the factory calibration material, you need to carry out static ZERO and GAIN adjustment as described in sections 4.1 and 4.2.

4.1 ZERO Adjustment



1. Install the sensor in the desired position at the measuring location using the provided mounting holes.
2. Allow approximately ten minutes for thermal stabilization of the sensor.
3. Thread the process material through the measuring and guide rollers, following the material path symbol on the front of the sensor.



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

4. Install the sensor in the desired position at the measuring location using the provided mounting holes.
5. Allow approximately ten minutes for thermal stabilization of the sensor.
6. Thread the process material through the measuring and guide rollers, following the material path symbol on the front of the sensor.



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

NOTE: Since ZERO and GAIN adjustments are always performed statically, the readings may differ under dynamic load.

7. Hang a weight that corresponds to e.g. 10% of the tension range from the process material.
8. Connect a volt meter to pins 4 and 5 of the connector on the rear side of the unit.
9. Adjust the potentiometer, which you can reach through the ZERO hole in the housing, with a screwdriver (with a point width of max. 1.9 mm) until the display of the connected volt meter reads,

for example:

Sensor model TS2 - 200:

Weight 20 g = Display 0.100 V for the TS2 standard version

or

Weight 20 g = Display 1.00 V for the TS2 version with 10 V output signal.



WARNING: Do not insert the screwdriver at an angle as this may damage the potentiometer.

4.2 GAIN Adjustment

Requirement: ZERO adjustment carried out.

1. Thread the process material through the measuring and guide rollers, following the material path symbol on the front of the sensor.
2. Hang a weight that corresponds to e.g. 95% of the tension range from the process material.
3. Adjust the potentiometer, which you can reach through the GAIN hole in the housing, with a screwdriver (with a point width of max. 1.9 mm) until the display of the connected volt meter reads,

for example:

Sensor model TS2 - 200:

Weight 190 g = Display 0.950 V for TS2 standard version

or

Weight 190 g = Display 9.50 V for TS2 version with 10 V output signal.



WARNING: Do not insert the screwdriver at an angle as this may damage the potentiometer.

4. Check the adjustments with a fresh portion of the process material and repeat the procedure, if required, as described in Chapters 3.3.1 and 3.3.2.

5.0 SPECIFICATIONS

5.1 General Specifications

Calibration	According to factory procedure
Accuracy	For 10% to 100% of range: $\pm 1\%$ Full Scale Other calibration material: $\pm 3\%$ Full Scale or better
Overload Protection	100% of range
Measuring Principle	Strain gauge bridge
Meas. Roller Deflection	0.5 mm, max.
Natural Frequency of Measuring Spring	Approx. 500 Hz, depending on tension range
Signal Processing	Analog
Output Signal	0 - 1 V DC, impedance: $> 5 \text{ kOhm}$ (standard)
Option Code DC	0 - 10 V DC
Damping (fg)	Standard: approx. 30 Hz (other values on request)
Temperature Coefficient	Zero point: less than $\pm 0.05\%$ FS* / °C
Temperature Range	10 – 45 °C
Air Humidity	85% RH, max.
Power Supply	15 to 24 V DC (21mA) (regulated) Option code A3: max. 50 mA
Housing	Aluminium

6.0 MAINTENANCE AND SERVICE

The tension meter is easy to maintain. Depending on operating time and load, the instrument should be checked according to the locally valid regulations and conditions. The use of other test methods than the procedure described in section 4.0 may cause deviating measuring results.

6.1 Cleaning

When cleaning the unit, do not use an aggressive solvents, such as trichloroethylene or similar chemicals. No warranty or liability shall be accepted for damage resulting from improper cleaning.

6.2 Care of the Rollers

You should regularly inspect the rollers to assure that they are running easily and smoothly. You can replace the rollers yourself, as necessary. Please indicate the tension meter model and the serial number in your spare-parts order.

6.3 Verifications Interval

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 to the tolerance band compared to previous calibrations

Therefore, the interval between verifications of calibration 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 one year.

7.0 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.

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