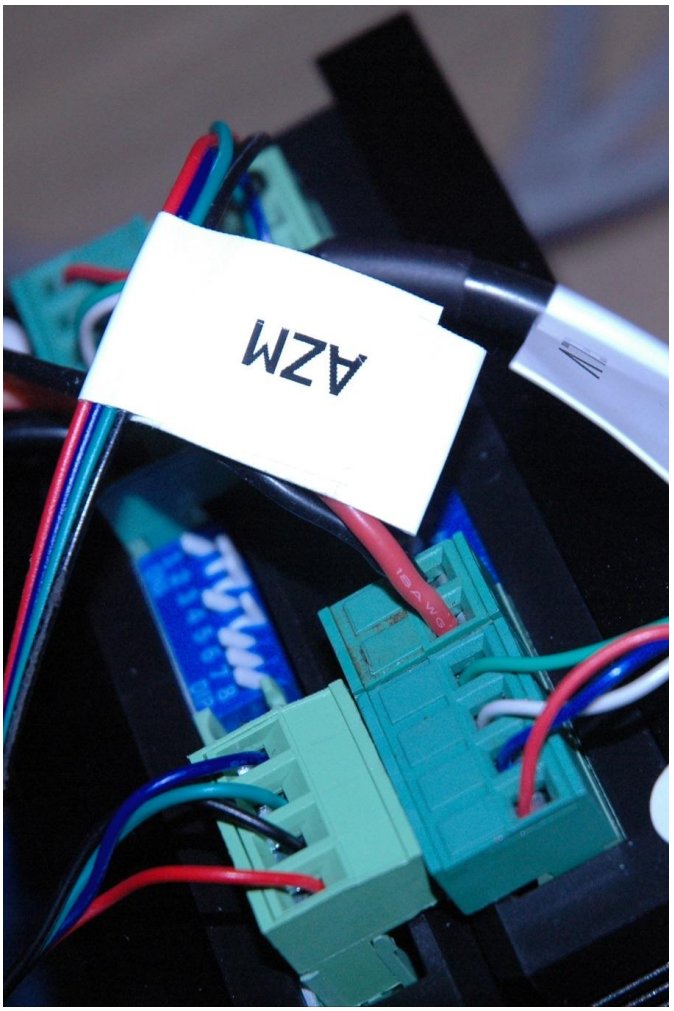
SuperAntennaz controller instructions



Thanks for purchasing your SuperAntennaz kit !

Introduction :

This guide will help you to build your SuperAntennaz controller, you will find drawings, and advice to try to avoid the bigger mistakes you can make during the assembly.

And if you have any questions, feel free to contact me at :

hadji.yohan (at) gmail.com

A) The parts :

Here is a short list of what you need to get a SuperAntennaz controller :

```
1 x Arduino UNO
3 x Nema 23 Stepper Driver
2 x Optical Endstop
1 x 36V ~300W Power supply
1 x 5V ~ 15W Power supply
```

You will also need enough cables to make all the wiring.

More precisely I recommend using :

Optical Endstop :
https://fr.banggood.com/3pcs-Optical-Endstop-Limit-Switch-Sensor-with-1M-3Pin-Cable-for-3D-Printer-p-1399210.html?cur_warehouse=CN&rmmds=search

Stepper Drivers :

First option : high quality
https://www.omc-stepperonline.com/digital-stepper-driver/digital-stepper-driver-18~56a-20-50vdc-for-nema-23-24-34-stepper-motor-dm556t.html

Second option : cheaper
https://fr.banggood.com/5_6A-DC-24-50V-57-or-86-2-Phase-Stepping-Driver-DM556-Stepper-Motor-Driver-Board-p-1374317.html?cur_warehouse=CZ&rmmds=search

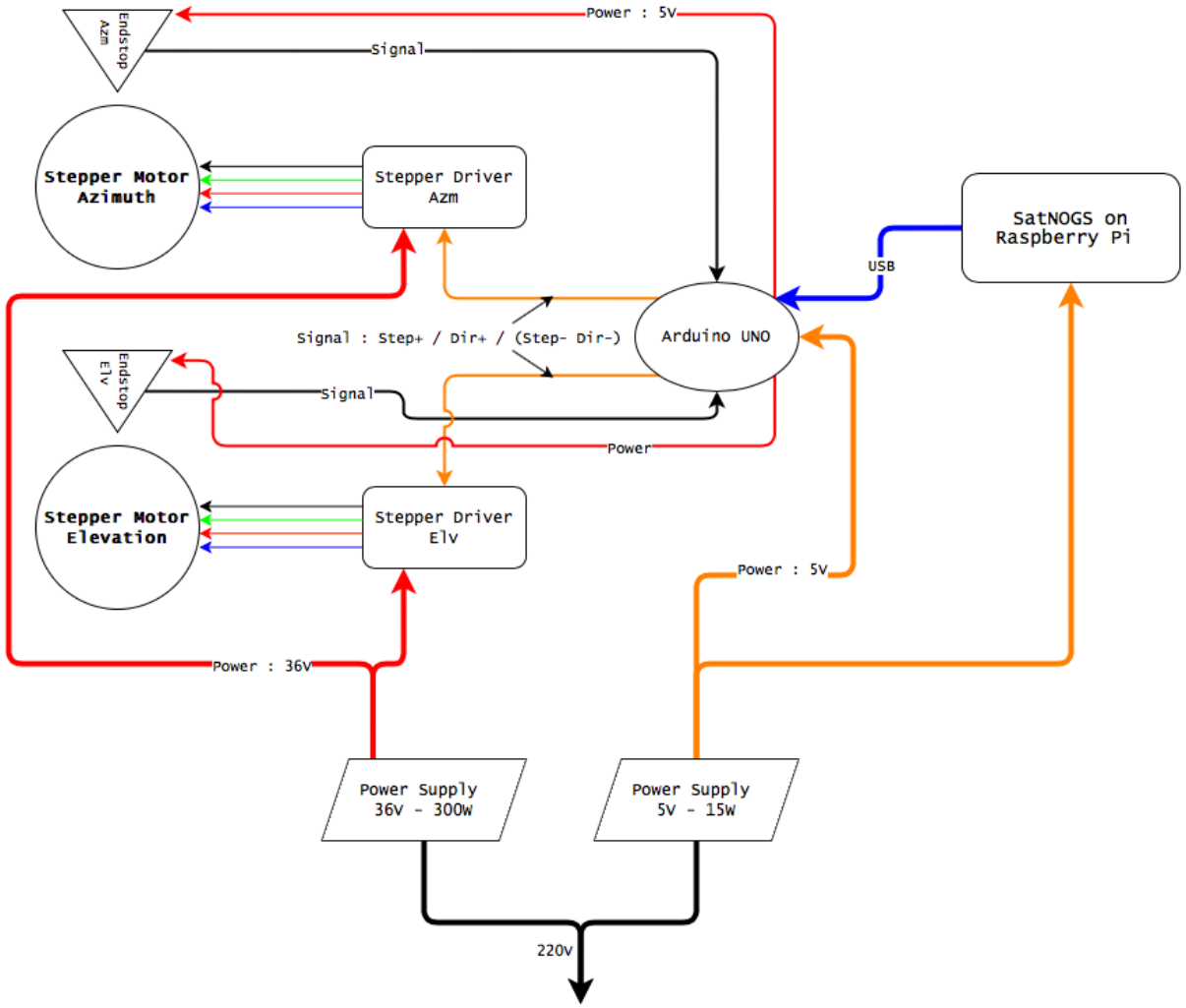
Power Supply 36V :
https://www.omc-stepperonline.com/switching-power-supply/350w-36v-97a-115230v-switching-power-supply-stepper-motor-cnc-router-kits-s-350-36.html

Another part which is not essential but I that **I highly recommend** :
https://www.robotshop.com/en/cytron-screw-terminal-shield-arduino.html

This will really simplify the assembly, the tests, and will avoid you to take out the soldering iron too often!

B) The wiring

Once you have all the parts, here is a drawing of the complet wiring :



Please note that this is only a drawing and that some multiple wire are represented by a single one, for powering for example.

You will then want to use the arduino code provided on github :
https://github.com/YohanHadji/SuperAntennaz/tree/master/Firmware

Please note this firmware is not my own, it is only a very slightly modified version of :

SatNOGS Arduino Uno/CNC Shield Based Rotator Controller
https://wiki.satnogs.org/SatNOGS_Arduino_Uno/CNC_Shield_Based_Rotator_Controller
Created by the **Libre Space Foundation** https://libre.space

If you want to make sure you are using my modified version and not the original one, please check :

1. The name of the file you are compiling :
   “satnogs_rotator_controller_modified_SuperAntennaz.ino”

2. The information provided at the beginning of the code (line 26) :
   `#define RATIO 80 ///< Gear ratio of rotator gear box`

If both are ok, then you are using the good file

What the code also tell you, is the wiring needed for the arduino :

At line 50 and 51 :

```
AccelStepper stepper_az(1, 3, 2);
AccelStepper stepper_el(1, 5, 4);
```

These two lines mean that signal lines, from the arduino to the stepper driver of the azimuth stepper (Dir+ and Step+ on the driver) should be connected to GPIO **3**, and **2**, on the arduino.

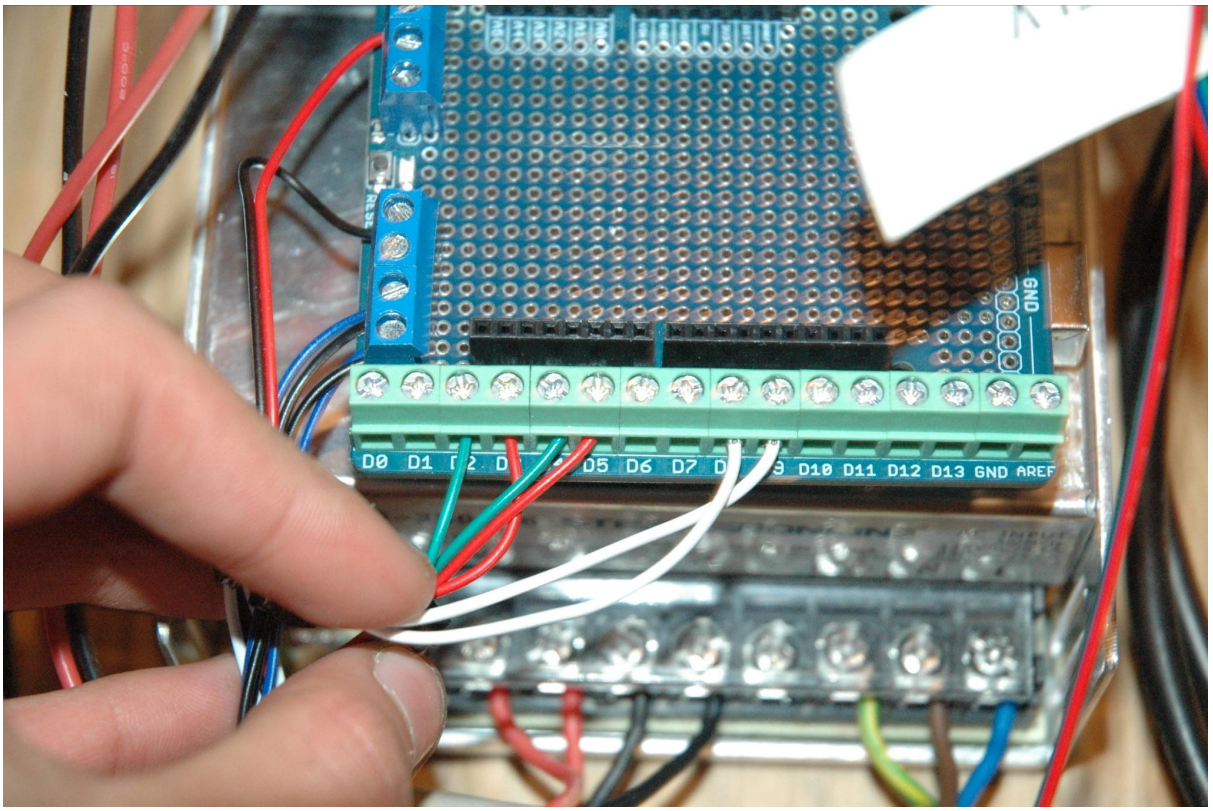
And the exact same thing for the elevation stepper : GPIO **5** and **4** on the arduino.

If everything is correct, GPIO **3** and **5** should both be Step+ for Azm and Elv, and GPIO **2** and **4** should both be Dir+ for Azm and Elv

Connection on driver	Azimuth	Elevation
Step+	**3**	**5**
Dir+	**2**	**4**

Step- and Dir- from each drivers are naturally connected all together to a ground point on the arduino

It is **possible** that Step and Dir GPIO could be inverted for each stepper on the arduino, in that case you just need to invert Step+ with Dir+ (from the same driver of course, do not invert one driver with another)



If you are using the arduino screw terminal shield as recommended your wiring should look a bit like this :

Each couple of one green and one red cable is a Step+ and Dir+ couple from one stepper.

On the left bottom you can see all Step- and Dir- connected together to a ground point

Now you might want to know what those white wires are : The signal wire from each optical endstop.

Again let's take a look at the code : Line 52 endstop are declared as following :

```
endstop switch_az(SW1, DEFAULT_HOME_STATE), switch_el(SW2, DEFAULT_HOME_STATE);
```

We want to find what SW1 and SW2 mean, we can find our solution in the file :

"rotator_pins.h"

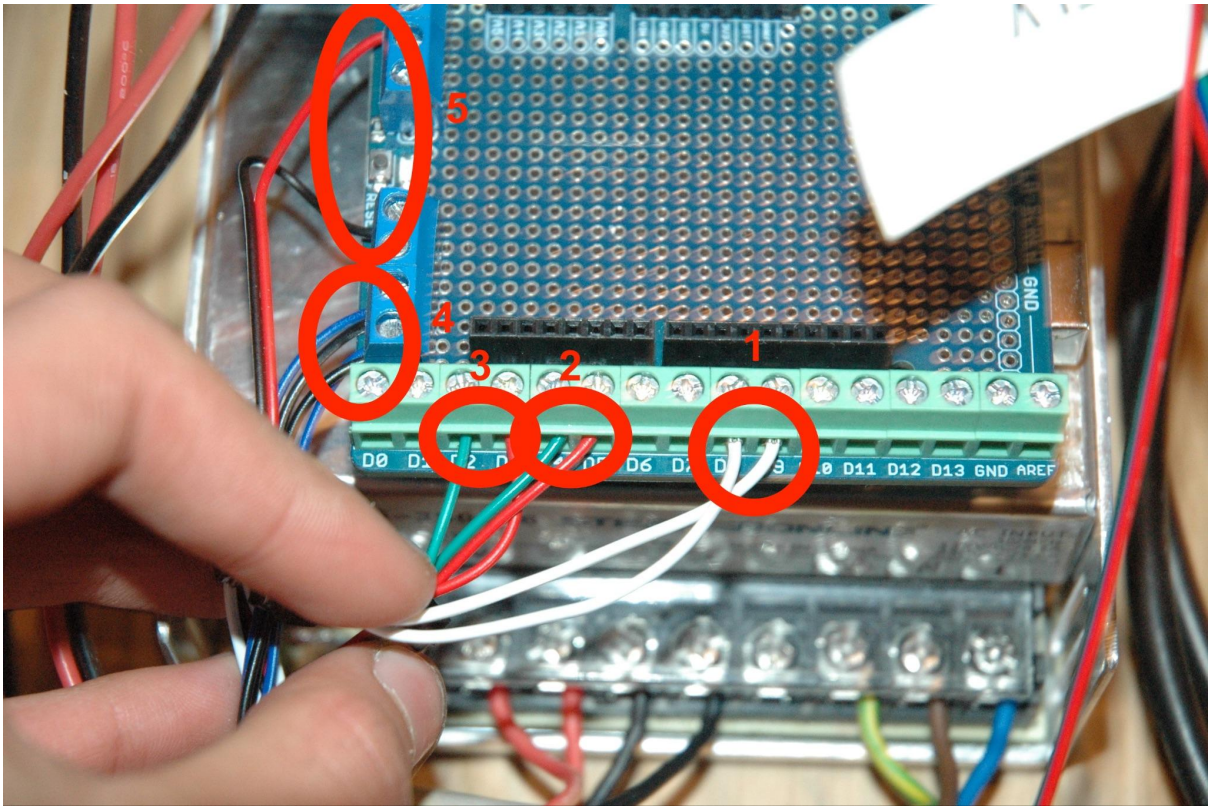
https://github.com/YohanHadji/SuperAntennaz/blob/master/Firmware/stepper_motor_controller/rotator_pins.h

Lines 26 and 27 we can find :

```
#define SW1 8
#define SW2 9
```

I recommend to always check, but SW1, so **GPIO 8**, should be the endstop for the Azm Driver, and SW2 so **GPIO 9** on the arduino should be the endstop for the Elv Driver

Each Endstop also need to be powered with 5V from the arduino, these are the last wire on the right top you can see on the picture, connected to ground and 5V point on the arduino shield



1 : Endstop signal, GPIO 8 = Azm, GPIO 9 = Elv
2 : Elevation driver control signal, GPIO 5 = Step+, GPIO 4 = Dir+
3 : Azimuth driver control signal, GPIO 3 = Step+, GPIO 2 = Dir+
4 : Dir- and Step- from each driver connected together to ground
5 : +5V and ground from arduino to optical endstop

C) Last steps

Connecting each stepper to its driver :

There are plenty of good tutorials on youtube that will explain way better than me how to connect each of 4 wire of the stepper to its driver

Here is the datasheet of the stepper motor I recommend, you will find the wiring informations from the motor :

https://www.omc-stepperonline.com/download/23IP65-12.pdf

Connecting power supply to drivers :

Please remember that these drivers don't have brains, so use your own, always, always, always double, or even triple check + and - polarities before powering anything!

Connecting arduino to Raspberry Pi :

Just use an USB cable

Drivers settings :

If you are using the same Stepper Motor as recommended :

https://www.omc-stepperonline.com/waterproof-stepper-motor/p-series-ip65-waterproof-nema-23-stepper-motor-4-0a-1-2nm-169-97oz-in.html

The rated Current/phase is : 4.0