

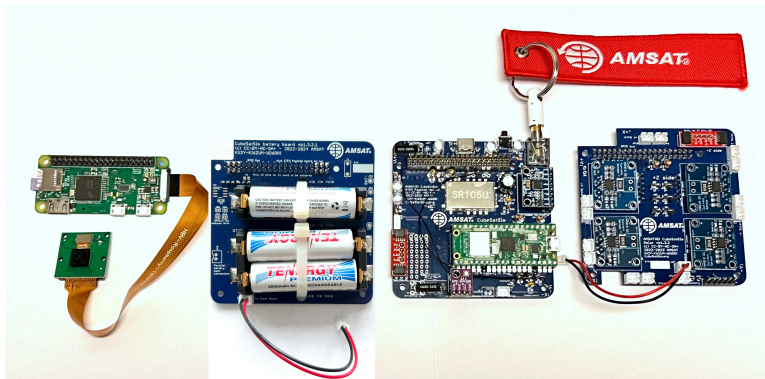
V2 Flat Sat Testing

[Edit](#) [New page](#)

Alan Johnston edited this page last week · 50 revisions

Step 8: Flat Sat Testing

Once the three boards are complete and tested, you are ready to do Flat Sat testing. The three boards plus the Pi Zero are shown here:



You will need:

- STEM Payload Board with Sensors and antenna fully assembled and tested
- Pi Zero with Pi Camera plugged in fully tested
- Solar Board fully assembled and tested
- Battery Board fully assembled and tested
- Two stacking GPIO headers
- Remove Before Flight plug with RBF tag
- micro USB cable to your computer running Arduino IDE software
- USB-C charger
- A solar panel with connector soldered on
- LED lamp

▼ Pages 131

Find a page...

- ▶ [Home](#)
- ▶ [1. Main Board 1](#)
- ▶ [2. Software Install](#)
- ▶ [3. Ground Station](#)
- ▶ [4. Main Board 2](#)
- ▶ [5. Battery Board](#)
- ▶ [6. Solar Panel and Frame](#)
- ▶ [7. Main Board 3](#)
- ▶ [8. STEM Payload Board](#)
- ▶ [9. Board Stack](#)
- ▶ [9. Index](#)
- ▶ [Creating the CubeSatSim Raspber...](#)
- ▶ [CubeSatSim Lite](#)
- ▶ [CubeSatSim Loaner User Guide](#)
- ▶ [CubeSatSim Mini](#)

Show 116 more pages...

- Ground Station with FoxTelem and SSTV software

+ Add a custom sidebar

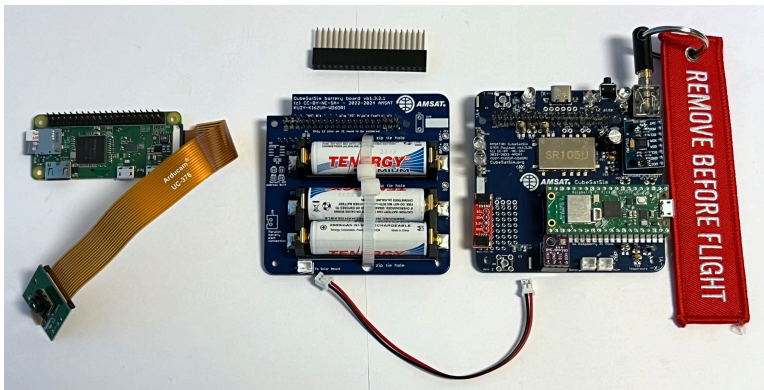
Testing Battery and STEM Payload Boards

Clone this wiki locally

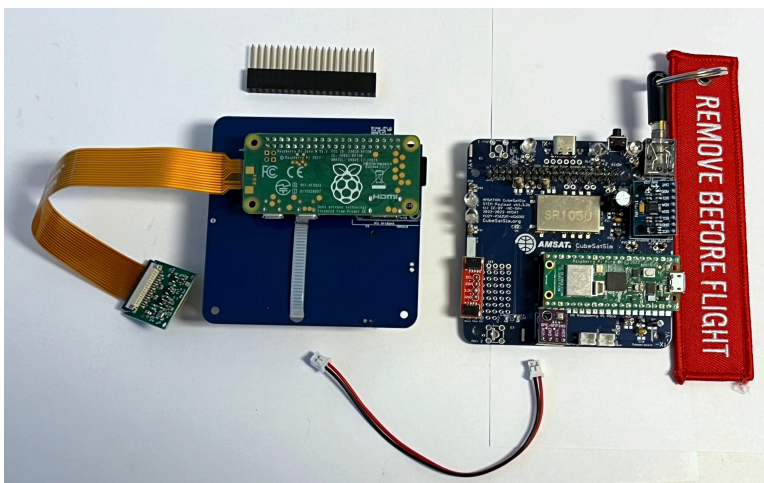
<https://github.com/alanbjohnston>



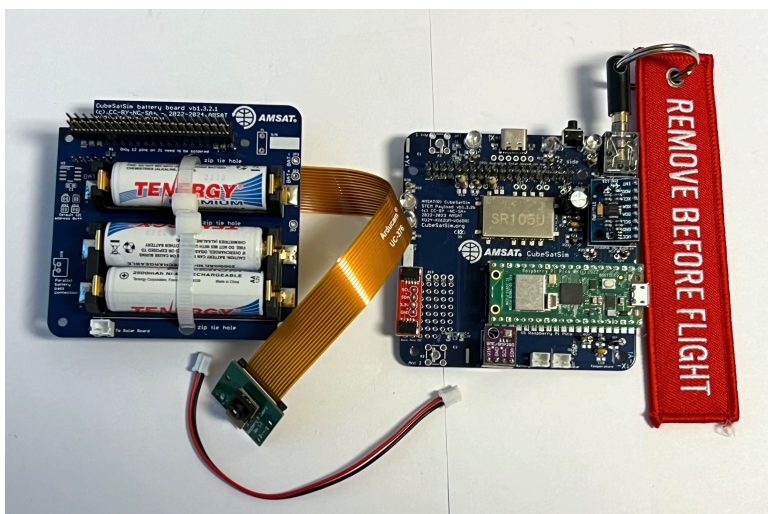
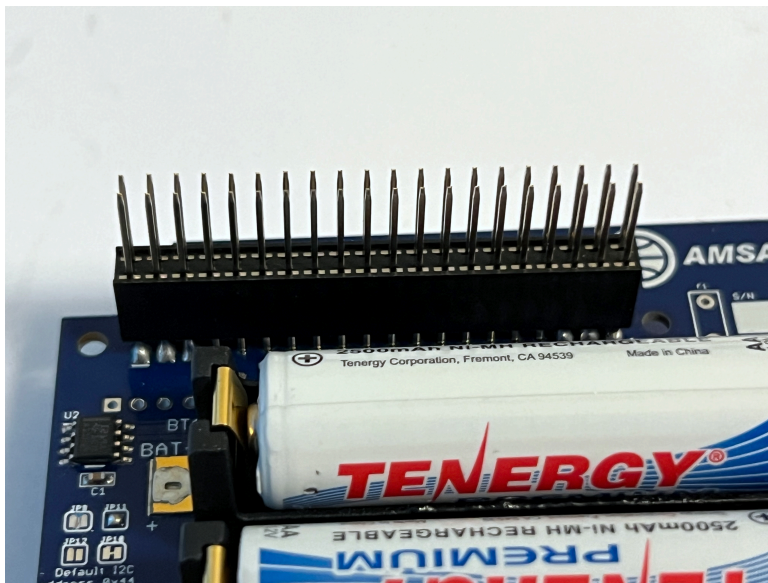
First, test the Battery and STEM Payload boards together. You will need the Pi Zero, Battery Board with JST jumper, and STEM Payload Board with RBF pin inserted, USB-C charging cable, and a GPIO stacking header



Flip the Battery board upside down and plug the Pi Zero into the bottom of the Battery board



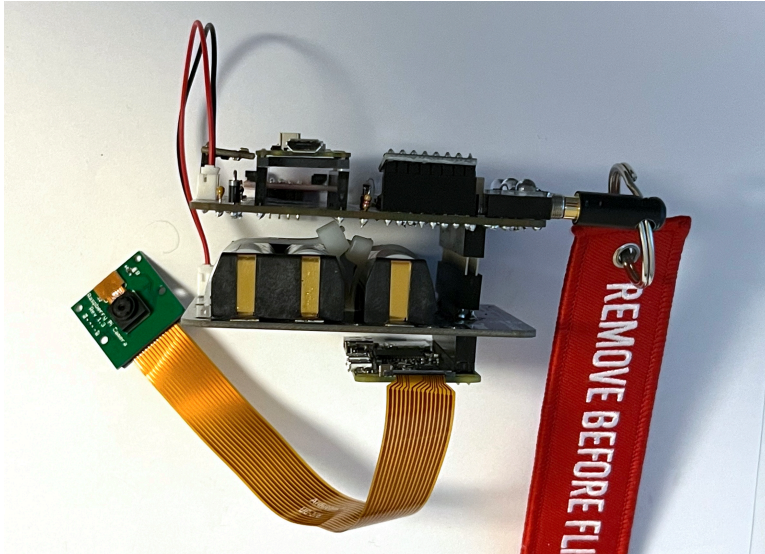
Flip the Battery board right side up. Plug a 20x2 pin GPIO stacking header on top of the Battery board



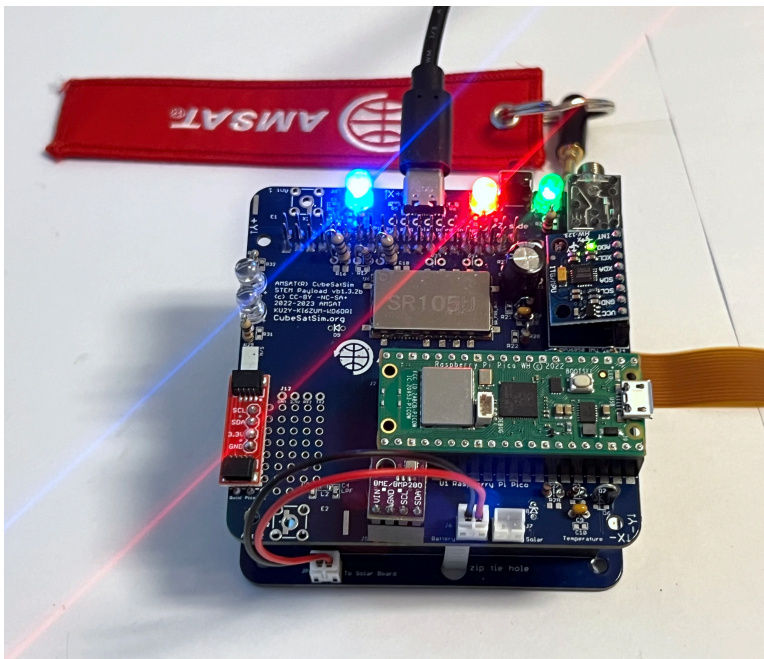
Plug the STEM Payload board on top of the Battery board. Make sure the RBF plug is inserted in the STEM Payload board. Plug a JST jumper cable between the Battery Board and the STEM Payload Board.



Here's the board stack looks from the side with the Pi Zero, Battery, Stacking header, the STEM Payload Board:



Plug the USB-C charger into the wall and into the USB-C connector on the Pico board. The red Charging LED will illuminate. Remove the RBF pin and Pi Zero should power up. The green Power LED should come on after 10 seconds. The blue Transmit LED should start to blink after about 30 seconds:



Log into the Pi Zero after 30 seconds.

Type a `CubeSatSim/config -v` and return and you should see the battery charging with a slightly larger negative current.

CubeSatSim v1.3.2 configuration tool



Real-time output from the INA219 voltage and current sensors:

CubeSatSim v1.3 INA219 Voltage and Current Telemetry

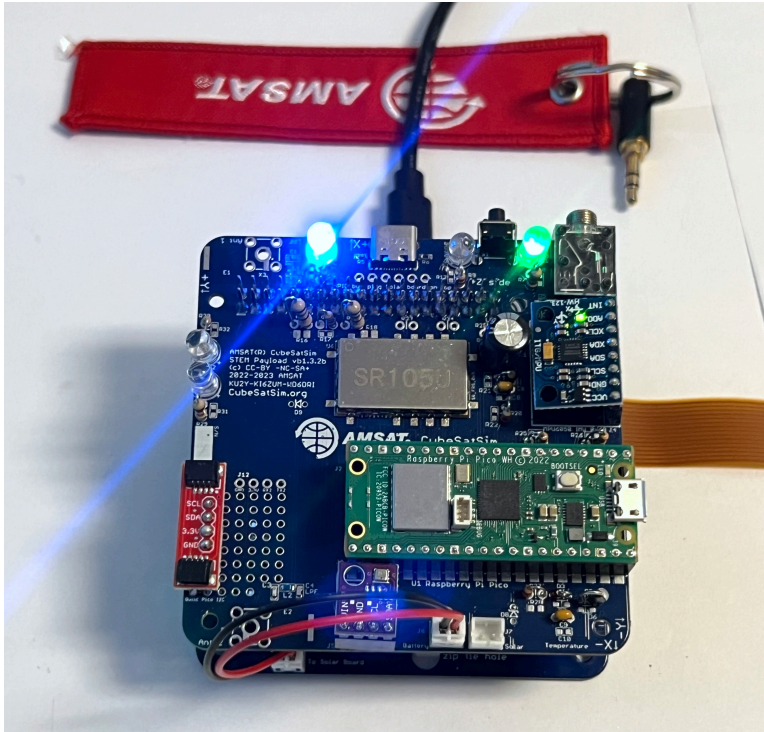
ERROR: 3 bus has a problem

Check I2C wiring and pullup resistors

+X		0.00 V	0 mA
+Y		0.00 V	0 mA
+Z		0.00 V	0 mA
-X		0.00 V	0 mA
-Y		0.00 V	0 mA
-Z		0.00 V	0 mA
Bat		4.47 V	-807 mA
Bus		0.00 V	0 mA

The "ERROR: 3 bus has a problem Check I2C wiring and pullup resistors" is an expected error since the Solar Board isn't plugged in yet. Your battery voltage and current will be different, but the battery voltage should be greater than 4 V and the battery current negative and in the hundreds of milliAmps.

Remove the USB-C cable and the Pi Zero should keep running but the red LED will go out.



The Battery should show a lower voltage and a positive current indicating that the CubeSatSim is running on battery. You should still be logged into the Pi. Type `CubeSatSim/config -v` again then return and look for this output showing the sensors.

CubeSatSim v1.3.2 configuration tool



Real-time output from the INA219 voltage and current sensors:

```
CubeSatSim v1.3 INA219 Voltage and  
Current Telemetry  
ERROR: 3 bus has a problem  
Check I2C wiring and pullup resistors
```

```
+X | 0.00 V 0 mA
```

+Y		0.00 V	0 mA
+Z		0.00 V	0 mA
-X		0.00 V	0 mA
-Y		0.00 V	0 mA
-Z		0.00 V	0 mA
Bat		3.88 V	285 mA
Bus		0.00 V	0 mA

If you get this, congrats: your CubeSatSim is now running on its own power!

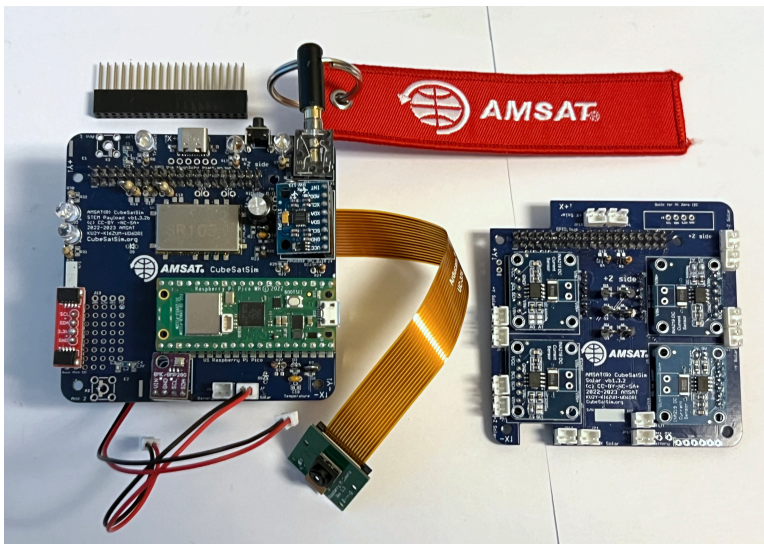
In the Pi Zero, type the command `sudo shutdown now` to shutdown the Pi Zero. After 30 seconds, plug in the RBF pin.

Testing STEM Payload, Solar, and Battery Boards

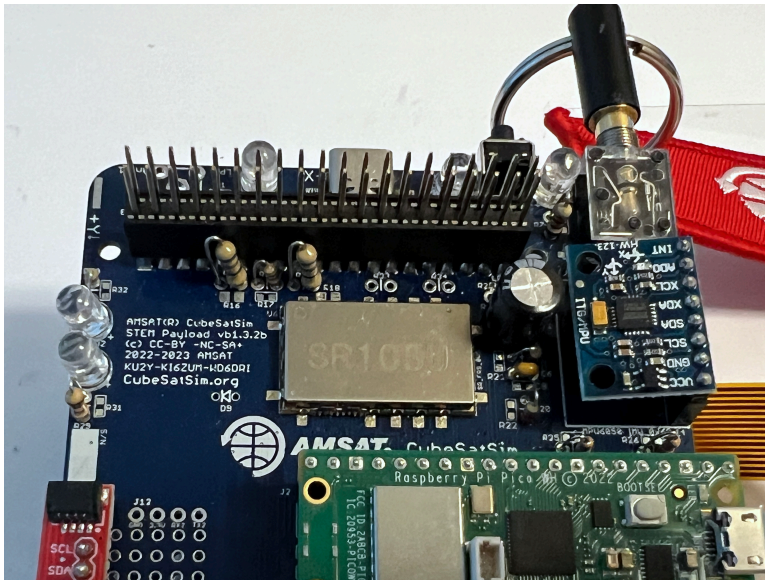
Next we will test the STEM Payload, Solar, and Battery Boards together.

Make sure the RBF is plugged in and the Pi Zero, Battery Board, and STEM Payload board are all plugged in from the previous test.

Unplug the JST jumper on the STEM Payload board from the Battery Board. Plug another JST jumper onto the STEM Payload board:



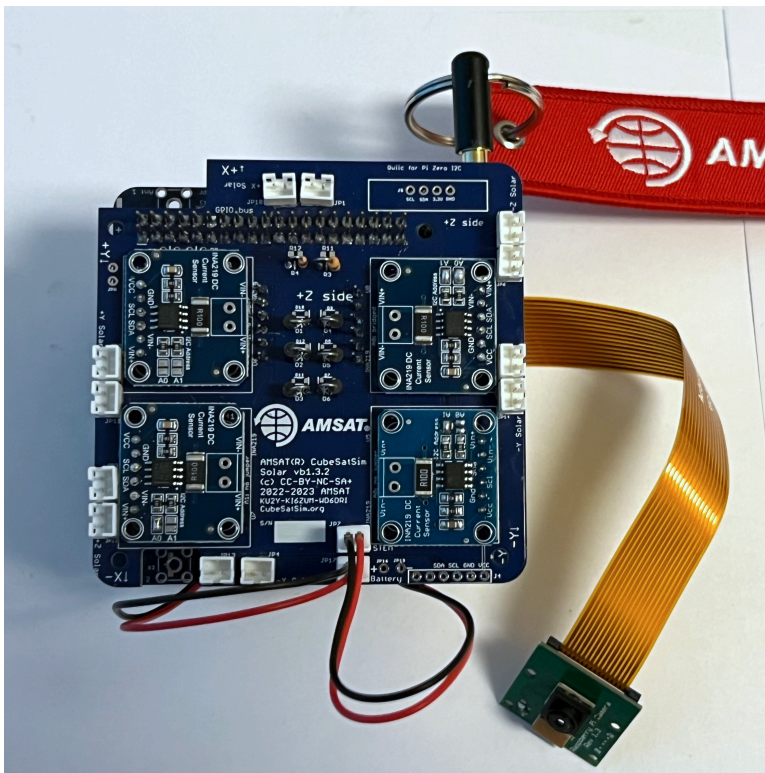
Plug a stacking GPIO header into the STEM Payload Board.



Plug the Solar Board on top of the STEM Payload Board.



Plug the other ends of both of the JST jumpers to the Solar Board (one is from the Battery Board, the other is from the STEM Payload Board)



Remove the RBF plug and after 30 seconds log back into the Pi

Type a `CubeSatSim/config -v` and return in the Pi Zero and you should see the correct battery voltage and the battery charging with a negative current.

CubeSatSim v1.3.2 configuration tool



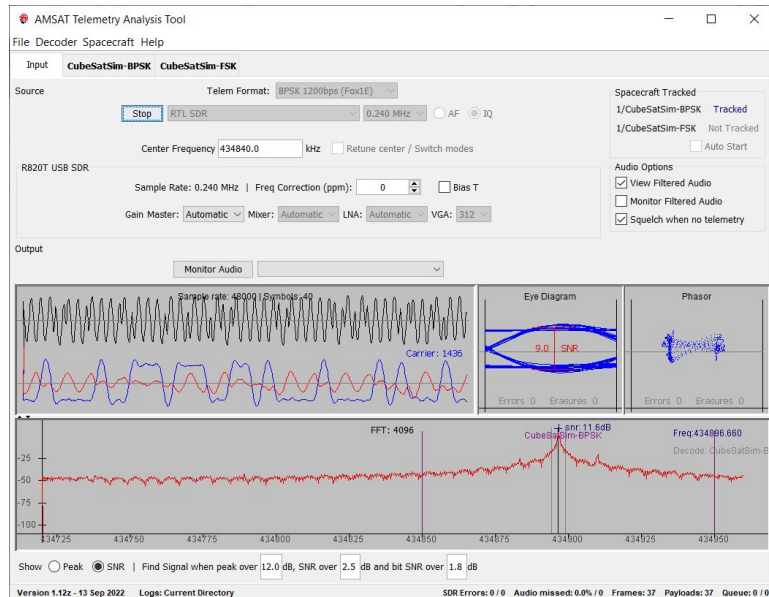
Real-time output from the INA219 voltage and current sensors:

CubeSatSim v1.3 INA219 Voltage and Current Telemetry

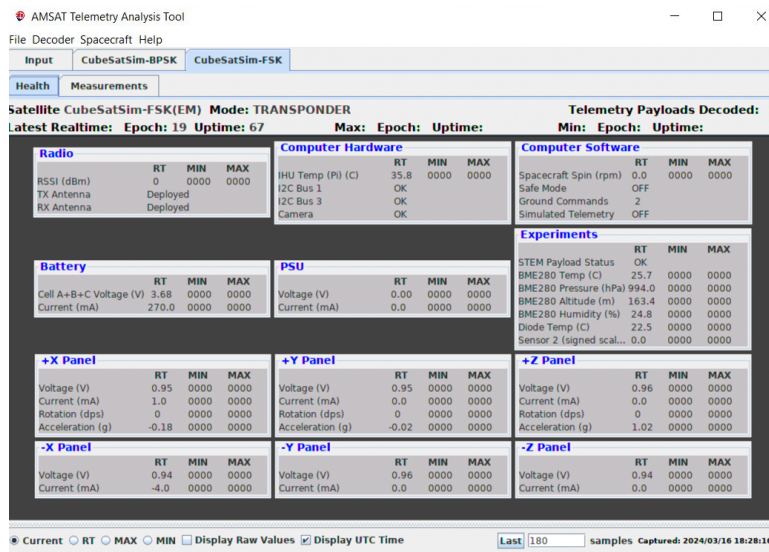
+X		0.95 V	0 mA
+Y		0.96 V	0 mA
+Z		0.97 V	0 mA
-X		0.95 V	0 mA
-Y		0.97 V	0 mA
-Z		0.94 V	0 mA
Bat		3.69 V	285 mA
Bus		0.00 V	0 mA

Verify you also see this in FoxTelem.

Open FoxTelem in your Ground Station and verify that you are receiving packets. I would recommend putting both the CubeSatSim and FoxTelem in BPSK mode 3 (three blinks).



Verify that the voltages and currents in the Health tab agree with the Serial Monitor voltages and currents.

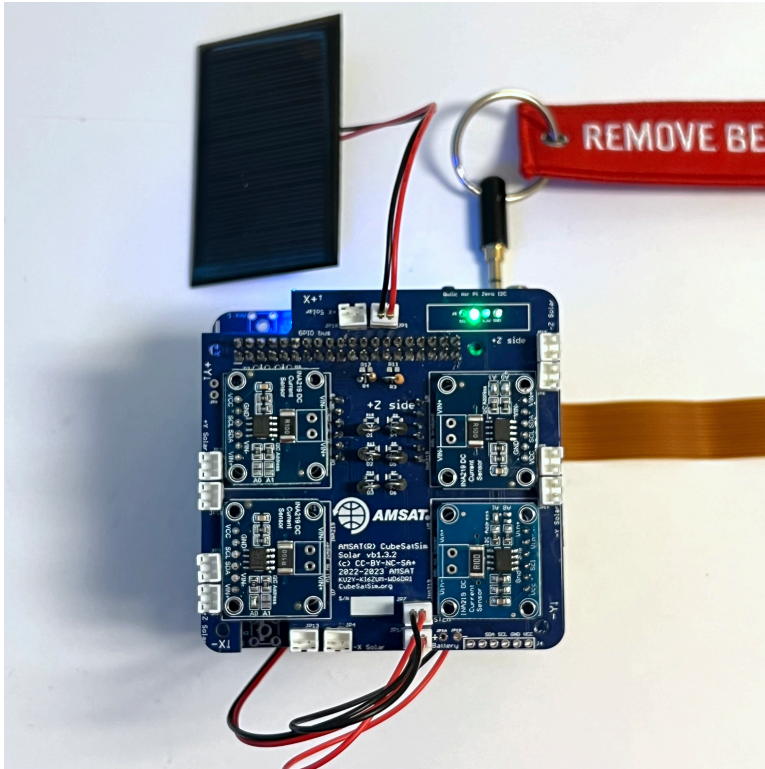


The battery current will be positive indicating that it is powering the CubeSatSim.

Next, insert the RBF plug and all the LEDs should turn off and the CubeSatSim should power down. No signal will be received by FoxTelem.

Remove the RBF plug and the CubeSatSim should power up and run. Using the Ground Station, verify the telemetry in FoxTelem and the battery voltage and current.

Plug a solar panel into one of the +X connectors on the Solar board.



Type a `CubeSatSim/config -v` and return in the Pi Zero and verify that you see an increase in the voltage for +X to be greater than 1 V.

CubeSatSim v1.3.2 configuration tool



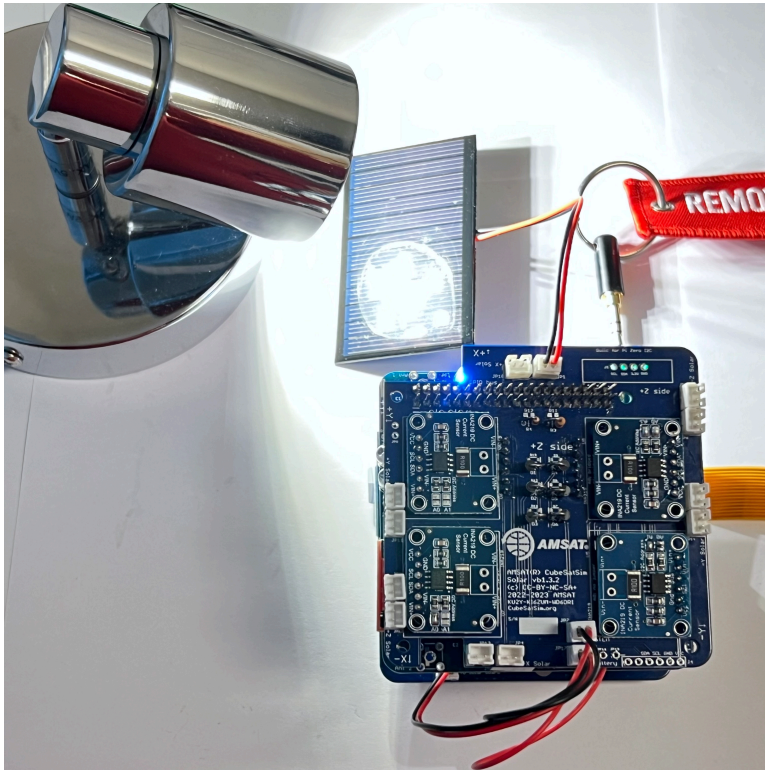
Real-time output from the INA219 voltage and current sensors:

CubeSatSim v1.3 INA219 Voltage and Current Telemetry

+X		1.44 V	0 mA
+Y		0.96 V	0 mA
+Z		0.97 V	0 mA
-X		0.95 V	0 mA
-Y		0.97 V	0 mA
-Z		0.94 V	0 mA
Bat		3.68 V	282 mA

Bus | 0.00 V 0 mA

You should also see the change in voltage in FoxTelem. Plug in the LED lamp and shine it on the solar panel.



Type `CubeSatSim/config -v` and return in Pi Zero and verify that you see an increase in voltage for +X and a small current of a few milliAmps.

CubeSatSim v1.3.2 configuration tool



Real-time output from the INA219 voltage and current sensors:

CubeSatSim v1.3 INA219 Voltage and Current Telemetry

+X		3.82 V	4 mA
+Y		0.96 V	0 mA
+Z		0.97 V	0 mA
-X		0.95 V	0 mA
-Y		0.97 V	0 mA
-Z		0.94 V	0 mA
Bat		3.67 V	293 mA
Bus		0.00 V	0 mA

If you can place the solar panel in sunlight, you will see a current for +X of more than 50 mA.

Move the solar panel connector to +Y, +Z, -X, -Y, and -Z positions, verifying that each of them gives a reading.

Type `sudo shutdown now` on the Pi to shut everything down. After 30 seconds, insert the RBF pin.

Carefully unplug each of the boards. You can leave the stacking GPIO headers - it doesn't matter which board they are attached to.

The Flat Sat testing is complete - you are ready to stack and mount the boards in [V2 Stacking](#)

+ Add a custom footer