

# AQUATERR

I N S T R U M E N T S

M, T & EC – 300 & 350  
User's Manual

# Aquaterr Digital Soil Moisture, Temperature and Salinity Meters



**AQUATERR INSTRUMENTS**

Leader in Portable Soil Measuring Technology

It is important to read these **SAFETY PRECAUTIONS** before using the M, T & EC -350 meters.

**Always know what you are probing into.** Be careful not to probe into power lines, drip tubing, gas lines, and other objects that may be invisible from the surface.

**Do not try to force the probe into rock or hard soil.** The handle is provided to help in probe removal, forcing may result in bending or breaking the probe or cause damage to the sensing area. **Sharp rocks can damage the sensor.** To determine the moisture content of areas with a hard cracked surface, first break through the hard layer with a shovel, and then insert the probe, If the ground is still too hard, use an auger or a pipe to create the hole.

**Do not hit the meter end.** This may result in loss of calibration or destruction of your meter.

**Do not cut the roots of plants,** if avoidable. Insert the probe with the flat edges parallel to the roots. Test the soil under plants by inserting the probe at an angle. Be especially careful of the tap root, the major root running directly under the plant.

**Do not leave the probe in the soil.** If the probe is left in the ground, it can lose intimate contact with the soil resulting in incorrect reading.

### **Guidebook**

The Aquaterr Instruments Guidebook explains how to use your meter to optimize your irrigation practices by helping you to look at the relationship between plants, soil and moisture.

# AQUATERR INSTRUMENTS

## Moisture and Multimeter Owner's Manual

Your patented Aquaterr Instruments Meter can assist you in effective soil-water management. It is light weight and portable providing instantaneous moisture and salinity readings in rapid succession at multiple sites and depths. It is virtually free from errors ordinarily caused by temperature, pH, dissolved salts and metallic ions. However, its greatest virtue is its ease of use.

This manual covers the M-200, 300, & 350 Moisture Meters, the T-200, 300, & 350 Temperature / Moisture Meters, and the EC-300, & 350 Multimeters.

### GO TRY IT

Although the meter is a versatile, high tech instrument, it is easy to use. The first thing you should do with your new meter is to calibrate the moisture function, and then go ahead outside and try using it.

1. Calibrate the meter's moisture function by following the procedure on page 5, than choose a reasonably soft and moist area to start making measurements.
2. Gently insert the probe into the ground. A depth of six inches (15 cm) is enough.
3. Press the "MSTR" or "TEST" button on the front panel. The meter will respond with the soil moisture reading.
4. Press the "TEMP" button, wait for 1minute, and the meter will show you the ground temperature.
5. To read EC (EC-300, & EC-350 only), a). Set the moisture calibration knob "W" (upper right corner), to the moisture reading from step 3. b). With the probe out of the ground, push the EC button, and wait until the red EC ON indicator is on. c). Move the CAL knob slowly clockwise, until the display shows 0.1 or higher reading. d). Move the CAL knob slowly counter clockwise, until the display shows 0.0 e). Put the probe back into the ground and press the "EC" button and after about 4 seconds, the salinity will be displayed.
6. Wipe the probe between tests.

NOTE: While your Meter was calibrated and tested before it left the factory, the Meter may need fine field calibration to assure that the readings will be accurate. This manual will show you how easy it is to calibrate and operate your new Meter. For the EC-350, the Salinity calibration is set at the factory and is very stable. It is very rare for this unit to require calibration after it is shipped from our facilities, do not attempt to calibrate the EC function, unless you are very certain that your readings are not accurate.

## FOUR CRITICAL STEPS

While your Meter is easy to use, four important steps must be performed to ensure repeatable results.

1. **CALIBRATE** the moisture section in water, and check its calibration at intervals of several hours.
2. **WIPE THE PROBE** with a towel between **EACH** test, remove all excess dirt. Dirt carryover will cause errors in future readings.
3. The probe sensor located at the bottom 6 inches (15cm), must be in **INTIMATE** contact with the soil.
4. Test **SEVERAL** spots at **EACH** location, and then average the measured results.

## CALIBRATING THE MOISTURE FUNCTION

Calibrating your Meter for moisture takes just a few seconds. The moisture calibration should be performed before testing and at regular intervals during testing (once every several hours). This will help ensure accuracy and repeatability of the tests.

1. Fully immerse the sensor end in water, keeping the meter top end out of the water at all times. If you have very soft water (EC below 200 ppm or 30 Us), call technical service for calibration recommendations.
2. While the probe is in the water, push the “MSTR” button (the only push button on the M-200, 300, &350 units). While pushing down on the “MSTR” button, turn the “SET” knob until the meter reads 100 (clockwise increases the meter reading).
3. The Moisture Meter is now ready to use.

## MEASURING SOIL MOISTURE CONTENT

There are a couple of important things to remember when measuring the moisture content: make sure the probe is contacting the soil (good soil to sensor adhesion is very important) and take several readings about one foot apart at each location to make sure that there is not a problem with one location.

1. Push the probe into the soil to desired depth. If the ground is too hard, use an auger or a piece of pipe to make a hole to the desired test depth, and then push the probe into the soil. The sensing window must be in contact with the soil to get repeatable results.
2. Push the “MSTR” button. The meter reading indicates the soil moisture level.
3. WIPE off the probe with a towel between readings.

## COMMON PROBLEMS (Soil Moisture Measurements)

### PROBLEMS

Widely varying readings, due to lack of Soil Compaction caused by wiggling the probe.

Lower or higher than expected readings.

Probe in water, meter will not read 100.

### SOLUTIONS

Insert probe, press the dirt around the probe by standing close to both sides of the probe. Then take reading.

Recalibrate the meter in water.

Change the battery. Remove battery cover with a screw driver and replace the 9 volt battery inside with a new one.

## MEASURING SOIL SALINITY

With the sensor in air, push the “EC” button and wait until the “EC-ON” light illuminates. The EC reading should be zero. If the reading is not zero, turn the upper left knob “CAL” until the display shows a zero reading.

The EC-300, & EC-350 senses the salinity of the moisture component in the soil, thus the more water present, the better the readings will be. The best time to take a reading is shortly after irrigation. Also, make sure the sensor has intimate contact with the soil and take several readings at each location. Make sure that the sensor has reached temperature equilibrium (in the soil for one minute) before calibrating, and recalibrate when temperature changes occur.

1. Push the probe into the soil to the desired depth. If the ground is too hard use an auger. The sensing window and wings must be in contact with the soil for repeatability.
2. Push the “MSTR” button. The reading is the soil moisture level. Set the moisture compensation knob “W” (upper right corner) to the moisture level being displayed.
3. Push the “EC” button. After about 4 seconds the “EC-ON” light will illuminate and the meter will read the salinity in  $\mu\text{S}$ . (micro Siemens).
4. WIPE OFF the probe with a towel between readings. Soil carry-over (attached to sensor) between readings can be a significant problem with salinity readings.

## MEASURING LIQUID SALINITY

When measuring the salinity of a liquid with your Meter, the most accurate reading is made when the liquid just covers the winged portion of the probe which is located about 6 inches (15cm) above the tip. Make sure the sensor has reached temperature equilibrium with the liquid (typically one minute) before calibrating and is recalibrated whenever temperature changes occur.

1. Place sensor into the liquid.
2. With the moisture calibration knob "W" (upper right side of meter) in the full clockwise position, push the EC button. After about 4 seconds, the "EC-ON" light will illuminate and the meter will read the salinity in  $\mu\text{S}$  (microSiemens).
- 3 WIPE OFF the sensor between readings.

## MEASURING SOIL TEMPERATURE

(Available with TEMP-300, & 350 and EC-300, & 350 Meters)

This is the easiest multimeter function to use. As with all of the other functions it is important to have soil contact with the probe.

1. Push the probe into the ground until the temperature sensor is covered. This means covering the entire winged section.
2. Wait until the sensor stabilizes (typically 1 minute), and the sensor's temperature approaches the soil's temperature. Generally, the more moisture in the soil, the faster the sensor stabilizes.
3. Push the "TEMP" button. The meter reading indicates the sensor temperature.
4. WIPE OFF the probe between readings.

## COMMON PROBLEMS (Soil Temperature Measurements)

### PROBLEMS

Sensor readings move slowly.

### SOLUTION

The sensor gradually reaches equilibrium with the soil. This is called an asymptotic approach, meaning it moves fast at first, and then slows down as it approaches equilibrium. If you are taking other readings (i.e. moisture), then take your temperature readings last.

## **EVALUATING THE MOISTURE MEASUREMENTS**

It is important to remember that your Meter is a capacitance moisture meter. Capacitance meters “look” at the air-water ratio in the soil. Thus, soil compaction has an effect on the reading. A more compact soil will hold less air than a loose soil (like a sponge). This means that the more compact soil will have higher readings than a loose soil. (See Guidebook for further explanation). Also important is that your Meter is averaging the readings over the entire sensor area. Thus, soil contact with the entire sensor is important.

When reading and interpreting the meter’s color coding you should remember that the coding is only meant to serve as a reference. It does not provide an optimal guide for all plants in all soil types during all stages of growth.

- Blue: Free water is present.
- Dark Green: Ample soil moisture exists for virtually all plant growth.
- Light Green: Water level is approaching stress conditions. For young, budding and drought sensitive plants irrigate in the upper one half of the zone. Use the lower end of the zone for mature and drought resistant plants.
- Yellow: Stress is apt to occur, although most plants will survive if water condition is temporary.
- Orange: Damaging stress to most plants.
- Red: Permanent wilting and death is likely.

While the color coding should only be used as a reference, it points out that plant stress not only depends on plant type and stage of growth, but also depends on soil types. Thus, the “C”, “L” and “S” on the meter face indicate the reference color bands for Clay, Loam and Sandy Loam, respectively.

## **EVALUATING THE SALINITY MEASUREMENTS (EC-300, & EC-350)**

Remember that you are taking a measurement of the salinity in the soil water. This is not the same as finding the salinity of a solution extracted from the soil sample the way a lab does. The difference is that the EC-300, & EC-350 measurements are evaluated at different soil moisture levels. This means that:

- The measurement is what the roots are “seeing” now.
- Some salts, which do not dissolve as easily, might not be present in the soil water which you are measuring.
- Salinity is more concentrated at lower moisture contents.

Good sources of information for salinity data include the local University Extension, Soil Conservation Service agents, or the Internet.

## COMMON PROBLEMS (Soil Salinity Measurements)

### PROBLEMS

### SOLUTIONS

Battery indicator is on

The battery must be replaced. Remove the battery cover and replace with a 9 volt battery.

EC of soil matches EC of the water

Give more time for the soil to come to equilibrium. Do not test so soon after irrigation.

Salinity is lower than expected

Check soil moisture level. If the soil moisture level is below 65% the readings need to be calibrated with a soil sampling test. Salt will precipitate in the soil's free (available) water, and will saturate out in this soil/water mixture. There is not enough water present for the salts to mix with the water evenly. For this reason, a sample of the soil must be taken, then the moisture and salt content of the soil sample has to be determined, and the results can be used to calibrate the "EC" readings of the EC-300, or EC-350.

### **EC-300, & EC-350 PROBE CARE**

It is important to keep the wings of the probe clean and free of dirt and buildup. It is suggested that every couple of weeks, the wings be polished with a plastic abrasive pad to remove buildup. When cleaning it is also important not to abrade the blue epoxy area.

## CALIBRATING THE SALINITY FUNCTION (EC-300, and EC-350)

**Caution: This should only be done as a last resort after you have tried everything else and you are certain that it is required.**

We have provided two methods of calibrating the salinity function. The first method is more convenient for laboratory or controlled conditions; the second is more convenient in the field.

The calibration knob "CAL" is located on the upper left hand side of the meter's panel. Make sure that the knob to the right of the meter's panel "W" is turned the furthest clockwise position for liquids (100), or set to the measured moisture reading for soils.

### First Method:

**Using a Bench Top Meter** – If you have a calibrated bench-top or laboratory EC meter:

1. Prepare a water sample at or near the field EC using table salt and your bench top meter.
2. Follow instructions for measuring liquid salinity. Remember to give the meter two to three minutes to reach temperature equilibrium.
3. Compare the EC-300, or EC-350 meter reading to the bench top reading.
4. Adjust the EC-300, or EC-350 calibration knob "CAL" (left of the meter) until both meter readings are the same.

### Second Method:

**Air** – This will set your meter to a repeatable value, but not to the accuracy which can be obtained by calibration with a bench top meter. With the meter in air:

1. Push the EC button.
2. When the EC-ON light comes on adjust the calibration knob "CAL" (left of the meter) until the EC-300, or EC-350 reads zero (0) in the air. This is the best starting point for field use.

If neither of these methods work, the unit must be sent back to Aquaterr for diagnosis, repair, or re-calibration.

## SPECIFICATIONS

PROBE LENGTH: 30 Inches (76.2cm)

PROBE DIAMETER: ½ Inch (1.27cm)

PROBE CONSTRUCTION: Stainless Steel

OVERALL LENGTH: 36 Inches (approx.) (91.44cm)

TEMPERATURE RANGE: 32 – 150 deg. F (0 to 65.55 deg. C)

(The T-300 and EC-300 meters are made to display temperature in degrees Fahrenheit, or in degrees Celsius as specified.)

POWER SOURCE: 9 volt battery

LIFE OF POWER SOURCE: Approx. 3 months

WEIGHT: Approx. 5 pounds (2.26Kg)

SALINITY SCALE: 0 – 1.999 mS (milli Siemens) or 0 – 1999 µS (micro Siemens)

MOISTURE: 0 – 100%

## CONTACTING TECHNICAL SERVICE

If you have trouble solving a problem with your Meter:

Email us at: [Info@aquaterr.net](mailto:Info@aquaterr.net)

or

Locate us on the Internet at: [www.aquaterr.net](http://www.aquaterr.net)

or

Call Technical Support at: (949) 646-7274 telephone  
(949) 646-7493 fax

If the Aquaterr representative can't help you, arrangements will be made to service your Meter at our facility. Meters which need to be sent in for service, should be sent to:

Aquaterr Repairs  
1685 Babcock Street #A  
Costa Mesa, CA 92627