TrolMaster

WCS-2

Substrate Sensor

(Temp,EC & WC)

TrolMaster

www.trolmaster.com

For Aqua-X Control System

Overview

The TrolMaster's WCS-2 Water Content Sensor is specifically designed to measure the water content data (percentage), temperature and the EC of the grow media in the Aqua-X, Aqua-x Pro and Hydro-X Pro Control System.

Each WCS-2 sensor includes a five-prong sensor assembly connected to a LCD communication module (Display Screen & Button). To use the WCS-2, the five prong sensor is inserted into the grow media such as soil or rock wool to be measured. Normally placed horizontally about 1/3 of the way up from the bottom of the grow media container or rock wool block. You can connect multiple Water Content Sensors (up to 50 WCS-2 on the NFS-2 and HCS-2 controllers, 8 on the NFS-1 controller). The NFS-2 screen will display the value of the 3 parameters (grow medium temperature, moisture level and EC) of each individual sensor.

When using TrolMaster's free TM+ app, you can see the water content %, temperature and EC of the grow media on your Smartphone. You can view historical data graphs on the app and also receive notifications if the WCS-2 readings exceeds your highest or lowest alarm settings.

Features

- LCD Display, Easy Operation
- Addressing / Calibration Button
- Water Content Real-time Measuring Water Content, Temperature & EC of Grow Media
- Alarm When Set-point Exceeded

FRONT PANEL

Principal of Operation

Water content and EC measurement within the growth media are critically important, however rather difficult to accomplish. The WCS-2 uses sophisticated technology to read temperature, Water Content % and EC within various types of grow media and with all types of nutrients. TrolMaster's WCS-2 sensor will allow growers to monitor their grow medium (aka "the root zone") 24-7. To use the sensor to its full capability, it is important to better understand how the sensor works, and what the readings coming from the WCS-2 are telling you.

First let's take a look at what is being measured by the WCS-2 and how it is being measured.

1) **Temperature:** Root zone temperature is critical to maintaining overall plant health. We measure temperature within the root zone using a precision temperature sensor embedded in one of the steel spikes. Temperature within the root zone can be manipulated by either heating or cooling the nutrient mix being supplied to the plants.

2) **Water Content %:** The WCS-2 uses several steel spikes inserted into the grow media to measure the water content. Measuring water content % is complicated by multiple factors including the grow media type, salt content of the water within the grow media and of course the amount of water being held within the grow media. All of those factors can affect the electrical conductivity (EC) of the grow media which can then affect the water content readings. Below we will explain how each of these 3 factors will affect the actual Water Content reading from the WCS-2.

3) **Water EC:** Measuring EC of the nutrient / water mixture surrounding the roots will provide the user with detailed "feedback" from the root zone. Growers can then either increase the feed water strength to increase root zone EC, or possibly initiate freshwater flush cycles to reduce root zone EC, or keep it the same if the EC is perfect and the plants look fantastic. Without active ways to measure root zone EC, growers are faced with difficult leachate tests to determine EC of the grow media. The WCS-2 historical data will allow you to chart day-by-day water EC within your root zone.

   Now to be able to interpret the data from the EC measurements on the WCS-2, you should understand how it is actually reading the EC of the root zone, and how to use the data from the WCS-2.

How we measure EC: There are other grow media EC sensors in the market, and most of them use the same principle: Position two (or more) stainless steel probes a certain distance apart, and measure the conductivity (capacitance) of the grow media. If the grow media is saturated with water that is high EC, the grow media will be more electrically conductive. Conversely, if the grow media is saturated with low EC water, the grow media is less conductive. We can measure that difference and then display it as a Grow Media EC level on the NFS-1 and NFS-2 controllers.

The actual Water Content within the growth media can also affect the Water EC reading. As the amount of water within the grow media increases, so does the overall conductivity of the grow media. If you increase the EC of the water being fed to the plants, there'd be an increase in the conductivity of the grow medium. Either one of these conditions will result in an elevated EC reading coming from the WCS-2 sensor. So keep in mind that the EC data coming from the WCS-2 sensor could be affected by the amount of water within the grow medium: EC readings might increase when the grow media is very wet, or the EC will decrease when the grow media is very dry.

1. Factors affecting the readings

i) **Grow media type:** Grow media varies how much actual liquid / water can be held within the microscopic spaces within the grow media. TrolMaster has chosen to allow the user to calibrate the WCS-2 to their specific grow media which will then provide a standard reading from 100% to 10% depending on how much water is present within the grow media.

ii) **Water salt content:** Pure water (de-ionized) does not conduct electricity. Only when nutrients or "salts" are added to it, the water becomes electrically conductive. The more salts added, (a stronger nutrient solution) the more conductive the water will be. On this basis, we'll have to put the electric conductivity of the water itself in consideration when we measure the electrical conductivity of the grow media to determine the water content. Calibrating the WCS-2 allows better prediction on how the salt content will affect not only the actual WC% readings, but also the EC reading.

NOTE: The WC% reading will be most accurate if users continue to feed with water that's roughly the same EC as the one used for calibration. If they change the EC of the water used for irrigation, that will alter the WC% reading. If the EC of the feed water is higher than what we calibrated with, the Water Content reading will go up slightly, and vice versa.

iii) **"Actual" Water Content:** Calibration is easy to do, and critical to getting correct 100-10% readings of your growth medium. Once calibrated, the WCS-2 will provide the user with a more "complete" picture of exactly how much water the grow media can hold, and how much water is currently being held within the grow media sample. This is represented with a 10-100% capacity scale. Calibrate using a sample of grow media that's fully saturated with the exact nutrient that will be used for irrigation to establish a baseline for calibration.

First, establish a 100% saturation point by placing the sensor in a grow media sample that has been fully saturated and allowed to drain for 10 minutes. The sensor is then calibrated at 100% to represent a fully soaked grow media.

Next you would remove the WCS-2 from the sample, and calibrate a second water content point at 0% which represents a fully dry grow medium. We can then accurately display readings from 100 down to 10%. That will provide greater measurement resolution.

NOTE: There are other factors besides the actual water weight of the grow media that can affect the water content reading.

If the grow media is wetter, the grow media will be more electrically conductive. Conversely, if the grow media is dry, the grow media is less conductive.

2. EC Data Interpretation

It is recommended to calibrate the sensor using the same feeding solution that will be used for actual feeding, so we established a baseline for the EC reading based on that sample. Also, calibrate the WCS-2 EC reading when the grow media sample was fully saturated with the feed water. So the baseline for the Water Content and the EC readings are at _ _ ._ EC and 100% Water Content.

As the Water Content goes up and down, it is normal to see small fluctuations with the EC reading.

Example 1: Each time you turn on the irrigation to your plants, you will likely see a small "bump" on the EC readings coming from the WCS-2. That is from the Water Content increasing with the grow media. Once the water drains back down, you will see the EC reading going down slightly.

Example 2: When you change the strength of your feed water EC, you will also see those changes within the readings coming back from the WCS-2 sensor. Especially when you make large changes, e.g. if you flush with fresh water, you will see the EC reading from the WCS-2 sensor go down considerably.

As long as the user understands the basic principle of how the WCS-2 measures EC and Water Content, they will better understand how to interpret and use the data it is presenting to them.

3. Installation of the WCS-2

The WCS-2 sensor can be used with multiple versions of TrolMaster controllers including the Aqua-X, Aqua-X Pro and Hydro-X Pro.

1. Mount the Water Content Sensor LCD module near the grow media you will be measuring.

2a. Aqua-X: If connecting to the Aqua-x, connect a RJ12 cable to the Water Detector port on the bottom panel of the Aqua-X Controller.

2b. Hydro-X Pro: If connecting to the Hydro-X Pro, connect a RJ12 cable to the port labeled SENSORS on the back of the controller.

2c. Aqua-X Pro: If connecting to the Aqua-X Pro, connect a RJ12 cable to the Water Detector port on the back of the Aqua-X Pro Controller.

3. Then connect the other end of the RJ12 cable to a Y-shape Splitter, or to the SPH-1 splitter hub. Plug the RJ12 cable from the first WCS-2 into the Y-Splitter or the SPH-1. Similarly, other Water Content Sensors can be connected to your controller using the Y-splitters or the SPH-1 hub.

4. Press the Addressing button on each of the WCS-2 LCD modules. The controller will assign an address to each of the WCS-2 sensors sequentially. The LCD screen of the WCS-2 Water Content Sensor will show a WC percentage, the EC and temperature indicating that the WCS-2 is connected successfully.

*NOTE: The WCS-2 display module will display the "Sensor #" of that sensor in the order the sensor was Addressed to the controller.

4. Calibration methods

There are two ways to calibrate the WCS-2. You can calibrate directly on the WCS-2 LCD module, or through the settings on the controller that the WCS-2 is connected to. You can calibrate all 3 parameters measured by the WCS-2 including the Water Content, EC and water temperature.

NOTE: Calibration of the temperature is not needed in most cases, but calibration of the Water Content and EC levels are critical in order to receive accurate data from the WCS-2 sensors.

5. Calibration preparation

IMPORTANT REMINDER
Before using the WCS-2 for the first time, you MUST calibrate the sensor to your grow media and your nutrient / feed water. You MUST first prepare a sample of the grow media you will be using in order to calibrate the WCS-2 sensor. The calibration can be done on an actual plant already potted in the grow media. To prepare the grow media for the initial calibration, you will need a supply of the actual feedwater / nutrients that you plan on using on your plants.

6. Calibration on the NFS-1

1) Using your test feedwater, flush your grow media sample from the top of the container or block until the water is coming out the bottom. Ensuring that the entire sample is fully saturated.

2) Now you will wait for 7-10 minutes for gravity to work to allow the excess to exit the bottom of your sample.

3) Next insert the WCS-2 probe horizontally into the grow media, approximately 1/3 of the way from the bottom of the media.

4) Press the "Enter" button on the NFS-1, then choose "System Settings".

5) Now select "Calibration" and then WCS-2.

6) Now you can choose to calibrate either the EC, Temperature, or Moist (Water Content).

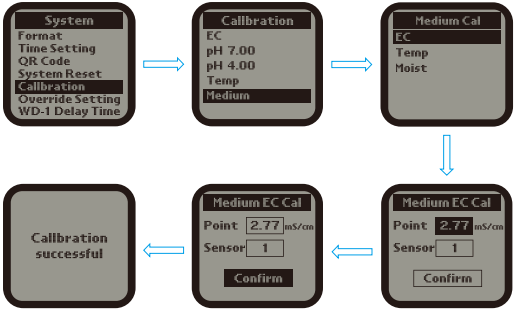
7) Move the cursor to the item you want to calibrate and then press the “Enter” button.

8) With the cursor on the box labeled “Point” press Enter.

9) Using the up and down arrow buttons, select the new calibration point and then press the “Enter” button.

10) Now move the cursor down to select the sensor you want to calibrate in the “Sensor” box.

11) Then using the up and down arrow buttons, choose the sensor to calibrate, and then press Confirm to complete the process . The LCD screen will display a message “Calibration successful.”



NFS-1 Demonstration

NOTE: If the probe was not removed from the medium after calibration for 100%, the calibration for 0% moisture level will not proceed, and the LCD screen will display “Error”. The calibration for 0.0 EC level will also not be able to be completed, and the LCD screen will display “Out Of Range”.

7. Calibration on HCS-2 & NFS-2

1) Using your test feedwater, flush your grow media sample from the top of the container or block until the water is coming out the bottom. Ensuring that the entire sample is fully saturated.

2) Now you will wait for 7-10 minutes for gravity to work to allow the excess to exit the bottom of your sample.

3) Next insert the WCS-2 probe horizontally into the grow media, approximately 1/3 of the way from the bottom of the media.

4) Tap nut icon.

5) Choose Calibration.

6) Tap Enter below Medium EC.

7) Input EC value of the EC solution and tap Save.

8) Return to Calibration main page.

9) Tap Enter below Medium Moisture.

10) Calibrate for 0% water content, choose the sensor you're calibrating.

11) Tap Save, then continue to calibrate for 100% water content.

12) Save setting.

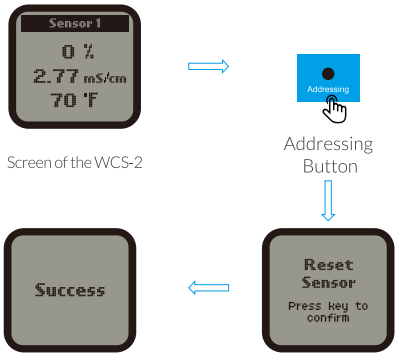
NOTE: The inactivity timeout time is 3 minutes. When the calibration page is inactive for more than 3 minutes, it will automatically return to the main page.

NOTE: If the probe was not removed from the medium after calibration for 100%, the calibration for 0% moisture level will not proceed, and the LCD screen will display "Error". The calibration for 0 EC level will also not be able to be completed, and the LCD screen will display "Out Of Range".

8. Calibration Reset on WCS-2

The user can clear previous calibration data by resetting the WCS-2.

To Press and hold the addressing button for 5 seconds to reset. Press again to confirm and you will see a "success" message; or else it will return to the main interface after 5 seconds.



Screen of the WCS-2

Addressing Button

9. Package Contents:

1 x Water Content Sensor
1 x RJ12 T-Splitter
1 x 16ft RJ12 Cable

10. Specifications

Input Voltage:	12 VDC
Max Input Current:	0.1A
Working Environments:	Temperature 32°-122°F
	Humidity≤90%
Water Content Range:	0~100%
EC Range:	0-5 mS/cm
Temp Range:	32°-122°F
Packaging Dimensions:	275mm(L) x 164mm(W) x 65mm(H)

NOTES:

1. Multiple Water Content Sensors (up to 50 pcs) can be connected to the Aqua-X Pro Control System and the LED Display of the Aqua-X Pro Controller will show the average value.

WARNING : DO NOT allow the WCS-2 Dry Contact Board to be exposed to water or excessive heat. DO NOT open or attempt to repair or disassemble the controller, as there are no user-serviceable parts inside. Opening the controller will void the warranty.

If the surface of WCS-2 Dry Contact Board is dirty, wipe it with a dry towel. The WCS-2 Dry Contact Board operates under natural ventilation conditions.

AVERTSSEMENT : NE PAS exposer la carte de contact sec WCS-2 à l'eau ou à une chaleur excessive. NE PAS ouvrir ou tenter de réparer ou de démonter le contrôleur, car il ne contient aucune pièce réparable par l'utilisateur. L'ouverture du contrôleur annulera la garantie.

Si la surface de la carte de contact sec WCS-2 est sale, essuyez-la avec une serviette sèche. La carte de contact sec WCS-2 fonctionne dans des conditions de ventilation naturelle.