

# PiArcade Raspberry Pi arcade box

Build instructions V 0.2



## Introduction

This kit includes everything you need to run your PiArcade except the software. All the software is available online and instructions on getting the software, installing and configuring is included in these instructions.

All the software required is freely available and open source, but some pieces cannot be distributed with any product, and must be directly downloaded from the author's approved sources. This means that we cannot 'pre-install' any software even though it is free, freely available and open source. Please respect these constraints if you choose to build your own versions of any arcade gadget that might use other people's software and sell them.

As is the nature of the internet links disappear all the time. If you find a link that does not work any more please feel free to let us know and we will try to update the documentation, but Google will still be your best friend ☺

Make sure you read these instructions completely from start to finish BEFORE you even open your kit. Then... open your kit and read the instructions again before doing anything beyond looking and touching!!! Then... read them again. I promise if you RTFM (Read The Flippin' Manual) your kit assembly will go a lot smoother than if you don't ☺

## Things you will need for setting up your PiArcade...

These items are only needed to setup your PiArcade initially due to the software distribution restrictions mentioned above. I would like nothing more than to pre-build everything and just give you the microSD card ready to run, but it simply isn't allowed. Sorry.

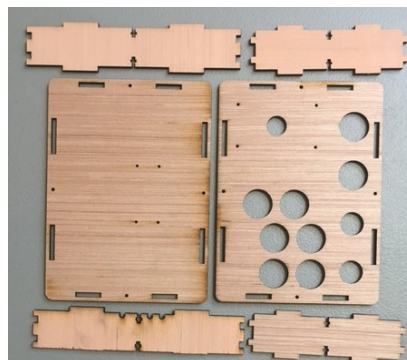
- 1) Memory card reader/writer capable of writing to SD or micro SD memory cards greater than 4GB. Some older readers won't work with larger than 4GB.
- 2) USB keyboard.
- 3) Philips screwdriver.
- 4) HDMI compatible TV/monitor. (Technically you need this after setup too!!)
- 5) Standard USB 'stick' formatted in FAT32 mode.

## Bits and pieces

The kit you have should include the following bits and pieces. Make sure you have everything before starting.

### ***Enclosure***

- 1x Top
- 1x Bottom
- 2x Side
- 1x Back
- 1x Front



## Buttons

- 1x Joystick
- 1x Joystick wire
- 8x Large buttons
- 2x Small buttons
- 10x Button wires
- 1x USB keyboard controller & USB wire
- 1x Power brick
- 1x USB 'pigtail'
- 1x USB power cable
- 1x HDMI cable



## Screws

- 4x #6 x 1/4" pan screws
- 8x M3 x 14mm screws
- 8x M3 nuts
- 4x M2.5 x 25mm screws
- 4x M2.5 nuts



## Electronics

- 1x Raspberry Pi Zero (Zero-W in deluxe kits)
- 1x MicroSD memory card
- 2x 3D printed supports
- 1x 3D printed spacer
- 1x GPIO expansion PCB



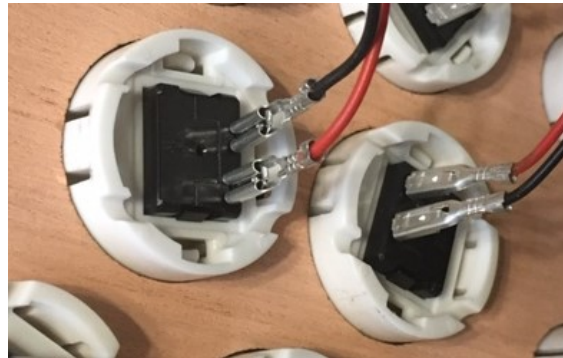
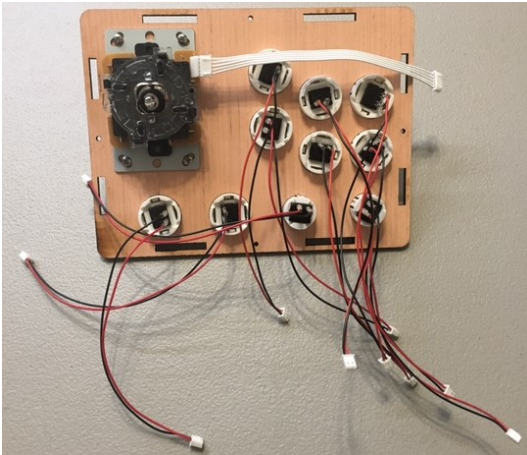
## Assemble buttons & joystick

This can be a little tricky and is easier if you happen to have 3 hands, although 2 will usually suffice.

- 1) Remove the joystick ball from the joystick & the cover plate and pass the joystick through the bottom of the top piece. Next use the 4x #6 x 1/4" pan screws to fix the joystick to the under side of the top. Do not tighten the screws too much otherwise you might strip the holes in the wood. Put the cover plate back on to the joystick and re-attach the ball. Note, the joystick shaft will turn as you try to unscrew/screw the ball so it might be necessary to gently hold the joystick shaft with grips/pliers. If so, protect the shaft from scratching with a paper towel.
- 2) Push the 8 large and 2 small buttons through their corresponding holes from the top side. Make sure the buttons are flush with the top piece.
- 3) Carefully attach the 5 pin cable to the joystick. Orientation doesn't matter at the moment.

4) Attach a jumper wire pair to each button. It does not matter which side get the black wire. The spades are designed so that the flat part of the connector faces outwards and the 'curly' side faces inward. You should feel the connectors 'click' when you push them on.

Once finished your top piece should look like the following. Note the location of the joystick cable!!!



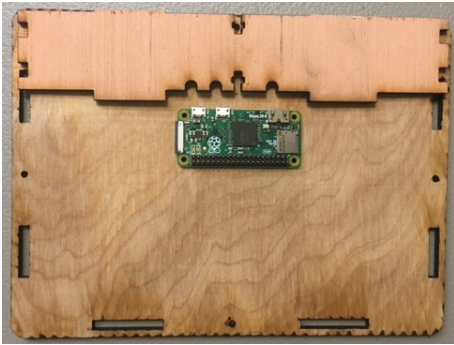
Note the enclosure was designed to have the joystick in the lower left side when viewed from the top, but lefties can flip this over if desired. It shouldn't matter, but you might need to play with the cables a little when putting the base on.

## Assemble the electronics

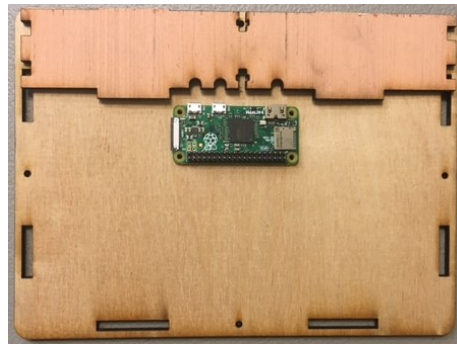
1) Place the bottom piece on a flat surface and align the Raspberry Pi Zero with the 4 mounting screw holes with the connectors pointing outwards. Align the back piece so that the center 'T-slot' is aligned with the hole on the bottom piece. Make sure that the cutouts in the back piece align with the connectors on the Pi Zero. If not flip the bottom piece over and repeat the alignment test. (We couldn't make this align in the center without getting the T-slot too close to the cable cutouts for comfort)



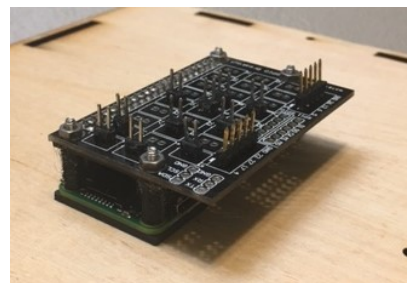
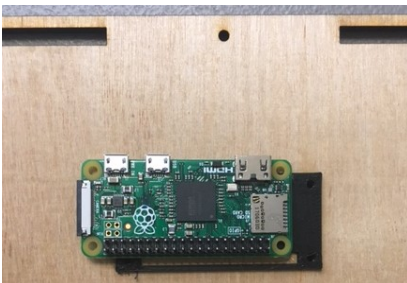
Bad



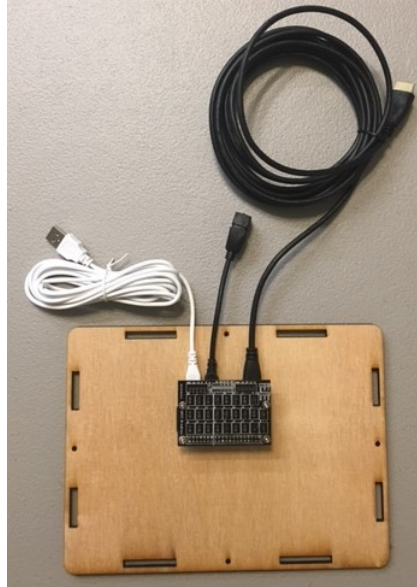
Good



- 2) Place the rectangular spacer under the Pi Zero so that the opening in the spacer aligns with the pins on the bottom of the Pi Zero.
- 3) Push a M2.5 x 25mm screw through from the bottom of the base, through the spacer and through the Pi Zero.
- 4) Place a support at each side of the Pi Zero. The supports should be placed so that the 'bridge' is away from the Pi Zero, and so that the slight curve on the bridge is facing inwards. Note, it might be necessary to use a screw driver to ease the screws through the supports/spacer.
- 5) Align the GPIO PCB connector with the pins on the Pi Zero and push them together. The 4 screws should align with the holes in the PCB and stick through. Note, if you didn't pay attention to step 3 regarding the curved orientation then the GPIO board will not fit snug at this point.
- 6) Put a M2.5 nut on each screw and gently tighten the screw/nut combinations. Do not over tighten, but make sure they are secure.



- 7) Carefully plug the long USB cable to the left most USB connector, plug the USB 'pigtail' to the middle, USB connector and plug the HDMI cable into the right most, HDMI mini connector. (Note, the HDMI cable is HDMI mini at one end and regular HDMI at the other)



Before we continue with the assembly we will now download and install the necessary software.

## Download required software

Create a directory on your computer called "c:\arcade"

Download "Etcher" from here...

<https://etcher.io/>

Once downloaded launch the Etcher installer to install on your computer. Once installation has finished Etcher will automatically launch itself. Just leave this open for the moment as we will be using it soon.

Etcher is a program that will allow us to put the Linux software onto the SD memory card in a format that will work on the Raspberry Pi.

Download "RetroPie" from here...

[https://github.com/RetroPie/RetroPie-Setup/releases/download/4.6/retropie-buster-4.6-rpi1\\_zero.img.gz](https://github.com/RetroPie/RetroPie-Setup/releases/download/4.6/retropie-buster-4.6-rpi1_zero.img.gz)

The link below is to the main page for RetroPie and has a lot more information for those of you who want to play and experiment more. There may also be a newer version of RetroPie, so you might want to check there to see.

<https://retropie.org.uk/>

**REMOVE ALL USB STORAGE DEVICES FROM YOUR COMPUTER. THE NEXT STEP CAN COMPLETELY ERASE ANY USB FLASH STICKS OR USB HARD DISK DRIVES YOU HAVE CONNECTED!!!**

Put the SD card into an SD card reader, then put the card reader into a USB socket on your computer.

If Etcher is not still open launch it again .

Click the blue "Select image" button, then navigate to “c:\arcade\” then click on “retropie-4.3-rpi1\_zero.img.gz”

Make sure that the middle icon correctly describes your SD card. Verify this by selecting "Change" then making sure that the size of the drive indicated closely matches the size of the SD card you have. If more than one drive is listed STOPP IMMEDIATELY and unplug all drives and USB sticks that are NOT the SD card you want to use for PiArcade.

**ONLY PROCEED IF YOU ARE 100% SURE THE LETTER CORRESPONDS TO THE SD CARD YOU WANT TO USE FOR PIARCADE.**

You can check by removing the SD card reader from the USB port and making sure that Etcher then shows “Select a drive”. Putting the SD card back in should then only show one drive letter.

Note, on Windows, if you get a message "You need to format the disk in drive...." Click Cancel. Windows doesn't know what it should be doing, and got this wrong. Ignore it.

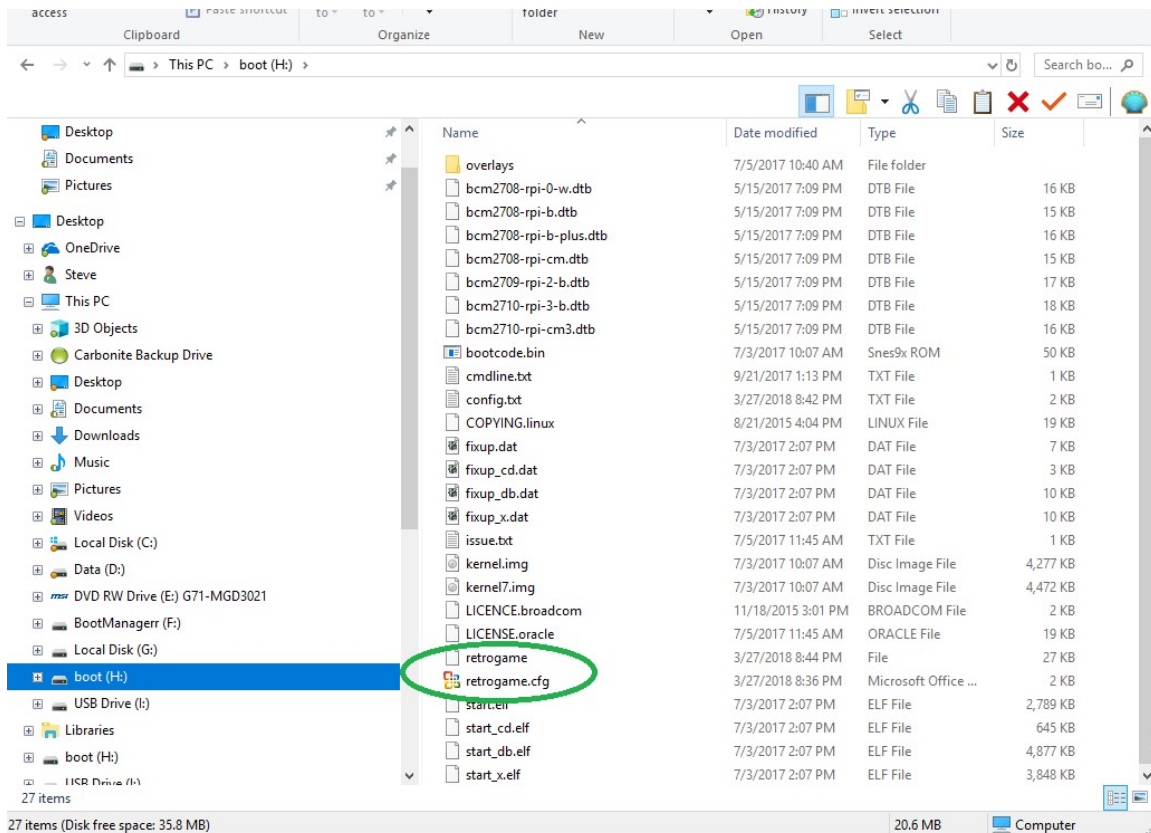
Once you are 100% sure everything is correct click “Flash” to transfer RetroPie to the SD card. You will get a message box on Windows saying "Do you want to allow this app to make changes to your computer", click “Yes” to actually transfer the RetroPie image to the SD card.

Go get a nice cup of tea for the next 5 minutes.

Once finished Windows will again get things completely wrong and really want to re-format the SD card. Every time the message "You need to reformat the disk..." appears, click "cancel". Windows will do this a lot.

Remove the SD card from your computer, then put it back in. (Click cancel to the Windows message AGAIN!!!)

You should now see a drive called "boot" appear. Select this drive and you should see something like the following... The circled files will be added in a moment so won't appear initially.



All files for the 3D printed parts, IO PCB, laser cutter DXF etc... are available here...

<https://github.com/SteveDC2/PiArcade>

From the above link download the file "retrogame.cfg" and save it to the root directory on the SD card (boot).

From the above link download the file "config.txt" and save it to the root directory on the SD card (boot).

From the above link download the file "10-retrogame.rules" and save it to the root directory on the SD card (boot).

From the above link download the file "autostart.sh" and save it to the root directory on the SD card (boot).

Download "Retrogame" from here...

<https://github.com/adafruit/Adafruit-Retrogame>

We only need one file from here, so click on "retrogame" in the list of files then click the "download" button. Save this file to the root directory on the SD card (boot).

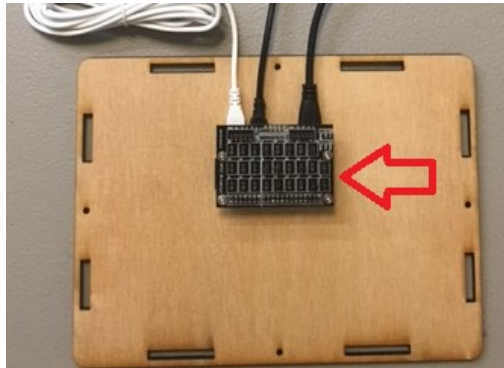
Actual games are not included since most are still under copyright. There are many 'open source' and public domain games available though. Use Google to find "ROMs" for the games you are interested in. ROMs must be from the MAME release 0.37b5. Google



“mame 0.37b5” to find the games. Note there are some web sites with complete ROM sets. Be warned, these files are HUGE so you may want to find somewhere that allows you to selectively download what you are interested in. It is also not recommended to add all the games to your PiArcade since searching through all the games will take a lot of effort to find the ones you really actually like !! We will discuss adding game ROMs later.

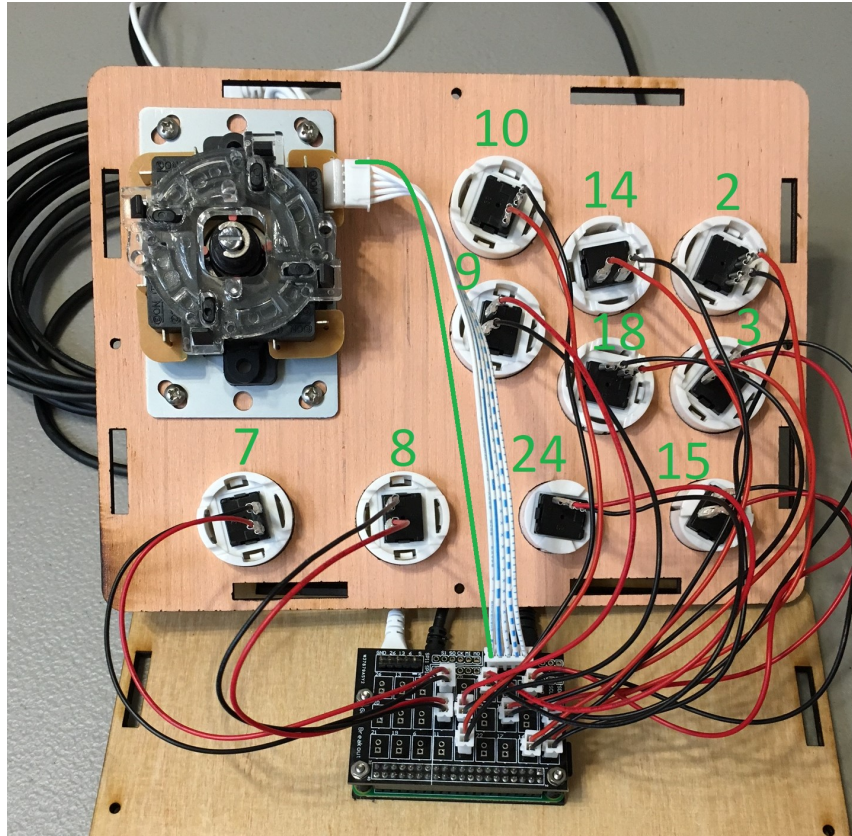
Right click on the SD card "boot" and select "eject". Once 'ejected' remove the SD card from your computer's SD card reader.

Insert the SD card into the slot on the side of the Raspberry Pi Zero.



Plug a keyboard into the USB 'pig-tail'. Plug the HDMI cable into the mini-HDMI socket on the Raspberry Pi Zero. Plug the USB power cord into the right most USB socket.

Next, plug in the joystick and buttons as outlined below.



Note that the joystick connection should be such that the 'top' wire from the joystick goes to the 'left' side on the interface PCB as shown by the green line in the above picture.

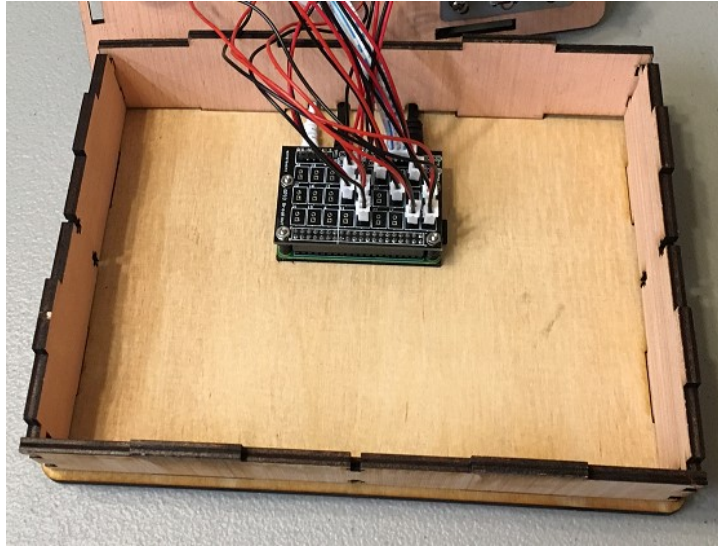
The orientation of all the other 2 pin switch connections do not matter (i.e. red and black can be swapped around, so don't worry about that)

Next, bend all the switch connections flat against the switch so that there is more space for the interface PCB.



Now it is time to start assembling the case, so go find an octopus or a friend with three hands, this part can be a little fiddly.

Start by placing the 4 side pieces into the bottom plate. Do not insert any screws yet. Be careful not to pull out any of the button cables.



Now put the top piece on. This will take some wiggling to align the slots and holes. Be careful not to force things though otherwise you might splinter the wood.



(Oops!!! I have the top on rotated 180 degrees in the picture, sigh!!!)

Now, gently insert one of the M3 nuts into the horizontal T-slot on one of the sides.





Once the nut is in the slot screw in one of the M3x14mm screws. If the nut falls inside the box try another nut. Do not try to retrieve the rogue nut just yet since that will require you to open the box, and you will recall just how much fun that was from the last hour of fiddling with the box !!

Once the screw is in the nut tighten it until the screw is flush with the box top, but don't over tighten.

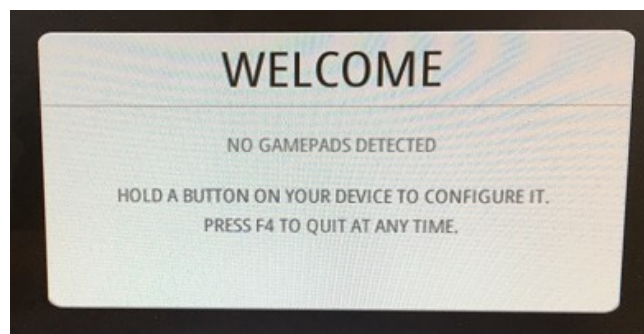
Repeat the process on the remaining 3 top fixtures.

Before screwing the bottom screws we are going to make sure everything is working correctly and do some setup.

Plug the HDMI cable into a TV/monitor and turn the monitor on, selecting the correct HDMI input.

Plug the USB power cord into the USB power brick and plug the brick in to power the Raspberry Pi.

You should now see lots of things go whizzing up on your TV/monitor. The first time you power up the Raspberry Pi it will take longer than normal as Linux configures a few things but eventually you should see the following...



Press and hold any key on the keyboard until the word "Keyboard" appears, then release the key.

You should now see "Configuring Keyboard". We are now going to tell Emulation Station which 'keys' we want to use for various things. Later we will make the joystick and buttons effectively push keyboard keys for us.

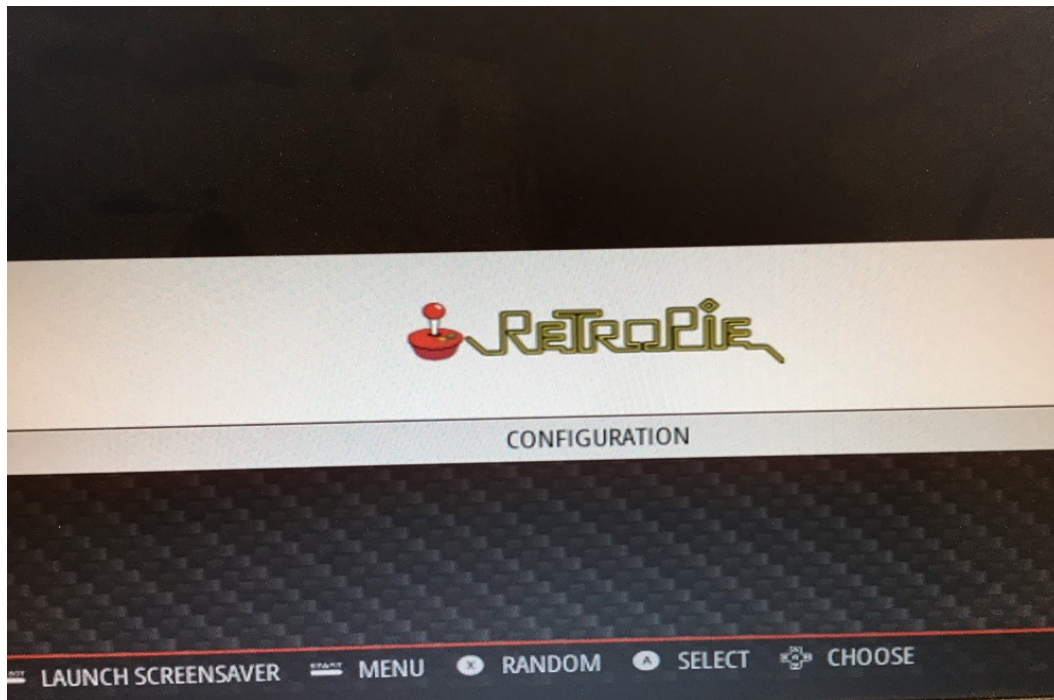
Press the keys listed below for each control...

D-Pad up	Up arrow
D-Pad down	Down arrow
D-Pad left	Left arrow
D-Pad right	Right arrow
Start	1
Select	Enter
A	Left Ctrl
B	Left Alt
X	X
Y	Space

Left shoulder and all remaining controls up until "Hotkey enable" just press and hold any key until "Not defined" appears and the next control is highlighted.

For "Hotkey enable" press the 'Esc' key

Once the 'OK' button highlights press 'Left Ctrl' and wait until the key configuration completes. You should now see the following.





Press the "F4" key to exit from Emulation Station.

Now we are going to set up the arcade buttons and joystick.

Type the following commands, note that all spaces, dots, quotes etc... are **important**.

```
cd
cp /boot/ 10-retrogame.rules /etc/udev/rules.d/
sudo cp /boot/rc.local /etc/
```

Now, this is where some personalization comes in. I don't like Emulation Station. Well, that isn't quite true. I don't like that you can very easily mess things up by setting things, deleting things or otherwise do things without knowing how/why. If you have young kids or friends playing with your arcade box I guarantee it will get messed up very quickly.

One thing you can do to help reduce that risk is disable some of the configurations from the menu. Rather than put everything in text here I am going to point you to a good video here...

<https://www.youtube.com/watch?v=fzQ0YRJssmA>

You can do this at any time. If Emulation Station is running just attach a keyboard to the pig tail and press "F4" to exit Emulation Station or exit using your joystick and buttons, then follow the video instructions.

Later I will show how to completely eliminate Emulation Station and go straight into MAME if you only want classic arcade games.

For more information on what Emulation Station can do visit their webpage here...

<https://emulationstation.org/>

Now type the following to restart things.

```
sudo reboot now
```

Now the arcade box will reboot, it might restart a couple of times so don't worry.

Eventually you should see the RetroPie screen as shown above.

Now we are going to finish some setup for the MAME emulator.

Take your USB stick and put it in your computer. (This is Windows centric. It MIGHT work on a Mac or Linux computer but I can't check. Sorry)

Right click on your USB drive and select "properties". Make sure that "File system" says "FAT" or "FAT32".

Create a directory on the root of the USB stick called 'retropie', then 'eject' it from your computer.

Plug the USB stick into the pigtail on the arcade box and wait about 2 minutes or until the activity indicator stops blinking on your USB stick (if it has one).

Unplug the USB stick from the arcade box and plug it back into your computer. You should now see that the 'retropie' directory has sub-directories. The one we are mainly concerned with is \retropie\roms\ You should see a large list of video game systems listed.

In the sub-directory "mame-mame4all" create a directory called "artwork" and one called "samples".

Download the MAME artwork files which can be found here...

<http://dl.openhandhelds.org/cgi-bin/gp2x.cgi?0,0,0,0,5,2512>

Open the "mame4all\_1.0\_artwork.zip" file and extract the contained files to the "artwork" directory you created.

Download the MAME audio samples which can be found here...

<https://archive.org/details/mamesamples>

Open the RAR file and extract the contained files to the "samples" directory you created.

Decide which games you would like to play then go locate them. I can't/won't tell you how to do this unfortunately, but it isn't difficult.

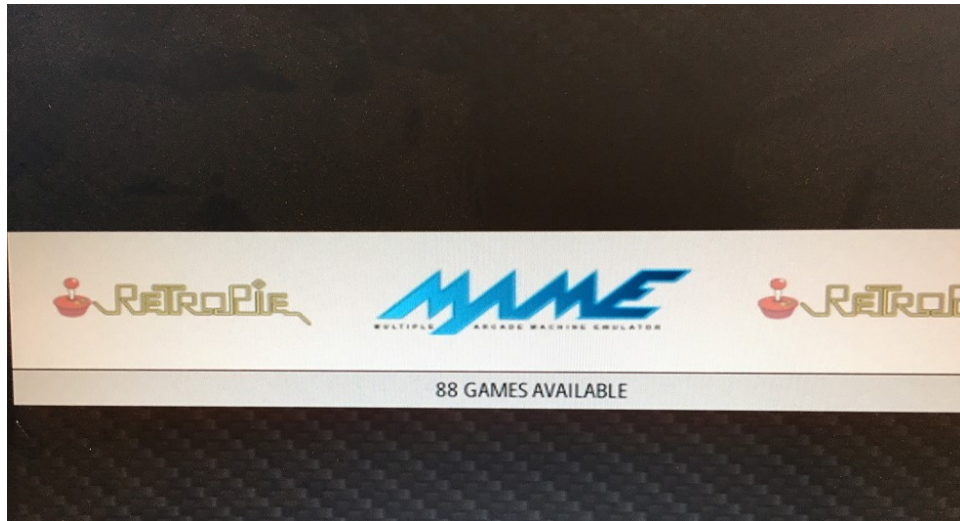
Once you have your game ROM zip files place them in the 'mame-mame4all' directory.

If you have a wireless Raspberry Pi, or have managed to connect it to your network then you can use the following web page for other ways to transfer files.

<https://github.com/retropie/retropie-setup/wiki/Transferring-Roms>

Eject your USB stick and plug it into the pigtail on your arcade box, then wait 5 minutes until all activity has completed. Next, we need to restart Emulation Station, plug your keyboard back in and press '1' to bring up the "Main Menu" then use the cursor keys to move down to "Quit". Next, press "Right-Ctrl" to bring up the "Quit" menu. Make sure "Restart Emulation Station" is highlighted and press "Right-Ctrl" again. At "Really Restart" press "Right-Ctrl" again to restart Emulation Station.

You should now see something similar to the following...



You should now also be able to use your arcade controls to move around and select things.

These are how the arcade buttons should now be assigned to Emulation Station controls (shown in purple) and in MAME (shown in red)



If all is well then you can unplug your arcade box and finish the remaining 4 screws to hold the bottom together. One suggestion here is to put some tape on the inside of the T-Slot to stop the nut falling completely through to the inside of the arcade box. Murphy's law states that the more difficult it was to get the pieces to fit together the higher the chance that the very last nut will fall inside, forcing you to throw it across the room, go retrieve it then open it up to retrieve the rogue nut.

These instructions will surely undergo modifications so please keep checking back to the GitHub page to see if anything new gets added or clarified.

<https://github.com/SteveDC2/PiArcade>

Final note : The Raspberry Pi computer boards are notorious for corrupting their SD cards. One recommendation I would make is to make a backup of your SD card once it is configured and running exactly like you want it to. Search online for many, many instructions on how to do this ☺ Another way to help reduce corruption is to make the SD card 'read only'. Again, Google is your friend here. Try searching "Raspberry Pi read only SD card" for lots of advice. Note that if you make the SD card read only that PiArcade will no longer be able to save high scores. Additionally you will not be able to make any other configuration changes. This is especially important for MAME which will try to save/update individual game information the very first time a game is played, so make sure every game has been played at least once and the controls are what you want before making the SD card read only.