



INNOVATION.PRECISION.EXCELLENCE.

Emergence PRO™ 3D Printer

Operation Manual

Revision E

Precision Valve & Automation
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Halfmoon, NY 12065





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1. Introduction

Before you operate this system, read the operation and setup manual. This will help you to become familiar with the product and ensure successful operation.

If any questions or problems arise, contact PVA's Technical Support department.

1.1 PVA Contact Information

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1.2 Document History

Revision	Revision Date	Reason for Changes
REV E	August 2021	WalkStrong Updates
REV D	April 2021	Printer Tool Kit Note
REV C	November 2020	Updated Getting Started and Print sections
REV B	July 2020	Emergence PRO™ v2 Updates
REV A	December 2019	Initial Release

Note: All photographs and CAD model representations in this document are a “general representation” of the system and its components. The actual appearance of the system and its components can differ based upon customer specific configuration.

1.3 Safety

Certain warning symbols are affixed to the machine and correspond to notations in this manual. Before operating the system, identify these warning labels and read the notices described below. Not all labels may be used on any specific system.



Always wear approved safety glasses when you operate or work near the workcell.



Before you operate the system, read and understand the manuals provided with the unit.



Never put hands or tools in areas with this symbol when the machine is in operation. A dangerous condition may exist.



Read and understand the manuals provided with the unit before any repairs or maintenance is done. Only a qualified individual should do service.



Use caution when there are pressurized vessels. Find and repair any leaks immediately. Always wear appropriate safety equipment when you work with pressurized vessels or vessels that contain chemicals.



Shear hazard from moving parts. Avoid contact.



Do not remove protective guarding.



In situations where inattention could cause either personal injury or damage to equipment, a warning notice is used.



Do not smoke near the machine. Always have a fire extinguisher available for emergency use.



Before performing any repairs or maintenance to the system, turn off power and lock out the power disconnect switch.



Warning notices are used to emphasize that hazardous voltages, current, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use. Only qualified personnel should enter areas designated with this symbol.



Laser light source present. Do not stare directly into the beam. Do not use in the presence of highly reflective surfaces



Pinch hazard from moving parts. Avoid contact.



Hot surface. Avoid contact.



Warning, Ultraviolet (UV) light hazard. Do not look directly at the UV light source.

1.4 Best Practices

- Do not wear loose clothes or jewelry when you operate the printer
- Do not touch the print head while it is moving
- Immediately engage the Emergency Stop button if personnel is in danger
- Locate and define all safety labels on and around the printer before you turn the machine "On"
- Dispose of all used parts and materials in accordance with local laws and regulations

Safety is a joint responsibility between the OEM and the end-user. All precautions and practices should be in accordance with local regulations.

Do Not: Use incompatible tools, remove door interlocks or bypass safety devices, make custom mechanics or change material from the original design.

2. Getting Started

2.1 Unboxing

1. Remove the packaging straps from the shipping crate.
2. Open the shipping crate by first taking the lid off and then removing the sides.
3. Remove plastic wrapping around the metal ramp and any additional items that may be included.



Figure 1: Remove Plastic Wrapping

4. Remove the four metal plates around each of the wheels by removing the lag screws using a 9/16" socket wrench.



Figure 2: Remove Metal Plates

5. Secure the metal ramp to the wooden pallet on the side of the printer with lag screws from prior step.
6. Offload the 3D printer using the metal ramp with two people -- one person in front of the printer and one person in the back.

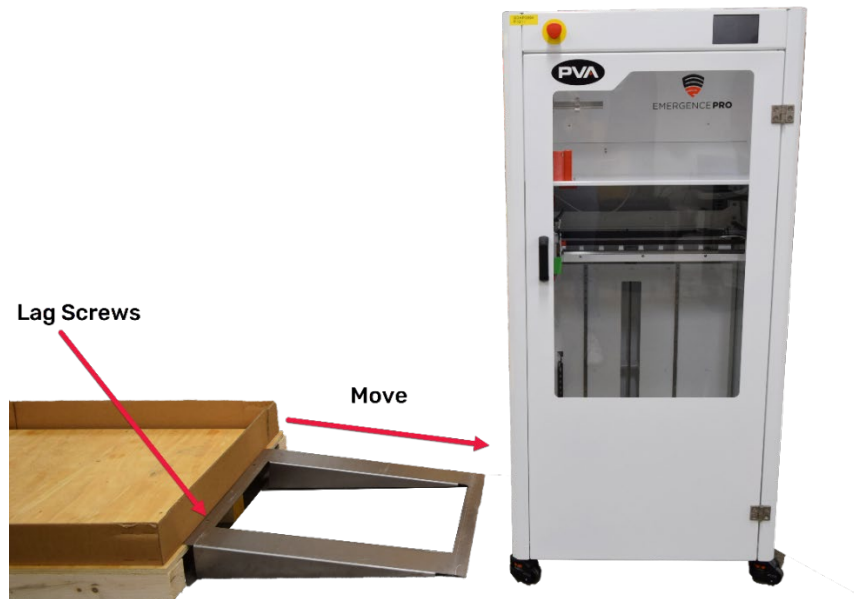


Figure 3: Secure Metal Ramp to Wooden Pallet and Move Printer

7. Move the printer to its location and position the printer on level ground.
8. To level the printer, lower the feet by turning the red knob on each leg to stabilize the 3D printer. Turning the knob to the left lowers the foot and turning the knob to the right raises the foot.

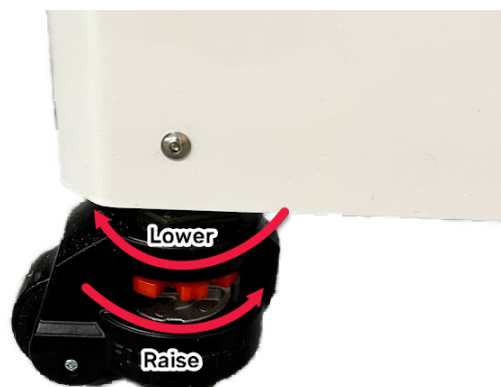


Figure 4: Raise and Lower Feet

2.2 Local Ventilation Disclaimer

IMPORTANT: End user should consult manufacturer safety data sheets to identify if local ventilation is required for their application and proceed as recommended. For composite materials please consult local regulations (OSHA PELs, NIOSH RELs, and/or ACGIH) for the particular materials being used and monitor locally to identify if local ventilation is required.

2.2.1 Exhaust Flange Installation

If local ventilation is required, follow the steps below to install the exhaust flange.

1. Remove cover from exhaust flange mount in the top rear corner of the machine.

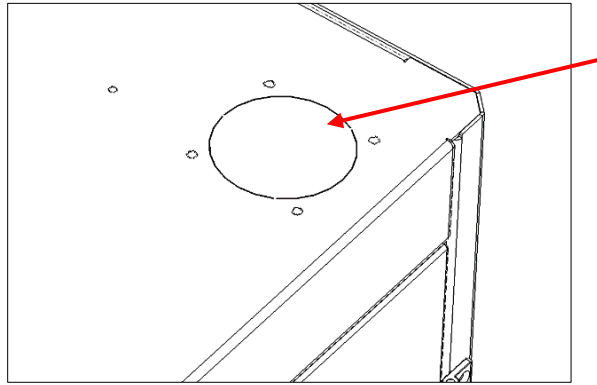


Figure 5: Remove Exhaust Flange Cover

2. Locate the 4-inch exhaust flange provided with the machine.

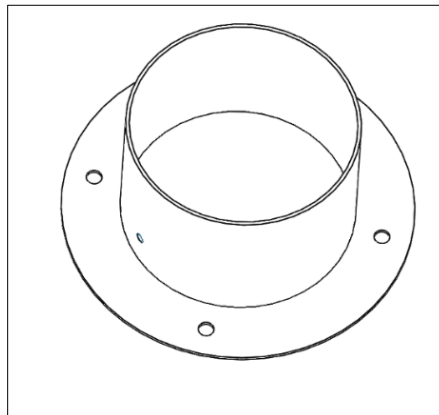


Figure 6: Exhaust Flange

3. Install exhaust flange through top hole and secure with 4 M6X1 hex nuts.

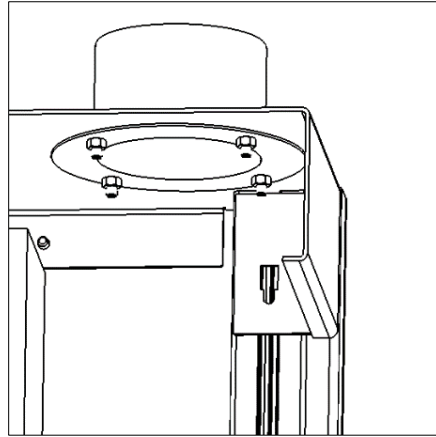


Figure 7: Secure Exhaust Flange

2.3 Initial Setup

2.3.1 Printer Tool Kit

Note: The printer tool kit is specific to orthotics and prosthetics and available for printer sales through PVA Med.

Before starting the setup process, locate the Tool Kit included with your printer. The following items are included and shown below.



Figure 8: Printer Tool Kit

- | | |
|-----------------|---------------------------------|
| 1. 7 mm wrench | 8. Cleaning needles |
| 2. Bubble level | 9. SD card and converter |
| 3. Toolbox | 10. Tweezers |
| 4. Lubricant | 11. Brass wire brush |
| 5. Hex wrenches | 12. Open ended wrench 9/16-inch |
| 6. 0.2 mm shim | 13. Spade/Putty knife |
| 7. Side cutters | |

2.3.2 Setting Up the Printer

1. Remove additional packing material from the outside of the printer.
2. Remove the key tied to the handle on the front door. The key is for the back door.
3. Open the front door and remove the green metal bracket holding the extruder in place by removing the mounting screws using a 4 mm hex key.

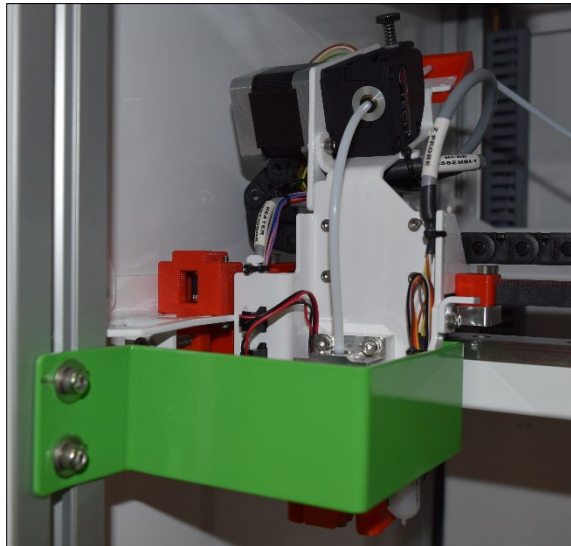


Figure 9: Remove Bracket from Front Door

4. Remove the two green brackets attached to the print bed using a 3 mm and 4 mm hex key.

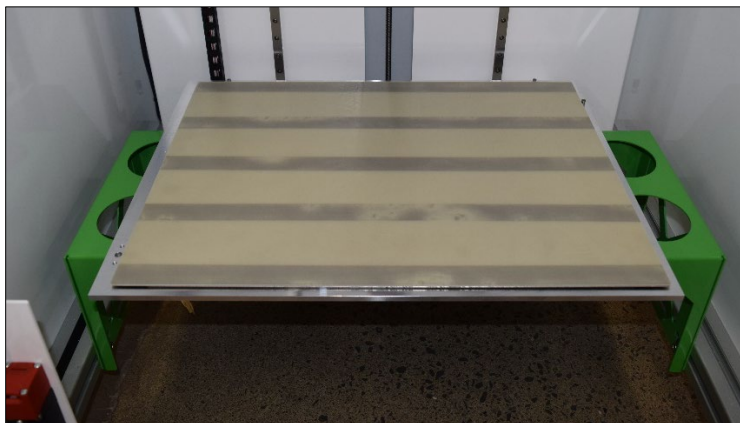


Figure 10: Remove Brackets from Print Bed

5. Unbox the nozzle brush from the box that is shipped with the printer.



Figure 11: Nozzle Brush Box

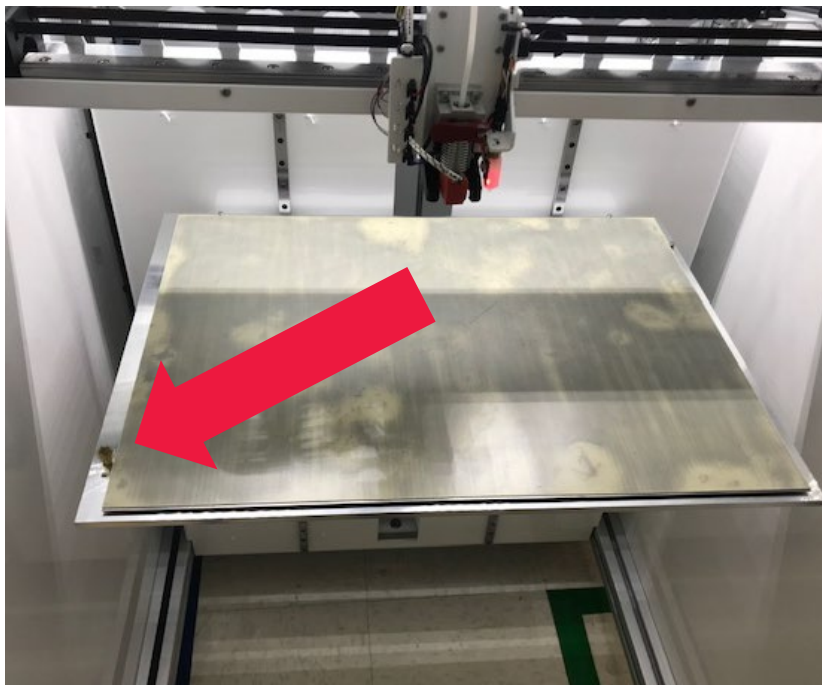


Figure 12: Install Nozzle Brush

7. Insert the dehumidifier into the dehumidifier holding brackets.



Figure 13: Insert Dehumidifier



Figure 14: Connect Power Cord

2.4 Emergence PRO™ Setup

2.4.1 Printer Control Screen

The printer control screen is a touch screen controller consisting of four screens: Control, Print, Console, and Setup. See image on next page.

- | | |
|-------------------------------|--|
| 1 Stop Button | Stops and reboots printer. |
| 2 Bed Button | Sets bed to active state or standby. |
| 3 Hot End Button | Sets hot end to active state or standby. |
| 4 Current Temperature | Displays current tool temperature. |
| 5 Active Temperature | Set point for active tool temperature. |
| 6 Standby Temperature | Set point for standby tool temperature. |
| 7 Print Head Position | Displays position of print head. |
| 8 Axes Homing Buttons | Homes the print head in all axes or in an individual axis. <ul style="list-style-type: none"> • Auto homing -- button on the far left • X-axis -- button in the middle left • Y-axis -- button in the middle right • Z-axis -- button on the far right |
| 9 Bed Probe | Probes bed and creates bed level profile. |
| 10 File Selection | Displays available prints. |
| 11 Move Selection | Allows movement of print head <ul style="list-style-type: none"> • X-axis -- negative moves left, positive moves right • Y-axis -- negative moves towards front of the machine, positive moves towards rear of the machine • Z-axis -- negative moves up, positive moves down |
| 12 Extrusion Selection | Allows for extrusion of filament when hot end is at temperature. |
| 13 Macro Selection | Allows for selection of macros. Three macros are found on the right side of the Control Screen. Additional macros can be accessed by selecting Macro button. |
| 14 Control Screen | Main menu for the control screen. |

- 15 Print Screen** Similar to the control screen and only used when printing. Allows for pause, resume, and cancel commands.
- 16 Console Screen** Displays codes and commands recently entered in the printer.
- 17 Setup Screen** Options for adjusting the touchscreen display settings.
- 18 Status** Displays the status of the printer.

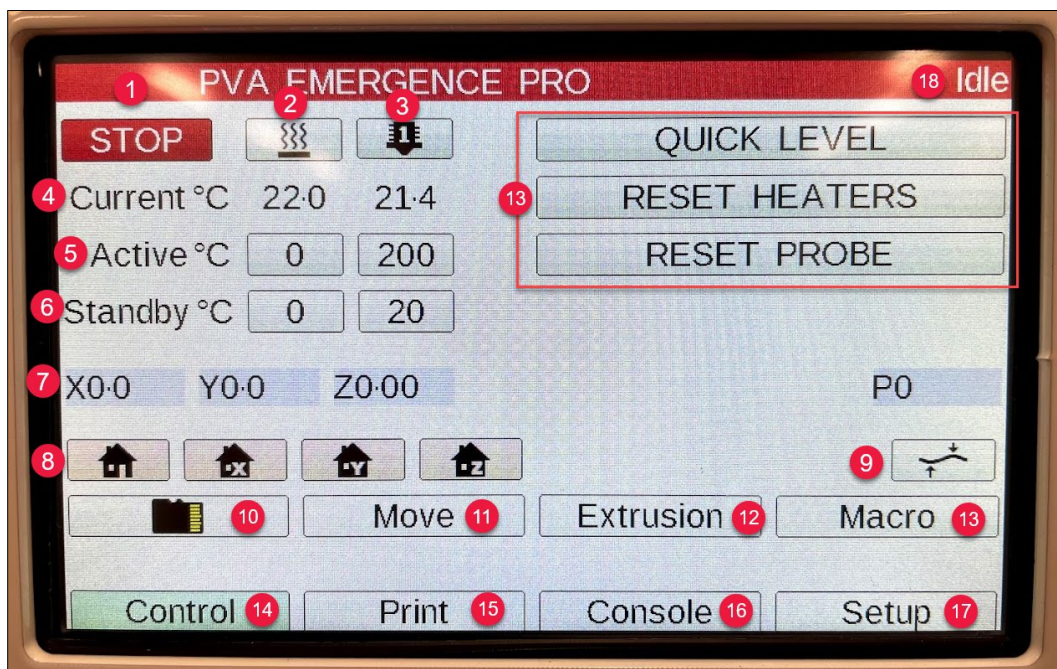


Figure 15: Printer Control Screen

2.4.2 Check Levelness of the Bed Relative to the Gantry

1. Check the status on the Printer Control Screen in the upper right corner. It should say **Idle** (Figure 16).
2. If it reads **Standby**, undo the red Emergency Stop button located on the front upper left corner of the machine. Rotate Emergency Stop button clockwise to disengage; status will turn to Idle.

Note: If the Emergency Stop Button is pressed when the printer is running, the status will read Halted. Rotate Emergency Stop button clockwise to release. To undo Halted status in the web interface, reconnect to the network.

3. On Printer Control Screen, select **Quick Level** on the right side of the display (Figure 16).
4. The print head will move to the rear right of print bed. The Print head will move to the center of the bed extending the profile probe. The bed will move upwards until the probe sensor is tripped. After homing the z-axis bed level, the head is run at four corners.

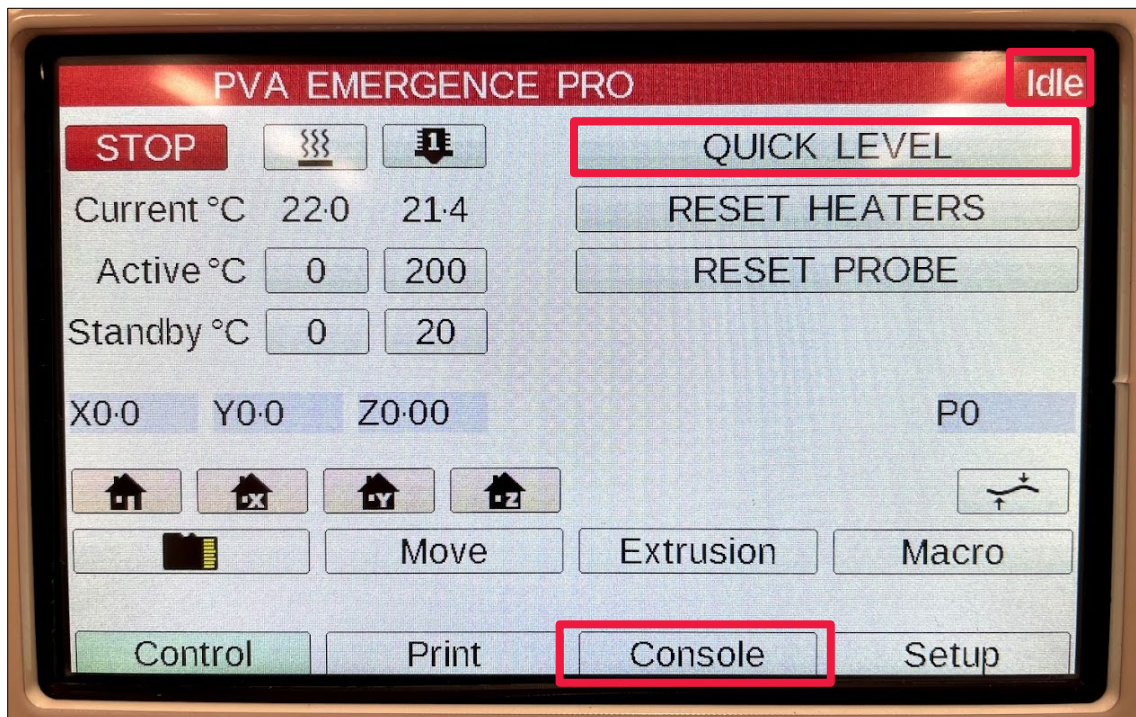


Figure 16: Quick Level

5. After the **Quick Level** macro is completed, the required adjustments to the leveling bolts will be displayed under the Console tab.
- On Printer Control Screen, select **Console** (Figure 16) and a message will be displayed (Figure 17).

Note: If connected to the web interface, the message can be found under the G-code Console.

- The **first value** will be for the rear **right leveling screw**. This will typically be 0.
- The **second value** will be the amount of adjustment required for the **left leveling screw**; 0.15 turn up (-0.10 mm) in Figure 17.
- The **third value** will be the amount of adjustment required for the **front right leveling screw**; 0.04 turn down (0.03 mm) in Figure 17.

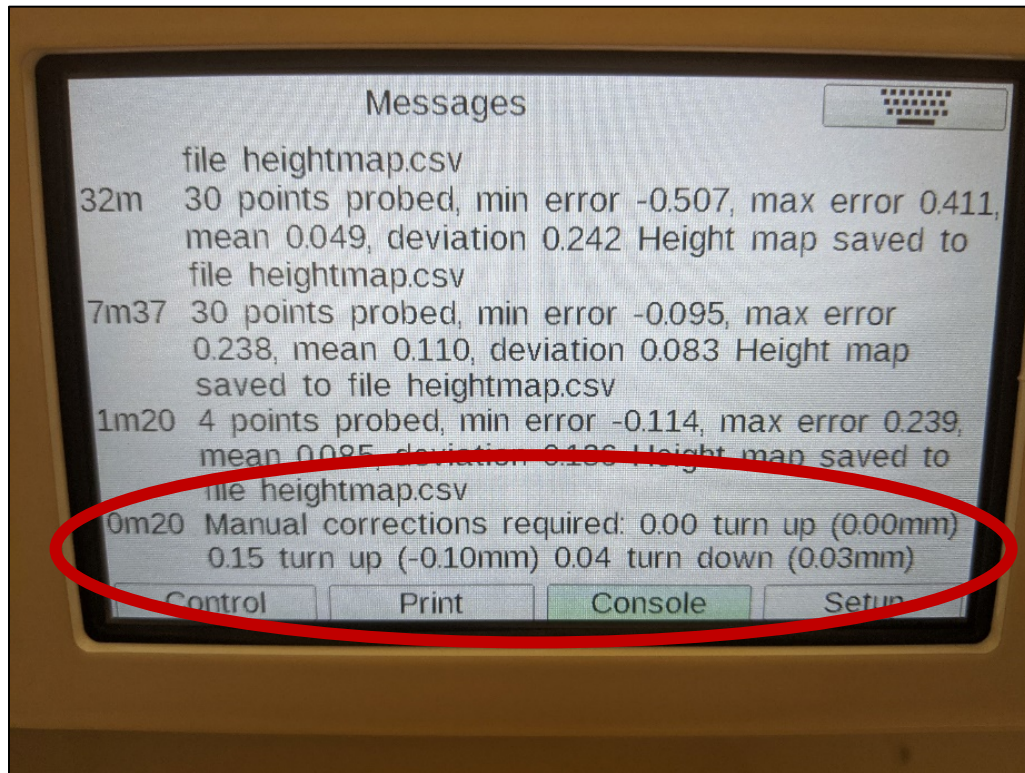


Figure 17: Leveling Values Displayed

2.4.3 Adjust Bed Level

1. If adjustments are needed, loosen the hex nut on the left and front right leveling screw on the bottom of the bed with a 7 mm wrench (Figure 19). The tools are included in the Printer Tool Kit.

Note: The back right adjustment screw does not need to be adjusted.



Figure 18: Three Leveling Screws



Figure 19: Hex Nut

2. Adjust the leveling screws according to the values displayed (Figure 20).
 - 1.00 turn – equivalent to a full rotation of the screw.
 - 0.50 turn – equivalent to a half rotation of the screw.
 - 0.25 turn – equivalent to a quarter rotation of the screw.
 - 0.12 turn – equivalent to an eighth rotation of the screw.
3. With a 2 mm hex wrench, move the screw up or down by rotating the leveling screw. To move the screw up, rotate clockwise. To move the screw down, rotate counter-clockwise.

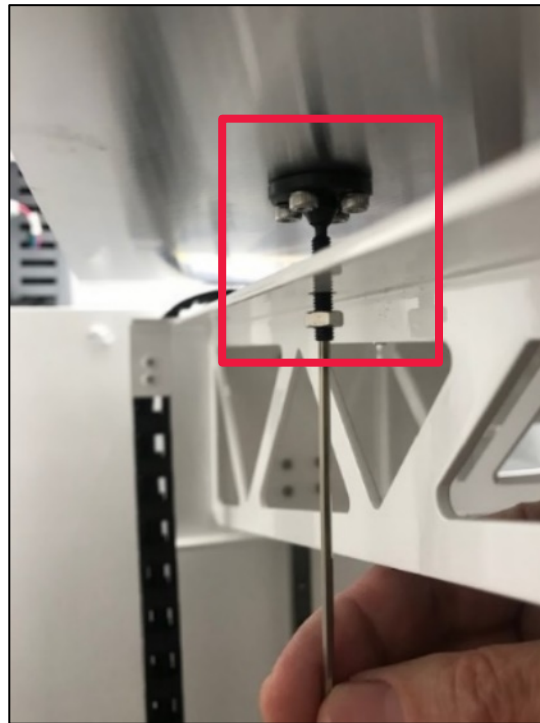


Figure 20: Rotate Leveling Screw

4. After adjusting the leveling screws, the appropriate amount, re-run the **Quick Level** macro to see if any additional adjustments are needed.
 - **If results require less than a 0.12 turn (an eighth of a rotation), the quick level is complete.**
 - If larger adjustments are needed, make the required adjustments then re-run **Quick Level** macro.

5. Once the three points of the bed level are within +/- 0.12 turn, lock the leveling screws in place.
 - To lock the leveling screws, hold the leveling screw in place with a 2mm hex key then tighten hex nut with 7mm wrench. Be sure not to rotate leveling screw during this process or bed may no longer be level.
6. Re-run the **Quick Level** macro and view results with the leveling screws locked in.

Note: Bed leveling should be performed periodically (every 5-10 prints) as well as during initial setup or if the printer is moved.

2.4.4 Install and Gap Hot End

1. On Printer Control Screen, select **Move**. The **Move Head** screen will display.
2. In the Z value field, press 50 twice to lower the bed 100 mm to install the hot end. A positive move will increase the gap between the hot end and the print bed.
3. To confirm the position of the bed, close out of **Move Head** screen and check the print head position to confirm that Z-position is roughly 100 mm.

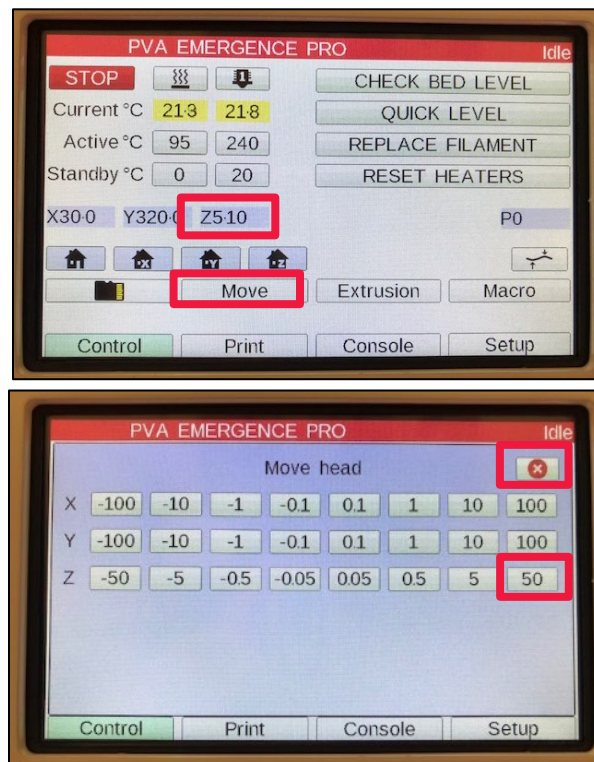


Figure 21: Move Print Bed

4. Release the red hot end clamp handle on the hot end receiver block by pulling it forward (Figure 22).
5. Fully insert a **Hot End** into the hot end receiver block and clamp. The white cables should face the front and the blue cables should be accessible. Ensure it is fully seated and pushed up as high as possible into the opening.

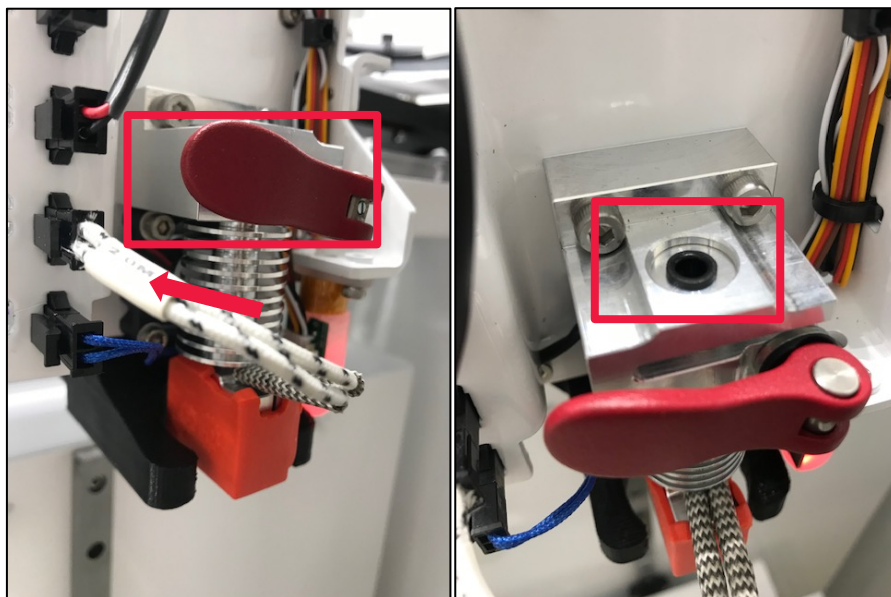


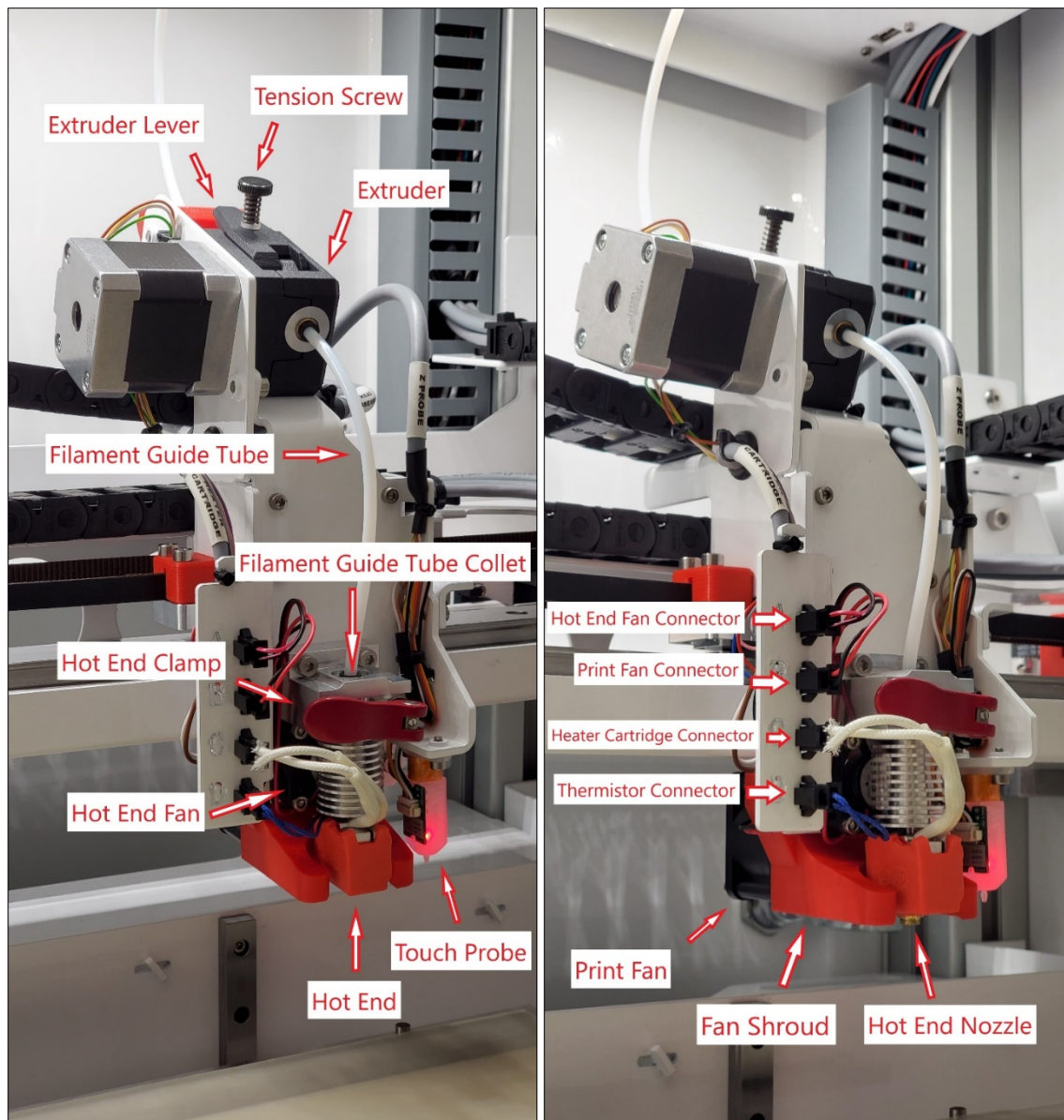
Figure 22: Inserting Hot End

Note: The hot ends are labeled based on nozzle size and material as follows:

Hot End Label	Nozzle Size and Material
0.4B	0.4 mm Brass Nozzle
0.6B	0.6 mm Brass Nozzle
1.5B	1.5 mm Brass Nozzle
2.0B	2.0 mm Brass Nozzle
2.0SS	2.0 mm Stainless Steel Nozzle

6. Fully insert the **Filament Guide Tube** into the hot end via the **Filament Guide Tube Collet**. Ensure the guide tube is fully inserted and bottomed out within the hot end.
7. Plug in the white **Heater Cartridge Connector** into the slot labeled C.
8. Plug in the blue **Thermistor Connector** into the slot labeled D.

Note: If the thermistor connector is not plugged in correctly, the Active Temp sensor will read 2000°C. In that case, correctly insert the thermistor connector and press Reset Heaters on the Printer Control Screen.



9. On Printer Control Screen, set the **Active Bed Temperature** to the appropriate print temperature for the filament you will use.

- Select the **Active Temp** button.

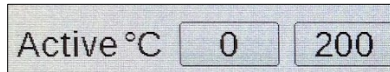


Figure 23: Active Temp Button

- Enter the desired temperature and press Set.

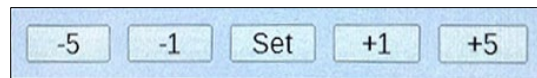


Figure 24: Set Temperature

- Select the **Bed icon** .
 - The current temperature icon will turn pink when it is heating the bed. If the button is selected again, it will turn yellow and target the standby temperature.

Note: The active hot end temperature will not accept new parameters or heat up while the tool icon is active.

10. On Printer Control Screen, set the **Active Hot End Temperature** to the appropriate print temperature for the filament you will use.

- Select the **Active Temp** button.

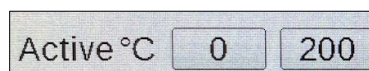


Figure 25: Active Temp Button

- Enter the desired temperature and press Set.

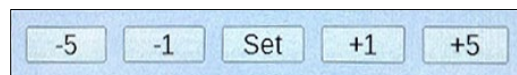


Figure 26: Set Temperature

- Select the **Hot End icon** .
 - The current temperature button will turn pink when it is heating the hot end. If the button is hit again, it will turn yellow and target the standby temperature.

Filament	Hot End/Nozzle	Bed Temperature	Hot End Temperature
ClearFit	1.5 mm Brass	95°C	270°C
PCTG	2.0 mm Brass	95°C	240°C
FlexyFit	0.6 mm Brass	40°C	235°C
PLA	0.6 mm Brass	65°C	210°C
Nylon 12	2 mm Stainless Steel	85°C	275°C
PLA/Carbon Fiber	2 mm Stainless Steel	70°C	210°C

Figure 27: Temperatures for Installing Hot End

- Once the hot end and print bed are at temperature, home the printer by pressing **Auto Homing Button**  (Figure 30).
- On Printer Control Screen, select **Move**. In the **Move Head** screen and in Z-values, press -50 twice to move bed up about 100 mm.

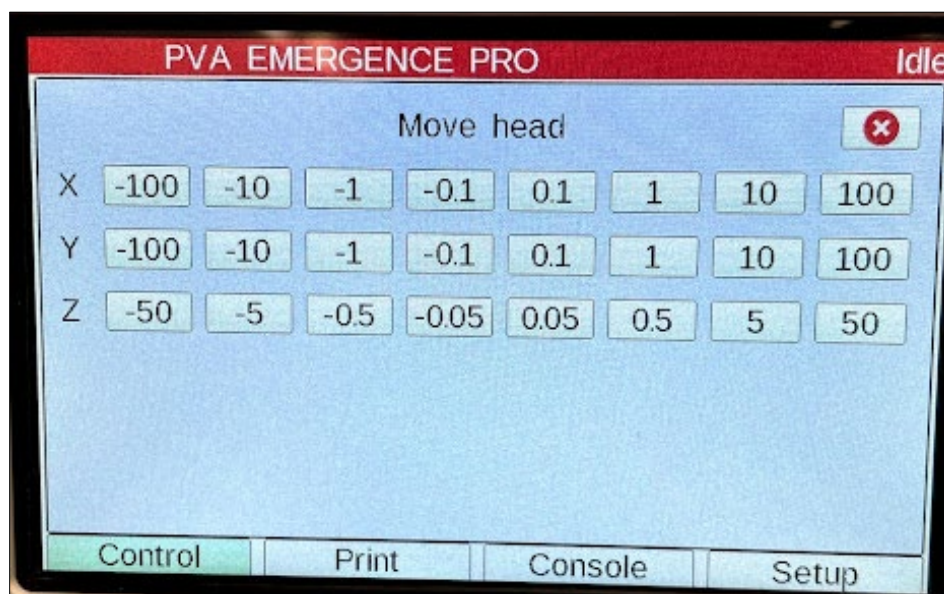
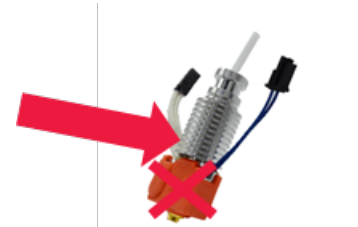
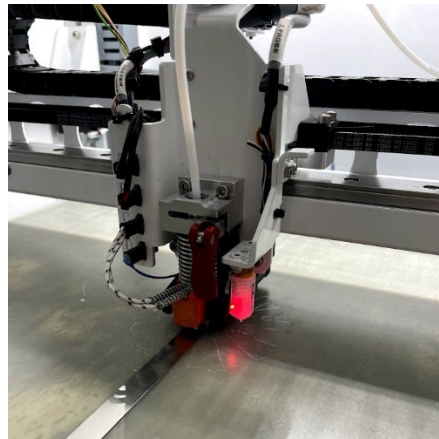


Figure 28: Move Head

- A negative move will reduce the distance between the bed plate and the nozzle. If a larger Z move is commanded, the machine will stop at 0.

13. Insert the 0.2 mm shim provided in the Tool Kit between the bed and the nozzle.
14. Physically lower the hot end height until it just touches the 0.2 mm shim.



WARNING: When moving the hot end, hold the coil part of the hot end. Do not hold the hot end enclosed in red plastic. The hot end and print bed are HOT.

Figure 29: Insert Shim

15. Tighten the red **Hot End Clamp** handle to lock the hot end into position.
16. Twist the red clamp handle until you feel enough tension. Close the red clamp.
17. On the Printer Control Screen, select **Move**. In Z-values, press 5 to lower the print bed 5 mm.
18. To confirm the position of the bed, close out of the **Move** screen and check the Print Head Position to confirm that the Z-position is roughly 5.

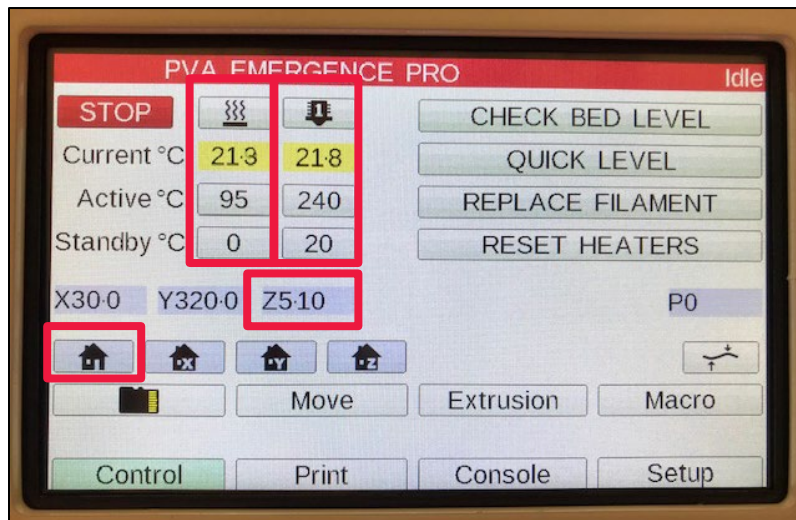


Figure 30: Set Active Temperatures

2.4.5 Load Filament

1. On the Printer Control Screen, select **Move** and press 50 once in Z values to lower print bed 50 mm.
2. On the Printer Control Screen, set the **Active Bed and Hot End Temperature** to the appropriate print temperature for material.

Filament	Hot End/Nozzle	Bed Temperature	Hot End Temperature
ClearFit™	Stainless Steel	95°C	270°C
PCTG	Brass	95°C	240°C
FlexyFit™	Brass	40°C	235°C
PLA	Brass	65°C	210°C
Nylon 12	Stainless Steel	85°C	275°C
PLA/Carbon Fiber	Stainless Steel	70°C	210°C

Figure 31: Temperatures for Installing Filament

3. Slide the appropriate filament onto the filament support roller. The filament roll should be oriented so the filament will be coming off the top of the roll toward the front of the machine (Figure 32).

WARNING: When removing the free end of the filament from the roll, ensure that the roll is always secured in your hand. If not properly handled, the roll can unwind and tangle which leads to extrusion issues.

4. Manually push the filament into the filament guide and continue to feed until it reaches the extruder. You will no longer be able to push the filament at this point.

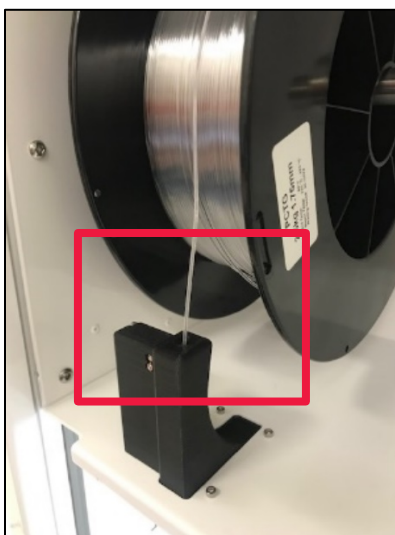


Figure 32: Filament Load

5. If necessary, adjust the shaft collars on the filament roll support so the filament roll is centered relative to the filament guide (Figure 33).
6. Loosen the bolts with a 5 mm Allen key. A 10-20 mm gap between the collar and the side of the roll is sufficient.

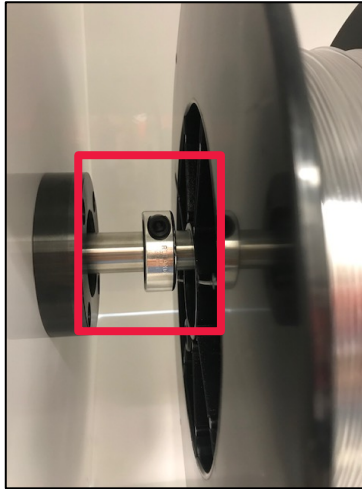


Figure 33: Shaft Collars

7. Via the **Extrusion** button on the printer display, quickly extrude 200 mm to prime the hot end (Figure 34).
 - In the **Extrusion Amount**, select 100.
 - In **Speed**, select 50.
 - Press **Extrude** twice.
8. The first 200 mm can be fed quickly. During this extrude, material will be pulled from the roll. If this is not occurring, manually feed material from the roll to ensure it has reached the extruder.
9. After the initial 200 mm is fed, extrude another 100 mm at a slower speed (less than 20 mm/s) until material is freely flowing through the nozzle. The example below reflects a speed of 10 mm/s.
 - In **Extrusion Amount**, select 100.
 - In **Speed**, select 10.
 - Press **Extrude**.
 - If necessary, extrude additional material.

10. Wipe nozzle with the putty knife from the printer tool kit and perform a 2 mm retract by pressing '1' twice (Figure 34).

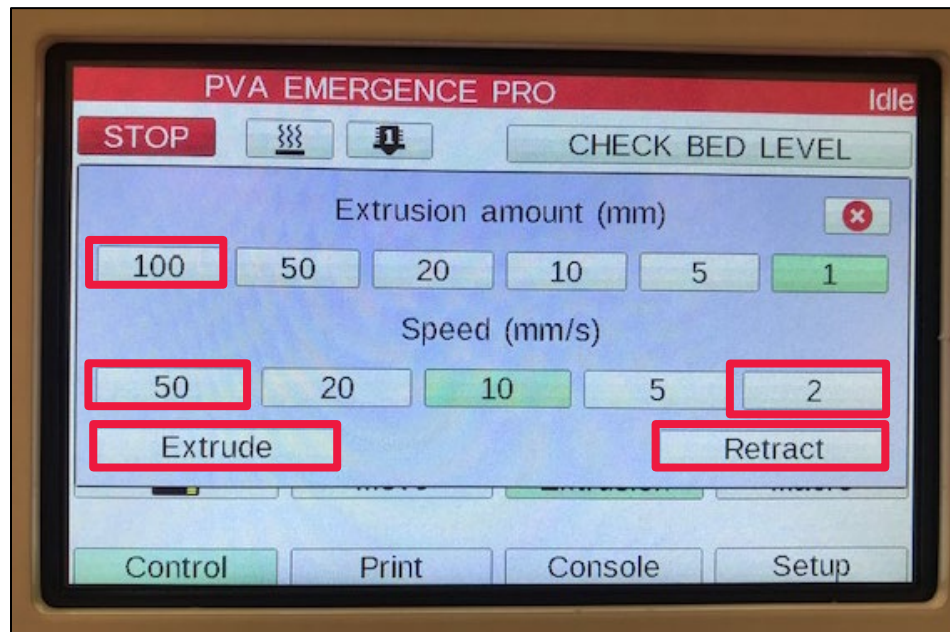


Figure 34: Extrusion

2.4.6 Load Filament Mid-Print

If a filament change is needed mid-print, perform the following steps.

1. Select the Pause button on the print screen if the printer is not already paused.

Note: If the filament runner sensor was triggered a message will be displayed and the print will automatically be paused.

2. Use the Move button to jog the print head to a position that is away from the print.
3. Follow the steps outlined in 2.4.7 Unload Filament.
4. Follow the steps outlined in 2.4.5 Load Filament.
5. On the Printer Control Screen, select Resume.

Note: Changing filament mid-print can result in an imperfection within the print. It is best to track filament used on a roll and ensure you have the appropriate amount of filament to complete a print.

2.4.7 Unload Filament

1. On Printer Control Screen, set the **Active Hot End Temperature** to the appropriate print temperature for material.
2. Once the temperature is reached, select the **Extrusion** button on the printer display.
 - Set **Extrusion Amount** to 100.
 - Set **Speed** to 50.
 - Press **Retract** four times.
3. Once filament is retracted, manually wind up the filament spool until the filament is free from the filament guide.
4. Be sure to properly secure the free end of the filament to ensure not tangles on the spool.
5. You may notice a blob at the end of the filament; this can be trimmed off to make re-loading easier.

2.4.8 Remove Hot End

After the filament is removed, perform the steps below:

1. Remove the **Filament Guide Tube**.
2. Remove the white **Heater Cartridge Connector** in the slot labeled C.
3. Remove the blue **Thermistor Connector** in the slot labeled D.
4. Release red **Hot End Clamp** handle on hot end receiver block.
5. Remove the **Hot End**.

2.4.9 Setting Up the Emergence PRO™ Wireless Connection

The Emergence PRO™ has 2.4GHz wireless network connection capability that allows you to use the printer remotely with a computer.

1. Turn on the printer using the on/off switch located near the power cord connection. The printer control screen will start up on its own.
2. Release the Emergency Stop button.
3. Via a laptop or PC, connect to the network matching your printer serial number by pressing the WiFi icon.
4. Your printer serial number will automatically be broadcasted.

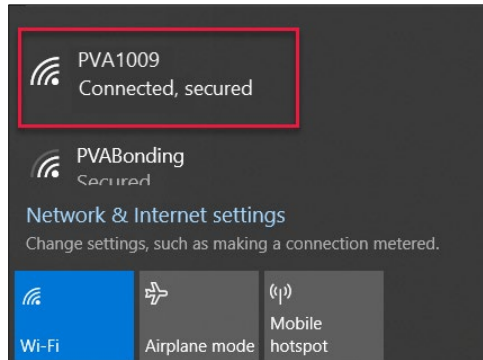


Figure 35: Connecting to Network

Note: The serial number is listed on the label located in the upper right corner of the back panel of the printer.

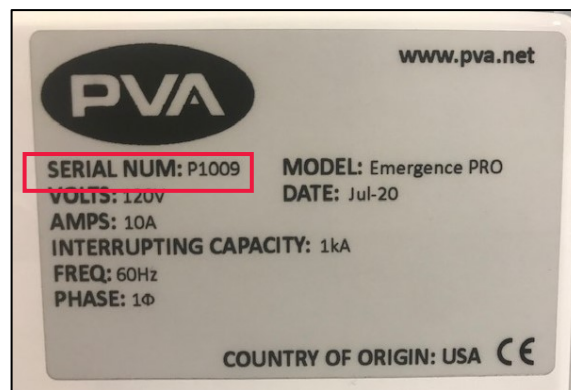


Figure 36: Serial Number

5. The password for the network is **PVA12345**. This should not be needed next time you connect.

- Once connected to the network, open Google Chrome web browser and type **11.22.33.44** into the address bar. This will bring you to the web interface.

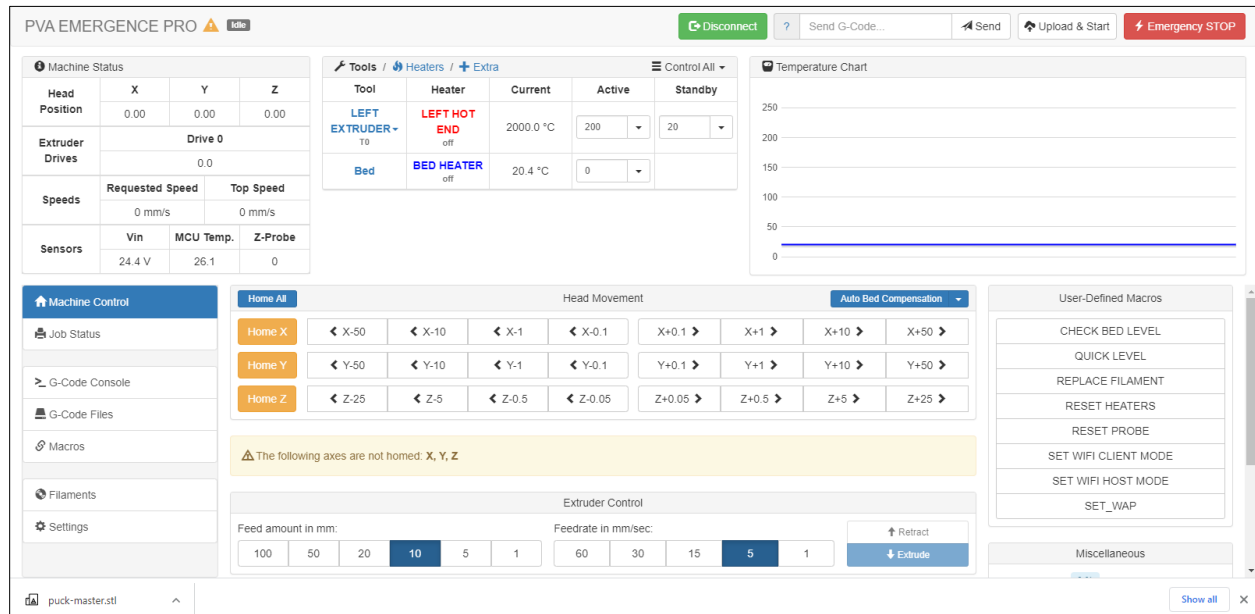


Figure 37: Web Interface

2.4.10 Connect Web Interface to Existing Network

There is an option to connect an existing 2.4 GHz WiFi network to the web interface.

Note: This option is not compatible with 5 GHz networks.

- Reserve a dedicated IP address with your IT team or via your router. The process to do this will be specific to your network hardware and you may need consult the manufacturer.
- Use the steps outlined in Section 2.4.9 to connect to the Emergence PRO's WiFi network.
- Once connected, access the Web Interface. Navigate to the G-Code Console.

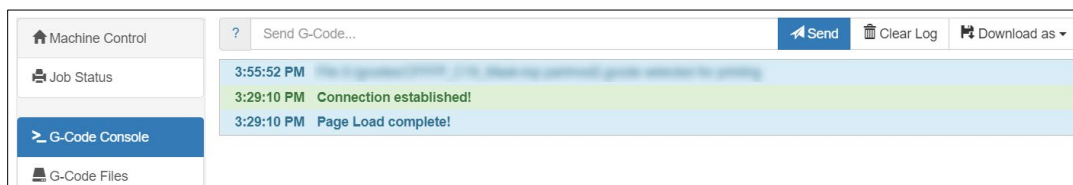


Figure 38: G-code Console

2.4.11 M587 Command

The M587 command will be used to send your desired network information to the web interface's G-code console. The M587 command must include three components.

- **S:** Network SSID
 - Must be enclosed in quotation marks
 - Case-sensitive
- **P:** Network Password
 - Must be enclosed in quotation marks
 - Case-sensitive
- **I:** IP address to use when connected to this network (optional).
 - This should be the IP address that you previously reserved
 - If zero is entered or not specified, an IP address will be acquired via DHCP.
 - This will result in your network hardware assigning the available IP addressed based on existing devices connected to the network.

The M587 command must be written in the following format:

M587 S"WIFI_NETWORK_NAME" P"PASSWORD" Ix.xxx.xx.xxx

Example:

Network SSID	TEST_Network
Network Password	Testing123
IP Address	1.160.10.240

Using the credentials listed above, the M587 command would be as follows:

M587 S"TEST_Network" P"Testing123" I1.160.10.240

1. In the **Send G-code field**, enter the full M587 command.
2. Click **Send**. Once received by the printer, if formatted correctly, you will see the M587 shown in green within the system messages.

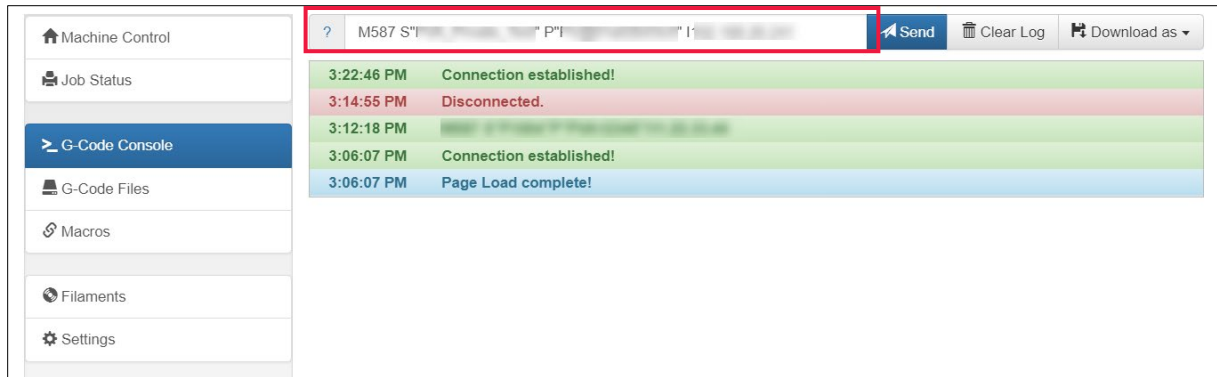


Figure 39: Enter M587 Command

Additional Commands:

- To view stored networks, enter **M587**
- To see the current network connection and IP, enter **M552**
- To remove the network from memory, enter **M588 S"NETWORK_NAME"**
- To remove all networks from memory, enter **M588 S""**

2.4.12 Change Web Interface to Client Mode

Confirm Network Connectivity

1. Navigate to **Macros** to via web interface or printer's HMI.
2. Select the **Set Wi-Fi Client Mode** macro.
3. The printer will temporarily switch to client mode and attempt to connect to the assigned network until there is a power cycle or emergency stop.
4. If printer does not connect to the network, confirm network credentials, network strength, and frequency.
 - To revert the printer back to host mode, select the **Set Wi-Fi Host Mode** macro to return the unit to host mode.
 - To view printers current network status, the M552 command can be entered in the console tab of the HMI.

Set Printer Wi-Fi to Start in Client Mode

1. To switch the printer so it will start in client mode moving forward, select **Settings**.
2. Select **System Editor**.
3. Navigate to the config.g file and right click. Select **Edit**. The file will open.

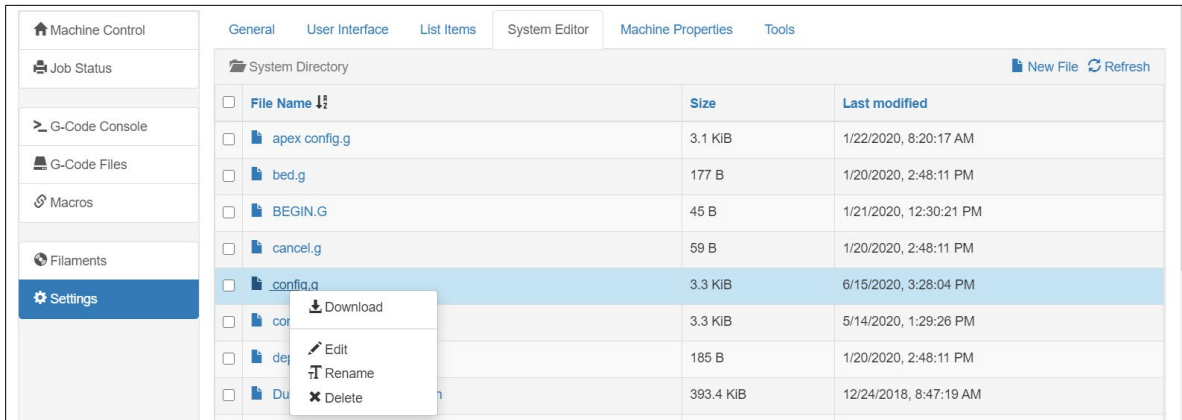


Figure 40: Access System Editor

4. Navigate to the **Network** section. Two lines will need to be modified to implement the change.

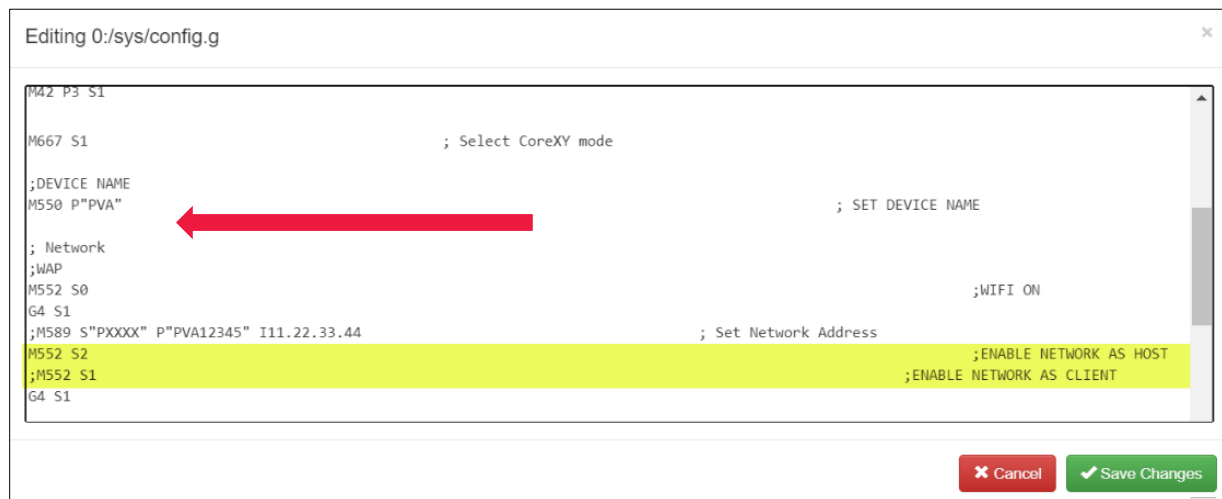


Figure 41: Edit Config.g File

5. Delete the semicolon (;) from M552 S1.
6. Add a semicolon (;) to M552 S2 to select the network.

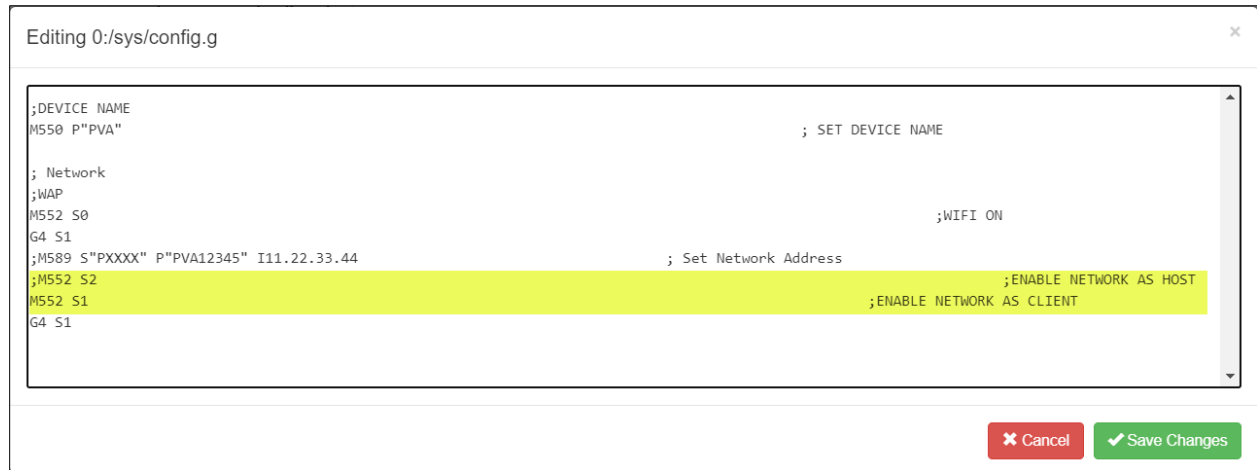


Figure 42: Change Network

7. Click **Save Changes**.

Note: The web interface must be rebooted after changes to the network have been made.

8. Click **Yes** to reboot the web interface.

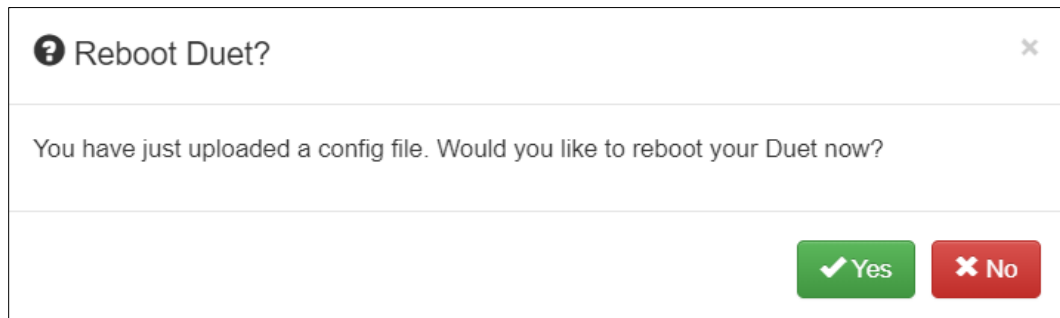


Figure 43: Reboot Confirmation

9. The web interface will confirm the file was successfully updated.

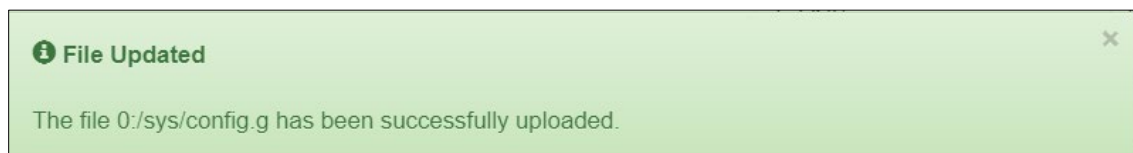


Figure 44: File Updated

10. The control screen on the Emergence PRO will confirm that the machine is connected to the network.

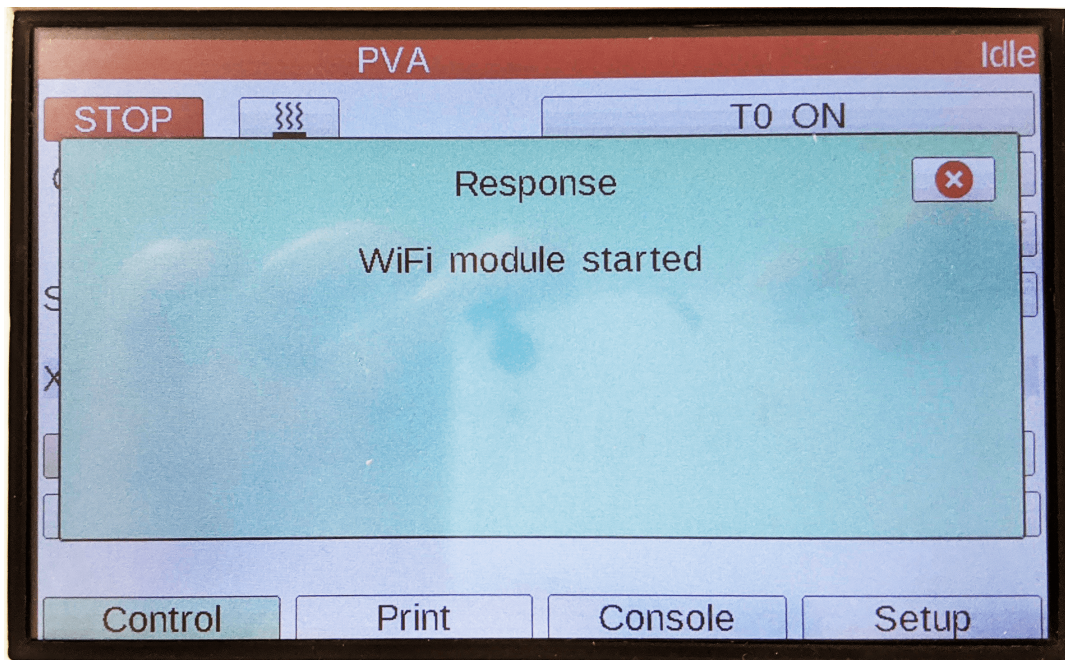


Figure 45: Network Connection Confirmation

11. The network and IP address will appear on the control screen as the console tab of the web interface. The green popup will disappear after 10 seconds.

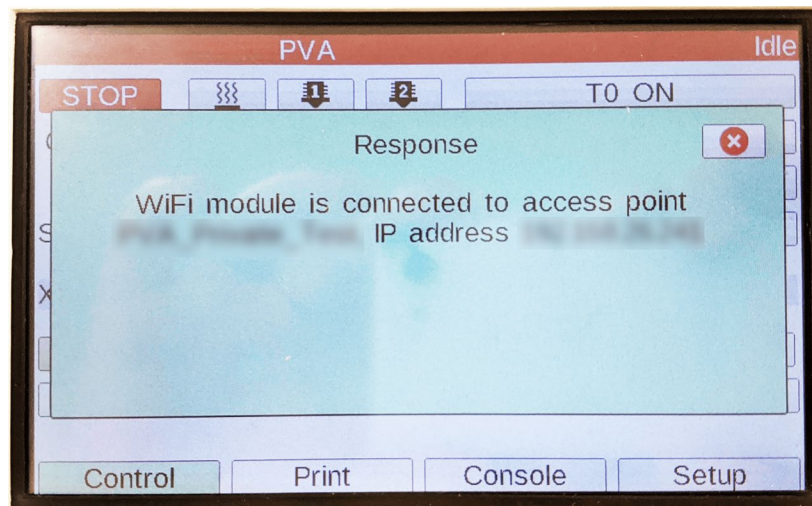


Figure 46: Control Screen WiFi Confirmation

Note: The Emergence PRO can also be powered down so the SD card storing the config.g file can be removed from the controller. Within the system file of the SD card is the Config.g file. This file can be opened and modified with a program editor such as Notepad.

3. Print

3.1 Print Screen

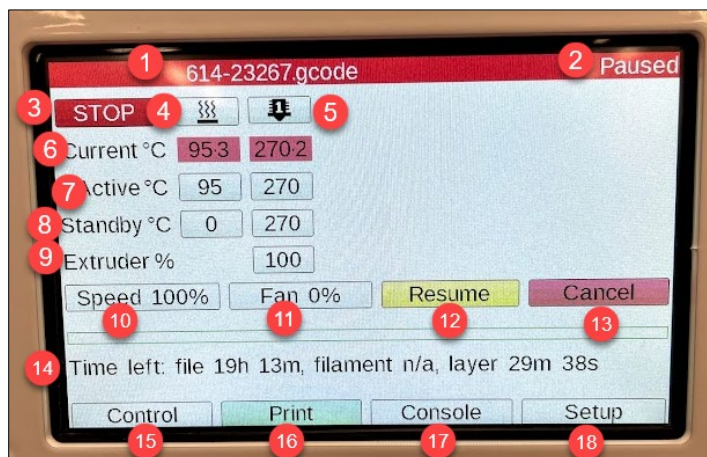


Figure 47: Print Screen

- | | |
|------------------------------|---|
| 1 Gcode File | Displays which Gcode file is currently printing. |
| 2 Status | Displays the status of the printer. |
| 3 Stop | Stops the current print. |
| 4 Bed Button | Sets bed to active state or standby. |
| 5 Hot End Button | Sets hot end to active state or standby. |
| 6 Current Temperature | Displays current tool temperature. |
| 7 Active Temperature | Set point for active tool temperature. |
| 8 Standby Temperature | Set point for standby tool temperature. |
| 9 Extruder | Adjust the amount of extrusion for the current print. |
| 10 Speed | Adjust the print speed for the current print. |
| 11 Fan | Adjust the speed of the part cooling fan. |
| 12 Pause/Resume | Allows you to pause and resume the print. |
| 13 Cancel | Cancels the print. |
| 14 Time Left | Displays the amount of time left on the print. |
| 15 Control Screen | Main menu for the control screen. |
| 16 Print Screen | Current Screen. |
| 17 Console Screen | Displays codes and commands entered in the printer. |
| 18 Setup Screen | Options for adjusting the touchscreen display settings. |

3.2 Starting the Print

The Emergence PRO™ allows for a G-code to be loaded through a MicroSD card or through a network upload. Once you have acquired your G-code, you can use either option.

3.2.1 MicroSD

1. Copy the G-code file from your PC to a MicroSD card.

Note: You may need to insert the microSD card into an adapter. The micro SD card will typically show up as drive D.



Figure 48: MicroSD Card

2. Insert the MicroSD card into the SD card reader located on top rear of machine next to Wi-Fi antenna.

Note: The MicroSD card must be inserted with the metallic contacts facing the center of the printer.

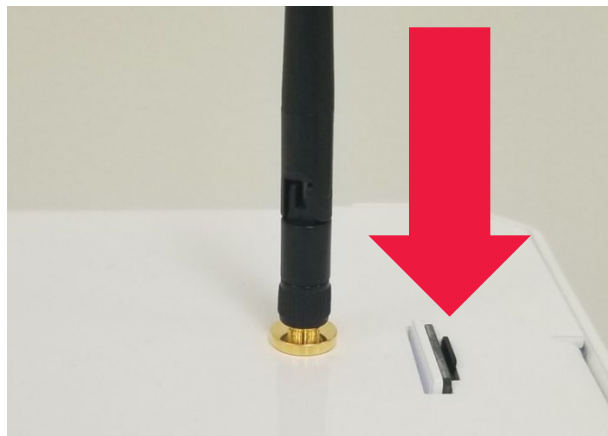


Figure 49: Insert MicroSD Card

3. Press the MicroSD card button on the Printer Control Screen.

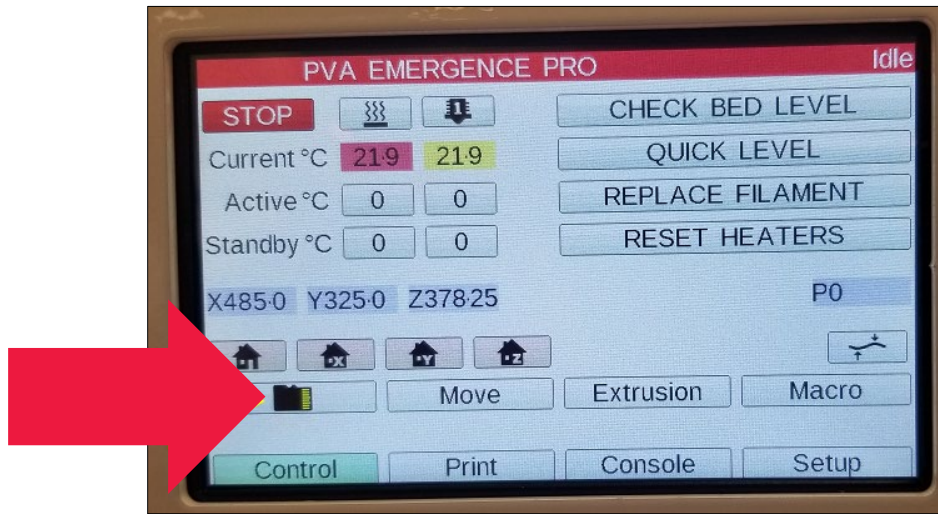


Figure 50: MicroSD Button

4. On the MicroSD screen, press the MicroSD card icon to switch between the onboard SD card (Card 0) and the secondary SD card on the top of the machine (Card 1).

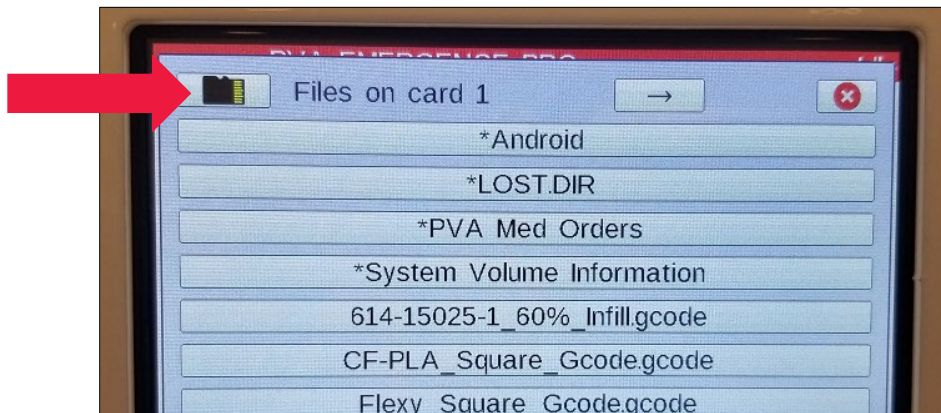


Figure 51: MicroSD Screen

5. Select a desired G-code to run.

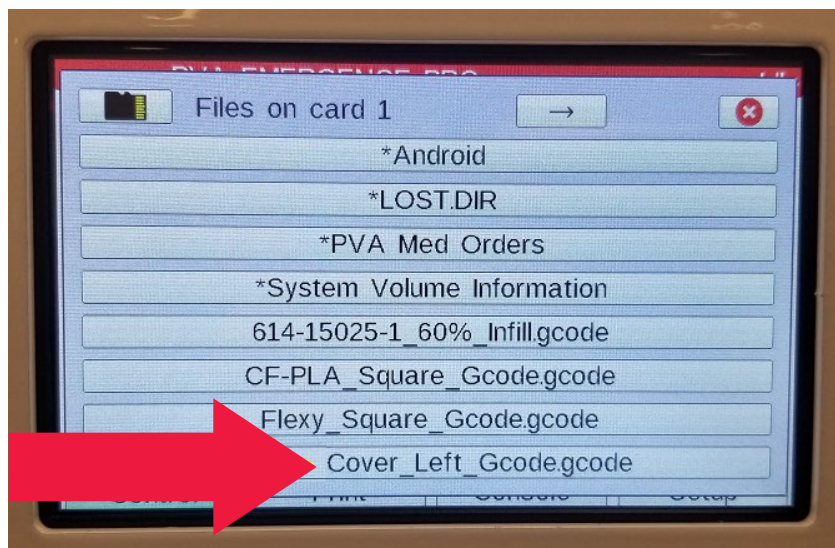


Figure 52: Select G-code

6. Select **Print**.

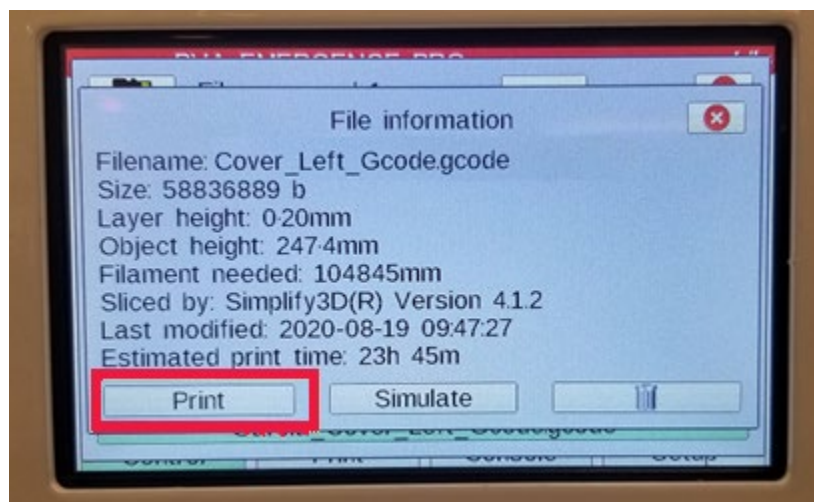


Figure 53: Print

3.2.2 Internet Upload

1. Connect to the printer via the Web Interface (Section 2.4.9).
2. To upload a new file from the Web Interface, click **Upload & Start** in the upper right-hand corner of the Web Interface Home Screen.

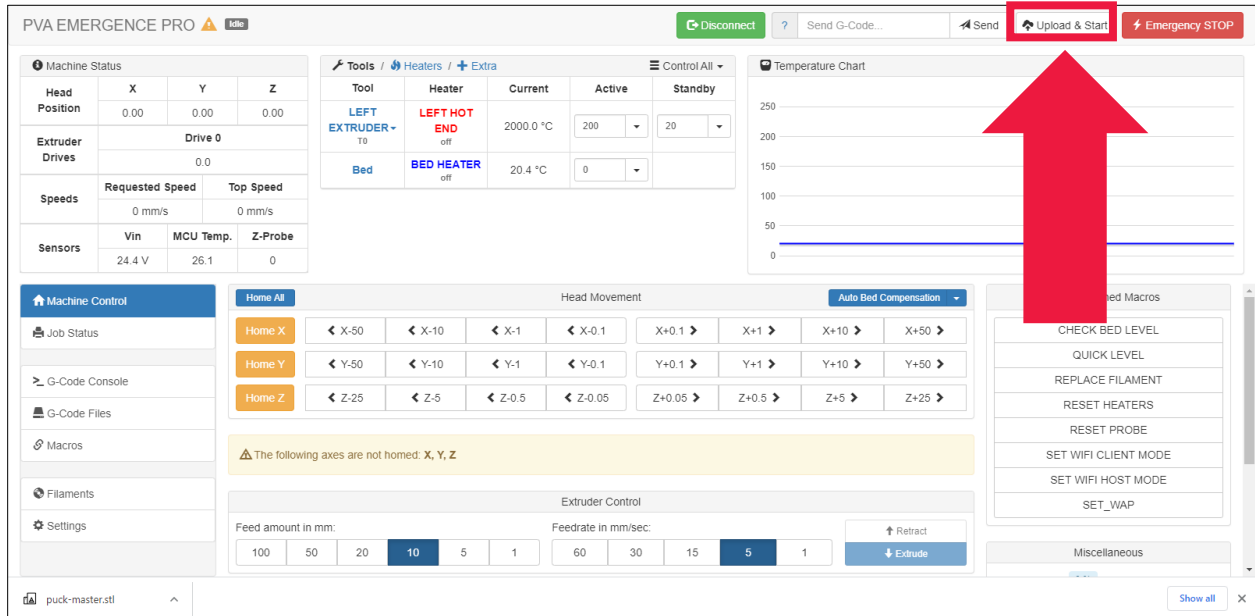


Figure 54: Emergence PRO™ Web Interface Home Screen

3. When prompted, select the desired G-code to print.
4. Select **Open**.

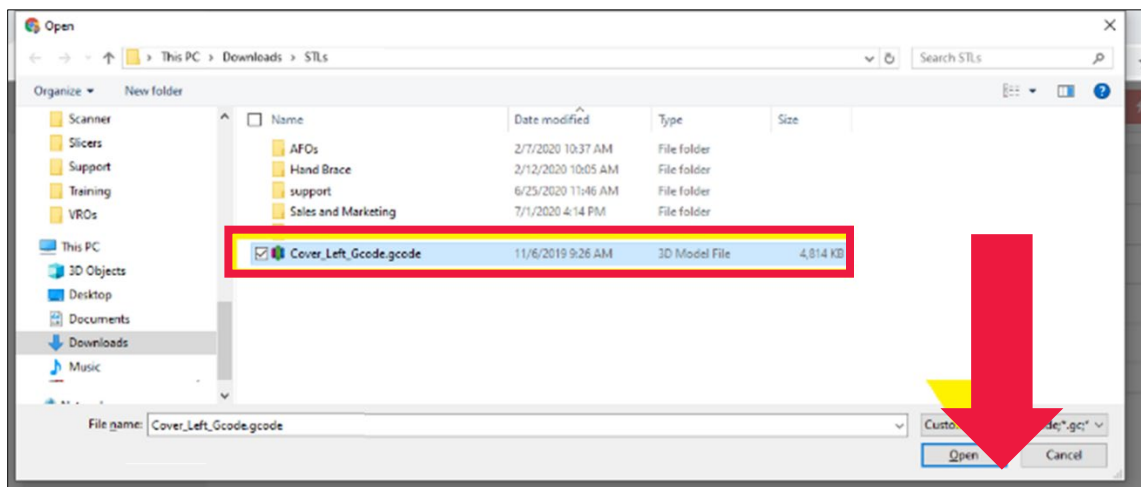


Figure 55: Select G-code and Open

- Once **Open** is selected, the file will be uploaded to the printer and the print will begin. This file will be saved on Card 0, which is inserted into the printer controller.

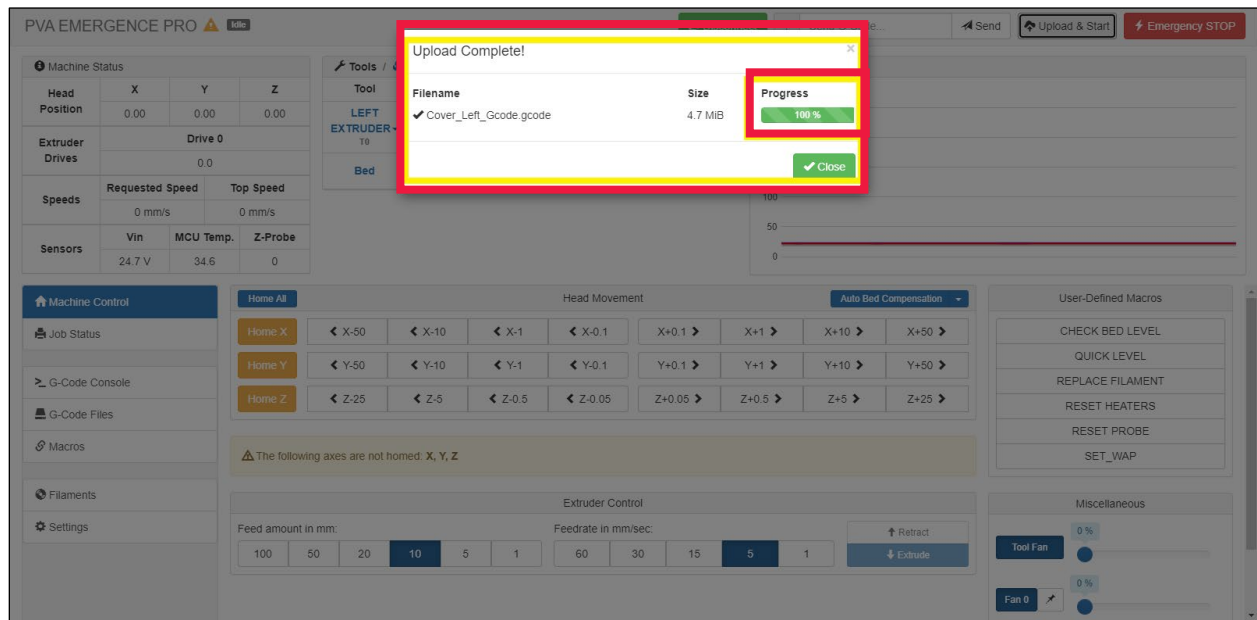


Figure 56: Upload Complete

A status bar will show the progress of the G-code file upload as it is being transmitted wirelessly to the printer. Once the file has been successfully uploaded, the printer will begin the print sequence for the selected G-code.

3.2.3 G-code Files

G-Code Files allows for G-code files to be uploaded, downloaded, deleted and sorted into sub directories.

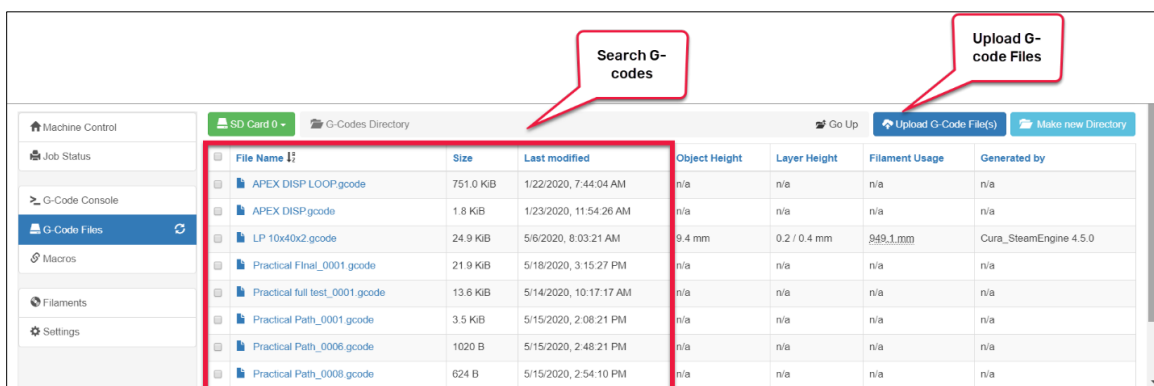


Figure 57: G-code Files

Files can be uploaded by browsing for them or dropping them onto the **Upload G Code Files(s)** button. The file upload functionality cannot be used while the machine is running.

Right-click on a G-code file to display a list of options. From here, you can run the dispense part (**Print File**), estimate the dispense path time (**Simulate File**), or download the G-code file (**Download**). You can also rename or delete the file, as well as manually edit the G-code.

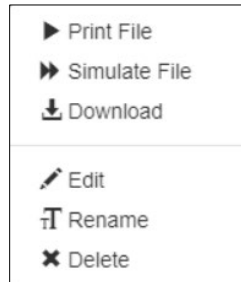


Figure 58: G-code Right Click Options

3.2.4 Run Test Prints

To run test prints preloaded on your printer, follow the steps below.

1. On Printer Control Screen, press **File Selection** button (Figure 59).

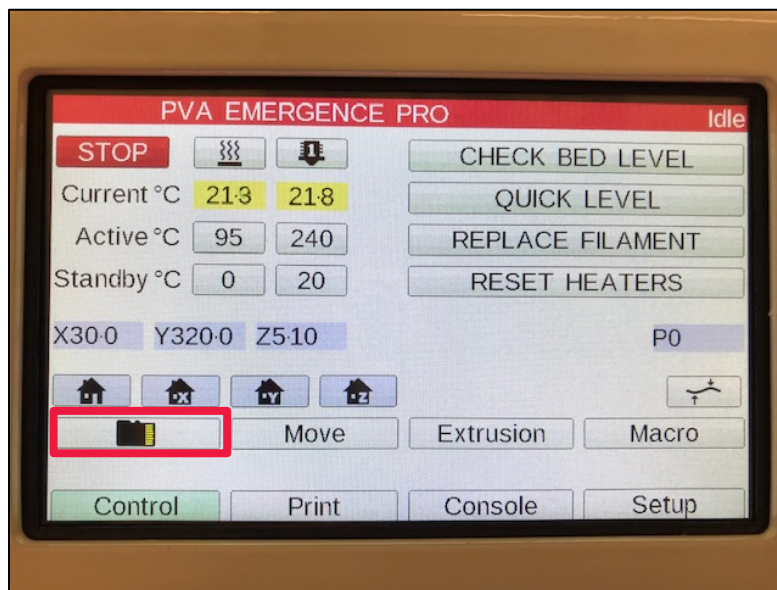


Figure 59: File Selection

2. Select **Test Prints** (Figure 60).

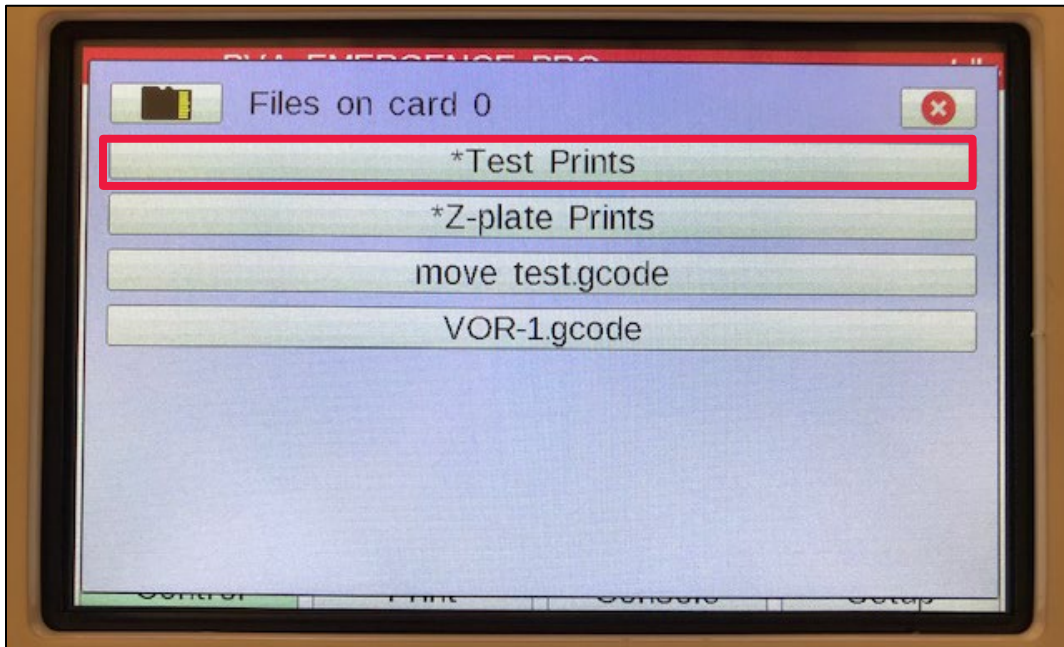


Figure 60: Test Print Files

3. The test prints loaded onto Card 0, which is part of the Printer Control Screen, will be listed. Select a test print for the filament loaded and hot end installed.
4. Press **Print**.

3.2.5 Run G-Codes

To run other G-codes preloaded on your printer, follow the steps below.

1. Load the appropriate hot end and filament used to print the selected test print.
2. On Printer Control Screen, press **File Selection** button.
3. Select the **appropriate G-code**.
4. Press **Print**.

3.3 Monitoring the Print Process

While it is easy to start a print and walk away, it is recommended that you check in at regular intervals.

3.3.1 First Layer

The first layer should have a smooth and even finish. A good first layer will feel like a smooth and flat bump with little difference in height between the layer and the print bed. If filament is extruding, but not sticking, try applying each of the following suggestions alone, then together consecutively:

- Ensure that the nozzle is gapped, then rerun the Quick Level option (see Section 2.4.3 for reference).
- Decrease the print speed (see Section 4.4.1 for reference).
- Increase the flow rate (see Section 4.4.2 for reference).

3.3.2 Next Layers

A first layer can indicate that a print is off to a good start, but it will not guarantee a print without issues. The following layers will be important in determining the quality of your print. For example, if you notice that filament is not being extruded consistently or that the printed filament is cloudy, it may indicate that you have improper tension on the extruder or that the filament is saturated with moisture. Paying attention to the next layers will help you save filament and identify any issues with your print.

3.3.3 Opening the Door and Pausing the Print

If you need to access the print, you should always pause the print before opening the door.

1. On the Printer Control Screen, select **Print** and then press **Pause**. Note: There may be a slight delay between when the button is selected and the print is paused, the printer will complete all moves in buffer prior to pausing.
2. To resume printing, select **Print** and then press **Resume**.

The Emergence PRO™ also includes a door sensor that will pause an active print when opening the front door. This function acts as an added layer of protection for the printer and operators.

3.3.4 Filament Break Detection System

The Emergence PRO™ offers a filament break detection system that will pause your print when the roll runs out of filament. While the printer is paused, you can replace the filament without losing your print.

4. Helpful Recommendations

4.1 Best Practices

In order to increase your familiarity and comfort with the Emergence PRO™, we have included a few best practices.

4.1.1 Filament Storage and Drying

For best printing results, it is recommended that open filament spools be stored in an airtight container with desiccant. A relative humidity level of 10% is ideal for storing filament, however, anything under 30% is acceptable.

If a filament is exposed to moisture, the roll can be dried in an oven. An estimated drying guide is below.

Note: Drying times may need to be increased for rolls over 500 g.

Material	Dryer Temperature	Drying Time
ClearFit™	65°C	4-6 hours
PCTG	65-70°C	4-8 hours
FlexyFit™	50°C	> 4 hours
PLA	45°C	> 4 hours
Nylon 12	70°C	> 12 hours
PLA/Carbon Fiber	45°C	> 4 hours

Figure 61: Recommended Drying Times

4.1.2 Tracking Filament

To avoid changing filament mid-print, PVA Med highly recommends tracking how much filament remains on a roll. To determine how much filament is left, weigh an empty roll to determine how much it weighs. Then, weigh the roll with the remaining filament and subtract the weight of the empty roll.

4.1.3 Hot End

The hot ends are completely made of metal which makes them resilient to the heating and cooling of multiple prints. However, in order to extend the life of the hot end, heat the hot end only when working on the printer or when the printer is fabricating a print.

Filament should not be left in the hot end when the printer is not in use. Leaving filament in the hot end can lead to clogs and jams. In addition, leaving filament in the hot end may expose the filament to humid air which will affect the quality of the print.

4.1.4 Touch Probe

When removing a print, ensure that the print head has been moved. This will prevent the touch probe from being inadvertently hit and damaged.

In the event of a failed print, it is important to inspect the touch probe and ensure that it was not snagged and bent on any errant filament.

4.1.5 Print Bed

Before each print, it is recommended to calibrate the print bed with the probe. This calibration is as simple as homing the axes and probing the print bed with the probe. Most G-codes received from PVA will already contain a command to run a bed probe before beginning a print.

For materials certified by PVA Med (see Figure 61: Recommended Drying Times), there should be no need to prepare the bed with blue tape or spray adhesive before starting a print.

4.1.6 Printer

In order to keep the printer working in excellent condition, it is recommended to adhere to these best practices and to regularly clean the printer (see Section 4.2 for details). In addition, it is recommended that the front door remain shut during printing, the back door remain locked, and the printer turned off when not in use for extended periods of time.

4.1.7 Spare Parts Kit

ITEM	PART NUMBER	DESCRIPTION	1/QTY
1	BL-touch	TOUCH PROBE	1
2	12882	IDLER, SMOOTH, 9MM BELT	1
3	12880	OPTICAL SWITCH, SLOTTED, RIGHT ANGLE, NPN	1
4	12877	TOOTHED IDLER, GT2, 20 TEETH, 9MM WIDE	1
5	12875	MOTOR, NEMA 17 STEPPER	1
6	12772	THERMISTOR CARTRIDGE	1
7	4792A32	LOW SCRATCH BRUSH WITH SHANK	1
8	01635	CONTACTOR	1
9	1055-SET	ANTI BACKLASH NUT	1
10	614-22929-1	FILAMENT FEED TUBE, 12783 CUT TO 7"	1
11	614-22928-1	FILAMENT FEED TUBE, 12783 CUT TO 40"	1
12	612-10780-1	NOZZLE COOLING FAN	1
13	612-10666-1	HEATER CARTRIDGE WITH CONNECTOR, 50W, 6MM	1
14	612-8992-1	24V COOLING FAN ASSEMBLY	1
15	17HS3001-CF5X	NEMA 17 STEPPER GEAR MOTOR, 5:1	1
16	3.5M-9MM-2GT	GT2 BELT, 9MM WIDTH, 2MM PITCH, 3.5M LG	1

Figure 62: Spare Parts Kit

4.2 Cleaning and Maintenance

4.2.1 Hot End Cleaning and Maintenance

It is highly recommended that a new hot end is installed every 3 to 6 months when under heavy use. This window may be shorter if using abrasive filaments like carbon fiber. After extended use, a filament jam, or discoloration in a print, it is recommended to clean the hot end.

To remove excess material from the exterior of the hot end, the nozzle can be heated to printing temperatures and a cotton swap can be used to wipe excess material.

To clean the inside of the nozzle, the Cold Pull Method is recommended.

4.2.1 Bed Maintenance

PVA recommends cleaning the print surface after every 2-3 prints. The print surface should be cleaned with isopropyl alcohol or soap and water to remove any oils or residue left behind when removing prints.

After extended use, it may be necessary to lightly rough the print surface with 200 grit sandpaper to extend the bed life.

4.2.1 Dehumidifier Charging

The dehumidifiers included will need to be recharged occasionally. The interval between charges is dependent on the humidity levels at your location, but generally range from 20-30 days. If the beads within the humidifier viewing window are no longer orange, remove the humidifier and plug it into a 120V wall outlet for 8-12 hours until beads return to orange.



Figure 63: Charge Dehumidifier

4.2.2 Rail Maintenance

The Emergence PRO™ uses linear guide rails for all axes. Maintaining these rails takes a small amount of synthetic lubricant applied once per month. In the printer kit is a small bottle of synthetic lubricant. To lubricate the rails:

- Dust the rails and remove any excessive buildups of dirt or grime.
- Apply a small amount of lubricant directly to the grooves in the rails.
- Use the control screen to move the extruder assembly along the entire length of each axis.

Note: The z-axis screw should also be lubricated.

4.2.3 Belt Maintenance

The Emergence PRO™ uses a single belt for moving along the X-/Y-axis. While testing is performed on the Emergence PRO™ before shipping, it is recommended that the belt be examined before use in case of looseness developed during shipping. In addition, it is recommended that the belt be checked weekly for the first few weeks as the printer is used more frequently. Eventually, the belt may be checked once a month, or as determined necessary, as the printer is used on a more regular basis.

- Check the belt by plucking it. The belt should resonate with a low noise and should feel taunt but not tight.
- To tighten the belt, locate the tensioning screws (located on the gantry). Use a 4 mm hex wrench to tighten the tensioning screws.
- Check the belt by plucking it. Adjust the belt as necessary.

Please refer to Appendix B for a breakdown of the X-/Y-assembly.

4.3 Check for Quality

Many print quality issues associated with 3D printing are a result of incorrect slicer settings or variance in filament from manufacturer to manufacturer. However, if you continue to experience the same issues with different slicer settings, there may be a mechanical issue.

The quality checklist below can be used as a guide to assist you in diagnosing an issue. Please call us or submit a support request if you need assistance diagnosing or fixing an on-going issue.

4.3.1 Quality Checklist

Under-extrusion: This occurs when too little filament is extruded, or it is unable to lay down properly. Small amounts of under-extrusion can manifest as delamination. More severe under-extrusion will appear as inconsistent extrusion. To remedy this issue, we recommend loosening or tightening the tension screw.

Over-extrusion: This occurs when too much filament is extruded and can potentially damage the printer. The printed part will appear as if it is oozing filament and create extremely textured walls. Minimal amounts of over-extrusion will create thick walls and slight discoloration; however, it will have minimal effect on the overall print quality.

Delamination: This is a specific type of under-extrusion. The outer shell looks good visually; however, it feels like it is not well-adhered to the rest of the model. This is a structural concern and indicative of future complications with prints. Any time the printer creates a print with delamination, it should be thoroughly cleaned.

Missing layers: This is an example of temporary under-extrusion and will be considered a weak layer. This can be a result of mechanical or filament issues. If this appears on the print, you should perform a thorough mechanical check of the printer, which includes checking for: z-axis screw alignment, movement of axis carriages, and rail lubrication. If these appear to be in working order, the issue was probably a mishap related to the filament. For example, this happens if the filament diameter varies too much or experiences a moment of increased friction. A missing layer may occur if the filament is changed mid print.

Gaps in thin walls: This occurs when there is a spot in the STL that is too thin to print. The STL appears normal but the layer view in the slicer, and resulting print, will have a hole. This cannot be salvaged and requires the STL or printing profile to be modified. This issue is sometimes hard to diagnose without looking at the slicer. This issue may be remedied by using a smaller nozzle and reslicing.

Layer Shifting and Separation: This is a result of the profile settings when two consecutive layers do not adhere. To manually fix this, try increasing the temperature by 5°. Layer shifting and separation causes significantly weaker layers.

Inconsistent texture: Inconsistent texture can be a sign of moist filament, under extrusion, and poor layer adhesion. If the filament finish is not as expected, moisture within the filament is likely the reason.

Overheating: This can cause drooping, poor layer adhesion, and gaps in the print. To solve this, first check if the fans are on. If they are not, it is worth stopping the print and fixing them. The cooling that the fans offer allow higher print speeds. Without fans, the print does not have enough time to cool before the next layer is extruded.

Blobs and Zits: These are small amounts of extra filament melted onto the product. They are not a sign of structural damage and can be removed using a razor blade or grinder. Be careful not to remove too much material, which would sacrifice some structural integrity. If this happens in excess, it is a sign that the nozzle must be cleaned.

Poor First Layer Adhesion: This is a sign that the print bed needs to be recalibrated. The first layer is essential in providing a sturdy base for the rest of the print. If the first layer does not lay down smoothly and adhere to the bed well, stop the print and recalibrate the bed before trying to print again.

Dimensional Accuracy: Is an important factor to consider when printing. Some materials are more likely to shrink than others. Prints should be checked for dimensional accuracy.

4.4 Quick Tips

As you gain more experience, you will be able to judge how to best address issues with prints. To get you started, here are some tips.

- Printing slower (5% to 10%) will help with print quality.
- Prints containing overhangs with angles greater than 45° should have support structures.
- Clean the hot end if you observe consistent under-extrusion.

4.4.1 Changing Print Speed

Slowing down the print speed may help improve print quality and improve first layer adhesion. However, slowing down too much may introduce new problems, such as drooping. Slowing down the print speed by 5% or 10% is a good start (remember that the speed is listed as a percentage).

4.4.2 Changing Flow Rate

The flow is the amount of extruded material and is dictated by several factors. Increasing the flow rate may help with first layer adhesion or in cases where slight under-extrusion is observed. The hot end should be cleaned using the Cold Pull method after any print where the flow is increased. The printer will also remember the last flow rate. Set the flow rate back to 100% before the next print.

4.5 Frequently Asked Questions

4.5.1 Probe Failed to Extend

1. Manually pull down the probe tip and ensure nothing is binding or damaged.
2. Wipe the probe shaft with isopropyl alcohol.
3. Run the **Reset Probe** macro option.
4. The probe will extend and retract then should be a solid red.

4.5.2 Probe Failed to Trigger Error

1. Ensure that the hot end is free and clear of material.
2. If manually homing, heat the nozzle, then rehome.

4.5.3 Probe Unexpectedly Triggered Error

1. Manually lower print bed to ensure there is room for the probe to extend.

Note: If you cannot move the move the Z axis via the controller, the Z axis is no longer energized. This will allow you to hold onto to the Z axis coupling and rotate it by hand. Before manually moving an axis, the operator should always engage the E-stop to ensure there is no power to the motors.

2. Manually pull the probe tip down and ensure nothing is binding or damaged.
3. Run the **Reset Probe** macro option.

4.5.4 Under Extrusion

Refer to Section 4.3.1 for more information regarding under extrusion. If there is little to no filament coming out from the hot end, follow the steps below.

1. Loosen or tighten the tension screw on the extruder.
2. Ensure there are no tangles on the filament roll and the filament can easily be pulled from the roll.
3. Increase the extrusion percentage on the Printer Control Screen or Web Interface.

Note: Filament diameters can occasionally be under diameter.

4.5.5 Over Extrusion

Refer to Section 4.3.1 for more information regarding over extrusion.

If there is excess filament coming out of the hot end, follow the steps below.

1. Reduce the extrusion percentage on the Printer Control Screen or Web Interface.

Note: Filament diameters can occasionally be over diameter.

4.5.6 First Layer Not Sticking to Bed/Print Lifting from Bed

If the first layer is not sticking to the print bed, confirm the following items:

- ✓ The bed temperature is at the correct temperature.
 - If not, wait until the temperature is met. Once bed temperature is reached, allow the bed to “soak” for 15 minutes before starting the first print.

Note: The bed can be preheated to the print temperature to allow for extra time for heat to transfer from the heater to the build plate.

- ✓ An approved material is being used.
- ✓ The end of the nozzle is clean of excess material.
- ✓ The nozzle is properly gapped to 0.2 mm.
- ✓ The bed is level.
 - This can be done by running the Quick Level macro.
- ✓ The filament is dry.
 - Consult the manufacturer for the appropriate drying procedure.
- ✓ The bed is residue free.
 - The bed can be cleaned with isopropyl alcohol or soap and water.

TIP: Lightly rough the bed surface with 200 grit sandpaper if necessary.

- ✓ Confirm appropriate bed material is being used.
 - Some material may require blue masking tape or adhesive to ensure the first layer is stuck to the bed.

4.5.7 Print Sagging or Drooping

If the print is sagging or drooping, review the geometry of the model. With a 1.5 mm nozzle, the maximum printable overhang angle with WalkStrong filament is 55°.

4.5.8 Print Appears Cloudy

If the print appears cloudy, the filament is not dry. For ClearFit™, PVA recommends drying the filament for 4-6 hours at 65°C. Refer to Figure 61: Recommended Drying Times for PVA's recommendations on other filament or consult the filament manufacturer for the appropriate drying procedure.

4.5.9 Layer Shift

If a print unexpectedly shifts in the middle of a print, follow the troubleshooting steps below.



Figure 64: Layer Shift

- ✓ Ensure that the nozzle is clear of any excess material build up that could hit the existing print.
- ✓ Confirm that the belts are tensioned. If plucked, the belt should audibly resonate like a guitar string.

4.5.10 Clogged Nozzle

1. Perform the Cold Pull method on the nozzle to remove any old material.
 - Remove the filament feeder tube from the extruder head.
 - Heat up the hot end to the printing temperature of your chosen cold pull filament, preferably the material most recently used in the hot end, while removing the old filament.
 - Feed the cold pull filament through the nozzle until it begins to ooze out.
 - Cool the hot end while applying constant pressure on the filament strand. This ensures the tip of the strand molds to the shape of the nozzle's interior while cooling.
 - Heat the nozzle up again to the printing temperature of your filament and pull on the filament while the hot end is heating until the filament comes free with excess debris on the end.
 - You may need to repeat the process additional times as some debris may remain after the initial pull.

Initial Cold Pull with Burnt Material



Final Cold Pull

Figure 65: Cold Pull Examples

2. Heat the nozzle to the correct temperature and gently insert a cleaning needle up through the end of the nozzle, then purge.

Note: It is not necessary to remove all the material. This method is to break up the blockage.

4.5.11 Materials Errors

Refer to the filament manufacturer's recommendations or contact us with questions.

4.5.12 Printer Warning Messages and Remedies

Error Message	Possible Cause	Corrective Action
Warning: Vin Under-Voltage Event	Input voltage to control is below acceptable range	Ensure Emergency Stop button is disengaged
Error: G0/G1: insufficient axes homed	An attempt to perform a move without a homed axis.	Home the axis and try again. If this error occurs during the home sequence, ensure the Emergency Stop button is disengaged.
Error: Heating fault on Heater 1. Temperature rising much more slowly than the expected	Hot end is not heating as quickly as expected. Hot end 1 temperature will now be highlighted in purple on the display.	Ensure that Emergency Stop is disengaged. Run the heater reset macro then try again.

Figure 66: Printer Warnings

5.APPENDIX A

5.1 Printing Terminology

3D Model	Any digital shape occupying three dimensions.
Extruder	Allows for filament to be extruded; includes the hot end.
Feed Rate	The speed at which the extruder moves filament.
Flow Rate	The volume of filament extruded per unit time.
G-code	The file type that the printer will use to print the model. This file contains all the printer settings and model information needed to print.
Printer File	Has a .gcode file extension.
Print Speed	Defines at which speed (in millimeters/second) the print head moves while printing.
Profile	The saved settings applied to the 3D model when slicing in a slicing software.
Slicer	The software used to generate the toolpath and convert a 3D model into a .gcode.
STL	A file type common for 3D models. Has the file extension “.stl”.

6.APPENDIX B

6.1 Printer Dimensions and Parts

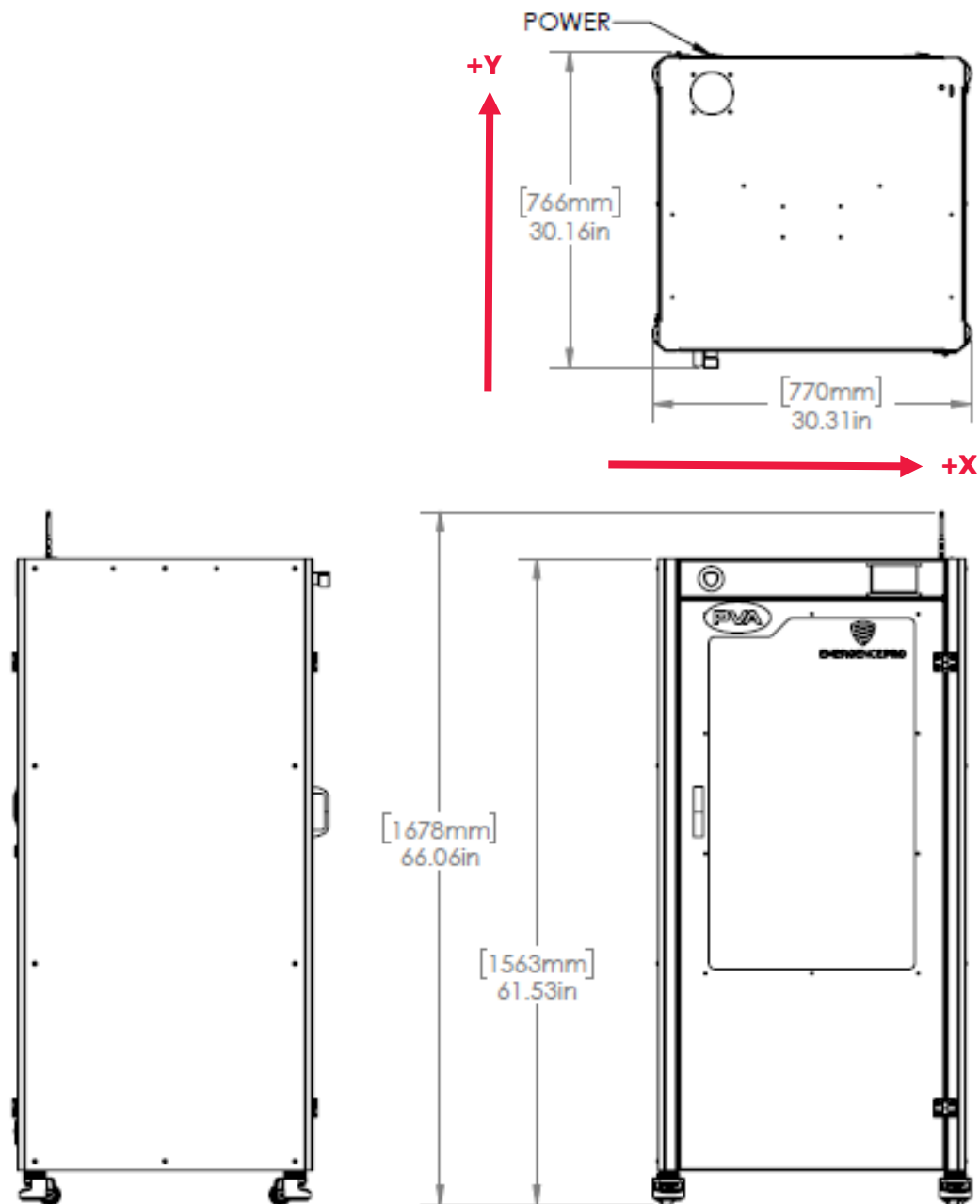
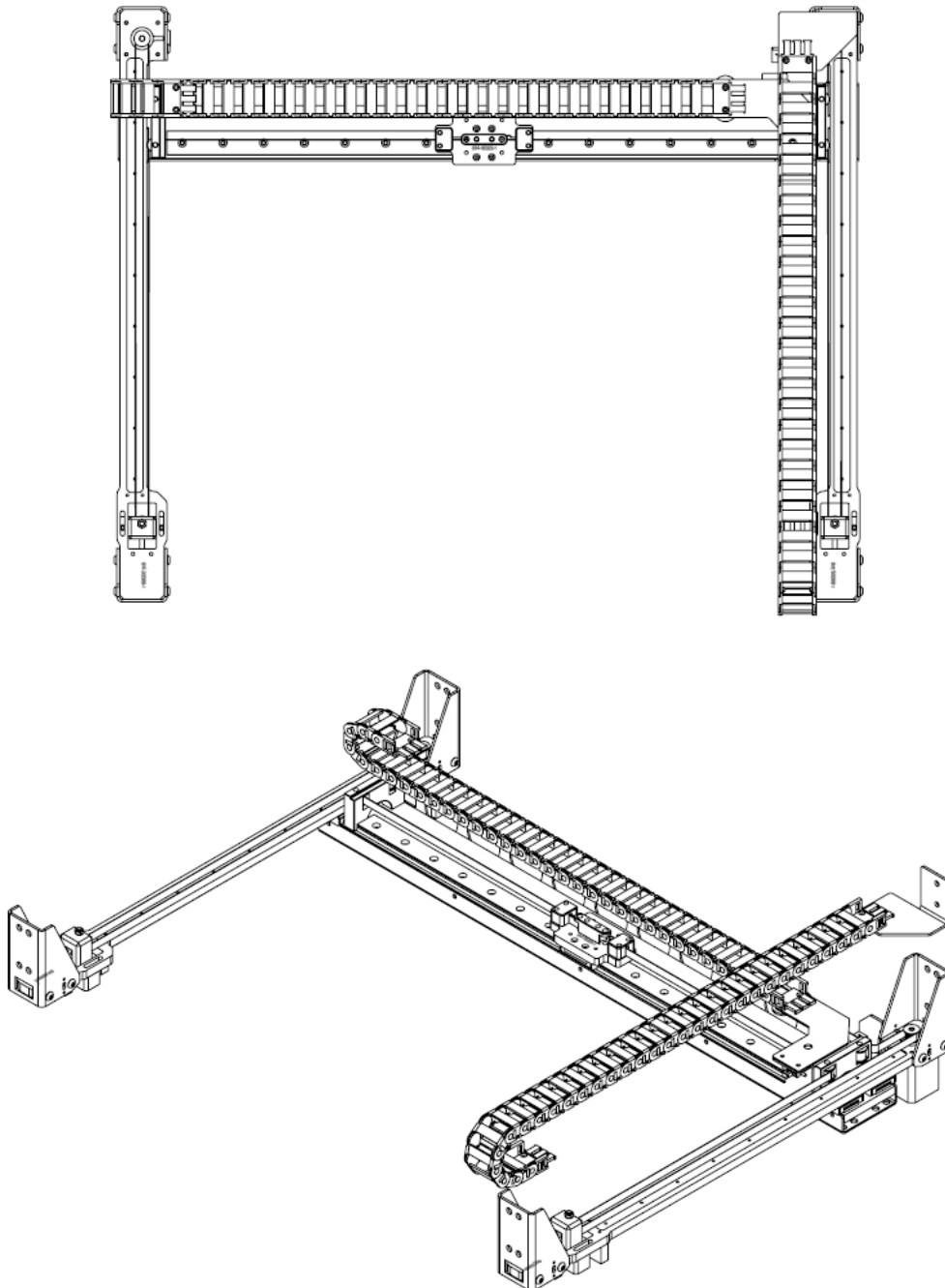


Figure 67: Printer Dimensions

6.1.1 X-/Y-Assembly

A breakdown of the X-/Y-assembly.



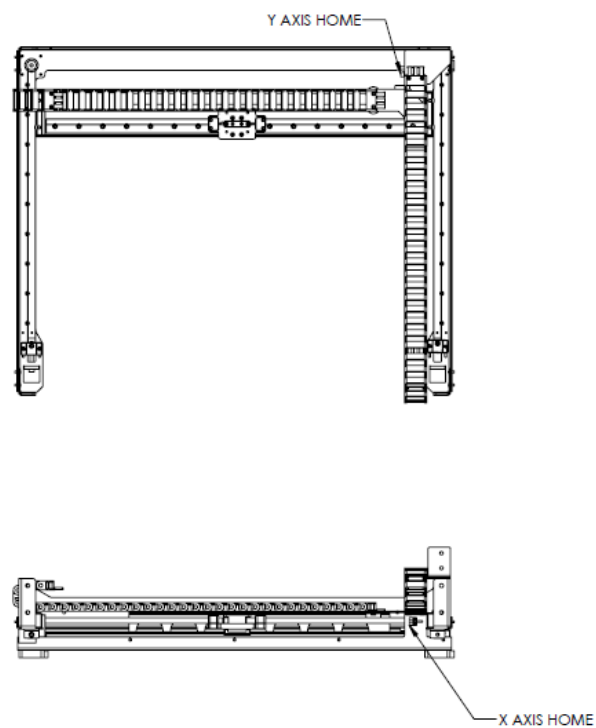


Figure 68: X-/Y- Assembly

6.1.2 Z Assembly

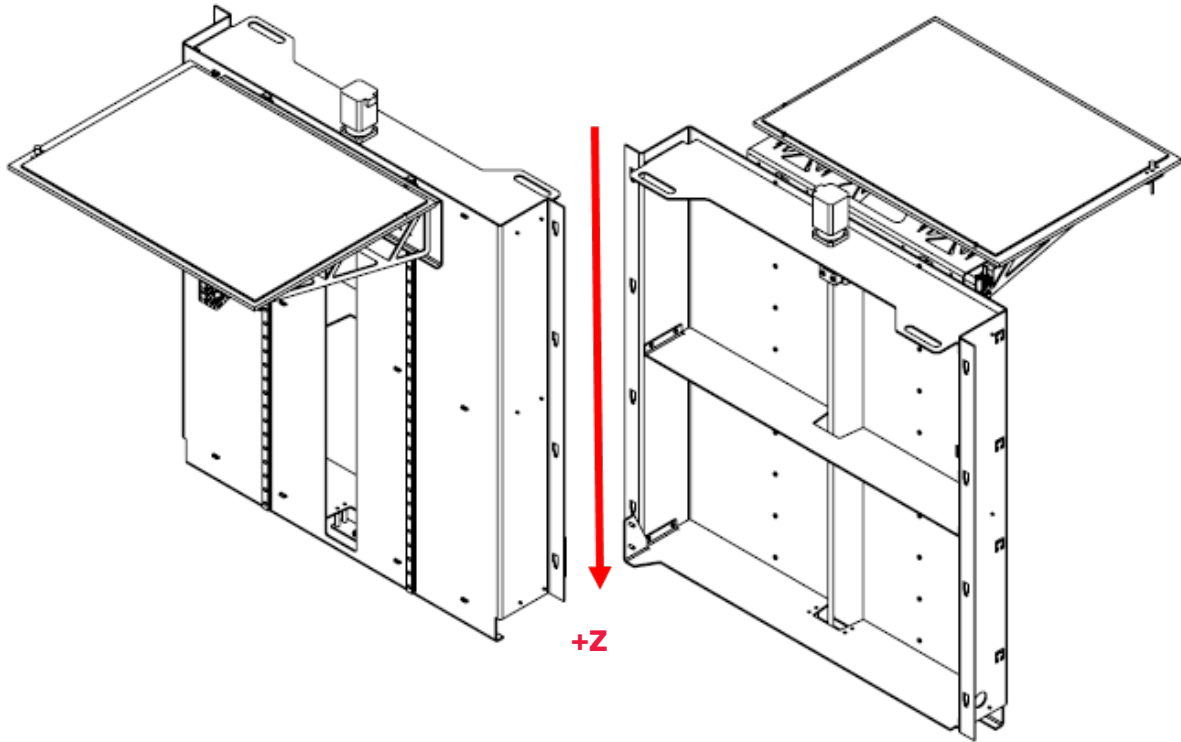


Figure 69: Z Assembly

6.1.3 Print Head

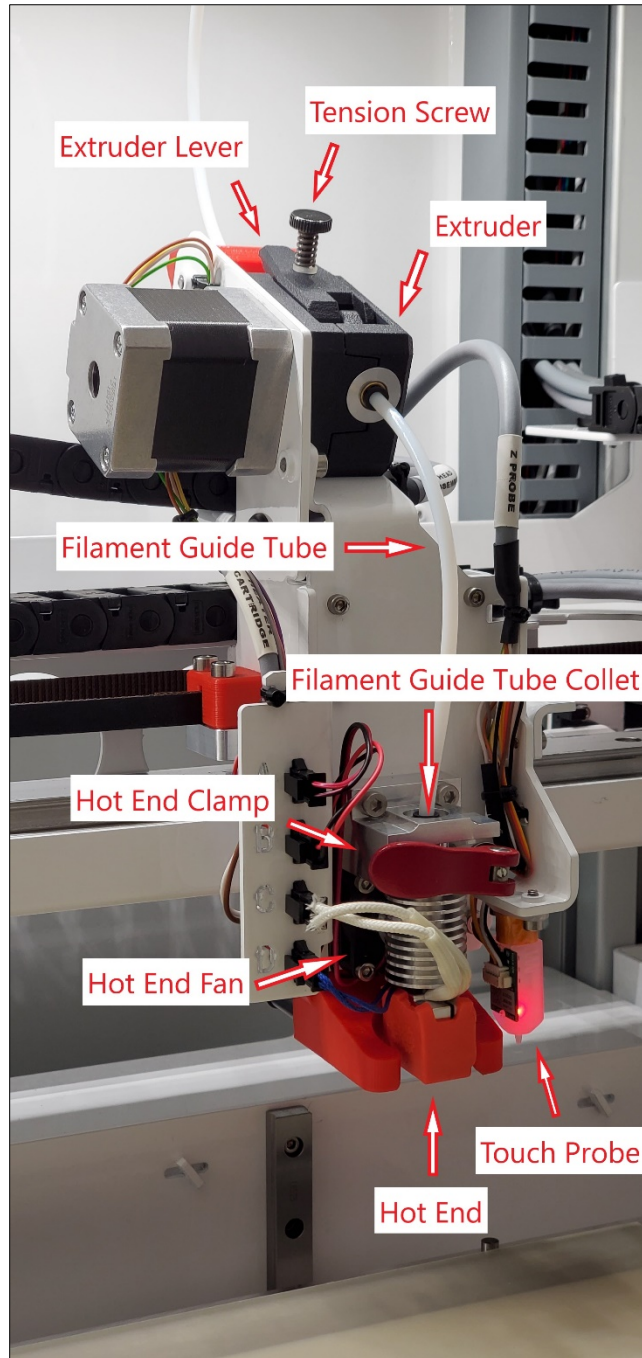


Figure 70: Print Head 1

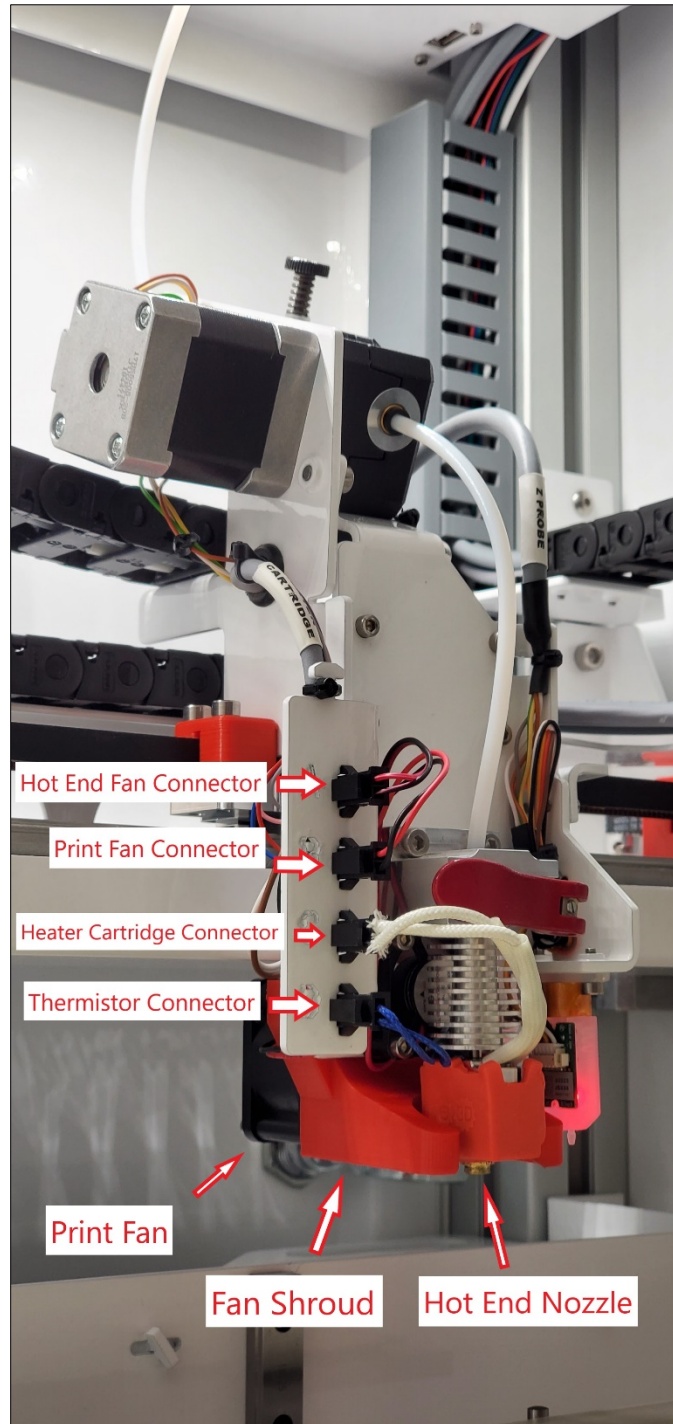


Figure 71: Print Head 2

6.2 Technical Specifications and Warnings

Build Volume	480 mm X 330 mm X 635 mm (19 in x 13 in x 25 in)
Power Requirements	Volts: 120/220V (Refer to machine serial tag) Amps: 10A Frequency: 50/60Hz
Hot End Temperature Limit	Up to 285°C (518°F)
Heated Print Surface Temperature Limit	Up to 100°C (212°F)
Layer Height	100 - 1000 microns
Print Head Speed	Up to 400 mm/sec (16 in/sec)
Available Nozzle Diameter	0.4 - 3 mm (0.02 - 0.12 in)
• Compatible with multiple print materials • Heated build platform • Rigid metal frame • Mesh bed leveling • Made in the USA • Front-loading, multi-roll enclosed material storage • Precision Aluminum build plate • 5-inch touch interface with Wi-Fi connectivity • Filament break detection	

6.2.1 Warnings

- Do not use if wires are frayed, connections are loose, or you detect unusual conditions that could indicate a short.
- Do not use hot end in or around water.
- This product is designed to melt plastic. During and after use, parts of the hot end and printer may burn or ignite items that touch it. Do not touch or allow any item to touch the hot end until it has completely cooled.
- Do not use near volatile or flammable substances.
- This machine is made of machined metal which may retain sharp edges. Improper handling may result in property damage or personal injury.
- Supervise any children who are near or using this product.



7. APPENDIX C

7.1 Recommended Maintenance Schedule

Task	Frequency	Date Last Performed					
Recharge Dehumidifier	Once per Week						
Check Belt Tension	Once per Month						
Clean Hot End	Every 5 prints						
Lubricate Rails	Once per Month						
Replace Hot End	Every 3 to 6 Months						
Clean Bed	Every 2-3 Prints						

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9. Warranty

9.1 PVA Warranty Policy

PVA warrants the enclosed product against defects in material or workmanship on all components for one year from the date of shipment.

The warranty does not extend to components damaged due to misuse, negligence, or installation and operation that are not in accordance with the recommended factory instructions. Unauthorized repair or modification of the enclosed product, and/or the use of spare parts not directly obtained from PVA (or from factory authorized dealers) will void all warranties.

All PVA warranties extend only to the original purchaser. Third-party warranty claims will not be honored at any time.

Prior to returning a product for a warranty claim, a return authorization must be obtained from PVA's customer service department. Authorization will be issued either via the telephone, facsimile, or in writing upon your request.

To qualify as a valid warranty claim, the defective product must be returned to the factory during the warranty period. Upon return, PVA will repair (or replace) all components found to be defective in material or workmanship.

(Retain this for your records)

Product Information

PRODUCT:

SERIAL NUMBER:

DATE OF PURCHASE:
