AGRIOCOM

IoT For Every Farm

Tensiometer AgrioTens

User Manual

1. General description and technical data

Having enough moisture in the soil is the most important requirement for normal growth of plants. Accurate information about amount of water and its availability is required for optimal irrigation

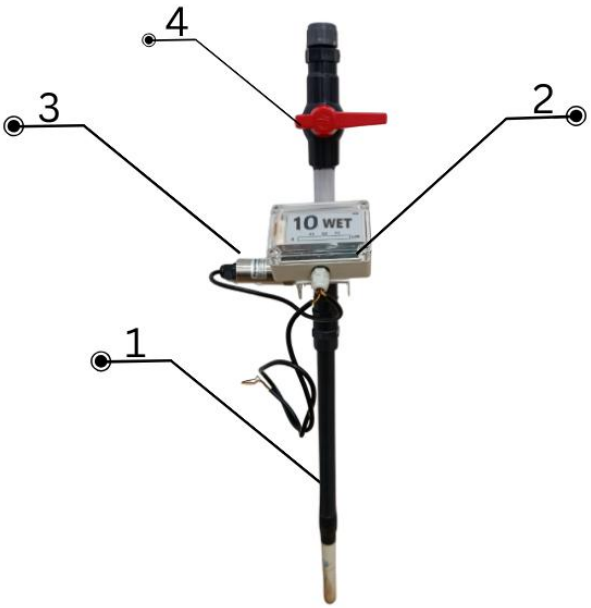
All climate factors influencing plant health (wind, evaporation, photosynthesis, solar radiation, air temperature etc) define activity of the plant roots, its ability to absorb water from soil. Availability of moisture depends on its connection with soil

Energy of water can be defined through the capillary potential. Soil water potential is the pressure, the power, which plant roots need to exhibit in order to pull this water from the soil. The higher the soil water potential, the more power is required to pull it, the less water is available for plants. This pressure is measured by tensiometer.

Tensiometer can be used for measuring water availability in different kinds of soil and for different plants. kPa or bar is used as measurement unit for pressure. Soil water potential is negative.

Main part of tensiometer is ceramic probe of fixed size made of high quality pore materials. Its main parameters are water and air penetration ability. Air penetration defines the range of pressure measurement. Water penetration defines the speed of equalizing of pressure inside of tensiometer and inside of soil.

Tensiometer consists of PVC pipe with connectors and ceramic probe, transparent pipe for controlling of water level, valve and cap, vacuum meter and electronic sensor.



1 – pipe with ceramics probe;

2 – e-paper display

3 – Negative pressure sensor

5 – Manual valve for refilling of water

Technical data

Model	TS-1
Material	PVC (UV- resistant)
Color	Dark blue
Measurement range	0 .. -100 kPa
Accuracy	± 2kPa
Output signal	0.5-4.5 analog

Power supply	9V primary battery
Display	E-Paper
Minimum time without filling water.	< 30Kpa: 30 days; 30-45Kpa 14 days; 45-60KPa: 7 days;
Cable length	3m (standard) or by requirements
Diameter	20mm
Ceramic probe length	10cm working / 18 cm full
Total probe length	30-50 cm. on demand
Height	H 50 - 80 cm
Width	L 16cm
Weight	W 0.38 - 0.46 Kg

2. Main advantages of tensiometers AgrioTens

- low cost, high reliability and easy installation
- Can be used in open field, greenhouse, parks, roads
- Measuring water potential - most important parameter for making decision about irrigation
- Data sent to AgrioCom central web platform
- Can be used for automatic irrigation contro
- E-Paper display, sun readable

3. Principle of operation

Operation of tensiometer is based on ability of ceramics probe to pass the soil water and not pass the air up to certain pressure. When probe interacts with dry soil, capillary-sorption forces move water from tensiometer to soil,

increasing negative pressure inside of tensiometer. On the contrary, when probe interacts with wet soil, water if forced to move from soil to tensiometer, reducing negative pressure inside of tensiometer. Soil moisture close to field capacity (field capacity) corresponds to pressure of 0 kPa. When soil moisture decreases, negative pressure of tensiometer increases.

4. Operating manual

Correct functionality of tensiometer is guaranteed only if installation has been done according to this manual. Tensiometer should be used under air temperature from 5 to 50 ° C, relative humidity below 90%. Installation place of tensiometer should be protected from direct water flow. Tensiometer should be kept clean from soil and dust. To avoid direct sun light and mechanical damages, cover the above ground part of tensiometer by net and plastic cover. It is recommended to read data from tensiometer early morning or after 6pm to minimize the influence of air temperature fluctuation.

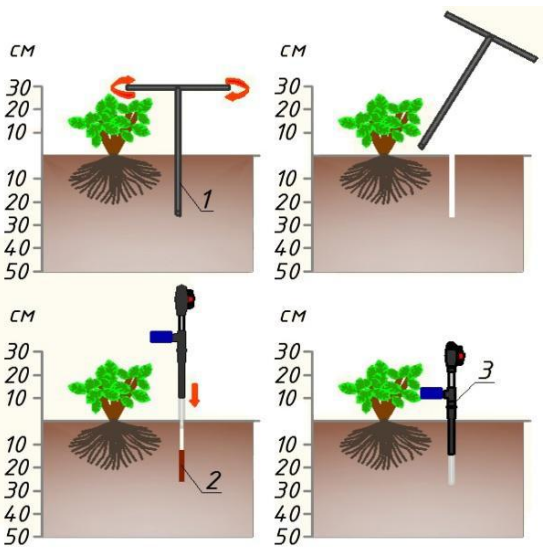
4.1 Preparing for installation

Before installing, check the tensiometer optically for damages, specially ceramics probe. It is not recommended to touch the ceramics probe.

Then, ceramic probe should be placed in water for 12 hours. Tightness test should be done under air temperature above 20 ° C and relative humidity below 80%. Fill the tensiometer with clean water with 30-40 ° C through the valve and close the valve. Then set it vertically and observe the vacuum meter readings. Reading of 50 - 80 kPa within 24 hours shows that tensiometer is in good conditions.

Before installing in the soil, ceramic probe should be placed in clean water for 1 - 2 hours. This is necessary to fill the ceramics probe with water that was evaporated during the tightness test.

4.2 Installing in the soil



Drill a hole in the soil about 20-22 mm diameter. Compactness of soil should not be changed inside of hole (!). Depth should be from ceramic probe to the mark on the pipe. Please note, that maximum soil depth that interacts with the probe is 20 - 25cm. (see 5.4).

Using the extracted soil, prepare soil paste and apply it on ceramics probe. Part of the paste insert in the hole to improve contact between tensiometer and soil. Insert tensiometer in the hole. Fill free space above with compacted soil. Fill the tensiometer with clean water and close the valve tightly. First readings can be taken after 24 hours.

4.3 Refilling tensiometer

Because of diffusion of air through (or very dry soil) the ceramic probe, air will be condensed inside of tensiometer and influence measurements. To keep tensiometer in working conditions, refilling must be done 2-3 times per month using boiled water. Keeping tensiometer in place, open the valve and fill it with water. Readings can be taken after 24 hours after refilling.

4.4 Placing tensiometers over irrigation area

Choose place for tensiometer according to variations of soil structure and plants. Various soils and plants need separate measurements. Normally, 2-3 tensiometers are installed at every measurement point. Tensiometers should be installed at the most representative areas of irrigation plot. First sensor

could be installed at 1/4 of root depth, second 3/4. Another method is to install one tensiometer for every 20 cm of root depth area. For plants with small roots (up to 0.2 - 0.3m) it is sufficient to install single tensiometer at 12 - 20cm.

In case of drip irrigation, tensiometer should be installed 15 - 30 cm away from the plants, depending on drip line row width.

4.5 Uninstalling, transportation and storing of tensiometer

Carefully remove soil around tensiometer. Pull the device holding by the PVC pipe. Clean tensiometer from soil, pour out the water, and pack in the box. Indoor, clean the ceramic probe with soft brush. Clean all PVC parts with soap water. Fill tensiometer with water and keep the valve open. Then set (hang) it vertically. Under gravitation force, water will pass though the ceramic probe and clean it. After cleaning is done, tensiometer should be dried and store in a box for winter time. Tensiometers should be stored in warm and dry place. If necessary, tensiometer can be sent back to AgrioCom for repair and testing.

Transportation of tensiometer should be done in original packing box or similar packing box using special packing material, such as packaging paper or plastic filled with air.