

Manual Tensiometer Model TXSU (Substrate Model)

Components

1. Ceramic Tip with fine Pores
2. Transparent Shaft (in use filled with water)
3. Manometer with self-explanatory color coding (-250 to 0 hPa)
4. Screw cap



The Manometer measures low pressure in the range between -250 to 0 hPa (= mbar). It is a device of accuracy class 1,6 i.e.max. deviation is $\pm 1,6$ % of the measured value.

Interpretation of the color coding:

The Manometer has a self-explanatory color-coding especially for non-soil substrates like peat-moss, coco-fibre, rockwool and others.

The green range indicates the optimal moisture range for most crops grown in substrate-culture.

Blue	(0 to 20 hPa)	Substrate is wet, some drainage will occur
Blue-Green	(20 to 40 hPa)	Substrate is saturated with water
Green	(40 to 100 hPa)	Optimal Substrate Moisture for many crops
Green-Yellow	(100 to 200 hPa)	Getting dry (Irrigation possible, depending on production goal)
Yellow-Red	(200 to 250 hPa)	Irrigation advised to avoid stress

Precautions

To avoid damages at your Tensiometer, following points must be observed:

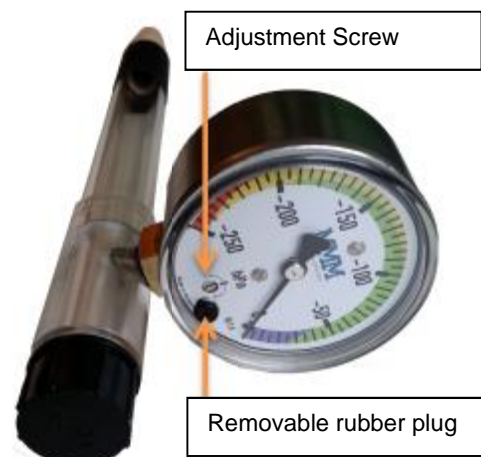
- The components of the Tensiometer must be protected from shocks (do not drop on the ground, do not beat the instrument with a hammer into the soil etc.)
- The Tensiometer may not be exposed to temperatures below 0° degrees Celsius as long as it is filled with water
- The ceramic mustn't come into touch with grease, oil or other substances which could close the pores

Special features of the TXSU Model

The special feature of the TXSU Tensiometer is, it's possibility to re-adjust the zero-point of the Manometer with a small screwdriver. This feature is especially valuable in low-tension Manometers like necessary for substrate moisture monitoring, since these Manometers are especially sensible for shocks.

How to re-adjust the Zero-Point:

1. Please remove screw cap and empty out all water from instrument
2. Remove small rubber plug from cover glass of the Manometer
3. Put small screwdriver through hole in cover glass and turn screw slowly until Indicator of Manometer is again on Zero
4. Replace rubber plug to close hole in cover glass
5. Re-fill Instrument completely with water and close it again with screw cap



Operation Principle

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

The water inside the Tensiometer is in connection with the water of the surrounding substrate by water bridges through the pores of the ceramic tip. When the substrate dries, the substrate water "pulls" at the water inside the Tensiometer and a low pressure develops inside the Instrument, which is measured by the manometer. This low pressure equals the tension with which water is held back in substrate (=substrate water potential). Of course this process also works backwards, i.e. after an irrigation-event the force with which the water is held back in substrate is lower than the low pressure trapped inside the Tensiometer. Consequently the Tensiometer "draws" water in via the porous ceramic tip from the surrounding substrate until the low pressure in the Tensiometer comes to an equilibrium with the substrate water potential in the surroundings of the ceramic tip.

Where shall the Tensiometer(s) be placed?

We generally advise to use several Tensiometers, i.e. to have some replications of measurement in one irrigation management unit.

As first step the measuring location must be determined. The measuring location should be representative for the substrate moisture for the complete block or unit. Therefore eliminate the outer edges and other untypical areas. Furthermore the measuring location should be close to an "average" plant.

For the control of the water applications the Tensiometer shall be installed in the main root zone. E.g. an installation depth of approx. 10 to 20 cm has proved to be favorable for many crops grown in substrate containers, growbags etc. In drip irrigation systems, the Tensiometer(s) should be placed approx. 5cm beside a dripper.

Putting Tensiometer into operation and Installation

Step 1: Remove screw cap

Step 2: Fill Tensiometer completely with water

Step 3: Wait till Water has wetted ceramic tip completely from inside (screw cap off, takes 1 Min. approx)

Step 4: After this fill the Tensiometer again with water to the brim.

Step 5: Screw top cap firmly on the shaft

Step 6: Make slightly undersized hole (approx. 16-18 mm diameter) to desired depth in Substrate

Step 7: Push Tensiometer firmly but with caution to the bottom of this hole.

The needle of the manometer should start to move within few minutes, and should have reached end value after maximum 1 hour

Solving potential Problems

Your Tensiometer can keep water up to a substrate water potential well beyond the measurement range of -250 hPa. However, please avoid to use the TXSU Model outside the measurement range, if measurements in drier conditions are desired, please use our Tensiometer Models TX6 or TX10.

Problem	Maßnahme
The manometer shows zero, and no water is in the shaft	<ul style="list-style-type: none"> • Re-fill Tensiometer with Water and close it air-tight • check the ceramic tip for fine cracks and other damages • Check if seal in screw cap is damaged. Eventually replace seal in screw cap
Manometer shows zero, water is in the shaft	<ul style="list-style-type: none"> • Is the substrate wet? In case yes, no malfunction • Is the screw cap of the Tensiometer closed air-tight and undamaged?
Manometer shows with open screw cap a different value than zero	<ul style="list-style-type: none"> • Indicator Needle of Manometer is off-Zero. Please re-adjust Zero-Point as described above
Manometer shows high value (i.e. dryness) but substrate is wet	<ul style="list-style-type: none"> • Has the ceramic tip good substrate contact? (eventually relocate the Tensiometer) • Remove Tensiometer from Substrate and hold ceramic tip into water. If Measurement value drops rapidly, the Tensiometer is ok, but the measurement location is not suitable. Please re-install Tensiometer at different location and make sure ceramic tip has good contact with substrate.
Tensiometer looses water rapidly, even with low substrate water potentials	<ul style="list-style-type: none"> • Is the screw cap of the Tensiometer closed air-tight and undamaged? • check the ceramic tip for fine cracks and other damages • eventually screw connection Manometer to shaft needs to be re-sealed. This can be done with the help of normal teflon tape from plumbing. In case additional Informations should be needed, please contact MMM tech support