Adding ADXL345 Accelerometer

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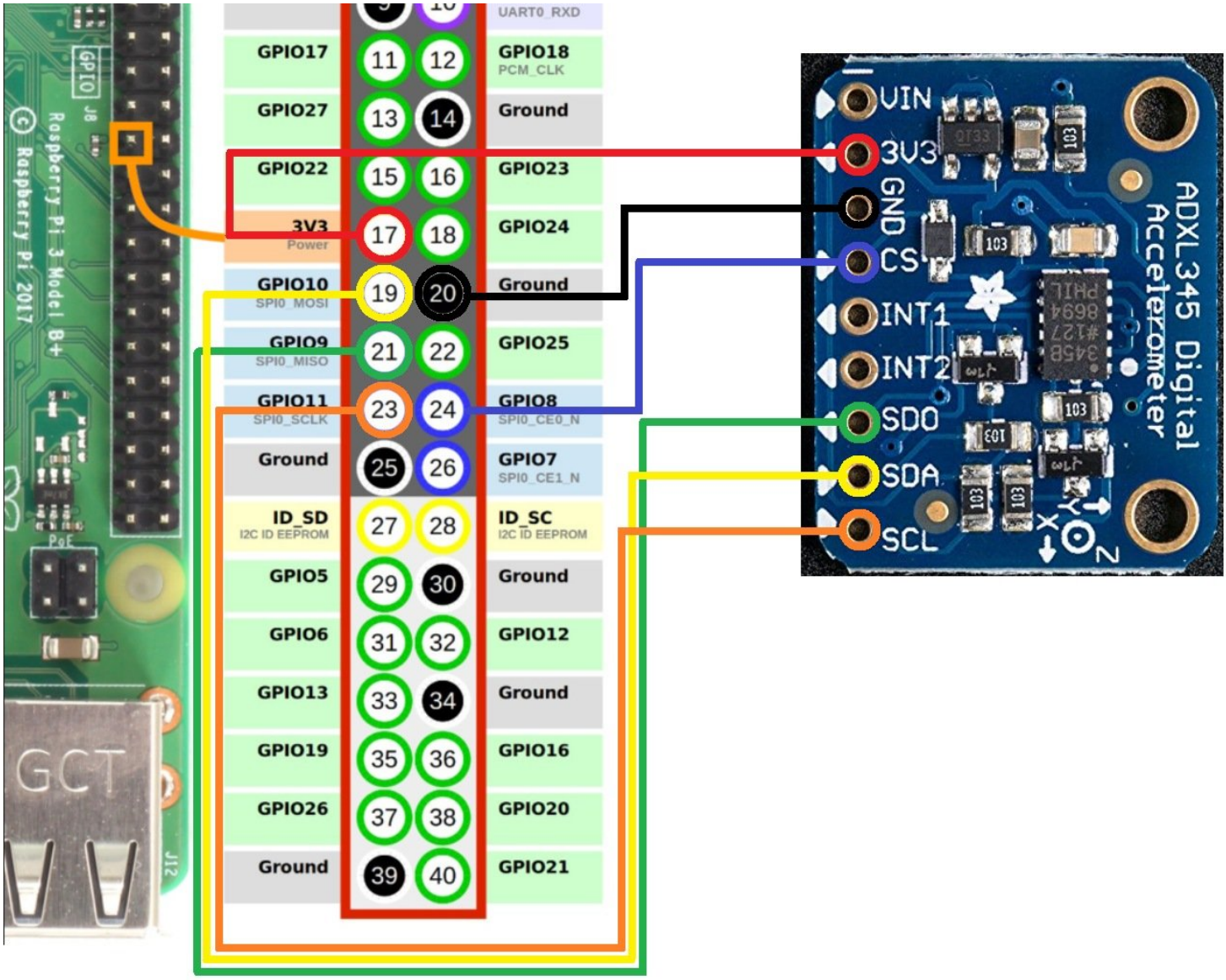


INTRODUCTION

You will need a printed adapter to mount the ADXL345 to the rear of the X carriage. You can find one here

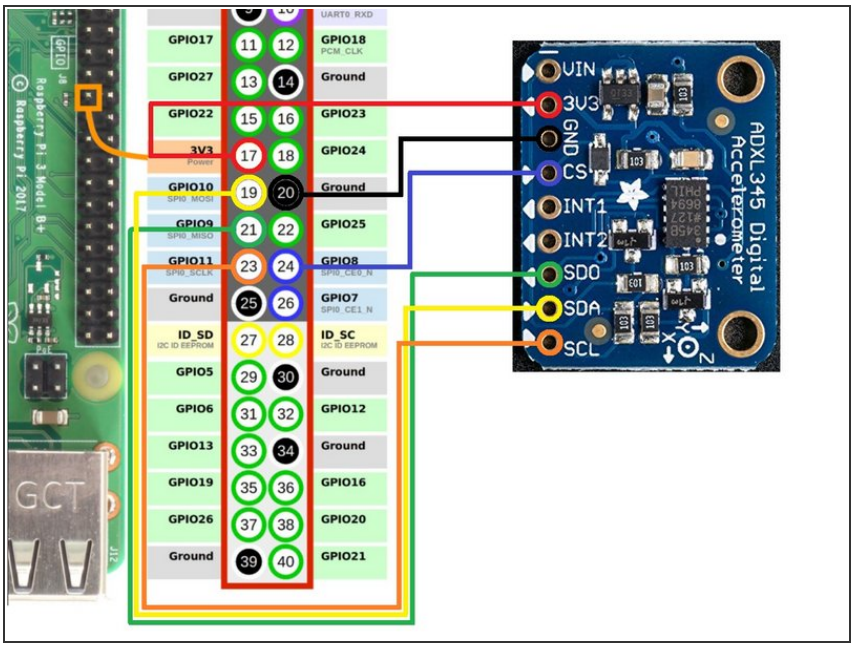
https://www.klipper3d.org/Measuring_Reso...

PARTS:

- ADXL345 (1)
- ADXL345 Printed Mount (1)
- M3x8 countersunk screw (3)
- M2.5x6 socket head screw (2)
- M2.5*3*3.5 Heat Set Inserts (2)

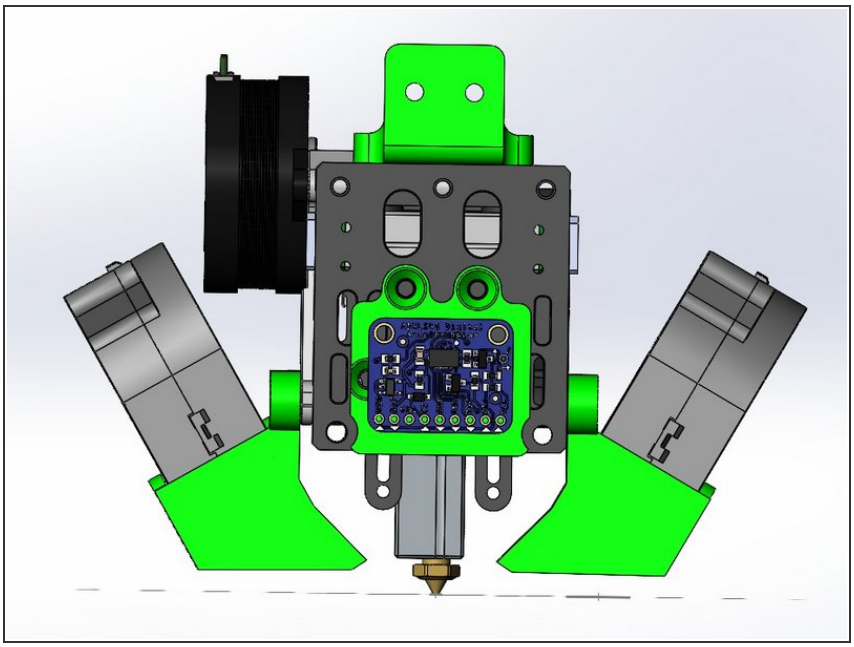
Optional

Step 1 — Wiring



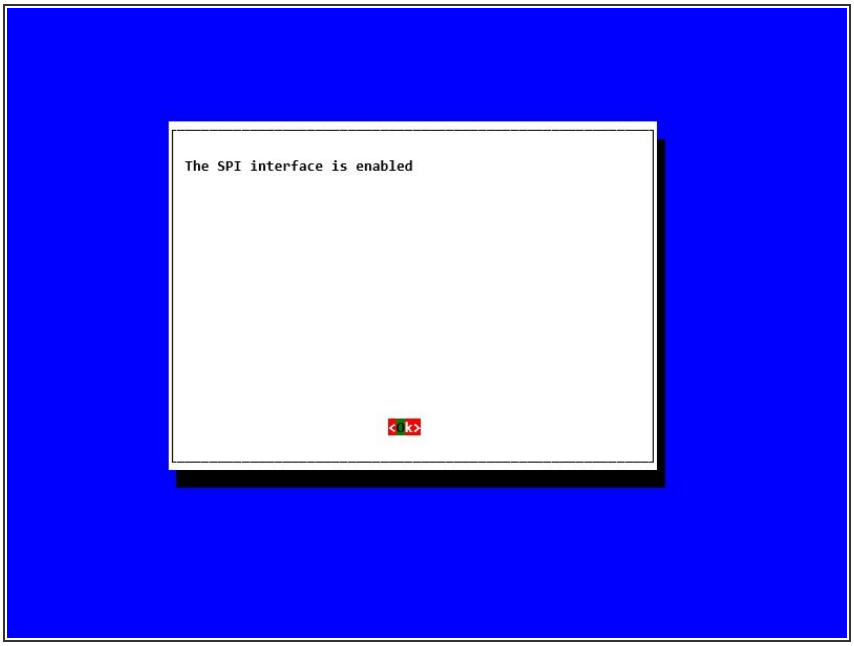
- Connect the Accelerometer to the RPI
  - Accelerometer 3V3 to RPI pin 17 3.3v
  - Accelerometer GND to RPI pin 20 Ground
  - Accelerometer CS to RPI pin 24 GPIO08 (SPI0_CE0_N)
  - Accelerometer SDO 21 to RPI pin GPIO09 (SPI0_MISO)
  - Accelerometer SDA to RPI pin 19 GPIO10 (SPI0_MOSI)
  - Accelerometer SCL 23 to RPI pin GPIO11 (SPI0_SCLK)

Step 2 — Mounting the ADXL345



- There are a number of options you can use to mount the accelerometer. I used this mount

Step 3 — Installing The Packages



- You need to SSH into to your printer and install Numby.
  - ~/klippy-env/bin/pip install -v numpy

Be patient, this package can take 10-20 minutes to install. When finished run:

- sudo apt update
- sudo apt install python3-numpy python3-matplotlib -y

- Verify Linux SPI driver is enabled
  - sudo raspi-config
  - #3 Interface Options > P4 SPI > Yes > OK > Finish

Step 4 — Preparing printer.cfg

```
271
272
273
274
275 ######################################################################
276 #   Input shaper & resonance_tester]
277 ######################################################################
278
279 [mcu rpi]
280 serial: /tmp/klipper_host_mcu
281
282 [adxl345]
283 cs_pin: rpi:None
284
285 [resonance_tester]
286 accel_chip: adxl345
287 probe_points:
288     179,115,20
289
290
291
292
293
294
```

- Uncomment the input shaper & resonance tester section in the config.
  - probe_points: It's recommended to use 1 point in the center of the bed slightly above. I used the same coordinates used when homing Z

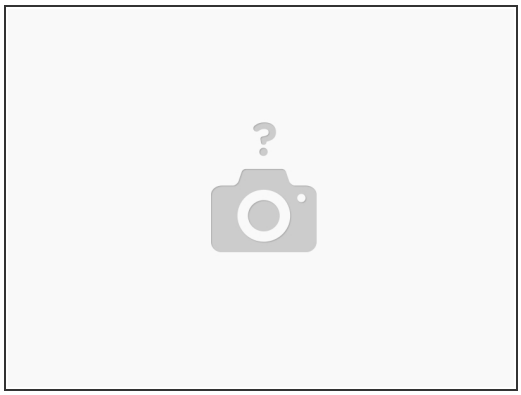
- Restart klipper with
  - RESTART

Step 5 — Prechecks

- Check to make sure the RPI can communicate with the ADXL345 by running the following command in console
  - ACCELEROMETER_QUERY
- It should return something like:
  - adxl345 values (x, y, z): -152.983740, 10249.910580, 152.983740

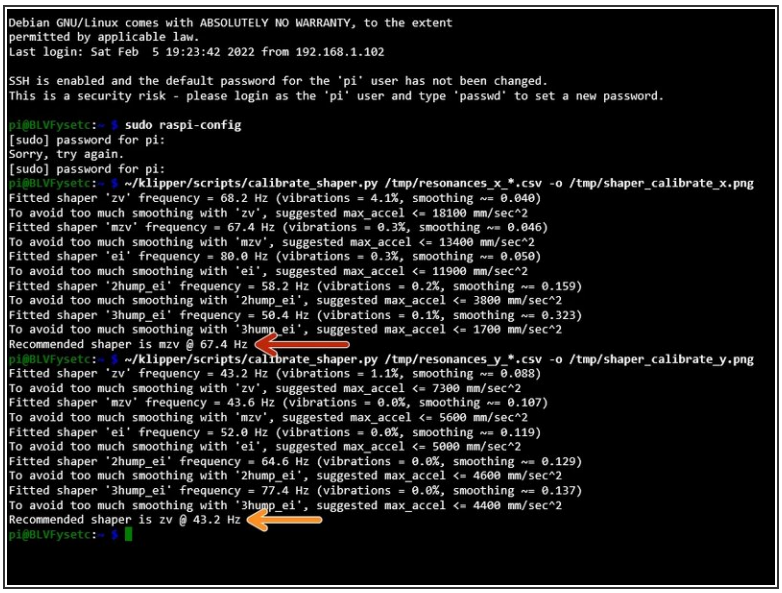
f you get an error like Invalid adxl345 id (got xx vs e5), where xx is some other ID, it is indicative of the connection problem with ADXL345, or the faulty sensor. Double-check the power, the wiring (that it matches the schematics, no wire is broken or loose, etc.), and soldering quality.

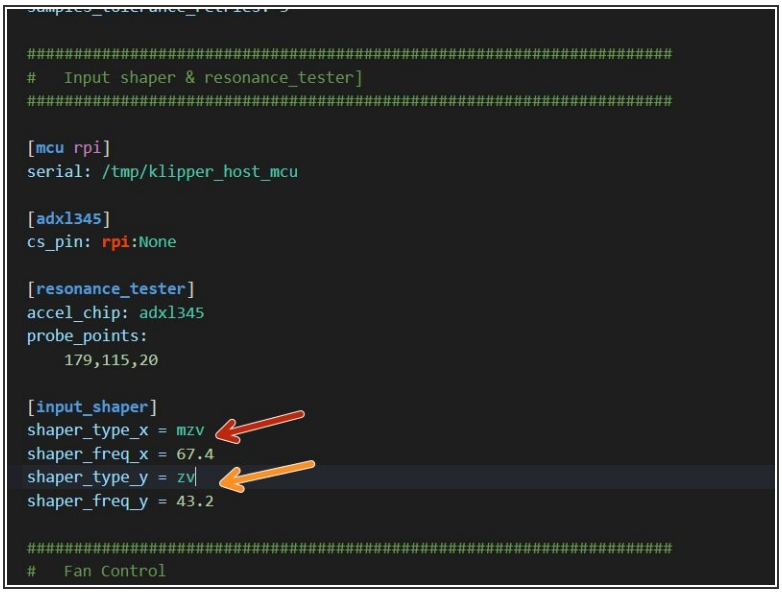
Step 6 — Configuring Resonance



- Home the printer.
- During resonance testing the vibrations can become extremely violent. Make sure you're in proximity of the printer in case you need to cancel the test with M112
- Now you can run the first resonance test for X
  - TEST_RESONANCES AXIS=X
- When the test completes run it again for Y
  - TEST_RESONANCES AXIS=Y
- When the test is complete it will generate CSV files stored on the pi.

Step 7 — Interpreting Resonance Results

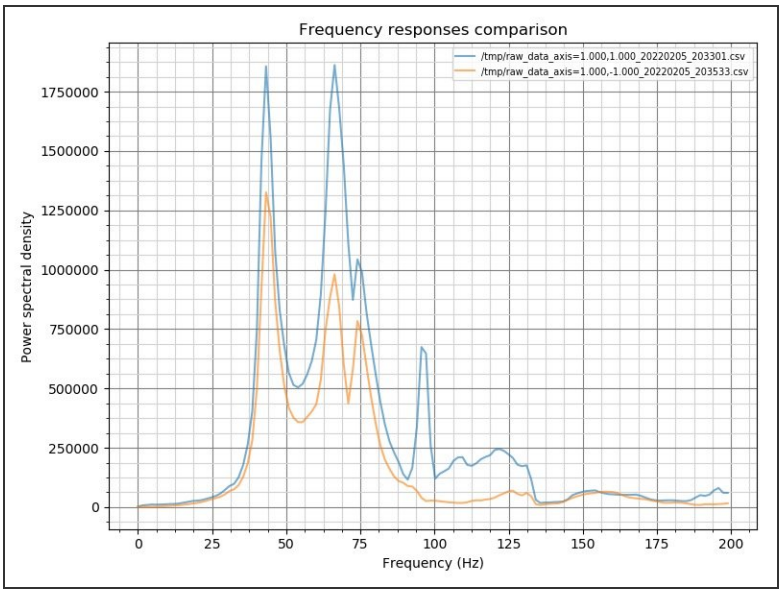


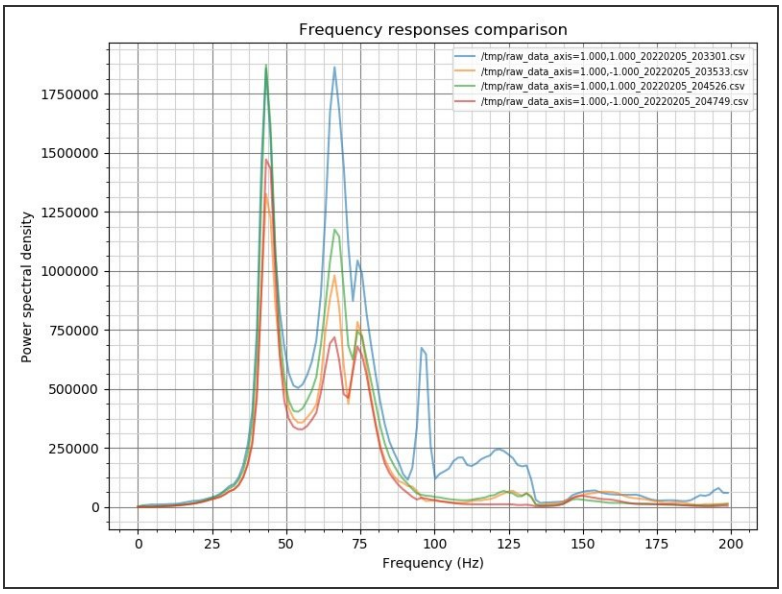


- SSH back in to the printer and run the following 2 commands
  - ~/klipper/scripts/calibrate_shaper.py /tmp/resonances_x_*.csv -o /tmp/shaper_calibrate_x.png
  - ~/klipper/scripts/calibrate_shaper.py /tmp/resonances_y_*.csv -o /tmp/shaper_calibrate_y.png
- This script will generate the charts /tmp/shaper_calibrate_x.png and /tmp/shaper_calibrate_y.png with frequency responses

  ⓘ You can use WINSCP to copy them to your PC if you like but it's not necessary.
- You will also get the suggested frequencies for each input shaper, as well as which input shaper is recommended for your setup.
  - You can see my values for X
  - You can see my values for Y

Step 8 — Comparing Belt Tension





- With a CoreXY you can also use Klipper to compare belt tension between X and Y. This doesn't tell you if the belts are too tight or too loose. It tells you have the belts are tensioned equally.
- Run the following commands in the console
  - TEST_RESONANCES AXIS=1,1 OUTPUT=raw_data
  - TEST_RESONANCES AXIS=1,-1 OUTPUT=raw_data
- SSH into the pi and run
  - ~/klipper/scripts/graph_accelerometer.py -c /tmp/raw_data_axis*.csv -o /tmp/resonances.png
  - Based off the generated graph, X had much higher frequencies than Y. I had to tighten the left belt tensioner to to bring the frequencies closer to each other.
- As you can see from the 2nd test the frequencies for X and Y are closer together, but could still use a little more adjustment. I think a lot of the frequency variation is due to my cable chain. At lower frequencies it rattles considerably more only when calibrating X.