How to Update Klipper and Flash the Printer Firmware

QIDI X-MAX3/X-PLUS3/X-SMART3 3D PRINTERS

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DISCLAIMERS

- While it is not possible to do permanent damage to your printer by flashing the Klipper firmware, it is possible to flash it incorrectly and make the printer inoperable until flashed correctly.

- Flashing Klipper requires strong familiarity with Linux, Linux Tools and the confidence to make system changes. Do not proceed if you are not confident in your Linux skills.

- Flashing Klipper also requires removal of the rear panel and the back cover of the Toolboard.

    - DO NOT remove or touch any physical components while the Printer is powered on.

- A degree of finger dexterity is also extremely helpful as several small screws must be handled and a tiny button on the back of the Toolboard pressed while the system is powered cycled.

- Although updates to Klipper and its associated components are available, they are not required in order for the QIDI Tech X-MAX3, X-PLUS3 and X-SMART 3 to print properly. As of the writing of this document there are zero (0) known problems fixed by updating the Klipper firmware to a version newer than the one that QIDI Tech installs.

- The primary reason some choose to update is to enable support for new features, such as the Spoolman Filament Manager project.

- This process has been successfully tested on multiple X-MAX3 and X-PLUS3 printers but not yet on an X-SMART3. If you use this guide on an X-SMART3 please let the author know.

- Updating the firmware on these printers is STRONGLY DISCOURAGED by QIDI Tech and may void your warranty.

    - QIDI Tech provides THE BEST support in the industry.

    - It is difficult enough for QIDI Tech to provide high quality support with all of its customers running the same version of Klipper.

    - Do NOT expect QIDI Tech to provide assistance if this process does not work.

    - Reach out to the community on Facebook and Discord if you do need help.

WHEN IN DOUBT: DO NOT PROCEED

How to Update Klipper and Flash the Printer Firmware for the QIDI X-MAX3 / X-PLUS3 / X-SMART3 Printers

REQUIREMENTS

A few tools are required to update Klipper on the QIDI X-MAX3 / X-PLUS3 / X-SMART3 Printers:

1. A 2mm hex wrench
2. An SSH Client such as PuTTY for Windows
3. An SCP \ SFTP Client such as WinSCP for Windows
4. Internet connectivity for the Printer

PREPARATION

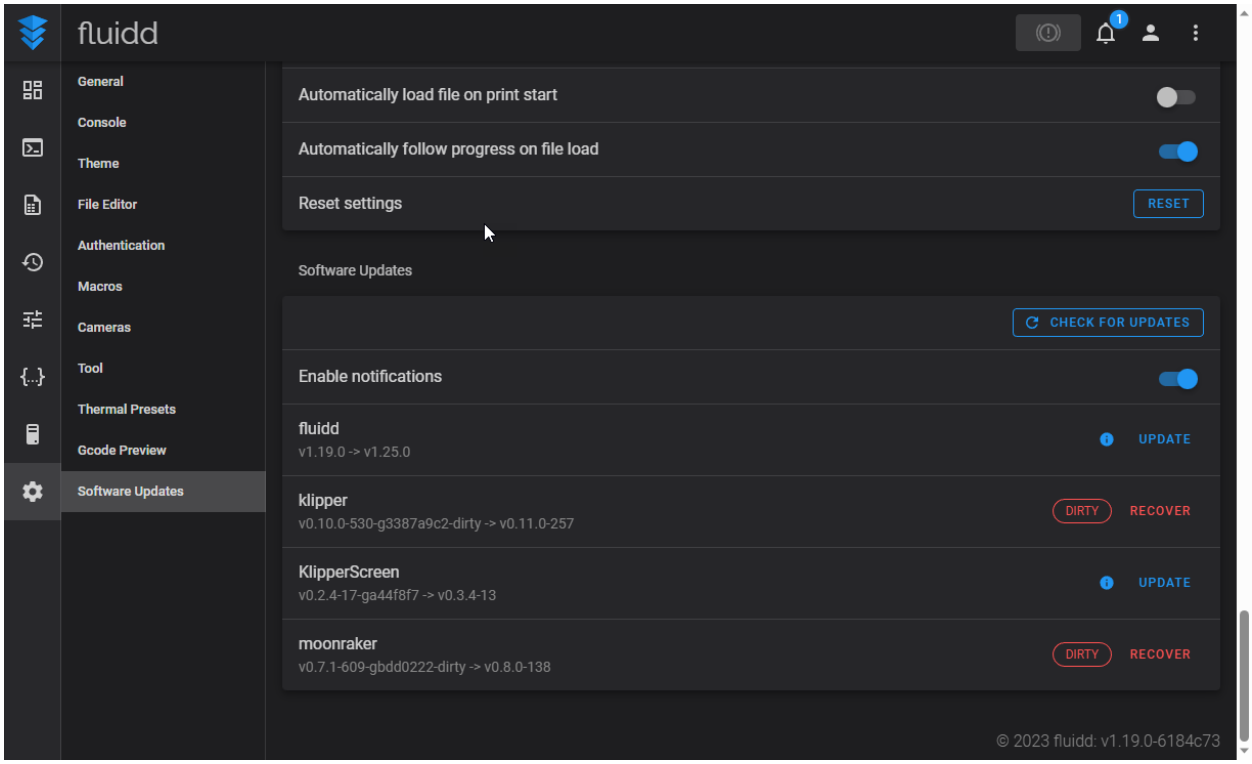
Before Klipper can be updated and the MCU and Toolboard can be flashed, two parts must be removed from the printer to expose the electronics and the time and date on the printer properly set.

1. Shutdown the printer using the **power switch**. Wait for it to shut down.
2. Using the 2mm hex key, remove the **rear panel** of the Printer.
    a. It covers the X-4 MCU and other electronics.
3. Next, use the 2mm hex key to **carefully** remove the **rear cover of the Extruder**.
    a. It is secured by four screws.
4. Power the printer back on and wait for it to start up.
5. Once the printer is online, use the SSH Client to connect to the **IP address** of the printer.
6. Login using the **mks** account (NOT root).
7. Verify the time, date and time zone are correct by entering:
    a. **timedatectl**
8. If all three are **correct,** skip ahead to the next step: **Update Klipper**
9. If the time, date and/or time zone are **not correct**, follow the guide located at the following link to set them to the correct values: How to Set Time, Timezone and Synchronize System Clock Using timedatectl Command (tecmint.com)
    a. **Note: updating Klipper will fail if the time, date and time zone are not correct.**

UPDATE KLIPPER

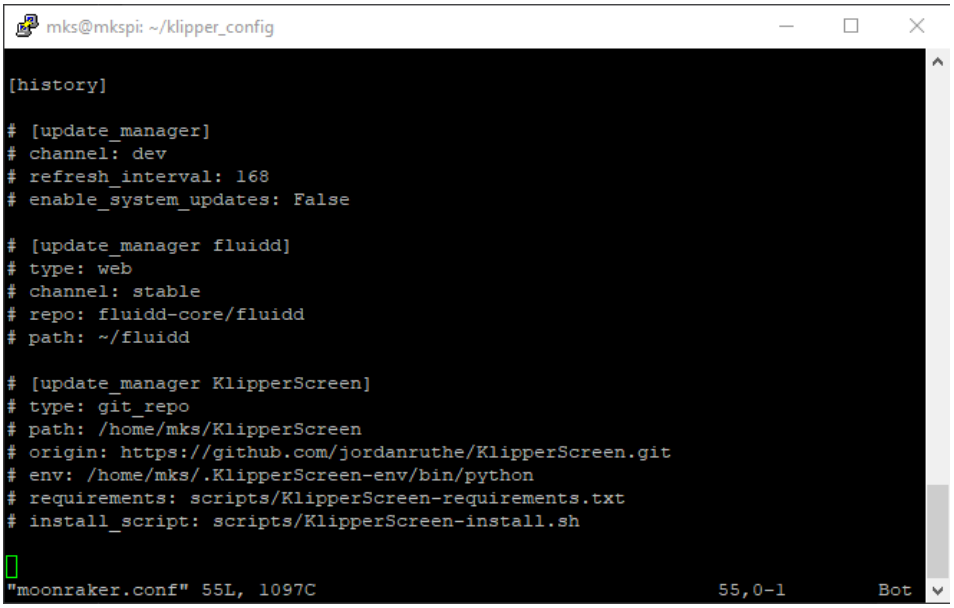
Once the preparations have been completed, the Klipper System can be updated using Fluidd.

1. Connect to the Fluidd Web Management Console using a Web Browser.
    a. The URL is either: http://printer_ip_address **OR** http://printer_ip_address:10088 depending on the QIDI firmware version installed on the printer.
2. Within Fluidd, click **Settings** in the menu along the left side, then click **Software Updates** or simply scroll to the bottom of the Settings menu.

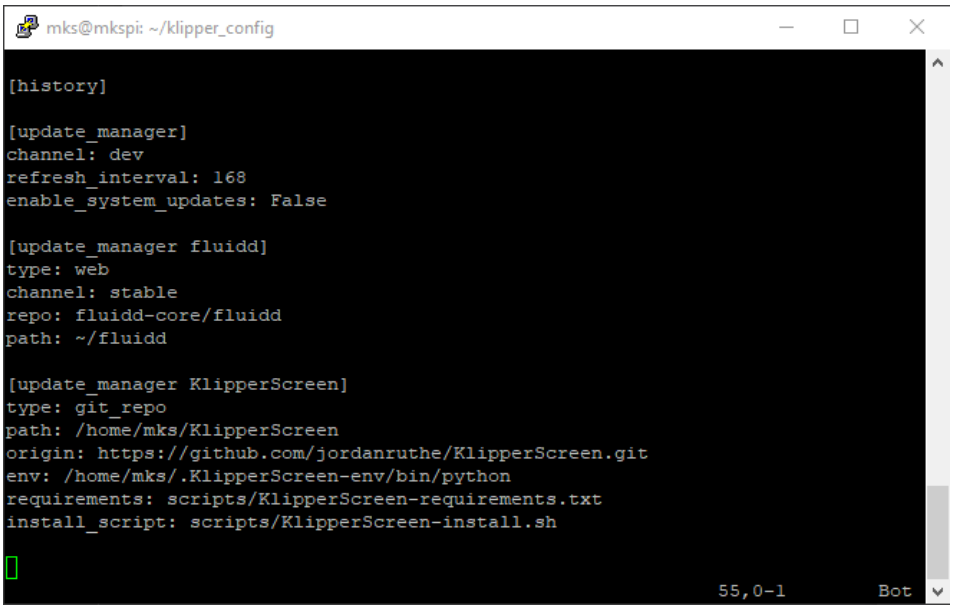


Note: do not be concerned if any of the components are marked **DIRTY.** It simply means that the installed versions have been modified making them different from the opensource versions stored online. This will be corrected as part of the update process.

3. If you do not see **Software Updates** then updating the system has been disabled. Perform the following steps to enable software updates:
    a. Use an SSH Client such as Putty to connect to the **IP address** of the printer.
        i. Login using the **mks** account (NOT root).
    b. Use your preferred editor such as **vi** or **nano** to edit the **/home/mks/klipper_config/moonraker.conf** file.
    c. Once the file is open, locate the update section beneath [history]:



d. Remove all of the **#** (hash comment tags) from each of the lines in the update sections so that it matches the screenshot below:



e. Save the moonraker.conf file and exit the editor.

f. Shutdown the printer using the **power switch**. Wait 30 seconds then power it on.

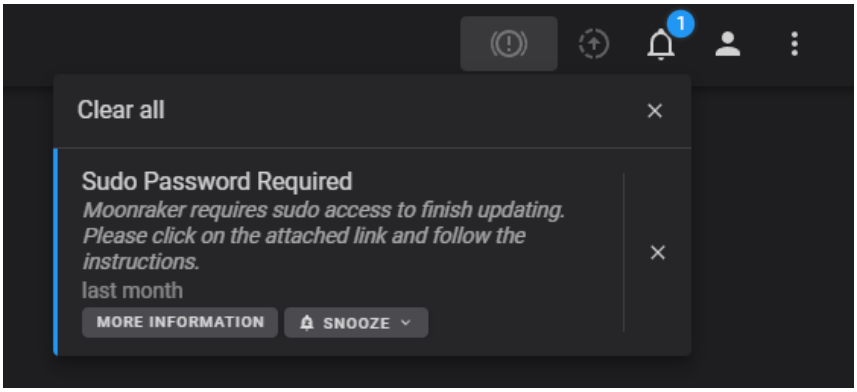
g. Reconnect to the Fluidd web management interface and verify that the Software Updates now appear.

   i. If they do not, repeat this step to verify the update sections of moonraker.conf have been properly uncommented.

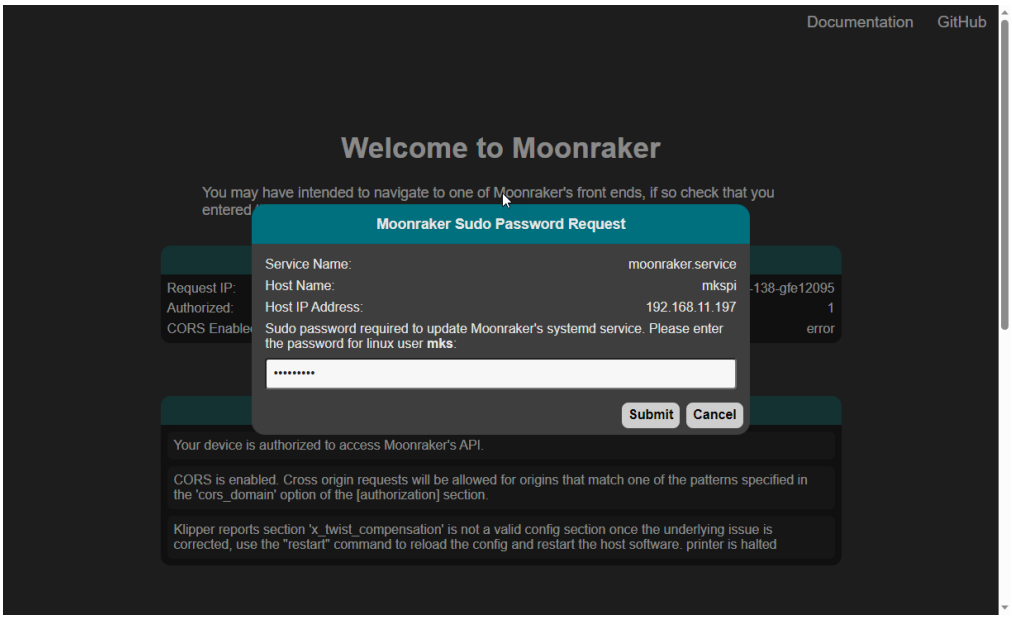
4. Within the Fluidd Software Updates menu, click **UPDATE** next to each major component to update them.

   a. Updates may be available for **fluidd, klipper**, **klipper-screen** and/or **moonraker.**

b. If any of the components are marked **DIRTY,** click **RECOVER**.
    i. This will both “clean” and update Moonraker.
    ii. Klipper will be recovered, but then an **UPDATE** button will appear.
        1. **Click it** to update Klipper.
c. Wait for each of the updates to finish.
d. Depending on the component being updated, you may become temporarily disconnected from the fluidd management interface.
    i. Simply reconnect.
e. If this is the first time you have updated Moonraker, watch for the following message in the upper-right corner of the Fluidd interface:



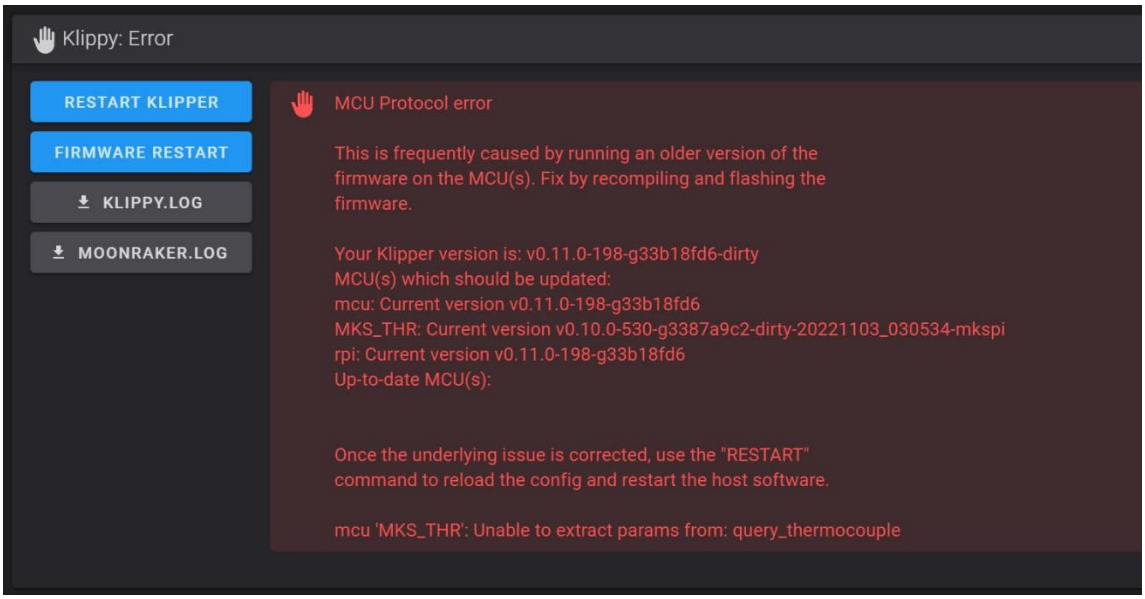
    i. Click **MORE INFORMATION** which will open a new menu in a new browser tab:



1. Enter the password for the **mks** account, then click **Submit.**

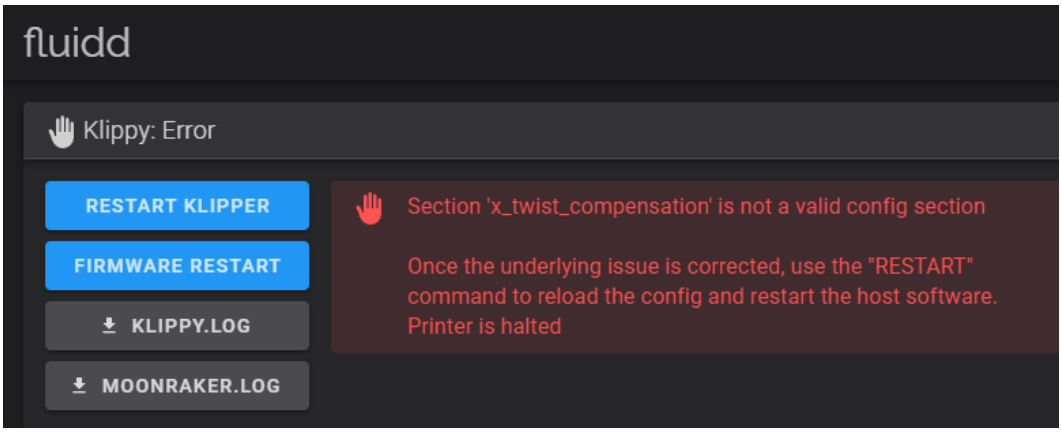
2. You can then **close** this browser tab and return to the one containing the Fluidd interface.

f. Once Klipper itself has been updated, it is also normal to see error messages warning that the Klipper Firmware on one or more of the MCUs are now out-of-date such as:

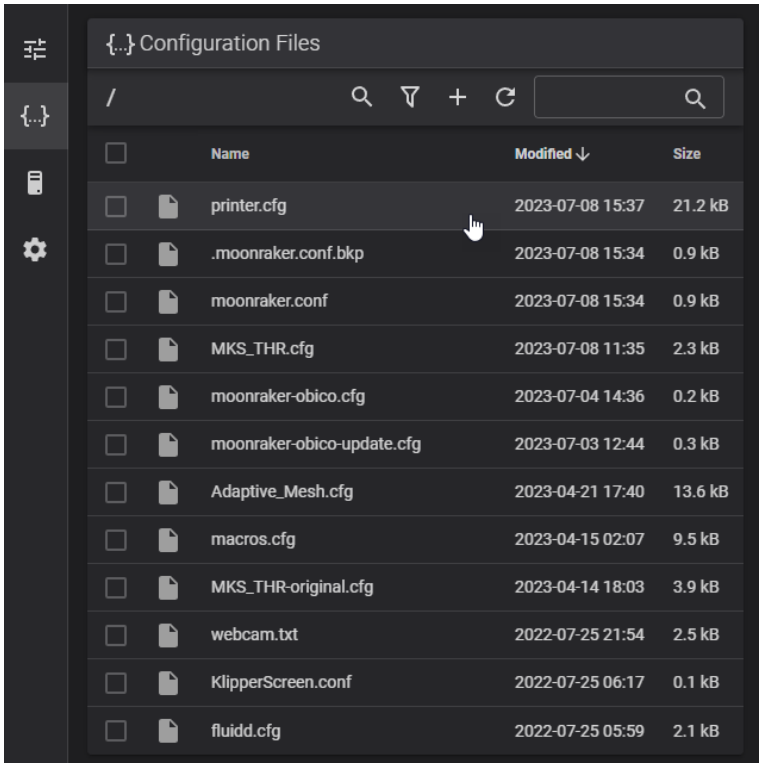


i. This is normal and to be expected if the installed versions are quite outdated.

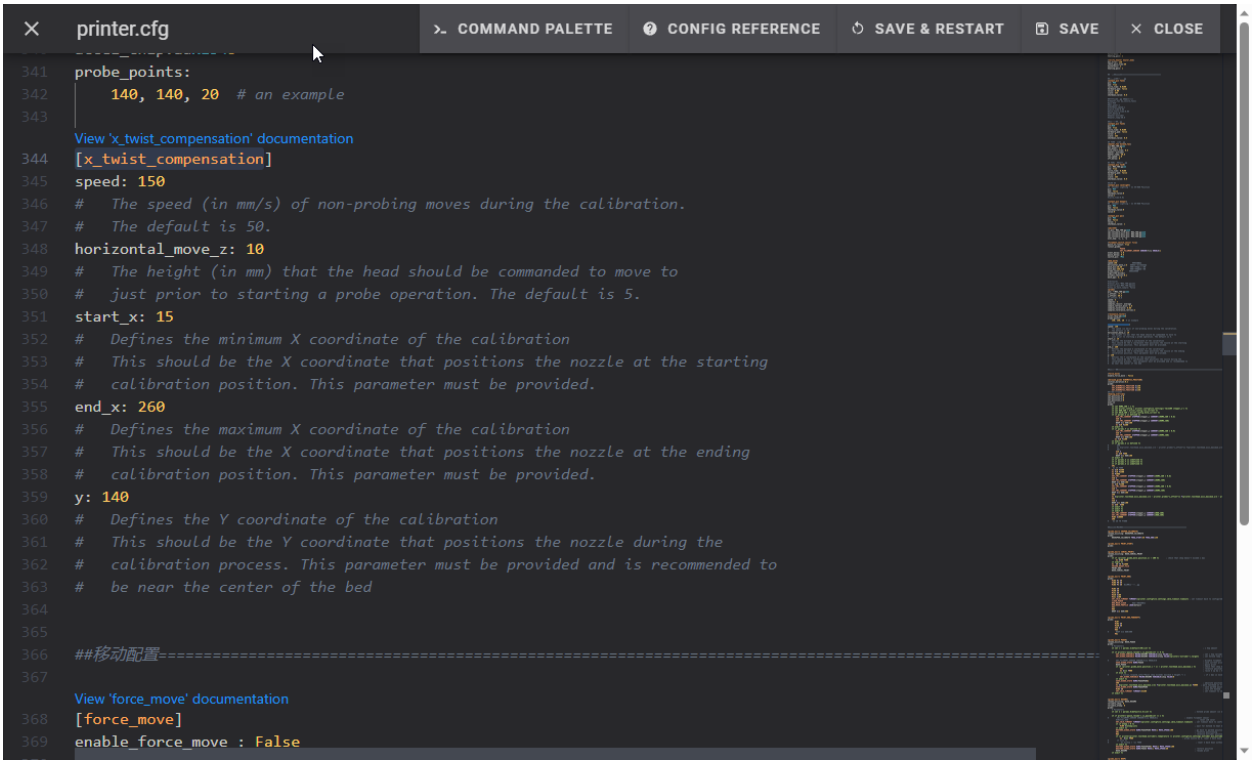
g. If the Printer had been running **Klipper v0.10.0-530 or earlier**, you may also receive the following error message:

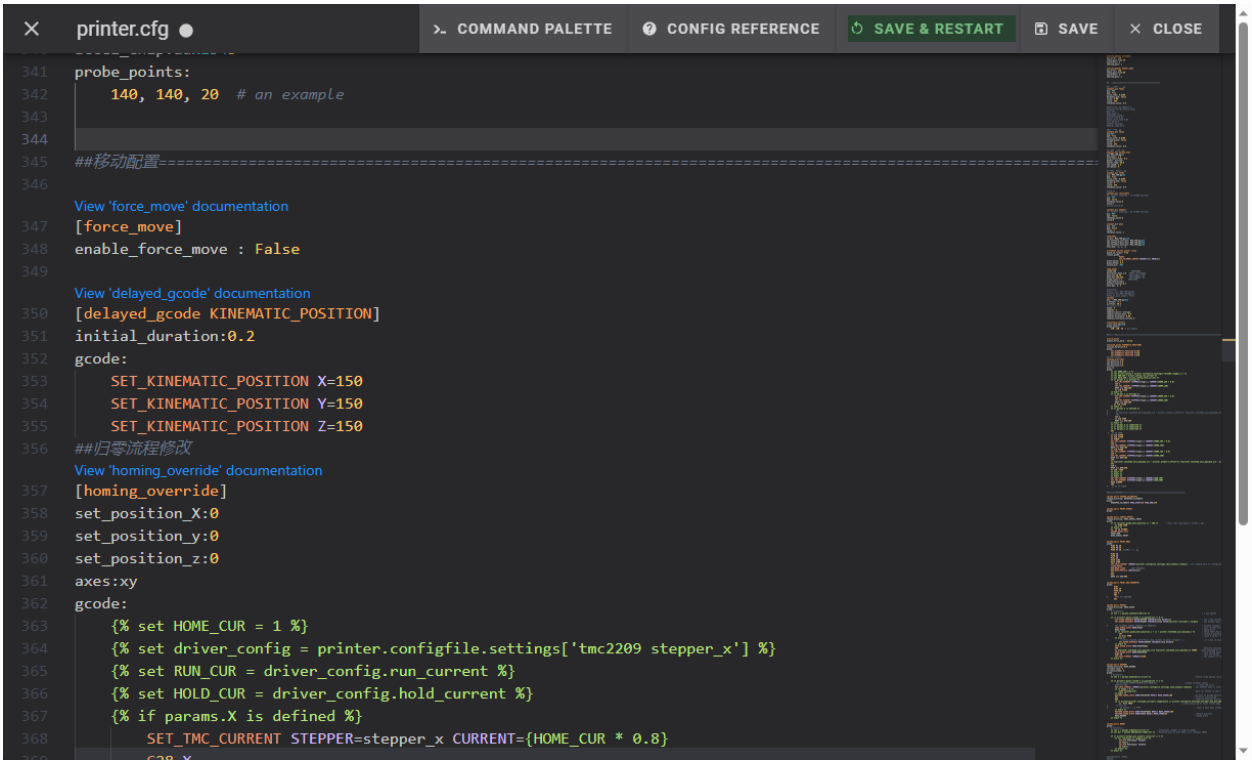


i. Use the **Fluidd Configuration** menu to open and edit the **printer.cfg** file.



ii. **Remove (delete) the entire [x_twist_compensation] section** so that it resembles the second screenshot below:



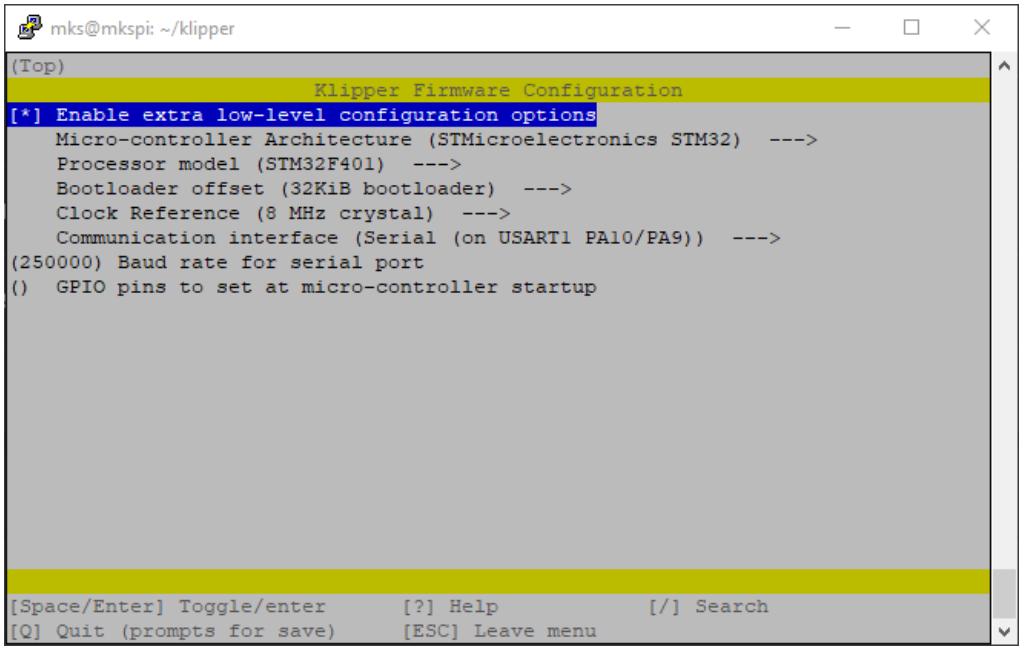


iii. Click **SAVE & RESTART**

FLASH THE MCU (X-4)

Now that Klipper has been updated, the primary **X-4 MCU** is the first controller board that will be flashed with the new **Klipper Firmware**. This MCU controls most of the printer hardware and is the controller board one sees when the panel on the back of the printer is removed.

1. Use an SSH Client such as Putty to connect to the **IP address** of the printer.
    a. Login using the **mks** account (NOT root).
2. Once logged in, compile the firmware for the X-4 MCU by typing the following commands using the SSH Client:
    a. cd klipper
    b. make clean
    c. make menuconfig
    d. The firmware configuration menu will be displayed.
    Be sure to select the correct options so that it matches the screenshot below:



e. Once the correct options have been selected, press **q** and then **y** to save the configuration.

f. make

i. This will compile the firmware. Wait until the process has finished.

g. ls -al out

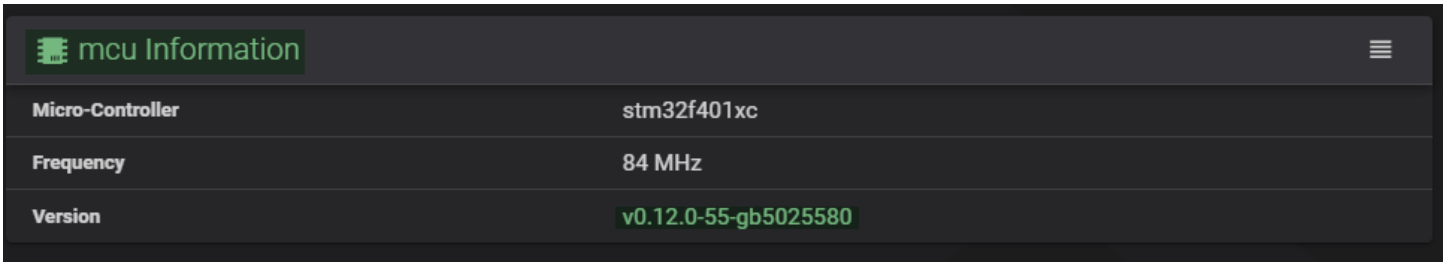
i. Verify there is a **klipper.bin** file in the out folder.

ii. If the **klipper.bin** file exists, proceed to the next step. If not, verify the configuration and try repeating the process to compile the firmware. Watch for any error messages.

3. Now that the firmware has been compiled, it needs to be transferred to an SD Card which can be used to flash the X-4 MCU. Using an SCP/SFTP client application such as WinSCP for Windows:
   a. Connect to the **IP address** of the Printer and login using the **mks** account (NOT root).
   b. Navigate to the **/home/mks/klipper/out** directory using the SCP Client.
   c. Transfer the **klipper.bin** file located in the **/home/mks/klipper/out** directory to your computer.
      i. Be sure to transfer it as a **binary** file.
   d. Once the klipper.bin file has been transferred to your computer, rename it to: **X_4.bin**
      i. Note: the X needs to be capitalized.
   e. Next, copy the X_4.bin file to an SD Card **32GB in size or smaller, formatted as FAT32**.
   f. Once the X_4.bin file has been copied, safely remove the SD Card from your computer and insert in in the TF Slot in the Printer.
4. Flash the Printer with the New Klipper Firmware
   a. **Turn off** the Printer using the **power switch** on the rear of the printer.
   b. Wait for it to shut down.
   c. Insert the SD Card containing the new firmware into the TF Slot on the X-4 MCU installed in the rear of the printer.

i. Verify the printer is turned off first!
ii. The TF Slot is located in the middle of the bottom edge of the X-4 MCU.
iii. The SD Card should be inserted with the label facing you.

d. Turn on the Printer once the SD Card has been inserted into the TF Slot.
   i. Wait for it to start up completely.
e. Verify the firmware has been successfully updated using Fluidd's **System Menu:**

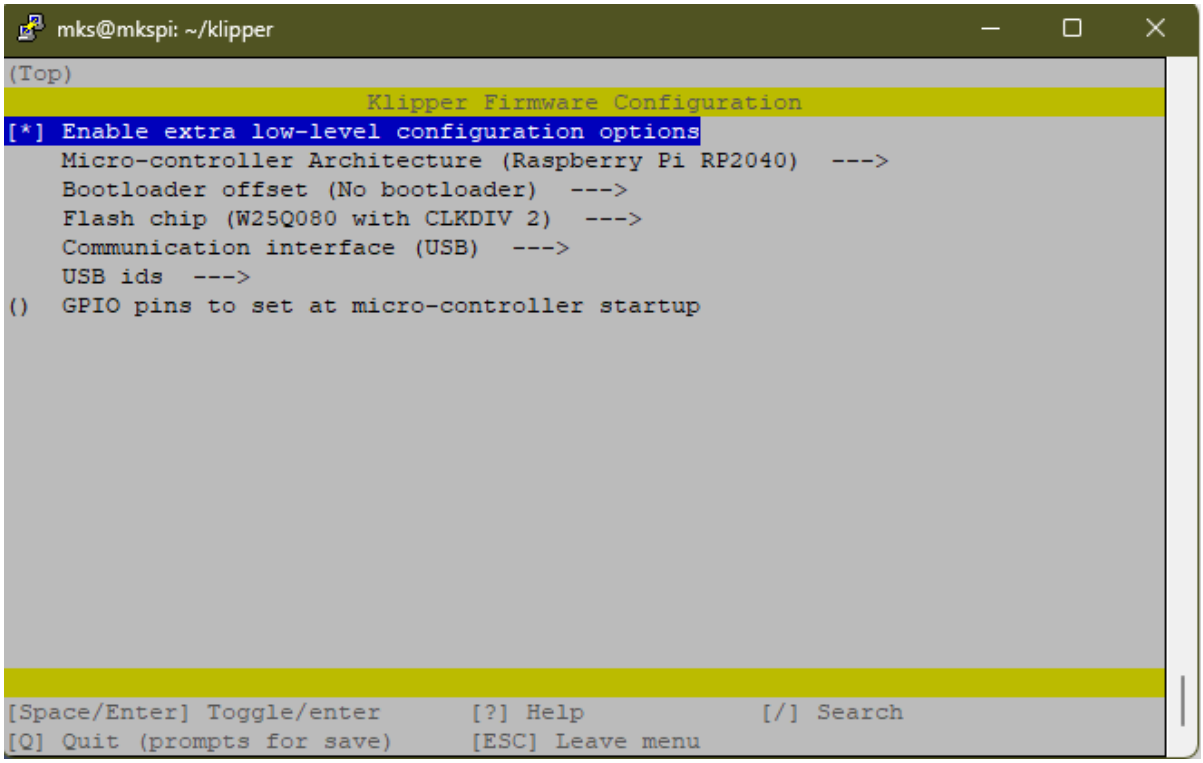


f. Shutdown the Printer and remove the SD Card from the TF Slot.
   i. If the flash worked, the firmware file on the SD Card will also have been renamed to: **X_4.cur**
g. Turn the Printer back on.
   i. Note that until all three MCUs have been updated the Printer may not function properly. This includes the lights in the printer not turning on at startup. Once the three MCUs have been updated the printer should function normally.

FLASH THE MKS_THR (A-4 Toolboard)

Next to flash is the **MKS_THR** (also known as the **A-4**) which is the toolboard installed on the **back of the Extruder** and connected to the X-4 MCU by a USB C cable. To flash the MKS_THR:

1. Use an SSH Client such as Putty to connect to the **IP address** of the printer.
   a. Login using the **mks** account (NOT root).
2. Change to the Klipper directory and compile the firmware:
   a. cd klipper
   b. make clean
   c. make menuconfig
   d. The firmware configuration menu will be displayed.
   Be sure to select the correct options so that it matches the screenshot below:



e. Once the correct options have been selected, press q and then y to save the configuration.

f. make

a. This will compile the firmware. Wait until the process has finished.

g. ls -al out

a. Verify there is a **klipper.uf2** file in the out folder.

b. If the **klipper.uf2** file exists, proceed to the next step. If not, verify the configuration and try repeating the process to compile the firmware. Watch for any error messages.

3. **Power off** the printer using the power switch.
4. **Wait 30 seconds.**
5. **Carefully press and hold the BOOT button** located in the bottom left corner of the A-4 Toolboard.
    a. Note that the A-4 board can flex, making it difficult to depress the BOOT button. Try pressing the button with your thumb while holding and supporting the A-4 with your other fingers.
6. **Continue holding the BOOT button** in while using your other hand to turn on the Printer using the **power switch**.
7. **DO NOT** release the **BOOT button** until the Printer has **completed booting**.
    a. This can take up to 60 seconds.
    b. The Printer has finished booting once the Home Menu appears on its screen.
8. **Release** the **BOOT button** once the **Home Menu** appears.
9. Reconnect to the Printer via SSH.
10. Login using the **mks** account (NOT root).
11. Enter: **lsblk**

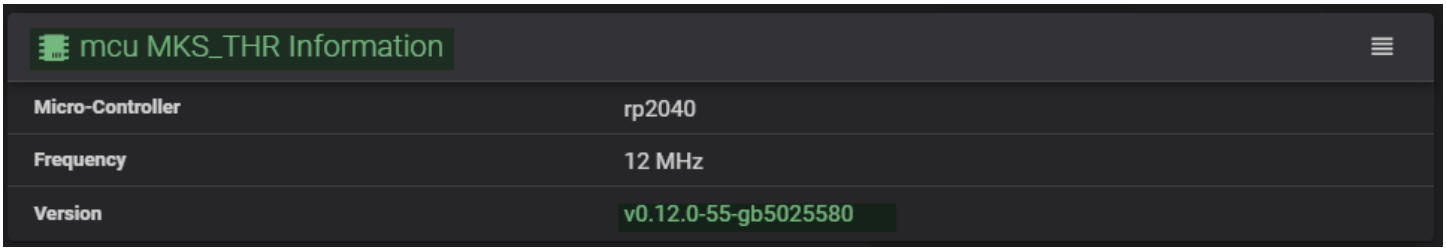
12. Verify that you see the sda1 directory in the lsblk output:

    sda 8:16 1 128M 0 disk

    └─sda1 8:17 1 128M 0 part /home/mks/gcode_files/sda1

    a. Note: the directory might be **sdb1** instead of sda1.
    b. Continue to the next step if the directory has appeared.
    c. If you do not see **sda1** or **sdb1** in the lsblk output:
        i. **Power off** the printer using the **power switch**.
        ii. **Wait 30 seconds**
        iii. Retry holding the **BOOT button** while the printer starts.
        iv. Be sure **NOT** to release the **BOOT button** at any time until the printer has started completely.
        v. Once the printer is back online, repeat this step to verify either the **sda1** or **sdb1** directory has appeared.

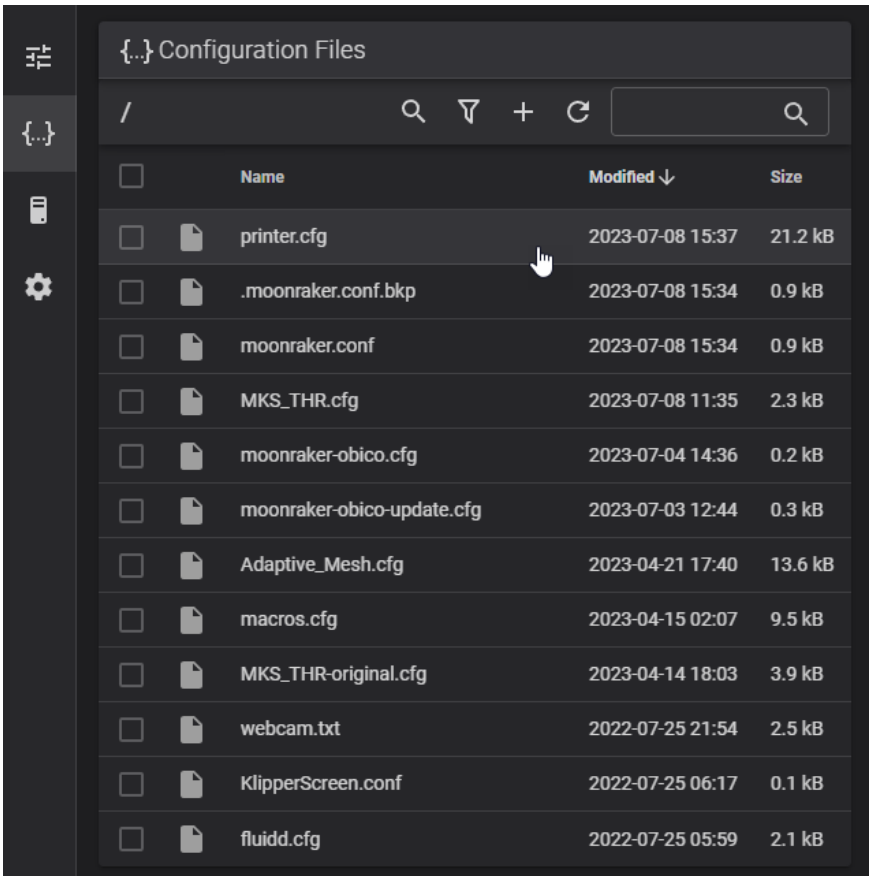
13. Copy the new A-4 firmware into this directory:
    a. cp /home/mks/klipper/out/klipper.uf2 /home/mks/gcode_files/sda1
        i. be sure to change sda1 to sdb1 if you saw sdb1 instead of sda1 in the prior task.
14. Wait **30 seconds** for the A-4 Toolhead to flash its firmware.
    a. The klipper.uf2 file will **disappear** from the sda1\sdb1 directory once the flashing has completed.
    b. Verify the directory is empty using:
        i. ls /home/mks/gcode_files/sda1 OR ls /home/mks/gcode_files/sdb1
15. **Power off** the Printer using the **power switch** on the back of the Printer.
16. **Wait 30 seconds.**
17. Power the Printer back on and wait for it to boot.
18. Verify the firmware has been successfully updated using Fluidd's **System Menu:**



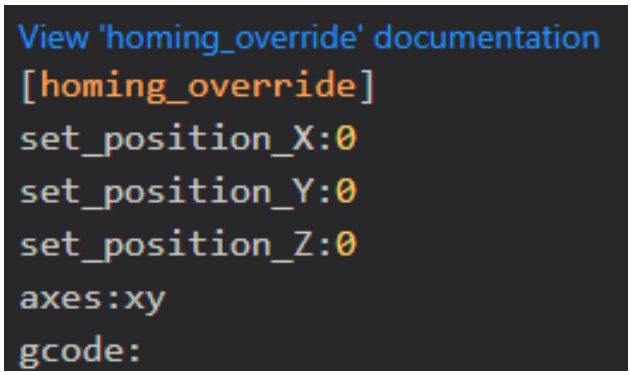
FIX HOMING OVERRIDE AND M4029 MACRO

Once Klipper has been successfully updated and flashed, **two sections** of the printer.cfg configuration file must be fixed. Until this is done, the Home All button on the Printer Screen and within Fluidd with fail with an error.

19. The first to fix is the **[homing_override]** section.
    a. Use the **Fluidd Configuration** menu to open and edit the **printer.cfg** file:



    b. Next, locate the **[homing_override]** section:



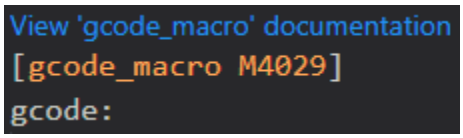
c. Within [homing_override], locate the following line:

G1 X{printer.toolhead.axis_maximum.x/2 - printer.probe["x_offset"]}
Y{printer.toolhead.axis_maximum.y/2 - printer.probe["y_offset"]} F7800

d. and change it to:

G1 X{printer.toolhead.axis_maximum.x/2 - printer.configfile.settings.probe.x_offset}
Y{printer.toolhead.axis_maximum.y/2 - printer.configfile.settings.probe.y_offset} F7800

e. Next, continue scrolling through printer.cfg until you locate the **M4029** macro:

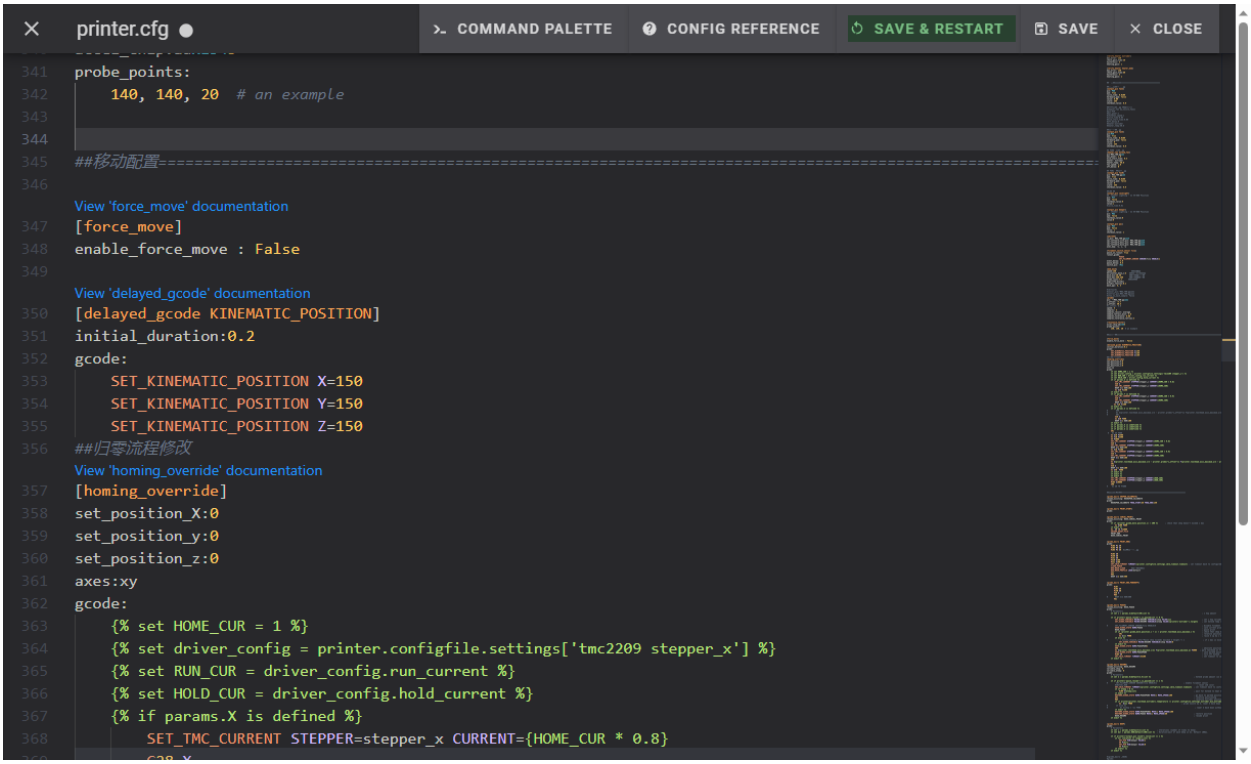


f. Within this macro, find the same line as you did within the **[homing_override]** section:

G1 X{printer.toolhead.axis_maximum.x/2 - printer.probe["x_offset"]}
Y{printer.toolhead.axis_maximum.y/2 - printer.probe["y_offset"]} F7800

g. And as you did in the [homing_override] section, change it to:

G1 X{printer.toolhead.axis_maximum.x/2 - printer.configfile.settings.probe.x_offset}
Y{printer.toolhead.axis_maximum.y/2 - printer.configfile.settings.probe.y_offset} F7800



h. Next, click **SAVE & RESTART** to save the changes and restart the Klipper firmware:

i. The Home All buttons on the Printer screen and within Fluidd should now operate without error.

FINAL STEPS

There are a few final steps to complete the process once Klipper has been updated and the firmware on both the X-4 MCU and MKS_THR Toolboard have been flashed:

1. Re-Calibrate the Printer. From the Calibration Menu on the Printer run:
    a. Auto Bed Leveling
    b. INPUT SHAPER
2. Re-attach the panels
    a. **Power off** the Printer using the **power switch** on the rear of the printer.
    b. Wait for it to shut down.
    c. Use the **2mm hex key** to carefully re-attach the **rear cover of the extruder**.
    d. Next, also using the **2mm hex key**, reattach the **rear panel of the printer** which covers the electronics.
3. Power the Printer back on.

This completes the Klipper update process.

