



WaterSense[®] Specification for Weather-Based Irrigation Controllers

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1.0 Scope and Objective

This specification establishes the criteria for weather-based irrigation controllers labeled under the U.S. Environmental Protection Agency's (EPA's) WaterSense program. It applies to stand-alone controllers, add-on devices, and plug-in devices (collectively referred to in this specification as controllers) that use current weather data as a basis for scheduling irrigation.

This Based on the American National Standards Institute (ANSI)/American Society of Agricultural and Biological Engineers (ASABE) Standard S627 Weather-Based Landscape Irrigation Control Systems,¹ this specification applies to controllers that create or modify irrigation schedules based on evapotranspiration (ET) principles by:

- Storing historical crop evapotranspiration (ETc) data characteristics of the site and modifying these data with an onsite sensor;
- Using onsite weather sensors as a basis for calculating real-time ETc;
- Using a central weather station as a basis for ETc calculations and transmitting the data to individual users from remote sites; or
- Using onsite weather sensors.

For the purpose of this specification, the onsite weather sensor requirement includes weather sensors such as temperature or solar radiation. Because rainfall devices and soil moisture sensors do not modify ETc but interrupt or modify previously scheduled irrigation events based on rainfall or soil moisture readings, they do not meet this onsite weather sensor requirement when used as the sole method for modifying irrigation schedules.

The performance criteria contained in this specification are designed to test the capability of the controller to provide adequate and efficient irrigation while minimizing potential runoff when the controller is programmed and operated in compliance with the manufacturer's instructions. Conformance with these requirements is an indication that the controller has the capacity to modify or generate appropriate irrigation schedules based on weather inputs.

This specification applies to controllers for use in residential or commercial landscape irrigation applications, including controllers that connect to hose bibbs. It does not apply to controllers intended for use exclusively within agricultural irrigation systems.

2.0 Summary of Criteria

Controllers must meet criteria in the following areas, as applicable:

- Irrigation adequacy for each zone shall be greater than or equal to 80 percent as specified in Section 3.0.

¹ References to ANSI/ASABE S627 apply to the most current version this standard.

- Irrigation excess for each zone shall be less than or equal to 10 percent as specified in Section 3.0. The average of the irrigation excess scores calculated across the six zones shall be less than or equal to 5 percent as specified in Section 3.0.
- The controller must conform to the supplemental capability requirements specified in Section 4.0.

3.0 Performance Criteria

The controller, as configured for testing in accordance with Appendix A, shall be tested in accordance with ~~the eighth draft of the Smart Water Application Technologies™ (SWAT) test protocol for climatologically based controllers included in Appendix C, with the additional requirements listed in~~ Section ~~3.1,4~~ (Test Method #1) of ANSI/ASABE S627 and shall meet the performance criteria in Section ~~3.21~~ of this specification.

~~In accordance with the SWAT protocol, the~~ The test period shall be 30 consecutive days. However, the test may run past the initial 30 days until a 30-day period occurs where all conditions in Section ~~3.14.6~~ (Weather Requirements) of ANSI/ASABE S627 are met. ~~The first valid 30-day test period shall be used to calculate irrigation adequacy and irrigation excess. If, and those values shall be compared to the thresholds included~~ criteria in Section 3.2 ~~are not met, 1 to determine if the product passes the test shall be restarted.~~²

~~3.1 Testing Modifications to the SWAT Protocol³~~

~~3.1.1 Minimum Runtimes: All runtimes (irrigation cycles) that occur during the test period must be greater than three minutes in duration. Water applied during irrigation events totaling three minutes or less shall be excluded from the daily water balance calculation.~~

~~3.1.2 Missing Data From the Reference Weather Station:~~

~~3.1.2.1 For the test to be valid, there shall be no more than two consecutive days, or no more than three days in total, of missing reference evapotranspiration (ET_o) data generated by the reference weather station during the test period.~~

~~3.1.2.1.1 If ET_o data generated by the reference weather station are missing during the test, then the previous day's ET_o data shall be used instead.~~

~~3.1.2.2 There shall be no missing rainfall data during the test period; however, data from a backup rain gauge located at the same site as the reference weather station may be substituted for missing rainfall data. If data from a backup rain gauge are available, this is not considered missing data.~~

² ANSI/ASABE S627 implies the test may run longer than 30 days, but WaterSense is clarifying the test period shall be no more than 30 days and shall be the first 30-day period in which the weather requirements are met.

³ ~~WaterSense has prepared and will make available software that performs SWAT protocol calculations with these modifications.~~

~~3.1.3 Rainfall Requirement: There shall be at least four individual days during the test period with 0.10 inches or greater of gross rainfall for the test to be considered valid. These individual day rainfall amounts count toward the total rainfall requirement specified in the SWAT protocol.~~

~~3.1.4 Order of Operations: The order of operations implemented during the SWAT protocol daily water balance calculation shall be Etc, irrigation, then rainfall. This differs from the order as designated in the SWAT protocol where rainfall occurs first.~~

~~3.2.3.1~~ Performance Requirements

~~3.2.13.1.1~~ Irrigation adequacy, as calculated in accordance with ~~the SWAT protocol modified by Section 3.1 of this specification~~ Table 4 in ANSI/ASABE S627, shall be greater than or equal to 80 percent for each zone.

~~3.2.23.1.2~~ Irrigation excess, as calculated in accordance with ~~the SWAT protocol modified by Section 3.1 of this specification~~ Table 4 in ANSI/ASABE S627, shall be less than or equal to 10 percent for each zone. The average of the irrigation excess scores calculated across the six zones shall be less than or equal to 5 percent.

4.0 Supplemental Capability Requirements

The controller, as configured for testing in accordance with Appendix A, shall have the following supplemental capabilities in both ~~smart~~weather-based mode and standard mode:

- 4.1 ~~The controller shall be~~ Be capable of preserving the contents of the programmed irrigation ~~program~~ settings when the power source is lost and without relying on an external battery backup.
- 4.2 ~~The controller shall either~~ Either be capable of independent, zone-specific programming or storing a minimum of three different programs to allow for separate schedules for zones with differing water needs.
- 4.3 ~~The controller shall be~~ Be capable of indicating to the user when it is not receiving a signal or local sensor input and is not adjusting irrigation based on current weather conditions.
- 4.4 ~~The controller shall be~~ Be capable of interfacing with a rainfall device or soil moisture sensor.
- 4.5 ~~The controller shall be~~ Be capable of accommodating watering restrictions as follows:

- 4.5.1 Operation on a prescribed day(s)-of-week schedule (e.g., Monday-Wednesday-Friday, Tuesday-Thursday-Saturday; any two days; any single day, ~~etc.~~).
 - 4.5.2 Either even day or odd day scheduling, or any day interval scheduling between two and seven days.
 - 4.5.3 The ability to set irrigation runtimes to avoid watering during a prohibited time of day (e.g., between 9:00 a.m. and 9:00 p.m.).
 - 4.5.4 Complete shutoff (e.g., on/off switch) to accommodate outdoor irrigation prohibition restrictions.
- 4.6 ~~The controller shall include~~Include a percent adjust (water budget) feature.⁴
~~If the primary source of weather information is lost, the controller shall be~~
- 4.7 Be capable of reverting to either a proxy of historical weather data or a percent adjust (water budget) feature if the primary source of weather information is lost.
- 4.8 ~~The controller shall be~~Be capable of allowing for a manual operation troubleshooting test cycle and ~~shall~~ automatically return to ~~smart~~weather-based mode within some period of time as designated by the manufacturer, ~~even if the switch is still positioned for manual operation.~~

5.0 Packaging and Product Documentation Requirements

Controllers shall be packaged and provided with documentation as indicated in this section.

5.1 General: Applies to Stand-Alone, Add-on Devices, and Plug-in Devices

The product, as packaged, shall include the same components (excluding the base controller for add-on or plug-in devices) or attributes that it was tested with to meet the requirements of this specification. For controllers with weather stations, sensors, or rainfall devices, all components tested with the controller must be packaged with the controller. For signal-based controllers, instructions on acquiring the proper weather signal shall be packaged with the controller.

The product packaging shall include an instruction manual that lists the settings and specific parts used during the performance test described in Section 3.0. The instruction manual shall also include the maximum number of stations for the product.

The product shall not be packaged nor marked to encourage operation of the controller in standard mode. Any instruction related to the maintenance of the product shall direct the user ~~on~~ how to return the controller to ~~smart~~weather-based mode.

5.2 Add-on and Plug-in Devices

⁴ The percent adjust (water budget) feature is defined as having the means to increase or decrease the runtimes or application rates for zones by means of one adjustment without modifying the settings for each individual zone.

~~The add-on device is and plug-in devices are~~ not required to be packaged with the base controller(s) ~~that it was with which they were tested with to meet the requirements of this specification or have been determined to be compatible with, as specified in Appendix A.~~ However, the product documentation for the add-on ~~device and plug-in devices~~ must list ~~(or provide access to a list of)~~ each compatible base controller model ~~with which the device was tested and demonstrated to meet the requirements of this specification and with which the manufacturer intends it to be connected.~~ The documentation must also contain a statement to the effect that the device is only WaterSense labeled when used in combination with a base controller on the provided list.

5.3 Plug-in Devices

~~The plug-in device is not required to be packaged with the base controller(s) that it was tested with to meet the requirements of this specification. However, the product documentation for the plug-in device must list each base controller model with which the device was tested and demonstrated to meet the requirements of this specification and with which the manufacturer intends it to be connected.~~ The documentation must also contain a statement to the effect that the device is only WaterSense labeled when used in combination with a base controller on the provided compatibility list.

6.0 Effective Date

This specification is effective as of ~~November 3, 2011.~~ September 2, 2021.

7.0 Future Specification Revisions

EPA reserves the right to revise this specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. ~~Revisions~~ Major revisions to the specification shall be made following ~~discussions with~~ input from industry partners and other interested stakeholders.

8.0 Definitions

Definitions within ~~the SWAT test protocol for climatologically based controllers (Draft 8, September 2008)~~ ANSI/ASABE S627 are included by reference.

Add-on device: A ~~product weather-based irrigation controller~~ that ~~modifies an existing system equipped~~ communicates with a ~~standard clock timer~~ base controller ~~to use and uses~~ current weather data as a basis for controlling the irrigation schedule. For purposes of this specification, add-on devices are defined as those that are designed to work with ~~any brand of base controller and may connect through a variety of ways~~ multiple brands of base controllers.

Base controller: The ~~standard clock timer~~ irrigation controller ~~to with~~ which ~~the an~~ add-on or plug-in device ~~is attached~~ communicates for full operation.

Plug-in device: A ~~product~~ weather-based irrigation controller that ~~modifies an existing system-~~ ~~equipped~~ communicates with a ~~standard clock timer~~ base controller ~~to use~~ and uses current weather data as a basis for controlling the irrigation schedule. For purposes of this specification, plug-in devices are defined as those that are designed to work specifically with one brand of ~~controller and may connect with the~~ base controller ~~through a variety of ways~~.

Rainfall device: A device that either senses or measures rainfall to reduce or interrupt irrigation in response to rain events. For the purpose of this specification, this includes, but is not limited to, rainfall interrupt devices and tipping bucket rain gauges.

Reference weather station: The weather station ~~maintained~~ utilized by the licensed certifying body that produces the reference weather data used during the performance test.

~~Smart mode: The operating mode in which the controller is using weather data to schedule irrigation or modify the irrigation schedule.~~

Soil moisture sensor: A sensor mechanism and interface device that enables (allows) or disables (prevents/interrupts) an irrigation event at preset or selected soil water values.

Stand-alone controller: A ~~product~~ weather-based irrigation controller for which weather-based control is an integrated capability. This includes a single controlling device (i.e., the irrigation controller) and all of the sensors and/or weather service(s) that provide the weather data.

Standard mode: The operating mode in which the controller is not using weather data to schedule irrigation or modify the irrigation schedule (i.e., when a weather-based controller is not in ~~smart~~ weather-based mode).

Weather-based mode: The operating mode in which the stand-alone controller (or plug-in or add-on device and associated base controller) is using weather data to schedule irrigation or modify the irrigation schedule.

APPENDIX A: Testing Configuration ~~and~~, Programming, and Compatible Base Controller Determination

Controllers shall be configured for testing in accordance with the relevant sections below.

1.0 General: Applies to Stand-Alone, Add-on Devices, and Plug-in Devices

The controller shall be tested with all weather stations, sensors, rainfall devices, or service(s) required to meet this specification.

The controller shall be programmed according to the list of settings provided by the manufacturer in the product's instruction manual described in Section 5.1 of this specification. Manufacturers shall have no interaction with the product during testing, including programming of the controller during setup or for the duration of the test.

Licensed certifying bodies shall not make any special accommodations during testing for the controller to select the reference weather station as its data source. The test report shall include the name and address of the reference weather station.

2.0 Add-on and Plug-in Devices

2.1 ~~Add-on devices must be tested with each~~ Initial Configuration for Testing

The manufacturer shall specify a base controller model with which the ~~manufacturer intends it to add-on or plug-in device shall be tested. Together, the unit shall be connected in order to meet~~capable of meeting the requirements of this specification. ~~As a unit, the add-on device and the~~, including the supplemental capability requirements specified in Section 4.0.

2.2 Determining Additional Compatible Base Controllers

At the discretion of the licensed certifying body (LCB), additional base controller ~~must meet all of the requirements contained in this specification~~models with which the add-on or plug-in device can be paired, and that together as a unit meet the requirements of this specification, including the supplemental capability requirements specified in Section 4.0, can be identified and listed as compatible base controllers according to Section 5.2 of this specification and labeled in accordance with Section 3 of Appendix B. See the *Supplemental Guidance for WaterSense Certification and Labeling of Irrigation Controllers* and the *WaterSense Product Certification System* for more information.

~~3.0 Plug-in Devices~~

~~Plug-in devices must be tested with each base controller model with which the manufacturer intends it to be connected in order to meet the requirements of this specification. As a unit, the plug-in device and the base controller must meet all of the requirements contained in this specification.~~

3.0 Controllers With Fewer Than Six Stations

For controllers that offer fewer than six stations, multiple products shall be tested simultaneously to cover the six zone programming requirements required in ANSI/ASABE S627. For example, two products capable of controlling three irrigation zones each must be programmed together to meet the six-zone requirement.

APPENDIX B: Informative Annex for WaterSense Labeling

The following requirements must be met for products to earn the WaterSense label.

1.0 WaterSense Partnership

The manufacturer of a controller must have a signed partnership agreement in place with EPA. Manufacturers of components, such as weather stations ~~or~~, additional sensors, or weather services are not eligible for partnership on that basis alone.

2.0 Conformity Assessment

Conformance to this specification must be certified by a licensed certifying body accredited in accordance with the *WaterSense Product Certification System*.

3.0 WaterSense Labeling

- 3.1 The label ~~can~~ shall be applied to product packaging that includes the certified controller and all components (excluding the base controller for add-on and plug-in devices) or attributes with which the controller was tested to meet the requirements of this specification.
- 3.2 For add-on and plug-in devices, only the devices certified to meet the requirements of this specification may bear the WaterSense label. Base controllers with which the add-on or plug-in devices are tested and ~~that are sold separately from the add-on devices/or determined to be compatible~~ shall not bear the WaterSense label. Product documentation shall indicate that the add-on or plug-in device is only WaterSense labeled when used in combination with the base controller(s) listed in product documentation described in Section 5.0 of this specification.
- ~~3.3 For plug-in devices, only the devices certified to meet the requirements of this specification may bear the WaterSense label. Base controllers with which the plug-in devices are tested and that are sold separately from the plug-in devices shall not bear the WaterSense label. Product documentation shall indicate that the plug-in device is only WaterSense labeled when used in combination with the base controller(s) listed in product documentation described in Section 5.0 of this specification.~~
- 3.3 Base controllers that are tested, or determined to be compatible with an add-on or plug-in device, may bear the WaterSense promotional label and include language similar to “Look for the WaterSense labeled [plug-in or add-on device] to improve the water efficiency capabilities of this controller.” See the *WaterSense Program Mark Guidelines* for more information about the use of the WaterSense promotional label.
- 3.4 Products (i.e., stand-alone controllers, plug-in and add-on devices) that are packaged and sold as a single unit and integrate weather-based scheduling (i.e., the use of current weather data as a basis for scheduling irrigation) and soil moisture-based scheduling (i.e. an allowance or prevention of an irrigation event based on readings from a soil moisture mechanism) shall be certified to meet the requirements of this *WaterSense Specification for Weather-Based Irrigation Controllers* and the

WaterSense Specification for Soil-Moisture Based Irrigation Controllers in order for the product to earn the WaterSense label.

4.0 Product Sampling for Certification

Products shall be sampled in accordance with sample selection requirements described in the *WaterSense Product Certification System* and Section 4.1 of ANSI/ASABE S627.

[Note that Appendix C, which included the SWAT protocol, has been deleted.]