SwitchDoc Labs

The Smart Garden System Version 2
Weather Add-On Assembly and Test

July 2020
Version 1.1

SmartGarden System

Table of Contents

Cautions when building and using The Smart Garden System **2**

Errata **2**

What is The Smart Garden System? **6**

Preparing and Learning your Raspberry Pi ..... Error! Bookmark not defined.

What is in the The Smart Garden System Box? **8**

Parts Not Included **9**

Step by Step Assembly **10**

What are we doing here? **10**

Assembling the Smart Garden System Wireless Extender **11**

Assembling the Raspberry Pi ..... Error! Bookmark not defined.

Testing your Smart Garden Setup **12**

Installing the The Smart Garden System Software and Initial Testing on the Raspberry Pi ..... Error! Bookmark not defined.

SGS Wireless Extender Board Setup ..... Error! Bookmark not defined.

Final Testing Your SGS System on the Raspberry Pi ..... Error! Bookmark not defined.

Disclaimer **17**

Cautions when building and using The Smart Garden System

1) **Keep all water away from the electronics and power supply at all times!**
2) **The Smart Garden System is designed for indoor use only and should be placed in a dry environment where no water or rain can reach to avoid short circuiting the electronics**
3) **Insert the moisture sensor into the CENTER of the flower pot, and keep it near the center of the plant and away from the water coming out of the holes cut in the watering pipe.**
4) **This is not a toy! Keep it out of reach of young children and pets.**
5) **SwitchDoc Labs assumes no liabilities in the use of this kit, beyond the refund of the purchase price.**

Errata

What is The Smart Garden System?

Did you ever want to build your own remote monitoring and management system for your indoor or outdoor garden? Do you want to share your garden and the weather world wide? This project is for you. You can learn the Raspberry Pi and how to connect to the real world through this easy to build **no-soldering** kit. You can measure soil moisture and then use that as feedback to provide your plant or garden just the right about of water.

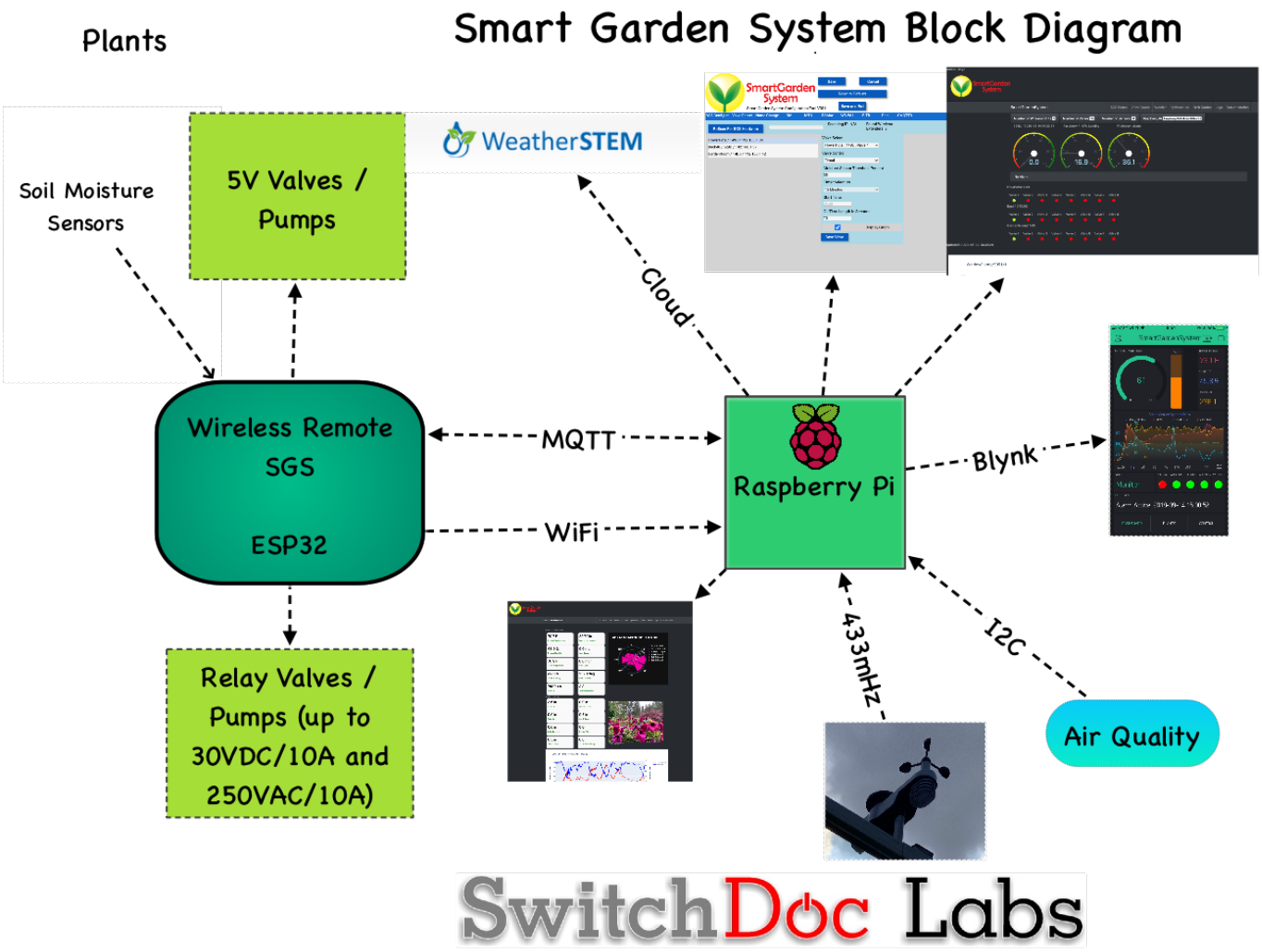
Highly expandable! You can have your Raspberry Pi Base Unit inside your house and have multiple wireless control units in your outdoor garden, greenhouse or in the upstairs bedroom. Up to 250 wireless control units can be connected up to one Raspberry Pi base unit. This allows you to control your truly MASSIVE garden. Or your small one. Either way!

This is a perfect highly expandable project kit for kids with some help from the adults and for adults trying to learn some new things. We have done this before with our successful OurWeather KickStarter so we know what we are talking about. People all over the world have built the OurWeather weather station with great success. This project has **no soldering** involved and uses Grove connectors to wire everything up! You can't reverse them and blow things up. Here is our tutorial on the Grove system.

The Smart Garden System Features

- Control Valves, Pumps and Lights
- Measure your Soil Moisture
- Measure your Sunlight
- Measure your Air Quality
- Measure your Weather
- Show your results on the Internet and your Phone

Easy to build. Easy to learn about the IOT (Internet Of Things) and the Raspberry Pi.

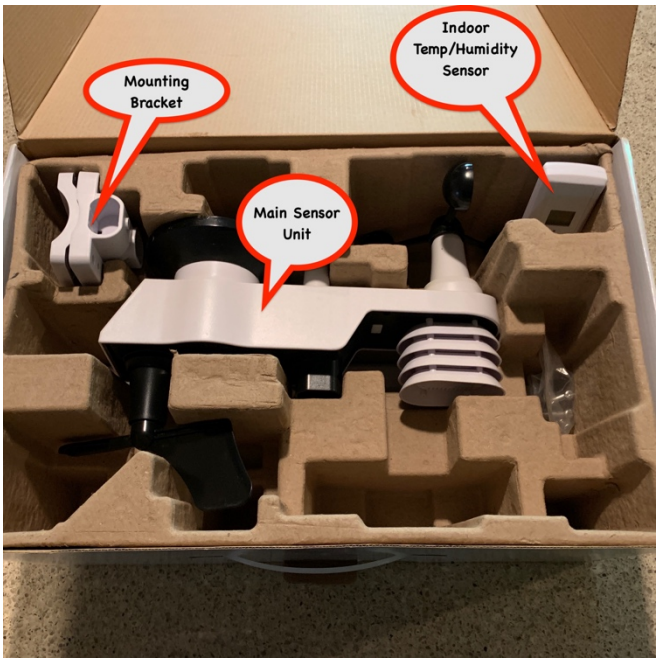


Before You Build Your Weather Station for the Smart Garden System

You must complete the instructions in the "Smart Garden System Assembly and Test Manual" before you assemble the Weather Station

What is in Weather Add-on for the Smart Garden System Box?

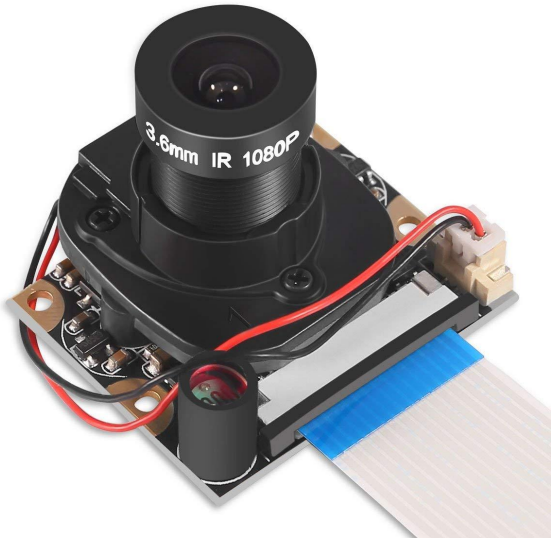
Part A – SwitchDoc Labs WeatherRack2



Part B – Indoor Temperature / Humidity Sensor (or Similar)

Part C – SDR Radio / Antenna

Part D - SkyCam Raspberry Pi Camera



Part E – 50cm Camera Cable

Part F – 15cm Raspberry Pi Cable (unused)

Part G – Mounting Pole (under Part A in Weather Sensor box)

Parts Not Included

- 3 AA Batteries
- 2 AAA Batteries

Step by Step Assembly

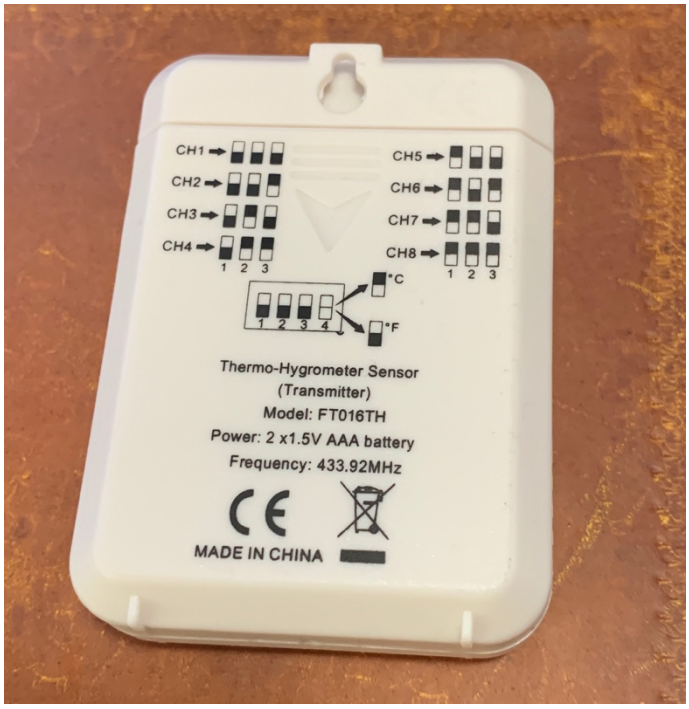
Cautions: Keep your static charge to a minimum during your assembly and operation. Touch metal before handling parts. Avoid shuffling your feet. Before starting assembly, layout all the parts above and familiarize yourself with the various parts.

What are we doing here?

We are assembling the Weather Add On to add to an existing Smart Garden System. You must complete your assembly and testing of the Smart Garden System before adding the Weather Kit

Assembling the Weather Add-on Kit

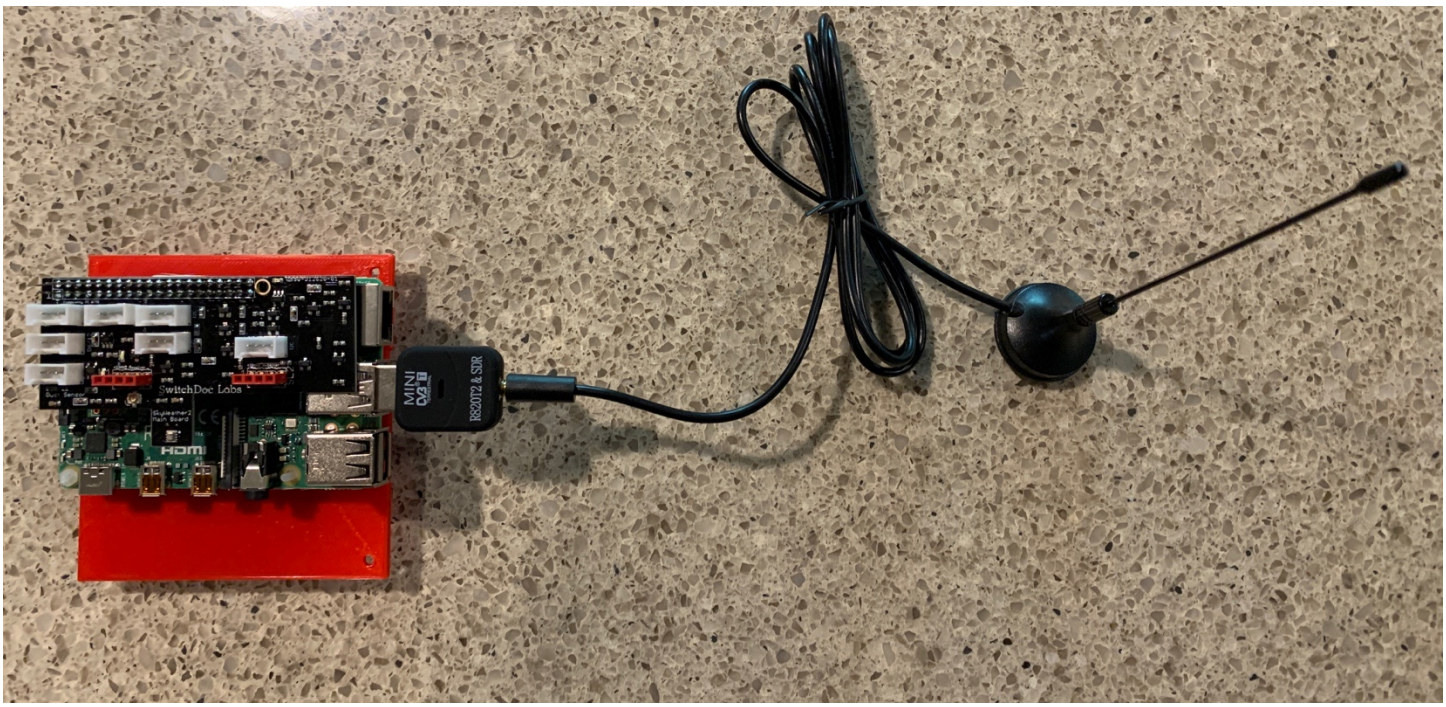
Step 1) Take the Main Sensor Unit (Part A) and put three AA Batteries in the battery compartment. Take the Indoor Wireless Sensor and put two AA batteries in the battery compartment. Put the panels back on and screw them down if needed. Set the dip switch inside to Channel 1 and then your choice of units of C or F.



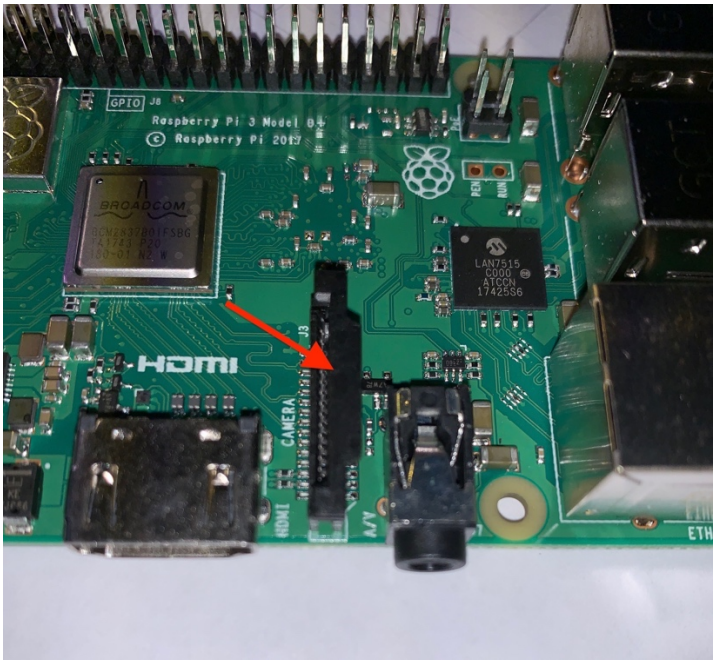
Step 2) Take the Mounting Pole (Part G) and attach it to the base of the Weather Sensor Unit (Part A).using one of the supplied screws. It is left to the reader to determine how they will mount the Weather Sensor to the roof or deck area. In general, the higher the better.

Step 3) Place your indoor temperature and humidity sensor (Part B) where you like but don't place it where you will get water on the device.

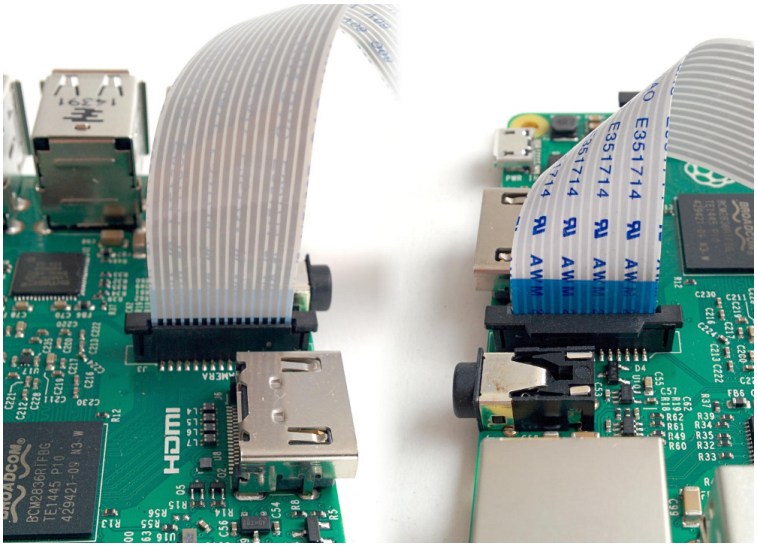
Step 4) Take the SDR USB Dongle (Part C) and plug the Antenna (Part C) into the socket. Plug the USB Dongle into your Raspberry Pi.



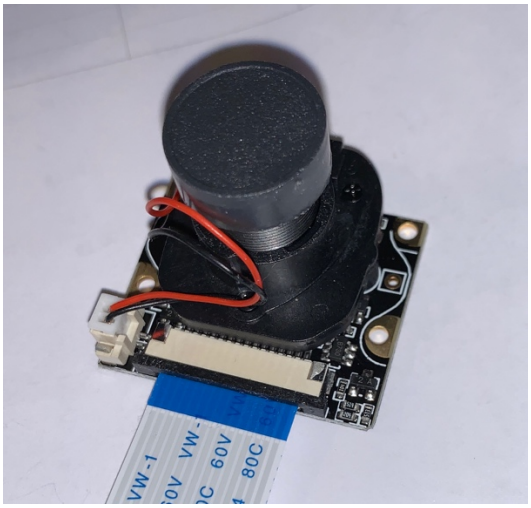
Step 5) Connect the 50cm Raspberry Pi Camera Cable (Part E) to the Raspberry Pi. Gently pull up on the black camera connector wings next to the HDMI connector.



Step 6) Insert the cable (Part E) into the Raspberry Pi. The cable slots into the connector situated between the Ethernet and HDMI ports, with the silver connectors facing the HDMI port. Push down the wings on the camera connector.



Step 7) Take the SkyCamera (Part D) and install the other end of the 50cm Pi Camera Cable (Part E) into the SkyCamera connector by gently lifting the black wings, pushing in the cable and then pushing the black wings back down into the connector. Make sure the cable is in straight. You can remove the camera cap at this time.



Congratulations. You have now complete assembly of your Weather Add-on kit for the Smart Garden System

Testing your Weather Add-on

If you have the SwitchDoc Labs SD Card, you can proceed to Step X.

Step 1) Install the SDL modified version of rtl_433.

In a terminal window on your Pi at /home/pi type:

```
git clone https://github.com/switchdoclabs/rtl_433.git
```

Then compile it on the Raspberry Pi:

```
cd rtl_433/
mkdir build
cd build
cmake ..
make
make install
```

Step 2) Test your installation as follows. Note you must have completed the assembly testing above. Especially putting the batteries in the Main Weather Sensor and in the Indoor Temperature Humidity Sensor.

```
cd /home/pi/SDL_Pi_SmartGardenSystem2

sudo python3 testWeatherSensors.py
```

You will then see something similar to this on your terminal window:

```
pi@SwitchDocLabs:~/SDL_Pi_SmartGardenSystem2 sudo python3 testWeatherSensors.py
Starting Wireless Read
rtl_433 version -128-NOTFOUND branch master at 202007090750 inputs file rtl_tcp RTL-SDR

Use -h for usage help and see https://triq.org/ for documentation.

Trying conf file at "rtl_433.conf"...
```

```
Trying conf file at "/root/.config/rtl_433/rtl_433.conf"...

Trying conf file at "/usr/local/etc/rtl_433/rtl_433.conf"...

Trying conf file at "/etc/rtl_433/rtl_433.conf"...

quiet option (-q) is default and deprecated. See -v to increase verbosity


       Consider using "-M newmodel" to transition to new model keys. This will become the default
someday.

       A table of changes and discussion is at https://github.com/merbanan/rtl_433/pull/986.


Registered 2 out of 147 device decoding protocols [ 146-147 ]

Found Rafael Micro R820T tuner

Exact sample rate is: 250000.000414 Hz

[R82XX] PLL not locked!

Sample rate set to 250000 S/s.

Tuner gain set to Auto.

Tuned to 433.920MHz.

Allocating 15 zero-copy buffers

{"time" : "2020-07-24 14:04:32", "model" : "SwitchDoc Labs F007TH Thermo-Hygrometer", "device" :
233, "modelnumber" : 5, "channel" : 3, "battery" : "OK", "temperature_F" : 71.000, "humidity" : 42,
"mic" : "CRC"}

This is the raw data: {"time" : "2020-07-24 14:04:32", "model" : "SwitchDoc Labs F007TH Thermo-
Hygrometer", "device" : 233, "modelnumber" : 5, "channel" : 3, "battery" : "OK", "temperature_F" :
71.000, "humidity" : 42, "mic" : "CRC"}

{"time" : "2020-07-24 14:04:46", "model" : "SwitchDoc Labs FT0300 AIO", "device" : 12, "id" : 0,
"batterylow" : 0, "avewindspeed" : 13, "gustwindspeed" : 20, "winddirection" : 245,
"cumulativerain" : 1353, "temperature" : 1190, "humidity" : 27, "light" : 52649, "uv" : 33, "mic" :
"CRC"}

This is the raw data: {"time" : "2020-07-24 14:04:46", "model" : "SwitchDoc Labs FT0300 AIO",
"device" : 12, "id" : 0, "batterylow" : 0, "avewindspeed" : 13, "gustwindspeed" : 20,
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52649, "uv" : 33, "mic" : "CRC"}
```

What does this mean?

The testWeatherSensors.py python3 program reads in the 433MHz signals into the Raspberry Pi, decodes them and formats the results as a JSON packet that will be provided to the Smart Garden System for processing.

There are two types of packets that are received. First are the radio packets from the Indoor Temperature and Humidity Sensors (SwitchDoc Labs F007TH). Remember that you can have up to 8 of these in your Smart Garden System (Garden Shed, in house, in basement, etc.)

```
{"time" : "2020-07-24 14:04:32", "model" : "SwitchDoc Labs F007TH Thermo-Hygrometer", "device" :
233, "modelnumber" : 5, "channel" : 3, "battery" : "OK", "temperature_F" : 71.000, "humidity" : 42,
"mic" : "CRC"}
```

This JSON package is self-explanatory. The temperature is always sent down a F, but Smart Garden will translate this to C if "metric" is selected in SGSConfigure.

The second packet is from the Main Weather Sensor (SwitchDoc Labs FT0300 AIO) and contains a lot of information:

```
{"time" : "2020-07-24 14:04:46", "model" : "SwitchDoc Labs FT0300 AIO", "device" : 12, "id" : 0,
"batterylow" : 0, "avewindspeed" : 13, "gustwindspeed" : 20, "winddirection" : 245,
"cumulativerain" : 1353, "temperature" : 1190, "humidity" : 27, "light" : 52649, "uv" : 33, "mic" :
"CRC"}
```

The values and units are:

- avewindspeed (to get m/s, divide by 10)
- gustwindspeed (to get m/s, divide by 10)
- windirection (degrees)
- temperature (to get F, subtract 400 and divide by 10)
- humidity (%)
- cumulativerain (to get mm, divide by 10)
- light (Lux)
- UV (UV Index)
-

This completes the testing of the Weather Sensors. If you aren't receiving this, adjust the placement of your antenna (not too close – you can over modulate the receiver), check your batteries and recheck your assembly steps. Next, we will configure the Smart Garden System to use the Weather Add-on Kit

Configuring your Smart Garden System to display Weather

Remember you must have set up your Smart Garden System before running the below as show in the "Smart Garden System Configuration and Testing" Manual.

Step 1) Open up SGSConfigure by doing this:

Run SGSConfigure.py

```
sudo python3 SGSConfigure.py
```

You will see something like this:

```
pi@SwitchDocLabs:~/SDL_Pi_SmartGardenSystem2 $ sudo python3 SGSConfigure.py
SGSConfigure.py:24: DeprecationWarning: AppURLopener style of invoking requests is deprecated. Use
newer urlopen functions/methods
  myURLOpener = AppURLopener()
remi.server      INFO     Started httpserver http://0.0.0.0:8001/
remi.request     INFO     built UI (path=/)
```

```
SGS.JSON File does not exist
SGSConfiguration.JSON File does not exist
```

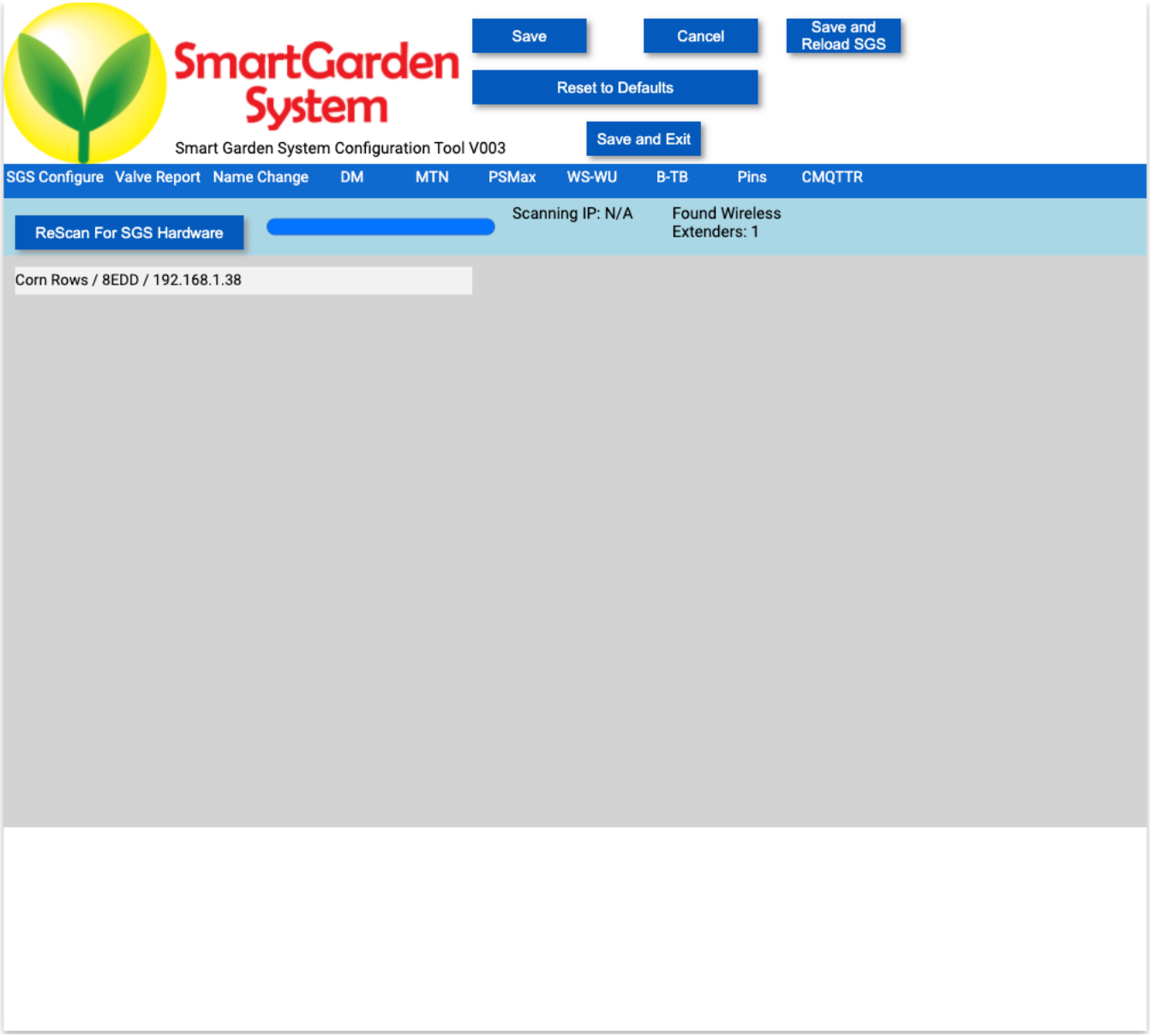
Now open up a browser window (either on the Raspberry Pi or on another computer on your local WiFi network) and enter this URL:

On your Raspberry Pi: http://127.0.0.1:8001/

On another computer type: http://xxx.xxx.xxx.xxx:8001/

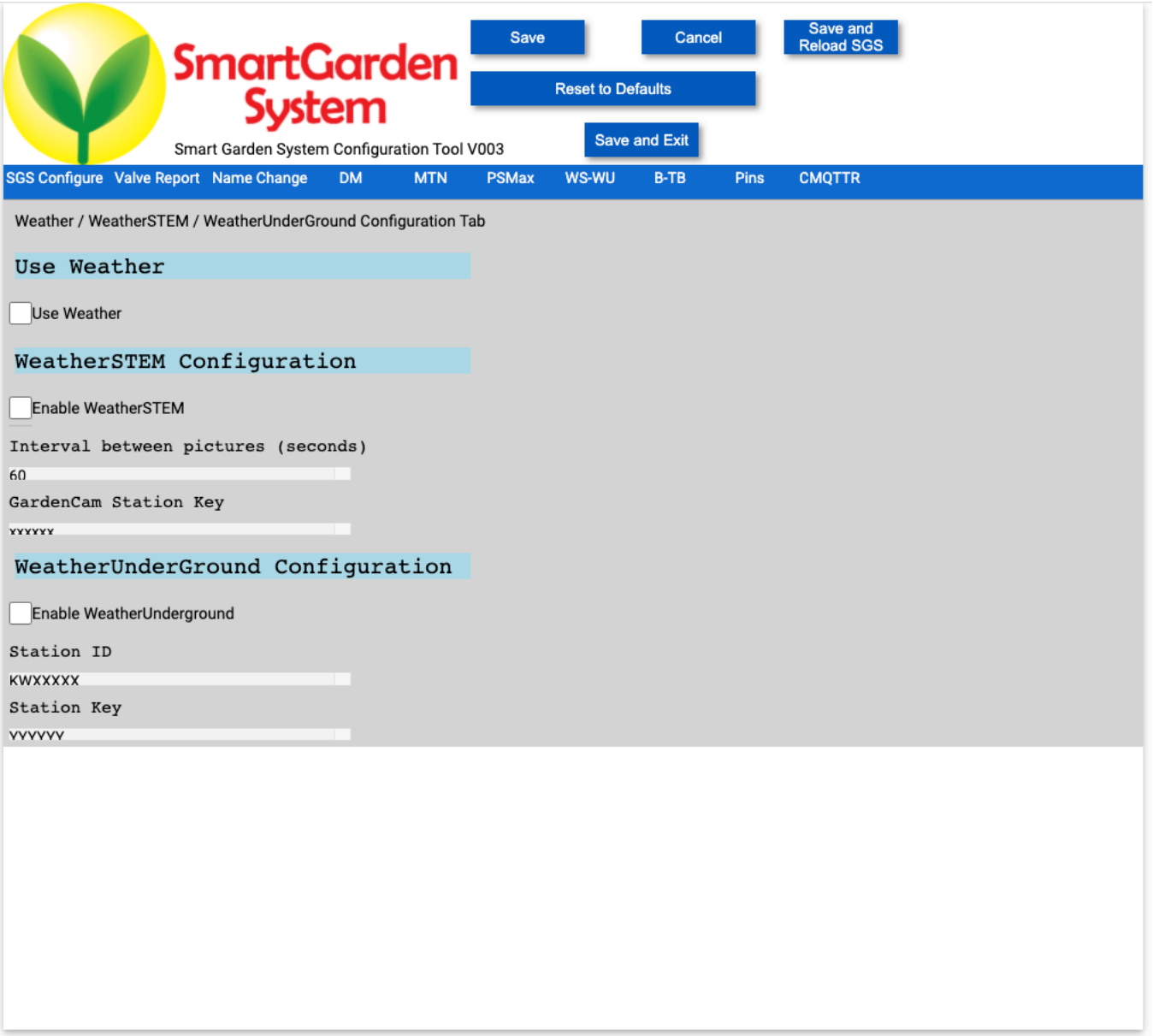
Where “xxx.xxx.xxx.xxx” is the IP address of your Raspberry Pi that you wrote down above.

You will see something like this screen on your browser:



Step 2) Click on the WS-WU button:

You will see a screen similar to this:



Check the “Use Weather” check box and if you are going to use WeatherSTEM, then check the “Enable WeatherSTEM” box if you want to display your GardenCam on WeatherSTEM (see more information about WeatherSTEM below).

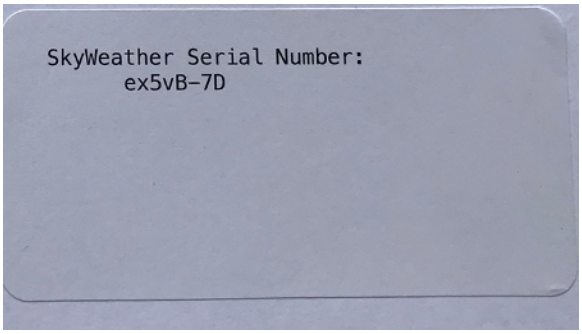
Put your GardenCam Station Key (the SkyWeather Serial Number) in the “GardenCam Station Key” box.

Continue with Step 3) below.

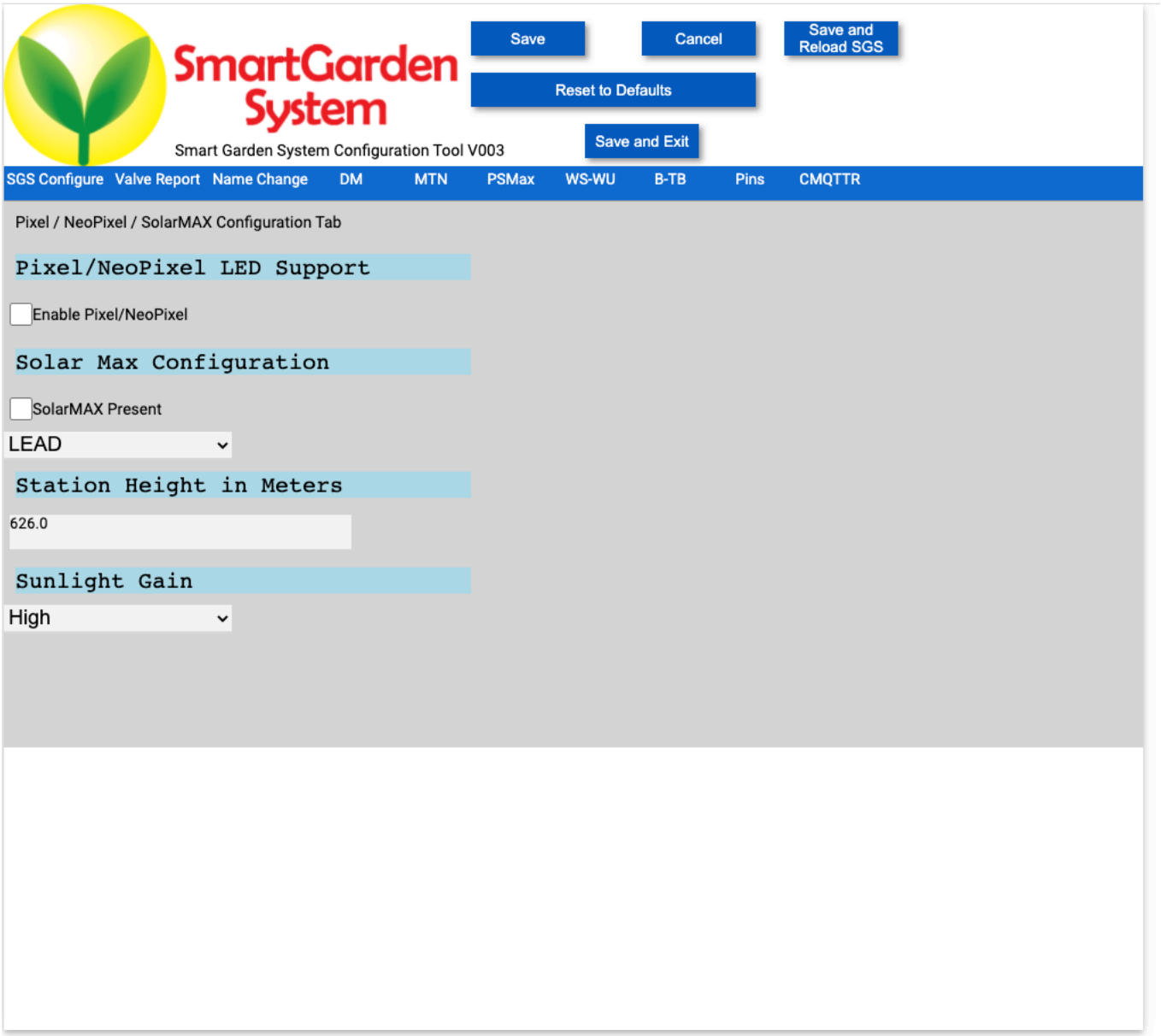
Finding your SkyWeather Serial Number in your Smart Garden System

When you buy a Weather Add-on kit for the Smart Garden System, you will receive an 8 character serial number that you will use to link your weather station with WeatherSTEM. This 8 character code (also known as the **device key**) will be entered into both the SkyWeather software and into the WeatherSTEM website. Your code will look something like this: **X7d3dkkk. Don't use this example code in your configuration file. It will not work. Do not use the serial number in the picture below. It will not work.**

You will find your SkyWeather Serial Number on your packing slip (this one won't work).



Step 3) Click on the PSMax tab on the SGSConfigure browser window. Put the altitude of your station in meters in the "Station Height in Meters" to make your sea level barometric pressure more accurately.



Step 4) Now click on “Save and Reload SGS” button wait 15 minutes and your weather station will start displaying on the dash_app in the Smart Garden System and will also start recording lots of weather to your database.

If SGS2 was not running at this time, start the Smart Garden System program now. (sudo python3 SGS2.py)

Configure WeatherSTEM

What is WeatherSTEM?

Empowering teachers to create STEM lessons, activities, and assessments from real-world weather

EDUCATORS: WeatherSTEM.com has a tremendous amount of curriculum material available about using WeatherSTEM (and the Smart Garden System) in your classroom.

More than ever in our history, schools across the United States face the challenge of better preparing students to enter careers where competency in STEM-related subject areas (Science, Technology, Engineering, and Mathematics) is a requirement.

We believe weather provides an excellent foundation for STEM education. It also provides myriad opportunities for exposing students to topics from a plethora of disciplines in the scope of a single activity. Any weather situation, from the most benign scenario where a few cumulus humilus clouds dot the sky to the most intense Category 5 hurricane, can turn into a discussion covering everything from algebra to zoology.

WeatherSTEM is a platform built by Ucompass CEO Edward Mansouri who has a Bachelors degree (Penn State) and Masters degree (Florida State) in Meteorology. Fascinated by weather since childhood, Mansouri created the WeatherSTEM platform to infuse K-12 STEM curriculum with live data collected by weather instruments, cloud cameras, agricultural probes, and other sensors.

Experience The Data

The WeatherSTEM platform consumes live information to create and deliver interactive activities and assessments. The platform combines data from weather instruments, agricultural probes, Web cameras and other sensors to create immersive science education experiences and an introduction to "Big Data" and computer programming.

How will Smart Garden System Integrate with WeatherSTEM?

Each Smart Garden System station will:

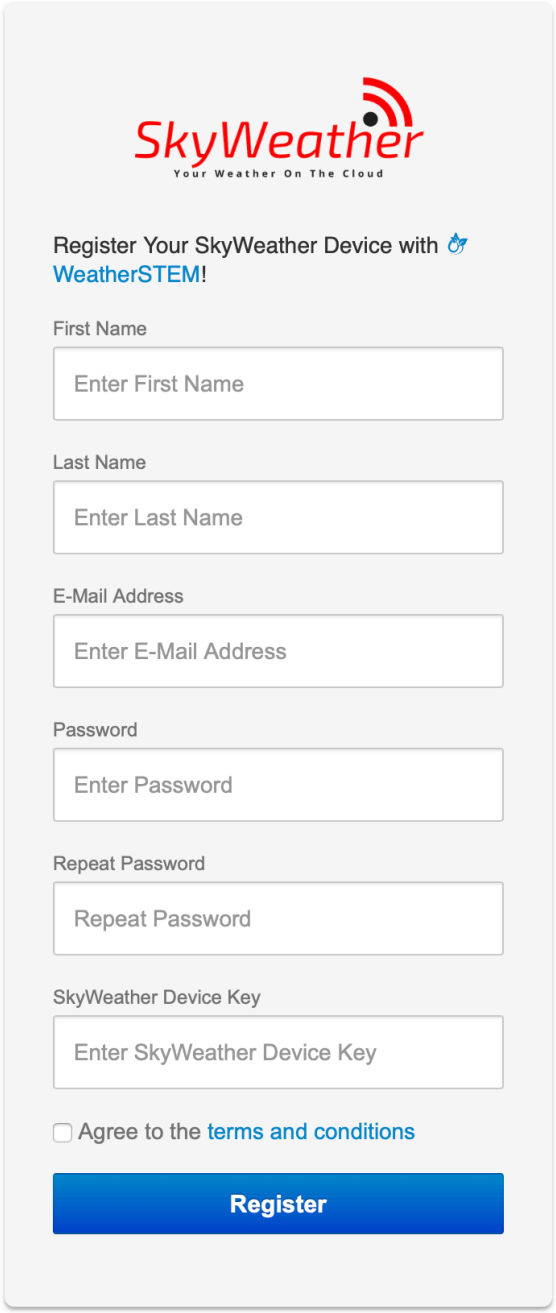
- Publish data and images to its own WeatherSTEM website once per minute
- Store data and images permanently that are accessible via the WeatherSTEM Data Mining Tool
- Integrate data and images into WeatherSTEM's education repository that you and your stakeholders will have access to
- Publish data and images to the WeatherSTEM SkyWeather social media platform integrated with Twitter, Facebook, and YouTube
- Create daily time-lapse "sky movies"
- Integrate data into WeatherSTEM's Safety Platform featuring lightning alerts and other important situational awareness notifications
- Offer the capability for real-time, moment by moment data streaming
- Enable real-time access to the data via WeatherSTEM's API
- So much more!

Setting up your WeatherSTEM Account

Your WeatherSTEM account is where you register your Smart Garden Systemstation for the WeatherSTEM cloud data storage and display.

Go to “skyweather.weatherstem.com” and you will see the screen below:

Click on “Register a SkyWeather Device” Fill out the form, paying special attention to the SkyWeather device key (your serial number from the SkyWeather sticker on your Smart Garden System packing slip above.

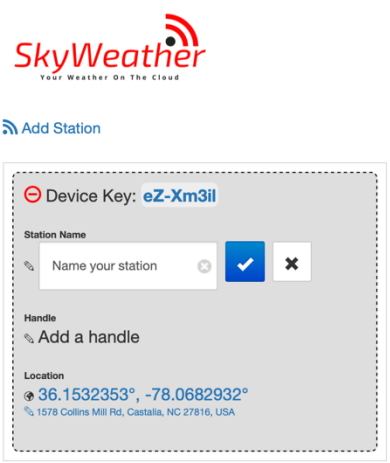


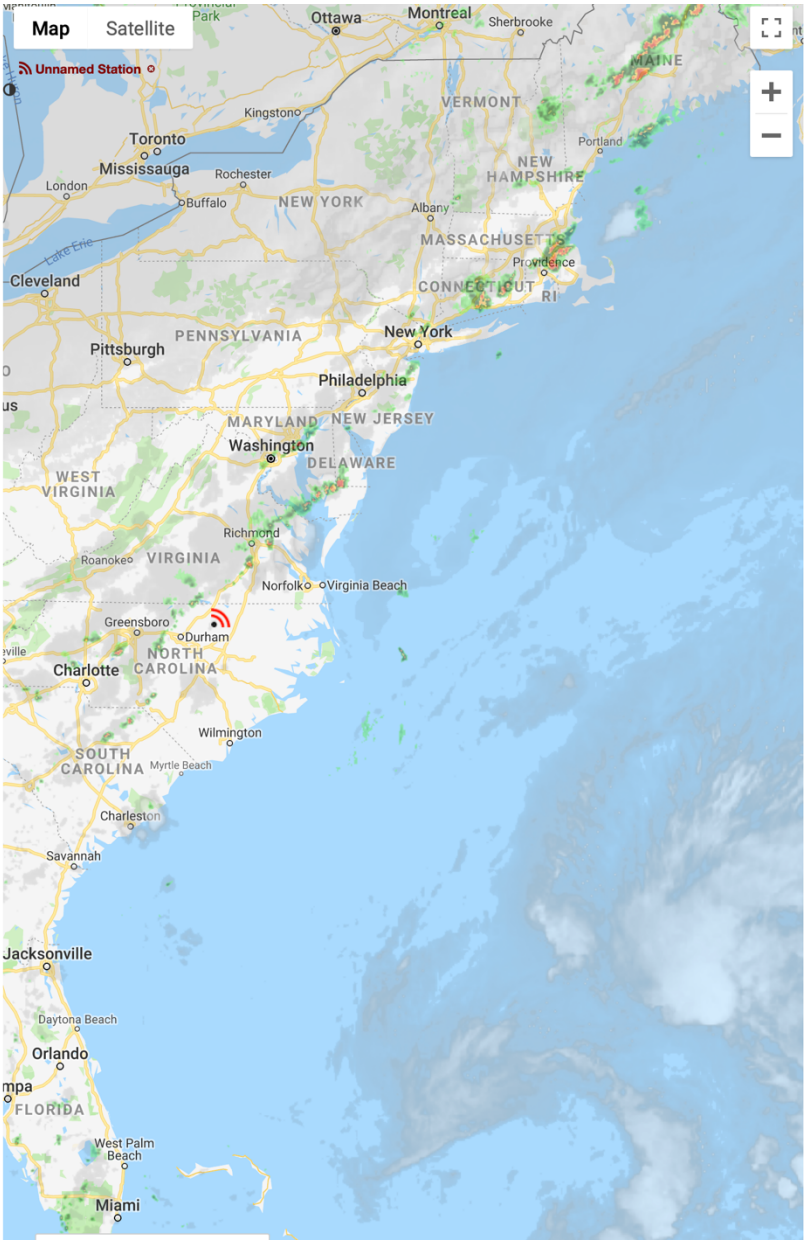
Respond to the email from skyweather@weatherstem.com to complete linking your account.

Click on the link in the email and then login to your account.

Add the name of your station (Xandau, Palm Springs, CA – Paris, France or something like that) and then the handle of the station. The handle is what your station is called in URLs.

Select your location on the map on the right.





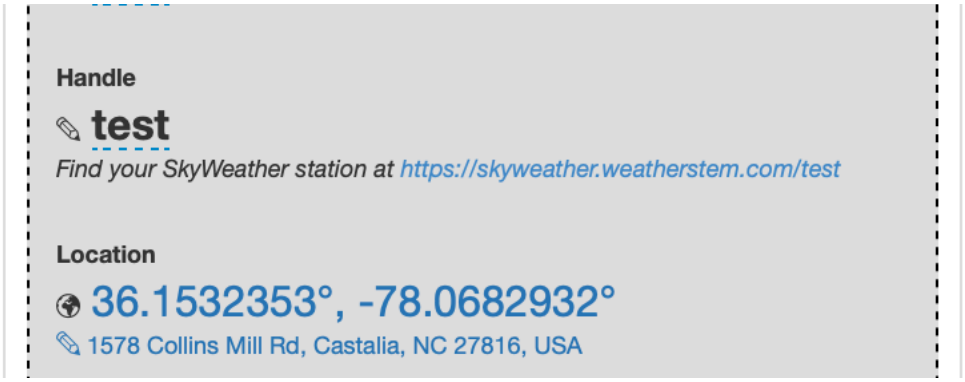
You can add additional SkyWeather stations from the add station links if you want to have more than one SkyWeather station on your account

Testing the Connection. Looking at your Station Results

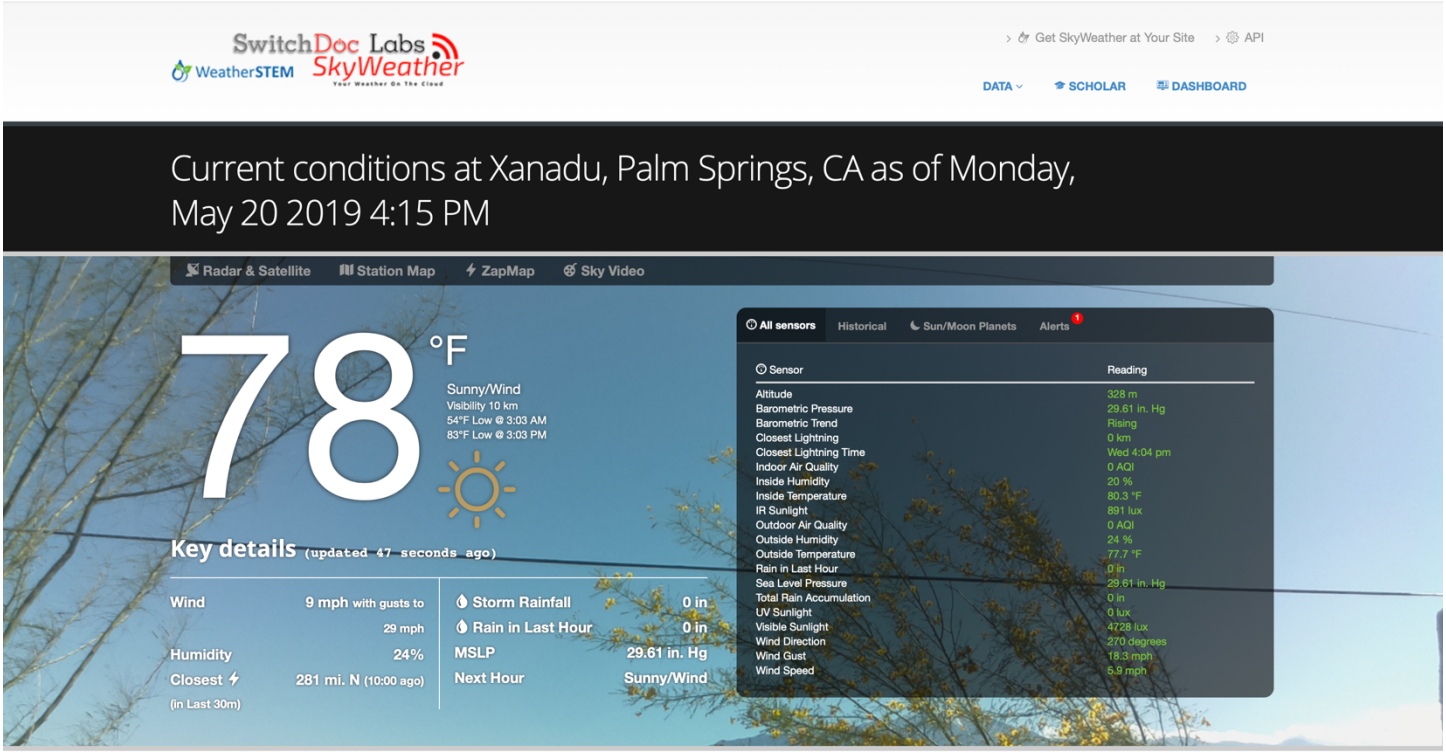
After your Smart Garden System has been running for about 10 minutes, you will see your data appear.

You are now connected to WeatherSTEM!

Go to the link shown on your control page (see below – yours will be a different link) and you are now connected to WeatherSTEM.


Handle
test
Find your SkyWeather station at https://skyweather.weatherstem.com/test
Location
36.1532353°, -78.0682932°
1578 Collins Mill Rd, Castalia, NC 27816, USA

At the link you will see a display like this:



Oh and one more exciting thing. After you station has been up for more than one day, click on the SkyVideo item and you will see time lapse videos that are generated on a daily basis and archived for a week.

Other WeatherSTEM Features

WeatherSTEM has a number of different features. It keeps historical information, generates graphs, generates a daily time lapse and has a complete API (Application Programming Interface) for more advanced programmers. Explore the WeatherSTEM system!

EDUCATORS: WeatherSTEM.com has a tremendous amount of curriculum material available about using WeatherSTEM (and SkyWeather) in your classroom.

Disclaimer

SwitchDoc Labs, LLC takes no responsibility for any physical injuries and possession loss caused by those reasons which are not related to product quality, such as operating without following the operating manual and cautions, natural disasters or force majeure.
SwitchDoc Labs, LLC has compiled and published this manual which covers the latest product description and specification. The contents of this manual are subject to change without notice.