



Les Paul Controller for Guitar Hero/ Clone Hero/YARG



Long

[VIEW IN BROWSER](#)

updated 16. 8. 2024 | published 16. 8. 2024

Summary

No compromises guitar for guitar based rhythm games. Tilt/Whammy/USB-C or Bluetooth with 18650 lithium battery.

[Gadgets](#) > [Video Games](#)

Tags: [hero](#) [guitar](#) [clone](#) [gibson](#) [tilt](#) [bar](#) [paul](#) [les](#)
[whammy](#) [yarg](#)

Fret Buttons in Action

Note these are 90% buttons.

Gameplay Footage

This is my version of a clone hero/guitar hero guitar in the style of the Les Paul Gibson. My goal was to make the best possible guitar with no compromises.

Please also check out my Eddie Van Halen Star: <https://www.printables.com/model/737667>

Changelog:

- 2024-08-16
 - Added v0.2 of split face
 - Changes the print orientation of the face so it is printed face down for better surface finish.
 - Split between the two face pieces is currently 0.2mm. My thinking is that having less gap and maybe needing a little sanding is better than a big gap. Will have to see.
 - Added v0.1 of split neck for **220 beds**
 - **This requires assembly of the fret switch plate into the neck prior to attachment of the proximal neck piece.**
 - There isn't enough room for 4 heatsets to attach the neck pieces.
 - use two heatsets and m3x12mm for the attachment closer to the front of the neck.
 - use two m3x16 (or m3x12 if you don't have m3 x 16) for the other two holes.
- 2024-08-15
 - Added v0.2 of the split guitar body.
 - Now has 5 tabs so the guitar can be attached with five m3x8 and five m3 heatsets. There are 5 integrated support pieces that will need to be removed.
 - Alternatively, just glue the body together. Using the tabs may give some leeway with alignment versus just gluing.
 - Added v0.1 of the split guitar face. remove the support and glue the two pieces together. 3 indexing aligners should help with alignment.
- 2024-08-14
 - Uploaded 0.1 version of the split guitar body.
 - The guitar face can be printed vertically on a diagonal with support at the moment. Having the face one piece will be very desirable IMO.
- 2024-08-12
 - **A split version of this guitar is currently in the works!** I am currently targeting a bed size of 235mmx235mm to accommodate all the enders out there :). Just FYI it's still going to be super tight on a 235x235 bed, so a 250 will be much easier.
 - For now, alpha version of the split neck in 90% and 100% frets is uploaded.
 - Use 4 heatsets and 4x m3x12mm to attach (or glue the two pieces together).

Design Goals

- Modular/adjustable strumming mechanism that uses bearings for smooth strum with no play.
 - Strum bar uses bearings, giving a very smooth and consistent movement.
 - Strum switch mounts slide in and out to eliminate backlash in the strumming mechanism.
- As few bolts as possible visible from the front.
 - Only 4 neck bolts visible, which I like aesthetically. These could easily have been hidden also.
- Single piece neck
 - Better rigidity as a single piece.
 - Cleaner look without bolts as it's always hard to get multiple pieces to line up perfectly.
 - Fret switches are mounted onto a plate, which slides into the neck and is attached to the neck with screws that are hidden under the fret buttons.
- Buttons mounted into the keycap mounting holes
 - Buttons don't float and have a smooth action without sticking.
 - Button stops under the top and bottom of each fret prevent excessive leaning of the button.
 - Legs are printed separately and glued into the cap so the legs don't break along layer lines.
 - Flat or dimpled buttons
 - Small dimple makes it easy to locate the middle of the button.
- Modular wire exit plate
 - Wire exit is a face plate that can be easily adapted for whatever hole/wire plugs that you want.
 - Current Plates
 - USB-C using micro-USB to USB-C Extension/Adapter
 - TP4056 charging module and mini-rocker switch
 - Wireless play only.
 - USB-C is for charging only.
 - Pimoroni Pico Lipo Shim
 - Direct connection to pico for less latency and wireless via bluetooth are both possible.
 - Charge and connect to the pico from the same USB C port.
- Whammy Bar (optional)
 - Uses a spring, mr83 bearing, and a cheap potentiometer
 - Different options for whammy bar coming (waiting on Aliexpress)
 - m6 whammy directly into plastic (stays in place)
 - m5 whammy into a m5 heat set (allows the whammy to be loose and fall away when not in use)

- Tilt sensor (optional)
 - Dual Mercury/ball bearing switch
 - Two in series, mounted at a slight angle to each other to reduce accidental triggers.
- Electronics
 - Pi Pico mount.
 - Tons of zip tie spots for easy wire management.
 - Wireless support via an 18650 or 21700 lithium battery and charging module.

BOM

- Screws
 - (6) m3 x 8mm **Button** head screws (BHCS)
 - Button heads are required for mounting the fret switch plate to the neck
 - (22) m3 x 8mm BHCS or socket head cap screws (SHCS)
 - (4) m3 x 40mm SHCS or BHCS
 - for mounting the neck to the body
 - (4) m3 x 12mm SHCS or BHCS
 - two of these are for the neck strap mounts
 - two are for the strum bar bearing bolts (can also use much longer screws here)
 - (3) m3 x 12 - 16mm SHCS or BHCS
 - Used to attach the headstock to the neck.
 - 16mm bolts will give more purchase into the two lateral holes that thread directly into plastic.
 - (4) m2 x 8mm-12mm screws
 - I used a coarse thread screw here but it shouldn't matter as it is only holding the pi pico.
- Heat sets
 - (28) m3 x 5mm (diameter) x 4mm (length)
 - https://a.aliexpress.com/_m02dh3U
- Bearings
 - (2) MR83 bearings (3 total if you are adding a whammy)
 - <https://a.co/d/fSe7y0F>
- Switches
 - 9x Kailh choc low profile for neck and body buttons
 - I like linear red for the frets and pale blue (similar to box navy but shorter throw) for the rest
 - https://a.aliexpress.com/_mtsCjJk
- Electronics Options
 - Direct wire (simple and low latency)
 - (1) Pi Pico

- (1) Micro USB (male) to USB-C (female) panel adapter
17mm mount holes, 0.3m length.
■ https://a.aliexpress.com/_mN3BSBI
- Wireless via TP4056 (wireless only)
 - (1) Pi Pico W
 - (1) TP4056 USB-C
■ <https://a.co/d/he0ckG8>
 - (1) Mini rocker switch 8.5mm x 13mm
■ https://a.aliexpress.com/_mrU1EWO
 - Optional power indicator LED
 - (1) 50-100 ohm resistor
 - (1) 3mm LED
 - Battery Mount
 - 18650 Battery Holder
■ https://a.aliexpress.com/_mN6rs0w
 - OR use the either the naked 18650 mount/naked 21700 mount if you solder wires to the battery directly.
- Wireless via Pimoroni Pico Lipo Shim (wireless or direct connection for best of both worlds)
 - This board is nice because you can direct plug (for lower latency) the pi pico and charge from the same port. The TP4056 version basically limits you to wireless only.
 - (1) Pi Pico W
 - (1) Pimoroni Pico Lipo Shim
■ <https://www.digikey.com/en/products/detail/pimoroni-ltd/PIM557/15851380>
 - (1) Micro USB (male) to USB-C (female) panel adapter, 17mm mount holes, 0.3m length.
■ https://a.aliexpress.com/_mN3BSBI
 - (1) JST-PH 2pin Male plug
 - (2) JST-PH crimps
 - Battery Mount
 - 18650 Battery Holder
■ https://a.aliexpress.com/_mN6rs0w
 - OR use the either the naked 18650 mount/naked 21700 mount if you solder wires to the battery directly.
- Optional: Tilt switch
 - (2) 3mm **OR** 5mm Mercury/ball switch
 - https://a.aliexpress.com/_mt1rlue
 - My guitars are using the 3mm switches and they work pretty well, but it looks like the 5mm switches might be better because the mercury seems to flow better in the bigger 5mm switches.
- Optional: Whammy Bar
 - Potentiometer
 - WH148, 15mm 3pin Linear Potentiometer With Nuts And Washers

- 10k-100k Ohm
 - https://a.aliexpress.com/_m0mJJj6
- (8- 10) m3 x 8 SHCS or BHCS
 - 8 if using a single spring, 10 if double
- (1) mr83 bearing (same bearing as the strummer assembly, 3 total needed for strumbar + whammy)
- (1-2) spring
 - <https://www.amazon.com/Ruibapa-Assortment-Extension-Compression-P-038-kit/dp/B0B9BDRK25>
 - I used 5.5mm x 25.5mm from this kit, but you can experiment to see what you like. There's an option to have double spring also if you want to make it even tighter.
- Static Whammy
 - (1) m6 whammy bar
 - https://a.aliexpress.com/_mNq2G86
 - This whammy will still move out of the way manually, but it won't fall by itself.
- Printer with at least 300 x 300mm build plate.
- Superglue

Printing

- Parts should be printed in the orientation provided.
- No Supports. Any required supports are already modeled into the STLs.
- Buttons/Legs *****Important*****
 - Buttons and legs should be printed at **0.1mm layer height**.
 - **Thickness of the leg that inserts into the choc switch should measure 1.25mm - 1.35mm thick after printing for a good fit.**
 - Sometimes slicers do funny things so if your buttons don't fit well you may need to play with the slicer scaling so the legs end up around 1.3mm thick.
 - If you print the buttons with dimples, they should be printed standing up.
- Body, neck, headstock can be printed with 3 walls and low infill.

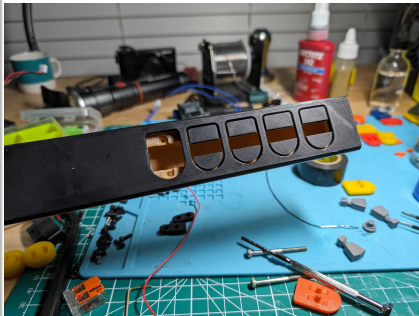
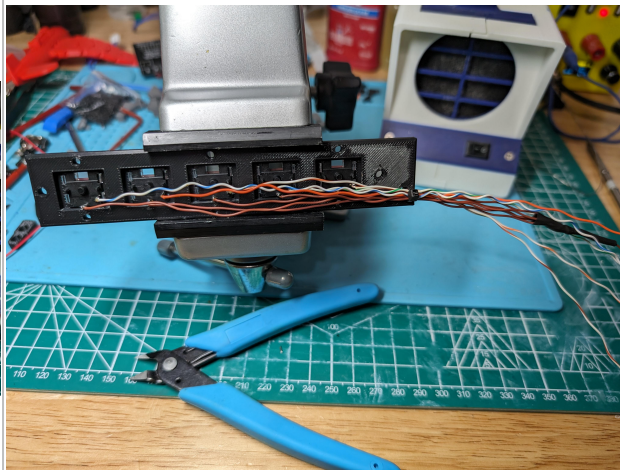
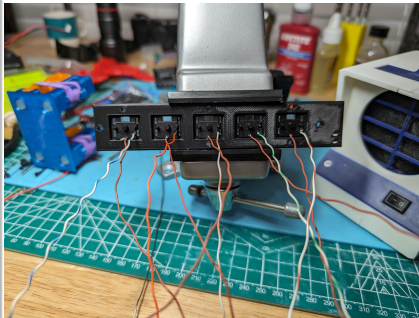
Feedback/Need Help?

- If you have comments, feedback, or need help, please don't hesitate to ask questions or message me. I have printed many of these guitars now, but I do realize everyone's printers/experience are different. So I can help!
- If you need help printing something, just message me and maybe something can be arranged. I haven't decided on whether or not to sell guitars yet, until then just let me know and we can talk.

- If you would like to sell guitars based on my design please message me and something can be arranged.

Fret Switch Plate and Neck Assembly

Neck/Fret Button assembly Video



Break off the supports.
The neck in this pic was printed with a color change.



Carefully install fret switch plate with m3 x 8mm **button head** screws. Tighten until the plate is flush with the neck.

• Neck

- Place the choc switches into the [fret switch plate]. The switches should be placed so that the keycap mounting slots are perpendicular to the neck.

- Solder the wires to the fret switches. The GPIO wires need to be long enough to reach the back corner of the body where the Pi Pico is mounted.
- For the ground wires (brown in the pic), I like to solder a short wire to each switch, then merge those wires into one wire at the end of the switch plate after the zip tie holes. You could also do it bus-bar style
 - Zip tie the wires to the switch plate for strain relief.
- Attach the fret switch plate to the neck
 - Break off the in-built supports on the neck fret-button holes.
 - Slide the switch plate into the neck and attach it to the neck with (6) m3 x 8mm **button head** cap screws. Socket head screws will stick up too high and interfere with the fret buttons.
 - Carefully tighten these bolts until the switch plate is completely flush with the neck. Try to tighten them all a little at a time so the plate comes up evenly.

Brass Heatsets

Note: I removed two heatsets for the Pi Pico Mount. They were unnecessary.

• Heatsets

- (1) top of the neck (attach the headstock to the neck)
- (9) Faceplate
- (14) Guitar Body
 - (8) to attach the strum bar
 - (2) on the sides for guitar strap mounts
 - The strap holders mount with m3x12mm bolts.
 - Note that the rear guitar strap mounting location has two possible locations. There is one at the end of the “arm,” and one under the arm (which is where the actual EVH Star guitar mounts it).
 - (4) underneath the body to mount the neck.

Buttons

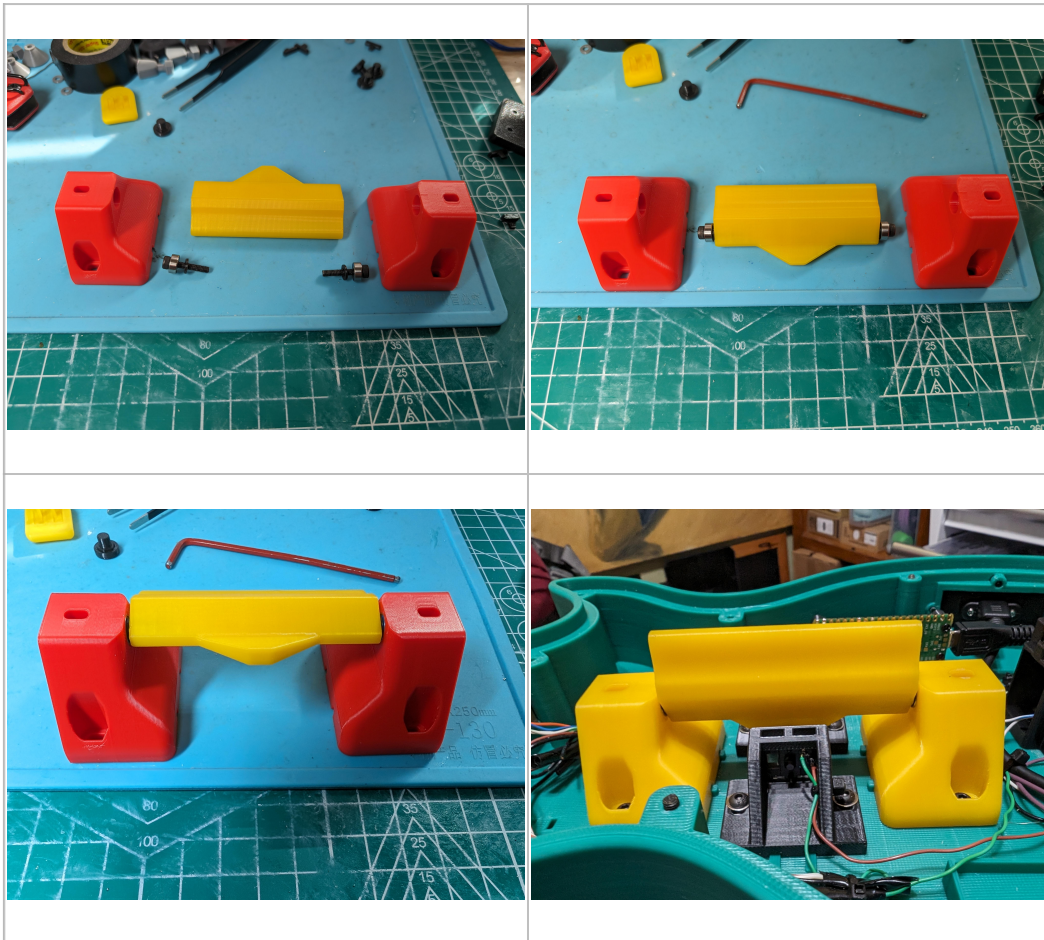


Legs must be printed at 0.1mm layer height. Ideal leg thickness is 1.25-1.35mm

- **Assemble fret buttons**

- Glue the legs into the buttons with some super glue. The leg portion goes towards the middle of the button.
 - Remember the button legs must be printed at 0.1mm layer height for a good fit. The leg thickness should be 1.25 - 1.35 mm after printing.
 - Install the fret buttons into the switches. If you have issues inserting your fret buttons into the choc switches, it is most likely because the switch plate is not completely flush with the neck.
- Attach the neck to the guitar body using (4) m3x40mm bolts.

Strummer Assembly



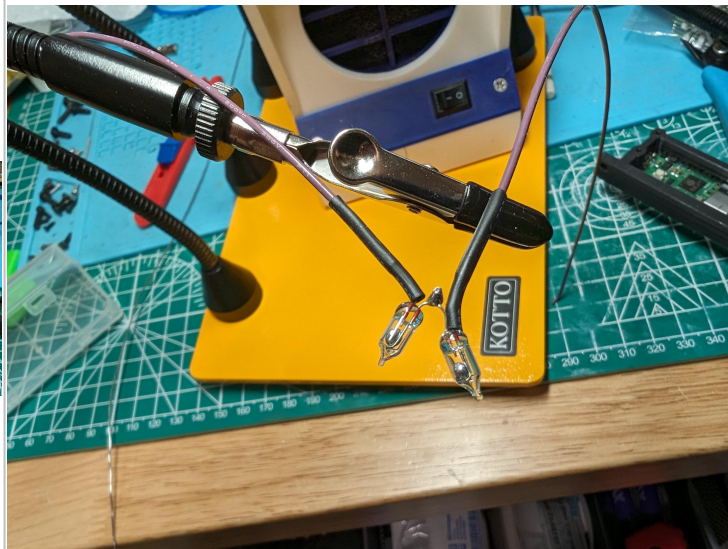
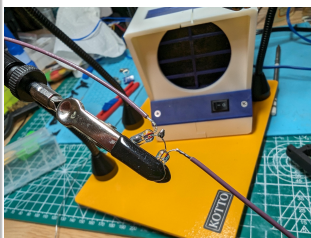
• **Strummer assembly**


- Attach the bearings to the strum bar
 - Basically any length m3 bolt will fit here. I put m3x12mm in the BOM (to use fewer bolt sizes), but I like to use m3x20.
 - From outside to in on each side of the strum bar:
 - Bolt>>mr83 bearing>>strum bar spacer>>strum bar
- Insert the bearings into the hole on the [strummer mount]. This should be a pretty snug fit. I have included two versions with different tolerances for the bearing. I personally like the 8.1mm version.
- Attach strummer mounts/bar to the guitar body using (4) m3 x 8mm bolts. Center it using the alignment lines on the guitar body.
- Switch holders [Switch Holder Choc or Box]
 - Solder wires and attach switches to the switch holders. There is ziptie for strain relief on the switch holder.
 - I know the current trend is for box navy switches, but I prefer choc pale blue because the throw is shorter.
 - Attach the switch holders to the guitar body using (4) m3 x 8mm bolts. I also recommend using m3 washers here, but they aren't required.
 - Center and adjust the switch locations so there is no play.

- **Star Button Mount**

- The Star button can be made dual color with a filament swap.
- Attach the body button mount to the guitar body using (2) m3 x 8mm bolts. The opening of the mount should face towards the neck.
- Heatsets for the body button are optional.
- If your button isn't centered in the face plate hole, you can adjust this slightly with these bolts.
- There is a zip tie strain relief on this mount.

Tilt Sensor



 <p>Use a zip tie to hold everything in place.</p>	<p>The switch should be mounted with the arms pointing at approximately 3:30 and 5 o'clock. Adjust it to your preferences.</p> <p>Treat the tilt switch as a digital switch. It can be wired to any digital GPIO/Ground.</p>
---	--

• Tilt Sensor

- The tilt sensor is designed around two 3mm or 5mm mercury switches. The switches are mounted at an angle to each other.
- The right one should point at around 3:30 and the left one at around 5 o'clock with the wires coming out at ~11 o'clock.
- This helps mitigate accidental triggers from single axis up and down or side to side movements.
 - The angle refers to the angle relative to the two switches. a higher angle means fewer accidental triggers, but requires a larger tilt to activate.
- Treat the tilt switch as a digital switch. It can be wired to any digital GPIO/Ground.

• Wiring

- I mount the Pi Pico with the USB port pointing to the back of the guitar.
- Wire one wire from each switch to any digital GPIO pin on the Pi Pico. You don't have to worry what GPIO pin you wire the switch to because the Santroller Configurator automatically detects which pin it is later.
- Wire the grounds to the Pi Pico. The grounds should be grouped together before connecting to the Pico since there isn't enough ground pins. I group the grounds for the neck switches into one group and group the body switches into another ground group, but do what works best for you :).
- If you can crimp duponts I think it is an easy way to get perfect wire lengths.
- Otherwise, just solder the wires to the pico and you can tidy them up using the many zip tie holes.
- Notes for TP-4056
 - <https://electrocredible.com/power-raspberry-pi-pico-with-batteries/>
 - Nice write-up regarding using a TP-4056. I opted to leave out the Schottky diode as I will never be plugging the Pico in after the guitar is wired up. If I do plug in the Pico later to

modify the firmware, I will just make sure the switch is turned off.

TP 4056 Charging Module (Wireless with 18650)

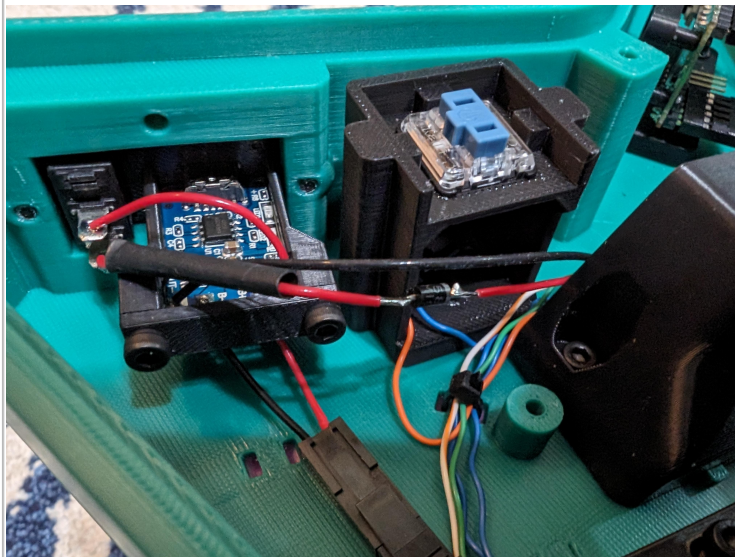


TP4056 with 18650 Battery

This is the EVH Star, but the concept is the same.



50 ohm resistor for 3mm LED. I wired (-) to pin 33, and (+) to pin 36 on the Pico.



A diode is pictured here between the TP4056 and VSYS of the pi pico. However since the Pico micro-usb port isn't accessible unless the guitar is opened, it's not a huge deal if you omit it. Just remember that you need the switch off if you plug in the Pico directly to prevent back feeding the battery.

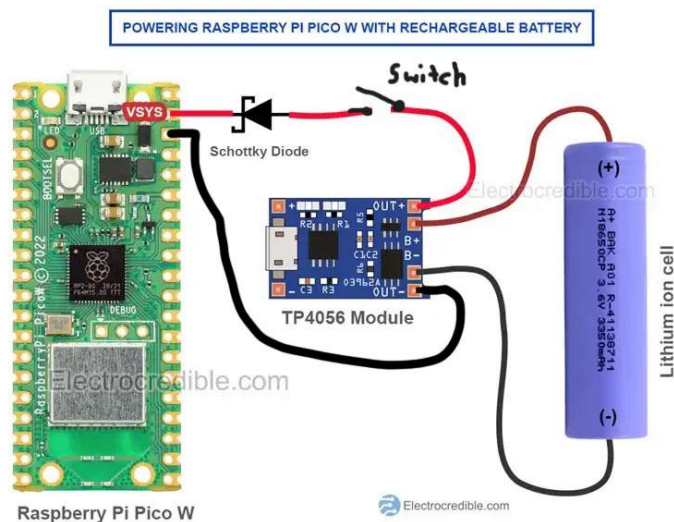
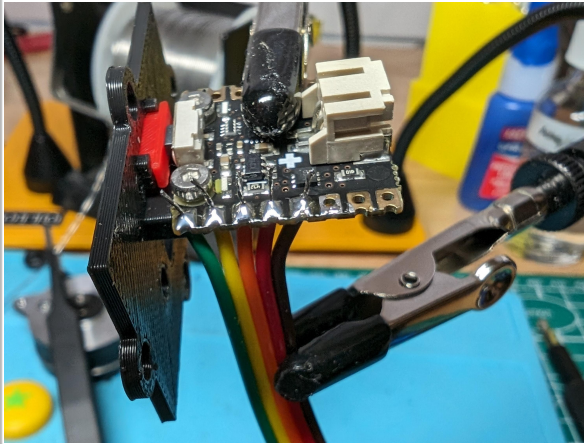


Diagram taken from: <https://electrocredible.com/power-raspberry-pi-pico-with-batteries/>

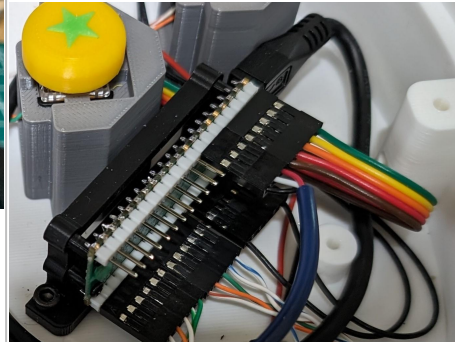
Green light is power light. The hole to the left of the USB-C allows you to see the charging status from the TP4056.

Pimoroni Pico Lipo 18650 Wiring (wireless with 18650)

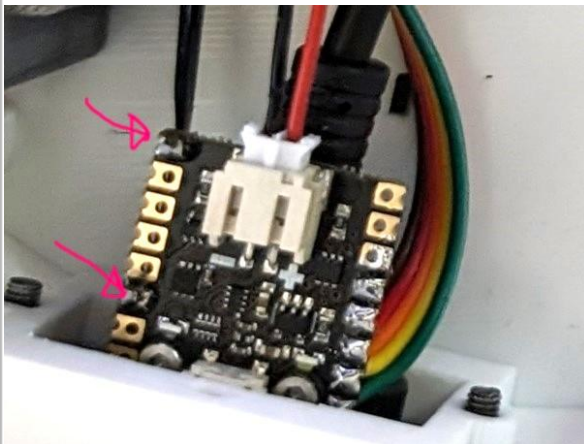


Wire these 5 pins (colored wires) to the corresponding pins on the pico (Pico pins 40-36)

Put the button into the wire plate then attach the Pimoroni Pico Lipo Shim to the plate with (2) m2 x 4mm screws. The Micro-USB to USB-C extension cable attaches with the provided m3 screws.

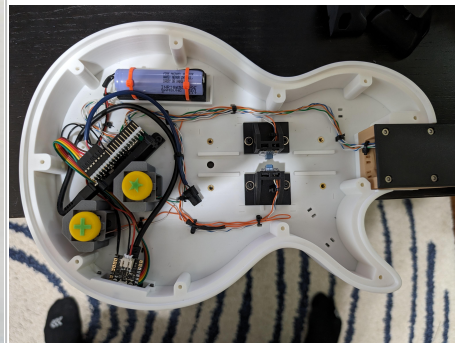


Pins 40-36 on the Pico

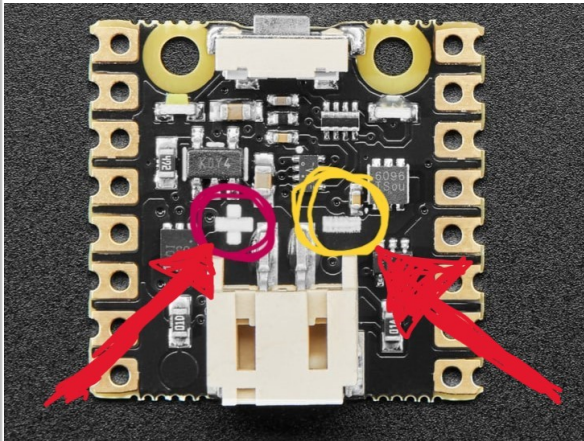


Wire the two arrow marked spots to ground on the pico (I used Pico pins 3,8).

The battery connector uses a JST-PH two pin plug.

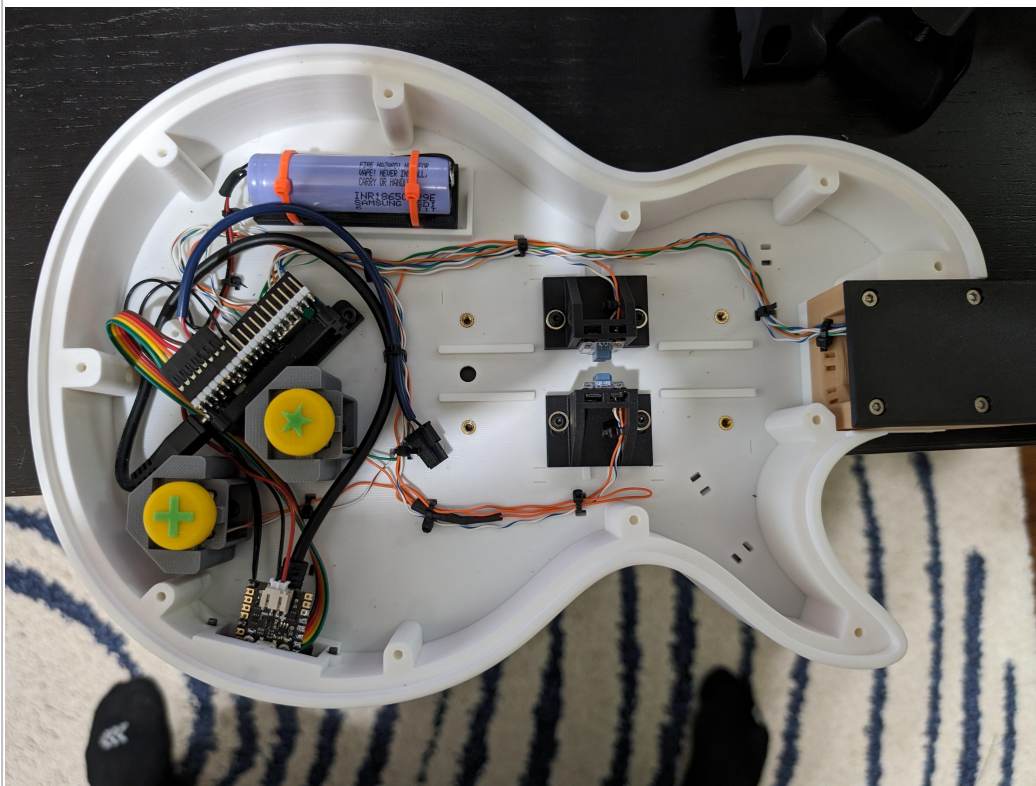


Pimoroni Pico Lipo fully installed with 18650 using the naked 18650 mount. My 18650 was salvaged from a laptop and had tabs on it, so I just soldered wires to the tabs.



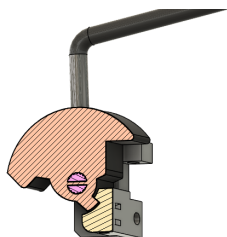
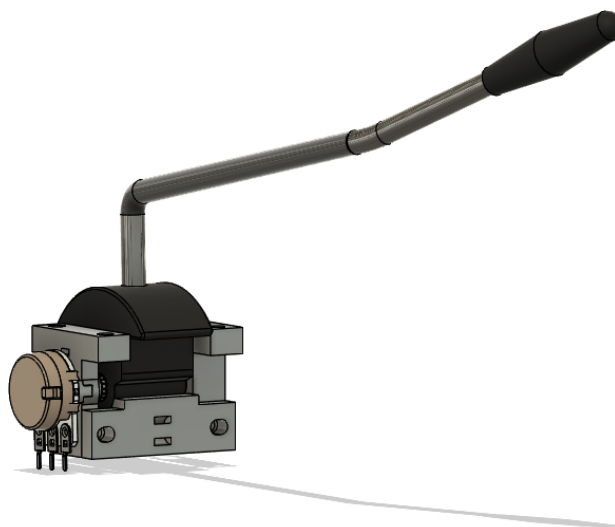
NOTE THE ORIENTATION OF THE POWER to the shim! Multiple people have smoked their pico shims by putting the power in backwards.

Direct Wire via Micro USB to USB-C Adapter Cable



This shows the Pimoroni Pico Lipo, but the routing of the micro-USB to USB-C adapter is the same.

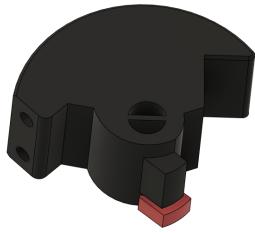
Whammy Bar



Integrated motion stops.



Can be mounted with single or dual springs for extra resistance if desired.



Don't forget to remove the support (red)

The outer pins of the potentiometer should be wired to GPIO 35/33. The middle pin should go to GPIO 34.

- Programming the Pi Pico
 - Santroller Configurator (<https://santroller.tangentmc.net>)
 - This is an amazing tool that makes programming a guitar super easy. Check out his excellent documentation also for some other tips on wiring up and configuring the guitar.
 - In a nutshell, you run the program and plug in your Pico after everything has been wired.
 - On first plug, it will do a quick installation onto the Pico. Next, hit “configure” and it will pull up all the options.
 - Choose “guitar” for controller type. Then, on the left there's a button to learn all the keys. Click the ones you have and skip the other ones. Once you've done that, remove any items you don't have a binding for then hit save on the left.
 - That's it! Your guitar should be working.

Acknowledgements

- @joshdesigns for his Les Paul design, which inspired me to make my own version. My strum bar mechanism is inspired by his.
- Sanjay900 for creating the Santroller Configurator, which makes programming these guitars a cinch.
- Clone hero and YARG creators for allowing me to relive my old guitar hero dreams.

This remix is based on



Eddie Van Halen Star Guitar for Guitar Hero/Clone Hero/YARG.

by Long

Model files



CAD

2 files

guitar-hero-controller-les-paul-90-buttons-v11-v65.step

guitar-hero-controller-les-paul-100-buttons-v11-v65.step



ALPHA - Split neck for 220x220 beds

3 files



neck-split-proximal-220-bed-100-and-90-v01.stl



neck-split-distal-220-bed-100-buttons-v01.stl



neck-split-distal-220-bed-90-buttons-v01.stl



ALPHA - Split Neck for 235x235 beds and larger

3 files



neck-split-proximal-235-bed-100-and-90-v01.stl



neck-split-distal-235-bed-100-buttons-v01.stl

neck-split-distal-235-bed-90-buttons-v01.stl



ALPHA - Split Guitar Body

4 files

guitar-body-strummer-side-with-support-v02.stl



guitar-body-whammy-side-with-support-v02.stl



face-strummer-side-v02.stl



face-whammy-side-with-support-v02.stl



Full Size Fret Buttons

7 files

neck-with-support-100-butons-v10.stl



fret-button-dimpled-noline-x4-v10.stl

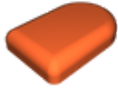


☐ Print at 0.1mm Layer Height

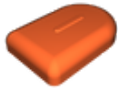


fret-button-dimpled-yellow-line-x1-v10.stl

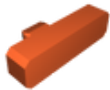
☐ Print at 0.1mm Layer Height



fret-button-flat-no-line-x4.stl



fret-button-flat-line-x1.stl



fret-button-leg-x-10-v10.stl

☐ Print at 0.1mm Layer Height



les-paul-fret-switch-plate.stl



90% Size Fret Buttons

7 files



neck-with-support-90-v10.stl



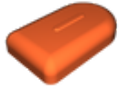
fret-button-90-dimpled-noline-x4-v10.stl

☐ Print at 0.1mm Layer Height

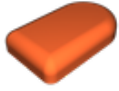


fret-button-90-dimpled-line-x1-v10.stl

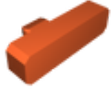
☐ Print at 0.1mm Layer Height



fret-button-90-flat-line-x1.stl



fret-button-90-flat-noline-x4.stl



fret-button-leg-x-10-v10.stl

☐ Print at 0.1mm Layer Height



fret-switch-plate-90.stl

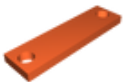


Wire Plates

5 files



wire-plate-tp4056-plate-v11.stl



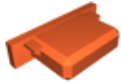
wire-plate-tp4056-back-plate-v11.stl



wire-plate-micro-usb-to-usb-c-plate-v11.stl



wire-plate-pimoroni-pico-lipo-shim-plate-v11.stl

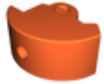


wire-plate-pimoroni-pico-lipo-shim-button-v11.stl

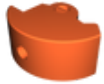


Whammy Bar

7 files



whammy-mount-with-support-single-spring.stl



whammy-mount-with-support-double-spring.stl



lower-spring-mount-single-spring.stl



lower-spring-mount-double-spring.stl



mr83-mount.stl



potentiometer-mount.stl



whammy-test-floor-for-testing-only.stl

☐ If you want to try the whammy mechanism without a guitar



guitar-body-with-support-v10.stl



guitar-face-no-whammy-v10.stl



guitar-face-whammy-v10.stl



headstock-v10.stl



headstock-nut-x6-v10.stl

☐ glue into the headstock



strummer-mount-v10-x2.stl



strummer-bar-v10.stl



spacer-32-x-6-x-1mm-v10-x3.stl

☐ Spacer used for Strumbar and Whammy Bar



switch-holder-choc-v10-x2.stl



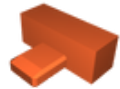
body-button-choc-switch-mount-v10-x2.stl



body-button-star-v10.stl



body-button-plus-v10.stl

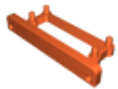


body-button-leg-v10-x4.stl

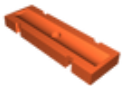
☐ Print at 0.1mm layer height



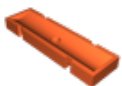
strap-knob-v10-x2.stl



pico-mount-v10.stl



18650-naked-holder-v10.stl



21700-naked-holder-v11.stl



tilt-switch-dual-mercury-3mm-switch-50-degrees.stl

☐ fewer degrees is slightly more accidental triggers, but you have to raise guitar less



tilt-switch-dual-mercury-5mm-switch-45-degrees.stl



tilt-switch-dual-mercury-5mm-switch-50-degrees.stl

License ©

This work is licensed under a
Creative Commons (4.0 International License)



Attribution-NonCommercial

- ✗ | Sharing without ATTRIBUTION
- ✓ | Remix Culture allowed
- ✗ | Commercial Use
- ✗ | Free Cultural Works
- ✗ | Meets Open Definition