

Forest Joystick Mouse Hub

MAKER GUIDE

Overview

This document contains the necessary information to build the device.

Contents

Overview	1
Maker Checklist.....	2
Maker To Do List	2
Items to Give to User	2
Tool List	3
Customization Guide.....	4
3D Printing Guide	5
3D Printing Summary	5
3D Printing Settings.....	5
Post-Processing	5
Examples of Quality Prints	5
Assembly Guide.....	6
Part A: PCB Assembly	6
Part A Components	6
Part A Tools	8
Part A Personal Protective Equipment (PPE)	8
Part A Steps.....	8
Part B: Firmware	15
Part C: Enclosure Assembly.....	17
Part C Components	17
Part C Steps	17
Testing.....	19
Testing using an Xbox Adaptive Controller	19
Testing using a PC	19

Forest Joystick Mouse Hub

MAKER GUIDE

Maker Checklist

This list provides an overview of the steps required to build and deliver the device.

Maker To Do List

- ☐ Read through the Assembly Guide to become familiar with required components, tools, supplies, and safety gear and overall assembly steps.
- ☐ Talk to User about customization options (e.g., colour, any special requests, etc.)
- ☐ Order the custom PCB
- ☐ Order hardware components
- ☐ Print or obtain the 3D prints
- ☐ Gather tools, supplies, and safety equipment.
- ☐ Assemble the device
- ☐ Test device
- ☐ Print “User Guide”

Items to Give to User

- ☐ Assembled, tested device
- ☐ “User Guide”

Forest Joystick Mouse Hub

MAKER GUIDE

Tool List

1. Soldering iron
2. Flush cutters
3. Phillips Head Screwdriver
4. Computer with USB port and Arduino IDE (or ability to install it)

Forest Joystick Mouse Hub

MAKER GUIDE

Customization Guide

The device can be printed in the user's desired colour.

Forest Joystick Mouse Hub

MAKER GUIDE

3D Printing Guide

3D Printing Summary

Metrics	Single Unit
Total Print Time (min)	3h52m
Total Number of Components	3
Typical Total Mass (g)	40
Typical Number of Print Setups	1

3D Printing Settings

Print File Name	Qty	Total Print Time (hr:min)	Mass (g)	Infill (%)	Support(Y/N)	Layer Height/ Nozzle Diameter(mm)	Notes
Forest_Hub_Top.stl	1	2:40	24	15	N	0.2/0.4	
Forest_Hub_Bottom.stl	1	0:51	13	15	N	0.2/0.4	
Forest_HUB_LED_Spacer.stl	1	0:20	3	15	N	0.2/0.4	

Post-Processing

- Add any processes that must be done after print such as removing supports

Examples of Quality Prints

Photo of Device



Forest Joystick Mouse Hub

MAKER GUIDE



Assembly Guide

The assembly of the Forest Hub is comprised of three parts:

1. **Error! Reference source not found.**

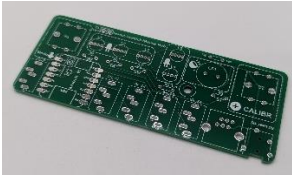

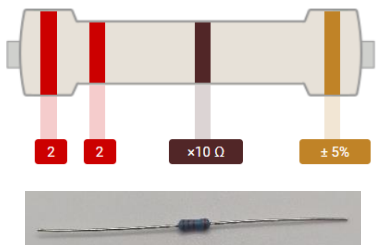
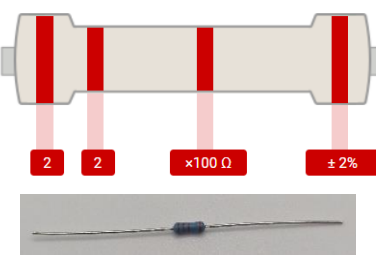
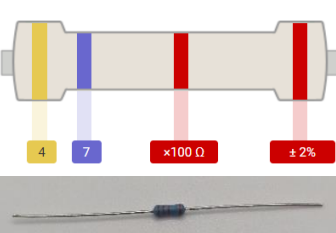
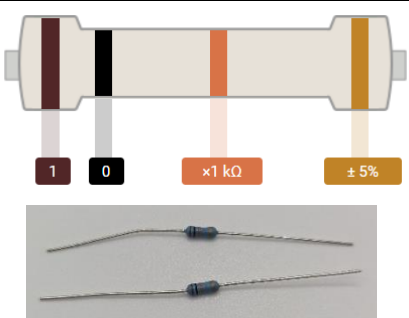
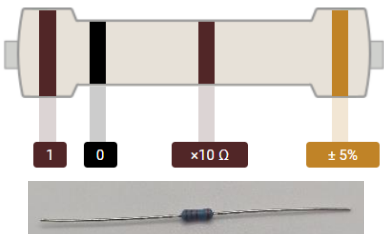
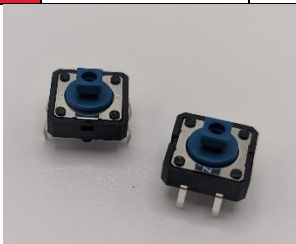
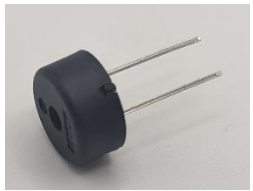
Forest Joystick Mouse Hub

MAKER GUIDE

2. Part B: Firmware
3. Part C: Enclosure Assembly

Part A: PCB Assembly

Part A Components

1	Forest Hub PCB	QTY 1	2	Capacitor, 10uF	QTY 1	3	Resistor, 220, 1/4W, Through hole	QTY 1
								
4	Resistor, 2.2K, 1/4W, Through hole	QTY 1	5	Resistor, 4.7K, 1/4W, Through Hole	QTY 1	6	Resistor, 10K, 1/4W, Through hole	QTY 2
								
7	Resistor, 100, 1/4W, Through hole	QTY 1	8	Tactile Buttons	QTY 2	9	Piezo Buzzer PS1240	QTY 1
								
10	TRRS Jack	QTY 1	11	Mono Switch Jacks	QTY 5	12	RJ 25 Connector	QTY 1

Forest Joystick Mouse Hub

MAKER GUIDE

								
13	Adafruit Qt PY SAMD21	QTY 1	14	Headers, Female, 7 Position	QTY 2	15	NeoPixel LEDs, 5mm through hole	QTY 5
								
16	Forest LED Spacer	QTY 1	17	Forest Enclosure Top	QTY 1	18	Screw, #4, 3/8" Length	QTY 1
								
19	Forest Enclosure Bottom	QTY 1	20	USB-C Cable	QTY 1	21	Solderless Breadboard	QTY 1
								

Part A Tools

- Soldering iron



© 2023 by [Neil Squire Society](https://neilsquire.org/).

This work is licensed under the CC BY SA 4.0 License: <http://creativecommons.org/licenses/by-sa/4.0>

Files available at <https://github.com/makersmakingchange/Forest-Joystick-Mouse-Hub>

Forest Joystick Mouse Hub

MAKER GUIDE

- Flush cutters
- Phillips Head Screwdriver

Part A Personal Protective Equipment (PPE)

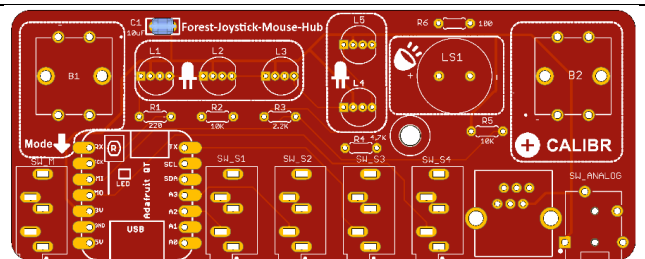
- Safety glasses

Part A Steps

Step 1: Insert and Solder Capacitor

Take the capacitor (Component 2) and bend the metal leads on either side so they will line up with the holes labelled C1 on the PCB.

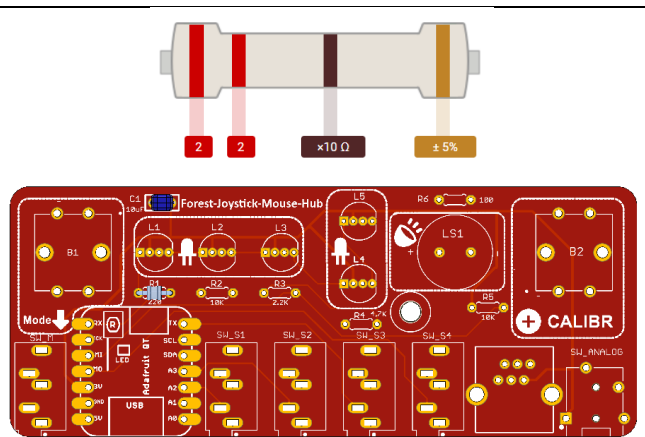
Insert the capacitor leads all the way into the C1 holes. Solder in place and trim the excess leads off.



Step 2: Insert and Solder R1 Resistor

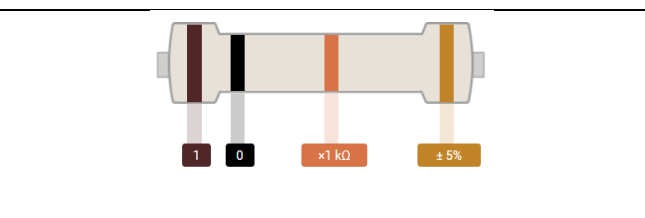
Take the R1 resistor (Component 3) and bend the metal leads on either side so they will line up with the holes labelled R1 on the PCB.

Insert the resistor leads all the way into the R1 holes. Solder in place and trim the excess leads off.



Step 3: Insert and Solder R2 Resistor

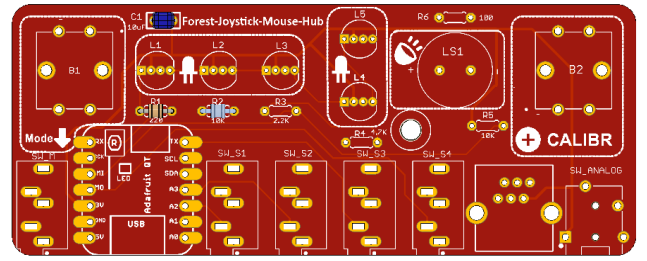
Take the R2 resistor (Component 6) and bend the metal leads on either side so they will line up with the holes labelled R2 on the PCB.



Forest Joystick Mouse Hub

MAKER GUIDE

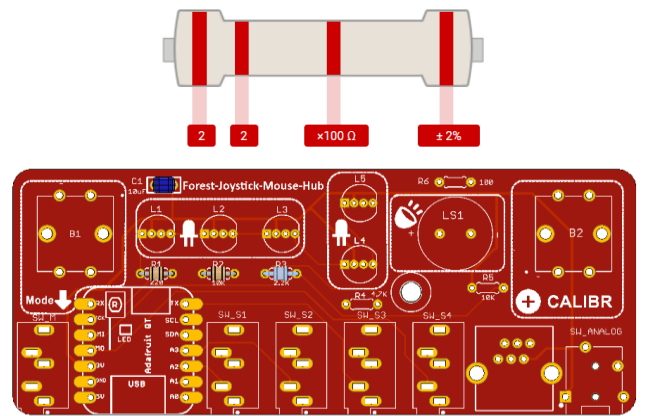
Insert the resistor leads all the way into the R2 holes. Solder in place and trim the excess leads off.



Step 4: Insert and Solder R3 Resistor (Component 4)

Take the R3 resistor (Component 4) and bend the metal leads on either side so they will line up with the holes labelled R3 on the PCB.

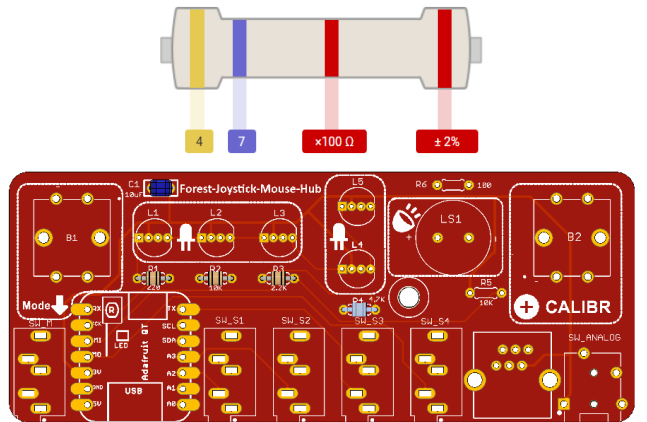
Insert the resistor leads all the way into the R3 holes. Solder in place and trim the excess leads off.



Step 5: Insert and Solder R4 Resistor (Component 5)

Take the R4 resistor (Component 5) and bend the metal leads on either side so they will line up with the holes labelled R4 on the PCB.

Insert the resistor leads all the way into the R4 holes. Solder in place and trim the excess leads off.



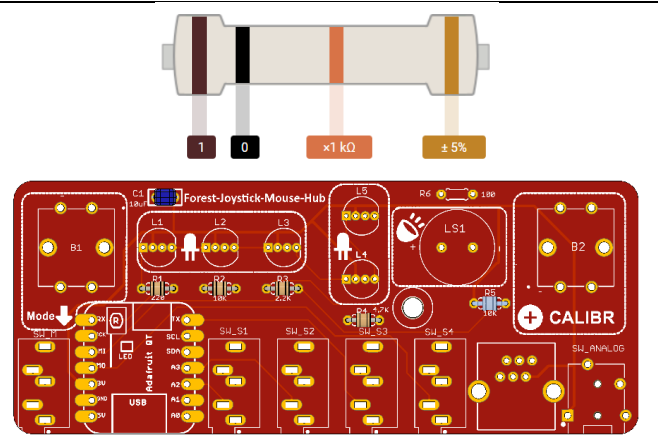
Forest Joystick Mouse Hub

MAKER GUIDE

Step 6: Insert and Solder R5 Resistor (Component 6)

Take the R5 resistor (Component 6) and bend the metal leads on either side so they will line up with the holes labelled R5 on the PCB.

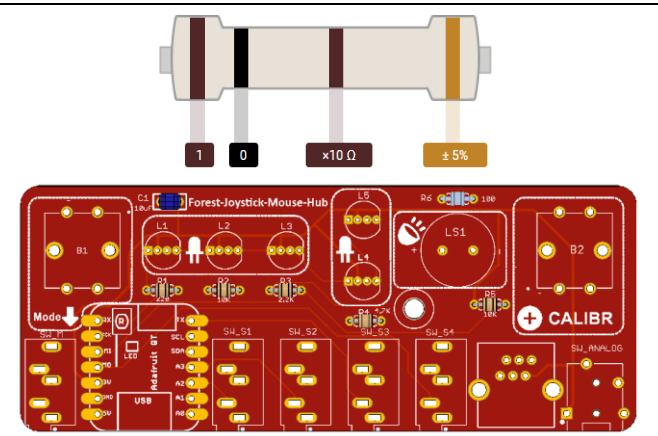
Insert the resistor leads all the way into the R5 holes. Solder in place and trim the excess leads off.



Step 7: Insert and Solder R6 Resistor (Component 7)

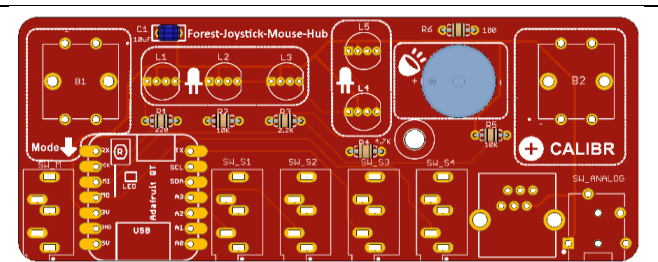
Take the R6 resistor (Component 7) and bend the metal leads on either side so they will line up with the holes labelled R6 on the PCB.

Insert the resistor leads all the way into the R6 holes. Solder in place and trim the excess leads off.



Step 8: Insert and Solder Buzzer

Take the Buzzer (Component 9) and insert the leads all the way into the PCB holes labelled with a speaker icon from the top. Solder in place and trim the excess leads.

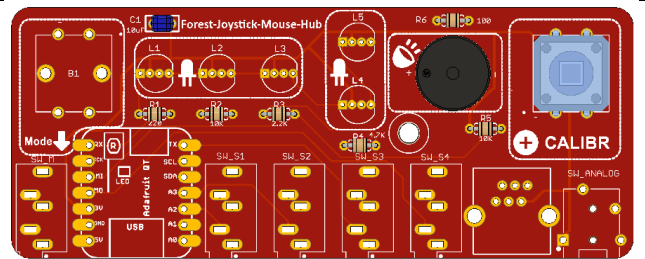


Forest Joystick Mouse Hub

MAKER GUIDE

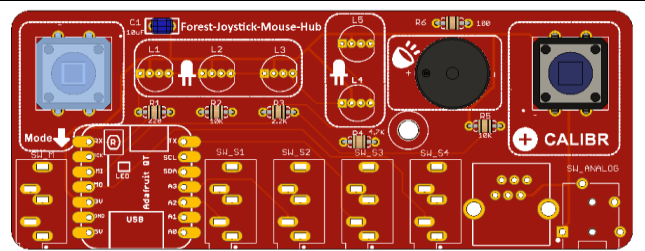
Step 9: Insert and Solder Calibration Button

Take a button (Component 8) and insert the leads all the way into the PCB holes labelled CALIBR from the top. Solder a single pin, check that the component is fully flush to the PCB, and solder the remaining pins.



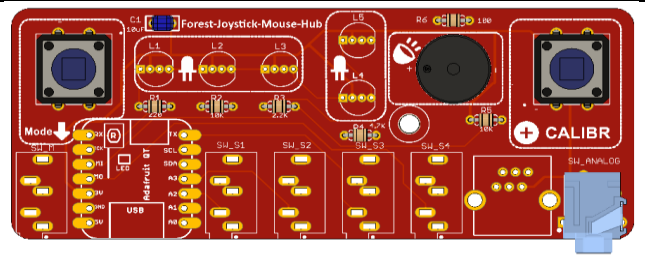
Step 10: Insert and Solder Mode Button

Take a button (Component 8) and insert the leads all the way into the PCB holes labelled Mode from the top. Solder a single pin, check that the component is fully flush to the PCB, and solder the remaining pins.



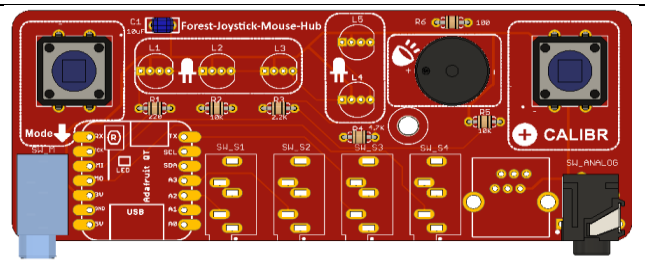
Step 11: Insert and Solder TRRS Jack

Take the TRRS jack (Component 10) and insert the leads all the way into the PCB holes labelled SW_ANALOG from the top. Solder a single pin, check that the component is fully flush to the PCB, and solder the remaining pins.



Step 12: Insert and Solder SM Audio Jack

Take an audio jack (Component 11) and insert the leads all the way into the PCB holes labelled SW_M from the top. Solder a single pin, check that the component is fully flush to the PCB, and solder the remaining pins.

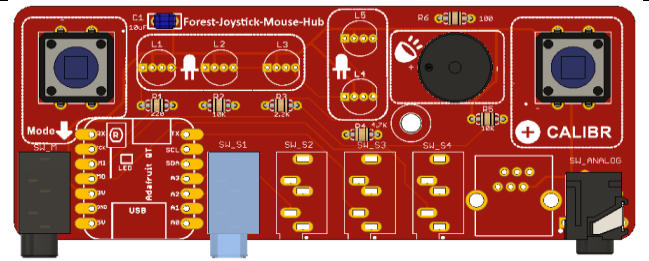


Forest Joystick Mouse Hub

MAKER GUIDE

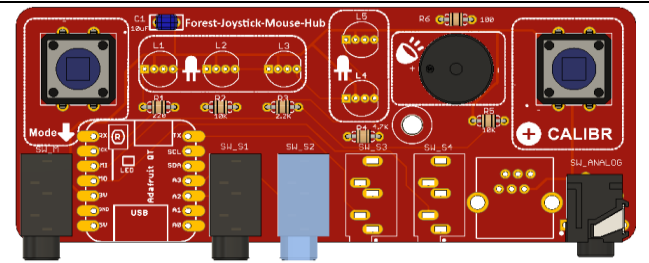
Step 13: Insert and Solder S1 Audio Jack

Take an audio jack (Component 11) and insert the leads all the way into the PCB holes labelled SW_S1 from the top. Solder a single pin, check that the component is fully flush to the PCB, and solder the remaining pins.



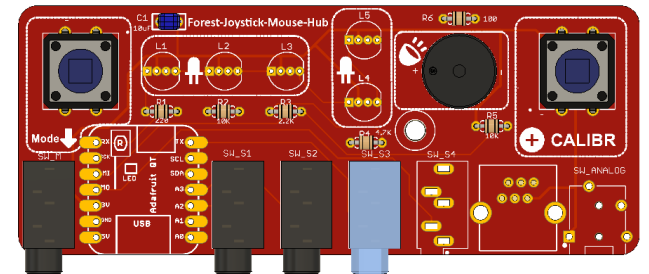
Step 14: Insert and Solder S2 Audio Jack

Take an audio jack (Component 11) and insert the leads all the way into the PCB holes labelled SW_S2 from the top. Solder a single pin, check that the component is fully flush to the PCB, and solder the remaining pins.



Step 15: Insert and Solder S3 Audio Jack

Take an audio jack (Component 11) and insert the leads all the way into the PCB holes labelled SW_S3 from the top. Solder a single pin, check that the component is fully flush to the PCB, and solder the remaining pins.



Step 16: Insert and Solder S4 Audio Jack

Take an audio jack (Component 11) and insert the leads all the way into the PCB holes labelled SW_S4 from the top. Solder a single pin, check that the component is fully flush to the PCB, and solder the remaining pins.



Forest Joystick Mouse Hub

MAKER GUIDE

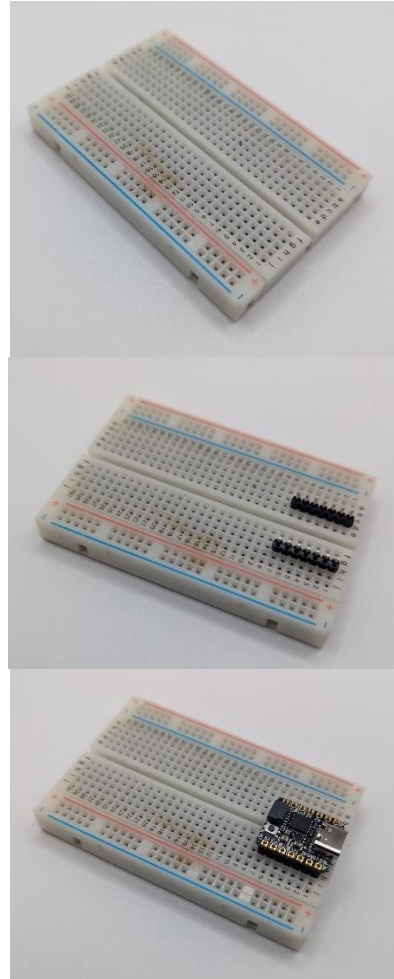
Step 17: Insert and Solder Male Headers to QT Py

Take the QT Py microcontroller and male headers (Component 13).

If you have a solderless breadboard. Insert the long leads of the male headers into the breadboard and insert the microcontroller on top. Solder the pins in place and remove the assembly.

If you do not have a solderless breadboard, with the bottom of the PCB raised from the table surface (could place the PCB inside the enclosure bottom for this) insert the female headers (Component 14) into the PCB holes outlined with the microcontroller footprint. Insert the long leads of the male headers into the female headers and install the QT Py microcontroller on top.

Solder a single male header pin to the microcontroller, ensuring the headers are perpendicular to the PCB and the microcontroller is parallel with the PCB. Check that the male headers are flush and perpendicular to the microcontroller, solder the remaining male headers pins in place.



Step 18: Insert and Solder Female Headers

Insert the male headers into the female headers (Component 14) and insert the female headers into the PCB holes outlined with the microcontroller footprint from the top. Solder a single pin of one female header and check to ensure the female headers are flush and perpendicular with the PCB. Solder the remaining female header pins.

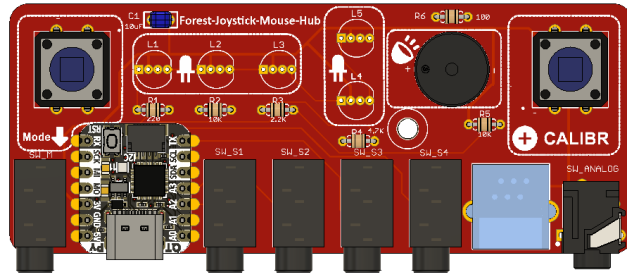


Forest Joystick Mouse Hub

MAKER GUIDE

Step 19: Insert and Solder RJ 25 Connector

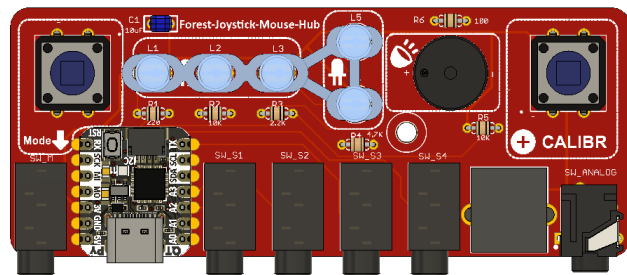
Take the RJ 25 connector (Component 12) and insert it into the PCB holes located between SW_S4 and SW_ANALOG. Solder a single pin, check that the component is fully flush to the PCB, and solder the remaining pins.



Step 20: Insert NeoPixel LEDs using Forest LED Spacer

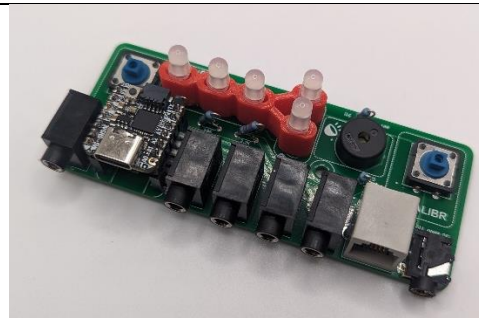
Take the NeoPixel LEDs (Component 15) and the Forest LED spacer (Component 16). Line up and place the spacer over the PCB holes labelled L1, L2, L3, L4, and L5.

Ensuring that the flat side of the NeoPixel LEDs lines up with the outline on the PCB (all LED flat sides should face towards the Buzzer), insert the LEDs into the PCB. Solder in place and trim the excess leads.



Step 21: PCB is Fully Assembled

The Forest Hub PCB is now fully assembled. Move to Part B: Firmware.



Forest Joystick Mouse Hub

MAKER GUIDE

Part B: Firmware

Part B: Firmware Steps

Step B1: Setup Arduino IDE

1. Download Arduino IDE for your operating system at <https://www.arduino.cc/en/software>
2. Install the Arduino IDE.

Step B2: Setup Arduino IDE for QT Py Board

1. Open Arduino IDE.
2. Click on **File -> Preferences**.
3. Locate the text field that says **Additional Boards Manager URLs** beside it.
4. Copy and paste the following link into the field as a new line:
https://adafruit.github.io/arduino-board-index/package_adafruit_index.json
5. Click on **OK**.
6. Restart the Arduino IDE.
7. Open the **Boards Manager** option from the **Tools-> Board-> Boards Manager...**,
8. Search for “Adafruit SAMD” and select “Adafruit SAMD Boards” by Adafruit.
9. Click **Install** to install the board.

Step B3: Install Libraries

1. In a web browser, go to https://github.com/cyborg5/TinyUSB_Mouse_and_Keyboard and go to Code -> Download ZIP.
2. In Arduino IDE, click **Sketch -> Include Library -> Add .ZIP Library**.
3. Navigate to the ZIP file downloaded in Step (a). Click **OK**.
4. Go to **Tools -> Manage Libraries...**, search for “Flash Storage” and install the library “FlashStorage” by Various.
5. Go to **Tools -> Manage Libraries...**, search for “Adafruit_Neopixel” and install the library “Adafruit_Neopixel” by Adafruit.
6. Go to **Tools -> Manage Libraries...**, search for “WiiChuck” and install the library “WiiChuck” by Kevin Harrington.

Step B4: Setup Local Code Directory

1. Download the Firmware_Files from the GitHub Repository:
https://github.com/makersmakingchange/Forest-Hub/blob/main/Build_Files/Firmware_Files/Forest_Hub_Firmware.zip
2. Extract / unzip the folder to a known location.
3. Confirm that you have the following folder structure:
 - Forest_Hub_Firmware (folder)

Forest Joystick Mouse Hub

MAKER GUIDE

- Forest_Hub_Firmware.ino
- OpenAT_Joystick_Response.h
- XACGamepad.h

Step B5: Upload the Code to the microcontroller.

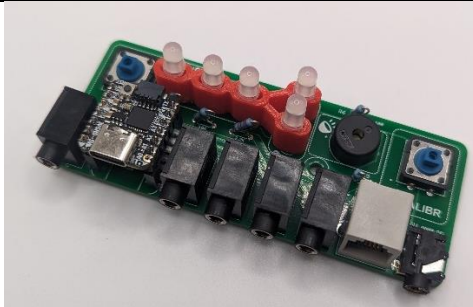




1. Open Forest_Hub_Firmware.ino with Arduino IDE.
2. Select **Adafruit QT Py M0 (SAMD21)** from **Tools -> Board -> Adafruit SAMD Boards**
3. Click on **Tools -> USB Stack** and select **TinyUSB**
4. Connect the Forest Hub using the USB cable to the computer.
5. Select the correct port from **Tools -> Port** menu.
6. Verify and upload the code.

Forest Joystick Mouse Hub

MAKER GUIDE

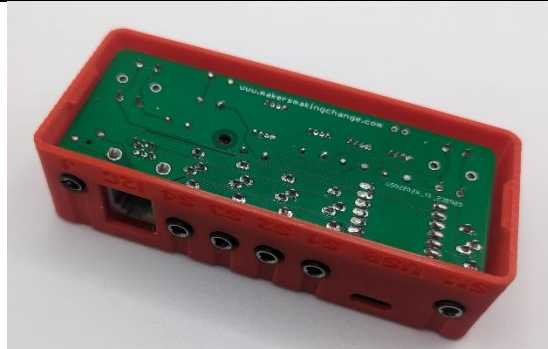
Part C: Enclosure Assembly

Part C Components

22	Assembled Forest Hub PCB	QTY 1	17	Forest Enclosure Top	QTY 1	18	Screw, #4, 3/8" Length	QTY 1
								
19	Forest Enclosure Bottom	QTY 1	20	USB-C Cable	QTY 1			
								

Part C Steps

Step C1: Insert PCB into Enclosure Top

Insert the assembled PCB into the Enclosure Top.	
--	--

Forest Joystick Mouse Hub

MAKER GUIDE

Step C2: Secure PCB into place with Screw

Secure the PCB in place with using the #4 screw and the Phillips screwdriver.



Step C3: Snap Enclosure Bottom

Position the Enclosure Bottom over the Enclosure Top and push down to snap in place.



Step C4: Enclosure Finished

Flip the device over. The Forest Hub is now complete.



Forest Joystick Mouse Hub

MAKER GUIDE

Testing

To test the Forest Hub, you will need an analog joystick and at least one (1), but up preferably five (5) assistive switches.

Testing using an Xbox Adaptive Controller

1. Connect the Forest Hub into the Left USB port for the left joystick or the Right USB port for the right joystick.
2. Connect the Xbox Adaptive Controller (XAC) using a USB-C cable to the computer.
3. If using Windows, open “Set up USB Game Controllers” from the Control Panel. You can find this by searching your computer in the search bar next to the Windows icon.
4. Select the Xbox Adaptive Controller from the list of controllers and go to “Properties”.
5. Move your joystick and observe the movement of the cross hatch in the “Axes” window. Ensure it moves in the proper directions when you move the joystick (the arrow points in the up direction). If not, open up the joystick and check your connections.

Testing using a PC

1. Connect the joystick using the USB C cable to the computer.
2. If using Windows, open “Set up USB Game Controllers” from the Control Panel. You can find this by searching your computer in the search bar next to the Windows icon.
3. Ensure that the joystick is registered as a game controller and select your joystick from the list and go to “Properties”.
4. Move your joystick and observe the movement of the cross hatch in the “Axes” window. Ensure it moves in the proper directions when you move the joystick (the arrow points in the up direction). If not, open the joystick and check your connections.
5. Using assistive switches plugged into each mono jack, activate each switch, and ensure that one of buttons 1-4 light up when you press the switch, and stops when you release the switch. If not, open the joystick and check your connections.