



**WaterSense® Draft Specification for Soil Moisture-Based
Irrigation Control Technologies**

Version 1.0

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1.0 Scope and Objective

This specification establishes the criteria for soil moisture-based irrigation control technologies 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 that inhibit or allow an irrigation event based on a reading(s) from a soil moisture sensor mechanism (i.e., sensor mechanism). The EPA is defining this product category as follows, based on the definitions of the applicable components included in the *American Society of Agricultural and Biological Engineers (ASABE) S633 Testing Protocol for Landscape Soil Moisture-Based Control Technologies*.¹

- Soil moisture-based irrigation control technology—a sensor mechanism and interface device that enables or disables an irrigation event at preset or selected soil water values. These products are commonly known as, and for the purpose of this specification shall be referred to as, soil moisture sensors (SMSs).
- Sensor mechanism—the portion of the device that contacts the soil and measures physical properties that are related to water content or potential.
- Interface device—the portion of the device that either enables/disables irrigation events, and/or transmits soil water information to a control system for irrigation decision-making. The interface device could be part of an irrigation controller or can be a separate component, either integrated into or separate from the sensor mechanism.

The performance criteria contained in this specification are designed to test the capability of the SMS, when programmed and operated in accordance with the manufacturer's instructions, to successfully enable or disable an irrigation event based on soil moisture readings.

This specification applies to SMSs for use in residential or commercial landscape irrigation applications.

The specification does not apply to:

- On-demand SMSs, or those that automatically adjust irrigation schedules based on soil water values.
- Sensor mechanisms alone (i.e., sold without an interface device).
- SMSs intended for use exclusively within agricultural irrigation systems.

2.0 Performance Criteria

SMSs shall be tested in accordance with the relevant sections of *ASABE S633*, as modified in Section 2.1, and shall meet the performance criteria outlined in Section 2.2.

¹ WaterSense intends to require soil moisture-based irrigation technologies to be tested in accordance with *ASABE S633 Testing Protocol for Landscape Soil Moisture-Based Control Technologies* upon the standard's final publication. This standard is currently undergoing public comment and final review.

2.1 Testing modifications to ASABE S633

- 2.1.1 For add-on or plug-in devices, the interface device shall be connected to a base controller, as described in Appendix A.
- 2.1.2 SMSs shall only be tested in the moderately coarse test medium and water with an electrical conductivity (EC) of 3 dS/m, as defined in ASABE S633.
- 2.1.3 The freeze test shall be conducted in the 40 percent water depletion container using the moderately coarse medium after the initial test is complete.

2.2 Performance criteria

- 2.2.1 When tested in accordance with Section 6 of ASABE S633, as modified in Section 2.1 of this specification, SMSs shall meet the following performance criteria:

2.2.1.1 Each SMS evaluated shall enable and disable irrigation at each of the three depletion levels.

2.2.1.2 The relative average deviation (RAD) of the readings at which the replicate SMSs enable and disable irrigation, calculated in accordance with Equations 1 and 2 below, when averaged across all water depletion level readings, shall be less than or equal to 10 percent.

Equation (1)
$$\text{Relative Avg Deviation} = \frac{\text{Avg Deviation}}{\bar{x}}$$

Where: \bar{x} is the mean

Equation (2)
$$\text{Avg Deviation} = \frac{\sum_{i=1}^n |\bar{x} - x_i|}{n}$$

Where: \bar{x} is the mean

x_i is the observation

n is the number of observations

2.2.1.3 The absolute value of the slope of the line generated by plotting irrigation enable readings for all three replicates across all three depletion levels and the absolute value of the slope of the line generated by plotting irrigation disable readings for all three replicates across all three depletion levels shall both be greater than zero when rounded to two significant digits (i.e., ≥ 0.01).

- 2.2.2 When tested in accordance with Section 7.2 of ASABE S633, as modified in Section 2.1 of this specification, each SMS evaluated shall enable and disable irrigation after the sensor mechanism is placed in a freezer for three days and thawed to pre-freeze medium temperature.

3.0 Supplemental Capability Requirements

Add-on and plug-in devices, configured for testing in accordance with Appendix A, and stand-alone controllers shall meet the following requirements in both soil moisture mode and standard mode:

- 3.1 Be capable of preserving the contents of the irrigation program and sensor mechanism settings when the power source is lost and without relying on an external battery backup.
- 3.2 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.
- 3.3 Be capable of indicating to the user when it is not receiving sensor mechanism input and is not adjusting irrigation based on soil moisture content in the landscape.
- 3.4 Be capable of interfacing with a rainfall device.
- 3.5 Be capable of accommodating watering restrictions as follows:
 - 3.5.1 Operation on a prescribed day(s)-of-week schedule (e.g., Monday-Wednesday-Friday, Tuesday-Thursday-Saturday; any two days; any single day).
 - 3.5.2 Either even day or odd day scheduling, or any day interval scheduling between two and seven days.
 - 3.5.3 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.).
 - 3.5.4 Complete shutoff (e.g., on/off switch) to accommodate outdoor irrigation prohibition restrictions.
- 3.6 Include a percent adjust (water budget) feature.²
- 3.7 Be capable of reverting to a percent adjust (water budget) feature if the sensor mechanism signal is lost.
- 3.8 Be capable of allowing for a manual operation troubleshooting test cycle and shall automatically return to soil moisture mode within some period of time as designated by the manufacturer, even if the switch is still positioned for manual operation.

4.0 Packaging and Product Documentation Requirements

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

² 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.

4.1 Stand-Alone Controllers

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 soil moisture mode.

4.2 Add-on and Plug-in Devices

Add-on and plug-in devices are not required to be packaged with the base controller(s) with which they were tested or have been determined compatible, as specified in Appendix A. However, the product documentation for the add-on and plug-in devices shall list each compatible base controller model. The documentation shall 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.

5.0 Effective Date

This specification is effective on [TBD].

6.0 Future Specification Revisions

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

7.0 Definitions

Definitions within *ASABE S633 Testing Protocol for Landscape Soil Moisture-Based Control Technologies* are included by reference. The following definitions are additional terms that are referenced in the specification:

Add-on device: An SMS in which the interface device is separate from the controller (either a separate component or part of the sensor mechanism). It communicates the sensor mechanism readings to a base controller (typically a standard clock-timer controller). For purposes of this specification, add-on devices are defined as those that are designed to work with multiple brands of base controllers.

Base controller: The irrigation controller to which the add-on or plug-in device is connected for full operation. Mostly commonly, a base controller is a standard clock-timer controller.

Plug-in device: An SMS in which the interface device is separate from the controller (either a separate component or part of the sensor mechanism). It communicates the sensor mechanism readings to a base controller (typically a standard clock-timer controller). For purposes of this specification, plug-in devices are defined as those that are designed to work specifically with one brand of controller.

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.

Stand-alone controller: An SMS in which the interface device is integrated into the controller. This includes a single controlling device (i.e., the irrigation controller) and the sensor mechanism(s) that provide the soil moisture data.

Soil-moisture mode: The operating mode in which the stand-alone controller, or plug-in and add-on device and associated base controller, is using readings from the sensor mechanism to modify the irrigation schedule.

Standard mode: The operating mode in which the stand-alone controller, or plug-in and add-on device and associated base controller, is not using readings from the sensor mechanism to modify the irrigation schedule.

Appendix A: Testing Configuration and Compatible Base Controller Determination

The requirements of this appendix apply to add-on or plug-in devices.

1.0 Initial Configuration for Testing

The manufacturer shall specify a base controller model with which the add-on or plug-in device shall be connected and tested. Together, the unit shall be capable of meeting the requirements of this specification, including the supplemental capability requirements specified in Section 3.0.

2.0 Determining Additional Compatible Base Controllers

If desired, additional base controller 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 3.0, can be identified.

The add-on or plug-in device is not required to be tested with the additional base controllers determined to be compatible; however, any compatible base controllers shall communicate with the interface device in the same way as the base controller with which the add-on or plug-in device was tested (e.g., common wire interrupt).

Appendix B: Informative Annex for WaterSense Labeling

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

1.0 WaterSense Partnership

The manufacturer of the SMS must have a signed WaterSense partnership agreement in place with the EPA.

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 For add-on devices 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/or determined to be compatible with 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 4.0 of this specification.

3.2 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.

4.0 Product Sampling for Certification

SMSs shall be sampled and selected for testing in accordance with Section 5.1 of *ASABE S633* (i.e., each test shall consist of three SMSs per manufacturer model randomly selected from a lot of at least 10 items supplied by the manufacturer).