STACKER

INDUSTRIAL GRADE 3D PRINTERS

STACKER S4 and STACKER S2
USER GUIDE – PART II

User Guide - STACKER S2/S4 - Part II

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1. Introduction

Welcome to STACKER! Our high performance industrial grade "S" Series 3D printers capable of producing everything from one-off prototypes to multiple part production runs. To get the most out of your Stacker 3D printer, please read the entire User Guide – Part I before attempting to operate your printer. Part I of the User Guide should provide all the information necessary to set up and operate your printer.

1.1 About This Guide

The Stacker S2 and Stacker S4 User Guide – Part II provides expanded and advanced information about printer operation.

2. CONTROLS

2.1. LCD Controls

The LCD controller is a very powerful tool for operating your printer. For most users, the LCD controls will be used for basic functions like warming up the printer's nozzles and bed, and starting from and SD card and stopping prints. The following section is provided for the advanced users. The LCD menus enable the user to do just about anything that can be done with Stacker RUN. Because the LCD menus provide so much control, you should always be very careful when making changes to your printer's settings through the LCD.

Default Screen
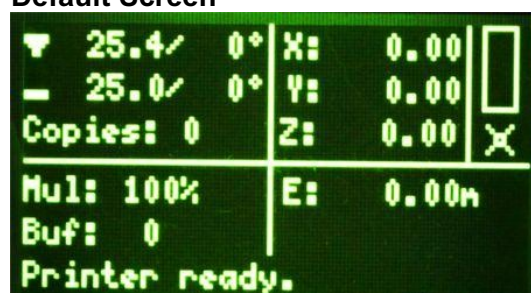
The Stacker splash screen will appear briefly on your LCD screen during startup. When the splash screen vanishes, you will see the default screen. The default screen divided into four quadrants which provide basic information about the printer's status.

▸ The top left quadrant shows the actual extruder and bed temperatures, as well as, the temperatures the bed and extruder are attempting to reach. In the image above, the bed and extruder are both showing about 25°C which is near room temperature, and they are set to a temperature of 0°C, so the extruders are turned off. Below the temperatures, it shows the number of copies selected. On our screen, it shows 0 copes which means multi-part mode has not been turned on and the printer will only print with head one.
▸ The lower left displays the speed multiplier and the buffer number.
▸ The upper right shows the position of extruder one. In our case, the printhead has been homed to the X, Y, Z position of 0,0,0.
▸ The lower right quadrant shows the amount of filament that has been extruded during the print. In our case, the number is 0.00m.

Main Menu
By pressing the controller once knob, you will open the main menu. From the main menu, you can choose from a number of a number of sub-menus by turning the knob and depressing it to make your selection. If you ever wish to go back, select "Back ⌐" from the menu to return to the previous screen.

 Main Menu

Back ⌐
Quick Settings »
Position »
Extruder »
Fan Speed »
SD Card »
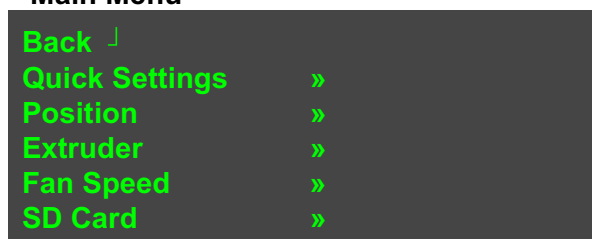
```
Debugging              »
Configuration          »
```

Main Menu » Quick Settings

```
Back ⌐
Home All
Z babystep. : 0.00mm
Speed mul. : 100%
Flow mul. : 100%
Change filament
Preheat PLA
Preheat ABS
Cooldown
Set to origin
Disable stepper
```

Home All: The X, Y, and Z axes will all move to their home positions.

Z babystep: Will move Z axis incremental distances around 0.01mm per click.

Speed multiplier: While you are printing, this will override the programed rate of movement to increase or decrease the actual print speed by a percentage.

Flow multiplier: While printing, this will override the programmed filament feed rate to increase or decrease the amount of filament extruded by a percentage.

Change filament: Drops bed a small amount and enables filament to be changed.

Preheat PLA: Unfortunately, these settings are incorrect for Stacker, but Extruder 1 will be set to 190°C and the bed temperature will preheat 60°C.

Preheat ABS: Unfortunately, these settings are incorrect for Stacker, but Extruder 1 will be set to 240°C and the bed temperature will preheat 110°C.

Cooldown: Will turn off the temperatures to allow the printer to cool down prior to turning off the printer.

Set to origin: n/a

Disable Stepper: Turns off the X and Y stepper motors enabling the user to easily move the X/Y gantry by hand.

Main Menu » Position

```
Back ⌐
Home All
Home X
Home Y
Home Z
X pos. Fast              »
X position               »
Y pos. Fast              »
Y position               »
Z pos. Fast              »
Z position               »
Extr. position           »
Set print offsets        »
```

Home All: The X, Y, and Z axes will all move to their home positions.

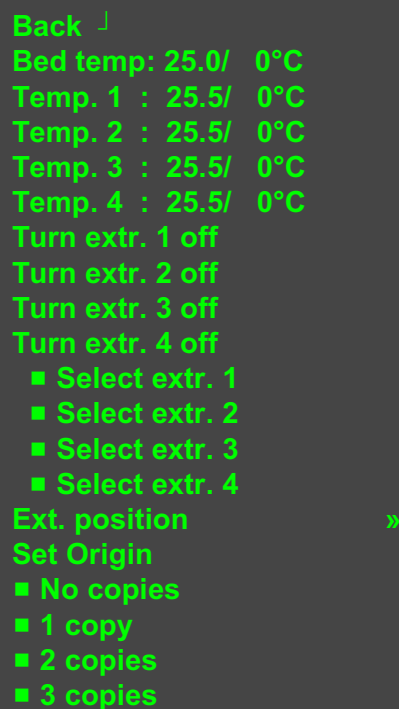**Home X / Home Y / Home Z:** Will move the selected axis to its home position.

X pos. Fast / Y pos. Fast / Z pos. Fast: Enables user to change the selected axis position quickly by turning the knob. Each rotated click moves the axis about 10mm.

X position / Y position / Z position: Enables user to make small changes the chosen position by turning the knob. Each rotated click moves the axis about 1mm.

Extr. Position: Advance or retract the filament by turning the knob right or left. **Note, be sure your extruder is hot before attempting to advance filament into the extruder**. Filament will not move through a cold extruder, and your filament will strip in the filament drive.

Set print offsets: Allows you to set print offsets for X, Y, and Z in mm.

Main Menu » Extruder

```
Back  ↵
Bed temp: 25.0/  0°C
Temp. 1 :  25.5/  0°C
Temp. 2 :  25.5/  0°C
Temp. 3 :  25.5/  0°C
Temp. 4 :  25.5/  0°C
Turn extr. 1 off
Turn extr. 2 off
Turn extr. 3 off
Turn extr. 4 off
 ■ Select extr. 1
 ■ Select extr. 2
 ■ Select extr. 3
 ■ Select extr. 4
Ext. position              »
Set Origin
 ■ No copies
 ■ 1 copy
 ■ 2 copies
 ■ 3 copies
```

Bed temp: Turning the knob will allow you to adjust the bed temperature. The temperature on the right shows the current temperature of the bed, and the temperature on the left displays the temperature you have requested Adjustments made during a print will override any GCODE bed temperature settings.

Temp. 1 / Temp 2. / Temp. 3. / Temp. 4: Turning the knob will allow you to adjust the extruder temperature. The temperature on the right shows the current temperature of the extruder, and the temperature on the left displays the temperature you have requested Adjustments made during a print will override any GCODE bed temperature settings.

Turn extr. 1 off / Turn extr. 2 off / Turn extr. 3 off / Turn extr. 4 off: The extruder selected will be turned off, i.e., the temperature will immediately be set to 0°C.

Select extr. 1 / Select extr. 2 / Select extr. 3 / Select extr 4: Selects an extruder that will be affected by changes.

Ext. position: Makes changes to the extruder position.

Set origin: This will reset the feed position counter.

No copies / 1 copy / 2 copies / 3 copies: When printing with multi-head mode and making copies of a print, No copies will only operate extruder 1, 1 copy will enable extruder 1 and

extruder 2 to perform duplicate movements, 2 copies will enable extruders 1, 2, and 3 to perform the same movements, and 3 copies will enable all of the heads to make the same movements.

Main Menu » Fan Speed

```
Back  ⌋
Turn Fan Off
Set Fan 25%
Set Fan 50%
Set Fan 75%
Set Fan Full
Ignore M106 cmd ■
```

Turn Fan Off: Shuts down the fan.
Set Fan 25% / Set Fan 50% / Set Fan 75% / Set Fan Full: Adjusts the blower fan speed on the print from 25% to 100%.
Ignore M106 cmd: Turning this feature on will override any GCODE commands regarding the fan for the remainder of the print. Therefore you can manually set a fan speed, and the GCODE will not override your manual setting.

Main Menu » SD Card

```
Back  ⌋
Print file
Pause print
Resume print
Delete file
```

Print file: Selecting this option will open a list of files available on the SD card. You can browse and select the file you wish to print. *The selected print will begin immediately*.
Pause print: To temporarily stop the printing process, pause print will move heads close to Y-max position.
Resume print: This will resume a paused print, and continue the print where it left off.
Delete file: This will permanently remove the selected file from the SD card.

Main Menu » Debugging

```
Back  ⌋
Echo                :Off
Info                :On
Errors              :On
Dry Run             :Off
```

Echo: Will enable sending feedback to your host (a PC connected to the printer). To prevent communication errors, it is best to leave the echo *off*.
Info: Will send diagnostic messages to your host (a PC connected to the printer).
**Error:** Error messages will be sent to your host (a PC connected to the printer).
Dry Run: If turned on, your printer will ignore any extrusion commands. This is a useful method to watch the movements of your printheads without wasting any filament.

Main Menu » Configuration

```
Back        ⌐
General                »
Language               »
Acceleration           »
Feedrate               »
Extruder               »
Heating bed            »
Store to EEPROM        »
Load f. EEPROM         »
```

ATTENTION: Be careful with the Configuration menu items. Altering values in the Configuration menu can have major effects upon the printer. Read and be sure to fully understand the ramifications of the setting you are changing before making any changes within the Configuration menu. Improper settings can damage your printer.

Main Menu » Configuration » General

```
Back        ⌐
Baudrate            250000
Stepper inactive    »
Max. inactive       »
Autolevel:          Off
```
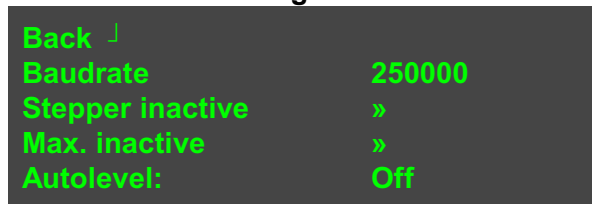
Baudrate: This should be set to 250000.
Stepper inactive: This sets a timer as to when the stepper motors to power off after remaining idle for a specified amount of time.
Max. inactive: This sets a timer as to when the extruders and heated bed are powered off after remaining idle for a specified amount of time. *Note, this has been turned off to allow your GCODE to control heat power off.*
Autolevel: Should be set to Off.

Main Menu » Configuration » Language

```
Back        ⌐
English
Deutsch
Expanol
Portugues
Francais
Nederlandse
Italiano
Svenska
Cestina
Polski
Türk
```

The language menu allows to to change all of the menus on the LCD to one of the listed languages.

Main Menu » Configuration » Acceleration

```
Back  ⌐
Print X              : 800
Print Y              : 800
Print Z              :   50
Move X               : 1000
Move Y               : 1000
Move Z               :   50
Jerk                 : 15.0
Z-Jerk               :  0.3
```

Acceleration is the time it takes for a movment to change from zero to a desired speed, and it is expressed in mm/sec².

With higher acceleration:
- Printer runs faster
- Corners are sharper
- Printer shakes more and makes more noise
- Possibility of missed steps increases (i.e., the printer can lose positional accuracy)

With lower acceleration:
- Prints runs slower
- Corners are more round and less sharp
- Printer is quieter
- More precision

Print X / Print Y / Print Z: These set the maximum acceleration for the for the X, Y, and Z movements while the printer is extruding.
Move X / Move Y / Move Z: These set the maximum acceleration rate for the X, Y, and Z movements when the printer is not extruding.
Jerk: Jerk is the speed at which the extruder changes direction. A high setting will make your printer shake more, but it will reduce print time and have less blobs. A low jerk value will cause less mechanical stress to the printer, but you can lose sharp edges because of the smoother movement.
Z-Jerk: Is the Jerk setting for Z movements rather than the X/Y movements of the printer.

Main Menu » Configuration » Feedrate

```
Back  ⌐
Max X                : 200
Max Y                : 200
Max Z                :  80
Home X               :  40
Home Y               :  40
Home Z               :  10
```

Feedrate is the axes speeds expressed in mm/sec².
Max X / Max Y / Max Z: Set the maximum speed of movements of the X, Y, and Z axes.
Home X / Home Y / Home Z: These set the maximum movement rate of the X, Y, and Z axes during homing movements.

Main Menu » Configuration » Extruder

Back ⏎	
■ **Select extr. 1**	
■ **Select extr. 2**	
■ **Select extr. 3**	
■ **Select extr. 4**	
X-Offset:	0.00
Y-Offset:	0.00
Steps/MM:	239.4
Start FR:	20
Max FR:	50
Accel:	5000
Stab. Time:	1
Wait retr.:	0 mm
Wait temp.	150°C
Control:	PID
PID P:	8.94
PID I:	0.51
PID D:	20.00
Drive Min:	40
Drive Max:	255
PID Max:	255

■ **Select extr. 1 / extr. 2 /extr. 3 / extr. 4:** Enables you to select which of the four extruders you are changing the settings. Once selected, you will see the parameters for the selected extruder.

X-Offset / Y-Offset: This setting will offset the head by a specified number of steps. Changes to the offset can be used for multi-material prints.

Steps/MM: This is the number of steps required to extrude 1mm of filament.

Start FR: This is the minimum feed rate (mm/minute) for the filament drive motor.

Max FR: This is the maximum feed rate (mm/minute) for the filament drive motor.

Accel: Sets the maximum acceleration (mm/sec²) for the filament drive motor.

Stab. Time: Sets the wait time (in seconds) once the temperatures have been reached on the extruder before starting the print.

Wait temp.: Automatic retraction will be performed after reaching a specified temperature.

Control: Set this to PID.

PID P / PID I / PID D: These parameters set the rules for a PID heater. See section 6.3 for more information.

Drive Min: Sets the minimum I value for the PID (0-255).

Drive Max: Sets the maximum I value for the PID (0-255).

PID Max: Sets the maximum voltage you can send to the heater (0-255).

Main Menu » Configuration » Heating bed

Back ⏎	
Control:	PID
PID P:	196.00
PID I:	33.00
PID D:	290.00

```
Drive Min:        80
Drive Max:        255
PID Max:          255
```

Control: Set this to PID.
PID P / PID I / PID D: These parameters set the rules for a PID heater. See section 6.3 for more information.
Drive Min: Sets the minimum I value for the PID (0-255).
Drive Max: Sets the maximum I value for the PID (0-255).
PID Max: Sets the maximum voltage you can send to the heater (0-255).

Main Menu » Configuration » Store to EEPROM

```
Back    ⌋
Configuration
stored in EEPROM
```

Store to EEPROM: If you have made changes within the Configuration settings, the changes will be lost unless you store the changes to the EEPROM. Store to EEPROM will save your changes permanently to the printer, so next time you turn on the printer, the settings will be the same.

Main Menu » Configuration » Read f. EEPROM

```
Back    ⌋
Configuration
loaded f. EEPROM
```

Loaded f. EEPROM: This option will overwrite the current machine settings with the last saved settings.

2.2. Manual control via Stacker RUN

A. Overview of controls

The manual control panel in Stacker RUN allows you to make incremental movements and home the X, Y, and Z axes, manually extrude or retract filament, turn on extruders, fans, and the heat bed. You can also manually adjust temperatures for the heat bed and extruders. Learn more about the manual control panel on the Repetier website:

http://www.repetier.com/documentation/repetier-host/rhmanual-control/

B. Sending G-code to the printer.

From the manual control panel, Stacker RUN can accept most G-code commands. For advanced users this can be quite helpful. Here is a list of some codes that are compatible with Stacker.

Implemented Codes
• G0 [X/Y/Z] [Position] - Rapid movement to position
• G1 [X/Y/Z/E] [Position]- Coordinated Movement to position

- G4 [S/P] - Dwell / Wait in ms
- G20 - Set units for G0/G1 to inches
- G21 - Set units for G0/G1 to mm
- G28 [X/Y/Z] - Home all axis or named axis
- G90 - Use absolute coordinates
- G91 - Use relative coordinates
- G92 [X Position/Y Position/Z Position/E Position] - Set position to coordinates given

RepRap M Codes
- M104 S [temperature] - Set extruder target temp
- M105 - Read current temp
- M106 S [0-255] - Set fan speed
- M107 - Fan off
- M109 S [temperature]- Wait for extruder current temp to reach target temp
- M112 - Emergency stop
- M114 - Display current position

Custom M Codes
- M20 - List files on SD card
- M21 - mount SD card
- M22 - unmount SD card
- M23 [filename] - Select an SD file for printing
- M24 - Pause/resume SD print
- M25 - Pause SD print
- M26 S [bytes]- Set SD position in bytes
- M27 - Report SD print status
- M28 [filename] - Write program to SD card
- M29 [filename] - Stop program write to SD card
- M82 - Set E codes absolute (default)
- M83 - Set E codes relative while in Absolute Coordinates (G90) mode
- M84 S [value]- Disable steppers until next move, or use S to specify an inactivity timeout, after which the steppers will be disabled. S0 to disable the timeout.
- M85 S [value]- Set inactivity shutdown timer with parameter S. To disable set zero (default)
- M92 [X Position/Y Position/Z Position/E Position] - Set axis steps per unit
- M115 - Capabilities string
- M140 S [Target Temperature] - Set bed target temp
- M190 - Wait for bed current temp to reach target temp.
- M201 X [value] Y [value] - Set max acceleration in units/s^2 for print moves (e.g., M201 X1000 Y1000)
- M202 X [value] Y[value] - Set max acceleration in units/s^2 for travel moves (M202 X1000 Y1000)
- M203 S[value]- Set temperature monitor to Sx
- M204 X[Kp] Y[Ki] Z[Kd] - Set PID parameter. Values are 100 x real value!
- M205 - Output EEPROM settings
- M206 - Set EEPROM value
- M231 S[OPS_MODE] X[Min_Distance] Y[Retract] Z[Backslash] F[Retract Move] - Set OPS parameter
- M232 - Read and reset maximum advance values
- M280 S0 - Print single head only (cancels ditto mode for more than one head)
- M280 S1 - Ditto print mode for heads 1 and 2 (for making two copies at same time)

- M280 S2 - Ditto print mode for heads 1, 2 and 3 (for making three copies at same time)
- M280 S3 - Ditto print mode for heads 1, 2, 3 and 4 (for making four copies at same time)

3. Multi-Head Printing

The Stacker S4 has four extruders and the Stacker S2 has two extruders. These extruders can be used to print the same part in different materials, at the same time. When printing copies of the same part, this is called *multi-part print mode*. When using more than one print head to print one part with different materials, it is called *multi-material print mode*.

3.1. Multi-part Print Mode

With Stacker's *multi-part print mode*, each extruder can print a copy of whatever is being printed by the first extruder. In other words, selected extruders will duplicate (copy) the movements of the first extruder. Because the S4 has four heads, you are able to print up to four copies in multi-part print mode, and the S2 can print up to two copies in multi-part print mode.

Step 1. Space and Secure the Extruder Heads. In multi-part print mode, each of your heads will operate on only a portion of the print bed. You must space your printheads apart at specific distances along the X gantry depending upon the number of printheads you will be using. Use the "Print Head Spacing Guide" on our custom BuildTak to determine the locations of the heads you will be using.
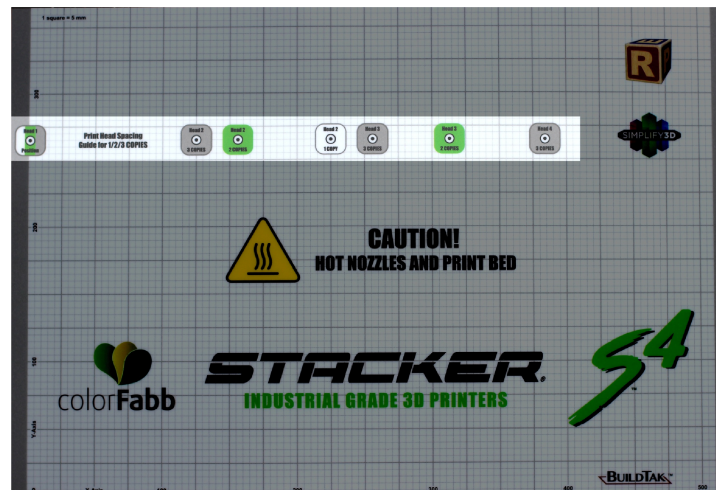

For example, if you were printing three copies, then you will be using three heads, and they would be positioned in the locations shown below.
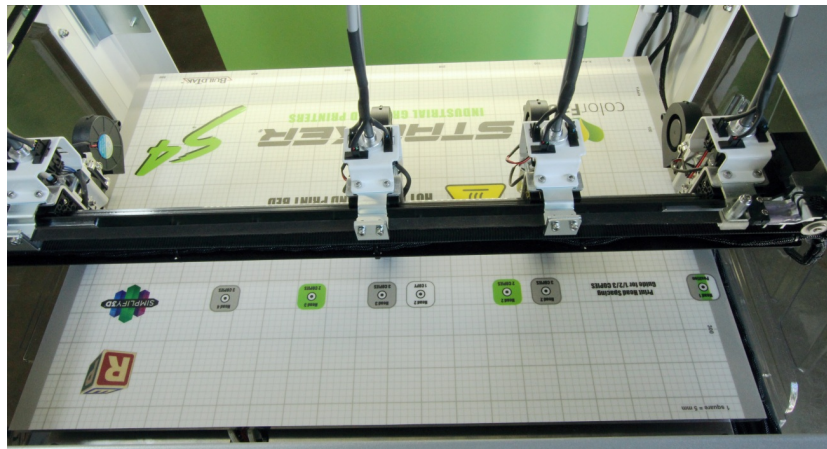
Once the heads have been positioned along the gantry where indicated by the guide, secure the heads by pushing the belt clamp bracket upward with your finger and securing it with a 2.5mm hex driver. Once tightened, make sure it is secured to the belt by moving head one. When head one moves, all of the secured heads should move together along the X-gantry in tandem.

It is best practice to slide the unused heads to the right side of the gantry away from the printing heads. Be careful to avoid tripping the X-Max End Stop with unused heads. The unused heads can also be removed from the gantry, see section 3.3.

X-Max Endstop
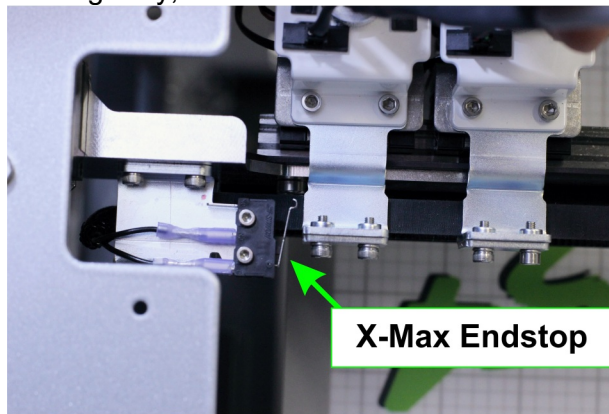
Step 2. Set Extrusion Mode on the LCD. To set the number of printheads you will be using in *multi-part print mode*, use the LCD to set the number of copies you wish to print.   **Main Menu » Extruder » (■ 1 Copy/■ 2 Copies/■ 3 Copies)**.

Be aware that when you are printing in *multi-part mode*, the total build volume available on the bed changes depending upon the number of printheads you are using in *multi-part mode*.

With the S4 printer:

Print Mode	Area (X-Axis)	Area (Y-Axis)	Area (Z-Axis)
No Copies	380	365	625
1 Copy	220	365	625

| 2 Copies | 150 | 365 | 625 |
| 3 Copies | 120 | 365 | 625 |

With the S2 Printer:

Print Mode	Area (X-Axis)	Area (Y-Axis)	Area (Z-Axis)
No Copies	380	310	525
1 Copy	195	310	525

When preparing the object to print in your slicing engine (e.g., Simplify3D), it is a good idea to adjust the bed size, so you see the actual space available for part placement and avoid overlapping your parts or tripping the endstop.
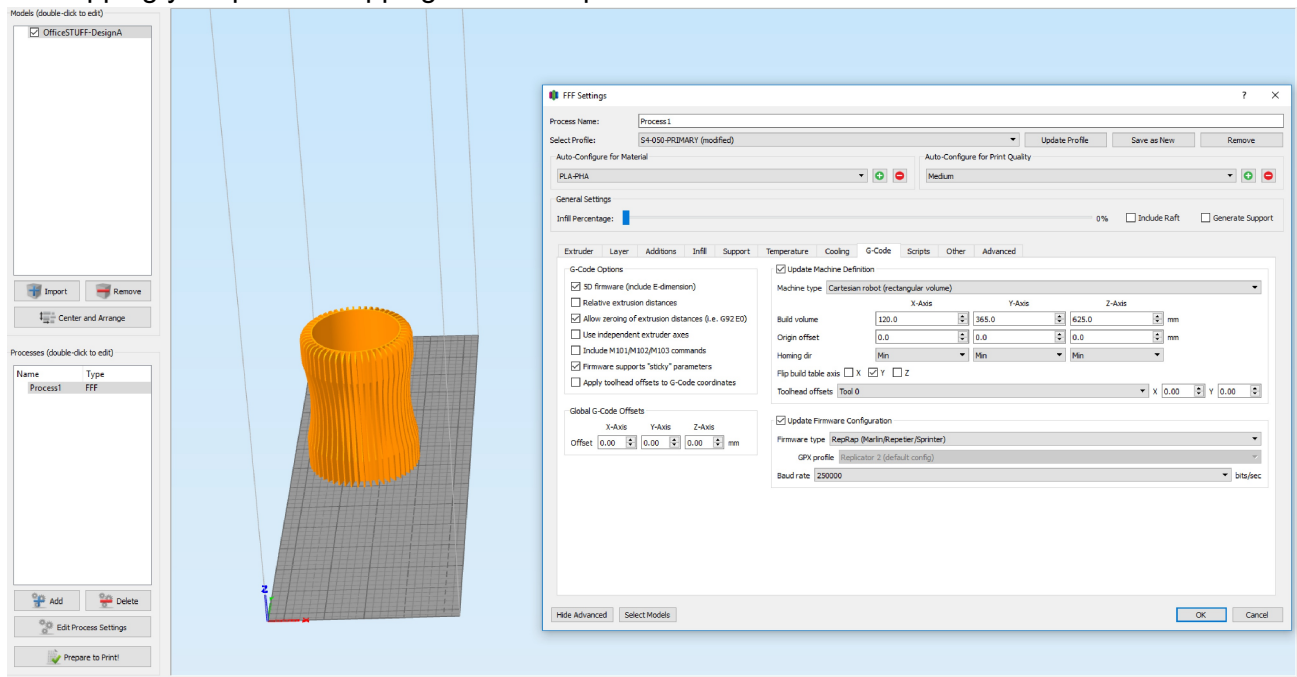
Step 3. Run your print. If the head spacing is correct in your GCODE and on the printer, you will be able to print multiple copies of the same parts.

3.2. Multi-material Print Mode

Printing in multi-material mode is for advanced users and requires a good understanding of the operation of your Stacker printer and Simplify3D. Multi-material printing involves a critical process of calibration, and if calibration is not performed correctly, the results will be imperfect. Before attempting *multi-material* printing, Stacker recommends viewing the Simplify3D tutorials to learn the basics about slicing your objects for multi-material printing.

Because the calibration process for multi-material printing is time consuming, we recommend you record your settings. In the future, when you switch between multi-material printing and normal printing, you will be able to easily enter your previous settings into the EEPROM of StackerRUN to speed the calibration process.

A. Dual Color Prints (2 Head Printing)

Step 1. Set the X Offset for Extruder 2. To begin, if you have a Stacker S4, you must remove heads three and four from the X rail (see section 3.3 for removal instructions).

With only two heads on the X rail, position head two approximately 150mm from head one and secure head two to the belt. Now, use a caliper to measure the exact distance between the nozzle tip of head one and the nozzle tip of head two.

Connect the printer to StackerRUN and open the EEPROM to enter the offsets. Note, StackerRUN uses *steps per millimeter* rather than *millimeters*. To calculate the *steps per millimeter*, you multiply your offset distance measurement by the number of **X-axis steps per mm** to get the distance in steps for the **Extr.2 X-Offset**.

> For example, if your **X-axis steps per mm** is 146.1, then you would multiply 146.1 by the exact distance you measured between the two nozzle tips. Thus, if the nozzle tips were 151mm apart, then 146.1 x 151 = 22,061.10 steps.

Enter the resulting number of steps into the **Extr.2 X-offset** in the EEPROM. The offset in the EEPROM will be your starting point, and you will make fine adjustments to this setting using the LCD after you perform a test print.

Step 2. Prepare your Print in Simplify3D. The Dual Extrusion Wizard in Simplify3D is a useful tool to prepare your model for printing with two heads. Be sure to view the tutorials on the Simplify3D website to better understand how to use this wizard. The bullet points below are essential components for successful two head prints:

• When placing the model in Simplify3D, be sure to position it to the far left side of the bed. The model will automatically reposition to accommodate for the offset, so you want the model placed as far to the left as possible.
• You will need to bring in two models for dual color prints. Use the Dual Extrusion Wizard to align models and establish a grouped process.
• If you are printing with support structures, then be sure to only have the model that gets support selected and manually place the supports.
• Assign ONLY the ooze shield to extruder 1 and ONLY the wipe and prime tower to extruder 2.
• If you have the nozzle cleaning brush option installed on your printer, add the brush cleaning script to your printer, so the nozzle will preform a wipe movement during your dual

color print. Go to Edit the Process Settings in Simplify3D and add a Starting Script and a Tool Change Script under the Scrips tab.

Scripts	
Starting Script	Tool Change Script
G21 G28 G90 G92 E0 {IF NEW TOOL=0}G1 E15 T0 {IF NEW TOOL=1}G1 E15 T1	G1 E-15 T0 G1 E-15 T1 G1 X100 Y7 F9000 G1 X100 X50 F2000 G1 X50 X150 F2000 G1 Y7 Y2 F2000 {IF NEW TOOL=0}G1 E15 T0 F2000 {If NEW TOOL=0}G1 E-6 T0 F2000 {If NEW TOOL=1}G1 E15 T1 F2000 {If NEW TOOL=1}G1 E-6 T1 F2000

Step 3. Perform a Test Print. It is best to perform a simple test print to precisely calibrate the X and Y offsets. We recommend printing a simple dual color calibration object such as the "Dual Extruder Calibration Print" (http://www.thingiverse.com/thing:533814). Looking at a simple calibration print and measuring the offset error with a calipers enables you to make small adjustments to the X and Y offsets.

To make these small adjustments to the X and Y offsets use the LCD controller. Select **Main Menu » Configuration » Extruder » Select extr. 2 » X-offset** (or **Y-offset**). Enter the distance for the offset in mm.

For example, on the test print below, you can see that the silver filament is 0.75mm to the left of where it should have been printing, so we need to add 0.75mm to the **X-offset**.

You may need to reprint the test print several times to precisely dial in the settings. Once your X and Y offsets have been precisely calibrated, you are ready to slice and print your object.

B. Three Color, Four Color, or Multi-material Prints (3 or 4 Head Printing)

The process of calibrating the printer for using three or four heads is nearly an identical process to dual color printing. Because of the limited travel distance available on the X-rail, you should position your heads together as a group depending upon the size of the object you are printing.

Because the nozzles are approximately 40mm apart, the expected offsets would be 40mm for Extruder 2, 80mm for Extruder 3, and 120mm for Extruder 4. Printing a simple calibration print will help with fine tuning these offsets.

Unfortunately, having the heads positioned together as a group can cause scarring and oozing of filament on your print, but careful slicing and placement of custom wipe and prime towers can alleviate many of these problems, and using the optional cleaning brush and tool change script will help reduce oozing of filament on your printed parts.

3.3. Removing Print Heads

Depending upon the number of print heads used for a print, any unused hot ends on the X-rail will reduce the total available print area along the X axis. Each hot end attached to the X-rail reduces the total available movement by approximately 40mm. Therefore, removing unused hot ends from the the X-rail will increase the maximum available print area.

Number of Print Heads on X-Rail of S4	Maximum X travel distance of head 1
4	390mm
3	430mm
2	470mm
1	510mm

On the Stacker S4, you can remove the second, third, and fourth hot ends fairly easily. The first hot end should never be removed from the printer.

On the Stacker S2, you can only remove head two. The first hot end should never be removed from the printer.

Whenever removing hot ends, it is critical that the electrical connections are not detached. If the wires are disconnected from the hot end, the printer will go into an error state.

When removing one or more hot ends, please follow these steps:

Step 1. Make sure the hot ends are turned off. Confirm that your hot ends are at room temperature to avoid injuring yourself or damaging the printer. If your hot ends are not at room

temperature, reduce the temperature and wait for them to cool before attempting to detach the hot end from the X rail.

Step 2. Remove Guard Plate. On the printer frame, use a 2.5mm hex driver to remove the two M3 x 6mm screws and lock washers holding the guard plate in place.
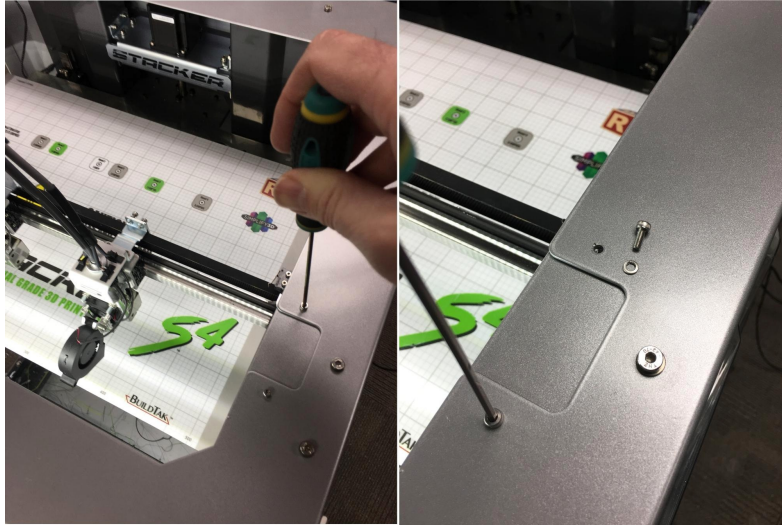
Step 3. Remove Belt Clamp Bracket. On the rear of the hot end, use a 2.5mm hex driver to remove the two M3 x 8mm screws attaching the belt clamp bracket. After the screws are removed, remove the belt clamp bracket from the hot end.
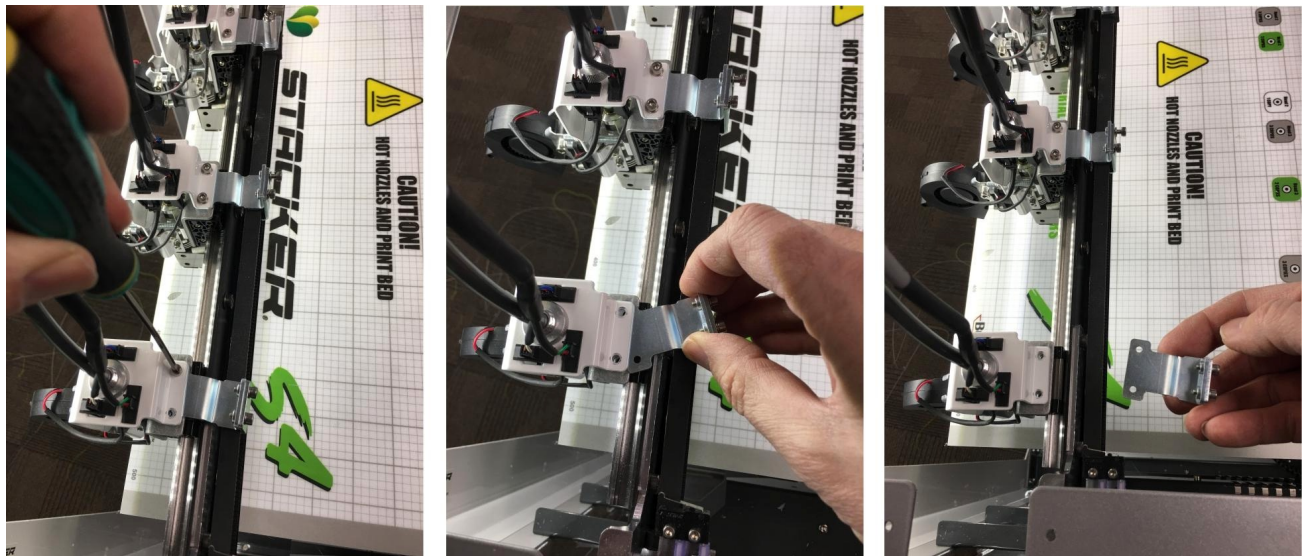

Step 4. Carefully slide the hot end from the linear rail. Using the space opened by removing the guard plate, carefully and slowly slide the hot end to the right to remove it from the linear rail.
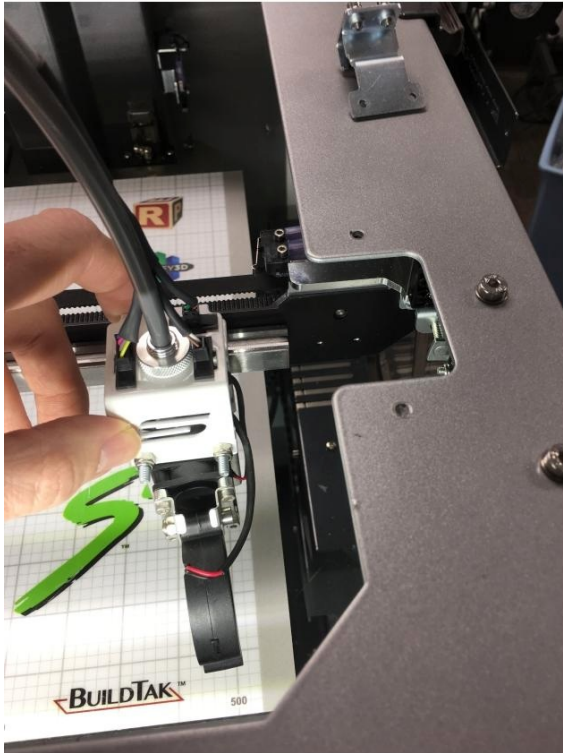
CAUTION! BE CAREFUL! Whenever a hot end is removed is removed from the rail, you must handle it very carefully. The linear block which attaches to the linear rail uses tiny recirculating ball bearings for movement, and if any of these ball bearings fall out of the block, it will lead to catastrophic failure of the movement system. **Always handle the hot ends carefully to prevent any damage to the linear blocks!**

Step 5. Carefully Handle and Store the Removed Hot Ends. Because the electrical wires must remain attached to the printer, it is best to attach the hot end directly to the printer. Ideally, the hot ends should be attached using the Head Storage Rail which you can download and print from our support page (http://www.stacker3d.com/stacker-3d-printer-support/).
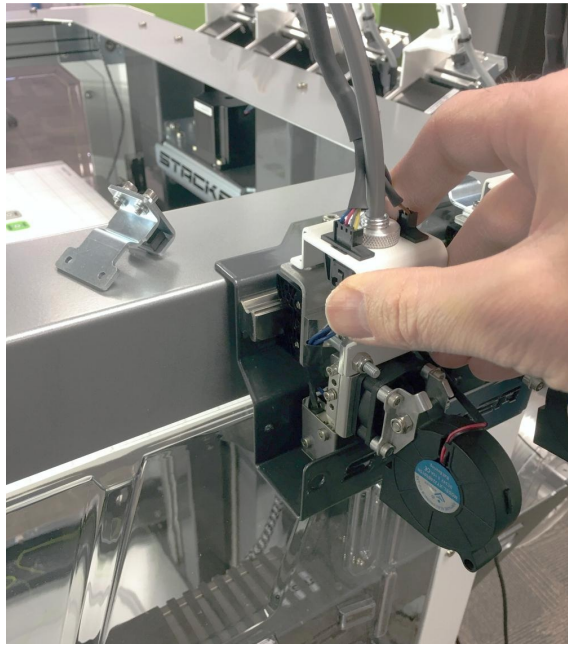
Step 6. Reattach the Guard Plate. After the heads have been removed and stored carefully, reattach the guard plate that was removed in Step 2.

4. PID Calibration

The PID controller on your printer continuously adjusts the power sent to the hot ends and heat bed in an effort to maintain efficient and consistent temperatures. When the PID settings are incorrect, the temperature changes of your bed and hot ends can affect your prints. Variations in nozzle temperatures over a short time may not seem like a problem, but in extreme cases, wide temperature variations during operation can cause stringing, blobs, or even clogged nozzles. To best control temperatures, you should run a PID autotune on each of your nozzles. Whenever you change a heater block, you should always perform a PID autotune and make the necessary changes to your EEPROM.

To run a PID autotune, you will need to open Stacker RUN and enter the flowing text into the manual control line.

    M303 e0 s240

We should explain that command: M303 is the GCODE command to run a PID Autotune. The "e" is referring to the extruder number; whereby, e0 = head 1, e1 = head 2, e2 = head 3, and e3 = head 4. The "s" is setting the temperature, 240°C in our case. Therefore if you were going to run a PID Autotune on head 2 at 240°C, you would type the following line into Stacker RUN:

    M303 e1 s240

Whenever you run PID Autotune from Stacker RUN, you want the heaters to start *at room temperature!* If the heater blocks begin at a temperature other than "*cold*", then your PID results will be invalid.

When Stacker RUN has completed the PID Autotune, you will see three sets of PID numbers with the letters "Kp", "Ki", and "Kd". Always use the first set of "p", "i", and "d" numbers. Enter these numbers into your EEPROM for the corresponding nozzle you test.

```
Classic PID
Kp: 8.94
Ki: 0.51
Kd: 20.00
```

If you are calibrating all four nozzles, then you will need to run the PID autotune four times -- once for each head.

5. Calibration of X/Y/Z Motion System

Your Stacker printer was fully calibrated at the factory, but over time your X/Y/Z motion system may experience minor changes as belt tension changes and linear rail movement.

There are five basic calibration/adjustment areas associated with your X/Y/Z Motion System:
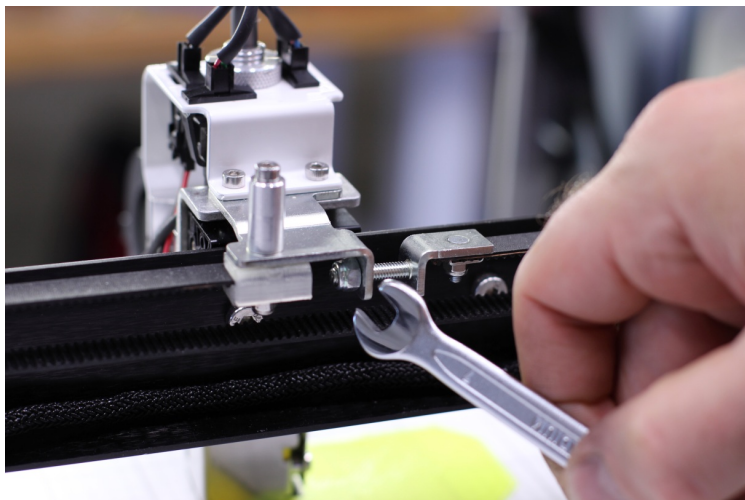 A. **Belt Tension**
  B. **X/Y Gantry Squareness**
  C. **X/Y/Z Motor Steps**
  D. **Z-Backlash**
  E. **Linear Block Tension**

Please take each one of these calibration steps in order. For example, it's important to get your gantry square and belts tensioned properly BEFORE you change the motor steps in your EEPROM, as changes to either of these two things will have an obvious impact on your step settings.

A. Belt Tension. Upon arrival, your printer's belts should be properly tensioned and stay properly tensioned for many hours of use. **Adjusting belt tension can affect the performance of your printer and should only be done if absolutely necessary.**

By pressing on the belt with your finger, you can feel the tension. The belts should all feel loosely-snug; in other words, there should be enough tension so that the belt will not slip when moving over the pulleys, but the belt should never be drum tight. The linear motion system is fairly forgiving, so variances in belt tension caused by temperature and humidity should not affect the quality of your prints.

X-Belt: If the X belt becomes too loose or too tight, simply use a 7mm hex wrench to turn the nut to tighten or loosen the tension on the belt.

Y-Belt: Adjusting the belt tension on the Y-axis belts can change the squareness of the gantry. When making adjustments to these belts, be careful to make equal changes to both belts. When making changes to the Y-axis belt tension, you will need a square to verify that the X-gantry remains square with the Y-gantry.

B. X/Y Gantry Squareness. The X/Y gantries should remain square unless the two belts of the Y-axis have been altered unevenly. Keep in mind, the two Y-axis belts are connected by a common shaft, so adjustments made to the Y-shaft at the collar connector found at the front of the printer next to the Y motor will affect the X/Y squareness. Therefore, once belt tension on the Y belts has been set. The easiest way to square the X/Y gantry is by using a special squaring jig placed upon the left (and only the left) Y-rail and the X-rail. With the square in place, loosen the collar connector, reposition X-rail, re-tighten the collar connector, and re-confirm squareness of the X/Y gantry.

To be sure you have the X/Y gantry square, the best test method is to print a test cube.

C. Changing the Motor Steps for the X/Y/Z movements. The easiest way to adjust the X/Y/Z steps is to use a dial indicator and holder. A good quality dial indicator and holder can be purchased for less than $100.


There are many ways to position your dial indicator to measure the X/Y/Z movements, and the photos below are provided as suggestions. Note, by placing a small piece of paper between the magnet on the printer frame, you can prevent the dial indicator holder from scratching your printer.

X-Axis Calibration Setup: Dial indicator is reading the right/left movements of head 1 along the X-axis.


Y-Axis Calibration Setup: Dial indicator is reading the forward/backward movements of the X-rail.
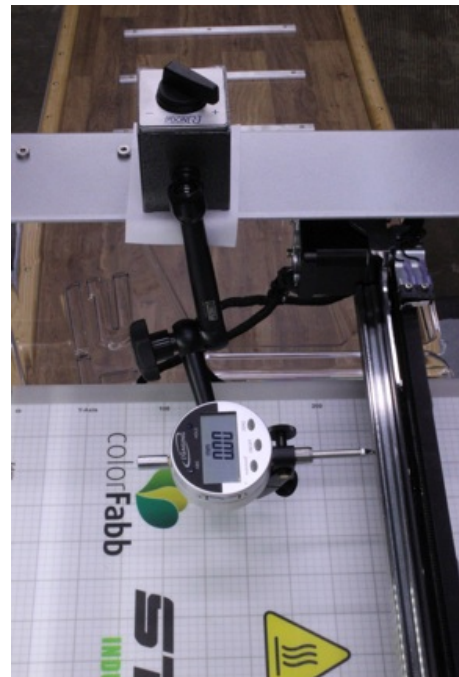
Change your steps in the EEPROM. Once you have the dial indicator positioned to measure the X, Y, or Z motor steps, you will need to open your EEPROM window in Stacker RUN by pressing the key combination Alt+E or select "Firmware EEPROM Configuration" under the Config menu.

Within the EEPROM settings, locate the number you will be changing. Write this number down or take a screenshot.
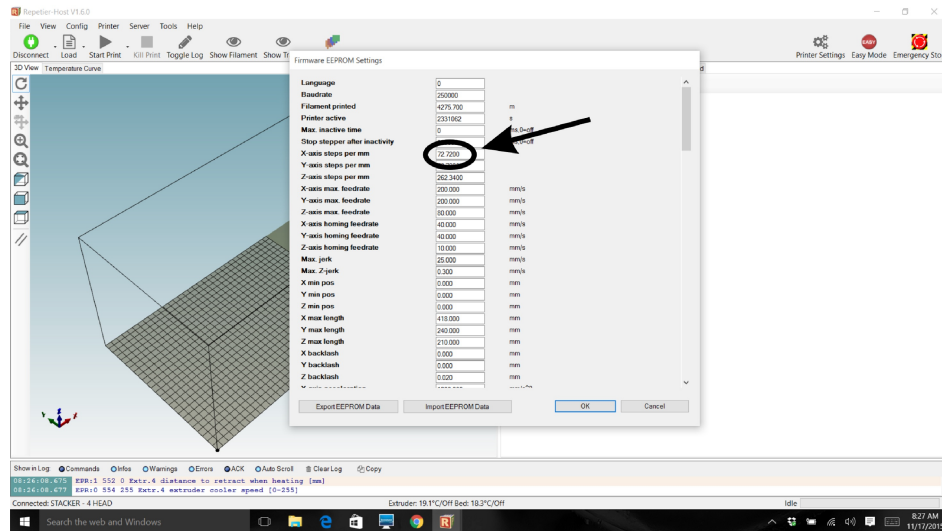
To calculate the new motor steps, zero the dial indicator, then use Stacker RUN to manually move the motor 10mm. To calculate the new steps, use this formula below:

$$\frac{\text{Distance you requested} \div \text{Distance measured on dial indicator} \times \text{Current Motor Steps}}{= \text{Your new motor steps Number}}$$

For example, if you attempted to move a print head (X axis) to the right 10mm, but the printer only moved the print head 9.5mm.

10 ÷ 9.5 = 1.05263

If the current "X axis steps per mm" in the EEPROM was set to 72.72. We need to change it, therefore:

1.05263 x 72.72 = 76.547

Thus, in this example, I should change the "X axis steps per mm" from 72.72 to 76.547.

Once you have entered your new steps into the EEPROM and saved it. You should test the results and make incremental changes as necessary. Retesting your results two or three times will provide more precise results.

Measuring and fine tuning the motor steps found in your EEPROM for the X, Y, and Z motors will enable your printer to make the highest quality prints.

If you accidentally make changes to your motor steps, the table below provides the factory default settings. Use these settings as a starting point as each printer will have slight variations

X	146.1
Y	146.1
Z	320

D. Z-Axis Backlash Calibration Procedure. With an acme screw, there is a minimal amount of backlash, and a setting of 0.05mm is probably sufficient to account for the variances for the grease in the system. Nevertheless, if you wish to test and adjust your Z backlash, you can do the following step:

1. In Stacker RUN, open the EEPROM and change the Z backlash number to 0mm.
2. Home the Z-Axis.
3. Set up dial indicator and zero out.
4. Send the print bed down 1mm using Stacker RUN.
5. Measure the actual distance traveled using the dial indicator.
6. Subtract the distance traveled from 1mm. This is the number you put into the EEPROM for your Z backlash.
7. Repeat steps 1 through 6 to verify your result.

E. Linear Block Tension: Please contact Stacker at info@stacker3d.com with concerns about the linear rail block tension.

6. Controller Housing

6.1. Connecting and disconnecting the USB Cable: Your printer ships with the USB cable attached to the printer. If the USB cable becomes detached or if you would like to remove the USB cable, please follow the following steps to attach or detach the USB cable from the printer.

Step 1. Disconnect Power Cords. Make sure the print heads are cool before you turn off and unplug the printer.

Step 2. Carefully remove the three small screws at the top of the controller housing on the back of the printer. Once the screws are removed, the controller housing will swing open. **Open the controller housing SLOWLY!** If you do not support the housing with your hands, it can swing open and wires will detach from the controller board. Only open the housing enough so you can view the USB input on the far left corner of the controller card.

Step 3. The USB cable runs through a hole along the side of the controller housing. A USB standard B connector is located on the lower left side of the controller card. When connecting or disconnecting the USB cable, run the USB cable through this hole (as shown).
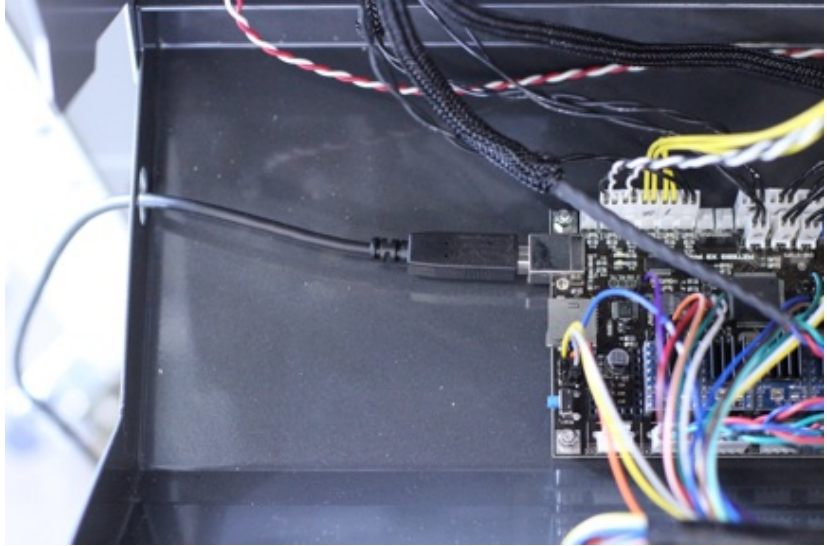
**Step 4. Close the controller housing**. Secure the controller housing with all three screws.

6.2. Setting Vref for Stepper Motor Drivers: The (Vref) voltage reference affects the strength and speed of the motor movement on your printer. *The information provided this section is primarily for reference.* The Vref for the stepper motor drivers was set at the factory. It is unlikely that you would ever be required to adjust these settings.

 If you decided to test or adjust your Vref settings be certain to discharge any static electricity before touching any of the electronic components on your printer. **DO NOT MAKE ADJUSTMENTS WHILE THE MOTORS ARE OPERATING**, and when making adjustments, NEVER EXCEED YOUR MOTOR'S CURRENT RATING.

To check the Vref settings do the following:
1. Turn on the printer.
2. Carefully open the controller housing, (see section 6.1, step 2).
3. Do not touch the LCD smart controller or connect via any host software, such as STACKER RUN or Simplify3D while making any Vref adjustments.
4. Using a high quality voltage meter touch the + of the voltmeter to the VREF Test Point on the driver and the [-] lead to the Ground Nut. **BE EXTREMELY CAREFUL!** You run the risk of shorting out all sorts of things with your voltmeter and small screw driver if you touch the incorrect locations. Proceed carefully and with steady hands.
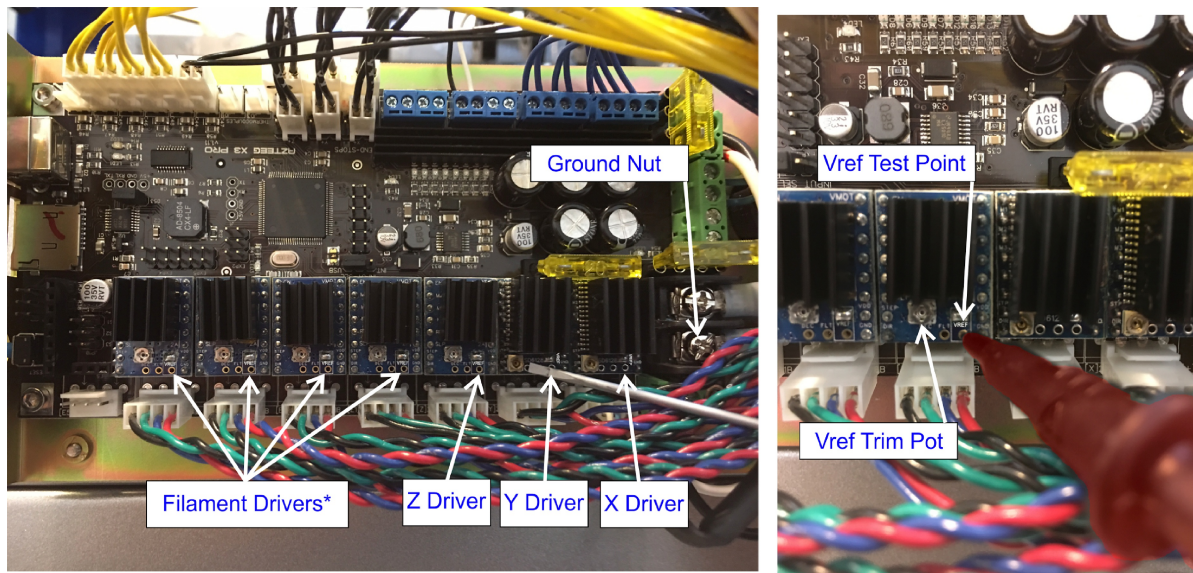
5. The current limit can be adjusted by turning the Vref Trim Pot with a small slot head screwdriver. While watching the voltage meter, turn the Vref Trim Pot with a small screwdriver until it has reached the voltage indicated for the driver on the table below. Turning clockwise will increase voltage. Turning counterclockwise will reduce voltage. **DO NOT EXCEED THE FACTORY VOLTAGES!**

Filament Drivers	0.9 V
Z Driver	1.1 V
Y Driver	0.9 V
X Driver	0.9 V

6. When voltages are set, close the controller housing.

More information about the stepper motor drivers can be found at:
http://files.panucatt.com/datasheets/sd8825_user_guide.pdf
http://files.panucatt.com/datasheets/sd6128_user_guide.pdf

7. Connecting the Raspberry Pi

The follow instructions are intended to assist a
Stacker operator with the installation of Repetier-
Server onto a Raspberry Pi. These instructions
are provided only as a guide and presume a basic knowledge of both computer hardware and
the LINUX operating system. Neither the Raspberry Pi nor the LINUX operating system are
covered by your Stacker warranty. *Stacker's customer support does not extend to third-party
products.*

The Raspberry Pi is a low-cost credit card-sized single-board computer
developed in the United Kingdom by the Raspberry Pi Foundation
(https://www.raspberrypi.org/). Repetier-Server (https://www.repetier-
server.com/) is software which enables the remote operation of your Stacker 3D
printer using any web enabled device such as a smart phone, tablet or desktop
computer. Although Repetier-Server is free, we strongly encourage you to either purchase the
Pro version or provide a donation to Repetier. Find the donation button at the bottom of the
download page https://www.repetier-server.com/download-repetier-server/
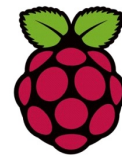
7.1 What you need

Before you begin, you will need:
1. Raspberry Pi (preferably the Raspberry Pi 3
    Model B)
2. Power supply (5v 2Amp)
3. 8GB or larger MicroSD card (class 10
    recommended).
4. Monitor or TV with an HDMI input
5. HDMI cable
6. Mouse
7. Keyboard
8. LAN (local area network) with WiFi or Cat5
    cable
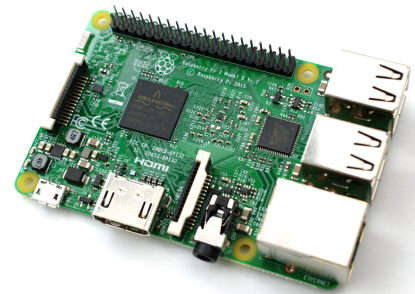
Please Note: Some users have experienced problems with their Raspberry Pi due to inadequate
power supply, unsupported microSD cards, or incompatible Wi-Fi adapters which are not plug
and play. There are many Raspberry Pi kits and accessories on the market. Make sure to do
your own research and read reviews before purchasing a Raspberry Pi and its accessories.

7.2 Software Installation

Step 1: Install Raspbian onto your microSD card

- Download the latest Raspbian image file to your computer: http://downloads.raspberrypi.org/raspbian_latest
- After downloading the .zip file, unzip the file to get the image file (.img).
- To write the image to your microSD card, follow the instruction found on https://www.raspberrypi.org/documentation/installation/installing-images/README.md
  - For Windows users, you should download Win32DiskImager
  - With Win32DiskImager software, write the Raspbian image to the microSD card (always double check and make sure you select the correct drive when writing an image file!)

Step 2: Setup the Raspberry Pi

- Now that the image is written to the microSD card, insert the card into the Raspberry Pi and connect a keyboard, mouse, and monitor.
- Connect the power supply, which will boot your Raspberry Pi (note the red and green lights).
- Open the terminal and type the command sudo raspi-config.
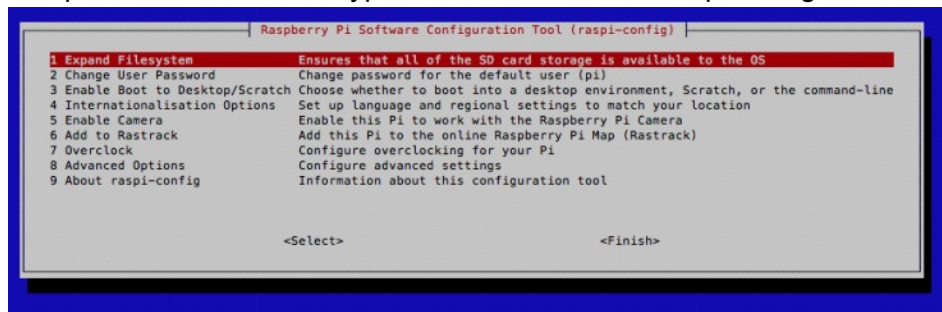
Within the Configuration Tool

- Select 1. Expand Filesystem – to use all the free space on the SD card
- Select 2. Change User Password – Change your password (recommended)
- Select 5. Internationalisation Options → I2 Change time zone – Change the timezone to suit your location.
- Press Finish to save the configuration and reboot

Step 3: Join Your LAN

- The Raspberry Pi 3 Model B comes with an internal 802.11n Wireless adapter. To utilize WiFi on older Raspberry Pi models, you will need to acquire a wireless adapter. You can always also use a Cat5 cable to connect to the Pi to the LAN.
- Upon restarting your Raspberry Pi, if the GUI doesn't load automatically, enter your username and password. Note, the default username is *pi* and the default password is *raspberry*, and manually start the GUI by typing the terminal command startx

- Once the GUI has loaded, click on network icon (top right) and select your network and enter the network password
- Open the Terminal and type sudo ifconfig command to discover your IP address. You will find your Raspberry Pi's IP address in the wlan0 section. Red boxes in the image below show where you should look for your Pi's IP address.

```
pi@raspberrypi ~ $ ifconfig
eth0      Link encap:Ethernet  HWaddr b8:27:eb:96:19:a2
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)   TX bytes:0 (0.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:136 errors:0 dropped:0 overruns:0 frame:0
          TX packets:136 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:11472 (11.2 KiB)  TX bytes:11472 (11.2 KiB)

wlan0     Link encap:Ethernet  HWaddr e8:4e:06:2b:8e:78
          inet addr:192.168.0.166  Bcast:192.168.0.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:330 errors:0 dropped:111 overruns:0 frame:0
          TX packets:176 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:50587 (49.4 KiB)  TX bytes:22595 (22.0 KiB)

pi@raspberrypi ~ $ 
```

Step 4: Update the Pi
- Now that your Raspberry Pi is working and connected to the network, you have the option of remotely accessing your Pi via SSH. The procedure varies according to your operating system and personal preference, to see the instructions for connecting with SSH, go to https://www.raspberrypi.org/documentation/remote-access/ssh/
- Update the Raspberry Pi by typing each of the following commands into the Terminal (note, some of these updates can take a considerable amount of time depending upon your internet download speed):
  - ▸ sudo apt-get update
  - ▸ sudo apt-get upgrade
  - ▸ sudo rpi-update
- After you have performed all the necessary updates, reboot your Pi with the terminal command sudo reboot

Step 5: Download and Install Repetier Server
- Open the terminal

- Download Repetier Server with the following command: wget http://download.repetier.com/files/server/debian-armel/Repetier-Server-0.80.0-Linux.deb
- Install the .deb file with the command sudo dpkg -i Repetier-Server-0.80.0-Linux.deb

Step 6: Access Repetier
- Connect your Raspberry Pi via USB cable to your Stacker printer, and then power on both the Raspberry Pi and the printer.
- With any web browser on the same network, enter the Raspberry Pi's IP address with port extension 3344. For example, if the Raspberry Pi's IP address was 192.168.0.104, you would type http://192.168.0.104:3344 into the web browser on your computer or phone. If you are unable to connect, confirm the IP address of your Raspberry Pi with either a Terminal ifconfig command.
- The first time you access your Stacker printer, you will see the Dashboard, and you will need to click + Add new Printer and complete the configuration items.
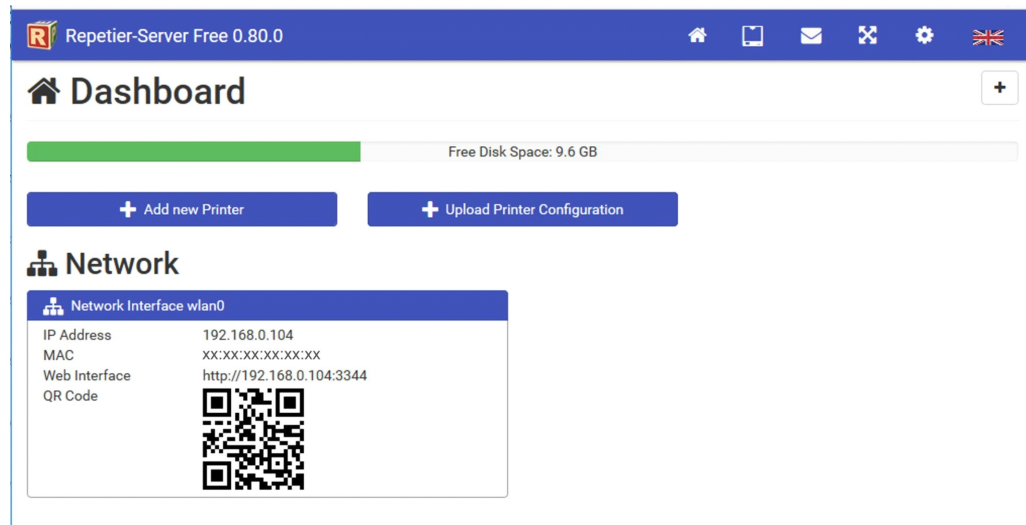
- When adding a printer, you will be directed through the following steps:
  1. Naming. Give your printer a name. If you anticipate using multiple 3D printers on your network, you will want to use unique descriptive names for your printers.
  2. Connecting Printer. You will need to change the baud rate to 250000. The other default settings should be correct.

3. Geometry. The Geometry should match that of your printer, so only make changes if necessary.
4. Extruders and Bed. Verify the number of exturders and change the filament diameter to 1.75mm.

5. Features. The features should match those of your printer, i.e.,
    Fan = Yes, SD Card = Yes, and Software Power = No
6. Click Finish
7. From the dashboard, select your printer and start using Repetier-Server.
8. For detailed documentation on using Repetier-Server, please visit https://www.repetier-server.com/documentation/

7.2 Hardware Installation

The controller housing on your printer includes four mounting holes positioned to accommodate a Raspberry Pi. These are located on the right side of the controller housing. Follow the instructions in section 6.1 step 2 to open the controller housing. Install the Raspberry Pi using hardware of your choice.

8. Optional Printing Surface Installation

8.1 FlexPlate System Installation

The FlexPlate System uses a magnetic base which is permanently attached to your aluminum build plate and a flexible metal plate with a printing surface such as BuildTak, Kapton, or PEI. The FlexPlate System is an option for either the Stacker S2 or S4 printer and is available on our website.

WARNING! THE FLEXPLATE IS A PERMANENT INSTALLATION! Once the FlexPlate Magnetic Base is attached to your printer's aluminum build plate, the magnetic base cannot be removed. Please be sure you understand all of the benefits and drawbacks of the FlexPlate System before installing it to your printer. If have any questions, please contact our customer support team at info@stacker3d.com.

NOTE! The FlexPlate System decreases the surface bed temperature of your print bed by approximately 10°C. After the FlexPlate System has been installed, you will typically need to increase your bed temperatures by 10°C. For example, if you wanted a bed temperature of 55°C, you should set the temperature to 65°C.

Step 1. Clean your printer's aluminum build plate. Remove the BuildTak from your printer, then use rubbing alcohol and a clean rag to remove any adhesive, dust, or debris from the aluminum bed.

Step 2. Peel backing from the magnetic base.

ATTENTION! THE MAGNETIC BASE PLATE USES A VERY STRONG ADHESIVE. YOU WILL ONLY GET ONE CHANCE TO ATTACH THE BASE PLATE TO THE ALUMINUM BED! MAKE SURE IT IS POSITIONED CORRECTLY BEFORE ATTACHING.

Step 3. Carefully position and attach the Magnetic Base Plate: Align the base plate so that it is parallel and slightly back from the front edge of the aluminum bed (see image below). Attach only the front of the magnetic base plate first, then work slowly from front to back of the bed by pressing firmly with your hand to carefully remove any air bubbles.

Before attaching, align magnetic base plate with the front of the bed

To avoid trapping air bubbles beneath the magnetic base plate, press firmly with your hand and work slowly from side to side. Attach the front of the bed first and then work toward the rear of the bed.

In the image to the left, the installer uses their left hand to bend and slowly lay down the magnetic base plate while their right hand presses down on the adhesive and removes air bubbles.

Step 4. Attach the BuildTak to the FlexPlate: Read, understand, then remove the warning sticker from the metal FlexPlate. Set the FlexPlate onto the magnetic base. Turn on the printer and allow the metal FlexPlate to warm to 50°C.

CAUTION! YOU CAN BURN YOURSELF ON A 50°C BED. FOLLOW THE NEXT STEP WITH CARE!

To attach the BuildTak to the heated FlexPlate, carefully peel the backing from the BuildTak sheet then starting at the front edge of the FlexPlate, slowly attach the sheet while using a plastic paint scraper to flatten the sheet and remove any air bubbles. Working slowly and methodically will ultimately prove the best and flattest printing surface.

Read and Remove Warning Sticker

Step 5. Adjust Z-height: Because of the added height of the FlexPlate System, you will need to adjust the Z-height of your printer. Please refer to the User Guide Part I section 6.1 for instructions on adjusting the first layer height. You will need raise the Z-height adjustment screw approximately 3mm.

Whenever you make adjustments to the Z-height, always move the X-gantry fully forward before homing the Z-axis to avoid crashing the nozzles into the print bed.
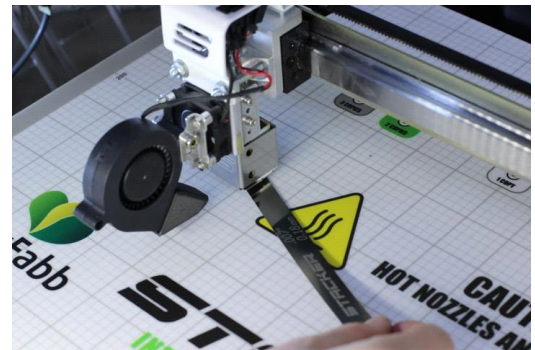
Step 6. Turn off the heat bed: After you have made changes to the Z-height of your printer, turn off the heat bed and allow it to cool before advancing to step 7.

Step 7. Install the Build Plate Glass Clips (optional but recommended): Although the magnetic base will typically hold the metal FlexPlate in place, there is a possibility of the

FlexPlate moving. In order to prevent the possibility of a layer shift, we recommend installing the Build Plate Glass Clips. See section 8.2. for installation instructions.

Final Note: In time, the BuidTak may tear or lose its adhesive properties. To attach a new sheet of BuildTak, simply peel and remove the BuildTak sheet from the FlexPlate, use rubbing alcohol and a clean rag to remove any adhesive, dust, or debris from the FlexPlate, and attach the new BuildTak sheet using the same process described in Step 4.

You can purchase additional FlexPlates and BuildTak from our website http://www.stacker3d.com.

8.2. Glass Bed Installation

Although BuildTak is an excellent printing surface for most filaments, BuildTak is not an ideal surface for materials such as nylon. If you choose to our optional glass bed, you will find that glass can be an excellent printing surface for most filaments. When using a glass bed, we recommend coating the bed with a thin layer of white glue stick to help parts adhere to the glass bed.[1]

In order to install the glass bed, please follow the instructions below. Note, your glass bed is placed directly over the BuildTak, so you will still be able to use the reference grid on the BuildTak for positioning.

Before you Begin you will need to download and print a Glass Spacer Block. The Glass Spacer Block is placed upon the Z-height adjustment screw to compensate for the thickness of the glass, so your heads do not crash in to the glass plate when you home the bed. You can find the file on our website.

- http://stacker3d.com/stl/S2-4-Glass-Spacer-Block.stl

---

[1]If printing with ABS filament, rather than use glue stick, try mixing a small amount of the ABS filament with acetone to create a glue like adhesive which works to secure the printed ABS material to the glass bed.
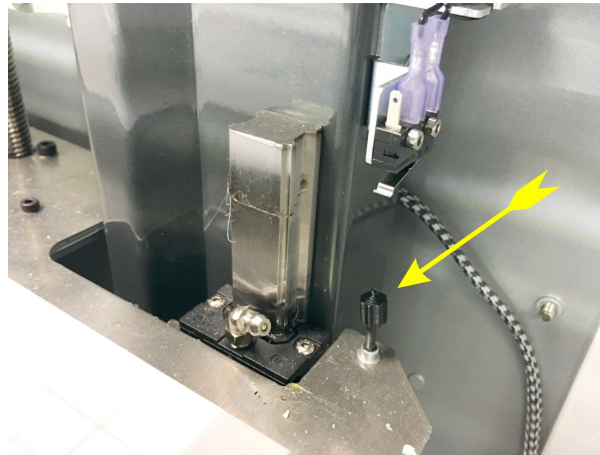
a) Glass Clip Locations: The glass clips secure the glass plate to the aluminum bed and prevent the glass from sliding. To install the glass clips, you will need a 3mm hex key.

The glass clips are mounted at four locations. The installation locations for the four clips can be identified by a small indent along the edge of your aluminum build plate and a threaded screw hole underneath your print bed. The arrows on the image indicate the four locations.
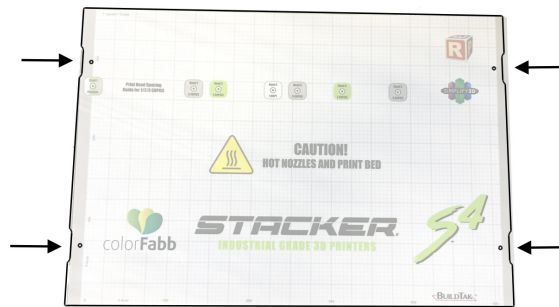
Each of the four glass clips is assembled with the following hardware:

M4 x 5mm SHCS (p/n 20-049)   Thumbscrew (p/n 40-008)

Bed Clamp (p/n 30-051)

Glass Clamp Holding Bracket (p/n 30-178)
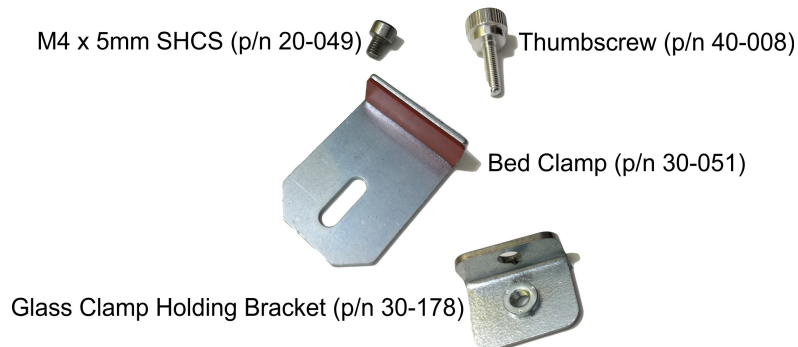
b) Attaching Glass Clips: Use the 3mm hex key to attach the four Glass Clamp Holding Brackets (p/n 30-178) to the underside of the bed using the M4 x 5mm SHCS. Face the threaded side of the Glass Clamp Holding Brackets outward as shown in the images below.
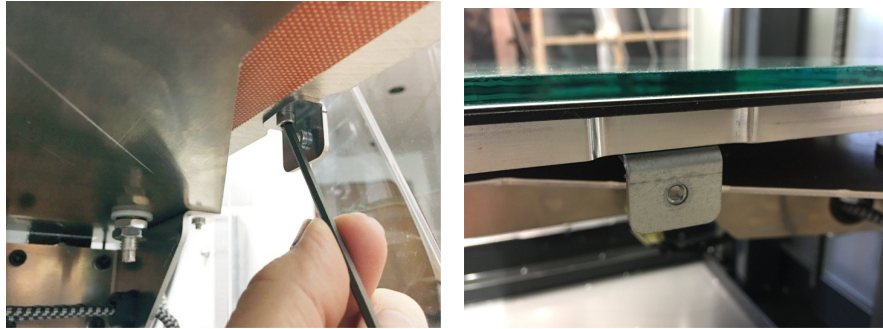
Place the glass plate on to the bed and attach the four Bed Clamps to the Glass Clamp Holding Brackets using a Thumbscrews.
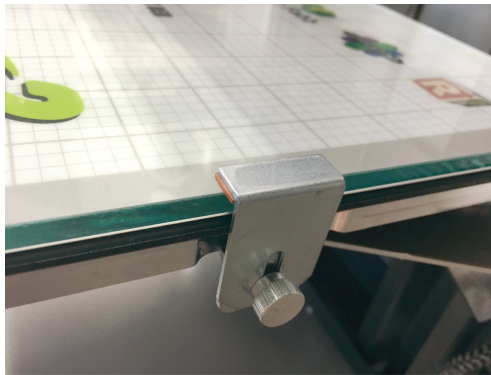
c) Confirm the Z-Height: Confirm and adjust the first layer height if necessary using the Z-height adjustment screw and a feeler gauge.

Whenever you make adjustments to the Z-height, always move the X-gantry fully forward before homing the Z-axis to avoid crashing the nozzles into the print bed.

Once your nozzle height is adjusted, you are ready to print.

9. Power Supply Data Sheets

LCM600
600 Watt Bulk Front End

RoHS 6/6 COMPLIANT

Data Sheet

Total Power: 600 W
# of Outputs: Single
Outputs: 12 to 60 V
Optional 5.0 V standby

COMPLIANCE
° EMI Class B
° EN61000 Immunity

SAFETY
° UL   60950-1
          1598/1433
          60601-1
° CSA   60950-1
° VDE   60950-1
          60601
° China CCC
° CB Scheme Report/Cert

Electrical Specifications

Input	
Input range:	85 - 264 Vac (Operating) 115/230 Vac (Nominal) Input through standard IEC connector/ TERMINAL BLOCK
Frequency:	47 - 440 Hz, Nominal 50/60
Input fusing:	Internal 10 A fuses, both lines fused
Inrush current:	≤ 25 A peak, either hot or cold start
Power factor:	0.99 typical, meets EN61000-3-2
Harmonics:	Meets IEC 1000-3-2 requirements
Input current:	8 A RMS max input current, at 100 Vac
Hold up time:	20 ms minimum for Main O/P, at full rated load
Efficiency:	> 89% at full load
Leakage current:	< 0.3 mA at 264 Vac
ON/OFF power switch:	N/A
Power line transient:	MOV directly after the fuse
Isolation:	Isolation: PRI-Chassis 2500 Vdc Basic PRI-SEC 4000 VAC Reinforced 2xMOPP SEC-Chassis 500 Vdc

Electrical Specifications

Output		
Output rating:	See ordering information table	85 - 264 Vac
Set point:	± 0.5%	85 - 264 Vac
Total regulation range:	Main output ± 2% 5 Vsb ± 1%	Combined line/load/transient when measured at output terminal
Rated load:	600 W maximum	Derate linear to 50% from 50 °C to 70 °C
Minimum load:	Main output @ 0.0 A 5 Vsb @ 0.0 A	No loss of regulation
Output noise (PARD):	1% max p-p 50 mV max p-p	Main output 5 Vsb output Measured with a 0.1 µF Ceramic and 10 µF Tantalum Capacitor on any output, 20 MHz
Output voltage overshoot:		No overshoot/undershoot outside the regulation band during on or off cycle
Transient response:	< 300 µSec	50% load step @ 1 A/µs Step load valid between 10% to 100% of output rating Recovery time to within 1% of set point at onset of transient
Max units in parallel:		Up to 10
Short circuit protection:	Protected, no damage to occur	Bounce mode
Remote sense:		Compensation up to 500 mV
Output isolation:		Standard per safety requirements
Forced load sharing:	To within 10% of all shared outputs	Analog sharing control
Overload protection (OCP):	105% to 125% 120% to 170%	Main output 5 Vsb output
Overvoltage protection (OVP):	125% to 145% 110% to 125%	12 V output 5 Vsb output
Overtemp protection:	10 - 15 °C above safe operating area	Both PFC and output converter monitored
Fan Fault Protection:		For-N option only. Will shutdown output and DC_OK

Environmental Specifications

Operating temperature:	-40 °C to +70 °C, linear derating to 50% from 50 °C to 70 °C
Storage temperature:	-40 °C to +85 °C
Humidity:	20 to 90%, non-condensing. Operating. Conformal coat option available
Fan noise:	< 45 dBA, 80% load at 30 °C -N Low Noise Option < 35 dBA, 80% Load at 30 °C
Altitude:	Operating - 16,404.2 feet Storage - 30,000 feet
Shock:	MIL-STD-810F 516.5, Procedure I, VI. Storage
Vibration:	MIL-STD-810F 514.5, Cat. 4, 10. Storage

Ordering Information

Model Number*	Output	Nominal Output Voltage Set Point	Set Point Tolerance	Adjustment Range	Current		Output Ripple P/P (0-50 °C)	Max Continuous Power	Combined Line/ Load Regulation
					Min	Max			
LCM600Q	24 V	24 V	±0.5%	19.2 - 28.8 V	0 A	27 A	240 mV	600 W	2%

Preliminary Data Sheet

LCM1000
1000 Watt Bulk Front End

Total Power:	1000 W
# of Outputs:	Single
Outputs:	12 to 48 V
Optional 5.0 V standby	

SPECIAL FEATURES

- 1000 W output power
- Low cost
- 2.5 x 5.2 x 10.0
- 7.7 Watts per cubic inch
- Industrial/Medical safety
- –40 °C to 70 °C with derating
- Optional 5 V @ 2 A housekeeping
- High efficiency: 89% typical
- Variable speed Smart Fans
- DSP controlled
- Conformal coat option
- ± 10% adjustment range
- Margin programming
- OR-ing FET
- Low acoustic noise

COMPLIANCE

- EMI Class A; Class B with internal modification option
- EN61000 immunity
- RoHS 2

SAFETY

- UL/cUL Recognized ITE (UL60950-1)
- UL/cUL Recognized Medical (ANSI/AAMI ES60601-1)
- TUV-SuD ITE + Medical (EN60950-1 and EN60601-1)
- CE LVD (EN60950-1 + ROHS)
- BSMI
- CB Report
  - through Demko for IEC60950-1
  - through TUV-SuD for IEC60601-1
- CCC Approval

Electrical Specifications

Input

Input range	90 - 264 Vac (Operating) 115/230 Vac (Nominal) TERMINAL BLOCK
Frequency	47 - 440 Hz, Nominal 50/60
Input fusing	Internal 20 A fuses, both lines fused
Inrush current	≤ 25 A peak, either hot or cold start
Power factor	0.99 typical, meets EN61000-3-2
Harmonics	Meets IEC 1000-3-2 requirements
Input current	12 A RMS max input current, at 100 Vac
Hold up time	20 ms minimum for Main O/P, at full rated load
Efficiency	> 91% typical at full load / 230 Vac nominal
Leakage current	< 0.4 mA at 264 Vac
ON/OFF power switch	N/A
Power line transient	MOV directly after the fuse
Isolation	PRI-Chassis 2500 Vdc Basic PRI-SEC 4000 VAC Reinforced 2xMOPP SEC-Chassis 500 Vdc

Electrical Specifications

Output

Output rating	See table 1	90 - 264 Vac
Set point	± 0.5%	90 - 264 Vac
Total regulation range	Main output ± 2% 5 Vsb ± 1%	Combined line/load/transient when measured at output terminal
Rated load	1000 W maximum	Derate linear to 50% from 50 °C to 70 °C
Minimum load	Main output @ 0.0 A 5 Vsb @ 0.0 A	No loss of regulation
Output noise (PARD)	1% max p-p 50 mV max p-p	Main output 5 Vsb output Measured with a 0.1 µF Ceramic and 10 µF Tantalum Capacitor on any output. 20 MHz
Output voltage overshoot		No overshoot/undershoot outside the regulation band during on or off cycle
Transient response	< 300 µsec	50% load step @ 1 A/µs Step load valid between 10% to 100% of output rating Recovery time to within 1% of set point at onset of transient
Max units in parallel		Up to 10
Short circuit protection	Protected, no damage to occur	Bounce mode
Remote sense		Compensation up to 500 mV
Output isolation		Standard per safety requirements
Forced load sharing	To within 10% of all shared outputs	Analog sharing control
Overload protection (OCP)	105% to 125% 120% to 170%	Main output 5 Vsb output
Overvoltage protection (OVP)	125% to 145% 110% to 125%	12 V output 5 Vsb output
Overtemp protection	10 - 15 °C above safe operating area	Both PFC and output converter monitored

Environmental Specifications

Operating temperature	-40 °C to +70 °C, linear derating to 75% from 50 °C to 70 °C
Storage temperature	-40 °C to +85 °C
Humidity	20 to 90%, non-condensing. Operating. Conformal coat option available
Fan noise	< 45 dBA, 100% load at 30°C
Altitude	Operating - 16,400 feet 5000 m Storage - 30,000 feet
Shock	MIL-STD-810F 516.5, Procedure I, V. Storage
Vibration	MIL-STD-810F 514.5, Cat. 4, 10. Storage