Version 1.0

Release Date: 2/27/2019

Design by Wagner's TechTalk

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Table of Contents

Why OpenCADE?

I originally created a video on [How To: Build an AWESOME Raspberry Pi/RetroPie ARCADE Joystic+Control Panel](). It was, an awesome case which is ideal for someone who doesn't have a 3D Printer and wants to quickly get up and running with a nice Joystick+buttons for their RetroPie setup. I had thought about installing the Pi into the case, but then everytime I needed to plug in a keyboard, I would have to open the case. That was a PITA concept, so I never installed the Pi into the case. Though, you could use a Dremel and make cutouts, etc. it wasn't something I was interested in doing.

After releasing the video, I had one subscriber ask me if there was a 2-player version of the case. I searched around and couldn't find one. He also searched and couldn't find one. So then I got to thinking, I have a 3D printer. I have [MoI 3d]() to design 3d models. Why not design my own case that would allow you to build a 1-player, 2-player, 3-player, etc? Why not make it so I can attach a female USB plug for the keyboard? Why not make it so I could someday add a spinner/trackball? Well, that was the idea behind OpenCADE.

I wanted to provide the Retro Gaming community with something that they could expand, enhance and make it what they want. After a number of iterations and late nights, the first model was built. Started with a 1-player only version and tested it out. It WORKED! Then, decided to print the 2-player side and it also worked. At this point, it really needed side covers and the USB connection so I didn't have to open the case. Spent some time on that, installed it and it worked as well.

I could have kept this design to myself, but that wouldn't have been very nice. I don't have any intentions of trying to make money off of this. However, if you like the project, I would appreciate if you subscribed to my YouTube channel at http://www.youtube.com/wagnerstechtalk . I would like to grow the channel to a point where I can do this on into my retirement and if it grows big enough, could potentially make a few extra dollars to bring you more exciting projects that are beyond my means. This is a hobby and your support is appreciated! Now, let's get back to OpenCADE!

DISCLAIMER

We do not build, sell nor deliver any of the items you see here for profit. Wagner's TechTalk provides this design as a free download for you to 3D Print and build yourself. If you do not have access to a 3D Printer, there are some on-line sites that will print and ship them to you. That is always an option.

We do use Amazon Associates, which is an affiliate program, that provides a small % of any items purchased through links we provide. Please consider using the links here as it will help support the channel and allow us to grow with no impact to your purchase price. Everything we receive will be rolled back into new projects for the future. This is a hobby for us, not a business.

Any build that you create based on this design is entirely up to you and Wagner's TechTalk will not be held liable for any damages resulting from your build. You should follow the manufacturers recommendations above anything you read here. We do not provide any games (i.e. Roms), Parts, or any tangible/intangible elements beyond the 3d models, please do not ask. That said, have fun building!

Advantages to OpenCADE

- You can start off with a single RPi+case quite inexpensively.
- You can add additional controllers as your budget permits.
- You can customize it however you want, in any color! Want a TNMT decor, go for it. DK, the same!
- Additional options can be added as they are developed. For example, add a cover plate to the end. Perhaps a USB input so you can attach external devices such as: Keyboards, trackballs, spinners, etc. without having to open the case!
- Did we mention, the case is basically FREE (minus the cost of the printer filament)
- Can be used with our Arcade Restrictor for an easy and simple solution for playing those classic 4-way games (Ms. Pac-Man, DK, etc.)
- Further down the road, we plan to design spinner and trackball attachments which you can place in any segment you wish.
- Empty control panels available which will allow you to, using design software of your choice, place the holes wherever you want, then print your custom panel.
- Expandable by you, since we'll be providing the source files, you can create new components that can be used by any OpenCADE user and share it with them.

Approximate Cost

Costs were as of Feb. 2019, subject to change and provided only for estimation. We do not provide any parts nor any pre-made kits. The information below is to assist you in sourcing the components for your build. Some of these links may be invalid at some point in the future or replaced. Be sure to use the latest copy of this document available at http://wagnerstechtalk.com/opencade.

- Raspberry Pi 3b+ ($38.10 USD)
- Power Supply for RPi ($10 USD)
- 128GB MicroSD ($22.99 USD)
- 3 rolls of PLA (for 3D printing in different colors ~$19 each)
- Button/Joystick Kits ($25.99 each USD)

Not counting the PLA in the following since there was plenty of various colors left over – we used black the most, for the base. From a hardware standpoint, the cost for a single Controller was around $98 USD. For 2 controllers, the cost was $124 USD. Both include a single RPi, shared power supply and microSD. Labor was free, as it will be for you too. This is a **Do-it-Yourself project (DIY)**, we don't build these for resale so please don't ask. We love our printer and don't want to wear it out. The fun in this project isn't just playing the games, it's making it what you want it to be! There are on-line shops that will print the pieces and ship them to you. Also, some local libraries have printers available for use.

Pretty sweet for a 2-player setup which includes everything needed to hook it up to your HDTV! You could save a little by going with a smaller microSD or perhaps a different set of sticks/buttons. But the prices above are pretty darn good. You could order from China direct and save around 10-20% but you may have to wait 3 weeks or so if you're in the US.

Printing the Case

For the model I built, I used PLA plastic. It's not as durable as other options such as ABS, PETG, etc. However, PLA is much easier to work with and doesn't require a heated print bed. It's up to you what material you want to use, PLA is just a suggestion.

The printer I used was a Flash Forge Creator Pro and the build volume is 8.9 X 5.8 X 5.9 inches. You will need a printer with dimensions this size or larger to print this case, so do check that first before continuing.

In the archive you'll find a few .STL files, these are the files that you load into your splicing software for your printer. There are a number of packages for that, so I can only assume you already know how to load a .STL into the splicer and generate the file output needed for your printer. I used FlashPrint with my printer and it's free for Flash Forge printers and one I recommend. There're many others that range in price from free to a few hundred USD.

Recommended Tools

Aside from the obvious, access to a 3D Printer, you'll need the following additional tools:

- Philips head screwdriver
- Small needle-nose plyers
- Hot glue gun (Optional - for the USB Plate)

The Components

At the time of this writing, the following components have been developed. Their design and number of components may change as I receive feedback. However, those will likely be added to supplemental documentation. For now, let's just consider these components.
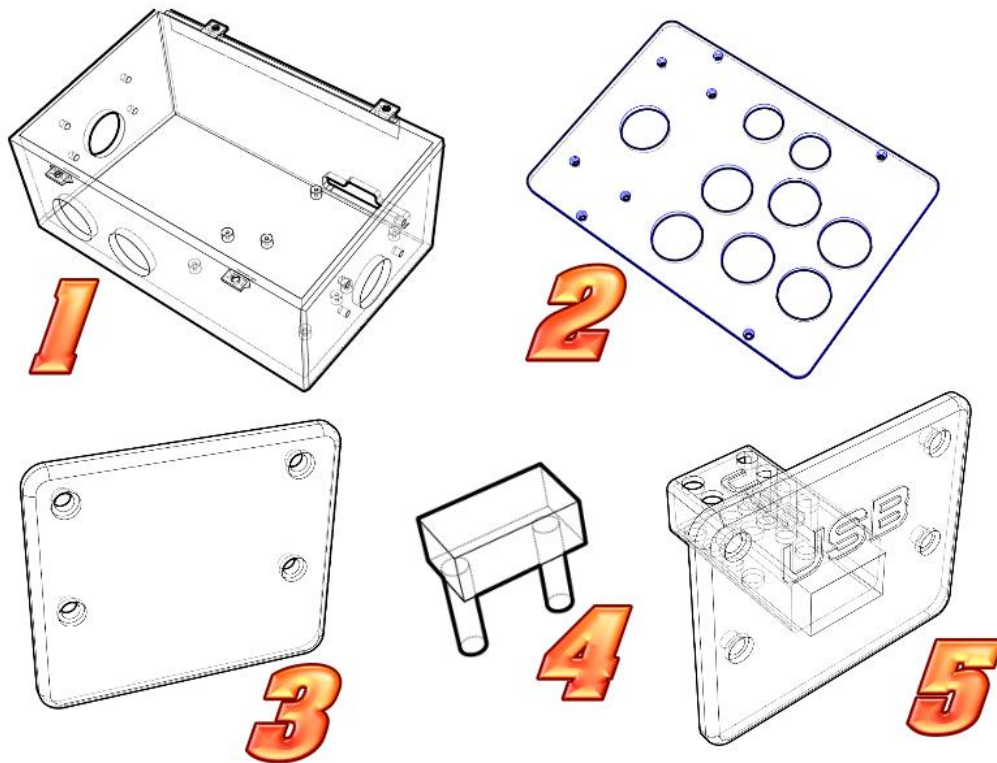
Explanation

At any point in this document, if you see (# some number), it is referring you here.

Base (1) – This is the largest of all the components and it will take time to print. It's one of those prints you start early in the morning and it might be done by late evening or the next morning. It all depends on your printer, speed/quality settings. This is the key component, everything else you see somehow attaches to this piece. There are 8 standoffs on the bottom. The opening near the back is where the Raspberry Pi connections will be made. The standoffs near the front are for the Joystick encoder board. There are 4 tabs at the top of box where an M3 screw will pass through with a nut. You can find the screws at your local hardware store or online. At the bottom of the base, you'll find two holes where two additional buttons may be installed.

Control Panel (2) – This is where you will install a joystick and buttons. Notice, the very top holes are slightly smaller than the other holes. This is typically where the Start/Select buttons will be installed. The other buttons will be installed in whatever arrangement you wish.

Side Cover (3) – This cover can be used to cover the holes on the left/right side of the Base (#1) until such time that you decide you want to expand in those areas.

USB Tab (4) – This small piece will be used to keep the USB Cable (Female → Male) from sliding out the back of the adapter. You first slide the Female end into the USB Adapter (#5), then slide the Female portion out the front of the plate. Add large amounts of hot-glue into the holes where the USB Tab will reside and slide the Female USB cable so that it's flush against the USB Adapter (#5). Let the glue dry, then break-off the square portion of the USB Tab (#4) to make a solid seal that will keep the USB cable from moving back or forwards. If this is difficult to picture, please see the video on our YouTube channel (http://www.youtube.com/wagnerstechtalk).

USB Plate (5) – This plate will house the Female end of the USB Cable to the Raspberry Pi. This allows you to easily connect a keyboard, Trackball, spinner, etc. without having to open the case. Keep in mind, this plate should only be installed on the **Right-Side** of any case. Installing it on the left-side is likely not going to work well and interfere with the ability of the joystick to move freely. It can be installed on the right-side of any 1, 2, … n case but not on the left side.

Non-Printed Components (some optional)

- M2 screws – Required to attach the Pi (x4) and Encoder (x4) to the Base (#1). Installing just two on each corner should also suffice.
- M3 screws (flat recommended) – Required to assemble the Control Panel (#2) to the Base (#1). Also needed to assemble any side cover (#3) or USB Plate (#5). They are also needed to assemble the Joystick to the Control Panel (#2).
- M3 Nuts – Required to secure the M3 screws to just about everything.
- Hot-Glue and Gun recommended if you plan to utilize the USB Plate (#5) with a USB Cable. Your local dollar/craft store is a good place for these items.
- Rubber Feet (Large) – This is optional, but a good idea for added stability on the desk/table and to limit the potential for the assembly to slide during gameplay.
- USB Female → Male Extensions – This is optional, but necessary if you want to add a USB port on the right-side of your case. If installing into a 2-player configuration (or larger), you will likely need a longer cable or attach two of these together (what we did for the 2-player build).

Assembly

The following are some general assembly guidelines. Keep in mind, you are free to customize this case however you wish and therefore there are a number of permutations. For a more helpful assembly explanation, please see your YouTube video at http://www.youtube.com/wagnerstechtalk (at the time of this writing, it wasn't yet public).

Getting Started

It is assumed that you have already 3D Printed the following components:

- X1 Base (#1)
- X1 Control Panel (#2)
- X1 or X2 Side Covers (#3) – *Optional*, but recommended
- X1 USB Plate (#5) - *Optional*
- X1 or X2 of USB Tab (#4) - *Optional*

The above will allow you to build a single 1 player case. Additional components will be needed if you want to turn it into a 2-player, 3-player, etc.

Step 1 – Burn RetroPie to the microSD card

1. Download RetroPie from https://retropie.org.uk/download/
2. Burn the image to your microSD card (32Gb or higher is recommended by us) using *Win32 Disk Imager* or *Etcher*.
3. Insert the microSD card into the Raspberry Pi 3B/B+
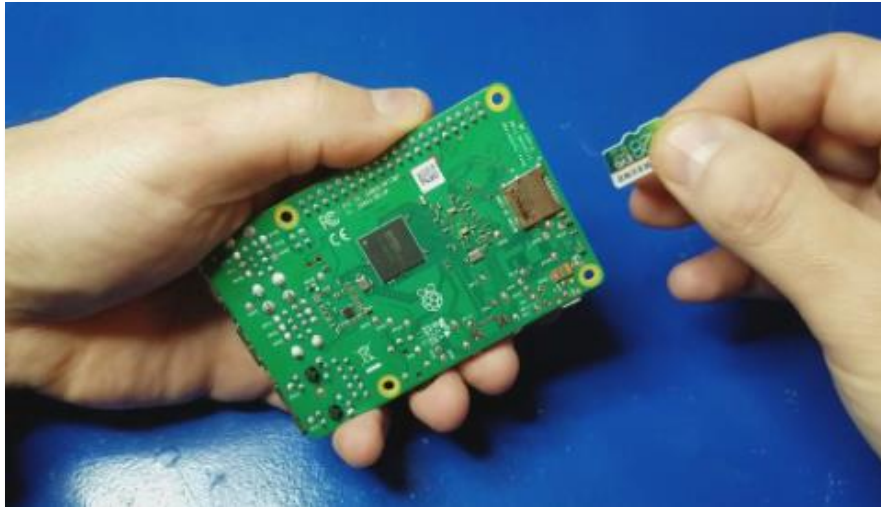
Step 2 – Install Raspberry Pi and Encoder to the Base

1. Using X4 (or X2 diagonal from each other) M2 screws, attach the Raspberry Pi to the standoffs located at the very back of the Base (#1). The Audio, HDMI and Power connectors should be facing out the back. Securely tighten the screws.
2. Repeat the same for the USB Encoder board that came with the Joystick kit. Make sure the USB Female connector is facing towards the middle of the inside of the case.

3. Attach the USB cable from the encoder to the Raspberry Pi.

Step 3 – Install Joystick to the Control Panel
1. Using X4 M3 screws and nuts, attach the Joystick to the control panel using the 4 holes provided in the control panel.
2. Make sure the center of the stick is centered to the hole in the top of the control panel.
3. Install the Joystick cover (round plastic washer)
4. Screw the Joystick ball to the rod.

Step 4 – Install Buttons to the Control Panel

1. Install the Button on the top of the control panel. **Note** – we also provide a sheet you can print and install the artwork inside the plastic cap of each button. This is optional, but eliminates wear on any external labels and looks a bit more professional. Though, takes more time to do. See http://wagnerstechtalk.com/opencade for the downloadable button sheet.
2. Install the black or white nut to the bottom of the button. The white nuts are for the two smaller buttons. The black nuts are for the larger buttons.
3. Repeat steps 1-2 (above) until all buttons are installed.

Step 5 – Wire up the Buttons to the Encoder board

1. Follow the manufacturer's information on installing the wires.
2. Repeat for all buttons.
3. Attach the connectors from each button to the encoder. Typically, it doesn't matter which button is connected where (again, see manufacturer's instructions to verify).
4. Repeat the above steps for all buttons.
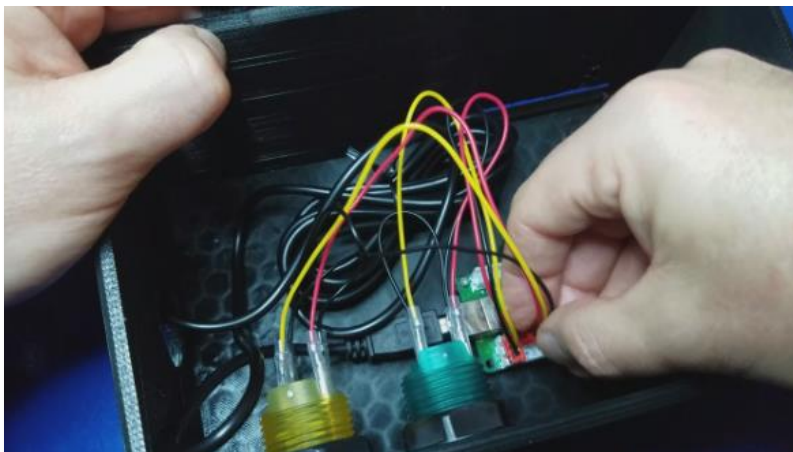
Step 6 – Install Side Cover (Left side)

If the case being assembled will not have another case assemble don the left, install a side cover on the left-side.

1. Align Side Cover (#2) holes to the Base (#1).
2. Insert X4 M3 screws with the heads on the outside of the box, going into the case.
3. Install X4 nuts to the inside of the case.
4. Tighten well.

Step 6A – Install USB Adapter

If you want to provide easy access to a USB port, you can install the USB Plate (#5) on the right-side of your build. Keep in mind, installation of this component should always be on the far-right. Installing to the left side will most likely impede the ability to use the Joystick properly.

1. Using a 1-3 foot USB Female → Male extension cable, slide the female in to the adapter.
2. Align the female adapter so that the connector is flush with the outside of the adapter.
3. Slide the Female USB adapter out slightly and apply some hot glue through the holes in the USB Plate.
4. Push the Female adapter back into the plate so that it is flush.
5. Insert X1 USB Tab through an appropriate hole to secure the movement of the USB Female end.
6. Add more hot glue at the end and install a 2nd USB Tab.
7. Allow the hot glue to dry completely, usually 2-3 minutes.
8. You can now slide the USB cable through the side expansion and mount the USB Plate to the side of the Base.
9. Install the male end of the USB cable into the Raspberry Pi.

Step 7 – Install Control Panel

The moment you've been waiting for! But keep in mind, if you are making this control panel a 2 (or more) player controller, you first will need to screw the two sides of each Base (#2) together first. Make sure you tighten them well to prevent any movement. Don't hand-tighten (as we did), you'll have to open it back up later to secure them better. A washer can also be used if you have them to help add extra support. Also route/connect the 2-player USB cable to the RPi in the primary control panel.

1. Install an M3 screw in any corner going from the top of the control panel down into the provided Base support holes. Make sure there are no wires obstructing any buttons or joysticks (press/move each to make sure). You may need to adjust at this step to make sure everything fits well. Once ok, install the nut.

2. Repeat the above for all 4 nuts.
3. Tighten well, but don't over tighten (too much torque could potentially break the base supports). While this hadn't happened to us, theoretically it could.

Step 8 – Try it out!

1. Attach the HDMI cable from the back of the Raspberry Pi to your TV
2. Attach the power cable to the Raspberry Pi's micro usb connector. If the power supply has a push button, make sure it's turned on.
3. Make sure your HDMI TV's input is set correctly.
4. You should see the Raspberry Pi booting into Emulation Station.
5. For more information on setting up RetroPie to your WiFi, setting hostnames, etc. please see our Wagner's Arcade page at http://wagnerstechtalk.com/wagners-arcade

Troubleshooting

The following are some issues that we encountered and their solution:

- **Joystick won't move** – First, make sure you did not install the USB Adapter plate on the left-side of the case. It should only be installed on the right-side of any segment. The reason, the bottom of the joystick needs to be able to move freely. Also, any USB cables should be routed such that it won't interfere with the joystick operation.
- **Buttons Stick** – The reason for this is typically there are wires below the button or the nuts of the button washer are applying too much pressure to the button. Try Rotating the button+nut such that the flat end is facing the side of the case. Re-install the control panel (without screws) by holding it down with one hand. Press each of the buttons to see if there is anything preventing the button from being depressed. Once all is ok, screw the control panel (#2) to the Base (#1).
- **Where can I get the latest information**? – The latest information regarding OpenCADE will always be available at http://wagnerstechtalk.com/opencade . Including all links to the 3D Model download, any potential expansion designs and other artifacts.