

SwitchDoc Labs

SolarMAX2 Assembly and Testing Guide

September 2021

Version 1.51

For powering solar systems such as systems based on the
Raspberry Pi, Arduino and ESP32/ESP8266
and the SwitchDoc Labs System

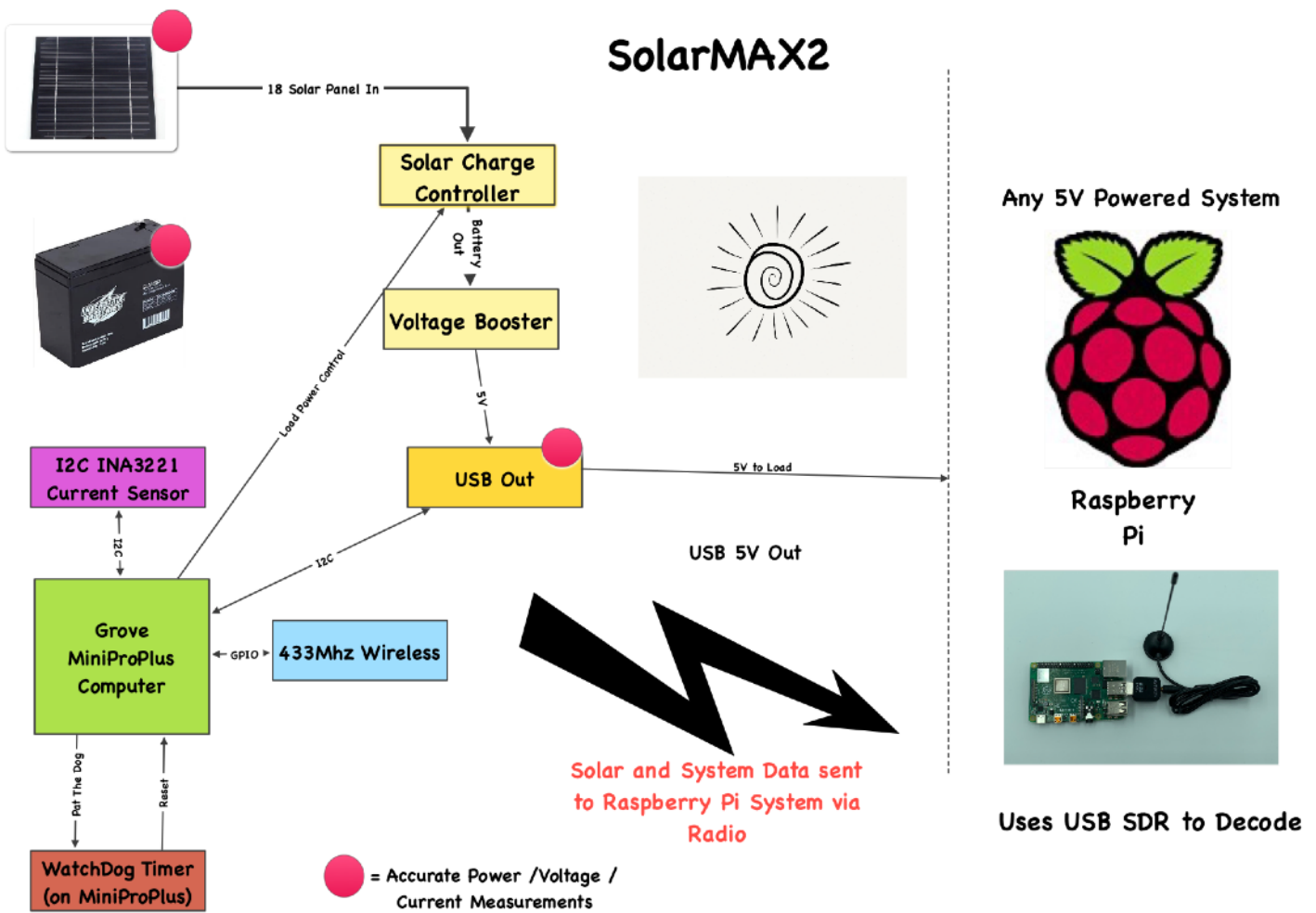


Table of Contents

Errata	1
What is SolarMAX2?	2
SolarMAX2 Specifications	3
What is in the SolarMAX2 Kit?	4
What Else is Required for the SolarMAX2 Kit?	4
SolarMAX2 Part Identification	6
Step by Step Assembly	11
Wiring the SolarMAX2	17
Solar Panel Wiring	17
Grove Wiring Table	20
433MHz Transmitter Installation	23
USB Cable Wiring	23
Fully Wired SolarMAX2 for Reference	24
Lead Acid Battery Tab Wiring	25
Connect your 12 V Lead Acid Battery	27
Testing Your SolarMAX2 System	29
Testing With SkyWeather	29
Testing with a Raspberry Pi (without SkyWeather)	30
What is in the SolarMAX2 Data Packet?	31
Power Management and Pi Protection in SolarMAX2	32
WatchDog Timer Enable	34
Installing Your SolarMAX2 System	34
The Science and Education Goals Behind SolarMAX2	36
Support	36
Disclaimer	37

Errata

SolarMAX2



What is SolarMAX2?

SolarMAX2 is a SwitchDoc Labs designed system to charge Lead Acid batteries from 18V Solar panels in order to provide more power to small computer systems. SolarMAX2 is designed to collect and return data about the solar panel system to the powered (or other) computer via a 433MHz link. SolarMAX2 collects and transmits the following data every 30 seconds:

- Battery Voltage
- Battery Current
- Solar Panel Voltage
- Solar Panel Current
- Load Voltage
- Load Current

It also supplies the following about inside the SolarMAX2 box:

- Inbox Temperature
- Inbox Humidity

SolarMAX2 uses a 433MHz module which can transmit up to 100 meters or further with larger antennas and uses very little power.

This is a perfect system for powering SkyWeather2, Raspberry Pi and other small computer systems.

SolarMAX2 Specifications

Table 1-1

Solar Max LeadAcid				Solar Max LeadAcid
	Minimum	Nominal	Maximum	
Solar Panel Voltage	15V	18V	18V	Solar Panel Voltage
Solar Panel VOC			25V	Solar Panel VOC
5V Load Current			5A	5V Load Current
Solar Charging Current			4A	Solar Charging Current
Battery Type		12V Lead Acid		Battery Type
Size of Battery		Large		Size of Battery
Cost of Battery		Low		Cost of Battery
Available Output Voltages		5V, 12V		Available Output Voltages

What is in the SolarMAX2 Kit?

- Mini Pro Plus Low Power Computer
- INA3221 High Current with Large Screw Down Terminals
- 18V Solar Panel Charger for 12V Lead Acid Battery
- HDC1080 Temp Hum
- 433MHz Transmitter and Antenna
- MC4 Solar Plus Female (and Pin)
- MC4 Solar Minus Male (and Pin)
- USB Weatherproof Plug
- Short USB Cable Type A - Type A
- 20cm Grove Cable
- 30cm (or 50cm) Grove Cable
- Grove Connector to Female Pin Headers - 1 Cable

What Else is Required for the SolarMAX2 Kit?

12 V Lead Acid battery - We recommend $\geq 20000\text{mAh}$ - <https://amzn.to/2qGCVd8> (This battery fits PERFECTLY in the Bud Enclosure below)

M2 Nylon Hex Thread Assortment - <https://shop.switchdoc.com/products/140pcs-box-m2-nylon-hex-thread-assortment-kit>

Solid Core Hookup Wire 22 Gauge - <https://amzn.to/3202Ppa>

Bud Enclosure NBB-22241 Style B - 6-25/32" x 10-23/32" x 6-25/32" - <https://amzn.to/2zk8B8R>

Spade Quick Connect Crimp Cold-Pressed Terminals (for 12V Battery) - <https://amzn.to/2OgxqLm>

100W 18V Solar Panel with MC4 Connectors - <https://amzn.to/2rjjmYi> (VOC 21.6V Max Power 17.4V)

Optional

Solar Panel Crimping tools for MC4 (optional) - <https://amzn.to/2U6IN9J>

Tools

Soldering Iron

Straight blade Small Screwdriver

Crosspoint Small Screwdriver

Super Glue

Silicon Caulking

Wire cutter

Wire stripper

Pliers

Drill

Drill Bits for:

1" holes

2/3" holes

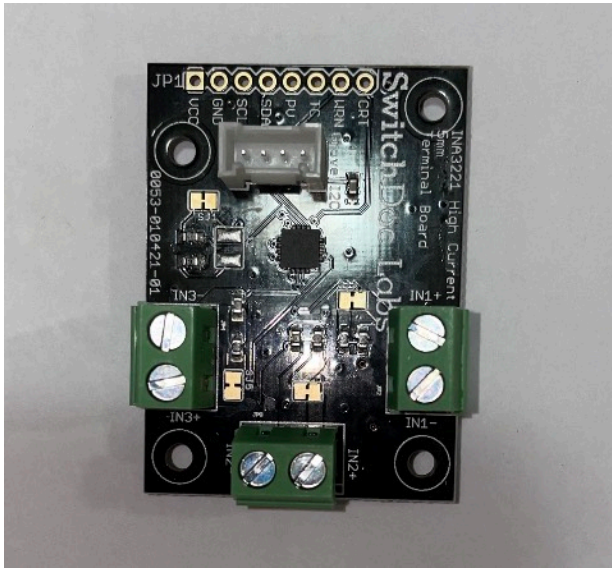
SolarMAX2 Part Identification

- **Part A - MC4 Minus Male (and Pin)**
- **Part B -MC4 Plus Female (and Pin)**
- **Part C -High Current INA3221 with Large Screw Terminals**
- **Part D -Solar Charger for 12V Lead Acid Batteries**
- **Part E - USB Weatherproof Plug**
- **Part F - USB Plug w/terminals**
- **Part G - 433MHz Transmitter and Antenna**
- **Part H - 16MHz Mini Pro Plus Computer**
- **Part I - HDC1080 Temp Hum**
- **Part J - Short USB Type A to USB micro Cable**

Cables

- **Part K -20cm Grove Cable**
- **Part L - 30cm (or 50cm) Grove Cable**
- **Part M - Grove Connector to Female Pin Header Cable**

Part C - High Current INA3221 with Large Screw Terminals



Part F - USB Plug with Terminals (Note + and - marking in plastic)!



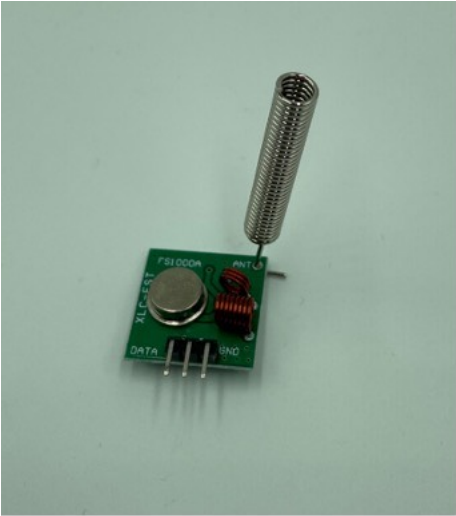
Part J - USB Type A to USB Micro Cable



Part A and Part B - MC4 Minus and Plus Plugs and Pins



Part G - 433MHz Transmitter and Antenna



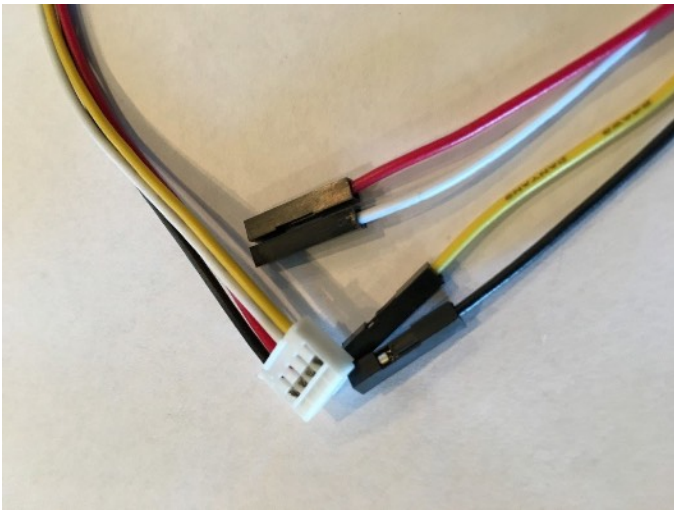
Part J - 20cm Grove Cable



Part K - 30cm (or 50cm) Grove Cable



Part L - Grove Connector to Female Pin Header Cable



Step by Step Assembly

Step 1) Drill two 2/3" holes in the upper left side of the lower part of the Bud Box. (See Part A and Part B location on pictures above)

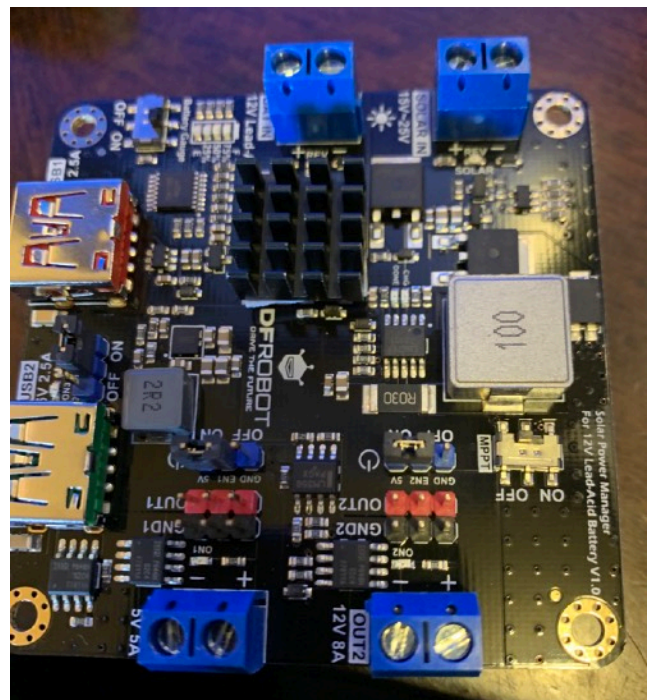
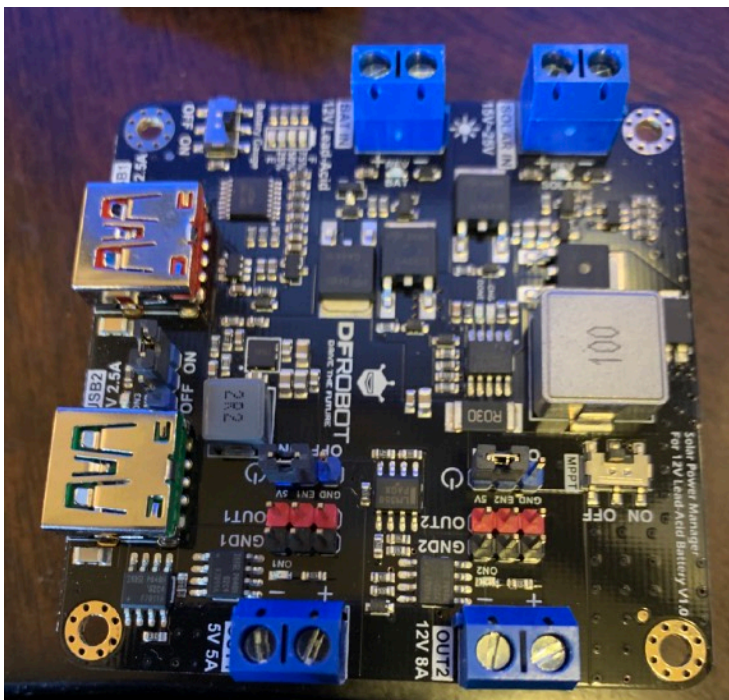
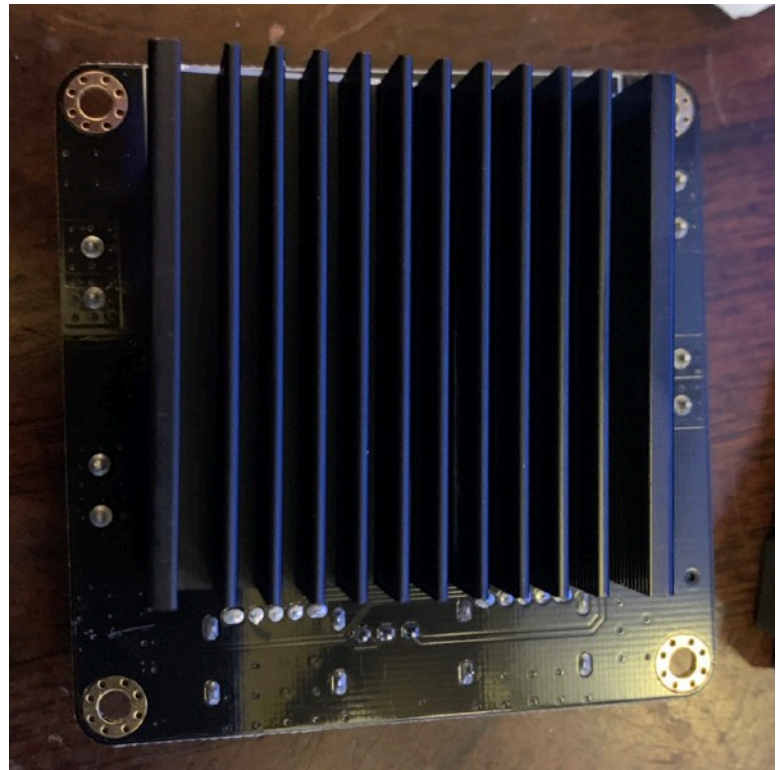
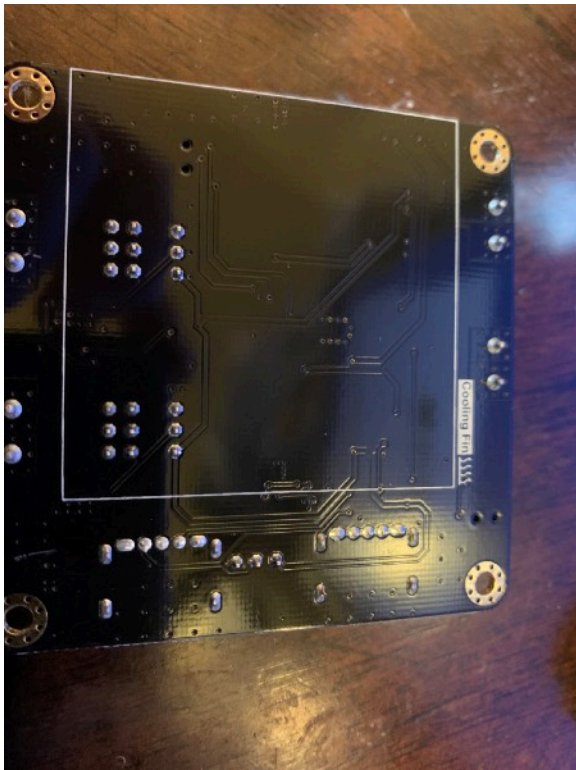


Step 2) Drill 3 1” holes in the front of the lower part of the box. Separate the holes by at least 2 inches, center to center. (Two vent holes and one hole for the Part F- USB Weatherproof Plug.

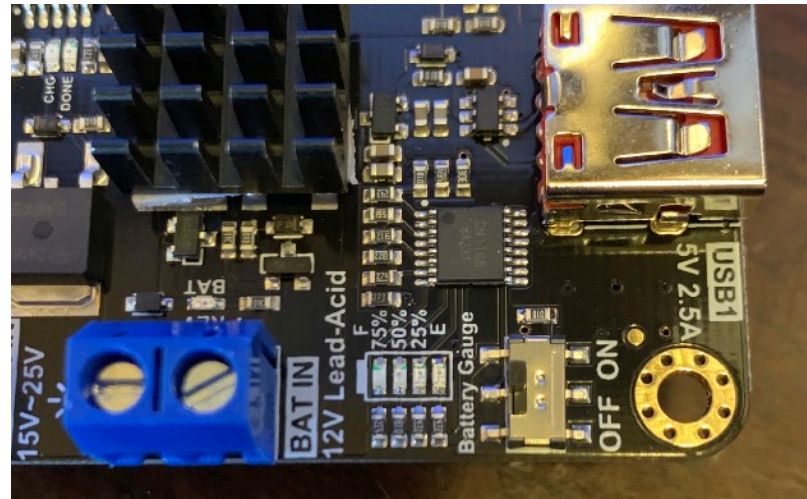
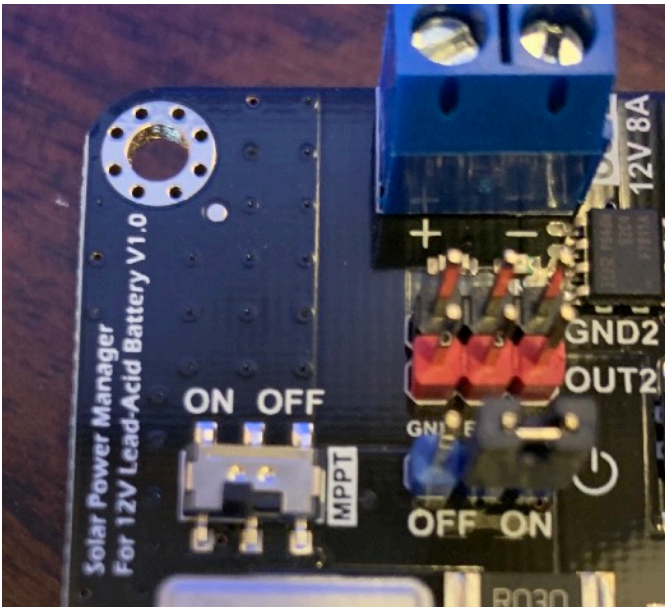


Step 3) Insert Part E - USB Weatherproof Plug into the BUD Box, with the cap on the outside in the rightmost 1” hole. Screw down. If you are using a large capacity Lead Acid Battery, put the cap in the leftmost 1” hole.

Step 4) Place the large heat sink on the back of Part D, the Solar Controller. Place the smaller heat sink on the top of Part D, the Solar Controller. If the heat sinks don't want to stay on, use a small amount of superglue under the heat sinks.



Step 5) Set the slide switch on the Solar Charger (Part D) to MPPT for the most efficient charging. Then set the Battery Gauge slide switch to Off also on the Solar Charger (Part D).



Step 6) Attach Nylon Headers (with screws or nuts) to all the boards. Note that the Solar Charger has screws and headers included in the package with the heatsink.

Step 7) Glue an additional nylon spacer on Part I (HDC1080 Temp/Humidity Sensor) and two on Part C (INA3221) the same height of the spacers from Step 5) to provide a stable base.

Step 8) Removed

Step 9) Removed

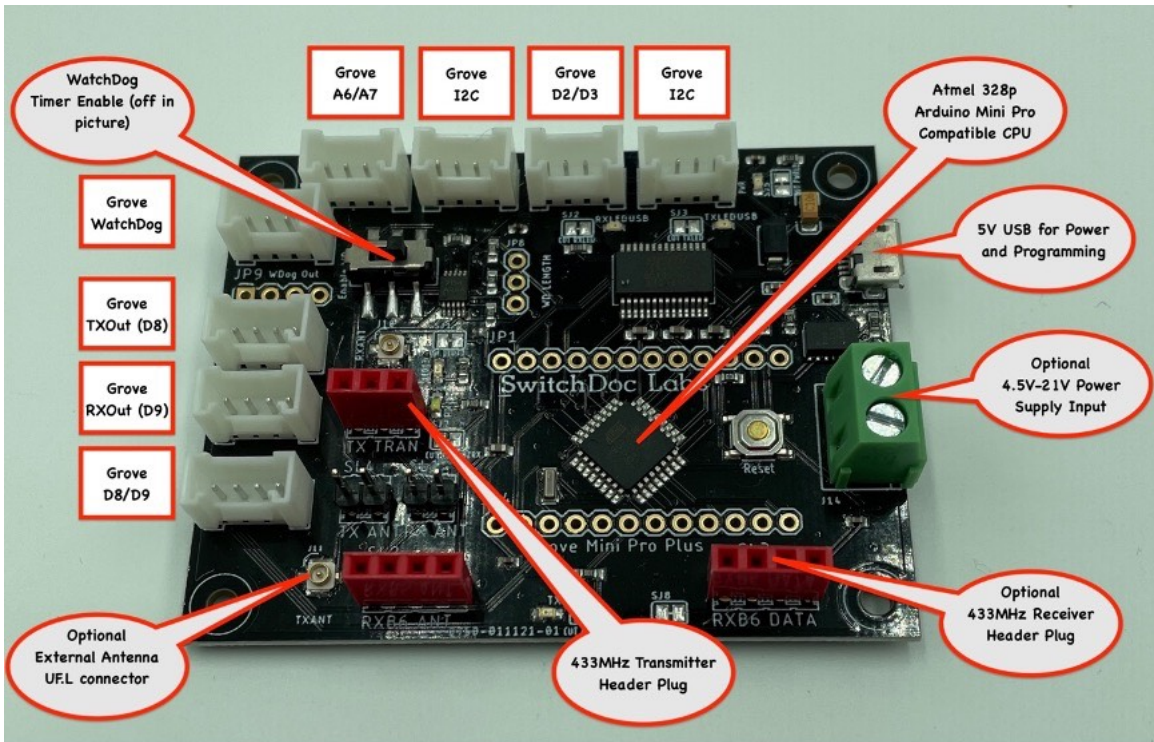
Step 10) Using the super glue, attach all the boards to the locations shown in the two two part identification pictures above. Let dry. The plug in the USB PowerCentral board (Part E) into the Solar Charger Board (Part D). Note you won't have the battery in the box yet. But it's OK if you do. Just don't short out the terminals on the battery!



Step 11) Label all parts - optional - but you will be happy you did.

Step 12) Using some Silicon Caulking, attach some door screen over the center and left 1" hole to keep the bugs out of the box.

Now we move on to the wiring of the SolarMAX2.



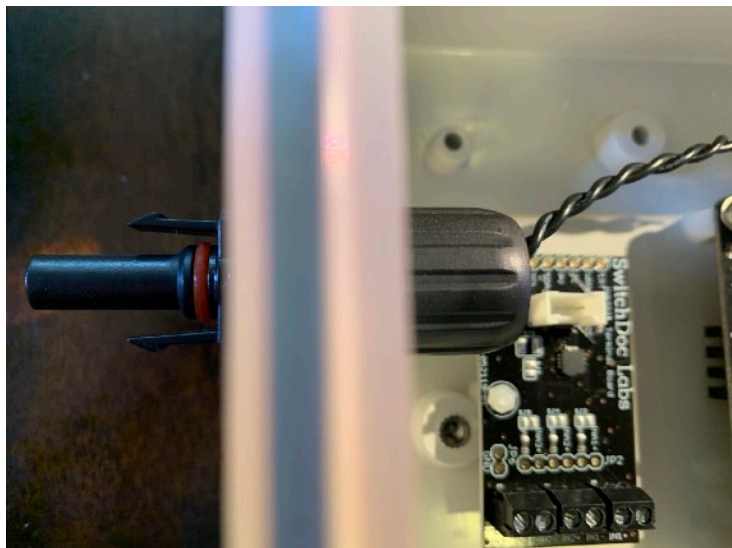
Wiring the SolarMAX2

As you wire this unit, remember you are dealing with lots of current and voltages. Triple check your wiring! Wiring things backwards or incorrectly can result in destruction of the electronics and possible over heating. BE CAREFUL!

Solar Panel Wiring

Step 1) Take the male Part A - MC4 Minus Male (and Pin) and two 33cm lengths of black wire. Strip the ends, twist them together (here's a fast way of doing that - <https://www.switchdoc.com/2015/07/handy-tip-building-braided-cables-for-projects/>). **NOTE: We have now determined that if you are using 22 AWG wire you do not need to to double the wires. One wire is sufficient for all the currents used inside the box.**

Now insert one end of the braided wire (with then ends stripped of the insulation) into the pin (the male pin has the larger hole in the end) and crimp it down. We recommend you buy the crimper tool for MC4 plugs as mentioned above. Slide the Male MC5 Plug into the Minus Hole in the box and put on the other parts and screw it down.





Step 2) Place the other end of the black wire into the “-“ terminal of the Solar Charger SOLAR IN terminal.



Step 4) Complete the rest of the wiring for SolarMAX2 according to the table below:

SolarMAX2 Wiring List					
Step #	Device From		Device To		Instructions
W1	12V Lead Acid Battery	+ terminal	Part C - INA3221	IN1+	DON'T CONNECT TO BATTERY. WAIT UNTIL END OF WIRING
W2	12V Lead Acid Battery	- terminal	Part D - Solar Controller Board	BATIN -	
W3	Part B - SolarPanel MC4 Plug Plus	+	Part C - INA3221	IN2+	
W4	Part A - SolarPanel MC4 Plug Minus	-	Part D - Solar Controller Board	SOLARIN -	
W5	USB Plug w/ Terminals	- Terminal	Part D Solar Controller Board	OUT1 -	
W6	USB Plug w/ Terminals	+ Terminal	INA3221	IN3-	
W7	Part C - INA3221	IN1-	Part D - Solar Controller Board	BATIN +	
W8	Part C - INA3221	IN2-	Part D - Solar Controller Board	SOLARIN +	
W9	INA3221	IN3+	Part D -Solar Controller Board	OUT1 +	

Now we move on the Grove Wiring table.

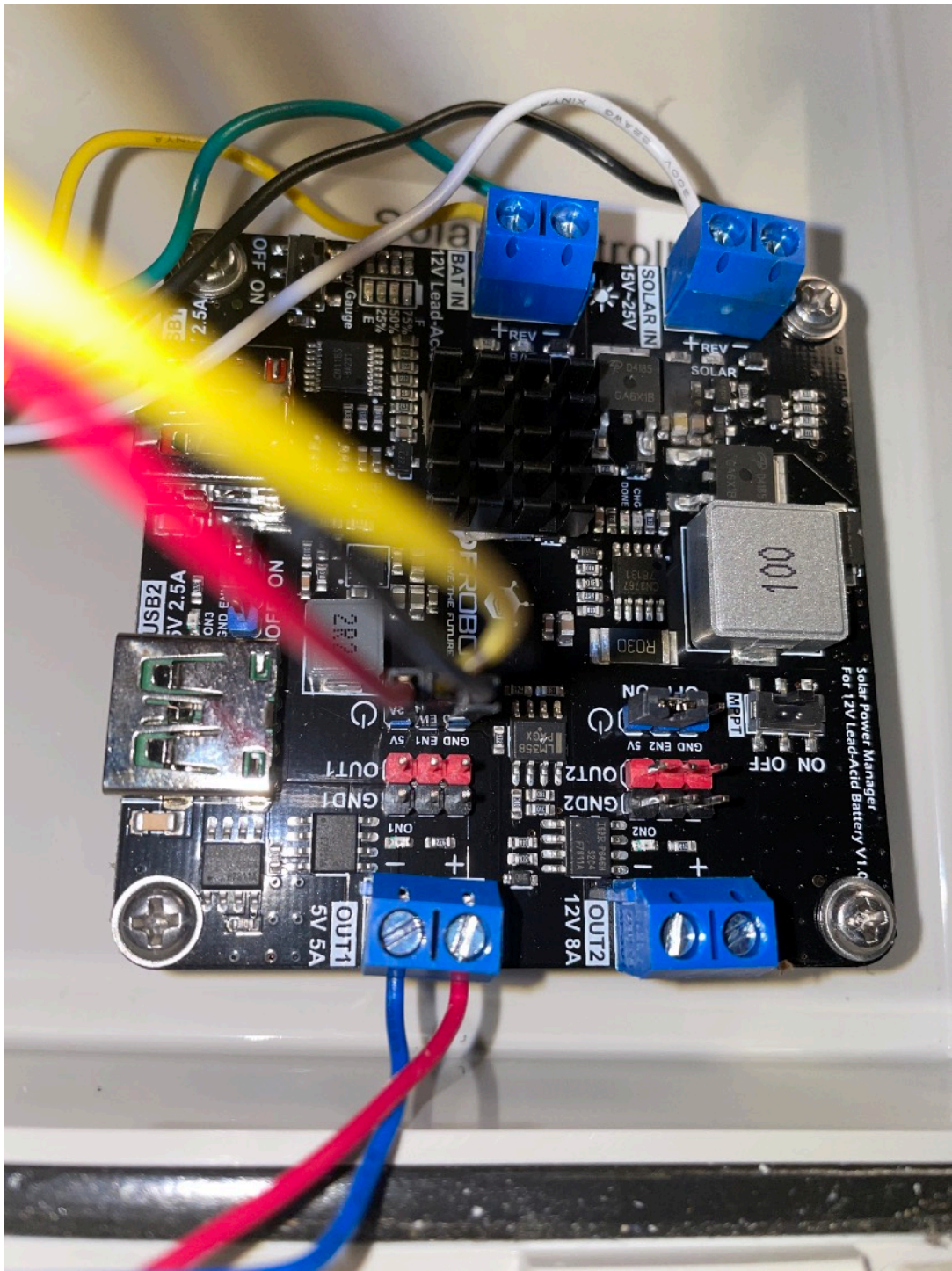
Grove Wiring Table

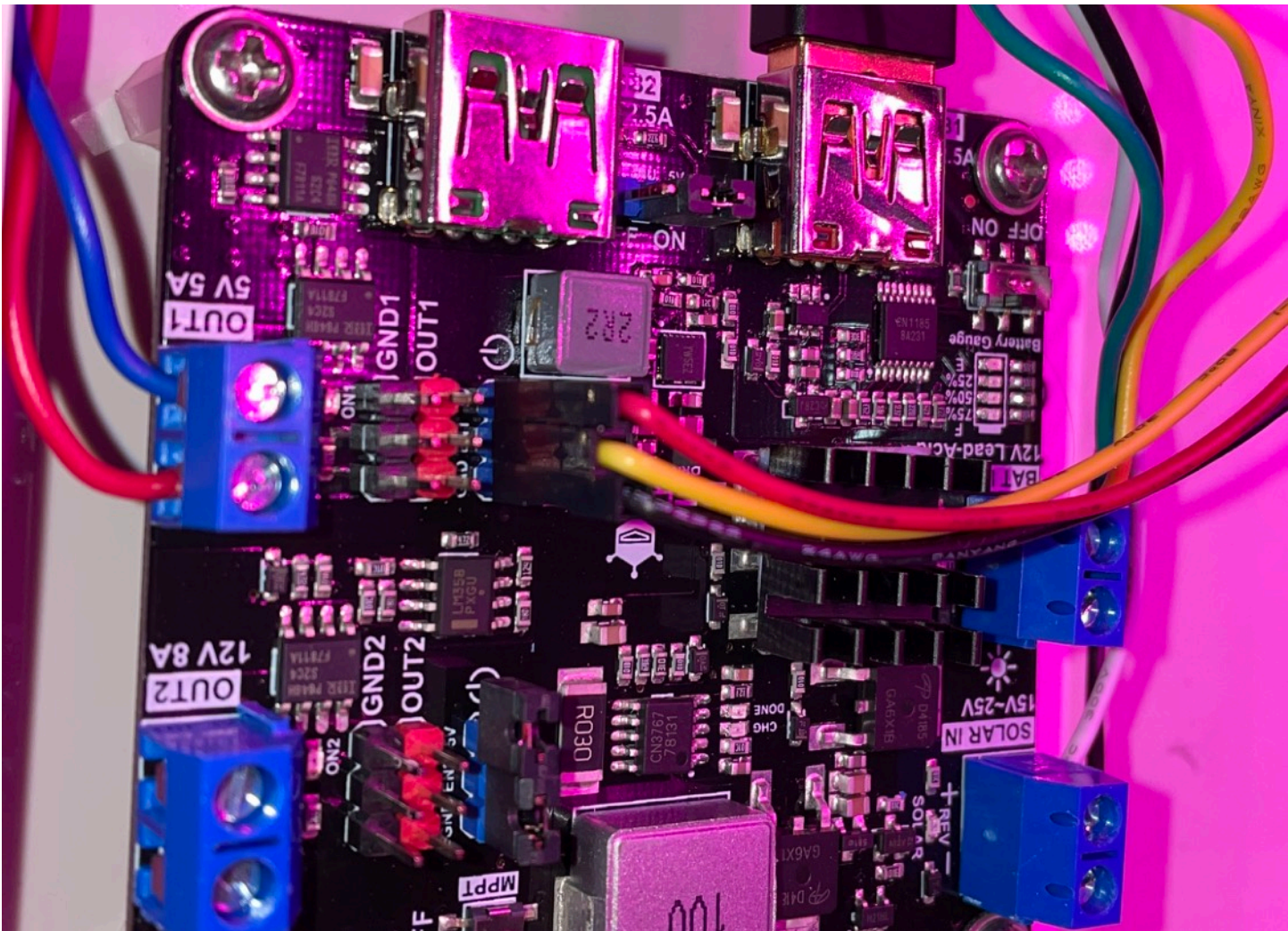
Note - again, make sure you are connecting things to the right places. It all matters. Optional: We find the plastic clips on the Grove cable plugs annoying and often cut them off with wire clippers.

Select the proper grove cables and connect them as shown in the table.

Table 1

Grove Wiring Table					
	From		To		
GW1	Part H - Mini Pro Plus	I2C	Part C - INA3221	I2C	
GW2	Part H - Mini Pro Plus	I2C	Part I - HDC1080 Temp/Humidity	I2C	
GW3	Part H - Mini Pro Plus	D3/D4 (White is no connect)	Part D - Solar Controller Board	OUT1 EN1 - Yellow, Red ON, Black OFF - No White connection (See picture below)	

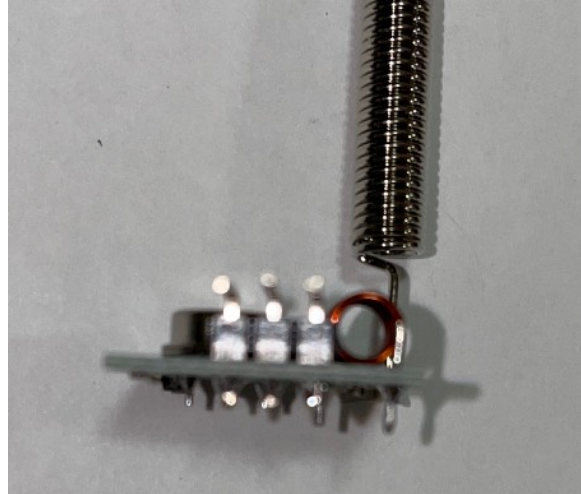
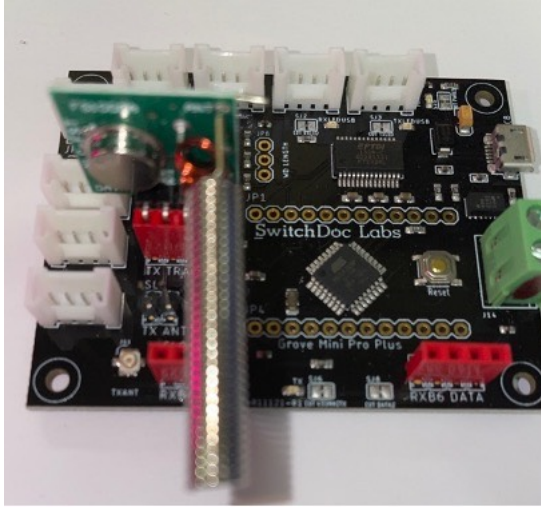




This completes the Grove Wiring for SolarMAX2.

433MHz Transmitter Installation

Step 1) Plug in the 433MHz Transmitter (Part G) into the MiniProPlus (Part H) three pin female header market TX Tran. Make sure it is oriented as shown in the picture. Make sure the pins are slightly bent out as in the second picture. This makes sure that the pins are connected in the header.



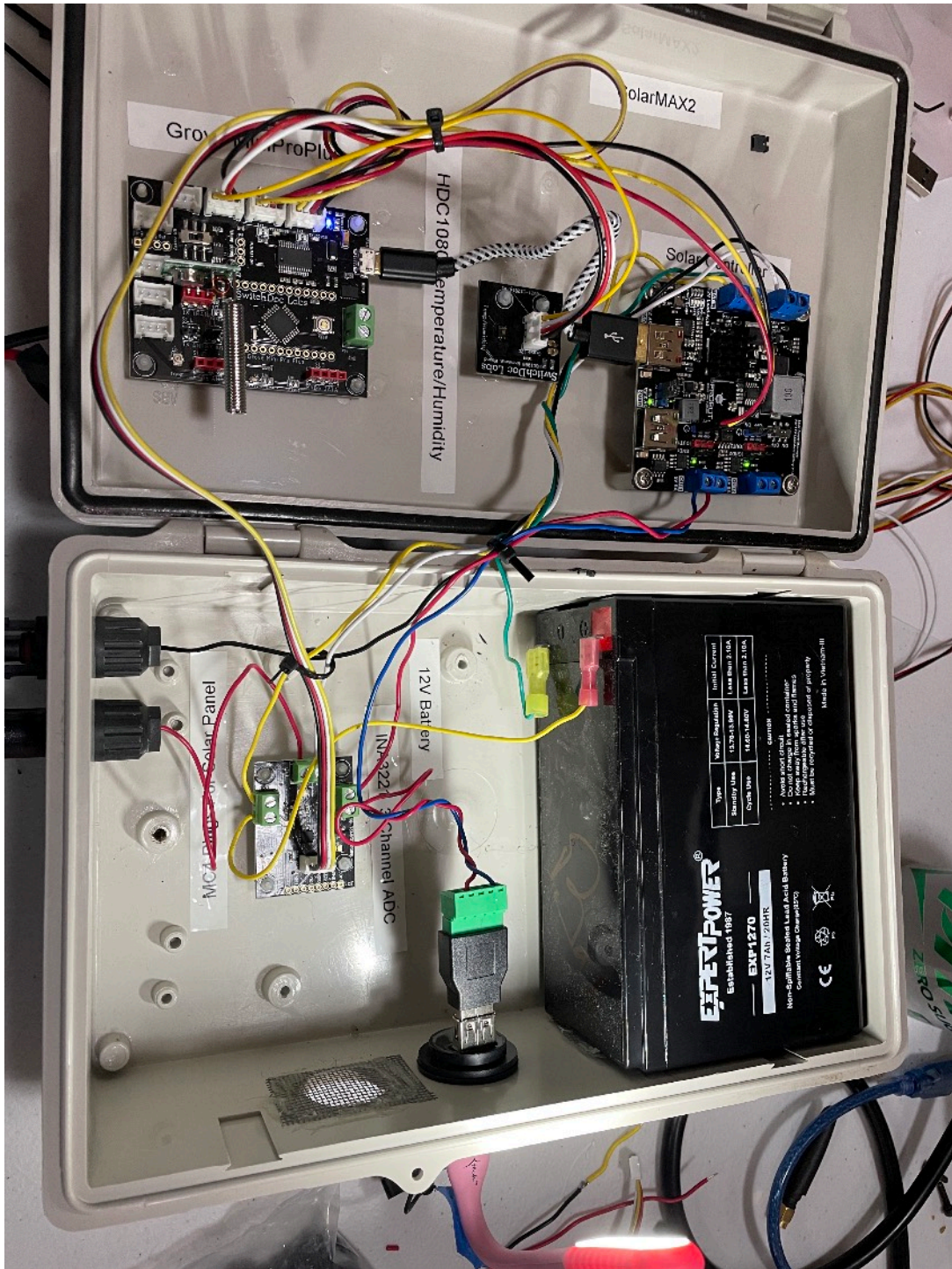
USB Cable Wiring

Step 1) Take your short Type A to Micro USB Cable (Part J) and plug one end into the Micro USB plug on Part H Mini Pro Plus Computer.

Step 2) Plug the USB Plug w/Terminals (Part F) into the USB WeatherProof Plug (Part E).

This finishes the USB Wiring. Now on to the Battery wiring.

Fully Wired SolarMAX2 for Reference



Lead Acid Battery Tab Wiring

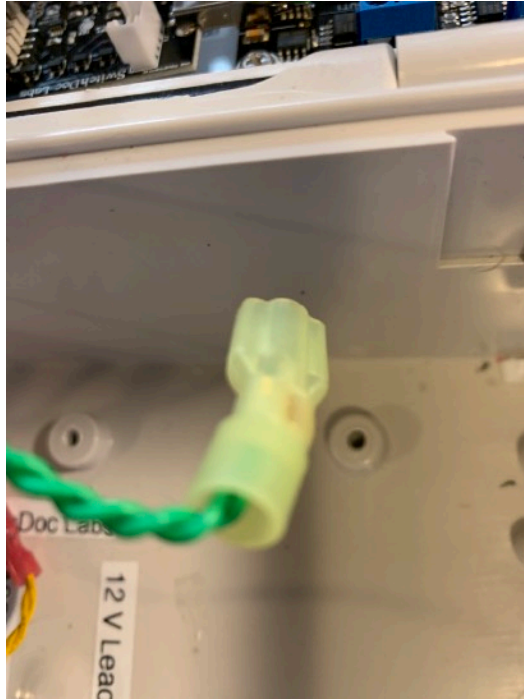
This is the last of our wiring for SolarMAX2.

Step 1) CHECK YOUR WIRING for BATIN on the Solar Controller Board (Part D). Specifically, steps W1, W2 and W7 in the wiring chart above! **CHECK IT AGAIN. If you get this wrong, you will destroy your controller.**

Step 2) Take the Red Cold Press Crimp spade connector and place the stripped wire from the INA1+ Screw down connector on the INA3221 ADC (Part C) into the spade connector and crimp the connector to hold them in place (and make connection with the spade).



Step 4) Take the Yellow Cold Press Crimp spade connector and place the wires from the 12V BATIN “-“ Screw Connector on the Solar Controller Board (Part D) into the spade connector and crimp the connector to hold the wires in place (and make connection with the spade).



Connect your 12 V Lead Acid Battery

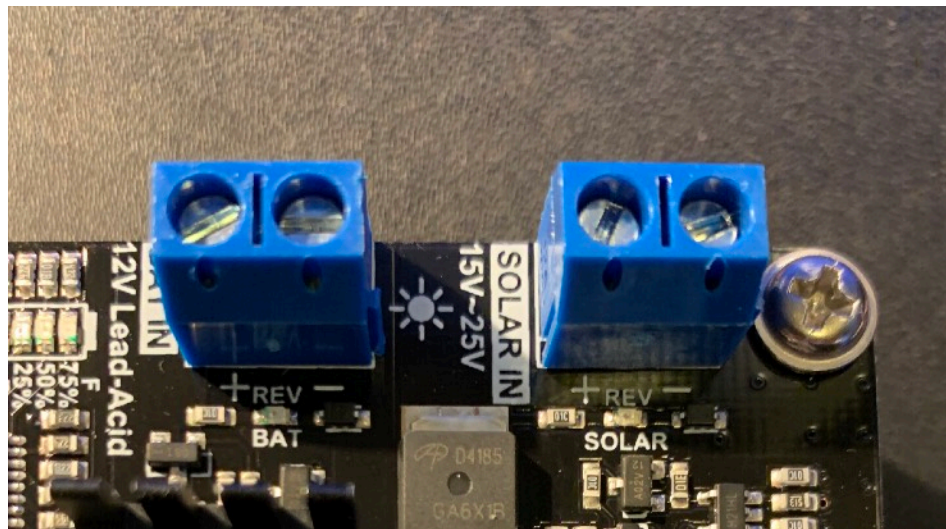
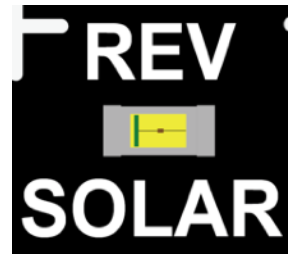
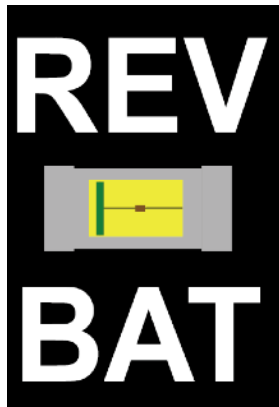
Step 1) If you have selected the recommended 12 V Lead Acid battery (<https://amzn.to/2qGCVd8>), then place it into the Bud Box as shown. Positive terminal up. Use Velcro to hold the heavy battery in place. It fits snugly into place.

Step 2) Slide the Yellow Spade connector (connected to the wire which is connected to the “-“ terminal on the Solar Controller (Part D) 12V BATIN “-“ screw down terminal) on the **Negative** Spade on the 12 V Battery **(CHECK YOUR WORK!!!!)**

Step 3) Slide the Red Spade connector (connected to the Yellow Wire which is connected to the IN1+ screw terminal on the IN3221A (Part C) board onto the **Positive** spade on the 12 V Battery (Make sure you do this right!).

NOTE: The Solar Charger Board (Part D) has protection for reversing the 12V battery and the solar panels. If you reverse them, the appropriate LED will light up and there will be no damage. But, nothing will work either. :)

Reverse connection LED indicator: when the battery is reverse connected at the BAT IN or SOLAR IN, the corresponding orange LED **REV BAT** or **REV SOLAR** turns ON, informing the user a reverse connection error.



If you have hooked up everything correctly you will see a number of LED lights on the Mini Pro Plus (Part H), and on the Solar Controller (Part D).

Clean up your wiring by using some wire ties to make it neat!

Testing Your SolarMAX2 System

If you are using a SkyWeather2 system, SkyWeather comes with support for SolarMAX2. If you don't have a SkyWeather system, jump down to "Testing your SolarMAX2 with a Raspberry Pi". If you see the yellow light on the Mini Pro LP board (Part D) flicker about every 30 seconds then you are transmitting data.

If you don't have a SkyWeather2 system (SkyWeather2 comes with a Software Defined Radio - SDR - for the Raspberry Pi), download and install the WeatherSense Software from:

https://github.com/switchdoclabs/SDL_Pi_WeatherSense

You will need a compatible Software Defined Radio for your Raspberry Pi to pick up the SolarMAX2 433MHz signals. You can buy one here:

<https://shop.switchdoc.com/products/software-defined-radio-sdr-and-antenna>

Testing With SkyWeather

Next, login into your Raspberry Pi and "cd SDL_Pi_SkyWeather2"

Note: You can't be running SkyWeather2 in the background when you are running this test. You must kill the process by doing something similar to this (your process number will be different):

```
pi@switchdoclabs:~/SDL_Pi_SkyWeather2 $ ps xaf | grep python
 236 ?          Ss      24:52 /usr/bin/python -O /usr/share/wicd/daemon/wicd-daemon.py --no-daemon --
keep-connection
 502 ?          S       13:29 \_ /usr/bin/python -O /usr/share/wicd/daemon/monitor.py
22940 pts/0    S+      0:00 |          \_ grep --color=auto python
22889 pts/1    S+      0:00          \_ sudo python SkyWeather2.py
22894 pts/1    Sl+    0:18          \_ python SkyWeather2.py
pi@switchdoclabs:~/SDL_Pi_SkyWeather2 $
```

Then you have to kill the process:

```
sudo kill -9 22894
```

Then you can check to see the process has been killed.

```
pi@switchdoclabs:~/SDL_Pi_SkyWeather2 $ ps xaf | grep python
236 ?      Ss      24:53  /usr/bin/python -O /usr/share/wicd/daemon/wicd-daemon.py --no-daemon --
keep-connection
502 ?      S       13:30  \_ /usr/bin/python -O /usr/share/wicd/daemon/monitor.py
23014 pts/0  S+      0:00   |          \_ grep --color=auto python
pi@switchdoclabs:~/SDL_Pi_SkyWeather2 $
```

Now type the following command on your command line:

```
sudo python3 testWirelessSensors.py
```

Then you will see something like this:

```
pi@SwitchDocLabs:~/SDL_Pi_SkyWeather2 $ sudo python3 testWirelessSensors.py
Starting Wireless Read
rtl_433 version -128-NOTFOUND branch master at 202104131855 inputs file rtl_tcp RTL-SDR

.
.
.

Registered 6 out of 152 device decoding protocols [ 146-148 150-152 ]

Found Fitipower FC0012 tuner

Exact sample rate is: 250000.000414 Hz

Sample rate set to 250000 S/s.

Tuner gain set to Auto.

Tuned to 433.920MHz.

Allocating 15 zero-copy buffers

{"time" : "2021-09-18 14:29:08", "model" : "SwitchDoc Labs SolarMAX", "len" : 44, "messageid" :
448956, "deviceid" : 1, "protocolversion" : 1, "softwareversion" : 14, "weathersenseprotocol" : 10,
"loadvoltage" : 5.160, "internaltemperature" : 12.348, "internalhumidity" : 87.061,
"batteryvoltage" : 12.728, "batterycurrent" : -352.000, "loadcurrent" : 621.000,
"solarpanelvoltage" : 17.752, "solarpanelcurrent" : 566.000, "auxa" : 4, "mic" : "CRC"}
```

The last packet shows you are connected to SolarMAX2!

Testing with a Raspberry Pi (without SkyWeather2r)

To test on a Raspberry Pi (without SkyWeather2) you need to hook up the SDR to the USB port on the Raspberry Pi.

Step 1) Download the SolarMAX2 compatible WeatherSense Python3 library:

```
git clone https://github.com/switchdoclabs/SDL\_Pi\_WeatherSense
```

Page 30

Version 1.1 September 2021

Step 2) run the program WeatherSenseMonitor.py

```
pi@SwitchDocLabs:~/SDL_Pi_WeatherSense $ sudo python3 WeatherSenseMonitor.py
```

```
-----  
WeatherSense Monitoring Software  
Software Version V012  
-----
```

Pending jobs:

```
readSensors (trigger: date[2021-09-18 14:33:13 PDT], pending)  
startMQTT (trigger: date[2021-09-18 14:33:13 PDT], pending)  
cleanPictures (trigger: cron[day='*', hour='3', minute='4'], pending)  
cleanTimeLapses (trigger: cron[day='*', hour='3', minute='10'], pending)  
buildTimeLapse (trigger: cron[day='*', hour='5', minute='30'], pending)  
readSensors (trigger: date[2021-09-18 14:33:13 PDT], pending)  
-----
```

Scheduled Jobs

```
#####
```

```
Read Wireless Sensors
```

```
#####
```

```
creating new MQTT instance
```

```
Jobstore default:
```

```
#####
```

```
Read Wireless Sensors
```

```
cleanPictures (trigger: cron[day='*', hour='3', minute='4'], next run at: 2021-09-19 03:04:00  
PDT)
```

```
cleanTimeLapses (trigger: cron[day='*', hour='3', minute='10'], next run at: 2021-09-19  
03:10:00 PDT)
```

```
#####
```

```
buildTimeLapse (trigger: cron[day='*', hour='5', minute='30'], next run at: 2021-09-19 05:30:00  
PDT)
```

```
connecting to broker
```

```
-----  
starting 433MHz scanning
```

```
#####
```

```
starting 433MHz scanning
```

```
#####
```

```
Connected with result code 0
```

```
processing SolarMAX Data
```

```
This is the raw data: {"time" : "2021-09-18 14:33:19", "model" : "SwitchDoc Labs SolarMAX", "len" :  
44, "messageid" : 448970, "deviceid" : 1, "protocolversion" : 1, "softwareversion" : 14,  
"weathersenseprotocol" : 10, "loadvoltage" : 5.168, "internaltemperature" : 12.378,  
"internalhumidity" : 87.164, "batteryvoltage" : 12.752, "batterycurrent" : -454.000,  
"loadcurrent" : 486.000, "solarpanelvoltage" : 17.752, "solarpanelcurrent" : 592.000, "auxa" : 4,  
"mic" : "CRC"}
```

It's working!

What is in the SolarMAX2 Data Packet?

```
{"time" : "2021-09-18 14:33:19", "model" : "SwitchDoc Labs SolarMAX", "len" : 44, "messageid" :  
448970, "deviceid" : 1, "protocolversion" : 1, "softwareversion" : 14, "weathersenseprotocol" : 10,  
"loadvoltage" : 5.168, "internaltemperature" : 12.378, "internalhumidity" : 87.164,
```

Page 31

Version 1.1 September 2021

```
"batteryvoltage" : 12.752, "batterycurrent" : -454.000, "loadcurrent" : 486.000,  
"solarpanelvoltage" : 17.752, "solarpanelcurrent" : 592.000, "auxa" : 4, "mic" : "CRC"}
```

Here are the definitions of each one of the values in the packets:

- timestamp: When the packet has been received
- model: SwitchDoc Labs SolarMAX
- len: Number of bytes in the packet
- messageid: Reset to 0 on bootup
- deviceid: 1 – If you have more than one SolarMAX2, you can change this ID by recompiling the software for the MiniProPlus
- protocolversion: Current protocol of the SolarMAX2
- softwareversion: This shows the current version of the software on the Mini Pro Plus
- weathersenseprotocol: 10 for SolarMAX2

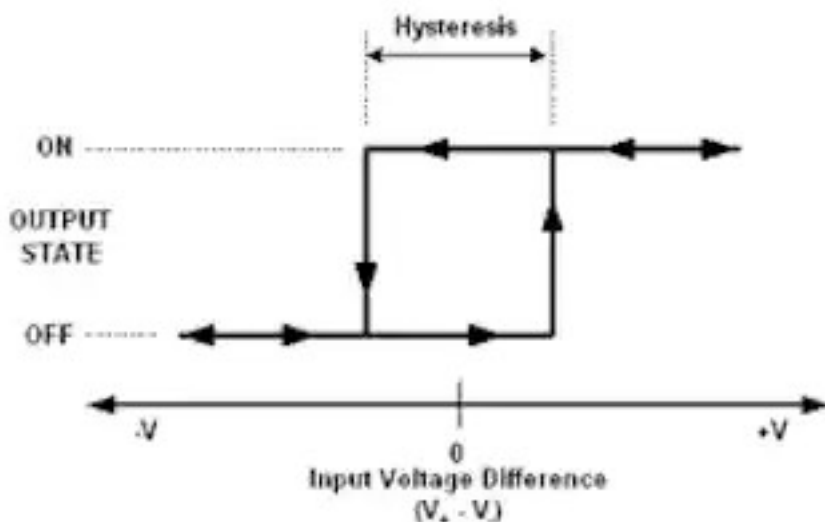
The solar data collected by the device is:

- loadvoltage: Voltage supplied to the Raspberry Pi or other Computer (V)
- batteryvoltage: Voltage of the LiPo Battery (V)
- batterycurrent: Current being supplied by the battery (mA)
- loadcurrent: Current being supplied to the Raspberry Pi or other Computer (mA)
- solarpanelvoltage: Voltage of the Solar Panel (V)
- solarpanelcurrent: Current being supplied by the Solar Panel (mA)

The AuxA variable contains state information about what is going on with the SolarMAX2 Controller. See the values in the next section.

Power Management and Pi Protection in SolarMAX2

A standard solar power controller will not correctly protect your Pi and the SD Card. One has to avoid brown out conditions and the power turn on and off rapidly. This kills SD Cards.



There are three major components to the SolarMAX2 software power management system (these numbers are current as of Version 015 of the SolarMAX2 MiniProPlus Computer software:

- **Hysteresis** - [Hysteresis](#) is the first line of defense for your Pi and your SD Card. Basically, SolarMAX2 will turn the on the USB Power (to the Pi) at a higher voltage than it will turn on. The criteria for turning on (subject to the timers below) is: battery voltage 11.8V and 100mA of solar current. The criteria for turning off is: battery 10.86V or Pi Load Voltage of less than 4.76V.
- **First Time On Timer** - Delays a turn on of the USB Power (to the Pi) when SolarMAX2 has determined that it is time to turn on the USB Power. Doesn't occur on power on to the SolarMAX2 computer, but only after the Hysteresis function has determined that it is time to turn on the USB Power
- **Ten Minute Timer** - Used to prevent a quick turn off and turn on on a well discharged battery. If SolarMAX2 turns the USB Power off (to the Pi) then this timer prevents it from turning on again for 10 minutes.

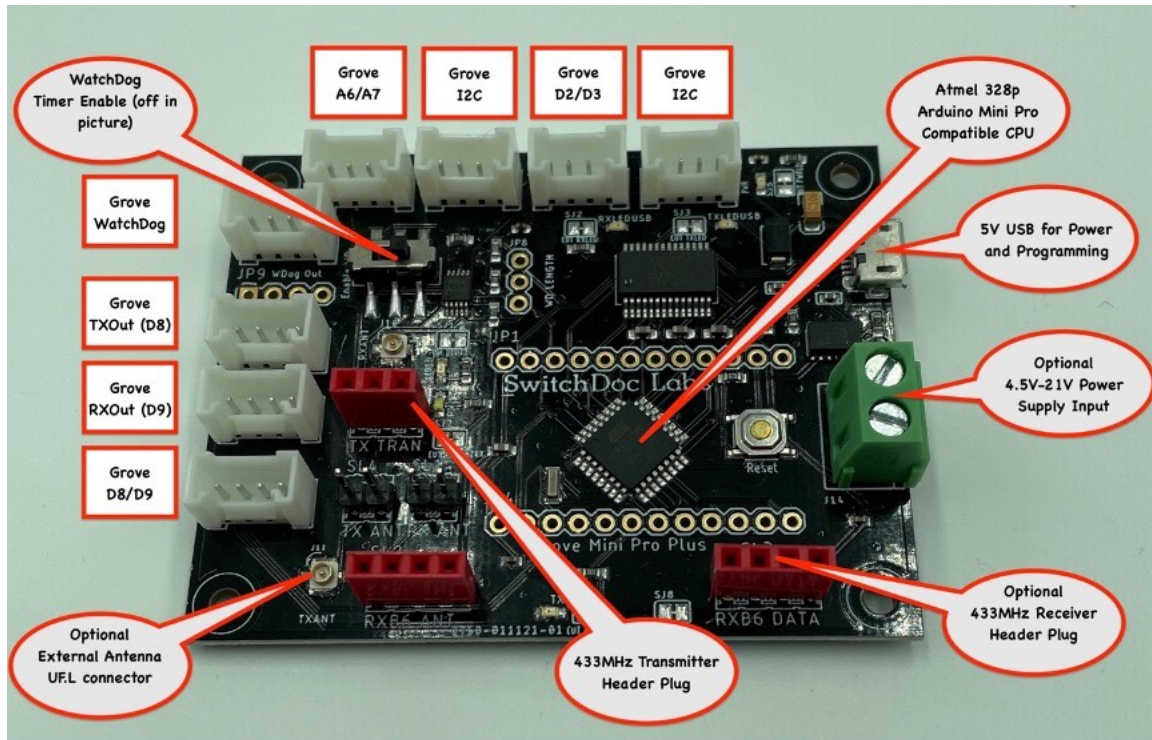
The AuxA variable (which is on the Solar Voltages Graph) has the following meaning:

```
// AuxA has state information
// coded in the long integer
// 00000000 00000000 00000000 000X ABCD
// X - reserved (0)

// A = reserved (0)
// B = 5V Load Power state
// C = 1 - Ten Minute Power Off / On Timer
// D = 1 - First Time On Timer On, 0 First Time Timer Off
```

WatchDog Timer Enable

The last thing to do before installing your SolarMAX2 system is to make sure the WatchDog Timer has been enabled on the MiniProPlus Board (Part H). Locate the Watchdog Timer Enable (upper left in the picture below) switch and turn it towards the left of the MiniProPlus board. Now it is enabled. If your SolarMAX2 MiniProPlus hangs, then it will be rebooted by the WatchDog Timer after 60 seconds. Makes your system much more reliable!



Here's an article about watchdog timers:

<https://www.switchdoc.com/2017/08/reliable-projects-1-watchdog-timers-raspberry-pi-arduinos/>

Installing Your SolarMAX2 System

Plug your solar panel into the appropriate MC4 plugs on the outside of your box and your SolarMAX2 system is complete.

Take a TypeA USB to TypeA USB Cable and plug in your computer system. SolarMAX2 provides 5V through the USB cable. If you need a USB Micro, or USB C cable you will need to get the appropriate converters to go from USB Type A to your device.

SkyWeather comes with a Type A USB input so you just need a Male to Male Type A USB extender cord.

Enjoy getting all this data about your solar system!

The Science and Education Goals Behind SolarMAX2

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 SolarMAX2 are:

- Building a solar panel controller and charger system
- Using an Arduino and 433MHz radio to gather and transmit data to a Raspberry Pi or Arduino
- Connecting up a radio to the Raspberry Pi
- Understand how your Solar Panel system is behaving by looking at the4 data.
- Understand your solar environment and what affects it
- Learn about the new technology called the Internet of Things

Support

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

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.