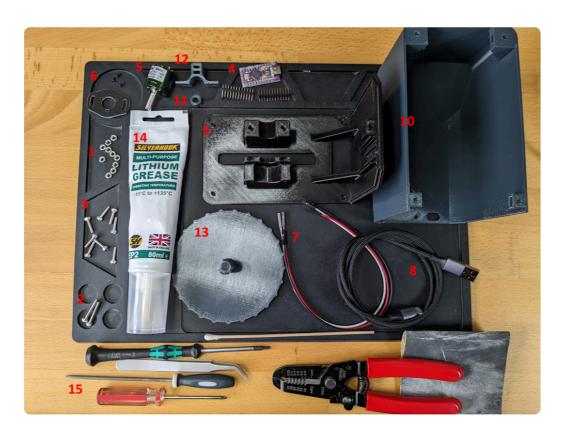
## TWP Assembly Guide

Whilst it is relatively easy to put together the TWP (assuming you have all the parts in the parts list) it is probably still necessary to include some assembly instructions to add some clarity. So here is the said instructions.

For every M3 screw and nut, I used **this set**, but there are only 2 lengths needed for this build, so you don't need a big set like this. You can buy smaller packets as needed. The screws are hexagon socket head screws, but actually you can use any head you like as long as they are M3's of the correct length.

Please let me know if I missed something out in this guide, or you have any other questions. Thanks.

## Parts



- 2. 2 x M3 20mm screws
- 3. 8 x M3 12mm screws
- 4. 1 Arduino Leonardo Pro Micro (preferably USB-C) + pins
- 5. 1 hall-effect sensor (P3022-V1-CW360)
- 6. Mounting bracket + 3 mount screws (should be packaged with the sensor)
- 7. 3 Female to Male or Female jumper wires (~150mm length)
- 8. 1 USB-C to USB-A cable
- 9. 1 3D printed base
- 10. 1 3D printed lid
- 11. 1 3D printed spacer
- 12. 1 3D printed tensioner
- 13. 1 3D printed trim wheel
- 14. Lithium grease
- 15. Tools screwdriver (mine is a hex 2.5mm to match the screws used above)

smaller Philips screwdriver for small screws for sensor bracket small tweezers

tool for clearing out the screw holes (I used a small circular file here) Wire strippers / cutters

Sandpaper 400 grit

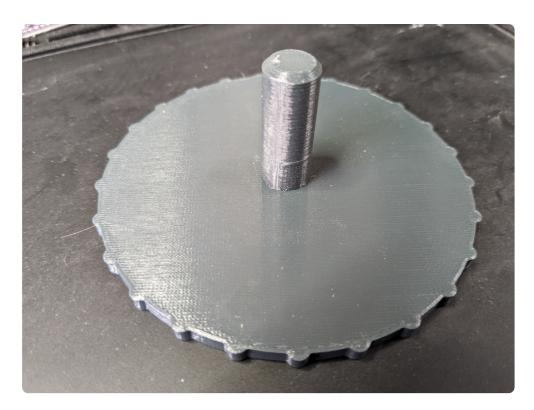
Note: soldering iron and solder not shown.

Steps

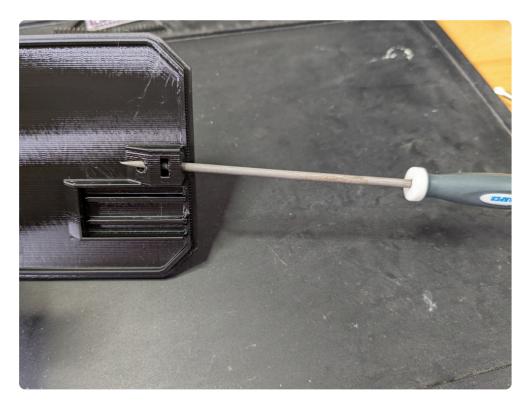




1. Attach the mounting bracket to the sensor with the 3 screws. Make sure the bracket is parallel with the sensor otherwise the wheel will be at a slight angle when it gets mounted. The slots on the side of the bracket will be used to mount the sensor to the base. Plus it gives us somewhere convenient to get hold of when we solder the wires soon.



2. You may see a seam on the trim wheel shaft and this may cause the wheel to catch as you're turning it later. So, before doing anything else we need to sand the seam to remove it and smooth any other imperfections on the shaft. Take care not to sand and scratch the wheel surface. We don't need to sand right up to the base of the shaft, so leave about a 10mm gap between the wheel surface and where you start sanding the shaft. That will be fine.



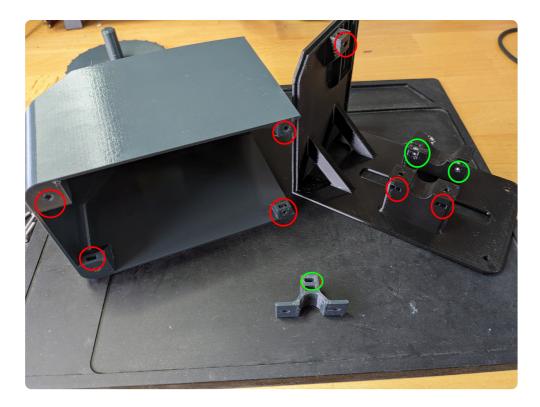
2. There is a thin sacrificial layer at the top of the nut pocket for 3D printing purposes and this needs to be pierced and cleared out as much as possible to allow the screw to go in. Take the circular file or

whatever you have available and push it into the open screw hole to break the sacrificial layer. Push it in, wiggle it a bit and remove it. The aim is to clear the hole for the screw to go in.

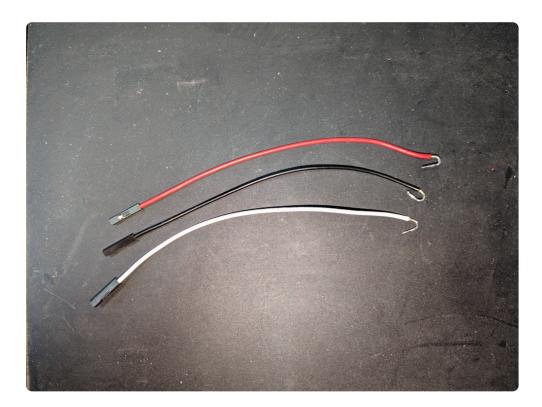


3. Add a nut to the pocket. To stop the nut rotating in the pocket once the screw goes in and is turned there should be the only one orientation of the nut possible (that shown in the picture).

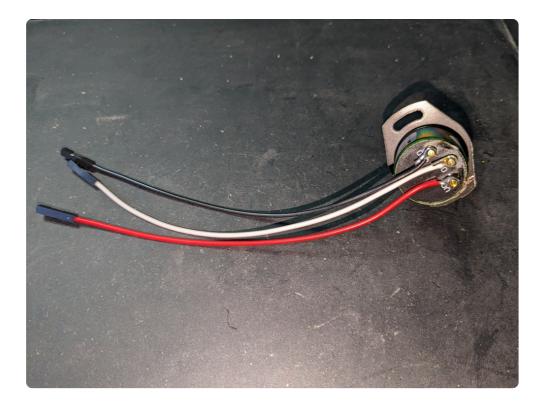
Use the same tool used previously to align the centre of the nut with the centre of the screw hole. This will make it easy for the screw to go in later and you can do this by inserting the tool through the screw hole and through the inserted nut at the same time as shown.



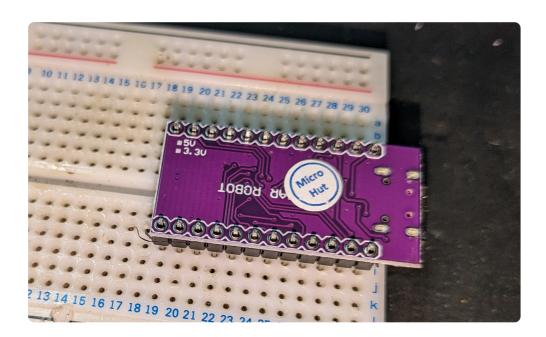
4. Repeat steps 2 and 3 for each of the nut pockets circled. The pockets circled green have no sacrificial layer so you will not need to perform step 2 with them. You do still need to insert a nut in them though, so step 3 is still valid with these. There are 10 pockets in total.

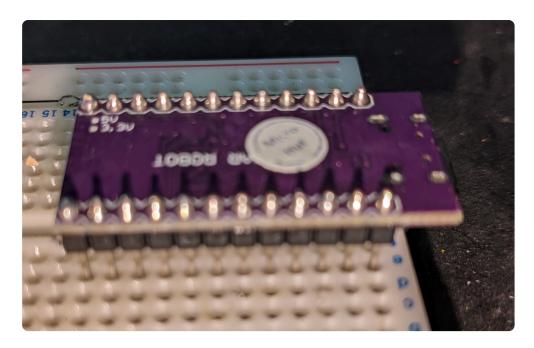


5. Cut the jumper wires so that there is a female jumper header at one end and about 150mm of wire the other. Strip that and tin the tips before bending these tips and creating a hook to go on the sensor solder terminals.

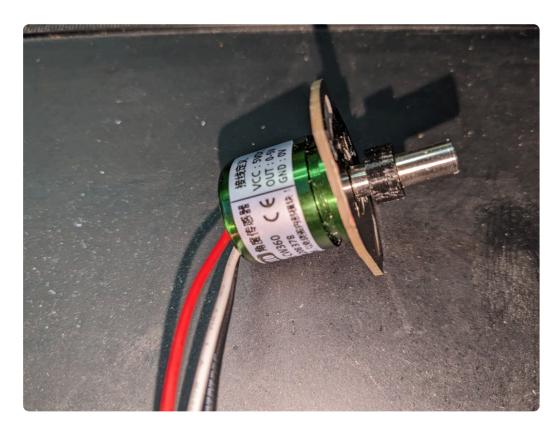


6. Hook the wires to the correct terminals on the sensor. Here, red to VCC, black to GND, and white to OUT. I used some pliers to pinch the hooked wires round the terminals. Solder the wires to the sensor terminals to make it permanent.



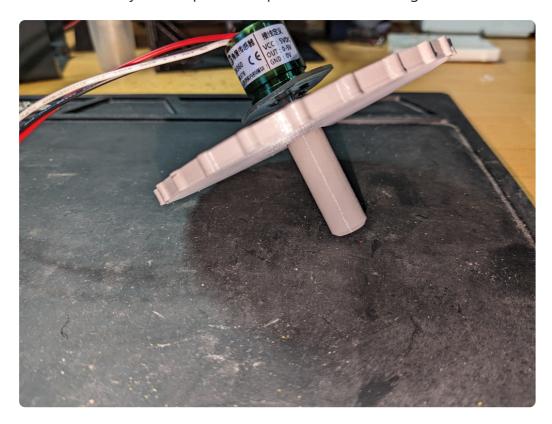


7. Now we need to solder the 2 strips of pins to the pro micro. The best way that I found to do this is to put the pins in a breadboard long side in the holes then lay the pro micro upside down on top of the pins as shown in the first image. Do not push the pins in all the way because you need to leave some space between the breadboard and the top mounted components such as the USB-C port. Once you are happy with the placement, solder in place. Optionally use some Isopropanol alcohol and an old toothbrush to clean off the flux.

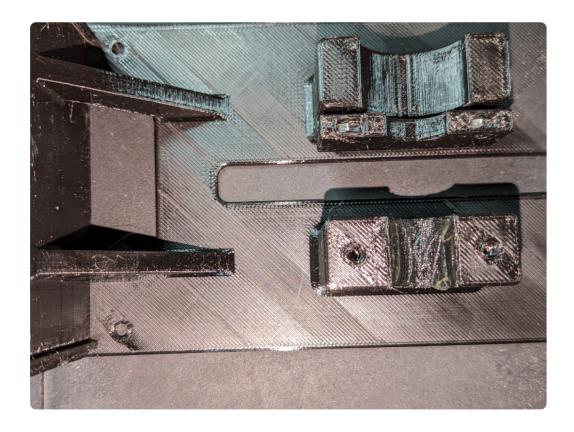


8. Push the spacer onto the sensor shaft. The flat inner part of the spacer should line up nicely with the flat part of the shaft.

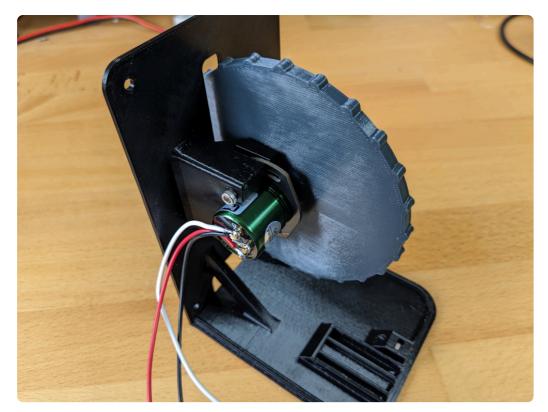
Note: This spacer is a small but important piece. It dictates the position of the trim wheel in the main base slot where the wheel should be in the middle of the slot. Once you get to step 11 and before fastening with screws, you may want to return to this step if the trim wheel is not centred correctly and re-print this spacer at a scaled height as needed.

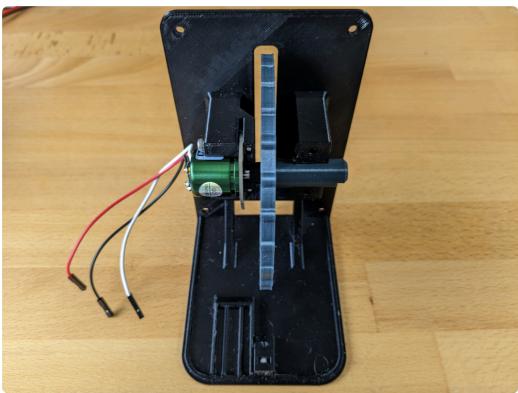


9. The main wheel should follow. It should go on tightly, and it should fit flush with the spacer.



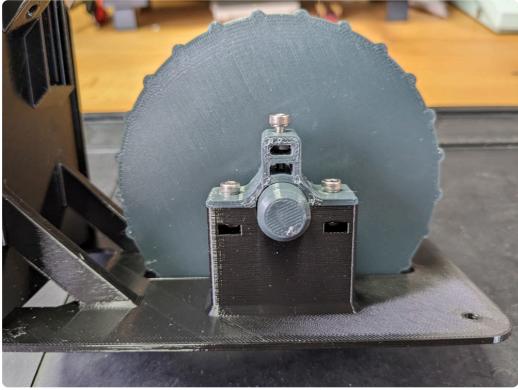






11. Stand the base upright and push the sensor bracket into the slot on the first holder. The wheel should protrude out the central slot and the wheel shaft should be resting in the greased holder as shown. Secure in place with the 2 20mm screws as shown. Check the wheel is centred in the front slot before going further.





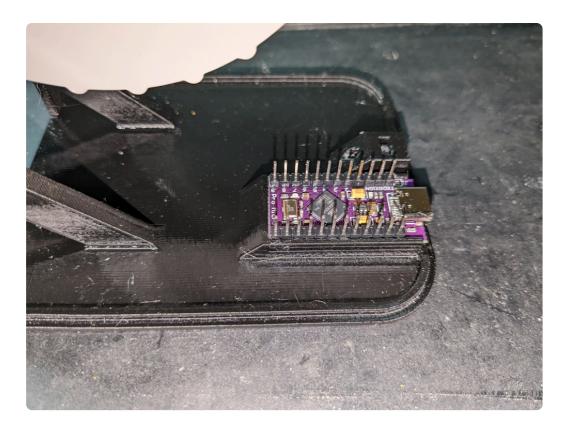
12. Apply some more lithium grease to the groove of the tensioner. This will help the wheel move easily.

Screw the tensioner in position across the wheel shaft and insert but don't tighten the central tensioning screw. The purpose of this is to allow you to make small adjustments evenly to the wheel tension to suit. Which we will do next.



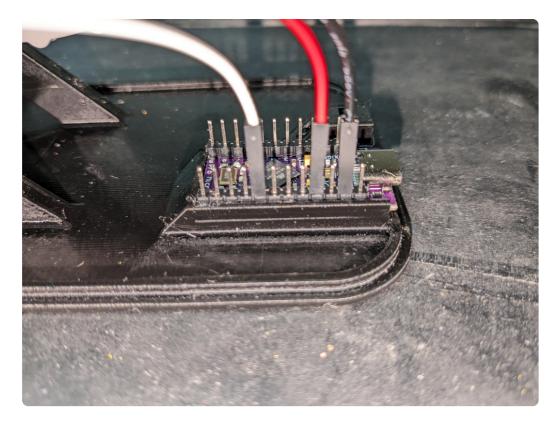
13. It might be a good idea to test the wheel before the lid goes on. Stand the unit upright and turn the wheel as you would in the sim. Make sure everything works smoothly and adjust the tension screw till it feels you have the correct tension for you.





14. Slide in the pro micro from the side into the pro micro housing rather than push it down from the top. There are small runners on the inside of the housing which have been designed to allow this and reduces any vertical movement.





15. Connect the ends of the jumper cables to the correct pins on the promicro. The pins are labelled on the board. Connect black to GND, red to VCC, and white to A0 as shown.





16. Slide the lid on from the rear and use the 5 remaining screws to fix it in place. There should be 4 holes on the front and 1 on the rear, Apart from protecting the insides of the wheel assembly, the lid also acts to stop lateral movement of the pro micro.



17. Push the USB-C cable into the port. In my experience the micro-USB version of this board has a poorly soldered port which breaks off very easily leaving you with a fairly useless pro micro. The pro micros with a USB-C connector seem fine however.

If, at any point, you need to adjust the tension, you can tighten or loosen the tensioner screw via the cutout at the rear.

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18. The final part of this guide is to upload the firmware for TWP. I make 2 assumptions here. First is that you will be using the popular Arduino IDE. The second is that you know how to use the basic functions, such as verifying and uploading code.

You will first need to download and open the code which can be found as a short .ino file via the **Resources** page.

The code uses 2 libraries which need to be installed before verifying and uploading... The first is **ArduinoJoystickLibrary**. Follow the installation instructions in the readme to install the library. The other library used is **ResponsiveAnalogRead** which can be installed via the Arduino library manager. Tools > Manage Libraries Search for "ResponsiveAnalogRead" and install it. Once that's done, you should be able to verify and upload the code after selecting the correct port.

Please ask on my **discord** server if I have missed something or want to ask anything. I hope this guide and TWP works for you and that you find TWP an essential peripheral. Enjoy.