Extras : How to Build a Raspberry Pi 4B (RPi 4B) Computer with Jacktrip
Version betaFeb282022: Moved sections from main guide

This document contains extra sections that were originally in the **How to Build a Raspberry Pi 4B (RPi 4B) Computer with Jacktrip** guide.

They have not been reviewed/checked since March 2021.

CONTENTS:

Setups Tested:

As of February 2022: Bonnie, Sid, Gloria, Ximena and I were able to successfully update our RPi 4B's to jacktrip version 1.5.1 through various methods.

Notes by Jane Wang - my test and setup:

For the initial set up I didn't plug any audio components in, I just wanted to get the RPi 4B up and running and Jacktrip installed.

I had bought a pre-loaded 32GB MicroSD card on Vilros, so I skipped the Set up your SD card step in the online Raspberry Pi guide https://projects.raspberrypi.org/en/projects/raspberry-pi-setting-up/2 the first time I tried to boot my RPi 4B.   I found that the pre-loaded MicroSD card I had bought had a version of NOOBS (the OS Installer for Raspberry Pi) that didn't work with the Raspberry Pi 4 so I had to download the latest version of NOOBS using my Macbook running MacOS 10.10.5 (Yosemite). I added a section on how to do this as it ended up somewhat involved due to my having an old MacOS. It's possible that one can just download the Raspberry Pi OS onto the MicroSD card but I'm not sure.

I plugged my mouse into the middle USB port of the keyboard so I would have an extra USB port free on the RPi 4B board for my audio input.

My monitor was supposed to be touch screen (7" one I got off Amazon that was advertised as being compatible https://www.amazon.com/gp/product/B07L6WT77H/) but I saw on the Raspberry Pi forum that a lot of people were having trouble getting touch screens to work with their Raspberry Pi's so I decided not to bother trying after it didn't seem to work - I just plugged my monitor into one of the HDMI ports so it would function solely as a monitor.

Another issue I ran into was not being able to get audio out from the headphones output jack. I looked at the forums and was finally able to get it working by switching my monitor to the 2nd HDMI output on the board and using raspi-config in Terminal to force audio out to the headphones output.

Currently for the NowNet Arts Lab Ensemble sessions, I plug the following into the RPi 4B:

- keyboard into the lower left USB port
- Tascam 4x4 USB mixer (has own power adapter) into the upper left USB port
- monitor (has own power adapter) into the 2nd HDMI port (rightmost)
- ethernet Cat6 cable (goes out to our house router)
- RPi power supply

In an earlier test with Bonnie, I was able to connect using my Apogee USB mic (that has a built-in headphone out) in lieu of my Tascam 4x4 USB mixer, plugged into the upper left USB port of the RPi 4B.

Update Feb 12, 2022: I was able to manually burn a microSD via my Macbook running MacOS 10.10.5 with the latest version of RPi OS (Release Date: January 28, 2022) and jacktrip 1.5.1

Audio Devices Tested on RPi 4B by Bonnie Kwong:

1. AKG Lyra USB Mic
USB Mic into RPi 4B using a USB cable, headphones into the USB Mic

run jackd with this command:
/usr/bin/jackd -dalsa -dhw:2 -p512 -r48000

2. TASCAM 2x2 interface
aplay -l
arecord -l
both say card 2: US2x2

run jackd with this command:
/usr/bin/jackd -dalsa -dhw:US2x2 -p512 -r48000

Audio Devices Tested on RPi 4B by Sid Gulick:

1. Pyle PDUSBPP10 (~60$ on amazon)
worked with jacktrip and Audacity
This device is a USB to XLR adapter - it has a mini trs headphone socket and a female XLR connector
and can provide phantom 48v power to a condenser mic. it was plug and play with the RPi 4B; had to
choose Pyle USB for the input and output in Audacity and had to adjust the levels with **alsamixe**r[1] but the
results for recording and playing back with Audacity were satisfactory.

2. Roland ua1000 audio interface
worked with jacktrip and Audacity

3. Rosetta Stone Language Program usb headphones and mic
worked with jacktrip and Audacity

4. UGREEN USB Audio Adapter External Stereo Sound Card
worked with jacktrip and Audacity
a C-Media based device. The headphones worked right away but the mic input only worked
with a mic with a mini TRS jack and it wasn't just the jack— had an adaptor
which went from XLR to TRS and that didn't work but an old tiny electret mic worked.

Audio Devices Tested on RPi 4B by Jane Wang:

1. Tascam USB 4x4 with one mic (input one), plugged into upper left USB port of RPi 4B.

2. Apogee USB mic (has it's own headphone out), plugged into upper left USB port of RPi 4B

3. Pyle PSUSBPP10, used an SM58 mic, similar results as Sid Gulick except uncertain if the gain on mic
is high enough even if boosted to the max - tested with CCRMA jackloop256 successfully and Audacity.

Note: Gloria, Ximena and I found that using jackd (version 1.9.12) generates errors if either jacktrip 1.2.2
or jacktrip 1.3.0 are built onto the RPi 4B. The GUI qjackctl (version 0.5.0) however does work with both
those versions of jacktrip.

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[1] alsamixer is a GUI accessible via typing in **alsamixer** in Terminal; it lets you adjust gains of audio input
and output on the RPi 4B via the Function keys on the keyboard.

Audio Device Tested on RPi 4B by Gloria Damijan:

1. Motu M2

Tested with jacktrip 1.2.2 and jacktrip 1.3.0 — jackd command didn't work but qjackctl did.

Setup Tested on RPI 4B by Ximena Alarcón (she was able to use non-RPi Keyboard, Mouse, Monitor):

1. Audio Device: Yamaha AG06
https://www.djfinance.co.uk/yamaha-ag06-6-channel-mixing-console.html

2. Mouse: GlidePoint Touchpad
http://www.inclusive.co.uk/glidepoint-touchpads-p2406

3. Keyboard: Microsoft Ergonomic Keyboard
https://www.posturite.co.uk/microsoft-ergonomic-keyboard.html?
msclkid=854df67d086f1a25151fa98a0d088e16&utm_::source=bing&utm_medium=cpc&utm_campaign=
Bing%20Shopping%20-%20Keyboards&utm_term=4578366456974108&utm_content=Keyboards

4. Monitor: Viewsonic Monitor VP930
https://dev.ap.viewsonic.com/uk/products/lcd/vp930

Ximena used this VGA adaptor to connect with RPI's HDMI cable:
https://www.amazon.co.uk/Adapter-Compatible-Computer-Projector-Raspberry/dp/B07XZ22KCD/
ref=cm_cr_arp_d_product_top?ie=UTF8

It is Ximena's understanding that any mouse and keyboard should work with the RPi 4B.

Tested with jacktrip 1.2.2 — jackd command didn't work but qjackctl did.

Setup Tested on RPI 4B by Anna Pasztor (Audio Monitoring Only):

Anna is a special case of someone who just wanted to be able to listen to the Nownet Arts Lab Ensemble through jacktrip with low latency. For all the tests she tried, she was able to hear locally (via the noise.wav test) clearly.

She tried using her Cyber Acoustics CA-3908 speakers through the headphone jack of the RPi and heard noise and crackles. She then tried headphones but the result was almost the same: she could only hear noise and crackles, no music or speech, the only difference was that she could distinguish between left and right. She could connect on jacktrip via hdmi monitor and could hear but the sound was bad. She also tried hooking up a USB headset via the upper left USB port of the RPi but was unable to connect to jacktrip. She didn't pursue the USB headset test further because using the headset would not have helped her anyway for the Nownet Arts Lab Ensemble jacktrip sessions. She tested her internet speeds and they seemed in acceptable ranges. Sarah Weaver said that it sounded like an audio equipment/routing issue rather than a jacktrip issue since Anna was able to make the connection. One factor is that some headphones and headphone-like devices (such as external monitors that connect with that port) default to sample rate 44100. On jacktrip we have been using sample rate 48000. That may be why it's working in some instances but stops working when she connects jacktrip.

In the end Anna decided to upgrade her laptop instead of trying to get audio in monitor only mode working via the RPi. Another factor is that there have been several RPi forum posts about issues around the headphone jack audio from the RPi. Jane W. also tried testing jacktrip audio monitor only mode via the RPi headphone jack and also experienced unacceptably bad audio quality results.

Wifi is WEP Protected Fix by Sid Gulick

If Your Wifi is WEP protected, the RPi 4B will most likely not connect, here's a fix from Sid Gulick (I edited his fix slightly for consistency with this guide):

When you open the pi desktop without having selected a wifi 'ap' (i think that's the term, the name for a router you might be able to log on to) there's an icon in the upper right, blue with 2 red x's. click on that and it will scan for possible connections. choose one and enter the password. If it's a WEP protected link it won't connect.

Open Terminal.

Type:
sudo nano /etc/wpa_supplicant/wpa_supplicant.conf

and nano will open **wpa_supplicant.conf**.

there should be one entry of the form

network={
        ssid="modem id"
        key_mgmt=NONE
        wep_key0="modem password"
        (wep_tx_keyidx=0)
}

the last line in parens was suggested by the article which suggested that WEP was useless, one should change over to WPA, but if one insisted on WEP one would need an entry in the **wpa_supplicant** file of the above form.

I burned a new sd with rpi raspian and booted it up and tried to enter my modem and password in the wifi initial configuration menu; it failed, I hit skip, and the desktop appeared with the blue icon with red x's in the right corner. I clicked that, entered my password. the connection failed. then i opened Terminal and typed:

sudo nano /etc/wpa_supplicant/wpa_supplicant.conf

In that file was an entry like the one above but without the 4th line in parens. I removed the quotes around the password, used **<Ctrl>x**, saved the file. I can't remember whether I rebooted but the wifi link was then working. I also can't remember where i saw the suggestion that when there's a WEP password in this file you have to remove the quotes but I tried a lot of things before stumbling on it.

About the Linux git Command by Bonnie Kwong

Git Concepts

A repository is simply a collection of files. Each time you "**cd**" into the "jacktrip" directory from your device, you're navigating to your local copy of the JackTrip files, so you don't have to pull. It's just like bunch of text files. For instance, if you "**cd**" into the ~/Downloads directory of your Mac and use the "**ls**" command to list all files, you'll see files of any type you've downloaded to your computer: installers, pdf, word docs, etc. You can have multiple copies of the JackTrip repo on your local file system as long as their names do not conflict in the same directory, just like text files.

You only need to **clone** a project when you're starting from zero, when you don't have the JackTrip repo on a particular device and you need to access the central repository on Github to download the project. A remote repository is one that's not on your device. Multiple versions of JackTrip exist on Github too. But for our purposes, we'll focus on the central repository, where engineers eventually "**push**" their code if they want their changes to make it to the official version of JackTrip. When you have a device and you want to build JackTrip from source for the first time, whether it's on your RPi or a computer, you always need to get the code from the central repository on Github.

git clone https://github.com/jacktrip/jacktrip.git

The url in this step is the central JackTrip repository. After the initial "cloning" of the project, **git** on your machine will recognize **https://github.com/jacktrip/jacktrip.git** as the remote called "**origin**" because this is where your local copy originated from. Now that you have a copy of the project, whenever you want the changes the engineers have made, e.g. a new version, you need to pull. Note: you're pulling the incremental changes, not the entire repository--the key difference between cloning and pulling. The "**git pull**" command is always for bringing content from a remote repository and immediately updating the local repository to match it. If you simply access want to access your local JackTrip repo as is, you would "**cd**" into it.

The only change you need to make is to replace "**git pull main**" with "**git pull origin main**." To answer your question, in the context of your instructions, "**git pull**" and "**git pull origin main**" are essentially the same because "**origin main**" is implied in the "**git pull**" command--you're telling **git** to **pull** from the remote repo you originally cloned your copy from, and from the "**main**" branch, which is the branch you should already be on. By including "**git checkout main**" in your instructions, you're making sure people are on the right branch. Looks good.

Bonus points:
There are other remotes and branches you can choose to **pull** from. For instance, Chris Chafe has a fork of the project (**https://github.com/cchafe/jacktrip/branches**). You could decide to add his remote to your JackTrip repo and nickname it "**chris**" instead of "**origin**" in your copy of git. Within his remote, there are many branches, e.g. **main-faust-hubpatch**. If you decided for some reason you want your main branch to pull from the **main-faust-hubpatch** branch of his repo, you could do something like **git pull chris main-faust-hubpatch**, once you set everything up. I won't go into the details you don't really want to do this. Just to give you a more concrete examples--that's all.

Switch Between Versions of Jacktrip on your RPi 4B
and/or Update to Latest Released Version of Jacktrip

In this example, there are two branches on your RPi 4B, **main** and **anotherone**.

Note that the same steps apply if you already have a version of jacktrip on your RPi 4B and you want to update jacktrip to the latest released version of jacktrip.

1. Open new Terminal window

2. See where you are - you should be at **/home/pi**
pwd

3. Change to subdirectory jacktrip:
cd jacktrip

4. Check what branches you have:
git branch

5a. Select the branch you want (if you want to set the branch to **anotherone** or a different branch, substitute the name of the branch you want for **main** in this step)[2]:
git checkout main

5b. If you just want to switch branches locally on your RPi (as in cases where you want to restore an older version of jacktrip that you already have on your RPi), skip on to Step 6. Otherwise, to update the branch that you just selected in Step 5a. to include any developer changes made to that version (if you substituted **anotherone** or a different branch in Step 5a. for **main**, do likewise in this step), type:
git pull origin main

6. Build the version of jacktrip you selected in Step 5a. on your RPi:
cd src
./build

7. After it finishes building:

cd ../builddir

or

cd
cd jacktrip
cd builddir

8. Check that you have the correct version of jacktrip:

./jacktrip -v

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[2] online documentation about **git-checkout** - *Switch branches or restore working tree files*: https://git-scm.com/docs/git-checkout

Setting the Audio Out to Headphones on Your Raspberry Pi 4B

The RPi 4B gives you the option of having audio out via one of the HDMI outputs (it assumes you have speakers on any monitor you plug into the HDMI outputs) or via the headphones out.

For using jacktrip, as a safety to prevent possible feedback through speakers on your monitor, you should set your RPi 4B audio out to the headphones out. Additionally, be sure to plug your monitor into the 2nd HDMI port of the RPi 4B (due to possible bug in OS, see List of References for more info).

You can test if the audio on your RPi 4B is set to Headphones one of two ways:

Go to the RPi main menu, click on Games and select Boing. You should see lights running up and down and hear continuous thumping audio either through your headphones or the monitor speakers.

OR

In Terminal, type in (this just generates a brief noise sound burst and stops):
aplay /usr/share/sounds/alsa/Noise.wav

To set headphones as the audio out, the most reliable way is to do it through Terminal

In Terminal, type in:

sudo raspi-config

You should see the menu below pop up, with the first line highlighted in RED (instead of BLUE)
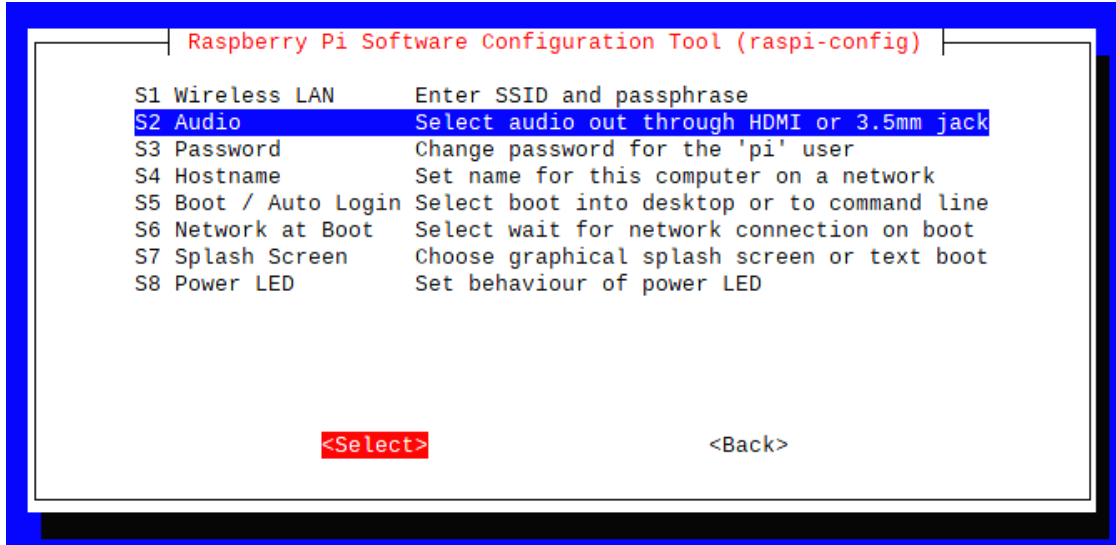
For the three **raspi-config** menus shown here, use the down and up arrows to move up and down the menu options, use the **<right arrow>** to **<Select>** that option (or in the case of the Audio Options menu **<Ok>** that option), use the **<Enter>** key to activate.

<Select> **System Options**, then hit the **<Enter>** key.

```
File  Edit  Tabs  Help
Raspberry Pi 4 Model B Rev 1.4



        ┤ Raspberry Pi Software Configuration Tool (raspi-config) ├

        1 System Options       Configure system settings
        2 Display Options      Configure display settings
        3 Interface Options    Configure connections to peripherals
        4 Performance Options  Configure performance settings
        5 Localisation Options Configure language and regional settings
        6 Advanced Options     Configure advanced settings
        8 Update               Update this tool to the latest version
        9 About raspi-config   Information about this configuration tool




                <Select>                        <Finish>
```

The System Options Menu should appear. <Select> Audio using the arrow keys as described previously, then hit the <Enter> key.

```
┤ Raspberry Pi Software Configuration Tool (raspi-config) ├

    S1 Wireless LAN     Enter SSID and passphrase
    S2 Audio            Select audio out through HDMI or 3.5mm jack
    S3 Password         Change password for the 'pi' user
    S4 Hostname         Set name for this computer on a network
    S5 Boot / Auto Login Select boot into desktop or to command line
    S6 Network at Boot  Select wait for network connection on boot
    S7 Splash Screen    Choose graphical splash screen or text boot
    S8 Power LED        Set behaviour of power LED




            <Select>                    <Back>
```

The Audio Options Menu should appear. <Ok>Headphones using the arrow keys as described previously, then hit the <Enter> key.

```
Choose the audio output

            0 HDMI 1
            1 Headphones












    <Ok>                    <Cancel>
```
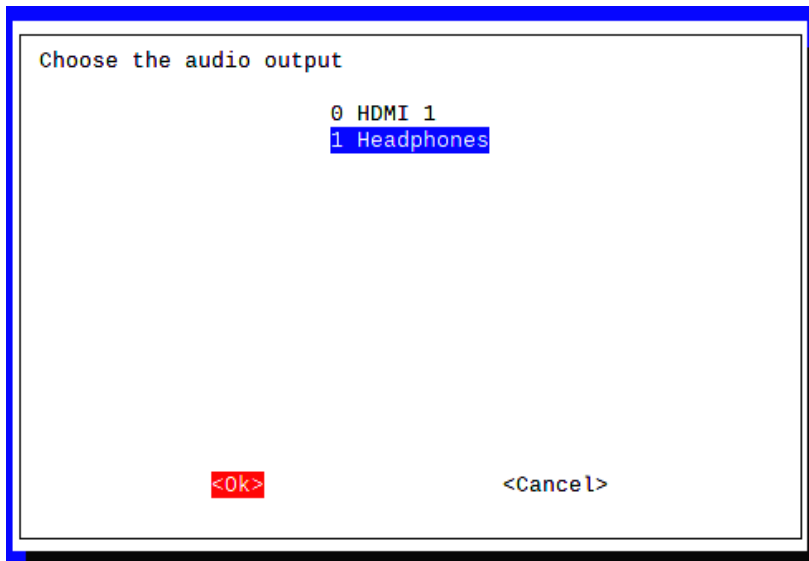
You should now be back at the main **raspi-config** menu. Hit the **<right arrow>** key twice, so that **<Finish>** is highlighted in RED, then hit the **<Enter>** key to exit **raspi-config**.

List of References

1. Jacktrip Related Helpful Links and Documents:

Jacktrip remote server or raspberry pi notes.docx
JackTrip remote server notes (on Debian via Linode) by Michael Dessen and Bonnie Kwong,
last updated Sept. 6, 2020

Jacktrip Website (being developed by Mike Dickey):
Hub for information regarding how to set up and use JackTrip
https://jacktrip.zendesk.com/hc/en-us

Michael Dessen website includes helpful documentation and videos re: Jacktrip, Sonobus, Nettie:
https://mdessen.com/portfolio/networked-music-performance-resources/

Jacktrip Help Site (not sure who is working on this):
https://sites.google.com/view/jacktrip-help/home

CCRMA[3] IEFT[4] Jacktrip documentation, includes index to sections:
https://ccrma.stanford.edu/docs/common/IETF.html

And re Jacktrip, includes parameters meaning
https://ccrma.stanford.edu/docs/common/IETF.html#building-jacktrip-from-source

How to install new version of Jacktrip and save old one:
https://ccrma.stanford.edu/docs/common/IETF.html#managing-multiple-versions-of-jacktrip

CCRMA jacktrip servers:
https://ccrma.stanford.edu/wiki/IETF

2. Raspberry Pi Online Guides

General Help (master page with links to all guides):
https://www.raspberrypi.org/help/

Download image software:
https://www.raspberrypi.org/software/

Manually download image software:
https://www.raspberrypi.org/software/operating-systems/

Download NOOBS (New Out Of the Box Software):
https://www.raspberrypi.org/downloads/noobs/

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[3] CCRMA : Center for Computer Research in Music and Acoustics (Stanford University)

[4] IEFT : Internet Ensemble Tech Force

3. Forum and Blog Posts re RPi 4B Audio Issues:

"Pi 4 B HDMI Sound issues" - July 2, 2019 - Post about audio output bug in the RPi 4B, solution plug monitor into the 2nd HDMI port, not sure if you really need to do this but since it works, I'm keepin' it:
https://www.raspberrypi.org/forums/viewtopic.php?t=244376

Latest Raspberry Pi OS update – May 2020 - many comments including re audio issues
https://www.raspberrypi.org/blog/latest-raspberry-pi-os-update-may-2020/

JACK and Headphones - Ted Felix - headphones not working on Jack
http://tedfelix.com/linux/jack-headphones.html

RPI 4 & Ubuntu MATE - Audio configuration Updated: July 3, 2020
https://www.dedoimedo.com/computers/rpi4-ubuntu-mate-audio.html

aplay command in Linux with examples Last Updated: 05-03-2019
https://www.geeksforgeeks.org/aplay-command-in-linux-with-examples/

Alsa Device Names
https://alsa-project.org/wiki/DeviceNames

Alsa no audio (glitch) issue Pi 4 fix Post by gam3t3ch in Raspberry Pi : Sep 14, 2019
https://www.element14.com/community/community/raspberry-pi/blog/2019/09/14/asla-audio-glitch-issue-pi-4-fix

Unable to force sound to headphone jack RPI 4 Post by gofireworks : Wed Jul 29, 2020
https://dietpi.com/phpbb/viewtopic.php?t=7934

4. Cloud Server services:

Linode
Cloud servers pay as you go or by the month, various plans - being used by NowNet Arts and CCRMA for testing:
https://www.linode.com/

Musicians Together Apart
Jacktrip cloud servers for ensemble in 31 cities (monthly fee by # of users: 2/4/6/10):
https://musicianstogetherapart.com

5. Free Network speed/Bandwidth tests accessible via web on the RPi 4B:

General Bandwidth speed test:
https://www.bandwidthplace.com/speedtest/

Free network test to Musicians Together Apart cloud servers by region:
https://musicianstogetherapart.com/network-test/

6. Alternative RPi 4B audio devices:

JACKSTREAMER :: RPi 4 based audio kit that runs Jacktrip; does require web browser to start and stop sessions; this is not a standalone RPi system:
http://networksound.com/index.php/products/jrpbox

Virtual Studio :: an RPi 4B with HiFiBerry's ADC DAC+ Pro device which runs Jacktrip in Hub mode; does require web browser to start and stop sessions; this is not a standalone RPi system:
https://jacktrip.zendesk.com/hc/en-us/categories/360004519513-User-Guide-Virtual-Studio

7. A User's Guide to ALSA By Dave Phillips : Jun 30, 2005 From Issue #136 in Audio/Video
https://web.archive.org/web/20120109014951/http://www.linuxjournal.com/node/8234/print