

## **GPS Locales**

ADD001 =  
9°00'44.3"N 38°43'47.9"E  
9.012297, 38.729965

ADD002 =  
9°00'45.6"N 38°43'47.6"E  
9.012659, 38.729879

ADD003 =  
9°00'44.3"N 38°43'47.4"E  
9.012305, 38.729841

## **Particle Photon Board Nodes**

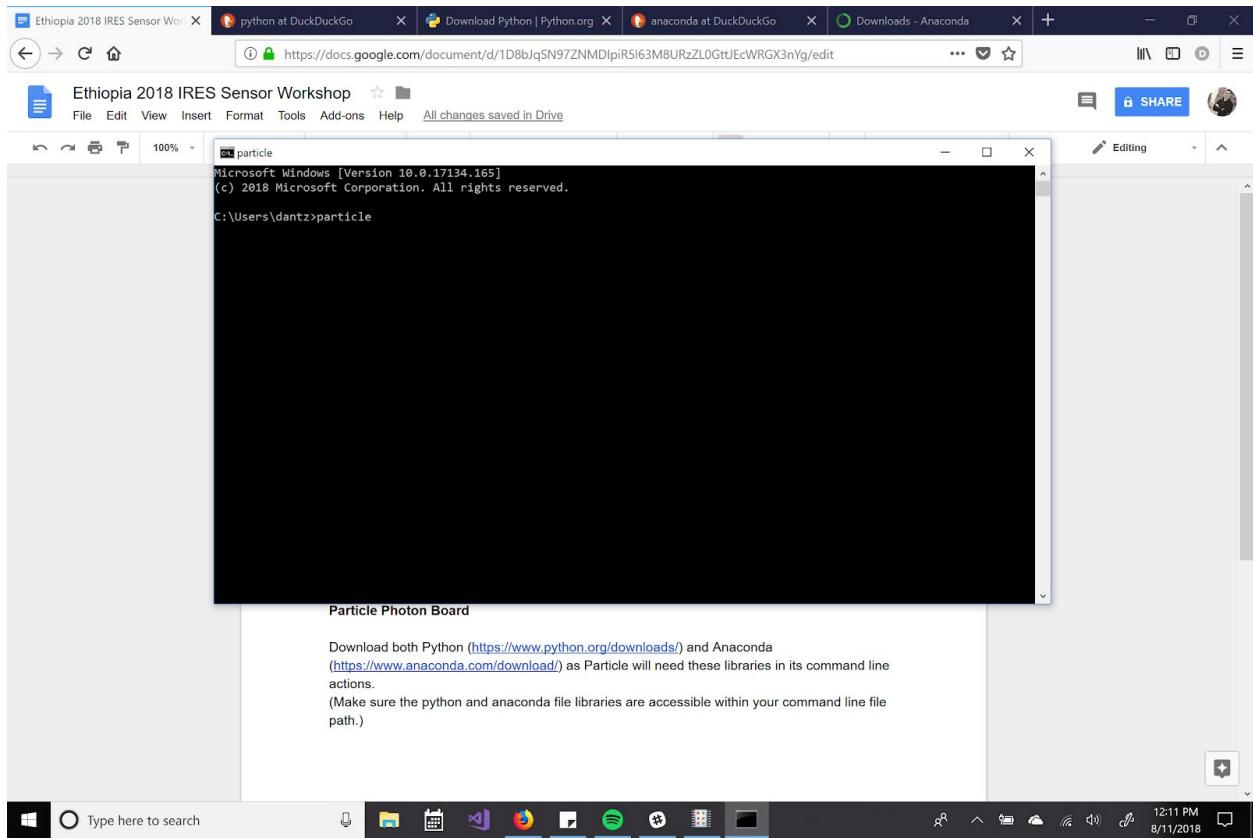
### **Required Software**

Particle has extensive documentation so I'd encourage you to check out their official documentation (Command Line Interface)

<https://docs.particle.io/guide/tools-and-features/cli/photon/> or community at  
<https://community.particle.io/>

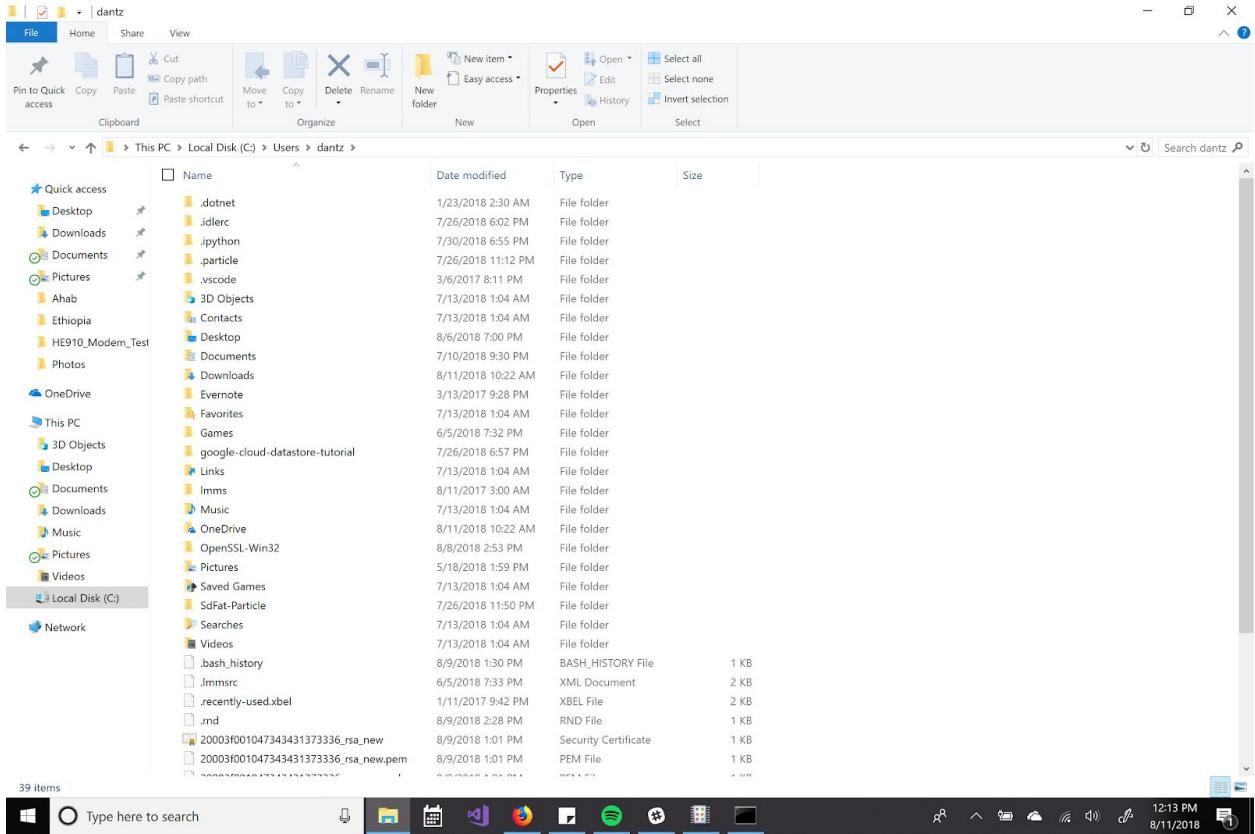
Download both Python (<https://www.python.org/downloads/>) and Anaconda (<https://www.anaconda.com/download/>) as Particle will need these libraries in its command line actions.

(Make sure the python and anaconda file libraries are accessible within your command line file path.)



Make sure the python and anaconda libraries are within your filepath. Here, it is C:\Users\dantz

Make sure OpenSSL is within your filepath as well (used for generating keys when you setup the particle)



Here you can also see the .particle file library.

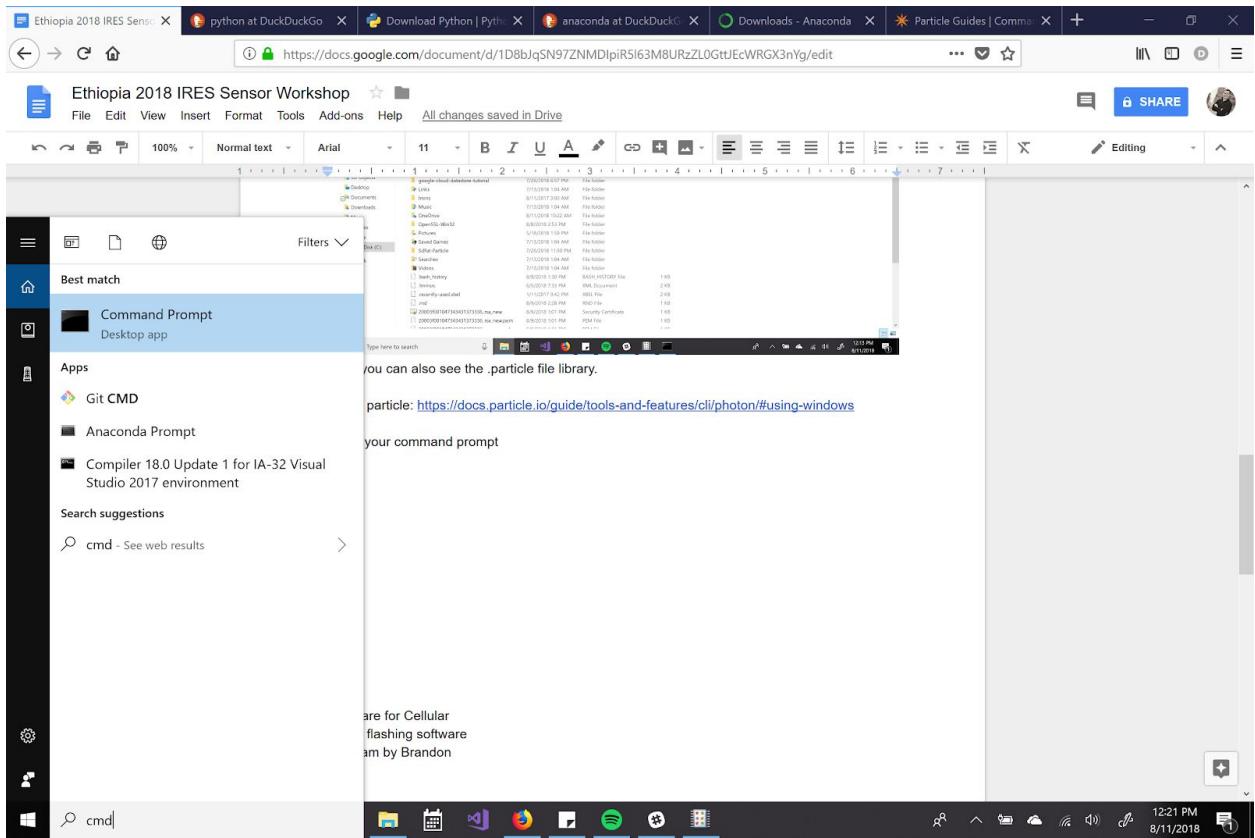
Create a particle account by clicking the login button in the upper right hand corner and following the prompts: <https://www.particle.io/>

Install particle command line interface:

<https://docs.particle.io/guide/tools-and-features/cli/photon/#using-windows>

## Photon Setup Walkthrough

Open your command prompt (I'm on Windows)



The particle photon has a micro usb port. I'll go through two methods of setup here: via usb connection (sometimes faster but seems to have more bugs), and via wifi (slower but usually works more straightforward).

## Via USB

Firstly plug the USB cable into your computer and photon, then open your command prompt and type in “particle setup”

```
clx Select particle setup
Particle
https://particle.io

> Setup is easy! Let's get started...
It appears as though you are already logged in as dantzert@umich.edu
? Would you like to use this account? Yes

! PROTIP: Hold the MODE/SETUP button on your device until it blinks blue!
! PROTIP: Please make sure you are connected to the internet.

> I have detected a P1 connected via USB.
? Would you like to continue with this one? Yes
! The device supports setup via serial.
setting up device 3b0051000551353532343835
> Obtained magical secure claim code.

Claim code set. Now setting up Wi-Fi
? Should I scan for nearby Wi-Fi networks? Yes
? Select the Wi-Fi network with which you wish to connect your device: Jupiter-Caza
? Security Type Unsecured
? Cipher Type AES
Done! Your device should now restart.
! It doesn't look like your Photon has made it to the cloud yet.

? What would you like to do? (Use arrow keys)
> Check again to see if the Photon has connected
Reconfigure the Wi-Fi settings of the Photon
```

The Photon Board seems to have an issue with open networks as it will ask for cipher type. In my experience if the board asks for cipher type, it's not going to work. Try connecting to the board a different way (via wifi) or running "particle device doctor" and trying again.

On a secured wifi network the setup will ask you for the password (but not the cipher type) and work as expected.

I have never been able to successfully connect to a network when the particle menu asked for the cipher type. What's worked for me in that case has been setup via Wifi (not USB).

## Setup via Wifi

Plug the Photon Board into a power supply via the USB (or a battery pack) and put it into listening mode (blinking blue).

C:\ Command Prompt

```
C:\Users\dantz>particle setup
[Particle]
https://particle.io

> Setup is easy! Let's get started...
> It appears as though you are already logged in as dantzert@umich.edu
? Would you like to use this account? Yes

| PROTIP: Hold the MODE/SETUP button on your device until it blinks blue!
| PROTIP: Please make sure you are connected to the internet.

> No devices detected via USB.
? Would you like to scan for nearby Photons in Wi-Fi setup mode? Yes

| PROTIP: Wireless setup of Photons works like a wizard!
| PROTIP: We will automatically change the Wi-Fi network to which your computer is connected.
| PROTIP: You will lose your connection to the internet periodically.

> No nearby Photons detected. Try the `particle help` command for more information.
? Would you like to wait and monitor for Photons entering setup mode? Yes
? Monitoring nearby Wi-Fi networks for Photons. This may take up to a minute.
? Found "Photon-X4XY3X". Would you like to perform setup on this one now? Yes

| PROTIP: You will need to know the password for your Wi-Fi network (if any) to proceed.
| PROTIP: You can press ctrl + C to quit setup at any time.

> Obtained magical secure claim code.

> Hey! We successfully connected to Photon-X4XY3X

> Now to configure our precious Photon-X4XY3X

| PROTIP: If you want to skip scanning, or your network is configured as a
| PROTIP: non-broadcast network, please choose No to the next prompt to enter manual mode.

? Shall I have the Photon scan for available Wi-Fi networks? Yes
? Please select the network to which your Photon should connect: [rescan networks]

? Please select the network to which your Photon should connect: [rescan networks]

? Please select the network to which your Photon should connect: Jupiter-Caza-Lobby
> Here's what we're going to send to the Photon:

> Wi-Fi Network: Jupiter-Caza-Lobby
> Security: NONE
> Password: [none]

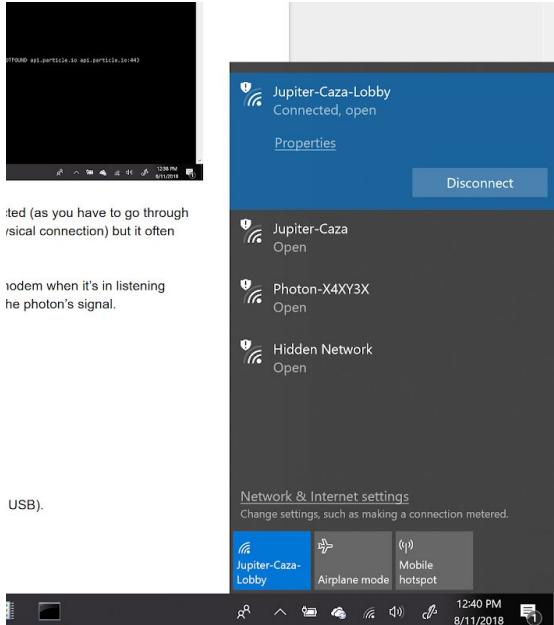
? Would you like to continue with the information shown above? Yes
```

The screenshot shows a Windows Command Prompt window with the title 'Command Prompt'. The window displays a series of text-based interactions between the user and the Photon device. The text includes various tips, configuration steps, and status messages. The command prompt shows the path 'C:\Users\dantz>' and the system tray indicates the date and time as 8/11/2018 12:38 PM.

```
C:\ Command Prompt
| Found "Photon-X4XY3X". Would you like to perform setup on this one now? Yes
| PROTIP: You will need to know the password for your Wi-Fi network (if any) to proceed.
| PROTIP: You can press ctrl + C to quit setup at any time.
> Obtained magical secure claim code.
> Hey! We successfully connected to Photon-X4XY3X
> Now to configure our precious Photon-X4XY3X
| PROTIP: If you want to skip scanning, or your network is configured as a
| PROTIP: non-broadcast network, please choose No to the next prompt to enter manual mode.
? Shall I have the Photon scan for available Wi-Fi networks? Yes
? Please select the network to which your Photon should connect: [rescan networks]
? Please select the network to which your Photon should connect: [rescan networks]
? Please select the network to which your Photon should connect: Jupiter-Caza-Lobby
> Here's what we're going to send to the Photon:
> Wi-Fi Network: Jupiter-Caza-Lobby
> Security: NONE
> Password: [none]
? Would you like to continue with the information shown above? Yes
> Obtaining device information...
> Setting up device id 3b0051000551353532343835
> Requesting public key from the device...
> Setting the magical cloud claim code...
> Telling the Photon to apply your Wi-Fi configuration...
> The Photon will now attempt to connect to your Wi-Fi network...
| Network not ready yet, retrying...
| Attempting to verify the Photon's connection to the cloud...Potentially unhandled rejection [2] Error: getaddrinfo ENOTFOUND api.particle.io api.particle.io:443
| at errnoException (dns.js:26:10)
| at GetAddrInfoReqWrap.onlookup [as oncomplete] (dns.js:77:26)
> It looks like your Photon has made it happily to the cloud!
| PROTIP: Your Photon may start a firmware update immediately upon connecting for the first time.
| PROTIP: If it starts an update, you will see it flash MAGENTA until the update has completed.
? What would you like to call your Photon (Enter to skip)? Ethiopia_Spare
> Your Photon has been given the name Ethiopia_Spare
> Congratulations! You've just won the internet!
> Ok, bye! Don't forget `particle help` if you're stuck! <3
C:\Users\dantz>
```

Setup via Wifi seems to be less buggy and work more as expected (as you have to go through the Wifi network in the first place and are never relying on a physical connection) but it often takes longer.

Basically, the photon begins broadcasting as though it were a modem when it's in listening mode, so you must make sure that your computer can pick up the photon's signal.



Here, it's Photon-X4XY3X

## Particle Device Doctor

The device must be plugged in to the computer (as in setup via USB).

```
[x] particle device doctor
Chain code set. Now setting up Wi-Fi
? Should I scan for nearby Wi-Fi networks? Yes
? Select the Wi-Fi network with which you wish to connect your device: Jupiter-Caza
? Security Type Unsecured
? Cipher Type AES
Done! Your device should now restart.
! It doesn't look like your Photon has made it to the cloud yet.

? What would you like to do?
Check again to see if the Photon has connected
> Reconfigure the Wi-Fi settings of the Photon
C:\Users\dantz\particle device doctor
The Device Doctor will put your device back into a healthy state
It will:
- Upgrade system firmware
- Flash the default Tinker app
- Reset the device and server keys
- Clear the Wi-Fi settings

The Doctor will operate on your P1 connected over USB
You'll be asked to put your device in DFU mode several times to reset different settings.

Updating system firmware

Put the device in DFU mode
Tap RESET/RST while holding MODE/SETUP until the device blinks yellow.
? Select Continue when ready Continue

> Your device is ready for a system update.
> This process should take about 50 seconds. Here it goes!

! System firmware update successfully completed!

> Your device should now restart automatically.

Flashing the Device Doctor app

This app allows changing more settings on your device

Put the device in DFU mode
Tap RESET/RST while holding MODE/SETUP until the device blinks yellow.
? Select Continue when ready Continue

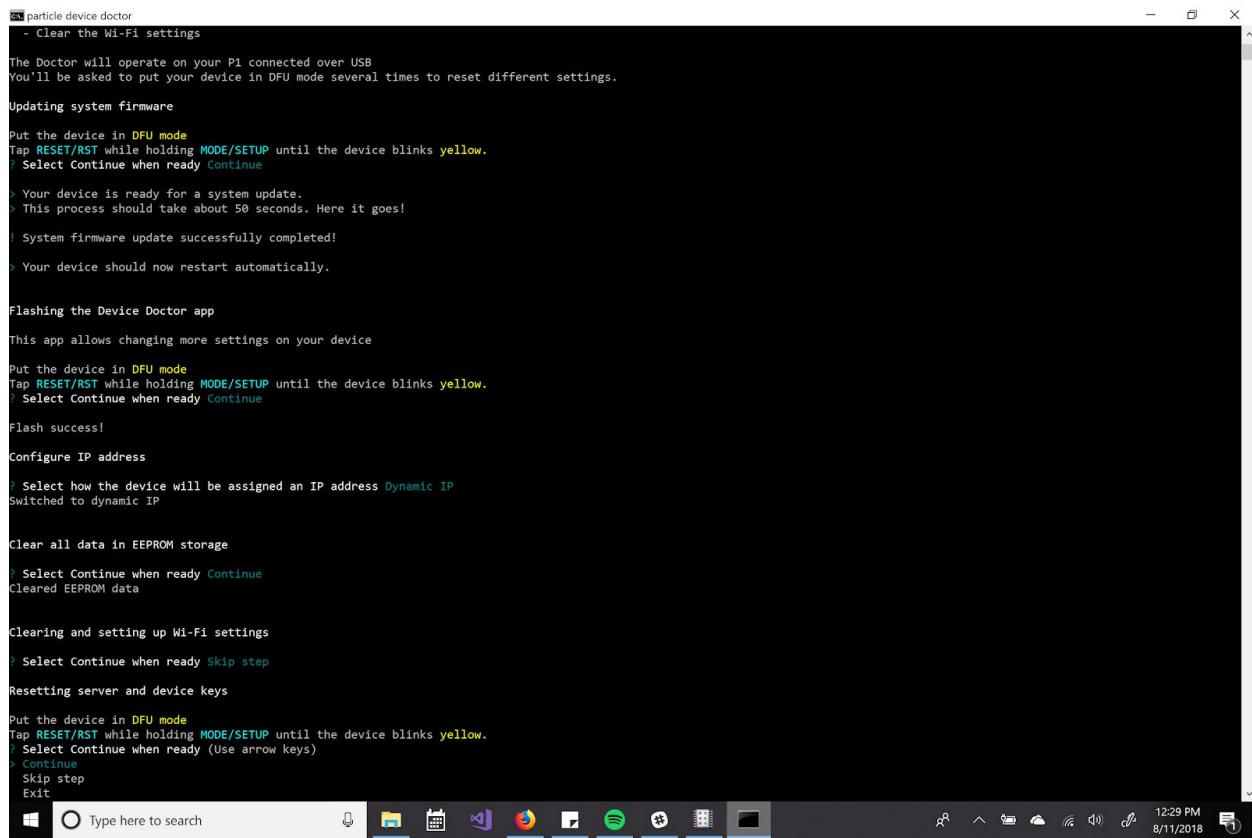
Flash success!

Configure IP address

? Select how the device will be assigned an IP address (Use arrow keys)
> Dynamic IP
Static IP
Skip step
Exit

Windows icon Type here to search
```

If you're having difficulty with the network (you've tried two or three times and it keeps asking you for the cipher type) try skipping the wifi setting setup in particle device doctor.



The screenshot shows a Windows-style application window titled "particle device doctor". The main area contains a command-line interface for performing various device operations. The text output includes:

- Clear the Wi-Fi settings
- The Doctor will operate on your P1 connected over USB  
You'll be asked to put your device in DFU mode several times to reset different settings.
- Updating system firmware
- Put the device in DFU mode  
Tap RESET/RST while holding MODE/SETUP until the device blinks yellow.  
? Select Continue when ready Continue
- > Your device is ready for a system update.  
> This process should take about 50 seconds. Here it goes!
- ! System firmware update successfully completed!
- > Your device should now restart automatically.
- Flashing the Device Doctor app
- This app allows changing more settings on your device
- Put the device in DFU mode  
Tap RESET/RST while holding MODE/SETUP until the device blinks yellow.  
? Select Continue when ready Continue
- Flash success!
- Configure IP address
- ? Select how the device will be assigned an IP address Dynamic IP  
Switched to dynamic IP
- Clear all data in EEPROM storage
- ? Select Continue when ready Continue  
Cleared EEPROM data
- Clearing and setting up Wi-Fi settings
- ? Select Continue when ready Skip step
- Resetting server and device keys
- Put the device in DFU mode  
Tap RESET/RST while holding MODE/SETUP until the device blinks yellow.  
? Select Continue when ready (Use arrow keys)  
> Continue  
Skip step  
Exit

The taskbar at the bottom shows the date and time as 12:29 PM, 8/11/2018.

If you're getting an error on key creation, that's likely a path issue with openssl.

```
Command Prompt
Flashing the Device Doctor app
This app allows changing more settings on your device

Put the device in DFU mode
Tap RESET/RST while holding MODE/SETUP until the device blinks yellow.
? Select Continue when ready Continue

Flash success!
Configure IP address
? Select how the device will be assigned an IP address Dynamic IP
Switched to dynamic IP

Clear all data in EEPROM storage
? Select Continue when ready Continue
Cleared EEPROM data

Clearing and setting up Wi-Fi settings
? Select Continue when ready Skip step

Resetting server and device keys
Put the device in DFU mode
Tap RESET/RST while holding MODE/SETUP until the device blinks yellow.
? Select Continue when ready Continue
Okay! New keys in place, your device will not restart.
New Key Created!
Saved!
Saved!
attempting to add a new public key for device 3b0051000551353532343835
submitting public key succeeded!
Okay! New keys in place, your device should restart.

Flashing the default Particle Tinker app
Put the device in DFU mode
Tap RESET/RST while holding MODE/SETUP until the device blinks yellow.
? Select Continue when ready Continue

Flash success!
The Doctor has restored your device!
> Please visit our community forums if your device still can't connect to the Particle cloud
https://community.particle.io/
C:\Users\dantz>
```

## Transferring Ownership of Devices

On the particle cloud devices are registered to an account. Once you run through setup on a device it will be registered as your device and you'll be able to flash firmware to the device.

### Creating an Account

<https://login.particle.io/login>

<https://login.particle.io/signup>

### Utilizing Particle Build (<http://build.particle.io/>) and Console (<http://console.particle.io/>)

I'll show a simple function that will just post a random analog reading (whatever the terminal is floating at as there's no sensor attached) as a way to show how to use Build and Console.

Use the "Device" Tab to select the appropriate Photon

The screenshot shows the Particle Build interface. On the left, the 'Particle Devices' sidebar lists three devices under 'P1': 'Ethiopia\_Depth\_2', 'Ethiopia\_Pressure\_2', and 'Ethiopia\_Spare'. A yellow button labeled 'ADD NEW DEVICE' is visible. The main workspace displays the following C++ code:

```
analog-publish.ino
1 void setup() {
2 }
3
4 void loop() {
5     int myReadA0 = analogRead(A0);
6     String myA0 = String(myReadA0,DEC);
7     Particle.publish("depth_measurement",String("A0 = " + myA0), 60, PRIVATE);
8
9     delay(5000);
10}
```

The status bar at the bottom indicates the device is 'Ethiopia\_Spare v0.7.0'. The taskbar shows various open applications, and the system tray shows the date and time as '8/11/2018 12:47 PM'.

And select the code you desire to flash to that photon

The screenshot shows the Particle Console interface. On the left, there's a sidebar titled "Particle Apps" with icons for Current App, Files, Share, Remove, My apps, Create New App, and Example apps. The "Current App" section is expanded, showing "ANALOG\_PUBLISH" with an optional description and a file named "analog-publish.ino". The main panel displays the code for "analog-publish.ino":

```
1 void setup() {  
2     // put your setup code here, to run once:  
3     //  
4 }  
5  
6 void loop() {  
7     // put your main code here, to run repeatedly:  
8     int myReadA0 = analogRead(A0);  
9     String myA0 = String(myReadA0,DEC);  
10    Particle.publish("depth_measurement",String("A0 = " + myA0), 60, PRIVATE);  
11    delay(5000);  
12 }  
13 }
```

Below the code, there's a message: "Please enter the title to create your first app." The status bar at the bottom right shows "Ethiopia\_Spare v0.7.0" and the date/time "8/11/2018 12:47 PM".

What you should see after you click the flash icon in the upper left corner.

Ethiopia 2018 IRES Sensor Workstation

Particle Build

Particle Console | Build your code

analog-publish.ino

```
1 void setup() {  
2 }  
3  
4 void loop() {  
5  
6 int myReadA0 = analogRead(A0);  
7 String myA0 = String(myReadA0,DEC);  
8 Particle.publish("depth_measurement",String("A0 = " + myA0), 60, PRIVATE);  
9  
10 delay(5000);  
11  
12 }  
13  
14 }
```

Flash successful! Your device is being updated..

Last Event: depth\_measurement = A0 = 1211

Transferring data from cdn.segment.com...

12:48 PM 8/11/2018

Ethiopia 2018 IRES Sensor Workstation

Particle Build

Particle Console | Build your code

analog-publish.ino

```
1 void setup() {  
2 }  
3  
4 void loop() {  
5  
6 int myReadA0 = analogRead(A0);  
7 String myA0 = String(myReadA0,DEC);  
8 Particle.publish("depth_measurement",String("A0 = " + myA0), 60, PRIVATE);  
9  
10 delay(5000);  
11  
12 }  
13  
14 }
```

Screenshot saved

The screenshot was added to your OneDrive.

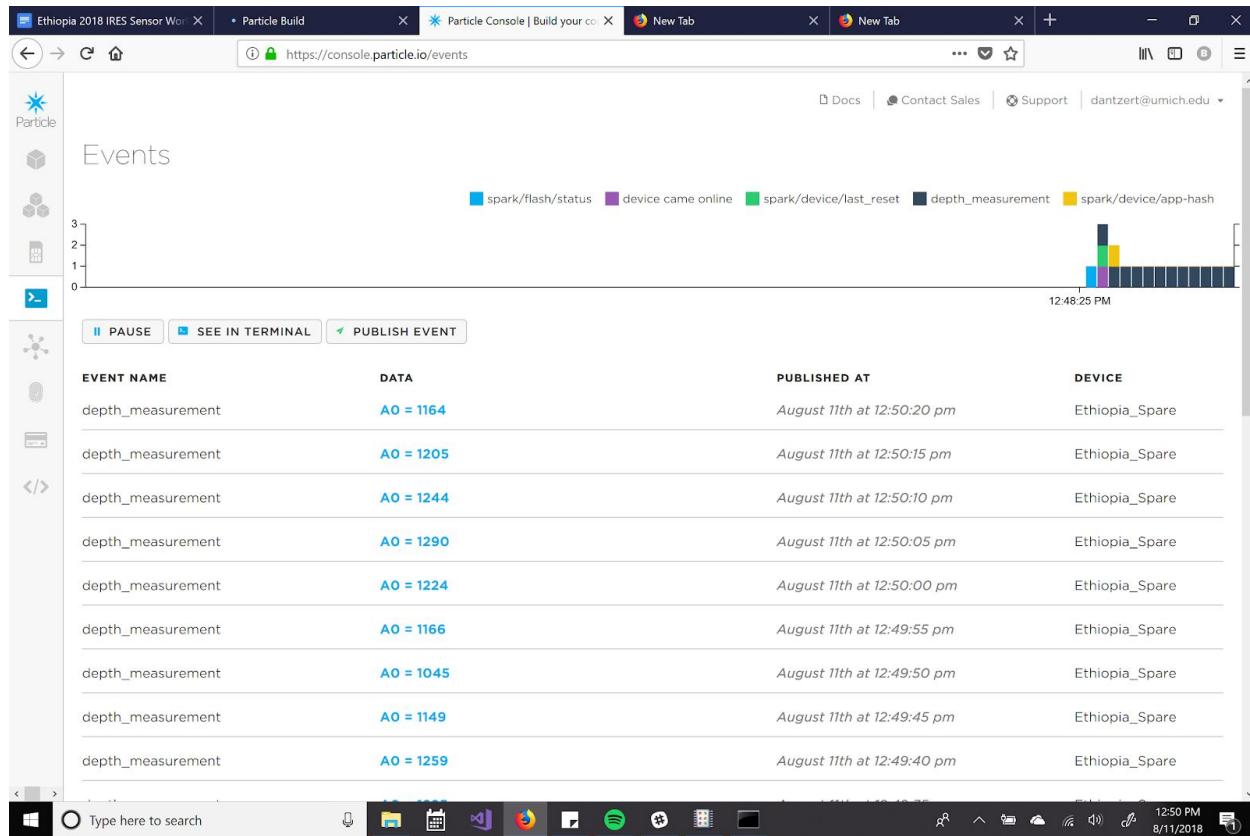
OneDrive

Ready.

Last Event: depth\_

12:49 PM 8/11/2018

Going to the “Events” tab of Particle Console should show our meaningless readings.



Turning the delay small (such as five seconds) and consulting Console is a good way to check and make sure your sensors are working correctly.

## Currently Used Firmware

**Depth:** [https://go.particle.io/shared\\_apps/5b6d9f1b85d3ae9e420004b6](https://go.particle.io/shared_apps/5b6d9f1b85d3ae9e420004b6)

**Pressure:** [https://go.particle.io/shared\\_apps/5b6d639985d3aeba8e0002ed](https://go.particle.io/shared_apps/5b6d639985d3aeba8e0002ed)

Pressure needs to be altered as it currently outputs the raw analog voltage reading.

## Viewing the Grafana stream

<http://data.open-storm.org:3000/?orgId=8>

Sign in information for data stream

UserName: ADD

Password: stream\_sensors

Currently no stream as all the batteries are dead.

## **Cellular Board Required Software**

### **PSoC**

Download PSoC Creator 4.1 :

<http://www.cypress.com/documentation/software-and-drivers/psoc-creator-software-archive>

### **PSoC Programs**

If you're failing on "arm-..." commands make sure emFile\_V322c folder is in the same folder as your project folder. Download the whole folder for the next steps.

### **Debugging PSoC Program :**

<https://drive.google.com/open?id=1V3LbmJkg2S05F0Vo2ngTTq2Yb60-tHCZ>

### **Write to SD and Connect to Cellular :**

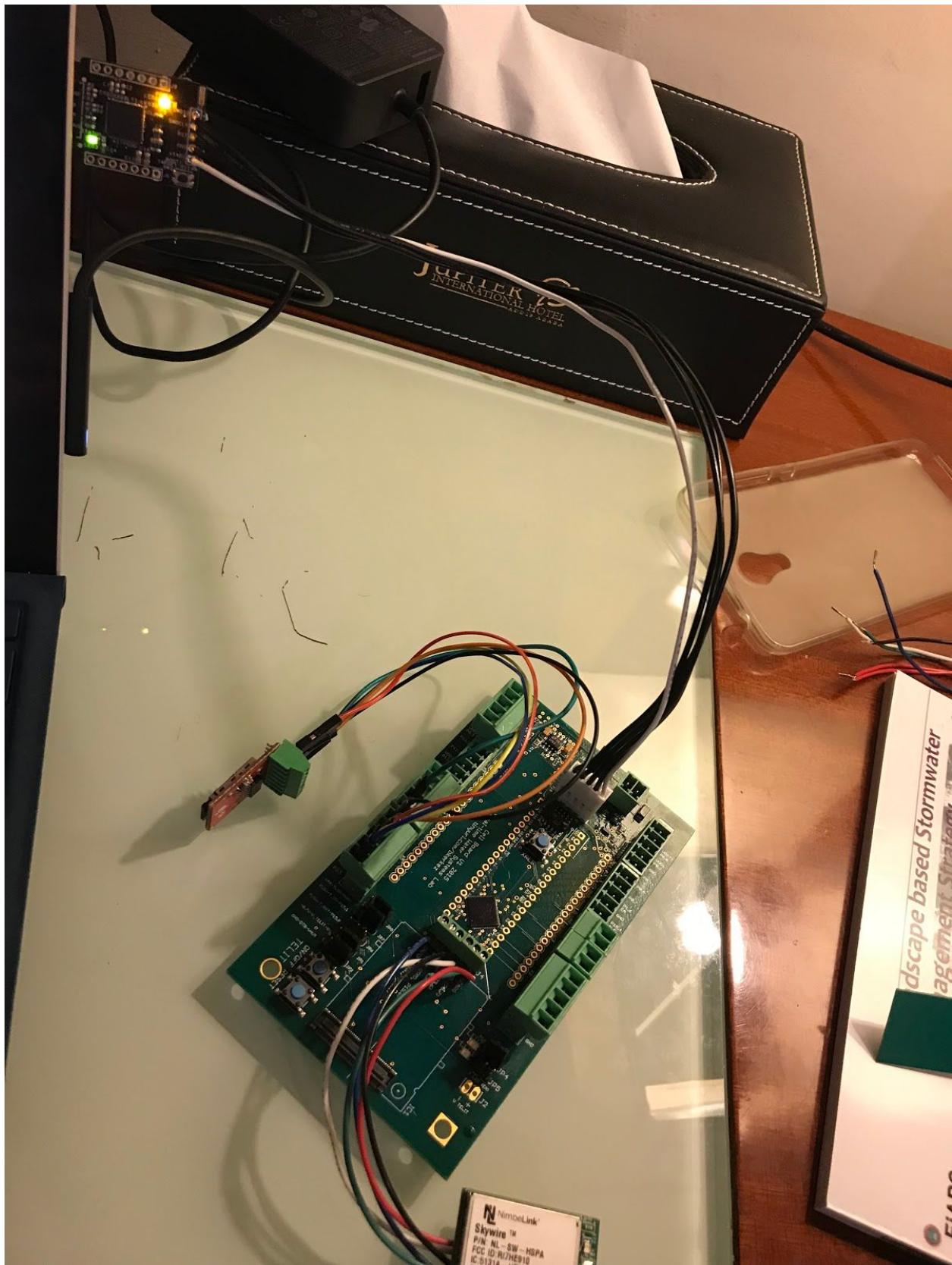
[https://drive.google.com/open?id=1hYygl7RHsLSAcjy\\_CbSAGy7-Th-nmr1s](https://drive.google.com/open?id=1hYygl7RHsLSAcjy_CbSAGy7-Th-nmr1s)

### **Hardware**

You'll just need the PSoc flasher

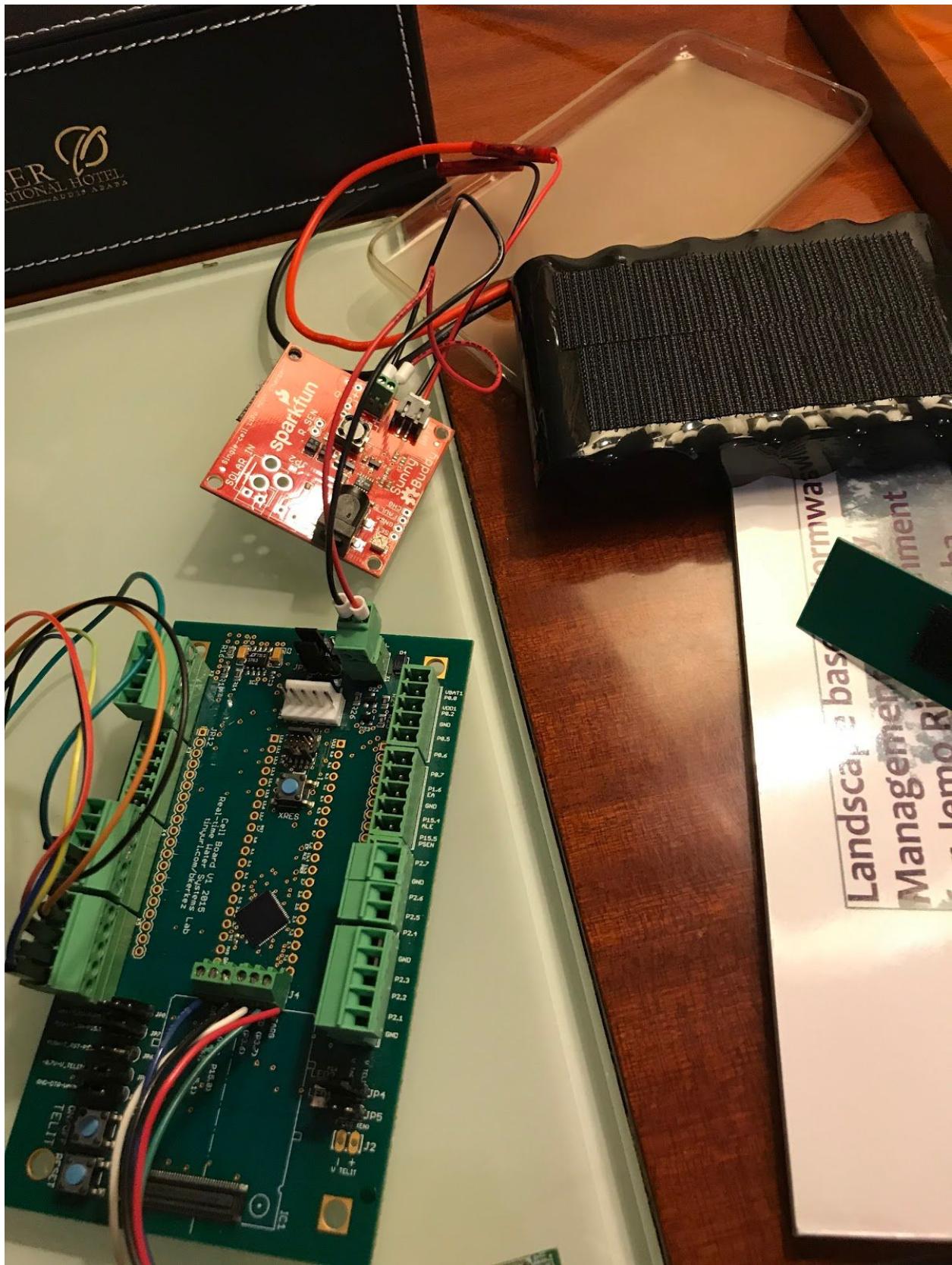


And the green board (shown here assembled)



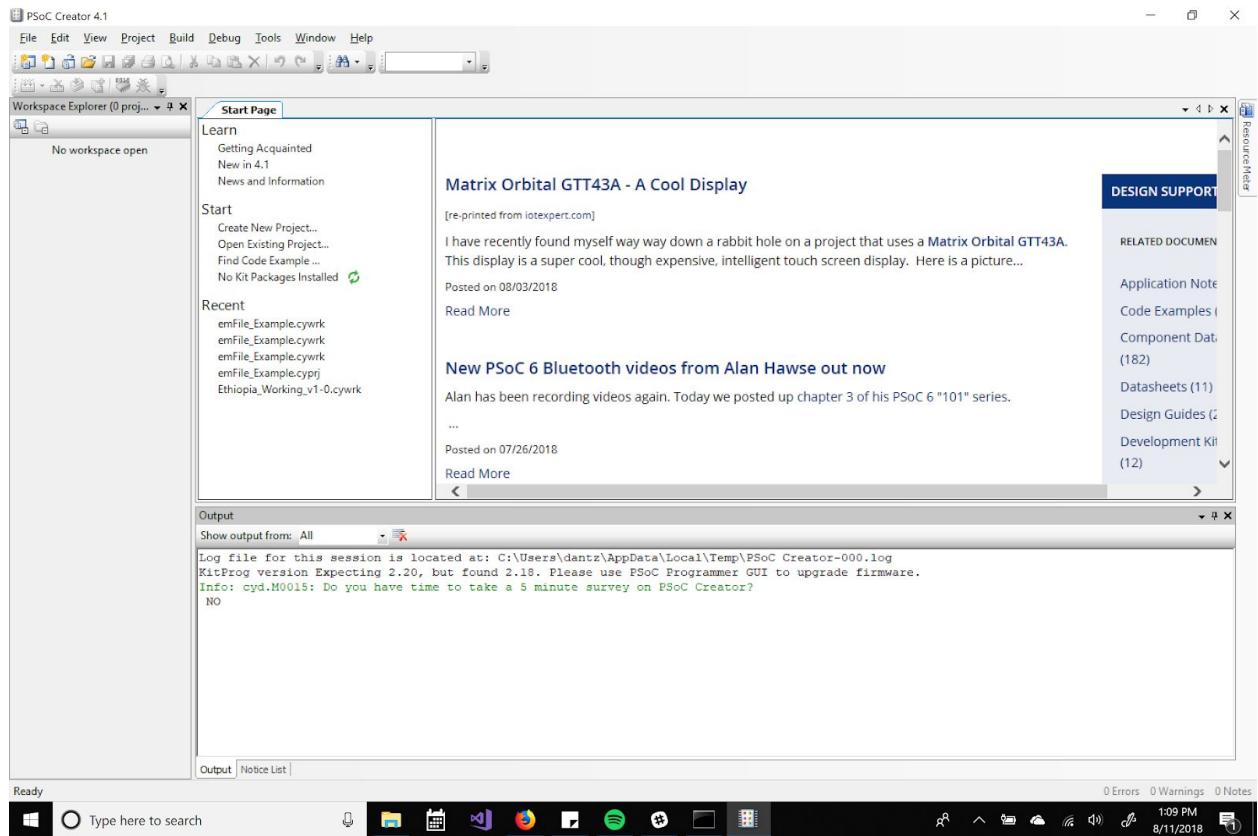
For actually running the firmware you'll need a power supply other than the debug port (battery here)

Note: Power supply to the modem (red and black wires) has been altered as we were having power problems when routing modem power through the circuit board.

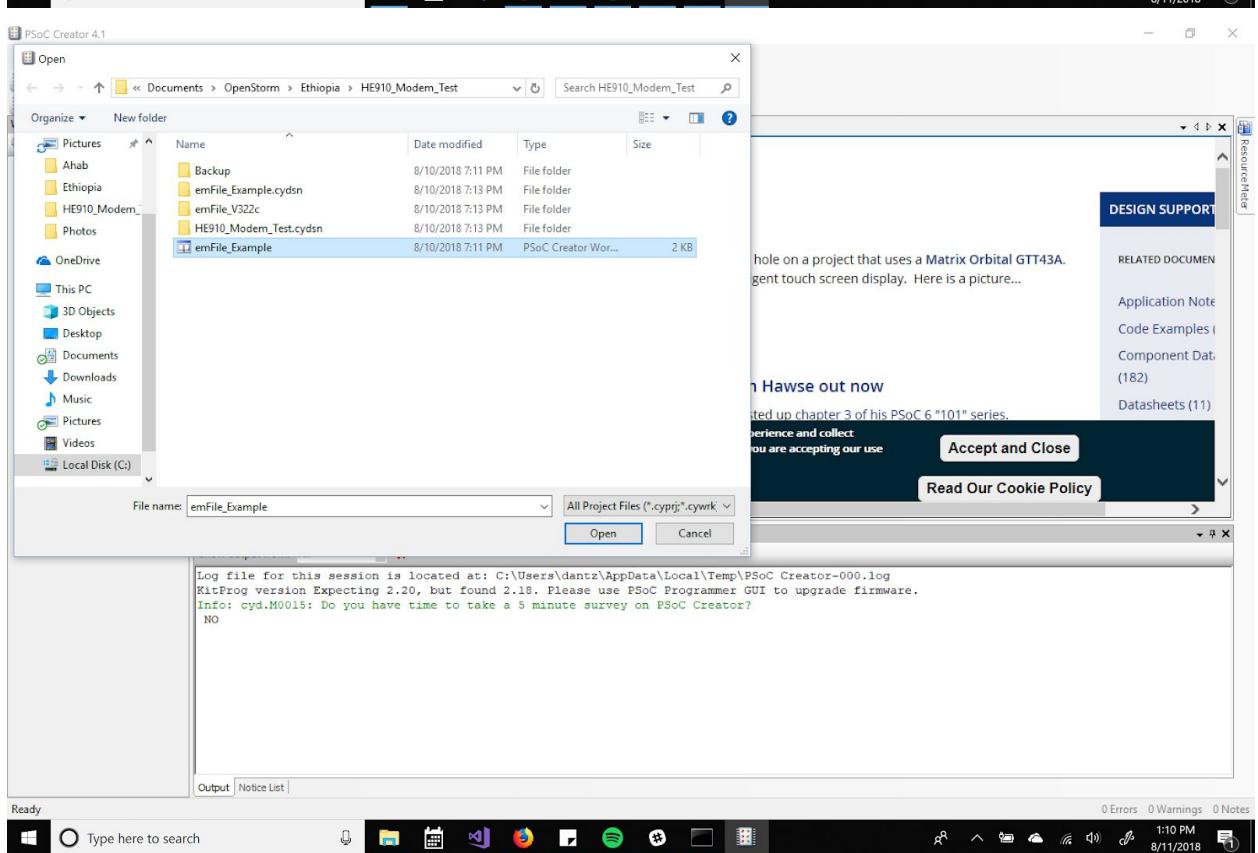
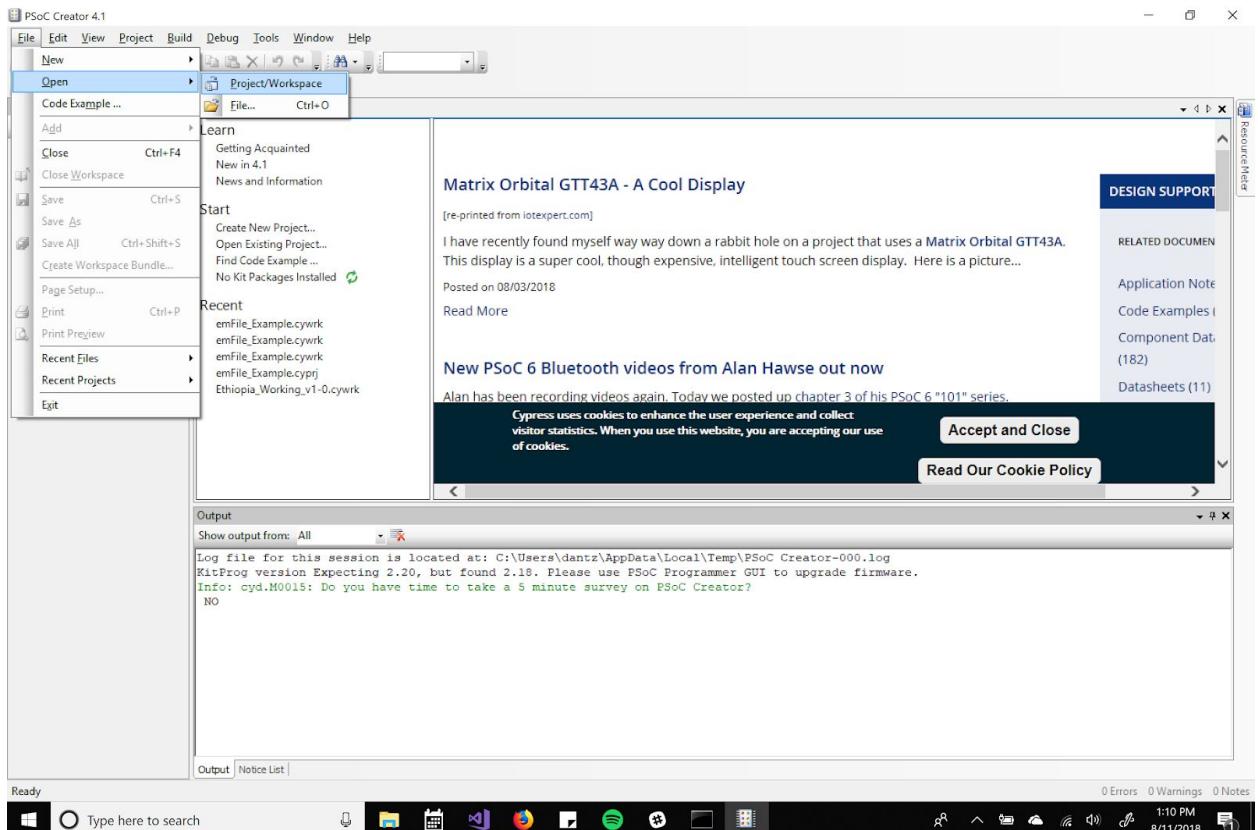


## Flashing Firmware to Your Green Cellular Board

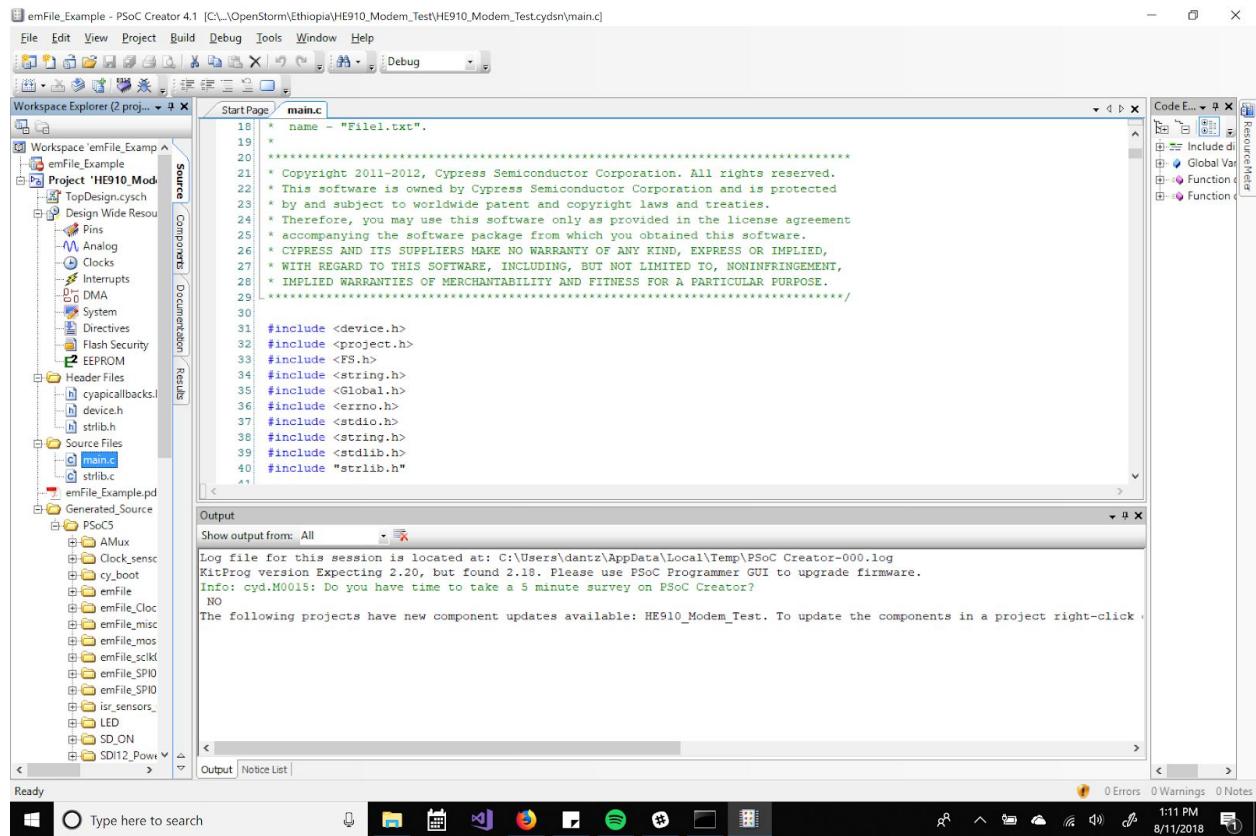
### The opening screen of PSoC



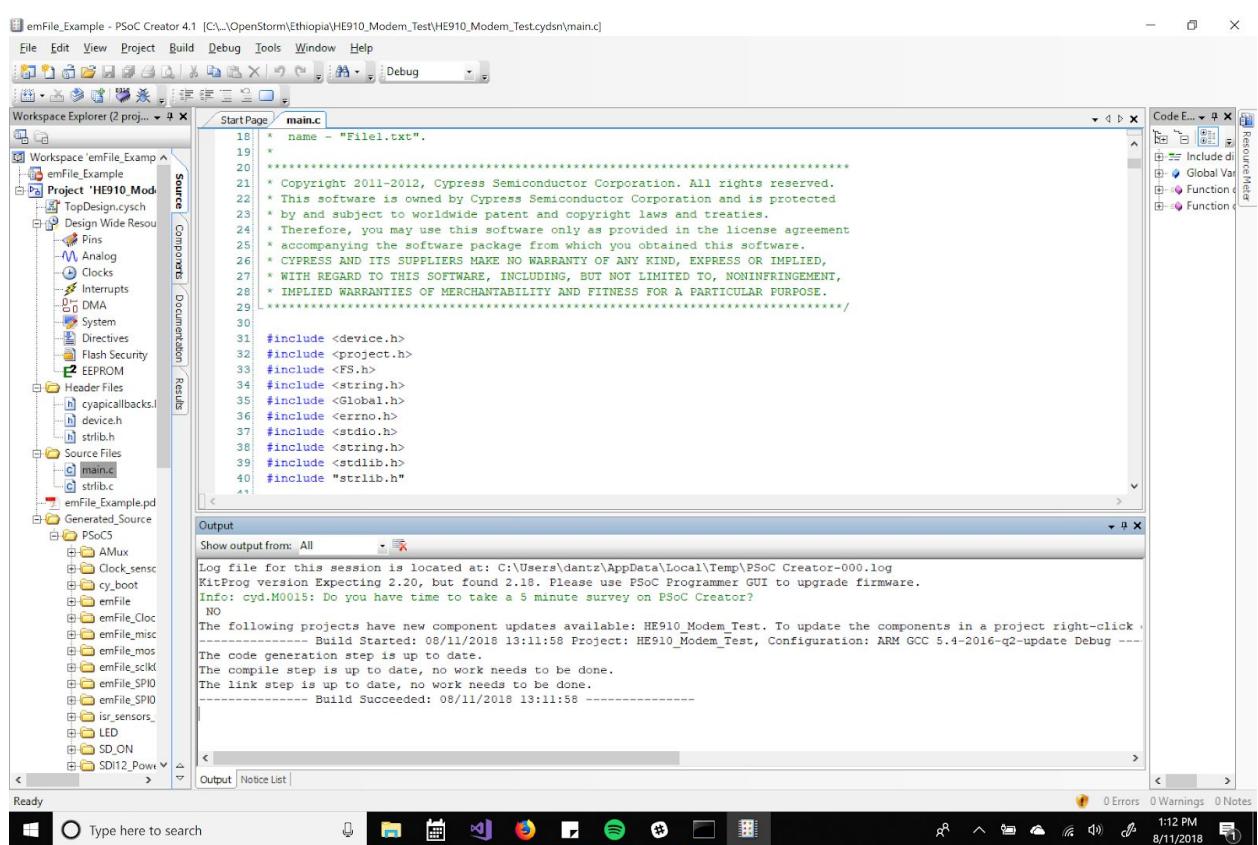
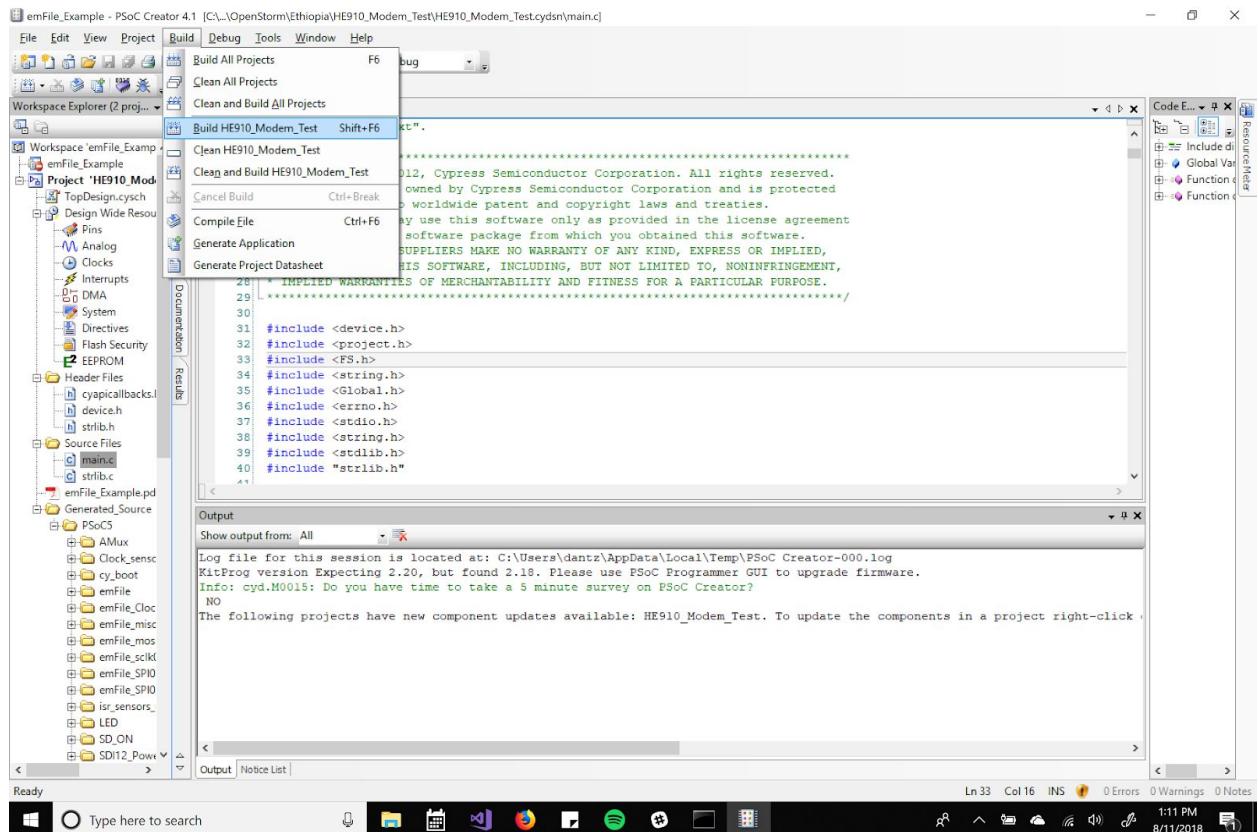
Go to file->open and find the project/workspace desired within your file structure



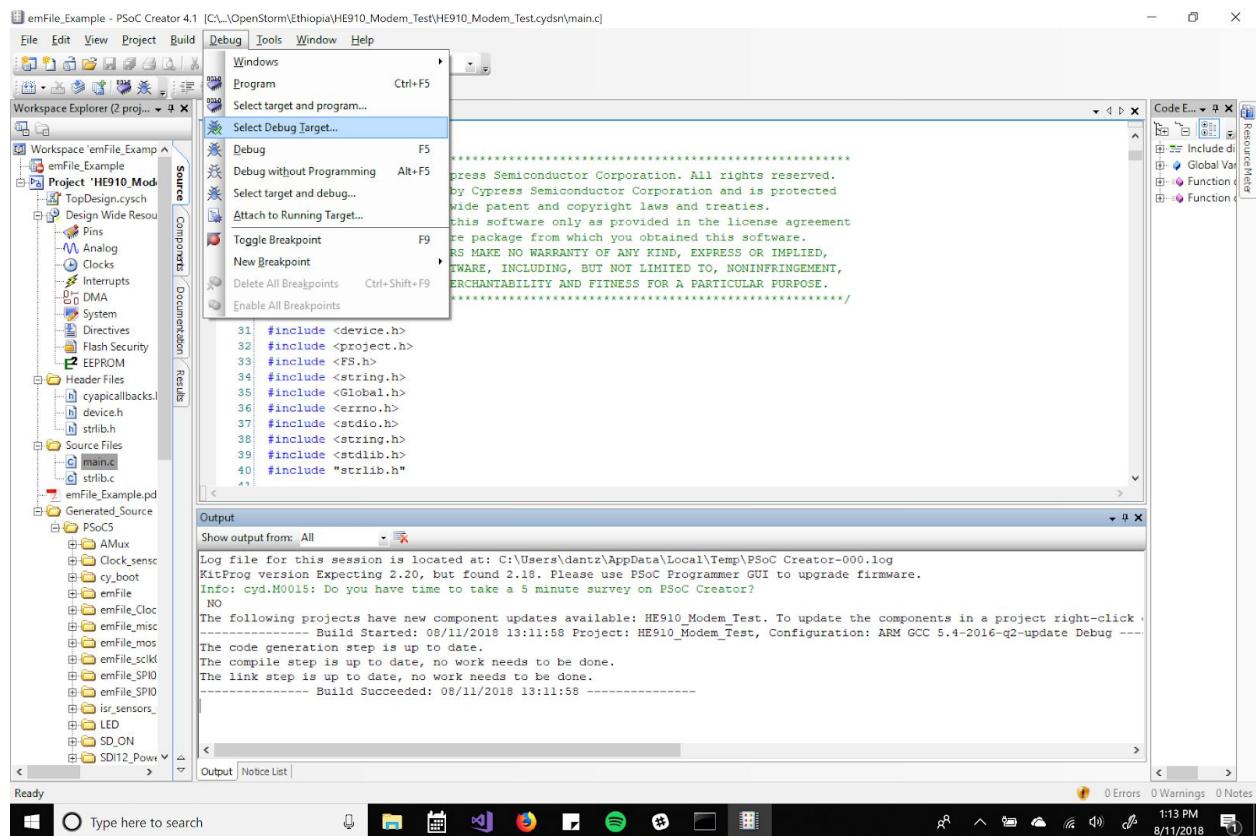
Nearly all the editing you do should be within the main.cc file

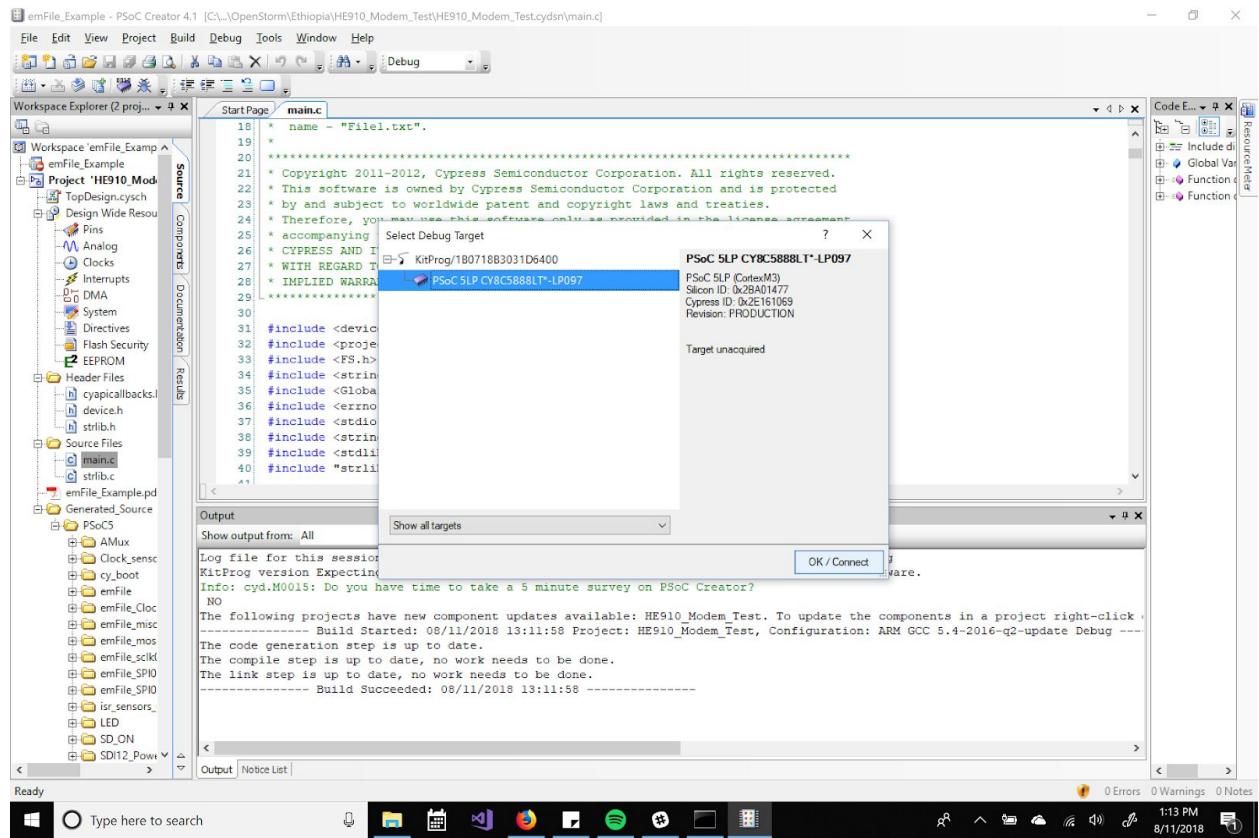


First build your project. If you get an error here you most likely don't have "emFile\_V322c" within your file path.

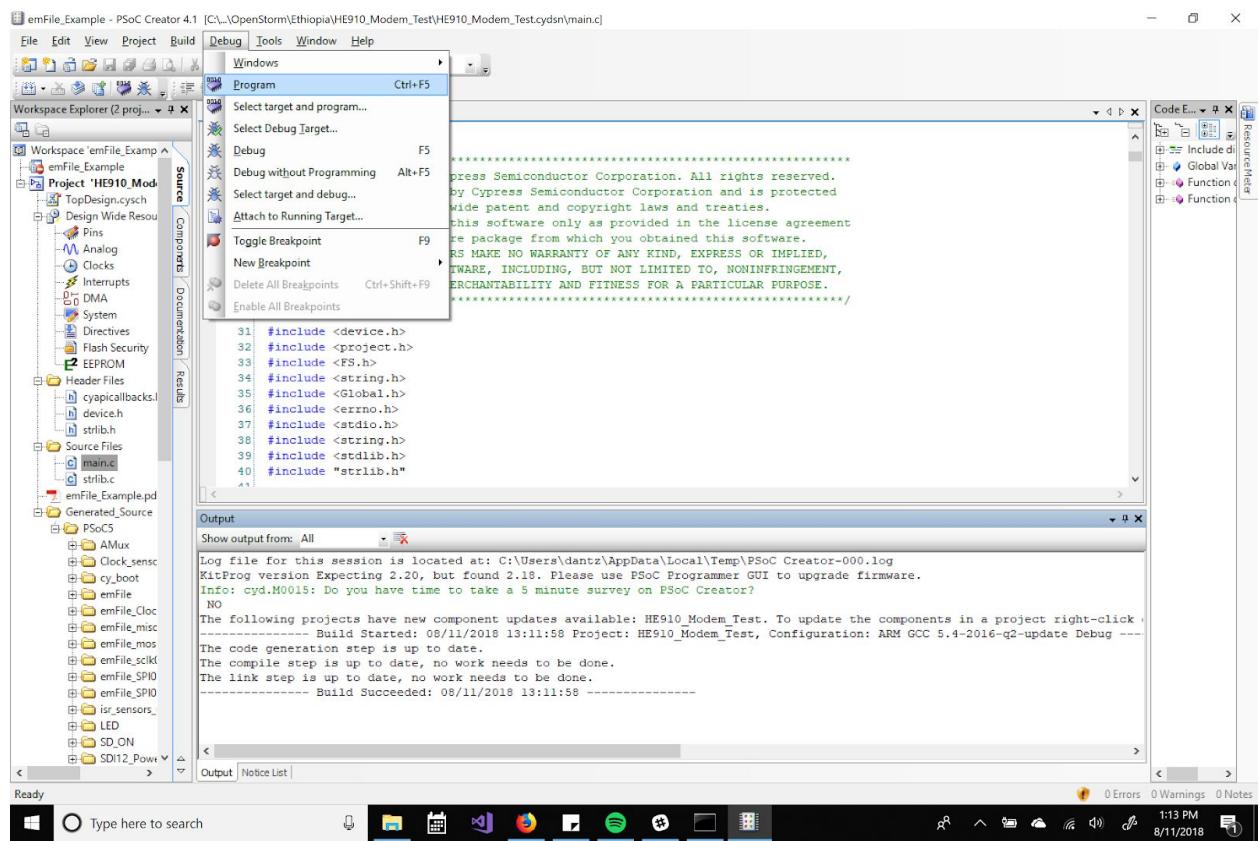


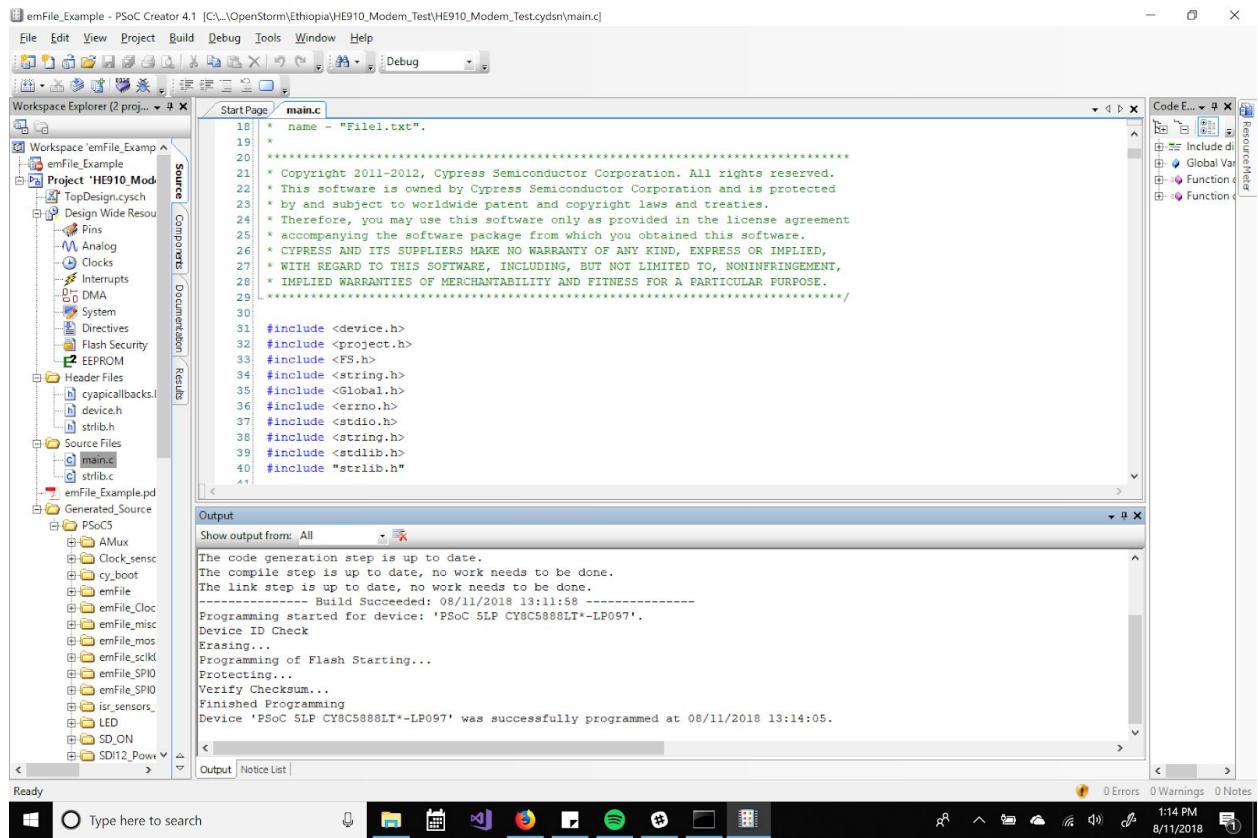
Plug the PSoC flasher into the white 5 pin debug port on your green board. Then select your debug target.





Then select program





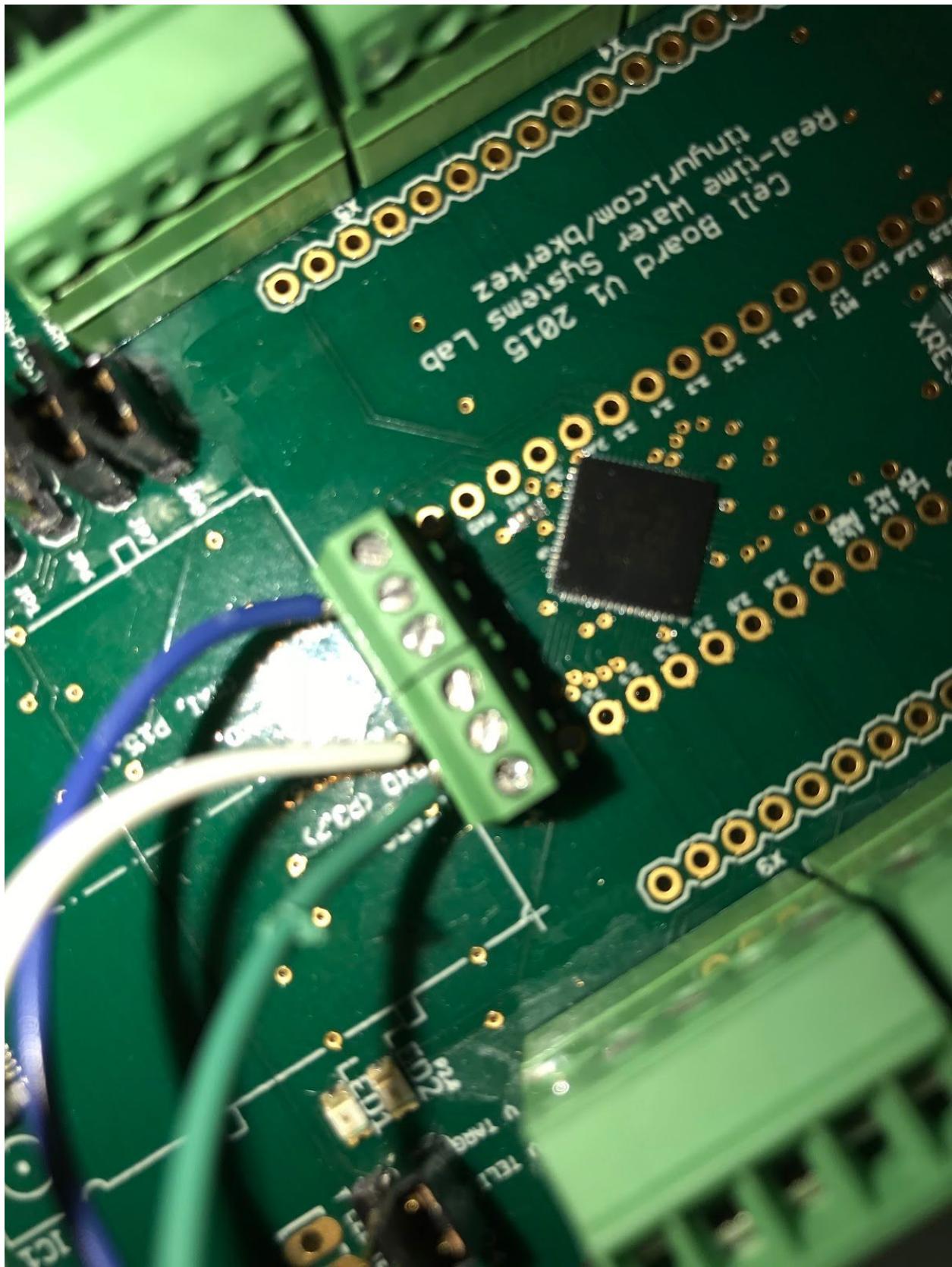
Once the device is successfully programmed, remove the debug pin and run the board off battery power.

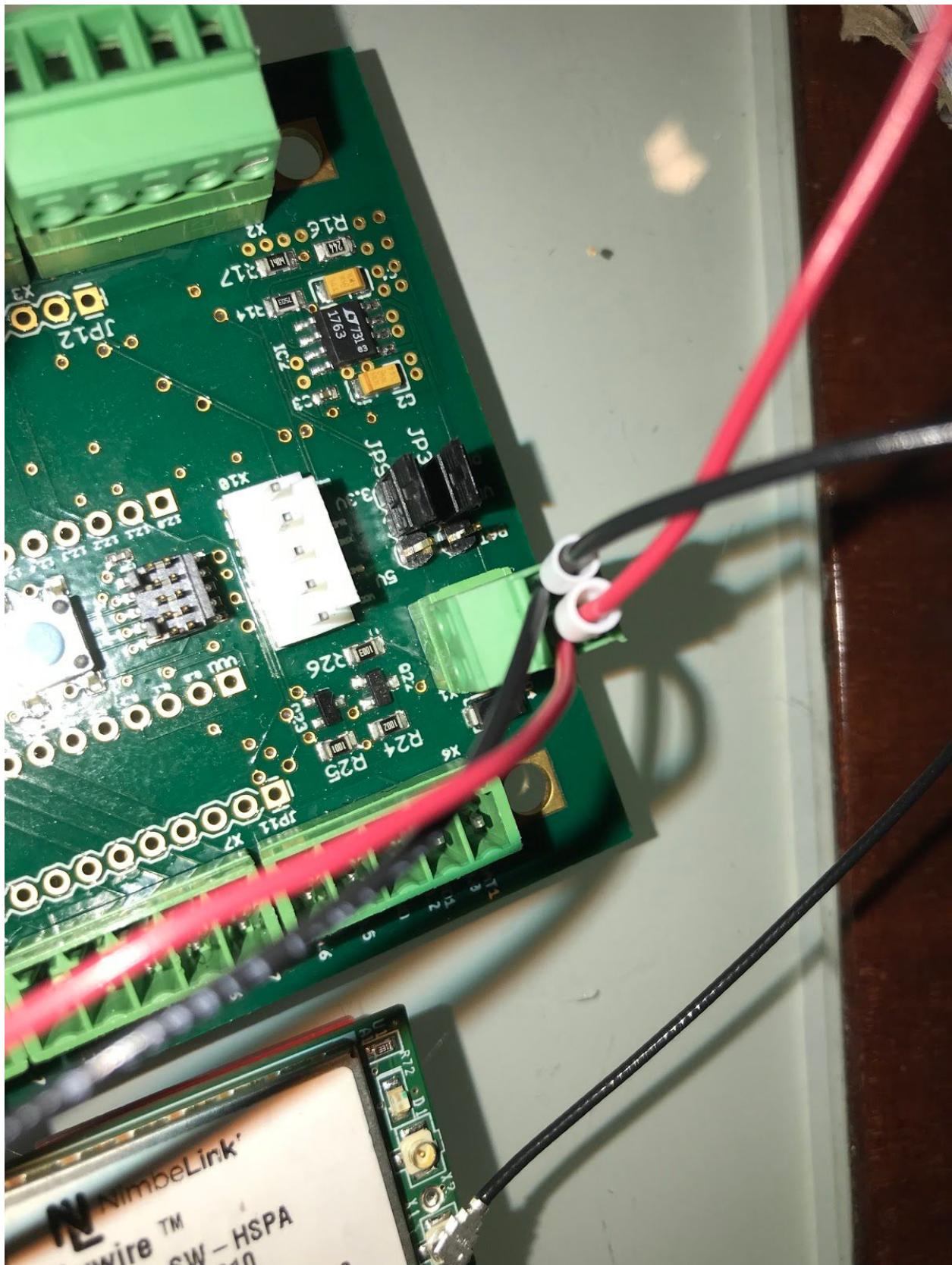
For the HE910 debug script a double LED flash every second will indicate the program has finished.

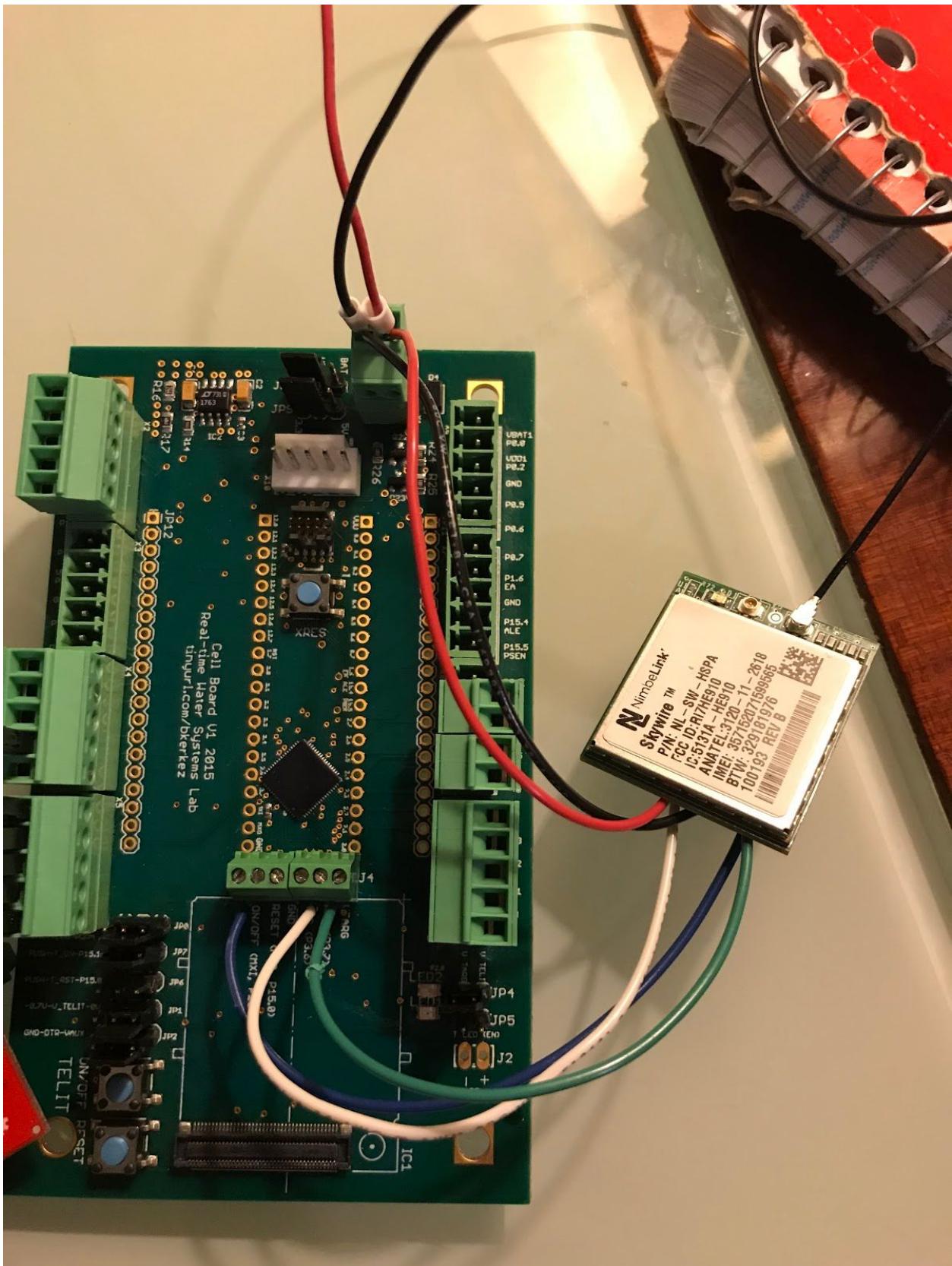
## Debugging

Both programs will write debug statements to the micro SD card attached. View this within a phone, computer, or anything else than can view the .txt file. They should be within the ADD003 folder.

I recommend deleting all the files on the microSD before you put it back in to avoid clutter on the drive.







The larger sim card that fits within the GC864 cell modules is not activated and the programs are not written for these modules.

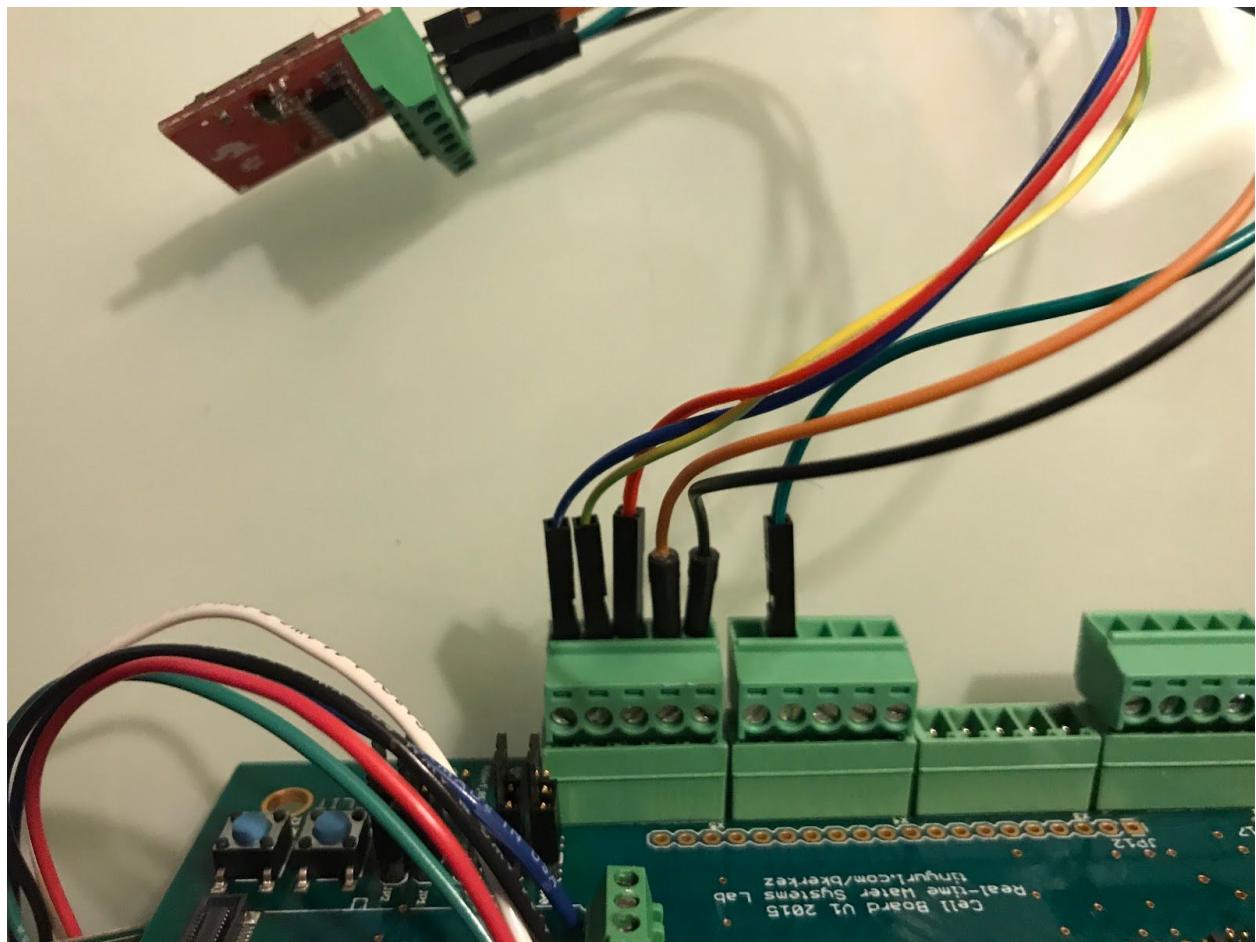
## Wiring Schematics

### Photon Board Wiring

Pressure Node

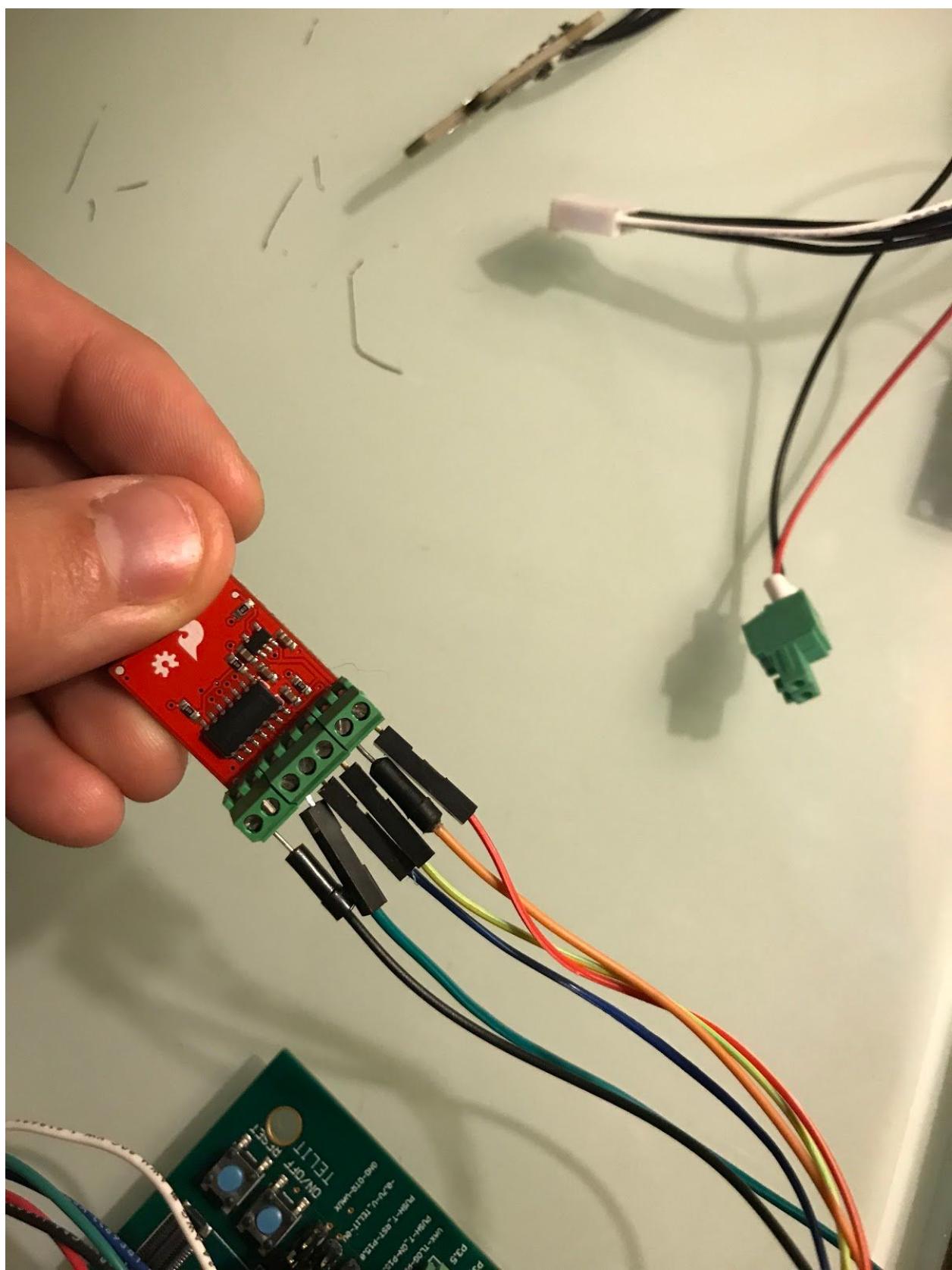
Depth Node

### XBee Cell Module wiring



Micro SD wiring

In



More details (measurements and schematics) in

<https://drive.google.com/file/d/1aZS3lqD1arz8thTdrpPpFyBLyrlujZN9/view?usp=sharing>

SIM card for Cellular Pressure Node ADD003 is 094 429 6906

Josh -

Abi did most of the work setting up the grafana stream

Brandon would be the one to ask about the PSOC code