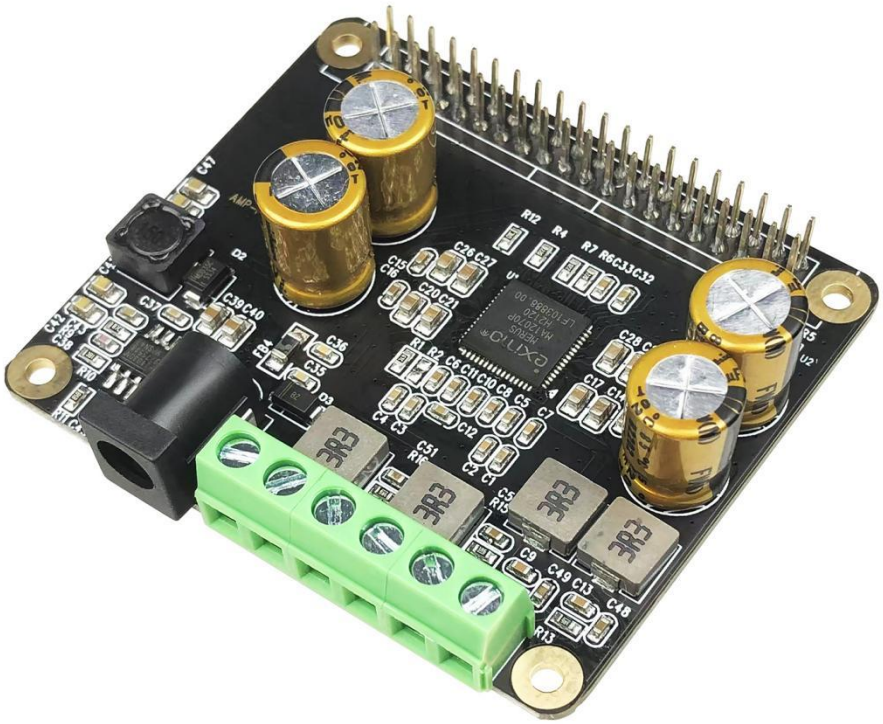
HIFI AMP Pro HAT User Manual



1、Overview

The Innomaker HiFi AMP Pro Hat is the best optimized partner for Raspberry Pi audio output, high-quality, highly efficient ,up to 2x80W peak Class-D power amplifier output for the Raspberry Pi. Just plug it into Raspberry and do some simple configuration, You can get a same high-class music player, but only pay 1/10 to 1/100 of the market price. This is a good choice to DIY your home stereo theatre or broadcasting system.

On-board MA12070P is a super-efficient audio power amplifier based on proprietary multi-level switching technology. Features an embedded digital power management scheme. The power management algorithm dynamically adjusts switching frequency and modulation to optimize power loss and EMI across the output power range. It supports sample rates from 44.1 kHz to 192 kHz, 2x30W continuous output and 2x80W peak output.It is largely used in Soundbars, Multiroom Systems and Home Theater Systems

2、Functions and Features

1. Compatible with all series Raspberry Pi through the 40-pin connector. Connects directly to the Raspberry Pi board, no additional cables required,no soldering required. Easy to get more beautiful and fantastic sound.

2. Perfect to support all Raspberry Pi music player system ,such as LibreELEC OSMC, Raspbian, RuneAudio, Volumio, Moode, Ubuntu etc. Support play music from a hard disk or over the network.

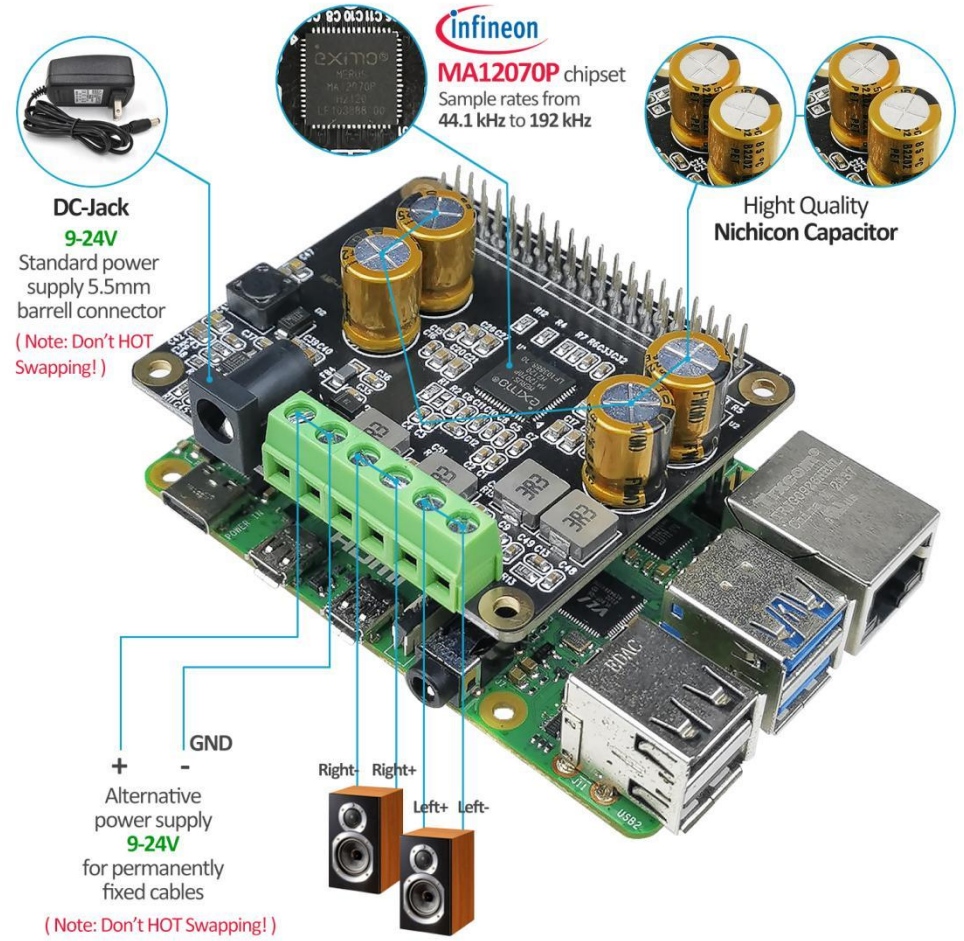
3. On-board MA12070P proprietary multilevel amplifier is a 2x80W Class-D digital-audio power amplifier for driving stereo bridge-tied speakers. Offers low distortion and acoustically accurate audio reproduction.

4. It supports sample rates from 44.1 kHz to 192 kHz. Up to 92% Efficient, Low EMI emission

5. Comes with software, document and friendly technology support. For more information please refer to our wiki（view the link on color page comes with the goods)

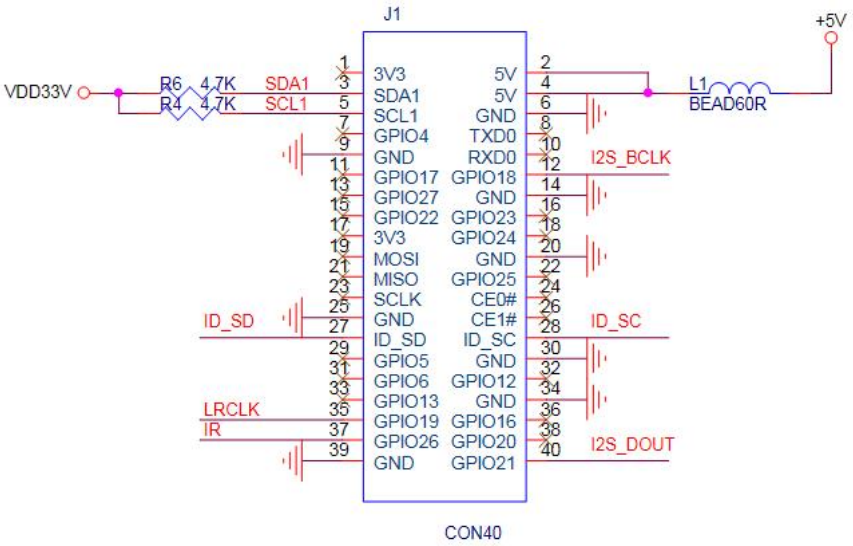
3.Hardware Description

3.1 Overview



3.2 PINOUT USAGE- FEMALE CONNECTOR

1)40 PIN Interface Schematic



2)40 PIN Interface Description

PIN	Symbol	Description
2, 4	+5V	+5V Supply Pin, connected to the main 5V supply of the Raspberry Pi. AMP Pro will power the Raspberry Pi Via this pins.
3	SDA1	SDA Used for AMP and EEPROM
5	SCL1	SCL Used for AMP and EEPROM
12	GPIO_18	IIS_BCLK
35	GPIO_19	IIS_LRCLK
37	GPIO_26	Infrared receiver reserved port
40	GPIO_21	IIS_DOUT
27, 28	ID SCL and ID SDA	Reserved for an ID EEPROM on the Raspberry Pi. These pins are always reserved and should never be used to connect external components
6, 9, 14, 20, 25, 30, 34, 39	GND	Ground Pin, connected to the main system Ground of the Raspberry Pi
The remaining pins are unused, You can use them for your other hardware boards.		

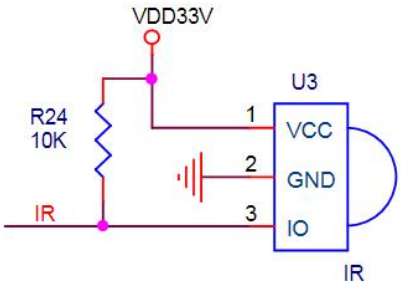
For more information about GPIO of Raspberry PI, please refer to below link:

https://www.raspberrypi-spy.co.uk/2012/06/simple-guide-to-the-rpi-gpio-header-and-pins/#prettyPhoto

https://docs.microsoft.com/en-us/windows/iot-core/learn-about-hardware/pinmappings/pinmappingsrpi

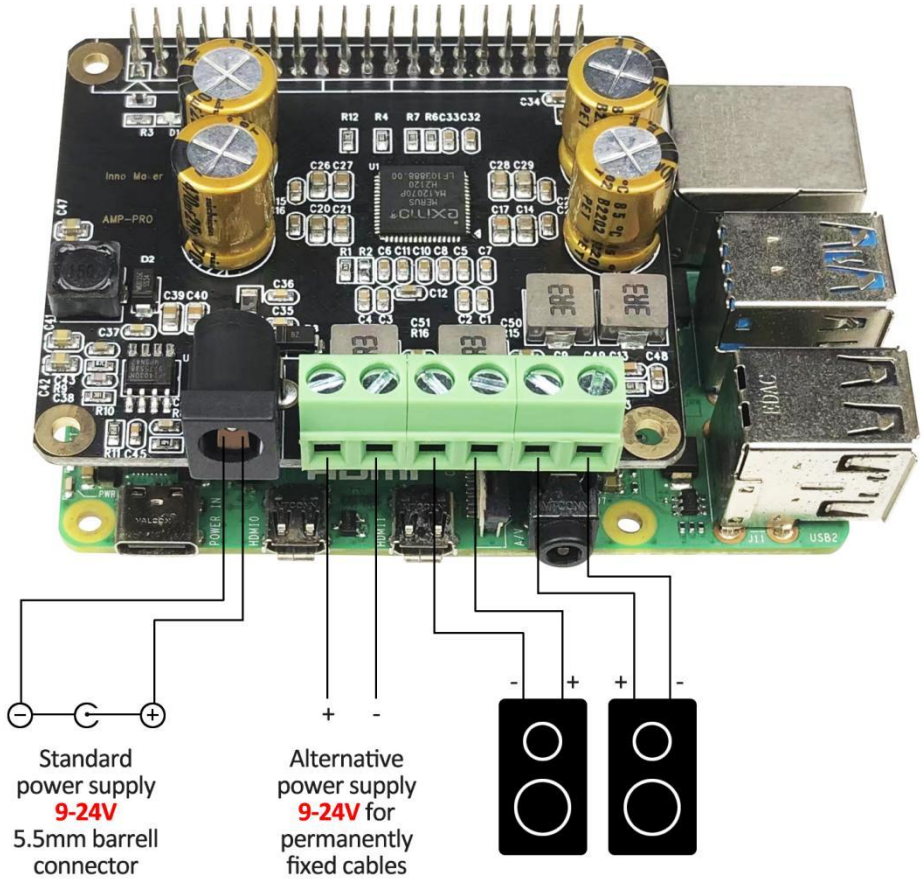
3.3 Extended Function

1) Infrared Receiver Function: (U3,No Soldering On-board)



IR is connected to PIN37(GPIO_26) , But we have no software for it right now. We will release new software version after finish it. If you have any advices please feel free to E-mail to us.

4.Hardware connection



Warning :

1. The Raspberry Pi will be powered by the Amp module only.So do not connect the 5V power supply to the USB port of the Raspberry Pi. Power supply is only one external 12-24V that will be connected directly to the Amp.

2. According to the datasheet from Infineon.Don't hot swapping the AMP board, otherwise the board will be burned. The right approach: Connect the power adapter to AMP PRO board, and then power up the adapter.

Description of the issue/limitation:

Hot plugging the PVDD pins can cause damage to the amplifier. Hot plugging can trigger the ESD-cells that are designed for ESD (Electro static discharge) and not the power/energy level of a fast voltage ramp up from power supply.

5. Software Description

5.1 Overview

Innomaker HIFI AMP Rro HAT module compatible with many Raspberry pi music playback system such as:
OSMC / Max2Play / RuneAudio / Volumio / Moode / PiCorePlayer / PiMusicBox / OpenELEC etc. You can choose your favorite. We take **Volumio/MoOde/Raspbian/LibreELEC** System for Example.

Note:

1) Because the third party will update the version unscheduled, so the actual UI may different from below user guide. But the configurations will be the same. If you meet any problem, you can Check the user help on the website of the third party or feel free to e-mail us.

2) The default setting is maximum volume of most system, it' will offensive your ears. So please turn down the volume before you enjoy it.

5.2 Download Image from website

Download the lastest image for Raspberry PI:

Volumio Image:
http://volumio.org/get-started/

MoOde Image:
http://www.moodeaudio.org/

Max2Play Image:
https://www.max2play.com/en/max2play-image/

LibreELEC:
https://libreelec.tv/downloads/raspberry/

Raspbian and Raspbian lite Image:
https://www.raspberrypi.com/software/operating-systems/

5.3 Load Image on to SD card.

Prepare a capacity of more than 8GB TF card and a card reader. Load the image file onto a SD card, using the instructions provided on the Raspberry Pi website for Linux, Mac or PC: https://www.raspberrypi.org/documentation/installation/installing-images/README.md

5.4 VOLUMIO Setup

Volumio is an entirely new music system. It is designed to play all your music, whether is an Hi-Res file or a Web Radio, with the highest quality. Control it with your favourite device, a smartphone, PC or tablet, and enjoy your music as you never did before.

Volumio is a Free and Open Source Linux Distribution, designed and fine-tuned exclusively for music playback. I supports all filetypes: FLAC, Alac, Aac, Vorbis, Mp3, DSD etc. and support

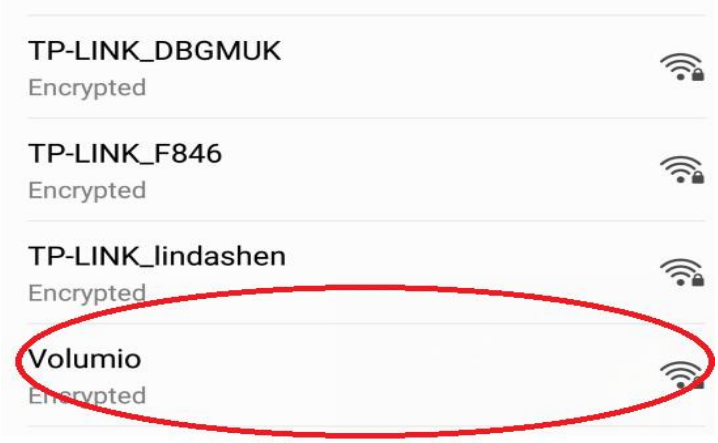
By flashing (installing) Volumio on any platforms, it will then become a headless Audiophile Music Player. Headless means that the only way to control it will be with another device, such as a Smartphone, Tablet, PC or anything that has a browser.

For more detail please refer to https://volumio.org/discover/.

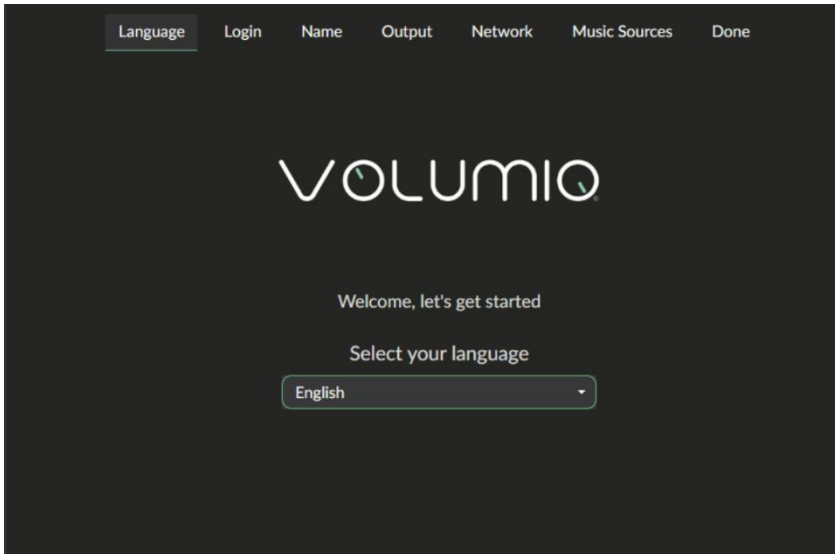
STEP:

1) Insert the TF card with volumio image into the Raspberry pi then power on.

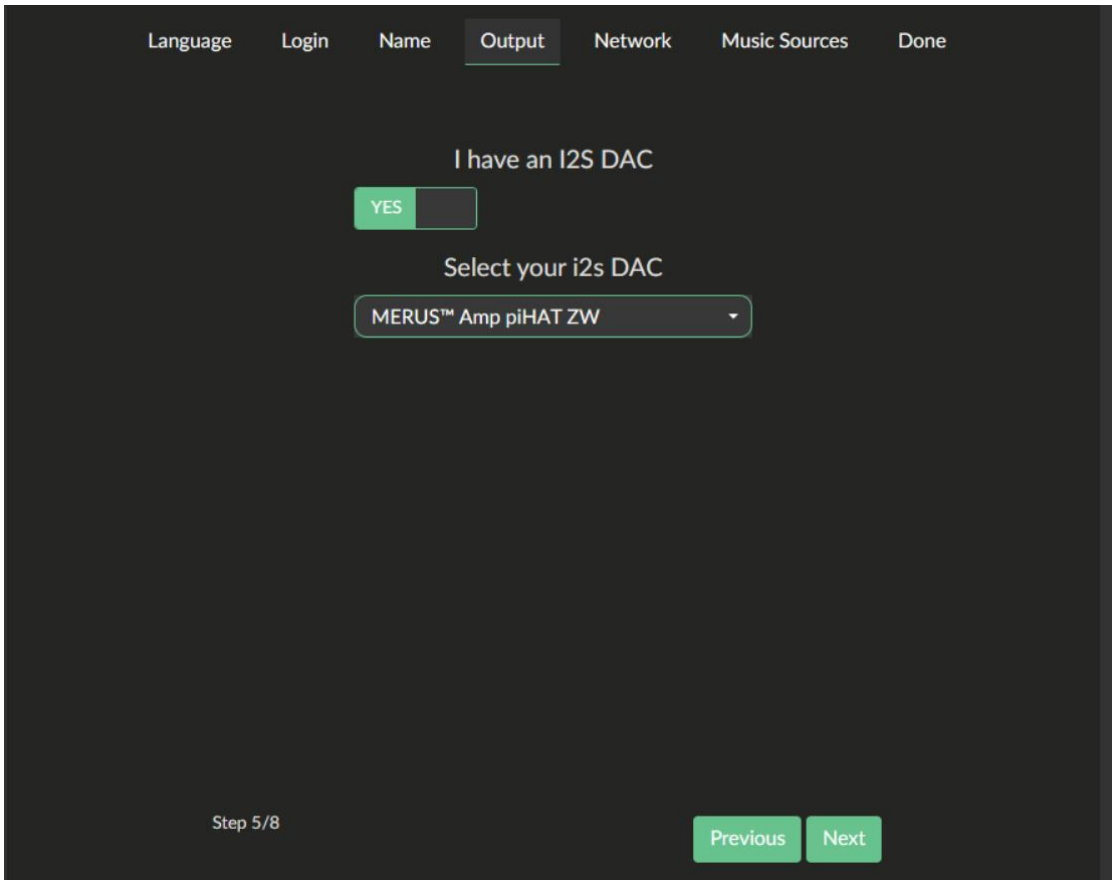
2) By using your smart phone, tablet or any device with WIFI and browser search for WIFI hotpots. You can see a ‘Volumio’ name in the search list. Connect this hotspot with password ‘volumio2’. You can change your password after login.



3)The browser will automatically eject playback software UI which is based on web interface (if you connect the hotspot successfully but for some reason browser can’t pop up the playback page automatically, you can using http://192.168.211.1 to login. You can see below wizard of Volumio. We only need to set “Language” , “Name” “Output” and “Done” for simple application.

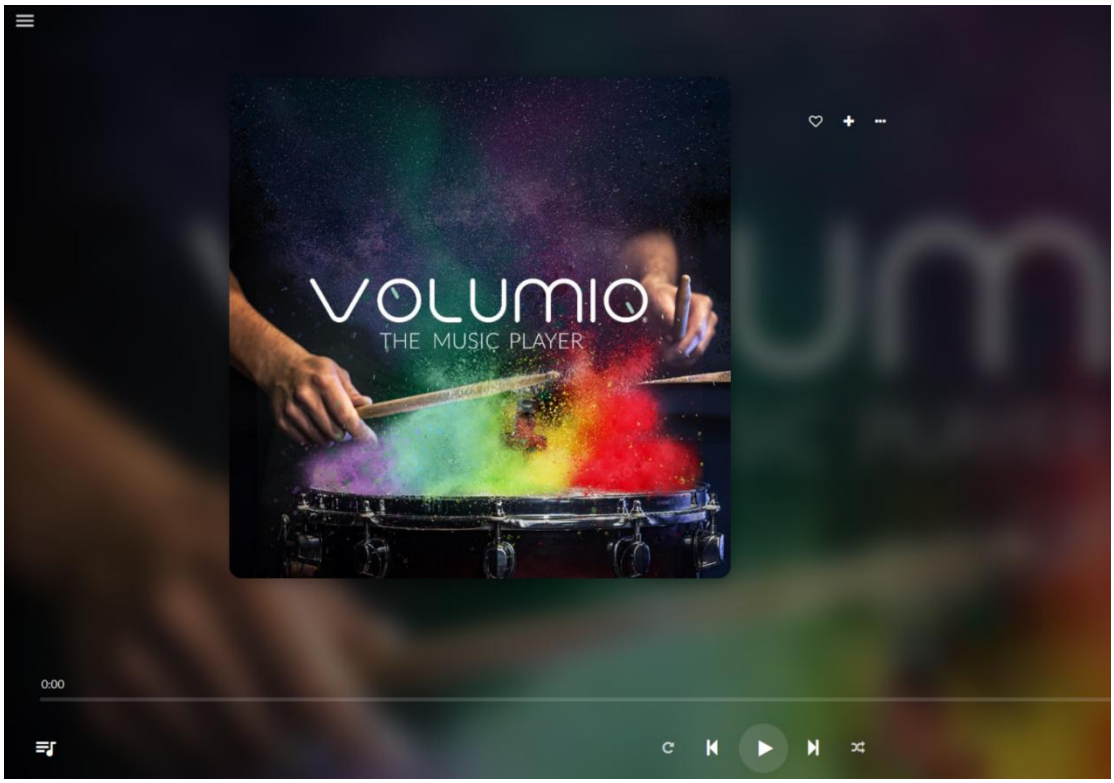


4)It should be noted that 'Output' page must set as **MERUSTM audio amp piHAT ZW**. This is an essential step, otherwise you can't hear anything.

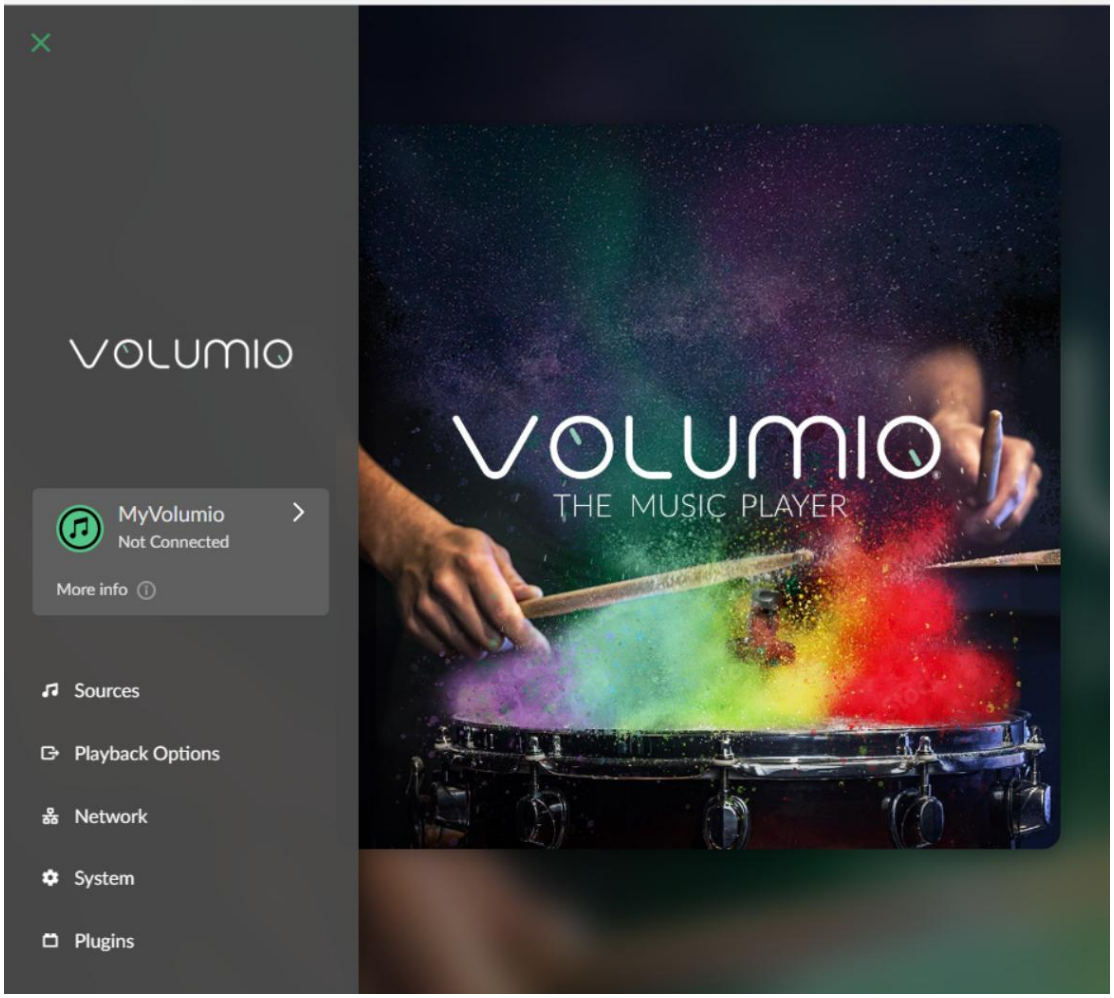


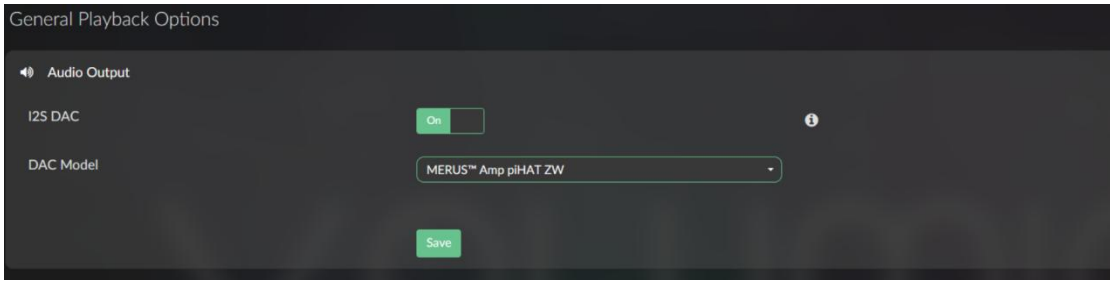
5)Click 'Done' to finish initialization of Volumio. And then restart Volumio.

6)In this restart process, “Volumio” hotpot will turn off for a moment. Sometimes your mobile phone or Tablet or PC will automatic connect to other. You need to set back to ‘Volumio’ hotpot. After restart you can see the main page of Volumio.

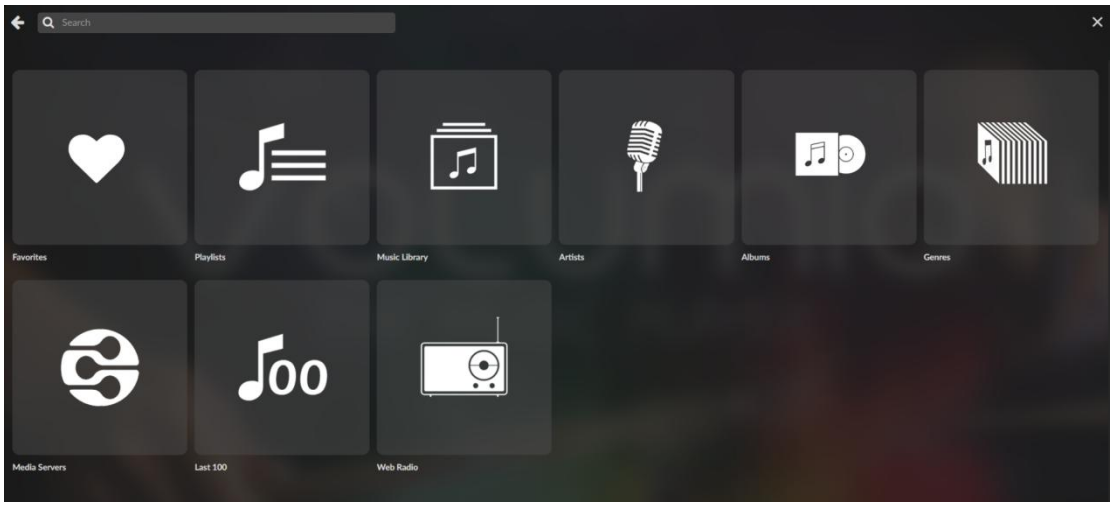


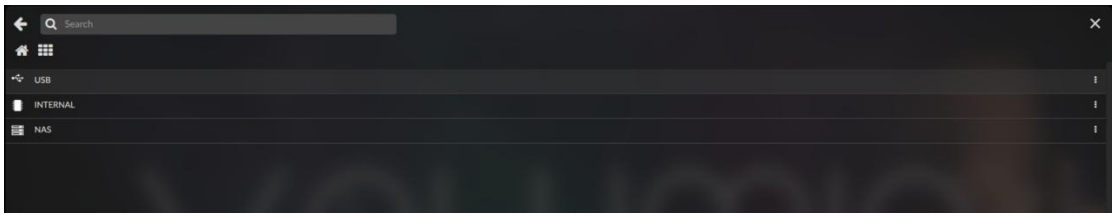
7)If you can't play music properly, please Click **Setting → PLAYBACK OPTION**, check the output setting as **MERUSTM audio amp piHAT ZW**. This is an essential step, otherwise you can't hear anything.





8)You can insert the USB Disk or mobile hard disk with your own audio file into Raspberry Pi USB connector, and find the music list of your USD disk in **Music Library → USB**.





5.6 MoOde Setup

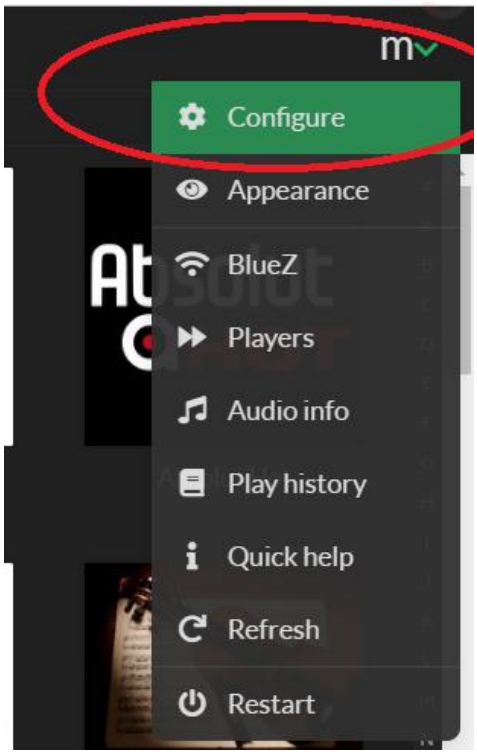
1)We just talk about the basics, for more Information please read the official user manual: https://github.com/moode-player/moode/blob/master/www/setup.txt

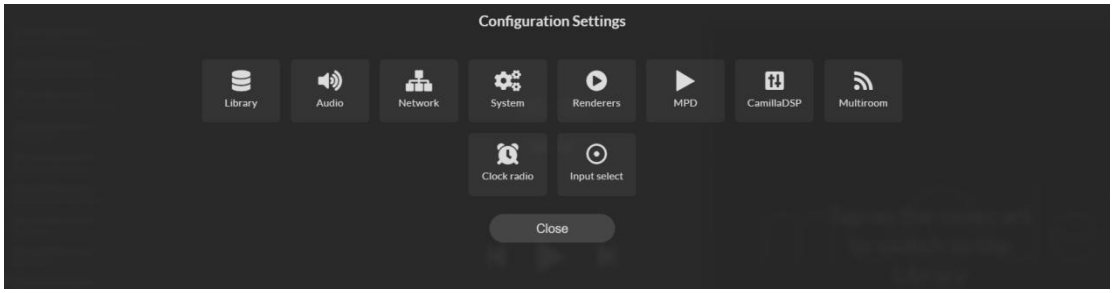
2) Insert the TF card with MoOde image into the Raspberry pi, and then connect to your router by LAN cable, Finally power on. Make sure your Raspberry Pi , Desktop (mobile phones, laptop, pad and so on) in the same local area network(LAN). Get the IP address of Raspberry PI through check up the router or use some IP checker tools.

3)You also use your device(mobile phones, laptop, pad and so on) to connect the hotspot of moode. Named: ‘Moode’, and Password is ‘moodeaudio’. Login page: http://172.24.1.1/

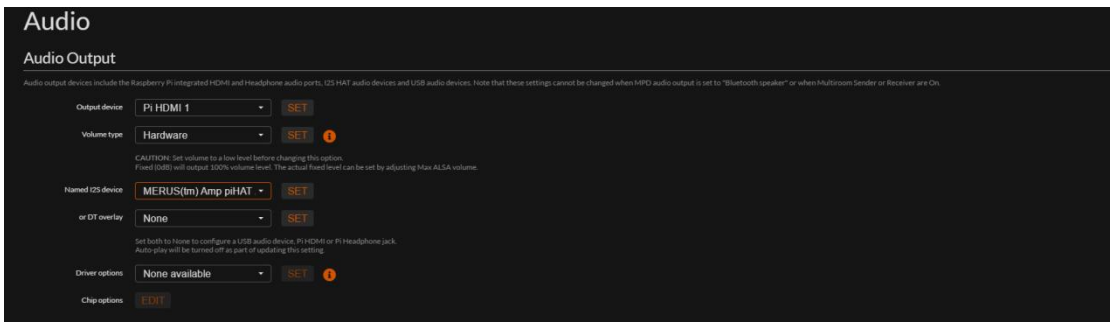
4) Connected the Raspberry Pi through browser. You get the display of Moode.

5)Click the icon in the upper right for setting the system.





6) Click 'Audio', set as **MERUSTM audio amp piHAT** and save and restart. This is an essential step, otherwise you can't hear anything.



7)Now you can enjoy your music.

8)You can play music in the SD/MMC card, U disk which connected with Raspberry Pi. But Moode may not automatic update disk default, so you need to set usb auto DB update.

5.8 Raspbian(Lite) Setup

1) Preparation

Download the Raspbian image into the TF card and insert the your TF card into Raspberry.

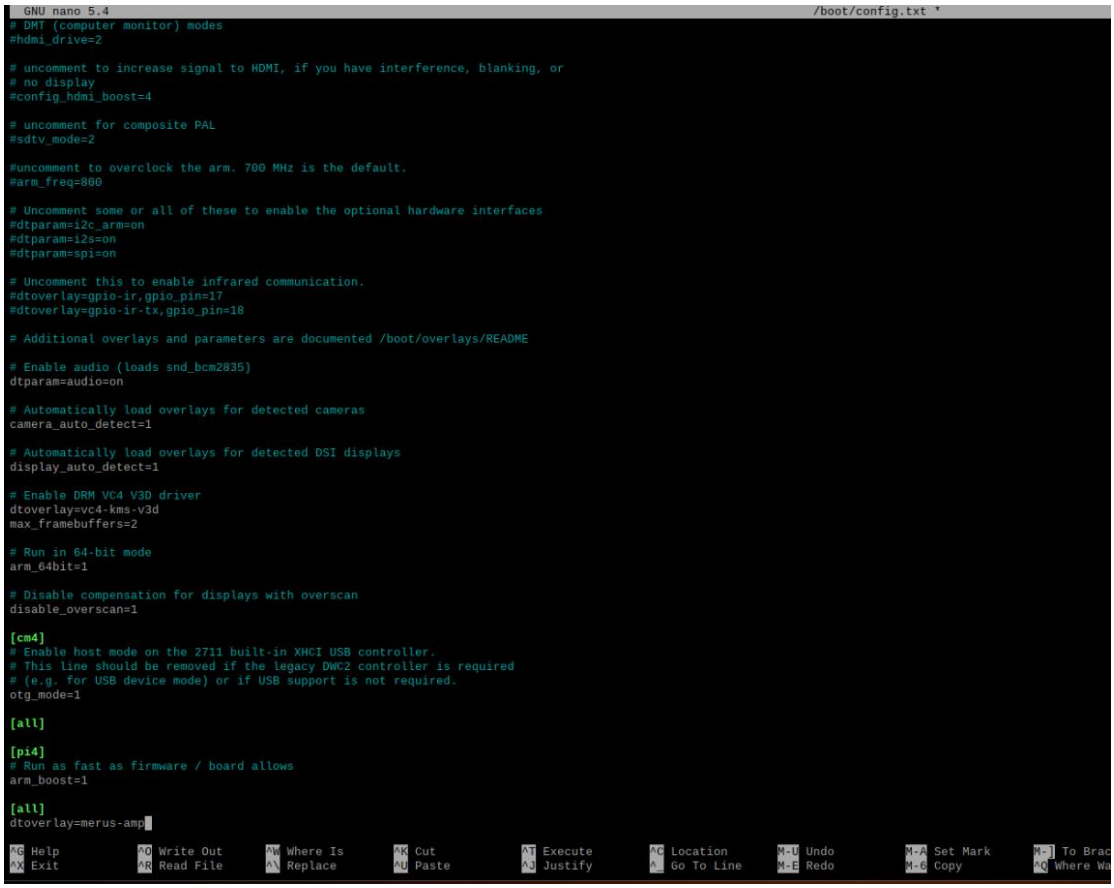
2) Open the config.txt

```
sudo nano /boot/config.txt
```

3)Modify the config.txt

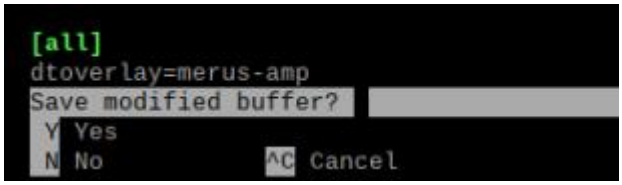
Add the following line below the previous modification in order to load the MERUSTM amp driver during boot-up.

```
dtoverlay=merus-amp
```

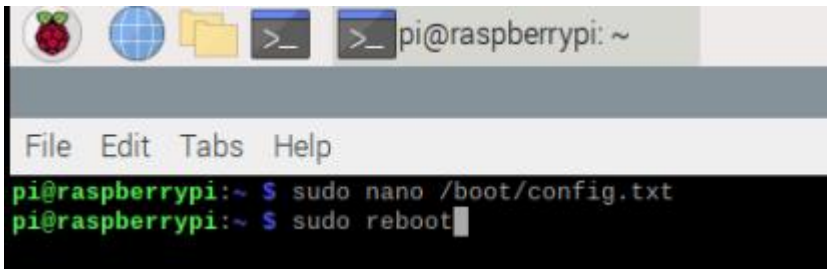


4)Save the file.

Press CTRL+X to exit and Press Y to save the file.

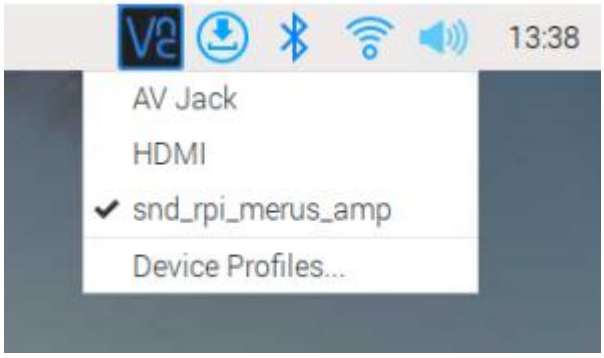


5) Reboot



6) Select the audio device on Raspbian with Desktop.

If you are using the Raspbian with desktop, you could selecet the output device at the top-right corner.



7) Select the audio device on Raspbian Lite.

Type in the commands that are shown below. You can see the , the **3** is the AMP Pro device number.

```
aplay -l
cat /proc/asound/cards
```

```
pi@raspberrypi:~ $ aplay -l
**** List of PLAYBACK Hardware Devices ****
card 0: Headphones [bcm2835 Headphones], device 0: bcm2835 Headphones [bcm2835 Headphones]
  Subdevices: 8/8
  Subdevice #0: subdevice #0
  Subdevice #1: subdevice #1
  Subdevice #2: subdevice #2
  Subdevice #3: subdevice #3
  Subdevice #4: subdevice #4
  Subdevice #5: subdevice #5
  Subdevice #6: subdevice #6
  Subdevice #7: subdevice #7
card 1: vc4hdmi0 [vc4-hdmi-0], device 0: MAI PCM i2s-hifi-0 [MAI PCM i2s-hifi-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 2: vc4hdmi1 [vc4-hdmi-1], device 0: MAI PCM i2s-hifi-0 [MAI PCM i2s-hifi-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 3: sndrpimerusamp [snd_rpi_merus_amp], device 0: Merus Audio Amp ma120x0p-amp-0 [Merus Audio Amp ma120x0p-amp-0]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
pi@raspberrypi:~ $
```

```
pi@raspberrypi:~ $ cat /proc/asound/cards
 0 [Headphones     ]: bcm2835_headpho - bcm2835 Headphones
                      bcm2835 Headphones
 1 [vc4hdmi0       ]: vc4-hdmi - vc4-hdmi-0
                      vc4-hdmi-0
 2 [vc4hdmi1       ]: vc4-hdmi - vc4-hdmi-1
                      vc4-hdmi-1
 3 [sndrpimerusamp ]: RPi-simple - snd_rpi_merus_amp
                      snd_rpi_merus_amp
pi@raspberrypi:~ $
```

8)Set as default sound card.

Create /etc/asound.conf

```
sudo nano /etc/asound.conf
```

```
pi@raspberrypi:~ $ sudo nano /etc/asound.conf
```

Type in the following content and then press "ctrl+x" and press "Enter" to save the file. Reboot again. 3 is the DAC module device number.

9)Alsamixer

Type in the commands that are shown below, you can see the alsamixer tool.

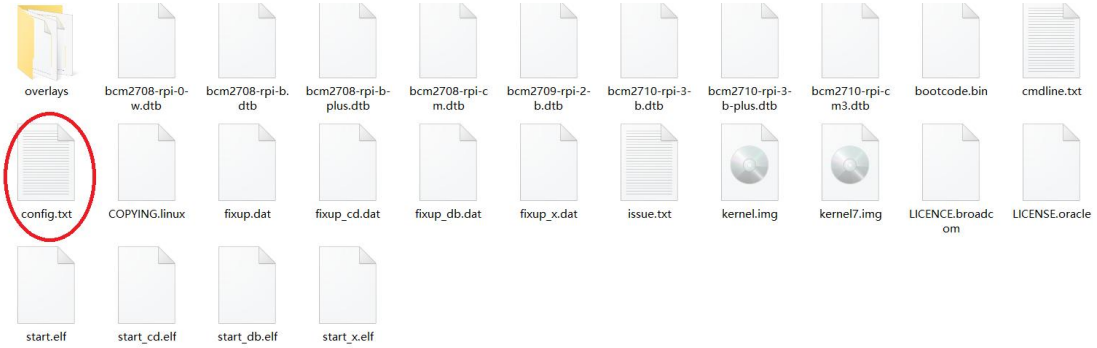
```
alsamixer
```


AlsaMixer v1.2.4
Card: snd_rpi_hifiberry_amp
Chip:
View: F3:[Playback] F4: Capture F5: All
Item: Master
F1: Help
F2: System information
F6: Select sound card
Esc: Exit
100
88<>88
Master
Channels

5.10 LibreELEC Setup

1) Modify the config.txt

After load the LibreELEC image into the TF card, Open TF disk directory on your computer and check the file named config.txt. For more information about this file please refer to : https://www.raspberrypi.org/documentation/configuration/config-txt/



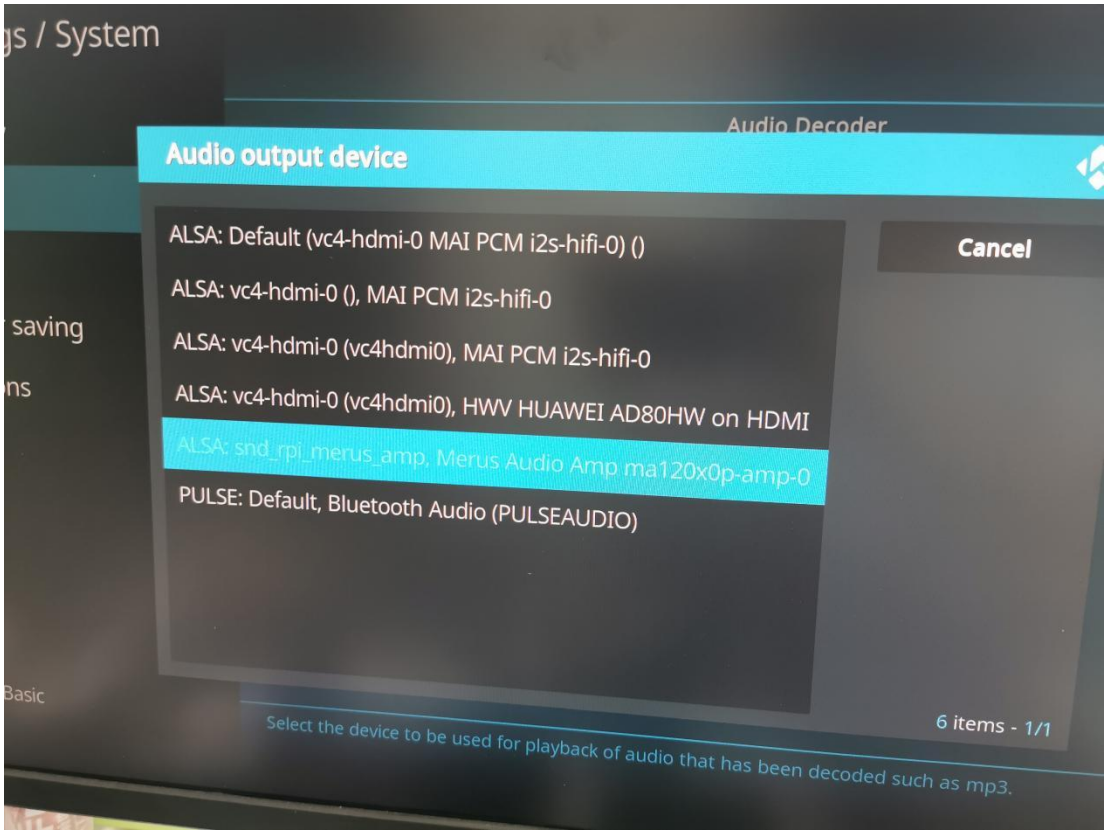
Append the following lines to the end of the file,enable the audio module.Draw attention to the format , Otherwise it doesn't work.

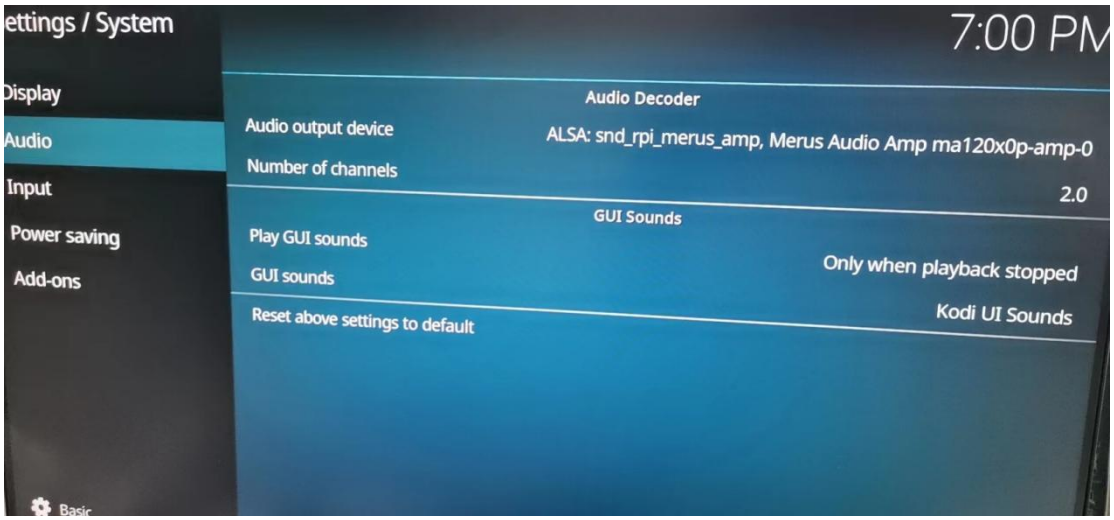
dtoverlay=merus-amp

```
[all]
################################################################################
# Use distroconfig-composite.txt instead of distroconfig.txt to enable
# composite video output.
# The composite video mode needs to be configured in cmdline.txt:
# For PAL add: video=Composite-1:720x576@50ie
# For NTSC add: video=Composite-1:720x480@60ie
################################################################################
include distroconfig.txt
#include distroconfig-composite.txt

# uncomment to enable analog audio output
#dtparam=audio=on
#audio_pwm_mode=1

# uncomment to enable infrared remote receiver connected to GPIO 18
#dtoverlay=gpio-ir,gpio_pin=18
dtoverlay=merus-amp
```

2)Open the system page on LibreELEC

3) Set the Audio output device as snd_rpi_merus_amp.





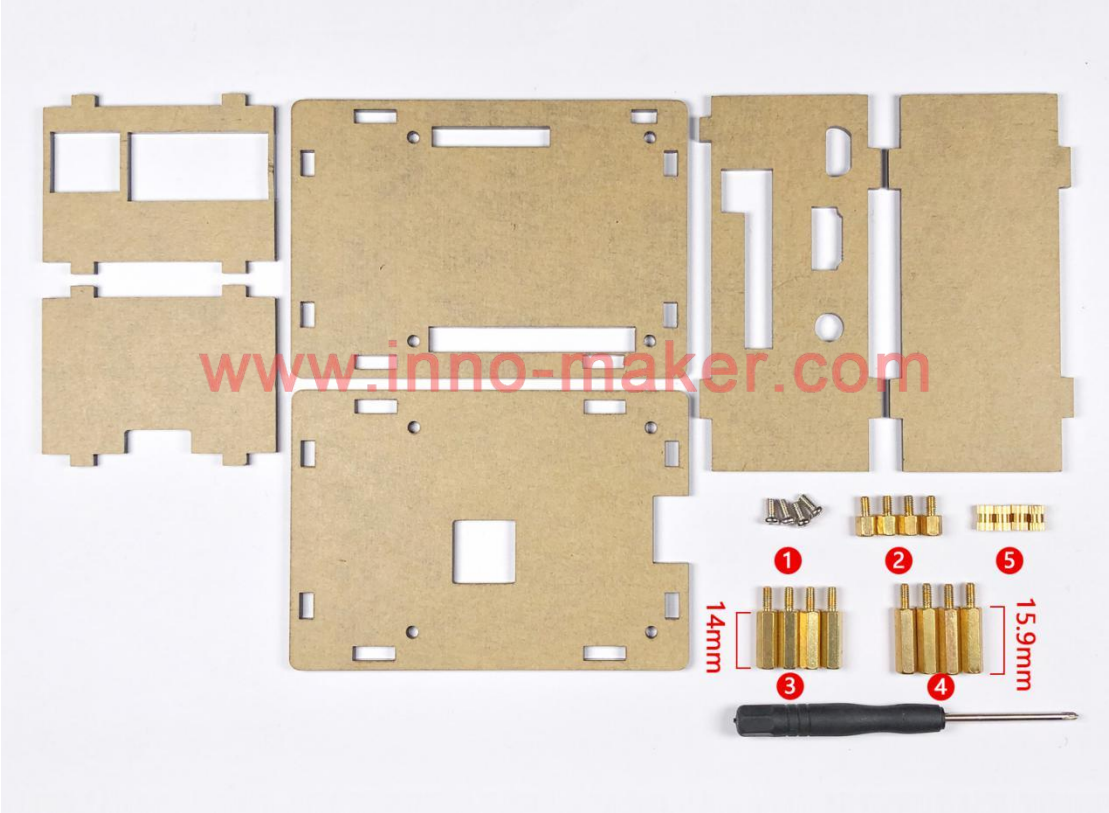
6. HIFI AMP Pro Acrylic Case Assembly

We provide case as an optional accessory if interested.

5.1 Unpack it.

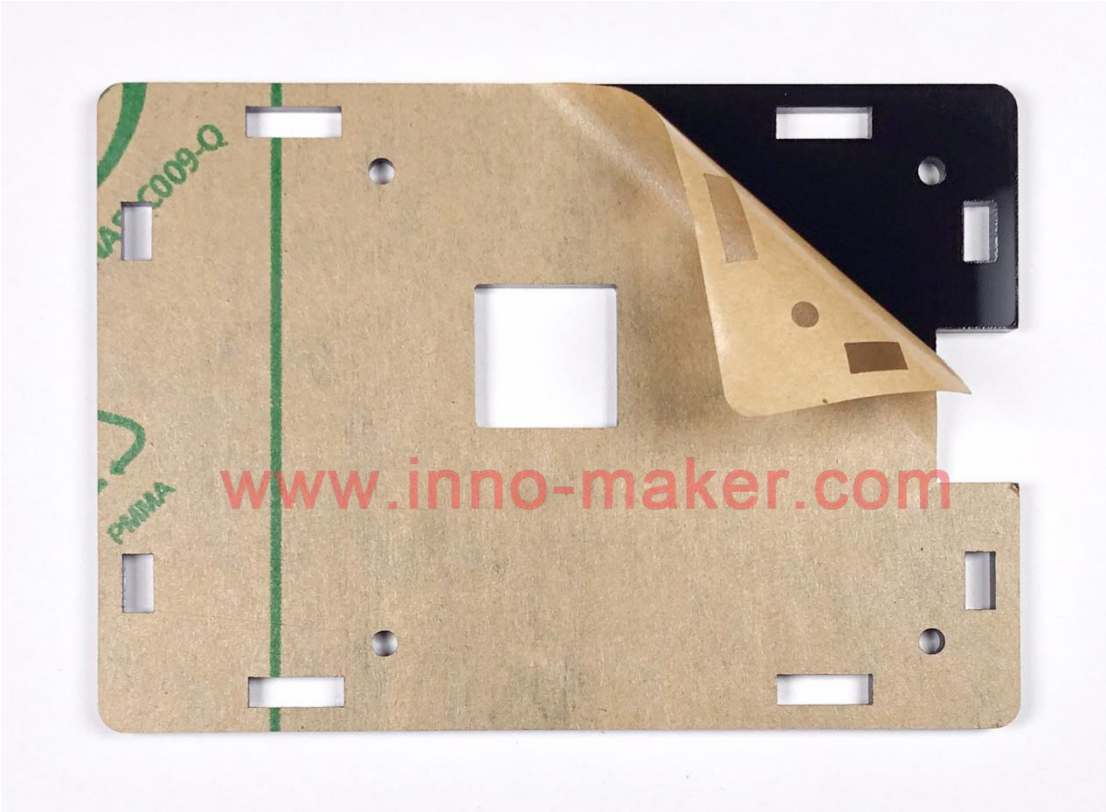
Package contain :

1. 6 pcs acrylic plate
2. 5 groups of screw
3. 1 screwdriver

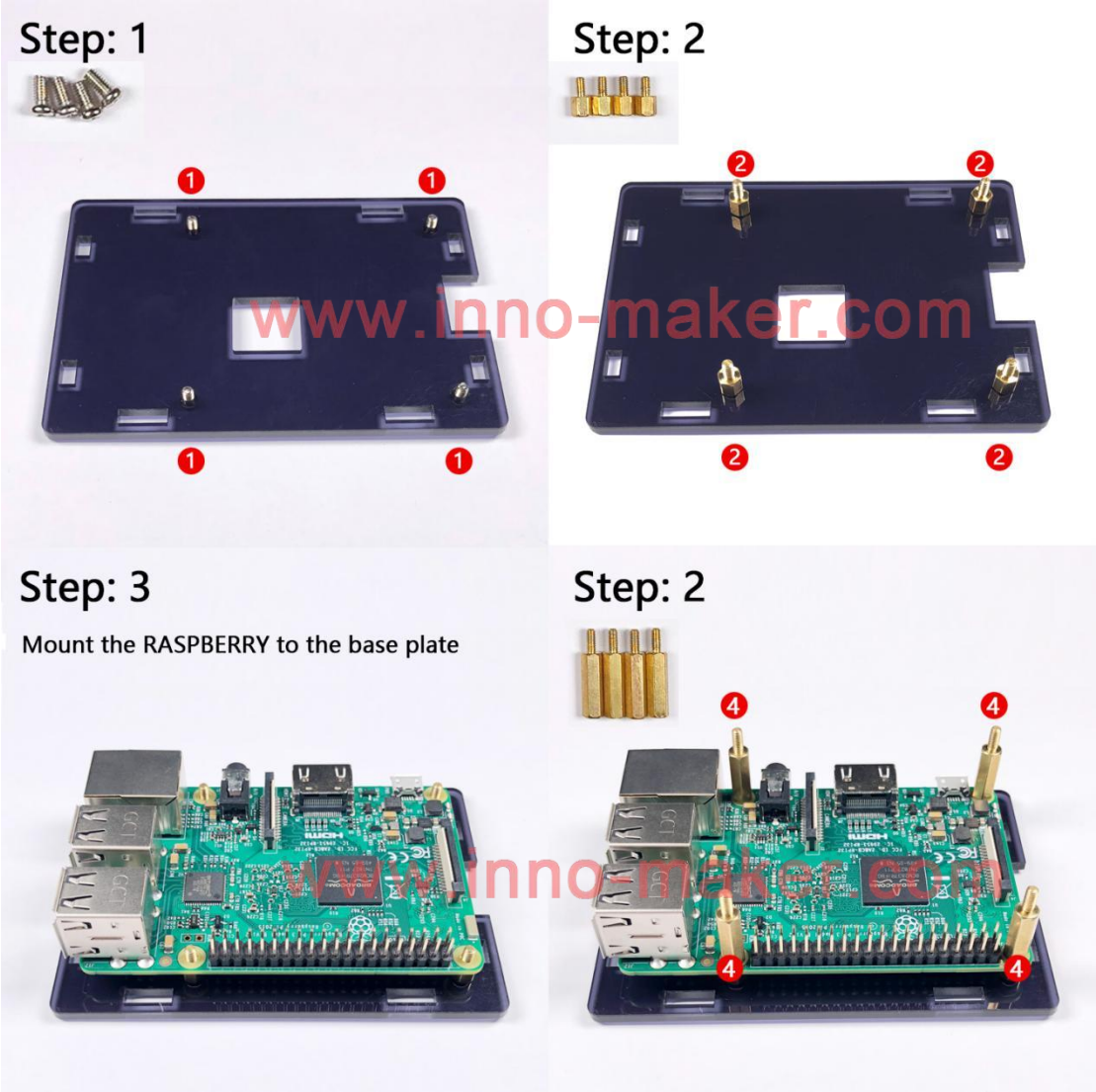


5.2 Peel the protection film

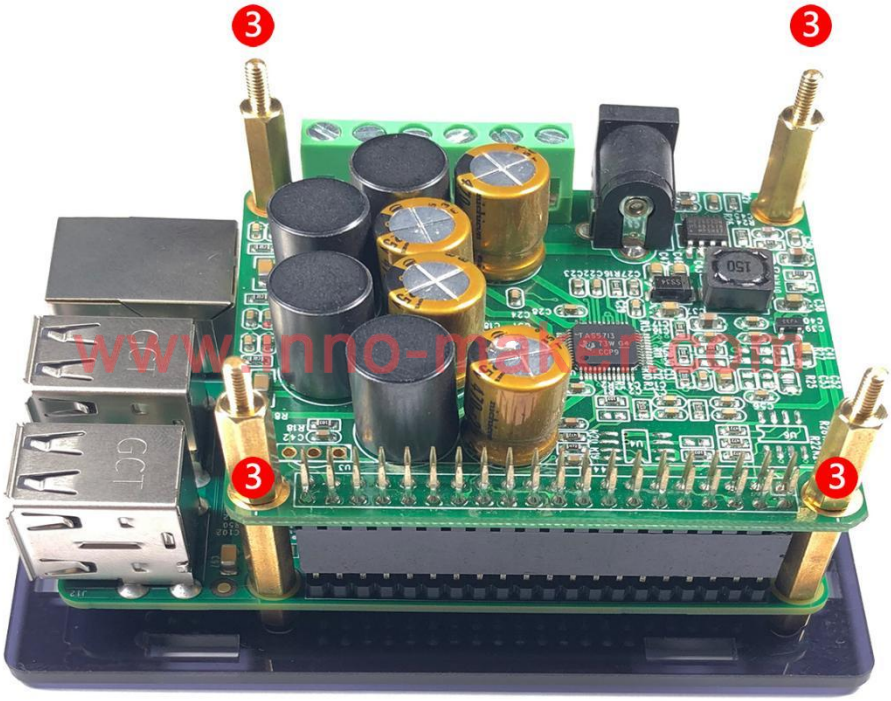
There is a protection film on both sides of all acrylic plate. You need to peel it off before assembling the case.



5.3 Mount the RASPBERRY to the base plate.Please pay attention to the groud number.

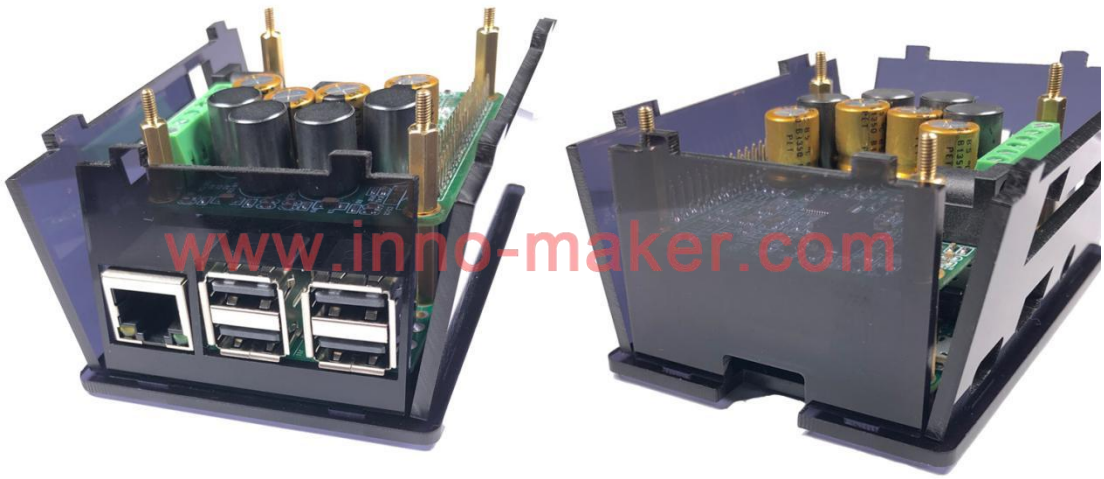


5.4 Plug the AMP module into the 40 pin GPIO head.



5.5 Add two long side plates.

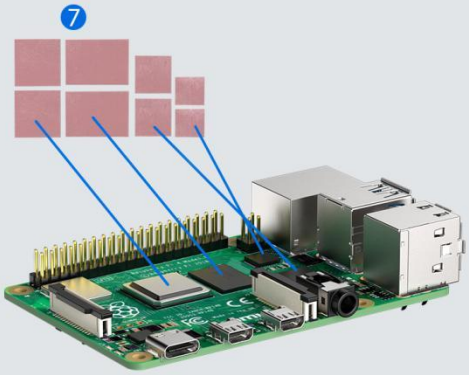
5.6 Add two short side plates.



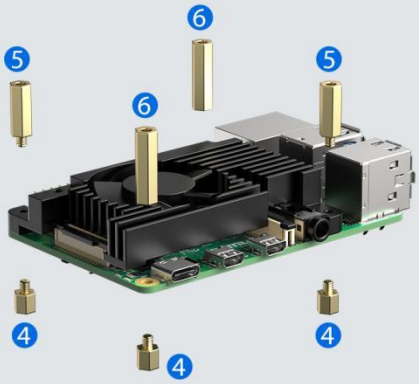
5.7 Add top plate and screw down.

7. HIFI AMP Pro Aluminum Case Assembly

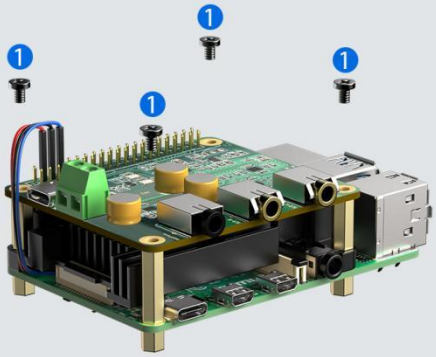
1. Install the thermal pads to raspberry pi 4



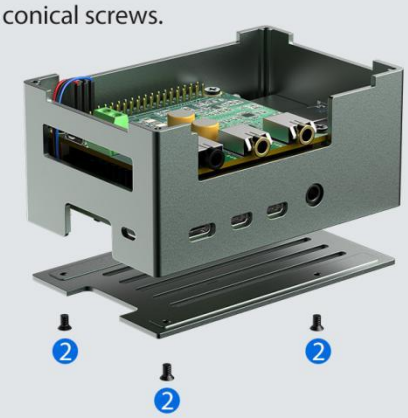
2. Install the heatsink to raspberry pi 4 with copper column screws.



3. Install InnoMaker audio hat to raspberry pi 4 with flat-head cross screws.



4. Put the item into aluminum alloy shell and install bottom with conical screws.



5. Install acrylic top cover with hexagon socket screws.

6. Install buffer strips to the bottom.