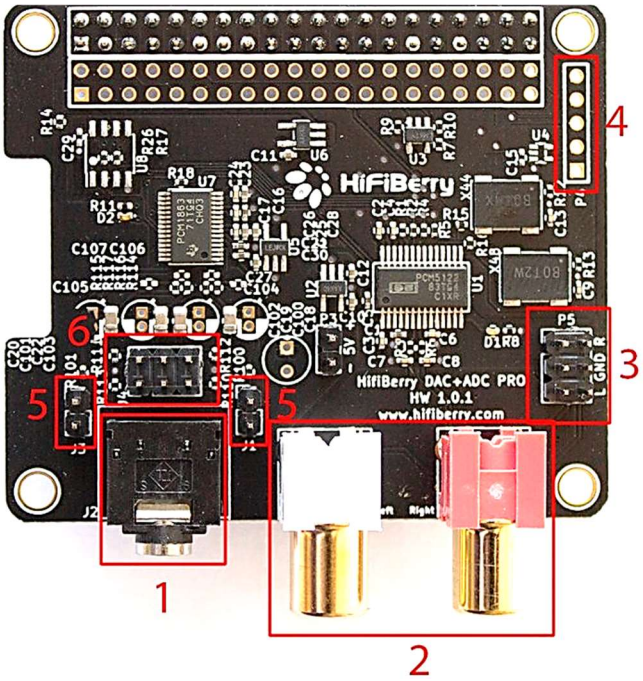
Building and Initialization of the hearing loss simulator

1. Hardware assembly

The Hifiberry DAC+ADC Pro is delivered with four spacers, screws and nuts. The spacers are put on top of the Raspberry Pi (RPi) and tightened with nuts from the backside of the RPi.

Now you can push the Hifiberry HAT onto the GPIO-pins of the RPi and tighten it with the screws.

To activate phantom power for the microphone inputs, two pins on either side of the microphone connector (see nr. 5 on the picture below) have to be bridged by jumpers or cable bridges. The RCA to TRS adaptor has to be applied to the RCA audio outputs of the hat so the Roaland headset can be connected. The red plug of the headset is connected directly to the microphone input, the black plug is connected to the adaptor.



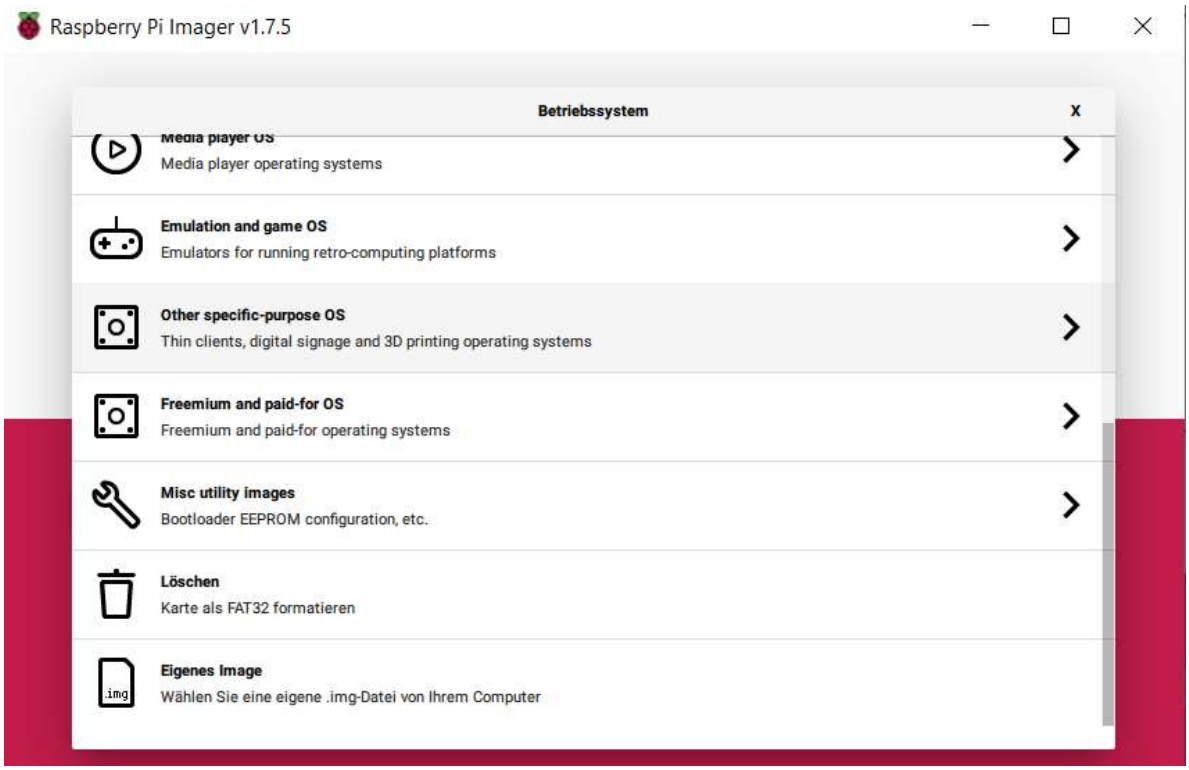
For further details look at: https://www.hifiberry.com/docs/data-sheets/datasheet-dac-adc-pro/

2. Software setup
    a. Install Patchbox OS

The OS for an RPi is “etched” (installed/copied) onto an SD-card. 8 GB or more is recommended.

Patchbox OS provides an installation manual at https://blokas.io/patchbox-os/docs/install-os-to-sd-card/.

Alternatively, an image of Patchbox OS can be found and downloaded here: https://blokas.io/patchbox-os/. You can etch this on a Card with the official Raspberry Pi Imager provided here: https://www.raspberrypi.com/software/ In the imager software select „choose OS“ and then the last option in the list „Own Image“. Then locate the previously downloaded image (Zip-File) of Patchbox OS.



Optionally it is recommended to set a custom user name and password in the options menu of the Raspberry Pi Imager. You can also automatically transfer UUID and password of the currently used Wifi connection so you can immediately access the internet on the RPi.

After the process has finished (may take several minutes), you insert the SD-card into the RPi and power it up. On first startup, Patchbox OS will configure for your specific RPi model and after a few minutes you will find yourself in a terminal.

b. Add Hifiberry HAT to Device Tree and configure it

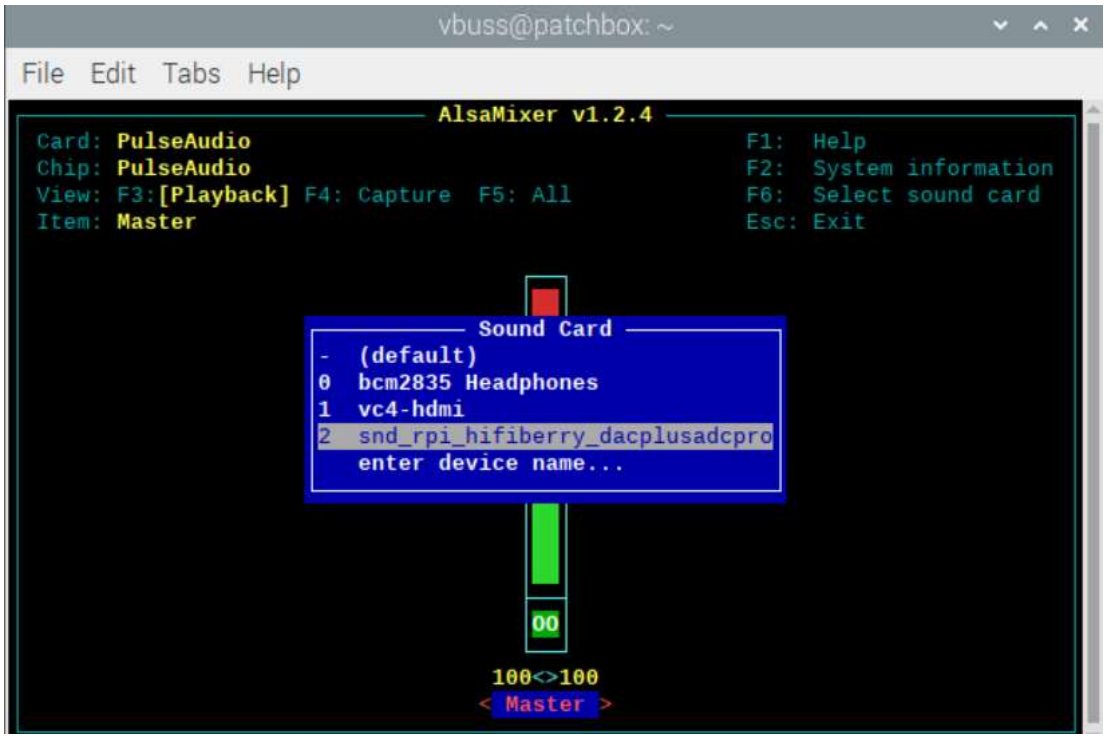
To use the HAT as a soundcard, you have to add the correct dtoverlay to the boot.config.

You can open boot.config by executing `sudo nano /boot/config.txt` in the Terminal.

A textfile will open, where you add the line `dtoverlay=hifiberry-dacplusadcpro` and save with Ctrl+O, return. Then you can close it with Ctrl+X. Reboot with the reboot command or by switching the power off and on again.

After rebooting, open aslamixer to check, whether the HAT was found.

Execute the `alsamixer` command in Terminal and after it has opened, press F6. Then select „snd_rpi_hifiberry_dacplusadcpro“. If you can’t find this entry, something has gone wrong. Either the HAT is not connected correctly or the boot.config has not been updated correctly.



After selecting the Hifiberry HAT, lots of options will appear.

The only important thing is to configure the HAT for the use with headset-microphones. You will have to change the following options accordingly:

- ADC Mic Bias [Mic Bias on]
- Analogue [dB Gain: -6.00, -6.00]
- PGA Gain Left [30.0dB]
- PGA Gain Right [30.0dB]

Now you can close Alsamixer and start the patchbox configuration wizard by executing the command wizard. First select the Hifiberry HAT as the sounddevice, then set the sample rate to 44100 the buffer size to 128 and the number of periods to 2.

Should you experience audio dropouts accompanied by cracks, you can run the wizard again and set the buffer size to 256 or 512.

It is also recommended to set Patchbox OS to automatically login and start the desktop environment (mandatory for automatically starting the simulation as described later).

c. Cloning of current PD-Patches from GitHub

To run the simulation, you need the PD-Patches. You can clone them by executing git clone https://github.com/Va-Bu/hl-sim.git

When you do this in your root directory, you will find the patches in /home/USERNAME/hl-sim/pd with USERNAME being the name you set when installing Patchbox OS (the default name is patch). The simulation is started by executing pd /home/USERNAME/hl-sim/pd/hlsim.pd

As soon as Pure Data has loaded, the mic signal should immediately be audible. You can test this by inserting one earphone and scratching the silver part of the other earphone (the one not inserted in your ear). The scratching should be audible on the piece in your ear.

d. Autostart

To automatically start the simulation upon powering up the RPi, you create an autostart desktop file. The file can be created executing `sudo nano /etc/xdg/autostart/pd.desktop` and then writing the following lines in it:

```
[Desktop Entry]
Name=PD
Exec=pd /home/USERNAME/hl-sim/pd/hlsim.pd
Type=Application
Terminal=false
```

With `USERNAME` being your chosen username again (default value is `patch`). If you cloned the GitHub repo to another folder, the path after `Exec=` has to be changed accordingly.

Now the RPi can be used without display or controls. Just power it up and the simulation will automatically start.