

# SwitchDoc Labs



## SkyWeather Series Configuration and Operations Guide (For Full, Lite, Solar and WXLINK SkyWeather Kits)

June 2019  
Version 1.2

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# Errata

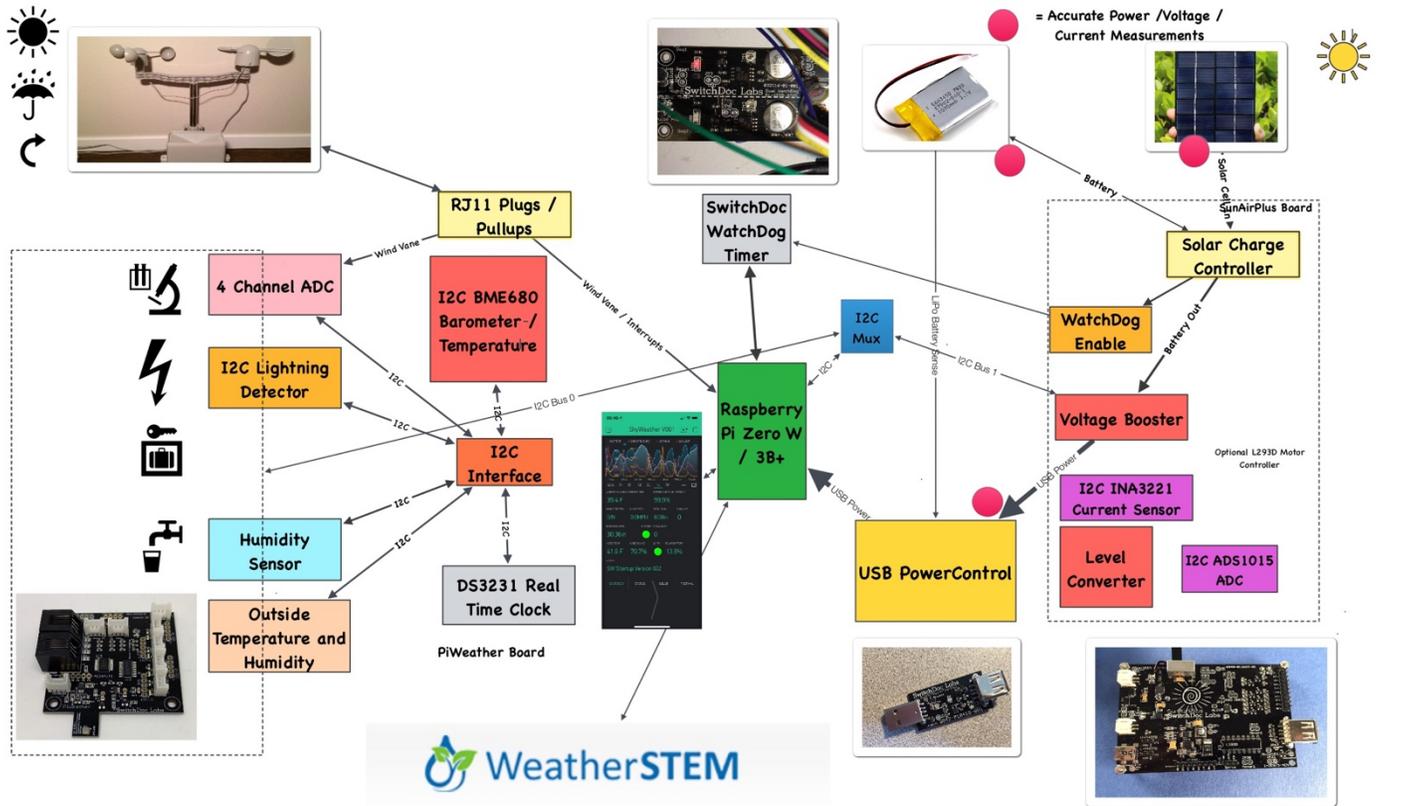
## What is SkyWeather?

This is a perfect 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.](#)

### SkyWeather Features

- Barometric Pressure
- LIGHTNING!
- Outside Temperature
- Outside Humidity
- Altitude
- Inside Temperature (in box)
- Inside Humidity (in box)
- Air Quality - AQI (your own local Air Quality Sensor)
- Sunlight
- Wind Speed
- Wind Direction
- Rain
- All your weather information on the Cloud including history

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



## Versions of SkyWeather

### SkyWeather

The full SkyWeather kit including the Lightning and Wind Direction, Speed and Rain sensors. Includes: Rain, Wind Speed / Direction, Lighting Detection, Outside Temperature and Humidity, Barometric Pressure, Internal Temperature/Humidity, Sunlight Strength, and Outside Air Quality.

### SkyWeather Lite

SkyWeather Lite does not contain the Lightning Detector and the WeatherRack wind and rain sensors. Because of that, do not drill the holes for the Lightning Detector Pylon and you do not need to have the RJ11 box connectors for the WeatherRack

### SkyWeather Solar

SkyWeather Solar adds a set of solar panels on the top of the SkyWeather Box. We have a special assembly manual for that add on to the SkyWeather kit. Note that you have to think about where and how to orient your solar panels versus the orientation you want for your Sky Camera. Solar Panels should generally point south (in the northern hemisphere) and north (in the southern hemisphere – right Topher?).

### SkyWeather Plus Solar WXLink Remote

This SkyWeather package places the WeatherRack wind / rain sensors and the outside temperature and humidity sensor, along with a solar system in an external box connected by wireless LoRa. See the weatherproofing manual for the WXLink Box. Basically, you place the WeatherRack and the outside temperature / humidity sensors outside and the rest of SkyWeather can either be inside or outside. There are no wires between the WXLink remote box and the SkyWeather system. You may still want to place the Sky Camera and SkyWeather system outside and in that case you do not need to have the RJ11 box connectors for the WeatherRack or the hole AM2315 Outside Temperature and Humidity Sensor.

This manual is for the base SkyWeather kit.

## Preparing and Learning your Raspberry Pi

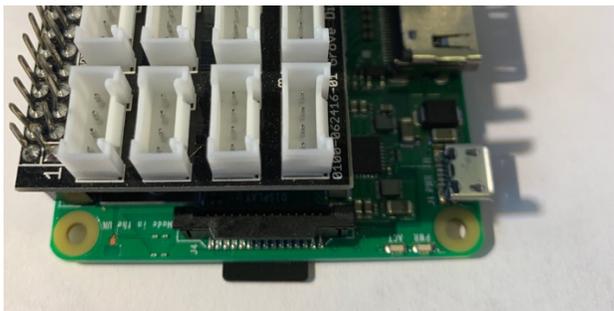
The SkyWeather system requires a working Raspberry Pi. You can use virtually any not too old Raspberry Pi (2, 3, Zero, etc.) but you do need to set it up before starting the process of building SkyWeather.

Initial setting up your Raspberry Pi and connecting to it on your network is well beyond the scope of this manual. There are just too many variables in how you might set up your Raspberry Pi.

SwitchDoc Labs provides an SD Card that has the Raspberry Pi operating system, version Stretch, and all the SkyWeather software installed. <https://shop.switchdoc.com/products/16gb-sd-card-with-stretch-smart-garden-system-grovetweatherpi>

Insert your SD Card (Part N from below if you have a SkyWeather Kit) into the Raspberry Pi SD Card. It goes colored face down on the Raspberry Pi 3B+ and face up on the Raspberry Pi ZeroW. The picture below shows the SD Card pluggend into a Raspberry Pi 3B+ (with the Pi2Grover board installed – Part A if you have the SkyWeather Kit).

(Default user: pi Default password: raspberry)



Once you have your Raspberry Pi setup up, running and can access a command line window (terminal) than you are ready to go with this manual.

This is the reason that we consider The SkyWeather Kit an advanced beginners kit, rather than a beginners kit (like the OurWeather Weather Station).

Here are some resources to get you set up and running as quickly as possible.

Helpful Getting Started Videos:

<https://www.raspberrypi.org/help/videos/>

Helpful Getting Started Written Tutorial:

<https://www.raspberrypi.org/wp-content/uploads/2012/12/quick-start-guide-v1.1.pdf>

If you want to set up a headless (no monitor, keyboard, mouse) Raspberry Pi, it is more complicated. Here are some links to tutorials for that process.

<http://www.circuitbasics.com/raspberry-pi-basics-setup-without-monitor-keyboard-headless-mode/>

<http://blog.self.li/post/63281257339/raspberry-pi-part-1-basic-setup-without-cables>

Many, many more tutorials are available on the web.

Once you have it set up, take a brief tutorial about using the terminal window and the very powerful Raspberry Pi Command Line.

<https://www.raspberrypi.org/blog/learning-the-command-line/>

<https://www.raspberrypi.org/blog/learn-to-love-the-command-line-with-the-magpi/>

You don't need to know a lot about the command line to enjoy building and running SkyWeather but you do need a bit of knowledge.

## Setting up your own SD Card

The installation instructions are in the README.md file for installing your own software on the Raspberry Pi Stretch operating system.

The SkyWeather software is located here:

[https://github.com/switchdoclabs/SDL\\_Pi\\_SkyWeather](https://github.com/switchdoclabs/SDL_Pi_SkyWeather)

## SkyWeather Initial Testing

Make sure you have done the initial testing as shown in the SkyWeather Assembly and Testing Manual.

## Configuring SkyWeather

There are a number of items that should be set in the configuration file before starting SkyWeather for normal operation. Note: There are three major package configurations that are in separate manuals.

- WeatherSTEM Configuration
- Blynk App Configuration
- WeatherUnderground Configuration

### Step by Step Configuration

Using the supplied USB Type A to USB Micro cable (or one of your own), plug in your Raspberry Pi and open up a terminal window (if you are using a video monitor) or ssh into your computer. Login to your computer (Default user: pi Default password: raspberry) and open a terminal window.

Change directory to SDL\_Pi\_SkyWeather

```
cd SDL_Pi_SkyWeather
```

**Step 1)** Copy the config.py file over to conflocal.py. You do this so your configuration files won't be overwritten by new SkyWeather software.

```
cp config.py conflocal.py
```

**Step 2)** Open up the conflocal.py file in your favorite text editor (nano or "vi" for example). All the text below can be found in conflocal.py

**Step 3) Optional** - Set up email and text addresses. Find the following text in the conflocal.py file:

```
mailUser = "yourusername"  
mailPassword = "yourmailpassword"  
  
notifyAddress = "you@example.com"  
  
fromAddress = "yourfromaddress@example.com"  
  
enableText = False  
textnotifyAddress = "yourphonenumber@yourprovider"
```

We recommend gmail.com for these emails. There are too many variables on other mail servers for us to mention here. Each of these fields are described in the following table:

Parameter	Description	Example
mailUser	Your email account login name	<a href="mailto:myaccount@gmail.com">myaccount@gmail.com</a>

<b>mailPassword</b>	Your email account password	yourrealpassword
<b>notifyAddress</b>	What email address you want SkyWeather to email	myaccountToo@example.com
<b>fromAddress</b>	From Address	myaccount@gmail.com
<b>enableText</b>	If True, then sends text message to given textnotifyAddress for lightning detection	False
<b>textnotifyAddress</b>	The email address for the phone number you want to be texted. Each carrier will be different. The example is for att.	2085551212@txt.att.net

**Step 4) Optional** - Set up MySQL database logging. Find the following lines.

```
#MySQL Logging and Password Information
```

```
enable_MySQL_Logging = False
MySQL_Password = "password"
```

Parameter	Description	Example
<b>Enable_MySQL_Logging</b>	Set to True to record data to local MySQL database "SkyWeather"	False
<b>MySQL_Password</b>	The root user password for MySQL	password

**Step 5) Optional** – Set up WLAN detect. On rare occasions, the Raspberry Pi will drop the WLAN connection and it will need to be reestablished. This is disabled by default. Find the following lines:

```
# modify this IP to enable WLAN operating detection - search for WLAN_check in SkyWeather.py
enable_WLAN_Detection = False
PingableRouterAddress = "192.168.1.1"
```

Parameter	Description	Example
<b>enable_WLAN_Detection</b>	Set to True to enable WLAN recovery	False
<b>PingableRouterAddress</b>	This is the gateway address on your local network. If	password

**Step 6) Required** – Set your current weatherstation altitude in meters. Find the following text:

```
# for barometric pressure - needed to calculate sealevel equivalent - set your weatherstation elevation here
```

```
BMP280_Altitude_Meters = 648.0
```

Parameter	Description	Example
<b>BMP280_Altitude_Meters</b>	The altitude of your weather station above sea level in meters.	648.0

## Setting up WeatherSTEM

The next thing to do is to set up your Cloud connection with WeatherSTEM.com.

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

## What is WeatherSTEM?

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

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 SkyWeather Integrate with WeatherSTEM?

#### Each SkyWeather 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!

The SkyWeather station will offer numerous power and connectivity options including solar panels for power and cellular and WiFi for connectivity.

### Finding your SkyWeather Serial Number

When you buy a SkyWeather kit, 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.**

# SkyWeather

Your Weather On The Cloud

0011-WPIRDD0DSBT	PiWeather Board
0015-WR-DSBT	WeatherRack
0020-GRVOTH-DSBT	AM2315 Temp/Humid Sensor
0027-TSL2591GRV-DSBT	Sunlight Sensor (TSL2591)
0075-GRV20C-DSBT	5/pk 20 cm Cables
0079-GRV50C-DSBT	2 single 50 cm Cables
0100-GRV2PIA-DSBT	Pi2Grover Board
0121-USBAM-DSBT	USB Cable from USB Type A to Micro
0203-GRV6I2CH-DSBT	6 Port i2C Hub
0232-GPOWERSAVE-DSBT	Grove PowerSave for AM2315
0232-GPOWERSAVE-DSBT	Grove PowerSave for AQI
0240-THNDRBRD-DSBT	ThunderBoard
0270-GRVDUST-DSBT	GRV Dust Sensor - Air Quality Sensor
0675-RPSDCARD-DSBT	SD Card
0800-CAMIRCUT-DSBT	Sky Camera
0820-50CAMPi3CAM-DSBT	50cm Pi3 Camera Cable
0830-PIZEROCAMCAB-DSBT	PiZero Cable

SkyWeather Serial Number:  
ex5vB-7D

[SkyWeather Assembly and Testing Manual](https://www.switchdoc.com/wp-content/uploads/2019/04/SkyWeatherAssemblyAndTesting.pdf)

<https://www.switchdoc.com/wp-content/uploads/2019/04/SkyWeatherAssemblyAndTesting.pdf>

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## Putting your Serial Number into the SkyWeather Software

The first thing you need to do is setup your SkyWeather software configuration file. This should be done as shown in the **SkyWeather Configuration and Operations Manual**. Come back here after you have completed the configuration in the configuration manual.

Once you have completed the configuration in the above manual, perform the following steps:

Step 1) Open up a terminal window on your Raspberry Pi.

Step 2) `cd SDL_Pi_SkyWeather`

Step 3) Using your favorite editor, (nano or vi for example) open up the `conflocal.py` file and locate the following lines:

```
# WeatherSTEM configuration  
  
USEWEATHERSTEM = False  
INTERVAL_CAM_PICS_SECONDS = 60  
STATIONMAC = MACADDRESS  
STATIONKEY="XXXXXXXX"  
STATIONHARDWARE=""
```

Step 4) Change `USEWEATHERSTEM = False` to `USERWEATHERSTEM = True`

Step 5) Leave `INTERVAL_CAM_PICS_SECONDS` as it is. If you are using a solar version of SkyWeather you may want to move this 500 seconds. The camera uses a significant amount of power.

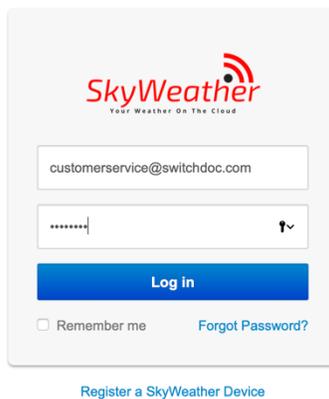
Step 6) Replace “XXXXXX” in the `STATIONKEY` line with your serial number from the SkyWeather Serial Number Sticker. It will have 8 characters.

Save the file. You have now configured SkyWeather to work with WeatherSTEM. Next we set up WeatherSTEM to receive your data.

### Setting up your WeatherSTEM Account

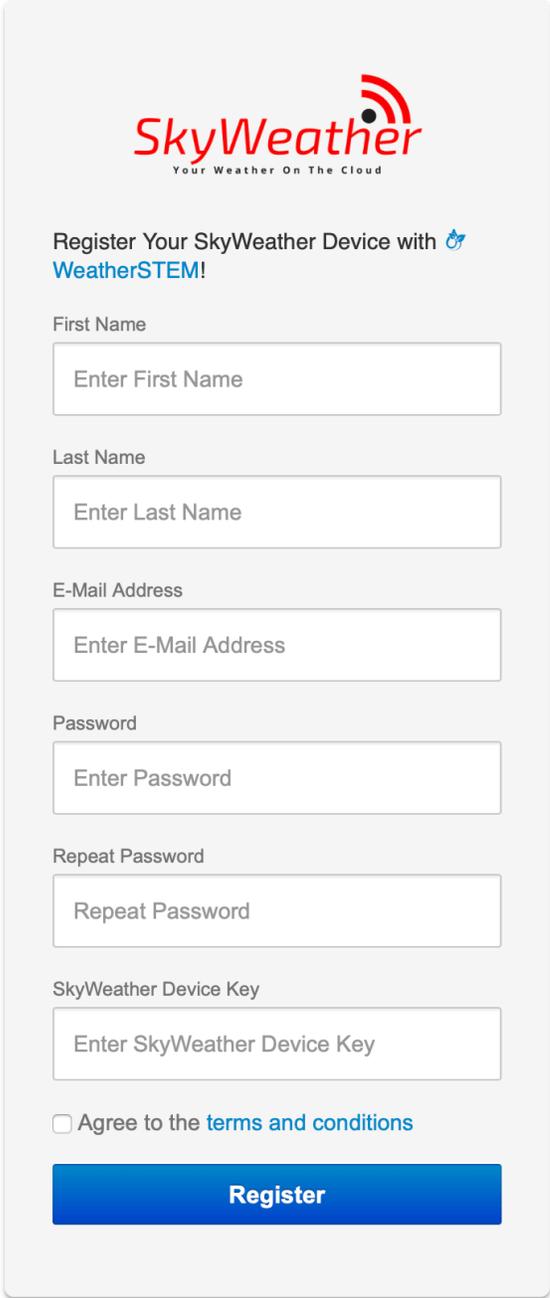
Your WeatherSTEM account is where you register your SkyWeather station for the WeatherSTEM cloud data storage and display. This is a free service provided by WeatherSTEM to SkyWeather users.

Go to “[skyweather.weatherstem.com](http://skyweather.weatherstem.com)” and you will see the screen below:



The screenshot shows the SkyWeather login interface. At the top is the SkyWeather logo with the tagline "Your Weather On The Cloud". Below the logo is a text input field containing the email address "customerservice@switchdoc.com". Underneath that is a password input field with a toggle icon to the right. A blue "Log in" button is positioned below the password field. To the left of the button is a checkbox labeled "Remember me", and to the right is a link labeled "Forgot Password?". At the bottom of the form is a link labeled "Register a SkyWeather Device".

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 in Step 6) above.



The registration form features the SkyWeather logo at the top, which includes a red Wi-Fi symbol and the tagline "Your Weather On The Cloud". Below the logo, the text "Register Your SkyWeather Device with WeatherSTEM!" is displayed, with a small blue icon of a person. The form contains several input fields: "First Name", "Last Name", "E-Mail Address", "Password", "Repeat Password", and "SkyWeather Device Key". Each field has a placeholder text that matches the field's label. At the bottom of the form, there is a checkbox labeled "Agree to the terms and conditions" and a prominent blue "Register" button.

[Return to Login Screen](#)

Respond to the email from [skyweather@weatherstem.com](mailto: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 (Xandadu, 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.



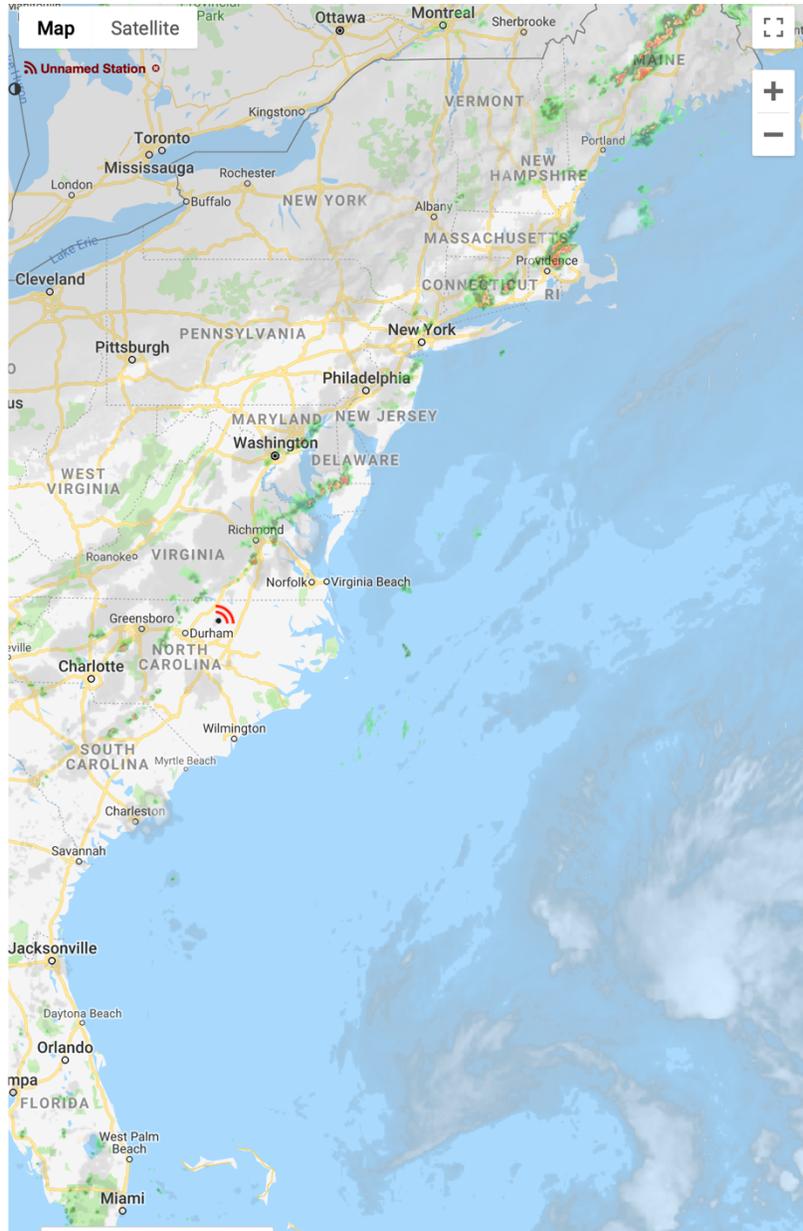
Add Station

Device Key: eZ-Xm3il

Station Name  
Name your station

Handle  
Add a handle

Location  
36.1532353°, -78.0682932°  
1578 Collins Mill Rd, Castalia, NC 27816, USA



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](#)

Step 1) Open up “conflocal.py” and change:

```
SWDEBUG = False
```

to:

SWDEBUG = True

Step 2) Start SkyWeather.py  
sudo python SkyWeather.py

After about a minute of messages scrolling by, you will see something like this:

```
-----  
SkyCam Picture Taken  
-----
```

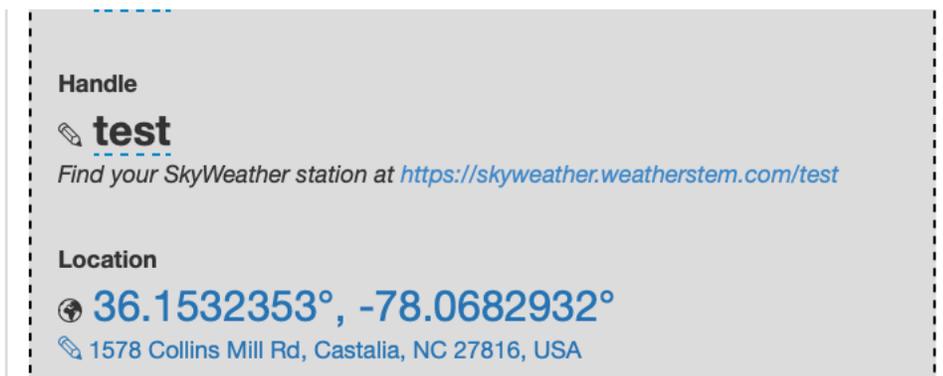
And after another couple of dozen lines or so, something like this:

```
-----  
SkyCam Package Sending  
-----
```

```
The pastebin URL is (r.text): {"internal": {"record": "28206", "image": "28650", "readings": [{"sensor": "1", "id": "639729", "value": "25.500"}, {"value": "24.400", "sensor": "4", "id": "639732"}, {"sensor": "7", "id": "639735", "value": "28.740"}, {"id": "639738", "sensor": "10", "value": "18.995"}, {"value": null, "sensor": "13", "id": "639741"}, {"id": "639744", "sensor": "16", "value": "4664.256"}, {"value": "820.000", "sensor": "19", "id": "639747"}, {"id": "639750", "sensor": "22", "value": null}, {"id": "639753", "sensor": "25", "value": "8.157"}, {"id": "639756", "sensor": "28", "value": "12.075"}, {"sensor": "31", "id": "639759", "value": "225.000"}, {"value": "0.140", "id": "639762", "sensor": "34"}, {"id": "639765", "sensor": "37", "value": "1002.864"}, {"value": "328.000", "sensor": "40", "id": "639768"}, {"id": "639771", "sensor": "43", "value": "1002.864"}, {"value": "0.000", "sensor": "46", "id": "639774"}, {"sensor": "49", "id": "639777", "value": null}, {"sensor": "52", "id": "639780", "value": null}, {"value": null, "sensor": "55", "id": "639783"}, {"sensor": "58", "id": "639786", "value": null}], "jpg": "https://cdn.weatherstem.com/user_generated/skyweather/xanadu/2019/05/20/23/03/46.jpg", "json": "https://cdn.weatherstem.com/user_generated/skyweather/xanadu/2019/05/20/23/03/46.json"}
```

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.



The screenshot shows a control page for a WeatherSTEM station. It features a 'Handle' section with a pencil icon and the text 'test'. Below this is a link: 'Find your SkyWeather station at <https://skyweather.weatherstem.com/test>'. The 'Location' section displays a globe icon followed by the coordinates '36.1532353°, -78.0682932°' and a location pin icon followed by the address '1578 Collins Mill Rd, Castalia, NC 27816, USA'.

At the link you will see a display like this:

SwitchDoc Labs  
WeatherSTEM SkyWeather  
Your Weather on the Cloud

Get SkyWeather at Your Site API

DATA SCHOLAR DASHBOARD

Current conditions at Xanadu, Palm Springs, CA as of Monday, May 20 2019 4:15 PM

Radar & Satellite Station Map ZapMap Sky Video

78°F  
Sunny/Wind  
Visibility 10 km  
54°F Low @ 3:03 AM  
83°F Low @ 3:03 PM

Key details (updated 47 seconds ago)

Wind	9 mph with gusts to 29 mph	Storm Rainfall	0 in
Humidity	24%	Rain in Last Hour	0 in
Closest	281 mi. N (10:00 ago) (in Last 30m)	MSLP	29.61 in. Hg
		Next Hour	Sunny/Wind

Sensor	Reading
Altitude	328 m
Barometric Pressure	29.61 in. Hg
Barometric Trend	Rising
Closest Lightning	0 km
Closest Lightning Time	Wed 4:04 pm
Indoor Air Quality	0 AQI
Inside Humidity	20 %
Inside Temperature	80.3 °F
IR Sunlight	891 lux
Outdoor Air Quality	0 AQI
Outside Humidity	24 %
Outside Temperature	77.7 °F
Rain in Last Hour	0 in
Sea Level Pressure	29.61 in. Hg
Total Rain Accumulation	0 in
UV Sunlight	0 lux
Visible Sunlight	4728 lux
Wind Direction	270 degrees
Wind Gust	18.3 mph
Wind Speed	6.9 mph

**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.**

## The Science and Education Goals Behind SkyWeather

Everything we build for the Maker market is designed for education and learning. Making is education. Making is learning. Building your own projects allows you to innovate around a framework and do wonderful things that of which we have never even thought.

The educational goals for SkyWeather are:

- Learn about the Raspberry Pi and installing software on the Pi
- Connecting up sensors to the Raspberry Pi
- Learning about Feedback loops
- Understand your indoor environment and what affects it
- Learn about the new technology called the Internet of Things

SkyWeather designed to be the hub to which you connect everything to turn your Raspberry Pi into a complete Weather Station that talks to the Cloud. Just ready to be customized to your project and usage. It is designed to be a great way of learning to hook up hardware to the Raspberry Pi. And you have all the source code to modify to work the way you want it to do.

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

Our partnership with WeatherSTEM brings this kit into the realm of cloud based data mining, great graphics displays and even time lapse photography. SkyWeather and WeatherSTEM together rock. This is a great kit in which to learn about weather sensing, data sharing in the cloud and the Raspberry Pi.

## Setting up Other Communication Options

The instructions for Blynk and WeatherUnderground are in their own respective configuration documents.

## Operating SkyWeather

### Starting SkyWeather

Starting SkyWeather is very straight forward.

Open a command line terminal window.

```
cd SDL_Pi_SkyWeather
sudo pigpiod
sudo python SkyWeather.py
```

Then you should see something like this:

```
pi@switchdoclabs:~/SDL_Pi_SkyWeather $ sudo python SkyWeather.py
(15.177600000000002, 7, 2)
()
('Pi Camera Revision', u'ov5647')
('HW-Version: ', 18)
('after bme680', True)
as3935 start
as3935 present at 0x02
```

SkyWeather Weather Station Version 034 - SwitchDoc Labs

Program Started at:2019-05-02 06:48:03

```
-----
I2C Mux - TCA9545:           Present
BME680:                     Present
BMP280:                      Not Present
SkyCam:                      Present
DS3231:                     Not Present
HDC1080:                    Not Present
AM2315:                     Not Present
ADS1015:                    Not Present
```

ADS1115: Present  
AS3935: Present  
OLED: Not Present  
SunAirPlus: Not Present  
SI1145 Sun Sensor: Not Present  
TSL2591 Sun Sensor: Present  
DustSensor: Present  
WXLink: Present

UseBlynk: Present  
UseMySQL: Present  
Check WLAN: Present  
WeatherUnderground: Not Present  
UseWeatherStem: Present

-----  
sendmail exception raised  
-----

Sample and Display  
-----

Weather Sampling  
-----

SunAirPlus Not Present  
-----

-----  
AS3935 Lightning Detector  
-----

Last result from AS3935:  
----No Lightning detected---  
Lightning Count = 0  
-----

Sample and Display Done  
-----

Scheduled Jobs  
-----

Jobstore default:

patTheDog (trigger: interval[0:00:10], next run at: 2019-05-02 06:48:28 PDT)  
checkForButtons (trigger: interval[0:00:10], next run at: 2019-05-02 06:48:28 PDT)  
readRawWXLink (trigger: interval[0:00:15], next run at: 2019-05-02 06:48:33 PDT)  
sampleAndDisplay (trigger: interval[0:00:30], next run at: 2019-05-02 06:48:48 PDT)  
tick (trigger: interval[0:01:00], next run at: 2019-05-02 06:49:18 PDT)  
takeSkyPicture (trigger: interval[0:01:00], next run at: 2019-05-02 06:49:18 PDT)  
writeWeatherRecord (trigger: interval[0:05:00], next run at: 2019-05-02 06:53:18 PDT)  
writePowerRecord (trigger: interval[0:05:00], next run at: 2019-05-02 06:53:18 PDT)  
updateRain (trigger: interval[0:05:00], next run at: 2019-05-02 06:53:18 PDT)  
checkForShutdown (trigger: interval[0:05:00], next run at: 2019-05-02 06:53:18 PDT)  
doAllGraphs (trigger: interval[0:15:00], next run at: 2019-05-02 07:03:18 PDT)  
barometricTrend (trigger: interval[0:15:00], next run at: 2019-05-02 07:03:18 PDT)  
read\_AQI (trigger: interval[0:15:00], next run at: 2019-05-02 07:03:18 PDT)  
WLAN\_check (trigger: interval[0:30:00], next run at: 2019-05-02 07:18:18 PDT)  
statusRain (trigger: interval[1:00:00], next run at: 2019-05-02 07:48:18 PDT)  
rebootPi (trigger: cron[day='5-30/5', hour='0', minute='4'], next run at: 2019-05-05 00:04:00  
PDT)  
-----

-----Patting The Dog-----

Depending on what you have connected, your results will vary. Pay special attention to what is present in the start up list. This will help you debug many errors!

This particular installation is the SkyWeather Solar WXLink (wireless weather instruments) kit.

Note further:

```
WXLink:           Present
UseBlynk:         Present
UseMySQL:        Present
Check WLAN:      Present
WeatherUnderground:  Not Present
UseWeatherStem:  Present
```

This tells us we have WXLink set up (wireless WeatherRack and AM2315) as well as we are using the Blynk app, have MySQL running and are using WeathetSTEM.

The above starting commands will only run as long as you keep the terminal window open. If you want to shut the terminal window, in order for SkyWeather to keep running, you should use the following commands to start SkyWeather.

```
cd SDL_Pi_SkyWeather
sudo pigpiod
nohup sudo python SkyWeather.py &
```

The command “nohup” keeps your process running even after you shut the terminal window. The “&” runs it in the background freeing up your terminal.

Further, the command “nohup” puts the console output into a file called “nohup.out”. If you want to follow along in the terminal window, type:

```
sudo tail -f nohup.out
```

This will output the console to your terminal as it comes out. It is buffered and will come out in blocks, so be patient for it to start.

Note: The SkyWeather system is programmed to reboot every 5 days to clear out any Raspberry Pi memory problems. This will shutdown the SkyWeather process if you haven’t installed it for start on reboot. See the next topic for installing SkyWeather for Bootup Startup.

If you don’t want this behavior, comment out the following line in SkyWeather.py or change it to a different amount of time.

```
# every 5 days at 00:04, reboot
scheduler.add_job(rebootPi, 'cron', day='5-30/5', hour=0, minute=4, args=["5 day Reboot"])
```

It’s located about line 1600 in SkyWeather.py

## Installing SkyWeather for Bootup Startup

In ordinary operation, you will want SkyWeather to restart on bootup of the Raspberry Pi. This is necessary because of the 5 day reboot cycle in SkyWeather as well as unexpected shutdowns or if you have run out of solar power and are shutting down the system.

The file /etc/rc.local is executed during the operating system rebooting process and is a good place to put your starting code.

Use “sudo nano /etc/rc.local” or your favorite editor to modify the file.

Insert the following in your /etc/rc.local before the exit 0 statement:

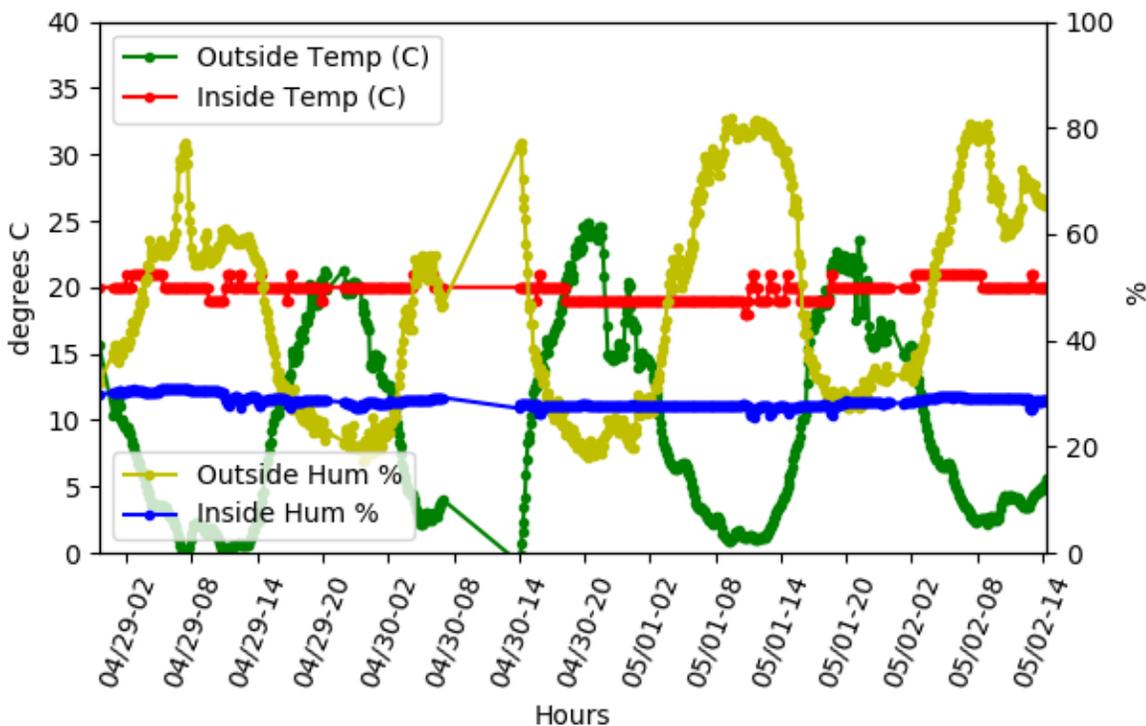
```
pi@pi:~$ pigpiod
pi@pi:~$ cd /home/pi/SDL_Pi_SkyWeather
pi@pi:~$ nohup sudo python SkyWeather.py &
```

This will start your SkyWeather system and log the console to /home/pi/SDL\_Pi\_SkyWeather/nohup.out

### Looking at the MySQL Database

If you have enabled the MySQL Database option in conflocal.py, you can look at the data and manipulate it using Python and other languages. If you enable the MySQL database, SkyWeather builds graphs in the directory /home/pi/SDL\_Pi\_SkyWeather/static every 15 minutes when MySQL is enabled. You can also find the latest “skycamera.jpg” in the static directory.

For example:



Environmental Statistics Last 10 Days

A good way of examining your database on your Raspberry Pi is to use “phpMyAdmin”. There are many tutorials on how to use this. Your SD Card comes with phpMyAdmin already installed and you can access it by typing in a browser:

<http://192.168.1.32/phpmyadmin>

You need to replace the “192.168.1.32” with your IP address on your local network. On the SDCard, the default phpadmin username is “admin” and the password is “password”.

The screenshot shows the phpMyAdmin interface for a MySQL database named 'SkyWeather'. The selected table is 'PowerSystem'. The interface displays a table with 25 rows of data. The columns are: ID, TimeStamp, batteryVoltage, batteryCurrent, solarVoltage, solarCurrent, loadVoltage, loadCurrent, batteryPower, solarPower, and loadPower. The data shows various power readings over time, with timestamps ranging from 2019-04-29 00:58:31 to 2019-04-29 02:58:31.

ID	TimeStamp	batteryVoltage	batteryCurrent	solarVoltage	solarCurrent	loadVoltage	loadCurrent	batteryPower	solarPower	loadPower
1	2019-04-29 00:58:31	4.112	34.8	4.696	24.4	5	39.2	0.143	0.115	0.196
2	2019-04-29 01:03:31	4.104	43.2	4.688	17.2	5	39.2	0.177	0.081	0.196
3	2019-04-29 01:08:31	4.104	55.6	4.688	16	5	48	0.228	0.075	0.24
4	2019-04-29 01:13:31	4.104	43.2	4.688	15.6	5	38.8	0.177	0.073	0.194
5	2019-04-29 01:18:31	4.104	44.8	4.688	14.8	5	38.8	0.184	0.069	0.194
6	2019-04-29 01:23:31	4.104	56.4	4.688	14.4	5	47.6	0.231	0.068	0.238
7	2019-04-29 01:28:31	4.104	57.6	4.688	13.6	5	48	0.236	0.064	0.24
8	2019-04-29 01:33:31	4.104	57.6	4.688	13.6	5	48	0.236	0.064	0.24
9	2019-04-29 01:38:31	4.096	58.8	4.68	12.4	5	47.2	0.241	0.058	0.236
10	2019-04-29 01:43:31	4.096	49.2	4.68	12	5	39.6	0.202	0.056	0.198
11	2019-04-29 01:48:31	4.104	49.6	4.68	11.6	5	39.2	0.204	0.054	0.196
12	2019-04-29 01:53:31	4.096	49.6	4.672	10.4	5	39.2	0.203	0.049	0.196
13	2019-04-29 01:58:31	4.096	51.2	4.672	9.6	5	39.6	0.21	0.045	0.198
14	2019-04-29 02:03:31	4.096	52.4	4.672	8.8	5	39.6	0.215	0.041	0.198
15	2019-04-29 02:08:31	4.096	53.2	4.672	8	5	40	0.218	0.037	0.2
16	2019-04-29 02:13:31	4.096	54.4	4.664	6.8	5	39.2	0.223	0.032	0.196
17	2019-04-29 02:18:31	4.088	66.4	4.664	6	5	48.4	0.271	0.028	0.242
18	2019-04-29 02:23:31	4.096	56.4	4.656	4.4	5	38.8	0.231	0.02	0.194
19	2019-04-29 02:28:31	4.088	69.2	4.648	3.2	5	48	0.283	0.015	0.24
20	2019-04-29 02:33:31	4.088	58.8	4.472	2.8	5	39.2	0.24	0.013	0.196
21	2019-04-29 02:38:31	4.088	70.4	4.472	1.6	5	47.2	0.288	0.007	0.236
22	2019-04-29 02:43:31	4.088	58.4	4.4	0.4	5	38.8	0.239	0.002	0.194
23	2019-04-29 02:48:31	4.088	59.2	4.032	0	5	39.2	0.242	0	0.196
24	2019-04-29 02:53:31	4.088	58.8	3.744	0	5	39.6	0.24	0	0.198
25	2019-04-29 02:58:31	4.088	59.2	3	0	5	39.2	0.242	0	0.196

## SkyWeather Lite Operations

SkyWeather Lite Operations are essentially the same as the full Kit operations. However, no WeatherRack (Anemometer, Wind Vane and Rain Bucket) or ThunderBoard (Lightning Detection) is included. Those columns and panel entries will have blank or zero values on the Blynk app, WeatherSTEM.com and in the MySQL Database. Other operations are the same.

Your list of devices present during the initialization of SkyWeather will show that those devices are missing. The WeatherRack just will not be used and will report zeros.

## SkyWeather Solar Operations

SkyWeather Solar adds solar panels and a solar controller (SunControl) to the standard SkyWeather Kit. Operations are the same as for the standard kit, with the exception of the addition of measurement of the solar panels voltage and current, the battery voltage and current and the computer voltage and current. This data collection allows you to understand what is happening in your solar power system and gives you the information to make adjustments to your solar power system. There is a great deal to be learned from monitoring your system. The Solar Pages will fill in with information about your solar panel system on both Blynk and WeatherSTEM.com.

## SkyWeather WXLink Operations

SkyWeather Solar WXLink operations again are similar to the full kit. The Solar WXLink allows you to mount the AM2315 and the WeatherRack sensors in a remote location from your Raspberry Pi. While the Solar WXLink only contains solar panels and a SUNAirPlus controller for the WeatherRack and AM2315. This means that these devices are not read from the local unit and will instead be read from the WXLink. If SkyWeather detects the WXLink then it will read the data from there. Note that the startup of reading the WXLink can take some time (even minutes) before it will start reading. A quick way of testing the WXLink (obviously after you have assembled it) is to run the testWXLink.py program located in the SDL\_Pi\_SkyWeather main directory.

```
cd SDL_Pi_SkyWeather
Sudo python testWXLink.py
```

```
'HW-Version: ', 18)
after WXLink waitRX
-----
block1= [171, 102, 37, 71, 81, 52, 0, 0, 0, 215, 151, 202, 64, 153, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 205, 204, 132, 65, 0, 0, 40]
block2= [66, 129, 149, 131, 64, 51, 51, 51, 66, 204, 204, 60, 66, 162, 69, 150, 64, 204, 204, 204, 65, 0, 0, 0, 0, 96, 26, 0, 0, 236, 197]
-----
block 1
ab6625475134000000d797ca40990000000000000000000000cdcc8441000028
block 2
428195834033333342cccc3c42a2459640cccccc410000000601a0000ecc5
-----
ReversedreceivedCRC= ecc5
length of stb1+sb2= 59
ab6625475134000000d797ca40990000000000000000000000cdcc8441000028
428195834033333342cccc3c42a2459640cccccc410000000601a
calculatedCRC = ecc5
Good CRC Received
Rain Total= 0.00 in
Wind Speed= 3.96 MPH
Wind Direction= 0 Degrees
OTFloat=cdcc8441
AM2315 from WXLink temperature: 16.6C
AM2315 from WXLink humidity: 42.0%
```

```

WXLink batteryVoltage = 4.11
WXLink batteryCurrent = 44.80
WXLink loadCurrent = 47.20
WXLink solarPanelVoltage = 4.70
WXLink solarPanelCurrent = 25.60
WXLink auxA = 0.00
WXLink Message ID 6752
WXLink Data_Fresh set to True
ReversedreceivedCRC= ecc5
length of stb1+sb2= 59

```

Note that the WXLink device will take some time to sync in (especially if you are in an electrically noisy environment) and you may see a number of bad CRCs from that kind of environment. If you don't see good messages after a while, move the LoRa receiver plugged into your Raspberry Pi to a place farther away from sources of noise (like phones, monitors and 3D printers – our 3D printer is munching our LoRa receiver right now!). These kind of errors look like:

```

ReversedreceivedCRC= 128b
length of stb1+sb2= 59
ab6625eb4e34000000301534404400000000000000000000066668641333327
4281958340ffff074200002042a24596409999c941000000005f1a
calculatedCRC = 12cb
Bad CRC Received

```

If you are not using a solar powered system on your base unit (which you can use – it is just not one of the pre-packaged kits), then the SkyWeather software will put the WXLink solar system information into the data structures reserved for the base unit solar power data. That way you can monitor your remote WXLink power.

If you have a solar system on your base unit, then SkyWeather will use the base unit solar information for the displays and the MySQL database. If you want both, some modifications to the software are needed, which is beyond the scope of this manual.

## Where to go From Here

The next thing to do is to get connectivity to the Internet from SkyWeather. We suggest going to the manual for connecting to WeatherSTEM.com, then putting your system display on your phone by using Blynk and then maybe even connecting to WeatherUnderground.

Feel free to modify the code and add sensors to SkyWeather. The more information you gather, the better the experience.

## SkyWeather I2C and GPIO Connections

SkyWeather I2C Chart					
Device	Address	PiWeather Bus	I2C Plug Location	Description	Board
TCA9545	0x73	All Buses	Built Into PiWeather	I2C 4 Channel Mux	PiWeather
BME680	0x77	Bus 0	Built into PiWeather	Barometric Pressure, AQI, Temp/Humidity	PiWeather

<b>ADS1115</b>	0x48	Bus 0	Built into PiWeather	ADC for Wind Vane	PiWeather
<b>ThunderBoard</b>	0x02	Base	ThunderBoard I2C to Pi2Grover I2C	Lightning Detection	ThunderBoard - AS3935
<b>I2C Hub</b>		Bus 0	PiWeather I2C Bus 0 to I2C hub		
<b>AM2315 Grove Power Save</b>	0x5C	Bus 0	I2C Hub to AM2315 Grove Power Save In	Outside Temp/Humidity	AM2315
<b>AM2315</b>	0x5C	Bus 0	AM2315 to AM2315 Grove Power Save Out		
<b>TSL2591 Sunlight</b>	0x29	Bus 3		Visible / IR	Grove TSL2591
<b>PiWeather Board</b>			PiWeather Computer I2C to Pi2Grover I2C		
<b>Optional Devices</b>					
<b>SunAirPlus/SunControl</b>	0x48	Bus 2		Solar Controller	SunAirPlus/SunControl
<b>OLED</b>	0x3C	Bus 0		OLED Display	Grove OLED
<b>Real Time Clock</b>	0x68	Bus 0		Real Time Clock	DS3231 RTC

Table 1 – I2C Connections

SkyWeather GPIO Connections Chart							
Device	From Port	To Port	Description	Board	Notes		
<b>Anemometer/Vane</b>	WeatherRack	Anem Vane / RJ11	Anemometer/Wind Vane	PiWeather Board			
<b>Rain Bucket</b>	WeatherRack	Rain Bucket / RJ11	Rain Bucket	PiWeather Board			
<b>Anemometer</b>	PiWeather/J5	Pi2Grover / D20/21	Anemometer to Computer	PiWeather Board			
<b>Rain Bucket</b>	PiWeather/J6	Pi2Grover/ D13/D16	Rain Bucket to Computer	PiWeather Board			
<b>AM2315 Grove PowerSave</b>	Pi2Grover / D6/12	Grove PowerSave/ Control	Control for AM2315 Power	Grove Power Save			
<b>AQI Grove Power Save</b>	Pi2Grover / D19/20	AQI Grove PowerSave / IN	Input for AQI Grove Power	Grove Power Save			
<b>AQI Grove Power Save</b>	Pi2Grover / D26	AQI Grove PowerSave/ CONTROL	Control for AQI Grove Power	Grove Power Save			
<b>AQI Dust Detector</b>	AQI Grove PowerSave OUT	Dust Detector	Out for AQI Grove Power Save	Grove Dust Detector			
<b>ThunderBoard</b>	Pi2Grover / D16/19	ThunderBoard IRQ	Interrupt for the ThunderBoard	ThunderBoard			

<b>WXLink</b>	Pi2Grover / Serial	On Grove LoRa Board	connection to WXLink		Only used in SkyWeather WXLink Kit		
<b>Optional Devices</b>							
<b>Fan Power</b>	Pi2Grover / D5/6	5V Fan	Fan Control - <b>NOTE: Cut the White wire of this Grove Cable</b>	Input Grove PowerDrive	Only if you are using an optional 5V Fan for thermal control		
<b>PixelStrips</b>	Pi2Grover / D21/26	Pixel Sticks In			If you are using the optional Pixel Sticks with SkyWeather		
<b>WatchDog Wiring</b>							
<b>USB Control</b>	SunControl USB Control - J2/1 (Yellow)	SunControl - JP7 - WatchDog Out - JP7/1 RESETN			Only Used in SkyWeather Solar Kits		
<b>USB Enable</b>	SunControl USB Enable - J2/2 (White)	SunControl - JP7 - WatchDog Out - JP7/2 PULSEHIGH			Only Used in SkyWeather Solar Kits		
<b>WatchDog Pat</b>	Pi2Grover / D4/5	SunControl - Grove J4 - WatchDog Done / Wake Plug	<b>NOTE: Cut the White wire of this Grove Cable</b>		Only Used in SkyWeather Solar Kits		

Table 2 – GPIO Connections

## The Science and Education Goals Behind SkyWeather

Everything we build for the Maker market is designed for education and learning. Making is education. Making is learning. Building your own projects allows you to innovate around a framework and do wonderful things that of which we have never thought.

The educational goals for SkyWeather are:

- Learn about the Raspberry Pi and installing software on the Pi
- Connecting up sensors to the Raspberry Pi
- Learning about Feedback loops
- Understand your indoor environment and what affects it
- Learn about the new technology called the Internet of Things

SkyWeather designed to be the hub to which you connect everything to turn your Raspberry Pi into a complete Weather Station that talks to the Cloud. Just ready to be customized to your project and usage. It is designed to be a great way of learning to hook up hardware to the Raspberry Pi. And you have all the source code to modify to work the way you want it to do.

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

Our partnership with WeatherSTEM brings this kickstarter into the realm of cloud based data mining, great graphics displays and even time lapse photography. SkyWeather and WeatherSTEM together rock.

This is a great kit in which to learn about weather sensing, data sharing in the cloud and the Raspberry Pi.

## Support

As with all SwitchDoc Labs products, technical support is given through the forums on [Forum.switchdoc.com](http://Forum.switchdoc.com). If you have issues that can be solved by our fabulous customer service department, please go to [www.switchdoc.com](http://www.switchdoc.com) and send your issues through our Contact page on the top menu.

## Disclaimer

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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.