

ENSC 351 Project – How-To-Guide

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Resistor Sorter Machine

Step 1. Alignment of the bins

Before we can start sorting resistors, we have to make sure that the bins are aligned with their corresponding bin numbers. This step is vital to make sure the stepper motors and bins are moving simultaneously. The bins themselves move separately from the outer shell, so to ensure the bins are aligned to their correct position, flip over the base and bins and align the corresponding bin number to its correct sorted position (make sure '0' on the bottom of the bin layer is lined up with the out base's '0'). This is the 'reset' position that the machine will go to after every time a resistor is sorted.

Step 2. Powering the device

Getting the device set up and ready requires correctly supplying power to both boards. The power supply and the CNC shield are extremely important for powering both the Arduino, as well as ensuring all components are receiving the correct amount of voltage and amperage. With the CNC shield connected to the Arduino, you can safely verify the Arduino is running correctly by connecting USB into the laptop and running a test .ino script. As for the Raspberry Pi, it needs an external adapter to supply its power. Otherwise, it will give an incorrect voltage error when you boot up the Raspberry Pi.

Step 3. Setting up your software

Now, we can connect your computer to each device. You can complete this step on each device independently, to ensure both the Arduino and Pi are set up correctly. We will be using the serial communication port of the Arduino and any of the four USB ports on the Raspberry pi. To begin communication between the controllers, we need to ensure that Raspberry Pi is connected to a stable internet. Then we connect the Raspberry Pi to the laptop through ssh and upload our codes. Afterwards, download the required packages like rpical, pyserial, requests, etc onto the Raspberry Pi. Next, use your laptop to upload

stepper.ino file into the Arduino. Finally, we can connect the Arduino into our Raspberry Pi through USB and begin testing the sorting function.

Step 4. Setting up the camera

This sorting machine relies on image processing and depends on a clear picture from the camera. As such, we need to connect our camera into the RPI5. After downloading `rpicam` using the “`sudo apt install libcamera-apps`” code, you can check the camera by running the “`rpicam-hello --preview -t 0`” command. Once the camera is up and running, make sure that the angle is centered on the resistor holding platform. With the camera opened on your device, make sure that it is focused on the center of the platform by adding a test resistor. It is vital that the camera has an unblocked view of the resistor, if the camera is unfocused or blurry, carefully rotate the lens of the camera clockwise to either increase or decrease the focal length, depending on your need.

Step 5. Testing / Troubleshooting

Now we are ready to test. Find a 12k resistor (which should go to bin 4) and place it on the platform at the top layer. Now run the program using `main.py`. With your computer connected, you should first see the terminal confirm the color bands of the resistor (Brown, Red, Orange, Gold). Then, the correct bin should rotate underneath the resistor platform (bin 4 should be centered under the platform) Lastly, the resistor will be dropped into the bin, and the bin will reset to its original position with all bins in their corresponding slots 0 to 0, 1 to 1, etc.

On your terminal, you should see an output that describes if the camera was able to read the resistor, along with the colour bands that it read and an output that tells you which bin it assigned the resistor to.

If any of these steps fail, please go back and re-read through steps 1 through 4. Errors are likely to be found by troubleshooting the camera focal length, angle and positioning of the resistor

Step 6. Ready for sorting!

Now that the machine is running smoothly, sorting can now take place! Remember to only put one resistor at a time and to clean out the bins when there are too many resistors there.