

DYI: using Thrustmaster wheels with QR and working buttons on DD wheelbase like VRS DirectForce Pro / MiGE 130ST



Insert Coin

March 2022

Manual version 1.1



## Version history

### 1.0 Initial release

#### 1.1 Improved the design of the adapter:

1. 5 bolts instead of 3. The original design didn't have a bolt at one side. I have managed to squeeze in 2 more bolts, which wasn't easy: I had to prevent loss of material. It won't win a beauty contest, but the two adapters are now firmly attached to each other.
2. Added an interlock to the design of the adapters. Previously the adapters were pushed together on a flat surface, which, after some time of use, started to shift and due to the movement between the two adapters it caused the bolts to loosen. The interlock prevents this from happening.
3. Larger tolerances for the shaft, keyway and nuts.
4. Removed the unused holes in the QD JA adapter.

Use of other PLA filament: 3DJake ecoPLA is much stronger (70 MPa) than Extrudr NX-2 (47 MPa). I didn't have broken parts though, but 3DJake ecoPLA is a better choice for this.

I'm using Thrustmaster wheels for years. Until recently on a T300 wheelbase, but now I have moved on to a Virtual Racing School DirectForce Pro direct drive wheelbase.

A direct drive wheelbase is quite an expense, I did not want to buy new wheels as well. Since I had already added a quick release to my Thrustmaster wheels I was looking for a way to reuse these on the VRS DirectForce Pro, with working buttons. A few guys figured out parts of my project:

- Peter Makes Things made an excellent quick release for Thrustmaster wheels. Available here: <https://kapral.store/collections/pmt-peter-make-things>
- Ultrawipf made a Thrustmaster quick release compatible wheel mount for direct drive wheels with servo or stepper motors with keyways, available on Thingiverse: <https://www.thingiverse.com/thing:4379504>
- RamjetX made a lock ring (a big nut): <https://www.thingiverse.com/thing:3117355>
- You need a 22 mm bore Quick Disconnect JA bushing (bolts and rings are included): <https://nl.aliexpress.com/item/32579638637.html> (add "22 mm bore" in the remarks when ordering)
- Someone on Aliexpress found out a 34,9 mm bicycle seat pin clamp fits this QD JA bushing perfectly: <https://www.internet-bikes.com/102476-m-wave-zadelpenklem-349-mm-zwart/>
- Taras figured out how to read the buttons of a Thrustmaster wheel using an Arduino Uno: <https://rr-m.org/blog/hacking-a-thrustmaster-tx-rw-gaming-wheel-with-arduino-uno-part-1/>
- Noel McCullagh converted Taras' project to a Sparkfun Pro Micro board: <https://www.noelmccullagh.com/>
- I have done the last bit:
  - Figuring out how to connect the Sparkfun Pro Micro to a female 6 pin mini-DIN connector.
  - Enhanced Noel's Arduino code by adding support for hot plugging Thrustmaster R383, F1 and Ferrari 599xx Evo wheels. It detects which wheel is plugged in and maps the corresponding buttons.
  - Added support for the Thrustmaster F1 wheel. This took me a few days since I had a lot of timing issues with this wheel. Maybe Thrustmaster is using different chips inside the wheel, I don't know, but I managed to solve it in the end.
  - Converting all button numbers on these wheels to the standard Thrustmaster button numbering, this makes swapping wheels easier. All buttons are working on the wheels mentioned.

Other parts you need:

- Spark Fun Pro Micro (clone): <https://opencircuit.nl/product/arduino-pro-micro-5v-16mhz-clone>
- Mini-DIN 6 pin curled (coiled) cable: <https://www.onlinekabelshop.nl/ps-2-spiraal-verlengkabel-2-meter>
- 3 x M4 50 mm bolts: [https://www.rvspaleis.nl/bouten/binnenzeskant/din-912/din-912-\[-\]-a2/din-912-\[-\]-a2-\[-\]-m4/912-2-4x50\\_1](https://www.rvspaleis.nl/bouten/binnenzeskant/din-912/din-912-[-]-a2/din-912-[-]-a2-[-]-m4/912-2-4x50_1)
- 3 x M4 spring washer: [https://www.rvspaleis.nl/ringen/veerring/din-7980/din-7980-\[-\]-a2-\[-\]-m4/7980-2-4\\_1](https://www.rvspaleis.nl/ringen/veerring/din-7980/din-7980-[-]-a2-[-]-m4/7980-2-4_1)
- 3 x M4 locknut: [https://www.rvspaleis.nl/moeren/borgmoeren/din-982/din-982-\[-\]-a2/din-982-\[-\]-a2-\[-\]-m4/982-2-4\\_1](https://www.rvspaleis.nl/moeren/borgmoeren/din-982/din-982-[-]-a2/din-982-[-]-a2-[-]-m4/982-2-4_1)
- 2 x M3 bolts to secure the mini-DIN plug in the metal case: [https://www.rvspaleis.nl/bouten/binnenzeskant/din-912/din-912-\[-\]-a2/din-912-\[-\]-a2-\[-\]-m3/912-2-3x10\\_1](https://www.rvspaleis.nl/bouten/binnenzeskant/din-912/din-912-[-]-a2/din-912-[-]-a2-[-]-m3/912-2-3x10_1)

- 2 x M3 locknuts: [https://www.rvspaleis.nl/moeren/borgmoeren/din-985/din-985-\[-\]-a2/din-985-\[-\]-a2-\[-\]-m3/985-2-3\\_1](https://www.rvspaleis.nl/moeren/borgmoeren/din-985/din-985-[-]-a2/din-985-[-]-a2-[-]-m3/985-2-3_1)
- 1 x M6 bolt to secure the QD JA adapter: [https://www.rvspaleis.nl/bouten/binnenzeskant/din-912/din-912-\[-\]-a2/din-912-\[-\]-a2-\[-\]-m6/912-2-6x16\\_1](https://www.rvspaleis.nl/bouten/binnenzeskant/din-912/din-912-[-]-a2/din-912-[-]-a2-[-]-m6/912-2-6x16_1)
- A USB micro cable to connect the Arduino Pro Micro to the PC (check which length you need, I'm using a 3 meter cable). Buy a good quality USB cable to prevent problems!
- Metal case for the Arduino: <https://www.amazon.nl/gp/product/B08S3NDQQ9>
- Mini-DIN 6 pin female connector: [https://www.haje.nl/product\\_info.php/products\\_id/17182](https://www.haje.nl/product_info.php/products_id/17182)
- Double-sided tape (thick) to secure the Sparkfun Pro Micro inside the metal case, like this: <https://www.123inkt.nl/Tesa-Powerbond-Indoor-dubbelzijdige-tape-19-mm-x-1-5-m-55740-i55673-t62000.html>
- Dupont jumper wires: <https://opencircuit.nl/product/male-female-10-cm-bandkabel-40-stuks>

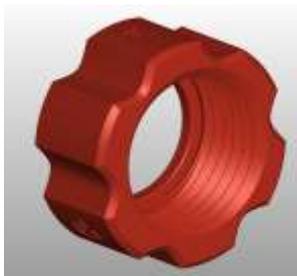
### 3D printing

To build this you need to have (someone with) a 3D printer. The filament I used is 3DJake ecoPLA, available here: <https://www.3djake.com/3djake/ecopla-black>. This type of PLA is tougher than regular PLA and is less brittle. My printer is a Creality Ender 3 Pro with a glass bed. Settings used:

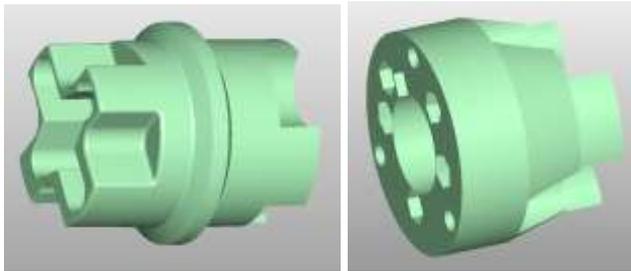
- bed temperature: 50 degrees
- nozzle temperature: 215 degrees
- retraction: length 6,5 mm, speed 20 mm/s, retract on layer change enabled
- layer height: 0.15 mm
- first layer height: 0.2 mm
- vertical shells: 8 perimeters
- horizontal shells: 8 layers
- infill: 100%
- brim width: 7 mm
- supports: yes (touching build plate only).

### Parts to print

RamjetX's lock ring (nut) <https://www.thingiverse.com/thing:3117355/files>



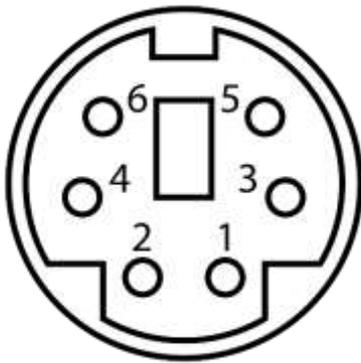
Ultrawipf's parts, improved by me: <https://www.thingiverse.com/thing:5321818>



## Electronics

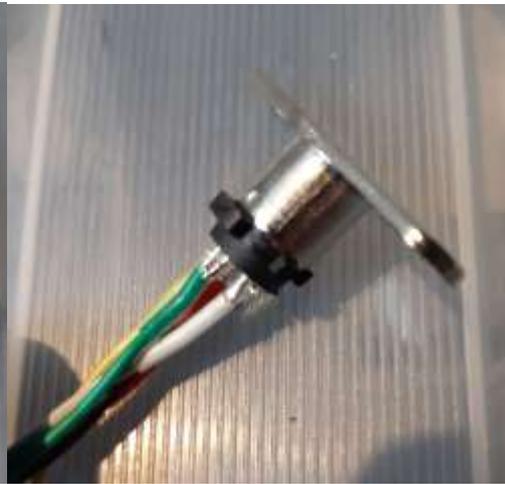
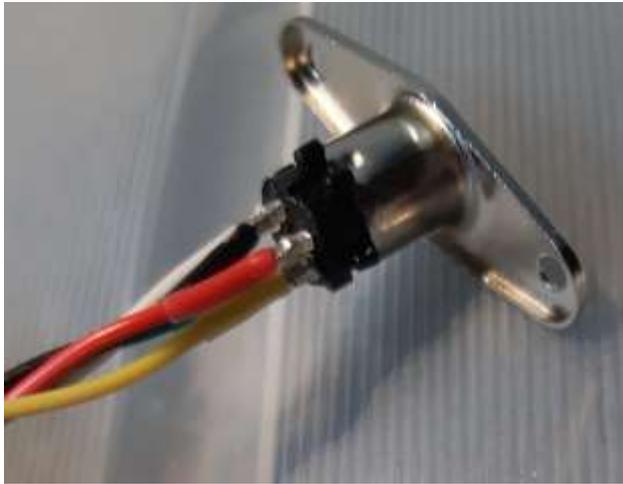
### 6 pin female mini-DIN plug

Pin layout as seen from the front of the plug:



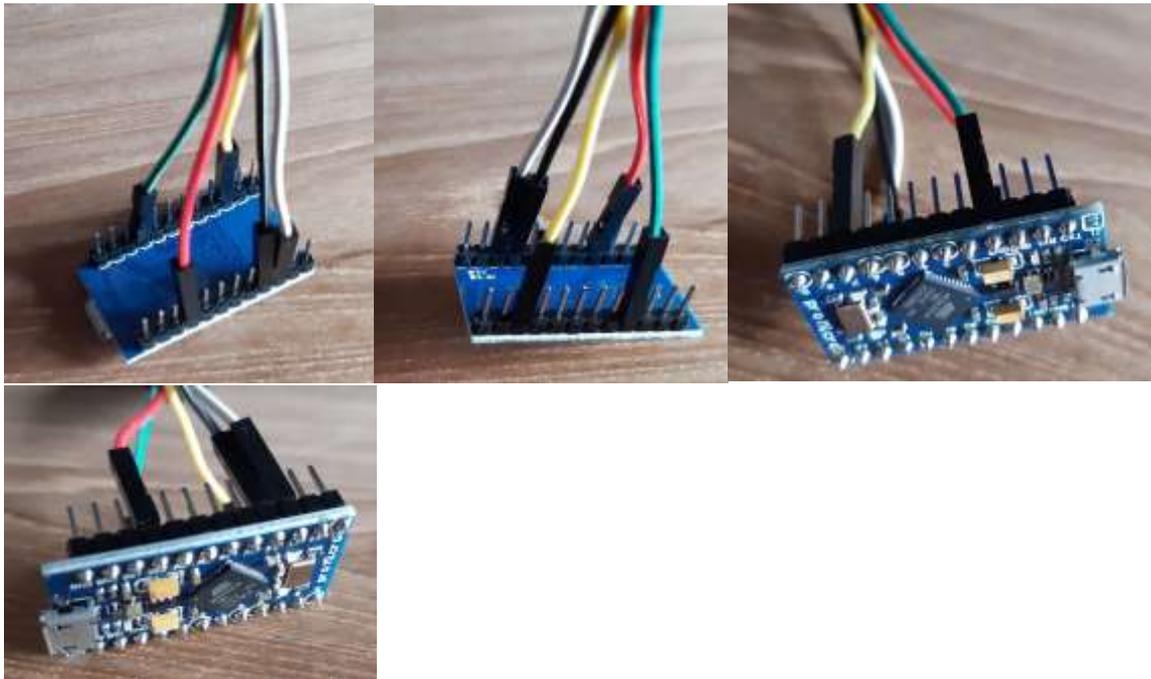
- 1: not connected
- 2: **Green** (GND) to Sparkfun Pro Micro GND
- 3: **White** (MISO) to Sparkfun Pro Micro pin 14
- 4: **Yellow** (SS) to Sparkfun Pro Micro pin 7
- 5: **Black** (SCK) to Sparkfun Pro Micro pin 15
- 6: **Red** (VCC) to Sparkfun Pro Micro +5V

**Do not forget to drill holes in the lid of the box first and to put the wires through the lid.**

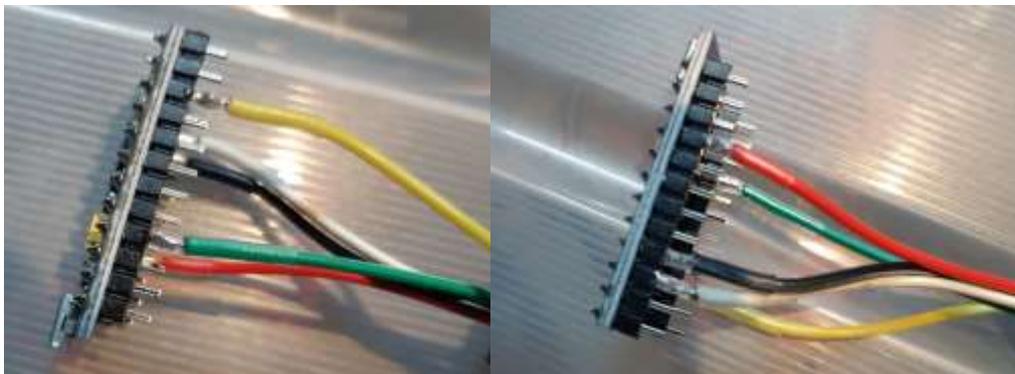


I have soldered headers on my Sparkfun Pro Micro to make testing easier, but this isn't strictly necessary.

It looks like this with headers and Dupont jumper wires:



It was too tall for the case I bought, so I shortened the header pins later and soldered the wires onto the pins:



But you can leave out the headers and solder the wires directly to the board if you want.

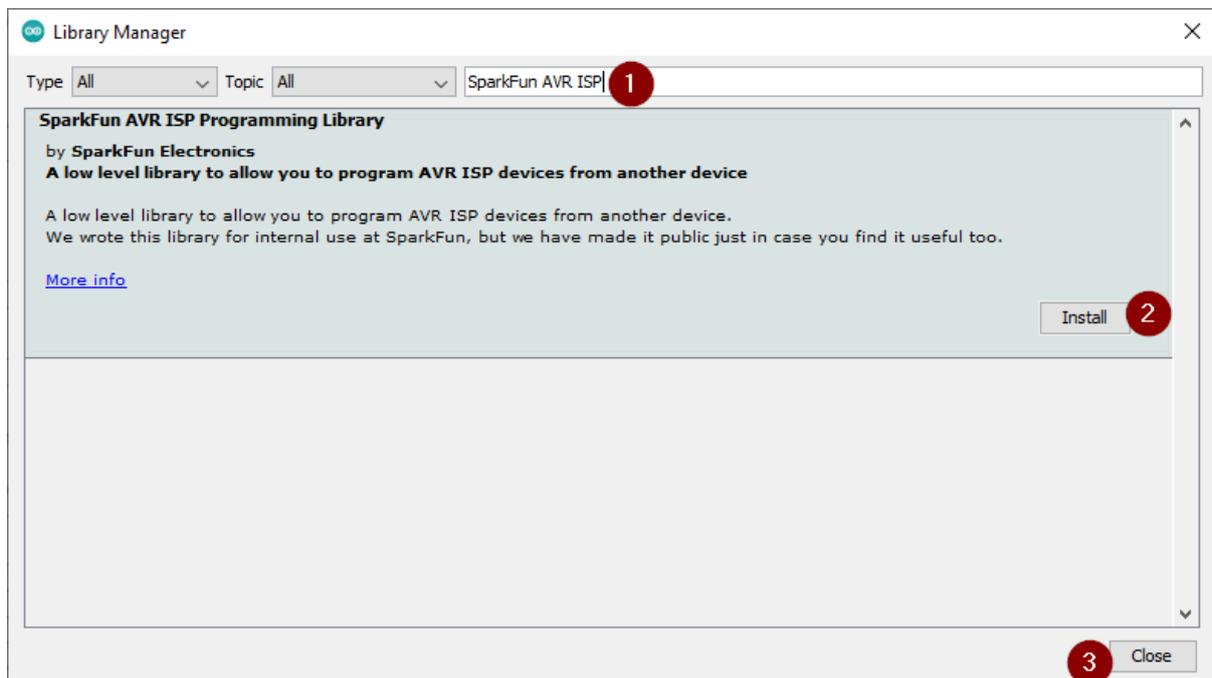
## Flashing the firmware

Get the Arduino IDE software here: <https://www.arduino.cc/en/software> and install it.

Download <https://github.com/MHeironimus/ArduinoJoystickLibrary/archive/master.zip>

Start the Arduino IDE. In the Arduino IDE, select “Sketch” – “Include Library” – “Add .ZIP Library...”. Browse to where the downloaded ZIP file is located and click “Open”. To check if it is installed correctly: the joystick library’s examples will now appear under “File” – “Examples” – “Joystick”.

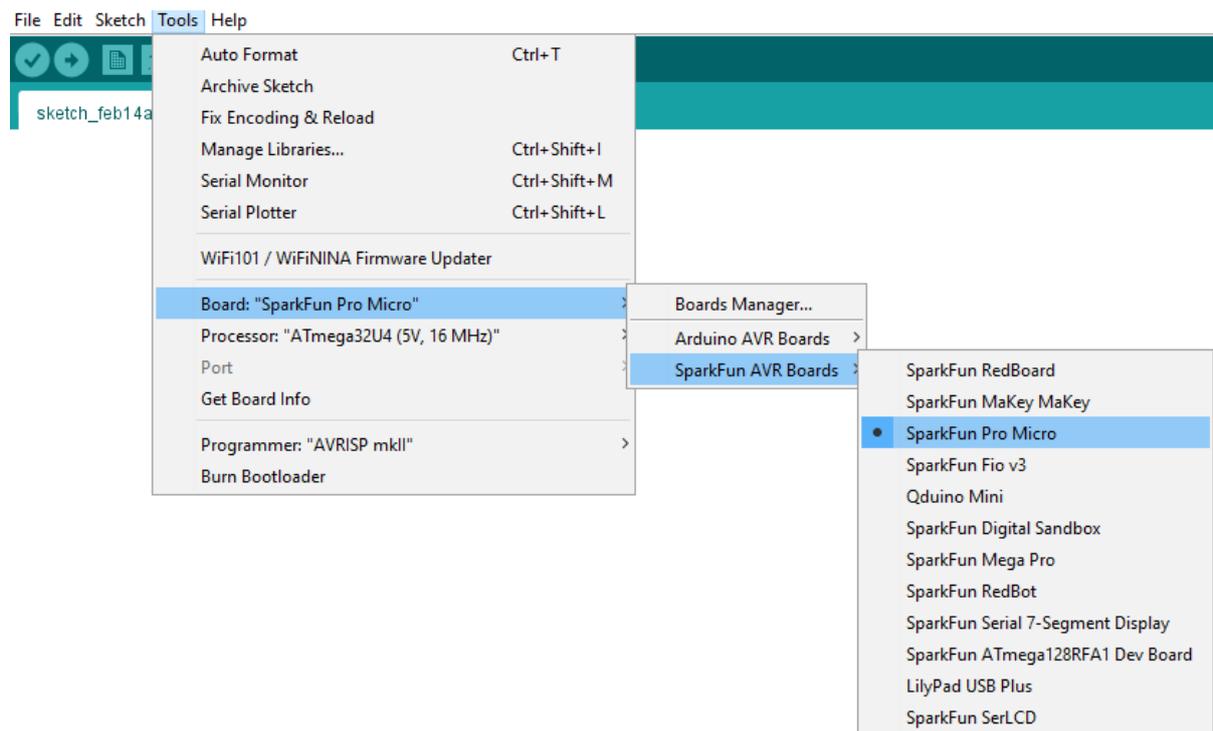
The Sparkfun Pro Micro library needs to be added to the Arduino IDE. This library can be installed via the Arduino Library manager. Select “Sketch” – “Include Library” – “Manage Libraries”. Search for “SparkFun AVR ISP”. Click on Install and Close.



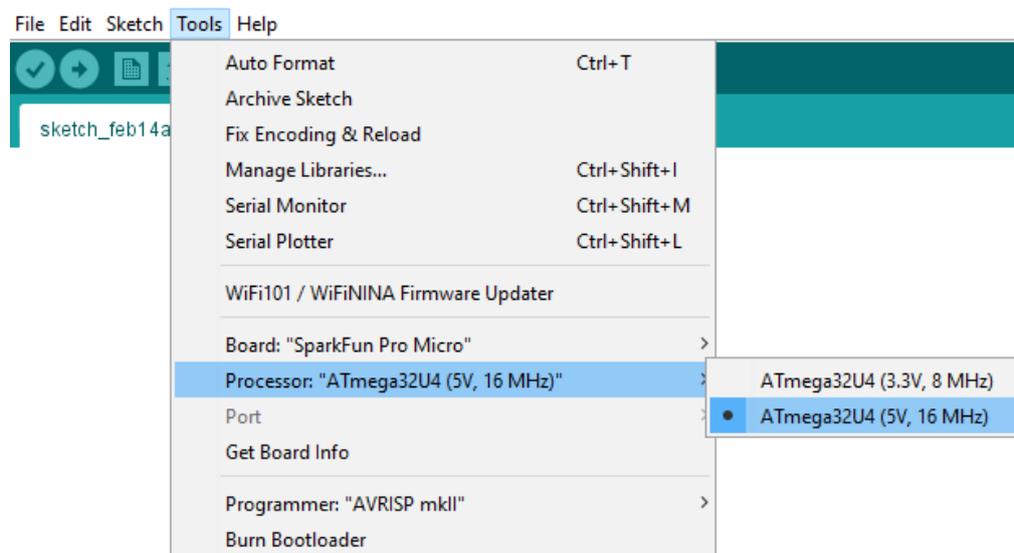
Plug the Sparkfun Pro Micro into a USB port.

Windows will assign a com port to it.

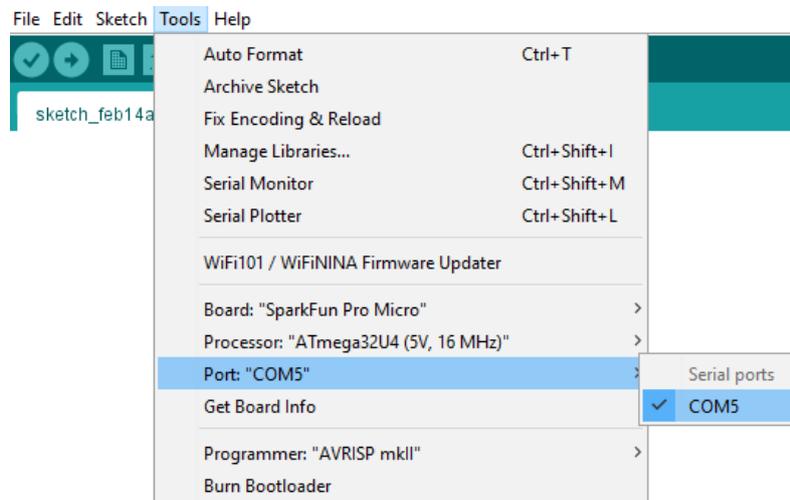
Click on “Tools” – “Board” – “Sparkfun AVR Boards”, select “Sparkfun Pro Micro”:



**Important**, do not skip this step, click on “Tools” – “Processor” and select “ATmega32U4 (5V, 16 MHz)”. If the 3.3V board is selected and you flash the Sparkfun Pro Micro you will ‘brick’ the board (don’t ask me how I know 😊). If you have bricked it, instructions to ‘unbrick’ it can be found here: <https://learn.sparkfun.com/tutorials/pro-micro--fio-v3-hookup-guide/troubleshooting-and-faq>

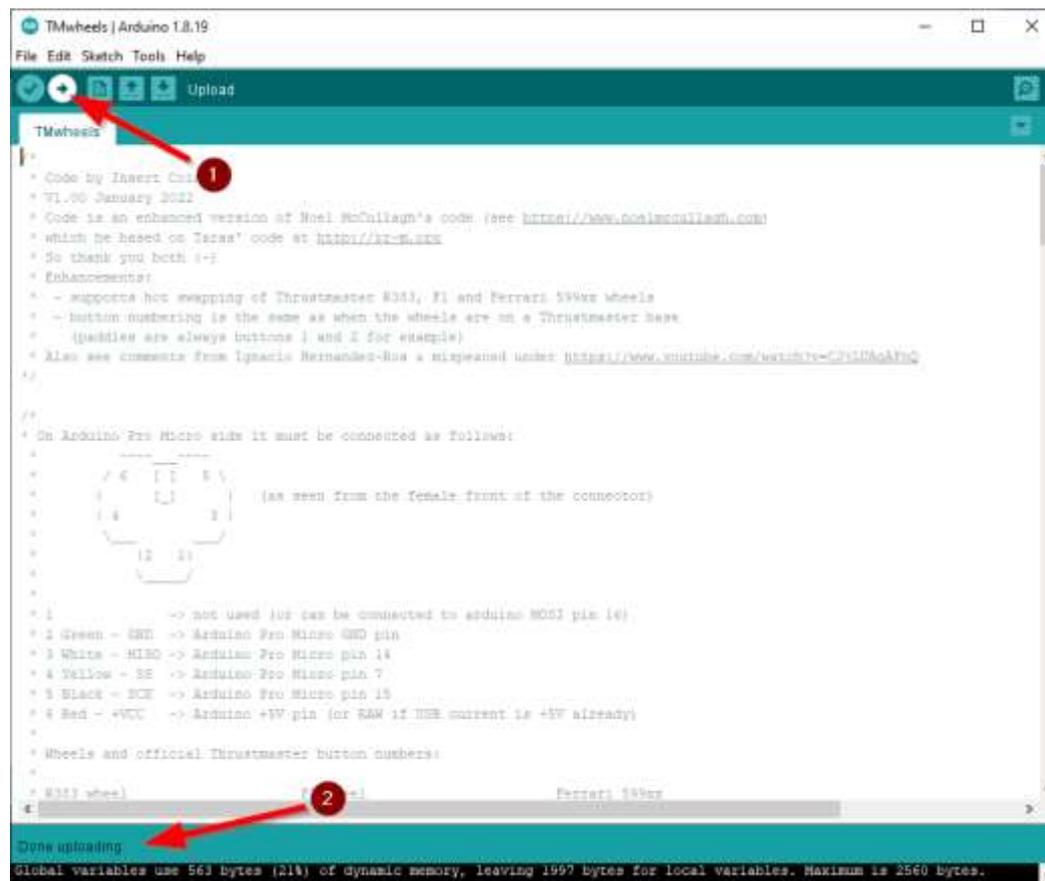


Make sure the com port of the Sparkfun Pro Micro is chosen (check Windows' device manager to find out which port it is). In this example it's COM5, but it will most likely be a different port in your case.



Open my TMwheels.ino file which contains the Arduino code.

Flash it to the Sparkfun Pro Micro by clicking on the arrow icon:



(After flashing for the first time Windows will redetect the board; it may assign a different com port.)

In Windows open "USB Game Controllers", it should show the Sparkfun Pro Micro as a game controller.

## Metal case

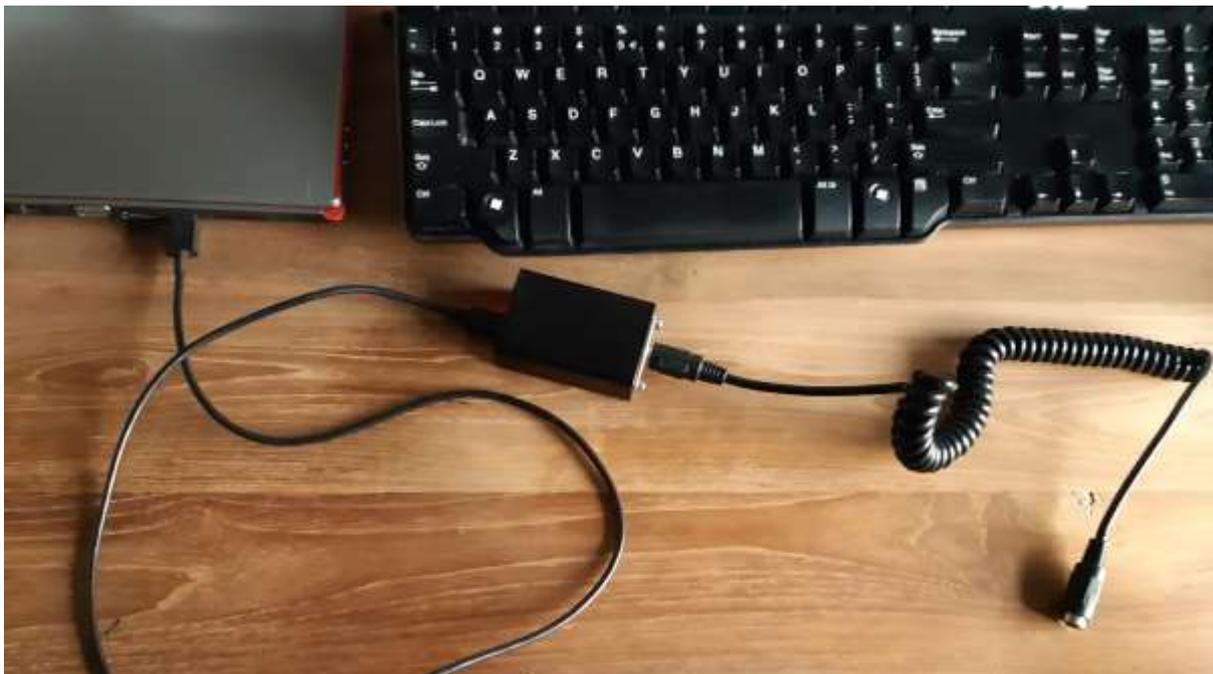
I have mounted the mini-DIN plug under an angle or it wouldn't fit 😊.

The Sparkfun Pro Micro is glued inside the case with a few layers of thick double-sided tape.

Use a big file to make the notch for the micro-USB connector.



Fully assembled and cables attached:



## Assembly



Put the locknuts into the QD JA adapter:



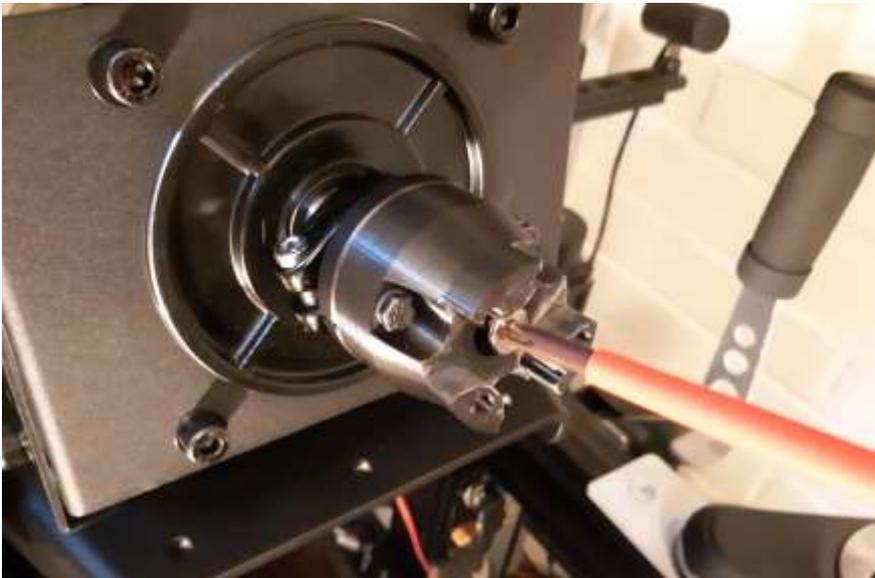
Mount the QD JA bushing onto the QD JA adapter using the supplied black rings and bolts. Mind the keyway. **Do not tighten the bolts yet.**



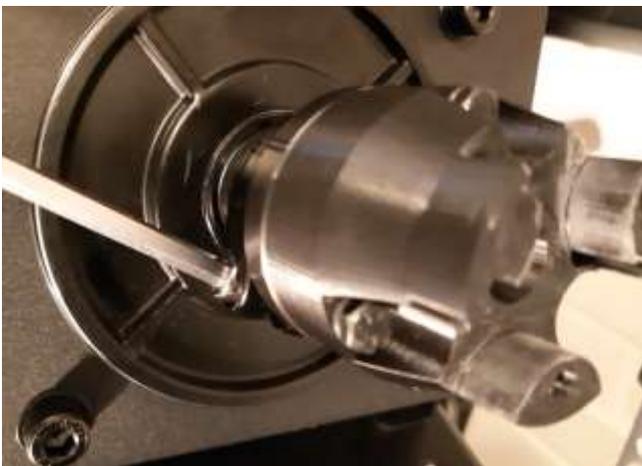
Mount the bicycle seat pin clamp loosely:



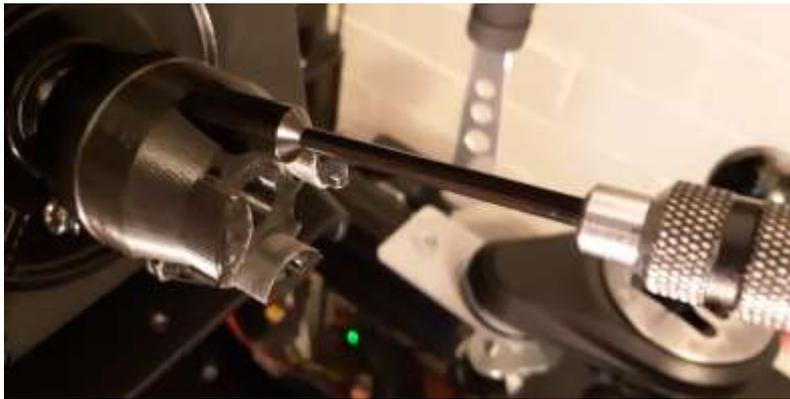
Mount the QD JA adapter onto the shaft of the servo and use the bolt to secure the adapter.



Fasten the bicycle seat pin clamp.



Fasten the black bolts.



Make the female plug of the spiral cable a bit thinner so it will fit into the hole of the adapter. Do not cut off all of it, it needs to be a snug fit into the adapter.



Put the female plug into the adapter. **Do not push or pull the cable in with your fingers: the wires in the cable may break. Use pliers to clamp the plug, then push:**



Carefully align it like this:



Double check the plug is **straight** (not under an angle / twisted).

To temporarily prevent the plug from moving, use the tips of tiewraps to secure the plug.



## Testing



**Important:** mount Peter Makes Things' quick release adapter onto it and secure it with the big lock ring.



If needed push the plug further down with pliers while it is attached the wheel.

Connect the Sparkfun Pro Micro to the PC.

In Windows open "USB Game Controllers".

Double click Sparkfun Pro Micro to see the button status.

Test the plug on all wheels to see if the buttons work. When unplugging a wheel make sure the plug inside the adapter isn't pulled out as well. If needed 'lock' the plug at the back with a toothpick or a paperclip pin.

If all is working fine put some dots of **super glue** next to the plug. This is **irreversible**, so be very sure! My first attempt had gone wrong because I tested it without Peter Makes Things' QR adapter: the plug turned out to be too deep into the adapter. Since I had already glued it, I had to print another adapter and buy a new spiral cable (oops).

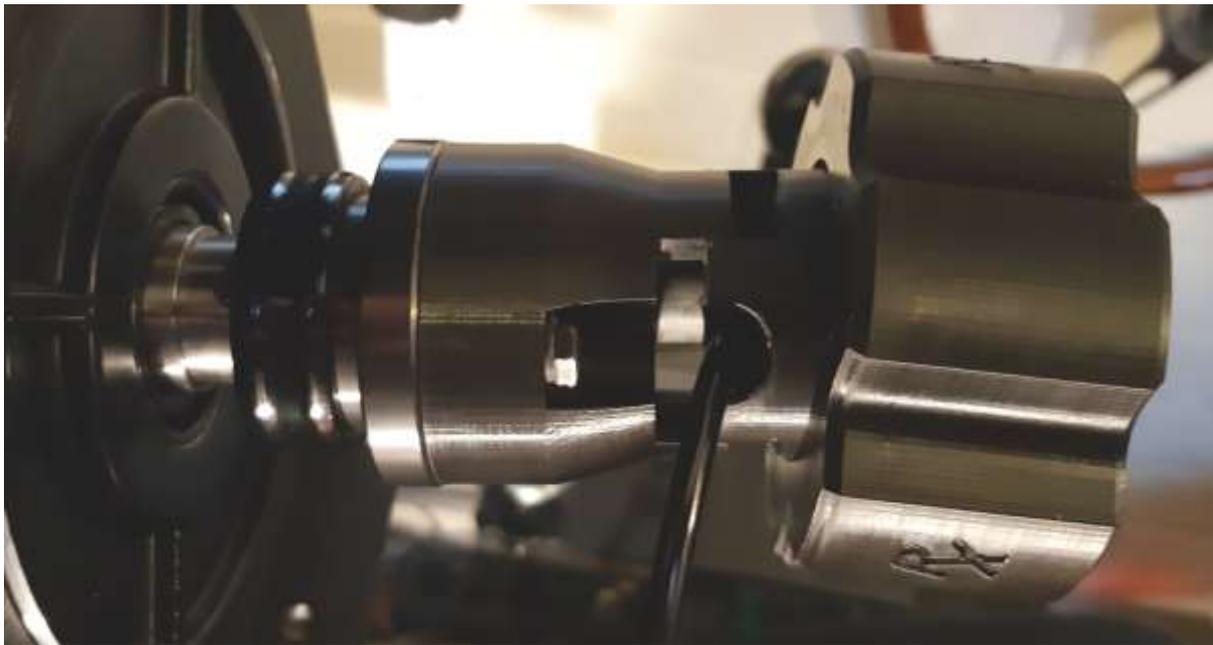
Let the glue dry for a few hours.

Now it's time to mount it onto the servo.

Put the spring washer on every 50 mm bolt:



Mount it onto the other QD JA part. It's a tight fit. If it doesn't fit: sand down the edges of the interlock a tiny bit.



Put the bolts into the adapter.



**Tip**

I'm using this clip to hold the cable and metal box on top of the servo motor:



See <https://www.thingiverse.com/thing:4800479>.

Ready to race!