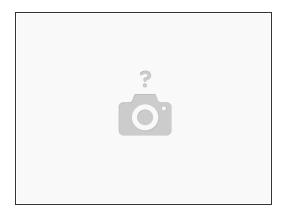# ZT Automations, LLC

Determining G29 Offset Constant (Non FSR Touch Probe)

This guide determines the Z-offset constant used for G29 auto levelling.
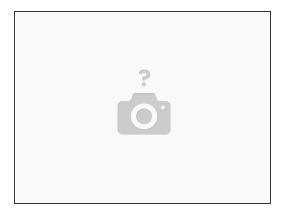
Written By: Terence Tam

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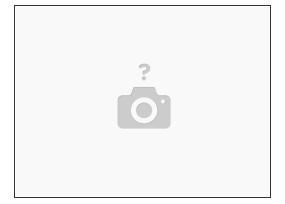## Step 1 — Initial Power Up

- If this is your first time powering up the printer, it is highly advisable that you connect the printer, and nothing else, to a standalone power strip, and use the power strip's switch to turn on and off the device.

- The reason for this precaution is if there were to be a wiring defect, your hands will be far away from the defect and in a position to cut power to the device.

- Verify that the power switch is off, plug device in.

- With the power switch set to "Off", turn on the switch on the side of the printer.

- Now, keeping hands and tools away from the printer, click the switch to "On" position on the power strip, but be prepared to cut power if something does go wrong.

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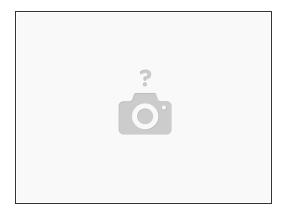
Step 2 — Initial Power Up - Status Check

- The following should happen when power is applied

- Fans will spin up

- White LED ring on end effector will light up

- Motors may snap and energize, it will become difficult to move the end effector.

- Lights will come on on the Brainwave Pro controller board.
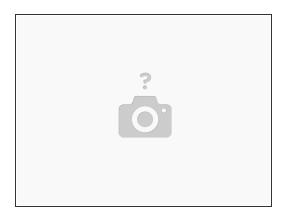
Step 3 — Installing Software

- If you have not done so already, download a copy of MatterControl. MatterControl contains the driver which Windows needs to communicate with the Brainwave Pro controller board.

- Windows users: Even if you plan on using other software to drive the printer, install MatterControl first and establish Serial communications with the printer (by connecting and homing all 3 axis up).

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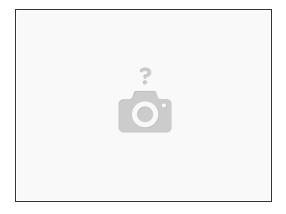## Step 4 — Verify printer is communicating with the PC

- Open up device manager (Right click on "My Computer", click "Manage", then go to Device Manager in computer management). Expand out the tab "Ports"

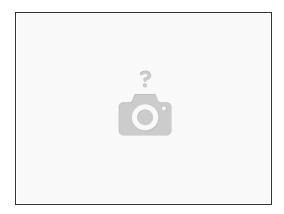## Step 5 — Configuring MatterControl to talk to the Kossel Pro ¶

- Insert something about connecting to printer

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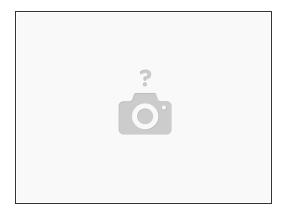
Step 6 — Disable Motors

- When the printer first power up, all the motors engage and will attempt to hold position.

- Verify that the motors are indeed energized, and holding position by trying to lightly move the carriage up and down by hand. The carriage should hold position. If the motors do not engage, something is wrong with the motor wiring or with the board.

- Click "Release" under the Movement Controls tab to unlock all the motors. The three carriages should move freely up and down with the motors released.

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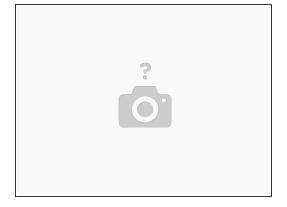
Step 7 — Verify End Stop Operation ¶

- Pull the end effector downwards to move the carriage away from the end stops.

- In MatterControl, expose the GCode terminal by clicking on the Configuration Tab, then click "Show Terminal"

- In the terminal that will open, type "M119" and hit ENTER.

- M119 is a GCode command, telling the printer to report its end stop status. You are looking to see a message that tells you that XMAX, YMAX and ZMAX are OPEN.

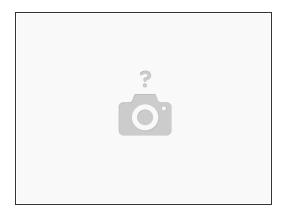## Step 8 — Verify End Stop Operation (Continued)

- Now, move the X carriage up until you can hear the end stop switch click.

- Run M119 again. (Note, you can just hit Up Arrow to repeat the command, and press enter)

- You should see a message that says XMAX has been triggered, while YMAX and ZMax remain open.

- Repeat this procedure, one carriage at a time, for Y and Z axis.
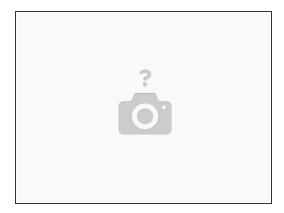
Step 9 — Verify Auto Probe

- Now, deploy the auto probe by rotating the tab until it clicks downwards.

- Run M119. It should report that Z_MIN is OPEN.

- Press up on the auto probe and run M119 again while holding the auto probe up.

- It should report that Z_MIN is Triggered.

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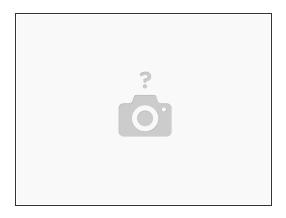
Step 10 — Home XYZ axis

- NOTE: IT IS HIGHLY ADVISABLE TO KEEP A FINGER ON THE POWER SWITCH DURING THIS PROCEDURE.

- With the end stop functionality verified, prepare to home the printer.

- Click back on the "Controls Tab" of the printer, and under "Movement Controls", click the HOME ALL button.

- The three carriages should move up and "bounce" off the end stop switches.

- If any or all of the carriages start moving down, disconnect power immediately, and check the orientation of the timing belt being attached.

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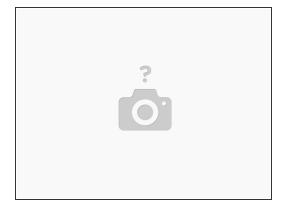
Step 11 — Verify Hot End Sensor

- Now let we've verified that the printer moves, let's check the end effector.

- One fan should be on; this is the fan that blows into the heat break on the hot end.

- Two other fans should be off.

- In the "Controls" tab of MatterControl, under "Extruder Temperature", verify that the temperature being read is non-zero and a reasonable (15-30 deg C, depending on your ambient temperature) value.

- Troubleshooting: If temperature reads zero, it indicates a broken connection to the hot end thermistor. If the temperature reads overly high (>500 deg C), it indicates a short on the thermistor wiring.

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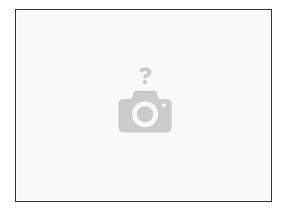
Step 12 — Bring hot end to temp

- With the thermistor reading, it's time to fire up the heater circuit for the hot end.

- Click "PLA" next to the extruder temperature and "Preheat"

- Temperature should climb. It is ok to overshoot a little bit (10 deg or so) but temperature should settle down on the hot end fairly quickly.
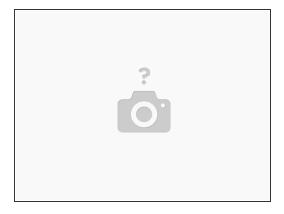
Step 13 — Test extruder motor

- With the hot end at temperature, now it's time to test the extruder motor

- Note: The firmware contains a lockout to stop the extruder motor if the hot end temperature drops, to prevent putting excessive pressure on the hot end.

- Under movement control, select 10mm, then extrude 10mm

- Verify that the motor spins on the extruder motor and that it is spinning in the correct direction.

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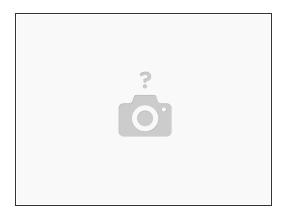
Step 14 — Test heated bed

- Now, let's verify heated bed functionality. As with the hot end thermistor, verify that the heated bed thermistor reads back a sensible value (15-30 deg C, depending on your ambient conditions).

- Troubleshooting tip: 0 deg indicates a broken connection, an abnormally high (>500 deg) temp indicates a dead short.

- Preheat the bed to 60 degs. Bed should reach 60 deg C in about 2 minutes.

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Step 15 — Test G29 Auto-Levelling procedure

- Home the printer.

- Manually release the auto-levelling probe.

- Back in the G-Code window, type G29.

- The following should happen

- Probe should tap a pattern of dots on the glass build plate

- Print head will move to the edge of the glass, and press downwards.

- This retracts the probe.

Step 16 — Wrapping up

- At this point, we've verified that all major subsystems on the printer is working. Now, onwards to a quick calibration step, and we're off and running!

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