



# FAIO MULTIPLEXER

## MANUAL

What if you could have a switch interface that could that would let you perform many actions using only 4 switches?

**Version 1.0**

[https://github.com/milador/FAIO\\_Multiplexer](https://github.com/milador/FAIO_Multiplexer)

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## Components List

1. ADAFRUIT FEATHER **x 1**
  - A. USB Version: ADAFRUIT FEATHER 32U4 BASIC PROTO
  - B. XAC Joystick Version: ADAFRUIT FEATHER 32U4 BASIC PROTO
  - C. Bluetooth Version: ADAFRUIT FEATHER 32U4 BLUEFRUIT LE or ADAFRUIT FEATHER M0 BLUEFRUIT LE
2. ADDRESS LED DISC SER RGB 5MM **x 1**
3. FEATHER HEADER KIT FML **x 1**
4. RES 470 OHM 1/4W 5% AXIAL **x 1**
5. CONN JACK STEREO 3.5MM R/A **x 4**
6. ANALOG 2-AXIS THUMB JOYSTICK WIT **(Optional: XAC Joystick version) x 1**
7. CONN HDR 5POS 0.1 GOLD PCB **(Optional: XAC Joystick version) x 1**
8. CONN HEADER VERT 5POS 2.54MM **(Optional: XAC Joystick version) x 1**
9. MACHINE SCREW 2.5 **x 4**
10. HEX NUT 2.5 **x 4**

The FAIO\_Multiplexer\_BOM or FAIO Multiplexer bill of materials can also be downloaded from GitHub repository under main directory.

[https://github.com/milador/FAIO\\_Multiplexer/blob/master/Components/FAIO\\_Multiplexer\\_BOM.xlsx](https://github.com/milador/FAIO_Multiplexer/blob/master/Components/FAIO_Multiplexer_BOM.xlsx)

## Software

The FAIO Multiplexer software can be downloaded from the GitHub repository under software directory.

[https://github.com/milador/FAIO\\_Multiplexer/tree/master/Software](https://github.com/milador/FAIO_Multiplexer/tree/master/Software)

The FAIO Multiplexer hardware can be used along different software as input device for multiple devices. The FAIO Multiplexer software is offered in the following flavors:

1. USB Version: FAIO\_Multiplexer\_USB\_Software
2. XAC Joystick Version: FAIO\_Multiplexer\_XAC\_Software
3. Bluetooth Version: FAIO\_Multiplexer\_Wireless\_Software

## Installing Arduino Libraries

The following instructions on how to install additional Arduino libraries helps you to get started with setting up Arduino IDE with required libraries and dependencies.

<https://www.arduino.cc/en/guide/libraries>

## Required Software and libraries

### USB Version

The USB version of the software requires the following files and libraries:

- [StopWatch.h](#)
- [EasyMorse.h](#)
- [Adafruit\\_NeoPixel.h](#)
- [FlashStorage.h](#) (Optional: Only M0 processor)
- [FAIO\\_Multiplexer\\_USB\\_Software.ino](#)

StopWatch library helps to calculate the reaction time and timeout in the morse code interface.

EasyMorse library is used to provide morse code input interface by translating morse code into characters.

FAIO Multiplexer is using Adafruit\_NeoPixel library to provide visual feedback using RGB LED.

The M0 processor doesn't come with EEPROM support and requires using FlashStorage library to handle saving variables and settings.

### XAC Joystick Version

The XAC Joystick version of the software requires the following files and libraries:

- [Joystick.h](#)
- [Adafruit\\_NeoPixel.h](#)
- [FAIO\\_Multiplexer\\_XAC\\_Software.ino](#)

The joystick library is used to turn FAIO Multiplexer into a joystick USB HID device which can be supported by Xbox adaptive controller.

FAIO Multiplexer is using Adafruit\_NeoPixel library to provide visual feedback using RGB LED.

### Wireless Version

The wireless version of the software requires the following files and libraries:

- [StopWatch.h](#)
- [EasyMorse.h](#)
- [Adafruit\\_NeoPixel.h](#)
- [FlashStorage.h](#) (Optional: Only M0 processor)
- [BluefruitConfig.h](#)
- [BluefruitRoutines.h](#)
- [FAIO\\_Multiplexer\\_Wireless\\_Software.ino](#)

StopWatch library helps to calculate the reaction time and timeout in the morse code interface.

EasyMorse library is used to provide morse code input interface by translating morse code into characters.

FAIO Multiplexer is using Adafruit\_NeoPixel library to provide visual feedback using RGB LED.

The M0 processor doesn't come with EEPROM support and requires using FlashStorage library to handle saving variables and settings.

There is a great instructions manual on how to use Arduino IDE and Adafruit Feather 32u4 Bluefruit LE board which can help you get started using Arduino IDE and install necessary Adafruit drivers.

<https://learn.adafruit.com/adafruit-feather-32u4-bluefruit-le/using-with-arduino-ide>

The wireless version of the FAIO Multiplexer is using nRF51 Bluetooth chip to communicate with host devices. Bluetooth communication might seem complicated but Adafruit has made the bluetooth communication process less challenging by providing Adafruit nRF51 BLE Library which you can download from Adafruit and import it to your locally installed Arduino directory under libraries directory.

[https://github.com/adafruit/Adafruit\\_BluefruitLE\\_nRF51](https://github.com/adafruit/Adafruit_BluefruitLE_nRF51)

The instructions on how to install Adafruit nRF51 BLE Library can be found in following link:

<https://learn.adafruit.com/adafruit-feather-32u4-bluefruit-le/installing-ble-library>

### Uploading Software

**Note: Make sure all three files are included in your local copy of Software directory before uploading it to the Adafruit Feather board. The libraries can be installed in Arduino libraries.**

The downloaded software and libraries can be uploaded to the Adafruit Feather board in FAIO Multiplexer using Arduino IDE which you can download from Arduino official website.

<https://www.arduino.cc/en/Main/Software>

You can go ahead and upload the downloaded .ino software to Adafruit Feather board using Arduino IDE once all the necessary libraries are installed.

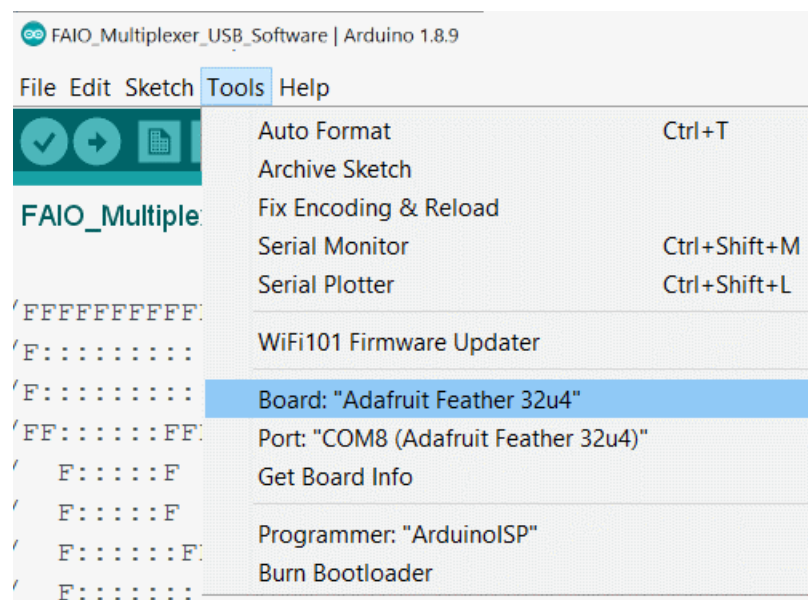
1. Select the Board under **Tools > Board** as **Adafruit Feather 32u4** or **Adafruit Feather M0** based on your board
2. Select the correct port number under **Tools > Port** which should say **COM XX (Adafruit Feather 32u4)** or **COM XX (Adafruit Feather M0)** based on your board

**Note: It's very important to make sure the correct Board and port number are selected as selecting the wrong board may result problems with bootloader of Adafruit Feather board.**

3. Press the Verify button to make sure there is no problem with the software and libraries
4. Press Upload button

Here you can see an example of my selected Board and port number.

**Note: Your port number won't be the same**



You can now go ahead and upload the software. Arduino IDE will show you a “Done uploading” message indicating the software is uploaded to your FAIO Multiplexer.

The LED on the FAIO Multiplexer main board blinks two times in green to indicate the start of initialization process has been started and it will blink again two times in green to indicate end of the initialization process.

You can also open the Serial Monitor in Arduino IDE on 115200 baud rate to read initialization information about the version of software.

## Hardware Assembly

### Printed circuit Board design

The printed circuit boards (PCB) can be downloaded from GitHub repository under Hardware directory.

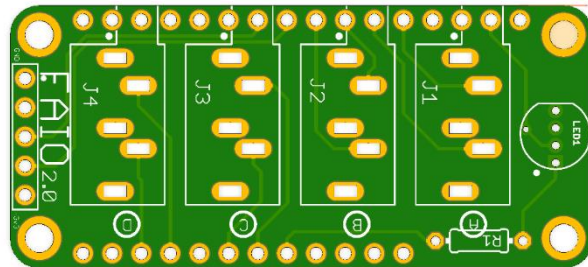
[https://github.com/milador/FAIO\\_Multiplexer/tree/master/Hardware/PCB\\_design](https://github.com/milador/FAIO_Multiplexer/tree/master/Hardware/PCB_design)

### Enclosure design

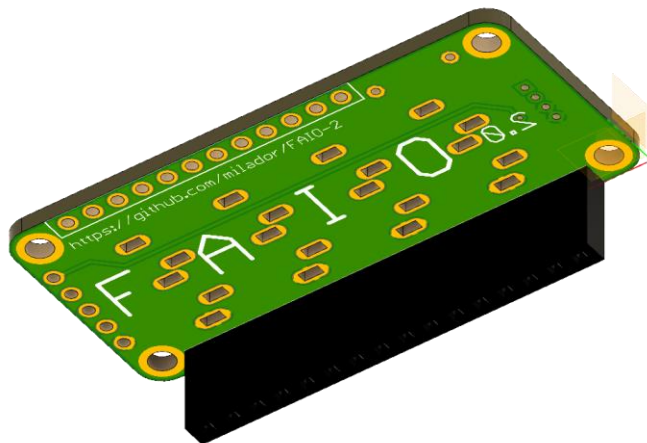
The enclosure/housing files in STL format can be downloaded from GitHub repository under Hardware directory.

[https://github.com/milador/FAIO\\_Multiplexer/tree/master/Hardware/Housing\\_design](https://github.com/milador/FAIO_Multiplexer/tree/master/Hardware/Housing_design)

## Assembly Instructions

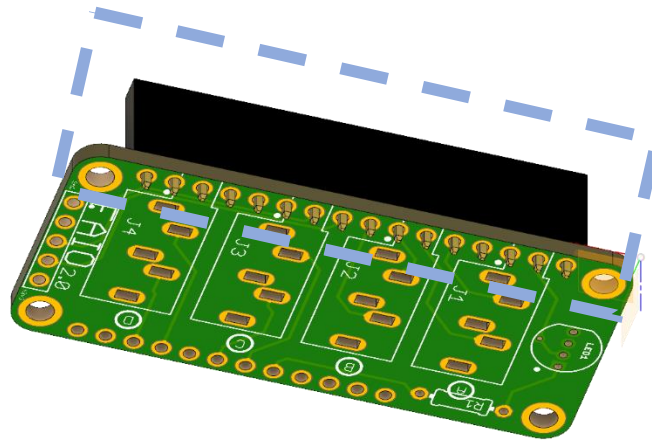


**Step 1 – FAIO Switch main board x 1**

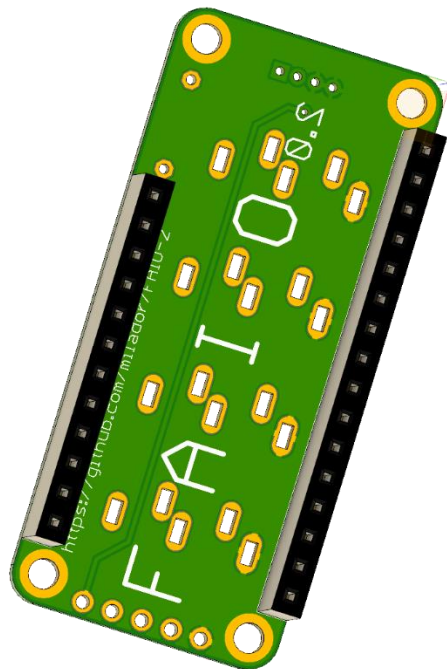


**Step 2 – 16 position female header connector x 1**

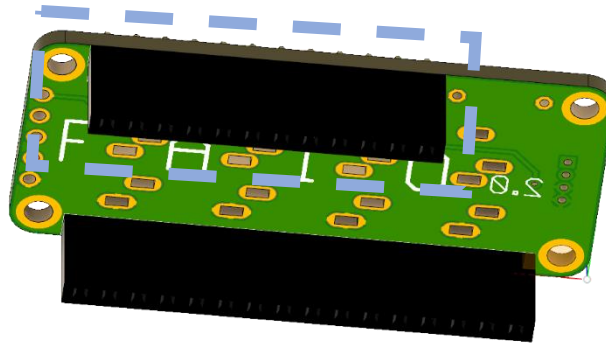




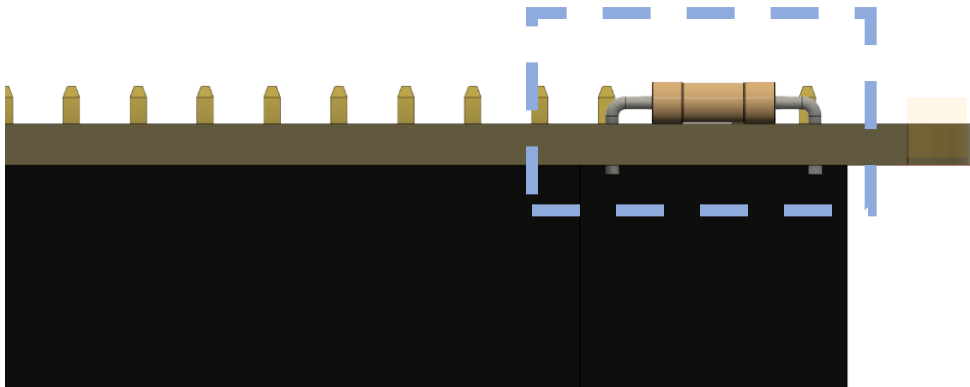
**Step 3 – Solder 16 position female header connector**



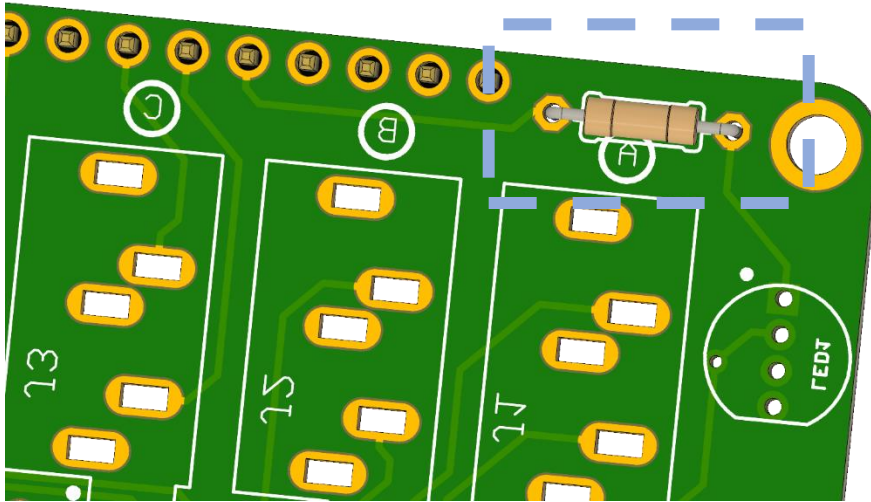
**Step 4 – 12 position female header connector x 1**



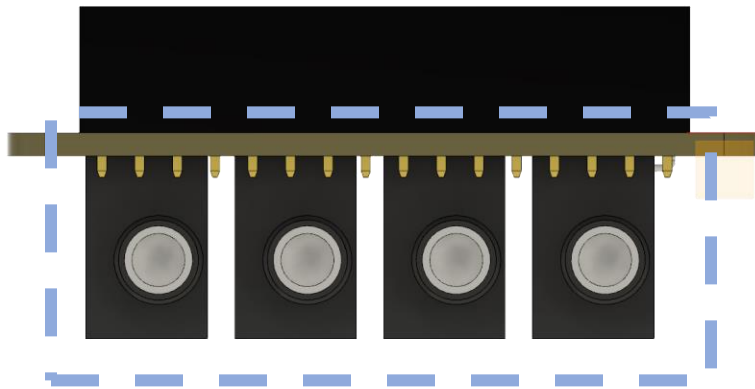
**Step 5 – Solder 14 position female header connector**



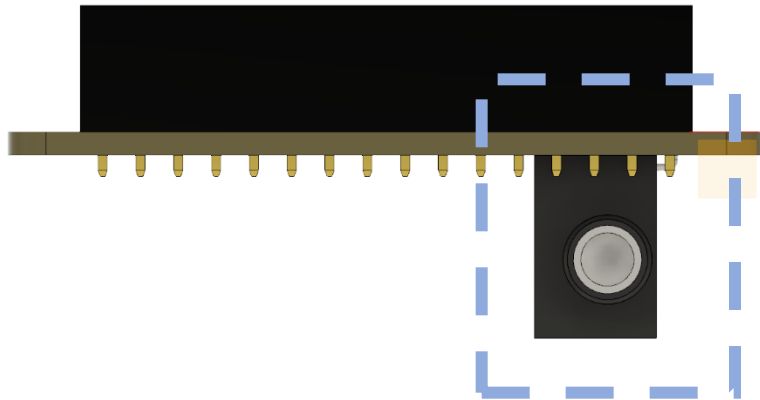
**Step 6 – 470 OHM Resistor**



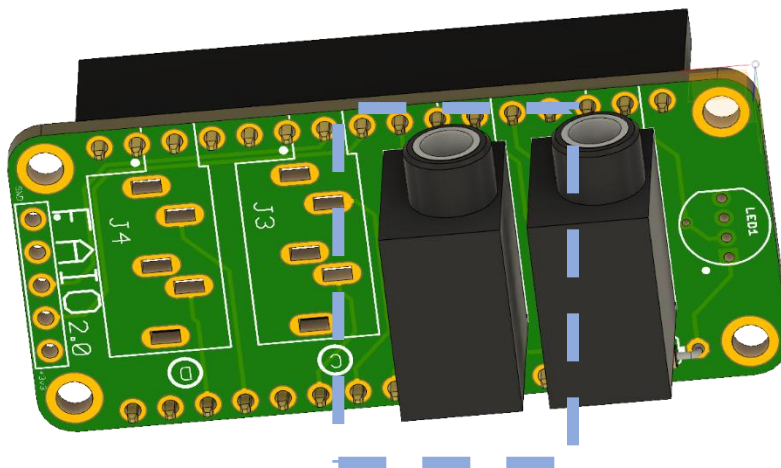
**Step 7 – Solder 470 OHM Resistor**



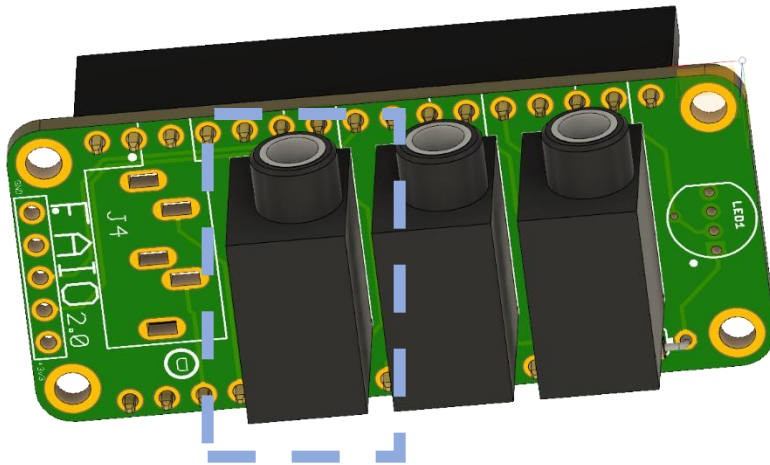
**Step 8 – 3.5 mm stereo audio plugs x 4**



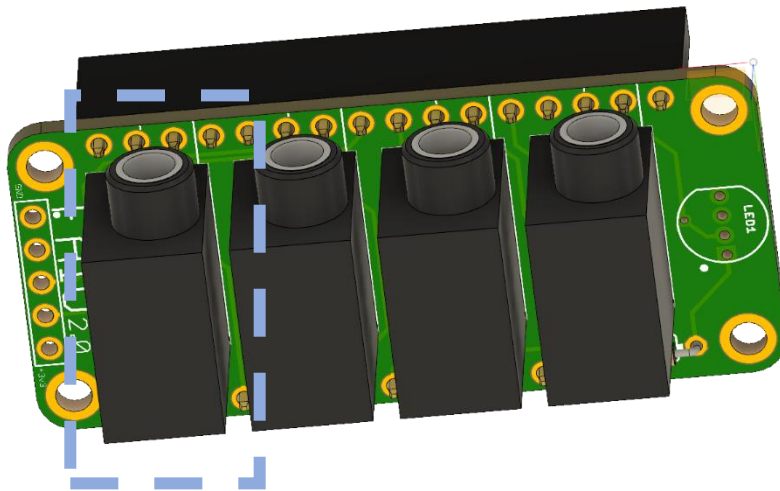
Step 9 – Solder 3.5MM plug A



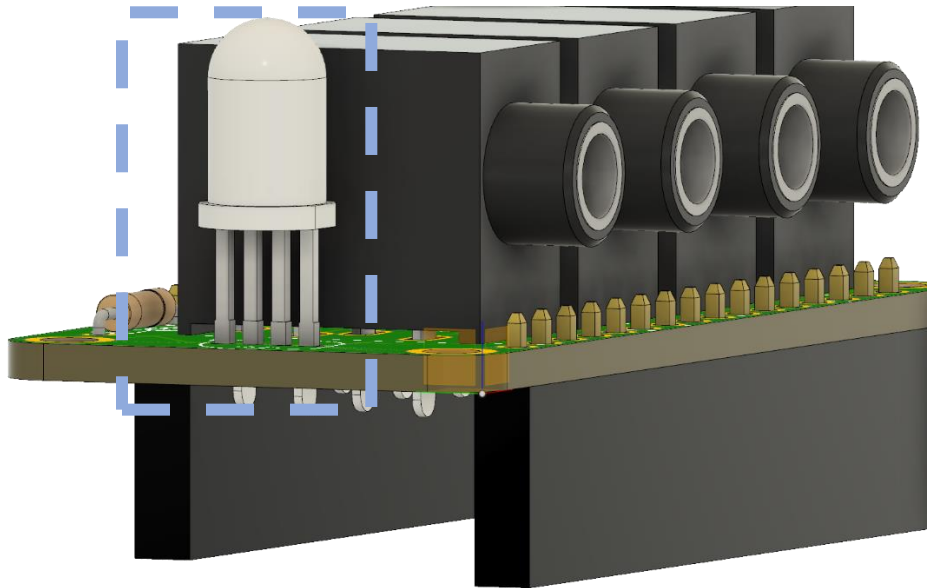
Step 10 – Solder 3.5MM plug B



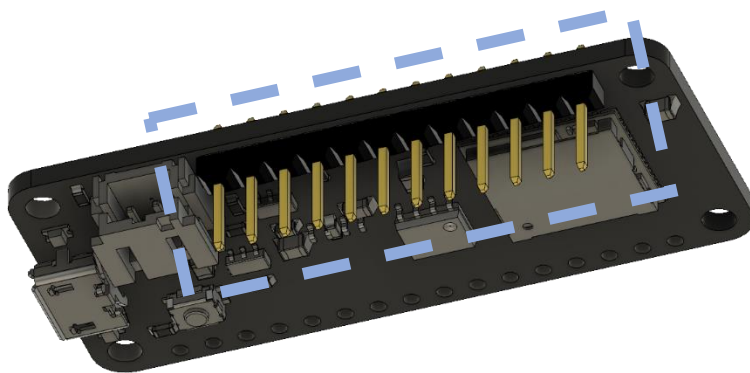
**Step 11 – Solder 3.5MM plug C**



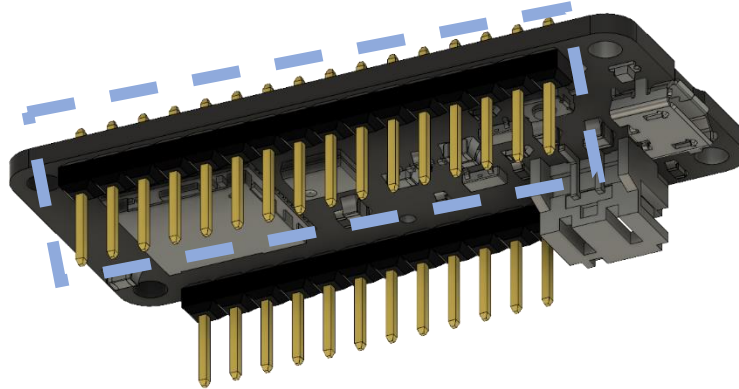
**Step 12 – Solder 3.5mm plug D**



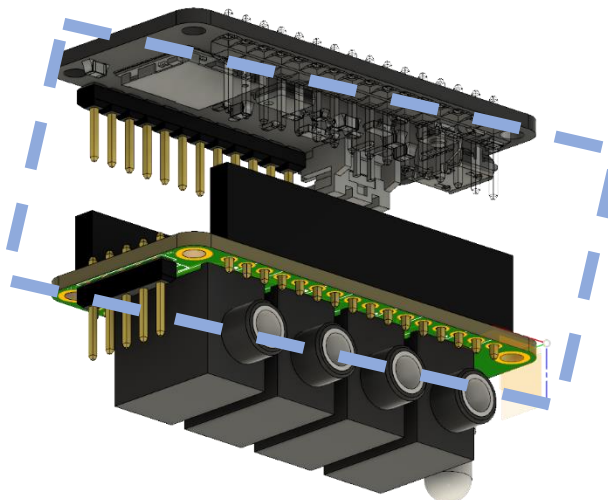
**Step 13 – Solder RGB LED x 1**



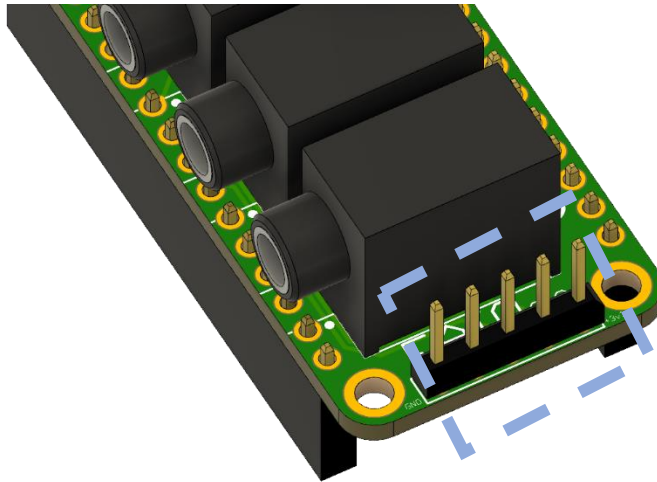
**Step 14 – Solder 16 position male header connector on feather board**



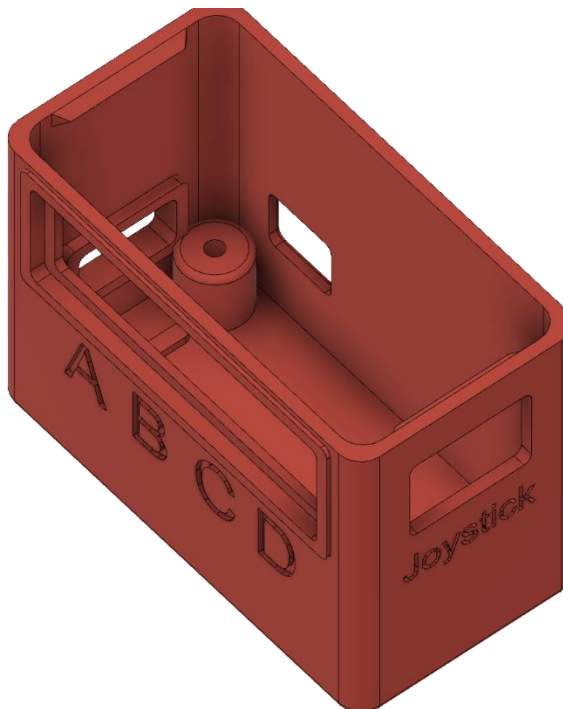
**Step 15 – Solder 12 position male header connector on feather board**



**Step 16 – Stack FAIO Multiplexer wing over the feather board**



**Step 17 – Solder 5 position male header connector on feather board**

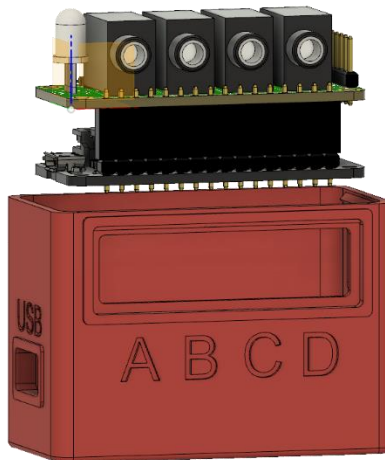


**Step 18 – 3D Print FAIO Multiplexer enclosure bottom part**





**Step 19 – 3D Print FAIO Multiplexer enclosure battery holder part and insert it into the enclosure**



**Step 20 – Insert the FAIO Multiplexer PCB Boards and electronics into the enclosure**



**Step 21 – Insert the M2.5 machine screws and nuts**



**Step 22 – 3D Print FAIO Multiplexer enclosure top part and insert it into the enclosure**