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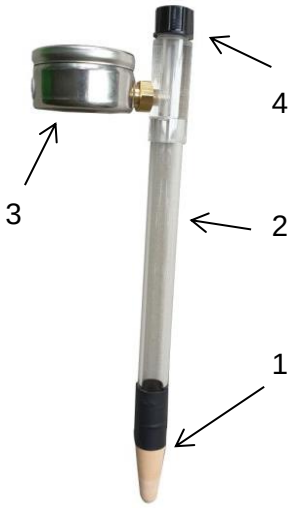
# Manual

# Tensiometer Model TX6 and TX10




## Components

1. Ceramic Tip with fine Pores
2. Transparent Shaft (in use filled with water)
3. Manometer with self-explanatory color coding ( -600 or -1000 to 0 hPa)
4. Screw cap

The Manometer measures low pressure in the range between -600 to 0 hPa or -1000 to 0 hPa (= mbar). It is a device of accuracy class 1,6 i.e.max. deviation is ± 1,6 % of the measured value.

Interpretation of the color coding:

The Manometer has a self-explanatory color-coding for mineral soils.
The green range indicates the optimal moisture range for most fruit and vegetable crops and for potatoes. This range is valid for all common soils (Sand-, Silt-, Loam- and Clay Soils).

Model TX6 (specially for drip irrigation systems)

| | | |
|---|---|---|
| Blue | (0 to 80 hPa) | Too wet |
| Blue-Green | (80 to 100 hPa) | Soil is saturated to field capacity |
| Green | (100 to 350 hPa) | Optimal Soil Moisture |
| Green-Yellow | (350 to 450 hPa) | Getting dry (Irrigation possible) |
| Yellow | (450 to 500 hPa) | Irrigate! |
| Yellow-Red | (500 to 550 hPa) | Immediate Irrigation necessary !! |
| Red | (550 to 600 hPa) | Too dry - Stress !!! |

Model TX10 (for drip- and overhead irrigation systems)

| | | |
|---|---|---|
| Blue | (0 to 100 hPa) | Too Wet |
| Green | (100 to 450 hPa) | Optimale Soil Moisture |
| Green-Yellow | (450 to 500 hPa) | Getting dry (Irrigation possible) |
| Yellow | (500 to 700 hPa) | Irrigate! |
| Yellow-Red | (700 to 750 hPa) | Immediate Irrigation necessary !! |
| Red | (750 to 1000 hPa) | Too dry - Stress !!! |

## Precautions

To avoid damagees at your Tensiometer, following points 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.).
- Option: Protective Rubber cap, for both models available
- 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

## Field of application

Per management unit (a management unit is an area with similar soil conditions, the same plant type and same development stage of the plants, like an irrigation block) three Tensiometers for measurement in the main rooting zone are necessary. To receive information about the penetration depth of the irrigation water or the water withdrawal of the plants from different layers of soil, additional Tensiometers should be installed in deeper soil layers (e.g. 50 to 90 cm).

## Operation Principle

Your Tensiometer measures the tension of water in soil (= soil water potential), i.e. it measures the strength by with 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 with water up to the top of the shaft. After this any remaining (trapped) air is pumped out from the shaft and Manometer. Then the shaft is filled again with water and then the shaft is closed air-tight with the screw cap.
The water inside the Tensiometer is in connection with the water of the surrounding soil by water bridges through the pores of the ceramic tip. When the soil dries, the soil water "pulls" at the water inside the Tensiometer and a low pressure develops inside the Instrument, which is measured. This low pressure equals the tension with which water is hold back in soil (= 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 soil is lower than the low pressure inside the Tensiometer. Consequently 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 5 to 60 minutes until the Tensiometer shows the "true" value. This is so, because it takes some time until the water penetrates into deeper layers of soil. Further, 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 determined. The measuring location should be representative for the soil moisture for the complete field. Therefore eliminate the edges of the field. The soil should correspond to the prevailing soil conditions on the total field. Furthermore the measuring location should be close to an "average" plant. 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 applications the Tensiometer shall be installed in the main root zone. E.g. an installation depth of approx. 20 cm has proved to be favorable for many vegetable and softfruit crops. In drip irrigation systems, the Tensiometer(s) should be placed approx. 5cm beside a dripper.

## Putting into operation and Field Installation

Step 1: remove screw cap

Step 2: fill Tensiometer completely with water

Step 3: Remove trapped air from Tensiometer with the service pump (included). This process must be repeated several times until no more air bubbles come from the inside of the Tensiometer and the Manometer. After this fill the Tensiometer again with water to the brim.

Step 4: srew cap firmly on the shaft

Schritt 5: Auger hole with 22mm diameter to desiered depth

Step 6: Push Tensiometer firmly but with caution to the bottom of the hole. The needle of the manometer should start to move within few minutes

## Solving potential Problems

Your Tensiometer can keep water up to a soil water potential of approx -850 hPa. Should the soil water potential increases to higher values, (i.e. the soil dries out beyond this value), all water is sucked out completely from the Tensiometer and the manometer shows the measurement zero. In this case air will penetrate into the inside of the Tensiometer, and the water bridges are cut.

| Problem | Maßnahme |
|---|---|
| The manometer shows zero, and no water is in the shaft | • Re-fill Tensiometer with Water and close it air-tight<br>• check the ceramic tip for fine cracks and other damages<br>• Check if seal in screw cap is damaged. Eventally replace seal in screw cap |
| Manometer shows zero, water is in the shaft | • Is the soil wet? In case yes, no malfunction<br>• Is the screw cap of the Tensiometer closed air-tight and undamaged? |
| Manometer shows with open screw cap a different value than zero | • Manometer has been damaged and must be repaired or replaced. Please contact MMM tech support. |
| Manometer shows high value (i.e. dryness) but soil is wet | • Has the ceramic tip good soil contact? (evetually relocate the Tensiometer)<br>• Eventually the Manometer is damaged, please contact MMM tech support |
| Tensiometer looses water rapidly, even with low soil water potentials | • Is the screw cap of the Tensiometer closed air-tight and undamaged?<br>• check the ceramic tip for fine cracks and other damages<br>• eventually screw connection Manometer to shaft needs to be re-sealed → How to do: Please contact MMM tech support |

## Correct choice of measurement spot in Drip Irrigation Systems: