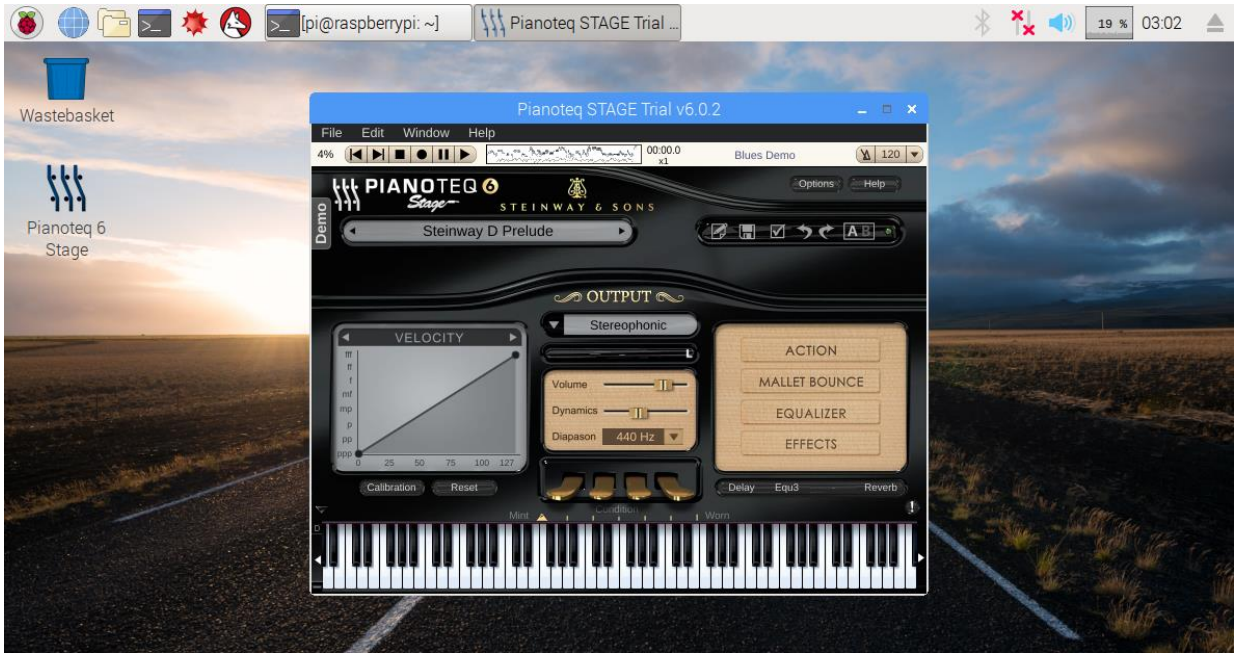
Pianoteq 6

Raspberry Pi 3

Station

By

Edgar Bustamante



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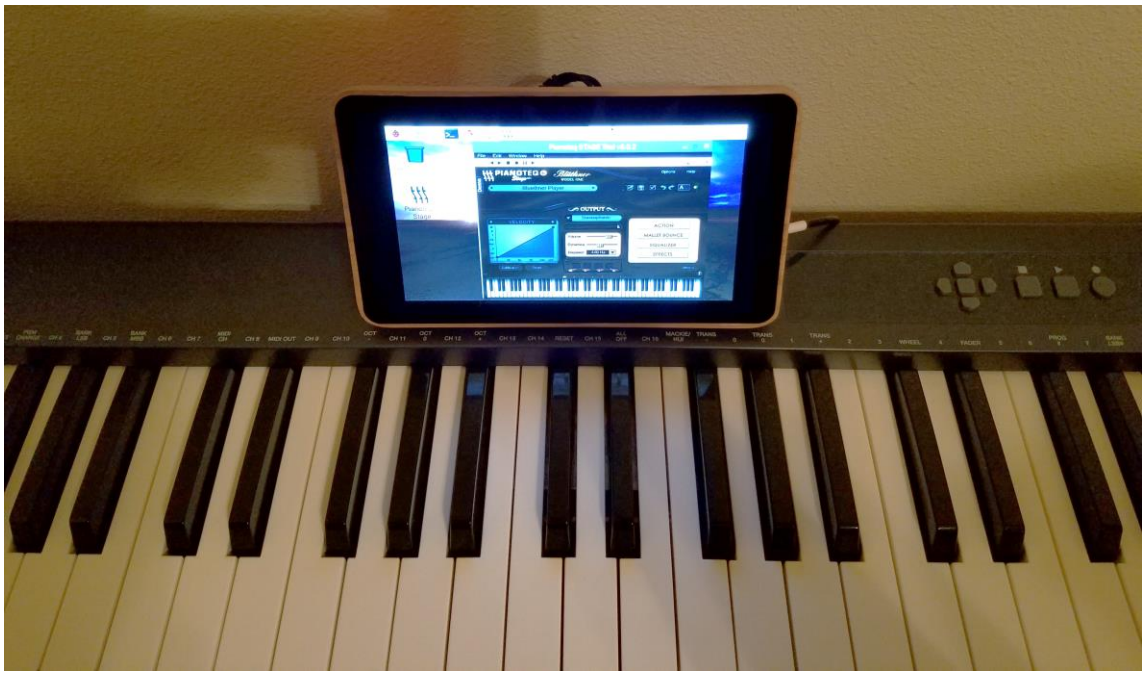
1 Introduction

This document will explain in detail how to install and setup Pianoteq 6 Stage in a Raspberry Pi 3 although the process is very similar for the Standard and Pro versions of Pianoteq 6. This can be of great benefit if you do not want to use your computer solely to run Pianoteq. A Raspberry Pi 3 is one of the answers for this purpose while keeping the price relatively inexpensive.

The outcome of this document is a nice looking Pianoteq station running on a Raspberry Pi 3 with a high quality audio output signal and a touchscreen display embedded in a gorgeous bamboo case. This takes Pianoteq to a new level!



2 Parts

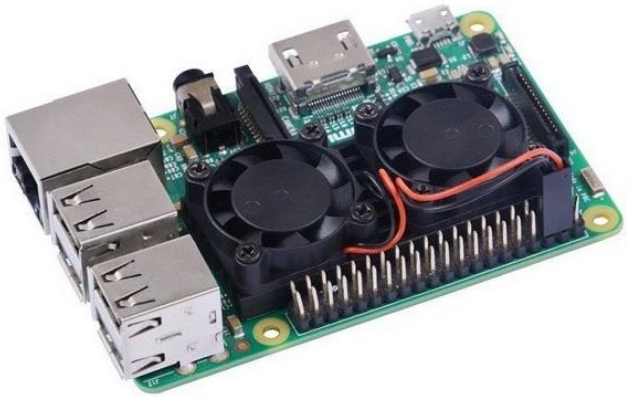
This section will cover the parts that you will need to install Pianoteq on a Raspberry Pi 3. Some of these are required and some are optional like the touchscreen display or the bamboo case. The optional parts will help you create a nice looking Pianoteq Raspberry Pi 3 station.

2.1 Raspberry Pi 3

Due to the weak processing power of other Raspberry Pi models (1, 2, Zero, etc.), you will only be able to run Pianoteq 6 on a Raspberry Pi 3 model.

2.2 Fan/Heat Sinks

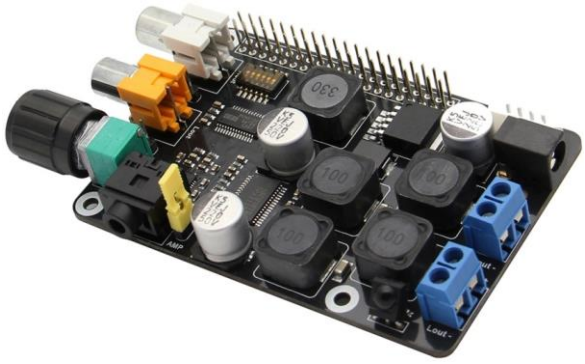
A fan and/or heat sink is highly recommended to cool off the CPU due to the high amount of computations Pianoteq requires. The Raspberry Pi 3 will begin to throttle once it reaches a temperature of 85 °C and ultimately affect Pianoteq by creating pops and crackles. The fans shown below have a thin copper heat sink under the fans and it is all one unit.

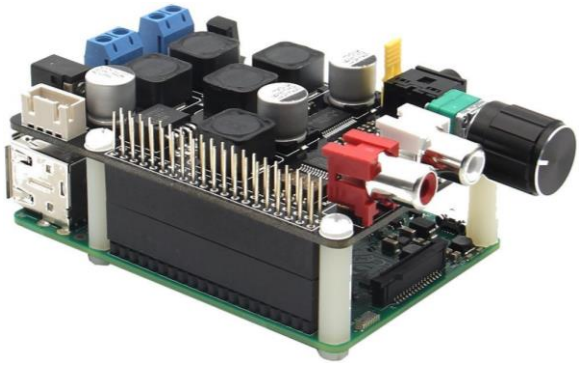


2.3 Digital to Analog Converter (DAC)

I do not recommended the use of the Raspberry Pi 3's internal sound card because of the poor audio quality and the increase of CPU usage; this can affect the performance of Pianoteq. An external sound card/digital to analog converter (DAC) would remove this CPU load and transfer

it to the external sound card. In this document, the external sound card Suptronics X400 is used. This sound card fits on top of the Raspberry Pi 3 due to its Pi HAT design.





2.4 Micro SD Card with USB Adapter

A micro SD card with a minimum of 8 GB and a micro SD card to USB adapter are required. You will copy the operating system (OS) Raspbian unto the micro SD card and then install it on the Raspberry Pi 3.

2.5 Display

You will need a computer monitor or TV that has HDMI connection to connect the Raspberry Pi 3. I will use the Raspberry Pi 7” Touchscreen Display for the system but this specific display is not required.

2.6 Display Case (Optional)

I will use a bamboo case from Eleduino for the Raspberry Pi 7” Touchscreen Display for aesthetic purposes only; it is not required.

2.7 Keyboard

You will need a regular computer keyboard that connects via USB to type commands in the Raspbian terminal.

2.8 Mouse

You will need a regular computer mouse that connects via USB to navigate and select things in Raspbian.

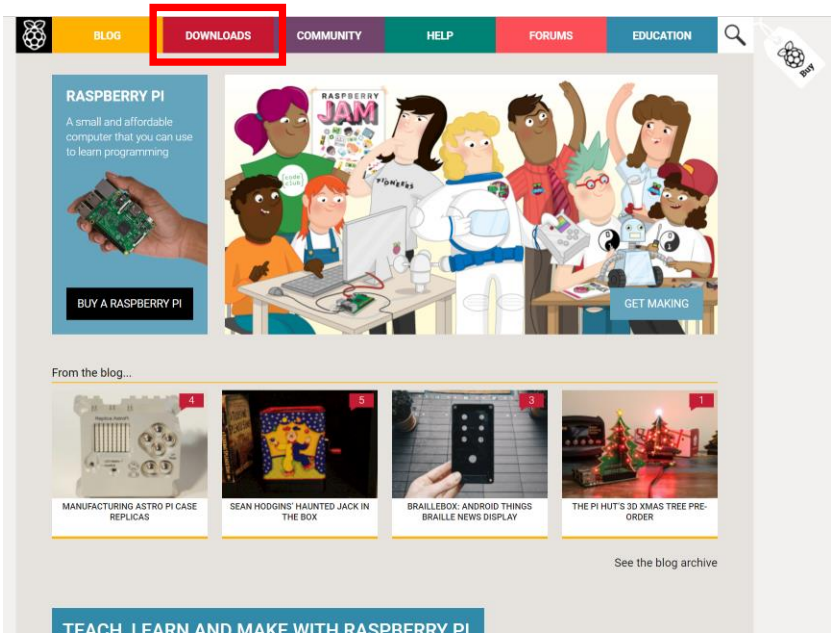
2.9 Power Supply

The power supply will depend on the power consumption of the Raspberry Pi 3, external sound card, and other electronics (touchscreen display, digital keyboard, etc) attached to the raspberry pi. The Suptronics X400 expansion board requires an input power of 6V to 24V DC 3A. The Suptronics X400 will power the Raspberry Pi 3, touchscreen display, and a digital keyboard (M-Audio Keystation 88 MKII) via a 12V 3A power supply. **Connecting the Raspberry Pi 3 and the Suptronics X400 to two different power supplies can damage some if not all of the electronics in your system.** PLEASE FOLLOW THE INSTRUCTION OF YOUR EXTERNAL SOUND CARD/DAC.

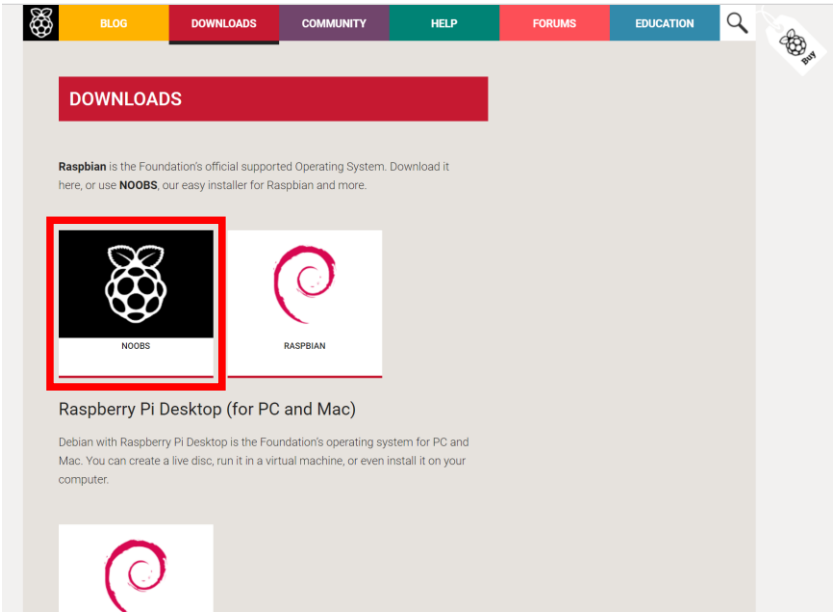
3 Computer Downloads

3.1 NOOBS

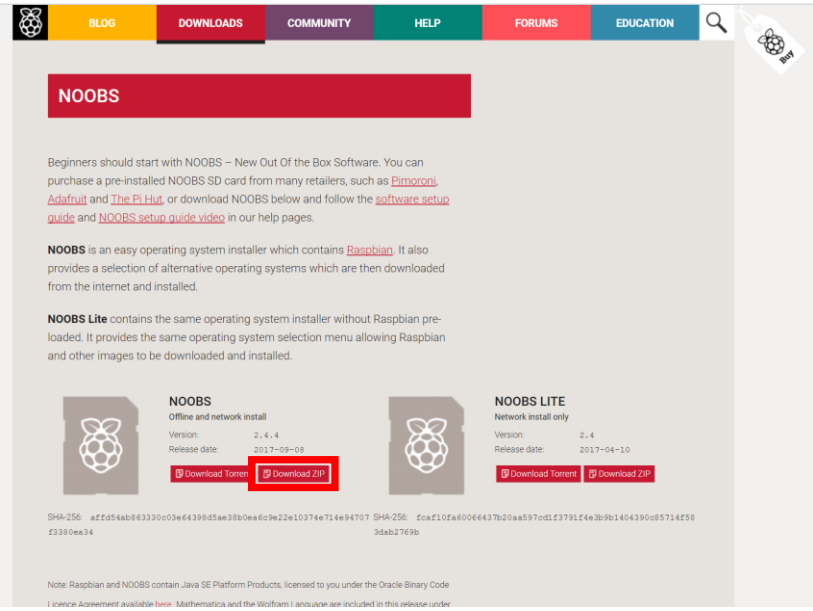
New Out Of the Box Software (NOOBS) is an operating system (OS) installer that contains Raspbian, the Raspberry Pi OS that will be used. To download NOOBS go to the raspberry pi website, www.raspberrypi.org and click on the Downloads tab.



Click on NOOBS.

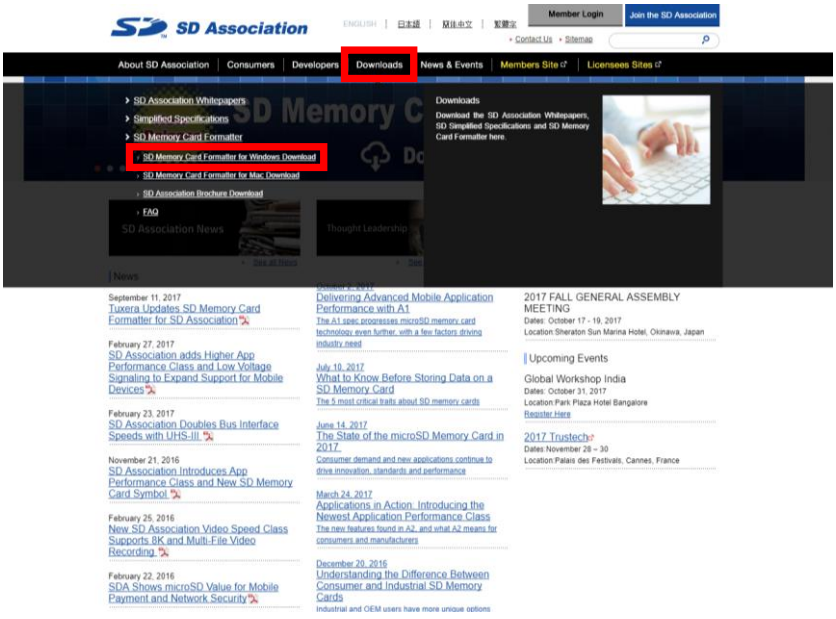


Click on Download Zip for the NOOBS version and wait for the download to finish.



3.2 SD Card Formatter

You will need to download the SD card formatter from the SD Association to ensure that the SD card you use is entirely complaint. A compliant SD card can result in better read and write speeds, buffering, and the total amount of storage available in the SD card. Go to www.sdcard.org, hover the mouse over the Downloads tab, and select SD Memory Card Formatter for Windows Download.



Scroll down to the bottom of the page, accept the User License Agreement, and once it finishes downloading install the program.

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YOU ACKNOWLEDGE AND AGREE THAT YOU HAVE READ THIS AGREEMENT AND INTEND TO BE BOUND AS IF YOU HAD SIGNED THIS AGREEMENT IN WRITING. IF YOU ARE ACTING ON BEHALF OF AN ENTITY, YOU WARRANT THAT YOU HAVE THE AUTHORITY TO ENTER INTO THIS AGREEMENT ON BEHALF OF SUCH ENTITY AND BIND SUCH ENTITY TO THE TERMS OF THIS AGREEMENT.

Decline › Accept ›

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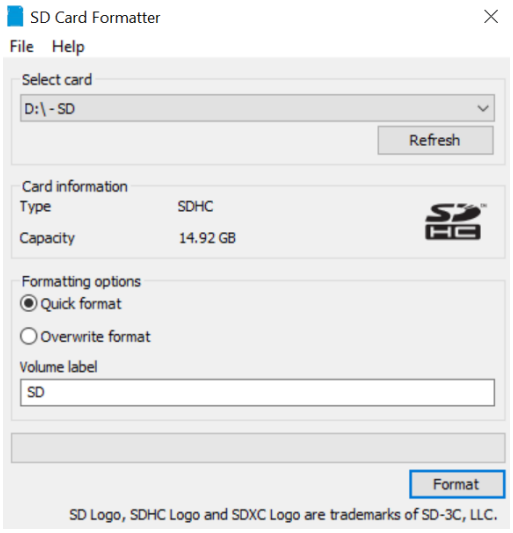
4 Installation of Raspbian

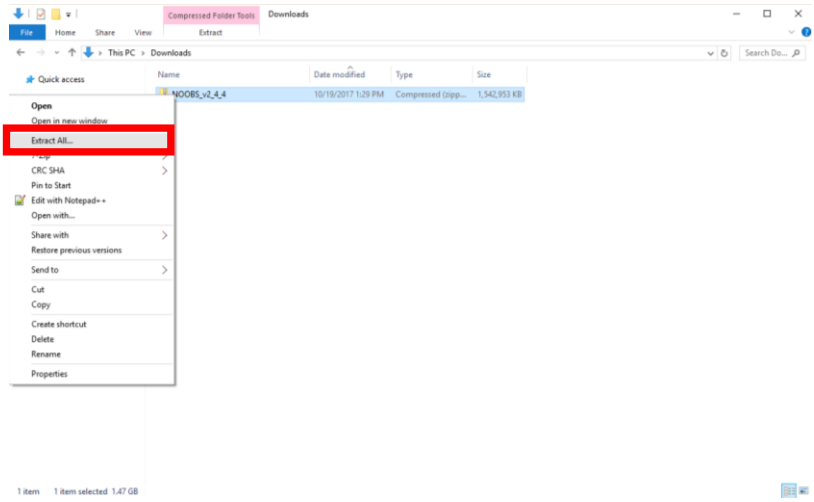
4.1 Format an SD Card

Insert the micro SD card in the USB adapter and connect it to the computer. Open the SD Card Formatter and select the SD card you connected to the computer. **Before proceeding make sure that the SD card you insert is selected and NOT the computer drive (C:) or any other memory devices because this will wipe everything in them!** Select Quick format, label the SD card anything you want or leave it blank, and click Format. Your SD card is ready for NOOBS.



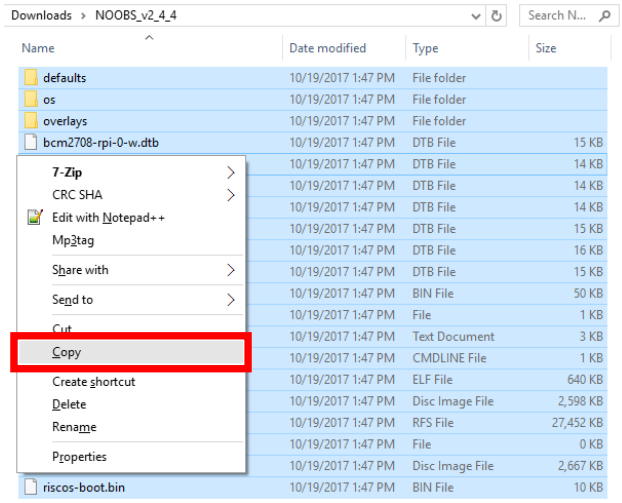
4.2 Unzip NOOBS

Unzip the NOOBS file downloaded in section 3.1 using the computer built in Compress Folder Tools, WinZip, or any other software able to extract NOOBS. I will use the built in Compress Folder Tools, right click on the compressed NOOBS folder in the default downloads folder and select Extract All….



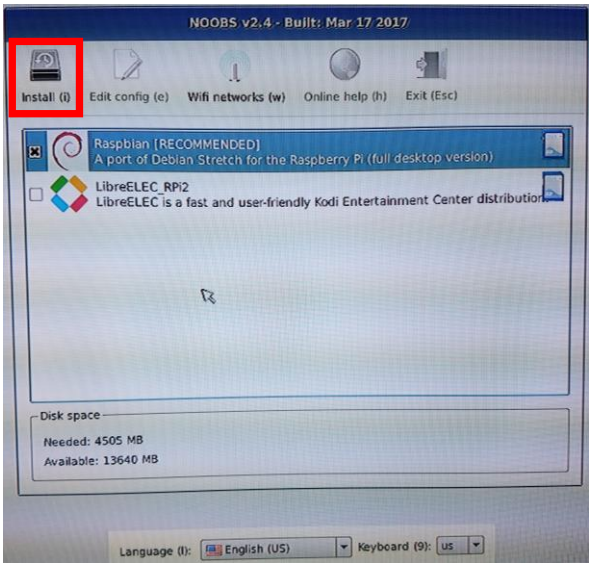
4.3 Copy NOOBS to an SD Card

Select the content of the extracted NOOBS folder, right click on the content, and copy this into the SD card. Do not copy the NOOBS folder; copy the contents of the NOOBS folder. When the files finish copying, eject the SD card.

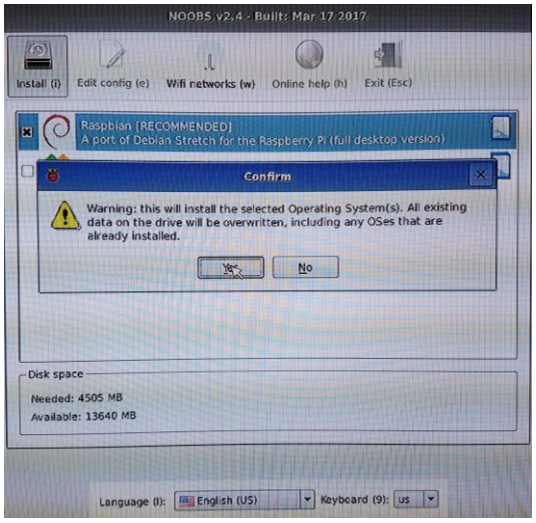


4.4 Install Raspbian

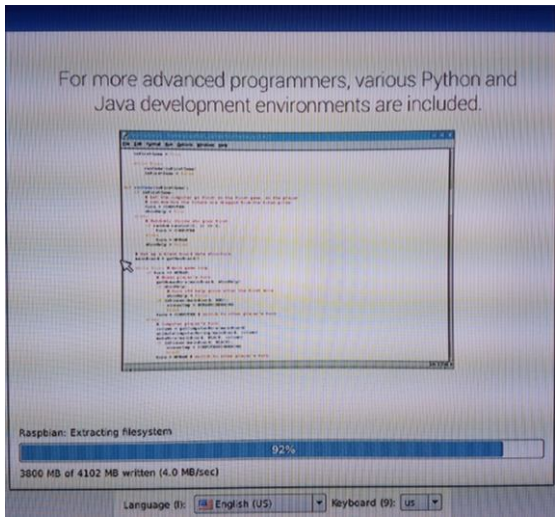
Insert the SD card in the Raspberry Pi 3, connect the mouse, connect the keyboard, connect the display (computer monitor, TV, touchscreen display, etc) via HDMI or DSI ribbon cable, and power it. Select the Raspbian OS and click Install.



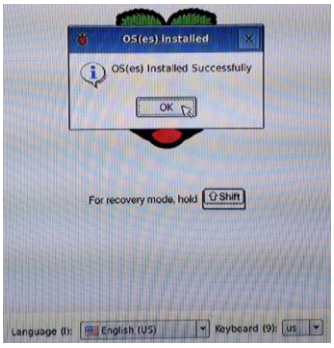
Confirm the installation by clicking Yes.



The installation will take about 10-20 minutes.

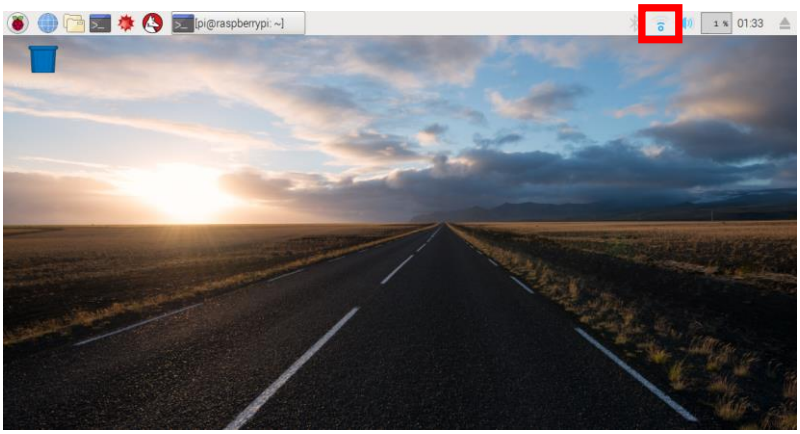


When the installation finishes click Ok.



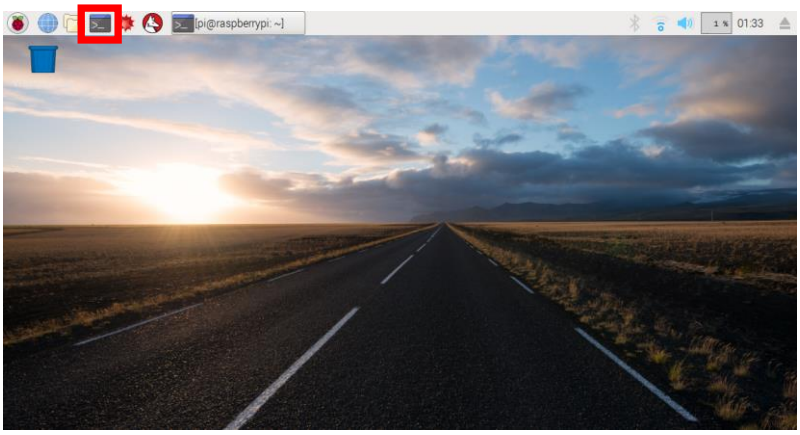
5 Raspbian Downloads

You will first need to connect to the internet either through Wi-Fi or through the Ethernet port on the Raspberry Pi 3 to update the Raspberry Pi 3, download some libraries you will need, and download Pianoteq. You can see the Wi-Fi settings button below.

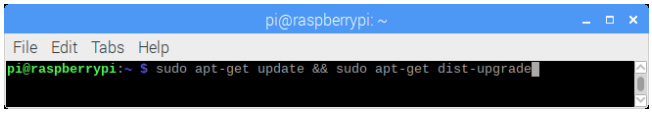


5.1 Raspbian Libraries Download

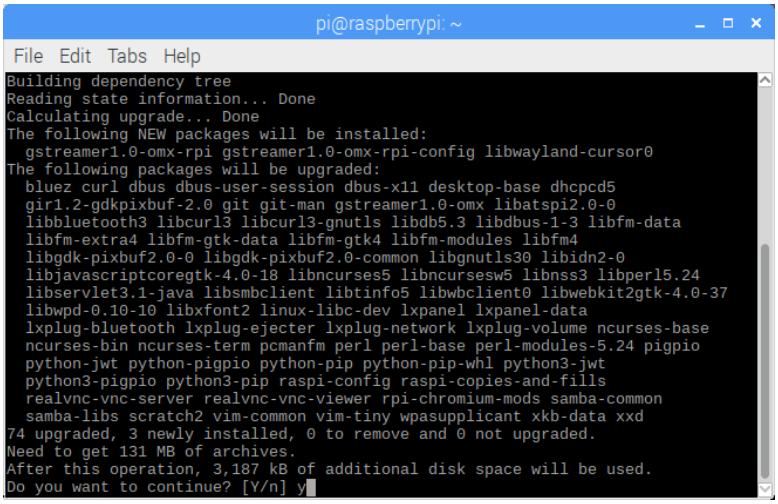
The Raspberry Pi 3 needs to be up to date to ensure it is running the latest software. Open the terminal.



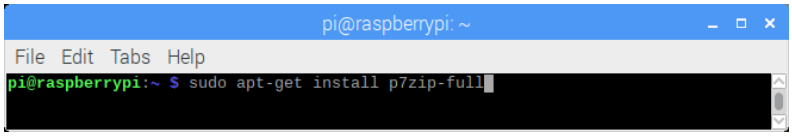
Type the following line of code in the terminal and press Enter.



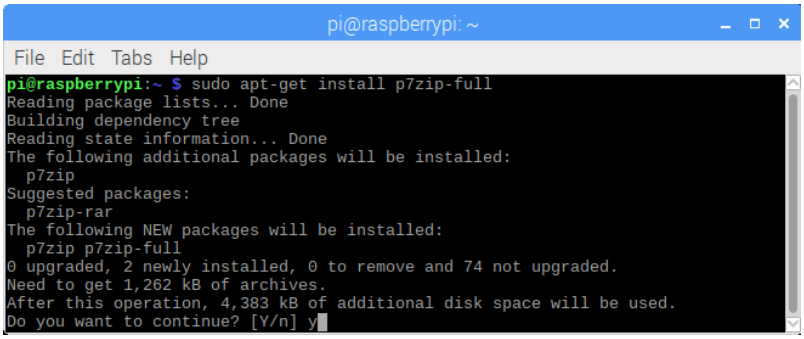
When the terminal asks if you want to continue, type y, and press Enter.



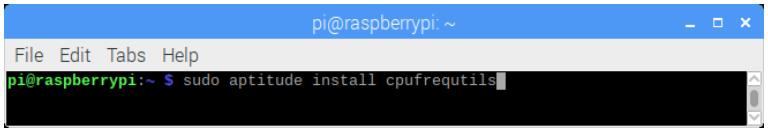
When the terminal finishes updating the Raspberry Pi 3 type the following line of code and press Enter. This will install the libraries needed to extract Pianoteq after you download it from the Pianoteq website, section 5.2.



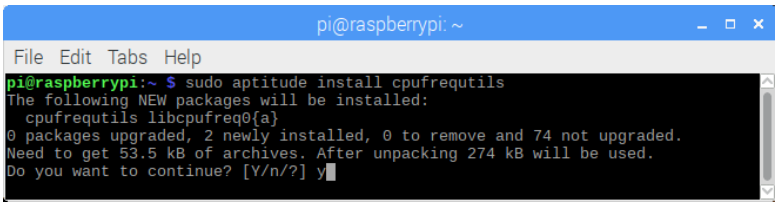
When the terminal asks if you want to continue, type y, and press Enter.



When the terminal finishes installing the 7z libraries type the following line of code and press Enter. This will install the libraries needed to disable CPU frequency throttling.



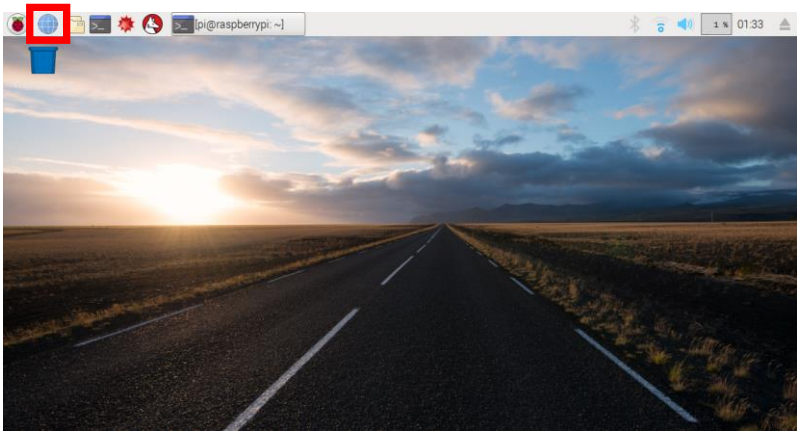
When the terminal asks if you want to continue, type y, and press Enter.



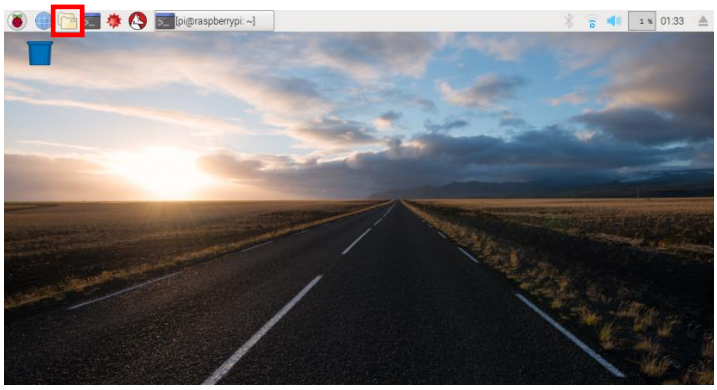
You now have all the libraries needed to install Pianoteq.

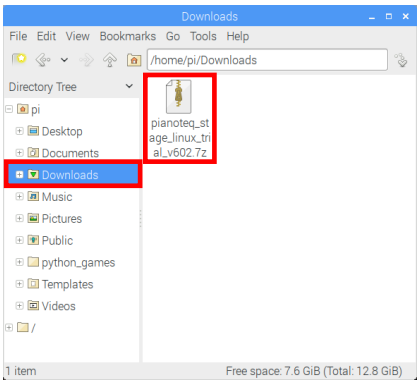
5.2 Pianoteq Download

Use Chromium to download the Linux version of your version of Pianoteq 6 from www.Pianoteq.com. I will use the Pianoteq 6 Stage Linux trial version.



A compressed file (.7z) containing Pianoteq will be in the default Downloads folder of Raspbian after you have download Pianoteq. You are now ready to install Pianoteq. **Note: The name of the downloaded Pianoteq file will be the name used in section 6.1, in this case it is "pianoteq_stage_linux_trial_v602.7z".**

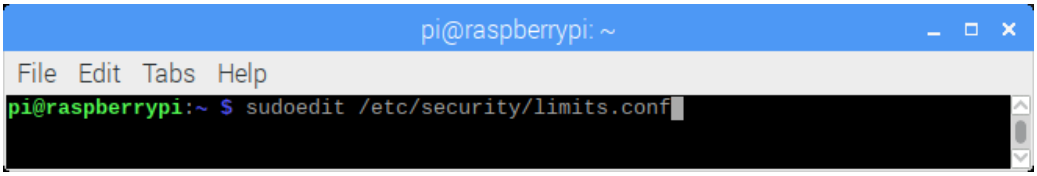




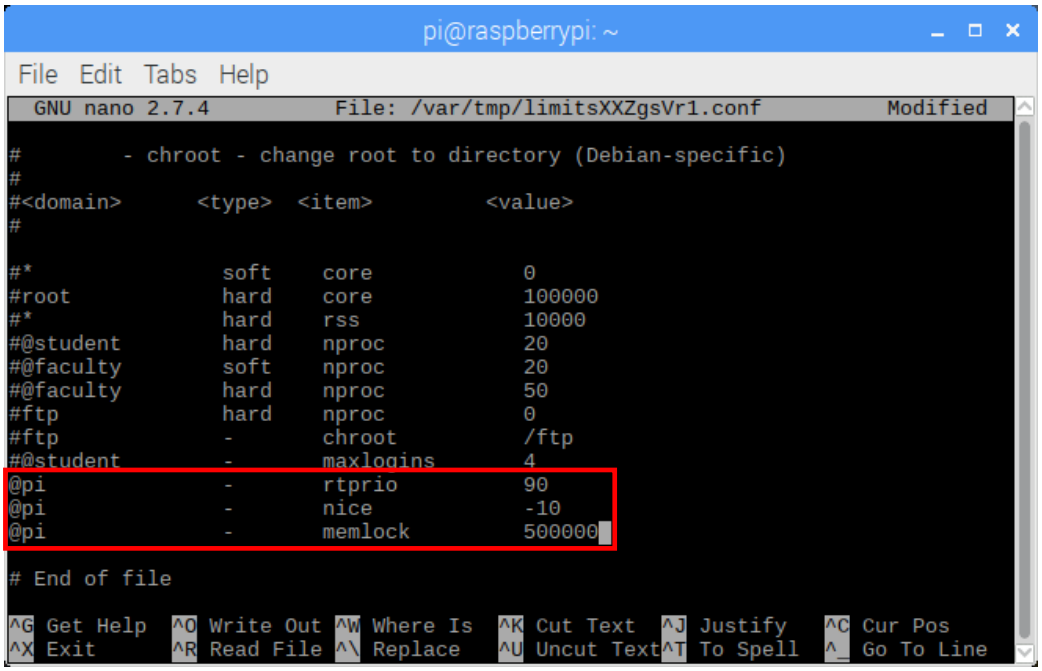
6 Installation of Pianoteq

6.1 Elevate Account Privileges

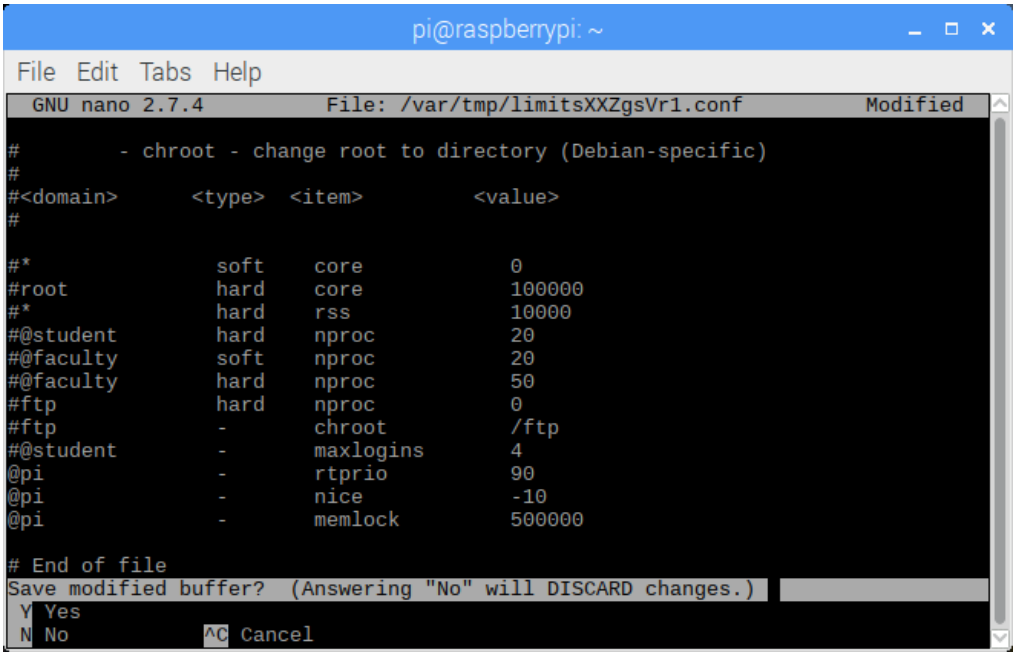
Your account privileges need to be elevated in the Raspberry Pi 3, to do this you need to modify a document containing these settings. Type the following line of code in the terminal and press Enter.



The terminal will show the contents of the document. Using the arrow keys in the keyboard scroll down and add the last three lines of code starting with @pi. “pi” is the default username Raspbian creates. If you created a new user or changed the default username, replace “pi” to the new username. When you finish adding the three lines of code press CTRL+X.

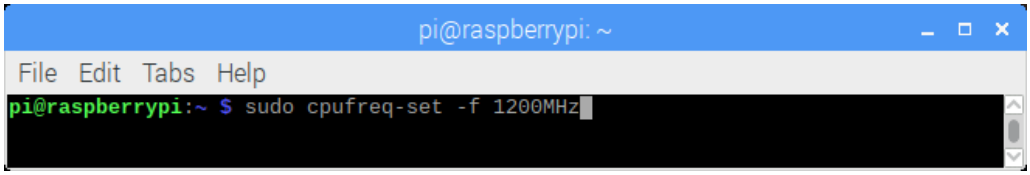


Save the modified file by pressing y and then pressing Enter.



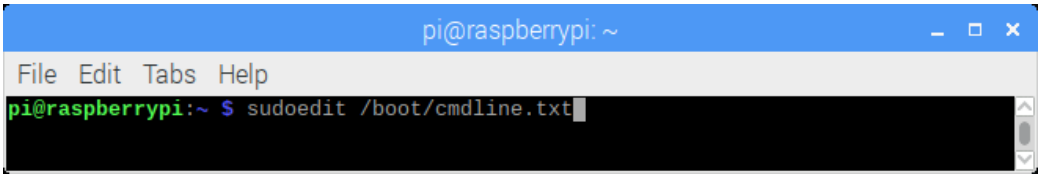
6.2 Set Maximum CPU Frequency

Set the maximum CPU frequency to 1200 MHz by typing the next line of code and pressing Enter.

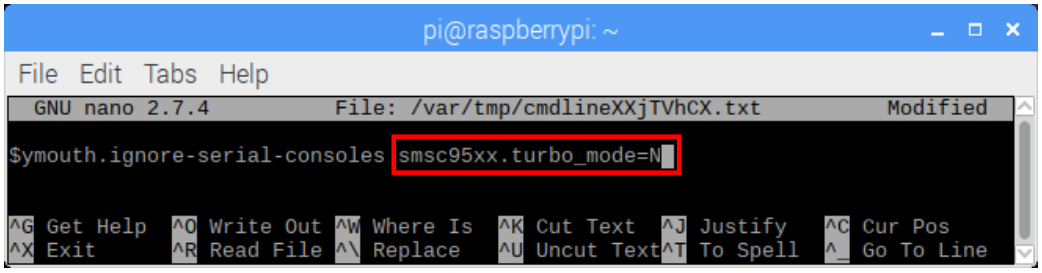


6.3 Configure Ethernet Driver

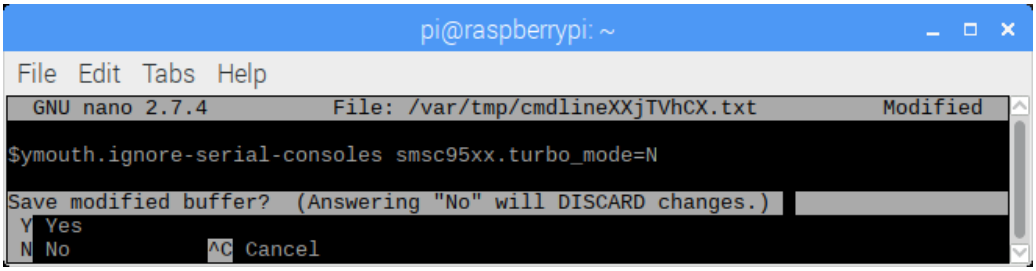
Edit the Ethernet driver to prevent possible pops and crackles by typing the following line of code and pressing Enter.



Using the keyboard arrow keys go to the end of the document, add the following text and press CTRL+X.

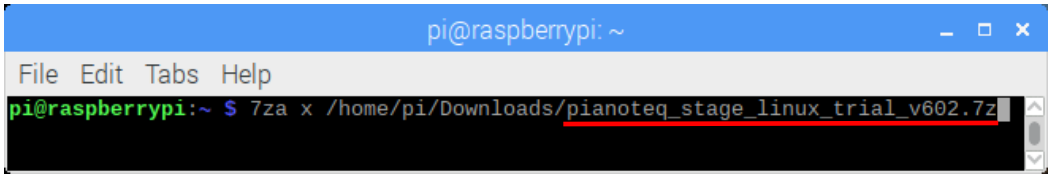


Save the document by pressing y and then pressing Enter.

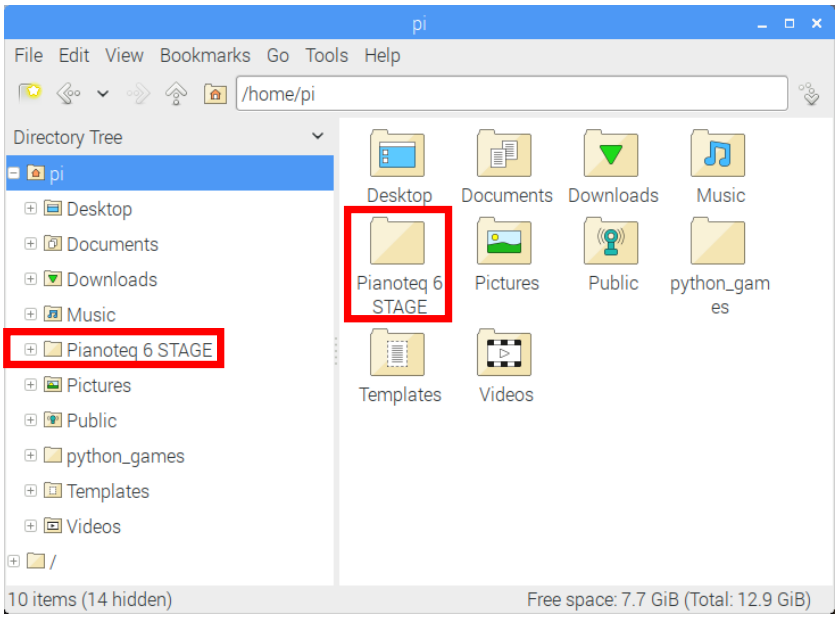


6.4 Extract Pianoteq

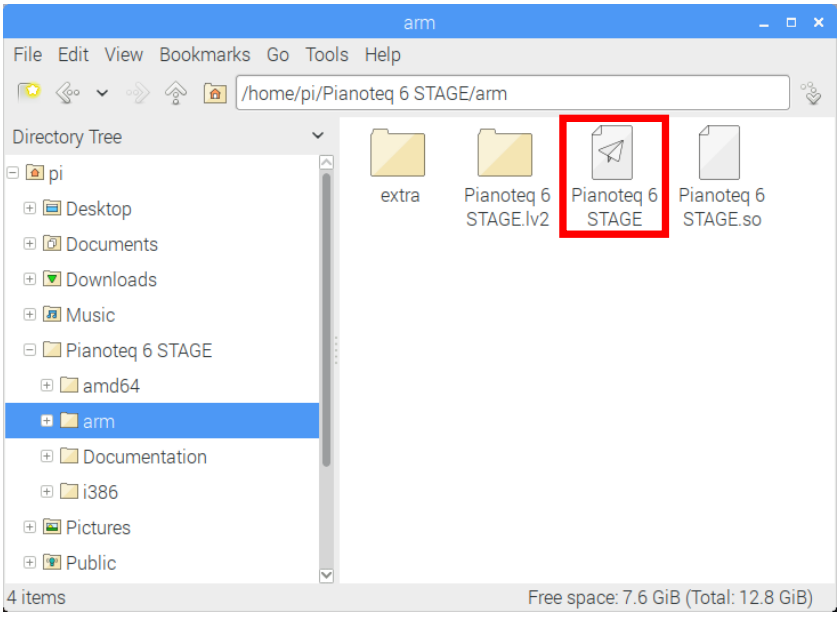
Type the following line of code in the terminal and change the highlighted text to the name of the file you downloaded from the Pianoteq website, see section 5.2. When you change this to your version of Pianoteq, press Enter. This will extract the files containing the trial version of Pianoteq 6 Stage Linux.



When Pianoteq finishes extracting, a new folder named after the version of Pianoteq you downloaded will be in the /home/pi directory. In this case, it is the stage version of Pianoteq 6. **Note: The name of the main folder where Pianoteq was extracted will be used in section 6.5, in this case it is "Pianoteq 6 STAGE".**

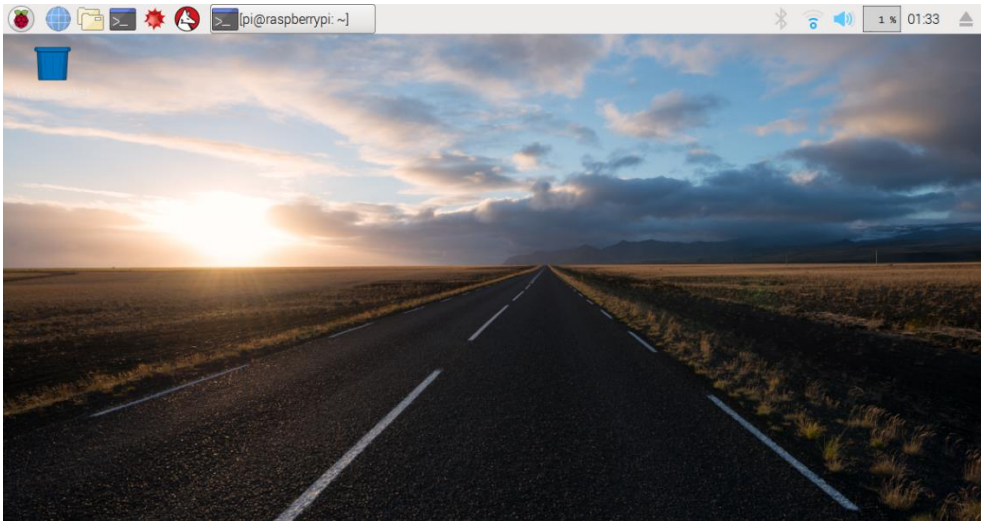


The arm folder (Raspberry Pi 3 uses an Arm processor) inside the main Pianoteq folder will contain the executable file that will open the standalone Pianoteq application.

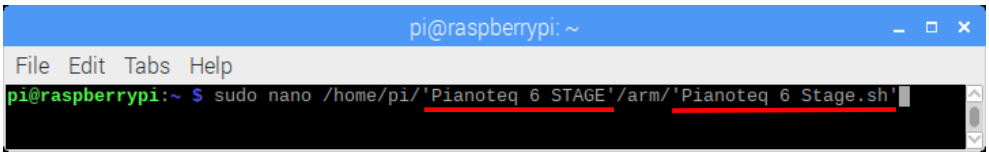


6.5 Create a Pianoteq Desktop Shortcut

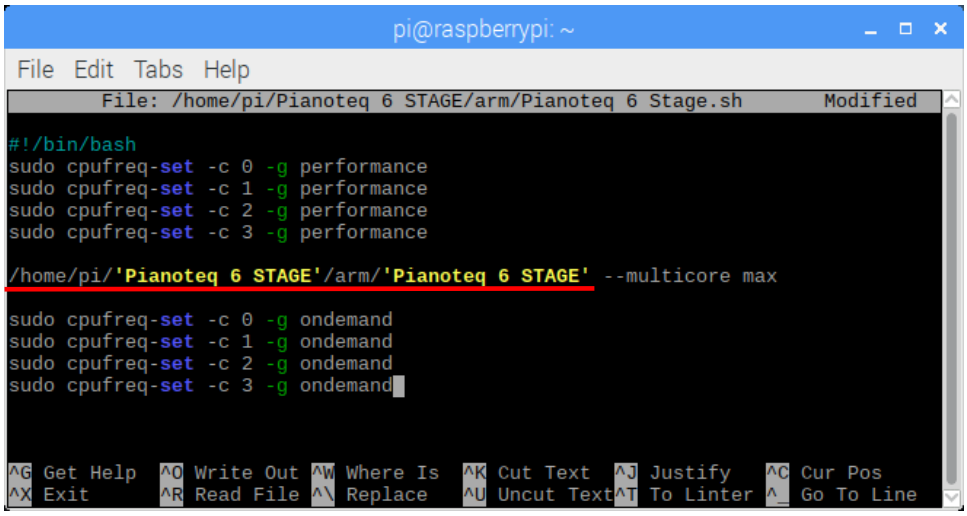
There is no Pianoteq desktop shortcut if you look at the desktop therefore you will create a desktop shortcut for Pianoteq. This desktop shortcut will also make sure that every time you launch Pianoteq all four cores are running at its maximum.



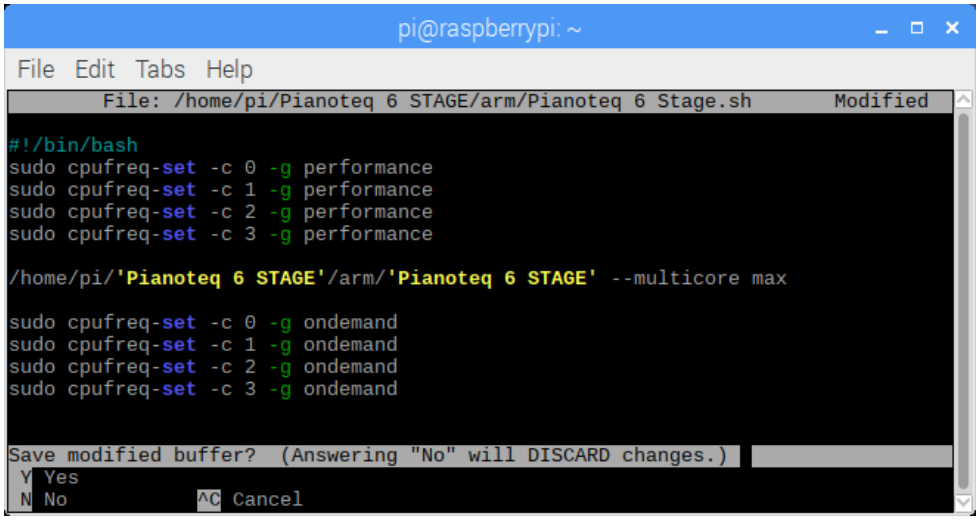
A shell script will be created that will run the command to start Pianoteq with all four cores at its maximum. Type the following line of code in the terminal but change the highlighted text with the name of the main folder explained in section 6.5, make sure to use quotations if the name has spaces. When this finishes press Enter.



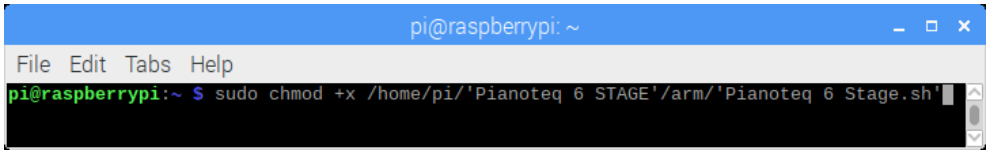
Type the following lines of code in the shell script but change the highlighted text to the path containing the executable of your version of Pianoteq, this is explained in section 6.5. Use quotations if a name has spaces. To prevent CPU frequency throttling (will create pops and crackles) when Pianoteq is running, you need to make sure that the CPU is always running in performance mode, which will make the CPU run at the maximum frequency, the first four lines of code take care of this. When Pianoteq is not running, the CPU frequency will return to its normal state (ondemand), the last four lines of code do this. When you finish press CTRL+X.



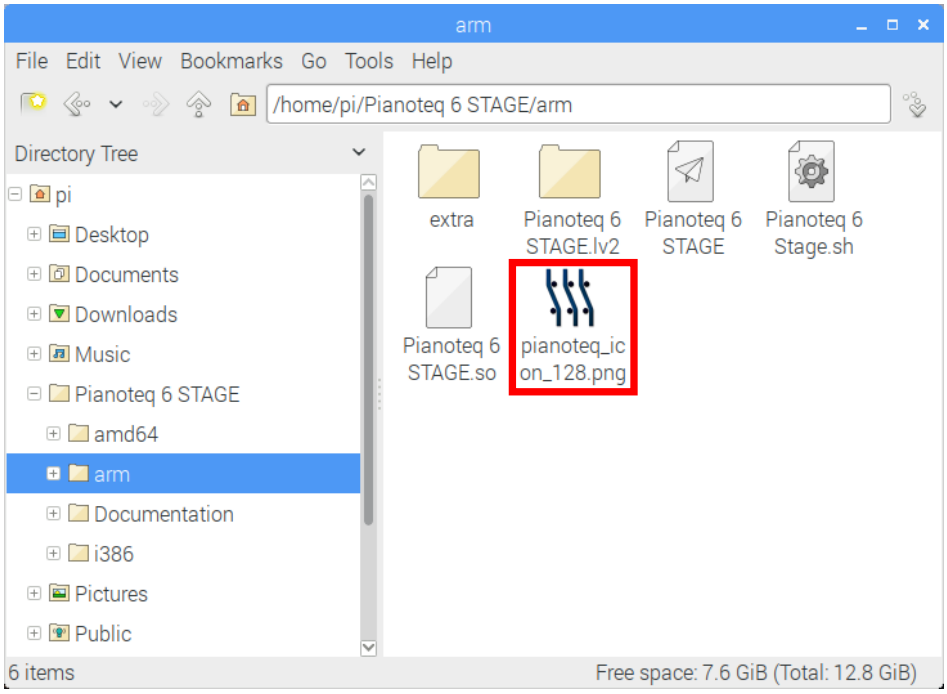
Save the shell script by pressing y and then pressing Enter.



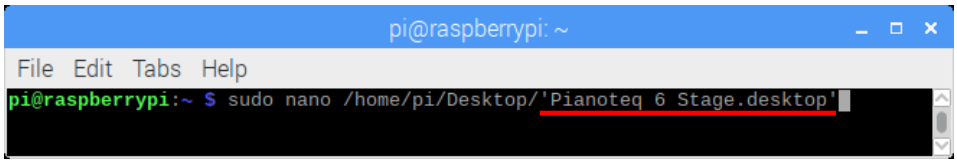
You need to turn the shell script into an executable for the desktop shortcut. To do this, type the following line of code in the terminal but change it to the path where the shell script is located. Notice that it is almost the same line of code that you used to create the shell script but with “nano” replaced for “chmod +x”. When you finish press Enter.



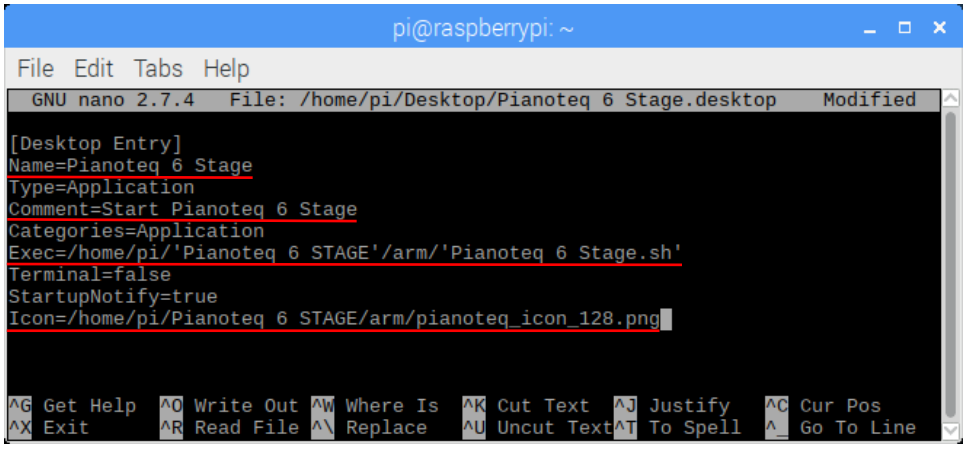
Go to Google images using Chromium, type Pianoteq icon, and download the Pianoteq Icon. Save it in the same folder where the Pianoteq executable and the shell script are saved. In this case, the icon was saved as “pianoteq_icon_128.png” in the folder “/home/pi/’Pianoteq 6 STAGE’/arm/”. The desktop shortcut will use this image as the icon.



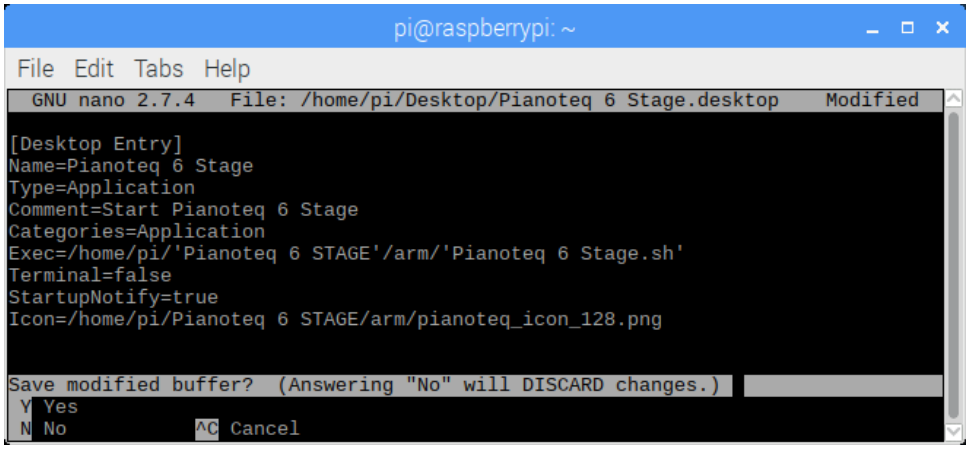
To create the desktop shortcut for Pianoteq, type the following line of code. Change the highlighted text to the name to your version of Pianoteq but include the ".desktop" at the end and include the quotations if you have spaces in the name. When you finish press Enter.



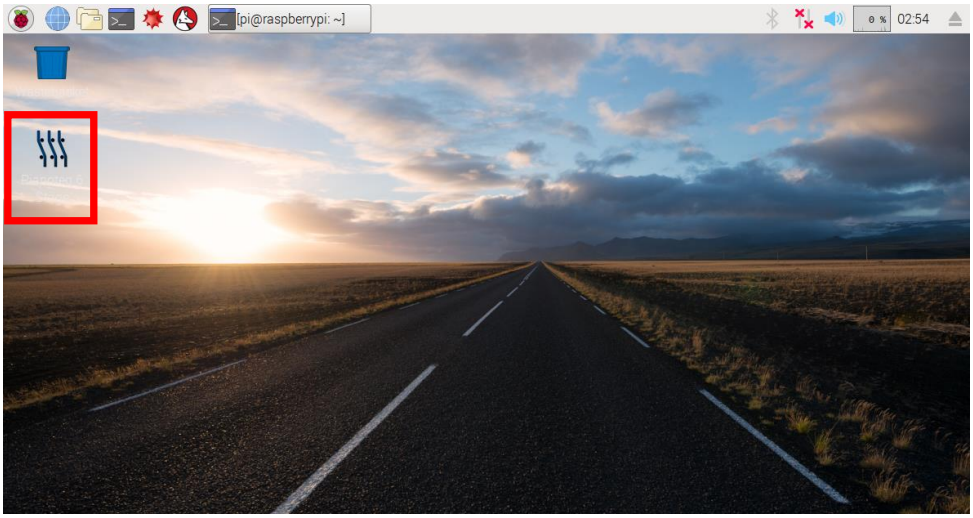
Type the following lines of code and change the highlighted text. Name is the name of the shortcut. Comment just explains what the shortcut does. Exec is the directory path to the executable shell script you created. Icon is the directory path to the Pianoteq image you downloaded (this is the only place where quotations are not needed for names with spaces). When you finish press CTRL+X.



Save the desktop shortcut by pressing y and then pressing Enter.

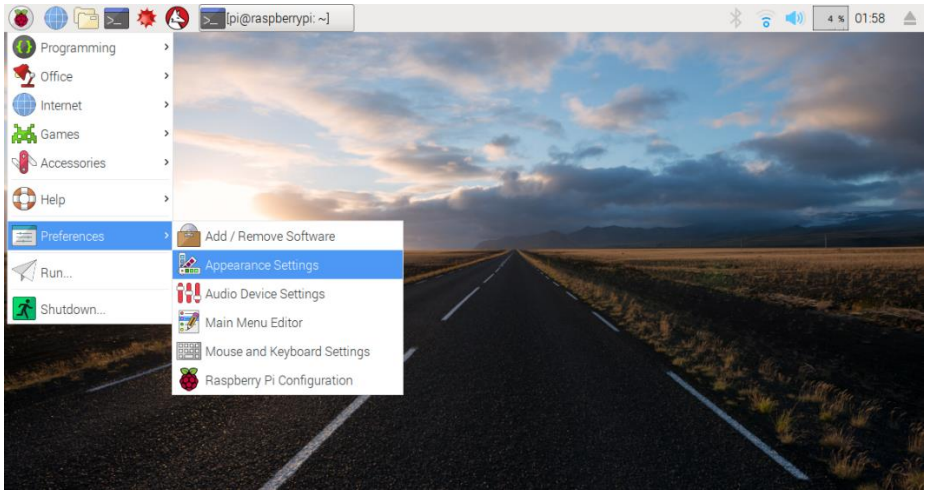


A new desktop shortcut with the Pianoteq logo is on the desktop now. Double clicking on it will start Pianoteq with all four cores in performance mode (at maximum frequency) with an aggressive multithreading strategy. For optimal results do not run CPU-intensive applications along with Pianoteq.

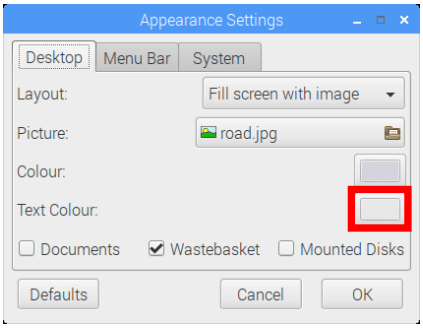


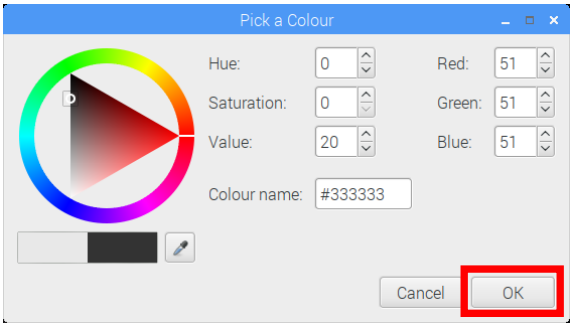
6.6 Change Desktop Icons Text Color

If the desktop icons text are hard to head due to the background color, you can change the desktops shortcuts' text color. Press the Raspberry Pi logo, go to Preferences and then to Appearance Settings.

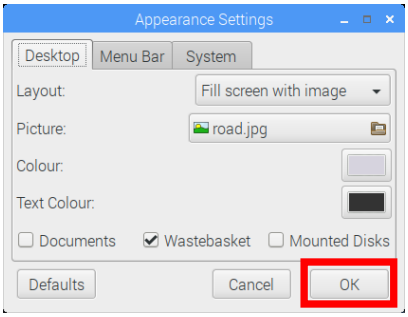


In here, you can change the background picture and/or the text color. I will change the text color to a dark color instead of the background picture.

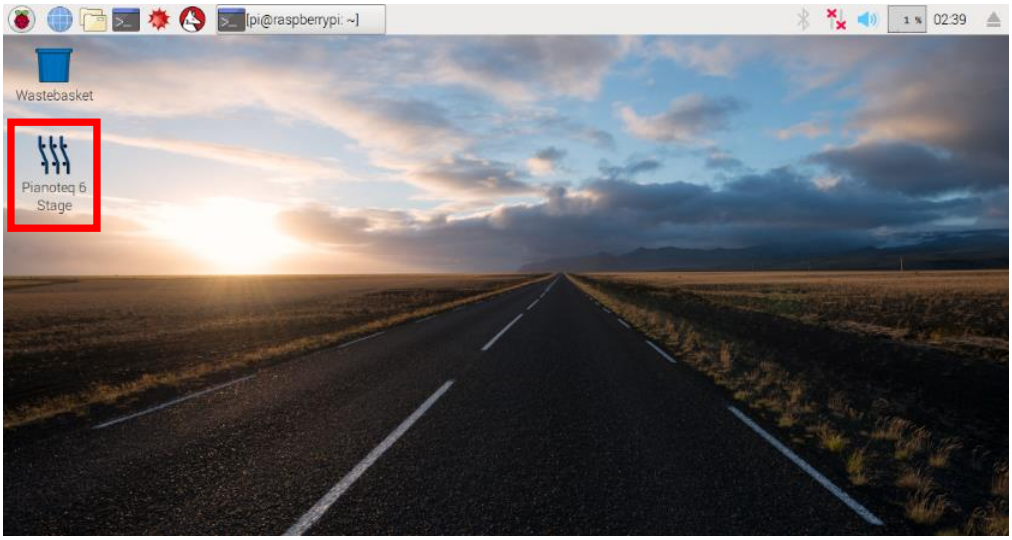




When you change the color press Ok.



The text of all the desktop shortcuts will now be dark and visible.

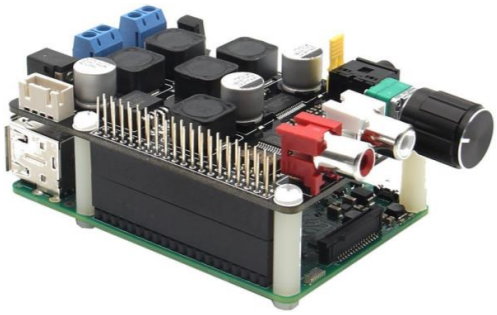

[pi@raspberrypi: ~]
1 %
02:39
Wastebasket
Pianoteq 6
Stage

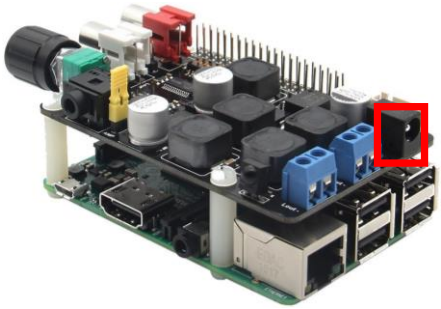
7 Digital to Analog Converter (DAC)

A high fidelity DAC can take the Pianoteq sound quality to a completely new level while helping lower the CPU load to allow Pianoteq to use higher internal sampling rates. The Suptronics X400 expansion board connects via I2S through the Raspberry Pi pins but other DACs that connect through a USB port can be connected such as the Audioengine D1.

7.1 Hardware Setup

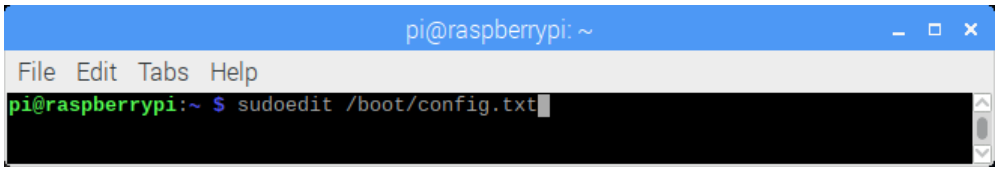
Take the X400 board and stack on top of the Raspberry Pi 3 so that it looks like the picture below. **Remember not to power the Raspberry Pi 3 using the micro USB port anymore! Power the system through the power port on the X400.** From now on, the X400 board will supply power through the pins to the Raspberry Pi 3 and any other electronic devices connected to the system.



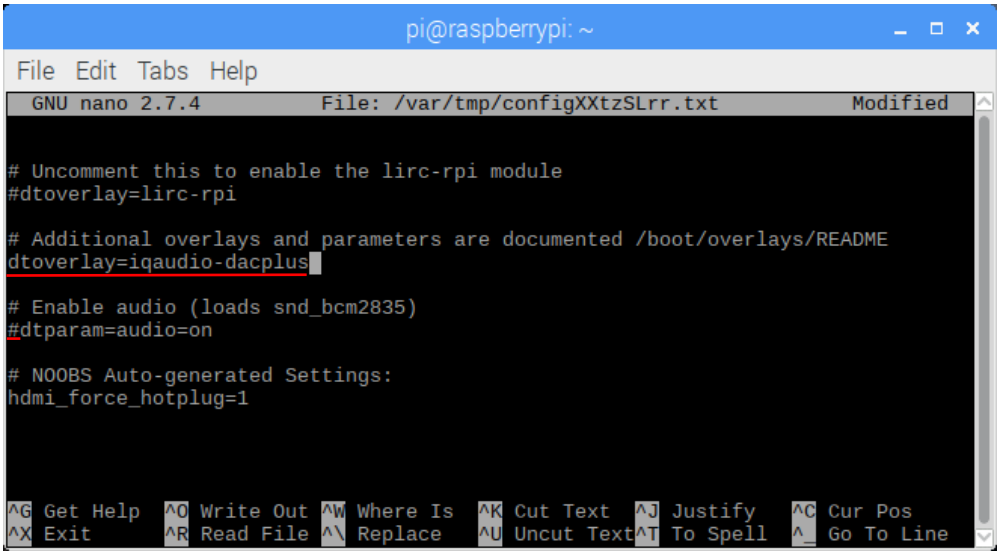


7.2 Software Setup

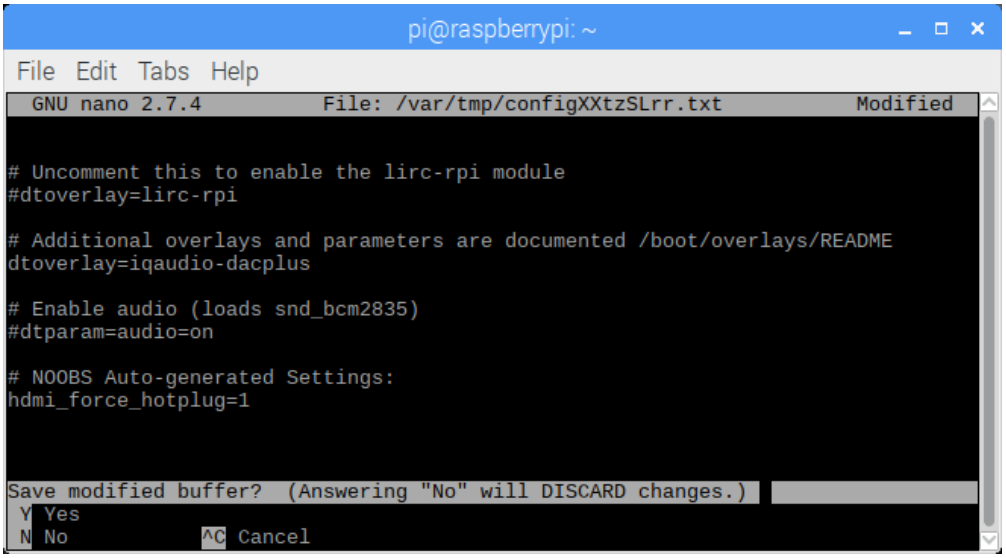
The Raspberry Pi's latest kernels and firmware use something called a Device Tree (DT), which simplifies the use of modules. To setup the X400 board type the following line in the terminal and press Enter.



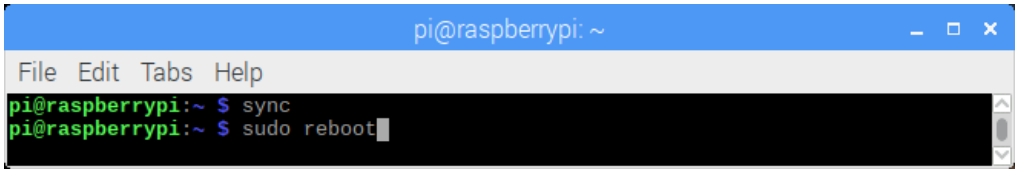
Scroll down to section of the config.txt file where it says "# Additional overlays…" using the arrow keys and type the following line of code and comment "dtparam=audio=on" with a "#" in front of it. Commenting this line of code will disable the Raspberry Pi 3 driver for the onboard sound, I want this because I will be using the X400 as the main sound card. You can always go back and uncomment this if you want to use the onboard sound card. Press CTRL+X when you have made the changes to the config.txt file.



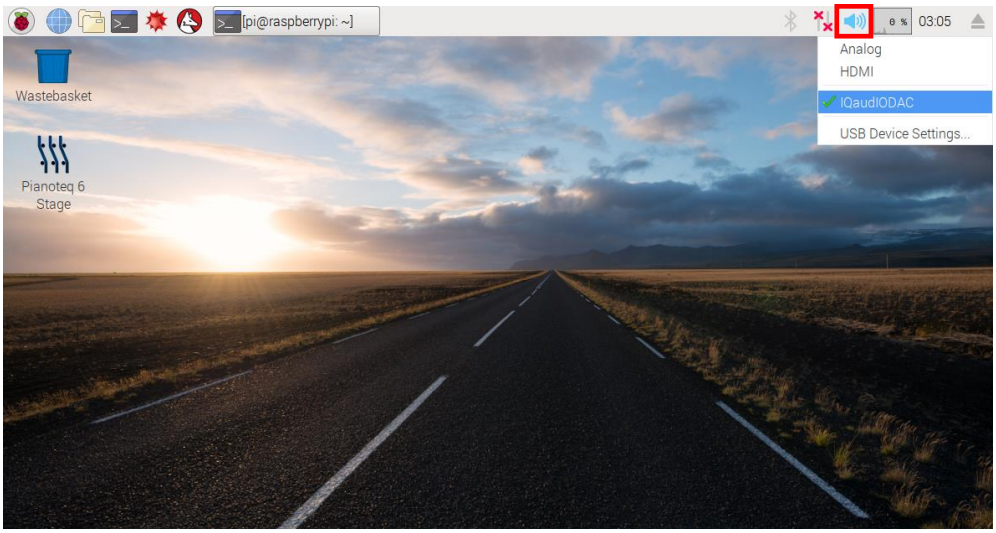
Save the config.txt file by pressing y and then pressing Enter.



Flush the file system changes you made and reboot the Raspberry Pi by typing the following lines of code and pressing Enter.



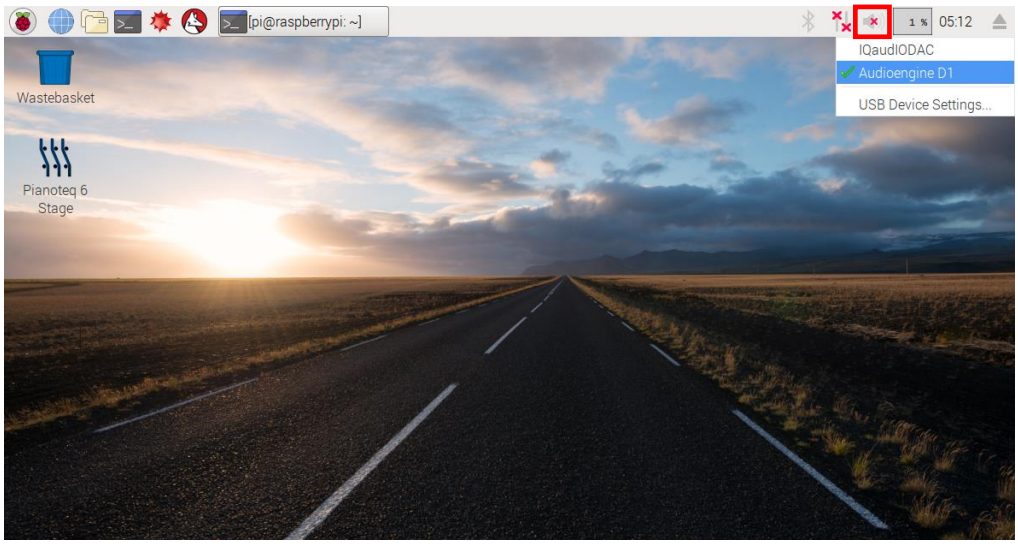
When the system reboots make sure that the X400 sound card is selected as the sound output by right clicking on the sound icon and selecting “IQaudIODAC”.



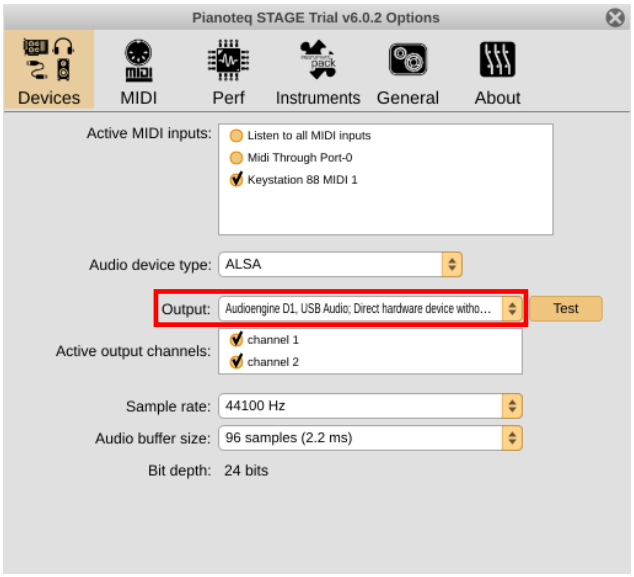
7.3 Other sound cards (USB type)

Sound cards such as the Audioengine D1 (USB) are as simple as plug and play.

To use these type of DACs connect the DAC through the USB Input to the Raspberry Pi 3 USB port and select the DAC as the sound output by right clicking in the sound icon. In this case I have both, the X400 board and the Audioengine D1 connected.



Make sure that you select the sound card you are using as the output in the Pianoteq settings, in this case it is the “Audioengine D1, USB Audio; Direct hardware device without any conversions“. The signal sent to the sound card needs to be without any conversions. This makes the sound card do all the work, reducing the CPU load.

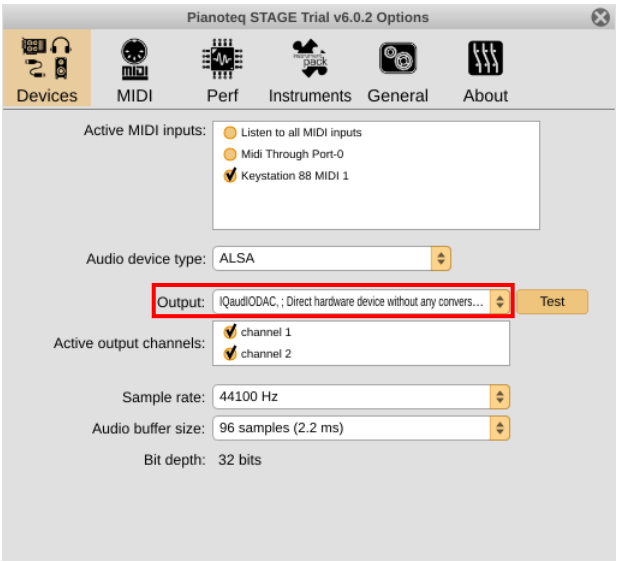


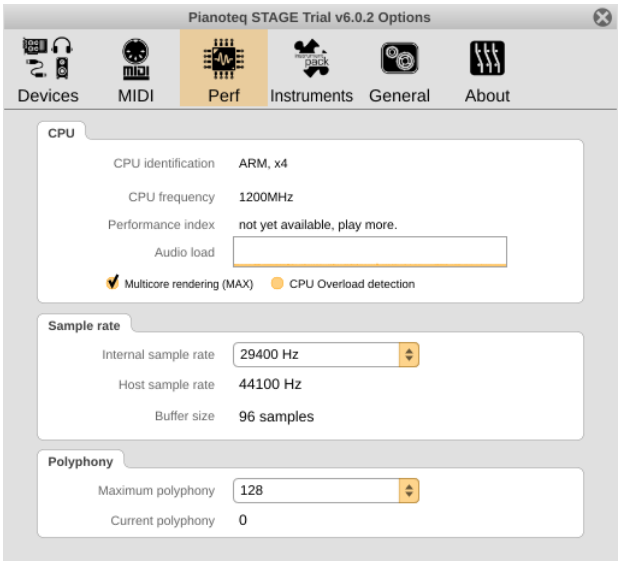
8 Pianoteq Settings

8.1 Recommended Settings

To access the Pianoteq settings click on the following tab under File.

The following settings are the recommended Pianoteq settings with the default Raspberry Pi 3 settings. Make sure that the Output option in the Devices tab is selected to the sound card that you are using and without conversions, in this case, is the X400 sound card “IQaudIODAC, ; Direct hardware device without any conversions”.





If you would like to increase the default recommended settings for Pianoteq while preventing pops and crackles to go to section 8.2 for more information on how to do this.

8.2 Overclocking the CPU

Pianoteq and/or myself are not responsible for voiding the warranty on your Raspberry Pi 3, any injuries or damage caused to you, anyone, property, or your Raspberry Pi 3 due to overclocking your Raspberry Pi 3 CPU; proceed at your own risk.

Not all Raspberry Pi are created equal due to quality controls and this will work for some Raspberry Pi and not for others. The following things can void the warranty of your Raspberry Pi 3.

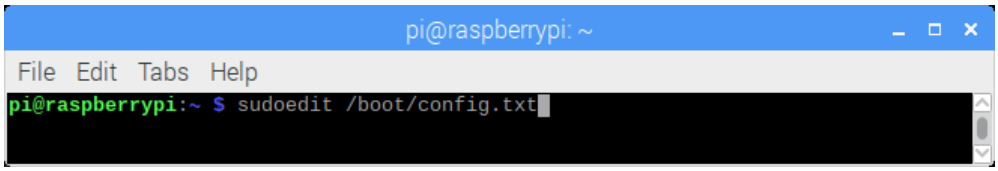
1. Setting the over_voltage setting above 6. This setting provides more voltage to the CPU and Core in increments of 0.025V.

2. Enabling the force_turbo setting. This setting forces the CPU to run at the max CPU frequency always.

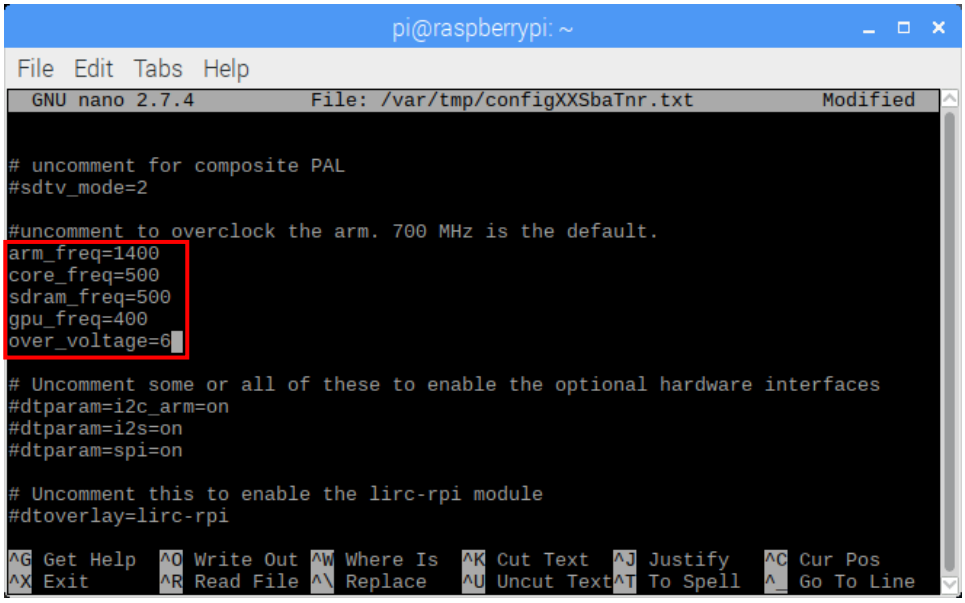
3. Disabling the current_limit_override setting. This setting offers hardware protection.

4. Setting the temp_limit above 85 °C. This is a CPU overheat protection.

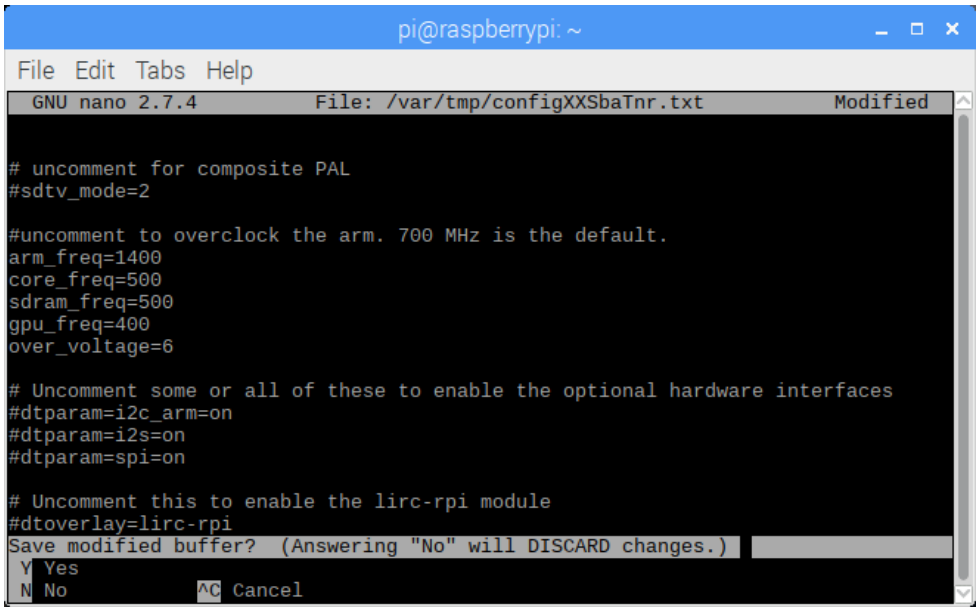
Overclocking the CPU of the Raspberry Pi 3 can help Pianoteq be setup to higher internal sampling rates. This however will create more heat inside the CPU, which is why you need fan/heat sink to maintain the CPU temperature at working conditions. The CPU will begin to throttle if the CPU reaches 85 °C. The settings used to overclock the CPU might be slightly different for every Raspberry Pi 3 because every Raspberry Pi is slightly different when it comes to overclocking it. You will have to play around with the settings to find the optimal settings. To change the settings to overclock the CPU type the following line of code in the terminal.



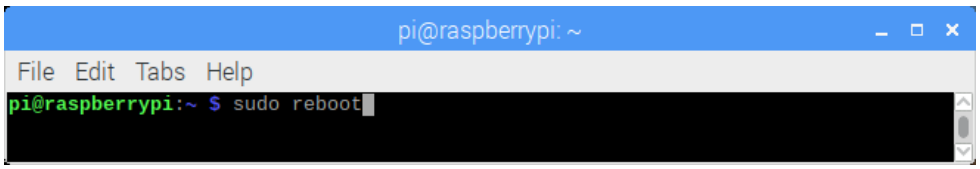
Mainly, two parameters need to be changed to overclock the Raspberry Pi 3. These are the speed of the ARM core and the voltage of the ARM core. You can change other parameters but these two are the only ones needed to boost Pianoteq. In section 6.2, the maximum CPU frequency was set to 1200 MHz; overclocking the device will automatically change that frequency to the new max frequency you define here.



Save the config.txt file by pressing y and then pressing Enter.



Reboot your system for the changes to take effect by typing the following line of code in the terminal.

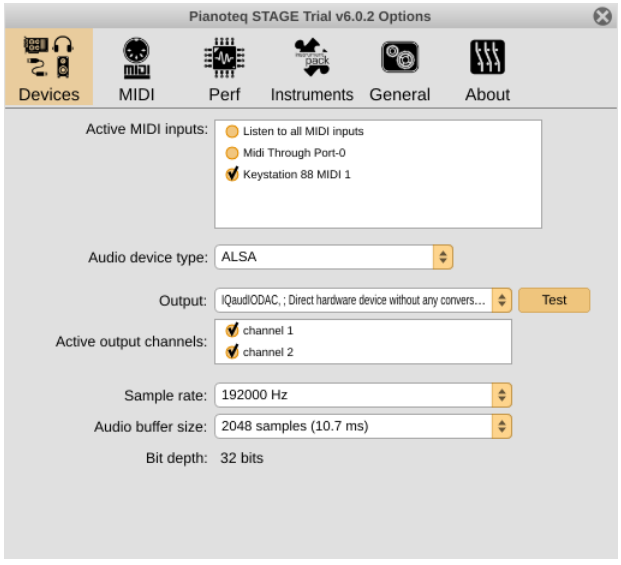


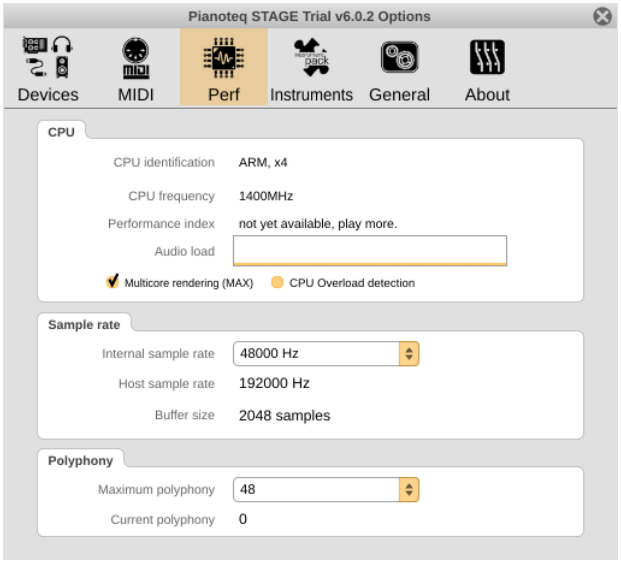
The following setups are there to serve as a guide and not as absolute settings. You will have to play with the settings, remember, not all Raspberry Pi 3 are created equal. Some Raspberry Pi 3 can overheat fast with a frequency of 1250 and in some cases a Raspberry Pi 3 can reach a

frequency of 1450 with proper cooling. Start with the first setting, move up the list, try Pianoteq, and reboot the system every time you change these settings. Also try changing the Maximum polyphony and Audio buffer size for better results.

arm_freq=1250	over_voltage=2
arm_freq=1300	over_voltage=3
arm_freq=1350	over_voltage=4
arm_freq=1400	over_voltage=5
arm_freq=1450	over_voltage=6

In my setup, I was able to overclock the Raspberry Pi 3 to a frequency of 1400MHz with an overvoltage of 6. The following images show my setup in Pianoteq. What worked for me may not necessarily work for you. To optimize your system look at the Audio load in the Performance tab as you play while tweaking the parameters, this will give you a good idea if the parameters you set are too much for the CPU (red lines) or not. To learn about more overclocking a Raspberry Pi go to https://www.raspberrypi.org/documentation/configuration/config-txt/overclocking.md.





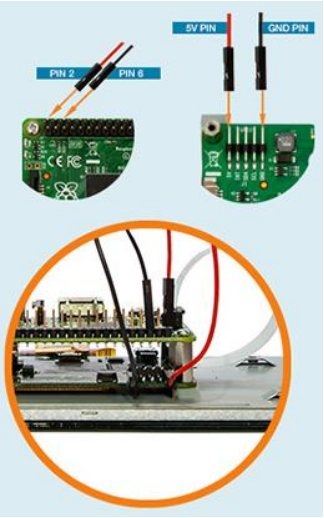
9 Raspberry Pi 7” Touchscreen Display

This section will explain how to connect and setup the Raspberry Pi 7” touchscreen display with the Raspberry Pi 3. Some cases for this display require the display to be rotated physically or through a command. I will show you how to rotate the display using a command.

9.1 Hardware Setup

Start by connecting the DSI ribbon cable to the display board and then connect the DSI ribbon cable to the Raspberry Pi 3 DSI connector.

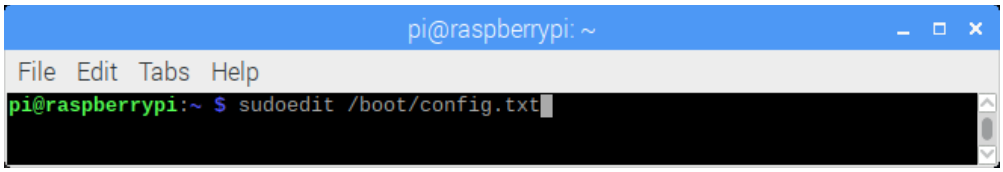
This display can receive power through the 5V and GND pins on the board or the micro USB input. In this configuration, I will connect the 5V and GND pins on the X400 board to the 5V and GND pins on the display board.



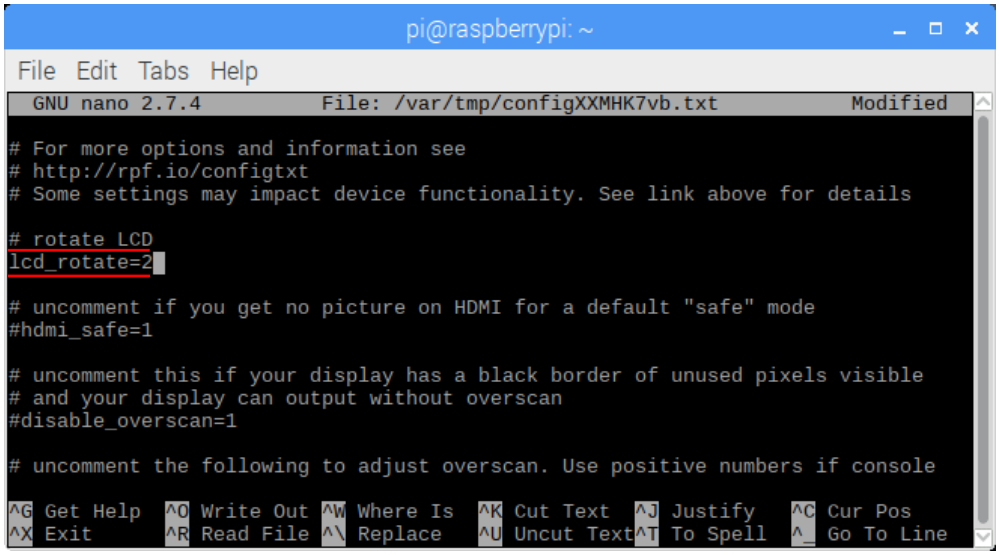
When the Raspberry Pi 3 gets powered on, the touchscreen display will be working.

9.2 Rotate Display

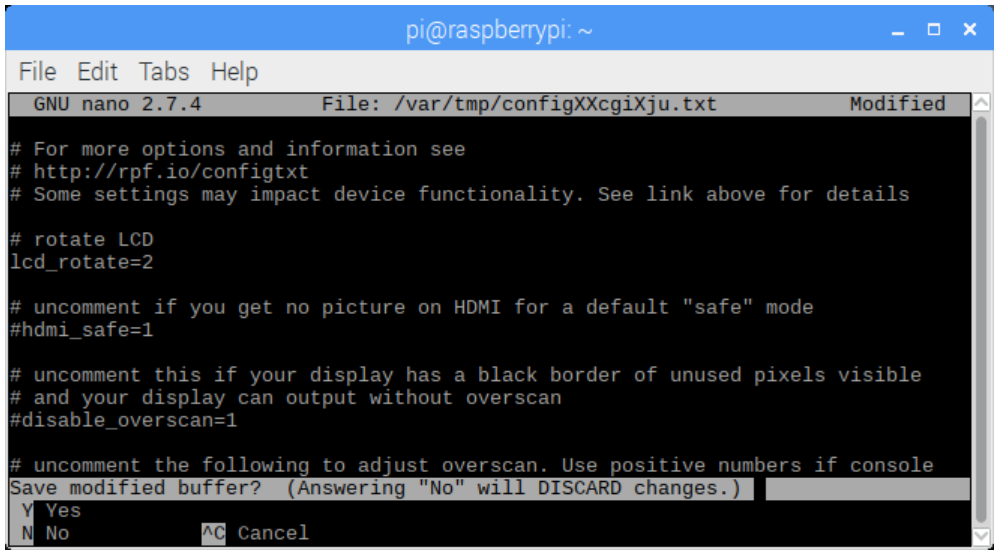
Some cases for the touchscreen display will show the display upside down, this happened to me with the Eleduino bamboo case. If this is the case with your system, you can rotate the display by editing the config.txt file. Type the following line of code in the terminal.



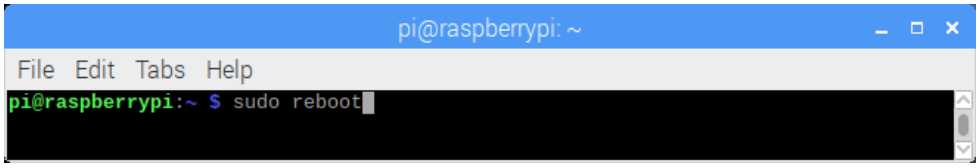
Add the following two lines of code in the config.txt file and press CTRL+X.



Save the config.txt file by pressing y and then pressing Enter.



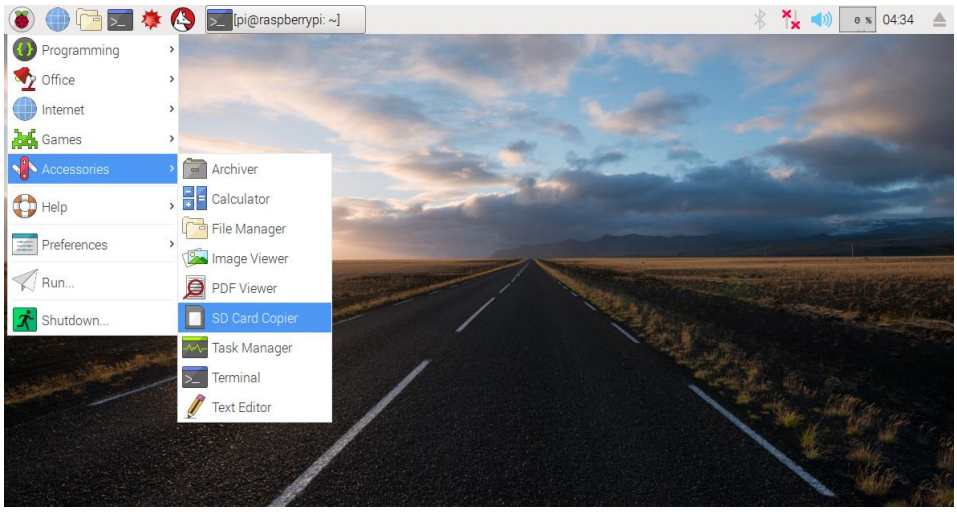
Type the following line of code to reboot the system. The display will be rotated 180° when the system reboots.


pi@raspberrypi: ~
File Edit Tabs Help
pi@raspberrypi:~ $ sudo reboot

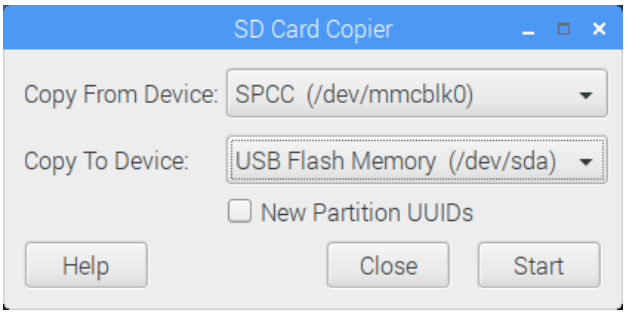
10 Additional Information

10.1 Create a Backup

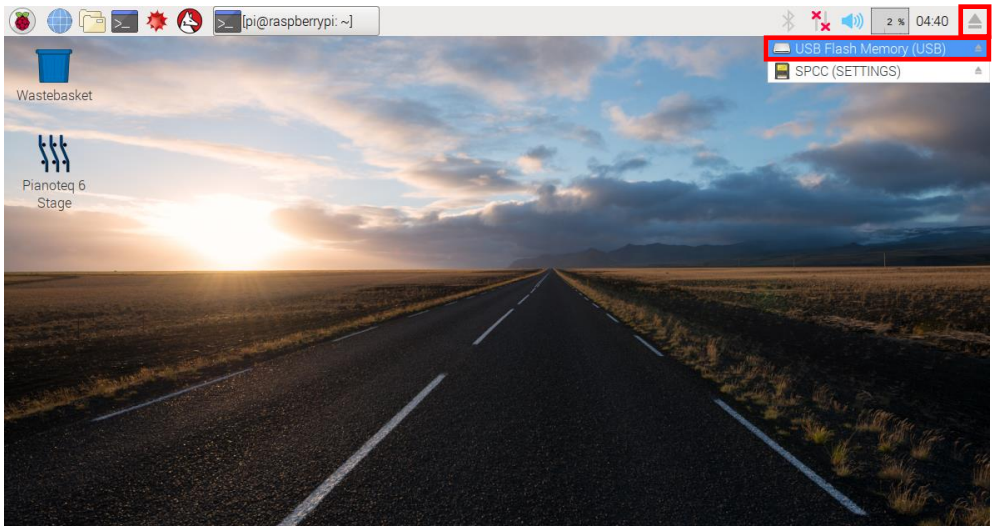
Creating a backup of your system is very important; it can save you from having to redo this tutorial all over again. You can create a backup on another SD card by using the SD Card Copier that is built into Raspbian. Connect a new SD card using a USB adapter to one of the Raspberry Pi 3 USB ports and select the following program.



Once the SD Card Copier program starts select the SD card containing Raspbian in “Copy From Device” and select the SD card that will contain the back up in “Copy To Device” and click on Start. This process will take a few minutes.



When the SD card finishes copying, close the SD Card Copier, and eject the SD card pressing on the following icon. You can now remove the SD card adapter from the Raspberry Pi 3 USB port and you now have a backup of your entire Pianoteq 6 Raspberry Pi 3 system.


[pi@raspberrypi: ~]
2 %
04:40
USB Flash Memory (USB)
SPCC (SETTINGS)
Wastebasket
Pianoteq 6
Stage