

Explorer Board HAT Test Procedure

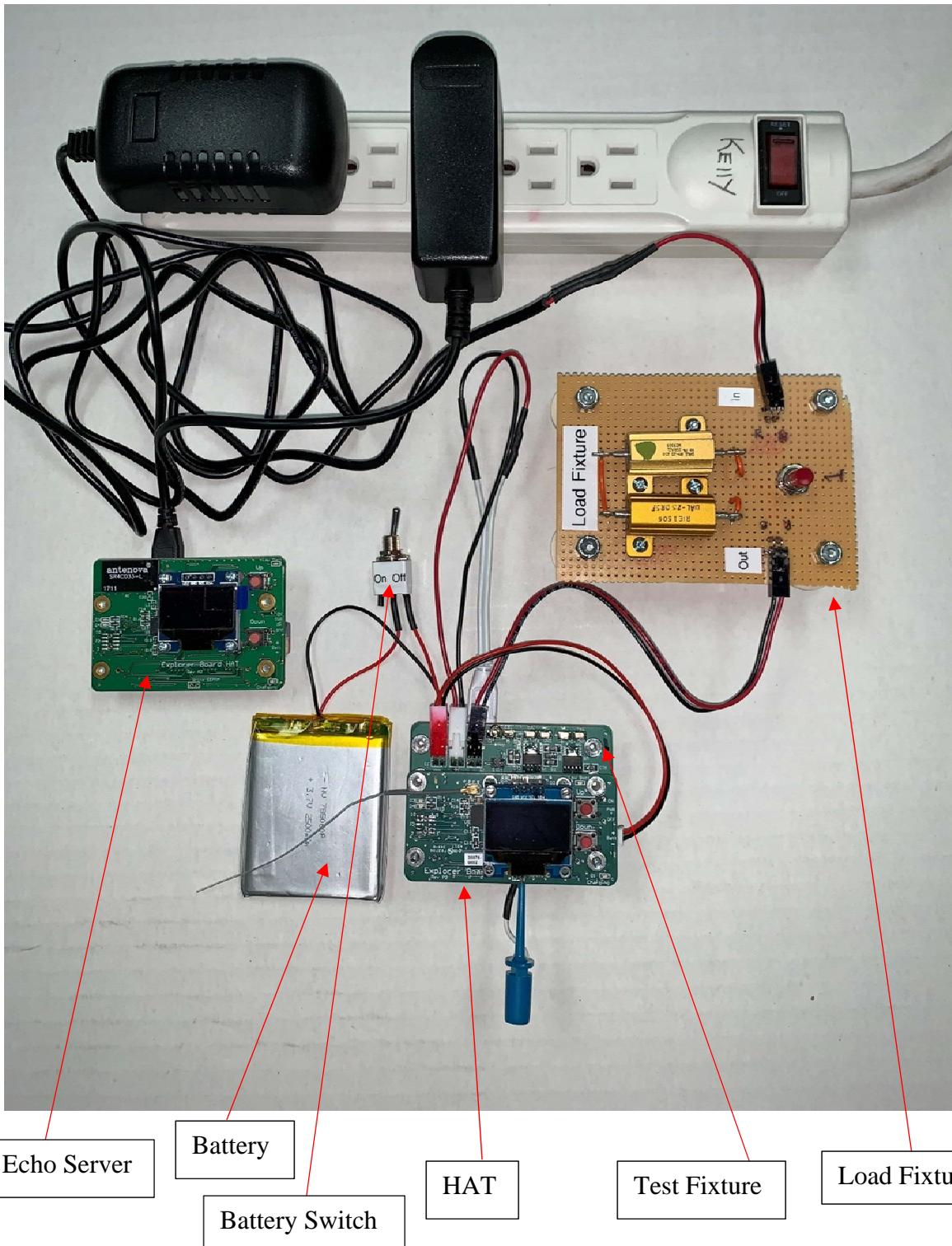
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Change History

Rev	Date	Comments
0.1	Dec 27, 2018	Initial Draft

Picture of a Raspberry Pi Zero W with an Explorer Board HAT and a battery and Test Fixture and with the Load Fixture.

Top View



Picture of a Raspberry Pi Zero W with an Explorer Board HAT.
This is used to test the radio on the Explorer Board HAT under test.
This is called the Echo Server.
This is placed near the Explorer Board HAT under test.

Top View



Documents

The Explorer Board HAT Test Fixture and Echo Server both have specially designed software. Below is a link to the software that is loaded on each SD card.

https://github.com/bnielsen1965/Explorer_HAT_Test_Fixture/tree/master/Software#explorer-hat-test-fixture-software

Below is a link to the Test Fixture hardware. Here you can find the Test Fixture schematic, BOM, and FAB drawings.

https://github.com/bnielsen1965/Explorer_HAT_Test_Fixture/tree/master/Documents

Below is a link to the Explorer Board HAT hardware.

<https://github.com/pdtkelly/Explorer-HAT>

Initial Setup

1. Plug USB power into Echo Server at “PWR IN” connector.
2. Plug USB power into Load Fixture.
Caution: On all 2 pin connectors check that the “latching ramp” is facing up. This is the polarizing keying method.
3. Plug the battery into the Test Fixture.
4. Plug the black 2 pin cable into the Load Fixture and the Test Fixture.
5. Plug the white 2 pin cable into the Test Fixture and the Raspberry Pi Zero W “PWR IN” connector.
6. Plug the red 2 pin cable into the Test Fixture and the HAT under test.

Overview of test procedure steps

1. On the Test Fixture the Green LED (D1) is on. This signifies that power is off to the Explorer Board HAT. Plug Explorer Board HAT onto the 40-pin connector. Use the two long screws as guides for the HAT. Then plug the 2-pin battery connector into the Explorer Board HAT. The display on the HAT will then show the Main Menu.
1. Run Display Tests
2. Run Electrical Tests
3. Run EEPROM Tests
 - Flash, then Verify
4. Run Radio Tests
 - Bit Bang Reset
 - Bit Bang Erase
 - Bit Bang Write
 - Firmware Version
 - LEDs On
 - LEDs Off
 - Ping
5. Power Off to the HAT, **Single** click **UP** button then **hold** **UP** button until green LED (D1) on Test Fixture comes on. This signifies that power is off to the Explorer Board HAT. Testing is complete. Remove the 2-pin battery connector from the HAT. Then **carefully** remove the Explorer Board HAT from the Test Fixture.
(See Appendix A, Appendix B and Appendix C)

The System Menu is used for DeBug if needed.

The Reboot on the Radio Menu is also used for DeBug if needed.

Main Menu

When the system under test powers up the Main Menu is displayed on the screen.

```
> Electrical Tests  
Display Tests  
System  
EEPROM  
Radio
```

Display Tests

1. **Single** click **UP** or **DOWN** button.
Move the arrow to Display Tests on the Main Menu.

```
Electrical Tests  
> Display Tests  
System  
EEPROM  
Radio
```

2. **Double** click the **DOWN** button.
A white screen appears on the display.
3. **Single** click **DOWN** button.
A checker board pattern appears on the display.
4. **Single** click **DOWN** button.
A reverse checker board pattern appears on the display.
5. **Single** click **DOWN** button.
Return to the Main Menu.

Electrical Tests

1. **Single** click **UP** or **DOWN** button.

Move the arrow to Electrical Tests on the Main Menu.

> Electrical Tests
Display Tests
System
EEPROM
Radio

2. **Double** click the **DOWN** button.

Battery Test
Running on battery
Charging LED off?

The USB power is disconnected. The system is running on the battery thus the Charging LED is off.

3. **Single** click **DOWN** button.

Charge Test
Charging LED on?

The system is using the USB power. The battery is charging. The Charging LED comes on.

(If the battery is not fully charged).

4. **Single** click **DOWN** button.

3.5 Volt Test
Press Load Fixture Red button 5 sec
Low Battery LED on?

The Red button allows the 3.5 Volt power on the Test Fixture to come on. Thus, the Low Battery LED comes on. The 5 seconds are needed to warm the resistors and discharge capacitors on the Test Fixture.

5. **Single** click **DOWN** button.

3.2 Volt Test
Press Load Fixture Red button 5 sec
Low Battery LED off?

The Red button allows the 3.2 Volt power on the Test Fixture to come on. Thus, the Low Battery LED comes on then goes off.

6. **Single click DOWN button.**

Test ADC
3 second intervals
Voltage x.xx VDC

Every 3 seconds the battery voltage will be displayed. Any voltage from 3.50 to 4.20 is good.

7. **Single click DOWN button.**
Return to the Main Menu.

EEPROM

Connect the EZ clip to ‘Write EEPROM’ J5 right side hole.

1. **Single** click **UP** or **DOWN** button.
Move the arrow to EEPROM on the Main Menu.

Electrical Tests
Display Tests
System
> EEPROM
Radio

2. **Double** click the **DOWN** button.

[EEPROM]
> Verify
Flash

This is the EEPROM Menu.

3. **Single** click **UP** or **DOWN** button.
Move the arrow to Flash on the EEPROM Menu.

[EEPROM]
Verify
> Flash

4. **Double** click the **DOWN** button.

Flashing in 10 sec.
Connect Jumper
Flashing
Flash done.

5. **Single** click **DOWN** button.

[EEPROM]
> Verify
Flash

Back to the EEPROM Menu.

6. **Double** click **DOWN** button.

Verifying ...
Verification success

7. **Single** click **DOWN** button.

[EEPROM]
> Verify
Flash

Back to the EEPROM Menu.

8. **Double** click the **UP** button.
Return to the Main Menu.

Radio

1. **Single** click **UP** or **DOWN** button.
Move the arrow to Radio on the Main Menu.

```
Electrical Tests  
Display Tests  
System  
EEPROM  
> Radio
```

2. **Double** click the **DOWN** button.

```
[Radio]  
> Bit Bang Reset  
Bit Bang Erase  
Bit Bang Write  
Reboot  
Firmware Version  
LEDs On  
LEDs Off  
Ping
```

This is the Radio Menu.

3. **Double** click **DOWN** button.

```
BitBang reset ...  
Command success.
```

Radio is reset.

4. **Single** click **UP** or **DOWN** button.
Move the arrow to Bit Bang Erase on the Radio Menu.

```
[Radio]  
Bit Bang Reset  
> Bit Bang Erase  
Bit Bang Write  
Reboot  
Firmware Version  
LEDs On  
LEDs Off  
Ping
```

5. **Double** click the **DOWN** button.

```
Bit Bang erase ...  
Command success.
```

6. **Single** click **UP** or **DOWN** button.

Move the arrow to Bit Bang Write on the Radio Menu.

```
[Radio]
Bit Bang Reset
Bit Bang Erase
> Bit Bang Write
Reboot
Firmware Version
LEDs On
LEDs Off
Ping
```

7. **Double** click the **DOWN** button.

```
Bit Bang write ...
Command success.
```

8. **Single** click **UP** or **DOWN** button.

Move the arrow to Firmware Version on the Radio Menu.

```
[Radio]
Bit Bang Reset
Bit Bang Erase
Bit Bang Write
Reboot
> Firmware Version
LEDs On
LEDs Off
Ping
```

9. **Double** click the **DOWN** button.

```
Firmware version ...
Command success.
subg-rfspy 0.8      (this could change)
Complete
```

10. **Single** click **UP** or **DOWN** button.
Move the arrow to LEDs On in the Radio Menu.

[Radio]
Bit Bang Reset
Bit Bang Erase
Bit Bang Write
Reboot
Firmware Version
> LEDs On
LEDs Off
Ping

11. **Double** click the **DOWN** button.
Takes a couple of seconds for the LEDs to come on.

Radio LEDs on ...
Command success. (D3 Green LED, D4 Red LED)
Complete.

12. **Single** click **UP** or **DOWN** button.
Move the arrow to LEDs Off in the Radio Menu.

[Radio]
Bit Bang Reset
Bit Bang Erase
Bit Bang Write
Reboot
Firmware Version
LEDs On
> LEDs Off
Ping

13. **Double** click the **DOWN** button.
Radio LEDs off ...
Command success. (D3 Green LED, D4 Red LED)
Complete.

14. **Single** click **UP** or **DOWN** button.
Move the arrow to Ping on the Radio Menu.

[Radio]
Bit Bang Reset
Bit Bang Erase
Bit Bang Write
Reboot
Firmware Version
LEDs On
LEDs Off
> Ping

15. **Double** click the **DOWN** button.

Ping test ...
Command success.

Success rate: 80% (60% to 100% is good)
Complete.

16. **Double** click the **UP** button
Return to the Main Menu

17. Power Off to the HAT, **Single** click **UP** button then **hold** **UP** button until green LED (D1) on Test Fixture comes on. This signifies that power is off to the Explorer Board HAT. Testing is complete. Remove the 2-pin battery connector from the HAT. Then remove the Explorer Board HAT from the Test Fixture.
(See Appendix A, Appendix B and Appendix C)

Radio Reboot

The Radio Reboot is used for DeBug if needed.

1. **Single** click **UP** or **DOWN** button.

Move the arrow to Reboot on the Radio Menu.

```
[Radio]
Bit Bang Reset
Bit Bang Erase
Bit Bang Write
> Reboot
Firmware Version
LEDs On
LEDs Off
Ping
```

2. **Double** click the **DOWN** button.

```
Radio reboot ...
Command success.
```

Complete.

3. **Double** click the **UP** button

Return to the Main Menu

System

The System Menu is used for DeBug if needed.

1. **Single** click **UP** or **DOWN** button.
Move the arrow to System on the Main Menu.

```
Electrical Tests  
Display Tests  
> System  
EEPROM  
Radio
```

2. **Double** click the **DOWN** button.

```
[System]  
> WiFi  
Date
```

This is the System Menu.

3. **Single** click **DOWN** button.
The WiFi option on the menu will display:

```
IP:  
SSID:  
BR:  
LQ:
```

4. **Single** click **DOWN** button.

```
[System]  
WiFi  
> Date
```

This is the System Menu again.

5. **Double** click the **DOWN** button.

```
Date:
```

The Date option on the menu will display the Date and Time

6. **Double** click the **UP** button
Return to the Main Menu

Appendix A

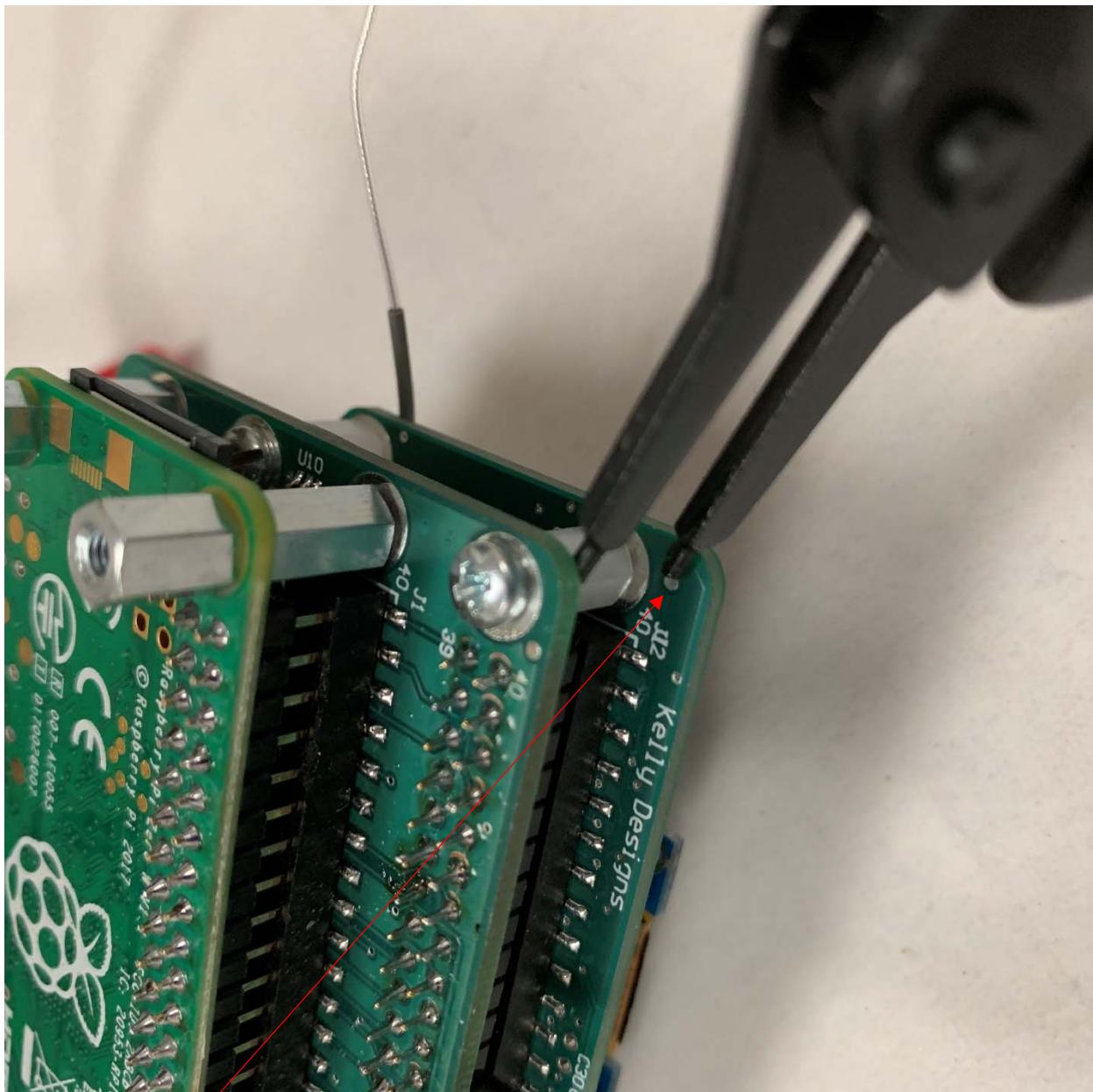
Below is a method for removing the Explorer Board HAT from the Test Fixture.

1. Use snap ring pliers. See picture below

https://www.amazon.com/IRWIN-VISE-GRIP-Convertible-Pliers-2078900/dp/B000JNRR0Y/ref=sr_1_3?ie=UTF8&qid=1543874186&sr=8-3&keywords=vise+grip+snap+ring+pliers



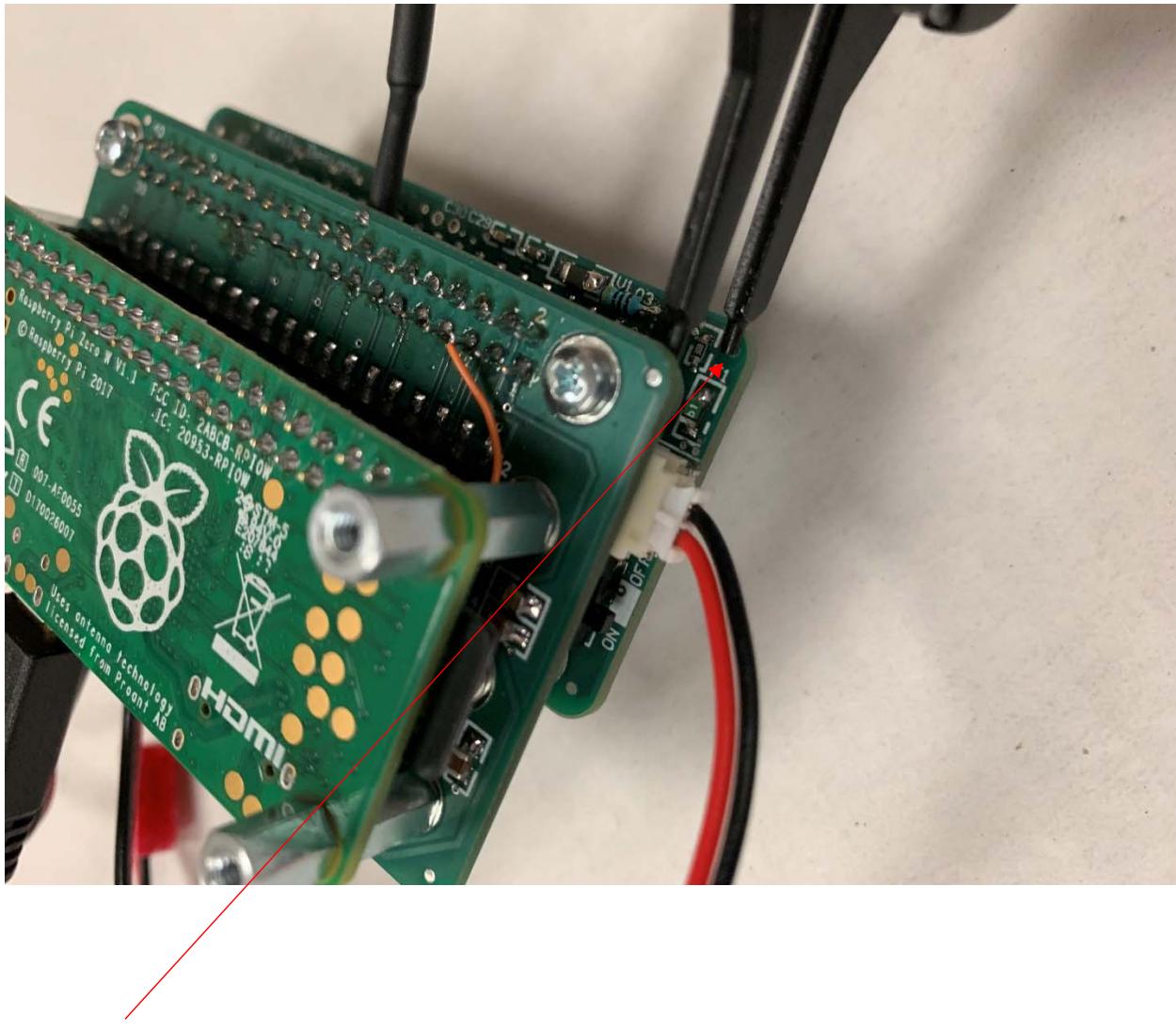
- Using the snap ring pliers carefully pry the two boards a little bit apart. Pry on the fiducial marks.



Fiducial mark

Using the snap ring pliers **carefully** pry the two boards a little bit apart on the other side of the 40-pin connector. Pry again on the fiducial marks. **Be careful to not crush any components** as parts very close to the fiducial mark.

Now go back to the other side and pry a little more there. Go back and forth until the HAT comes free.



Fiducial mark

Appendix B

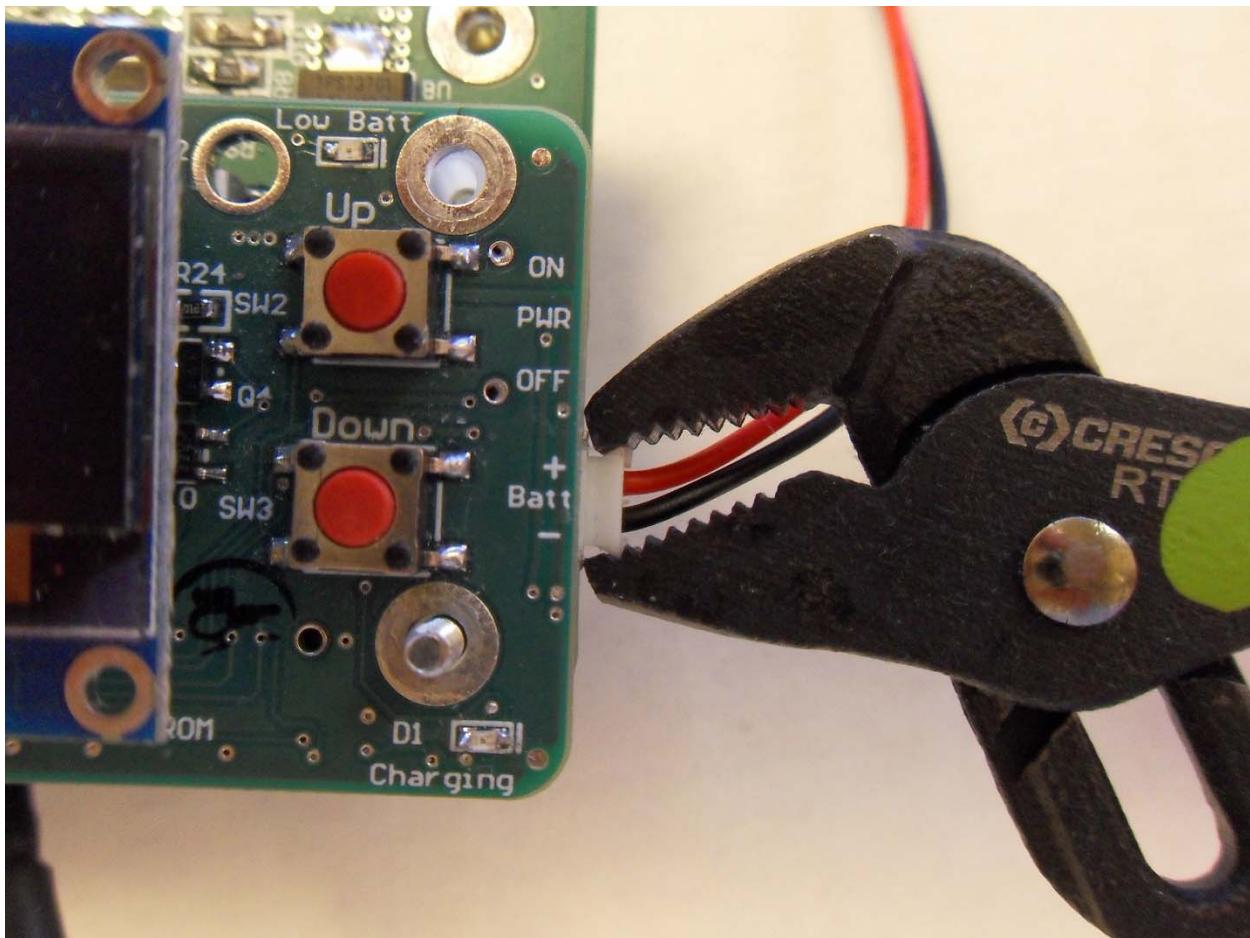
Below is a method for removing the 2-pin battery connector from the Explorer Board HAT.

1. Use Crescent RT24 pliers. See picture below

https://www.amazon.com/Crescent-RT24CVS-Cresent-Tongue-Groove/dp/B01CDJCPUI/ref=sr_1_9?ie=UTF8&qid=1543874016&sr=8-9&keywords=crescent+pliers

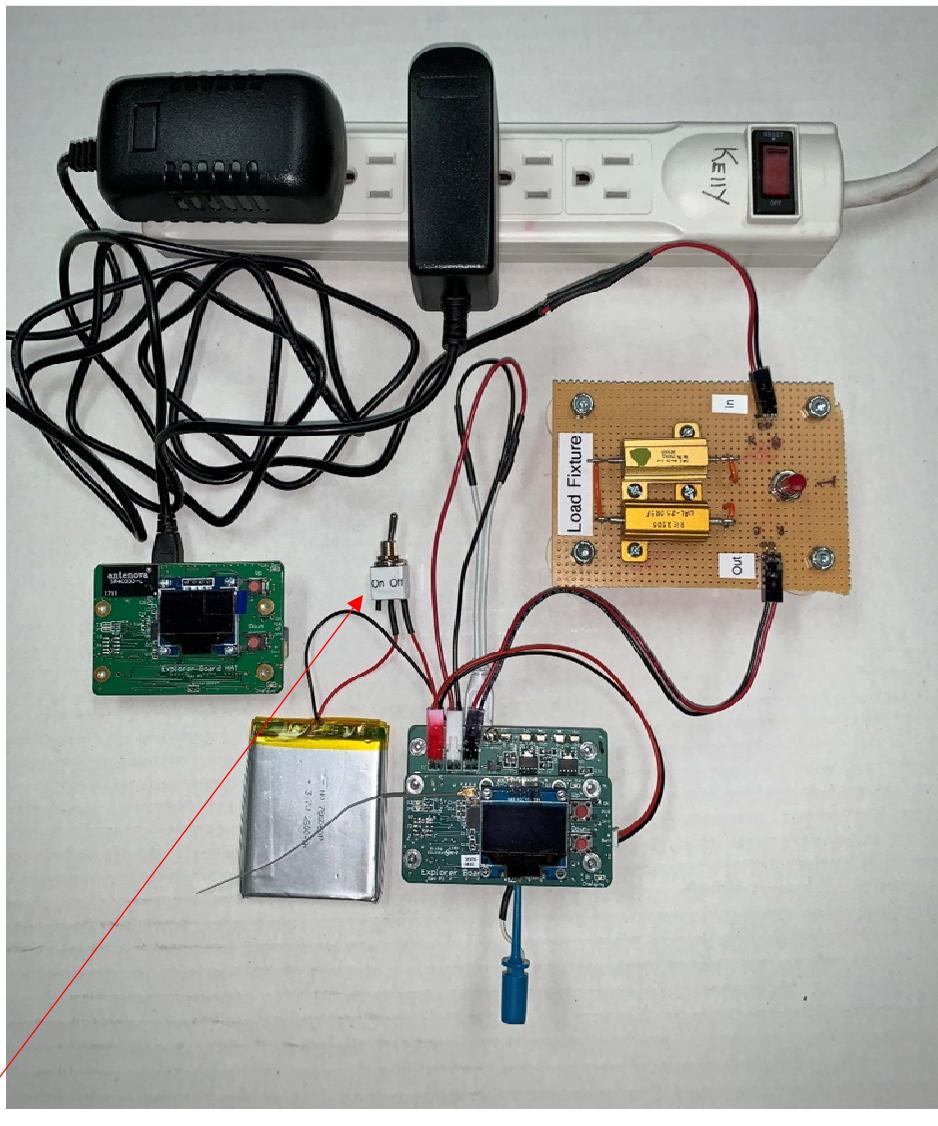


Using the Crescent RT24 pliers to remove the 2-pin battery connector from the Explorer Board HAT.



Appendix C

Below is a picture of the Battery Switch.



Battery Switch

When testing HATs the Battery Switch should be in the ON position.

When the Test Fixture is not being used for a period of time then the Battery Switch should be in the OFF position.