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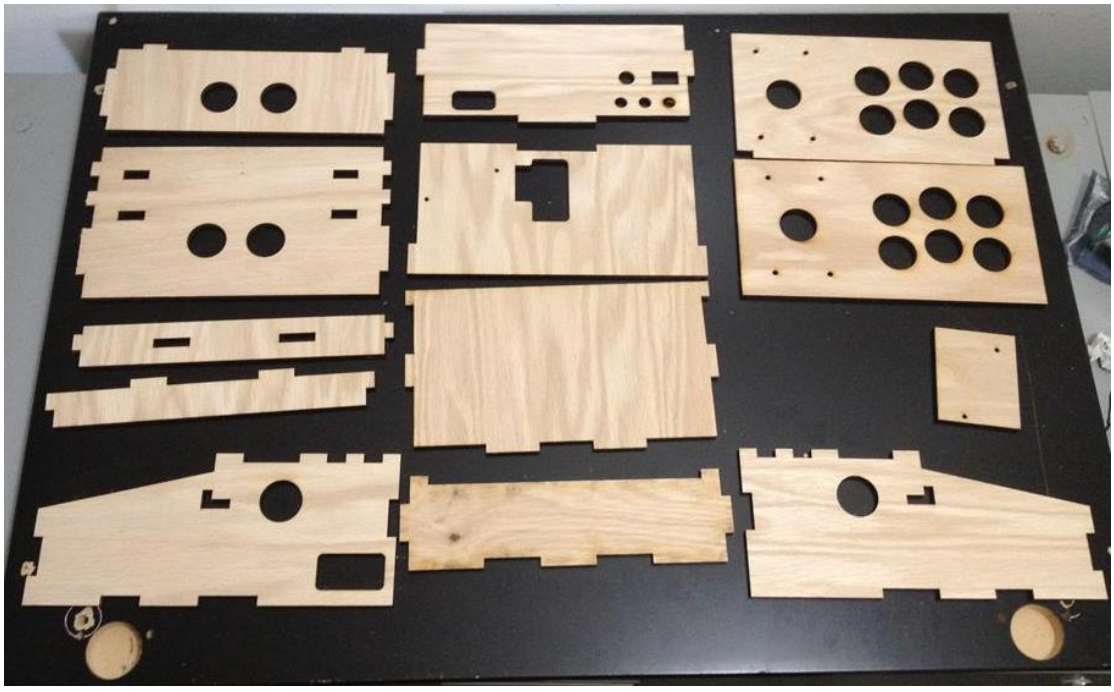
I. Contents, Bill of Materials, Notes

The Porta Pi Arcade Lite consists of the following pieces.



There are TWO Bill of Materials for the Porta Pi Lite. Since the Lite can be built as a stand-alone arcade for an HDTV/monitor OR as a wireless arcade panel for use with a tablet, there are two slightly different BOMs.

Stand Alone Arcade BoM with Bluetooth tablet option.

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Assembly	Item	Quantity	Description	Part No	Vendor
Body	1	1	Oak Plywood (furniture-grade plywood) 1/4" x 8' x 4'	n/a	Ryan Bates/ Lowes
Control Panel	2	1	Arcade button (red)	COM-09336	SparkFun
	3	1	Arcade button (blue)	COM-09337	SparkFun
	4	1	Arcade button (green)	COM-09341	SparkFun
	5	1	Arcade button (yellow)	COM-09338	SparkFun
	6	4	Arcade button (black)	COM-09339	SparkFun
	7	2	Arcade button (white)	COM-09340	SparkFun
	8	1	Joystick Zippyy Short Shaft (w/ microswitches)	480	Adafruit
	9	10	Microswitch contacts	supplied with Items 4-9	
	10	1	Female/Female jumper wires 40x 12"	80207	DX
	11	1	Hookup wire, ~3 Ft	101-903	Parts Express
	12	20	0.187" Quick Connect Crimp Female (18-22 AWG)	n/a	Ebay
Audio/ Video	13	1	Male/Male Composite RCA cable		MonoPrice
	14	1	3.5mm Male to Male Red/White RCA, 1FT		MonoPrice
	15	3	RCA Female Keystone Jacks, Red,White, Yellow		MonoPrice
Power	16	1	Panel Mount 2.1mm DC barrel jack	122741	Deal Extreme (DX.com)
Hardware	17	4	# 6 x 1" Flat Head	n/a	
	18	2	# 4 x 1" Flat Head	n/a	
	19	4	# 6 Nut	n/a	
	20	2	# 4 Nut	n/a	
	21	4	# 6 Washer	n/a	
	22	2	#4 Nylon Washer	n/a	
Bluetooth	23	1	Bluefruit HID Controller (12input)	1535	Adafruit
	24	1	4 x AA Battery Holder with On/Off Switch	830	Adafruit
	25	1	Break-away 0.1" 36-pin strip male header	392	Adafruit

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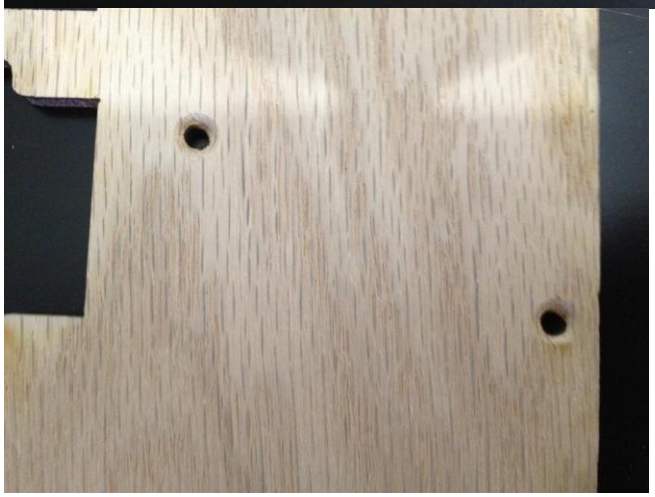
1. Assemble the Porta Pi Arcade Lite

First, counter sink the rear-bottom panel. Later you will need two #4 x 1" inch flat head machine screws to mount your Raspberry Pi. Note this is the reverse side of the assembly photos.



Position the two bottom pieces as shown.

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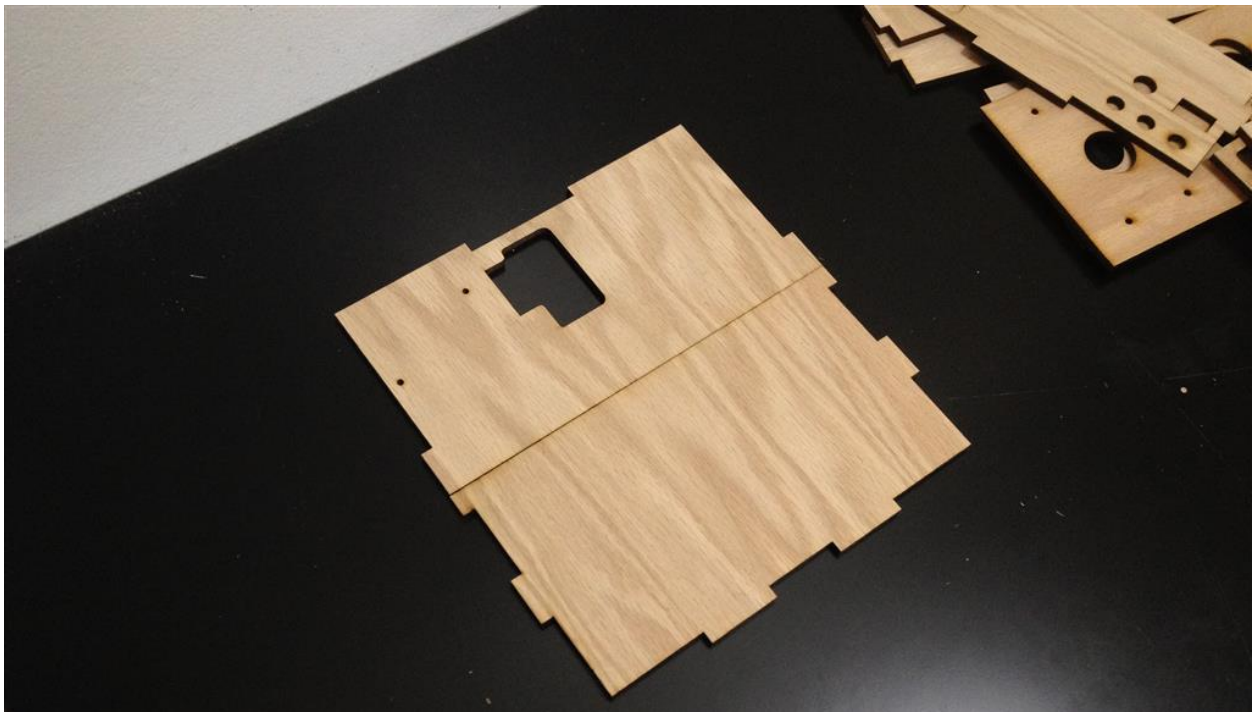

Build the middle cross brace using the two long bracket peices. Make sure to follow the picture. We want the shorter tab to be on the top.

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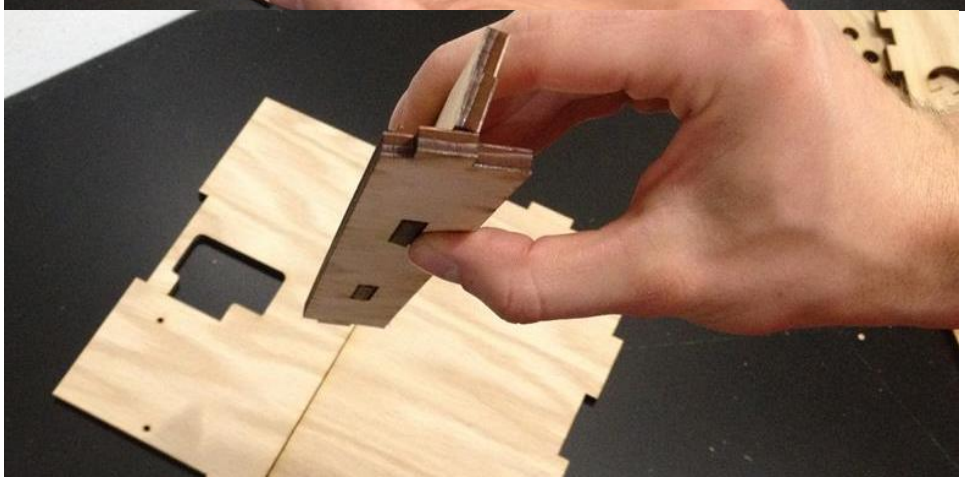

Place the Left and Right panels on as shown. The left panel has a large cutout where the Raspberry Pi's USB and Ethernet jacks are located. This cutout must be on left as shown. Add the cross-brace. Remeber the short tab must face up.

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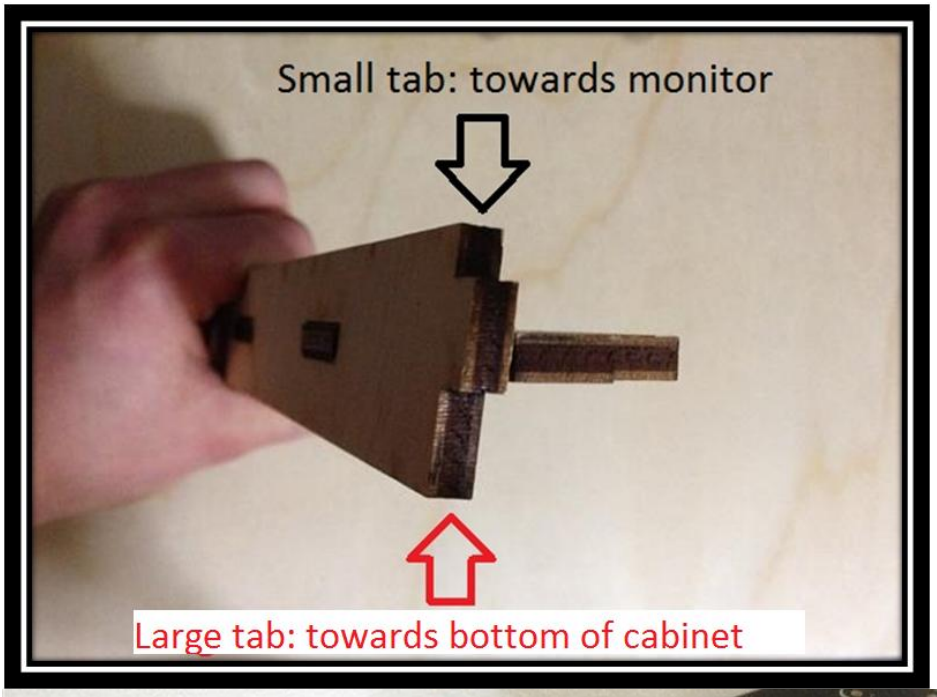

Add the Rear panel on. The larger rectangle cutout must be on the left (next to the other cutout on the adjacent panel).

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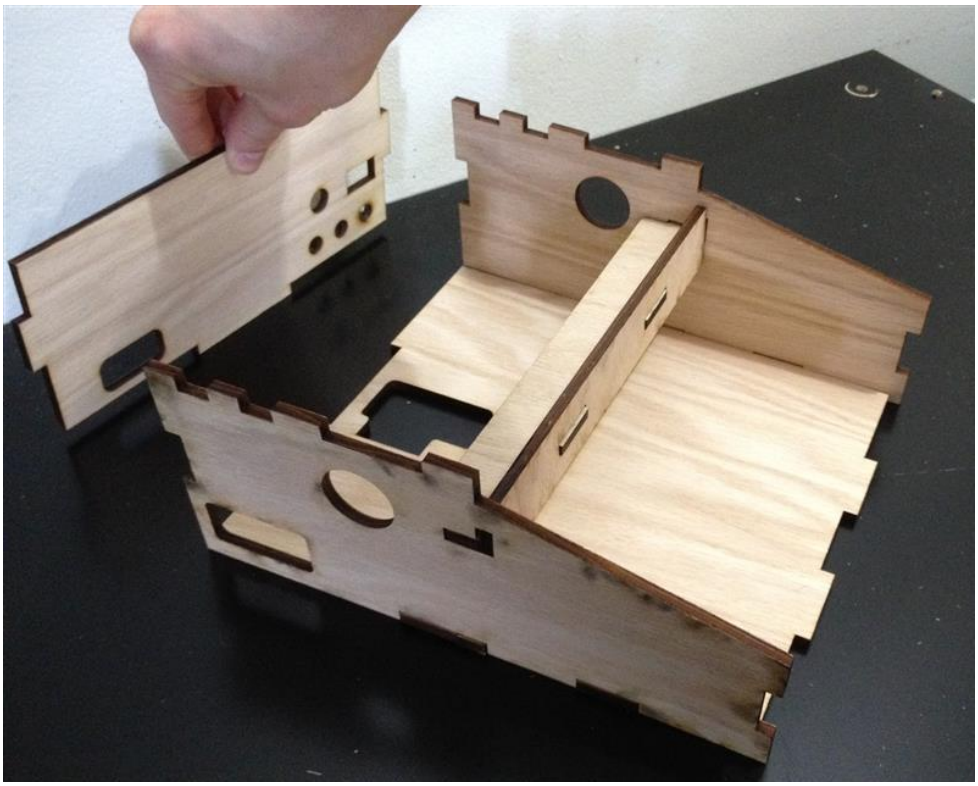

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Does yours look like this? Note the locations of all the cutouts.

Add the front panel.

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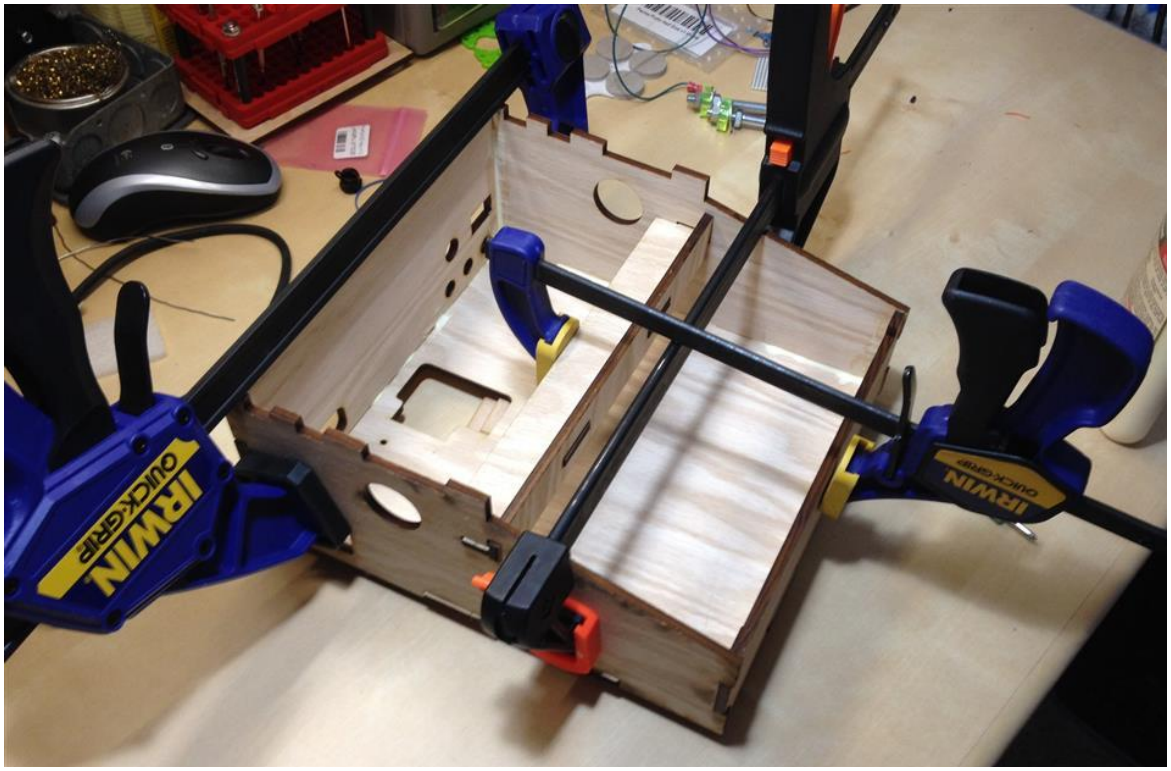
Add a few clamps if you have them, and wait for the glue to dry.



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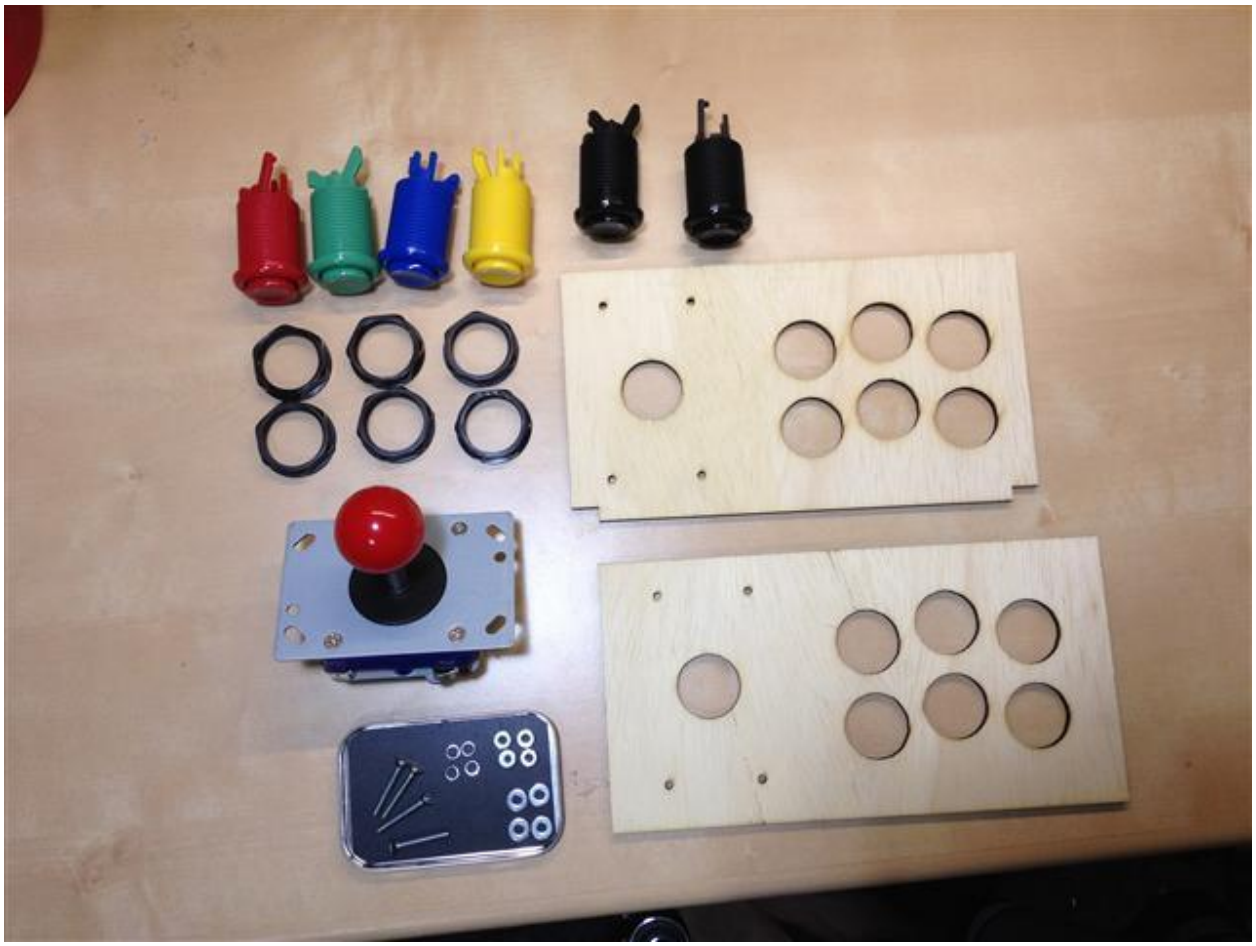
2. Front Panel Arcade Button/Joystick Assembly.

You will need the following cabinet panels.



You will also need the following hardware

(2) black* arcade buttons
(1) red* arcade button
(1) blue* arcade button
(1) yellow* arcade button
(1) green* arcade button
(4) #6 x 1" Flat head machine screws
(4) #6 machine nuts
(4) #6 nuts
(4) #6 lock washers (not provided but optional)

** or whatever colored buttons you choose.*

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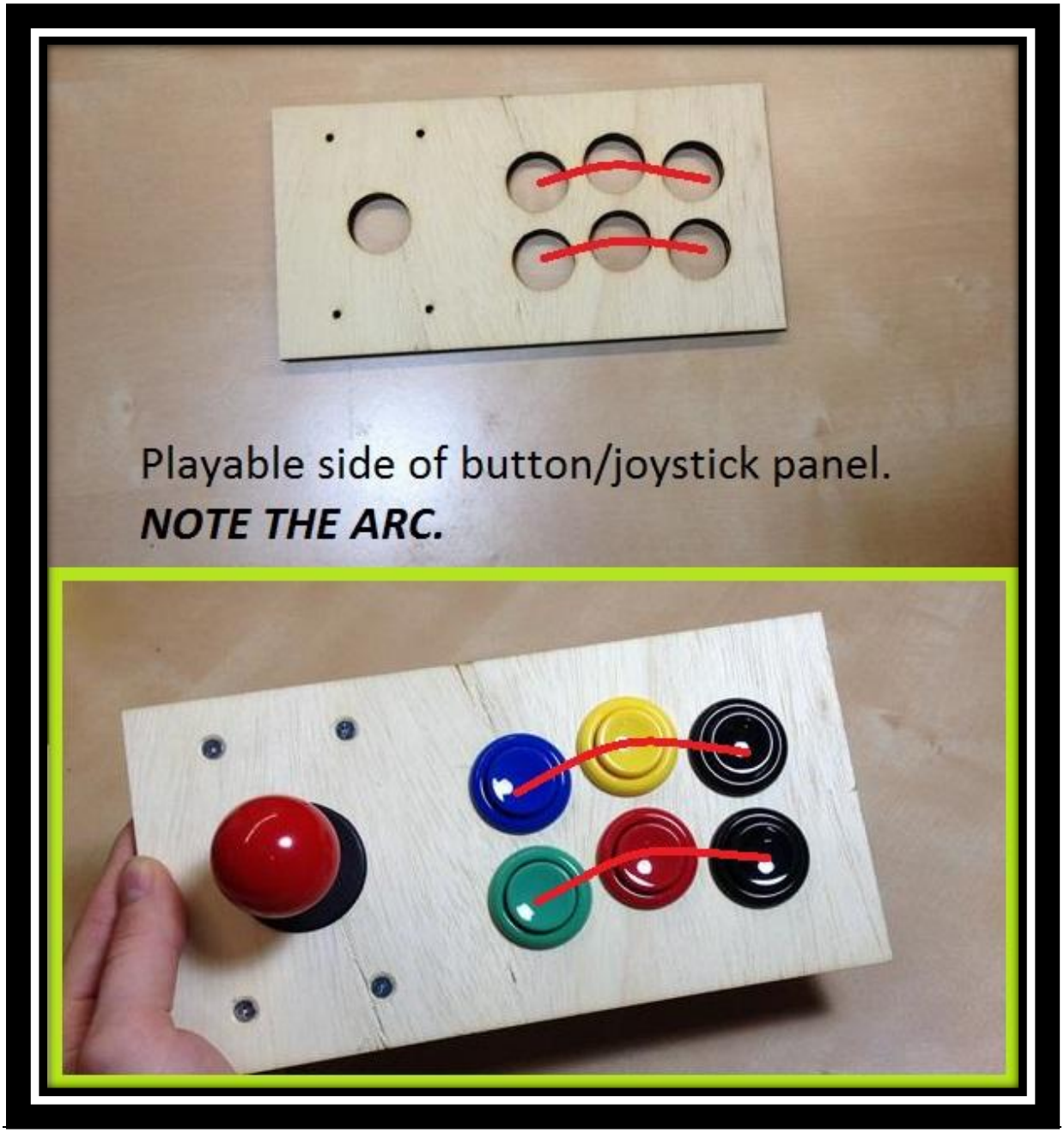
Follow these steps very closely. Pay attention to the pictures. The orientation and layering of these two pieces is critical.

If done wrong you will glue the font panel upside down and playing the arcade will be very uncomfortable.



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Place the two front panels on top of each other as shown. Glue these two together.

(*Bottom side* of joystick/button assembly.)

Do not get glue on the outer edges. These are the edges that do not overlap. All the holes will line up. **Take notice of the 6-button arc curvature**. Do not glue these two pieces in the opposite stack. Follow this picture.

(Button/joystick panel, play/ *top side.)*

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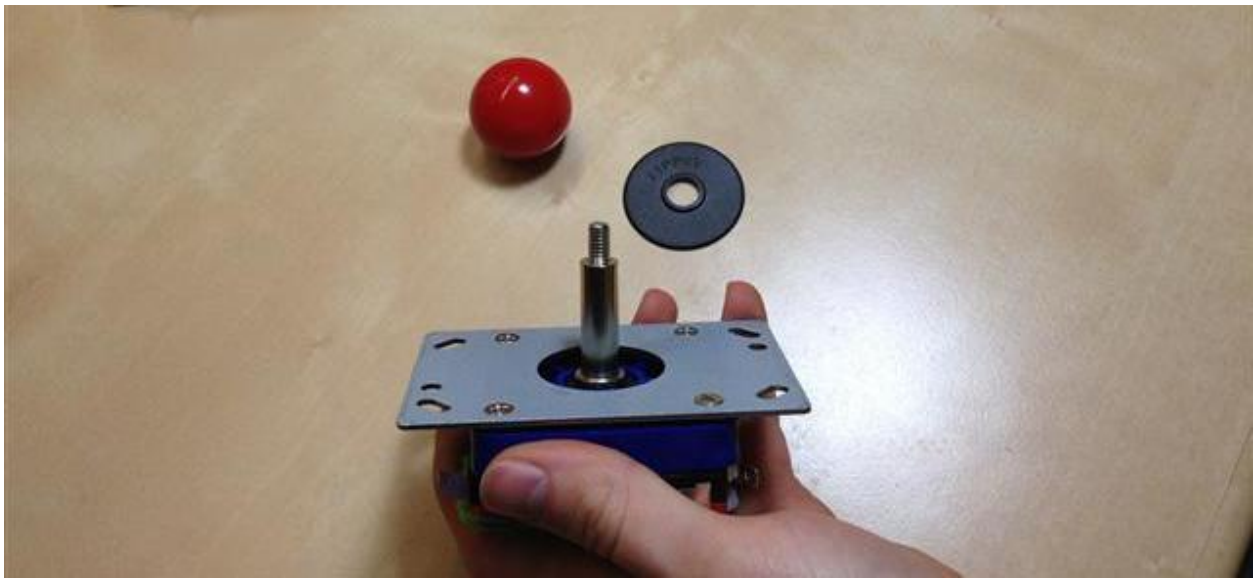
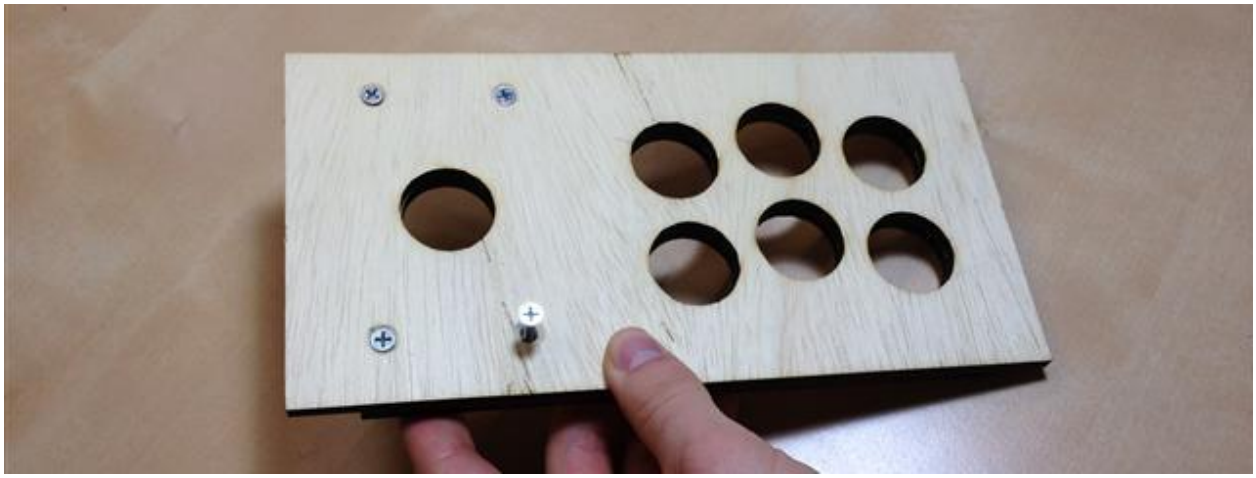
Unscrew the ball-top and cover plate (may differ in color) on the joystick. Place these aside.



Insert the four #6 x 1" flat head screw into the counter-sunk side (this is the top side).



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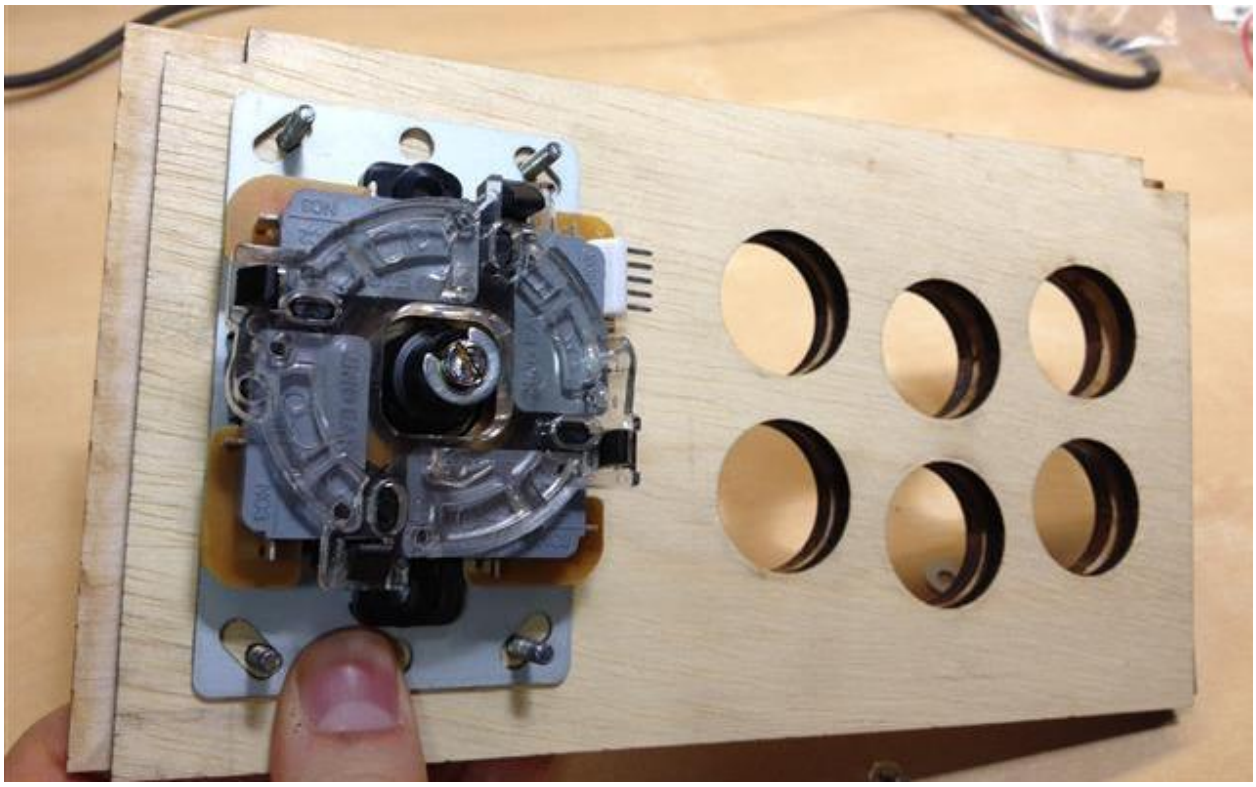
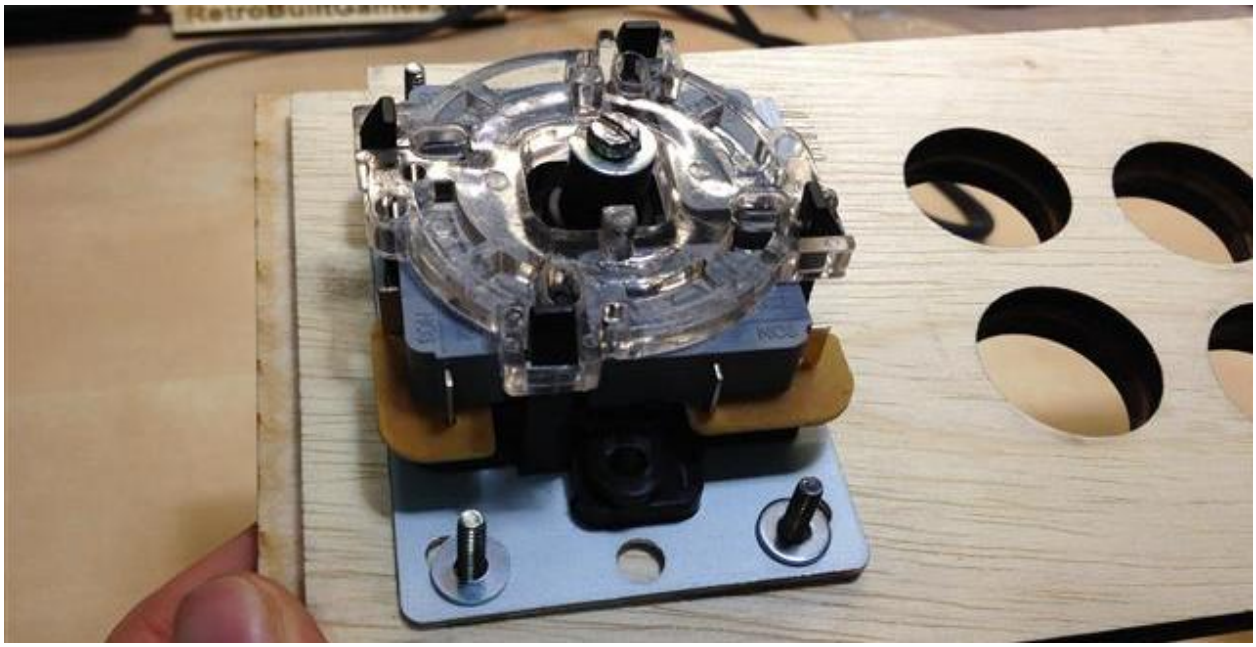
Flip the stack over and place the joystick over the four screws. Note the orientation; the five pins must face toward the button openings.



Add washers to all four screws.



Add lock-washers on top of the washers (*optional; lock washers are not provided*).

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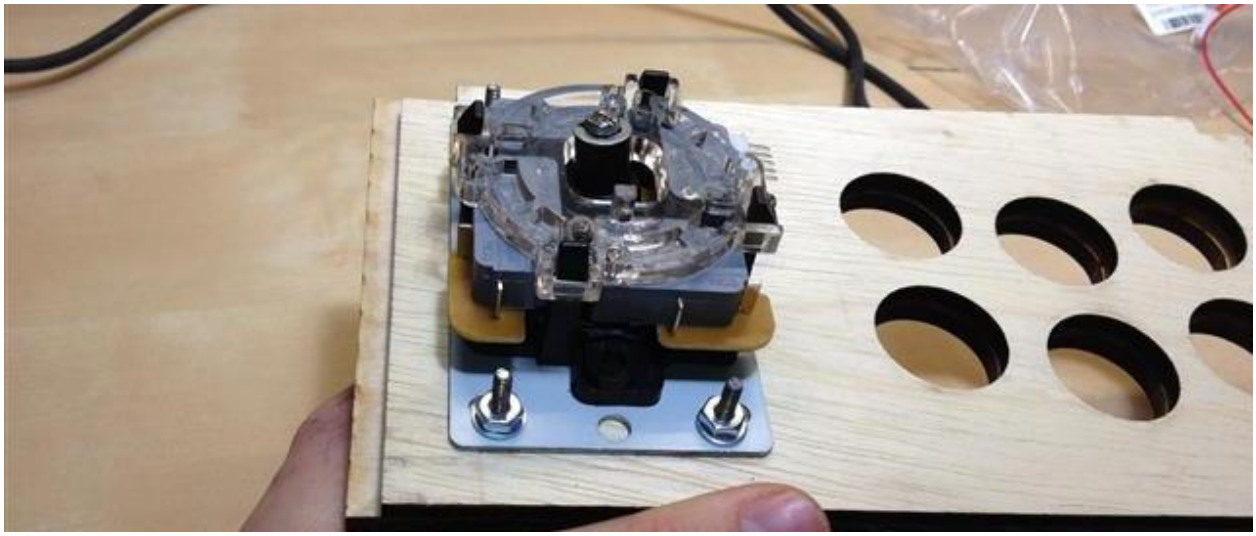
Add the #6 nuts to all four. Finger tighten all four.



If you have glue on the outer edges, shown is this picture. **WIPE AWAY THE GLUE BEFORE IT DRIES.**

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Flip the unit over and replace the cover plate and ball-top

Insert the six arcade buttons in any color pattern you like. Tighten the plastic washers on the arcade buttons. This will clamp the two pieces together while the glue dries and ensure the two panels are aligned properly.

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You can keep working or take a break while this glue dries. This is also a great time to get an energy drink (just a suggestion) the next step is going to ~~suck~~ be a blast.

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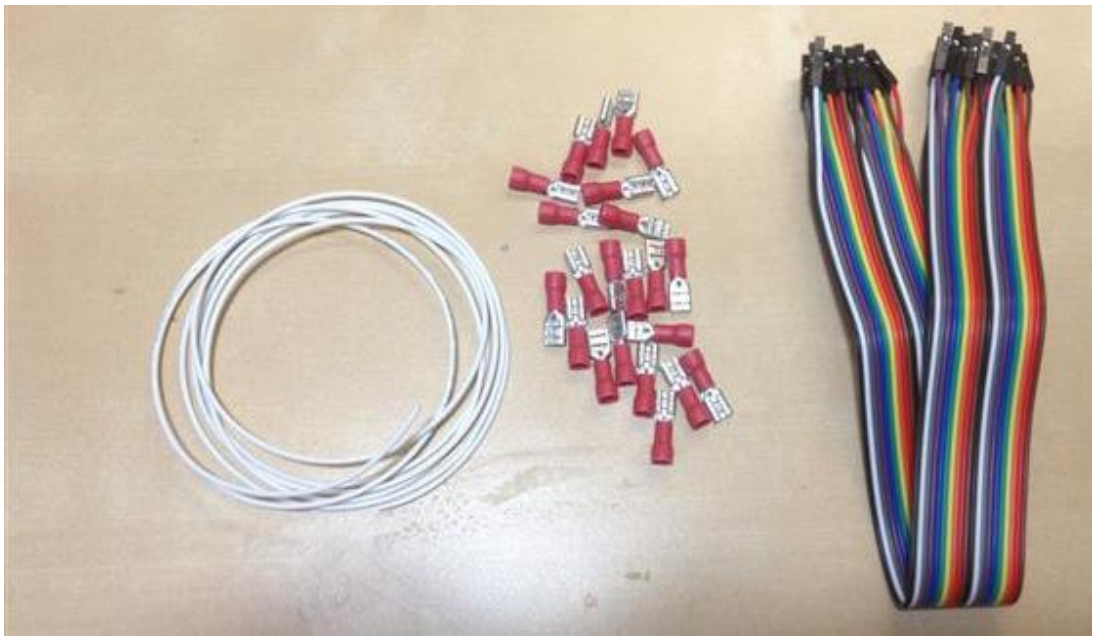
8. Wire the Front Panel Buttons and Joystick

You need the following hardware and assemblies:



Front Panel with buttons and joystick
(10x) micro switches
A Raspberry Pi Model B (512MB), *(not supplied)*
20 Crimp terminals,
4-5 ft of wire (22 AWG is best).
The Female/Female Ribbon cable.

You will also need some tools:
Very small tip screw driver, or something pointy
Wire strippers
Terminal Crimpers

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This tool crimps and strips! It's around $10.

Let's take a closer look at the micro switches.
They have three pins: NO, NC, and COM. These stand for Normally Open, Normally Closed, and Common (aka ground).

We will be using two of the three pins: Normally Open (N0) and Common (COM). These two tabs on the microswitch will be the circuit for each arcade button. When the button is pressed, the microswitch closes the contacts inside and the Raspberry Pi recognizes a button was initialized.

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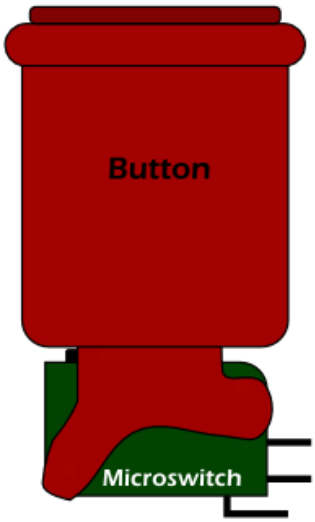

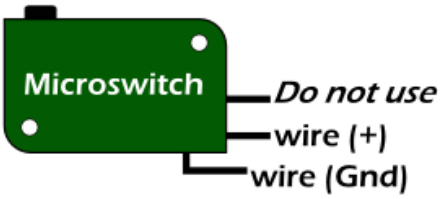

Each button requires its own circuit. Each button is mapped to an individual pin on the Raspberry Pi. When the circuit is completed (a button is pressed) the Raspberry Pi knows a specific button was pressed and passed this on to the emulator software.

Here's an abbreviated overview of what must be accomplished. The (+) side (middle tab of the microswitch) goes to a specific GIPO pin of the Raspberry Pi. The example shows what pins the "A","B", and "Start" controller buttons are terminated to. *I will explain what pins are which button commands later.*

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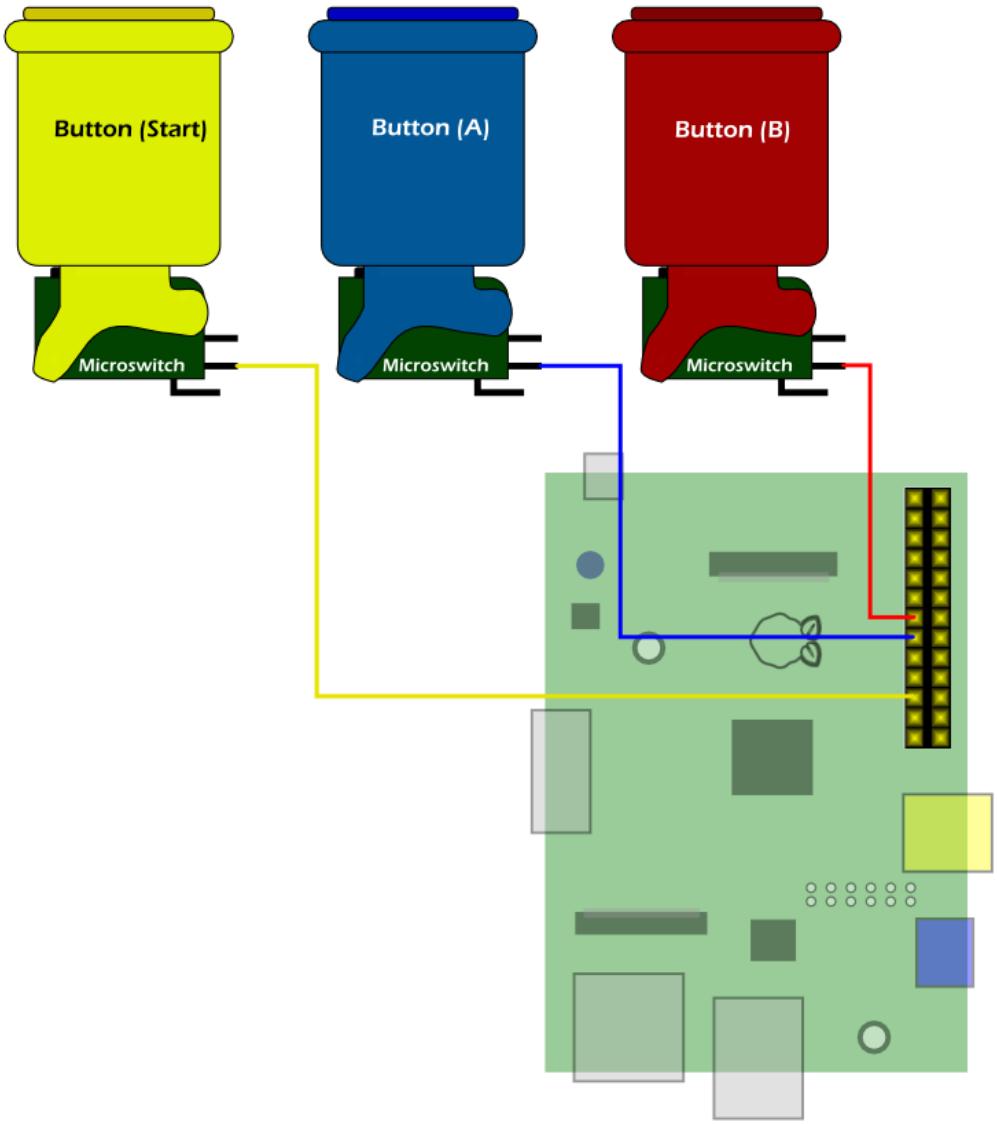

Terminate the wire from the + side to the correct pin of the Raspberry Pi.

The above example shows three separate circuits, however, they are missing the other half of the loop; the ground. The ground, or common all share the same return path. Therefore, we can connect them all together and wire this to any one of the RPi's ground pins. **Wiring to Ground completes the circuit for each button.**

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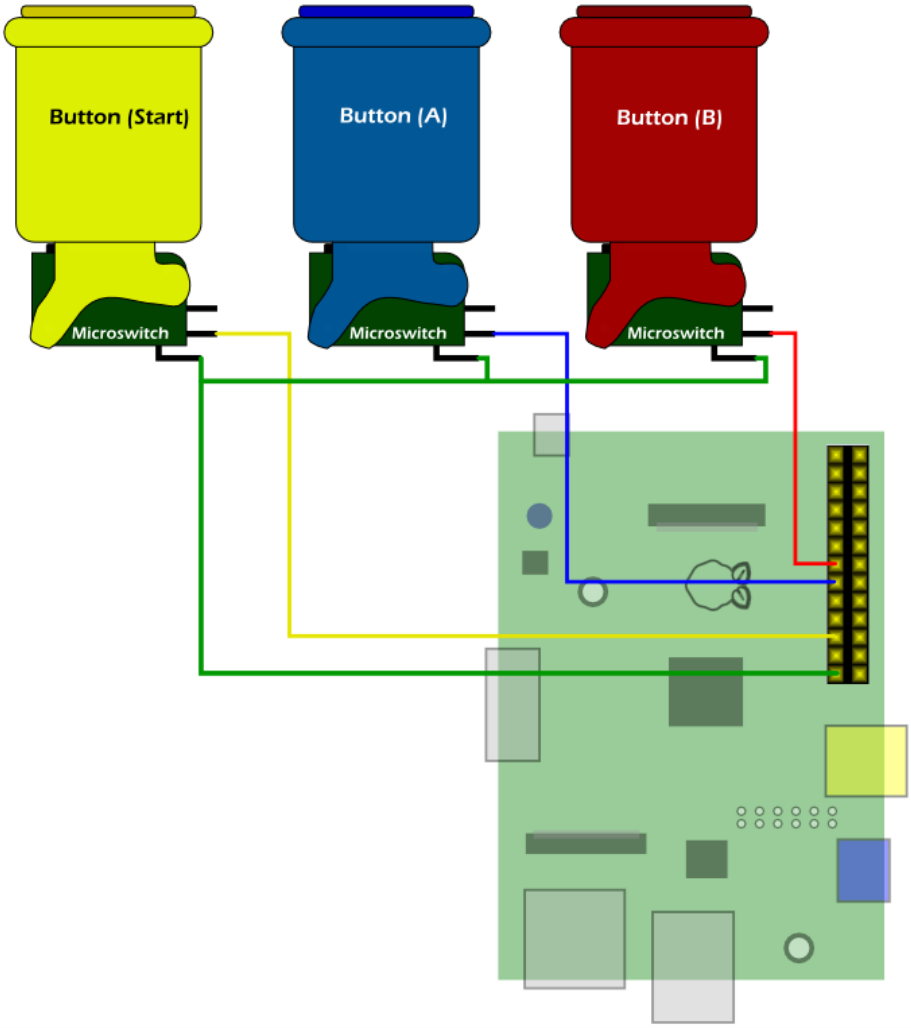

Easy right? Understanding the core concept here is important, since we are wiring 14 total circuits (ten buttons plus four directional buttons. Wiring the correct button to the correct pin is critical here. Otherwise your Porta-Pi might not work as expected, or at all. *Why all the explanation? If you do accidently wire something wrong, hopefully your understanding of what's happening here will help in the trouble-shooting process. It is very easy to mount the joystick backwards, or wire the controls backwards/upside down..Take your time.*

Now that you understand why we are wiring the buttons in this manner, we can begin wiring the control panel.

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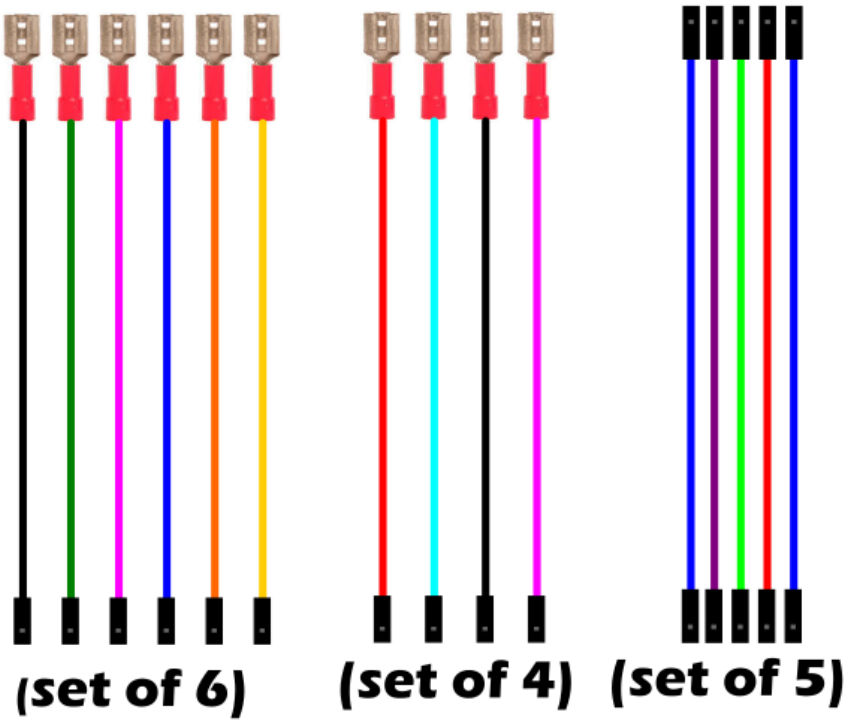
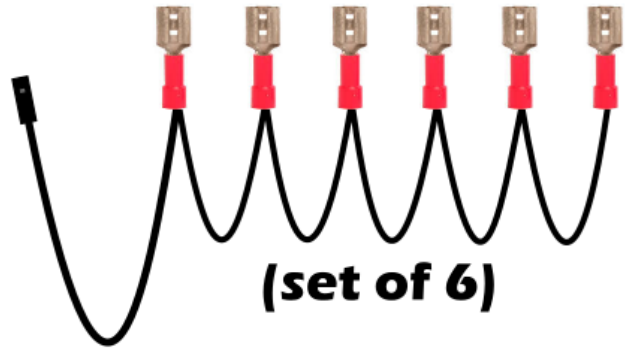
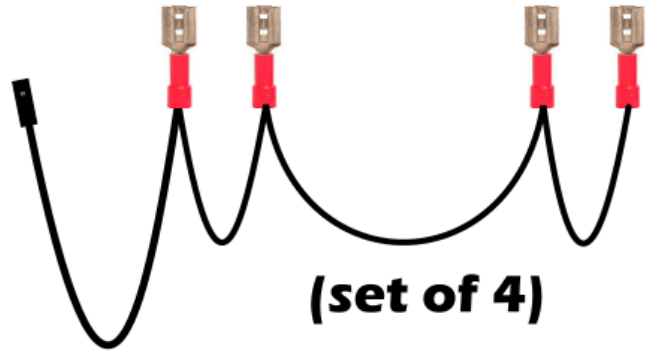
We (actually just you) need to build the wiring harnesses. You will need wire strippers/terminal crimpers and a very small flat screwdriver. The following wiring harness need to be made (ribbon color does not matter):







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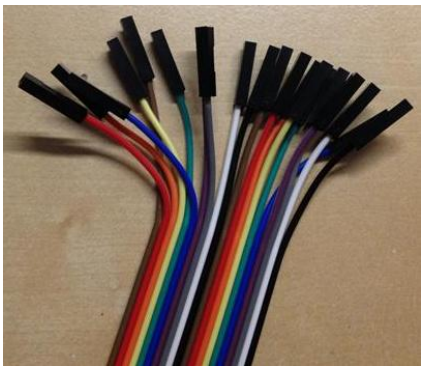
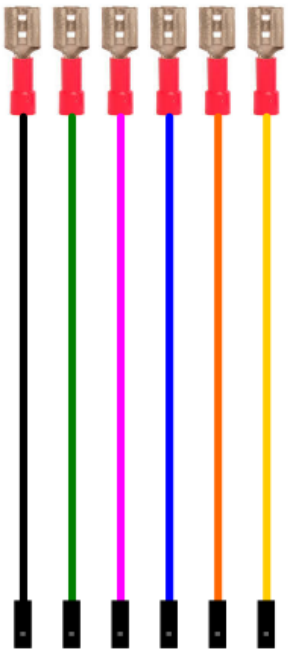
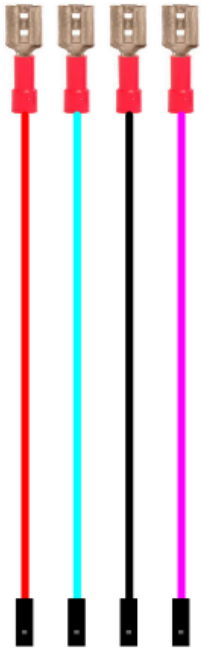
You will notice your kit is supplied with crimp connectors, extra wire, and a bundle of 12" female/female jumper cable.



Peel off groups of wires from the ribbon cable. Peel off groups of wires from the ribbon cable to match the "sets" shown in the wiring harness pictures. You will need a set of six, five, four, and two single wires.

We will start by making these wiring harnesses:





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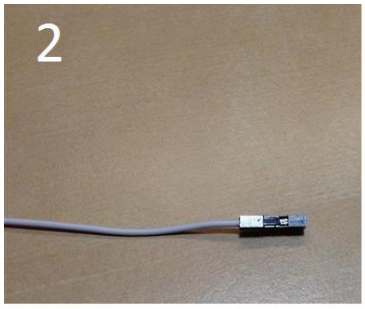
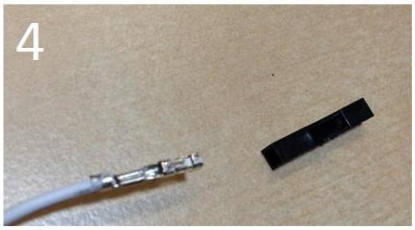
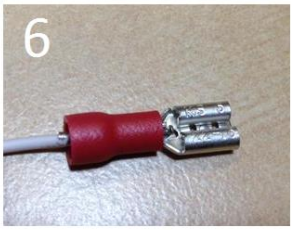
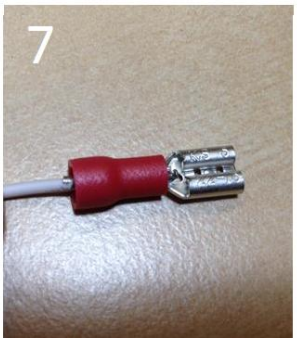
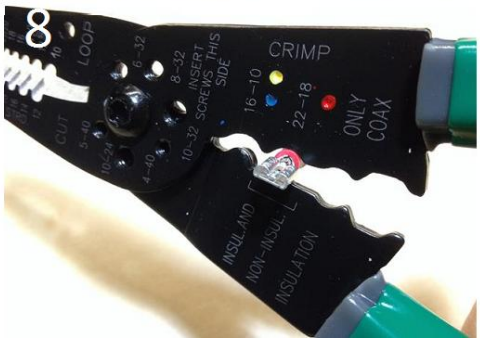
Start at one end of your female/female ribbon cable. Use a small flat screw driver and pry up the small plastic tab on the jumper-end. Remove this rectangular plastic jumper piece. Push a crimp connector on the bare metal part (it is a tight fit). Crimp. Repeat 5 more times on your "set". Then do this whole thing again for the set of four harness similar to this one.

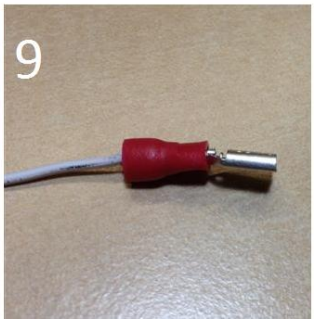












The set of 5 wiring harness does not need crimp connectors. Just peel of a set of 5 wires from the ribbon cable.

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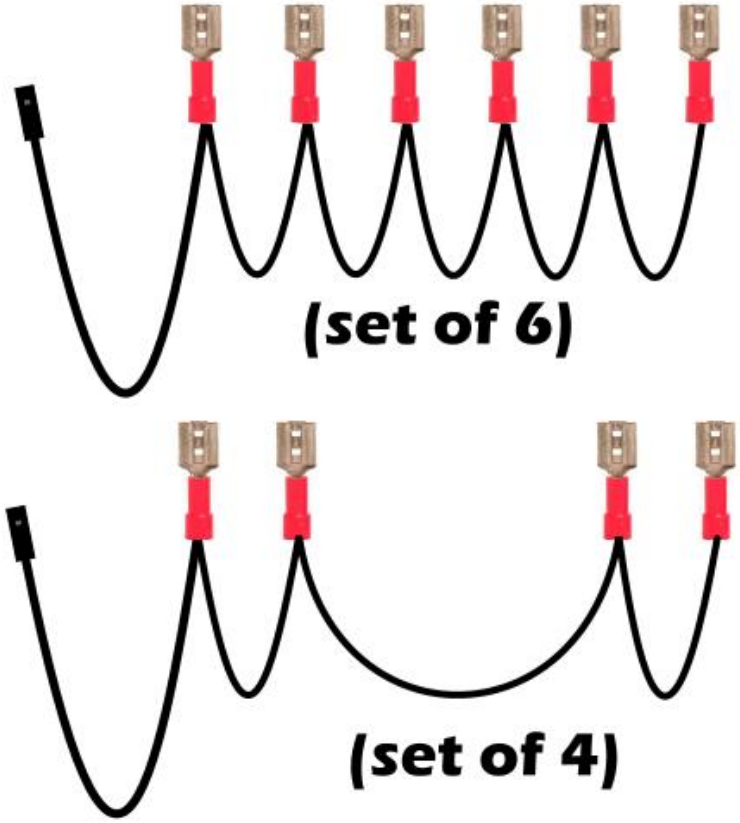
The last two wiring harness are called daisy chained. They all share the same electrical signal, which is 'ground' or 0V.



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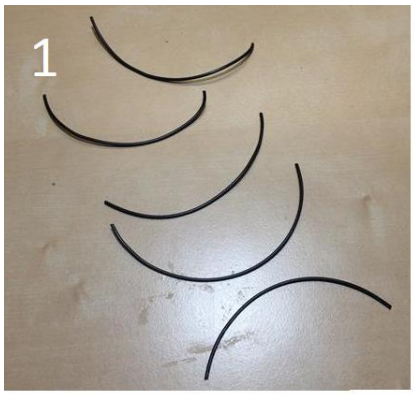
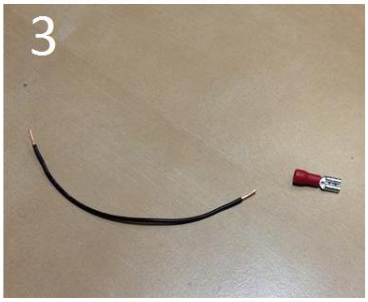
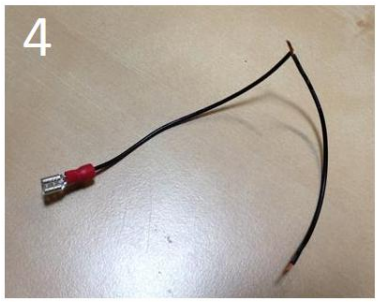
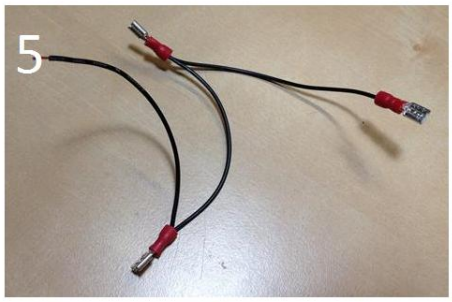
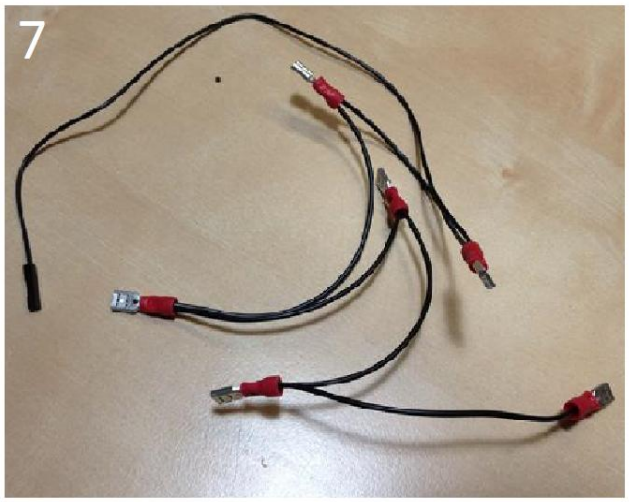
Start with the long wire provided in your cut. Cut this wire into ~3" (50mm) sections. You will need five of these 3inch sections. Strip ~0.25"(5mm) off each end. Crimp a terminal to one of these ends. Now, using the opposite end of the wire we just crimped, twist another wire on, then crimp a terminal. Do this four more times. On the last (sixth) crimp take a strip from the ribbon cable, remove one of the rectangular connectors and twist this end and crimp it.











You will need to make a second daisy chain harness, but only with four crimp terminals. **The set of four needs at least 8inches between the two pairs**. This connects the buttons on the side panels. Make the center daisy chain long enough to bridge the width of your Porta Pi Arcade cabinet.

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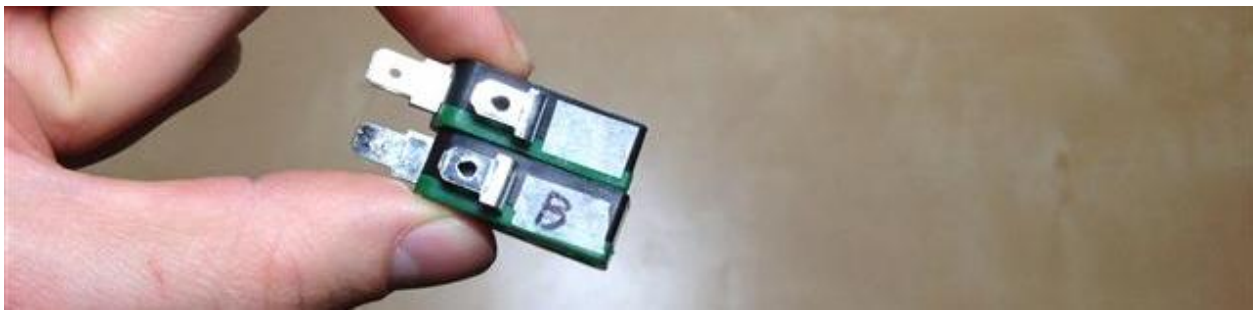
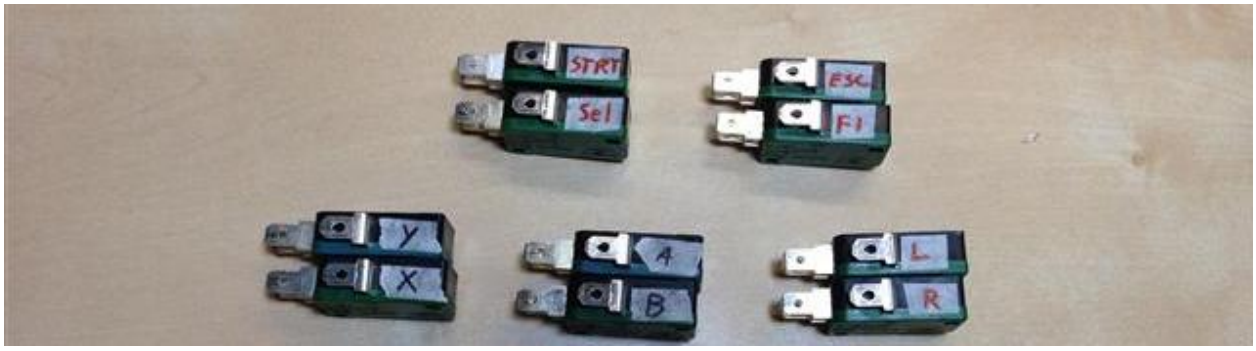
Now it's time to terminate (land/plug-in the wires) to the Raspberry Pi and the microswitches. Read over the rest of this chapter once, (if you haven't already), before landing the wires. It may get confusing. The fewer mistakes here will save a ton of time trouble shooting later.

As in, " When I press 'jump' my dude goes to the left." That kind of trouble shooting.

Note: It may help to get some masking tape and make some tiny squares. *You could label the microswitches and the end of each connected wire. Very soon everything will look like a pile of spaghetti (but made of wires). Labeling everything (though optional) will eliminate some confusion and ultimately frustration when wiring these buttons.*





You can also label the ends of each crimp connector (the red clips). But this optional.

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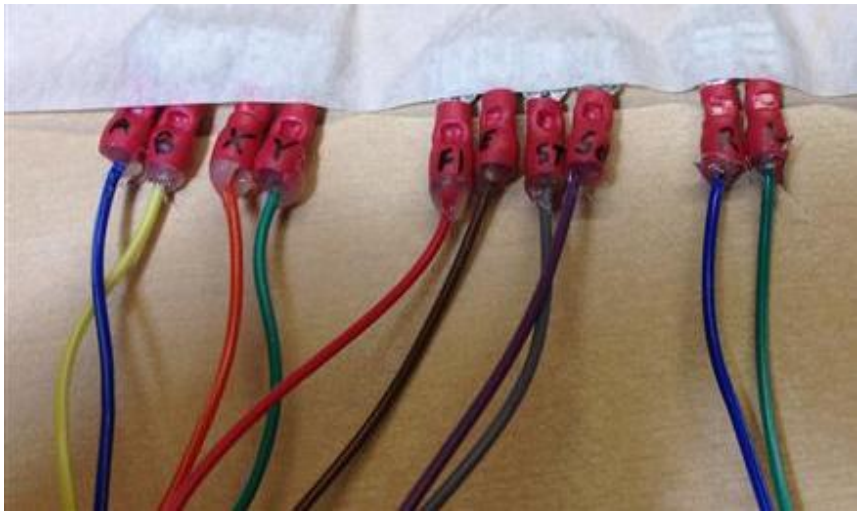
Note: *The "LEFT" and "RIGHT" wires are different from "L" and "R"! The L and R buttons are the shoulder buttons on either side of a normal controller.*



Consult this incredibly important and handy chart on following page(s). This chart shows which Raspberry Pi GPIO pins are mapped to what keyboard keys that control the emulators and front end. They keyboard keys can be changed in the Raspberry Pi Configuration files, which are discussed later. For now, stick to the instructions until you have a full understanding of the system.

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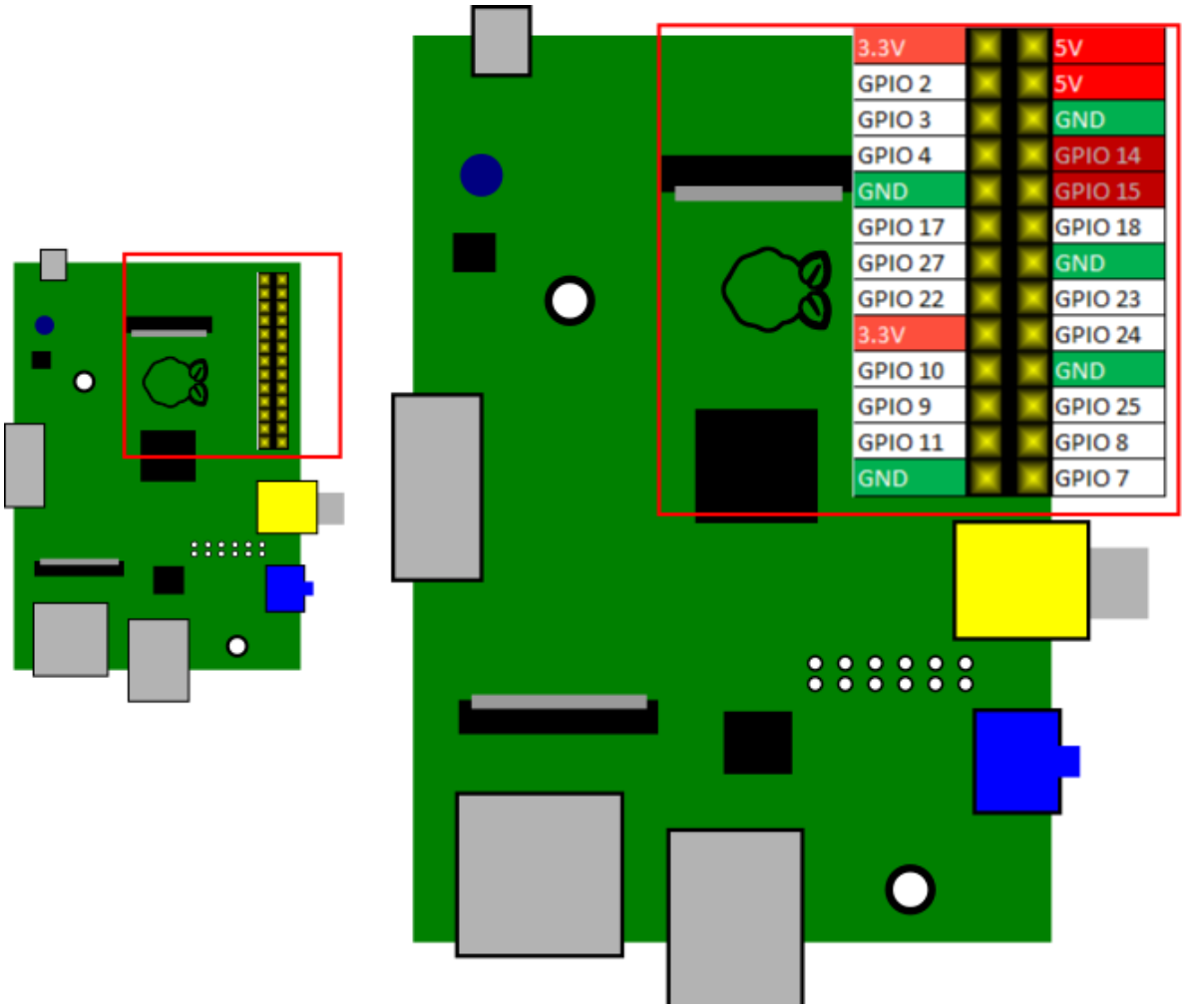
8.1 Raspberry Pi GIPO Pin out



The goal here is to plug the corresponding wiring harness buttons to the right Raspberry Pi Pin.

Note the position and orientation of the white (silkscreen) Raspberry Pi logo; match this to the pin-out diagram.

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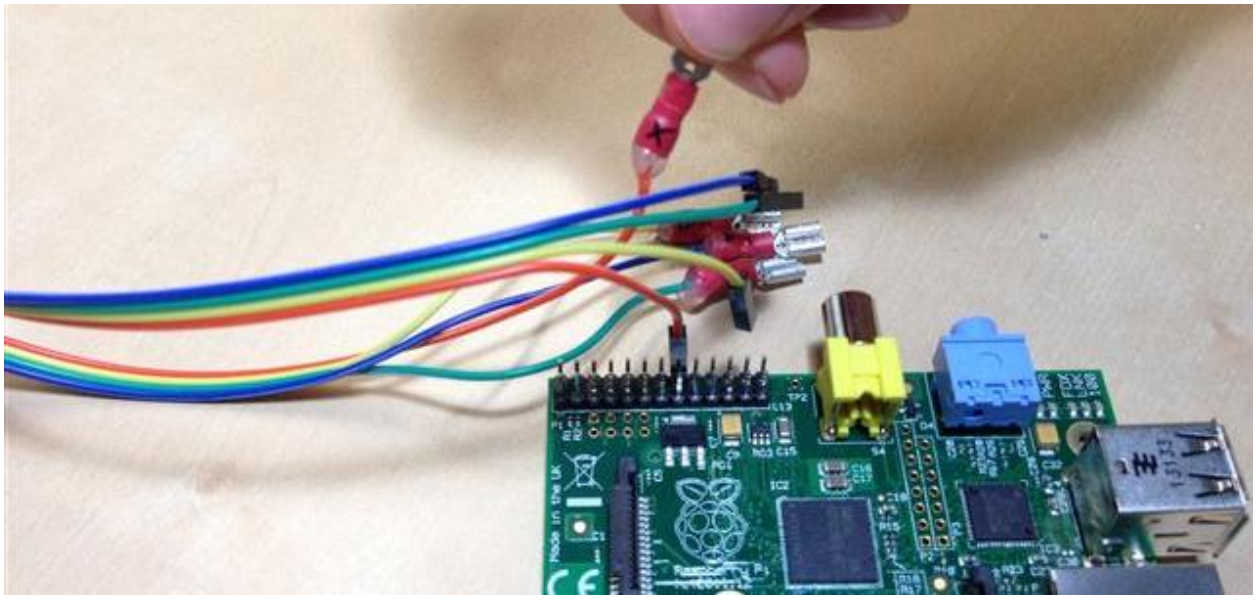
Similarly, here's the same information with the keyboard keys next to their respective GPIOs.

	3.3V		5V	
UP*	GPIO 2		5V	
DOWN*	GPIO 3		GND	
LEFT*	GPIO 4		GPIO 14	
	GND		GPIO 15	
RIGHT*	GPIO 17		GPIO 18	
B	GPIO 27		GND	
A	GPIO 22		GPIO 23	X
	3.3V		GPIO 24	Y
Right Shift	GPIO 10		GND	
Enter	GPIO 9		GPIO 25	L
R	GPIO 11		GPIO 8	Esc
	GND		GPIO 7	F1

**Arrow keys*

For example: We labeled a wire as the "X" button.



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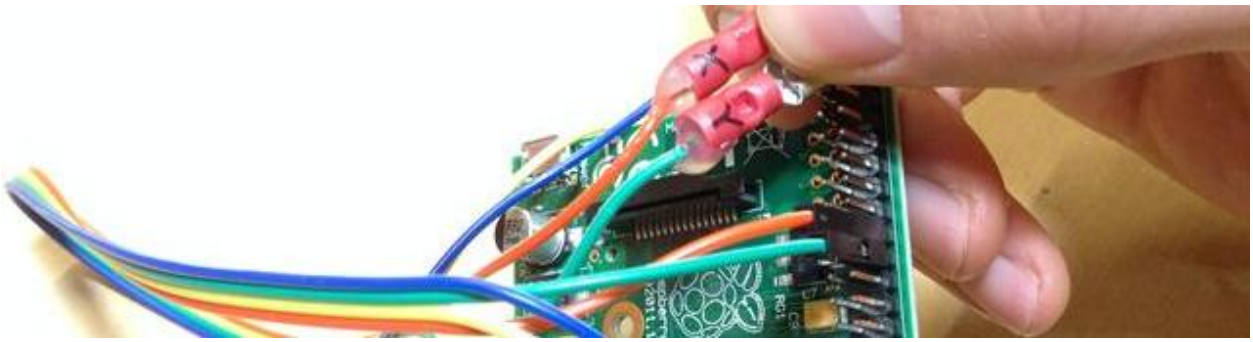
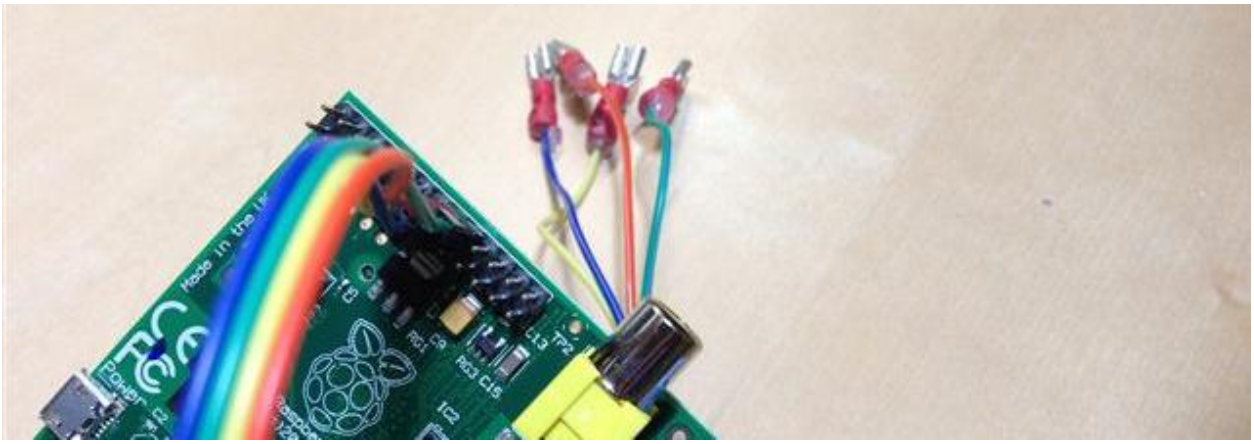
As we consult the chart, the keyboard key "X" is mapped to pin 23 on the Raspberry Pi. Plug that wire into pin 23. Repeat this for Y,A,B.





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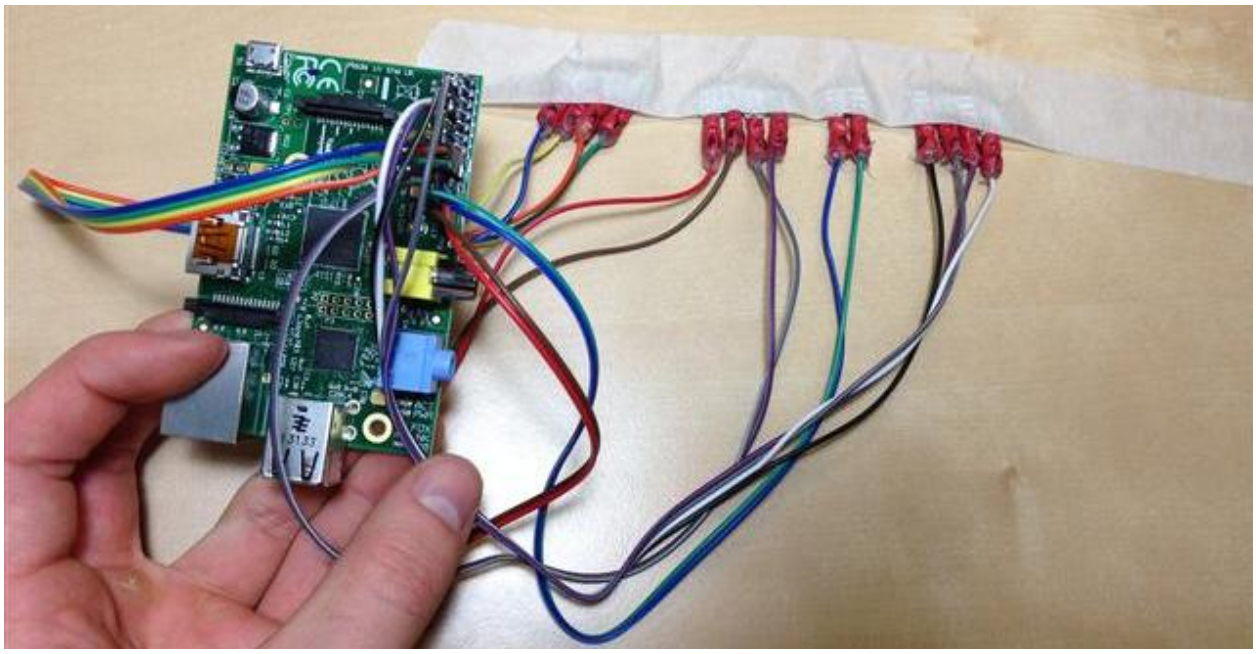
Keep going, Plug the remaining labeled wires into the Raspberry Pi's header. there are 14 buttons total. The does not include the GND pins, that complete the circuit.



Next, grab your assembled front panel and label the X, Y, A, B, buttons on the underside of the front panel.

Grab one of the micro switches and hold it with the COM end up.

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Align the lower hole on the micro switch and insert it into the short button pin.

Push the other end of the micro switch into the button mount.

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Repeat for the other 5 buttons and micro switches.

Plug the quick connect terminal end to the respective button/micro switches. Use the NO tabs (the middle tab).

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The directional (left, right, up, down) micro switches on the joystick are easy in comparison. Remember those 5 pins are facing the buttons?

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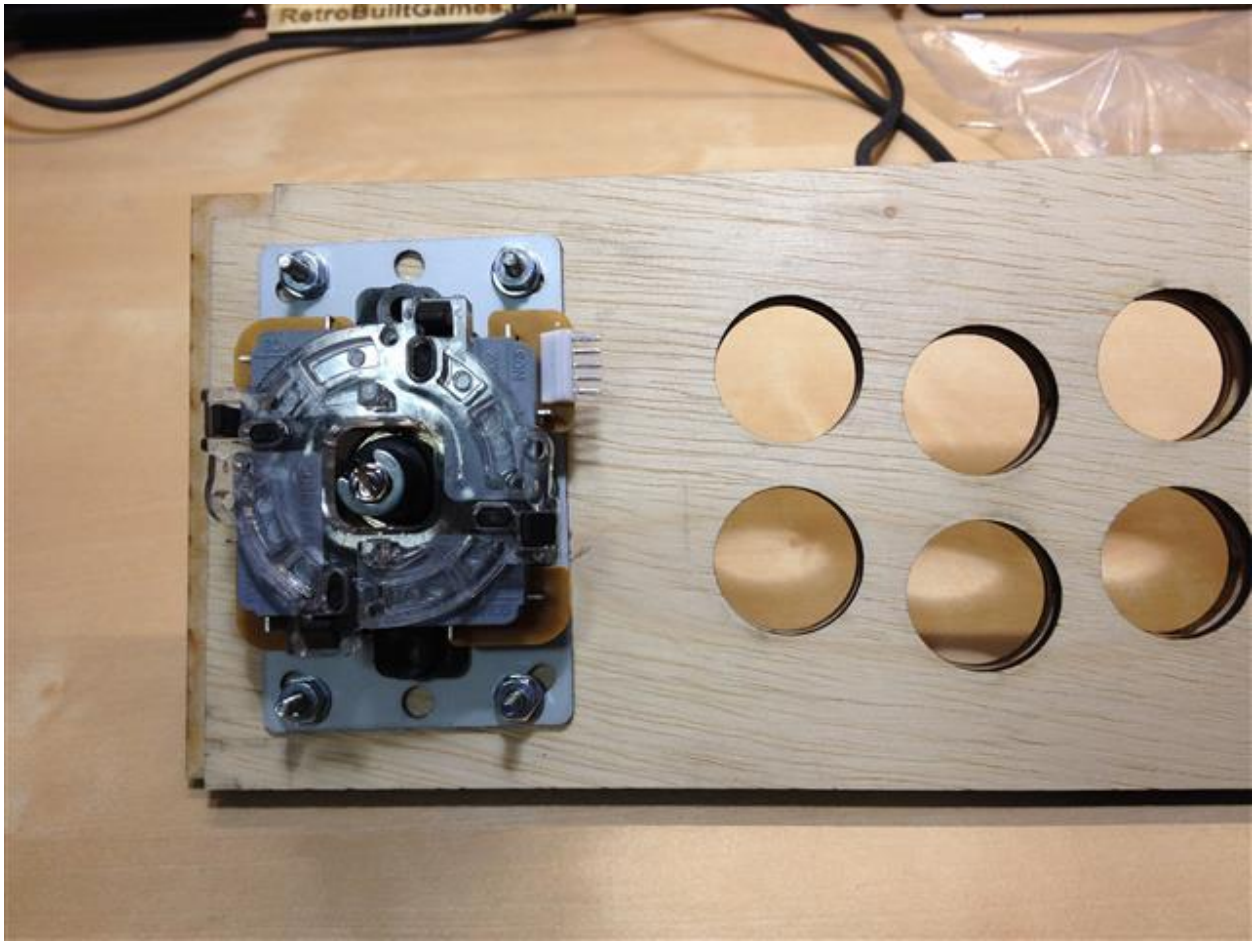

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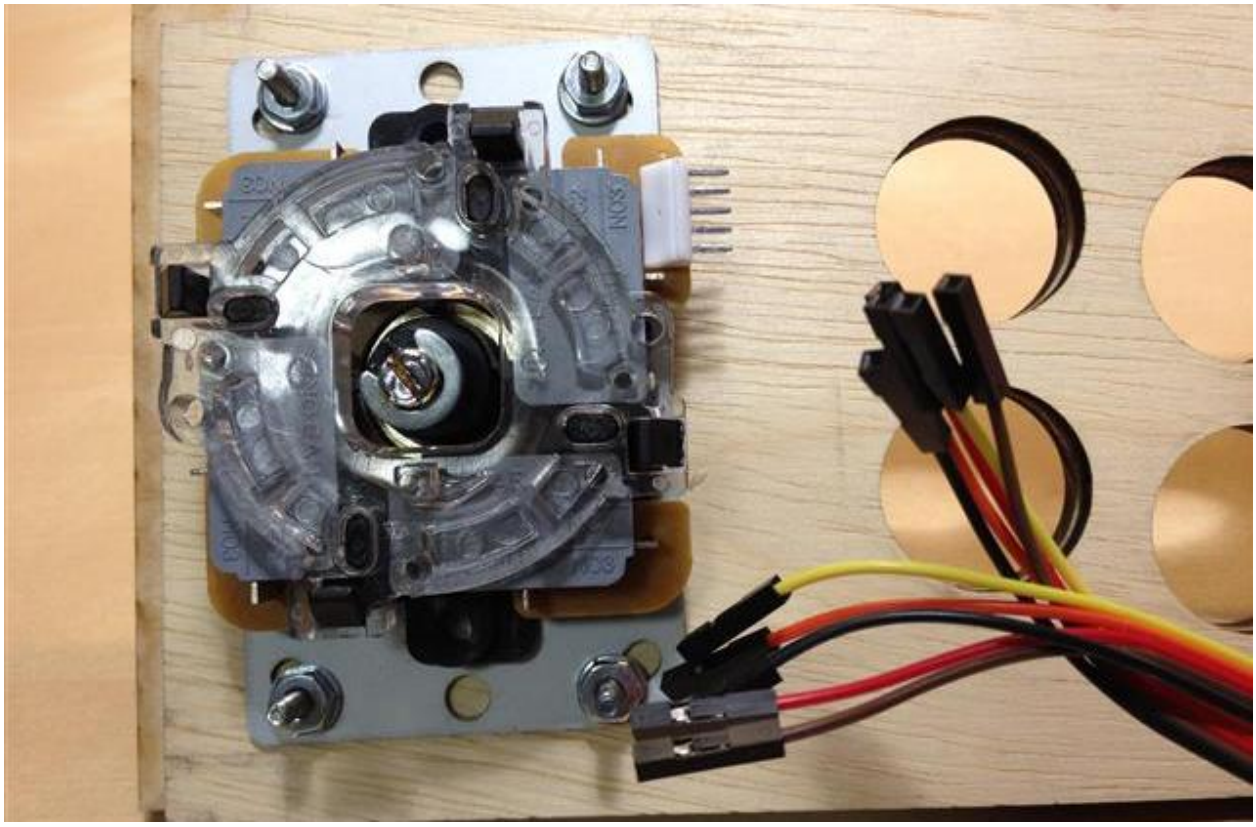
Grab that ribbon cable that has 5 wires with a tiny female plug on each end.



Grab the grounding wiring harness (the daisy chain harness). Plug each end into the these pins. See the wiring diagram or Pin out chart for what pin corresponds to what direction of the joystick. *NOTE. The charts and diagrams I made are in respect to the orientation of the joystick and the control panel layout for a right-hand build. If you flipped/mirrored the control panel pieces for a left-hand setup, some*

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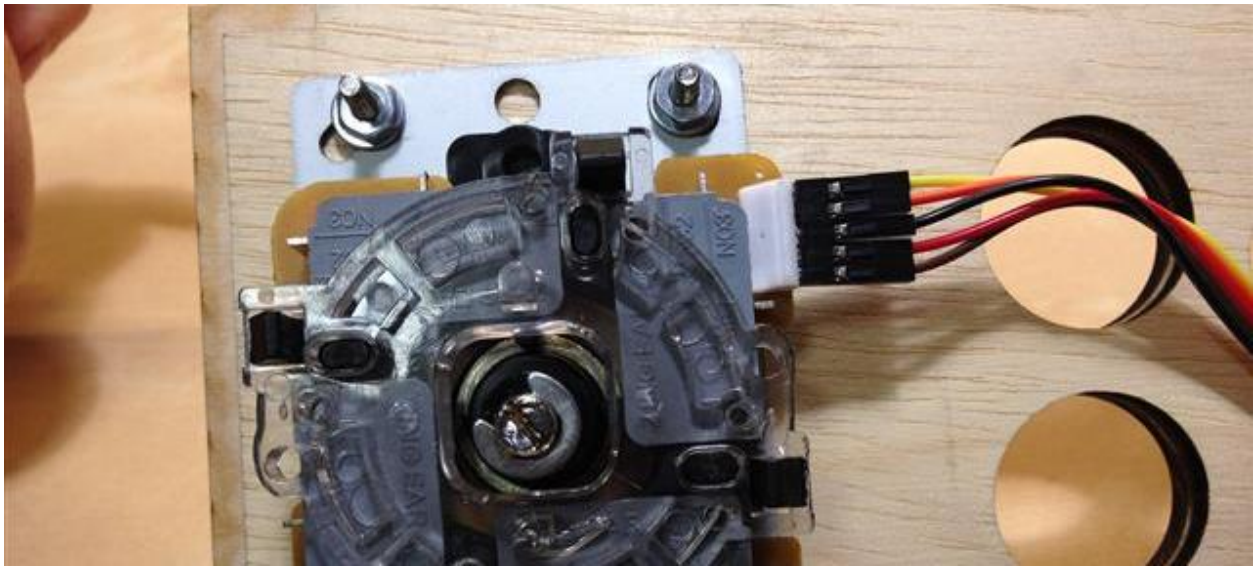
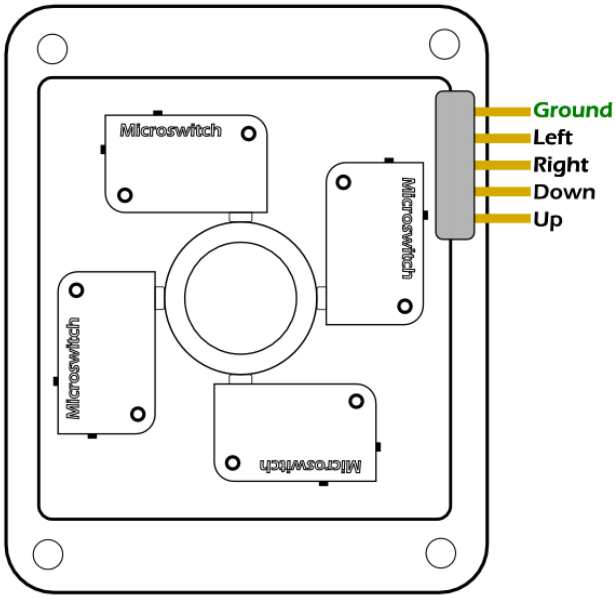
diagrams will be backwards.





Bottom

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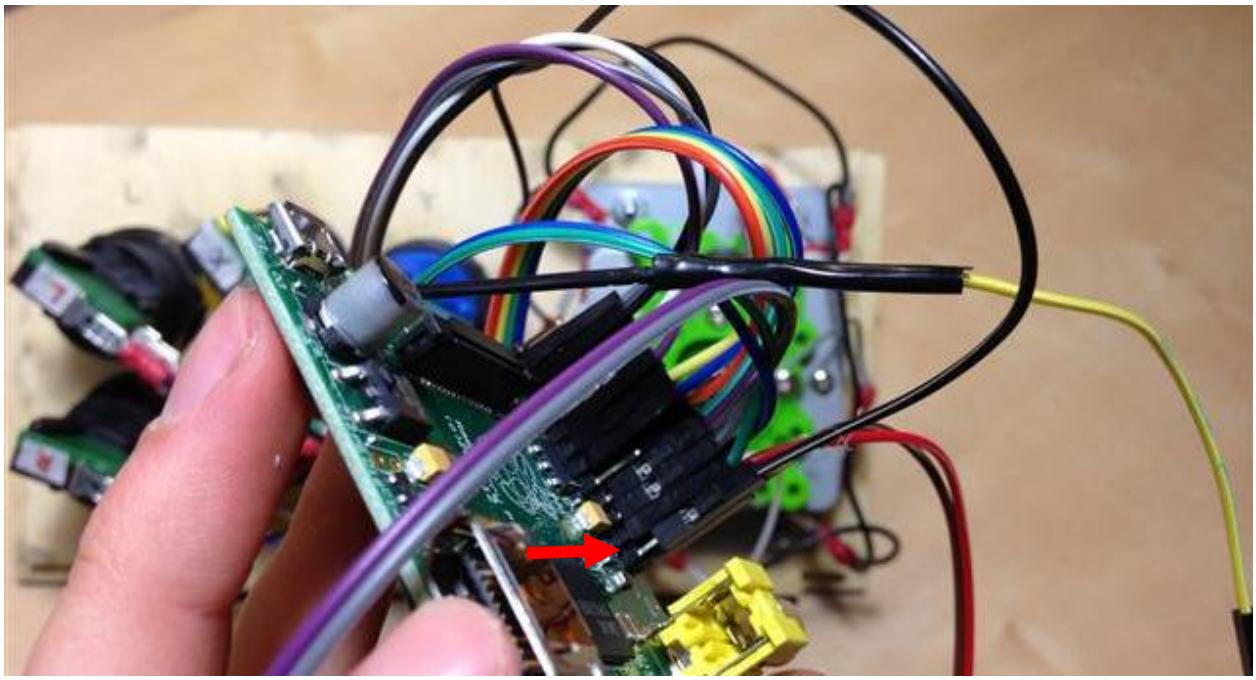
Plug the other end of the ribbon cable into the respective Raspberry Pi pins.. Pay attention to the ground pin.



Well done. If you skipped through this section looking for a wiring diagram; you're in luck! Hopefully you wired everything correctly...

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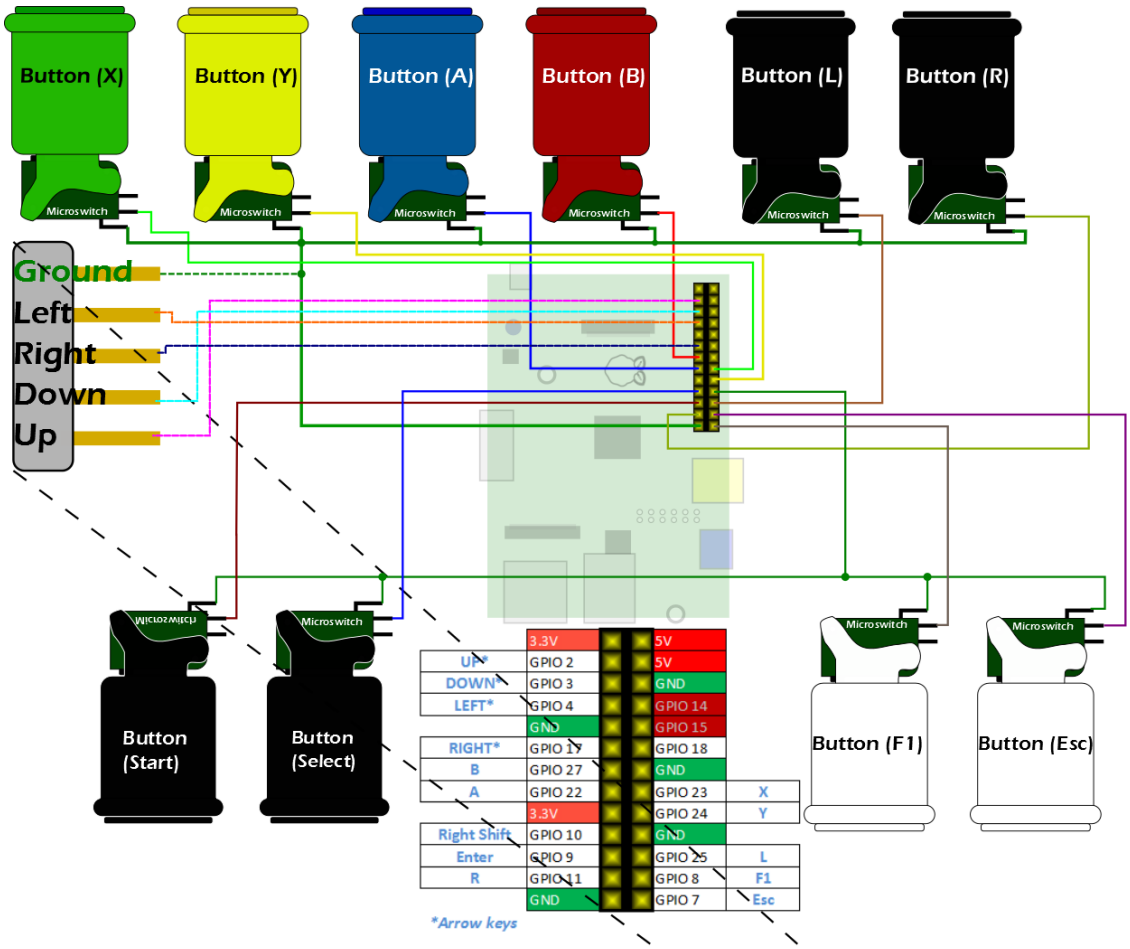
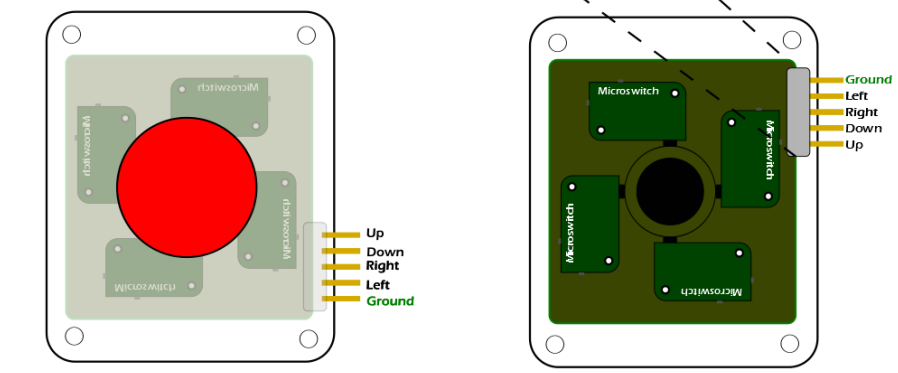
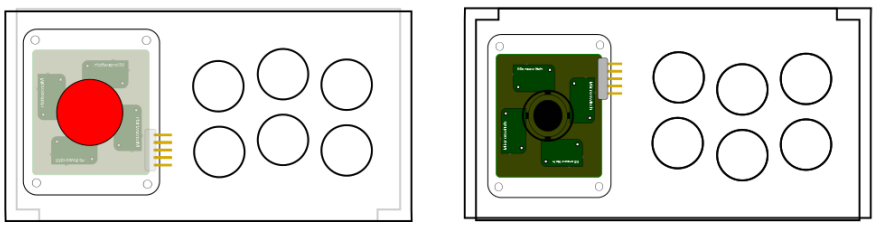


Joystick Orientation



Top

Bottom



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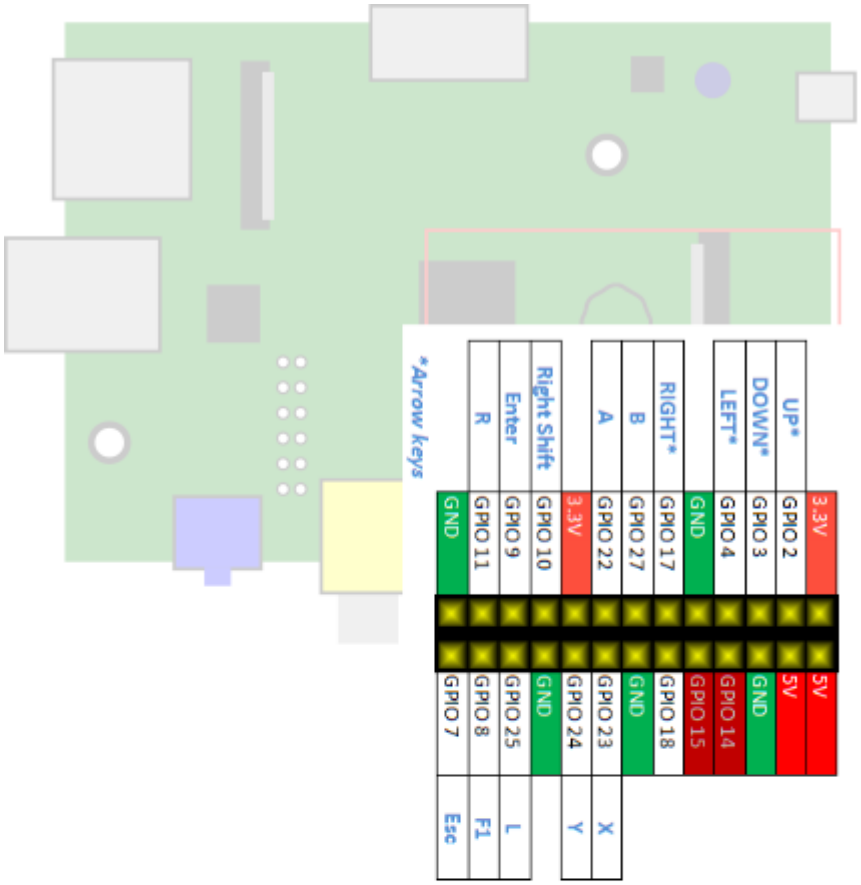

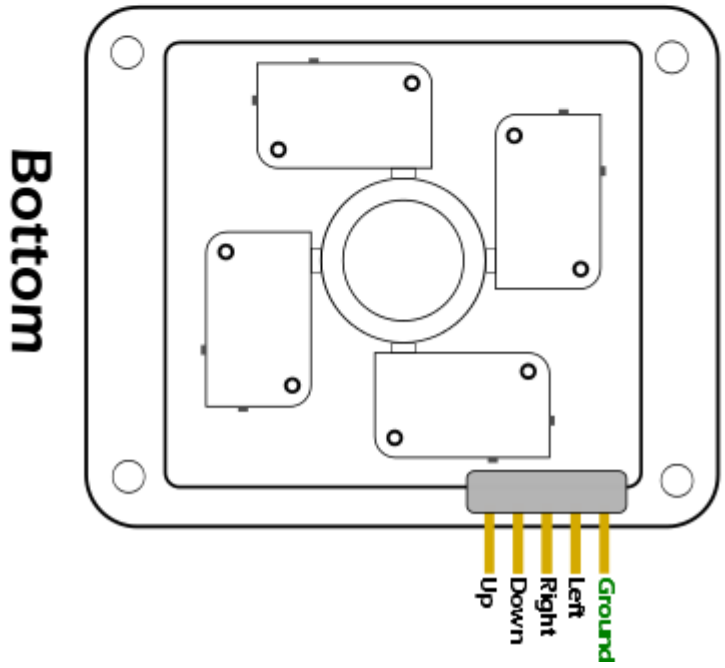

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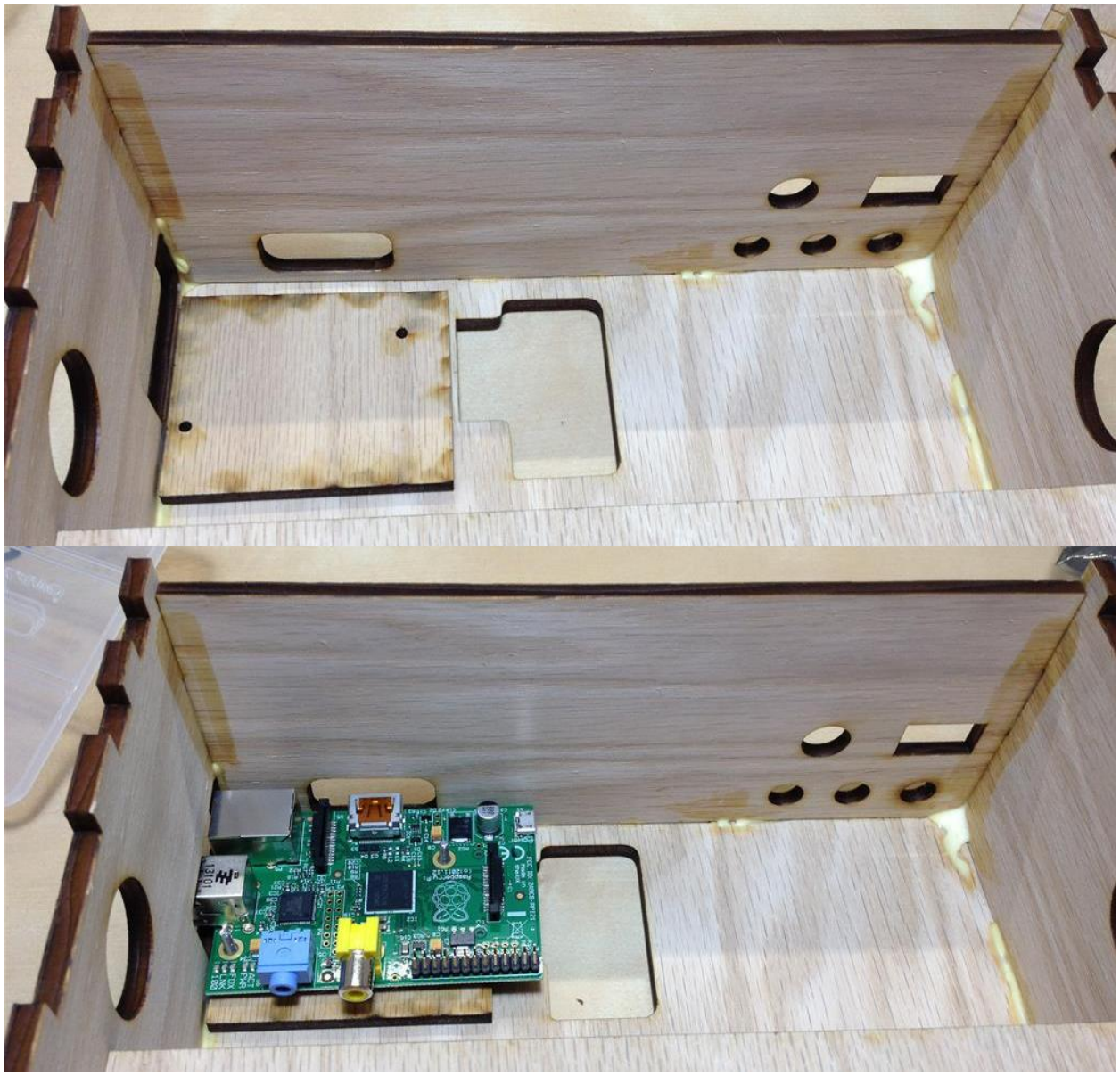
You can mount the Start, Select, F1, and ESC buttons as you see fit. Here is my setup.

If you are building the Tablet Arcade skip to Step ###

3. Mount the Raspberry Pi.

Add two #4 machine bolts, the mounting plate, and fasten your Raspberry Pi as shown.



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4. DC Power Cable to Micro USB B cable.

First you will need a 5V 2A power supply. For this mod you will need your micro USB-B to USB A cable that powers your RPi.

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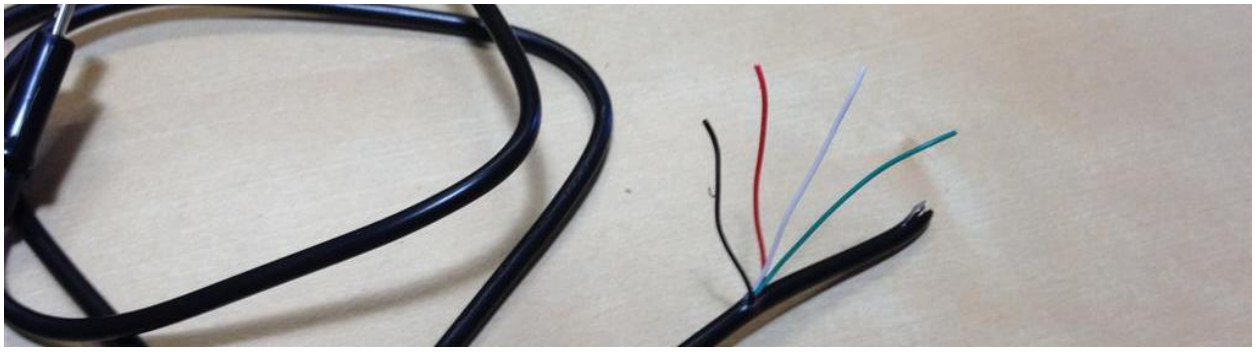
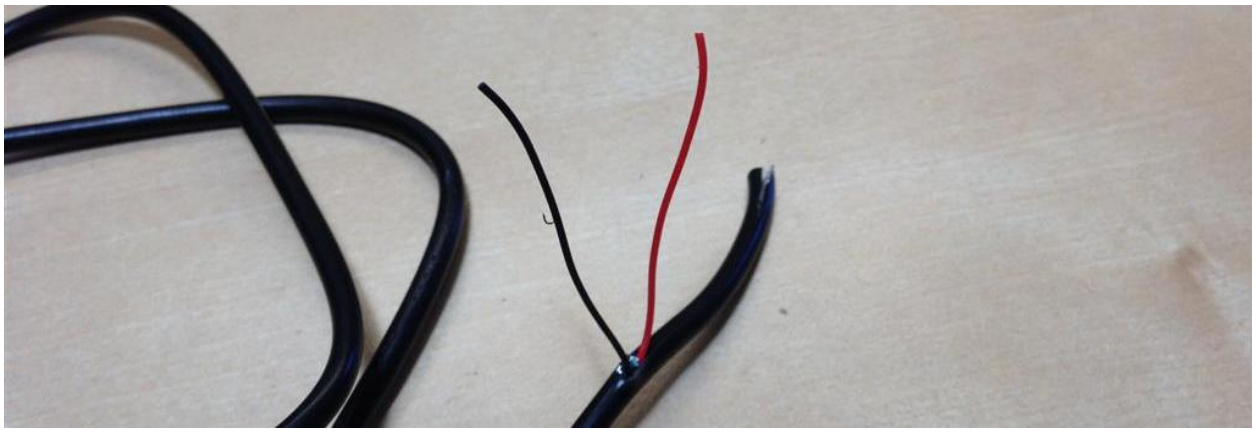
Cut the cable close to the regular USB "A" end.

Strip back the insulation on the longer section of the cable.



You will see a red, black, green and white (or green and yellow) set of wires. Cut off the White and Green. These are for data and are not needed to power the RPi.



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Strip off some insulation off the red and black wires. We will now solder them into the DC panel mount jack. Match the Black and Red to the current black and red wires soldered on.

Note: I have an extra pair of wires soldered here. Don't worry about those. Just match the polarity to your Power supply. If the center pin is positive, be sure to match that to the red wire on your USB cable.

If you have electrical tape, wrap some around this solder joint.

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4. Bluetooth Controls or Not?

If you bought the Adafruit bluetooth module and decide to turn your Lite into a Tablet arcade, they have a great tutorial on how to use it. You can find it at Adafruit's site. I will sum it up with a pinout diagram.

Pin	Key
0	Up arrow
1	Down arrow
2	Right arrow
3	Left arrow
4	Enter
5	Space
6	1
7	2
8	w
9	a
10	s
11	d

Vin 3-16 Vdc

They claim this device uses about 25mA when on, so two AA batteries should be enough. Dont forget to include a power switch to conserve power when not in use.

6. Tablet Mounting Options

I've included some extra pieces so you have the option to mount your tablet a little higher than the design normally permits.

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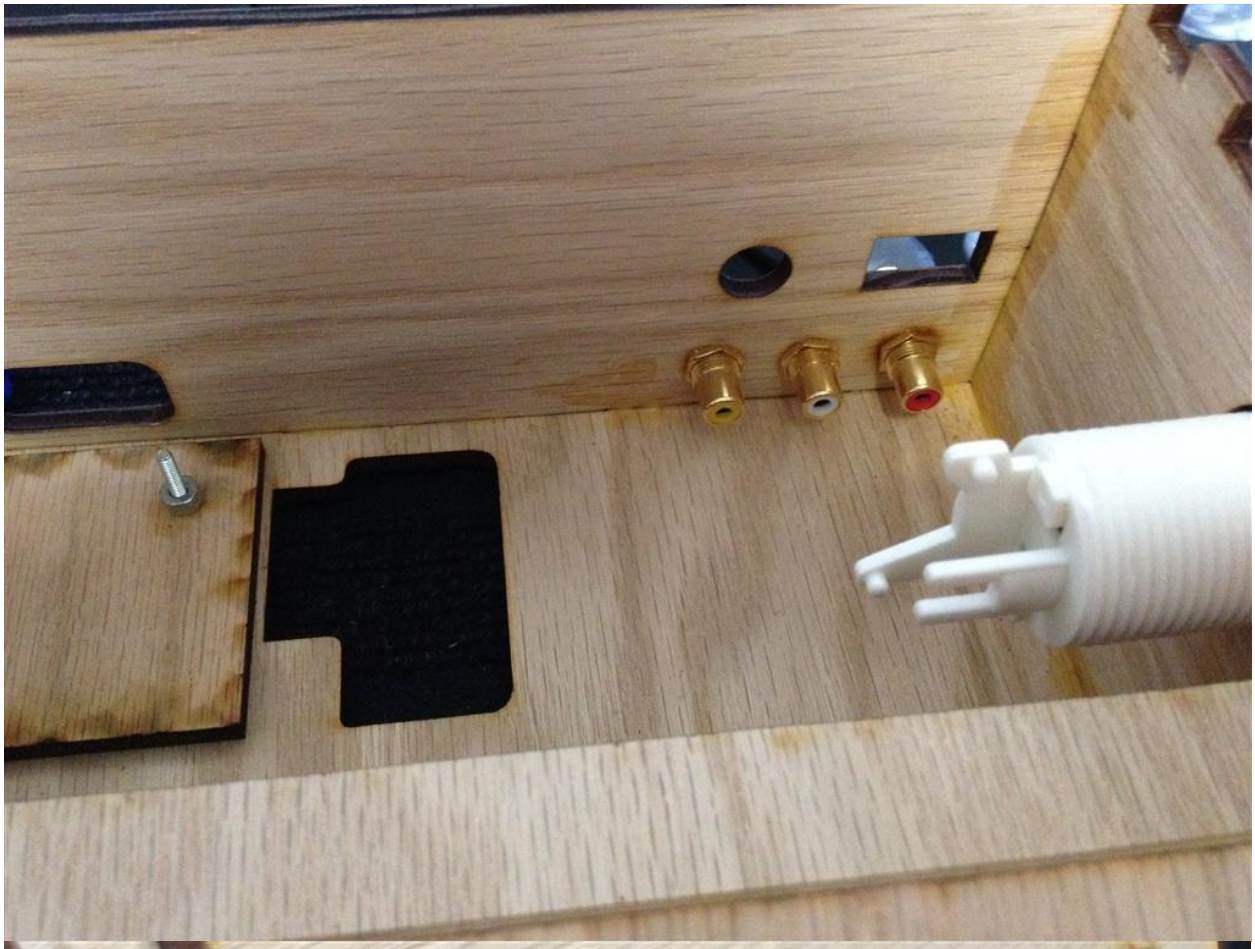
This is optional, and is up to you how you want to do it. I show an example as a suggestion.

7. Analog A/V Jacks (optional).

For the small price of $0.75 each (average) you can add the audio and video RCA jacks to the outside of your Porta Pi Lite. This gives you the convince of using a old composite video TV and that retro feel. The cut-outs will fit these jacks. I used keystone jacks and took off the plastic snap-in part. They work well since they also are threaded jacks.

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