

# Parts of the S.Sense Network

## Your Irrigation Controller

The S.Sense System is designed to work with your existing **Irrigation Controller**. Most controllers, no matter the brand, tend to work in much the same way.

In order to get the best results out of the system, your irrigation controller will need to be configured properly for cooperation with the S.Sense Receiver. The good news is, it will be a very simple configuration. Probably the same or close to the default setup of your controller. We will cover this a little later.

## Sensors

The S.Sense Sensor is a computer that you stick in the ground! It contains a sophisticated micro-controller, a radio transceiver, and sensors that monitor battery charge, soil temperature, and soil moisture levels.

The purpose of a Sensor is to tell the Receiver what the conditions are at that location in your lawn and garden. It does this by periodically sending radio messages to the Receiver.

Because we are running off a set of batteries for a year, the radio transceiver runs at a very low power level. Which is fine for the short distances involved if you are careful to install the Sensor in a location that “sees” the Receiver. We will cover this in detail in the section on “Planting Your Sensor.”

## The Receiver

The Receiver is the “hub” of the S.Sense Network. It monitors the health and status of Sensors in its network, gathers data reported by its Sensors, monitors the watering cycles of the Controller, and analyzes all these factors to decide when, and *if*, to irrigate.

It also has the User Interface on its front that allows you to customize and adjust the settings for your particular garden and its plants.

# Installation

## Designing Your Yard Network

This is all about placement. Putting the Receiver and Sensors in the right place will determine just how well, or if, your S.Sense System works.

The critical items in Receiver placement are:

- Controller Wires – Ideally the Receiver will be mounted next to the controller, but sometimes that location will not work. So you may need to extend the wires of the Receiver so they reach the controller from where the Receiver needs to be

mounted.

0. Line of sight to the Sensor – This means the from the location you intend to mount the Receiver's Antenna, you should be able to see the area when you plan to put the Sensor.
0. Protection – The Receiver is not water-proof so the mounting location should be protected. Most home irrigation controllers are not waterproof, so it is already in a safe location that you can also use for the Receiver. If you must install the S.Sense Receiver outside, then put it inside a plastic controller box (available at the irrigation section of hardware stores).
- . Access – The Front Panel Interface should be in a comfortable location when you use it.

If your yard's soil or drainage vary a lot, you might be better served if you add additional sensors, putting one in each distinctive area. S.Sense will use the data from all the Sensors to determine how to water.

One other note on your Yard Design – Write it down. After your Sensor has been in the ground for a year, it can be much harder to find that you expect. Your memory will not be enough and in any case grass and shrubs may have grown over the Sensor. Carefully measure the location from stable landmarks, such as a tree or irrigation standpipe, then write it down on the flyleaf of this manual. A year from now, when it's time to replace the Sensor's battery, you will be glad you did. Keep the manual in a safe place you will remember later.

### **Setting up your Controller**

Remember, the S.Sense System controls *if* a watering will occur, but it cannot turn the water on. The times, dates and duration of a watering cycle is still the responsibility of your controller.

If your municipality has any watering date restrictions, then be sure to continue setting the Controller to not violate “no water” times.

Currently, you probably adjust your controller's settings regularly, compensating for seasonal variations or rainfall. Or if you are like me, you set it up once being generous on the watering so nothing dies in the hottest part of the summer, then just leave it on that setting for all the year.

For lazy people like me, there is good news – You are probably already setup perfectly for S.Sense cooperation! We want the Controller to try to water as often and as much as would be needed on the hottest, driest summer day.

The Receiver will keep the Controller from over-watering. When the S.Sense data and analysis indicate that the lawn and garden have sufficient moisture to last to at least the next scheduled water cycle, it blocks the current water cycle from starting. So while the Controller will try to irrigate often, the end result is the watering only happens when it is needed.

If you have carefully programmed your controller to do just the correct amount of watering, then you need to relax the settings a little. Change the Controller back to its hot summer watering schedule.

## Installing the Receiver

[ILLISTRATION - Receiver Bottom goes here – arrows point to:

Power and Sense wire bundle with 4 wires separated and labeled as

- Black - GROUND,
- Red - POWER,
- Green - COMMON and White - COMMON

]

We begin with mounting the Receiver to the location you have selected. Attach the mounting plate to the wall or other surface. The Receiver slips down into the bracket and will lock in place.

The Antenna is connected to the Receiver by a six foot long coaxial cable. Mount the Antenna as high as practical to give the best line of sight to the Sensors. Aluminum siding, stucco siding and metal downspouts tend to interfere with the radio transmissions from the antenna, so it is important to keep metal items out of the path between the Receiver's antenna and the sensors.

Next, connect one of the Common Wires to the Common on your Irrigation Controller's wiring strip.

[ILLISTRATION – Arrow to Common on Controllers]

There should already be a wire attached to the Common. Disconnect that wire first, then using the enclosed wire nut, connect the green wire one of the Receiver Common Wires, then connect the white wire to Common. Those of you with a little wiring experience we see that we are putting the Receiver “in series” with the valve control circuit on the common side. The Receiver monitors the voltage and current on this circuit to detect when the Controller is turning on and off the valves. The Receiver also has a relay switch so it can “interrupt” the circuit when watering is not needed.

Next, connect the red and black Power Wires to the power terminals on the Irrigation Controller. Then connect the Ground Wire to the ground terminal on the Irrigation Controller. If your Irrigation Controller is unsuitable for supplying power to the Receiver, you can use a 24 Volt AC “wall-wart” power cube. They are available in the Irrigation section of your local hardware store. The Receiver is powered by using a little of the power from your controller's power cube. This power drain is small enough that usually the existing power cube can handle it without problems.

Once the power connections are made, the green Power LED on the Receiver Front Panel should light-up, the Receiver will play a *Charge!* tune. This means the Receiver has successfully started. The Display will look like this:

If the power LED is not green, re-check the power connections. If it is green but the Receiver does not play *Charge!* and the Display does not show MAIN MENU, then call customer support at 1-408-735-9407, available 24 hours.

After a few minutes the display will change to this:

## **Sensor Care!**

The casing to the Sensor is plastic. It is designed to survive in your lawn and garden for many years; if you follow a few simple rules:

- Always use the Install Tool to create a pilot hole for the sensor, then gently push the sensor into the pilot hole.
- Avoid removing the Sensor casing from the ground unless absolutely needed. The soil around the Sensor takes time to “settle in” so the longer a Sensor is undisturbed, the more accurate the moisture reading will be.
- 0. Avoid opening the sensor compartment except when needed, such as to replace the batteries. The compression gasket that keeps moisture out loses a little effectiveness each time you open it up.

## **Join**

Before a Sensor can be a part of your Yard Network, it must be joined with your Receiver. This is a process where the Receiver meets its new Sensor and assigns it an identity. Wait until your Receiver is mounted, powered-up and ready. Have the Installation Tool on hand with a rubber hammer.

### **Sensor Battery Installation**

Now we are ready to install the battery into the Sensor. Do not install the batteries until the Receiver Unit is installed and you are ready to stick the Sensor in the ground.

[ILLISTRATION – 3-D Drawings of probe (angled 45deg right) 1) wide arrow going around top of probe showing direction of turn to open. 2) Same view but with the Install Tool Cap above the probe with arrow pointing toward the top of the probe and the twist arrow now around the Cap]

The Sensor Unit is designed to keep moisture out while it sits, mostly buried in the soil. Not easy. The Sensor case is carefully designed and manufactured for tight fit and has a gasket and a separate O-rings to tightly seal the unit. This means it can be difficult to open. If you cannot open it by hand, you can use the Cap of the Install Tool as a wrench.

With the Sensor top off, you will see a clear plastic lens. It has two indentions: Take your thumb and pointer finger to grasp the sides on the clear plastic, then gently pull the Sensor electronics out of the Sensor body.

[ILLISTRATION – drawing off electronics unit with large battery compartment showing]

The Sensor needs 3 AA Alkaline batteries. Two batteries go in the large battery compartment on one side, the other battery in the small compartment on the opposite side. Make sure you observe proper battery polarity. When you put the final battery in, the LED at the top of the unit will light for a few seconds.

Slide the electronics unit back into the body, the screw the top back on the Sensor.

### **Sensor Network Join**

Walk over to the Receiver with the Sensor. The Receiver will hear the new Sensor.

When the batteries were inserted in a Sensor, the Sensor began sending out a radio

message that says, “Hello! Is there a network around here for me to join?” Take the Sensor and hold it in one hand, then walk up in front of the Receiver. Hold it up a foot or two from the Receiver. Soon the Receiver will hear that “Hello”. When it does, it will display this panel. The Sensor number on the display will be unique to each Sensor: This means the Receiver is ready to begin the join process. Continue to hold the Sensor up near the Receiver, then with your index finger, press the ENTER (check) button on the Front Panel of the Receiver. The panel will change to this:

This may display for only a second or two before being replaced with:

When you press ENTER (X), the Receiver will begin making a beeping sound and this panel will appear:

Now we follow the Sensor Placement section that follows.

## Sensor Placement

Hold the Sensor out a way from your body because your body can block the radio signal. Keep the Sensor vertical because its antenna is designed to work best in this attitude.

Slowly walk towards the area you plan to install the Sensor. Try to keep your body from getting between the Sensor and Receiver. Watch the LED on the top of the Sensor and listen to the pitch of the beeps from the Receiver. The colors on the LED indicate the signal strength. The signal strength will vary as you move about and sometimes even if you hold still. This is in the nature of radio propagation. What you are looking for are trends. After you do this a few minutes, taking your time as you move about this will become clearer.

The LED signal strength will update once a second. The color can be steady or change between colors. This table explains the LED color display and what signal strength it is indicating:

Green	strong signal
Yellow	fair signal
Red	bad signal
No light	No signal

If by the time you get to your intended Sensor location the signal has become poor or unusable, then you need to pick a better spot. Be aware of some of the peculiarities of radio. There may be “nulls” at specific distances from the Receiver. They are not very wide so see if the signal strength picks back up as you continue away from the Receiver. Sometimes you can get reflections from buildings and structures, especially things like metal storage sheds. These can cause problems or even help boost the signal depending on orientation and conditions. Just take your time and try to find a location that seems to work well and will still meet the requirements of a good Sensor location.

When you have a spot you like, lower the Sensor down to the ground, keeping it vertical. There may be some signal drop, but if it is still good (at least Yellow LED) and the

Receiver is still beeping regularly, then you are good to plant the Sensor.

- Its a Sensor, not a tent stake

Look at the Sensor for a moment. It is a fat plastic tube and the top has a clear plastic window. This thing is obviously not meant to be hammered into the ground. For that, we have included the **Installation Tool** in your kit.

[Insert Engineering drawing of tool here – arrows point to:

- Hole digger
- Sensor Cap Tool ]

This Tool is just the right diameter to make the perfect size hole in the ground for your Sensor. It is important for accurate moisture readings that the sides of the Sensor fit snugly in the hole, so use the Tool unless rocky soil or other impediments prevent it..

Use a rubber hammer (with eye protection) to drive the tool vertically into the soil to the point where the mushroom head of the tool is in contact with the soil. Remove the mushroom cap (which is also the Sensor opener wench), then pull the Tool out of the ground. It will remove a plug of soil leaving just the right size home for the Sensor.

If the soil is very dry or hard making it difficult to drive the Tool into the ground, then wet the area throughly, allowing the water to penetrate and soak the soil. Not only will this make it easier to drive the Tool into the ground, it will also help the Sensor to calibrate itself for your soil type.

Smoothly push the Sensor into the hole until the bottom of the sensor's head is firmly flush with ground level and the peak of the Sensor is below the level your mower cuts the grass. If there is any problem with the insertion, use the Tool again to make sure the hole is ready. Once the Sensor is in place, check the LED signal strength display. If it is still good, then we have completed this step.

Walk back to the Receiver, which should be still beeping. Check the display panel. It will show the signal strength. Use this table to do a final verification that the signal quality is good enough.

STRONG SIGNAL	Doesn't get any better than this
GOOD SIGNAL	Usable - Should do great.
FAIR SIGNAL	Marginal quality – If you must, probably OK.
WEAK SIGNAL	Marginal quality – If already in the ground, probably OK.
BAD SIGNAL	Unusable level – We must have better.
NO SIGNAL	No signal – Where did you put the sensor?

If the quality too low, then you have to go pull the Sensor back out of the ground and try again to find a better location. Otherwise push the Cancel (X) Button on the Receiver Front Panel and the beeping will stop.

- Calibration

The final step in the installation process is called Calibration. This allows the Sensor to measure the type of soil and how quickly it drains so the S.Sense can make the correct watering decision based on your soil.

A few minutes after the new Sensor has joined, the Receiver will display:

This shows that the Sensor is not yet calibrated. Because everyone's soil is different, a Sensor must be calibrated to properly measure the available moisture depending on your soil and drainage. Until the Sensor is calibrated, the Receiver will allow any watering cycles to happen. Better too wet than too dry. Don't worry! Doing calibration is simple and mostly automatic.

The calibration scale goes from 0 to 100, with 100 being your soil being completely saturated (standing water) and 0 being the *wilt point* of your plants. All we are doing is letting the Sensor experience what a 100 is in your soil. The Sensor figures out everything else by monitoring the moisture as your soil drains. All you need to do is to start the process.

To calibrate, get a bucket of water or your garden hose and go thoroughly soak the Sensor and the soil around it. This serves several purposes:

- . It helps settle the soil in around the Sensor, giving better soil contact for accurate sensor readings.
- . The saturated soil helps the Sensor to quickly calibrate its moisture sensor for maximum moisture.

If your soil drains quickly, you can do the next step immediately. If your soil has a lot of clay or drains slowly, then you may need to wait a few hours. Once the water has seeped in, go to the Receiver. It should be displaying the SYSTEM STATUS NORMAL screen as shown before. Press the (X) button. This will get you back to this screen:

Use the Down Arrow button to put the cursor on the CHECK SENSORS line, then press (v) button to select. You will then get this screen:

Use the arrow buttons to put the cursor on the CALIBRATE SENSOR line, then press the (v) button to select. This gets you to this screen:

Since we have already done steps 1 and 2, press the (v) button to set. The Receiver will communicate with the Sensor for a little while, then it will display this screen:

Use the arrow buttons to put the cursor on the MOISTURE LEVEL % line, then press (v) to select. This will put us on screen:

As we just saturated the soil, it should show the moisture level at or near 100%.

Next use the (X) button to go back to the prior screen. Use the arrow buttons to put the cursor on the MOISTURE THRESHOLD line, then press (v) button to select. We now see the screen:

This shows the watering threshold is currently at its default value of 77%. As long Sensor reports a moisture level above 77%, the Receiver will not allow watering. Later on we will discuss how to adjust watering threshold for optimal plant health with minimum watering.

After a few minutes, the screen will automatically go back to the STATUS screen, but now that we have a calibrated Sensor, it will be a lot more informative:

This screen displays the data from the driest Sensor in your network. Since we only have one Sensor installed at this point, it will be Sensor #1. Here we see the soil has drained a little but more but is well above the 77% watering threshold.

## **Installation Problems**

“One size fits all” never really works. So in case your install did not follow the plan, we will step you through dealing with possible installation problems.

If you problem is not covered by these cases or if following the recommended procedure does not solve the problem, then go to the Digital Sun website at [URL here].

### **0. Receiver never starts Join**

So you are holding the Sensor up to the Receiver, but the Join panel never appears on the Receiver display. Possible reasons are:

- . You forgot to put the batteries in the Sensor.
  - . You have not waited long enough. Transmitting uses a lot of battery power, so a Sensor is not constantly sending that “Hello” message. When the batteries are first inserted in the Sensor, it transmits often. But if it does not get an answer, it will over time space the transmissions further apart to save the batteries.
0. The Receiver is deaf. The usual cause is the antenna is not connected. Verify that its is connect, properly installed and in a location that can “see” the Sensor as you are holding it.

If none of these procedure gets Join to start, call Digital Sun Support.

### **Receiver exits Join early**

Once the Receiver goes into Join, it will stay in Join until you press the ENTER button or it loses the radio signal from the Sensor for too long. If you spend a lot of time at the edge of the range for the signal, the Receiver could lose the Sensor for too long and decide to give up.

In this case you can manually put the Receiver in the Signal Strength mode and then resume your hunt for that perfect location. The procedure to get into Signal Strength Mode is available on the Digital Sun website at [URL here].

### **Cannot get a good signal after Sensor inserted in ground**

When you are holding the Sensor in your hand, it will usually be getting a better signal from the Receiver than when it is inserted in the ground and the Sensor's antenna is literally at ground level down among the grass leaves. So the current location is just not working very well.

You need to pull the Sensor out and try to find a better spot. It will help if you test the new location a little by holding the Sensor down close to the ground, but still vertical, in

the new location. Make sure it then shows at least FAIR SIGNAL or better because it will probably drop level of quality when you put it in the ground.

## **FCC Notice**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does not cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

**CAUTION:** changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## **FCC RF Radiation Exposure Statement:**

To comply with FCC RF Exposure compliance requirements, for mobile configurations, a separation distance of at least 20cm must be maintained between the antenna of this device and all persons. This device must not be co-located or operating in conjunction with any other antenna or transmitter.