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# How to Prepare, Test & Install Watermark™ Sensors

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*This is the first in a series of three fact sheets on using Watermark Soil Moisture Sensors to aid in irrigation management. This fact sheet provides guidance on the proper construction and preparation of sensors for field installation. The second fact sheet discusses "How to Use Watermark Soil Moisture Sensors," and the third fact sheet provides guidelines for "Timing the Final Irrigation Using Watermark Soil Moisture Sensors."*

This publication shows how to construct Watermark Sensors using polyvinyl chloride (PVC) water pipe for use in monitoring soil moisture in row crops. Watermark sensors are manufactured by the Irrometer Company in Riverside, California.

## Materials

- PVC pipe ½ inch (Schedule 20, 315 psi thin wall ASTM D2241)
- Watermark sensor, 200SS
- Blue PVC cement (for wet conditions)
- PVC cleaner and primer (optional)
- Electrical tape
- ½ inch PVC cap
- Rubber washer (American Packaging and Gasket - APG 13880rf125a0050v)
- Saw or PVC cutter
- Permanent marker
- 7/8 inch x 33 inch soil sampling probe, part number 400.96 (AMS Soil Sampling, American Falls, ID). Other tools can be used.
- Side hammer, Part Number M401.01, (AMS Soil Sampling, American Falls, ID)

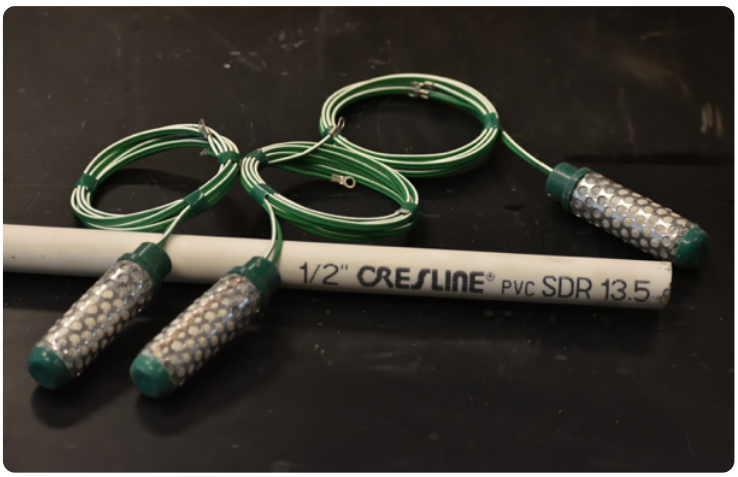


**Figure 1. The sensor is attached to a length of PVC pipe which facilitates installation to the desired depth in soil. The 1/2-inch SCH 20 PVC pipe (315 PSI, thin wall ASTM D2241) is the right size to provide a snug fit with the Watermark sensor collar. Do not use ordinary 1/2-inch PVC pipe.**

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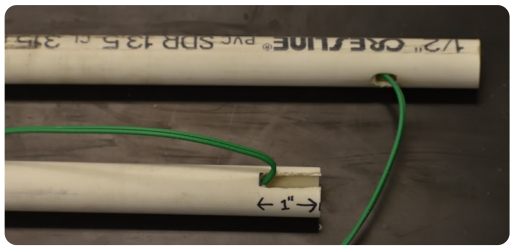
## Instructions

1. Cut the PVC tubing in lengths approximately 4 inches longer than the desired depth for sensor installation. For example, to prepare a sensor to measure soil moisture at a 6-inch depth, a 10-inch length of PVC pipe is needed.

| **Sensor Install Depth** (inches) | **Minimum Recommended PVC pipe length** (inches) |
|---|---|
| **6** | 10 |
| **12** | 16 |
| **18** | 22 |
| **30** | 34 |

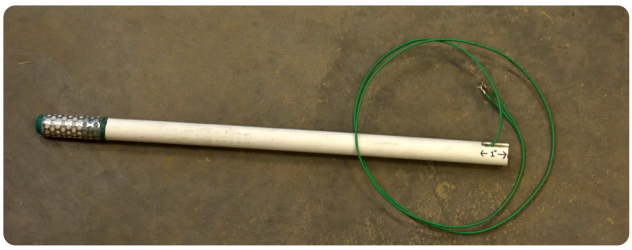
**Figure 2. Use PVC pipe cutter to get the desired lengths.**

2. Cut a 1-inch notch or drill a hole at the top of the pipe for the sensor wire so that when the PVC cap is placed on the top of the installation tube, the wire is not pinched.

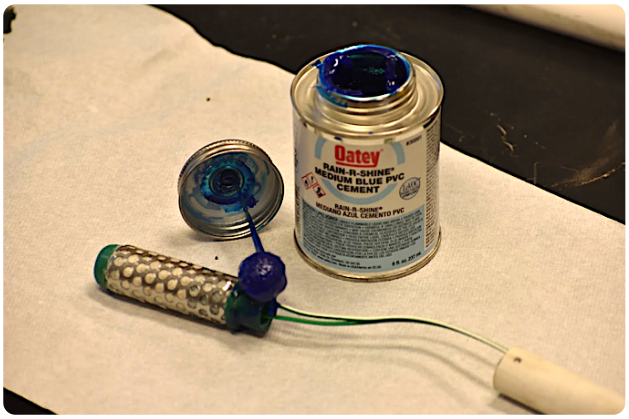



3. Drill a small 1/8-inch hole about 1/4 inch from the end of the pipe. This is a drain hole.

4. Extend the wire through the pipe from the sensor.

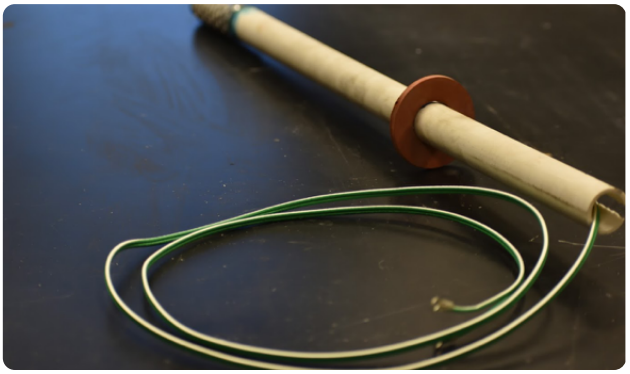


5. Apply PVC primer and glue to the sensor collar and pipe. The slot on the sensor and hole should align so that water can drain. Wipe off excess glue so the surface is smooth. Do not allow excess glue to build up around the seam.



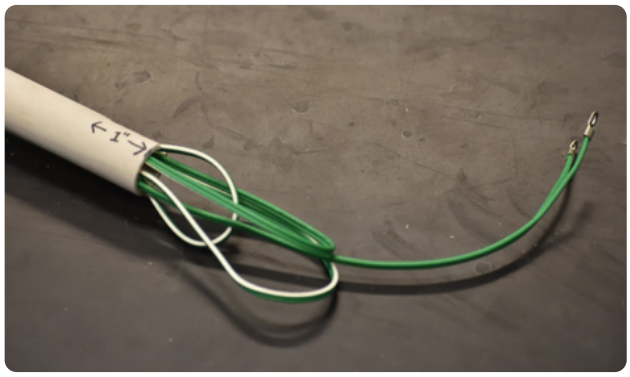

6. Measure from the end of the sensor and mark PVC pipe using a permanent marker at the desired sensor install depth. You can also label the tube cap (do not glue the cap).

7. Place rubber washer on PVC pipe to ensure sensor is installed to correct depth.



8. Tape cap with electrical tape.

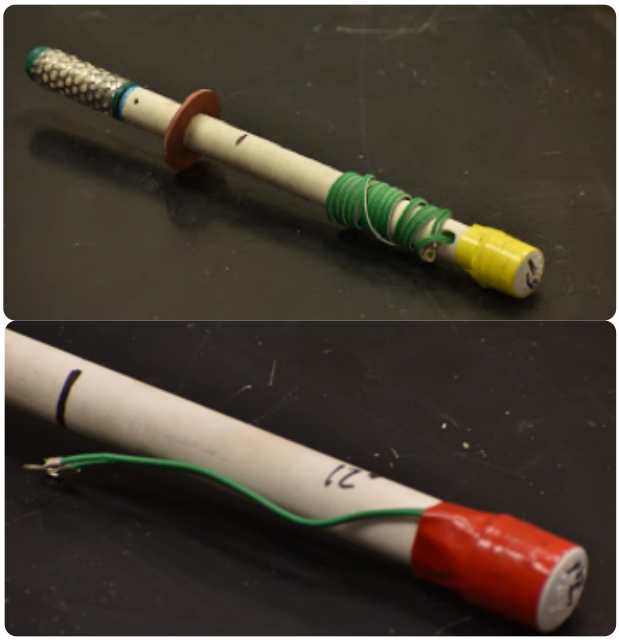
   For manual read sensors, put the excess wire in the pipe by looping it inside before routing the wire out of the PVC. Leave 2-4 inches of wire outside for the leads, just enough to connect a manual reader - less is better.



**Suggested Color Bar Code for Watermark Sensor Depths**

| | |
|---|---|
| Yellow | 6″ |
| Red | 12″ |
| Blue | 18″ |
| Green | 30″ |

Sensors to be used with collection units: these require 15 ft or longer leads for connection to telemetry units or data loggers. Excess wire can be wrapped around the completed sensor.



9. Prior to field installation, new Watermark sensors should be conditioned through two wetting and drying cycles. Soak sensors overnight (or at least halfway submerged) and then allow them to dry during the day (30-48 hours). Test with a manual reader. This reading should be greater than 150 cb. Submerge the sensor in water and the meter reading should be less than 5 cb. Let the sensor air dry for 30 to 48 hours. For a dry sensor, the reading should be 150-199 cb. Put the sensor back in water, and within 2 minutes, the meter reading should return to less than 5 cb.


**Figure 3. Soak sensors preferably in the irrigation water that will be applied to the field or fresh rainwater; however, tap water also can be used.**

10. Soak sensors overnight before installation, and keep sensors in water until installation.

11. Make a sensor access hole in the row or between plants at desired depth using a slide hammer. For twin row systems, install between the twin rows. Always install the sensor in the top of the bed. Install a wet sensor in a dry hole. Push the sensor down the hole until it bottoms out. Gently tap sensor with the handle of the slide hammer so that it is solid in the bottom of the hole. Sensors will need at least 2 days to acclimate. Install sensors at least 3 plants apart from each other in the row, preferably in order of depth.

**Figure 3. Sensors should be installed early in the season when plants are small so that the installation does not damage roots. Plants with roots that are damaged by sensor installations may not use water the same as undamaged plants.**

12. Push rubber washer into place so that it contacts the soil. Remove soil from slide hammer probe and place on top of washer and gently pack down. Use enough soil so that washer is no longer visible.

13. Locating the sensors for troubleshooting, or for removal prior to harvest, will be easier if flags are placed at the installation site and at the end of rows where sensors are positioned. Sensors are easier to extract when the soil is moist.

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