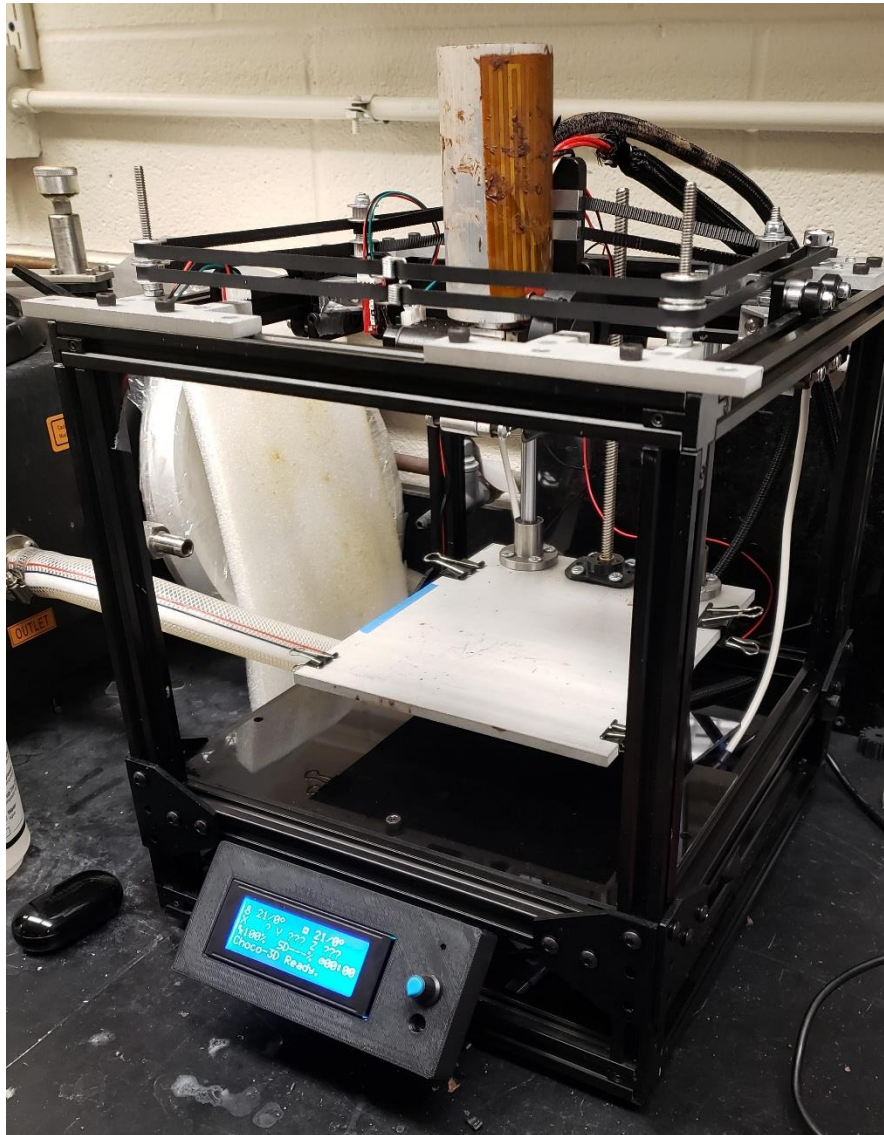**Appendix B: User Guide**

The 3D Chocolate Printer
# (3DCP)
User Guide

Overview

This is the home info screen for the 3DCP.

It gives a host of information about the printer.

- The top row shows the temperature of the of the Chocolate Vat and the Extruder.
- The 2nd row shows the position of the printer in millimeters.
  - This may be inaccurate until the printer has been homed (The 3DCP will home itself automatically at the beginning of every print)
- The 3rd row tracks the progress of a 3D print, showing both % completed and time elapsed.
- The bottom row displays any relevant messages or errors the 3DCP might have.

To the right of the screen is the control knob.
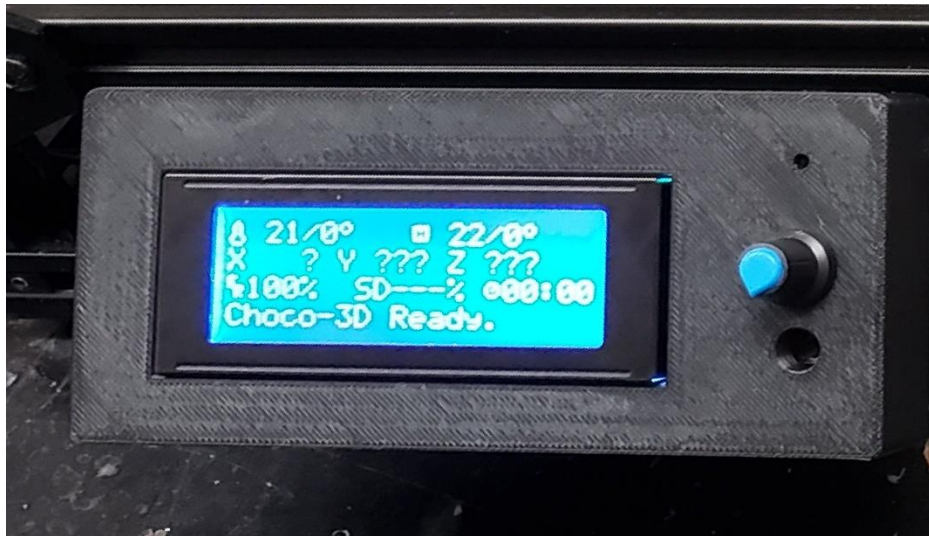
Twisting this knob allows the user to scroll through menus. Pressing the knob allows the user to select something.

On the left side of the screen is the SD card slot. This is where print files are stored, and this is how print files are moved from a computer to the 3DCP.

Preheating Procedure

Before starting any prints, the 3DCP must be preheated. This procedure melts the chocolate so that it is able to be printed. DO NOT START A PRINT UNTIL THE PREHEATING PROCEDURE IS COMPLETE.

1. To start the preheat, open the main menu and select "Temperature":

2. Select "Preheat Choco":

3. Select "Preheat Choco":

4. Once this is completed, return to the home screen.
5. WAIT. This step may take 10-15 minutes. Periodically check the chocolate in the vat. When the Chocolate in the vat is melted, the Preheating Procedure is complete. The 3DCP is now ready to print.

Start a 3D Print
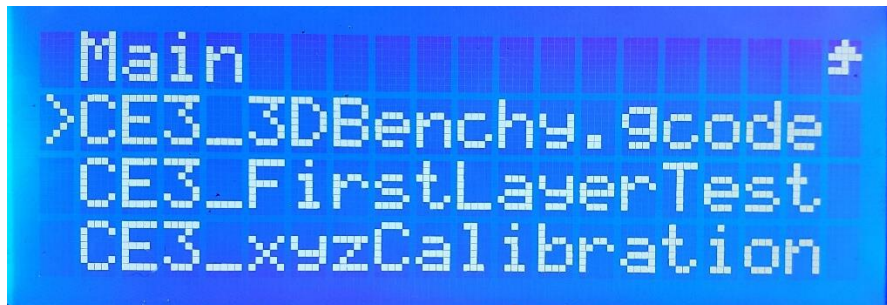
Ensure that the preheating procedure has been completed before starting a print. The 3DCP will not print properly until the chocolate is warmed up and melted.

1. To start a 3D print, open the main menu and scroll down to select "Print from Media":
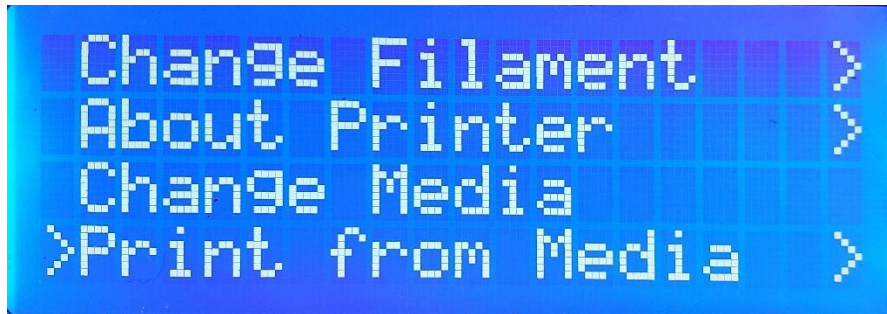
2. Select the model to print. In this example, "CE3_3DBenchy.gcode" will be printed.

3. Select "Print" and the 3DCP will start the print.

Using CURA to Slice 3D files

CURA is a 3D slicer that can be used to generate G-code files for the 3DCP to print. This procedure outlines setting up the 3DCP in CURA and adding a profile for printing chocolate.

1. Open CURA.
2. In the top left corner, click on "settings => printer => add printer". The following menu will appear.
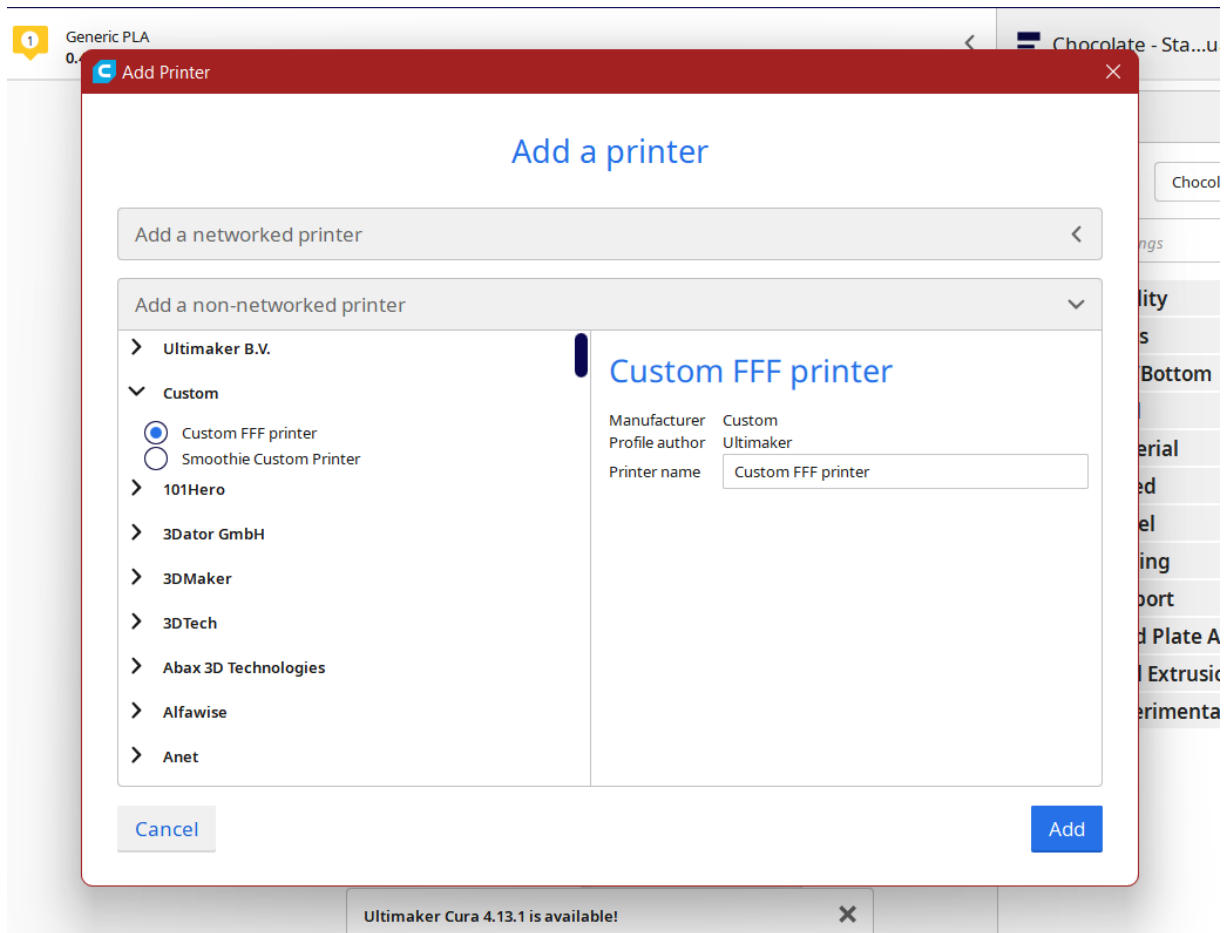
3. Click the "Add a non-networked printer", select "Custom" and "Custom FFF Printer".
4. Give it a name in the "Printer name" box on the right, and hit "Add". The Machine Settings should now appear.

Machine Settings

Choco3D

| Printer | Extruder 1 |

Printer Settings

X (Width)	115.0	mm
Y (Depth)	120.0	mm
Z (Height)	205.0	mm
Build plate shape	Rectangular	
Origin at center		
Heated bed	✓	
Heated build volume		
G-code flavor	Marlin	

Printhead Settings

X min	-26	mm
Y min	-32	mm
X max	32	mm
Y max	34	mm
Gantry Height	25.0	mm
Number of Extruders	1	
Apply Extruder offsets to GCode		

Start G-code

```
G92 E0 ; Reset Extruder
G28 ; Home all axes
G1 Z2.0 F3000 ; Move Z Axis up little to prev
G1 X0.1 Y20 Z0.3 F5000.0 ; Move to start posi
G1 X0.1 Y200.0 Z0.3 F1500.0 E15 ; Draw the fi
G1 X0.4 Y200.0 Z0.3 F5000.0 ; Move to side a
G1 X0.4 Y20 Z0.3 F1500.0 E30 ; Draw the secon
G92 E0 ; Reset Extruder
G1 Z2.0 F3000 ; Move Z Axis up little to prev
G1 X5 Y20 Z0.3 F5000.0 ; Move over to prevent
```

End G-code

```
G1 Z10 ;Raise Z more
G90 ;Absolute positioning

G1 X0 Y{machine_depth} ;Present print
M106 S0 ;Turn-off fan
M104 S0 ;Turn-off hotend
M140 S0 ;Turn-off bed

M84 X Y E ;Disable all steppers but Z
```

Close

1. Change the "X (Width)" value, the "Y (Depth)" value, and the "Z (Height)" value to match those shown above.
2. Select Build plate shape to be "Rectangular".
3. Make sure "Heated Bed" is checked.
4. Select "Marlin" as the G-code flavor.
5. Make sure "Apply Extruder offsets to Gcode" is NOT checked.
6. Paste the following in the "Start G-code" box:

```
G92 E0 ; Reset Extruder
G28 ; Home all axes
G1 Z2.0 F3000 ; Move Z Axis up little to prevent scratching of Heat Bed
G1 X0.1 Y20 Z0.3 F5000.0 ; Move to start position
G1 X0.1 Y200.0 Z0.3 F1500.0 E15 ; Draw the first line
G1 X0.4 Y200.0 Z0.3 F5000.0 ; Move to side a little
G1 X0.4 Y20 Z0.3 F1500.0 E30 ; Draw the second line
G92 E0 ; Reset Extruder
G1 Z2.0 F3000 ; Move Z Axis up little to prevent scratching of Heat Bed
G1 X5 Y20 Z0.3 F5000.0 ; Move over to prevent blob squish
```

7. Paste the following in the "End G-code" box:

```
91 ;Relative positioning
G1 E-2 F2700 ;Retract a bit
G1 E-2 Z0.2 F2400 ;Retract and raise Z
```

```
G1 X5 Y5 F3000 ;Wipe out
G1 Z10 ;Raise Z more
G90 ;Absolute positioning

G1 X0 Y{machine_depth} ;Present print
M106 S0 ;Turn-off fan
M104 S0 ;Turn-off hotend
M140 S0 ;Turn-off bed

M84 X Y E ;Disable all steppers but Z
```
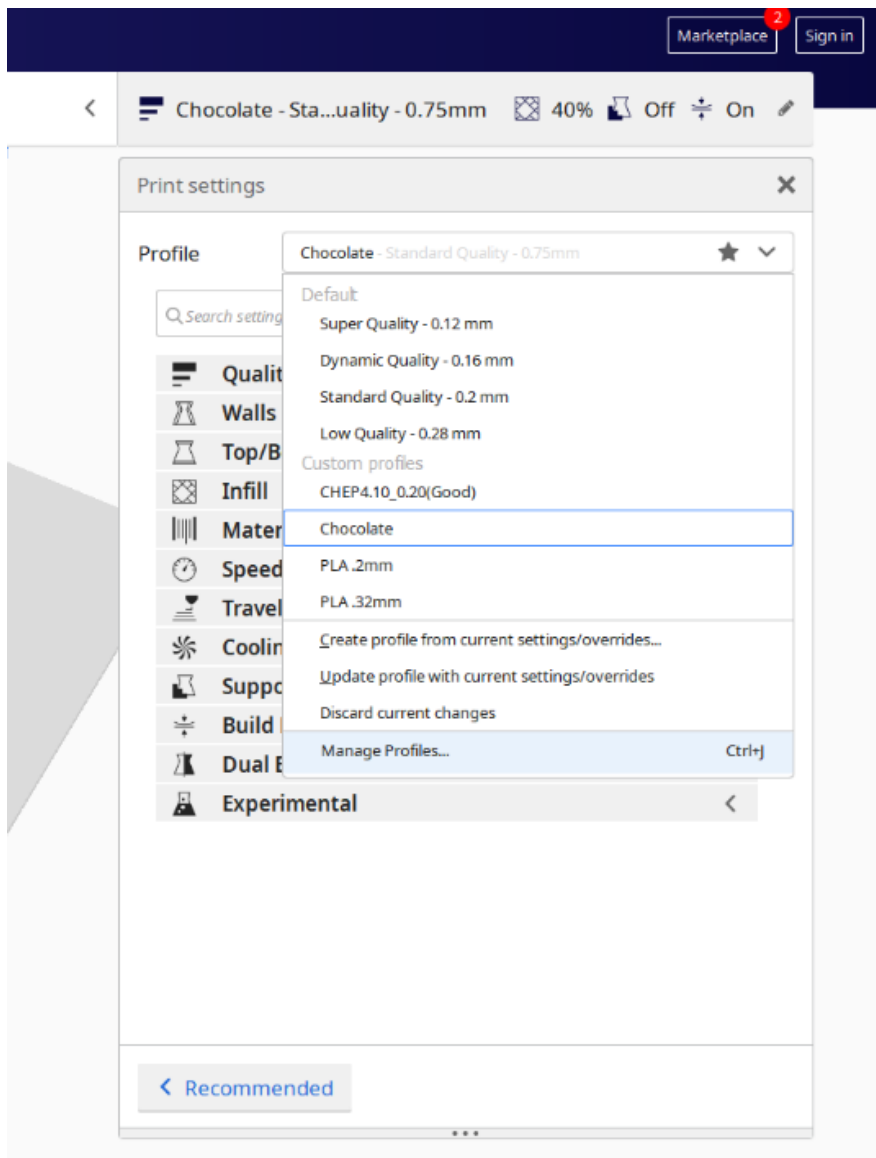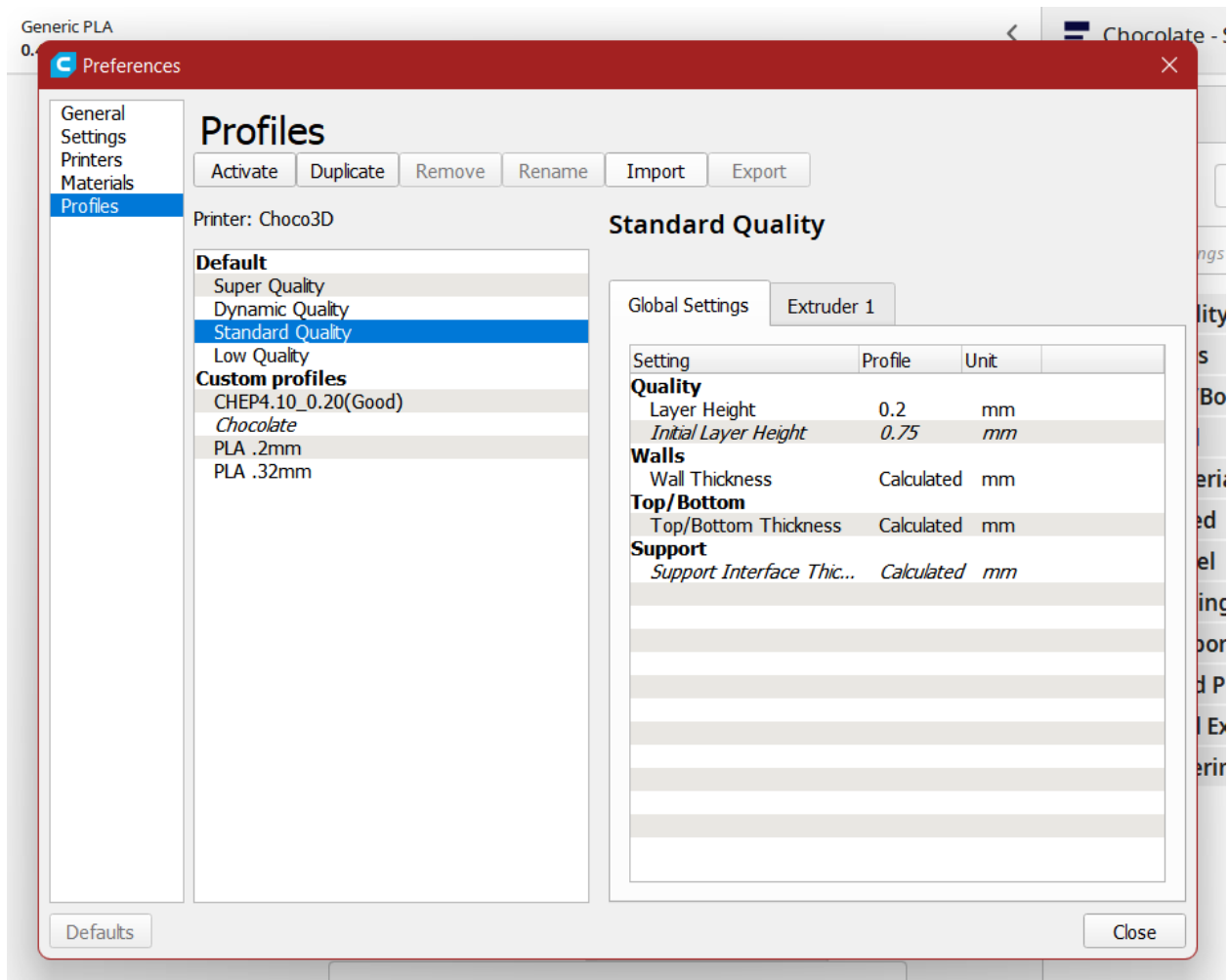
8. Select "close" in the bottom right to exit the settings.

The 3DCP is now set up in CURA. To add a profile to print chocolate, use the following steps.

9. Click the "Print Settings" drop-down in the top right. Click the dropdown next to "Profile" and select "Manage Profiles".

10. In the Profiles menu, select the "Import" button.

11. Use the file "Chocolate_Cura_Profile.curaprofile". It should appear under the Custom profiles tab.
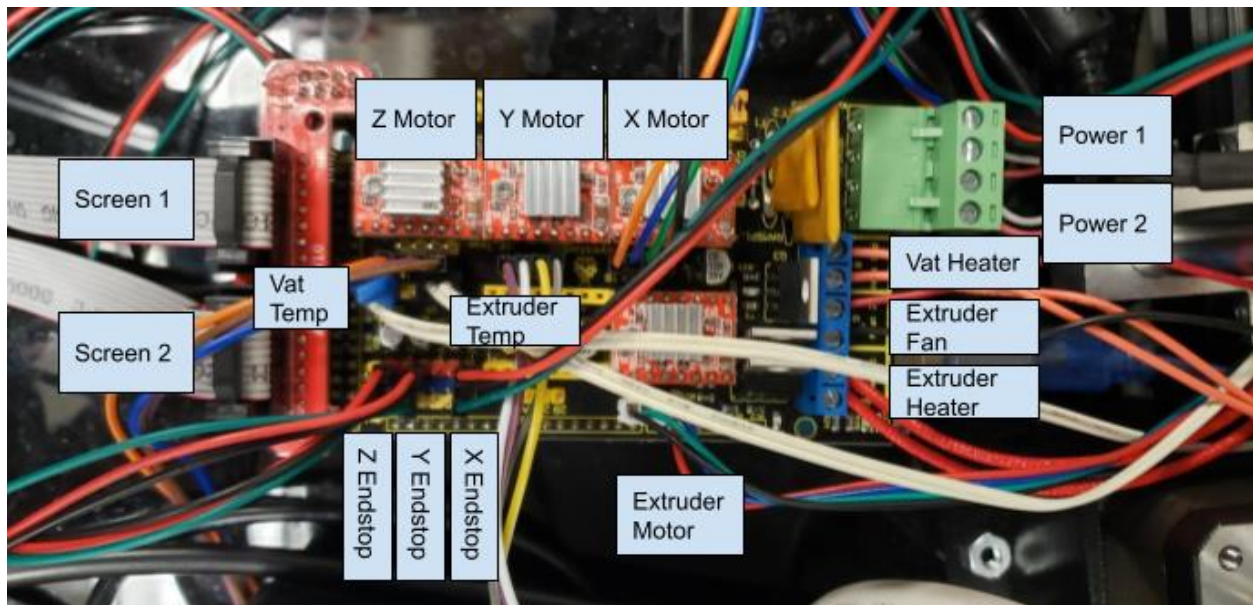12. Select the profile and hit "Activate" at the top left.
13. Close the menu.

CURA is now properly configured for the 3DCP. Upload any .STL file and CURA will generate a G-code for the 3DCP. Save the .gcode file to the SD card and insert the SD card into the 3DCP to print it.

Wiring Diagram

Additional wiring info can be found on the controller's website here:

https://reprap.org/wiki/RAMPS_1.4

Troubleshooting Common Problems

1. **Print from Media doesn't appear in menu:**
   a. Remove and re-insert the SD card. Sometimes it doesn't seat correctly in the SD card slot.
   b. Verify that the SD card appears if plugged into a computer. If not, there may be an issue with the SD card

2. **Extruder/Vat is "Heating" but the indicated temperature is not changing:**
   a. Check that the thermistor (sensor with white wires) is inserted into the extruder
   b. Check that the thermistor (sensor with white wires) is plugged into the controller correctly (see wiring diagram)
   c. Check the heater wires are wired correctly (see wiring diagram)
   d. Note – the 3DCP does have a feature called "Thermal Runaway Protection". While heating, if it does not detect a change in temperature for the vat/extruder after a certain period of time, it will throw an error and cease heating. Occasionally, the vat heats slowly enough that it triggers this protection. Unplug and re-plug in the 3DCP to reset it.

3. **The print has started, but chocolate isn't coming out of the extruder:**
   a. Verify that the chocolate is completely melted. Perform the preheating procedure again.
   b. Listen to the extruder motor. If it is making a clicking sound, it is skipping and not extruding correctly.
      i. Loosen the 4 bolts on the cover of the extruder slightly.
   c. Poke a needle up the nozzle to verify that the nozzle is not clogged. If the needle is covered in melted chocolate, the nozzle is not clogged.
   d. Use the temperature menu to increase the extruder temperature by a few degrees

4. **The print has started, but only a small amount of chocolate is coming out of the extruder:**
   a. Add more chocolate to the vat. When the vat gets low, the extruder does not extrude well.
   b. In the "tune" menu while printing, increase the "flow rate" parameter.

5. **The Motors are very loud:**
   a. Are they moving? Yes:
      i. This is probably normal: these stepper motors can be very noisy under load, especially the Z axis motor
      ii. Remove anything loose in the bottom of the 3DCP (bolts, screws, etc.) that could be vibrating
   b. Are they moving? No:
      i. Check to see if any of the motion system caught.
      ii. Try homing the printer: under the "motion menu" select "Auto Home".