

BaseStation 1000 Irrigation Controller Upper Threshold Moisture Sensor-Based Watering

If you have a Baseline soil moisture sensor (biSensor™) installed in your landscaping and connected to your BaseStation 1000 irrigation controller, you can program the controller to water based on the moisture levels in the soil. This watering strategy can reduce outdoor water use by up to 62 percent or more over traditional irrigation methods. And, by watering your plants when needed, you can increase landscape health, promote deeper root growth, and make your plants more disease resistant.

For areas that have a restricted schedule such as specific watering days or specific use schedules like sports fields, upper threshold (also referred to as “greater than limit” or “upper limit”) is a popular watering strategy. With upper threshold, you can choose which day and what time of day to start watering and the sensor will shut off watering when soil moisture reaches the upper threshold.

Overview of Soil Moisture Levels

The amount of moisture held in the soil varies depending on the type of soil and the amount of time between watering events. When you’re using a sensor-based watering methodology, you should have a general understanding of the water holding capacity of various types of soil. We’ve included a brief description of the standard soil moisture content levels in this document. You can learn more about soil moisture content, soil classification, and infiltration and water movement in Baseline’s document titled [Watering with Soil Moisture Sensors](#).

Soil moisture content is identified by the following levels:

Saturation: At the saturation level, nearly all of the spaces between soil particles are filled with water. As a rule, irrigators do not want to saturate the soil because it cuts off the plant’s supply of oxygen, which, in effect, drowns the plant.

Field Capacity: When soil is at the field capacity level, it means that all excess moisture has drained freely from that soil. The amount of remaining moisture is the field capacity. To irrigate properly, you would turn off the water when the soil in the root zone of the plants reaches field capacity. A Baseline biSensor measures field capacity in the calibration process and uses this value as the basis for other settings.

Maximum Allowed Depletion (MAD): In most cases, the maximum allowed depletion level is just before the plants begin to show visible signs of stress. Irrigators typically start watering at or before MAD is reached because they don’t want their landscapes to show signs of stress. MAD is not measured because it is based on observation and opinion.

Permanent Wilting Point: At the permanent wilting point, the level of water in the soil is not sufficient to meet the plant’s needs.

Upper Threshold Moisture Sensor-Based Watering

When you configure the BaseStation 1000 to use the upper threshold watering strategy, you are telling the controller to start watering based on a day and start time and stop watering when the biSensor detects that the moisture content in the soil has reached the upper limit, which is equivalent to field capacity.

Overview of the Steps for Configuring the Upper Threshold Watering Strategy

Perform the following steps to configure the controller for upper threshold watering:

Step 1 – Install the biSensor in the landscaping according to the instructions that came with the device.

Step 2 – In the BaseStation 1000 controller, search for and assign the biSensor.

Step 3 – Set up the biSensor and assign that sensor to the zone that will water it.

Step 4 – Assign the zones in the area that is monitored by the biSensor to a program by giving the zones runtimes.

Step 5 – Set up a Day & Time start condition for the program.

Step 6 – Set up the Soak Cycles for the program.

Step 7 – Set up the stop condition and the limit: you can find the limit manually or you can calibrate the biSensor to find the limit.

Step 8 – Set the controller to run.

Step 1 – Installing the biSensor

The biSensor needs to be placed in the effective root zone of the plant it is monitoring. Usually the biSensor will be making the irrigation decision for many plants or even multiple zones of plants with similar water needs, so it should be placed in the effective root zone of a representative plant.

Take note of the serial number of the biSensor that you are installing in the landscape. You will need this number when you program the controller.

Follow the wiring instructions in the biSensor installation guide to connect the biSensor to the two-wire path or to the biSensor ports on the controller or on the powered biCoder.

Make sure that you maintain polarity on the wire connections.

Fasten the wiring with wire nuts, and then test communication with the controller before you complete the installation with waterproof connectors.

Step 2 – Assigning the biSensor in the Controller

1. On the BaseStation 1000 controller, press the **Search & Assign** button. The Search & Assign menu displays.
2. Press the **↑** or **↓** button to highlight the **Moisture Sensor** option, and then press the **OK** button to select it. The Moisture Sensor screen displays.
3. If the **Device Assignment** option is highlighted, press the **OK** button to select it. If Device Assignment is not highlighted, press the **↑** or **↓** button to highlight it, and then press the **OK** button. The Moisture Assignment screen displays.
4. When the **Search** option in the Action column is highlighted, press the **OK** button to search for biSensors.

When the controller finds the devices, their serial numbers display in the Action column.

5. Press the **↑** or **↓** button to move through the list of devices in the Action column. Highlight the serial number of the biSensor that you installed in the landscape.
6. Press the **⇒** button to move to the Moisture Sensor column.
7. Press the **↑** or **↓** button to move through the list. Highlight the number that you want to assign the biSensor to.
8. Press the **OK** button. The serial number of the device that you selected in the Action column now displays next to the number in the Moisture Sensor column.

Step 3 – Assigning the biSensor to the Zone

1. Press the **Search & Assign** button. The Search & Assign menu displays.
2. Press the **↑** or **↓** button to highlight the **Moisture Sensor** option, and then press the **OK** button to select it. The Moisture Sensor screen displays.
3. Press the **↑** or **↓** button to highlight the **Device Setup** option, and then press the **OK** button. The Moisture Device Setup screen displays.
4. Press the **↑** or **↓** button to highlight the biSensor number in the left column, and then press the **⇒** button to move to the **Enabled** field.
 - If the device is currently enabled, a **checkmark displays** in the Enabled field. Press the **+** or **-** button to remove the checkmark.
 - If the device is currently disabled, **there is no checkmark** in the Enabled field. Press the **+** or **-** button to replace the checkmark.
5. Press the **↓** button to highlight the **Zone** field.
6. Press the **+** or **-** button to move through the list of zones, and then stop when the zone that you want to associate the biSensor with displays in the field.

Step 4 – Assign the biSensor Zones to a Program

Put all zones that you want to water with the upper threshold strategy into one program by giving them runtimes.

1. Press the **Program Setup** button. The Program Setup menu displays.
2. If the program that you are setting up to water based on biSensor readings displays in the upper-left corner of the screen, continue to step 3. Otherwise, press the **PRG** button until the program that you want to modify displays in the upper-left corner of the screen.

Note: To move backwards in the list of programs, press and hold the PRG button, and then press the – button repeatedly.

3. The **Zone Runtimes** option should be highlighted. If it is not highlighted, press the ↑ or ↓ button to highlight it, and then press the **OK** button. The Zone Runtimes screen displays. Zones are identified with a sequential number and by the serial number of the attached biCoder.

Note: Make sure the runtime is sufficient to get through the longest day interval during the hottest time of the year (typically ¾ inch of water).

4. Notice that the minutes placeholder in the **Zone 1** field is highlighted.

Prq 1	Zone Runtimes
1-E012471:	0:30:00
2-E012472:	0:30:00
3-0006641:	0:30:00
4-0006642:	0:30:00
5-0006643:	0:30:00
ZONE 1	

- To move to the hour placeholder, press the ← button.
- To move to the seconds placeholder, press the ⇒ button.
- To change the time, press the + or – button.

Note: To rapidly increase or decrease the value, press and hold the + button or the – button.

- To move to a different zone, press the ↑ or ↓ button.

Step 5 – Setting Up the Day & Time Start Condition for the Program

In the BaseStation 1000, a program is not active until you select a start condition for it. When you are using an upper threshold watering strategy, the program associated with the moisture sensor must have a day and time start condition.

1. Press the **Program Setup** button. The Program Setup menu displays.
2. If the program that you are setting up to water based on biSensor readings displays in the upper-left corner of the screen, continue to step 3. Otherwise, press the **PRG** button until the program that you want to modify displays in the upper-left corner of the screen.

Note: To move backwards in the list of programs, press and hold the PRG button, and then press the – button repeatedly.

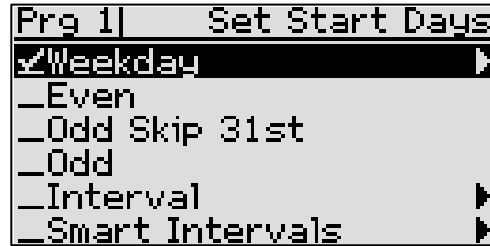
3. Press the ↓ button to highlight the **Setup Prg. Start** option, and then press the **OK** button. The Setup Prg. Start screen displays the list of start conditions.

Note: If you want the controller to display a message whenever a program starts, refer to Enabling Start, Pause, and Stop Messages in the BaseStation 1000 User Manual.

4. Press the \downarrow button to highlight the **Day & Time Start** option, and then press the **OK** button. A checkmark displays next to the Day & Time Start option.

5. Press the \Rightarrow button to go to the Day & Time Start menu.

6. Press the \downarrow button to highlight the **Set Start Days** option, and then press the **OK** button. The Set Start Days screen displays.



7. Press the \downarrow button to highlight one of the following options, and then press the **OK** button:

- **Weekday** – After you select the Weekday option, press the \Rightarrow button to set up the weekdays when you want the program to start. By default, the boxes for the days of the week are marked with a checkmark, which indicates that the program will start every day. If you want to change a start day setting, press the \Rightarrow button to select the day, and then press the **OK** button to change the setting.
- **Even** – Select Even to start the program only on the even numbered days of the month.
- **Odd Skip 31st** – Select Odd Skip 31st to start the program only on the odd numbered days of the month, but skip the 31st day in order to maintain an every-two-day schedule when crossing to a new month.
- **Odd** – Select Odd to start the program only on the Odd numbered days of the month.
- **Interval** – After you select the Interval option, press the \Rightarrow button to set up a custom day interval. Press the + or – button to change the number in the Day Interval field.
- **Smart Interval** – After you select the Smart Interval option, press the \Rightarrow button to set up the intervals for each half month. The calendar displays boxes that represent the months of the year. The numbers in the boxes represent the day intervals for first half and second half of the month. Press the \Rightarrow button to move to the box where you want to change the interval, and then press the + or – button to change the number in the box.

Note: The Smart Interval based watering schedule works best in regions where landscapes are irrigated all year. Baseline recommends that you use the historical ET deficit data for your region to configure the intervals. To find the historical ET deficit data for your region, consult with your local Agricultural Cooperative Extension office – you can find a national register of the extension offices at: <http://www.csrees.usda.gov/Extension/>

8. Press the **BACK** button to return to the Day & Time Start menu.

9. Press the \downarrow button to highlight the **Set Start Times** option, and then press the **OK** button. The Set Start Times screen displays.

Note: Each active program must have at least one start time. Programs that have no start times will not run.

10. Press the \downarrow button to highlight the box for the start time that you want to change.

11. Press the + or – button to change the number in the box.

Note: To rapidly increase or decrease the number, press and hold the + button or the – button.

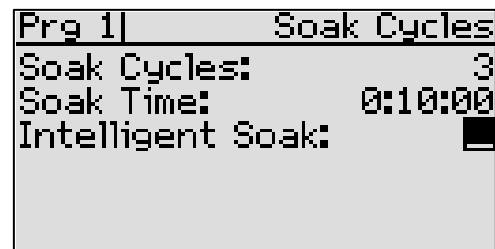
Step 6 – Setting Up the Soak Cycles for the Program

When you set a program to start based on a biSensor reading that is greater than the limit, you should set up at least 3 soak cycles with a soak time that is at least twice as long as the cycle time. Soak cycling breaks the total runtime into shorter water “cycles” with “soak” periods in between to allow time for water to soak into the soil.

1. Press the **Program Setup** button. The Program Setup menu displays.
2. If the program that you set up to water based on biSensor readings displays in the upper-left corner of the screen, continue to step 3. Otherwise, press the **PRG** button until the program that you want to modify displays in the upper-left corner of the screen.

Note: To move backwards in the list of programs, press and hold the PRG button, and then press the – button repeatedly.

3. Press the \uparrow or \downarrow button to highlight the **Soak Cycles** option, and then press the **OK** button. The Soak Cycles screen displays.
4. Notice that the **Soak Cycles** field is highlighted. Press the + or – button to change the number to indicate how many soak cycles will occur.



5. Press the \downarrow button to highlight the **Soak Time** field. Press the + or – button to change the time in this field to indicate how long you want the applied water to soak in.
6. Review the setting in the **Intelligent Soak** field. If there is a checkmark in the field, press the \downarrow button to highlight the field, and then press the + or – button to remove the checkmark. You must disable intelligent soak cycles for upper threshold watering to work properly.

Step 7 – Setting Up the Stop Condition and the Limit

When you use the upper threshold watering strategy, you are telling the controller to stop watering when the biSensor detects that the moisture content in the soil has reached the upper limit, which is equivalent to field capacity.

You can use one of the following methods to determine the upper threshold value.

- Manually identify field capacity by pouring a couple gallons of water directly over the spot where the sensor is buried to saturate the soil around the sensor. Over the next several hours, the water will spread out through capillary action. Wait at least 24 hours, and then take a sensor reading. This value is the field capacity/upper threshold.
- Run a biSensor calibration. When you enable calibration, the process either starts immediately or at the next day and time start. The program puts down 150% of the required water (based on the runtime of the zone) and then waits for 24 hours. The calibration reading is taken when the soil moisture is at field capacity.

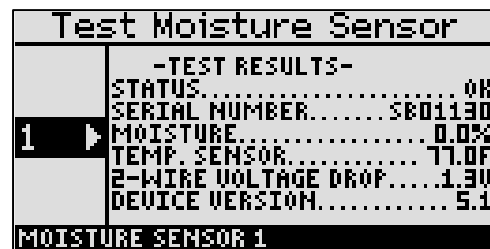
Taking a biSensor Reading and Manually Entering the Upper Threshold

1. Pour at least two gallons of water directly over the spot where the sensor is buried.
2. Temporarily disable the program so the area won't be watered for at least 24 hours:
 - a. On the BaseStation 1000 controller, press the **Program Setup** button. The Program Setup menu displays.
 - b. Press the **PRG** button until the program that you set up to water based on biSensor readings displays in the upper-left corner of the screen.

Note: To move backwards in the list of programs, press and hold the PRG button, and then press the – button repeatedly.

- c. Press the ↓ button to highlight the **Enable/Disable** option, and then press the **OK** button.
 - d. Press the **OK** button to remove the check mark from the **Enabled** field.
3. Wait 24 hours from the time when you saturated the sensor.
4. On the BaseStation 1000 controller, press the **Test** button. The Test menu displays.

5. Press the ↑ or ↓ button to highlight the **Test Moisture Sensor** option, and then press the **OK** button. The Test Moisture Sensor screen displays.



6. Press the ↑ or ↓ button to select the biSensor that is installed in the landscape.
7. Press the **OK** button to test the biSensor.

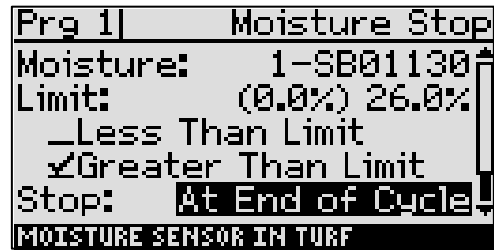
Note: If any zones or programs are running when the test is activated, watering will pause for 10 minutes. The test results display the moisture percentage.

8. Write down the moisture reading.
9. Press the **Program Setup** button. The Program Setup menu displays.
10. Make sure that the program that you set up to water based on biSensor readings displays in the upper-left corner of the screen. If it doesn't, press the **PRG** button until the correct program displays.

Note: To move backwards in the list of programs, press and hold the PRG button, and then press the – button repeatedly.

11. Press the ↓ button to highlight the **Setup Prg. Stop** option, and then press the **OK** button. The Setup Prg. Stop screen displays the list of stop conditions.
12. Press the ↓ button to highlight the **Moisture Stop** option, and then press the **OK** button. A checkmark displays next to the Moisture Stop option.

13. Press the \Rightarrow button to configure the moisture stop settings. The Moisture Stop screen displays.
14. Press the \Downarrow button to highlight the **Limit** field, and then press the + or – button to change the number in the field to match the moisture reading that you wrote down in step 8.



Note: In the Limit field, the value in parentheses is the most current reading from the biSensor. Keep in mind that the biSensor is read every 10 minutes.

15. Press the \Downarrow button to highlight the **Greater Than Limit** field, and then press the **OK** button. A checkmark displays next to the Greater Than Limit option.
16. Review the setting in the **Stop** field, and then perform one of the following:
 - If **At End of Cycle** displays in the field, continue to step 17.
 - If **Immediately** displays in the field, press the + or – button to change the setting to **At End of Cycle**. Continue to step 17.
17. Make sure that **Start** displays in the **Calibration** field. This means the calibration is not enabled.
18. Return the program status to **Enabled**:
 - a. Press the **Back** button to return to the Program Setup menu.
 - b. Press the \Downarrow button to highlight the **Enable/Disable** option, and then press the **OK** button.
 - c. Press the **OK** button to replace the check mark in the **Enabled** field.
19. Set the controller to run by pressing the **RUN** button.

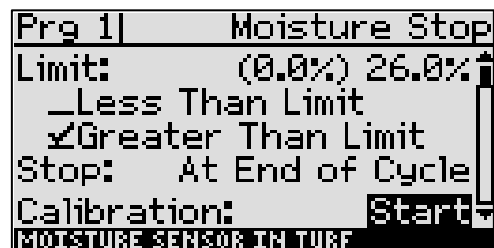
Running a biSensor Calibration

The biSensor can automatically set an upper threshold for you based on the measurement of field capacity.

1. Press the **Program Setup** button. The Program Setup menu displays.
2. Make sure that the program that you set up to water based on biSensor readings displays in the upper-left corner of the screen. If it doesn't, press the **PRG** button until the correct program displays.

Note: To move backwards in the list of programs, press and hold the PRG button, and then press the – button repeatedly.

3. Press the \Downarrow button to highlight the **Setup Prg. Stop** option, and then press the **OK** button. The Setup Prg. Stop screen displays the list of stop conditions.
4. Press the \Downarrow button to highlight the **Moisture Stop** option, and then press the **OK** button. A checkmark displays next to the Moisture Stop option.
5. Press the \Rightarrow button to configure the moisture stop settings. The Moisture Stop screen displays.



Upper Threshold Moisture Sensor-Based Watering

6. Press the **↓** button to highlight the **Greater Than Limit** field, and then press the **OK** button. A checkmark displays next to the Greater Than Limit option.
7. Review the setting in the **Stop** field, and then perform one of the following:
 - If **At End of Cycle** displays in the field, continue to step 8.
 - If **Immediately** displays in the field, press the **+** or **-** button to change the setting to **At End of Cycle**. Continue to step 8.
8. Press the **↓** button to highlight the **Calibration** field.
 - If the calibration has not been enabled, the **Start** option displays on the right side of the screen. To start the calibration, highlight the **Start** option, and then press the **OK** button.
 - If the calibration has been enabled, the **Stop** option displays on the right side of the screen. To stop the calibration, highlight the **Stop** option, and then press the **OK** button.
9. Set the controller to run by pressing the **RUN** button.

After you enable the calibration, the process either starts immediately or at the next day and time start. The controller adds 50% to the runtime of each zone in the program that's being calibrated. This additional runtime should water the landscape up to Saturation level. When the program is finished, the controller waits 24 hours for the landscape to dry to field capacity, and then it takes the calibration reading. That value is automatically entered into the Limit field.

After the calibration cycle runs one time, it is disabled in the controller.

Step 8 – Setting the Controller to Run

When you have finished making changes, press the **RUN** button.