

## ***Operating instructions***

### *Pressure transducer tensiometer*



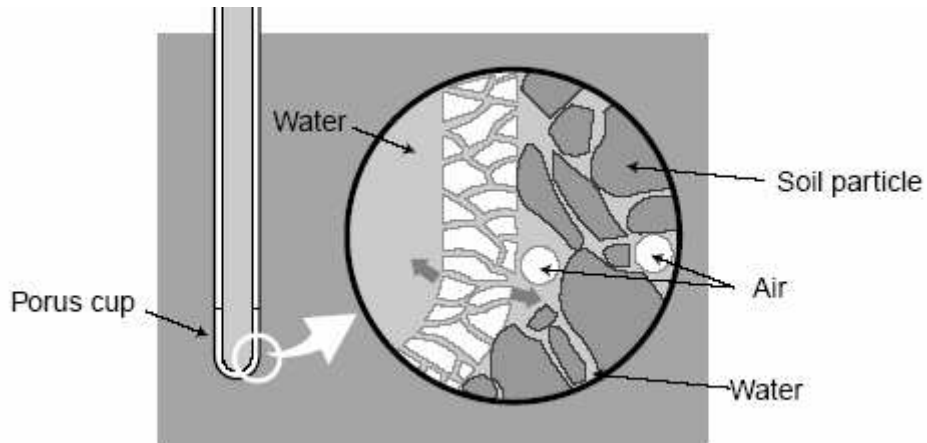
**1.0226.51.073**  
***(Tensio151)***  
***Output 0-5V***

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# 1. Structure and technical parameters

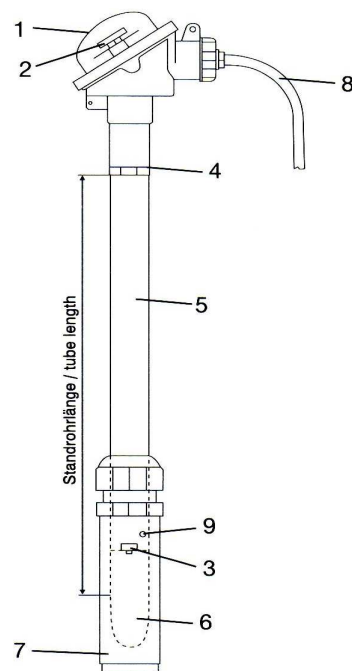
## How it works



Water moves freely in and out of the ceramic cell – an porous cup. As the soil dries, the water moves from the ceramic cell into the soil, creating a vacuum in the tube. This is registered. The drier the soil becomes, the higher the registered amount, indicating that it is more difficult for the plant to extract water from the soil. After irrigation or rainfall, water moves back into the ceramic cell.

## Structure

- (1) Gehäuse  
Housing
- (2) Operationsverstärker  
Operational amplifier
- (3) Druckwandler  
Pressure transducer
- (4) Dichtring  
Sealing ring
- (5) Standrohr  
Tensiometer tube
- (6) Tensiometerzelle  
Tensiometer cell
- (7) Transporthülle  
Protection tube
- (8) Anschlußkabel  
Measuring cable
- (9) Temperatursensor  
Temperatur sensor



The electronic tensiometer has a high-precision pressure transducer for continuous measurement of soil water tension and is helpful for the monitoring of a wide range of ecological aspects.

The functioning principle of the electronic tensiometer consists in the measurement of soil water tension on the basis of pressure balance between tensiometer fluid and surrounding soil through a diaphragm (ceramic plate). The tensiometer fluid is used to transmit the suction pressure to the transducer. The latter turns the tension into a defined continuous electric measuring signal.

Data loggers or personal computers are used for continuous data recording.

### Spezifikationen

Measuring range:	0... -85 kPa
Operating temperature:	0... +40 °C
Response time:	< 3s
Power supply:	12...24 VDC, 0,5 VA
Output signals:	0...5 VDC, 0...1 VDC 0...20 mA 4...20 mA, 200...3200 Hz
Non-linearity:	< 0,5 % K <sup>-1</sup>
Temperature coefficient:	0,025 % K <sup>-1</sup>
Ceramic cellsize Tensio 150:	ø 10 mm, Höhe 26 mm
Ceramic cellsize Tensio 151:	ø 20 mm, Höhe 50 mm
Tube length Tensio 150:	600 mm (standard) 300 mm, 900 mm spec. length on reg.
Tube length Tensio 151:	600 mm (standard) 300 mm, 900 mm length up to 5 m
Cable length:	5 m (standard) 10 m, 20 m

### Additional features

- Insertion auger, depth up to 100 cm
- Refilling unit

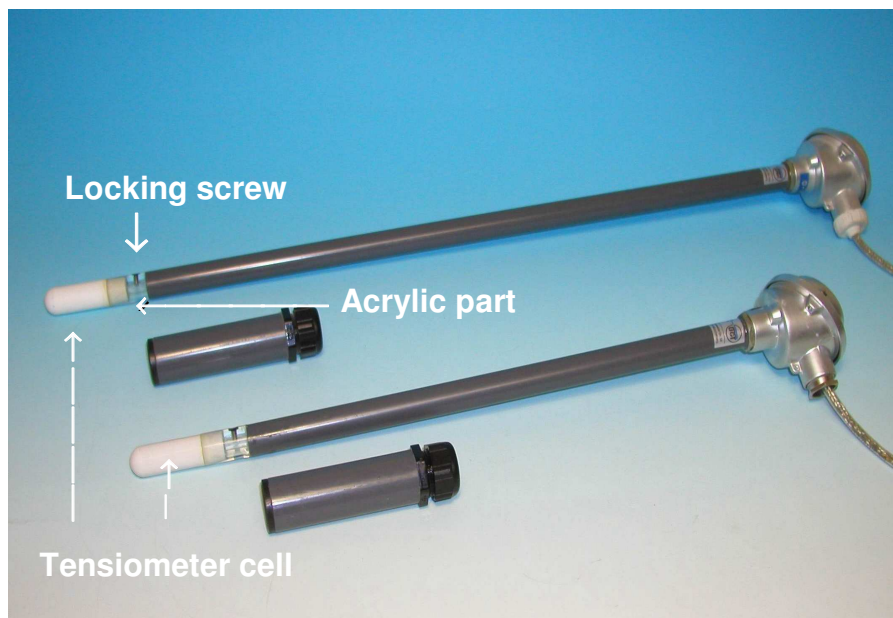
## 2. Getting ready for use

### **Caution!**

*The tensiometer will be delivered ready for use. The tensiometer cell is filled with distilled water. During the transport the ceramic cell will be protected against mechanical load and dehydration by a protective tube with cap, screw and sponge.*

Before installing the tensiometer its recommended to check the tensiometer cell for air pockets. Any air pocket inside will be visualised in the acrylic part of the tensiometer cone. Please hold the tensiometer upright and very softly knocking on the standpipe and then slowly turn the tensiometer at 90° and you might see some bubbles. Try to keep the bubbles around the locking screw. The air pockets will be pushed out by screwing out the locking screw of the acrylic part and refilling distilled water. After refilling please carefully screw in the locking screw until the O-ring sealed the feed opening allready. No bubbles should longer be inside.

The tensiometer is now ready for use and shall remain in the transport case until getting installed. Take care that the sponge in the transport case is always kept wet.



### **3. Measurement**

The tensiometer is a high precision and very sensitive measuring device. Before and during the installation a contact with the tensiometer cell should be avoided.

Please consider morphologic and vegetable aspects while choosing the measuring points in the field. The tensiometer must be put in a representative position.

#### ***Equipment***

- sets of tensiometers to give measurements at different zones
- hand auger needed to make the hole for the tensiometer

#### ***Installation***

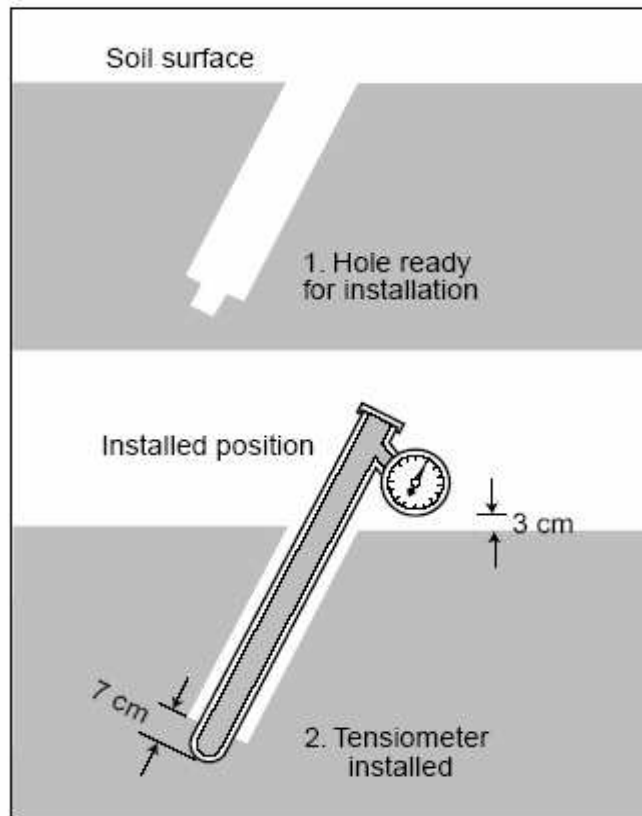
The installation of tensiometers and other soil hydrological sensors best should be done in spring time or in late autumn. The soil moisture content must conform to the measuring range of the tensiometer itself (0 ... 90kPa).

Installing the tensiometer three installation methods can be recommended:

- Horizontal installation from a measuring shaft
- Vertical installation after making a borehole
- Slantwise installation

The optimal connection of the tensiometer cell to the soil matrix is essential for recording plausible measuring data. Therefore first make a boring hole up to the depth the tensiometer should be installed in. The auger you use should have a conical end for reducing the diameter in the area of the ceramic – soil – contact. Later the homogenic drilling core and some water should be used for making the mud. This mud is necessary to ensure good contact between the ceramic and the surrounding soil.

If mud is added to the hole the tensiometer will read wetter then the surrounding soil for a few days.



Principle of tensiometer installation (slantwise)

For making the mud eliminate bigger particles by sieving or sedimentation otherwise they will jam against the side of the tensiometer, causing air pockets to form. These air pockets can help air to enter the ceramic, or hold more water than the surrounding soil, leading to false readings. The consistence of the mud should be between thin fluid and pasty. Before installing the tensiometer put some mud into the bottom of the hole.

Then put in the tensiometer softly. Please be aware that the surface of the ceramic will not touch the wall of the borehole. It might smeared to pores of the ceramic.

With the standpipe the tensiometer can be pressed on softly and be adjusted vertical, horizontal or slantwise. Simultaneously the mud can be filled in the borehole up to a few centimeters above the ceramic cell. At least fill up the borehole with dry autochthonous substrat. To avoid preferred trickle paths along the tensiometer tube the rubber sleeve sealed the boring area against precipitation and run-off.

While using allochthonous mud substrat always be aware of the influence of sorption and desorption.

## 4. Upkeep and Maintenance

- In case there is air in the tensiometer, find out the source of air intake and restore tightness
- Remove air bubbles by refilling with distilled water through the locking screw
- Keep sponge in transport case wet
- Protect tensiometer against mechanical load

## 5. Connections

	<i>cable colour</i>	<i>Signal name</i>
1	yellow	Power V+
2	brown	Power0V
3	green	out 0-1V (0-5V)
4	white	Signal 0V
5	yellow/green	screen

in case of integrated PT100 temperature sensor:

6	pink	A
7	grey	
	}	B
8	blue	