USB Audio Cards with a Raspberry Pi

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Instructions

The Raspberry Pi has an on-board audio jack, which is super handy for all kinds of sound effects and speech, just plug and go! However, for when you want better audio for music playback, a USB audio card can greatly improve the sound quality and volume, this tutorial will show you how.

This guide will also show you how to record audio via the headphone jack on the adapter

Pre-requisites

First up, you will need a fully set up Raspberry Pi that is otherwise working and you can log into. We have tons of tutorials on that front, so get your SD card loaded with Raspbian (that's what we're using in this tutorial), and either ssh in, log in with a monitor and keyboard, or a USB console cable

Just a reminder, this tutorial is only known good for the USB audio card in the Adafruit shop. Audio cards all use different chipsets so if you have another card, it may not work here! You'll have to figure out what's different for your model.
Figure out your chipset

Start by having your Raspi turned off/shutdown (perform a clean shutdown!) and then plugging in your USB audio card. Then boot the Pi as normal.

Once you log in, type `dmesg | grep cm109` to look at the boot messages. You should either see some lines about cm109 if you have a CM109 chipset

or if nothing comes up, try `dmesg | grep Headphone` you will see the C-Media USB Headphone Set driver. This means its a CM-headphone

or if nothing comes up, try `dmesg | grep C-Media` you will see some C-Media notes but no mention of the cm109 driver. This means its a CM108 or PCM2902

or if nothing comes up, try `dmesg | grep General` you will see mention of GeneralPlus. This means it’s a GeneralPlus
CM108 Type

If you have CM108

If you type in `lsusb` you should see a reference to C-Media Electronics, Inc. CM108 Audio Adapter or Texas Instruments PCM2902 Audio Codec.

We'll need to update the firmware, this requires Internet access but only takes 15 minutes or so. You might want to run `sudo apt-get update` first if you haven't lately. Then run the following commands in order:

```
sudo apt-get update
sudo apt-get upgrade
sudo reboot
```

You may see a lot of stuff happening like the below:
Now you can go down to the update alsa module options () section

CM-Headphone Type

Type dmesg to look at the boot messages. You should see a bunch of lines that talk about C-Media USB Headphone Set
And if you type in lsusb you should see a reference to C-Media Electronics Audio Adapter but no mention of CM108 and the VID/PID is 0x0d8c:0x00c

Nothing special needs to be done! Hurray! Continue on to the Updating ALSA Config section

**CM109 Type**

Type dmesg to look at the boot messages. You should see a bunch of lines that talk about cm109
And if you type in `lsusb` you should see a reference to C-Media Electronics Audio Adapter but no mention of CM108.

Nothing special needs to be done! Hurray! Continue on to the next section.

### GeneralPlus

Type `dmesg` to look at the boot messages. You should see a bunch of lines that talk about GeneralPlus.

And if you type in `lsusb` you should see a reference to Generalplus Technology with ID `1b3f:2008`.

Nothing special needs to be done! Hurray! Continue on to the next section.

### Updating ALSA Config

**Raspbian Bullseye - Updating alsa options**

First make sure you can see the alsa card for the USB audio device with
```bash
cat /proc/asound/cards
```

And look for something that says "USB Audio" or similar

Depending on whether you are running a Pi 4 or other, it may be device 1, 2 or 3.

![Image of sound card list](image)

we used to recommend manually setting the device number to be your USB audio card but that turned out to be fragile because the HDMI audio device numbers would change.

So now we suggest just disabling the built in headphone jack audio, and letting the USB audio card be 'first'

Start by disabling the built-in headphone jack with

```bash
sudo nano /etc/modprobe.d/raspi-blacklist.conf
```

and typing in

```bash
blacklist snd_bcm2835
```

hit return, then save with Control-X then Y then Return (to save)

![Image of nano editor](image)

Then enable the USB audio card with

```bash
sudo nano /lib/modprobe.d/aliases.conf
```

find the line with
options snd-usb-audio index=-2

and put a # in the beginning of that line. Then exit and save file.

Then `sudo reboot` to 'set' the changes

Upon reboot, if you run `sudo aplay -l` to list the interface, the USB audio card will be first and the default!

---

Testing Audio

Testing!

OK now that you've configured ALSA depending on your OS...that's it! Now reboot with `sudo reboot` and log in again, you can test with `speaker-test` by running

`speaker-test -c2`

Which will play white noise through the left and right 'speakers' on the audio card. Once you've got something coming out, try to play an audio file with `speaker-test` (for WAV files, not MP3)
If you want to play a stream of music, you can try

```bash
sudo apt-get install mpg123
mpg123 http://ice1.somafm.com/u80s-128-mp3()
```

If you want to play MP3's on command, check out this tutorial which covers how to set that up

## Headphone vs Audio card

Don't forget, you still have the built in headphone jack on the Pi, if you edited alsa.conf it might be called card 1 now (not the default card 0)

You can run `aplay -l` to list the devices

If you want to `aplay` through a specific card, specify card 1 with `-D plughw:1,0` or card 0 `-D plughw:0,0` etc
Setting Audio Levels

You can set audio levels for both output and input with

```
speaker-test -c2 -D plughw:1,0

aplay --device=hw:1,0 test.wav
```

Use the arrow keys and return/escape to set and save the settings. It's a sorta-cute text-graphics system

![Image of AlsaMixer](image)

Recording Audio

At least with the CM-Headphone type adapter, you can also record audio.

```
arecord --device=hw:1,0 --format S16_LE --rate 44100 -c1 test.wav
```

Will record signed 16-bit (S16_LE) audio at 44100 Hz (---rate 44100) mono (-c1) audio to test.wav. We've noted that any audio input will be echoed out the speakers as well

You can have a little VU meter show up if you add to the -V mono command line. Press control-C to quit
Once you're done recording you can play back with

```bash
aplay --device=plughw:1,0 test.wav
```

## Troubleshooting!

If you're using a Raspberry Pi and notice the output isn't totally clean, some USB Audio adapters don't like USB-1.2 and produce crackling in the output. You can work around the problem by adding `dwc_otg.speed=1` to `/boot/cmdline.txt` and setting the USB ports to USB-1.1 mode.

You can get user access to the audio hardware with other devices by granting access using `sudo usermod -a -G audio username`