

Manual for Digital Tensiometer

Description

Your Tensiometer is a precision instrument, measuring the soil moisture. Measuring the moisture of soil shows the necessity to irrigate plants, and helps to manage amount and frequency of irrigation water applications. Only plants growing under optimal soil moisture, can produce best results.

Your Tensiometer consists of:

1. the ceramic tip with Micropores
2. the shaft of transparent acrylic pipe (during operation filled with water)
3. the digital manometer with ON button
4. the threaded sealing connection

The manometer measures low pressure between 0 to 750 hPa (= mbar) in steps of 10 mbar.

Precautions

To avoid damages to your Tensiometer, the following precautions must be observed:

- The components of the Tensiometer must be protected from shocks (do not drop on the ground, do not beat the instrument with a hammer into the soil etc.)
- The Tensiometer may not be exposed to temperatures below 0° degrees Celsius as long as it is filled with water
- The ceramic mustn't come into touch with grease, oil or other substances which could close the pores
- Never put digital manometer fully under water

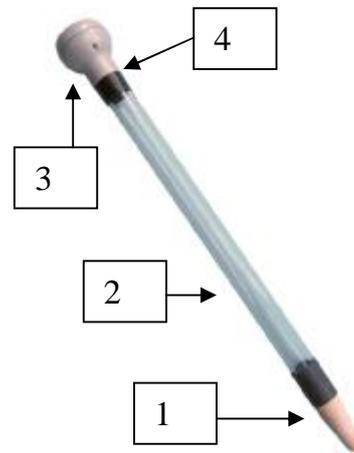
Operation Principle

Your Tensiometer measures the sucking tension of water in soil (= soil water potential), i.e. it measures the strength by which the water is held back in the soil, and thus also the power plant roots must apply to extract water from the soil.

For operation the Tensiometer-shaft is filled completely with water, after this the manometer is screwed on airtight. The water in the Tensiometer is in connection with the water of the surrounding soil by water bridges through the pores of the ceramic tip. If the soil dries, the soilwater "pulls" at the water inside the Tensiometer and a low pressure develops inside the Tensiometer-shaft, which is measured. This low pressure corresponds to the sucking tension (= soil water potential). Of course this process also works backwards, i.e. after an irrigation-event or rainfall the force with which the water is held back in the soil is less than the low pressure inside the Tensiometer. As consequence the Tensiometer "draws in" water over the porous ceramic tip from the surrounding soil and the low pressure in the Tensiometer decreases. After a water gift it lasts about 15 to 30 minutes until the Tensiometer shows the "true" value. This is so, because the water takes some time to penetrate into the deeper layers of soil. To obtain the exact value, it is necessary to subtract the length of shaft (in cm) from the value the manometer is showing.

Where shall the Tensiometer be placed?

First the measuring location must be fixed. The measuring spot shall be representative of the soil moisture for the complete field. Therefore eliminate the edges of the field, also the soil should correspond to the prevailing soil conditions on the total field. Furthermore the measuring location should be at an "average" plants. Therefore the plants in the immediate neighborhood of the measuring location should be neither too weak nor extraordinarily strong. If a field shows very variable soil-types, it is advisable to use several Tensiometers.



For the control of the water gifts the Tensiometer shall be installed in the main root zone. E.g. an installation depth of approx. 20 cm has proved to be favorable at many vegetable and softfruit cultures. Please see the enclosed table for more exact notes.

Putting into operation

The ceramic tip of the Tensiometer should be watered before the installation. To do this it is best to put the Tensiometer (without manometer put on) into a container with water overnight. The inside of the Tensiometer is not filled with water. In the next morning some water should have collected inside the Tensiometer shaft. Before the installation the shaft of the Tensiometer is filled with water up to the top and the manometer is screwed onto the shaft until it sits airtight.

Important: Please make sure there is no sand or dirt on the threads.

Installation of the Tensiometer to the soil

Tensiometers are installed under moist (not wet) soil conditions. Usually they remain at their site during a complete growing season. Tensiometers must, however, be recollected from fields, and emptied of water before the first frost (winter).

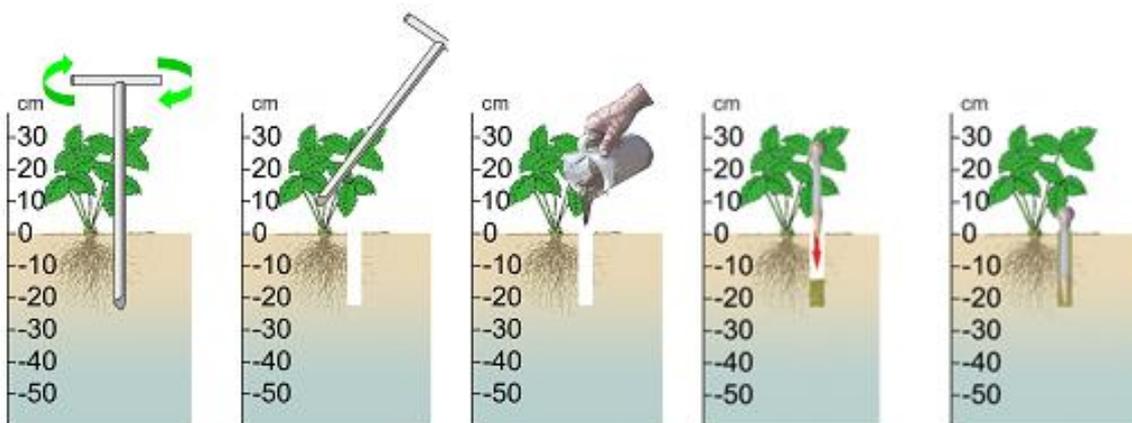
For the installation a hole of 25 to 30 mm of diameter down to a few cm under the desired depth is drilled (example: If the Tensiometer shall be installed at 20 cm under the soil surface, a hole of 23 to 25 cm depth is drilled).

Suitable for drilling the hole are normal soil augers (drills) for taking soil samples. But also a metal tube (best cut open at the side) can be used instead of the soil auger. Please use no solid stick or rod because the soil is compacted strongly with that type of tool around the hole and the measurements are biased by this.

After the hole is drilled, surface material is put through a sieve or screen to remove any rocks. The soil then is mixed with water to obtain a thick slurry (best consistence like Porridge). A smaller portion of this slurry is then poured into the Tensiometer hole so that the slurry is sitting in the hole at about 10 cm high.

Afterwards the Tensiometer is pushed carefully into the slurry down to the desired depth (work with caution, do not apply too heavy pressure!). The top 5 to 10 cm of the shaft is still above the surface after achieving this depth. The remaining gap between Tensiometer shaft and hole is then filled in with the soil slurry. On sandy soils it works best to wash in the soil between Tensiometer shaft and hole with water. It is most important to achieve good contact between the ceramic tip of the Tensiometer and the surrounding soil.

After the installation, the soil moisture in the immediate surroundings of the Tensiometer must adjust with the soil moisture of the rest of the field. Because of this, it lasts approximately 1 hour up to a half day (depending on soil type) until the Tensiometer can deliver the first meaningful measurements.



During Season

If soil water potential is permanently over 500 mBar water will gradually be lost from Tensiometer. In this case, please re-fill regularly

Change of Battery

Open digital manometer with Philipps screw driver. Replace battery (**3V CR 2032**).

Taking a Measurement

By short press the „ON“ button, the measured value is shown for 10 Seconds in mBar (1mBar = 1 hPa). By repeated press on „ON“ button, display switches to **PSI**, then to **kPa** and back to **mBar**. If „000“ is displayed the „ON“ button was pressed too long. (this is no problem, „000“ is the message that the digital manometer was re-set)

Messages on the LCD:

When testing the instrument

0 **System OK,**
ERR, 10, 20 **Re-set is necessary.** (Press „ON“ until LCD shows „000“. Re-set is completed.

During use

10 – 750	normal Measurements in mBar
(0 to 80 hPa)	Too wet
(80 to 100 hPa)	Surface is water filled but not too wet
(100 to 350 hPa)	Optimal soil moisture
(350 to 450 hPa)	Beginning dryness (water gift possible)
(450 to 500 hPa)	Give water!
(500 to 550 hPa)	High time to give water !!
(550 to 750 hPa)	Too dry -- dryness stress !!!
0	Tensiometer is dry, Re-fill with water.
ERR	High Pressure in Sensor after screwing on of Manometer. Will automatically normaize after few minutes.
750 flashing	Value over 750 mBar
 flashing	weak Battery. Replace Battery.