

DIY: 12 Key Macropad for Autodarts

Difficulty: Recommended for experienced makers

Requires 3D-Printing and soldering

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Bill of materials:

- *12x GATERON G Pro 3.0 switches:*
<https://de.aliexpress.com/item/1005007052507996.html>
- *1x nRF52840 developer board (SuperMini):*
<https://de.aliexpress.com/item/1005008664621573.html>
- *1x 503030 500mAh battery (Larger one possible too, there's enough space):*
<https://de.aliexpress.com/item/1005009836119485.html>
- *12x 1N4148 diodes:*
<https://de.aliexpress.com/item/1005006208000285.html>
- *16x Jumper wires female (minimum 20cm → 30cm recommended):*
<https://de.aliexpress.com/item/1005007046465880.html>
- *1x Toggle switch (not necessary, but recommended for longer battery life while in standby):* <https://de.aliexpress.com/item/1005005942183255.html>
- *1x ASUS USB-BT500 bluetooth 5.0 dongle adapter:*
<https://www.cyberport.de/pc-und-zubehoer/netzwerk/bluetooth/asus/pdp/4e18-007/asus-usb-bt500-bluetooth-5-0-usb-adapter.html>

Required tools & additional materials:

- USB-C charging cable
- Solder wire
- Soldering iron
- Hot air gun or lighter
- Heat shrinks
- Side cutters
- Pliers
- Wire stripping tool
- Super glue
- Filament - PLA or PETG or ... (2 different colors recommended)

3D-Printing:

Start by printing all provided models. If you are using a Bambu Lab printer, I recommend using the included .3mf files for optimized print settings and better results.

To achieve a dual-color look, a multi-color unit (like an AMS) is not required. You can simply insert a manual pause or a 'Filament Change' command in your slicer at the desired layer height. See: <https://youtu.be/tKPWpWb8gBw> The printer will stop at the designated point, allowing you to swap filament and resume the print.

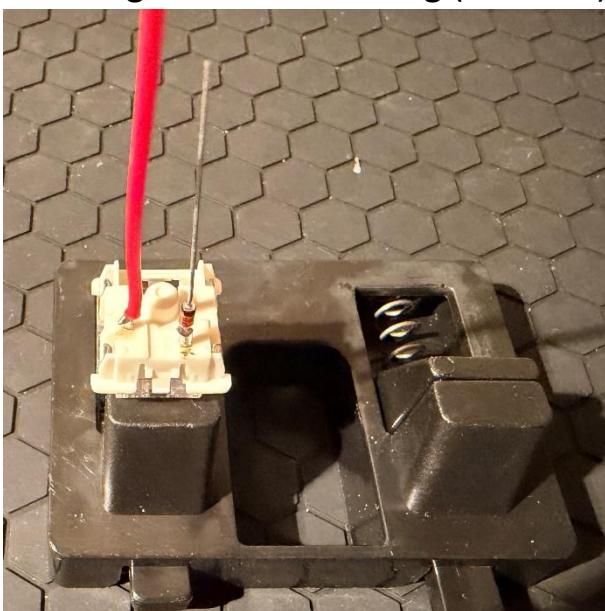
To ensure the best print quality, do not crowd the build plate with all models at once. I recommend grouping the prints as follows:

- Batch 1: The main case and the back cover
- Batch 2: All 12 keycaps (can be printed together)
- Individual Runs: Print the logos separately to maintain high detail. The optional wall mount should also be printed on its own.

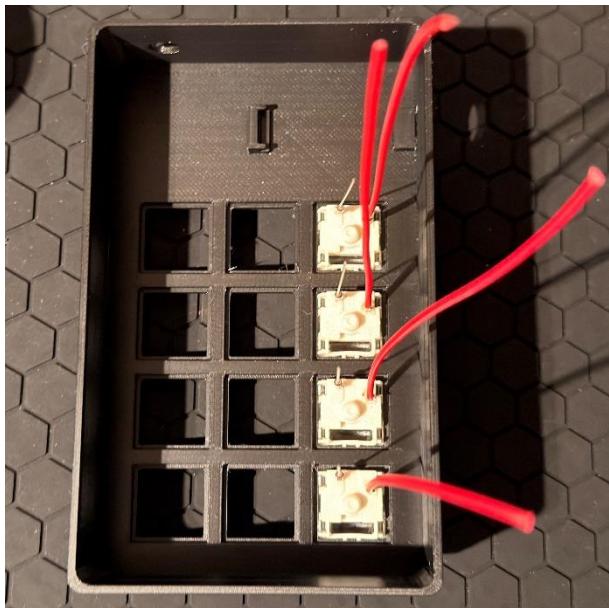
Soldering and assembly:

1. For the first four switches, begin by soldering a 15cm red lead to one of the contact pins. On the opposite pin, install a 1N4148 signal diode.

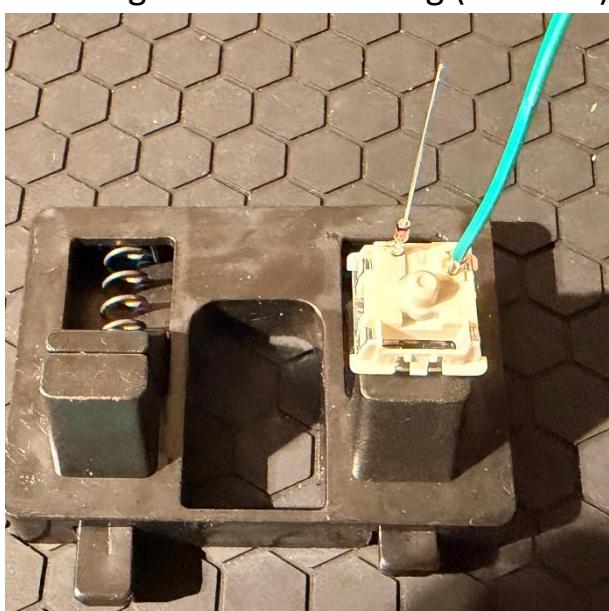
CRITICAL: Diode must be oriented in a "Switch-to-Row" configuration, meaning the black marking (cathode) must point away from the switch.



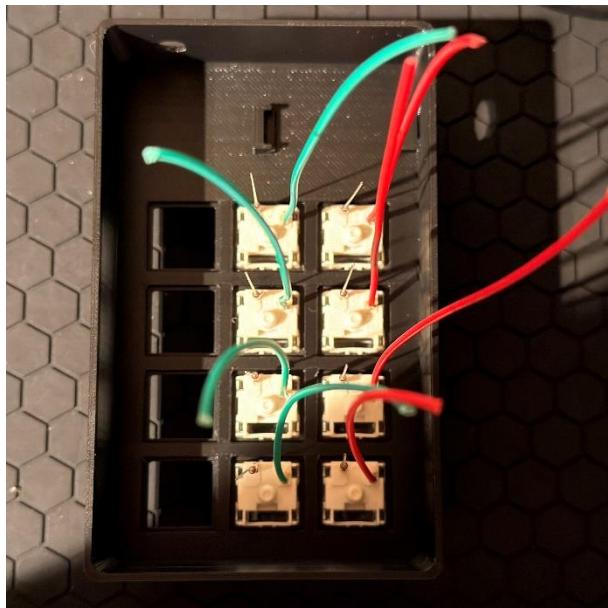
2. Snap the four pre-soldered switches into the housing, arranging them vertically to form the first column. Ensure each switch is firmly seated and flush with the mounting plate.



3. For the next four switches, begin by soldering a 15cm green lead to one of the contact pins. On the opposite pin, install a 1N4148 signal diode.
- CRITICAL:** Diode must be oriented in a "Switch-to-Row" configuration, meaning the black marking (cathode) must point away from the switch.

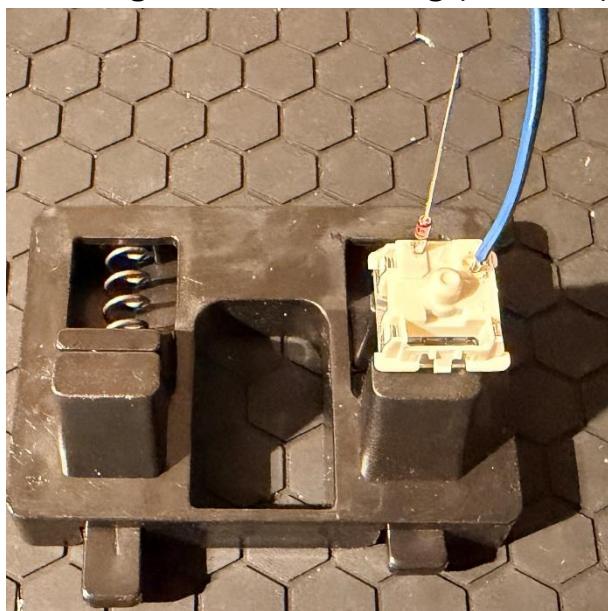


4. Snap the four pre-soldered switches into the housing, arranging them vertically to form the first column. Ensure each switch is firmly seated and flush with the mounting plate.

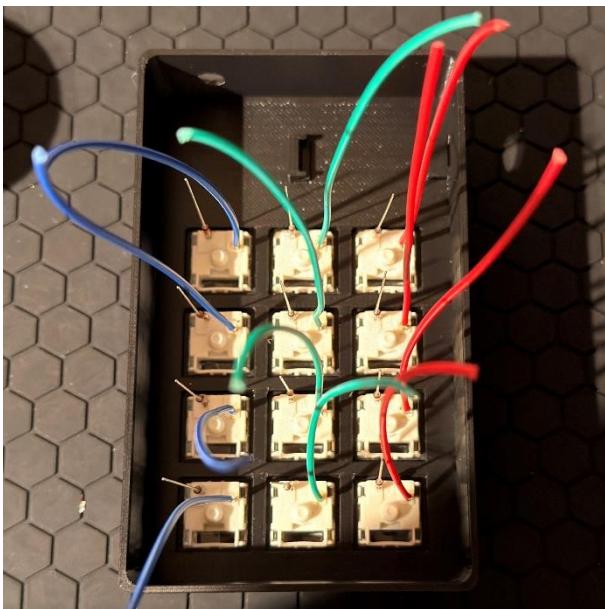


5. For the last four switches, begin by soldering a 15cm blue lead to one of the contact pins. On the opposite pin, install a 1N4148 signal diode.

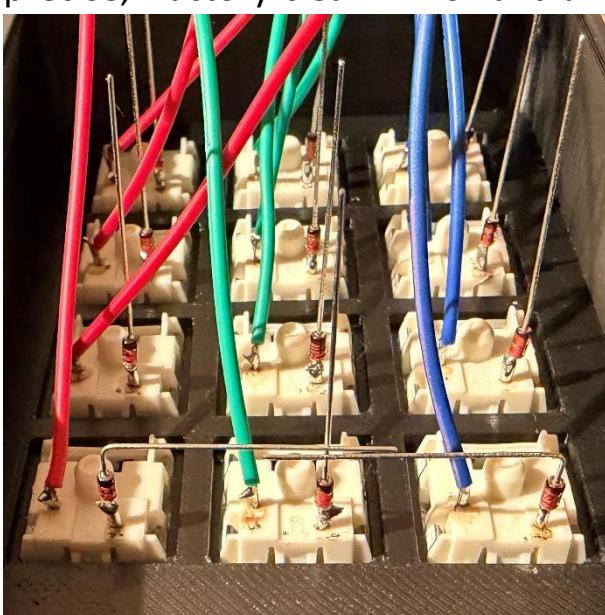
CRITICAL: Diode must be oriented in a "Switch-to-Row" configuration, meaning the black marking (cathode) must point away from the switch.



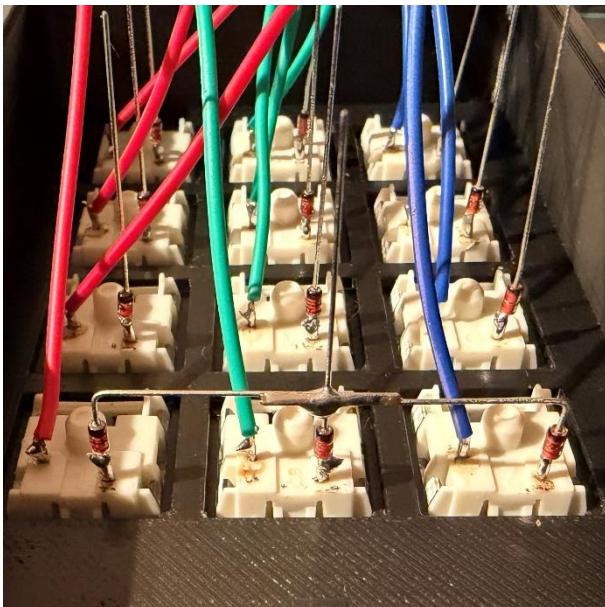
6. Snap the four pre-soldered switches into the housing, arranging them vertically to form the first column. Ensure each switch is firmly seated and flush with the mounting plate.



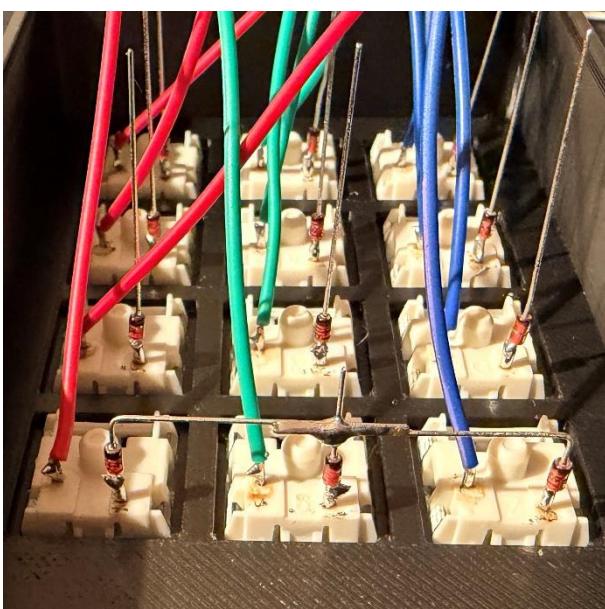
7. Identify the top row, characterized by the extra space reserved for the nRF52840. Bridge the three diodes by bending the outer leads so they overlap at the center component. Utilizing pliers for this process ensures a precise, "factory-clean" finish and a more reliable solder joint.



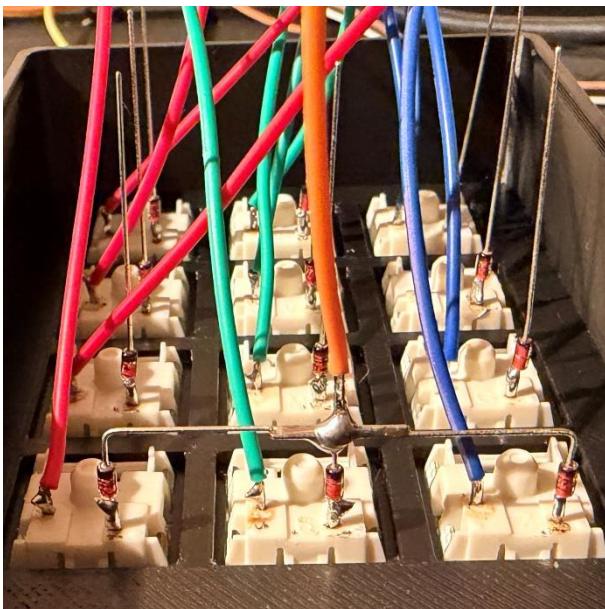
8. Apply solder to the junction where the three cathode leads meet. Ensure the joint is clean and covers all three leads to establish a reliable row bus.



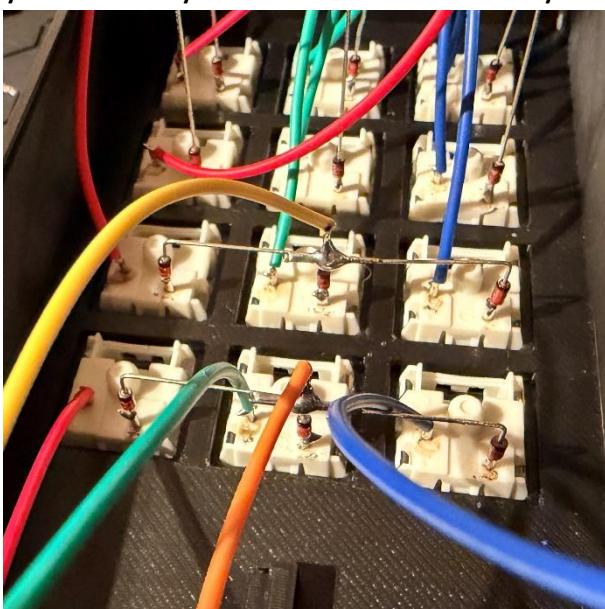
9. Use your side cutters (or flush cutters) to trim the lead of the middle diode to a length of approximately 8 mm. This will leave enough material for a secure connection for the next wire.



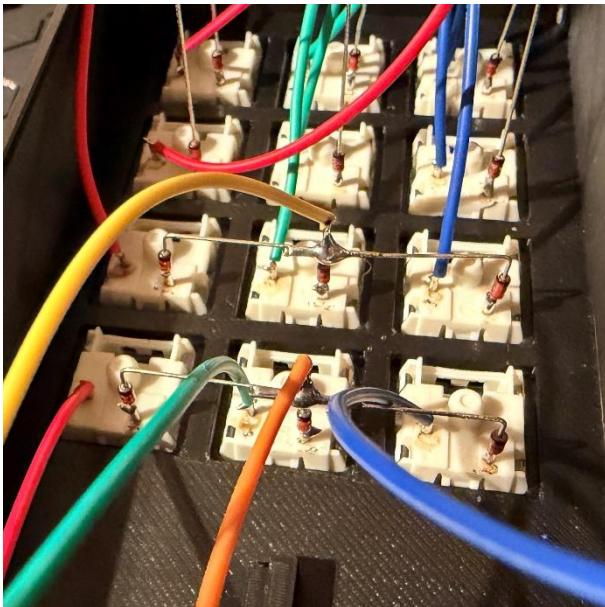
10. Solder a 20 cm orange wire with female connector to the trimmed end of the diode lead. This wire will serve as the main connection for your vertical column.



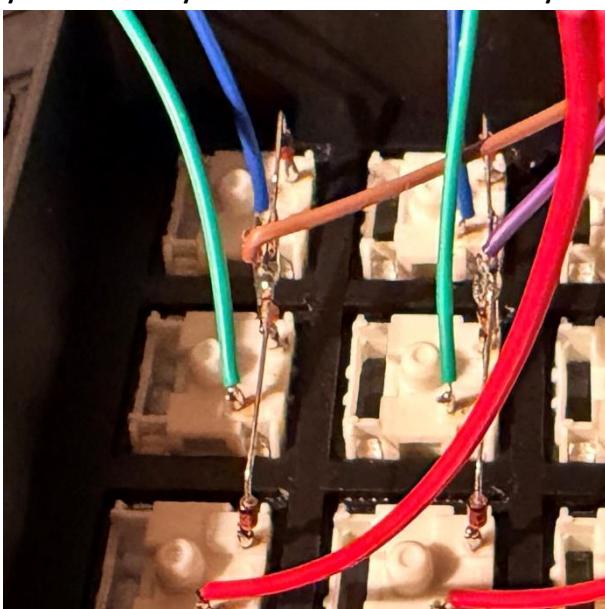
11. Repeat steps 7 through 10 for the second vertical column. However, substitute the orange wire with yellow wire. This color distinction will help you identify the columns correctly during the final wiring stage.



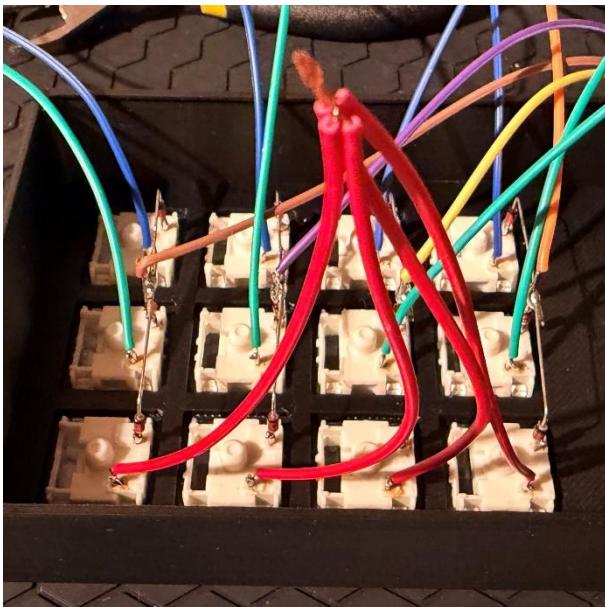
12. Repeat steps 7 through 10 for the third vertical column. However, substitute the orange wire with purple wire. This color distinction will help you identify the columns correctly during the final wiring stage.



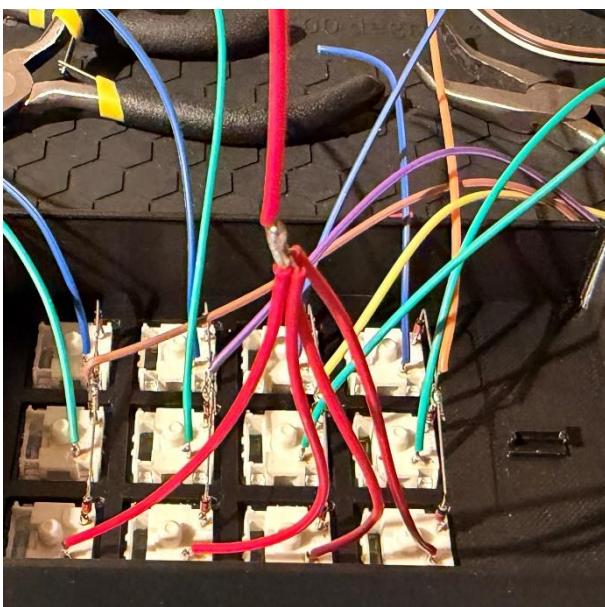
13. Repeat steps 7 through 10 for the last vertical column. However, substitute the orange wire with brown wire. This color distinction will help you identify the columns correctly during the final wiring stage.



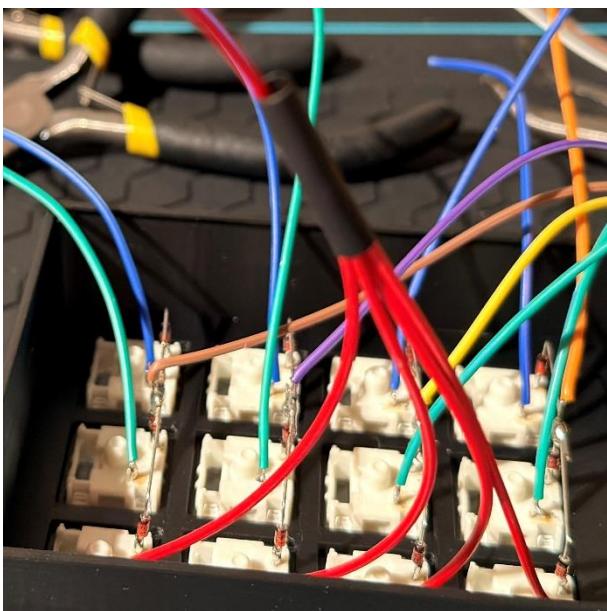
14. Gather all four red wires, strip the ends, and twist the copper strands together. Solder the bundle to create a single, secure termination point.



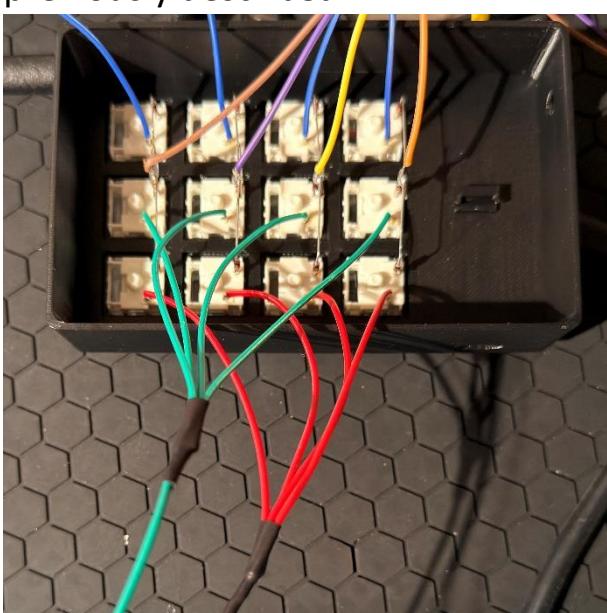
15. Prepare a 15 cm red wire equipped with a female connector. Slide a piece of heat-shrink tubing onto the wire before soldering. Solder the open end of this lead to the red wire bundle you created in the previous step.



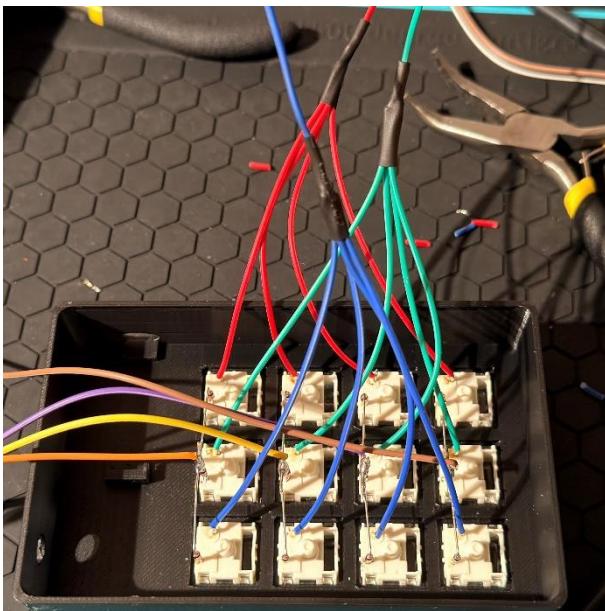
16. Slide the heat-shrink tubing over the solder joint. Use a heat gun or a lighter to shrink the tubing until it forms a tight, secure seal around the connection.



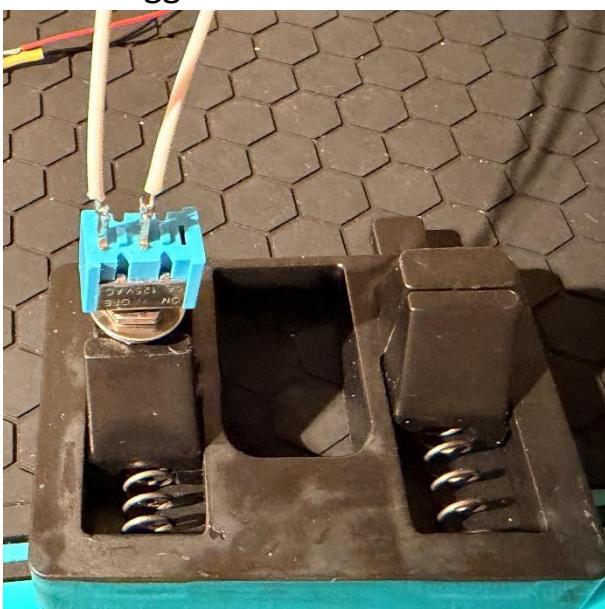
17. Repeat steps 14–16 using green wire instead of red for the middle column. Ensure the solder joint is well-insulated with heat-shrink tubing as previously described.



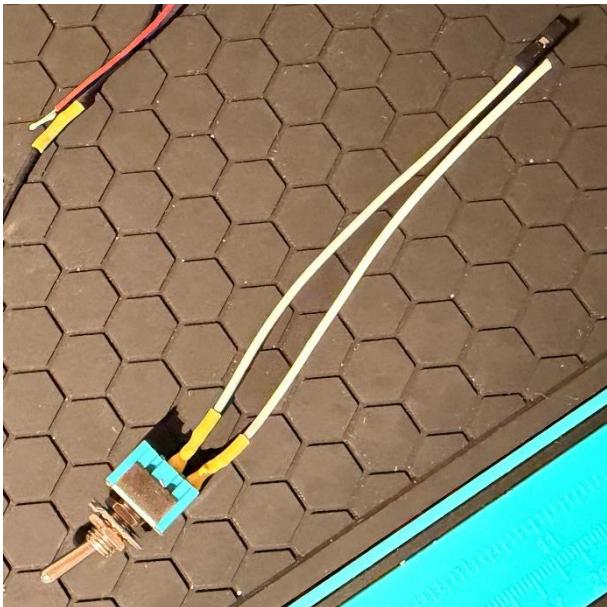
18. Repeat steps 14–16 using blue wire instead of red for the last column. Ensure the solder joint is well-insulated with heat-shrink tubing as previously described.



19. Prepare the power switch by cutting a 30 cm female jumper wire in half. Strip a few millimeters of insulation from the cut ends and slide a piece of heat-shrink tubing onto each wire. Solder the two leads to the terminals of the toggle switch.



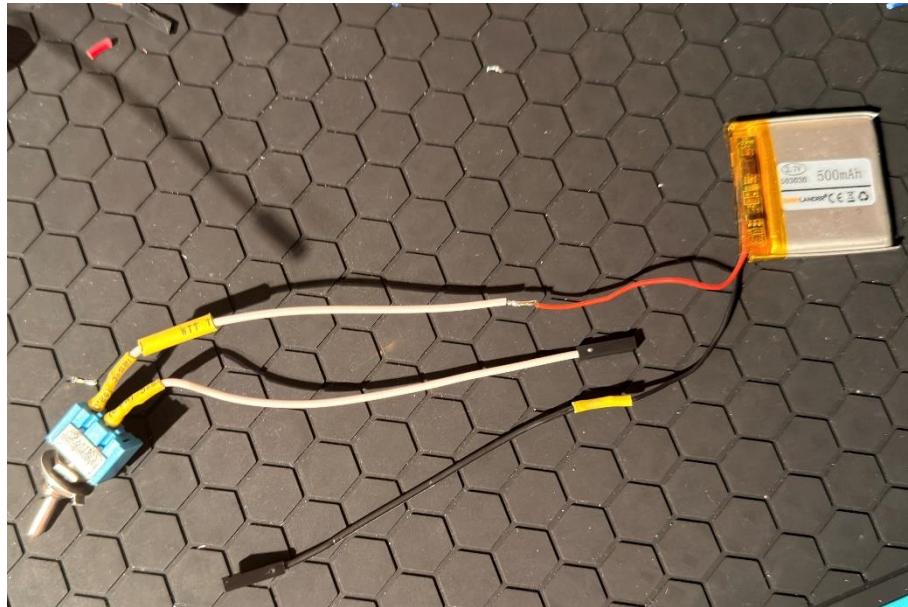
20. Slide the tubing over the solder joints and shrink them using a heat gun or a lighter for a fully insulated connection.



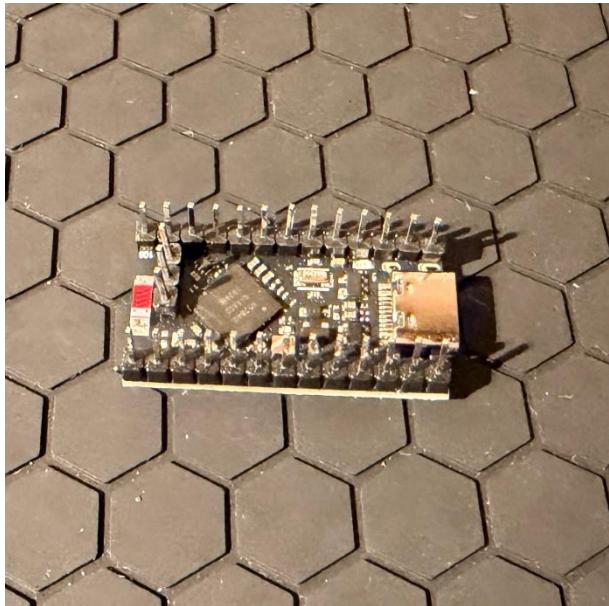
21.

- a. *Preparing the Battery:* If your battery has a connector, cut it off.
WARNING: Cut the wires one by one to prevent a short circuit. Do not allow the exposed ends to touch!
- b. *Connecting Toggle Switch:* Strip the ends of the red battery wire and the open lead of the toggle switch. Slide a piece of heat-shrink tubing onto the battery's red (positive) wire, then solder it to the toggle switch leads.
- c. *Battery Ground Extension:* Take a 15 cm black female jumper wire. Strip the insulation from the end and do the same for the battery's negative (black) lead. Slide your heat-shrink tubing onto the wire before soldering. Join the two black wires and solder them together to create a solid connection.

- d. *Insulation:* Position both heat-shrink tubes over the solder joints and shrink them using hot air or a lighter to fully insulate the connections.



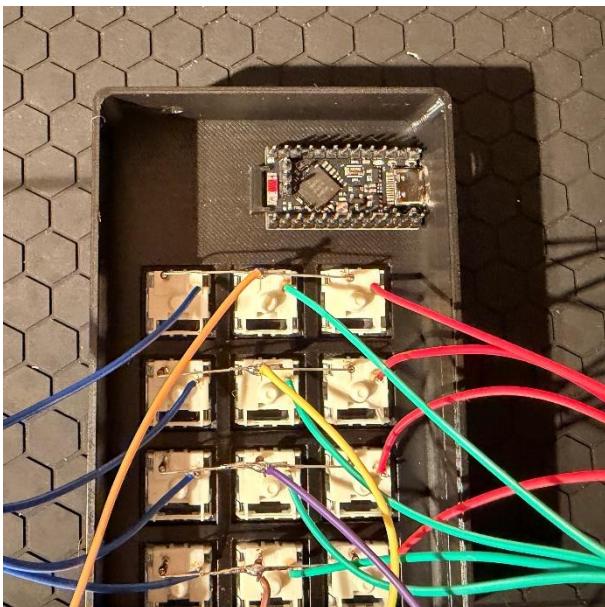
22. Unpack your microcontroller and solder the included male header pins to the board. Ensure the pins are perfectly vertical and the solder joints are clean, as these will be the connection points for all your female jumper wires.



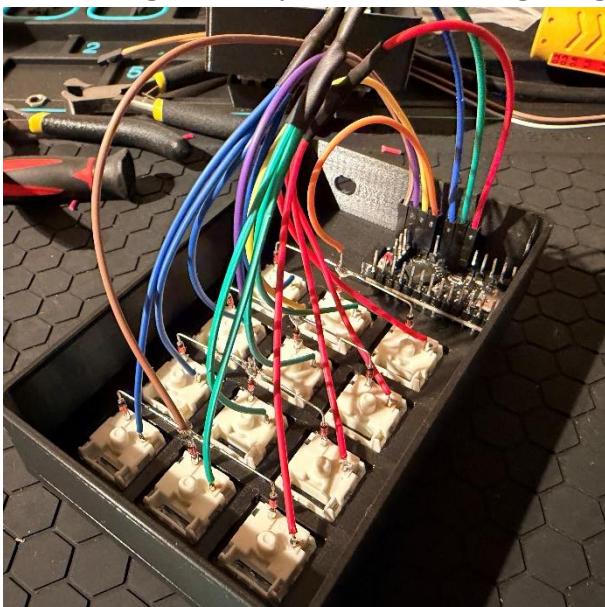
23. Seat the controller into the housing by aligning it with the two retaining clips in the center of the case. You will need to apply some firm

pressure near the USB-C port to slide the board down until the connector is perfectly aligned with the case opening.

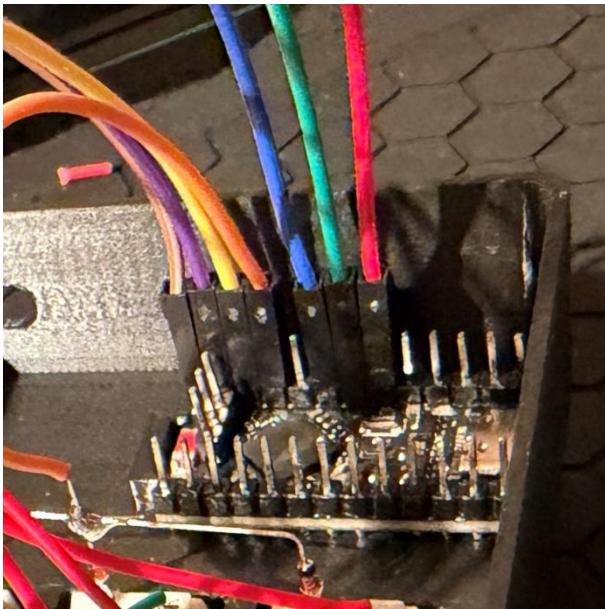
Note: You may need to gently wiggle the controller to find the perfect position. Be careful not to apply excessive force to avoid damaging the MCU or the 3D-printed mounting tabs.

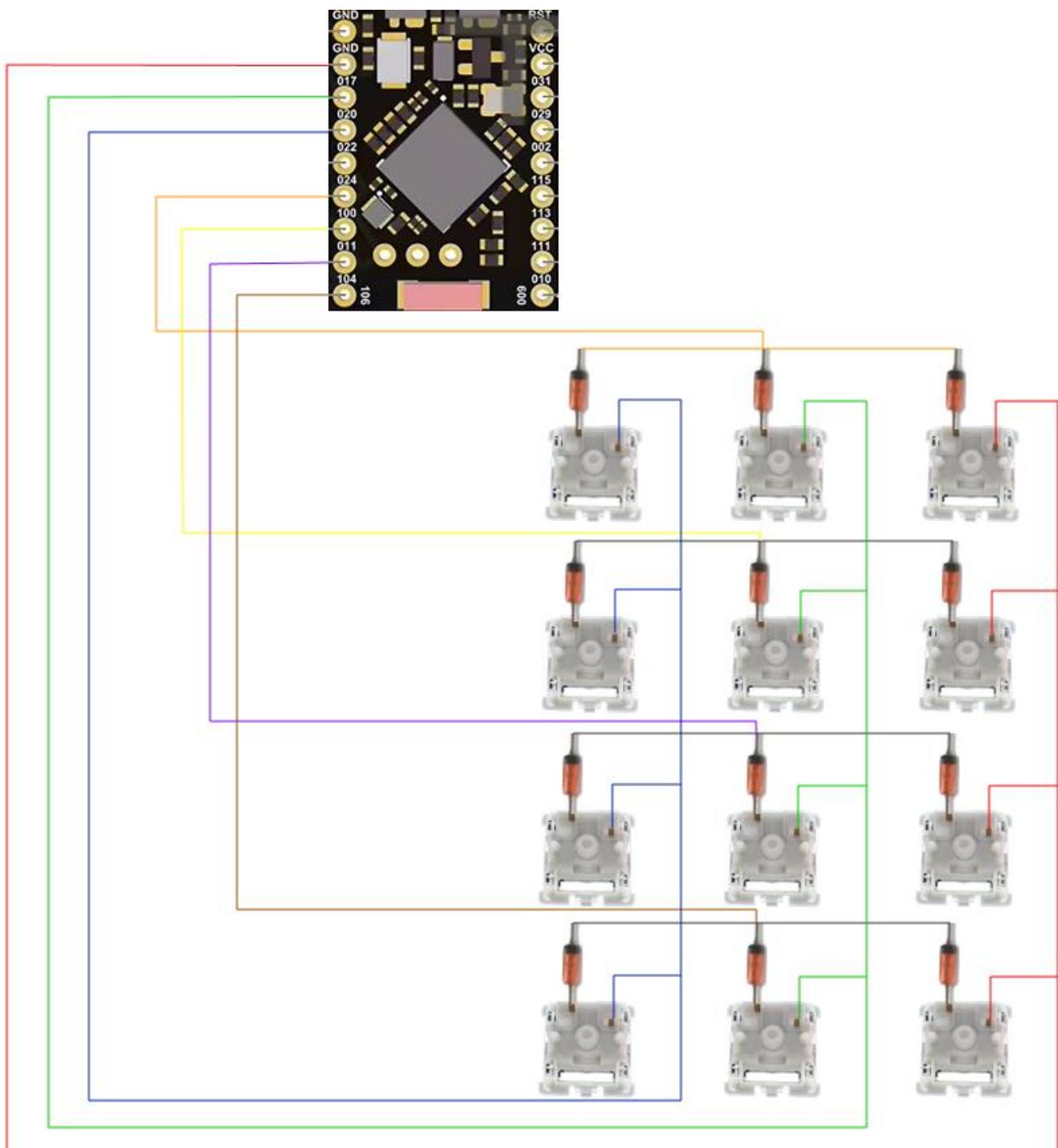


24. Now, connect the female jumpers to the controller's header pins according to the provided wiring diagram and pinout images.

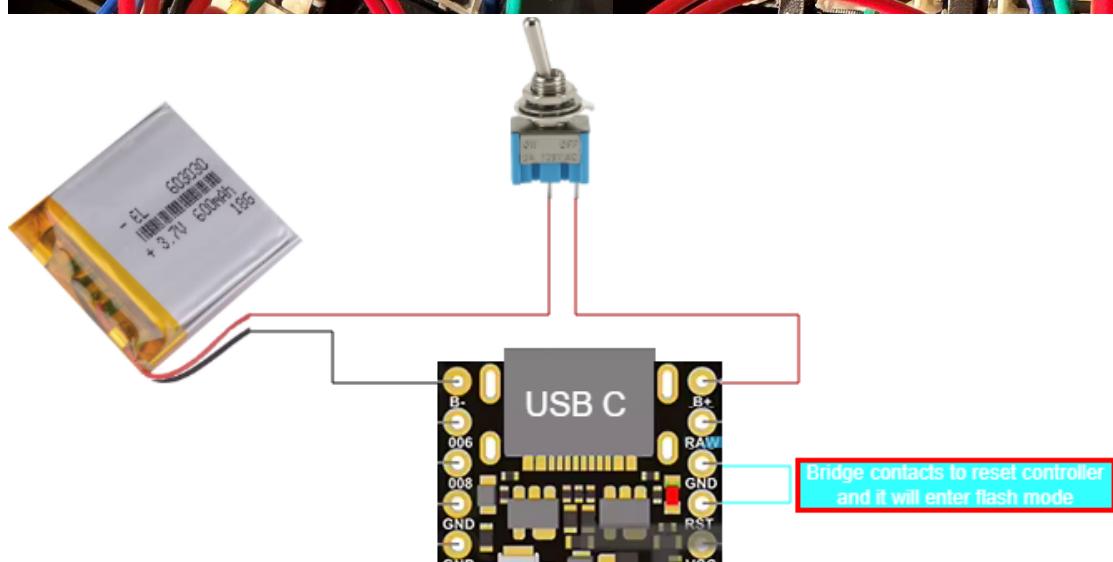
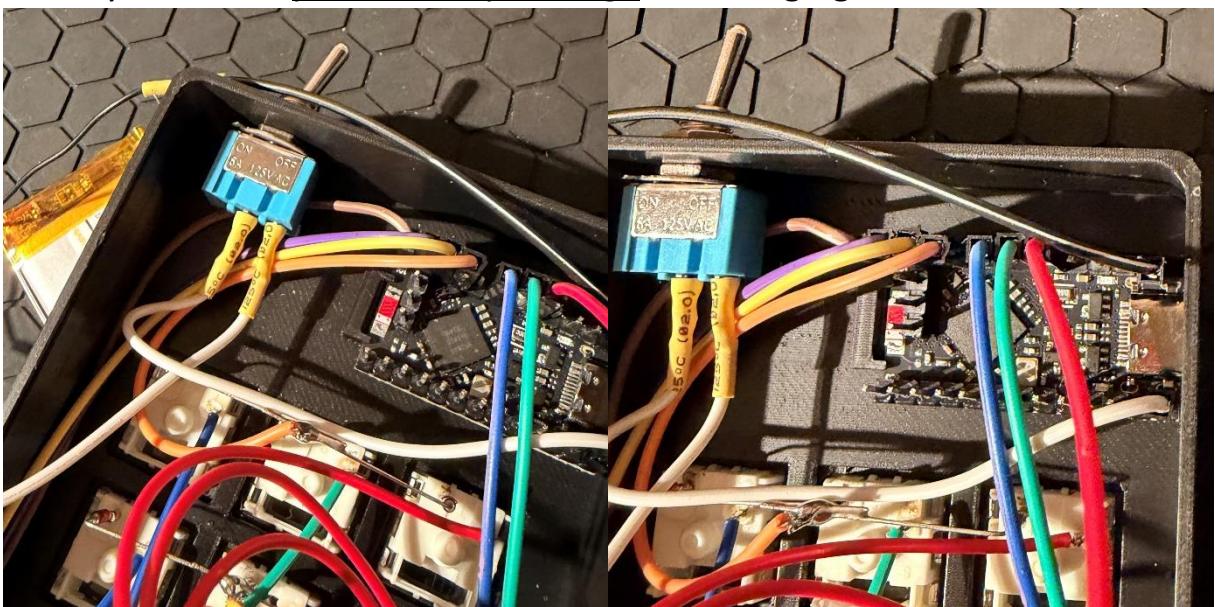


Important: Double-check that each row and column lead is connected to its designated GPIO pin. A single swapped wire will result in incorrect key presses or a non-responsive matrix.





25. Install the toggle switch into the designated mounting hole in the case. Connect the female leads (black and white) to the battery pads (B+ and B-) on the microcontroller as shown in the reference image.
Important: Double-check the polarity before connecting. Reversing the battery leads can permanently damage the charging circuit of nRF52840.



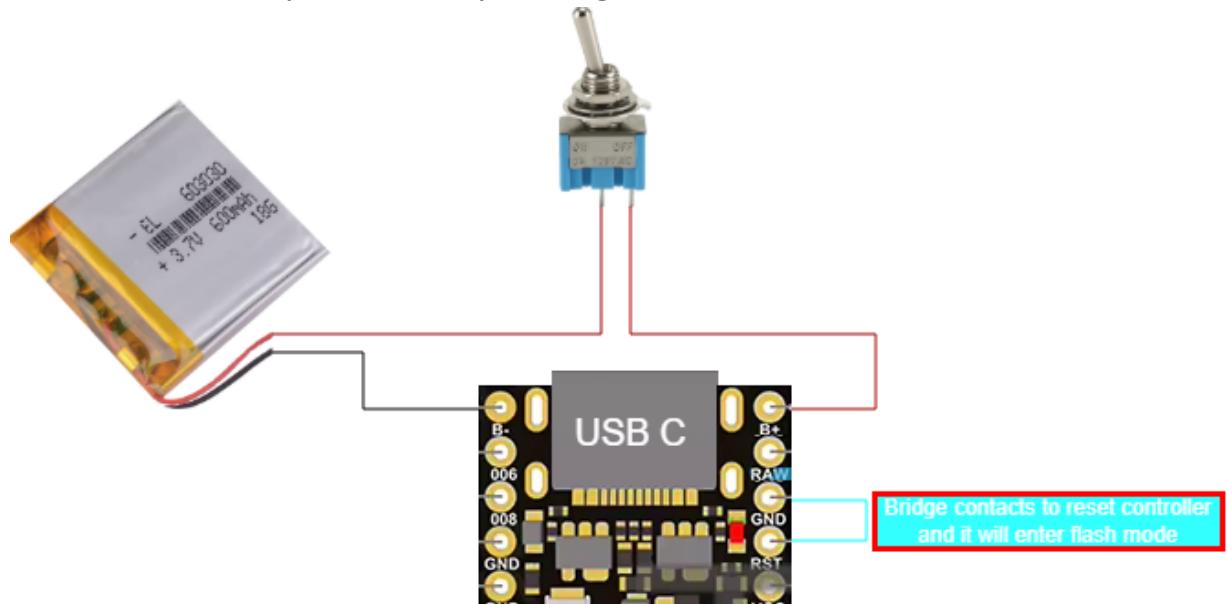
26.

a. *Internal Power Test:* Flip the toggle switch to ON. The onboard status LEDs should illuminate immediately.

b. *USB Connection:* Turn the switch OFF and connect the controller to your computer via USB-C. The LEDs will light up again, and your PC should recognize the device as a removable drive (e.g., NICENANO).

Troubleshooting: > If the drive does not appear, you may need to manually trigger the Bootloader Mode: Disconnect the USB cable and ensure the power switch is OFF. Use a screwdriver or tweezers to carefully bridge the GND and RST pins. While holding the bridge, plug the USB cable back in.

CAUTION: Be extremely precise. Bridging the wrong pins could cause a short circuit and permanently damage the MCU.



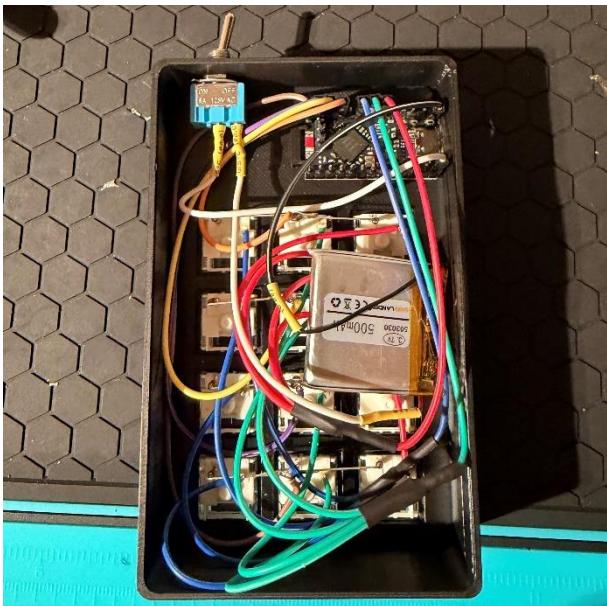
27.

- a. *Install Firmware:* Simply drag and drop (or copy/paste) the 6_Macropad_Firmware.uf2 file (Download here: https://github.com/mrcl-rckl/autodarts_macropad/releases/download/Autodarts/6_Macropad_Firmware.uf2) onto the controller's removable drive.
- b. *Auto-Restart:* The MCU will automatically flash the firmware and restart. The drive will disconnect and disappear from your computer. Note: To re-flash in the future, you must manually enter bootloader mode again by bridging the GND and RST pins.
- c. *Bluetooth Pairing:* Unplug the USB-C cable and toggle the power switch to ON. Your macropad is now discoverable as a Bluetooth keyboard in the settings of your Autodarts system.

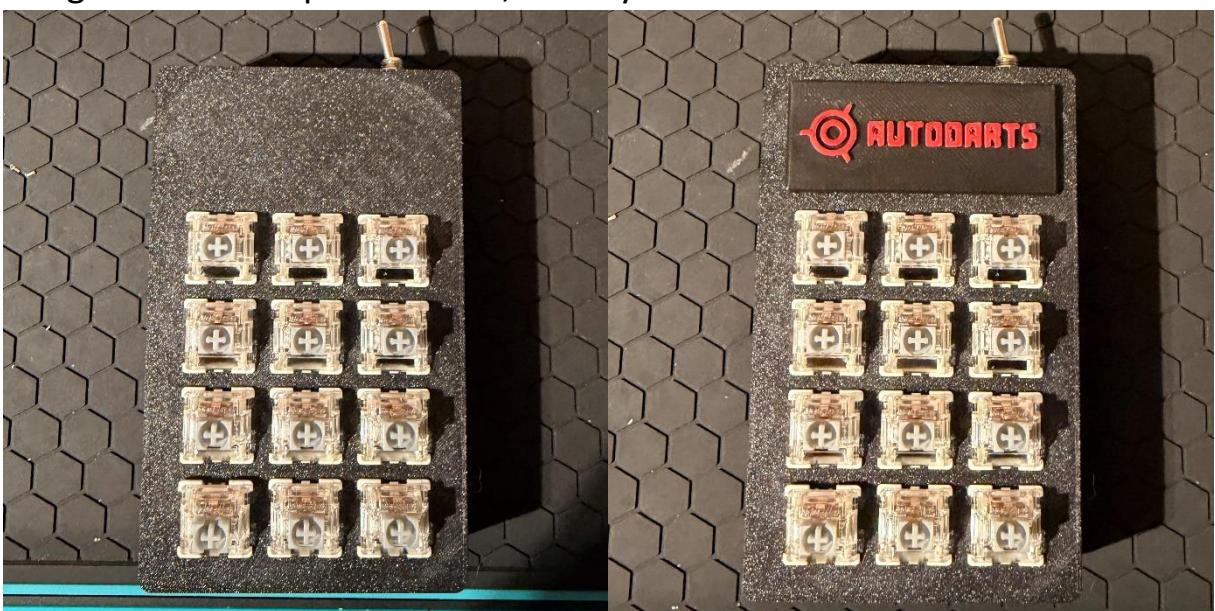
28.

- a. *Power Management Note:* To preserve battery longevity, ensure the device is always powered OFF via the toggle switch when not in use.
- b. *Charging Instructions:* To charge the battery, the toggle switch must be in the ON position. If the switch is off, the charging circuit will be disconnected and the battery will not receive power from the USB-C port.
- c. *Battery Life Efficiency:* Thanks to the low power consumption of the nRF52840, the battery is designed to last approximately 6 weeks on a single charge under normal usage conditions.
- d. *Pairing with a New Device:* To pair the macropad with a different computer or system: Turn the toggle switch ON and wait a few seconds for the device to initialize. Press and hold [Arrow Left] + [Arrow Right] simultaneously for 5 seconds. This will clear the existing Bluetooth bonds, and the pad will become discoverable again in your new device's Bluetooth settings.

29. Carefully place the battery into its designated compartment within the housing. Ensure all wires are neatly tucked away to avoid pinching them. Finally, align the back cover and snap it into place to complete your Autodarts Macropad.



30. Flip the macropad over and affix the logo to the front cover using a suitable adhesive. Ensure the logo is centered and aligned correctly before the glue sets for a professional, factory-clean look.



31. Seat the 12 keycaps onto the switches by pressing them firmly onto the stems. Ensure you follow the correct layout order to match your firmware mapping and the Autodarts interface.



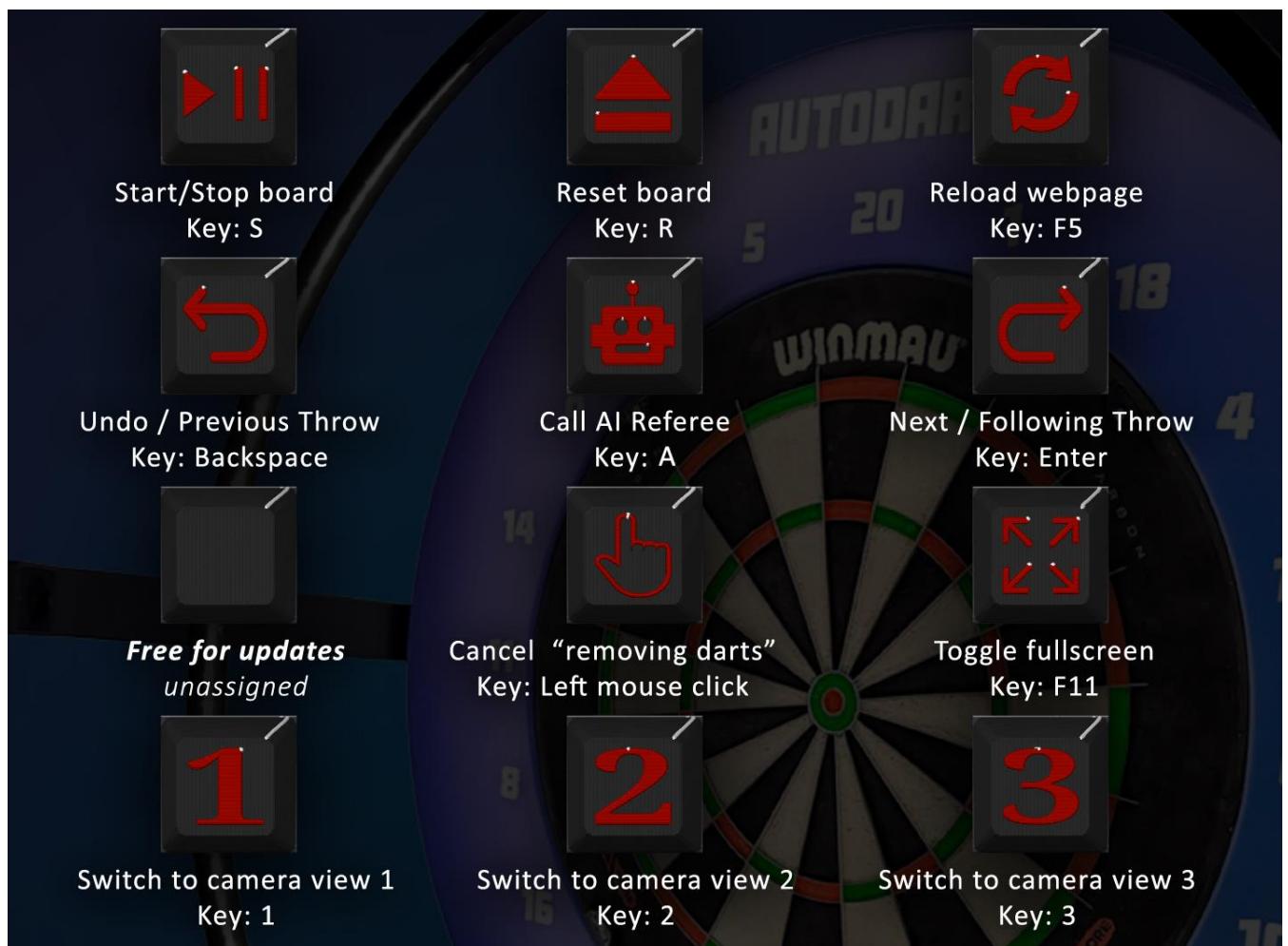
32. Last but not least: Secure the mounting bracket to your wall using the appropriate screws. Once the mount is fixed, simply slide the macropad into the bracket until it is firmly seated and ready for use.



Testing:

Refer to the following image for the specific key assignments. To verify that every switch is working correctly and mapped to the right command, navigate to the Online Keyboard Tester and actuate each key on your new macropad:

<https://www.onlinemictest.com/de/tastatur-test/>



Important: Board Reset hotkey is not yet supported in Autodarts

Operation guide:

1. Powering the Device Power On/Off: Use the physical toggle switch located on the side/back of the case. Energy Saving: To maximize battery longevity, it is recommended to switch the device OFF when not in use, even though the nRF52840 features a low-power deep sleep mode.
2. Monitoring Battery Levels The Autodarts Macropad reports its battery percentage directly to your operating system via the Bluetooth HID profile. You do not need to rely on internal LEDs. On Windows (10/11): Navigate to Settings > Bluetooth & devices. Locate the "Autodarts Macropad" in the list. The battery percentage will be displayed directly next to the device name. On Linux (GNOME/KDE): Open your System Settings and go to the Power or Bluetooth section. The battery status will be listed under "Devices" or "Input Devices." Command Line (Advanced): You can also use the command **upower -e** to find the device path and **upower -i [path]** to see the exact percentage.
3. Charging Instructions Requirement: The toggle switch must be in the ON position to charge the battery. If the switch is off, the charging circuit is physically disconnected and the battery will not charge via USB-C. Charging Source: You can charge the device using any standard USB-C cable connected to a computer or a 5V power adapter. Runtime: A full charge typically lasts about 6 weeks depending on usage.
4. Pairing & Resetting Bluetooth If you need to connect the macropad to a new computer or system, you must clear the existing Bluetooth "bonds": Ensure the device is powered ON. Press and hold the [Arrow Left] and [Arrow Right] keys simultaneously for 5 seconds. The device will clear its memory and enter pairing mode. It will now be discoverable again in your system's Bluetooth settings.

FAQ:

Connectivity & Bluetooth:

Q: My computer cannot find the "Autodarts Macropad" via Bluetooth.

A: First, ensure the toggle switch is in the ON position. If it is on and still not appearing, your macropad might still be bonded to another device. Perform a Bluetooth Reset by holding [Arrow Left] + [Arrow Right] for 5 seconds, then refresh your computer's Bluetooth search.

Q: The connection feels laggy or keys are repeating.

A: Bluetooth signals can be affected by interference. Ensure there are no large metal objects or high-powered 2.4GHz routers directly between the pad and your computer. If you are using a desktop PC, ensure your Bluetooth antenna is connected.

Power & Battery:

Q: I've had the pad plugged into USB-C for hours, but the battery is still empty.

A: Crucial Check: Is your toggle switch turned ON? Due to the hardware design, the battery only connects to the charging circuit when the switch is in the ON position. It will not charge if the device is switched off.

Q: The device works via USB, but turns off as soon as I unplug the cable.

A: Check the solder joints on the B+ and B- pins of the microcontroller and the battery leads. Also, ensure the toggle switch wiring is secure. If a wire has come loose, the battery power cannot reach the MCU.

Key Inputs & Hardware:

Q: One specific key is not registering at all.

A: This is usually a hardware issue. Check the solder joints on that specific switch. Check the diode orientation. If the diode is soldered backward, the signal will be blocked. Verify the connection between the row/column wire and the MCU pin.

Q: When I press one key, the wrong character appears on the screen.

A: Your physical wiring likely doesn't match the GPIO pins defined in the firmware. Double-check your wiring against the Wiring Diagram on page 29. If you swapped a row or column wire, the layout will be mirrored or shifted.

Firmware & Flashing:

Q: The controller does not appear as a "NICENANO" or "Removable Drive" when plugged in.

A: Use a different USB-C cable; many cables are "charge-only" and do not carry data. If the cable is good, you must manually enter Bootloader Mode by quickly bridging the GND and RST pins with a screwdriver while the device is connected to your PC.

Q: I flashed the .uf2 file, but nothing changed.

A: Ensure the file transfer finished completely before the drive disconnected. If the drive disappears immediately after dropping the file, the flash was likely successful. Perform a Bluetooth reset (Arrow L+R) to ensure the new mapping is active.

Autodarts Specifics:

Q: The "Board Reset" or "Call AI Referee" buttons don't do anything.

A: This is a known software limitation. While the macropad sends the correct hotkeys, Autodarts currently does not support these specific commands via external HID devices. These keys are placeholders and will work once Autodarts updates its hotkey support.

Q: No keys are working within the Autodarts interface.

A: Ensure your browser window is "in focus" (click inside the Autodarts window). Browsers block keyboard inputs to background tabs for security reasons.

Is your problem still not solved? If you've checked all the steps above and the pad still isn't behaving, please visit the GitHub Repository Issues page to report your problem or look for community-contributed solutions!

Firmware customization:

The Autodarts Macropad is fully customizable. If you want to change the key assignment or add new macros, you can modify the ZMK firmware. Since the project is hosted on GitHub, you don't need to install any coding tools on your PC—the firmware is built automatically in the cloud.

The configuration of your buttons is stored in the "keymap" file. You can find the original file at this address: https://github.com/mrcl-rckl/autodarts_macropad/blob/main/config/macro12.keymap

How to modify the Layout:

- Fork the repository: Go to the main project page: https://github.com/mrcl-rckl/autodarts_macropad. Click the "Fork" button in the top right to create your own copy of the project.
- Edit the Keymap: In your forked repository, navigate to the config/macro12.keymap file and click the pencil icon to edit the code directly in your browser.
- Change Keycodes: Replace the existing commands (e.g., &kp ENTER) with your desired ones.
 - *Example:* To change a key to the letter "M", use &kp M.
- Commit & Build: Click "Commit changes" to save. This automatically starts a build process in the "Actions" tab of your GitHub repository.
Pro Tip: Always check the "Actions" tab after committing your changes. If the build turns red, there is a syntax error in your code (like a missing semicolon). You can click on the failed build to see exactly which line caused the error.
- Download & Flash: Wait about 2–3 minutes. Once the build is finished (indicated by a green checkmark), click on it, scroll down to "Artifacts", and download the firmware. Unzip the file and flash the .uf2 file as described on page 23.

Useful Resources:

- ZMK Keycode Reference: A full list of all available keys (Media keys, F-keys, etc.) can be found here: <https://zmk.dev/docs/codes>
- Visual Keymap Editor: If you prefer a graphical interface over editing text, you can use this web tool: <https://nickcoutsos.github.io/keymap-editor/>

Thanks for your donation:

If this DIY project hit the bullseye for you and you enjoyed the build, feel free to support my work. Any donation is greatly appreciated and helps me develop more open-source tools for the community.

