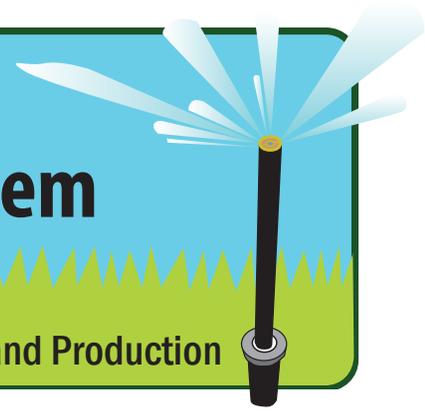




Rain sensors for a landscape irrigation system



Smart Technologies for Agricultural Management and Production

Using rainfall shutoff devices to bypass scheduled irrigation when it rains is important to conserving water resources and maintaining plant health. Rain sensors are a type of rain shutoff device designed to pause irrigation when there is a significant amount of rainfall.

For a residential system, one rain sensor is wired into the irrigation controller as an addition to the electrical circuit between the controller and the valves. In a typical configuration, the electrical circuit is opened when the rain sensor is triggered so the valves cannot activate. All sensors should be mounted in an open area such as a roofline or tall fence that will not be restricted from sensing rainfall by impediments like tree limbs or awnings. In addition, the rain sensor should be mounted high enough that the irrigation system will not interfere with the device. There are three main styles: tipping bucket, electrode and expanding disk.

Tipping bucket

The tipping bucket rain gauge is not much different than a seesaw on a playground. The water collected along the surface of the rain gauge is funneled into one side of a two-sided dish that sits on a pivot. The dish tips when one side becomes full because of the weight of the water, causing the first side to be dumped and the second side to begin filling. Each tip of the dish corresponds to a certain depth of water (i.e., 1 tip equals 0.1 inches). Certain irrigation controllers can use the rainfall measurement to estimate the number of days to pause irrigation.



ETM-RG tipping bucket rain gauge.
Image provided courtesy of Rain Bird Corp.

Pro: These devices are useful because they provide a measured amount of rainfall that can be used to make irrigation decisions.

Con: To be accurate, these types of sensors must be mounted completely level because of the sensitivity of the pivot. They require regular cleaning of the funnel to remove debris typically created by trees and birds.



Rain Check™ electrode rain shut off device.
Image provided courtesy of Rain Bird Corp.

Electrode

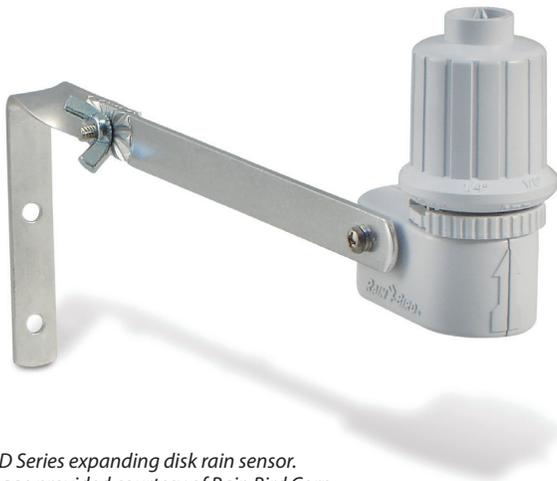
This electrode type of rain sensor relies on the ability of water to conduct electricity. It consists of two metal probes that extend into a basin where rainfall is collected. The sensor stops irrigation when the probes interact with the water. Typically, the height of the probes can be adjusted to specify the amount of water required before shutting the irrigation system off. Water evaporates from the basin to stop contact with the probes and allow irrigation again.

Pro: Once adjusted, these sensors are consistent in their operation.

Con: These sensors require regular cleaning of the basin, just like the tipping bucket funnel. The sensor must be mounted in a sunny location so water evaporates at a pace similar to the drying of the root zone of plants. If evaporation happens too slowly, the basin must be manually dumped so the landscape does not become stressed from lack of irrigation.

Expanding disk

The expanding disk rain sensor is, by far, the most commonly used rain sensor on the market. The sensor's operation relies on approximately six disks made of a cork material that expand as they absorb moisture from rainfall. In a typical configuration, the pressure from the expansion of the cork material causes the electrical circuit to open, stopping the electrical current from the irrigation controller to the solenoid valves. The cork material shrinks as it dries, resulting in the circuit closing again and normal irrigation system function resuming.

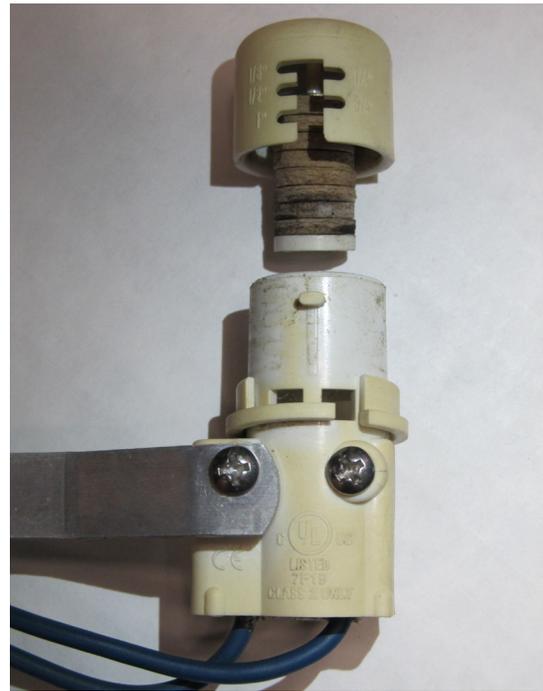


RSD Series expanding disk rain sensor.
Image provided courtesy of Rain Bird Corp.

Most wired versions have settings that allow the installer to pick when the irrigation shuts off based on the amount of rainfall (e.g. 0.25 inches). That point is called the threshold. Some wireless versions may have a quick shut-off at the first hint of rainfall rather than adjustable settings.

Based on the results of an extensive three- to five-year “bench test,” the following was learned:¹

- The sensors had high variability in their accuracy (measured rainfall compared with threshold setting), with a range of 27 percent to 97 percent of accuracy.
- The dry-out period, or the length of time before irrigation is allowed to occur after a rainfall event, was less than 36 hours for 80 percent of the time when using the 0.5 inch threshold.
- At that threshold, potential water savings were calculated as 17 percent when compared to an irrigation schedule of two days per week.
- Lower thresholds resulted in even shorter dry-out periods and increased potential water savings.



Cork material inside the cap of a Hunter Mini-Clik rain sensor.
Image provided courtesy of University of Florida – Institute of Food and Agricultural Sciences, Gainesville, Fla.

The cork material in the sensor retains a memory of the wetting/drying pattern based on the threshold, which can cause inaccurate measurements and eventual failure. If the threshold is high (e.g., 1 inch), the cork material fully expands and never fully shrinks again. Changing to a threshold of 0.125 inches results in unnecessarily bypassing all irrigation events (whether there's rain or not). The opposite is true when selecting the lower thresholds. The cork material no longer fully expands because of the small space available when adjusted to a 0.125-inch threshold. Changing the threshold to 1 inch would result in never bypassing any irrigation events because the cork remains compressed.

Adjustments to the thresholds should be made as soon as possible after installation. If the threshold needs to be adjusted after three months, it is better to replace the entire sensor due to the memory of the wetting/drying pattern.² In addition, the cork material has a short life span, which results in the need to evaluate the functionality at least once per year with a probable replacement rate of every one to three years.² This can be done by pressing and holding the trigger on top of the sensor while a zone is running to verify that it shuts off.

Pro: Expanding disk sensors are lower priced and require less maintenance compared to the other types of sensors.

Con: The cork material in expanding disk sensors has a short life span. Evaluations of functionality should occur at least once per year based on a necessary replacement rate of every one to three years.



Installation of RSD series expanding disk rain sensor.
Image provided courtesy of Rain Bird Corp.



Installation of WR2 wireless expanding disk rain/freeze sensor.
Image provided courtesy of Rain Bird Corp.



WR2 wireless expanding disk rain/freeze sensor.
Image provided courtesy of Rain Bird Corp.

Summary

With annual rainfall averaging 45 inches to 65 inches across Louisiana, it is important to take advantage of this naturally occurring water source. The main benefit of bypassing irrigation during rainy periods is the reduced number of irrigation events during the growing season. Reducing irrigation can reduce wear and tear on the irrigation system, lower operating costs for water and energy, result in less disease related to excess water and ultimately conserve water resources.

Although there are concerns with the variability in accuracy and the frequency of replacement of expanding disk rain sensors, they still are a viable option for water conservation. They generally are low-cost devices that can pay for themselves in less than a year when water rates are greater than \$1.50 per 1,000 gallons.¹

If the upkeep of a rain sensor is too much for the customer, a good alternative would be a soil moisture sensor that has significantly less maintenance but a larger price tag. Soil moisture sensors act as rainfall shutoff devices, similar to rain sensors, by skipping irrigation events when there is enough moisture in the root zone.

¹Cardenas-Lailhacar, B. and M. D. Dukes. 2008. Expanding disk rain sensor performance and potential irrigation savings. *Journal of Irrigation and Drainage Engineering*. 134(1): 67-73.

²Meeks, L., M. D. Dukes, K. W. Migliaccio, and B. Cardenas-Lailhacar. 2012. Long-term expanding disk rain sensor accuracy. *Journal of Irrigation and Drainage Engineering*. 138(1): 16-20.

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