CALIBRATION INSTRUCTIONS

SENSOR CALIBRATION

The Agrowtek software system relies on data received from its climate and hydro sensors to ensure an optimal environment in your farm. It is normal for electronic sensors to lose their accuracy over time, therefore, calibration is important to keep the sensors in an accurate range. If you do not address the periodic inaccuracy of the sensors, the climate or water conditions in your farm will not be optimal and your crops will be negatively affected.

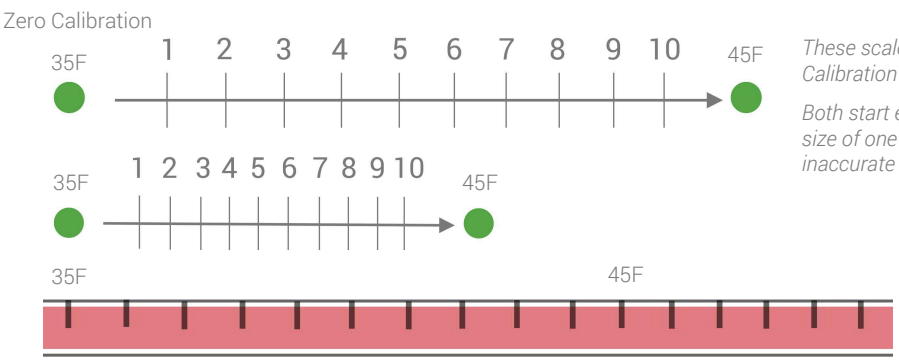
To calibrate your sensors you will use one of two sources as a reference point: a separate sensor (i.e. a water temperature thermometer giving an accurate reading - as seen in the example below), or calibration solution (i.e. pH calibration solution with a previously determined pH level). You will need to calibrate your farm's hydro sensors every two weeks and climate sensor quarterly.

It is important to understand how the calibration procedure works because if you understand it well you will be able to complete it confidently and correctly. Additionally, should you ever need to troubleshoot inaccurate sensor readings, understanding the calibration process will make a diagnosis much easier.

During each hydro sensor calibration you will set a Zero Calibration and a Span Calibration. The Zero Calibration sets the point from which incremental measurements begin (35F in the example below). Without a Zero Calibration the control has no point of reference to anchor further measurements. The Span Calibration gives the controller the end point so that it can calculate the size of each incremental measurement (i.e. the size of one degree Fahrenheit).

Another way to think about it: Imagine you are standing next to someone who is slightly taller than you and you are both told to take ten steps in the same direction. You both take your ten steps but you end in slightly different places. This happened because you started in slightly different places (a step or two away from each other) and the other person is slightly taller than you so they take larger steps (one step for them equals one and a half steps for you). In order for you both to take an equal ten steps (or in the case of a temperature sensor, measure an accurate ten degrees) you must be calibrated. To be calibrated you will be told to start in exactly the same spot (i.e. a Zero Calibration) and you will also be told where exactly ten steps is from your starting point (i.e. a Span Calibration). This information will allow you both to calculate the same size step and arrive at the same end point - therefore, you are both accurate in reference to a separate scale.

In case of a water temperature sensor: The Zero Calibration for this sensor has been set at 30 degrees Fahrenheit and its span set at 40 degrees Fahrenheit:



*These scales represent a calibration procedure done with a Zero Calibration but **without** a Span Calibration.*

*Both start exactly at 30F but the **incremental measurements** (the size of one degree) and the **end point** (definition of 40F) is inaccurate when compared to the separate thermometer.*

Separate thermometer with **true** temperature

CLIMATE SENSOR CALIBRATION INSTRUCTIONS

Air Temperature

You will need a **separate digital thermometer** placed as near to the climate sensor box as possible to measure the actual temperature in your farm. *Note: You will only calibrate Zone 1. There is only one climate environment in the farm so you will only refer to Zone 1 when observing your climate readings on the touch screen.*

Menu

1. Access the sensor calibration menu from "Main Menu > System > Sensors > Calibrate Sensors"
2. Select "Air Temp"

Zero

3. In **Zone 1** press the "Zero Cal" box to pull up the keypad & enter "0.0"
4. Press "Set Span" - *This step deletes any previous calibrations & resets the system to factory default*
5. Now, note the reading on your separate digital thermometer
6. Enter the **difference** between the farm's temperature sensor reading in Zone 1 and the reading on your separate digital thermometer

    Example: Your farm's air temperature sensor reads 68.3F but your separate thermometer reads 73.5F, you would enter 5.2 in the Zero Offset box.

Humidity

You will need a **separate digital-reading humidistat** placed as near to the climate sensor box as possible to measure the actual humidity in your farm.

Menu

1. Access the sensor calibration menu from "Main Menu > System > Sensors > Calibrate Sensors"
2. Select "Humidity"

Zero

3. In **Zone 1** press the "Zero Cal" box to pull up the keypad & enter "0.0"
4. Press "Set Span" - *This deletes any previous calibrations & resets the system to factory default*
5. Note the reading on your separate digital thermometer
6. Enter the difference between the farm's humidity sensor reading in **Zone 1** and the reading on your separate digital humidistat

    Example: Your farm's sensor reads 67% humidity but your separate humidistat reads 53% humidity, you would enter -14.0 into the Zero Cal box.

If you need to reset your calibration to factory default, i.e. removing any previous calibrations, input "0.0" in both the "Zero Cal" and the Cal boxes, then press "Set Span."

Finally, you may have noticed that you did not complete a Span Calibration for Air Temperature or Humidity. Given the difficulty and the negative effects of drastically altering the air temperature and humidity within your farm, it is OK to only perform a Zero Calibration when you calibrate your Climate sensors.

HYDRO SENSOR CALIBRATION INSTRUCTIONS

Before starting the Hydro Sensor Calibration process, first, turn the following **eight Outputs OFF**:

First,
Seed Nutrient A
Seed Nutrient B
Seed pH Lower
Main Nutrient A
Main Nutrient B
Main pH Lower

Then,
Seed Recirculator
Main Recirculator

This ensures that you can remove the sensor probes without triggering any dosing or the overflow of water from the recirculator pump out of the sensor ports.

Zero Cal & Span Cal

In each of the following calibration procedures there are two parts. Part 1 is **Zero Calibration**, and Part 2 is **Span Calibration**. You *must* set zero before setting a span. Be sure you complete these two calibration parts for each sensor you are calibrating before moving forward.

Zone 1 & 2

When calibrating your farm's sensors, it is much more efficient to calibrate your Main sensors (Zone 1) and your Seedling sensors (Zone 2) at the same time. There are two things to be aware of while calibrating both zones together:

1. Be sure you remember to switch between each zone throughout each calibration to preform each step in each zone - toggle between zones by pressing the 1 or 2 in the bottom right corner of your screen
2. Be sure you have all of the necessary sensors submerged in each solution during each step.
   *Example: when completing the Zero Cal step for pH, be sure you have **both** pH sensors **and** both temperature probes in the solution.*

Note: When you finish the entire hydro calibration process, reset the previous **eight Outputs** to their **default settings**:

First,
Seed Recirculator - ON
Main Recirculator - ON

Then,
Seed Nutrient A - AUTO
Seed Nutrient B - AUTO
Seed pH Lower - AUTO
Main Nutrient A - AUTO
Main Nutrient B - AUTO
Main pH Lower - AUTO

Water Temperature Calibration

Be sure to calibrate your temperature probes before proceeding with Nutrient (EC) Calibration

Menu

1. Access the sensor calibration menu from “Main Menu > System > Sensors > Calibrate Sensors”
2. Select “Hydro” > “Water Temp”

You will need:

A paper towel
A digital-reading waterproof thermometer
2 cups
Very cold or hot water
Room temperature water

Calibration Procedure

Zero Calibration

1. Remove both temperature probes by twisting the black plastic top nut to the left, clean and wipe probes dry.
2. On the touchscreen, press the "Zero Cal" box to pull up the keypad.
3. Enter 0.0 in the "Zero Cal" box, then press "Set Span" to delete any previous calibrations. Complete this step in Zones 1 and 2.
4. Place **both** temperature probes and your separate digital thermometer together in a cup of room temperature water and wait for the temperature reading on your separate thermometer to stabilize - this can take up to 5 minutes. *You will know the reading has stabilized when it stops changing or it only switches back and forth between two close values (ex. back and forth between 67.6F and 67.5F).* Keep in mind, the temperature of the water in the cup will change over time, using very cold water will provide a more stable temperature measurement in the cool room temperature of a freight farm.
5. Next, enter the **difference** between your separate thermometer's reading and your farm's temperature sensor reading in the "Zero Cal" box in **Zone 1**. Repeat this calculation for **Zone 2**. *Example: Your farm's temperature reading is 56.3F, but your separate thermometer reads 59.7F; enter, "3.4" in the "Zero Cal" box.*
6. Remove both the thermometer and the temperature sensor, wipe dry.

Span Calibration

7. Place the farm's temperature probe and the temperature sensor together in a cup of very cold or hot water and wait until for the separate temperature sensor reading to stabilize.
8. **In both Zones**, input the **actual temperature** from the separate thermometer into the "Span Cal" box, then press Set Span. The Span Cal button should say "Please wait..." and then the "Span Cal" box will change back to "0.0".
9. The calibration is complete. Now, the water temperature reading on the touch screen should should display the same temperature as the separate thermometer.

If you are only calibrating your farm's temperature sensors today, insert the temperature probes into the right-most sensor ports on each doser panel. The gray rubber gland should seal around the widest part of the probes, you may need to adjust your probe slightly to achieve a good seal. Tighten the black plastic top nut to create a water tight seal. Reset the necessary outputs back to their default settings.

If you are proceeding with EC and pH calibrations, leave the water temperature probes out of their ports and continue to Nutrient (EC) Calibration Instructions

Nutrient (EC) Calibration

Be sure to calibrate your temperature probes before proceeding with Nutrient (EC) Calibration

Menu Controls

1. Access the sensor calibration menu from “Main Menu > System > Sensors > Calibrate Sensors”
2. Select “Hydro” > “Water Temp”

You will need:

A paper towel
1 cup
EC calibration solution

Calibration Procedure

1. Remove both black EC probes by twisting the black plastic top nut to the left.
2. Wipe dry both temperature probes and place into calibration solution with both EC probes.

Zero Calibration

3. Go to "Menu > System > Sensors > Hydro Mapping" - *To achieve an "absolute zero," next, you will remove the avenue by which the sensors communicate with the controller. The controller will then be unable to receive data delivered by the sensor and read an error message of 9999.*
4. Change Zone 1 “cond 1” from "6" to "8".
5. Change Zone 2 “cond 2” from "10" to "12."
6. Go back to Menu > System > Sensors > Calibrate Sensors > Hydro > EC.
7. The EC sensor should now be reading an error message, and therefore, an absolute zero from the sensor
8. Press “Set Zero” in both zones.
9. Go to "Menu > System > Sensors > Hydro Mapping", change “cond 1” and “cond 2" back to 6 and 10” in their respective zones. *(i.e. 5, 6, 7, and 9, 10, 11).*

Span Calibration

10. Go back to EC calibration screen.
11. Wait for the reading to stabilize. The units for conductivity are so small (microsiemens) that the reading will keep changing indefinitely. The reading is considered stable when it has changed direction. *(i.e. if the reading is dropping from 2678 down to 2668 it is stable when it rebounds back up to 2669 or 2670 and starts changing between 2668 and 2670).*
12. In both zones, press the "Span Cal" box to pull up the keypad. Enter the EC of the calibration solution in microsiemens *as it is listed on the bottle* in the “Span Cal” box, and press “Set Span.” *For example, if you are using the bottle of 2.77 EC solution, input 2770µS*
13. The "Span Cal" button should read "please wait" and the value in the "Span Cal" box will change to "0.0."
14. Wipe down the EC and the temperature probes to remove any calibration solution.
15. Replace EC probes in the middle port in the dosing panel. *Make sure the hole at the bottom of the probe is oriented so that water will flow through the recirculator line from left to right* ***through the hole at the bottom of the sensor probe.*** Push the probe down into its port slowly until you feel it gently tap the bottom of the recirculator line, then, pull the sensor up about a centimeter to allow water flow around the bottom of the sensor and the sensor's hole is in the center of the line.

If you are proceeding to pH calibration, leave the water temperature probes out. *If not,* insert the temperature probes back into the right most ports on each doser panel. Tighten the black plastic top nut to create a water tight seal. Reset your outputs back to their default statuses.

If you ever need to set the calibration system back to default follow the instructions in the Nutrient (EC) Zero Calibration section above.

pH Calibration

Be sure to calibrate your temperature probes before proceeding with pH Calibration

Menu Controls

1. Access the sensor calibration menu from “Main Menu > System > Sensors > Calibrate Sensors"
2. Select “Hydro > pH”

You will need:

A paper towel
2 cups
pH calibration solutions for pH 7 and pH 4

Calibration Procedure

Zero Calibration

1. Remove **both** pH probes by twisting the black plastic top nut to the left, clean and wipe dry.
2. Wipe dry **both** temperature probes and place them into the pH 7.0 calibration solution **with both pH probes.** *You should have 4 probes in the same cup of solution.*
3. Allow the reading on the touchscreen to stabilize, then, press "Set Zero." The reading on the touchscreen should now display "7.00".
4. Rinse and dry both the pH and temperature probes.

Span Calibration

5. Place **both** probes into pH 4.0 (or 10.0) calibration solution. *Note: pH has a standard Zero Calibration level of 7.0. The Span Calibration is typically preformed at either a pH of 4.0 or 10.0. Simply input pH value as it is listed on your calibration solution.*
6. Allow the reading to stabilize. The reading has stabilized when it stops changing or when it only switches back and forth between two adjacent values *(i.e. 3.77 and 3.78).*
7. **In both zones,** press the "Span Cal" box to pull up the keypad and enter the pH of the calibration solution as it is listed on the bottle. **Press "Set Span" button** - the button will read "please wait..." and then the value should then change to "0.0".
8. Calibration is complete. The reading should now display the pH of the calibration solution you are using (within a decimal point is ok).
9. Wipe the sensor probes dry and insert back into their respective ports in each doser panel. *Be sure that one of the prongs on the end of the pH probe interrupts the flow of water as it flows from left to right through the recirculator line.* Push the pH probe down into its port slowly until you feel it gently tap the bottom of the recirculator line, then, pull the sensor up about a centimeter to allow water flow around the bottom of the sensor. Tighten the port's nut to achieve a water tight seal.

Note: If you have finished the entire hydro calibration process, be sure to reset the following **eight Outputs** to their **default settings**:

First,
Seed Recirculator - ON
Main Recirculator - ON

Then,
Seed Nutrient A - AUTO
Seed Nutrient B - AUTO
Seed pH Lower - AUTO
Main Nutrient A - AUTO
Main Nutrient B - AUTO
Main pH Lower - AUTO