Required Items To Buy

MKS Gen 1.4 - https://www.amazon.com/gp/product/B072ZZ3YQW - $36
Stepper Motor Driver x5 A4988 - https://www.amazon.com/gp/product/B01FFFYVV8 - $9
Stepper Motor - https://www.amazon.com/gp/product/B0753DS9FQ - $13
Extruder - https://www.amazon.com/gp/product/B0196B285I - $9
NF TC-01 - http://a.co/d/dXQYkbl - $40
Silicone Sock - https://amzn.to/2AI5WqG - $10
Stepper Motor Cables - https://amzn.to/2ADGgLB - $10

Items to Print

Stepper motor mount - https://drive.google.com/open?id=1fKbmlGC5itXDVMUxvcFsjz-7Ow2OsPks
Hot End Mount - https://www.thingiverse.com/thing:3148591
Board Mount - https://www.thingiverse.com/thing:1887031
Cooling Fan Duct - https://www.thingiverse.com/thing:2844019 This will require either one additional 40mm fan or one 50mm radial fan. Radial fan recommended.

Optionals

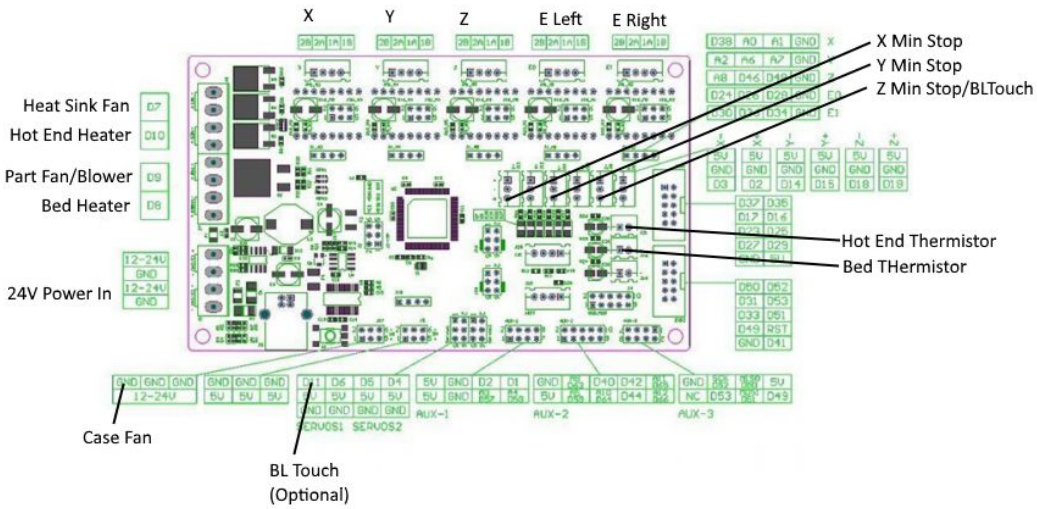
M3 Screws - https://amzn.to/2ABtm0T
M3 Hex Nuts - https://amzn.to/2ADEfz1
M3 T Nuts - https://amzn.to/2AI5adg
BLTouch - https://www.amazon.com/gp/product/B076PQG1FF - $45
Extra 40mm fans - http://a.co/d/0UA9mVp
5015 50 mm Radial Fans - http://a.co/d/9gzshXh
Extra 100K Thermistor - http://a.co/d/b3Uv3wT
Extra Heating Element - http://a.co/d/0qu34Ka

Upgrades - Replaces above items with better versions or options

Bulldog Extruder x 2 - https://amzn.to/2TQ47m4 http://a.co/d/5VeEaws - $12-25
Stepper Motor Driver x 5 LV872 - https://amzn.to/2AI4ZyC

Software

Marlin Firmware - https://drive.google.com/open?id=17enlJd_R7ROFpBYh1kd7GnJm1TrC95Qm
Arduino IDE - https://www.arduino.cc/en/Main/Software
IdeaMaker - https://www.raise3d.com/pages/download
PrintRun - http://kliment.kapsi.fi/printrun/



MKS Gen 1.4 Pinout
D10 - Hot End Heater
D9 - Blowers
D8 - Heated Bed
D11 - BLTouch
D7 - Hot End Heat Sink Fan

Note for End Stops and BLTouch. Use the lower 2 pins in the connector only. They will fit but not snap in firmly. That is fine.

Instructions

- Order all components
- Download and Install all Software
- Optional Z-Stop Edit firmware
- Compiling the Marlin Firmware
    - Board: Arduino/Genuino Mega or Mega2560
    - Processor: ATmega2560 (Mega 2560)
    - Programmer: AVRISP mkII
- Print all components -- DO NOT SKIP THIS OR YOU ARE SCREWED
    - All parts can be printed in PLA
    - If you have PETG, I recommend using it for the hot end mount and fan mount.
    - Optional - If you are using 5015 Radial fans, make sure you print the 40mm to 50mm radial adapter
- Disconnect Ender 3 from power.
- Removal of Melzi board. -- POINT OF NO RETURN
    - Unplug from power and USB
    - Label and disconnect all wires
    - Removal of the board tray
        - The MKS Gen 1.4 will not fit in the stock case.
- Removal of the old hot end
    - Keep the 40 MM fan
- Optional BLTouch remove Z-Stop
- Mount MKS Gen 1.4 into printed case.
- Install the firmware on the MKS Gen 1.4
- Move old extruder motor to top.
- Install new extruder on top.
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- Install hotend to the mount.
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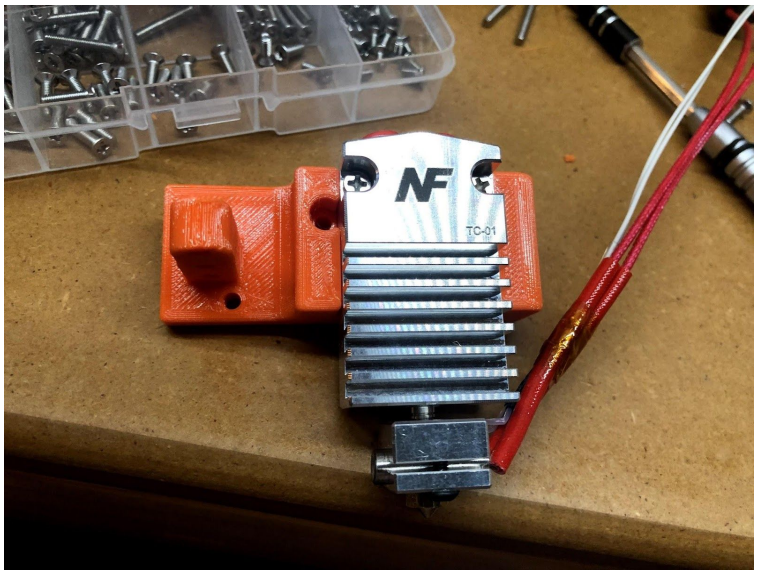
- 

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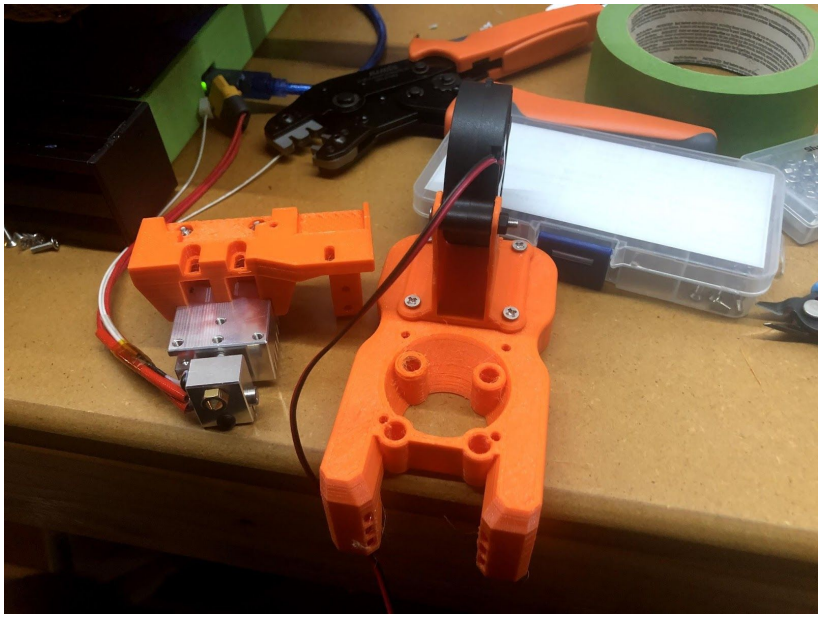
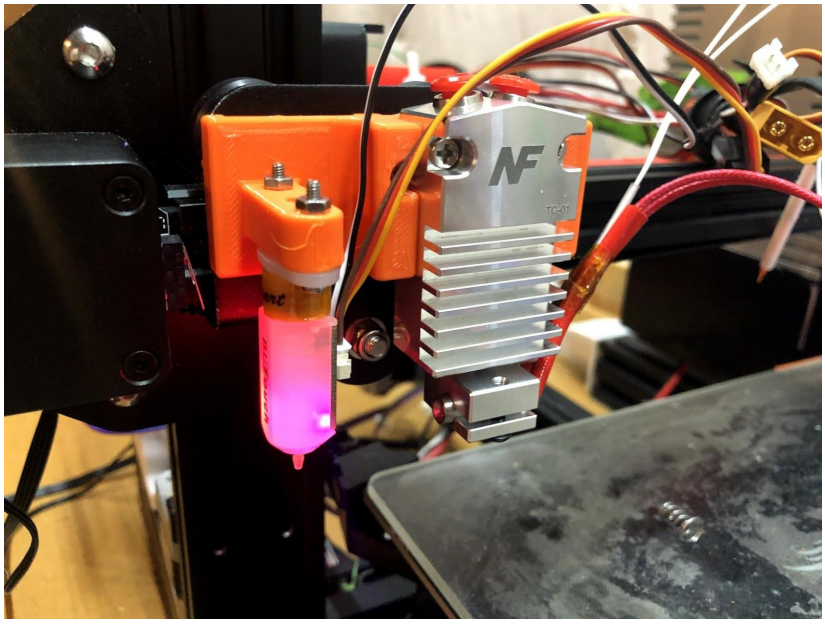
- Optional - Mount the 5015 radial fan
- 
- Install hotend mount to carriage.
- 
- Optional Install BLTouch to carriage
    - See above
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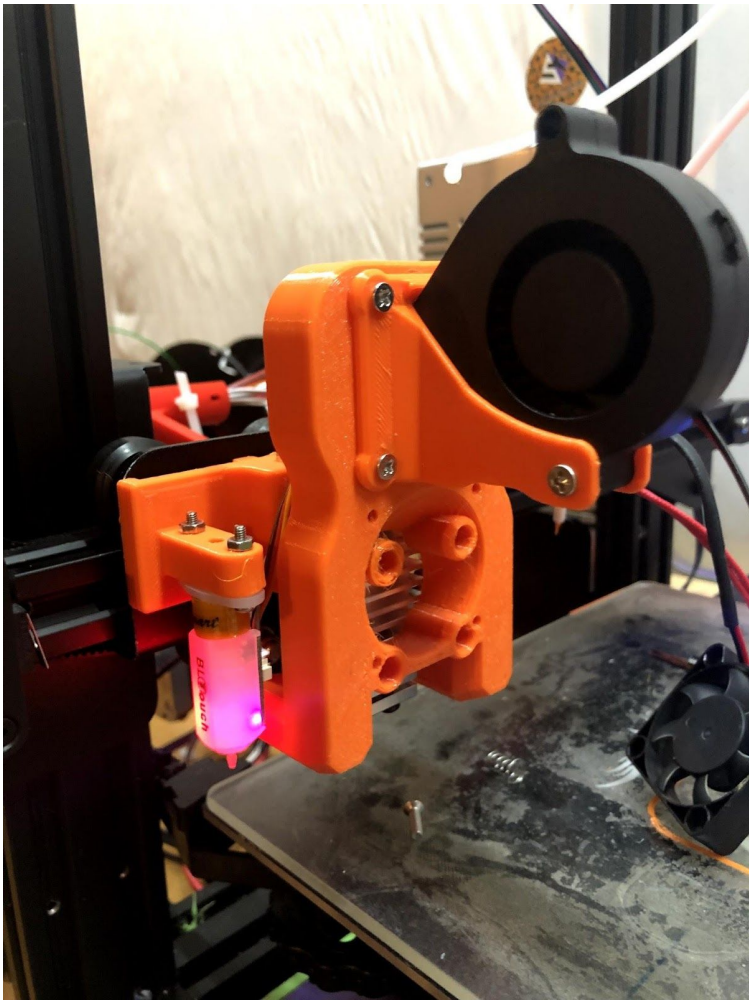
- Install parts cooler
  - 
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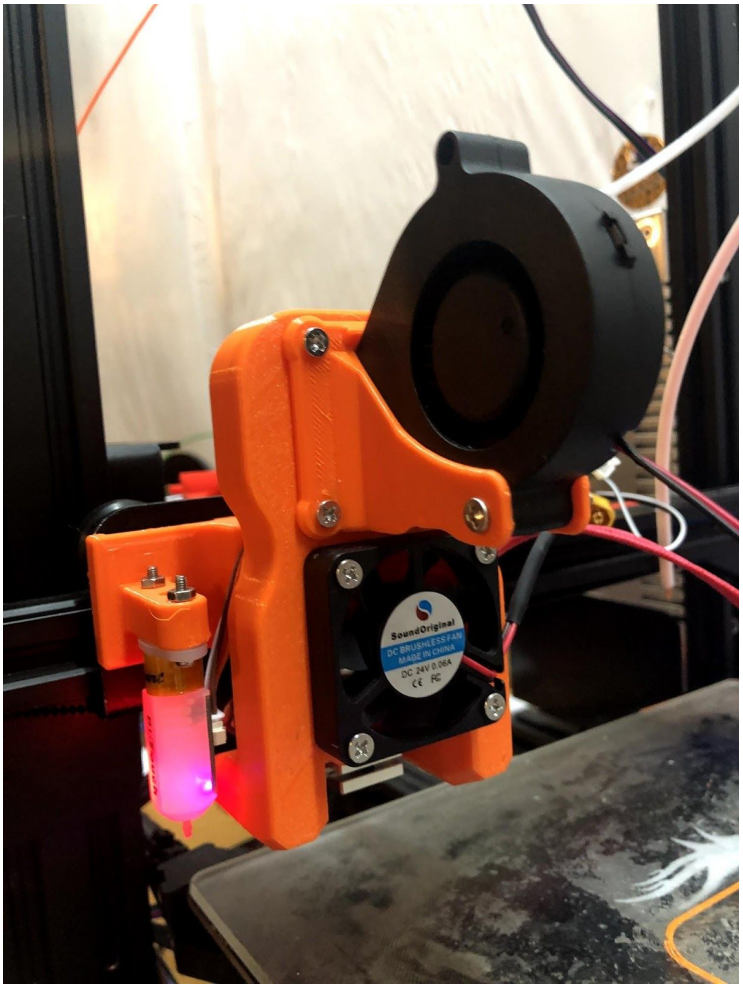
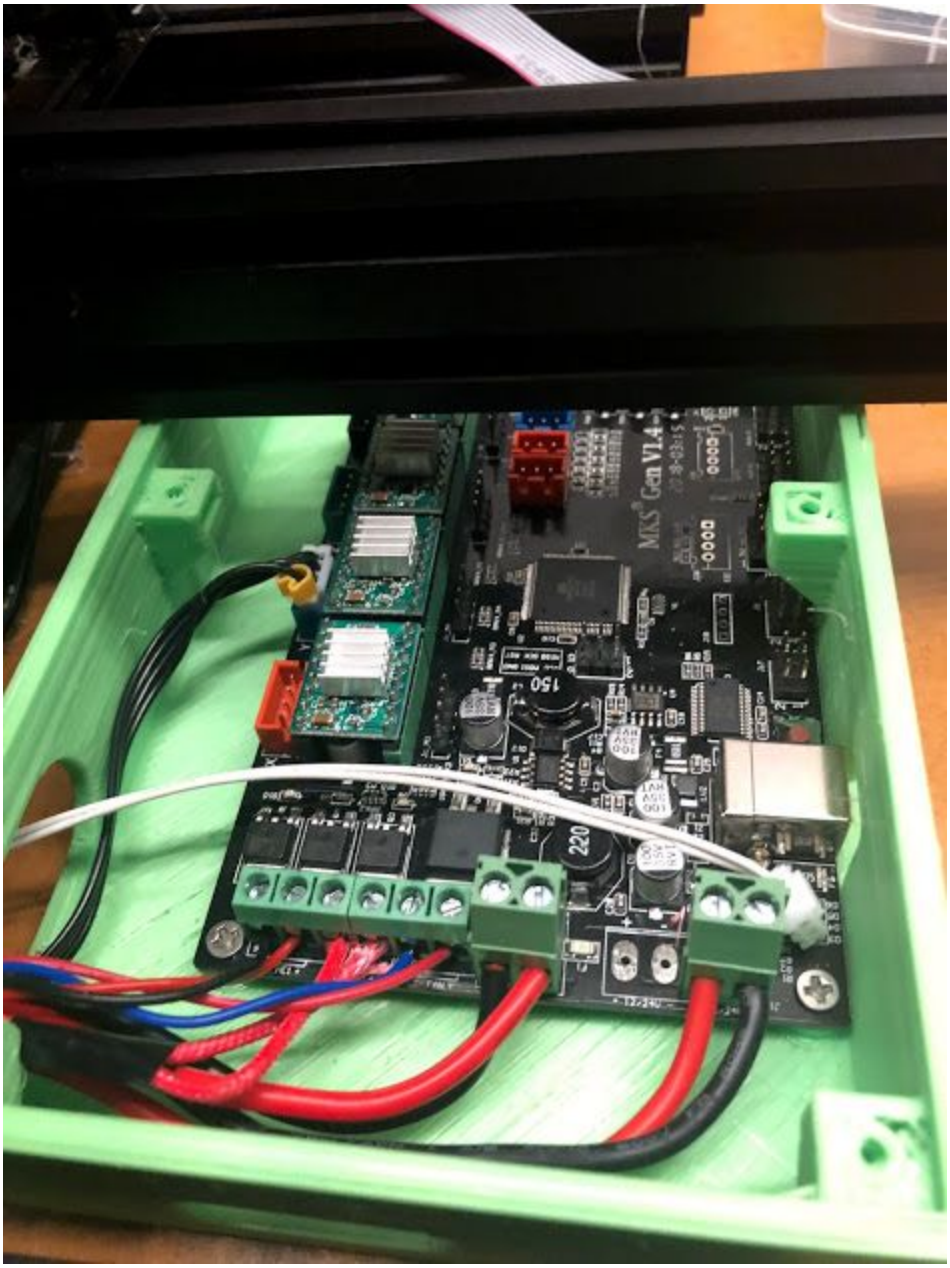
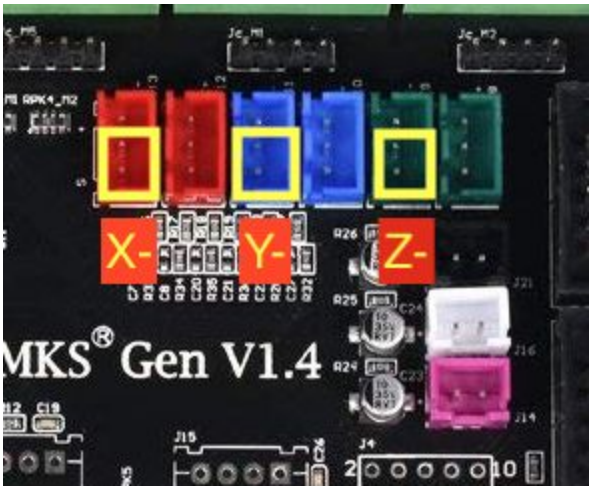
- Install the hot end fan.
- 

- Wire the main board
    - MOSFETs and Power

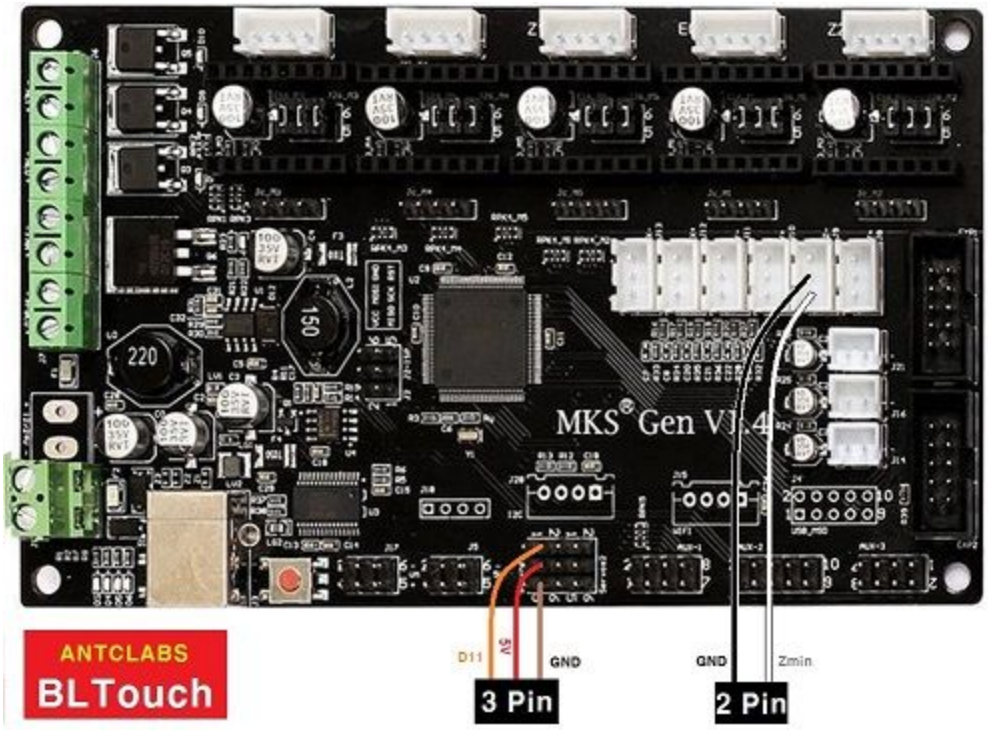


        - When a wire pair has a red/black: Red to +, Black to -
        - When a wire pair is same color, it doesn't matter which goes to which.
        - Connect the main line power into the 24V power in
        - Connect the hot end fan to the HE1 (HE1 is unused and reassigned to automatic hot end fan control.)
        - Connect the hot end heater to HE0
        - Connect the bed heater to HEAT BED
        - Connect the parts fan/blower to FAN

- Stops



  - Connect the X min stop to J13 (X-)
  - Connect the Y min stop to J11 (Y-)
  - Optional No BLTouch
    - Connect the Z min stop to J9 (Z-)
- BLTouch Wiring



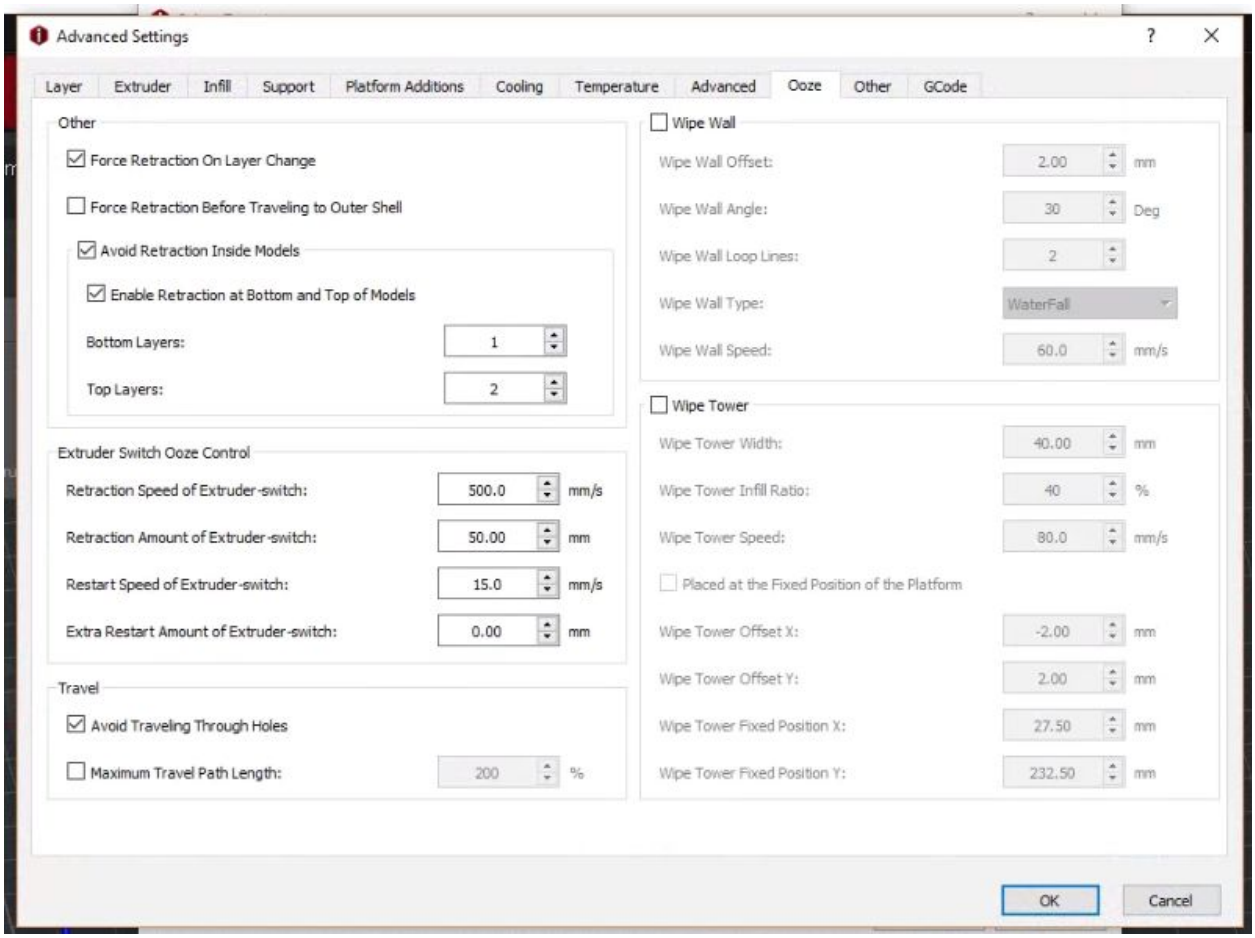
  - Z Stop
    - Place the White and Black BLTouch wires into the Z Stop Min
  - BLTouch Control Lines (Only for BLTouch)
    - Install the Orange wire onto D11
    - Install the Red wire to the +5V pin below D11
    - Install the Brown wire to the GND pin below the +5V pin

- Stepper Motors
    - Note for Creality Nema 17 Motors ONLY
        - If you are using new cables to connect to the stock nema 17 motors, you will need to switch the internal 2 wires on the cables.
        - The 4 pin side should be [1234], the 6 pin side should be [1 32 4].
    - Connect X, Y and Z. All labelled from the stock disassembly
    - Connect E0 to the left extruder stepper motor
    - Connect E1 to the right extruder stepper motor
- Thermistors

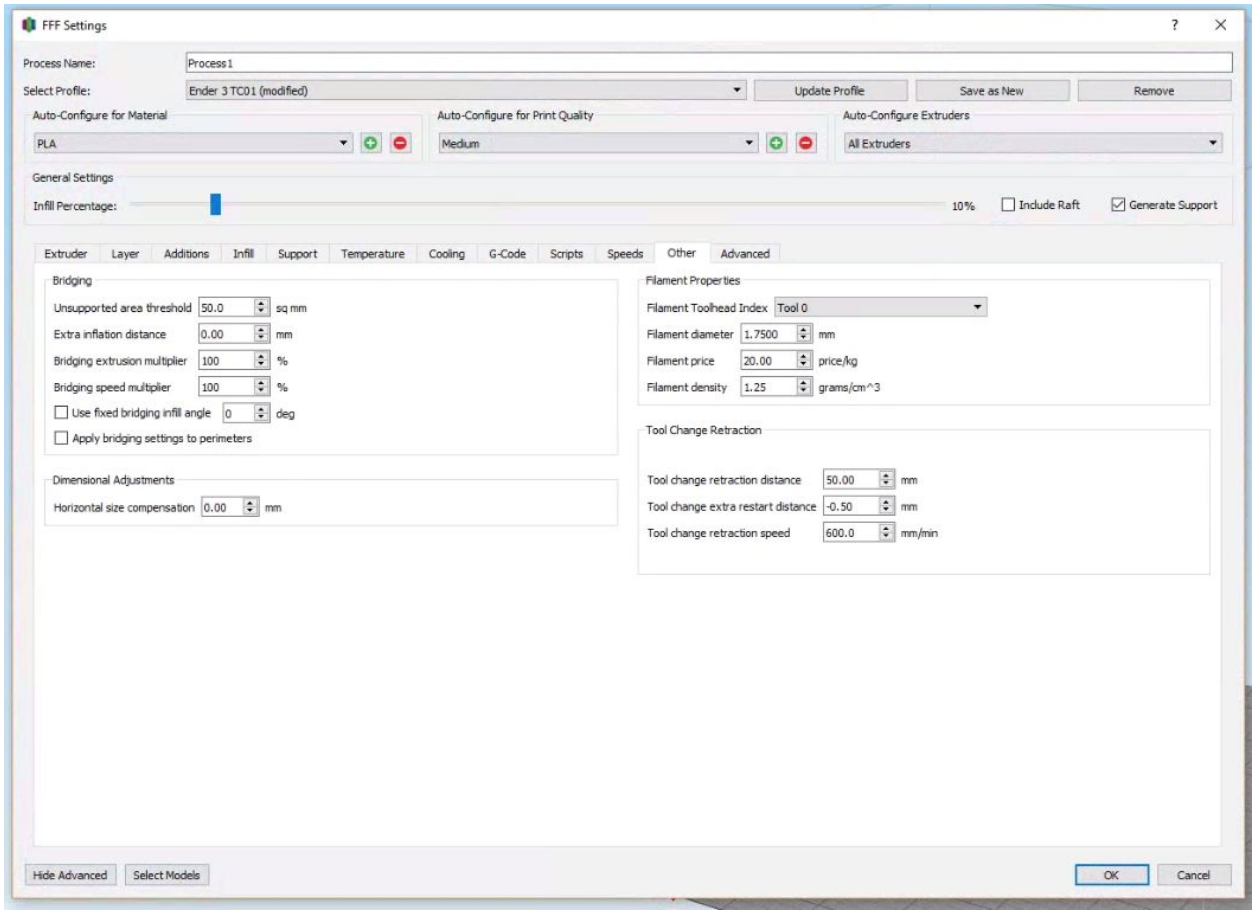
    - Connect the hot end thermistor to J21 (black)
    - Connect the bed thermistor to J16 (white)

- LCD Ribbon Cable

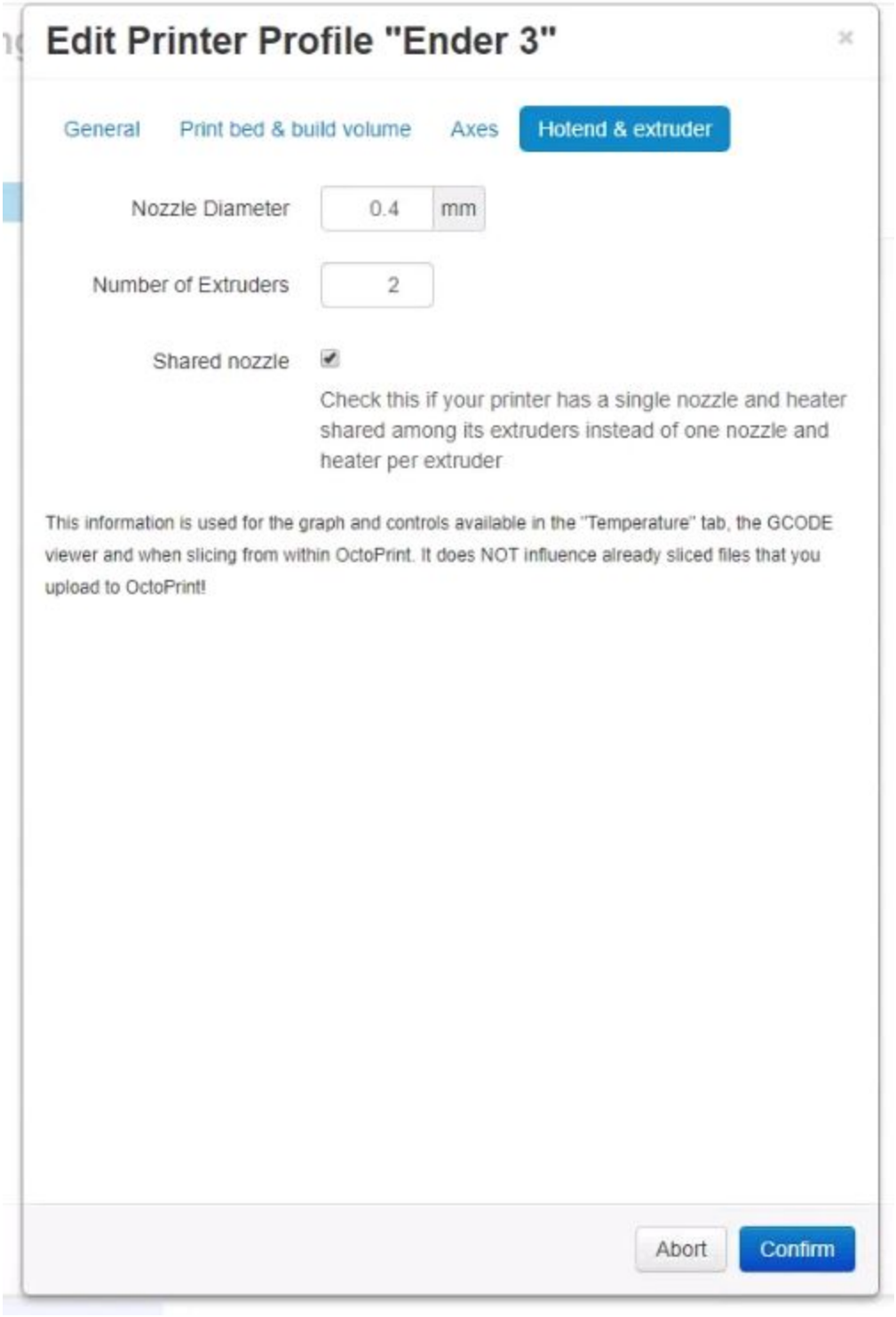
    - The LCD cable must be installed with the tab facing left. This means that the cutout for the guide tab is on the wrong side. Creating a new cutout is the easiest solution.
- Reconnect Ender 3 to power.
- Run PID Autotune and update values.
    - `M303 E0 S200 C8`
- Calibrate new Steps Per MM for each extruder.
    - Note: a common misunderstanding is that you calibrate from the nozzle. Take the bowden tube out of the hotend and calibrate from the end of the tube.

    - https://mattshub.com/2017/04/19/extruder-calibration/
- Update your settings in your slicer.
    - New Printer Settings
        - X=235
        - Y=235
        - Z=250
        - Extruders = 2
        - T0 is left
        - T1 is right
        - It is a shared nozzle or nozzle offset of 0,0. Whichever your slicer supports.
    - Dual Material Settings
        - TC-01 Retraction Amount 41 (I tuned mine to 50).
        - TC-02 Retraction Amount 35 (Untuned currently).
        - IdeaMaker
    - 

    - Simplify3d

- 

- Optional - update your printer settings in Octoprint
    - This will not change any print settings but will allow octoprint to show the controls for the second hot end and will render the GCode previews properly.


Edit Printer Profile "Ender 3"
General
Print bed & build volume
Axes
Hotend & extruder
Nozzle Diameter
0.4
mm
Number of Extruders
2
Shared nozzle
Check this if your printer has a single nozzle and heater shared among its extruders instead of one nozzle and heater per extruder
This information is used for the graph and controls available in the "Temperature" tab, the GCODE viewer and when slicing from within OctoPrint. It does NOT influence already sliced files that you upload to OctoPrint!
Abort
Confirm

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