

Z-Mod

User guide

Edition 1.7.7 · English

SUPPORTED PRINTERS

AD5M / AD5M Pro / AD5X

Creator 5 / Creator 5 Pro

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github.com/ghzserg/zmod · wiki.zmod.link

Contents

1. Index 3
2. Setup 8
3. Setup Calibrations 27
4. Recommendations 43
5. AD5X 49
6. C5Pro 80
7. Plugins 99
8. Telegram 104
9. FAQ 112
10. Help 136
11. List 140
12. Main 148
13. Calibrations 154
14. Start/Stop/Global 157
15. System 177
16. Zmod 183
17. Filament 195
18. PRO 197
19. Native firmware 198
20. Changelog 206
21. Support 223
22. Social 226
23. Video 229
24. ☁️ zmod.link Cloud 230

Index



Z-Mod LINK is available at this link ->

Z-Mod for FlashForge AD5M/AD5M PRO/AD5X/Creator 5/Creator 5 Pro: Full Control Over Your Printer

Congratulations on your FlashForge printer purchase! The stock firmware is great for getting started, but if you want to unlock your device's full potential, Z-Mod is a powerful and free solution that transforms your printer from "user-friendly" to "professional-grade".

What is Z-Mod?

Z-Mod is a custom firmware modification installed *on top of* the stock software. It does **not** replace the original firmware — instead, it extends it, adding a vast number of features familiar from advanced printers, all while preserving the benefits and ease of use of the native interface. If you want even more, welcome to the documentation with lots of settings.

Z-Mod: Qui non legit, non intrat

> **Why "Z-Mod"?** The author has been known by the nickname zserg for over 20 years. When it came time to name the mod, the answer was obvious: take the first letter of the nickname and add "mod". No hidden meaning, no symbolism — it really is exactly as simple as it looks.

Key Advantages of Z-Mod vs. Stock Firmware

Here's what you gain by installing Z-Mod:

1. Full Remote Control

Stock firmware: You can send files over Wi-Fi, but only via Orca FF or the FlashForge app (both may be unavailable due to server issues). **Z-Mod**: Complete browser-based control from your PC or phone:

- **Fluidd / Mainsail**: Intuitive web interfaces showing live print stats, temperatures, fan speed control, axis movement, and full console access.
- **Octo/Klipper-style file upload**: Seamless integration with Orca Slicer and other slicers for direct G-code file transfers.
- **Access to the printer's web interface via the Internet** cloud service zmod.link
- **Notification in Telegram and 100+ other services** notify plugin or Telegram only with lower memory usage: Telegram Notify plugin

2. Advanced Calibration & Bed Leveling

Stock firmware: Basic automatic bed leveling (ABL). **Z-Mod**:

- **Adaptive Mesh (KAMP)**: The printer generates a mesh map only over the area where your model is located — saving time and improving accuracy.
- **PID Tuning**: Precise calibration of extruder and bed thermal behavior for stable, oscillation-free temperatures.
- **Input Shaping**: Analyzes and compensates for frame vibrations, enabling faster printing without “ringing” artifacts.
- **Belt Spectrogram**: Diagnoses belt condition for predictive maintenance.
- **Screw Tilt Adjustment**: Fully level the bed in under 10 minutes.

3. Intelligent Reliability Features

Stock firmware: Basic filament-runout detection. No firmware or file integrity checks → print hangs possible. **Z-Mod**:

- **Nozzle Collision Detection**: Uses load cells to detect nozzle collisions with the print or bed — and automatically pauses to prevent damage.
- **Power-loss Recovery**: Remembers the last print position and resumes after power is restored.
- **Firmware Integrity Check**: Validates both stock firmware and Z-Mod files to prevent corruption.
- **G-code File Integrity Check**: Verifies MD5 checksums during file transfer.

4. Flexible Filament Handling (Especially for AD5X)

Stock firmware: Standard spool selection via UI menu. **Z-Mod (for AD5X)**:

- **Smart COLOR Menu**: Visually select spools, color changes, and material types directly from the web UI.
- **Infinite Spool Mode**: If multiple spools use the same material, the printer automatically switches to the next one when the current runs out.
- **Fine-tuned Purge Control**: Reduce purge filament volume during color changes, saving material.

5. Ecosystem & Integration

Stock firmware: Closed system. **Z-Mod**:

- **Telegram Bot**: Get real-time notifications and camera snapshots in Telegram for print start/completion.
- **Plugin Support**: Extend functionality via modules (e.g., `bambufy` for better Bambu Studio compatibility).
- **Alternative Camera Setup**: Adjustable resolution, FPS, and memory optimization for stable streaming.
- **Jingle Playback**: Plays custom tunes when prints start or finish.

6. Optimization & Low-level Control

Stock firmware: Limited configurability. **Z-Mod**:

- **Stock LCD Disable**: Frees up RAM (critical on AD5M with only 128 MB).
- **GuppyScreen**: Enhanced replacement UI for the printer's display.
- **HelixScreen**: Enhanced replacement UI for the printer's display.
- **Rivet**: Lightweight replacement UI for the AD5M / AD5M Pro display.
- **Log Viewing**: Full system logs for diagnostics.
- **Firmware Retraction**: Adjust retraction parameters on-the-fly, no reslicing needed.
- **Full ROOT Access**: Full system control always available.

7. Klipper 14

Stock firmware: AD5M runs outdated Klipper v11, plagued by bugs (E0011, E0017, incorrect object exclusion, broken SCV, faulty resume, etc.). **Z-Mod**:

- Fixes known Klipper bugs and enables a modern, stable version.

Summary: Who Is Z-Mod For?

If you are...	Z-Mod gives you...
A **beginner**	Easy remote control and automated calibrations for reliable "first-try" quality.
An **enthusiast**	Full control over every printing parameter, advanced tuning tools, and speed experimentation.
An **AD5X owner**	The most convenient multi-color workflow and reduced filament waste.

Z-Mod doesn't *replace* the stock firmware — it enhances it, giving you the **choice**: stick with the familiar touchscreen UI, or leverage modern 3D printing tools to get the absolute most from your FlashForge. It's the logical next step for any FlashForge owner aiming to maximize their printer's capabilities.

> **Danger**
>
> *If you want to install this mod on your AD5M (Pro) / AD5X, be aware that you risk voiding the warranty or damaging the printer. Proceed at your own risk if you wish to try this mod!*
>
> If you don't know what this is, don't understand why a Klipper web interface is needed, or are simply satisfied with the stock firmware, do NOT install this modification. For everyone else – **please read the entire instructions carefully!**
>
> After installing the mod, if you don't want to delve into details – just print as usual. No additional configuration or changes are required. If you decide to explore further – proceed by reading the documentation.

Before start

Do NOT install this mod if the following stock firmware fixes suffice

These features are ported to the stock firmware:

1. I want to install Klipper. (Klipper is already in the printer, but there is no web interface)
2. Install root
3. E0011 error fix
4. E0017 error fix
5. Disable printer updates/telemetry/Chinese clouds
6. Factory reset
7. Convert FF5M to FF5MPro
8. Convert FF5MPro to FF5M

Compatibility

Compatible with clean firmware versions:

- FF5M/FF5MPro: v2.7.5 or higher (2.7.5, 2.7.6, 2.7.7, 2.7.8, 2.7.9, 3.1.3, 3.1.4, 3.1.5, 3.1.9, **3.2.3**, 3.2.4, 3.2.5, 3.2.6, 3.2.7, 5.0.3, 5.1.7, 5.1.8, 5.1.9, 5.2.0)
- AD5X: only (1.0.2, 1.0.7, 1.0.8, 1.0.9, 1.1.1, 1.1.6, **1.1.7**, 1.1.9, 1.2.0, 1.2.1, 1.2.2, 1.2.3, 3.0.3, 3.0.9, 3.1.0, 3.1.5, 3.1.6, 3.1.7, 3.1.8) *any IFS version*
- Creator 5/Creator 5 Pro **only** (1.9.9, 2.0.0).

Native firmware files are located here.

Installation/Update/Removal

Installation/Update/Removal Guide

FAQ

Must-read

Printer Stability Recommendations

Read if encountering issues

Plugins

Z-Mod supports Plugins

Credits

- Root access based on @darksimpson's work. Login and password: root. Link
- Beeper based on @drmax_gc's work. M300. M356 Für Elise. Link
- MD5 verification by Igor Polunovskiy. Link
- GuppyScreen

The mod uses the developments of KlipperMod, but is not its development or continuation, and is not compatible with it either in macro syntax or binary.

Support Development

Since people have been asking, I accept donations but please remember that I work on Z-Mod for fun and not for the money. I will not accept donations to work on specific bugs or features.

You can find available support methods on a separate page

Setup

Restoring Printer to Factory Settings (Required for Mod Installation)

1. Uninstall KlipperMod if previously installed.
2. Reset the printer to default settings.
3. Format a USB drive to FAT/FAT16/FAT32(MBR).
4. Copy the appropriate file from the Native firmware to the USB root directory:
    - Adventurer5M-3.1.9-2.2.3-20250807-Factory.tgz for FF5M
    - Adventurer5MPro-3.1.3-2.2.3-20250107-Factory.tgz for FF5M **Pro**
    - AD5X-1.1.7-1.1.0-3.0.6-20250912-Factory.tgz for AD5X
    - Creator5-1.9.9-1.3.0-20260907.tgz for Creator 5
    - Creator5Pro-1.9.9-1.3.0-20260907.tgz for Creator 5 Pro

    Important: **Do not unpack the files!**
5. Power off the printer.
6. Insert the USB drive into the printer.
7. Power on the printer.
8. Wait for the stock firmware installation to complete. *If it takes too long or does not install at all, use a different flash drive.*
9. Configure Wi-Fi or LAN *new beaver*
10. Perform the initial calibrations.
11. Get the latest printer updates or install firmware 1.1.7 for AD5X, or 3.2.3 for AD5M/AD5M Pro if you don't want the printer to measure the bed center before each print

Installing the Mod

Video

https://www.youtube.com/embed/2sfb2OtY7wM

1. **Restore the printer to factory settings.** AD5X Warning
2. Format a USB drive to FAT/FAT16/FAT32(MBR).
3. Copy the mod file to the USB root directory:
    - For FF5M: Adventurer5M-**zmod**-*.tgz
    - For FF5M Pro: Adventurer5MPro-**zmod**-*.tgz
    - For AD5X: AD5X-**zmod**-*.tgz
    - For Creator 5: Creator5-**zmod**-*.tgz
    - For Creator 5 Pro: Creator5Pro-**zmod**-*.tgz

Even better: put all 5 files on the flash drive — the printer will pick the right one itself.

Important: **Do not unpack the files!**

4. Power off the printer.

5. Insert the USB drive.
6. Power on the printer.
7. Wait for the mod installation to complete.

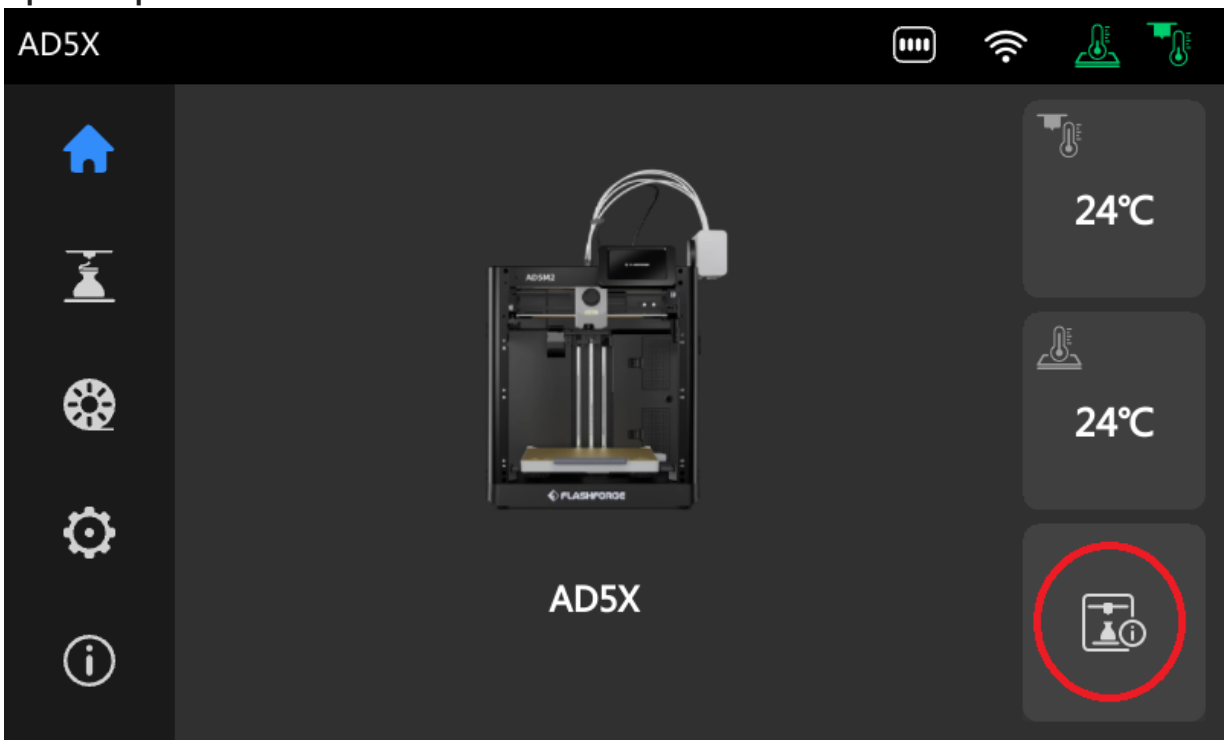


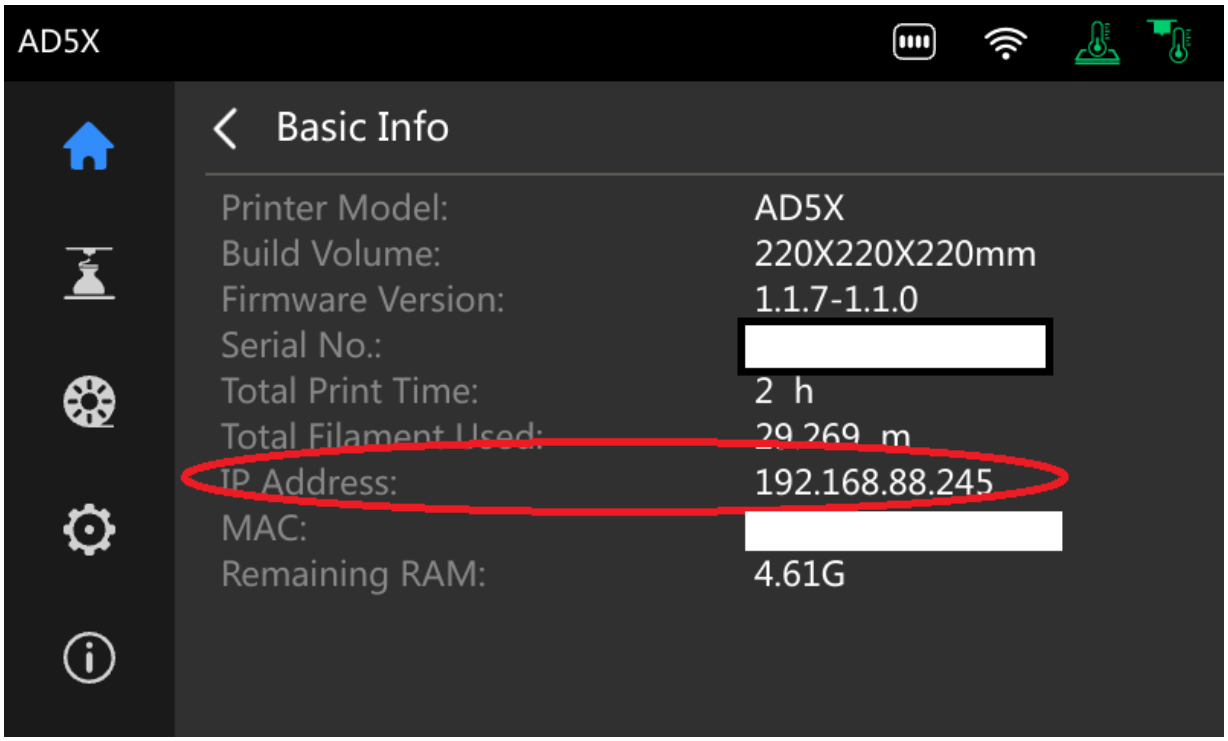


Installation on the AD5X/Creator 5/Creator 5 Pro can take up to 40 minutes. *If it takes too long or does not install at all, use a different flash drive.*

If you missed the window with the green check mark and the printer rebooted automatically, the standard printer screen will load; in this case you can go straight to step 11.

1. Remove the USB drive.
2. Power off the printer.
3. Power on the printer.
4. **Open the printer's IP address in the browser**

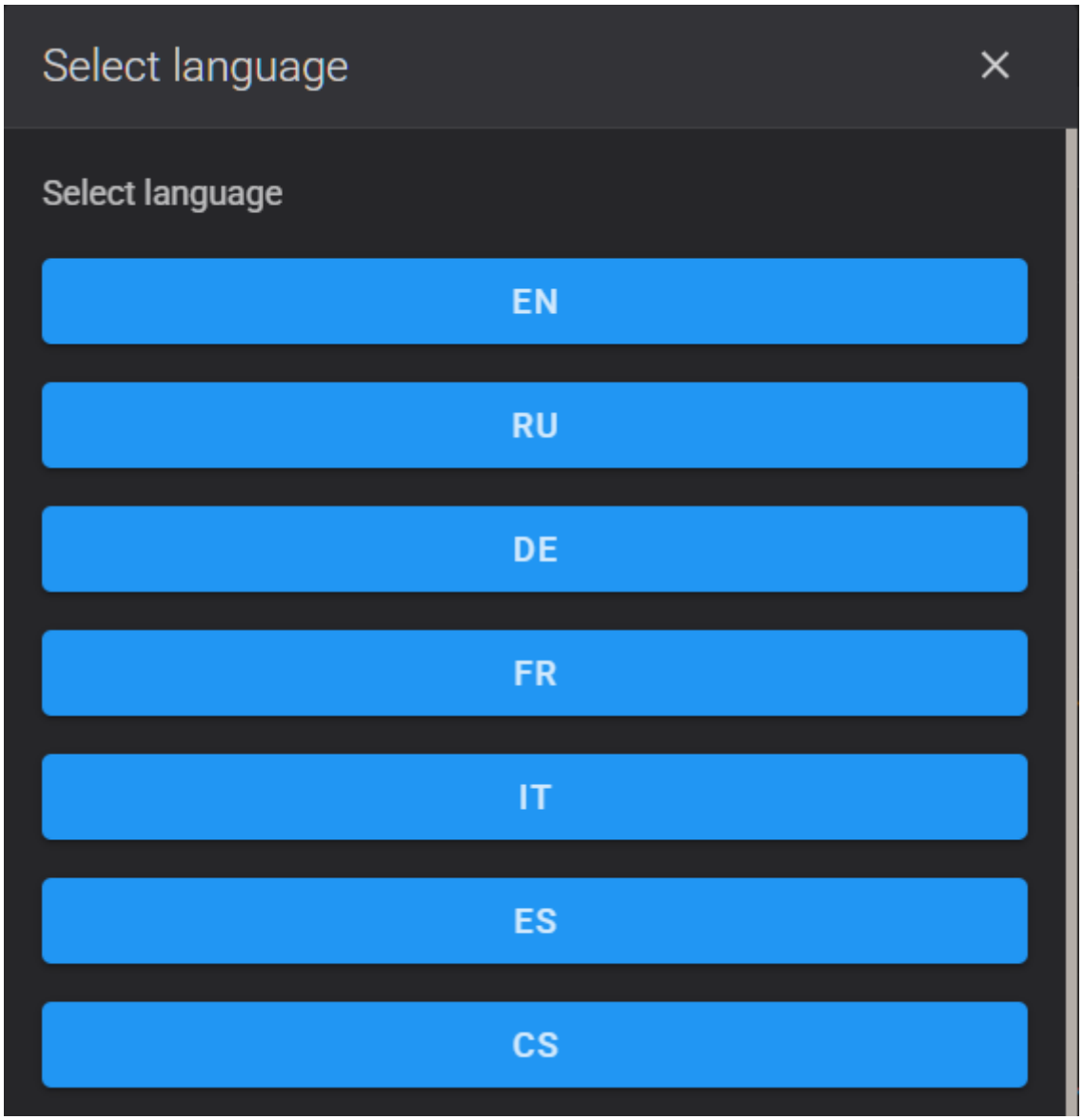




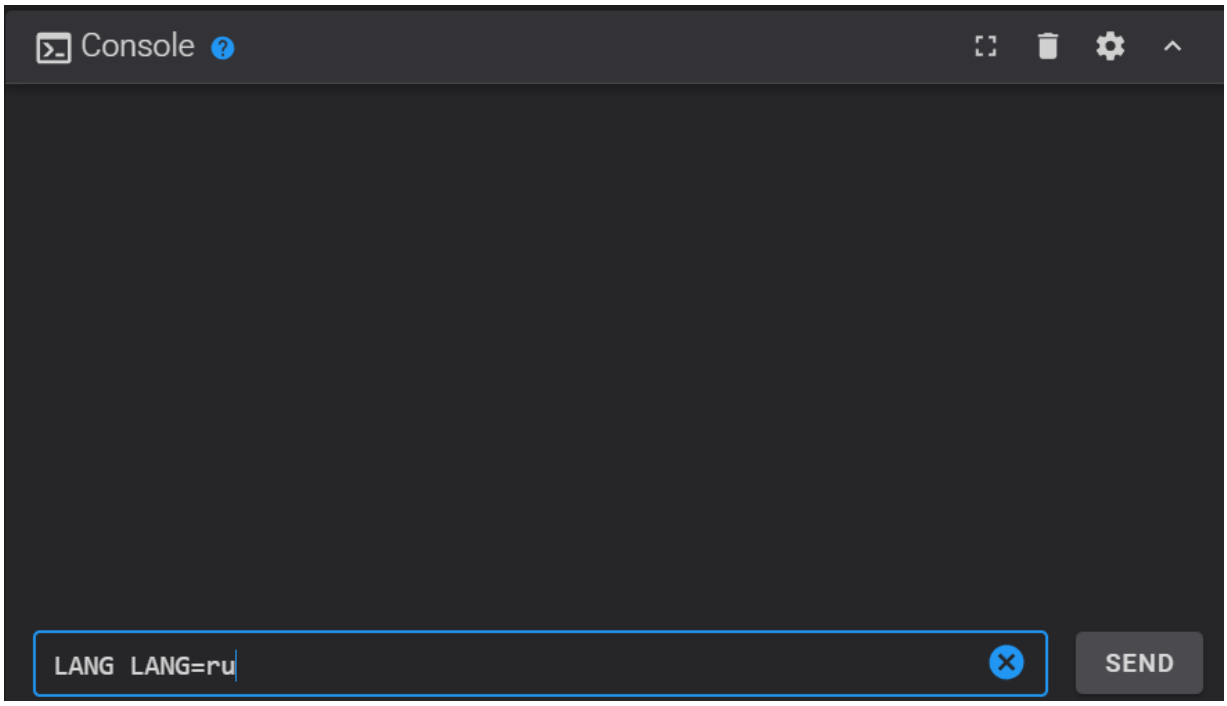
If the web interface doesn't open, the stock firmware has disabled the mod. To enable it, copy the file:

- AD5X-enable-zmod.tgz
- Creator5-enable-zmod.tgz
- Creator5Pro-enable-zmod.tgz

5. Translate the mod into your language.

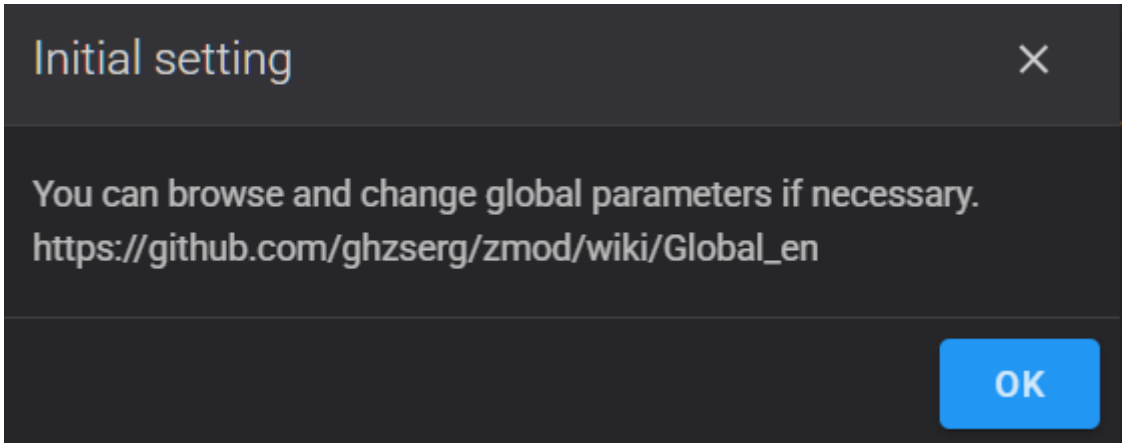


Or type in the console: `LANG LANG=en`

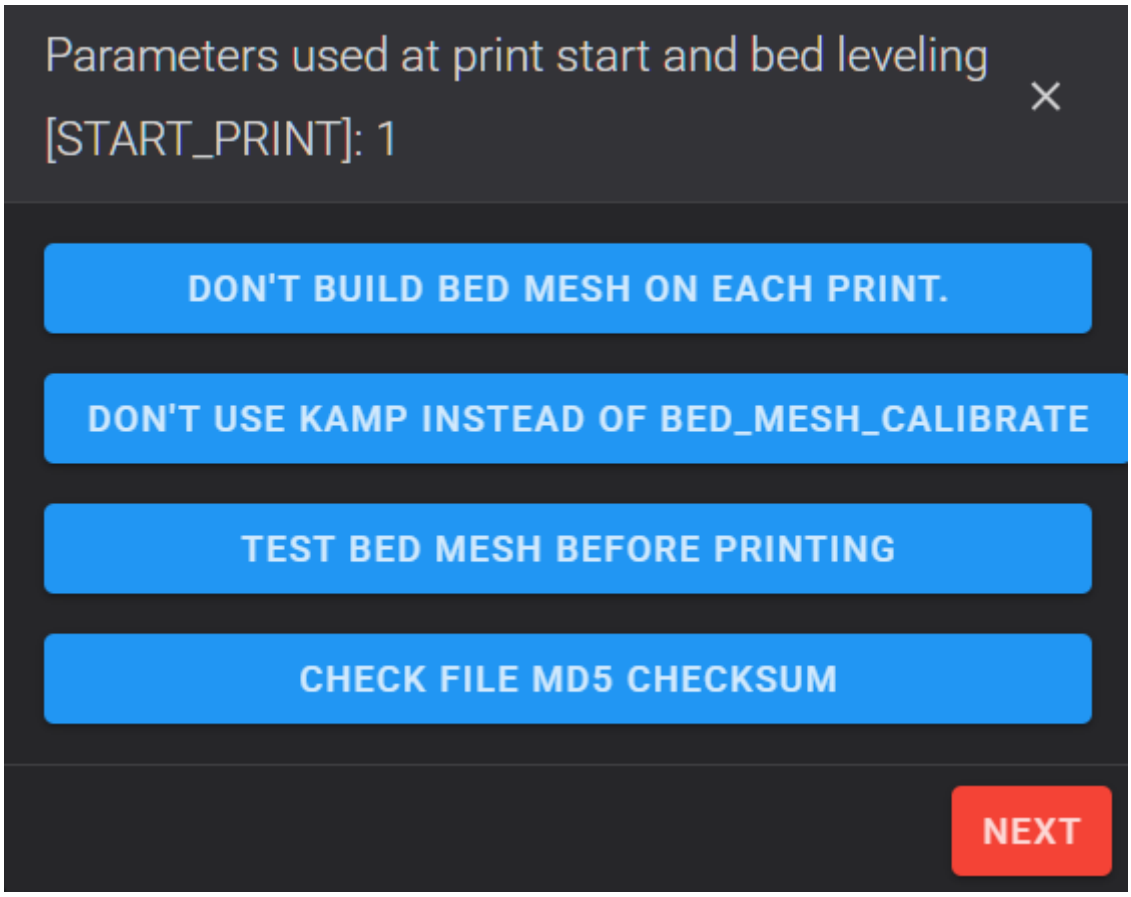


Set your timezone: `SET_TIMEZONE ZONE=Europe/London` (run `SET_TIMEZONE` without parameters to list zones). Details

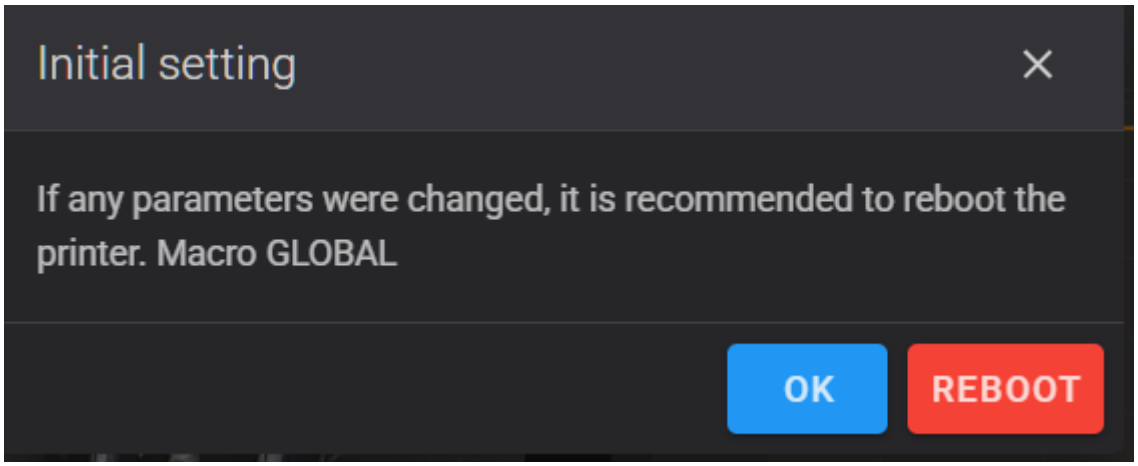
6. Configure the mod



This shows parameters used at print start, print end, and global settings. It is recommended to just review the settings — do not change them unless necessary. The description for each parameter can be found here.

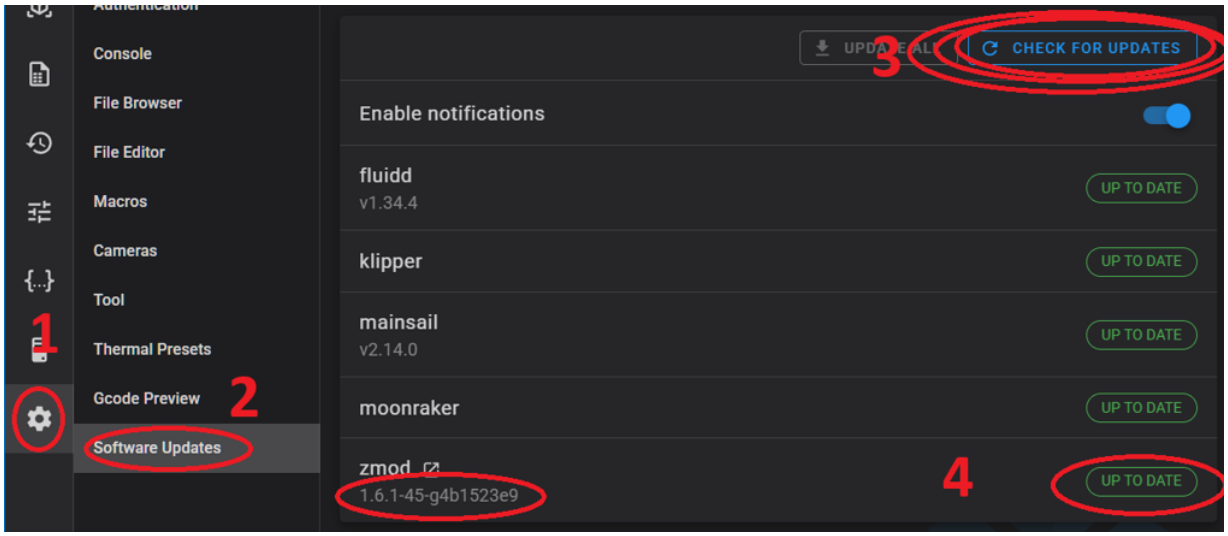


You must proceed to the last screen and press `Ok` or `Reboot`. If you skip this, the window will appear on every boot.

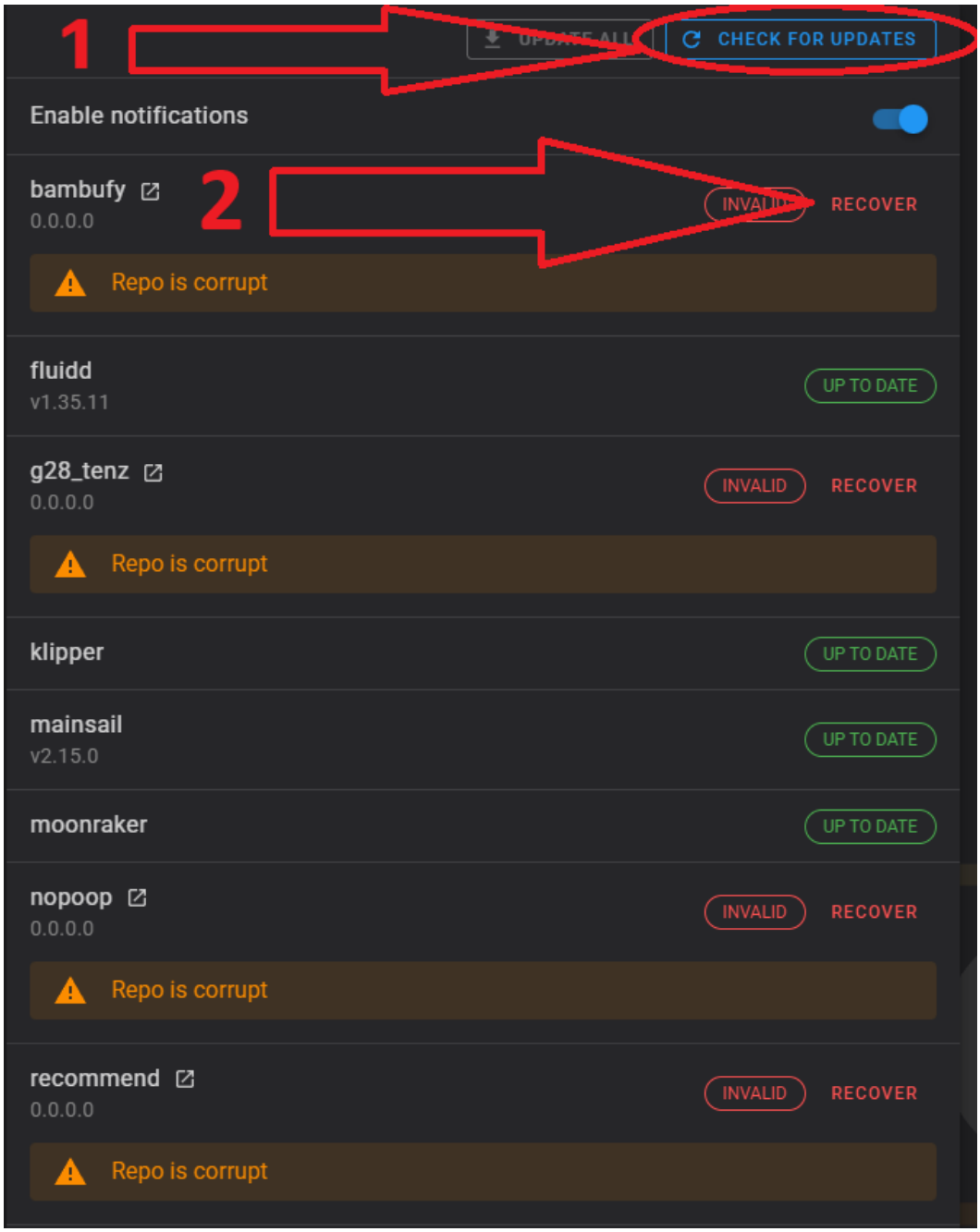


To display this window again later, type in the console: `GLOBAL`

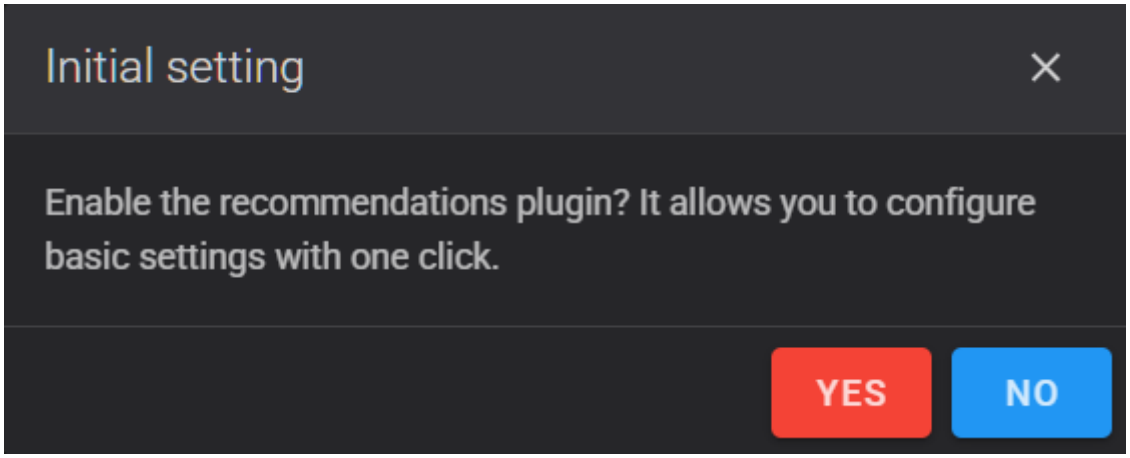
7. Go to `Settings` → `Firmware Updates`
8. Click `Check for Updates`, and wait until the check completes
9. Click **Update** and update all components.



If many errors appear — this is normal. Plugins are not part of the firmware and are downloaded separately. Click `Check for Updates` again, then restore and update each module individually. The printer will reboot during the process.



10. Enable the recommendations plugin



Or enter in the console: `ENABLE_PLUGIN name=recommend`



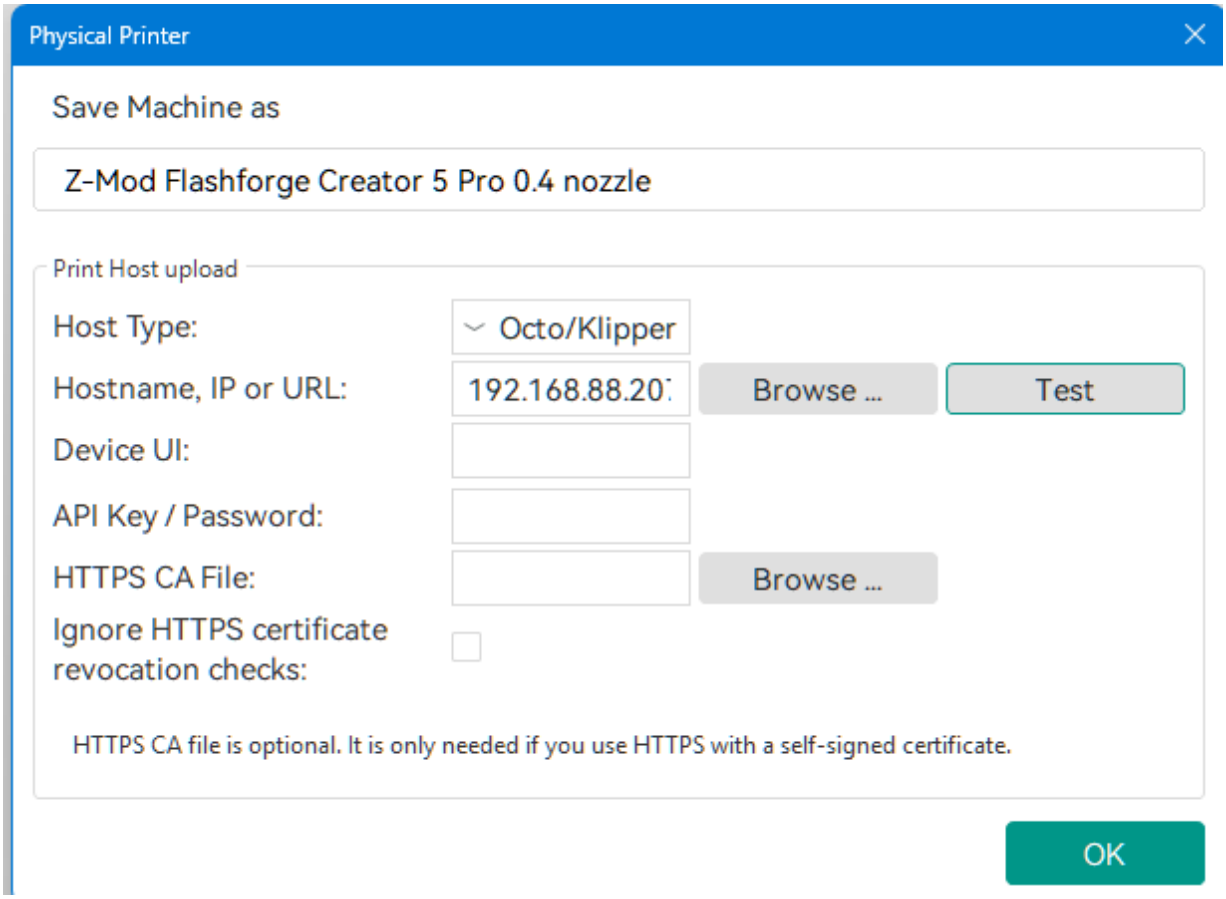
11. Send Files via "Octo/Klipper" for Printing

    You **need to switch to the Octo/Klipper protocol**:

    - **Host Type**: `Octo/Klipper`
    - **Printer Agent**: `Moonraker`

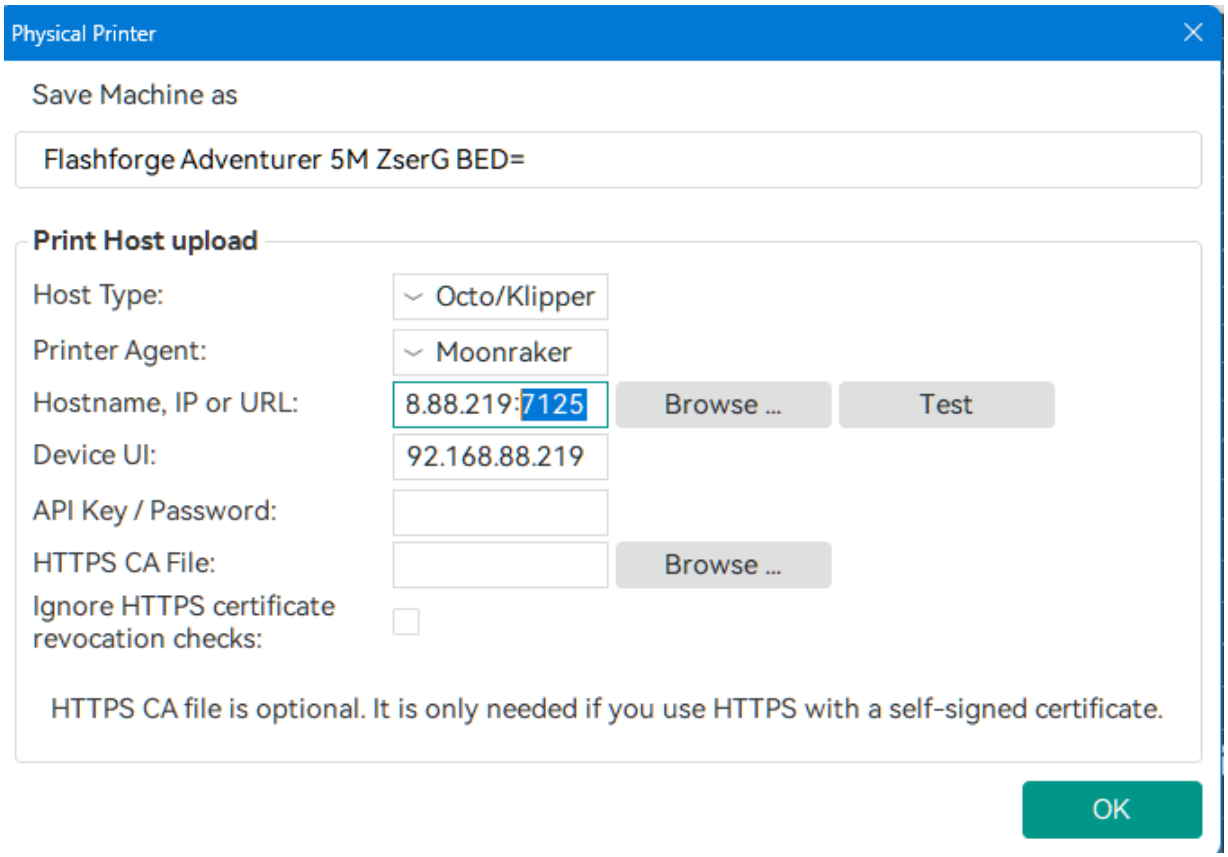
    For Creator 5 / Creator 5 Pro / AD5X:

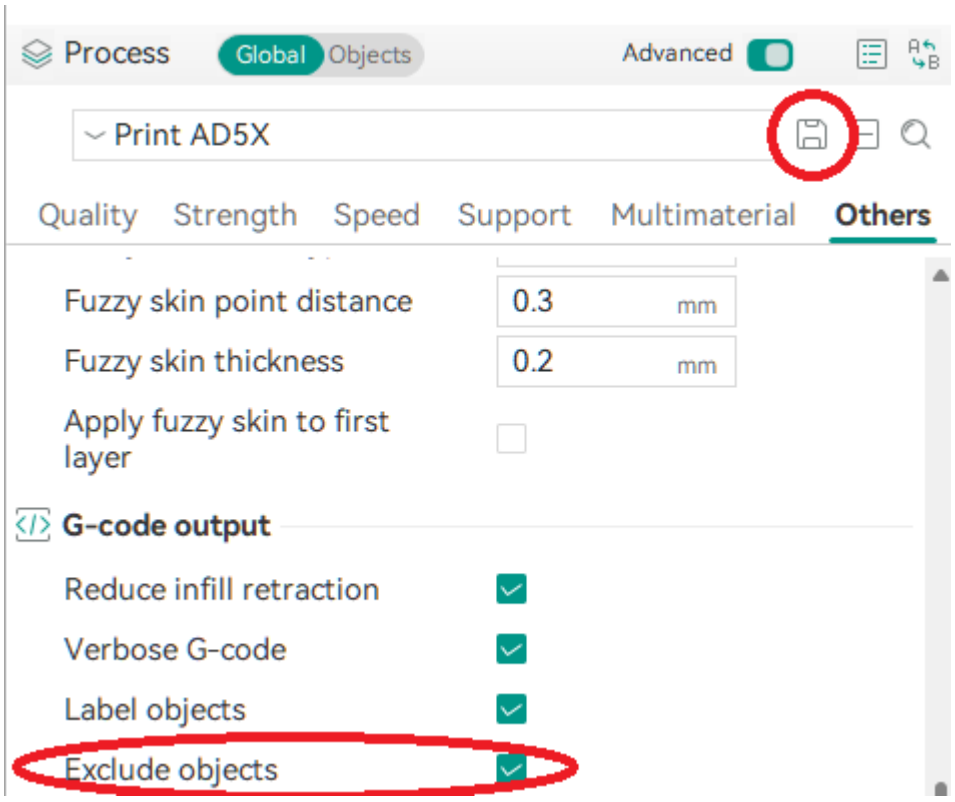
    - **Hostname**: `IP_printer`



    For FF5M / FF5M Pro:

    - **Hostname**: `IP_printer:7125`
    - **Device UI**: `IP_printer` or `IP_printer:80`





12. Ready-made profiles

    The entire start code should be replaced with this:

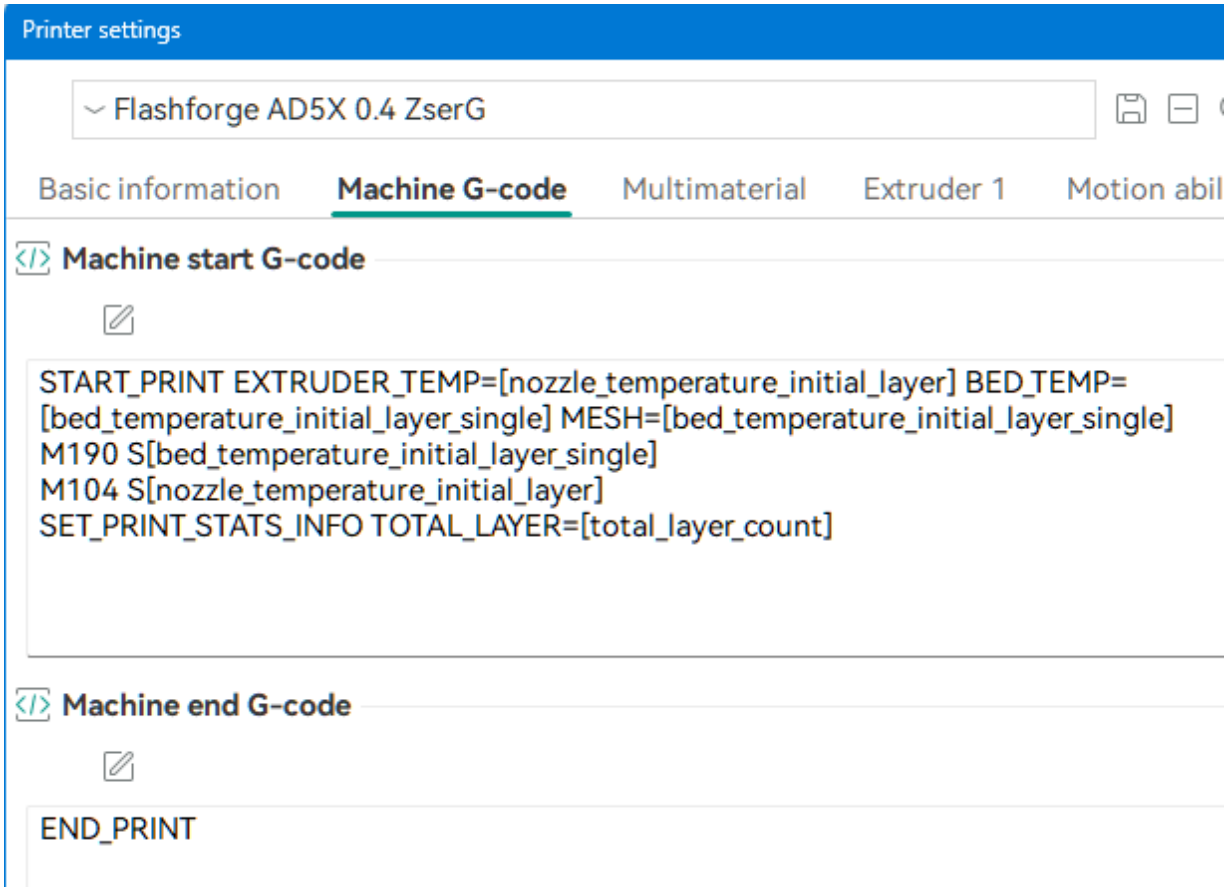
```
START_PRINT EXTRUDER_TEMP=[nozzle_temperature_initial_layer]
BED_TEMP=[bed_temperature_initial_layer_single]
M190 S[bed_temperature_initial_layer_single]
M104 S[nozzle_temperature_initial_layer] T{single_extruder_multi_material ? 0 :
```

```
initial_extruder}
SET_PRINT_STATS_INFO TOTAL_LAYER=[total_layer_count]
```

`START_PRINT EXTRUDER_TEMP=... BED_TEMP=...` should be written on one line

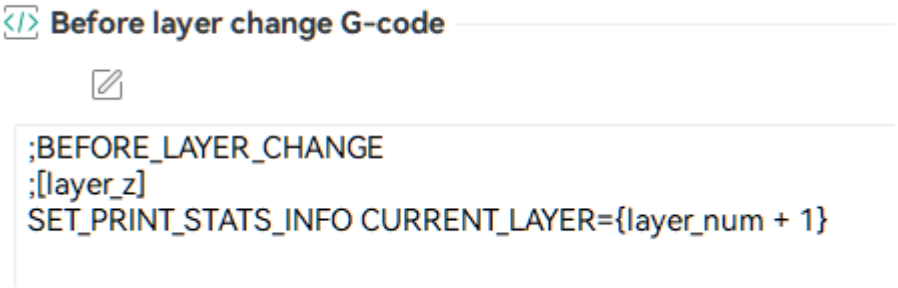
The end code should be this:

```
END_PRINT
```

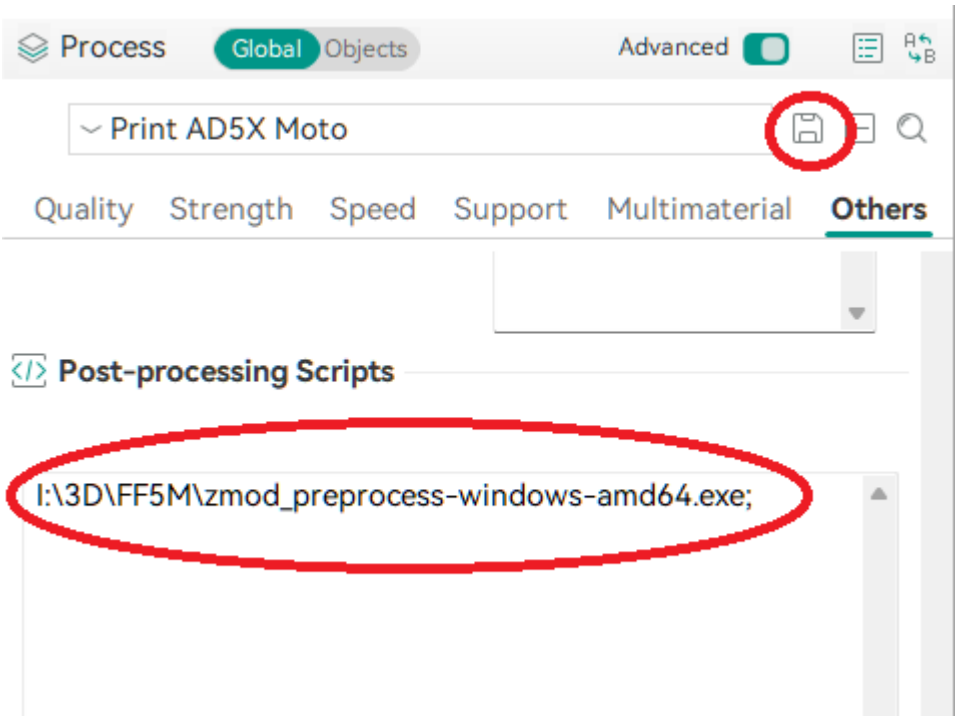


Code for before changing the layer to this one:

```
SET_PRINT_STATS_INFO CURRENT_LAYER={layer_num + 1}
```



13. Enable MD5 verification



14. Read the recommendations
15. Read the FAQ
16. Calibrate the printer
17. Read the specifics of AD5X and Creator 5 Pro

AD5X Warning

@Khamai

After installing the Native Firmware, the print head may not be correctly positioned against the filament receiver (the receiver shutter may not be fully closed, filament may be pushed onto the table, etc.).

Via the engineering menu on the stock firmware

If you encounter this issue, you need to calibrate the print head position using the following algorithm:

1. Download the Set.XY.Offset.zip archive and unzip it to the root of a flash drive.
2. Insert the flash drive into the turned-off printer and turn it on.
3. The calibration interface will appear on the printer screen. Press Reset.
4. Use the control arrows to position the print head against the receiver so that the print head presses the shutter lever firmly, the nozzle is behind the movable shutter, and the shutter itself is flush with the front surface of the receiver.
5. Press the Set button to confirm the calibration result.
6. Remove the flash drive and reboot the printer.

Updating the Mod

If the mod displays `Update Z-Mod via USB`, you must update via USB, even if you updated recently.

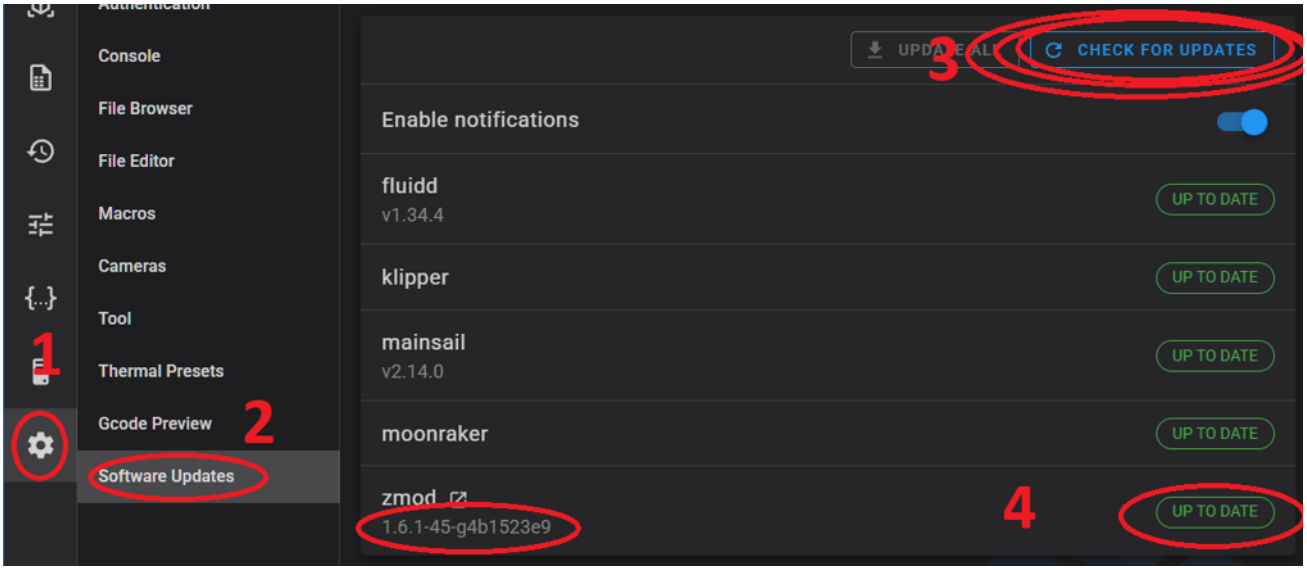
Updating via USB preserves all data.

Simplest method: Use the ZFLASH macro. Insert the USB drive, reboot the printer, and run `ZFLASH`. The macro will:

- Check for the latest version.
- Download the latest release for your printer model.
- Verify checksums.
- Reboot the printer.
- Automatically install the update (keep the USB drive inserted for future updates).

After installation:

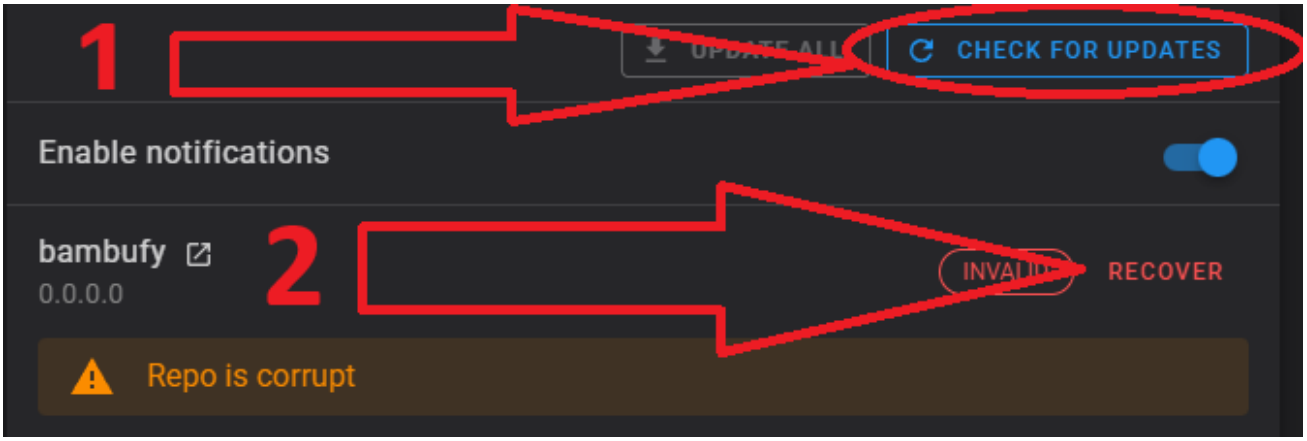
1. Go to Fluidd/Mainsail → `Settings` → `Software Update`.
2. Click `Check Updates` and install the latest Z-Mod updates.



If it shows a lot of errors, that's normal.

Plugins aren't included in the firmware and are downloaded separately.

Click `Check for updates`. Then restore and update all modules one by one. The printer will reboot during this process.



Version Compatibility:

- The OS version (under `System` → `Distribution`) must match the first two digits of the Z-Mod version (`Settings` → `Updates` → `Z-Mod`).

- **Mismatched versions cause instability.**

Manual USB Update:

1. Format a USB drive to FAT/FAT16/FAT32(MBR).
2. Copy the mod file to the USB root.
3. Power off the printer.
4. Insert the USB drive.
5. Power on the printer.
6. Wait for the printer to reboot (do not remove the USB drive).
7. Wait for the mod installation to complete and for the printer to report success.
8. Remove the USB drive.
9. Power cycle the printer.
10. Go to Fluidd/Mainsail → `Settings` → `Software Update`, click `Check Updates` and install the latest Z-Mod updates.

Removing or Temporarily Disabling the Mod

- **SKIP_ZMOD**: Reboots without starting Moonraker/Fluidd.
- **REMOVE_ZMOD**: Fully uninstalls the mod.

Recommended method: Use the `REMOVE_ZMOD` macro. Use USB removal only if macros are unavailable (*after USB removal the Z-Mod boot logo may remain*).

Attention!

- If you are using Klipper 14, you must run `UPDATE_MCU`. This will prevent the MCU and Klipper from being different versions.
- If you have enabled plugins, you must first disable them using `DISABLE_PLUGIN name=g28_tenz`

To remove the mod completely: `REMOVE_ZMOD FULL=1`

USB Removal:

1. Format a USB drive to FAT/FAT16/FAT32(MBR).
2. Copy flashforge_init.sh to the USB root.
3. Power off the printer.
4. Insert the USB drive.
5. Power on the printer.
6. Wait for three reboots.
7. Remove the USB drive and use the stock firmware.

Updating Stock Firmware

1. Disable all active plugins except `recommend`, `timelapse`, `notify`, and `telegram_notify`:
   `DISABLE_PLUGIN name=plugin_name`

2. If you are using **Klipper 14**, run `UPDATE_MCU` *before* updating the stock firmware. This prevents version mismatch issues between the MCU and Klipper.

3. Enable Chinese cloud services (if you wish to update via the stock touchscreen): `SAVE_ZMOD_DATA CHINA_CLOUD=1`

If the native screen does not find updates:

- Your serial number has not yet been included in the update rollout
- Install the stock firmware update from a USB drive

For AD5X/Creator 5/Creator 5 Pro, Z-Mod activation from a USB drive after updating the stock firmware:

- AD5X-enable-zmod.tgz
- Creator5-enable-zmod.tgz
- Creator5Pro-enable-zmod.tgz

If the update came through the native screen, then after it says the device needs to be rebooted, run the `RESET_PASSWD` macro: it activates the mod automatically.

Boot Recovery

Guide by @darksimpson, Alexander, @Ikaros413, @SoloMen88

Symptoms: Printer freezes on boot screen and is unreachable via LAN.





Try restoring the firmware by installing a full firmware:

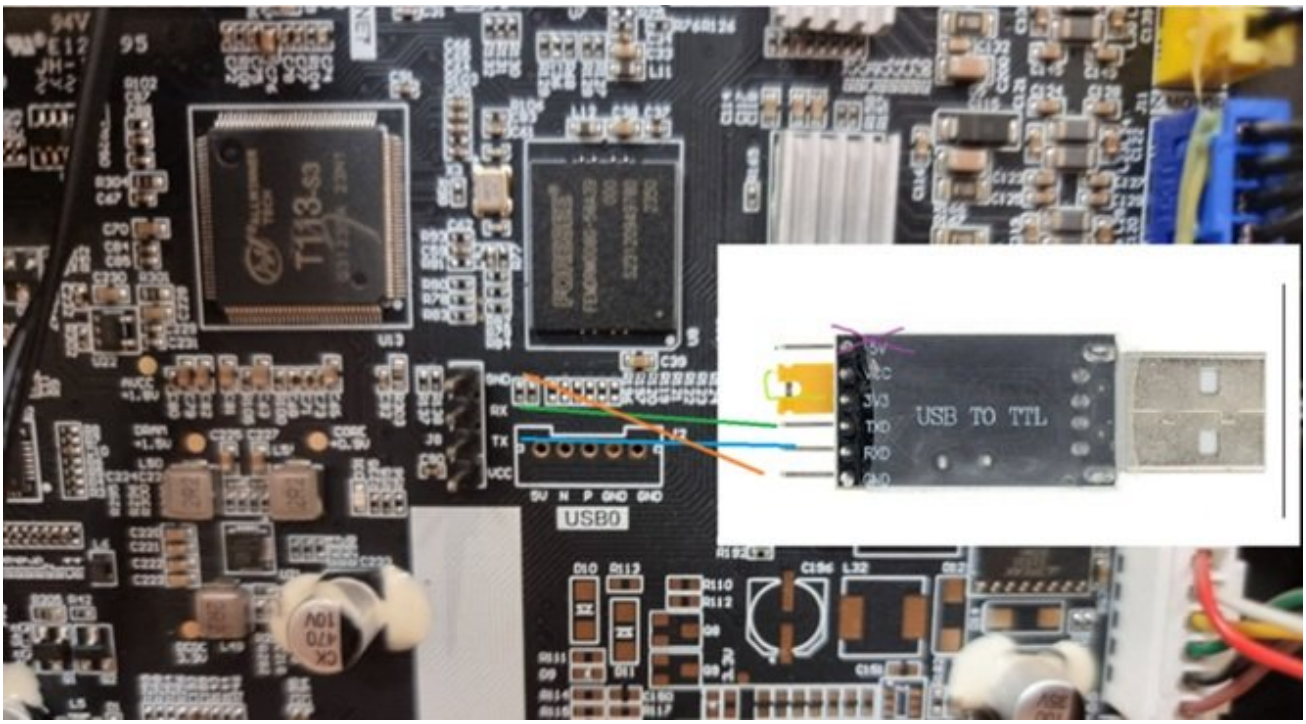
- FF5M
- AD5X

Steps:

1. **Unplug the printer.**
2. Prepare a **3.3V UART/USB converter** (ensure jumper is set to 3.3V).

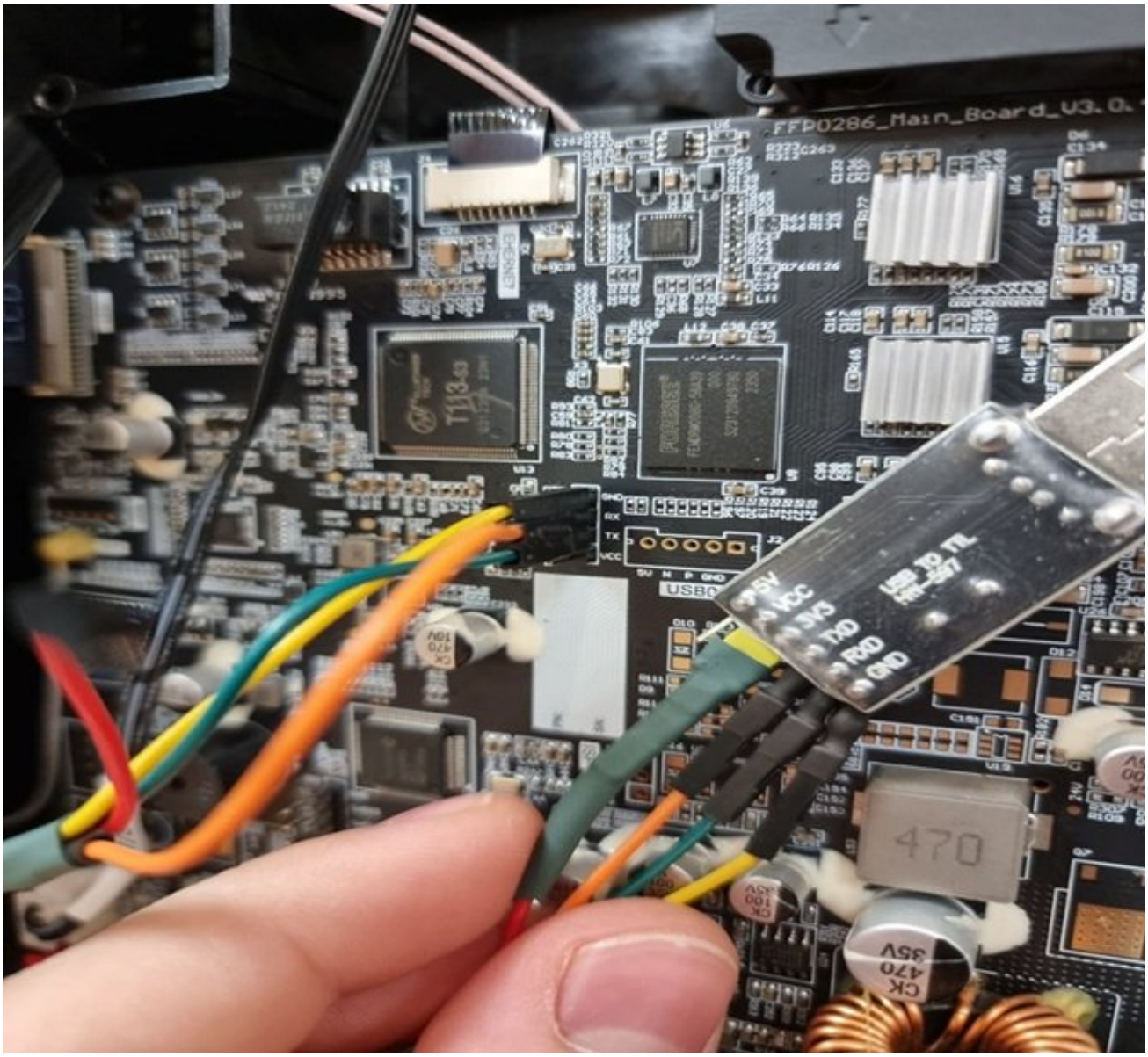


1. Open the printer's rear panel.
2. Connect to the UART pins (RX, TX, GND — **do NOT connect 3.3V**).

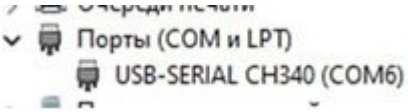


WARNING: The converter must be 3.3 V. If you apply 5 V, the CPU will burn out and you will have to replace the motherboard! If your converter has a jumper, MAKE SURE to move it from 5V to 3.3V.

1. Connect the converter crosswise:
    - Converter RX → Printer TX
    - Converter TX → Printer RX
    - Converter GND → Printer GND



1. Identify the new COM port in your OS.



1. Open PuTTY:
    - **Connection type**: Serial
    - **Speed**: 115200
    - **COM port**: (e.g., COM6)
2. Power on the printer.
3. When `Hit any key to stop autoboot` appears, press **Enter**.
4. In U-Boot, run:

```
setenv init /bin/sh
boot
```

5. After Linux boots, remount the filesystem as writable:

```
mount -t proc proc /proc
mount -o remount,rw /
```

6. Fix what is broken, e.g. delete a faulty script, or the camera script if boot fails because of the camera:

```
rm -f /etc/init.d/S01bad_script
rm -f /usr/data/zmod/zmod/.shell/S98camera
```

7. Save changes and reboot:

```
sync
reboot
```

Support Mod Development

SBP, bank card, T-pay



BTC `17wXTd9BqYp1K3zCLTxVyGLEXUDjf7XNLL`

Support via Boosty (international Visa/Mastercard)

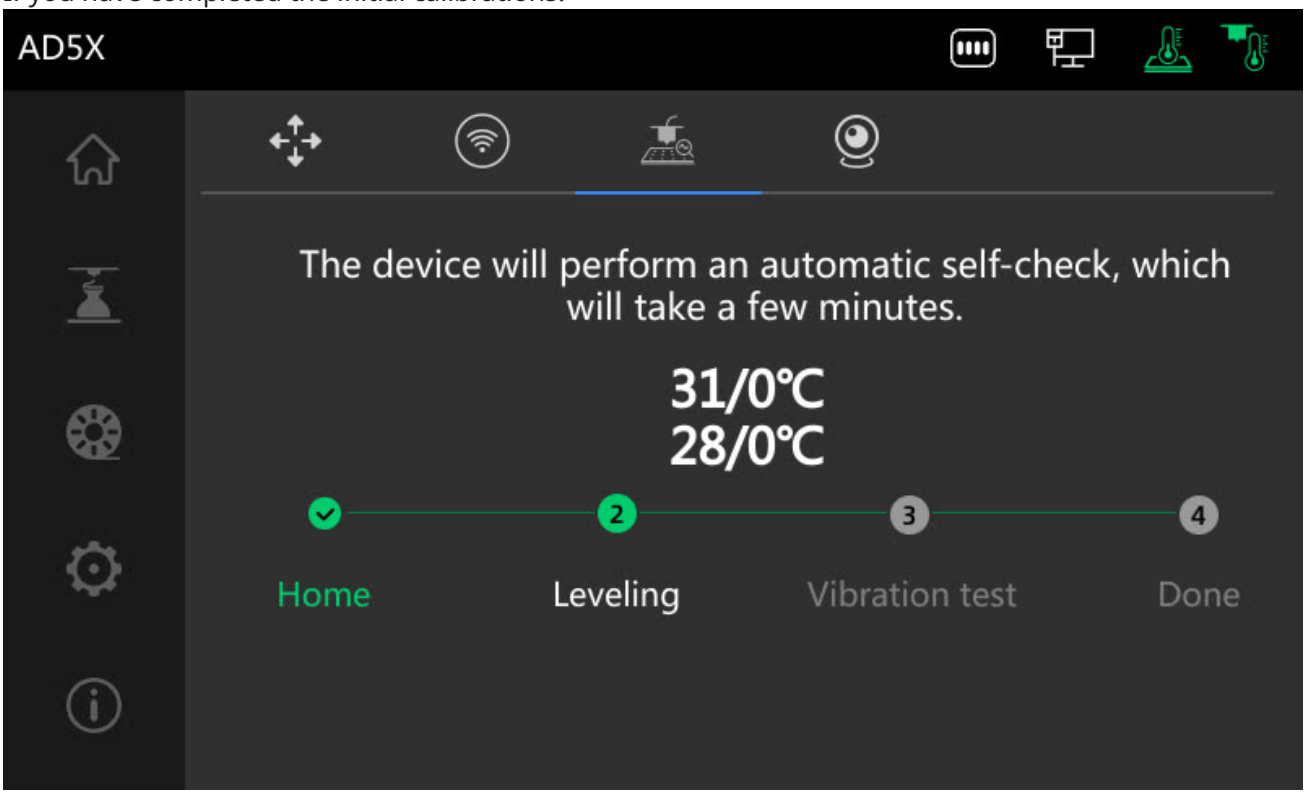


Setup Calibrations

Printer Calibration for Beginners

Generally, you don't need to calibrate anything, but if you want to fine-tune your printer, read on:

If you have completed the initial calibrations:



Then you already have:

- Configured z-offset
- A bed mesh `MESH_DATA` (taken at 60 degrees) - do not delete it if you use the stock screen, as it loads it for every print
- Extruder PID calibration for 240 degrees

But these settings are quite generic; few people print at a nozzle temperature of 240 degrees and a bed temperature of 60 degrees.

Extruder PID Tuning

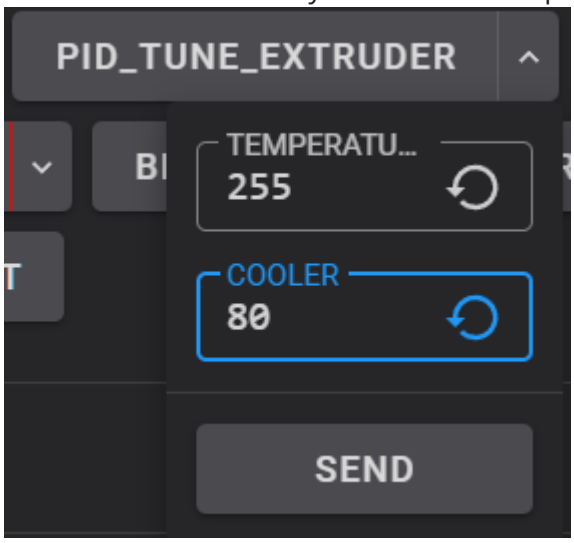
Why is this needed? Imagine the extruder is an oven. If the temperature constantly "jumps," your dish (your part) might bake unevenly. PID calibration "teaches" your printer to maintain the exact temperature without fluctuations. This is critical for print quality.

Important Note Before Starting! Calibrate specifically for the conditions you print in:

- **Temperature:** The one you most often use for your filament (e.g., 210°C for PLA or 255°C for PETG).
- **Cooling:** The part cooling fan should run at the same power as during normal printing.

How to Perform the Calibration?

- Use the special command (macro) PID_TUNE_EXTRUDER
- You can enter it manually in the console or press a button in the interface if available:



- The command itself looks like this (this is an example!):

```
PID_TUNE_EXTRUDER TEMPERATURE=255 COOLER=80
```

What this means:

  - `TEMPERATURE=255` — calibration is performed for 255°C. Set your desired temperature.
  - `COOLER=80` — the part cooling fan runs at 80% power.

- **After Completion:**

  - The printer will automatically save the new settings.
  - **Be sure to reboot the printer!** This is needed to update the system data and prevent freezes.

Bed PID Tuning

Why is this needed? Your printer's bed, like the extruder, must accurately maintain its temperature. If it fluctuates, it can lead to first-layer adhesion issues or even warping (curling) of the part at the edges. Bed PID calibration teaches it to reach and hold the target temperature quickly and stably without overshooting.

Recommendation for AD5X

Open the `printer.cfg` file and set in the `heater_bed` section:

```
[heater_bed]
max_power: 0.6
```

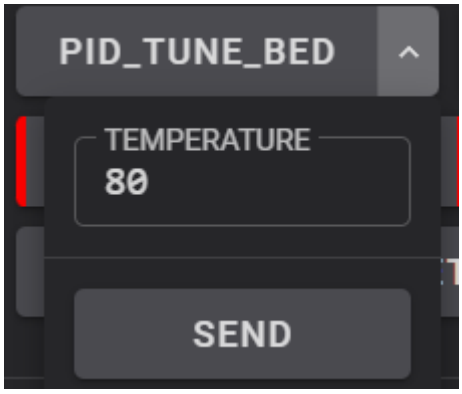
This allows the bed to heat up faster and the PID will tune correctly. After changing and saving the parameter, you need to reboot the printer.

Or you can enable the recommendation plugin and it will automatically correct this file: `ENABLE_PLUGIN NAME=recommend`

Important Note Before Starting! The same rule applies here as with the extruder: calibrate for the temperature you plan to use most often (e.g., 60°C for PLA or 110°C for ABS).

How to Perform the Calibration?

- Use the macro PID_TUNE_BED
- You can also enter it in the console or call it via a button in the interface (often located next to the extruder calibration button):



- The command for the bed is even simpler:

```
PID_TUNE_BED TEMPERATURE=80
```

What this means:

  - `TEMPERATURE=80` — calibration is performed for a bed temperature of 80°C. Set your desired temperature.

- **After Completion:**

  - The new settings are automatically saved.
  - **Don't forget to reboot the printer!** This completes the process of applying the new parameters.

Bed Screws Leveling (BED_LEVEL_SCREWS_TUNE)

Why is this needed? Your bed is held by several screws. If they are tightened differently, the bed becomes tilted, and the distance between it and the nozzle becomes uneven. This causes poor adhesion in some areas, and in others, the nozzle might even scrape the model. This calibration helps perfectly level the bed by adjusting its 4 mounting screws.

How it Works:

1. The printer sequentially moves the nozzle to positions above each screw.
2. It measures the distance to the bed and shows on the screen which screw to turn and in which direction.
3. You adjust the screws according to the prompts.
4. The process repeats until the bed is level.

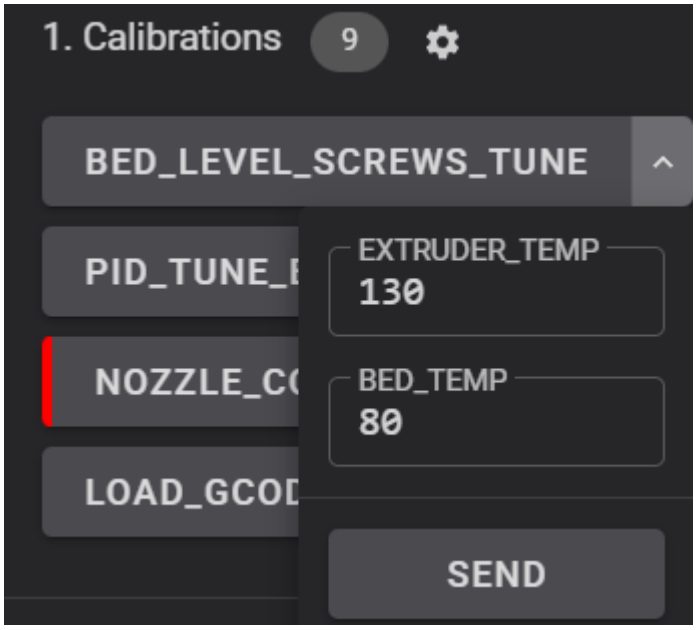
Configuration Parameters for BED_LEVEL_SCREWS_TUNE:

- `EXTRUDER_TEMP=130` — extruder temperature. Needed so that the nozzle's thermal expansion doesn't distort the measurements. Set a temperature where the filament doesn't ooze from the nozzle.
- `BED_TEMP=80` — bed temperature. The bed also expands when heated, so calibration should be done at the temperature you print at.

Before calibration, clean the nozzle, otherwise the measurements will be incorrect!

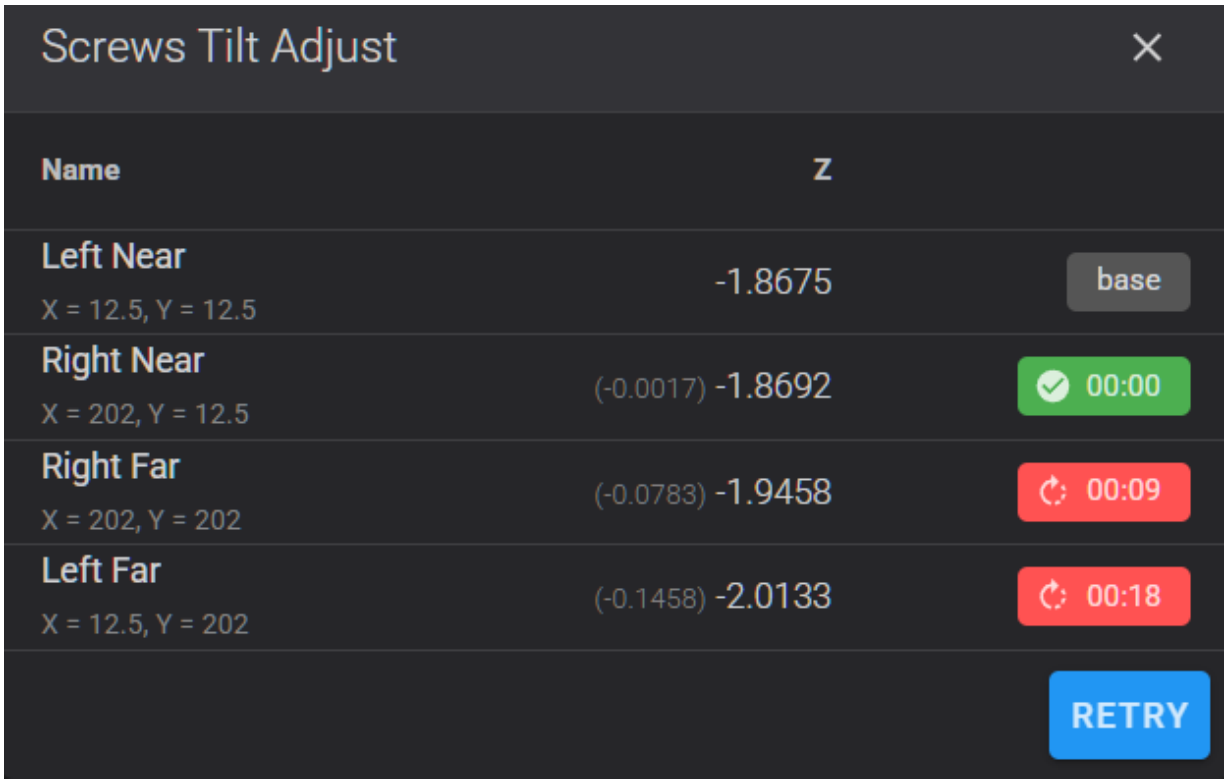
Calibration Process:

- Enter the command in the console or press the button:



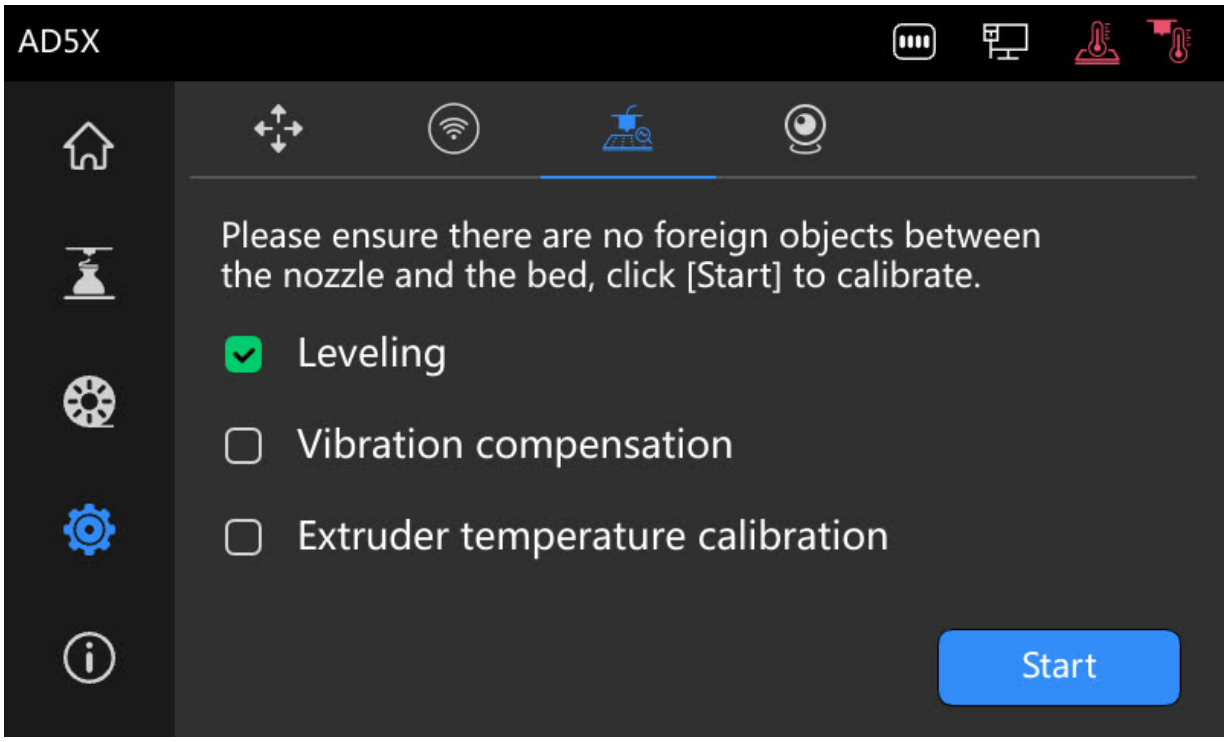

```
BED_LEVEL_SCREWS_TUNE EXTRUDER_TEMP=130 BED_TEMP=80
```

- **Important:**
  - The printer will heat the extruder and bed to the specified temperatures.
  - It will start the procedure and show you which screw and how much to adjust (e.g., "clockwise" or "counter-clockwise").



[This picture appears only on Klipper 14]

- After the first pass, the printer will wait for you to perform the adjustments. When all screws are adjusted, **press the repeat button** for the printer to check the result. Repeat until the readings are perfect.
- **Completion:**
    - When you finish and exit the calibration mode, the printer will **NOT reset** the temperatures automatically.
    - **Be sure to manually set the extruder and bed temperatures to zero via the control menu!**
    - **The bed mesh and z-offset will become invalid**. Start the leveling calibration from the **stock screen**.



Precise Bed Mesh Leveling (AUTO_FULL_BED_LEVEL)

Why is this needed? Even a perfectly leveled bed can have slight dips or bumps. A bed mesh (or "mesh calibration") is like a "topographic map" of your bed. The printer remembers these irregularities and will slightly move the Z-axis during printing to keep the nozzle at the perfect distance from the surface. This guarantees flawless first-layer adhesion across the entire bed area.

If you replace one plate with another (or glass), you also need mesh calibration, since the height of the plates may differ, and this will recalibrate the starting zero to the height of the new plate.

Why This Specific Command? The built-in tools in Fluidd and Mainsail are not suitable for our printers because they:

- Do not know how to work with the **load cells** (which is responsible for precise touch detection).
- Do not perform **nozzle cleaning** beforehand to remove plastic ooze that could ruin measurement accuracy.

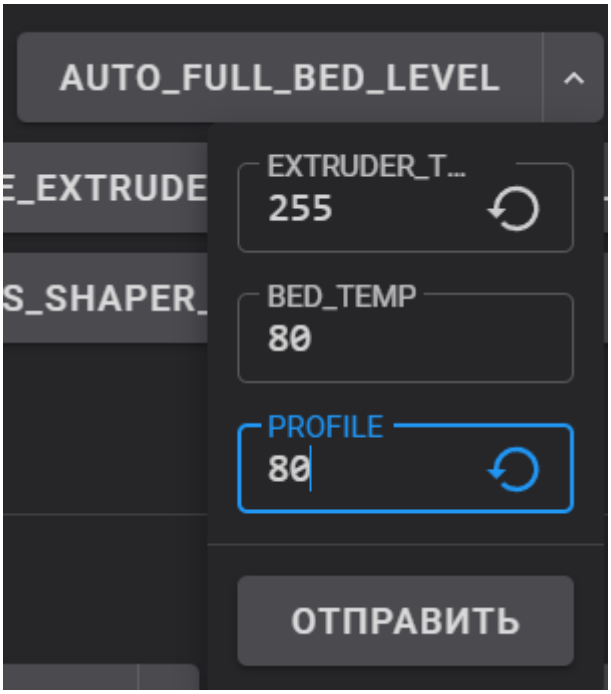
Our macro AUTO_FULL_BED_LEVEL accounts for both these features!

Important Settings: The mesh must be built under the same conditions you print in – on a heated bed and hot extruder, as metal expands slightly with heat. A bed mesh taken at 60 degrees is drastically different from one taken at 110 degrees.

- `EXTRUDER_TEMP=255` — extruder temperature. The plastic in the nozzle must be melted so it can be cleaned before measurement. Set your desired temperature.
- `BED_TEMP=80` — bed temperature. Specify the one you use for printing. Set your desired temperature.
- `PROFILE=auto` — the profile name under which the mesh will be saved. It's better to name it by the bed temperature, e.g., `80`.

Example Command:

```
AUTO_FULL_BED_LEVEL EXTRUDER_TEMP=255 BED_TEMP=80 PROFILE=80
```



In this example, we are building a mesh for printing on an 80°C bed and saving it under the name `80`.

How to Use the Saved Mesh in Printing?

To make the printer automatically load the required mesh at the start of each print, add the following lines to the **Start G-code** in your slicer (OrcaSlicer):

```
START_PRINT EXTRUDER_TEMP=[nozzle_temperature_initial_layer]
BED_TEMP=[bed_temperature_initial_layer_single] MESH=80
M190 S[bed_temperature_initial_layer_single] ; Wait for bed to heat
M104 S[nozzle_temperature_initial_layer] T{single_extruder_multi_material ? 0 :
initial_extruder} ; Set nozzle temperature
```

What happens here:

- START_PRINT - the main start print macro
- The line `START_PRINT... MESH=80` tells the printer: "Start the print and load the bed mesh named `80`".
- `[nozzle_temperature_initial_layer]` and `[bed_temperature_initial_layer_single]` are variables from the slicer that will automatically substitute your set temperatures for the first layer.
- The main thing is to ensure that the `MESH=` parameter points to the same profile name (in our example, `80`) that you used in `AUTO_FULL_BED_LEVEL`.

Even better, create several meshes for each temperature 60, 70, 80, 90, 100, 110 and use the following start code:

```
START_PRINT EXTRUDER_TEMP=[nozzle_temperature_initial_layer]
BED_TEMP=[bed_temperature_initial_layer_single] MESH=[bed_temperature_initial_layer_single]
M190 S[bed_temperature_initial_layer_single] ; Wait for bed to heat
M104 S[nozzle_temperature_initial_layer] T{single_extruder_multi_material ? 0 :
initial_extruder} ; Set nozzle temperature
```

In this case, the bed mesh corresponding to the bed temperature will be loaded.

Final Procedure:

1. Build the bed mesh using the `AUTO_FULL_BED_LEVEL` macro for your printing temperature.
2. Add the `START_PRINT` command with the `MESH=...` parameter pointing to your profile name to the slicer's start code.
3. Now, for every print, the printer will automatically use the correct irregularity map!

Adaptive Bed Leveling (KAMP)

Why is this needed? KAMP is a smart system that builds a bed mesh not over the entire area, but only in the zone where your models are located! This significantly speeds up print preparation, especially on large printers, while retaining all the benefits of a precise bed mesh.

How it Works:

1. Before starting a print, KAMP analyzes the location of all objects on the bed.
2. Instead of building a full grid, it measures the bed height only in the required area.
3. This saves time without sacrificing print quality.
4. The mesh becomes denser, hence more accurate.

Important Feature of the Process: When using KAMP (and full calibration too), the printer follows a smart scheme to ensure maximum accuracy:

1. The nozzle **heats to printing temperature**.
2. **Nozzle cleaning** occurs to remove oozing plastic.
3. The nozzle **cools down to 120°C**. This is necessary so that during measurements, no molten plastic drips from the clean nozzle, which could distort the results.
4. **Bed mesh measurement** takes place with a cold and clean nozzle.
5. After measurements, the nozzle **heats up again to printing temperature** to start printing.

KAMP Configuration

When to Use KAMP? In most cases, there is no need to build a bed mesh before every print. The exception is if you use **removable plates with different thicknesses** (e.g., PEI sheet and glass), as they may have different heights, therefore, the starting zero will be different for printing.

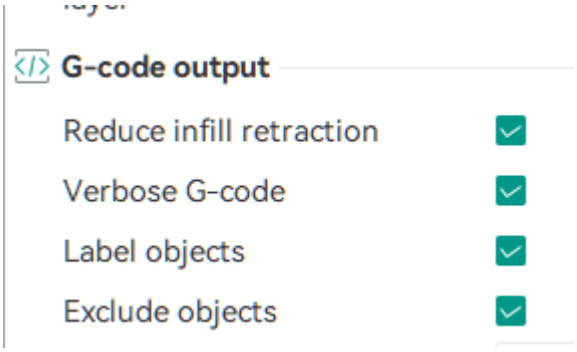
1. Enabling Adaptive Calibration (KAMP)

Activate this option to make the printer use KAMP wherever possible SAVE_ZMOD_DATA USE_KAMP=1.

```
SAVE_ZMOD_DATA USE_KAMP=1
```

Configure Orca:

- `Process Profile` -> `Other` -> `Custom G-code` -> `Exclude objects` check the box
- `Process Profile` -> `Other` -> `Custom G-code` -> `Label objects` check the box



2. Enabling Calibration Before Each Print

If you want the printer to automatically build a bed mesh before starting each job (e.g., when frequently changing plates), activate this function SAVE_ZMOD_DATA PRINT_LEVELING=1.

```
SAVE_ZMOD_DATA PRINT_LEVELING=1
```

You can use a start code like this:

```
START_PRINT EXTRUDER_TEMP=[nozzle_temperature_initial_layer]
BED_TEMP=[bed_temperature_initial_layer_single]
M190 S[bed_temperature_initial_layer_single] ; Wait for bed to heat
M104 S[nozzle_temperature_initial_layer] T{single_extruder_multi_material ? 0 :
initial_extruder} ; Set nozzle temperature
```

Important for stock screen operation: To initiate bed mesh leveling from the printer's stock screen, you must go to the screen menu: `Settings` → `WiFi Icon` → `Network Mode` → enable the `Local Networks Only` toggle.

3. Smart Purge Before Print

Add this setting to make the printer use the same area for nozzle cleaning where it just took the bed mesh. This saves space and time SAVE_ZMOD_DATA CLEAR=LINE_PURGE.

```
SAVE_ZMOD_DATA CLEAR=LINE_PURGE
```

Summary: How to Set Up KAMP for Perfect Printing

To enable smart bed mesh leveling before each print, run the following command once:

```
SAVE_ZMOD_DATA USE_KAMP=1 PRINT_LEVELING=1 CLEAR=LINE_PURGE
```

Now, before each print, the printer will take a bed mesh only where there are objects to print.

How Z-Offset Works on Your Printer

> **Creator 5 / Creator 5 Pro**
>
> On Creator 5 / Creator 5 Pro the Z-offset with the native screen and in screenless mode is the same — they are fully synchronized. If the native screen is disabled, you can change the Z-offset during printing via GuppyScreen, HelixScreen, Fluidd or Mainsail — it will be saved.

What is Z-Offset? Simply put, it is the **precise distance between the nozzle tip and the bed** at the moment the printer considers them to have "touched." The correct Z-Offset ensures that the first layer of plastic adheres perfectly to the bed – not too low (the nozzle will scrape the bed) and not too high (the plastic won't stick). Learn more

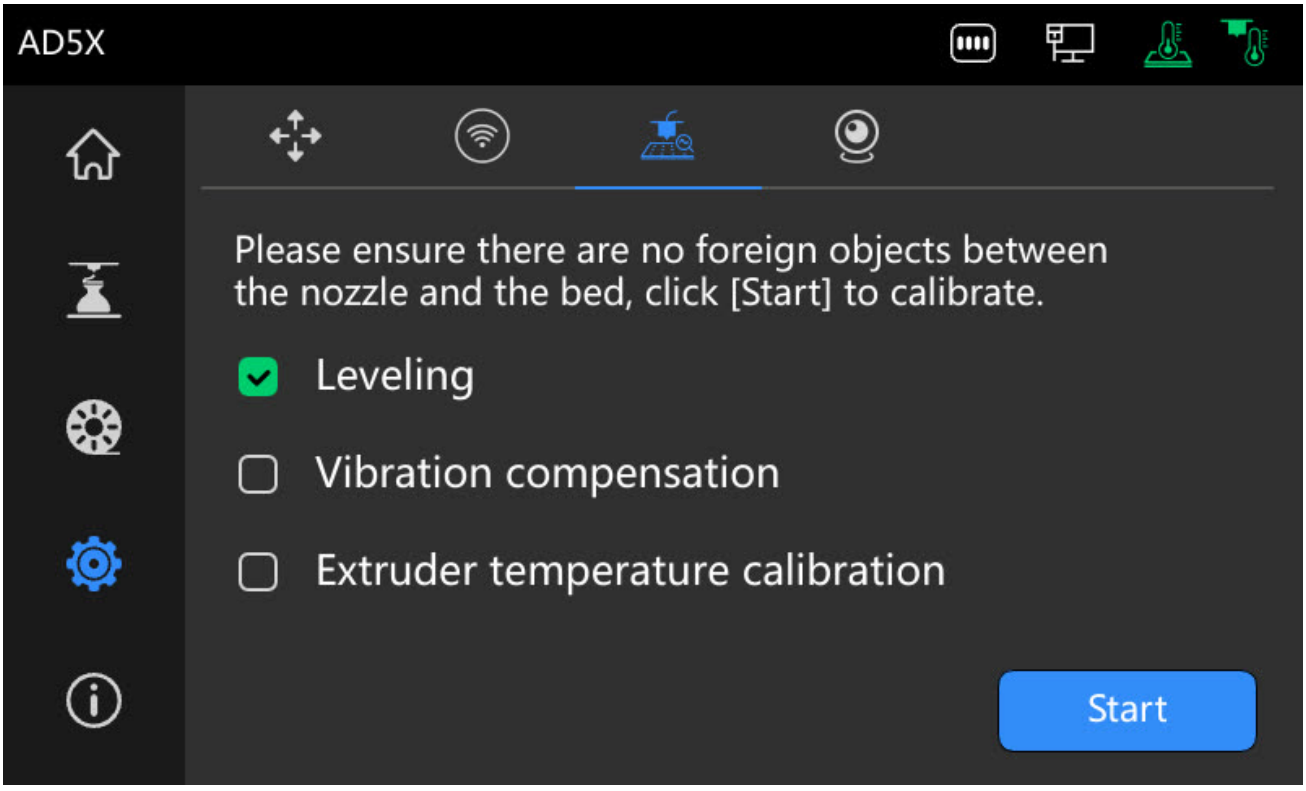
The Most Important Rule: On our printer, **Z-Offset is ONLY relevant DURING printing**. The values you see on the screen or in the interface BEFORE or AFTER printing are for reference only and do not reflect the actual situation.

The Second Most Important Rule: The Z-Offset with the native screen and in screenless mode is not the same: each lives its own life. When switching to screenless mode, run the `LOAD_ZOFFSET_NATIVE` macro — it reads the Z-Offset from the native screen and applies it to screenless mode. *Not required for Creator 5 / Creator 5 Pro.*

Adjusting Z-Offset from the Stock Printer Screen

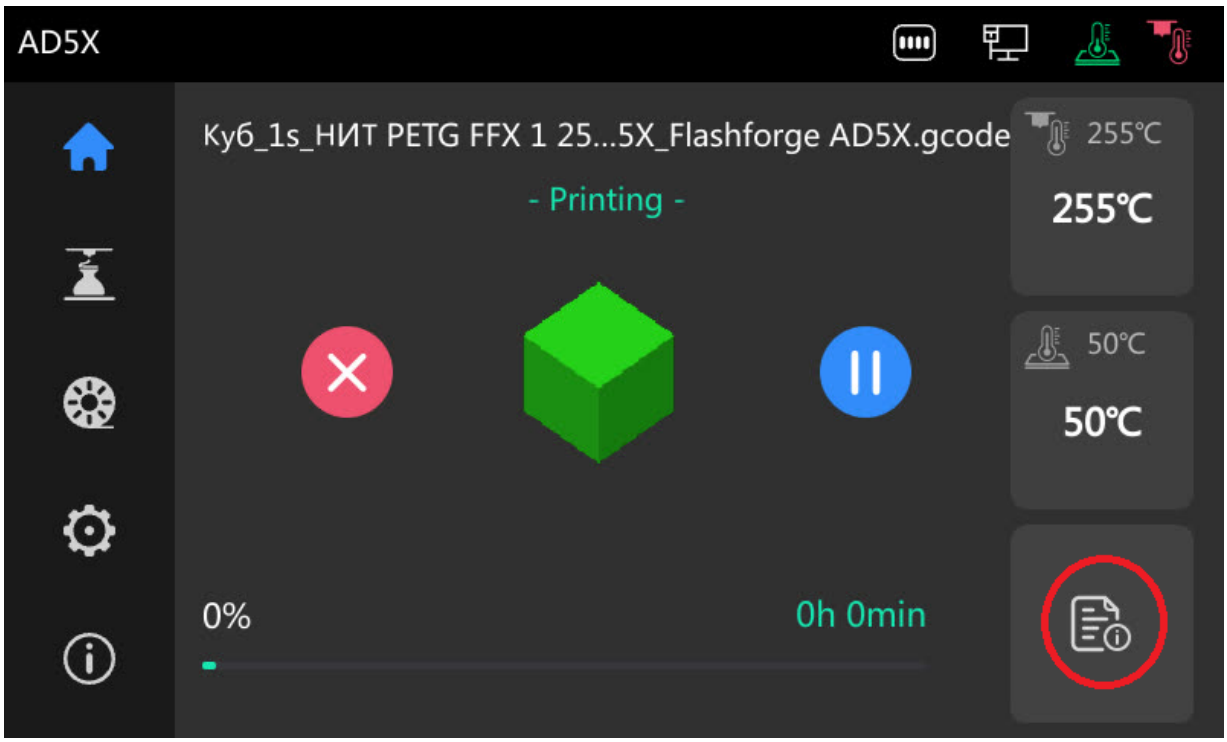
The stock screen is the primary tool for Z-Offset adjustment. It automatically manages the offset, and its settings are saved reliably.

To make the printer select the offset automatically, you need to start building the bed mesh from the native screen.

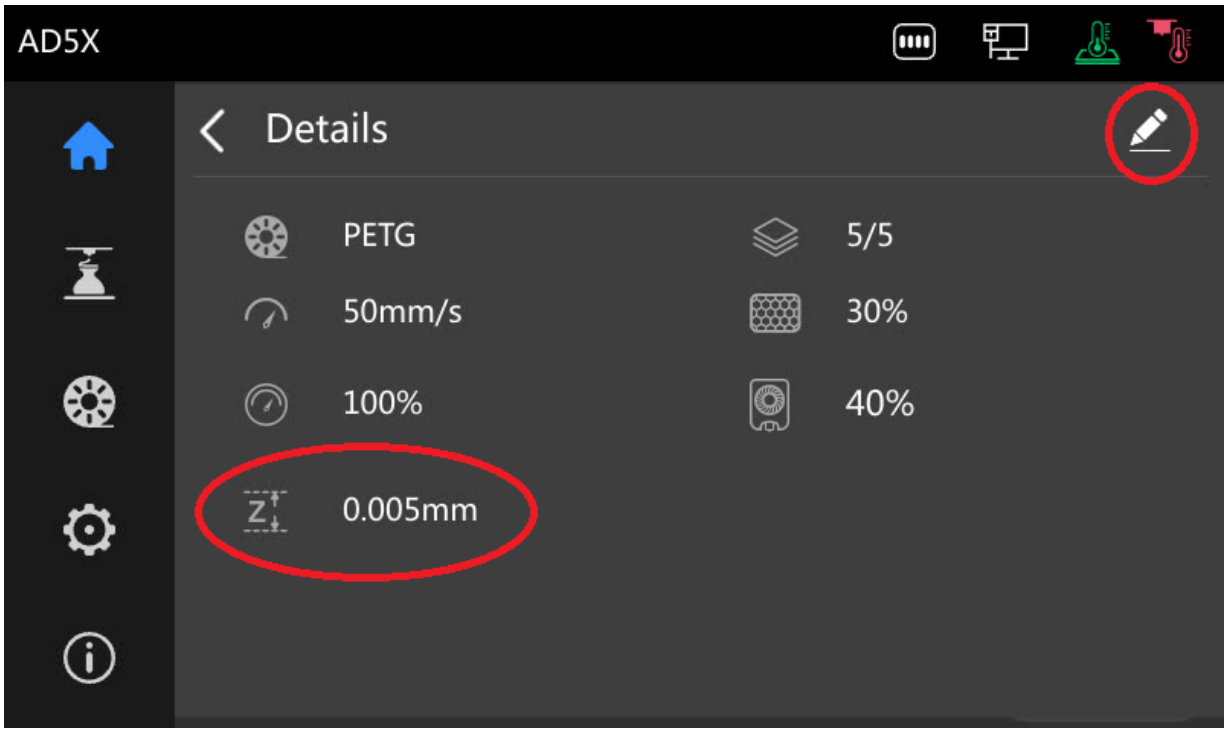


How to Adjust:

1. Adjustment is possible **only during printing**.
2. Press the **bottom right square** on the touch screen.



3. Then press the **"pencil" icon** to edit the Z-Offset value.



4. Make changes based on the first layer quality.
5. The printer's native screen will itself save the entered value and use it for the next print.

Important to Know:

- For the AD5M printer, the stock screen always adds a fixed value of **0.025 mm** to your setting.
- Therefore, the Z-Offset you see in the Fluidd or Mainsail interface will always be **0.025 mm MORE** than the value you set on the printer screen. This is normal!
- Adjusting the Z-Offset via Fluidd/Mainsail while using the native screen is not advisable, because the native screen is not aware of the existence of Fluidd/Mainsail.

Second important rule: The Z-Offset for native-screen mode and screenless mode is different; each has its own setting. Use `LOAD_ZOFFSET_NATIVE` to copy the Z-Offset from the native screen to screenless mode. *Not required for Creator 5 / Creator 5 Pro.*

Adjusting Z-Offset via Fluidd / Mainsail / GuppyScreen when operating *without the stock screen*

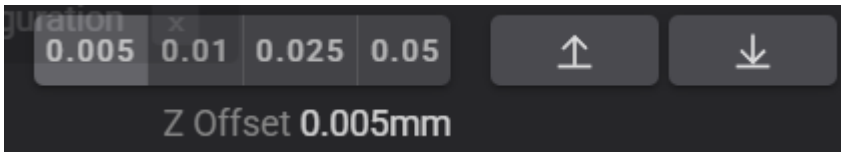
How it Works:

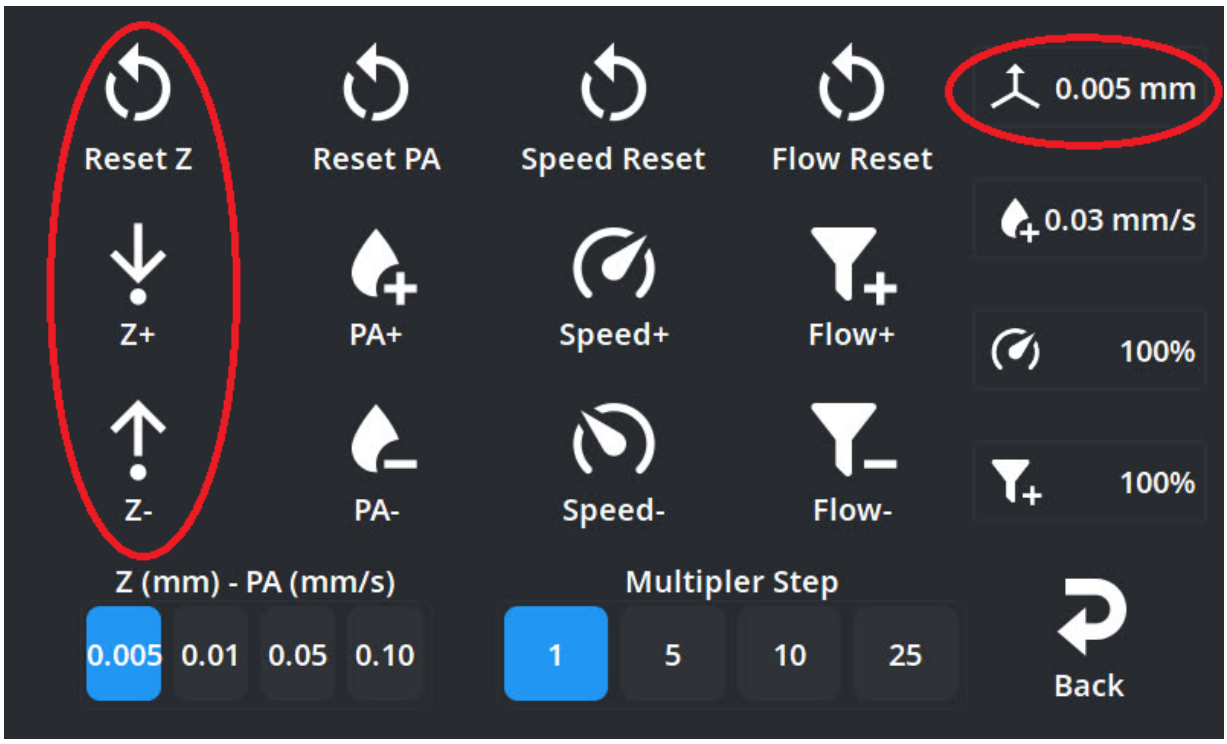
1. To make the printer remember the Z-Offset from the web interface and GuppyScreen/HelixScreen/Rivet, you need to activate a special setting once SAVE_ZMOD_DATA LOAD_ZOFFSET=1:

   ```
   SAVE_ZMOD_DATA LOAD_ZOFFSET=1
   ```

   This command tells the system: "Load the Z-Offset from the saved settings, don't reset it."

2. After enabling this option, you can adjust the Z-Offset directly during printing in Fluidd/Mainsail or via the adjustment panel in GuppyScreen/HelixScreen/Rivet.





3. If you want to transfer z-offset from the native screen to screenless mode, call the macro `LOAD_ZOFFSET_NATIVE` — it will read the z-offset value from the native screen and apply it to screenless mode. *Not required for Creator 5 / Creator 5 Pro.*

Key Advantages:

- **Automatically saved.** Regardless of the adjustment method (screen or web interface), the Z-Offset value is automatically saved and automatically applied on the next print.
- **No manual commands required.** You do NOT need to use the `Z_OFFSET_APPLY_PROBE` or `Z_OFFSET_APPLY_ENDSTOP` commands. Everything happens "under the hood."

About Z-Offset in Simple Terms:

> **Creator 5 / Creator 5 Pro**
>
> On Creator 5 / Creator 5 Pro the Z-offset with the native screen and in screenless mode is the same — they are fully synchronized. If the native screen is disabled, you can change the Z-offset during printing via GuppyScreen, HelixScreen, Fluidd or Mainsail — it will be saved.

- **Adjust Z-Offset only during the first layer printing.**
- **When working with the stock screen — adjust z-offset on it.**
- **When working without the stock screen**, first execute the command `SAVE_ZMOD_DATA LOAD_ZOFFSET=1`.
- The system will save everything itself. You have nothing to worry about.

> **Danger**
>
> You cannot use `Z_OFFSET_APPLY_ENDSTOP` on this printer.
>
> You cannot change `[probe] z_offset:` in `printer.cfg` or `printer.base.cfg`.
>
> Because the native screen and the `START_PRINT` macro load the offset at the start of printing.

Input Shaper Calibration (Input Shaper)

What are Input Shapers and Why are They Needed? When the printer moves quickly, it can vibrate, like a car at high speed. These vibrations are imprinted on your model as "ringing" or "ghosting" on the walls. Input Shapers are smart algorithms that "predict" and suppress these vibrations, allowing for faster printing without loss of quality.

Your printer has already automatically configured the input shapers during the first calibration, and this is sufficient for most tasks. But if you want to achieve maximum quality or understand how your printer works, you can look at the graphs and choose settings manually.

Important Note: The `FIX_SCV` Parameter

What's the Problem? The graph and input shaper calculations in Klipper by default use the value `square_corner_velocity = 5`. But in our printer, this parameter is set to `25`. This discrepancy causes the calculated maximum acceleration values on the graphs to be several times higher than they should be.

What to Do?

1. **Fix the Calculations:** Activate the fix for correct graph display SAVE_ZMOD_DATA FIX_SCV=1.

```
SAVE_ZMOD_DATA FIX_SCV=1
```

2. **Improve Print Quality (Recommended):** Add the following line to the `mod_data/user.cfg` file:

```
[printer]
square_corner_velocity: 9
```

   - **What does this do?** The printer will slightly reduce speed on sharp corners. This will marginally increase print time but significantly reduce vibrations and improve corner clarity.

You can simplify things: enter `ENABLE_PLUGIN name=recommend` into the console. This command will enable the recommendations plugin, which already has FIX_SCV enabled and square_corner_velocity: 9 set.

Don't forget to restart your printer!

How to Use the `ZSHAPER` Macro

ZSHAPER - this macro makes the printer vibrate at different frequencies, measures the response, and builds graphs to find the ideal input shaper parameters for the X and Y axes.

Specifics for Printers with Low Memory (AD5M, AD5M Pro): To avoid overloading the system, **calibrate the axes separately**.

- `ZSHAPER` — calibrates both axes (X and Y).
- `ZSHAPER X=1 Y=0` — calibrates only the X axis (faster and less load).
- `ZSHAPER Y=1 X=0` — calibrates only the Y axis.

Example Usage and Output:

1. Enter the command in the console to calibrate the Y axis:

```
ZSHAPER Y=1 X=0
```

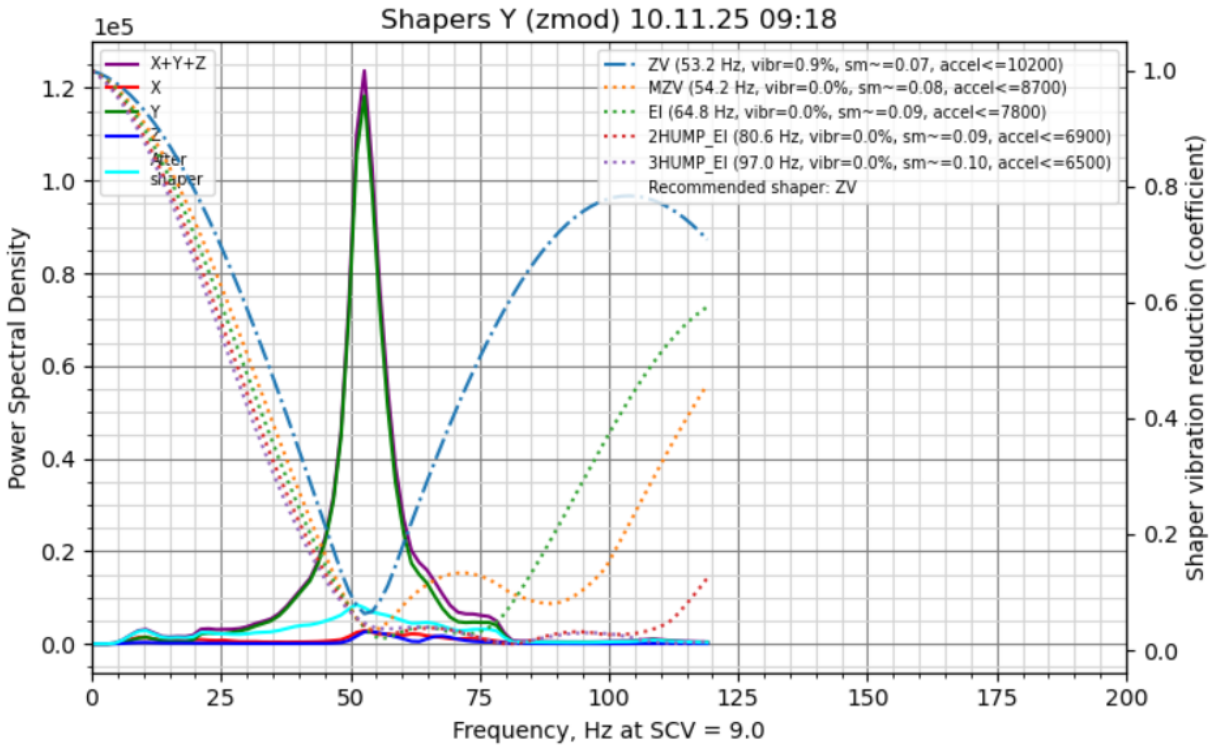
2. After the measurements are completed, you will get a report similar to this:

```
// Recommended shaper is zv @ 53.2 Hz
// Fitted shaper 'zv' frequency = 53.2 Hz (vibrations = 0.9%, smoothing ~= 0.074)
// To avoid too much smoothing with 'zv', suggested max_accel <= 10200 mm/sec^2
// Fitted shaper 'mzv' frequency = 54.2 Hz (vibrations = 0.0%, smoothing ~= 0.080)
// To avoid too much smoothing with 'mzv', suggested max_accel <= 8700 mm/sec^2
```

   - The system recommends the `zv` shaper because it has the least smoothing.
   - But the `mzv` shaper completely suppresses vibrations (`0.0%`), although it requires slightly lower acceleration.

How to Interpret the Results and Make a Decision

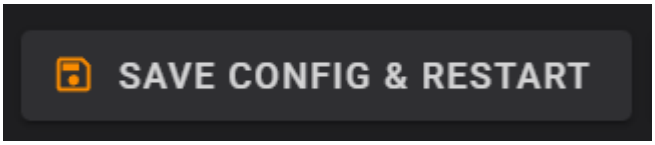
Where to View the Graphs? After executing `ZSHAPER`, graphs and CSV files will appear on the **"Configuration" -> mod_data** tab in your web interface (Fluidd/Mainsail).

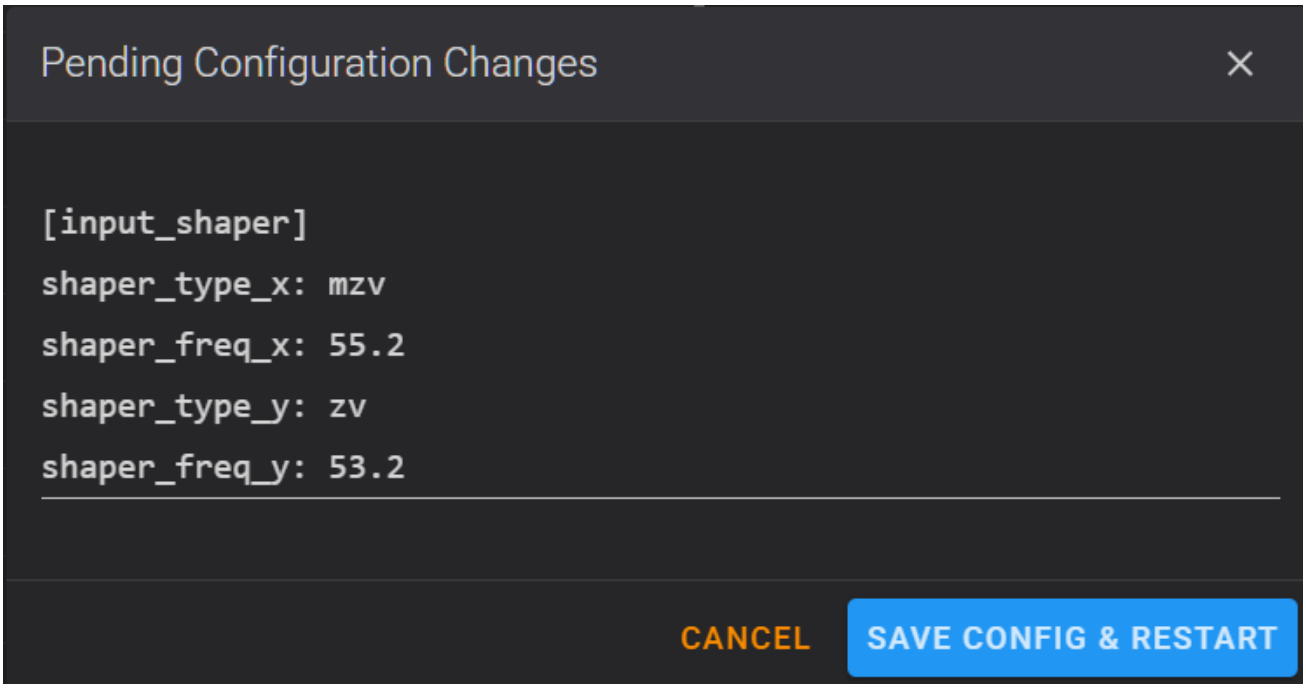


Detailed Guide on Reading Graphs: https://github.com/Tombraider2006/klipperFB6/blob/main/accel_graph/readme.md

Option 1: Accept the Automatic Setting

If you are satisfied with everything, simply press the **`SAVE CONFIG & RESTART`** button in the web interface, and the printer will automatically write the recommended parameters.





Option 2: Manual Configuration

In the example above, the `mzv` shaper seemed better because it completely eliminates vibrations. To use it, you need to manually add the settings to the `printer.cfg` file (in the `[input_shaper]` section):

```
[input_shaper]
shaper_type_y = mzv   ; Selected shaper type for Y axis
shaper_freq_y = 54.2  ; Resonant frequency for Y axis
```

And Don't Forget About Acceleration! Since the selected `mzv` shaper allows using acceleration no more than 8700 mm/s², this value must be written to the `mod_data/user.cfg` file:

```
[printer]
max_accel: 8700 ; Maximum acceleration for X and Y axes
```

Quick Action Algorithm for Input Shaper Calibration:

1. Execute `SAVE_ZMOD_DATA FIX_SCV=1` for correct calculations.
2. Add `square_corner_velocity: 9` to `mod_data/user.cfg` for better quality.
3. Start calibration for the desired axis, e.g., `ZSHAPER Y=1`.
4. Study the graphs and console output.
5. Either press `SAVE CONFIG`, or manually write your preferred `shaper_type` and `shaper_freq` to `printer.cfg`, and also `max_accel` to `mod_data/user.cfg`.
6. Reboot the printer.

Recommendations

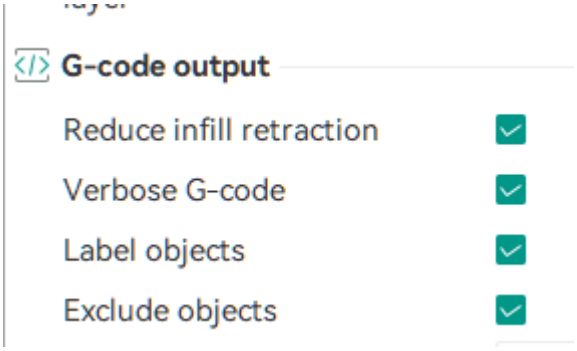
Recommendations to Improve Printer Stability

These recommendations apply to both stock firmware and Z-Mod.

Enable Object Exclusion

Enable object exclusion in Orca:

- `Process Profile` -> `Other` -> `Custom G-code` -> Check `Exclude objects`
- `Process Profile` -> `Other` -> `Custom G-code` -> Check `Label objects`



Install the Latest Stock Firmware and Z-Mod Updates

Only the latest version of Z-Mod is actively supported.

The developer lacks resources to maintain older versions, so install the latest stock firmware and Z-Mod updates.

Replace Spiral/Auto Z-Hop

The printer does not support this feature.

In Orca: `Printer Profile` -> `Extruder 1` -> `Z Hop Type` -> Set to `Normal` or `Slanted`.

Disable "Arc Move" Approximation

While the printer supports arc moves, they reduce print quality and may cause errors.

In Orca: `Process Profile` -> `Quality` -> `Precision` -> Uncheck `Arc Move Approximation`.

Disable the Built-in Camera on the Printer Screen

The built-in camera consumes excessive memory and offers poor image quality. Use an alternative camera instead.

On the printer screen: `Settings` -> `Camera Tab` -> Disable `Camera` and `Video` toggles.

Then, run the CAMERA_ON macro.

- What is an alternative camera?
- I installed Z-Mod, and my camera disappeared! It worked in Orca-FF!

Disable Chinese Cloud Services

Lan mode error

These services are unstable and may disconnect intermittently. Reconnection attempts can overload the printer with queued requests, causing errors.

Disabling them also enables faster dialog closure after printing and native bed leveling via the screen.

On the printer screen:

1. `Settings` -> `WiFi Tab` -> `Network Mode` -> Enable `Local Network Only`.
2. `Settings` -> `Cloud Tab` -> Disable `FlashCloud` and `Polar3d`.

Instead, you can use:

- zmod.link - a cloud for managing printers via Fluidd/Mainsail.
- Telegram bot.

More about Chinese cloud services.

Enable [MD5] Checksum Control

Igor Polunovskiy

> Note: Only applies when sending G-code. Not required for 3MF.

Add CHECK_MD5 to your workflow.

It is recommended to use the global parameter FORCE_MD5 `SAVE_ZMOD_DATA FORCE_MD5=1`

1. Select and download the file for your architecture and operating system:

- zmod_preprocess-windows-amd64.exe - Windows
- zmod_preprocess-linux-amd64 - Linux. Don't forget to run `chmod +x zmod_preprocess-linux-amd64`
- zmod_preprocess-darwin-arm64 - macOS Apple Silicon. Don't forget to run `chmod +x zmod_preprocess-darwin-arm64`
- zmod_preprocess-darwin-amd64 - macOS Intel. Don't forget to run `chmod +x zmod_preprocess-darwin-amd64`
- zmod-preprocess.py - Universal Python. Don't forget to run `chmod +x zmod-preprocess.py`

- zmod-preprocess.sh - Linux/MacOS Bash. Don't forget to run `chmod +x zmod-preprocess.sh`

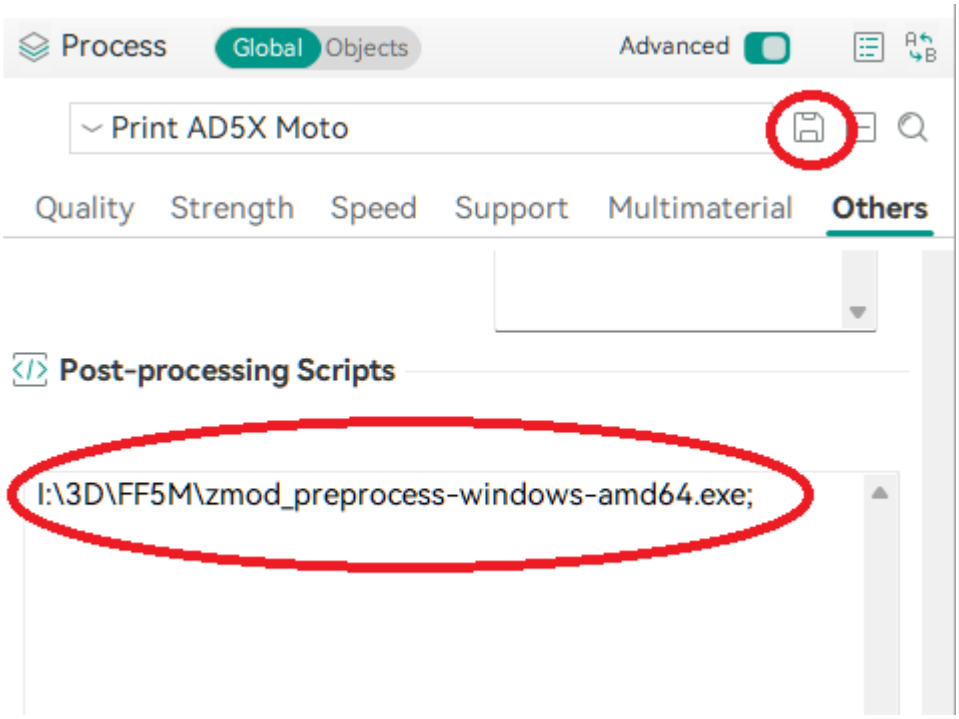
1. In Orca, you need to specify: `Process Profile` -> `Other` -> `Post Processing Scripts`.

If the path contains spaces, enclose the full path in quotes — but it is better to avoid spaces in folder names.

Here are the options for adding:

- `"C:\path_to_file\zmod_preprocess-windows-amd64.exe";`
- `"C:\python_folder\python.exe" "C:\Scripts\zmod-preprocess.py";`
- `"/usr/bin/python3" "/home/user/zmod-preprocess.py";`
- `"/home/user/zmod-preprocess.py";`
- `"/home/user/zmod_preprocess-darwin-amd64";`
- `"/home/user/zmod_preprocess-darwin-arm64";`
- `"/home/user/zmod_preprocess-linux-amd64";`

Details



hamster

Send Files via "Octo/Klipper" for Printing

The native FF protocol occasionally transfers corrupted files and lacks metadata support for the Telegram bot.

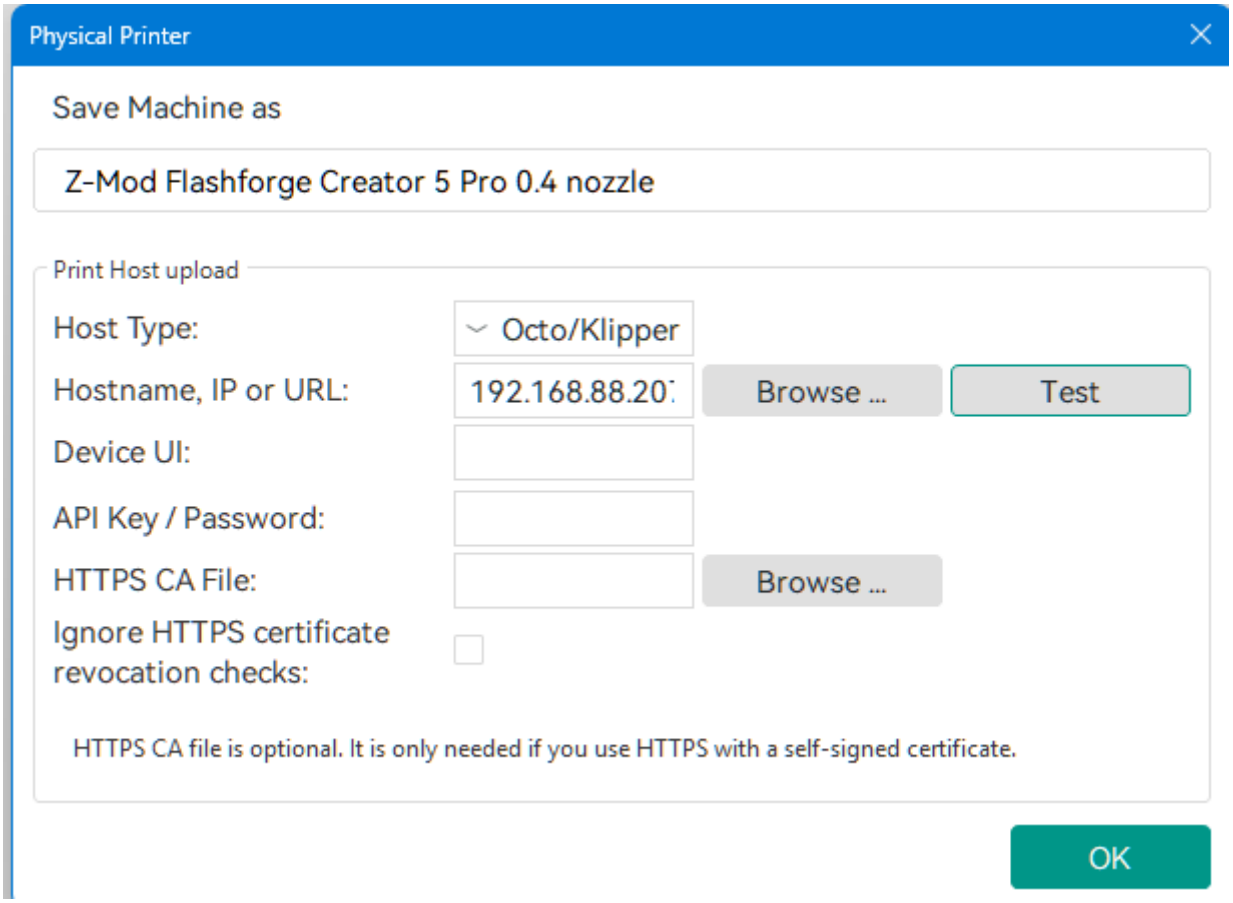
In Orca:

1. Click the WiFi icon next to the printer.
2. Set:

- **Host Type**: `Octo/Klipper`
- **Printer Agent**: `Moonraker`

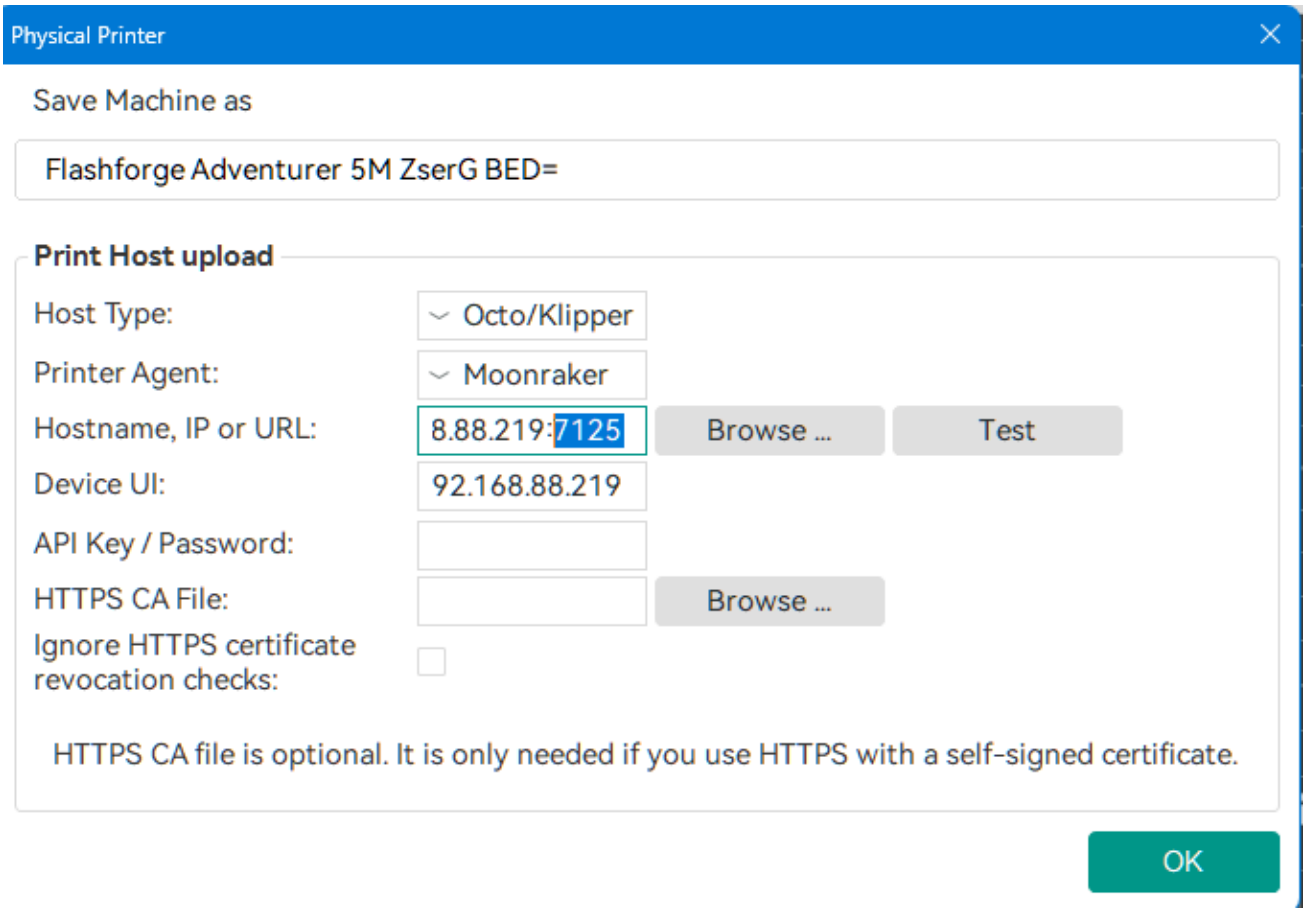
For Creator 5 / Creator 5 Pro / AD5X:

- **Hostname**: `IP_printer`



For FF5M / FF5M Pro:

- **Hostname**: `IP_printer:7125`
- **Device UI**: `IP_printer` or `IP_printer:80`



If using Mainsail, specify only these thumbnail sizes: `140x110/PNG, 64x64/PNG`

In Orca, `Printer Profile` -> `General Information` -> Advanced -> `G-Code Thumbnails`

Note that the native screen will no longer display thumbnails.

Enable Fix for E0017 Error

E0017 Fix

Enabled by default.

Enable Fix for E0011 Error

Resolves `E0011` and `Communication timeout during homing` errors.

E0011 Fix

Verify Stock OS File Integrity

Improper printer shutdowns can corrupt the filesystem, leading to minor or major bugs.

The CHECK_SYSTEM macro checks file MD5 hashes and repairs symbolic links if needed.

Enable Nozzle Collision Detection

Disabled by default. Enable using the NOZZLE_CONTROL macro:

```
NOZZLE_CONTROL WEIGHT=1500
```

Once enabled, it activates automatically during printing.

This halts Klipper if the nozzle scratches the bed or a part detaches. **Highly recommended for users employing nozzle pre-cleaning routines.**

AD5X

AD5X

1. Key Features
2. File Preparation in Orca
3. Color Selection (COLOR)
4. Print Menu (PRINT)
    - AD5X Global Parameters
5. Manual Spool Selection
6. Waste Filament Configuration
    - 🔧 Basic Parameters
    - ⚙️ Advanced Parameters
7. Add or remove filament types
8. Add custom colors
9. Fixing Trash Bin and Filament Cutting Knife Operation
    - Via the engineering menu on the stock firmware
    - Via a flash drive on the stock firmware
10. IFS commands
11. IFS Firmware Recovery

Plugins

- **bambufy** - Bambu Studio compatibility, better prime towers, accurate estimates, waste reduction
- **lessWaste** - Fork of Bambufy
- **nopoop** - Maximum waste reduction by ninjamida
- **IFS Jacker** - Plugin to support the IFS Jacker hardware mod

---

1. Key Features

Differences from AD5M:

- No `Entware` support
- **Always use** `FAST_CLOSE_DIALOGS` (fast closing) instead of `CLOSE_DIALOGS` (slow closing).
- The `NEW_SAVE_CONFIG` macro **does not work**.
- To enable the camera, use `CAMERA_ON VIDEO=video3` or `CAMERA_ON VIDEO=video0` or `CAMERA_ON VIDEO=video99`.
- Klipper may crash. Solution: `Process Profile` -> `Other` -> `Output G-code` -> uncheck `Exclude Models`.

---

2. How to Prepare a File in Orca

Send Files via "Octo/Klipper" for Printing

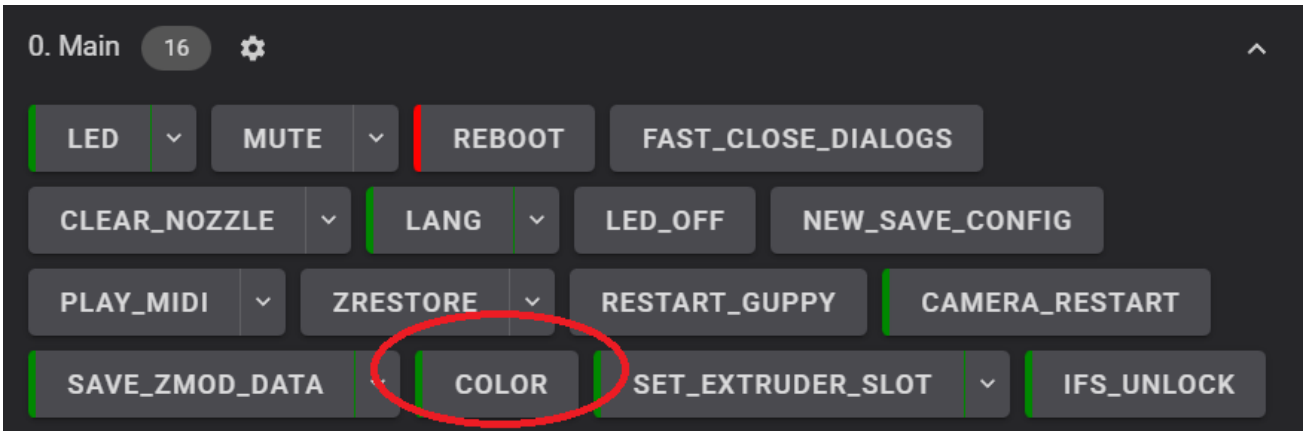
You must remove unused spools from the list in Orca.

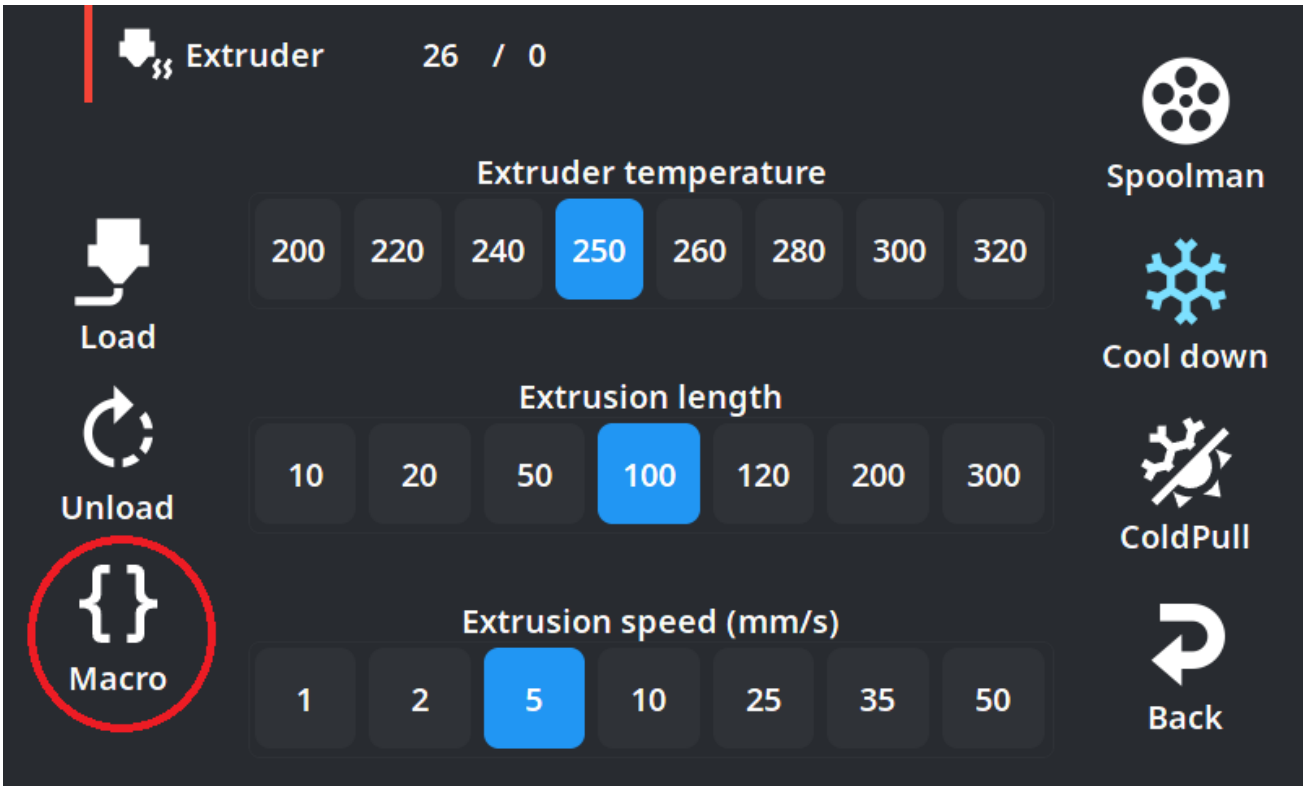
Example: The printer has 4 spools (№1, №2, №3, №4). Only spools №1 and №3 are needed for printing.

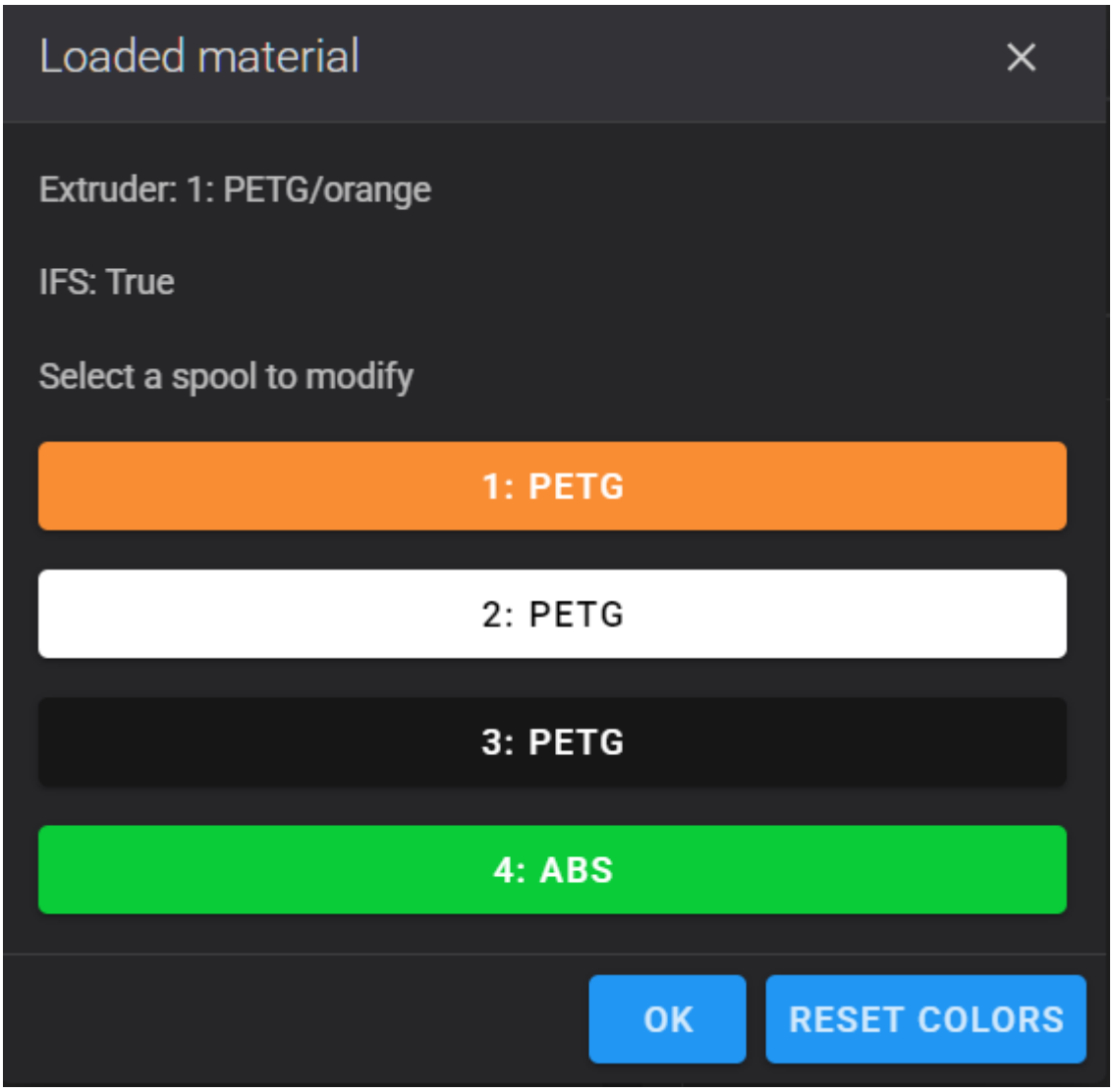
- In the file, they will be named **T0** (first color) and **T1** (second color).
- In the menu, you'll need to select:
  - **T0** → spool №1
  - **T1** → spool №3

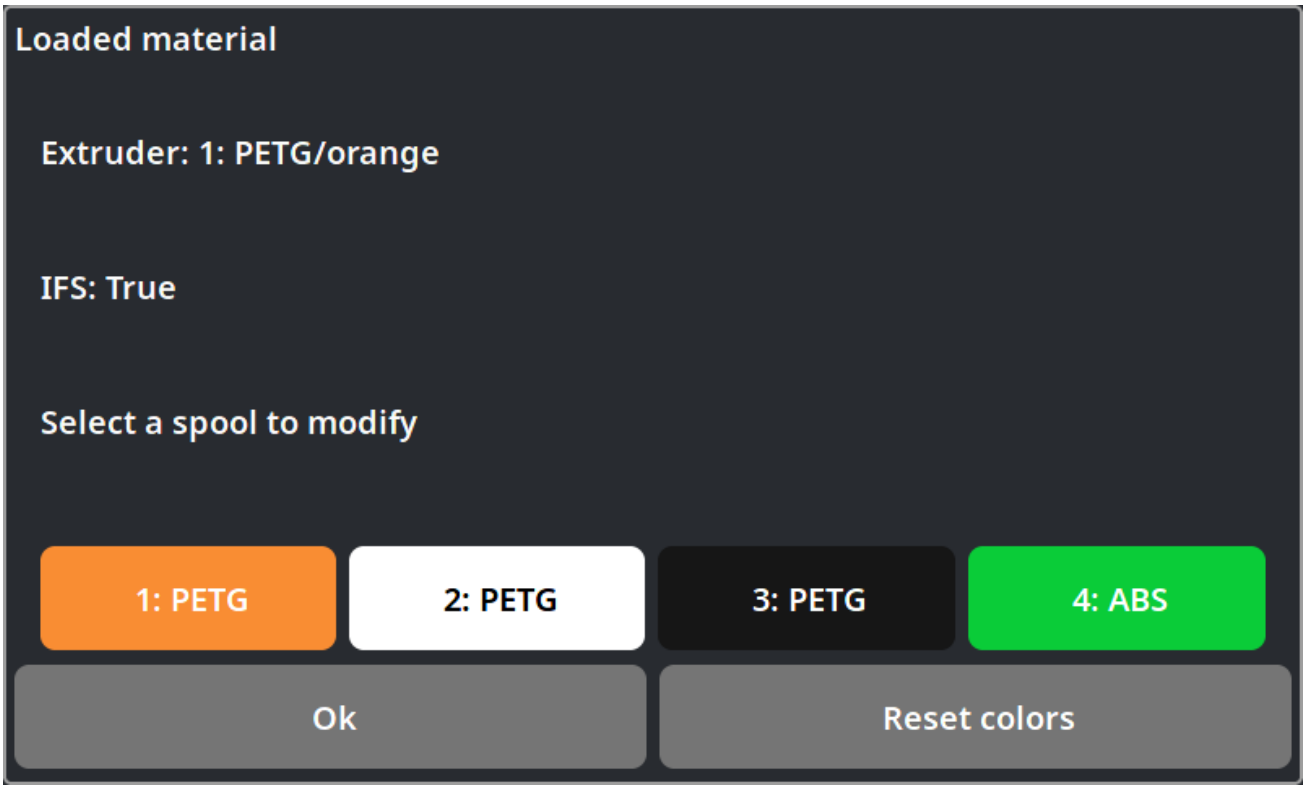
---

3. How to Use the Color Selection Menu (Macro COLOR)



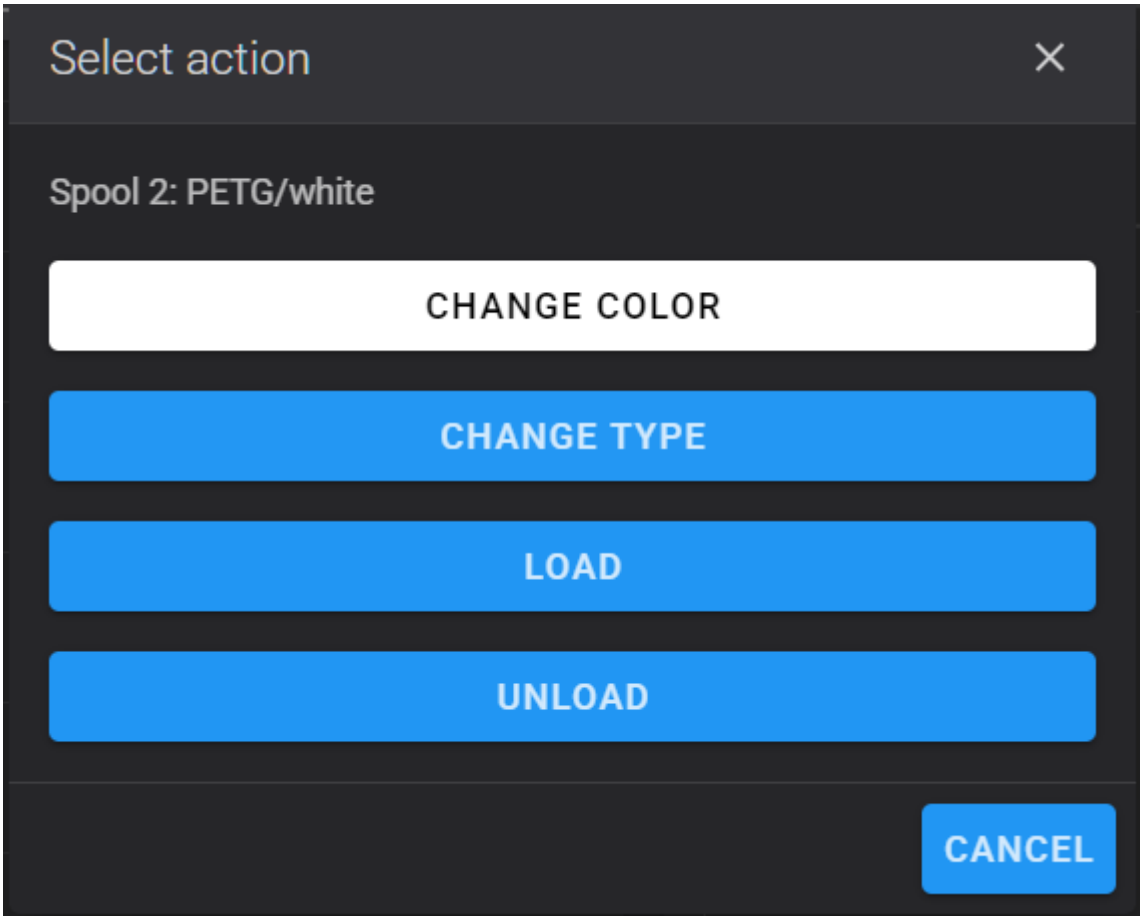


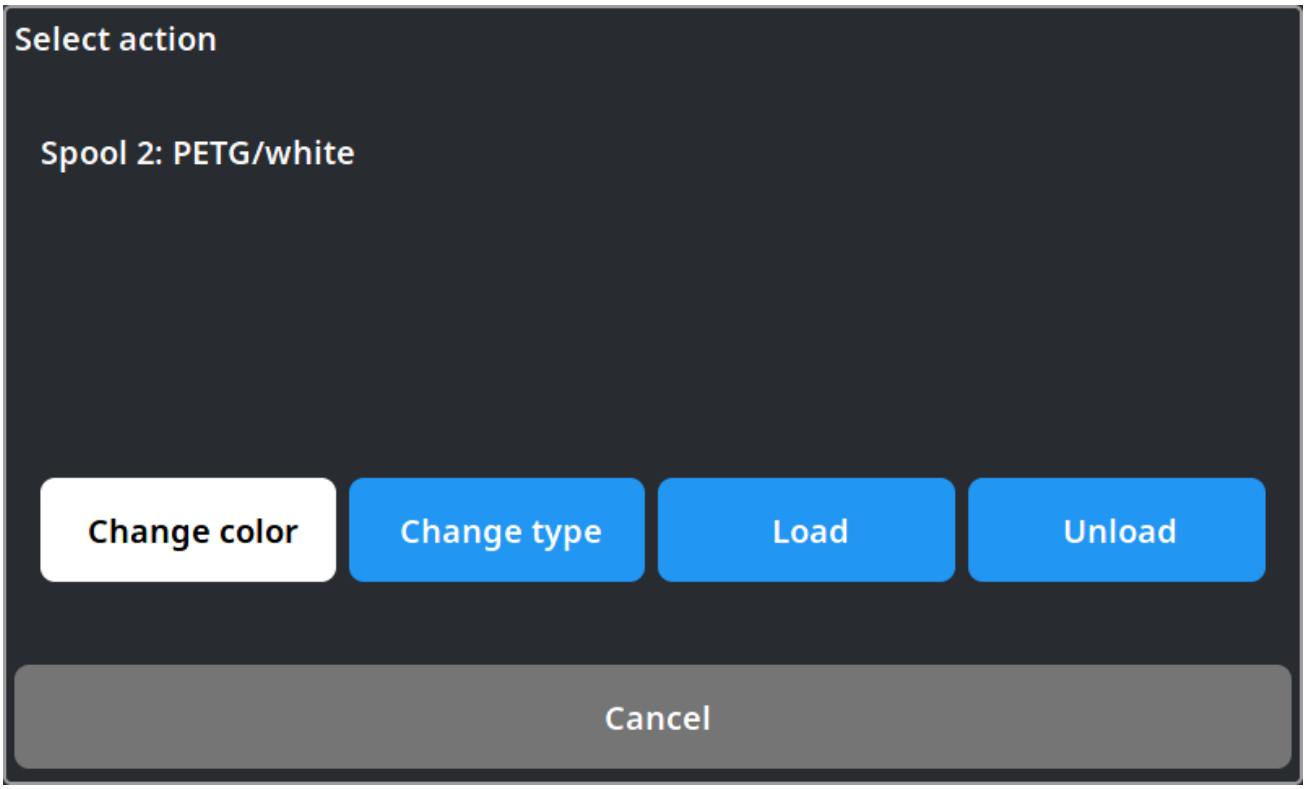

Loaded material
Extruder: 1: PETG/orange
IFS: True
Select a spool to modify
1: PETG
2: PETG
3: PETG
4: ABS
OK
RESET COLORS



- `Extruder: 1 (PETG/Orange)` – This means the printer is currently loaded with orange PETG filament from spool №1.
- `IFS: True` – The automatic filament feeding system is active.

Now select the spool you want to work with (e.g., spool 2):





You can perform four actions:

1. **Change the color** of the spool.
2. **Change the material type** (e.g., from PLA to PETG).
3. **Load** this filament into the printer.
4. **Unload** filament from the printer.

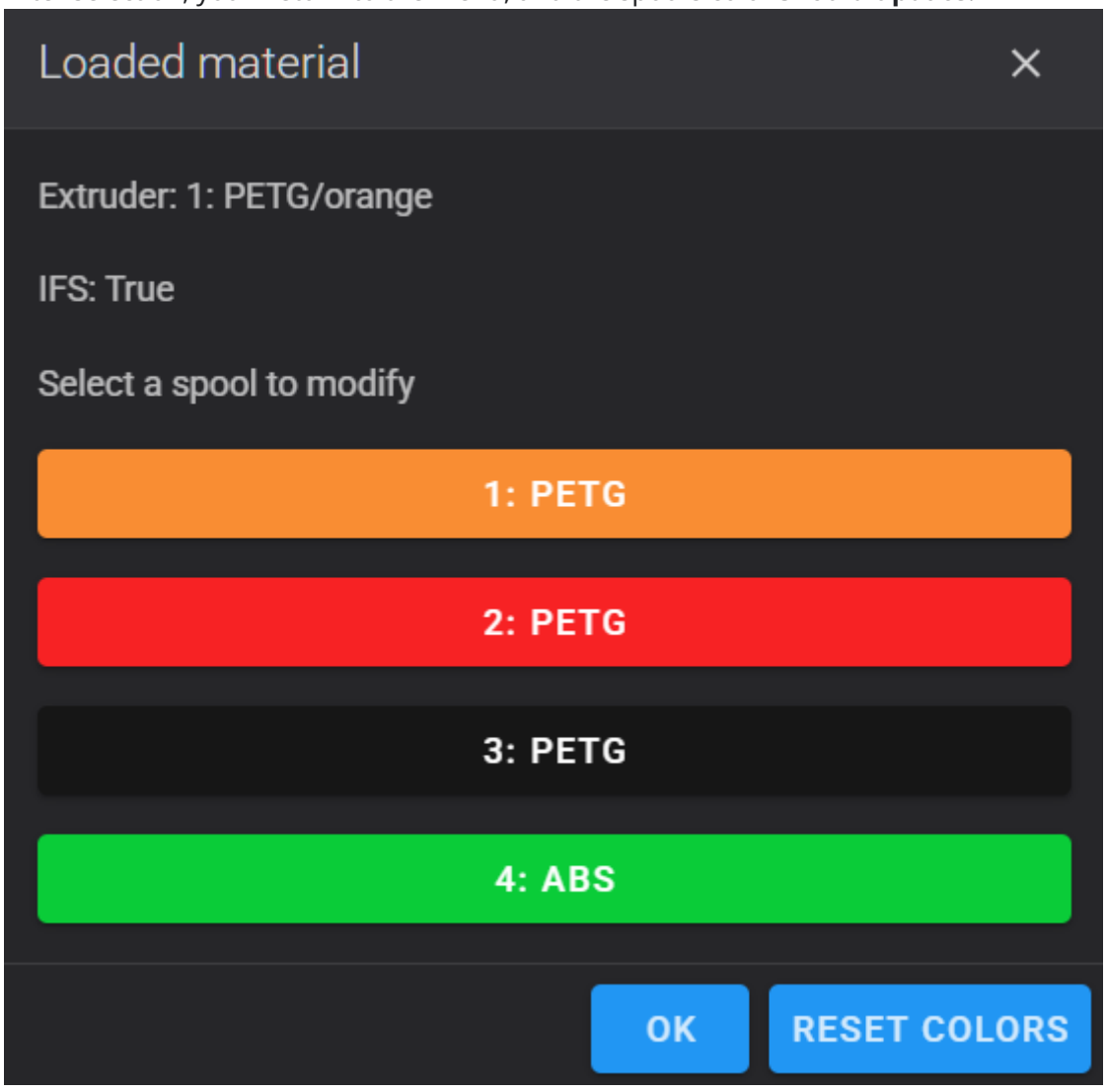
How to change color:

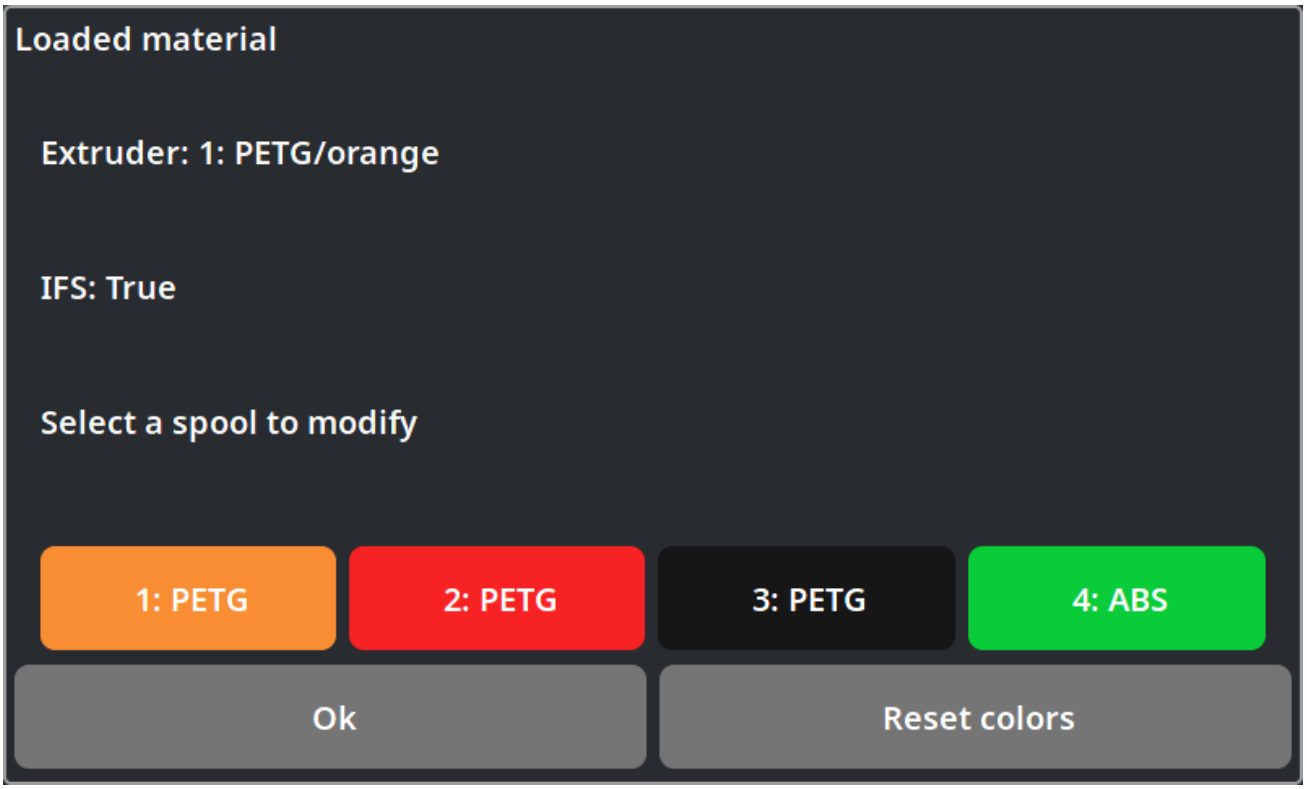
1. Click "Change Color".
2. **Select a color from the list.** This ensures the printer and native screen understand your selection.





1. After selection, you'll return to the menu, and the spool's color **should update**.

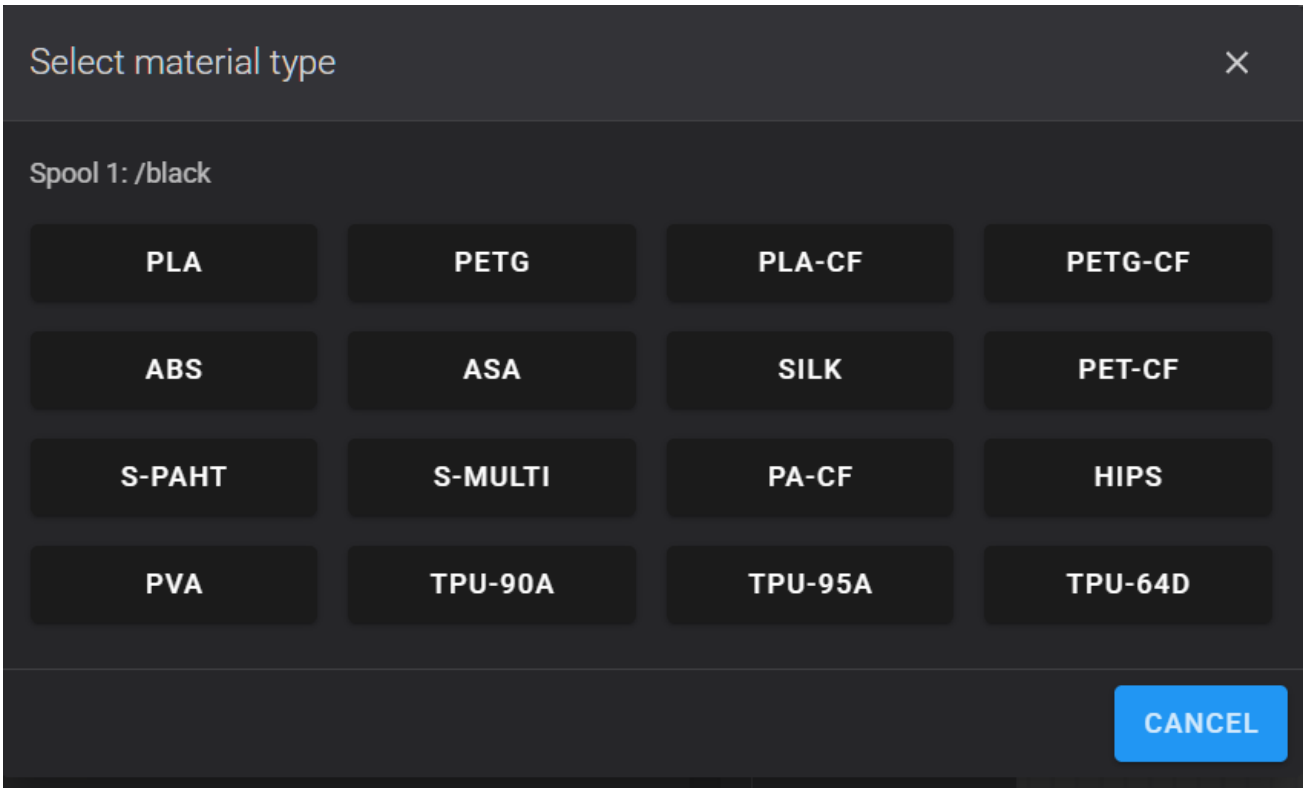


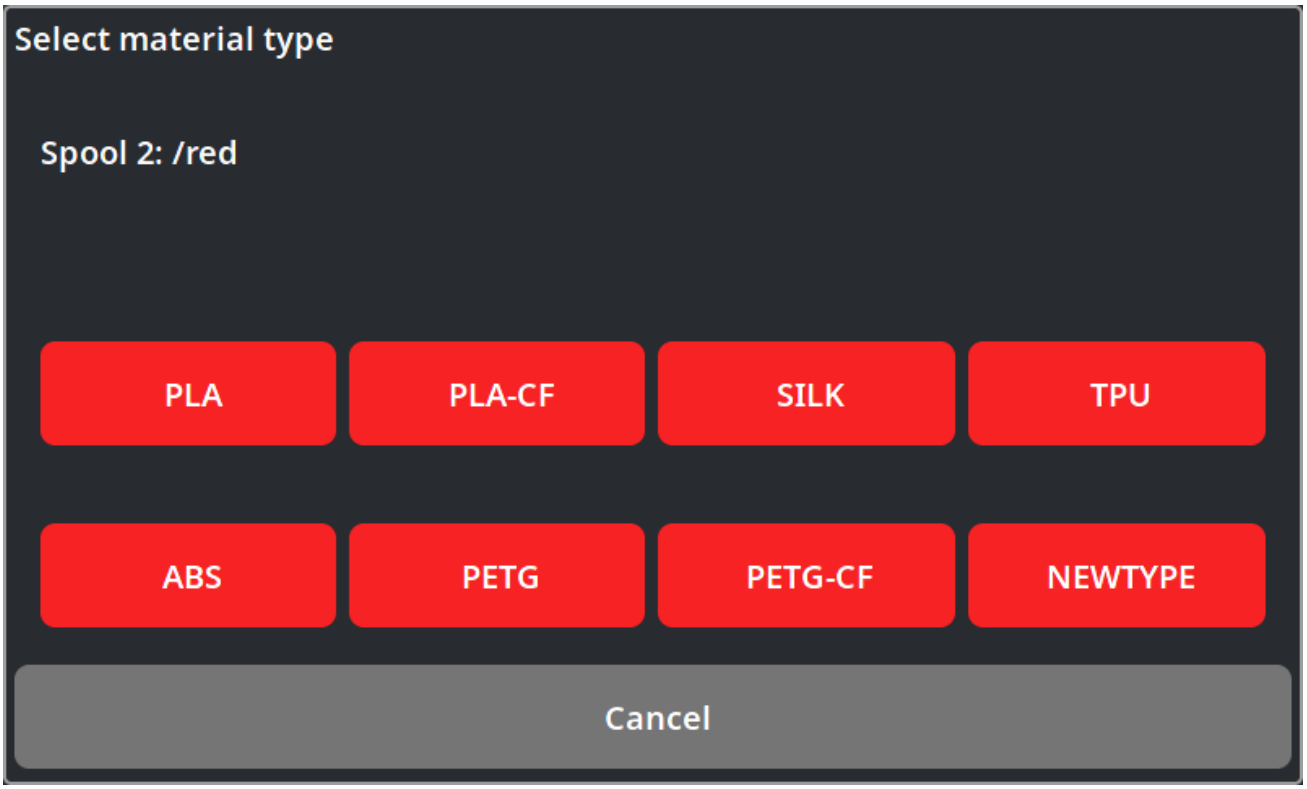


If the color doesn't change: Close the window with the "X" button and restart the `COLOR` macro. Sometimes the screen doesn't refresh immediately.

How to change material type:

1. Click "Change Type".
2. **Select a material type from the list.**





If the type doesn’t change: Close the window with the "X" button and restart the `COLOR` macro. Sometimes the screen doesn’t refresh immediately.

Tip: If multiple spools are assigned the **same color and material type**, the printer will automatically switch to the next spool when the current one runs out. This is called **"infinite spool mode"**.

---

4. Print Menu (Macro `PRINT`)

This window opens **by itself** when you start printing.

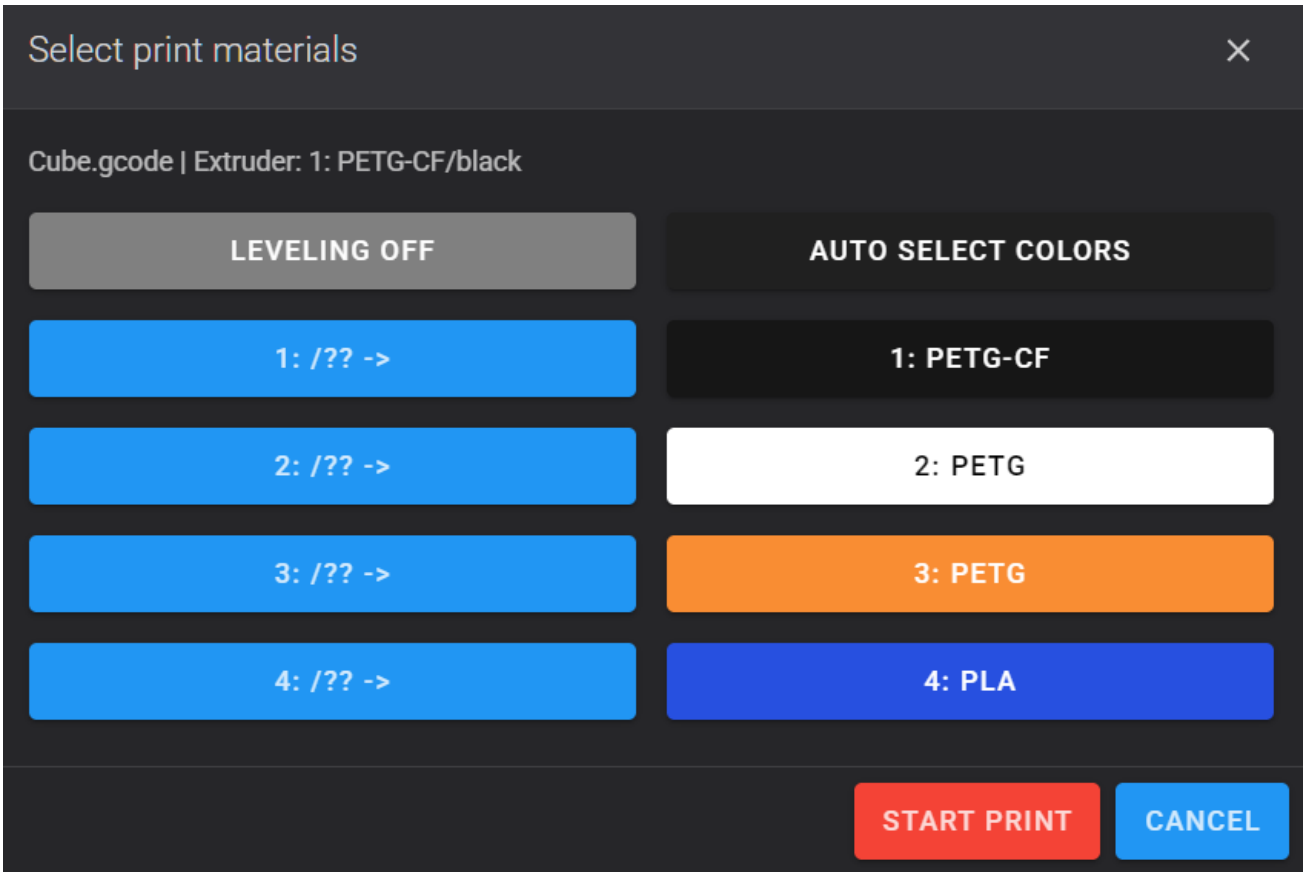
Alternative: with the ORCA_FF parameter, spools for colors are chosen right in OrcaSlicer or Flash Studio when sending a print.



How to understand what is written here:

- In the left column are tool numbers and colors from the file passed from the slicer.
- In the right column are spool numbers and colors loaded/used on the printer.
- `Cube.gcode` – this is the name of the file being printed.
- `1: PETG ->` – this is the first color from the file (orange PETG). It is printed with filament from spool 3 (orange PETG).
- `2: PLA ->` – this is the second color (gray PLA). It is printed with filament from spool 4 (blue PLA). Because there are no other PLA plastics in the printer.
- `3: PETG ->` – the third color (black PETG), printed from spool 3 (orange PETG). Because there are no other PETG plastics in the printer.
- `4: PETG-CF ->` – the fourth color (blue PETG-CF), printed from spool 1 (black PETG-CF). Because there are no other PETG-CF plastics in the printer.

If the image looks like this:



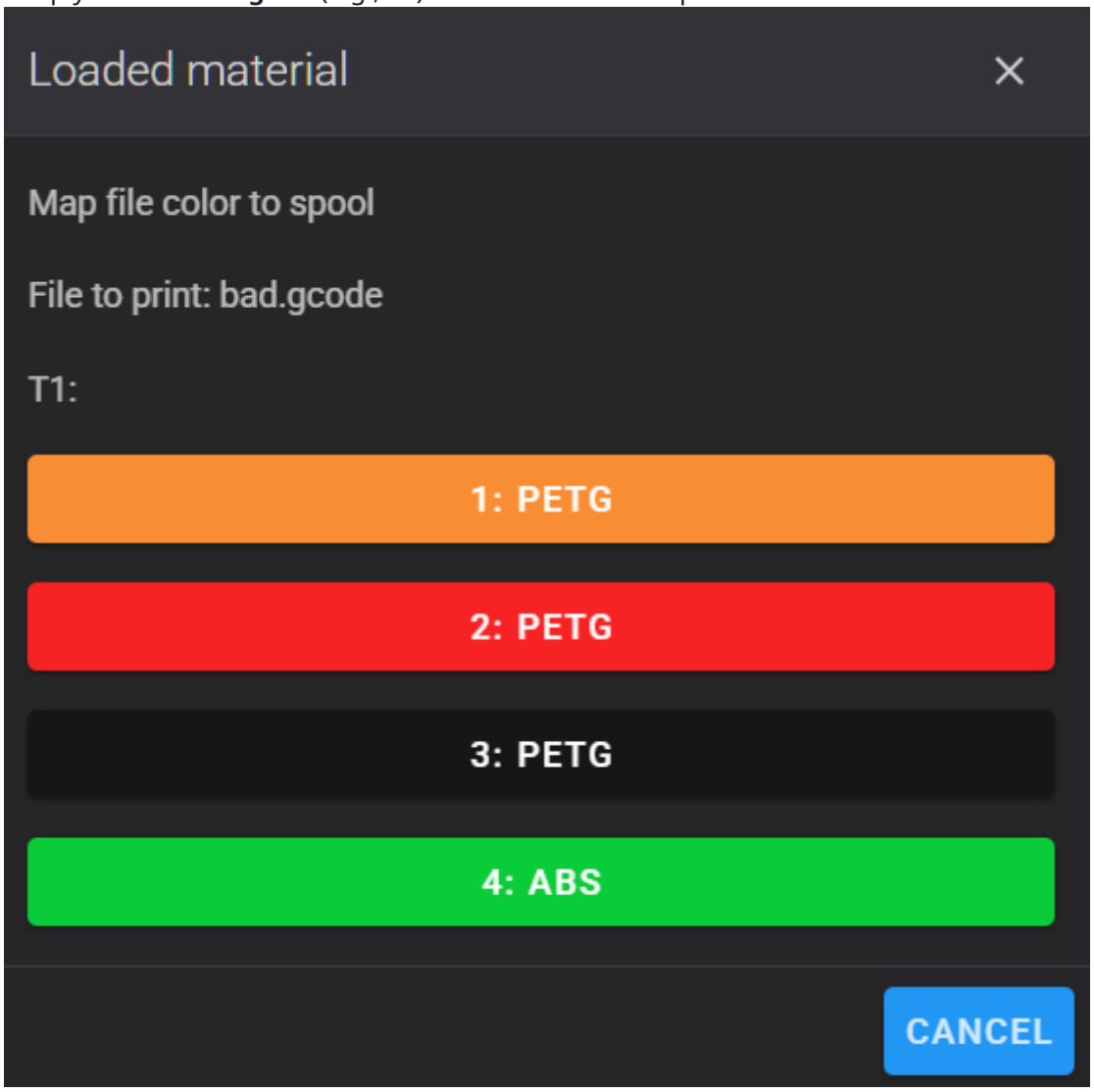
This means that you have disabled the auto color matching option and/or file scanning. You can click the `AUTO_SELECT_COLORS` button or enable it in global parameters:

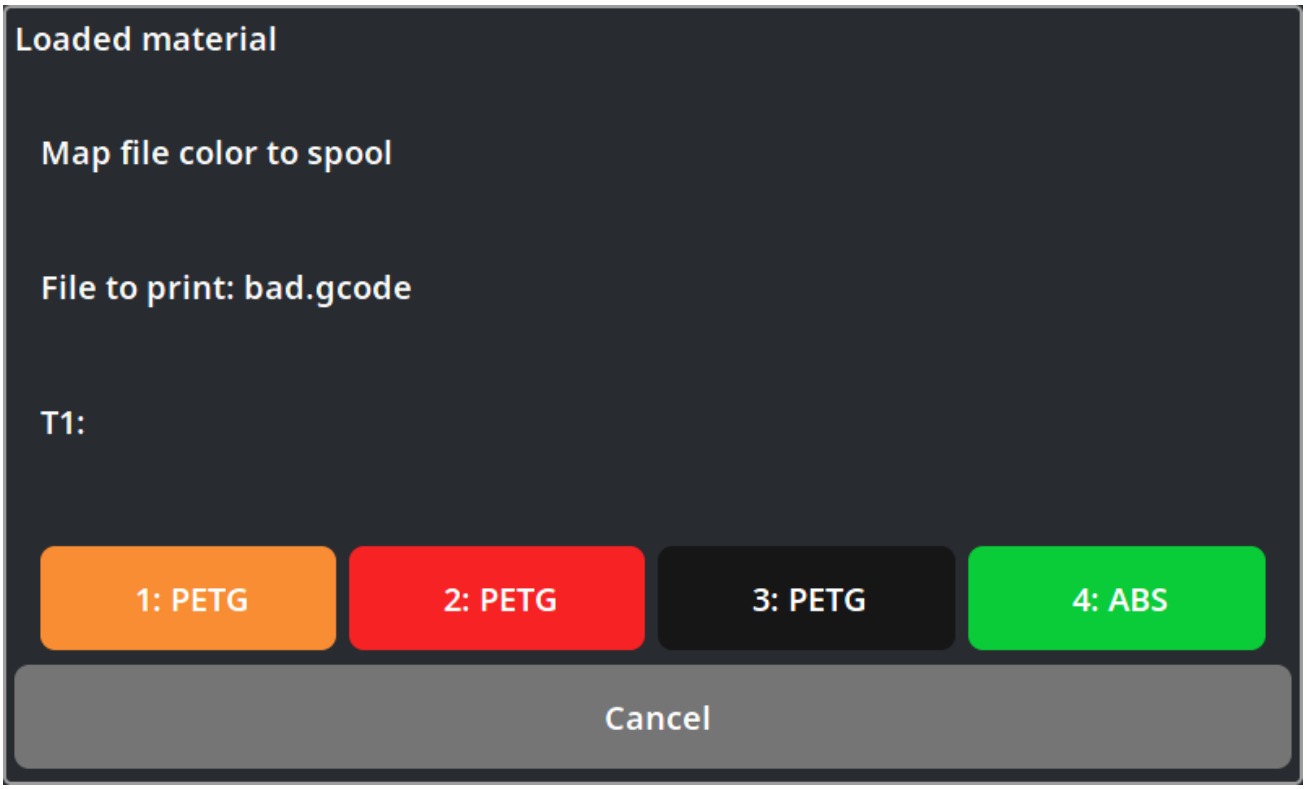
```
SAVE_ZMOD_DATA SCAN_FILE_COLORS=1 AUTO_ASSIGN_COLORS=1
```

[It is strongly recommended to enable the preprocessor]

To change the spool for a color during printing:

- Simply **click the target T** (e.g., T1) and select another spool from the list.





AD5X Global Parameters

To prevent the color selection dialog from appearing at the start of a print, use the global parameter SILENT:

- 0 – show dialog (default)
- 1 – do not show dialog, use previously set colors
- 2 – do not show dialog, do not use IFS

```
SAVE_ZMOD_DATA SILENT=1
```

To disable automatic filament insertion into the extruder, use the global parameter AUTOINSERT:

```
SAVE_ZMOD_DATA AUTOINSERT=0
```

To disable dumping of filament into the trash when printing, use the USE_TRASH_ON_PRINT parameter.

- 0 - No purge into the trash will occur. The print head will still travel to the trash chute during color changes on the first layer, to reduce blobs. If this is happening on every layer, check your start and layer change gcode!
- 1 - Purge will occur into the trash chute during color changes. Two purges of length equal to `filament_drop_length` in filament.json (plus `filament_drop_length_add` if the materials are different) will occur on each color change.
- 2 - After inserting the new color, the print head will travel to the trash chute then return control to the slicer from there. This should only be used together with a slicer profile designed for this mode.

```
SAVE_ZMOD_DATA USE_TRASH_ON_PRINT=0
```

To unload the filament after printing is complete, use the REMOVE_FILAMENT parameter.

```
SAVE_ZMOD_DATA REMOVE_FILAMENT=1
```

To set how many tools are shown in the color selection window (if file cannot be scanned for this info), use the ALLOWED_TOOL_COUNT parameter.

See preprocessing

```
SAVE_ZMOD_DATA ALLOWED_TOOL_COUNT=16
```

To enable scanning gcode files for tool, color and material info, use the SCAN_FILE_COLORS parameter. You can also set this to 2 to check for data prepared by the slicer script, but not attempt to scan entire files.

See preprocessing

```
SAVE_ZMOD_DATA SCAN_FILE_COLORS=1
```

To attempt automatic mapping of colors in the gcode file to physical spools, use the AUTO_ASSIGN_COLORS parameter. You must enable file scanning for this to be useful. Using a value of 30 will abort silent mode prints if there is any issue with the auto-assignment.

You can create custom values for when to abort in silent mode by adding together the following values:

- 2 (At least one material cannot be matched; eg. the gcode file specifies ABS, but you only have PLA loaded; or material data could not be loaded)
- 4 (At least one color cannot be matched at all, usually due to file scanning being disabled or failing)
- 8 (At least one color is potentially a poor match)
- 16 (At least one physical spool has been assigned to more than one tool index in the file)

See preprocessing

```
SAVE_ZMOD_DATA AUTO_ASSIGN_COLORS=30
```

When a color change command is encountered, if it indicates a switch to the already-loaded color, usually the change process would be skipped as it is pointless. If for some reason you wish to enable the full color change process, use the ALWAYS_FULL_COLOR_CHANGE parameter.

```
SAVE_ZMOD_DATA ALWAYS_FULL_COLOR_CHANGE=0
```

---

5. How to Manually Tell the Printer Which Spool Is Loaded

Sometimes you manually change the spool, but the printer doesn't recognize it and displays outdated information.

To fix this, use a dedicated command.

Type this phrase in the console:

```
SET_EXTRUDER_SLOT SLOT=1
```

What this means:

- `SET_EXTRUDER_SLOT` – Command telling the printer: "Remember this spool!"
- `SLOT=1` – The spool number you just loaded. **You can change this number!**

Examples:

- If you loaded filament from spool №3: `SET_EXTRUDER_SLOT SLOT=3`
- If from spool №2: `SET_EXTRUDER_SLOT SLOT=2`

After this command, the printer will know which spool is active and won't mix up colors.

---

6. How to Configure Waste Filament During Filament Change

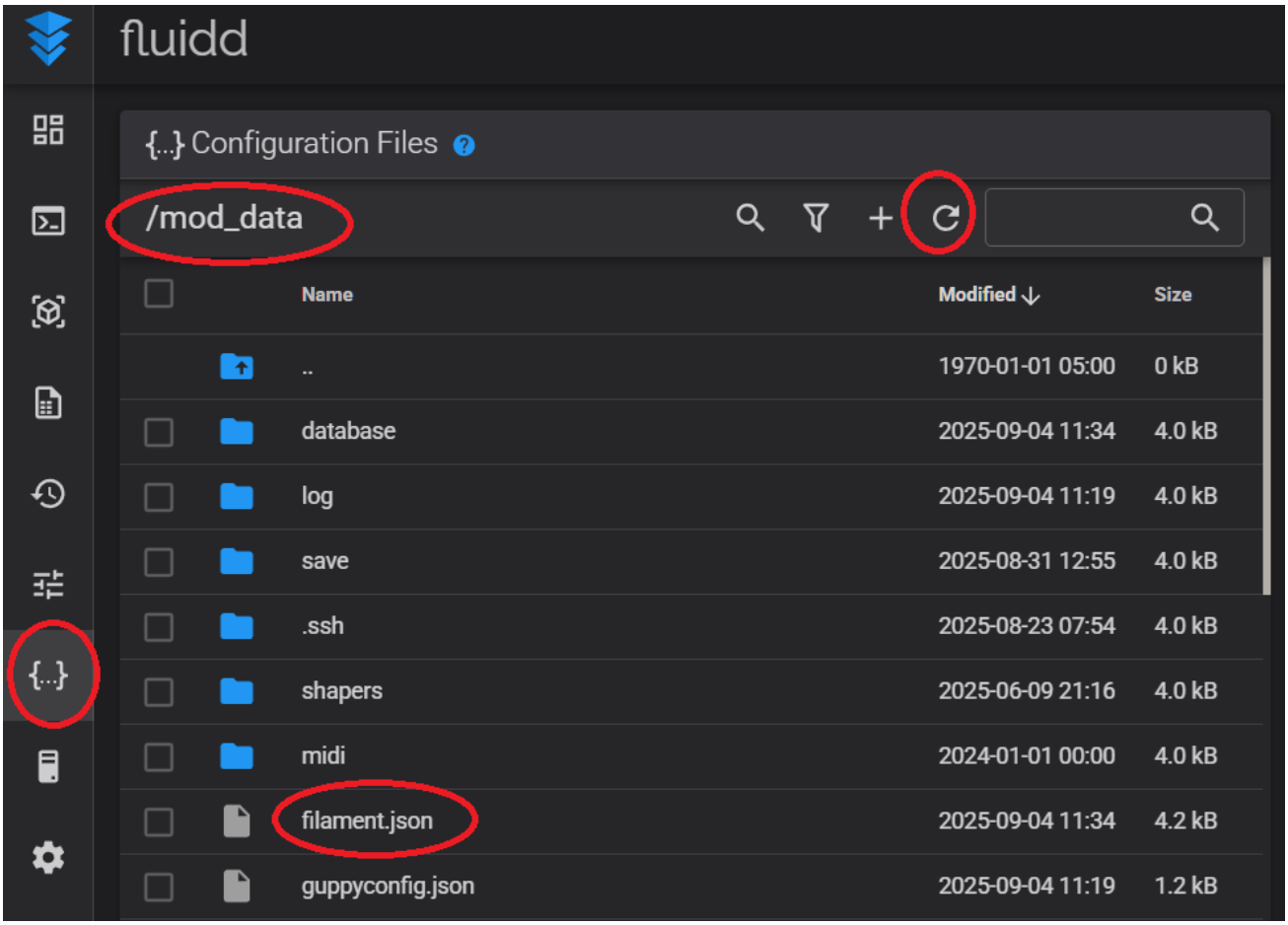
These settings help reduce plastic waste when switching spools. To adjust them, first **disable the printer's native screen** using the `DISPLAY_OFF` macro.

In screen-off mode, these sensors are enabled:

- `Head Switch Sensor` – Detects filament presence in the extruder
- `Ifs Motion Sensor` – Monitors filament movement in IFS

How to find these settings:

1. Open the **"Configuration"** tab.
2. Navigate to the **`mod_data`** folder.
3. Open the **`filament.json`** file.



In this file, each material type (PLA, ABS, PETG, etc.) has a list of values. Here's what they mean:

Basic Parameters (Most Frequently Adjusted):

For these settings to work, you need to **disable the printer's native display** using the `DISPLAY_OFF` macro.

1. **`temp`** — Nozzle temperature for filament change. **Default value depends on material type.**
2. **`filament_drop_length` (Purge Length)**
    - **In simple terms:** How many millimeters of filament the printer will purge into the waste bin to **clean the nozzle** from the previous color. This applies when loading colors outside of printing or before a print, or when changing colors with USE_TRASH_ON_PRINT set to 1.
    - **Tip:** Increase this value if colors mix during spool changes. Decrease it to reduce waste.
3. **`filament_drop_length_add` (Additional Purge)**
    - **In simple terms:** Extra purge length when switching **material types** (e.g., PLA to PETG), not just colors. This applies when loading colors outside of printing or before a print, or when changing colors with USE_TRASH_ON_PRINT set to 1.
    - **Why it's needed:** Different materials don't mix well, so deeper nozzle cleaning is required.
4. **`nozzle_cleaning_length`** — The length (in mm) of filament pulled out of the extruder when cleaning the nozzle when the spool is no longer in use. **Default: 60 mm.**

5. **`filament_unload_into_tube`** — How much filament to unload from the 4-in-1 module when the extruder is no longer used. **Default: 70 mm.**
    - If you have a new version 4-in-1 module, increase `filament_unload_into_tube` or, as a last resort, increase `nozzle_cleaning_length`

Advanced Parameters (Do Not Adjust If Unsure of the Result):

For these settings to work, you need to **disable the printer's native display** using the `DISPLAY_OFF` macro.

- **`filament_tube_length`** — Total PTFE tube length from IFS module to extruder. Useful for non-standard tubes. **Default: 1000 mm.**
- **`filament_unload_before_cutting`** — Filament lift distance **before** cutting. **Default: 0 mm.**
- **`filament_unload_after_cutting`** — Filament lift distance **after** cutting, before moving to the waste bin. **Default: 5 mm.**
- **`filament_unload_after_drop`** — Retraction distance after purging to prevent oozing. **Default: 3 mm.**
- **`filament_extruder_speed`** — Speed (in mm/min) at which filament is loaded into the extruder. **Default: 300 mm/min (5 mm/s).**
- **`filament_ifs_speed`** — Speed (in mm/min) at which the IFS module operates. **Default: 1200 mm/min (20 mm/s).**
- **`filament_fan_speed`** — Fan speed (0–255) during purging to cool oozing. **Default: 102.**
- **`filament_autoinsert_empty_length`** — Filament length pulled when auto-loading into an empty extruder. **Default: 600 mm.**
- **`filament_autoinsert_full_length`** — Filament length pulled when replacing existing filament. **Default: 550 mm.**
- **`filament_autoinsert_ret_length`** — Retraction distance after extruder sensor triggers (empty extruder only). **Default: 90 mm.**
- **`filament_autoinsert_speed`** — Auto-insertion speed (mm/min). **Default: 1200 mm/min (20 mm/s).**

Warning! Modifying advanced parameters may cause printer malfunctions, filament jams, or hardware damage. Adjust only if you fully understand each parameter's purpose and potential consequences.

Key takeaway: To reduce waste, start by decreasing **`filament_drop_length`** and **`filament_drop_length_add`** for your material. Don't forget to save the file after changes!

Slicer-controlled purge

It is possible to have the slicer control the purge instead by using other USE_TRASH_ON_PRINT settings, instead of the default value (1).

Nopoop Mode (`SAVE_ZMOD_DATA USE_TRASH_ON_PRINT=0`)

In this mode, no purge is performed by the printer during color changes. The printer will cut the filament, then return to the prime tower to unload and load filament, then immediately continue from there.

On the first layer, the printer will instead travel to the trash chute while changing filament, but will return to the prime tower afterwards without producing any poop.

In order to properly purge the old filament when in this mode, the recommended approach is to enable "Purge into prime tower" in OrcaSlicer's settings. This is found in the printer settings under the "Multimaterial" tab. You can then use the Flush Volumes setting to adjust purge amounts. If you wish to add a fixed amount to the automatically calculated flush volumes, you can do so by setting the "Nozzle Volume" under the General tab of printer settings.

It is normal for your prime tower to be considerably larger than usual when using this option, especially when working with thin layer heights.

You can additionally use options like "Purge to infill", "Purge to this object", etc when using this mode, to reduce the amount of waste purged into the prime tower.

This option is only supported in OrcaSlicer; it cannot be used with Bambu Studio due to the lack of "Purge in prime tower".

Slicer-Controlled Poop Mode (`SAVE_ZMOD_DATA USE_TRASH_ON_PRINT=2`)

In this mode, no purge is performed by the printer on its own during color changes. The printer will cut the filament, then travel to the trash chute, and return control to the slicer.

This mode requires proper support from the printer profile in the slicer, in particular, filament change gcode that handles pooping and returning to the prime tower afterwards is necessary. Do NOT use this mode with any gcode file that is not specifically sliced for it.

When using OrcaSlicer, options such as "Purge to infill" cannot be used in this mode. This is a bug in OrcaSlicer and cannot be fixed by Z-Mod. They work correctly when using Bambu Studio.

Printer profiles

Printer profiles set up for slicer-controlled purge are available for

- OrcaSlicer
- Bambu Studio.

These profiles are close to the stock AD5X profiles except for:

- All Z-Mod custom gcode added, including appropriate filament change gcode for `USE_TRASH_ON_PRINT=2`
- "Purge in prime tower" enabled (OrcaSlicer only)
- Automatically sets correct `USE_TRASH_ON_PRINT` setting at the start of printing
- Z-Hop type set to Normal
- Nozzle volume set to 144
- Filament unload time set to 66s for more-accurate estimates (based on default filament.json settings)
- Fan startup time set to 1.5s and kickstart to 0.5s (OrcaSlicer only)

When using OrcaSlicer, you can switch between the two modes by altering the "Purge in prime tower" setting. When it is enabled, nopoop mode will be used. When it is disabled, poop mode will be used. The profile will automatically set the correct USE_TRASH_ON_PRINT value for you at the start of a print.

When using Bambu Studio, only poop mode is supported.

If you do a print from these profiles in Slicer-Controlled Poop Mode, make sure to change your USE_TRASH_ON_PRINT setting back to 0 or 1 before printing any multicolor gcode that was not sliced with these profiles.

7. Add or remove filament types

For these settings to work, you need to **disable the printer's native display** using the `DISPLAY_OFF` macro.

To add a new filament type, add the following to `mod_data/user.cfg`:

```
[zmod_ifs]
filament_NEWTYPE: 300
```

Where NEWTYPE is replaced with the desired filament type (e.g., HIPS), and the number is the extruder temperature for loading, unloading and purging this filament.

To hide a filament type, add the following to `mod_data/user.cfg`:

```
[zmod_color]
hide_filament_types: XXX,YYY,ZZZ
```

Where XXX, YYY, ZZZ are replaced with the desired filament types (eg. PLA-CF,PETG-CF,SILK). You can use this to hide the default types, or to hide types you have manually added via the above setting. Doing so will not disable the filament type; it will only hide it from the type selection menu.

`IFS_PRINT_DEFAULTS` - displays available filament types and their melting points

---

8. Add custom colors

For these settings to work, you need to **disable the printer's native display** using the `DISPLAY_OFF` macro.

To add or rename a color, open `mod_data/color/en.json` (use your language instead of en):

Add a new color or rename an existing one.

To display the color name, the color name must begin with an underscore _

Example:

```
{
"ffffff": "white",
"fffff1": "_transparent",
"fef043": "bright yellow",
"dcf478": "light green",
"0acc38": "green",
"067749": "dark green",
"0c6283": "blue-green",
"0de2a0": "turquoise",
"75d9f3": "cyan",
"45a8f9": "blue",
"2750e0": "dark blue",
"46328e": "violet",
```

```
"a03cf7": "bright violet",
"f330f9": "purple",
"d4b0dc": "lilac",
"f95d73": "pink",
"f72224": "red",
"7c4b00": "brown",
"f98d33": "orange",
"fdebd5": "beige",
"d3c4a3": "light brown",
"af7836": "terracotta",
"898989": "gray",
"bcbcbc": "light gray",
"161616": "black"
}
```

The text `_transparent` will be displayed on buttons.

Filament sync with OrcaSlicer

For these settings to work, you need to **disable the printer's native screen** using the `DISPLAY_OFF` macro.

The `orca_lanes` parameter publishes the IFS slots to the Moonraker database. OrcaSlicer reads filament color and type from there for the "Sync filament" button when the printer is added via Octo/Klipper (agent `Moonraker`) or via the `FlashForge` type.

- `True` - publish slots (default)
- `False` - do not publish

If colors are managed by HelixScreen (`helix = 1`), publishing is skipped regardless of `orca_lanes`, so its data is not overwritten.

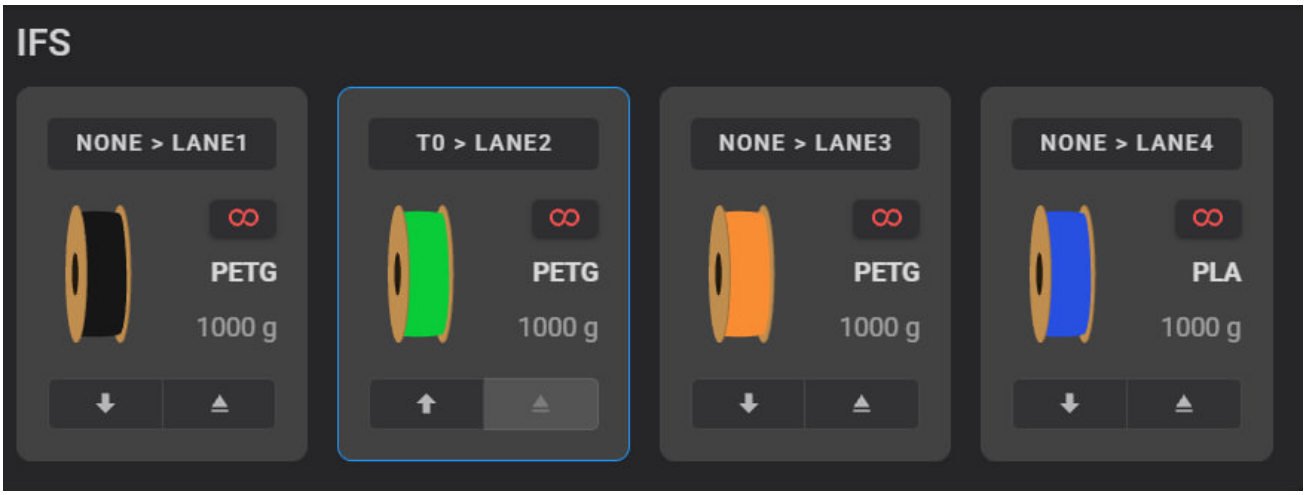
To disable, add to `mod_data/user.cfg`:

```
[zmod_color]
orca_lanes: False
```

> **Details**
>
> Slots are written to the `lane_data` namespace in the same format as AFC and Happy Hare: slot 1 → `lane0`, ..., slot 4 → `lane3`, for example `"lane0": {"lane": "0", "material": "PETG", "color": "#161616", "name": "PETG"}`. All slots are published when Klipper starts, then only the changed slot on every color or type change. A slot with type `?` is removed, filament presence from sensors is not taken into account. The external spool is not published.

AFC panel

The IFS slots (AD5X) and toolheads (Creator 5 Pro) are shown in Fluidd and Mainsail as a standard AFC panel. Works both with and without the native screen.



Enabling

`SAVE_ZMOD_DATA AFC=1`, then restart Klipper. To disable: `SAVE_ZMOD_DATA AFC=0`.

Features

- Color, type and filament presence in each slot.
- Change color and type, load and unload right from the panel.
- Lane selection window before printing in Fluidd (1.37.3+) and Mainsail: the mapping of file tools to slots is sent together with the print command, and the color selection window does not appear after it. The map can also be changed during a print.
- Mappings are kept between prints by default. To reset them after print completion or cancellation, set `SAVE_ZMOD_DATA IDLE_MAP=1`. Mappings are always preserved on print errors and Klipper restarts. See IDLE_MAP.
- The AFC window has a "Bed mesh" toggle. It changes the global setting immediately, before you press "Print".
- Printing via the FlashForge protocol (OrcaSlicer, Flash Studio) uses the mapping from the slicer and starts right away, with the usual preparation (KAMP, MD5 check).
- Printing without a mapping (OrcaSlicer via Moonraker, GuppyScreen, KlipperScreen, macros) shows the color selection window or runs automatic matching, depending on the settings, just as without AFC.
- The infinite spool button reports that the replacement is picked by filament type and color.

zmod_afclite plugin

The zmod_afclite plugin has been removed and replaced by built-in AFC support. On update:

- if the plugin was enabled, it is disabled and AFC is enabled automatically;
- the plugin is removed from the Moonraker configs and its directory is deleted.

Acknowledgements

Thanks to DIEHARDave for the zmod_afclite plugin, which showed the way and the solution.

9. Fixing Trash Bin and Filament Cutting Knife Operation

Alternative version of the instructions

Different AD5X printers may have different coordinates for the trash bin and knife. Sometimes the difference can reach up to 4 mm.

Because of this:

- Filament may not reach the trash bin;
- Knife does not cut the filament;
- Printer head may hit the wall.

To fix this, you need to:

1. Update Z-Mod.
2. Open the file `/rw/Adventurer5M.json`.
3. Find these lines:

```
{
        "CutXOffset" : 0.5,
        "CutYOffset" : -0.20000001788139343,
        "xOffset" : 0.0,
        "yOffset" : -0.20000001788139343,
        "zOffset" : 0.0,
        "zProbeOffset" : 0.004999995231628418
},
```



Replace **only** these values:

```
"CutXOffset": 0.0,
"CutYOffset": 0.0,
"xOffset": 0.0,
"yOffset": 0.0,
```

1. Enter the command: `UPDATE_FF_OFFSET` (this will update the settings).
2. Then enter: `_GOTO_TRASH` (this will move to the trash bin).

Trash Bin Calibration

Alternative version of the instructions

1. Enter the command `_GOTO_TRASH` — the printer head will move to the trash bin.
2. If the bin doesn't close, carefully move the head until the bin closes. Use GCODE: `G1 Y230.2`
3. Check what **Y** coordinate you now have.
4. Subtract 229 from this number. The result will be your `yOffset`.
5. Check what **X** coordinate you now have.
6. Subtract 52.5 from this number. The result will be your `xOffset`.

Examples:

- If Y = 230.2, then `yOffset = 230.2 - 229 = 1.2`
- If Y = 228.4, then `yOffset = 228.4 - 229 = -0.6`
- Formula: `yOffset = Y - 229`

Write this number to the file `/rw/Adventurer5M.json`. The bin is calibrated.

1. Enter the command: `UPDATE_FF_OFFSET` (this will update the settings).
2. Then enter: `_GOTO_TRASH` (this will move to the trash bin).

Knife Calibration

Alternative version of the instructions

1. Enter the command `_CUT_PRUTOK` — the head will move to the knife.
2. Using the screen, move the head until the knife activates. Use GCODE: `G1 Y-7.7` `G1 X-1.7`
3. Check what X and Y coordinates you have.
4. For **Y**:
    - Subtract your Y-coordinate from **7.5** by absolute value.
        - Example: if Y = -7.7, then `CutYOffset = 7.5 - 7.7 = -0.2`
        - Example: if Y = -5.9, then `CutYOffset = 7.5 - 5.9 = 1.6`
        - Formula: `CutYOffset = 7.5 + Y`
5. For **X**:
    - Subtract your X-coordinate from **2.5** by absolute value.
        - Example: if X = -1.7, then `CutXOffset = 2.5 - 1.7 = 0.8`
        - Example: if X = -2.8, then `CutXOffset = 2.5 - 2.8 = -0.3`
        - Formula: `CutXOffset = 2.5 + X`

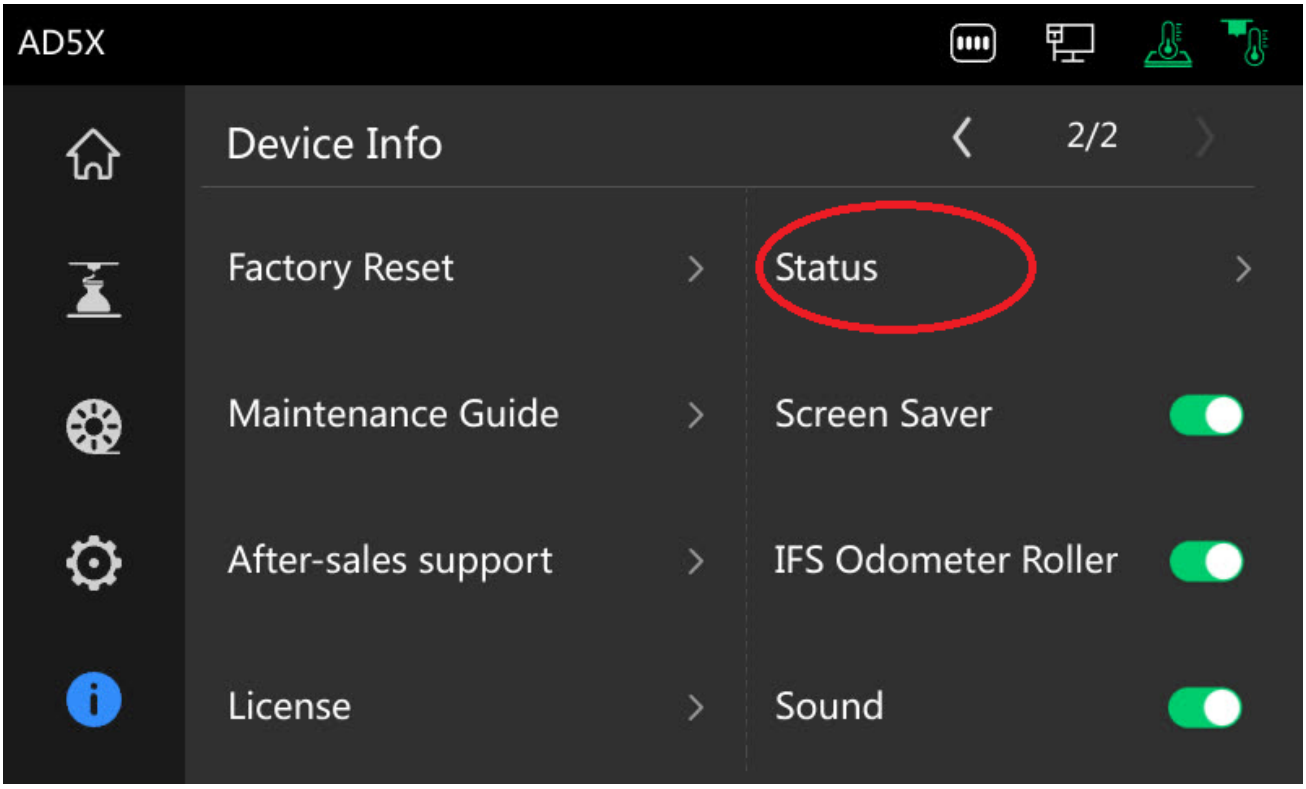
Write these numbers to the file `/rw/Adventurer5M.json`. The knife is calibrated.

1. Enter the command: `UPDATE_FF_OFFSET` (this will update the settings).
2. Then enter: `_GOTO_TRASH` (this will move to the trash bin).

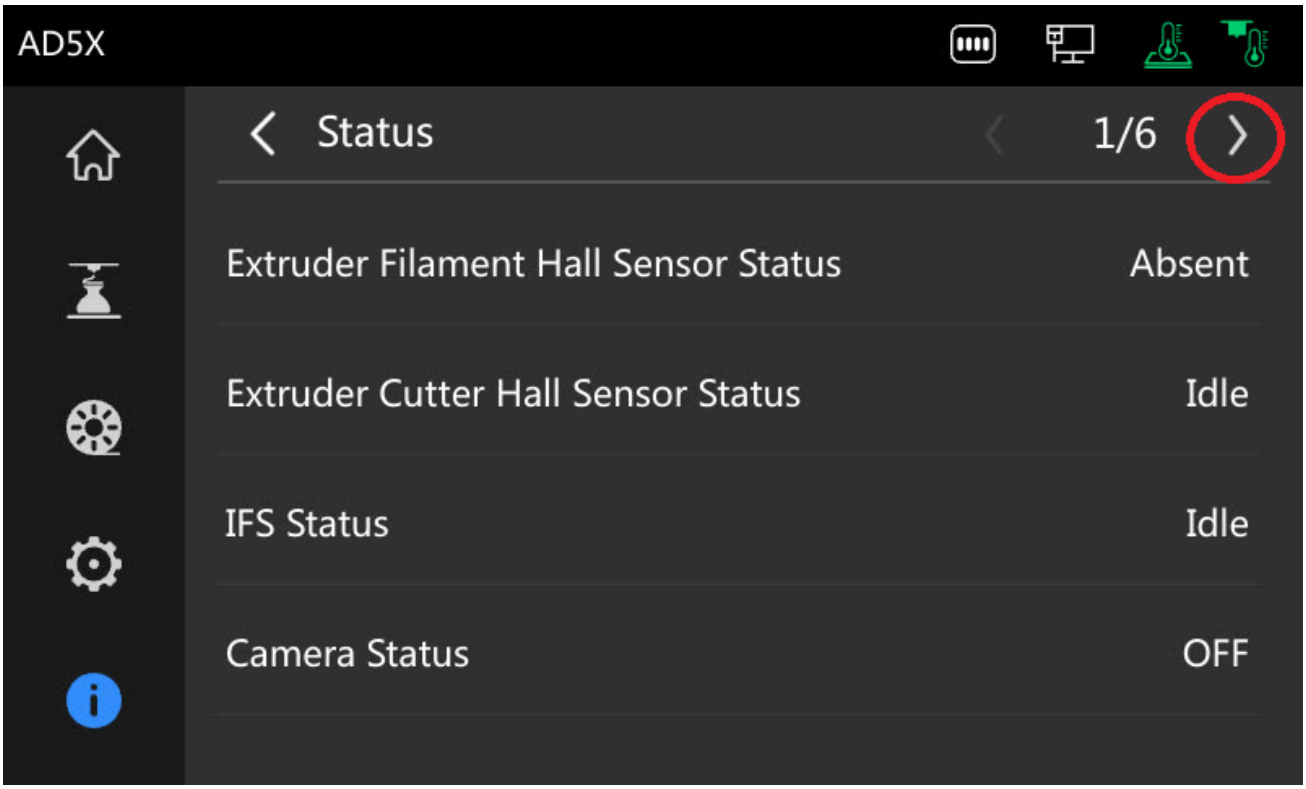
Restart the printer — everything is ready.

Setting up the basket on the AD5X stock firmware

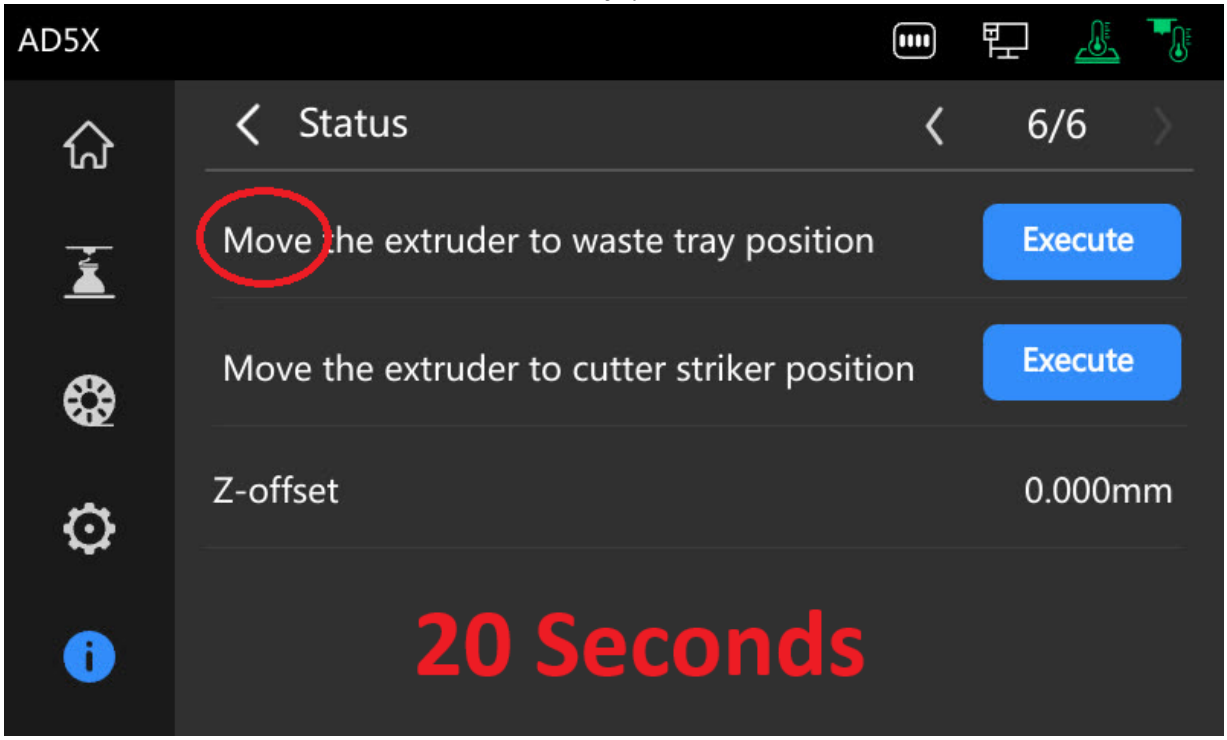
1. Go to the "i" tab and press the `Status` button



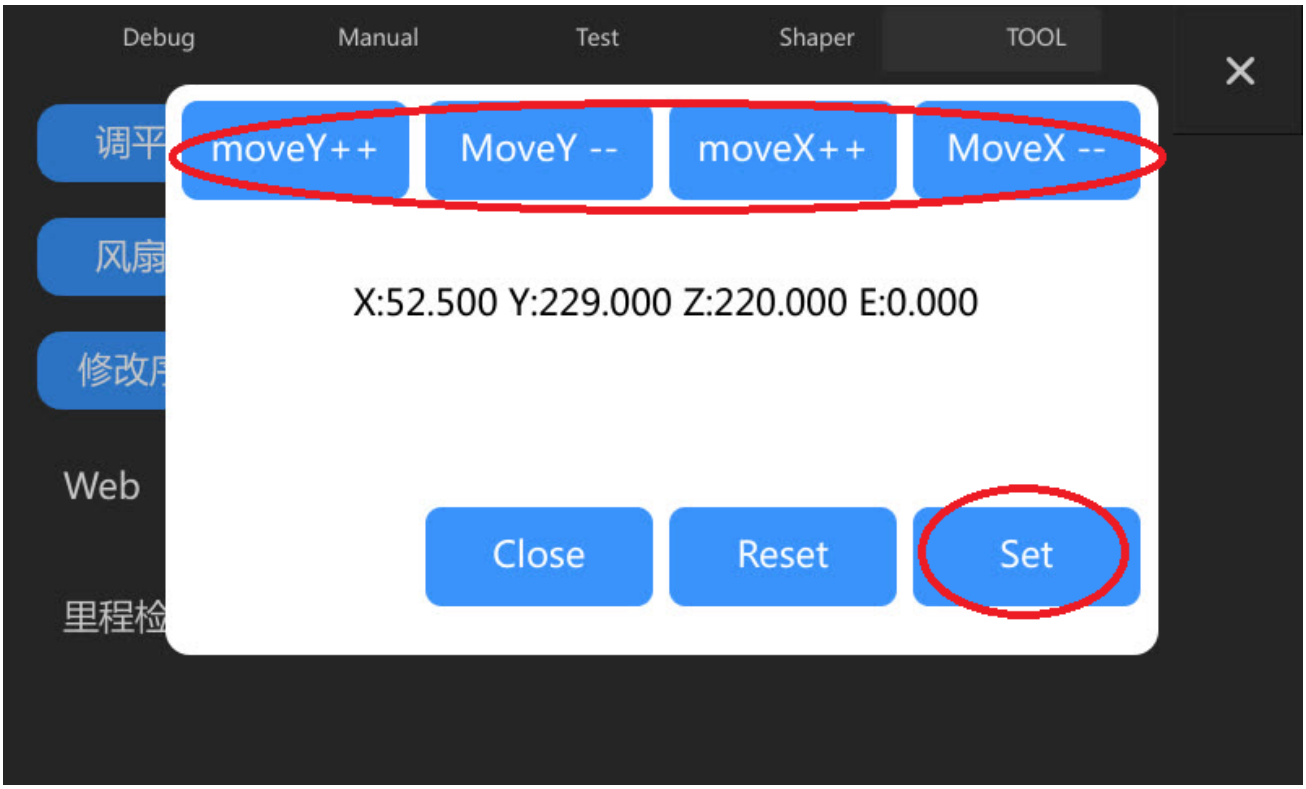
1. Go to the 6th tab



1. Press and hold `Move the extruder to waste tray position` for 20 seconds

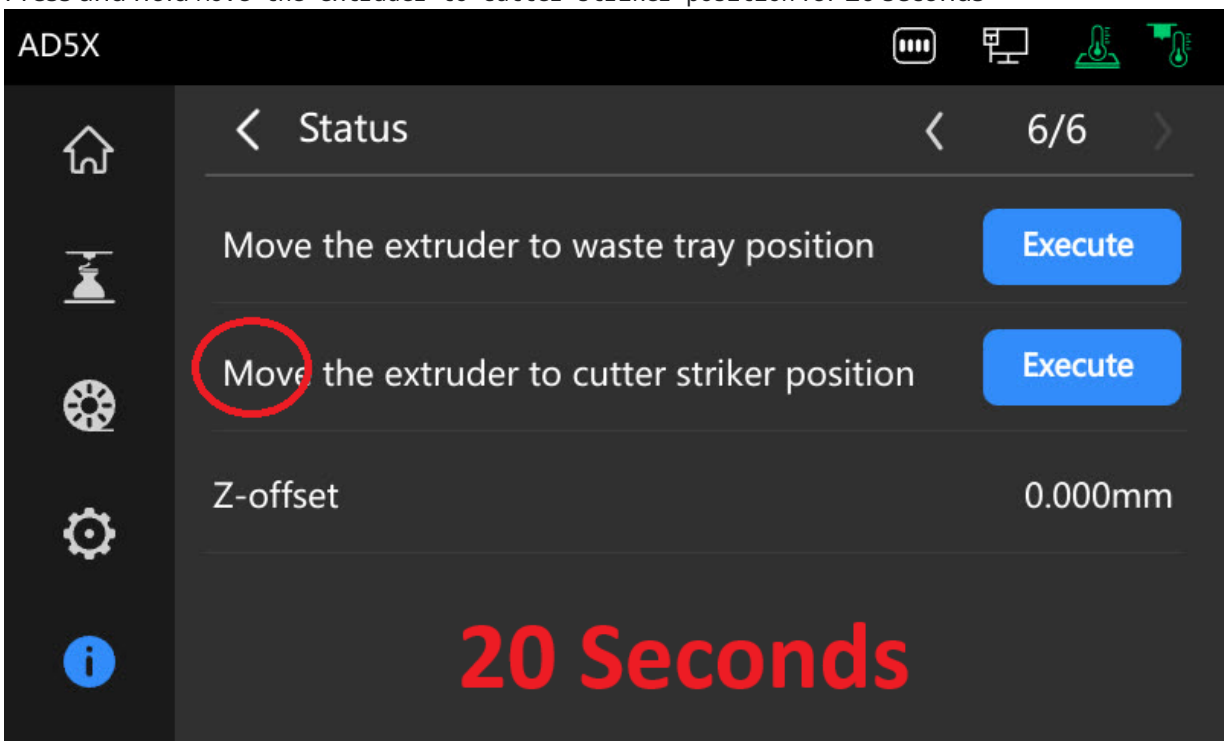


2. Adjust the head position in the waste tray so that it closes. Using the control arrows, park the print head at the receiver in such a way that the print head sufficiently presses the shutter lever, the nozzle is behind the moving shutter, and the shutter itself is flush with the front surface of the receiver.

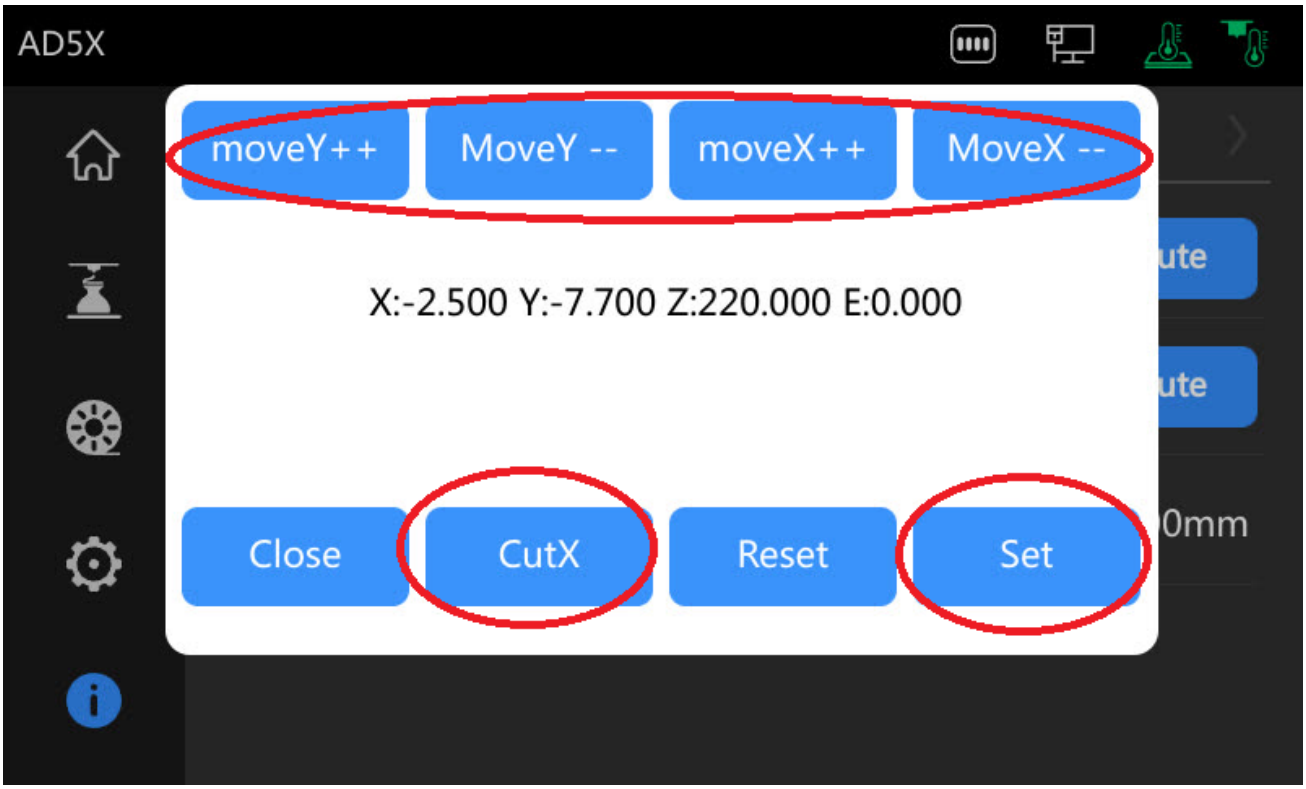


Press the `Set` button.

1. Press and hold `Move the extruder to cutter striker position` for 20 seconds



2. Adjust the cutter. Press `CutX` — the cutter should cut the filament without slipping or striking.



Press the `Set` button.

10. IFS commands

For these settings to work, you need to **disable the printer's native display** using the `DISPLAY_OFF` macro.

- `IFS_F10` - Insert filament
- `IFS_F11` - Remove filament
- `IFS_F13` - IFS state
- `IFS_F15` - Reset driver
- `IFS_F18` - Release filament in all channels
- `IFS_F23` - Mark filament as inserted
- `IFS_F24` - Filament clamp
- `IFS_F39` - Release filament
- `IFS_F112` - Stop filament feed
- `PURGE_PRUTOK_IFS` - Purge filament from IFS to the extruder
- `REMOVE_PRUTOK_IFS` - Removes filament by filament number
- `INSERT_PRUTOK_IFS` - Insert filament into IFS by filament number
- `SET_CURRENT_PRUTOK` - Tell Klipper which filament is currently active
- `ANALOG_PRUTOK` - Load an equivalent filament
- `IFS_MOTION` - Check if the filament has stopped or run out

IFS module parameters:

- debug - debugging (True, *False*)
- silk_count - on which attempt to consider the filament present in IFS (*1*)
- stall_count - on which attempt to consider the filament stopped (*1*)
- retry_count - number of times to retry the command on error (*3*)

- next_cmd_delay - duration to wait between processing IFS response and sending next command (*0.2*)
- send_ff_terminator - enables or disables 0.2s delay + 0xFF send after an IFS command; may be required by very old IFS firmwares (True, *False*)
- filament_NEWFILAMENT - Add a new filament type. Parameter - loading and unloading temperature for this material.

Set via `mod_data/user.cfg`:

```
[zmod_ifs]
debug: True
silk_count: 1
stall_count: 1
filament_NEWTYPE: 300
```

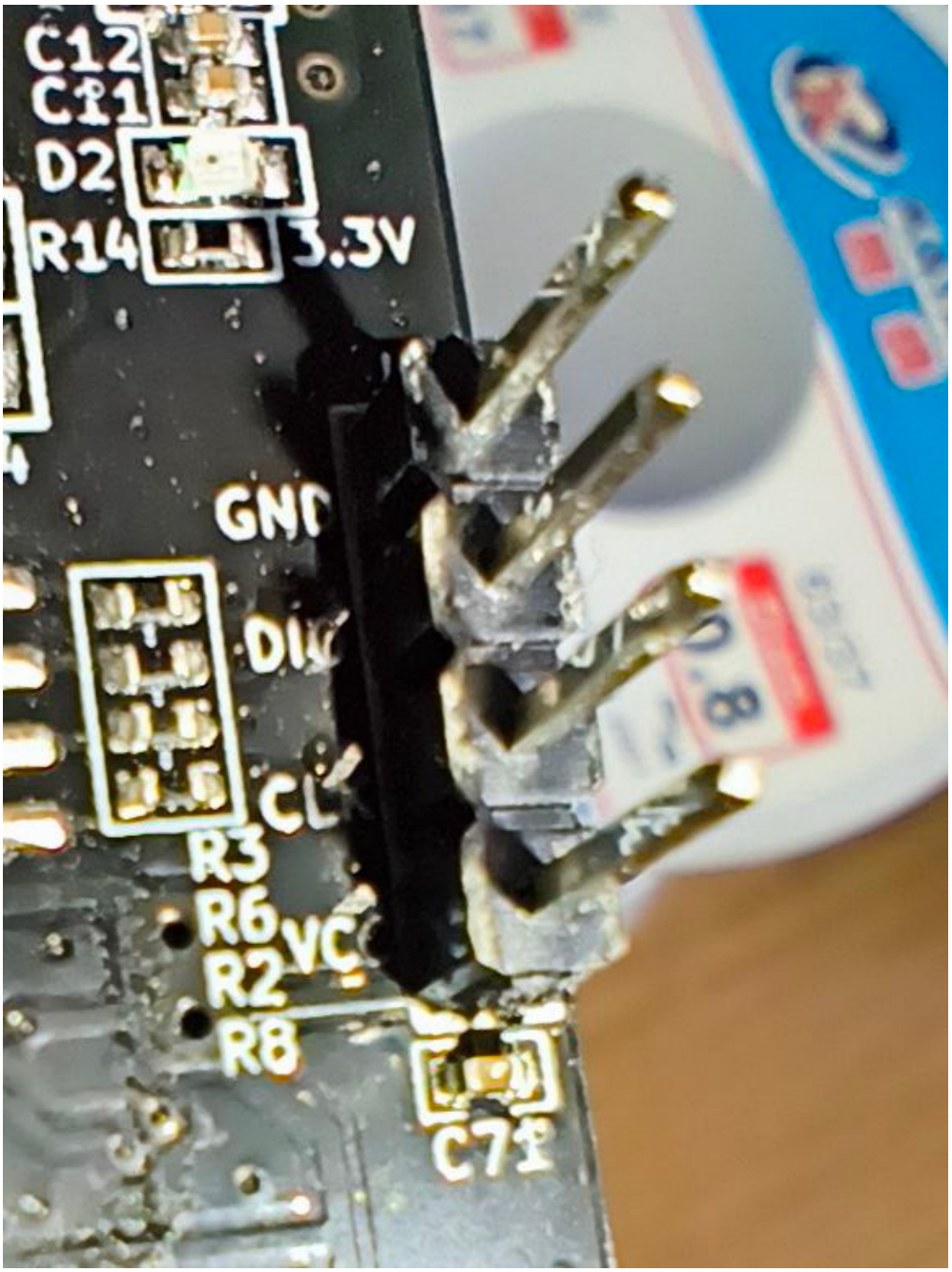
11. IFS Firmware Recovery

To recover the IFS firmware, you need an **ARM J-LINK V9** programmer.


USB
J-Link
SEGGER
www.segger.com
JTAG

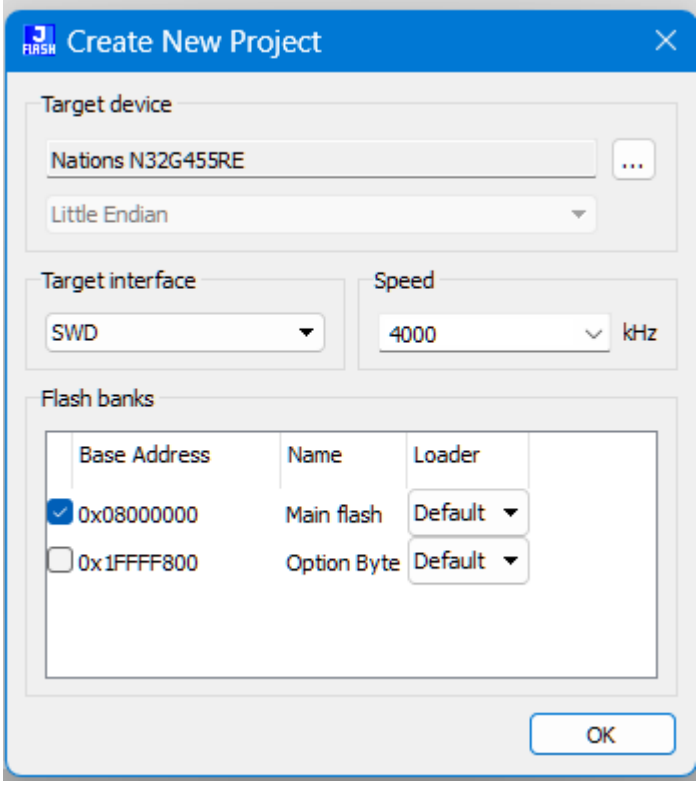


Solder wires to the IFS board.



Connect:

- CLK to SWCK
- DIO to SWIO
- VCC to 3.3
- GND to GND



- Target Device - `Nations N32G455RE`
- Target interface: `SWD`
- Speed: `4000`
- Check the first checkbox.
- Uncheck the second checkbox.

1. Connect.
2. Select the firmware file. **Don't forget to extract it**.
3. Press **F7** and wait for the device to be flashed.

IFS: sensor error: Serial communication error: read failed: device reports readiness to read but returned no data (device disconnected or multiple access on port?)

This error occurs when the native display and the mod access the IFS simultaneously.

It's best to reduce the native display lifetime to 10 seconds: `SAVE_ZMOD_DATA DISPLAY_OFF_TIMEOUT=10`

C5Pro

Creator5 Pro

> **Note**
>
> This document is relevant for Creator 5 and Creator 5 Pro

Important features

- The printer always works with **4 colors** (T0, T1, T2, T3). All four slots are available in the selection menu.
- To turn on the camera, use `CAMERA_ON VIDEO=video67`.
- Klipper may crash. Solution: `Process Profile` -> `Other` -> `Output G-code` -> `Exclude models` — uncheck the checkbox.
- Instead of the `CLOSE_DIALOGS` macro (slow closing), always use `FAST_CLOSE_DIALOGS` (fast closing).
- The `NEW_SAVE_CONFIG` macro does not work.
- No support for Klipper 14; contributions are welcome.
- On Creator 5 / Creator 5 Pro the Z-offset with the native screen and in screenless mode is the same — they are fully synchronized. If the native screen is disabled, you can change the Z-offset during printing via GuppyScreen, HelixScreen, Fluidd or Mainsail — it will be saved.

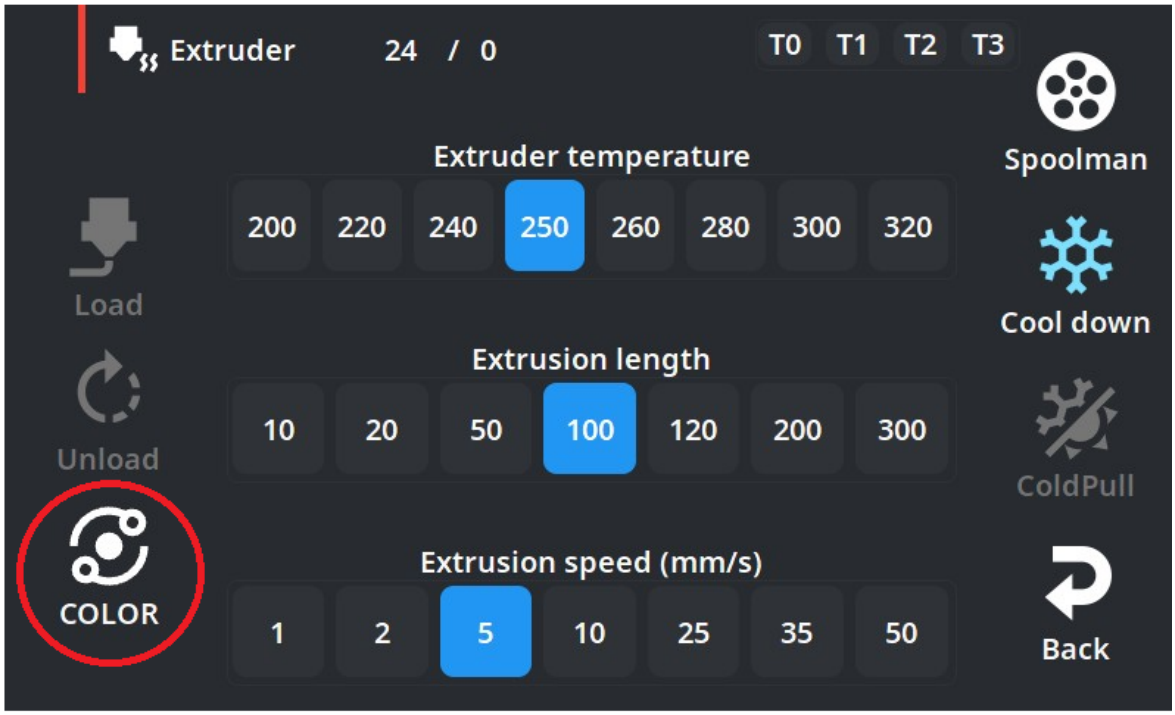
How to prepare a file in Orca

- Send files to print via Octo/Klipper.
- Orca Slicer Profiles
- It is strongly recommended to enable the preprocessor

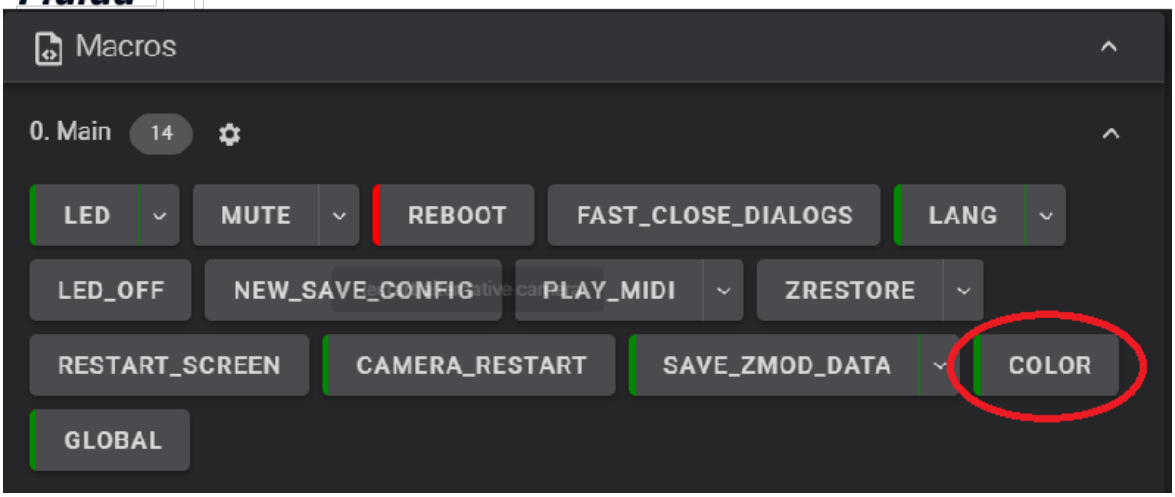
COLOR

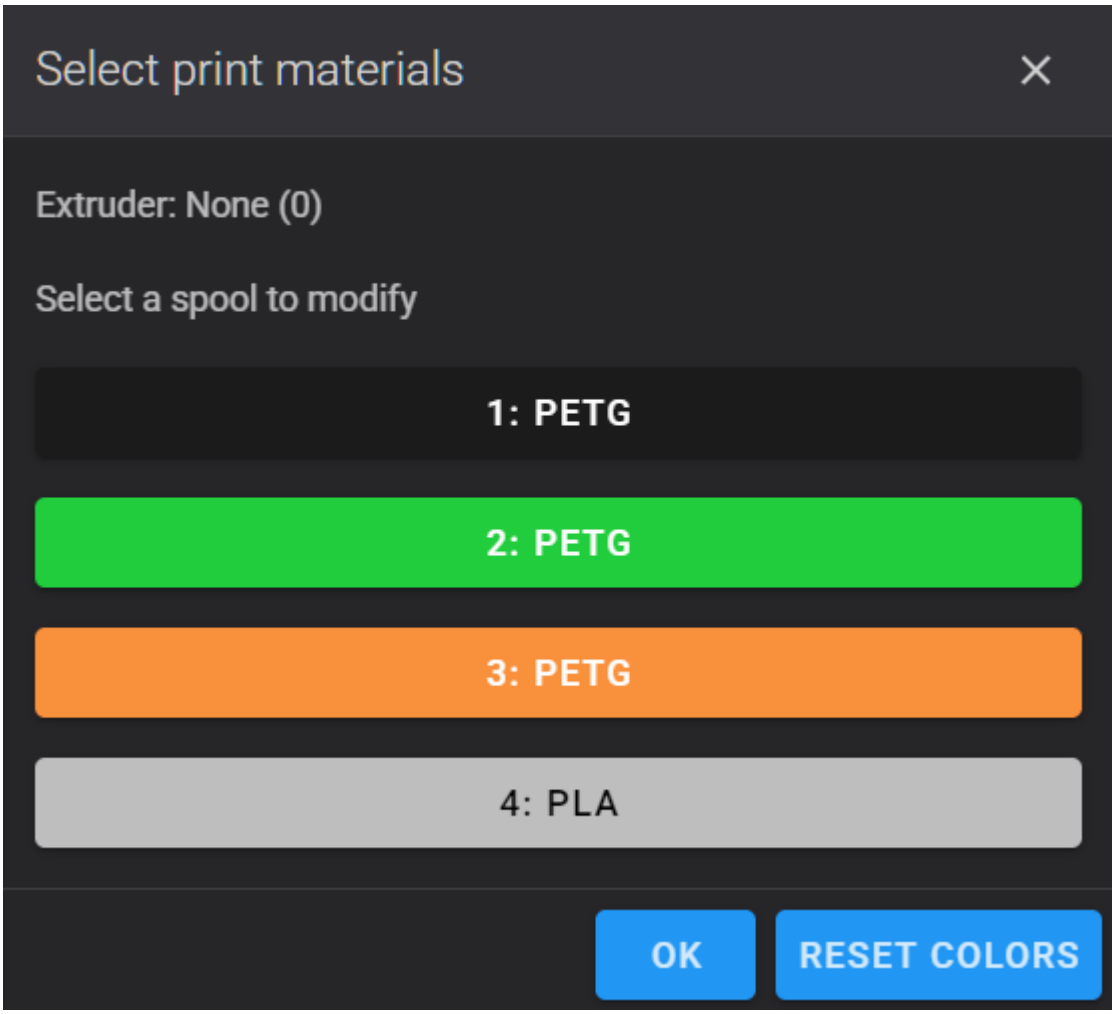
How to use the color and filament type selection menu

Guppy screen

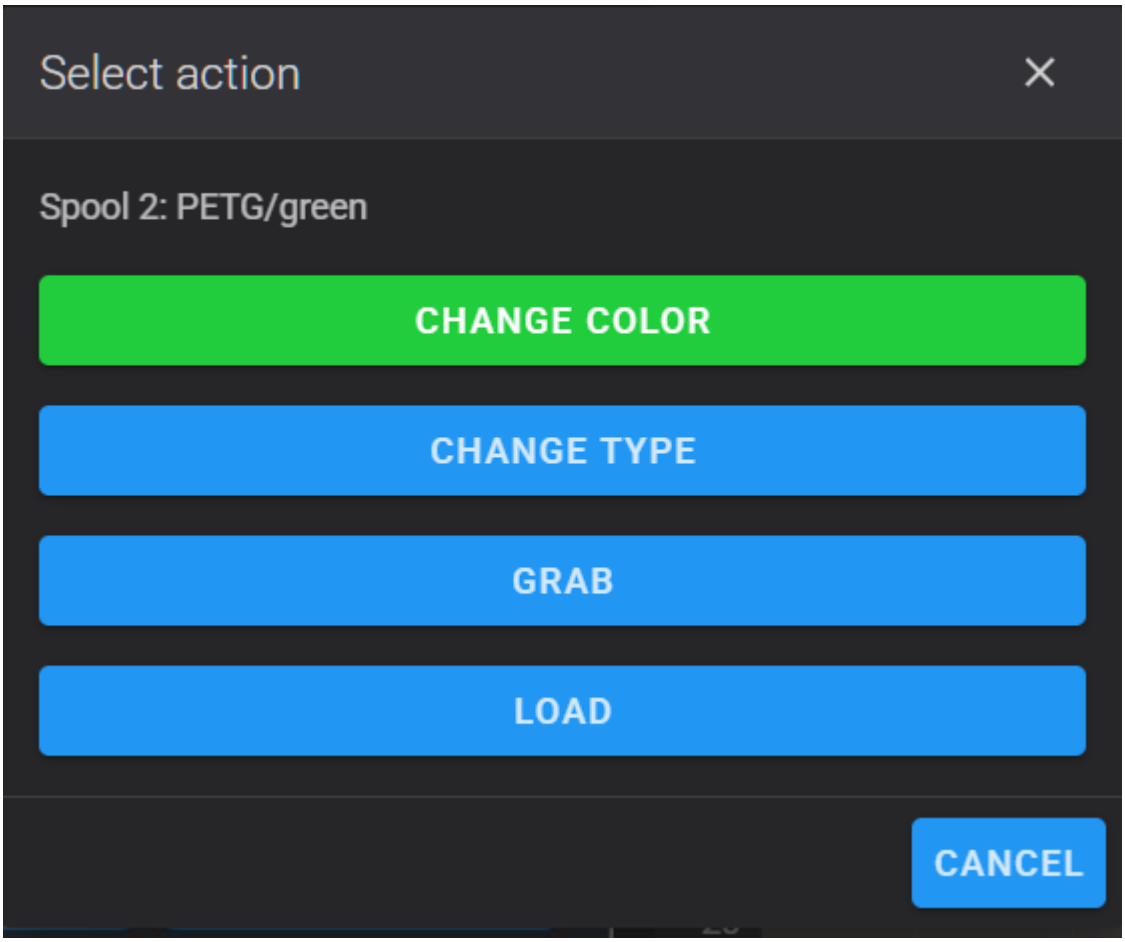


Fluidd





Select the spool you want to work with (for example, spool 2):



You can perform five actions:

- Change the spool color.
- Change the plastic type (PLA, PETG, ABS, ...).
- Pick up this extruder onto the carriage.
- Load new filament into the extruder.
- Remove this extruder from the carriage.

How to change color:

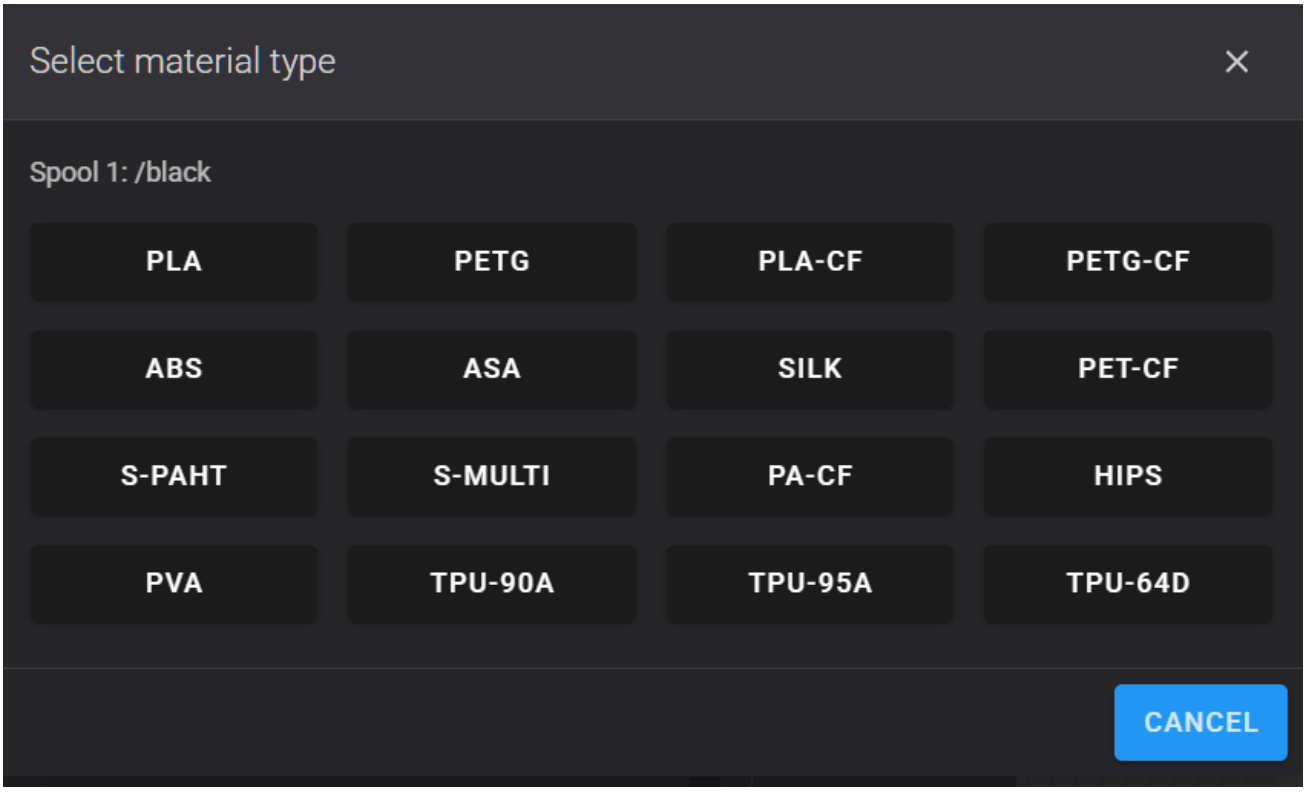
Click "Change color". Select a color from the list. This way the printer and the native screen will understand you best.



After selection you will return back, and the spool color in the list should change.

If the color did not change: close the window with the X and run the `COLOR` macro again. Sometimes the screen does not have time to refresh.

How to change type: Click "Change type". Select a type from the list. Types can be edited for screenless mode.



If the type did not change: close the window with the X and run the `COLOR` macro again. Sometimes the screen does not have time to refresh.

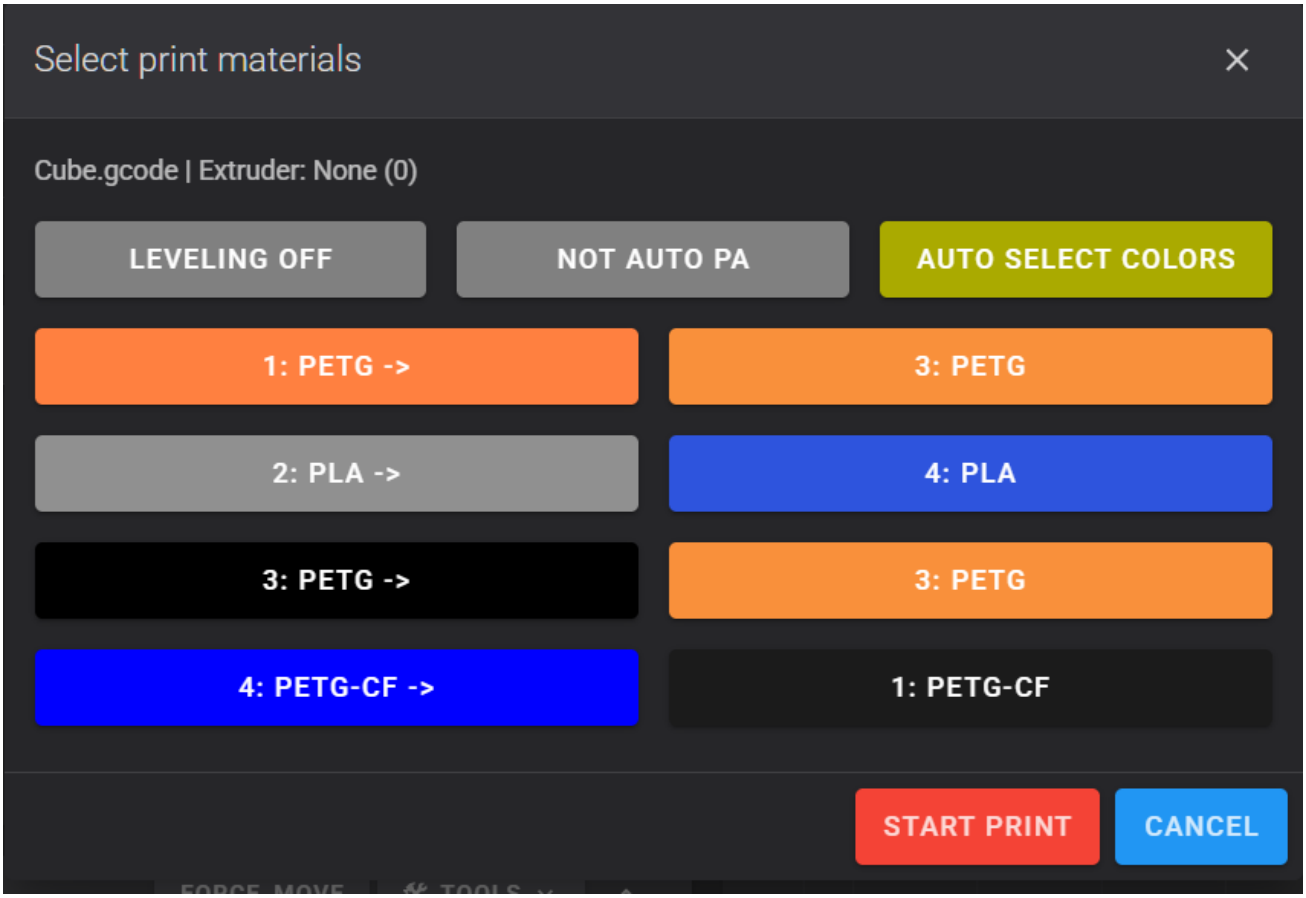
Tip: If several spools have the same color and type, the printer will automatically switch to the next spool when the first one runs out. This is called "endless spool mode".

PRINT

Print menu

This window opens automatically when you start printing, if the `SAVE_ZMOD_DATA SILENT=0` parameter is set by default.

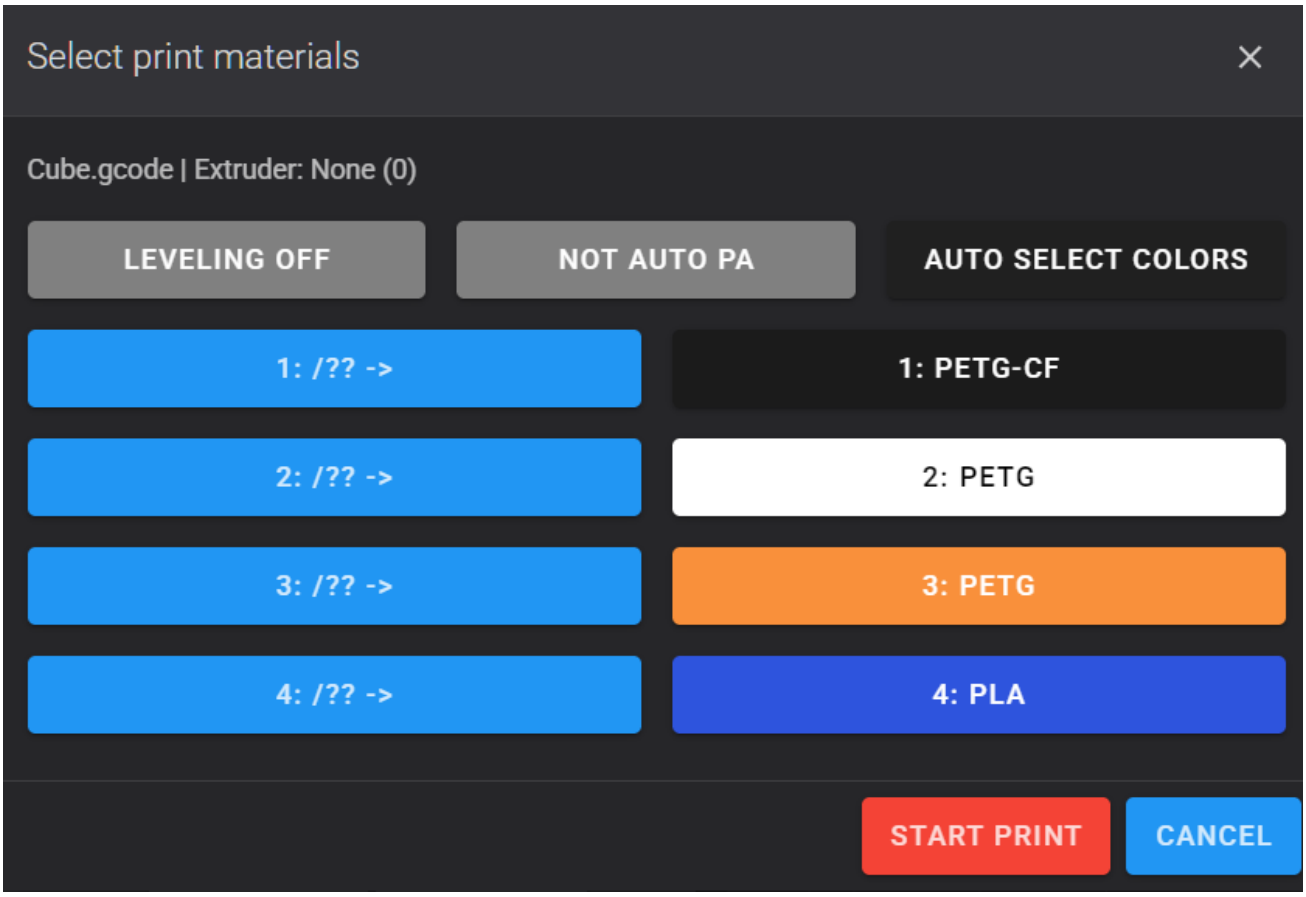
Alternative: with the ORCA_FF parameter, spools for colors are chosen right in OrcaSlicer or Flash Studio when sending a print.



How to understand what is written here:

- In the left column are tool numbers and colors from the file passed from the slicer.
- In the right column are spool numbers and colors loaded/used on the printer.
- `Cube.gcode` – this is the name of the file being printed.
- `1: PETG ->` – this is the first color from the file (orange PETG). It is printed with filament from spool 3 (orange PETG).
- `2: PLA ->` – this is the second color (gray PLA). It is printed with filament from spool 4 (blue PLA). Because there are no other PLA plastics in the printer.
- `3: PETG ->` – the third color (black PETG), printed from spool 3 (orange PETG). Because there are no other PETG plastics in the printer.
- `4: PETG-CF ->` – the fourth color (blue PETG-CF), printed from spool 1 (black PETG-CF). Because there are no other PETG-CF plastics in the printer.

If the image looks like this:



This means that you have disabled the auto color matching option and/or file scanning. You can click the `AUTO_SELECT_COLORS` button or enable it in global parameters:

```
SAVE_ZMOD_DATA SCAN_FILE_COLORS=1 AUTO_ASSIGN_COLORS=1
```

[It is strongly recommended to enable the preprocessor]

Bed mesh building and AUTO PA

There are two important buttons in the print menu:

Leveling (Bed mesh):

- `Probe bed mesh` — before printing, automatic bed mesh building will be performed.
- `Do not probe bed mesh` — the previously saved mesh will be used.

Auto PA (Automatic Pressure Advance selection):

- If the `Auto PA` button is active (green), then **before printing** the printer will automatically select the optimal Pressure Advance value for each used extruder.
- The process takes several minutes, but significantly improves the quality of corners and thin elements.
- If `Auto PA` is off, the PA values from the slicer will be used.

> **Note**
>
> By default the calibration runs from 0.010 to 0.040 in 0.005 steps, in 3 passes. For viscous plastics such as PETG the range can be widened in `mod_data/user.cfg`, for example:
>
> ```
> [zmod_color]
> pa_min: 0.010
> pa_max: 0.080
> pa_count: 3
> ```
>
> - `pa_min` — lower bound, at least 0.01 (default 0.010)
> - `pa_max` — upper bound, from 0.02 to 0.100 and not less than `pa_min` (default 0.040)
> - `pa_count` — number of passes, from 1 to 10 (default 3)
>
> The step is fixed: 0.005. The wider the range and the more passes, the longer the calibration.

Purging all extruders without Auto PA. By default only the first extruder is purged at print start. To purge all used extruders, enable the global parameter PURGE_ALL_EXTRUDERS: `SAVE_ZMOD_DATA PURGE_ALL_EXTRUDERS=1`

Fine tuning

Does not work with the factory screen view, so you first need to turn off the native printer screen using the `DISPLAY_OFF` macro.

How to find these settings:

1. Click the "Configuration" tab.
2. Find and open the `mod_data` folder.
3. In this folder, find and open the `filament.json` file.

filament.json

```
{
    "default": {
        "temp": 220,
        "temp_manual": 250,
        "temp_wait": 120,
        "filament_tube_length": 295,
        "filament_drop_length": 50,
        "trash_x": 275.0,
        "trash_y": 254.0,
        "fan_speed": 255.0,
        "wiper_x": 266.5,
        "wiper_y": 13.8,
        "wiper_z": 1,
        "trash_z": 10.0
    },
    "S-MULTI": {
        "temp": 270,
        "temp_manual": 300,
        "temp_wait": 170
    },
    "PLA": {
        "temp": 220
    },
    "ABS": {
        "temp": 250,
        "temp_manual": 280,
        "temp_wait": 150
    },
```

In this file, for each plastic type (PLA, ABS, PETG, etc.) there is a list of numbers. Here is what they mean:

Parameter	Default	Description
`temp`	220	Temperature to which the nozzle is heated to change filament. The value depends on the material type
`temp_manual`	250	Purge temperature in manual mode (when loading through the menu).
`temp_wait`	120	Idle temperature — the nozzle cools down to it after purging.
`filament_drop_length`	50	**Drop length.** How many millimeters of plastic the printer will extrude into the trash bin before printing; `0` disables moving to the trash bin.
`filament_full_length`	600	**Tube length.** How many millimeters of plastic the printer will extrude after the filament runout sensor triggers

Parameter	Default	Description
`filament_tube_length`	295	Filament loading length when inserting a new spool.

Default temperatures for different materials:

Material	`temp`	`temp_manual`	`temp_wait`
PLA	220	250	120
PETG	240	270	140
PLA-CF	220	250	120
PETG-CF	240	270	140
ABS	250	280	150
ASA	250	280	150
SILK	220	250	120
PET-CF	270	300	170
S-PAHT	280	310	180
S-MULTI	270	300	170
PA-CF	270	300	170
HIPS	250	280	150
PVA	220	250	120
TPU-90A	220	250	120
TPU-95A	220	250	120
TPU-64D	220	250	120

Advanced parameters

Parameter	Default	Description
`trash_x`	275.0	X coordinate of the trash bin.
`trash_y`	254.0	Y coordinate of the trash bin.
`trash_z`	10.0	Z coordinate of the trash bin.
`wiper_x`	266.50	X coordinate of the nozzle cleaning place (rubber).
`wiper_y`	13.80	Y coordinate of the nozzle cleaning place.

Parameter	Default	Description
`wiper_z`	1.0	Z coordinate of the nozzle cleaning place.
`fan_speed`	255.0	Fan speed (from 0 to 255) when cooling the nozzle after purging.

> **Warning!** Changing parameters in the advanced section may lead to incorrect printer operation, filament jams or breakdowns. Change them only if you fully understand what each parameter is responsible for and what the consequences may be.

Global parameters

To prevent the color selection window from showing at the start of printing, use the global parameter **SILENT**: - `0` — show the window (default) - `1` — do not show the window, use previously set colors - `2` — do not show the window; if auto-matching fails, show the selection menu

```
SAVE_ZMOD_DATA SILENT=1
```

To enable scanning of gcode files for information about tools, colors and materials, use the parameter **SCAN_FILE_COLORS**.

```
SAVE_ZMOD_DATA SCAN_FILE_COLORS=1
```

You can also set the value: - `0` — disable the parameter - `1` — full scan of the Gcode file - `2` — check only the data prepared by the slicer script, without scanning the entire file **!If file scanning is disabled**, the printer does not know how many extruders are used, so **Auto PA will be run for all spools**

> **Note**
>
> For 3MF files, auto-matching and scanning are enabled automatically

To enable **automatic color matching** from the gcode file with physical spools, use the parameter **AUTO_ASSIGN_COLORS**. For this function to work, file scanning must be enabled.

```
SAVE_ZMOD_DATA AUTO_ASSIGN_COLORS=30
```

You can configure your own values for aborting printing in silent mode by adding the following numbers: - `1` — printing continues even if auto color assignment failed - `2` — At least one material does not match (for example, gcode says ABS, but you only have PLA loaded) - `4` — At least one color does not match at all (usually because file scanning is disabled) - `8` — At least one color matches poorly - `16` — The same physical spool was assigned to more than one tool index in the file For example, using the value `30` will abort printing in silent mode if any problems with automatic assignment occur, and `AUTO_ASSIGN_COLORS=6` (2+4) will abort printing if at least one material does not match + at least one color does not match at all.

> **Note**
>
> For 3MF files, auto-matching and scanning are enabled automatically

---

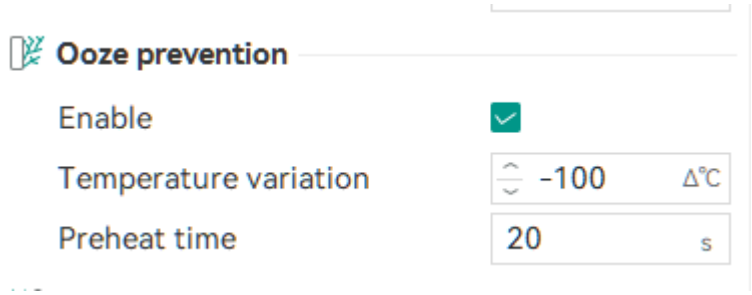
To automatically turn off heating of unused extruders during multi-color printing, use the parameter **unused_extruders_off_time**. It sets the timeout (in minutes) after which an idle tool will be turned off to avoid filament degradation and idle operation.

```
SAVE_ZMOD_DATA unused_extruders_off_time=5
```

Details: UNUSED_EXTRUDERS_OFF_TIME.

You can set the following values (in minutes): * `0` — function disabled (extruders do not turn off during idle) * `5`, `10`, `20`, `40`, `60` — time after which the unused extruder will be turned off

Important: For this option to work correctly, **Ooze prevention** must be enabled in the slicer (`Print settings` > `Multimaterial` > `Ooze prevention`). Without it, the printer cannot correctly handle the temperature modes of idle hotends during filament change.



Shapers from Klipper 14 are enabled by the parameter:

KLIPPER_C5:

- `0` — do not use (default).
- `1` — use shapers from Klipper 14.

```
SAVE_ZMOD_DATA KLIPPER_C5=1
```

Change the number of attempts to pick up or put back the tool

In the Fluidd web interface, open `mod_data/user.cfg` via "Configuration" in the left column and add the lines:

```
[zmod_color]
retry: 3
```

Default is 5. `[Sections]` and macros in this file are not changed by firmware updates.

Filament sync with OrcaSlicer

Does not work with the factory screen view, so you first need to turn off the native printer screen using the `DISPLAY_OFF` macro.

The `orca_lanes` parameter publishes the extruder slots to the Moonraker database. OrcaSlicer reads filament color and type from there for the "Sync filament" button when the printer is added via Octo/Klipper (agent `Moonraker`) or via the `FlashForge` type.

- `True` - publish slots (default)
- `False` - do not publish

If colors are managed by HelixScreen (`helix = 1`), publishing is skipped regardless of `orca_lanes`, so its data is not overwritten.

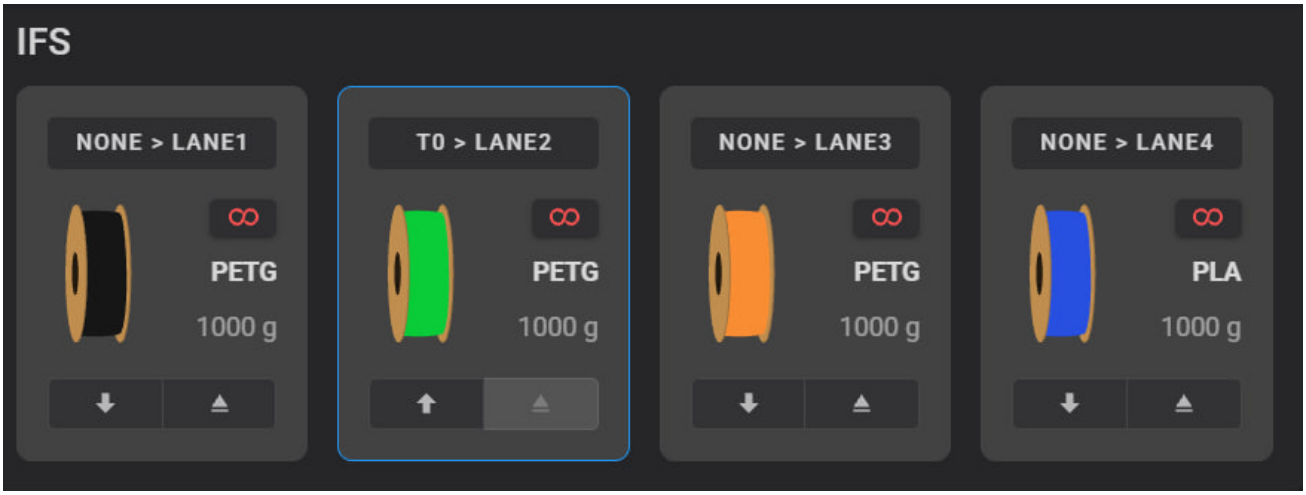
To disable, add to `mod_data/user.cfg`:

```
[zmod_color]
orca_lanes: False
```

> **Details**
>
> Slots are written to the `lane_data` namespace in the same format as AFC and Happy Hare: slot 1 → `lane0`, ..., slot 4 → `lane3`, for example `"lane0": {"lane": "0", "material": "PETG", "color": "#161616", "name": "PETG"}`. All slots are published when Klipper starts, then only the changed slot on every color or type change. A slot with type `?` is removed, filament presence from sensors is not taken into account. The color matched to the printer palette is sent.

AFC panel

The IFS slots (AD5X) and toolheads (Creator 5 Pro) are shown in Fluidd and Mainsail as a standard AFC panel. Works both with and without the native screen.



Enabling

`SAVE_ZMOD_DATA AFC=1`, then restart Klipper. To disable: `SAVE_ZMOD_DATA AFC=0`.

Features

- Color, type and filament presence in each slot.
- Change color and type, load and unload right from the panel.
- Lane selection window before printing in Fluidd (1.37.3+) and Mainsail: the mapping of file tools to slots is sent together with the print command, and the color selection window does not appear after it. The map can also be changed during a print.
- Mappings are kept between prints by default. To reset them after print completion or cancellation, set `SAVE_ZMOD_DATA IDLE_MAP=1`. Mappings are always preserved on print errors and Klipper restarts. See IDLE_MAP.
- The AFC window has "Bed mesh" and "Auto PA" (Creator 5 Pro only) toggles. They change the global settings immediately, before you press "Print".
- Printing via the FlashForge protocol (OrcaSlicer, Flash Studio) uses the mapping from the slicer and starts right away, with the usual preparation (KAMP, MD5 check).
- Printing without a mapping (OrcaSlicer via Moonraker, GuppyScreen, KlipperScreen, macros) shows the color selection window or runs automatic matching, depending on the settings, just as without AFC.
- The infinite spool button reports that the replacement is picked by filament type and color.

zmod_afclite plugin

The zmod_afclite plugin has been removed and replaced by built-in AFC support. On update:

- if the plugin was enabled, it is disabled and AFC is enabled automatically;
- the plugin is removed from the Moonraker configs and its directory is deleted.

Acknowledgements

Thanks to DIEHARDave for the zmod_afclite plugin, which showed the way and the solution.

Add your own filament types

For these settings to work, you need to turn off the native printer screen using the `DISPLAY_OFF` macro.

To add a new filament type, add to `mod_data/user.cfg`:

```
[zmod_color]
filament_NEWTYPE: 300
```

Where `NEWTYPE` is replaced with the desired filament type (for example `HIPS`), and the number is the extruder temperature for loading, unloading and purging this filament. Based on this value, `temp_manual` (+30) and `temp_wait` (−100) will be automatically calculated.

To hide a filament type, add to `mod_data/user.cfg`:

```
[zmod_color]
hide_filament_types: XXX,YYY,ZZZ
```

Where `XXX`, `YYY`, `ZZZ` are replaced with the desired filament types (for example `PLA-CF,PETG-CF,SILK`). This can be used to hide default types or types you added manually. The filament type is not disabled, only hidden in the type selection menu.

Add your own colors

For these settings to work, you need to turn off the native printer screen using the `DISPLAY_OFF` macro.

To add or rename a color, open `mod_data/color/en.json` (use your language instead of `en`) and add a new color or rename an existing one.

For the color name to be displayed, the color name must start with an underscore _.

Example:

```
{
   "ffffff": "white",
   "ffffff1": "_transparent",
   "fef043": "bright yellow",
   "dcf478": "light green",
   "0acc38": "green",
   "067749": "dark green",
   "0c6283": "blue-green",
   "0de2a0": "turquoise",
   "75d9f3": "light blue",
   "45a8f9": "blue",
   "2750e0": "dark blue",
   "46328e": "purple",
   "a03cf7": "bright purple",
   "f330f9": "magenta",
   "d4b0dc": "lilac",
   "f95d73": "pink",
   "f72224": "red",
   "7c4b00": "brown",
   "f98d33": "orange",
   "fdebd5": "beige",
   "d3c4a3": "light brown",
   "af7836": "terracotta",
   "898989": "gray",
   "bcbcbc": "light gray",
   "161616": "black"
}
```

The label `_transparent` will be displayed on the buttons.

Extruder calibration

> Works only **without the native screen** (`display_off` mode).

Extruder calibration allows the printer to know the exact position of each of the four nozzles relative to each other. This is necessary for high-quality multi-color printing.

When to calibrate: - After replacing or repairing an extruder. - If you notice that colors do not align on the model (offset in X, Y or Z).

How to run:

1. **Remove the build plate** from the bed!
2. Run the `CALIBRATE_EXTRUDERS` macro from the menu or enter in the console:

```
CALIBRATE_EXTRUDERS
```

3. A confirmation window will appear. Click `OK`.

What will happen:

- The printer will perform homing (G28).
- Heat the bed to 65°C.
- Take each of the 4 extruders (T0–T3) in turn.
- For each extruder: heat the nozzle, perform a purge, clean against the rubber, then use sensors to determine the exact X, Y and Z coordinates.
- The results are automatically written to `rw/extruder.json`.
- At the end, the printer will output the found offsets for each extruder to the console.

Additional parameters (for advanced):

Parameter	Default	Description
`BED_TEMP`	65.0	Bed temperature during calibration
`SEARCH`	14.0	Sensor search radius (mm)
`HOVER`	0.6	Hover height above the point
`SAFE_Z`	10.0	Safe Z height

Example with parameters:

```
CALIBRATE_EXTRUDERS BED_TEMP=70 SEARCH=12
```

> **Warning!** Do not interrupt calibration. The process takes several minutes.

VFA calibration

> Works only **without the native screen** (`display_off` mode).

VFA (Vertical Fine Artifacts) calibration allows reducing vertical artifacts on the print surface caused by stepper motor resonances.

How to run:

Enter in the console:

```
CALIBRATE_VFA T=0
```

Where `T=0` is the extruder number (0–3) that will be used during calibration.

What will happen:

- The printer will take the specified extruder.
- Reset all G-code offsets.
- Move the head to the bed center (X130 Y130).
- Run automatic resonance calibration (`STEPPER_RESONANCE_FACTORY_CALIBRATE`).
- Return the extruder to its place.
- Save the configuration (`SAVE_CONFIG`).

> **Tip:** It is recommended to perform VFA calibration when visible vertical stripes appear on the print surface.

`T_INFO` macro

The `T_INFO` macro shows the current state of all extruders and printer sensors.

How to run:

```
T_INFO
```

What will be output to the console:

```
// T0: home
// T1: HEAD
// T2: home
// T3: home
// Door: Close
// Top: Close
// Offset: X=0.000 Y=0.000 Z=0.061 (0.000)
```

How to read:

- `home` — the extruder is in its place (in the parking pocket).
- `HEAD` — the extruder is installed on the print head.
- `?` — undefined state (sensors did not trigger).
- `ERROR (both)` — error: the extruder is both home and on the head (sensor desync).
- `Door` — front door state (`Close` / `Open`).
- `Top` — top cover state (`Close` / `Open`).
- `Offset` — current G-code offsets along the X, Y, Z axes.

Ventilation modes

Creator 5 Pro is equipped with a chamber ventilation system with several fans. Proper ventilation control is critically important for the print quality of different materials.

External intake (PLA, TPU):

The `AIR_CIRCULATION_EXTERNAL` macro turns on chamber exhaust and fresh air supply. It is needed for PLA and TPU so the plastic cools quickly and does not soften from chamber heat.

```
AIR_CIRCULATION_EXTERNAL
```

Fan	Speed
`chamber_fan` (exhaust)	0.5
`chamber_cool_fan` (cooling)	0.7
`chamber_heat_fan` (heating)	0.0
`chamber_loop_fan` (circulation)	0.0

Internal circulation (ABS, ASA):

The `AIR_CIRCULATION_INTERNAL` macro turns on internal circulation and chamber heating. It is needed for ABS and ASA to avoid delamination and warping from temperature changes.

```
AIR_CIRCULATION_INTERNAL
```

| Fan | Speed | |---|---| | `chamber_fan` (exhaust) | 0.0 | | `chamber_cool_fan` (cooling) | 0.0 | | `chamber_heat_fan` (heating) | 0.9 | | `chamber_loop_fan` (circulation) | 0.3 |

Stopping ventilation: The `AIR_CIRCULATION_STOP` macro completely turns off all chamber fans.

```
AIR_CIRCULATION_STOP
```

Where to add ventilation macros

> **Recommendation:** It is best to add ventilation macro calls to the **filament code** in the slicer. This will ensure automatic mode switching when the material changes.

In OrcaSlicer:

1. Open filament settings.
2. Go to the "Filament Settings" tab.
3. In the **Filament start G-code** field, add the needed macro: - For PLA: `AIR_CIRCULATION_EXTERNAL` - For ABS: `AIR_CIRCULATION_INTERNAL` - For TPU: `AIR_CIRCULATION_EXTERNAL`

Example for PLA:

```
; Filament start gcode
AIR_CIRCULATION_EXTERNAL
```

Example for ABS:

```
; Filament start gcode
AIR_CIRCULATION_INTERNAL
```

Thus, during multi-color printing with different materials, ventilation will automatically switch to the required mode for each extruder.

Print acceleration

To disable the firmware slowdowns on short perimeters, open the Fluidd web interface -> left column -> `Configuration` tab -> `mod_data/user.cfg` and add three lines:

```
[printer]
short_move_limit: False
short_extrude_move_limit: False
```

Starting with factory firmware 1.9.9, this setting significantly speeds up printing, but can cause printer crashes when printing with fuzzy skin.

Disabling fast head return and preheating

Add to `mod_data/user.cfg`:

```
[virtual_sdcard]
enable_speed_return: False
enable_preheat: False
```

- **enable_speed_return**:
  - `enable_speed_return: False` — the head returns to the model from the hotend pickup area at the speed and along the trajectory set in the slicer.
  - `enable_speed_return: True` — the head returns to the model from the hotend pickup area at 600 mm/s along a trajectory chosen by the printer firmware (collisions with the edges of the prime tower are possible).
- **enable_preheat**:
  - `enable_preheat: False` — disables predictive background scanning of the G-code file during printing, unloading the CPU and disk. Predictive heating is calculated more accurately on the OrcaSlicer side.
  - `enable_preheat: True` — uses predictive background scanning of the G-code file to preheat the next nozzle. Speeds up heating when more than two nozzles are used within a short time, since the printer cannot heat more than two nozzles simultaneously.

Disabling the open door notification

To remove notifications about an open cover or door in screenless mode:

Add to `mod_data/user.cfg`:

```
[gcode_button topDoor]
press_gcode:
release_gcode:

[gcode_button frontDoor]
press_gcode:
release_gcode:
```

Disabling the color selection window when inserting filament

To stop the color and type selection window from appearing when filament is inserted in screenless mode:

Add to `mod_data/user.cfg`:

```
[gcode_macro _SENSOR_INSERT_HANDLER]
gcode:
```

Plugins

Any user can create and connect their own plugin to **zmod**.

Plugins included with Z-Mod:

1. Recommend - Settings recommended for immediate use after installing the mod.
2. G28_tenz – Z-axis parking using load cells
3. Nopoop - Maximum waste reduction by ninjamida
4. TimeLapse - Moonraker Timelapse
5. Notify - Receive notifications in Telegram and more than 100 other services

External plugins not developed by the Z-Mod author.

1. Bambufy - Compatible with Bambu Studio, improves feed tower control, provides accurate time and material consumption estimates, reduces waste, supports Mainsail, quick color changes, and advanced printing features. CANNOT BE USED WITH THE NATIVE SCREEN.
2. lessWaste - a fork of Bambufy
3. Dryer - Drying filament via heated bed
4. IFS Jacker - Plugin to support the IFS Jacker hardware mod, for auto-detection of available channel count and Klipper integration for fans / LEDs / sensors connected via an IFS Jacker
5. HelixScreen - an alternative screen implementation
6. QuickSwap - Plugin for faster color changing on AD5X
7. Flook32 - Plugin for connecting the Flook32 dryer En
8. Print Handy - Bambu Handy for every printer: paste a model link in Discord, Telegram or Matrix and it slices, matches your Spoolman spools, asks before printing, watches the camera for spaghetti and roasts your model.
9. ~~Zmod AFC Lite~~ - removed and replaced by built-in AFC support.
10. Telegram Notify - Telegram print notifications without the Apprise library: start, finish, error, pause, progress, camera snapshot and Z-Mod messages. Saves about 5 MB of Moonraker memory compared to notify. Do not enable together with notify.
11. Rivet - an alternative screen for the AD5M / AD5M Pro

To enable the repository of external plugins, run the command `PLUGINS`.

Plugin Management

Enable plugin:

```
ENABLE_PLUGIN name=g28_tenz
```

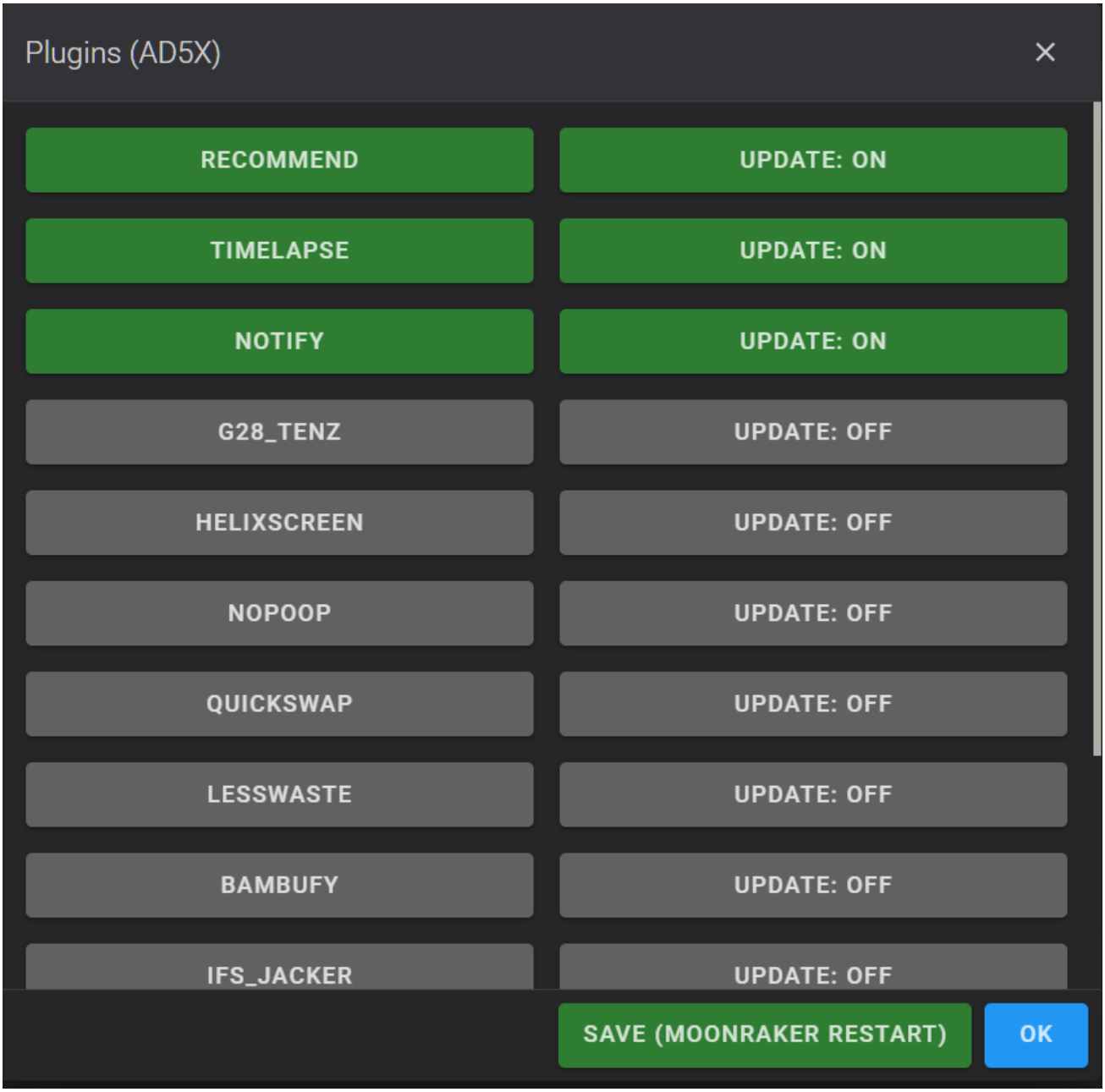
— downloads the plugin and restarts Klipper on success.

Disable plugin:

```
DISABLE_PLUGIN name=g28_tenz
```

PLUGINS

Displays the plugin management menu.



In this menu you can enable, disable and completely remove additional plugins.

- Left column (activation): click to enable or disable the plugin.
  - Green button — the plugin is active.
  - Gray button — the plugin is disabled.
- Right column (updates): enables or disables automatic updates via Moonraker.
  - UPDATE: ON — updates are enabled.
  - UPDATE: OFF — updates are disabled.

How to completely remove a plugin:

If you no longer need a plugin, make both of its buttons gray (disable the plugin itself and its updates), press SAVE (MOONRAKER RESTART), and then reboot the printer. The system will automatically delete its folder from `mod_data/plugins/`.

Installing Classic Klipper Plugins with Python Modules

For classic Klipper plugins that work with Python modules (e.g., klipper-led_effect), a special installation process is required that involves creating a symbolic link to the Klipper module.

Example: Installing led_effect

`led_effect` is a plugin for controlling WS2812 RGB LED strips through Klipper.

Step 1: Clone the repository

Run these commands in the chroot environment:

```
# For AD5M:
chroot /data/.mod/.zmod/
# For AD5X:
chroot /usr/data/.mod/.zmod/

# Same for all models:
cd /opt/config/mod_data/plugins/
git clone https://github.com/julianschill/klipper-led_effect.git
```

Step 2: Add an entry to the Moonraker config

In the file `mod_data/user.moonraker.conf`, add the following section:

```
[update_manager led_effect]
type: git_repo
channel: stable
path: /opt/config/mod_data/plugins/klipper-led_effect
origin: https://github.com/julianschill/klipper-led_effect.git
is_system_service: False
primary_branch: master
```

Step 3: Create a symbolic link to the Klipper module

Create a symbolic link to connect the module to Klipper:

```
exit
# Native Klipper
ln -s /opt/config/mod_data/plugins/klipper-led_effect/src/led_effect.py /usr/prog/klipper/
klippy/extras/led_effect.py
# Klipper 14
ln -s /opt/config/mod_data/plugins/klipper-led_effect/src/led_effect.py /usr/data/zmod/
klipper/klippy/extras/led_effect.py
```

Replace:

- `klipper-led_effect` with your plugin's folder name
- `led_effect.py` with the module name (may differ depending on the plugin)

Step 4: Restart Klipper

After creating the symbolic link, you need to restart Klipper using the restart button in the Fluidd/Mainsail web interface.

Important Notes

> **The module must be compatible with your Klipper version** Ensure that the plugin version is compatible with your installed Klipper version.

Creating Your Own Plugin

Plugin example: https://github.com/ghzserg/g28_tenz (In all examples below, the name `g28_tenz` is used — replace it with your plugin's name.)

Adding a Plugin

In the file `mod_data/user.moonraker.conf` add the following section:

```
[update_manager g28_tenz]
type: git_repo
channel: dev
path: /root/printer_data/config/mod_data/plugins/g28_tenz
origin: https://github.com/ghzserg/g28_tenz.git
is_system_service: False
primary_branch: main
```

- **Plugin path**: `/root/printer_data/config/mod_data/plugins/g28_tenz`
- **Source**: `https://github.com/ghzserg/g28_tenz.git`

> Stable plugins may be included in the zmod distribution, but are updated and maintained by their respective authors.

Installation Script

After calling `ENABLE_PLUGIN`, the file `install.sh` will be executed automatically.

After calling `DISABLE_PLUGIN`, the file `uninstall.sh` will be executed automatically.

Update Script

When the Update Manager updates the plugin, `update.sh` will be executed automatically if it exists.

Single-language Plugin

Must contain the file:

```
g28_tenz.cfg
```

All functionality goes inside this file.

Multi-language Plugin

Files are placed in language-specific subdirectories:

```
en/g28_tenz.cfg
ru/g28_tenz.cfg
de/g28_tenz.cfg
...
```

All output strings must be escaped, for example:

```
RESPOND PREFIX="info" MSG="===Cutting the filament==="
```

Translation

Translations are stored in the `translate/` directory in files like `de.csv`:

```
Cutting the filament;Schneiden des Filaments
```

Format:

```
English phrase;Translation in target language
```

To generate language files, run:

```
./Make.sh
```

The script will create the required directories and `.cfg` files.

Telegram

Feature / Capability	Notify Plugin	Telegram Notify Plugin	Moonraker Telegram Bot
Requires external server	–	–	+
Remote printer control	– (possible via zmod.link)	– (possible via zmod.link)	+
Timelapse creation	– (possible via timelapse)	– (possible via timelapse)	+
Print event notifications (start, pause, cancel, finish)	+	+	+
Filament sensor notifications	+	+	+
Print progress percentage	+	+	+
Multiple printers via a single bot	+	+	–
Notifications via other services	+	–	–
Spoolman	-	-	+
Additional Moonraker memory on the printer	~6 MB	~0.5 MB	–

> **Info**
>
> If you only need notifications, use the Notify plugin (Telegram and 100+ other services) or the Telegram Notify plugin (Telegram only, uses less memory).

Telegram Notify Plugin

Print notifications in Telegram without the Apprise library: Moonraker sends messages to the Telegram Bot API itself. This saves about 5 MB of Moonraker memory compared to notify, which is noticeable on printers with 128 MB of RAM. Services other than Telegram are not supported.

It does the same as notify does for Telegram: print start, finish, error, cancel, pause and resume, Z-Mod messages (filament sensors, printer power-on), progress in percent, camera snapshot.

Do not enable notify and telegram_notify at the same time.

Setup:

1. Register a bot and get the `bot_token`.
2. Send the bot any message and find out your `chat_id`, for example via @userinfobot.

3. Enable the plugin: `ENABLE_PLUGIN name=telegram_notify`.
4. Set `bot_token` and `chat_id` in `mod_data/telegram_notify.conf` and restart Moonraker.

More details in the plugin description.

Telegram Bot

Description

Core Idea: Our hardware is very slow and has limited memory. Therefore, running the moonraker-telegram-bot directly on the hardware is impractical. However, we can run it on an external server. This requires any server (physical/virtual) that the printer can reach via SSH.

The new version automatically generates SSH keys (used for passwordless authentication).

Key locations:

- `/mod_data/ssh.pub.txt` — public key. Copy its contents to the server's `~/.ssh/authorized_keys` file.
- `/mod_data/ssh.key` — private key. Used by the printer to connect to the server.

You don't need the keys themselves. Simply call the ZSSH_ON macro with the following parameters:

- `SSH_SERVER` — IP or hostname of your server
- `SSH_PORT` — SSH port on the server (default: 22)
- `SSH_USER` — SSH server username
- `VIDEO_PORT` — Server port for receiving video stream from the camera (default: 8080)
- `MOON_PORT` — Server port for receiving data from Moonraker (default: 7125)
- `REMOTE_RUN` — Command to execute on the remote server

SSH usage consumes approximately 300 KB of memory.

If the printer and server are on the same network, SSH is optional. Refer to the telegram.conf configuration file. Download the configuration file from the printer at `mod/telegram/`. Sample-config

---

Bot Registration

How to register your bot:

1. Go to @BotFather
2. Send `/newbot`
3. Enter any name you like
4. Enter the bot name (must end with `_bot`, e.g., `ff5msuper_bot`)
5. You'll receive a long ID — add this to the bot's `bot_token` parameter in the settings.

Server Deployment

One-Command Telegram Bot Installation on Debian

If you only need notifications, use the Notify plugin (Telegram and 100+ other services) or the Telegram Notify plugin (Telegram only, uses less memory).

Install the Telegram bot with one command on Debian:

Execute as the `root` user:

```
bash <(wget --cache=off -q -O - https://github.com/ghzserg/zmod_ff5m/raw/refs/heads/1.7/telegram/telegram.sh)
```

If `wget` is not installed:

```
apt update && apt install wget -y
```

This script will:

1. Install Docker
2. Download docker-compose.yml and telegram.conf Sample-config
3. Create a `tbot` user
4. Guide you through bot registration and request the `bot_token`
5. Guide you to obtain the `chat_id` and request it
6. Install ff5m.sh

Add SSH keys manually.

Step-by-Step Telegram Bot Installation

If you only need notifications, use the Notify plugin (Telegram and 100+ other services) or the Telegram Notify plugin (Telegram only, uses less memory).

1. Copy docker-compose.yml from the printer's `mod/telegram/` directory.

2. Install Docker (Debian instructions):

   ```
   apt update
   apt upgrade -y
   apt install docker.io docker-compose docker apparmor -y
   ```

3. Create a directory for the bot:

   ```
   mkdir bot1
   cd bot1
   ```

4. Place docker-compose.yml here.

5. Create subdirectories:

   ```
   mkdir config log timelapse_finished timelapse
   chmod 777 config log timelapse_finished timelapse
   ```

6. Copy telegram.conf from `mod/telegram/` to `config/` and edit it.

Sample-config

For more bot configuration details, see here.

1. Start the bot:

```
docker-compose up -d
```

2. Create a user and grant permissions:

```
useradd tbot
usermod -a -G docker tbot
```

Adding SSH Keys

1. Log in as the `tbot` user:

```
su - tbot
```

2. Add SSH keys:

```
mkdir .ssh
cat > .ssh/authorized_keys
```

Paste the public key from `mod_data/ssh.pub.txt`, then press `Ctrl + D`.

Starting ZSSH on the Printer

After setup, run the ZSSH_ON macro on the printer with the required parameters.

SSH will automatically restart 3 minutes after each reboot.

Spoolman

Edit the docker-compose.yml file.

Add:

```
  spoolman:
    image: ghcr.io/donkie/spoolman:latest
    restart: unless-stopped
    volumes:
      - ./spoolman:/home/app/.local/share/spoolman
    ports:
      - "7912:8000"
    environment:
      - TZ=Asia/Yekaterinburg
```

Open the port in the firewall, if you are using one:

```
iptables -I INPUT -p tcp --dport 7912 -j ACCEPT
```

Create the `spoolman` directory:

```
mkdir spoolman
chmod 777 spoolman
```

Restart Docker:

```
docker-compose down && docker-compose up -d
```

or

```
docker compose down && docker compose up -d
```

On the printer, add to `mod_data/user.moonraker.conf`

`external_IP` — the external IP address of the server running Docker.

The printer MUST have access to this IP.

```
[spoolman]
server: http://external_IP:7912
sync_rate: 5
```

TimeZone

Edit the file docker-compose.yml

Specify your time zone. The example file specifies `TZ=Asia/Yekaterinburg`

`docker-compose down && docker-compose up -d` or `docker compose down && docker compose up -d`

Installation and Setup for Armbian (by noyhay)

If you only need notifications, use the Notify plugin (Telegram and 100+ other services) or the Telegram Notify plugin (Telegram only, uses less memory).

Download Debian Minimal/IOT images with Armbian from the website https://www.armbian.com/download/

Install Armbian on an SD card using balenaEtcher from https://etcher.balena.io/

Boot the system, set a root password, and create a new user

Proceed under the root user:

```
su - root
```

Configure Wi-Fi if not set up during user creation:

```
sudo armbian-config
```

Update the system:

```
sudo apt update && sudo apt upgrade -y
```

Install AppArmor (Linux kernel security module):

```
sudo apt install -y apparmor apparmor-utils
```

Install Telegram bot:

```
<(wget --cache=off -q -O - https://github.com/ghzserg/zmod_ff5m/raw/refs/heads/1.7/telegram/
telegram.sh)
```

Add SSH keys: Switch to the `tbot` user from root:

```
su - tbot
```

Set up SSH keys:

```
mkdir -p .ssh
cat > .ssh/authorized_keys
```

Enter the public key from the file `mod_data/ssh.pub.txt` on your host system, then press **CTRL+D**

Reboot the system:

```
sudo reboot
```

Telegram Bot Installation On Kubernetes Via Helm (by aldiserg)

If you only need notifications, use the Notify plugin (Telegram and 100+ other services) or the Telegram Notify plugin (Telegram only, uses less memory).

Download and install helm https://helm.sh/docs/intro/install/

Clone the repository with the helm chart

```
git clone https://github.com/aldiserg/zmod_ff5m_tg_bot.git
```

Changes:

1. persistence.enabled change to "false" if you do not plan to store timelapses permanently
2. persistence.volumes...storageClass change if you will use external storage for timelapses
3. configMapAsFile.data.telegram.conf - this is the main config file; change the following fields:

```
[bot]
server: 3D_printer_host:7125
bot_token: 1111111111:AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
chat_id: 111111111

[camera]
host: http://3D_printer_host:8080/?action=stream
host_snapshot: http://3D_printer_host:8080/?action=snapshot
```

How to get bot_token and chat_id: see here

Installation:

Run the commands from the directory containing the chart

```
helm upgrade --install zmod_ff5m_tg_bot ./ -n default -f values.yaml
```

Solution to a Problem Connecting the Printer to the Server via SSH

After reinstalling the operating system on the server, the **SSH host keys** were changed, and the printer refused to connect with the following error message:

```
ssh-ed25519 host key mismatch ...
```

Solution

> **Important**
>
> The default password for the printer's root access is usually `root`.

> **Step 1: Delete stored keys on the printer**
>
> Connect to the printer via SSH:
>
> ```
> ssh root@<printer_IP> -p 22
> ```
>
> Then, execute the following commands to remove the old stored host keys:
>
> ```
> cd ~/.ssh
> rm -f know*
> ```

> **Step 2: Regenerate the SSH key pair (if required)**
>
> If you need to generate a new key pair, you must first delete the existing files:
>
> ```
> cd ~/mod_data
> rm -f ssh.pub.txt ssh.key
> ```
>
> After a **reboot**, the service will automatically generate new keys.
>
> The new public key (`ssh.pub.txt`) must be added to the server's `authorized_keys` file:
>
> ```
> ~/.ssh/authorized_keys
> ```
>
> Make sure to add it for the specific user running the connection (e.g., `tbot`).

> **Step 3: Test the connection**
>
> Once you have cleared the keys on the printer and updated the `authorized_keys` on the server, run the **ZSSH_ON** macro on the printer. The connection should now be established without errors.

Alternative to the bot

Because Telegram has recently experienced occasional outages, an alternative is to generate timelapses on a separate server (the same server previously used for the Telegram bot).

An example is available in the printer_timelapse repository. With a few small changes, it can be combined with web-timelapse to provide similar functionality without using a messaging app.

The main workflow is to poll the printer for the start of a print, capture screenshots while printing, and then create a video and preview image when the print finishes. Multiple printers are supported.

FAQ

Frequently Asked Questions

> **Note**
>
> Installed the mod.
>
> Don't want to figure anything out - print as you did before.
>
> No need to configure or change anything anywhere.
>
> Decided you're ready to move forward - proceed by reading the documentation.

Configuration Storage

Access the **mod_data** folder via Fluidd web interface: `Configuration` → `Configuration Files` → `mod_data`

- Custom Klipper settings go into `mod_data/user.cfg`, which can override/supplement `printer_base.cfg` and Z-Mod files.
- Custom Moonraker settings go into `mod_data/user.moonraker.conf`.
- Custom MIDI files are stored in `mod_data/midi/`.
- Global mod settings are saved via the SAVE_ZMOD_DATA macro.
- Shutdown scripts are stored in `mod_data/power_off.sh`.
- Power on scripts are stored in `mod_data/power_on.sh`.

You cannot make changes to zmod and plugin files, as this will break the update system.

Any function can be overridden in `mod_data/user.cfg` or `printer.cfg`

Known Peculiarities:

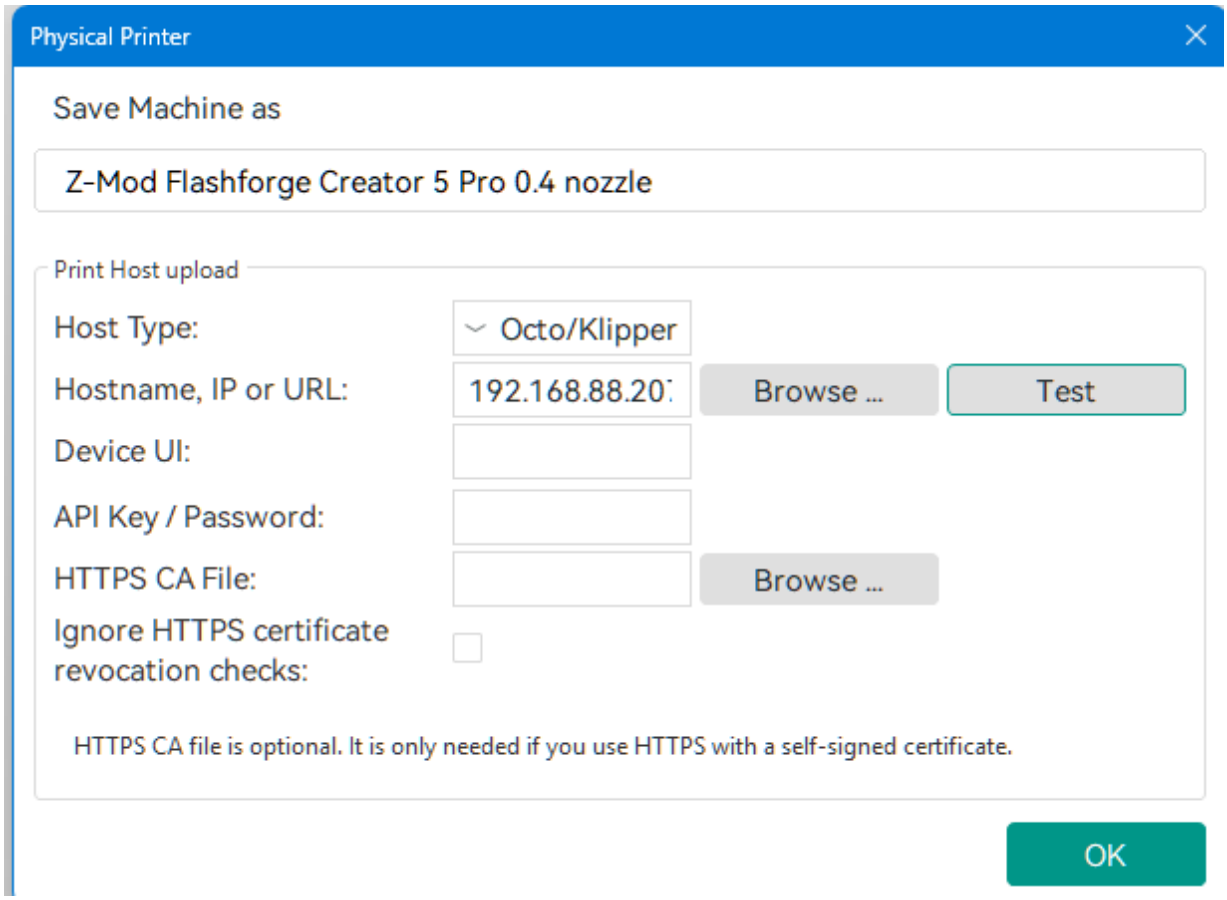
- During actions like `M109` (extruder heating), `M190` (bed heating), PID calibration, or any gcode-pausing task, the stock screen freezes.
- Restarting Klipper (after saving the bed mesh, PID, shapers, etc.) freezes the stock screen (use NEW_SAVE_CONFIG for restarts or the global parameter).
- After canceling a print, press "OK" on the stock screen (use CLOSE_DIALOGS or FAST_CLOSE_DIALOGS or the global parameter).
- The stock screen always loads the `DEFAULT_MESH` profile when starting a print and deletes the `Default` profile post-print.

Screenless Version Notes:

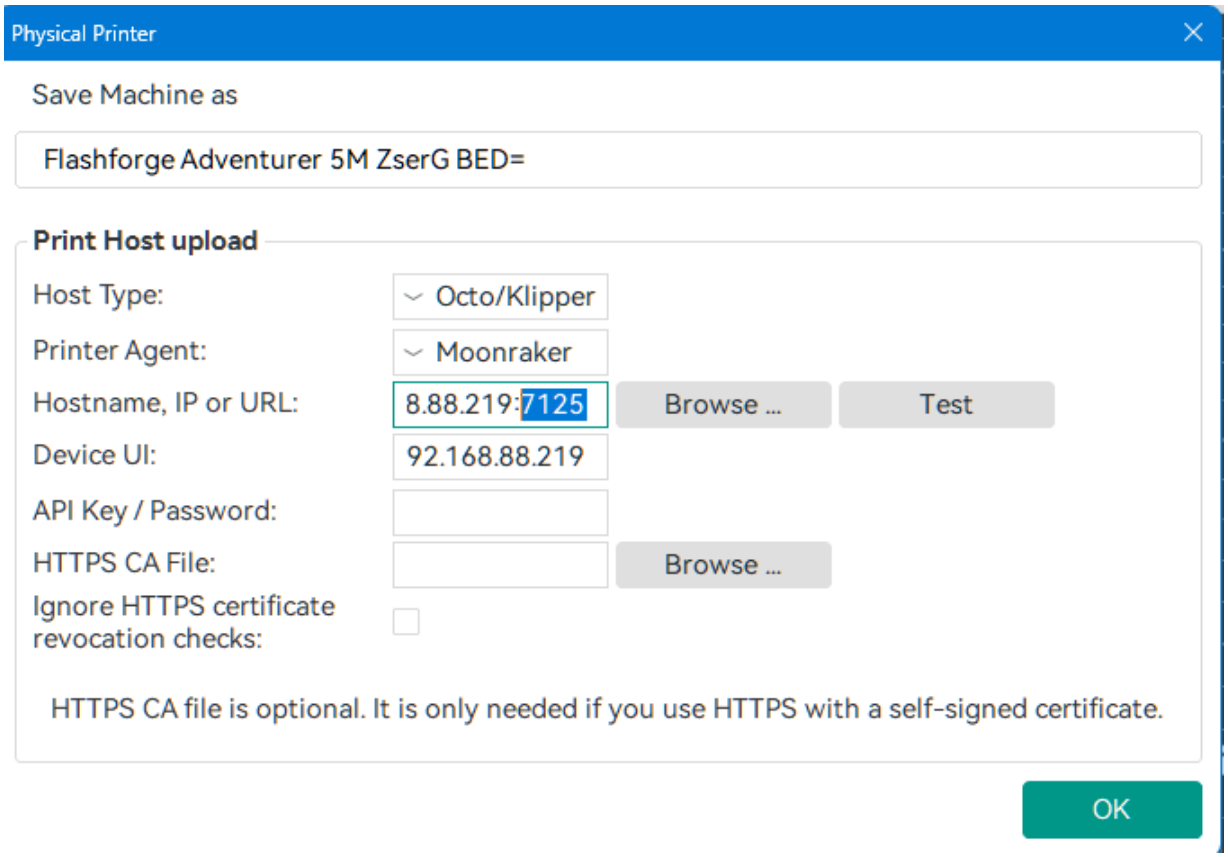
- Remove all start gcode and use START_PRINT and END_PRINT macros.
- Stock camera disabled; use the alternative via CAMERA_ON.
- AD5M/AD5X: If needed, manually set `Z_OFFSET` in START_PRINT or use LOAD_ZOFFSET to load saved offsets.
- If you want to transfer z-offset from the native screen to screenless mode, call the macro `LOAD_ZOFFSET_NATIVE` — it will read the z-offset value from the native screen and apply it to screenless mode. *Not required for Creator 5 / Creator 5 Pro.*
- Bed mesh `auto` loads automatically on startup.

- FlashForge protocol is unsupported (handled by the screen). Use "Octo/Klipper":
    - **Host Type**: `Octo/Klipper`
    - **Printer Agent**: `Moonraker`

  For Creator 5 / Creator 5 Pro / AD5X:
    - **Hostname**: `IP_printer`



  For FF5M / FF5M Pro:
    - **Hostname**: `IP_printer:7125`
    - **Device UI**: `IP_printer` or `IP_printer:80`



What's the difference between using the screen and without the native screen?

The printer can operate in two modes:

- With the native screen - in this case, almost all operating logic is controlled by the native screen, and many features cannot be changed.
- Without the native screen - in this case, all features are controlled by Z-Mod. This doesn't mean you need to turn off the screen or replace it with a different one. In the mode without the native screen, you can use the alternative software screen GuppyScreen/HelixScreen/Rivet or turn off the screen completely, and it will go dark.

> **Warning**
>
> Do not disable the screen unless you fully understand bed leveling, z-offset, and START_PRINT/ END_PRINT macros

AD5M/AD5M Pro have 128 MB of RAM; half of it is used by the system, and native screen management takes 13 MB (20 MB in older stock firmware versions). Disabling the native screen saves this memory.

Disabling the screen saves RAM but changes print management (start/pause/resume/cancel/ recovery, file upload, power-loss recovery). Modify start/end G-code accordingly. *elk*

Without the screen, Z-offset from the screen isn't applied. Use START_PRINT parameters or global settings. Details To transfer the z-offset from the native screen to screenless mode, run

`LOAD_ZOFFSET_NATIVE` — it reads the z-offset from the native screen and applies it to screenless mode. *Not required for Creator 5 / Creator 5 Pro.*

Read features of screenless operation.

How is Z-Mod different from KlipperMod/native firmware?

Differences between KlipperMod and Z-Mod:

- KlipperMod uses pure Klipper with minimal FlashForge 5M (Pro)-specific changes.
- Z-Mod uses the standard Klipper from the native firmware, as well as Klipper 14.
- KlipperMod uses KlipperScreen as a printer screen.
- Z-Mod uses the native screen or GuppyScreen/HelixScreen/Rivet instead of KlipperScreen.
- KlipperMod uses Moonraker-timelapse.
- Z-Mod uses moonraker-telegram-bot on an EXTERNAL host with timelapse support, or the TimeLapse plugin

Different philosophies:

- KlipperMod is essentially an alternative firmware implementation.
- Z-Mod has minimal intervention in the native firmware. All native firmware features are preserved.

This is why Z-Mod won't include G17, G18, G19 - even though it's simple. There won't be updates to native Klipper, no renaming or changes to standard macros, settings, pin names, etc.

Z-Mod is NOT based on KlipperMod and is NOT its evolution. However, Z-Mod uses some macros and scripts from KlipperMod and incorporates some of its developments. Don't expect Z-Mod to behave similarly to KlipperMod.

Z-Mod is binary incompatible with KlipperMod.

What's in KlipperMod but not in Z-Mod:

- KlipperScreen - screen for the printer. In Z-Mod, native screen or GuppyScreen/HelixScreen/Rivet is used instead of KlipperScreen
- Moonraker-timelapse - Z-Mod uses Telegram bot and plugin Timelapse
- Network configuration via iwd/wpa_supplicant (in case of GuppyScreen/HelixScreen/Rivet) - in Z-Mod network configuration is done through the native screen, network startup is possible even without the native screen

What's in Z-Mod but not in KlipperMod:

- AD5X support
- Creator 5 / Creator 5 Pro support
- Support for the following languages: English, German, French, Italian, Spanish, Chinese, Japanese, Korean, Portuguese, Czech, Turkish, Russian
- Native screen support
- Print recovery after power loss
- Shaper calibration with graphs considering SCV (square_corner_velocity)
- File/permission/symlink check and repair for the native filesystem
- Automatic updates for `Fluidd`/`Mainsail`/`Moonraker` and Z-Mod over the network

- Entware
- Fixed E0017 error
- Additionally, GuppyScreen/HelixScreen/Rivet supports: PID calibration, damper control, firmware retraction, nozzle cleaning, load cell reset, screw adjustment, ColdPull, enhanced bed leveling
- Fixed driver cooling fans operation. They automatically turn on when motors are running. On native firmware - only during printing.
- Adaptive bed leveling KAMP
- PID calibration for extruder and bed, including via GuppyScreen/HelixScreen/Rivet
- Implemented COLDPULL (nozzle cleaning) without force. Implementation of this algorithm

What's in Z-Mod but not in native firmware:

- Moonraker/Fluidd/Mainsail support
- Klipper 14 support
- Telegram bot support
- All features listed in the comparison with KlipperMod
- The native firmware sends a lot of data to Chinese servers, this can be avoided by using Z-Mod with GuppyScreen/HelixScreen/Rivet

---

What is a MACRO? How to Run, Download, and Use It

A macro is a small program written in Klipper/Gcode.

It can be called:

- From a GCODE file
- From the Fluidd/Mainsail console *hedgehog*

List of macros

I'm using the screen version. I send a file to print, but the screen displays a temperature of 0°C and the printing process doesn't start.

Add these two lines to the very beginning of the start code in the printer settings under Machine G-Code:

```
M190 S[bed_temperature_initial_layer_single]
M104 S[nozzle_temperature_initial_layer] T{single_extruder_multi_material ? 0 :
initial_extruder}
```

Without these lines, the printer screen doesn't know the target temperatures for the nozzle and bed. *hippopotamus*

After installing Z-Mod, my screen is dead and not responding to touches.

- Install the latest native firmware and Z-Mod updates
- Read known peculiarities *bison*
- You might have disabled the screen. Enable it with the DISPLAY_ON macro

---

Do I need to change anything in the start code?

If using the native screen, no changes are needed.

For operation without the native screen/Guppy (Helixscreen) (also recommended with the screen), replace the entire start code with:

```
START_PRINT EXTRUDER_TEMP=[nozzle_temperature_initial_layer]
BED_TEMP=[bed_temperature_initial_layer_single]
M190 S[bed_temperature_initial_layer_single]
M104 S[nozzle_temperature_initial_layer] T{single_extruder_multi_material ? 0 :
initial_extruder}
SET_PRINT_STATS_INFO TOTAL_LAYER=[total_layer_count]
```

`START_PRINT EXTRUDER_TEMP=... BED_TEMP=...` should be written on one line

And the end code with:

```
END_PRINT
```

For correct layer counting in Fluidd, add to the before layer change code:

```
SET_PRINT_STATS_INFO CURRENT_LAYER={layer_num + 1}
```

To enable auto-leveling for every print, enter once in Fluidd/Mainsail console:

```
SAVE_ZMOD_DATA CLOSE_DIALOGS=2 PRINT_LEVELING=1 USE_KAMP=1
```

Via the printer screen menu: `Settings` -> `WiFi icon` -> `Network Mode` -> enable `Local Networks Only`.

Read the documentation for START_PRINT and SAVE_ZMOD_DATA to utilize advanced Z-Mod features.

For firmware retraction, read the documentation and add to `Filament Profile` -> `Advanced` -> `Filament Start G-code`:

```
SET_RETRACTION RETRACT_LENGTH=[filament_retraction_length]
```

raccoon

How does Z-Offset work?

> **Creator 5 / Creator 5 Pro**
>
> On Creator 5 / Creator 5 Pro the Z-offset with the native screen and in screenless mode is the same — they are fully synchronized. If the native screen is disabled, you can change the Z-offset during printing via GuppyScreen, HelixScreen, Fluidd or Mainsail — it will be saved.

Read the article: How Z-Offset Works on Your Printer

When using the screen, the mod doesn't interfere with z-offset. The z-offset saved on the screen is used.

The Z-offset for native-screen mode and screenless mode is not the same: each lives its own life and is configured separately.

Use `LOAD_ZOFFSET_NATIVE` to copy the Z-offset from the native screen to screenless mode. *Not required for Creator 5 / Creator 5 Pro.*

Z-offset adjustments via Fluidd/Mainsail/GuppyScreen/HelixScreen/Rivet only apply until reboot. Changing it without understanding nozzle movement is not recommended.

Any `SET_GCODE_OFFSET` call (automatically triggered when adjusting Z-offset from Fluidd/Mainsail/GuppyScreen/HelixScreen/Rivet) saves the current z-offset to the mod's global parameters. This saved value is used only if the LOAD_ZOFFSET global parameter is enabled (disabled by default; enable with `SAVE_ZMOD_DATA LOAD_ZOFFSET=1`), native screen isn't used, and the START_PRINT macro is utilized.

Z-offset can also be set via START_PRINT parameters:

- Z_OFFSET - Set Z-offset (0.0)

What options are available for bed leveling?

To enable auto-leveling for every print, enter once in Fluidd/Mainsail console:

```
SAVE_ZMOD_DATA CLOSE_DIALOGS=2 PRINT_LEVELING=1 USE_KAMP=1
```

The native screen always uses:

- `MESH_DATA` by default
- `DEFAULT` if `leveling` is checked (bed leveling before print). `DEFAULT` is deleted after printing.

Without the native screen, the `auto` mesh is auto-loaded on startup.

If you want to use a different bed mesh for printing (e.g., `my_80_degree_mesh`), then:

- Disable automatic calibration in the global parameters.

`SAVE_ZMOD_DATA PRINT_LEVELING=0`

- Specify via the `MESH` parameter in START_PRINT. E.g., `START_PRINT MESH=my_80_degree_mesh`
- Load via `BED_MESH_PROFILE LOAD=my_80_degree_mesh` in filament profile. Ensure consistency between profile and `START_PRINT`, or disable nozzle cleaning in `START_PRINT`.
- Pre-level using AUTO_FULL_BED_LEVEL. E.g., `AUTO_FULL_BED_LEVEL EXTRUDER_TEMP=230 BED_TEMP=80 PROFILE=my_80_degree_mesh`

Via global parameters

I recommend using global parameters that are configured once and used for every print job. In this case, it is not necessary to change the start and end G-code.

Parameter `PRINT_LEVELING`:

- Probes the bed mesh on every print job
- When working with the screen, the bed mesh is probed by the native screen, as if you had selected a file on the screen and checked the `Leveling` checkbox. If the parameter is set to `SAVE_ZMOD_DATA PRINT_LEVELING=1`, when sending files via Orca/Fluidd/Mainsail, the printer

assumes you have selected the file on the native screen and checked `Leveling`. In this case, the bed mesh is probed every time you print.
- When working in screenless mode and using the macro START_PRINT in the start G-code, the bed mesh is also probed on every print job.

To activate this function, configure once the macro SAVE_ZMOD_DATA and the parameter PRINT_LEVELING

`SAVE_ZMOD_DATA PRINT_LEVELING=1` ***(must be entered in the Fluidd/Mainsail console)***. In this case, the bed mesh will be probed with every print.

- For bed mesh probing from the native screen to work, go to `Settings` -> `Wi-Fi icon` -> `Network mode` -> enable the `Local networks only` slider via the printer screen menu.

- When this option is enabled, all START_PRINT parameters related to creating/using a bed mesh (FORCE_LEVELING, FORCE_KAMP, SKIP_LEVELING, MESH) will be ignored.

Parameter `USE_KAMP`:

- Klipper Adaptive Meshing and Purging (KAMP) can be enabled. This means that instead of the whole bed, only the areas containing printable models are probed.

Automatic bed mesh probing is not triggered! This parameter specifies that whenever bed mesh probing is called, KAMP should be executed instead.

To enable this feature, you must configure the macro SAVE_ZMOD_DATA once, parameter USE_KAMP

`SAVE_ZMOD_DATA USE_KAMP=1` ***(must be entered in the Fluidd/Mainsail console)***. In this case, the adaptive bed mesh is used wherever possible, including when the bed mesh is probed by the native screen over the network.

By modifying the start code and START_PRINT macro

If you do not want to use the global parameters *(SAVE_ZMOD_DATA PRINT_LEVELING=0)*, the following parameters of the macro START_PRINT, which is written in the start G-code, are available.

- FORCE_LEVELING - force building a bed mesh; True - build, False - do not build (False)
- FORCE_KAMP - build an adaptive bed mesh; True - yes, False - no (False)
- SKIP_LEVELING - never build a bed mesh under any condition. Stronger than FORCE_KAMP and FORCE_LEVELING (False)
- MESH - name of the bed mesh to load; if not specified, nothing is loaded; if it does not exist, it is created ("")

Examples:

Probing the full bed mesh:

```
START_PRINT EXTRUDER_TEMP=[nozzle_temperature_initial_layer]
BED_TEMP=[bed_temperature_initial_layer_single] FORCE_LEVELING=True
M190 S[bed_temperature_initial_layer_single]
M104 S[nozzle_temperature_initial_layer] T{single_extruder_multi_material ? 0 :
initial_extruder}
```

Probing the adaptive bed mesh:

```
START_PRINT EXTRUDER_TEMP=[nozzle_temperature_initial_layer]
BED_TEMP=[bed_temperature_initial_layer_single] FORCE_KAMP=True
M190 S[bed_temperature_initial_layer_single]
M104 S[nozzle_temperature_initial_layer] T{single_extruder_multi_material ? 0 :
initial_extruder}
```

Bed mesh algorithm in the macro START_PRINT:

1. If MESH is not empty, the map with the name specified in the MESH parameter is loaded.
2. If `SKIP_LEVELING=True`, the bed mesh is never probed.
3. Otherwise, if `FORCE_KAMP=True` is set, KAMP is probed.
4. Otherwise, if no bed mesh is loaded (the native screen always loads the `MESH_DATA` mesh) or if `FORCE_LEVELING=True`, the bed mesh is built, but it is not saved.

Via macros and buttons in Fluidd

If you don't want to use the START_PRINT macro and global parameters, the following macros are available:

- AUTO_FULL_BED_LEVEL - probes the bed mesh with nozzle cleaning at a specified bed and extruder temperature. *Turns off heating after probing.*

This same macro can be called using the Fluidd/Mainsail button; it's called `BED CALIBRATION`. After probing the bed mesh at a specified temperature, you can click the `Save Parameters` button, and the bed mesh will be saved to the `printer.cfg` file.

It can also be written into the startup G-code:

```
AUTO_FULL_BED_LEVEL EXTRUDER_TEMP=[nozzle_temperature_initial_layer]
BED_TEMP=[bed_temperature_initial_layer_single]
M190 S[bed_temperature_initial_layer_single]
M104 S[nozzle_temperature_initial_layer] T{single_extruder_multi_material ? 0 :
initial_extruder}
```

- KAMP - Adaptive bed calibration with nozzle cleaning

  ```
  EXTRUDER_TEMP=[nozzle_temperature_initial_layer]
  BED_TEMP=[bed_temperature_initial_layer_single]
  ```

- BED_MESH_CALIBRATE - Bed mesh probing using the standard Klipper macro. **Not recommended**, as it does not clean the nozzle, resulting in incorrect results. **Orca's adaptive bed mesh is not recommended** at all, as it lacks randomization of point measurements, meaning that when printing identical models, the nozzle will consistently take measurements at the same points, resulting in micro-dents and, consequently, an incorrect bed mesh.

- Standard Klipper macros (**not recommended**)

Using Standard Klipper Commands

To work with MESH, there are standard Klipper macros:

- BED_MESH_CALIBRATE - Probe the bed mesh
- BED_MESH_OUTPUT - Output the bed mesh

- BED_MESH_PROFILE - Load, delete, and save bed meshes

When loading a bed mesh using Klipper commands in the filament profile, ensure you use the same bed mesh in both START_PRINT and the filament profile. Alternatively, you can disable nozzle cleaning in START_PRINT and perform it separately in the filament profile.

It is strongly recommended that you review the nozzle cleaning options:

- CLEAR_NOZZLE – Nozzle cleaning as in the native firmware.
- PRECLEAR – Additional nozzle cleaning when probing the bed mesh.
- CLEAR – Four algorithms (you can add your own) for purging the nozzle with a line before printing.

Why are animal names periodically mentioned in the documentation?

Documentation is often unread, though 90% of questions are answered here. To verify if someone actually read it, animal names are hidden in the text. If directed here, read the docs and mention the animal related to your question:

- FAQ
- Recommendations
- Setup/Update/Uninstall
- Macros
- Configuration Storage
- Known Issues

I want to remove Z-Mod - do I have to recalibrate everything?

No, all settings are preserved.

What is an alternative camera?

The native camera, which is turned on from the screen, has a number of disadvantages.

- High RAM consumption
- Low image quality
- Only one connection to the camera. Once it is opened in Orca, you will no longer see it in the browser
- Periodic image dropouts

The alternative camera allows you to change the resolution, FPS, allow multiple connections, does not overcompress the image, is easily restarted and is configured with a macro. *hare*

- Disable the native camera on the printer screen.
- Call the macro CAMERA_ON

Read: I installed a printer, and Z-Mod hid my camera!

Camera Setup

Basic Parameters

Parameter	Description	Default Value
`WIDTH`	Image width	640
`HEIGHT`	Image height	480
`FPS`	Frames per second	20
`VIDEO`	Camera device	video0
`FS`	Fix problematic cameras (1 – yes, 0 – no)	0
`STREAMER`	Program for handling the camera stream	auto
`FORMAT`	Image format (for ustreamer only)	MJPEG

What is a Streamer?

A streamer is a program that takes the image from the camera and displays it in a browser.

Two options are available:

- **mjpg_streamer** – a simple program, works only with MJPG cameras
- **ustreamer** – more powerful but uses more memory; supports various cameras

The `STREAMER=auto` parameter will automatically choose the suitable streamer.

Image Formats (for ustreamer only)

You can choose: YUYV, YVYU, UYVY, RGB565, RGB24, BGR24, MJPEG, JPEG.

The default is MJPEG.

Command Examples

Simple start of camera video0 via mjpg_streamer:

```
CAMERA_ON VIDEO=video0
```

Start camera video0 via ustreamer with custom settings:

```
CAMERA_ON VIDEO=video0 STREAMER=ustreamer FORMAT=YUYV WIDTH=640 HEIGHT=480
```

Where to View the Image?

Open in your browser: `http://printer_ip_address:8080`

There you can adjust brightness, contrast, and other settings.

Troubleshooting

Camera not detected? Run:

```
CAMERA_ON VIDEO=video99
```

The program will show a list of available cameras.

Logs (error records) are located in the folder: `log/cam/`

I installed the printer, but Z-Mod hid my camera! In Orca-FF I could see it, but now it's gone!

In the web interface (Fluidd), go to `Settings` -> `Cameras`.

There will already be one camera, "Camera_settings_example". Open it and look at the settings.

Create a new camera with settings similar to "Camera_settings_example":

- Stream type: `MJPEG stream`
- Stream URL: `http://your_IP:8080/?action=stream`
- Snapshot URL: `http://your_IP:8080/?action=snapshot`
- your_IP - replace with the IP address of your printer.

In versions newer than `1.4.3`, you can also specify:

- Stream type: `MJPEG stream`
- Stream URL: `/webcam/?action=stream`
- Snapshot URL: `/webcam/?action=snapshot`

If you want to configure the resolution and FPS, use the camera in the Telegram bot, reduce RAM usage or allow parallel connections, use the alternative camera. *mole*

Assign a *static IP address to the printer* on your router, otherwise it will change and the camera will drop out.

I have 2 cameras / how to disable/turn the camera

If you do not have a camera, or you are not satisfied with the settings of the automatic camera, then you need to open the file `mod_data/user.moonraker.conf` via Fluidd / Mainsail

And write:

To disable the camera:

```
[webcam video]
    enabled: false
```

To turn the camera:

```
 [webcam video]
    rotation: 90
```

Cannot Update MCU

After rebooting, the following error appears:

```
!! Cannot update MCU 'eboard' config as it is shutdown
```

If you believe this error appeared during printing, then your heater has a short circuit (after long use) and the printer reboots without you noticing.

Rebooting the printer is an abnormal operating mode.

This is why, when installing the original firmware, you are asked to power off the printer and turn it back on.

During a reboot, power is not removed from the MCU, meaning the program stored in the MCU continues running. This program attempts to communicate with Klipper, which is unavailable during the reboot, causing the MCU to freeze or disconnect.

In this case, choose one of the options:

- Execute `FIRMWARE_RESTART` — this will freeze the native screen.
- Power off the printer and turn it back on.

The difference between `REBOOT` and `FIRMWARE_RESTART` is that `REBOOT` restarts Linux and Klipper on the motherboard, while `FIRMWARE_RESTART` restarts Klipper and fully restarts the MCU.

I Switched the Web Interface, and Now Nothing Works

If you switched the interface using the WEB macro *desman*:

1. Press `Ctrl + F5` or `Ctrl + Shift + R` or `Option + Command + E`
2. If the issue persists in Orca, press `Ctrl + F5` or `Ctrl + Shift + R` or `Option + Command + E` again. *fox*
3. For other browsers, clear the cache and cookies, then navigate to the printer's IP without additional characters: `http://PRINTER_IP/`
4. If still unresolved, try another browser (Firefox, Chrome, Yandex, Opera, etc.).

I Access the Printer via Orca/Browser and See "Welcome to Moonraker"

Z-Mod uses the following ports:

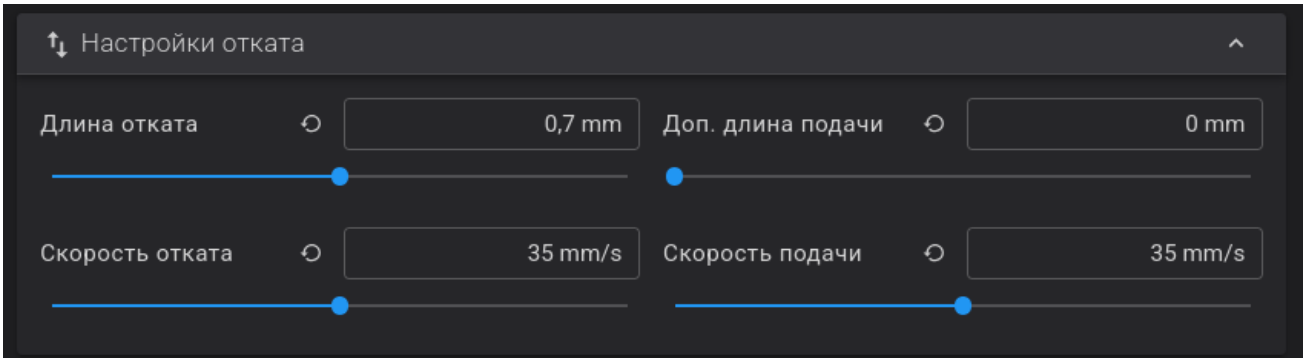
- `7125` — Moonraker
- `8080` — Camera
- `80` — Fluidd/Mainsail

To access the printer, enter its IP address **without specifying a port**. *rabbit*

How to configure in Orca

What is Firmware Retraction?

In Z-Mod, Fluidd/Mainsail has sliders to adjust firmware retraction speed and distance.



These do not affect prints unless the G-code file is sliced with firmware retraction enabled.

Firmware retraction allows adjusting retraction during printing without reslicing.

Instead of bulky commands like `G1 E-.5 F2100` for retraction, the short `G10` is used, and instead of `G1 E.5 F2100` for unretraction, `G11` is used.

To enable in Orca: `Printer Settings` -> `General` -> `Advanced` -> Enable `Use Firmware Retraction`.

To modify default retraction settings: Edit `user.cfg` in Fluidd (`Configuration` -> `mod_data` -> `user.cfg`):

```
[firmware_retraction]
retract_length: 0.9
retract_speed: 35
unretract_extra_length: 0
unretract_speed: 35
```

`SET_RETRACTION` parameters (configure per filament):

- `RETRACT_LENGTH`: Filament retract/unretract distance.
- `RETRACT_SPEED`: Retraction speed.
- `UNRETRACT_SPEED`: Unretraction speed (often lower).
- `UNRETRACT_EXTRA_LENGTH`: Extra filament length during unretraction.

Example in Orca: `Filament Profile` -> `Override Parameters` -> `Retraction` -> `Length` `Filament Profile` -> `Advanced` -> `Start G-code`:

```
SET_RETRACTION RETRACT_LENGTH=[filament_retraction_length]
```

Use `GET_RETRACTION` to view current settings in the terminal.

Retraction substitution variant by @minicx

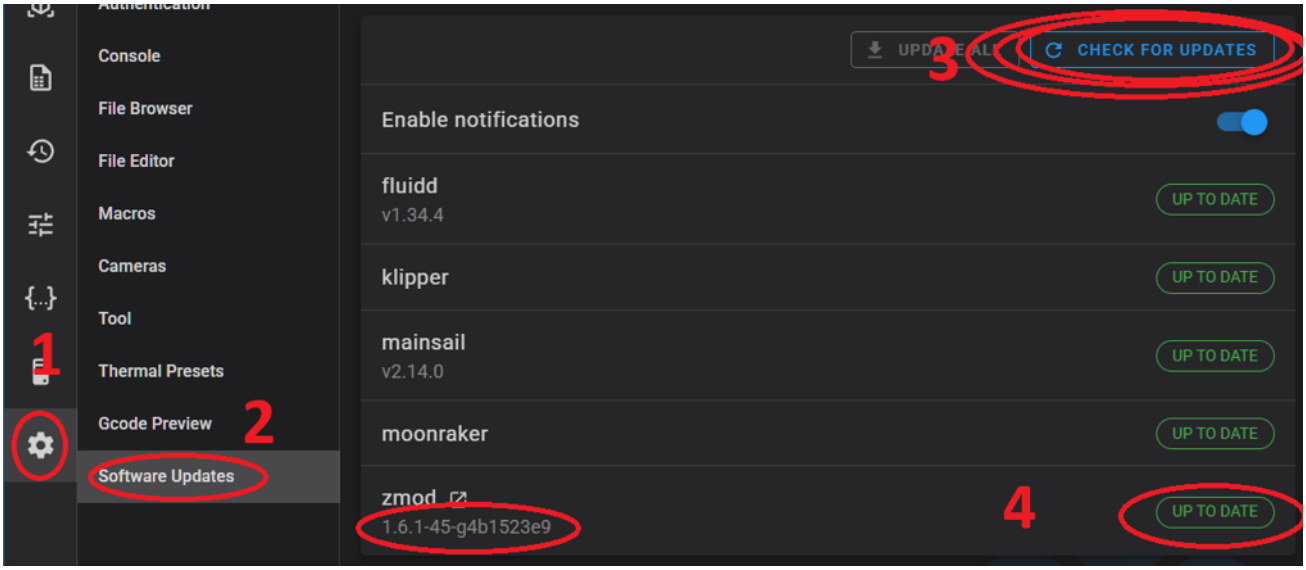
```
SET_RETRACTION RETRACT_LENGTH={if not is_nil(filament_retraction_length[current_extruder])}
[filament_retraction_length[current_extruder]]{else}[retraction_length]{endif}
RETRACT_SPEED={if not is_nil(filament_retraction_speed[current_extruder])}
[filament_retraction_speed[current_extruder]]{else}[retraction_speed]{endif}
```

I have installed the latest version, and the developer says you need to update.

- Make sure you installed the latest version from a flash drive
- **Go to the web interface**.

```
Settings-> Software updates-> Press Check for update
```

- Update all components *tree climber*
- Reboot the printer



Entware in Z-Mod: How to Use It

Warning! There is no Entware in [AD5X]

1. SSH into the printer (`root`:`root`, port `22`).
2. Run: `export PATH="$PATH:/opt/bin/:/opt/sbin/"`
3. Now you can use `mc` or `opkg`:
    - Update package database: `opkg update`
    - Install a package: `opkg install mc`

Entware directories:

- `/opt/bin`, `/opt/sbin`, `/opt/etc`, `/opt/home`, `/opt/lib`, `/opt/libexec`, `/opt/root`, `/opt/share`, `/opt/tmp`, `/opt/usr`, `/opt/var`

AD5X Specifics

AD5X

AD5X

Help

How to Contact Support

The instructions have moved

How to change the boot logo

The logo is located in the folder `mod_data/logo`.

Logo requirements:

- Size: 800×480, 24-bit color depth
- AD5M: BMP format. File name: `bootlogo.bmp`
- AD5X: JPG format. File name: `logo.jpeg`

Upload your logo to the folder `mod_data/logo`.

Reboot the printer twice.

Removing the mod will restore the original logo. If this doesn't happen on the AD5M:

- Install the mod
- Upload the boot.bmp file to the `mod_data/logo` folder
- Restart the printer

Logo by Alberto Maciel:

- AD5M/AD5M Pro
- AD5X

No trigger on probe after full movement

This error usually occurs if the z-axis isn't raised enough during measurement.

This can be fixed programmatically as follows:

Add to `mod_data/user.cfg`

```
[bed_mesh]
horizontal_move_z: 5
```

Hardware - all screws must be adjusted and the bed must not be warped.

WeightValue

WeightValue is the value on the load cells in grams. It is displayed in degrees, as it is implemented through the temperature sensor interface. Therefore, Fluidd and Mainsail display degrees.

What is this sensor for?

- It can be used to measure Z-offset via the g28_tenz plugin
- You can stop printing if the nozzle hits the part or the part is detached. NOZZLE_CONTROL
- Without resetting it, the bed mesh will be measured incorrectly.

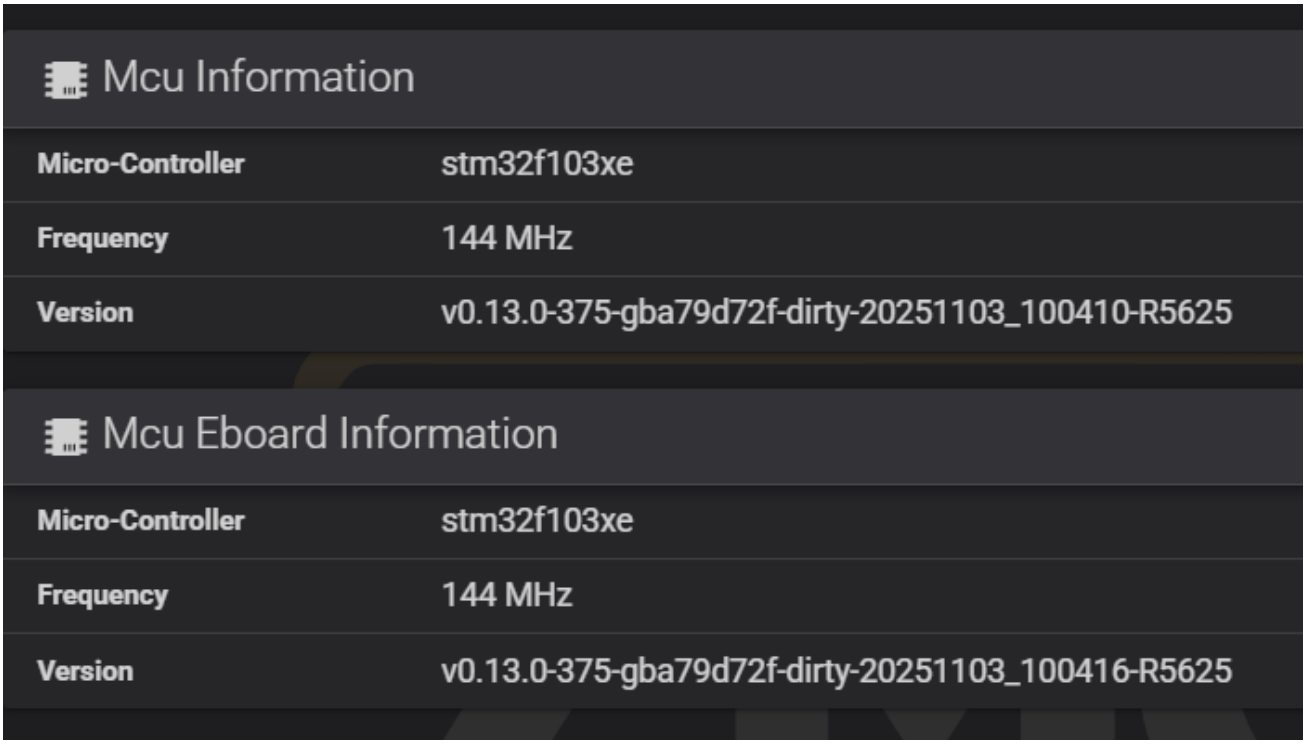
MCU Protocol error

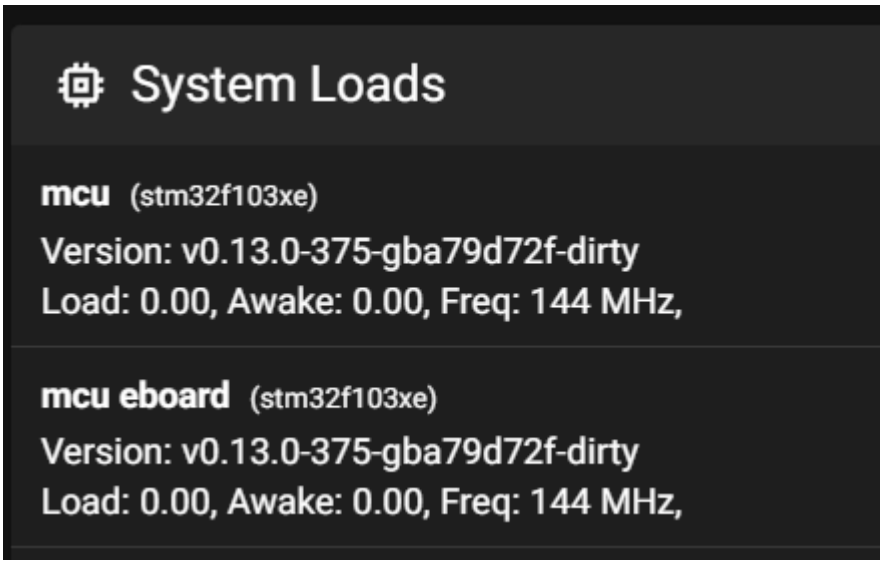
Here are some errors that depend on the MCU:

- MCU Protocol error
- Unknown temperature sensor flashforge_loadcell
- Required MCU command
- flashforge_loadcell: Required MCU command `flashforge_loadcell_h1` is not available

The essence of all these errors is that the Klipper version does not match the MCU version.

You can view the MCU version in the System tab.





For example, you are running Klipper 14, but the MCU used is from Klipper 11 or 12.

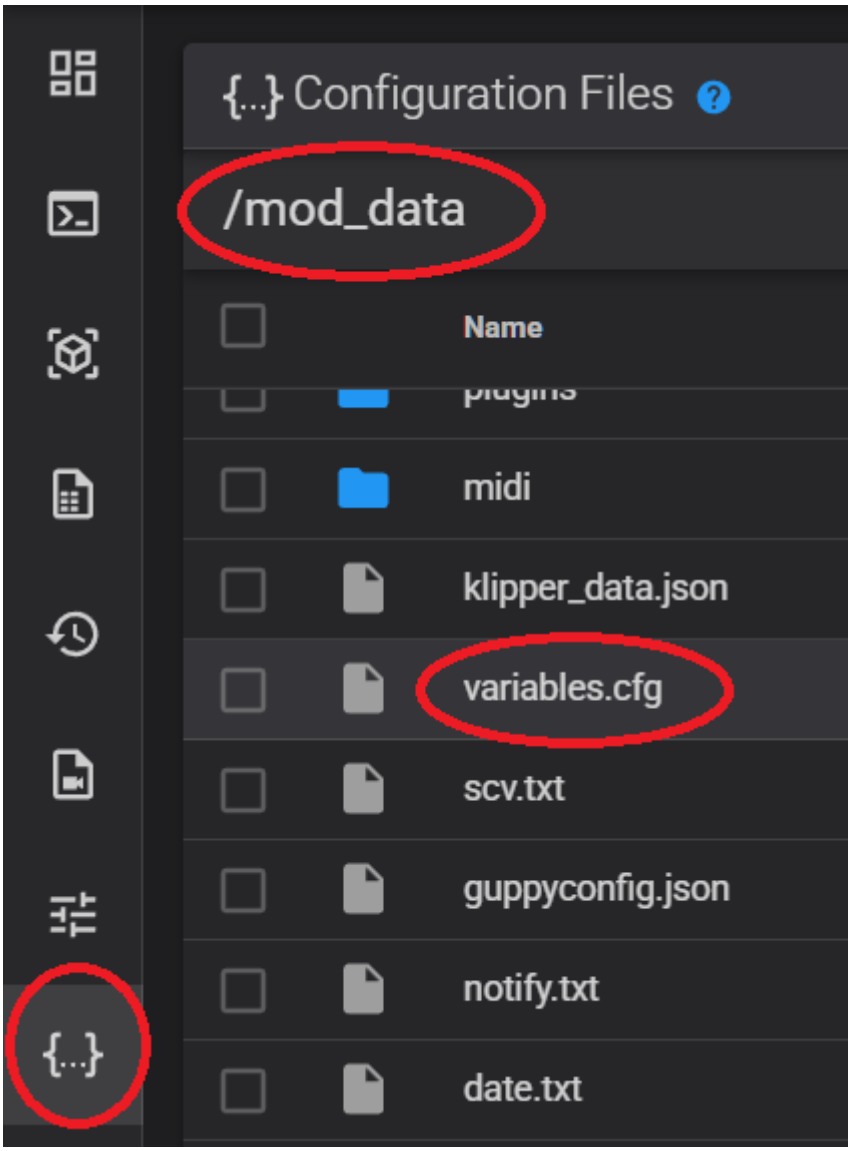
Or vice versa. You're running native Klipper, but you've loaded an MCU for Klipper 14.

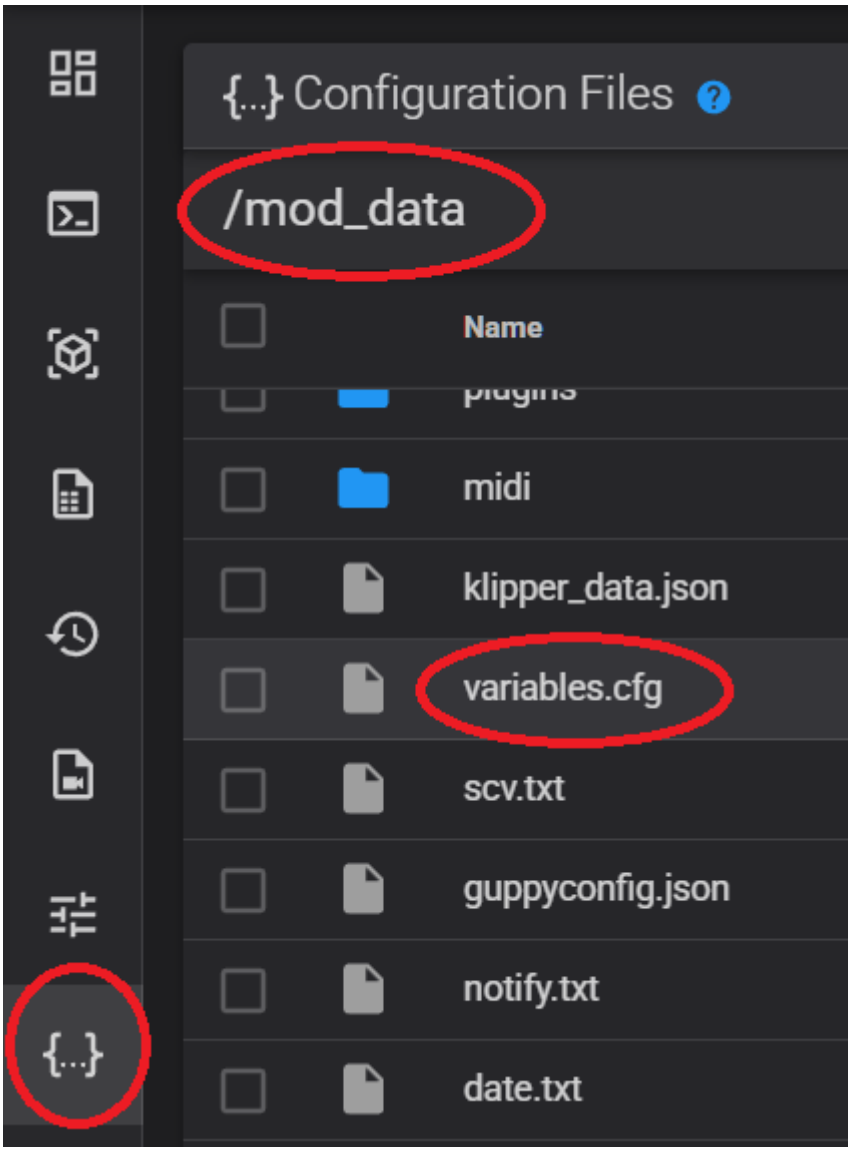
If your MCU version starts with `?-20230317_182329-ubuntu20-virtual-machine`, then you've loaded an MCU for Klipper 12 (AD5X) or Klipper 11 (AD5M/AD5M Pro).

Switch to Native Klipper

Accordingly, Z-Mod needs to load native Klipper.

- Go to `mod_data/variables.cfg` and delete the line `klippernew = 1`.
- Save the file
- Turn the printer off and on (do not reboot!)


{...} Configuration Files
/mod_data
Name
midi
klipper_data.json
variables.cfg
scv.txt
guppyconfig.json
notify.txt
date.txt



If this isn't the case and Klipper is working, run `UPDATE_MCU FORCE=new` - this command will install the latest MCU version.

If all else fails and **Klipper isn't working**:

- Switch to Native Klipper
- Install the native Factory firmware, which will install the native MCU.

Filament has run out or stopped

Filament runout or jam detected

For AD5M, you need to calibrate the sensor steps by trial and error. Enter this in `mod_data/user.cfg`

Increase this number. The standard 8 is sufficient for some, but some sensors only work correctly at 17.

```
[filament_motion_sensor e0_sensor]
detection_length: 8
```

Filament jam detected (IFS)

For AD5X, the IFS motion sensor step count must be calibrated manually. Add the following to `mod_data/user.cfg`:

```
[zmod_ifs_motion_sensor ifs_motion_sensor]
detection_length: 8
```

Increase this value—some printers work fine with the default `10`, while others require up to `17` for stable IFS operation.

Additionally, filament stoppage in IFS may be caused by:

- Extruder is loaded with spool 1, but spool 2 is being pulled out — use `SET_EXTRUDER_SLOT` to sync the extruder's current slot.
- New filament is being inserted, while old filament remains inside the extruder.
- The 4-in-1 modules and their tubes have different lengths, requiring adjustment of `filament_unload_into_tube` in `mod_data/filament.json`. Set it to **70 or higher**. ➜ More details

The issue may also stem from the **inability to unlock the filament in the IFS channel**.

Mechanical causes include:

- Plastic shavings stuck on the pinch roller shaft.
- Spring disengaged from the IFS channel lever.

Solution: Remove debris, disassemble the mechanism, and reinstall components correctly.

After repairs, test printing and filament lock/unlock behavior using the IFS commands.

Before each print, the printer measures the center of the bed.

Before printing, the printer:

- heats the bed and nozzle.
- cleans the nozzle.
- Cools the nozzle
- **Measures the bed center** (Starting manual Z probe. Use TESTZ to adjust position)
- Heats the nozzle
- Starts printing

This is a feature of the native firmware starting with version:

- **1.1.8** AD5X
- **3.2.4** AD5M/AD5M Pro

Solution:

- Roll back the native firmware to version **1.1.7** for AD5X, **3.2.3** for FF5M/FF5MPro
- Disable the native display

E0120

This is a Klipper error.

Most often it is corrected by the following simple actions:

- Turn off the power of the printer
- Wait 10 seconds
- Power on the printer

To see what exactly is the error:

- Open Fluidd/Mainsail
- Go to the console and read the error text
- Open the Telegram bot @zmod_help_bot and enter the error text or look up the description in the documentation yourself

If you can't fix it, you need to create a ticket.

Native configs

eMMC speed-up on AD5M / AD5M Pro

AD5M / AD5M Pro only, enabled by default. Not needed on AD5X, Creator 5 and Creator 5 Pro: their eMMC is already fast.

By default the eMMC runs at 25 MHz, reading at about 11 MB/s. HS52 mode is enabled at 50 MHz: a standard eMMC mode (up to 52 MHz) that FlashForge did not enable. Reading becomes about 2 times faster, up to ~22 MB/s.

How it works:

1. After installation, a test is prepared. The printer does not reboot by itself.
2. On the next boot the eMMC runs at 50 MHz and is tested: 128 MB is written and read and the checksum compared. At least 256 MB of free space in `/data` is required, otherwise the test is postponed.
3. Test passed: from then on the eMMC always runs at 50 MHz. Test failed or the chip does not support the mode: it stays at 25 MHz, with no further attempts.

Hang protection: 50 MHz is enabled only for the next single boot, and again after every successful boot. If the printer hangs while booting, turn it off and on: it will boot in stock mode. After 3 failed boots in a row the feature disables itself. When the mod is removed, the stock boot settings are restored automatically.

> **Risk**
>
> On an unstable chip, data corruption is possible before the test finishes. The mode is within the standard, so the risk is low.

- Disable: create the file `mod_data/emmc/disable.txt`. The next boot will be in stock mode. Delete the file to enable it again.
- Repeat the test: delete all files from `mod_data/emmc/` and reboot the printer twice. After an algorithm update the test is repeated automatically.
- Log: `mod_data/log/emmc/emmc.log`

DDR52 (option): about 2 times faster than HS52, up to ~44 MB/s. Enable: create the file `mod_data/emmc/ddr.txt`, the test runs on the next boot. If DDR52 does not work, `ddr.txt` is deleted automatically and

the eMMC returns to HS52. Disable: delete `ddr.txt`, one more boot will still be in DDR52, then HS52 with a test. Tested only on Hynix HAG2e.

Details

Speed on AD5M (Hynix HAG2e):

Mode	Frequency / voltage	Read	Write
Stock	25 MHz / 1.8 V	~11.5 MB/s	~10.6 MB/s
HS52 (default)	50 MHz / 3.3 V	~22.5 MB/s	~21 MB/s
DDR52 (`ddr.txt`)	50 MHz / 1.8 V	~43.9 MB/s	~42.6 MB/s

Higher is not possible: DDR52 is limited to 52 MHz by the standard, and HS400 requires an 8-bit bus, while AD5M has a 4-bit one.

HS200 is not used: on some chips (for example, FORESEE PSE6A0SL) it does not work, and the kernel then drops straight to 25 MHz, skipping HS52. HS52 is supported by any eMMC.

The `sunxi.dtb` file on disk is not modified: the DTB is edited in memory with U-Boot commands via env, and only for one boot. The editing method is chosen automatically by the printer memory size (128 or 256 MB), nothing needs to be configured.

Check the current mode (`clock`, `timing spec`: 1 = HS52, 8 = DDR52, 9 = HS200 (stock)):

```
cat /sys/kernel/debug/mmc0/ios
```

Chip model:

```
cat /sys/class/mmc_host/mmc0/mmc0:*/name
cat /sys/class/mmc_host/mmc0/mmc0:*/manfid
```

Manual rollback:

```
fw_setenv bootcmd 'run setargs_mmc boot_dsp0 boot_uImage'
fw_setenv boot_zmod
```

Extra RAM (extra_ram)

AD5M / AD5M Pro only (128 and 256 MB boards), enabled by default. Works in the same one-shot boot as the eMMC speed-up.

Returns about 7 MB of RAM: on a 128 MB board `MemTotal` 110,404 → 117,636 KB. During a print there is usually 20–30 MB free, so this is +24...35 %.

Where the memory comes from: `sunxi.dtb` reserves about 8 MB for the DSP (an audio processor the printer does not use) and OP-TEE. The reservation is removed, keeping only the 1 MB where OP-TEE itself runs: Linux uses it to control the CPU cores and reboot.

Protection: if this 1 MB is not reserved after boot, the stock boot is restored immediately and the printer reboots. After 3 boots in a row without extra_ram the feature disables itself.

- Disable: create the file `mod_data/emmc/disable_extra_ram.txt`.
- Enable again: delete `mod_data/emmc/disable_extra_ram.txt` and the `mod_data/emmc/xr_*.txt` files.

Method and research: mlengle, project ad5m-extra-ram.

Help

Open the Telegram bot @zmod_help_bot and ask it your question. It knows all the documentation.

1. Update Z-Mod and all plugins to the latest version via Fluidd -> Settings -> Software Updates
2. Clearly describe the issue: provide screenshots, photos, and a detailed textual explanation.
3. Run CLEAR_EMMC to clear previous logs.
4. **Power off the printer completely.**
5. Power the printer back on.
6. Reproduce the issue.
7. Run TAR_CONFIG to collect log files.
8. Submit **one** post with your description and the generated `config-1.6.6-28.tar.gz` file, where 1.6.6-28 is the current version of the mod.
9. Open the issue here.

If it is impossible to execute `TAR_CONFIG`:

- Download log
- Copy `config-1.6.6-28.tar.gz` from the USB flash drive, where 1.6.6-28 is the current version of the mod

Or connect to the printer via SSH:

AD5M/AD5M Pro:

```
chroot /data/.mod/.zmod/
/usr/data/zmod/zmod/.shell/tar_config.sh
```

AD5X/C5/C5Pro:

```
chroot /usr/data/.mod/.zmod/
/usr/data/zmod/zmod/.shell/tar_config.sh
```

Create a ticket

Why I Ask You to Create Tickets — Explained Simply

Imagine your printer is a car.

And I'm a mechanic in a huge garage, repairing *hundreds* of different vehicles every day.

You pull in and shout:

> **"My car won't drive!"**

And I have to start with the most basic question:

> **"Okay — what make, model, and year is your car?"**

Why This Matters — A Breakdown

Our “fleet” includes **over 100 unique configurations**. Just by major categories:

- **5 different printer models**:

FF5M, FF5M Pro, AD5X, C5, C5Pro

- **3 Klipper “engine” versions**:

11, 12, 13

- **2 CPU architectures**:

ARM and MIPS

- **Display options (“interior trim”)**:
  - Stock screen
  - GuppyScreen
  - HelixScreen
  - Rivet
  - Headless (no screen)
- **Primary UIs**:

Fluidd and Mainsail

- **Print initiation methods**:

Via stock screen, Guppy, OrcaSlicer (using FF protocol, Klipper protocol, etc.)

- **Optional “features” (plugins)**:

`nopoop`, `recommend`, `bambufy`, `g28_tenz`, `timelapse`, `notify` and others

- **Sensors and peripherals**:

filament presence, filament motion, IFS, etc.

On top of that, some users **modify hardware themselves**, install outdated firmware, or follow advice from forums or AI models that have **never seen their specific printer**.

The Result

When you write just **“doesn’t work”**, I waste **hours** just trying to identify:

- Which model you have
- Which Klipper/firmware version
- Whether you’re using a screen (and which one)
- Which slicer, settings, and plugins are active

That’s **inefficient**, **delays help**, and **frustrates everyone**.

✅ How to “Bring Your Car to the Shop” — Ticket Checklist

To help me **skip the guessing and start fixing**, please follow this checklist:

1. Update to the latest version

Follow the official update guide.

2. Describe the issue clearly and concretely

❌ Bad: *“It doesn’t work.”*

✅ Good:

• “After updating Z-Mod to v.X.Y.Z, when starting a print from the stock screen:

— the bed heats up,

— the extruder does NOT heat (screen shows 0°C),

— print aborts after ~2 minutes.”_

- Attach **screenshots**, **photos**,
- Describe **exact steps leading to the issue**,
- Attach the **G-code file** (the problem may be in the file itself!).

3. Run full diagnostics

Do these steps **in strict order**:

1. `CLEAR_EMMC` — clear old logs
2. **Unplug the printer from mains** → Wait 10 seconds
3. Power it back on
4. **Reproduce the issue** (start print, press button — trigger the error)
5. Run `TAR_CONFIG` — generates `config.tar.gz` containing all logs

4. Submit the ticket correctly

• Go to Issues page

• Create **one** new issue

• Include:

• Your clear description (step 2 above)

• **Attach `config.tar.gz`**

• Attach the **G-code file**, if applicable

> ⚠️ Without `config.tar.gz`, diagnosis is impossible — it's like submitting a blood test… *without the blood*.

What This Achieves

You stop shouting:

> **"My car won't drive!"**

And instead deliver:

> 🚗 **Your exact vehicle**,
>
> 📋 **Full service history**,
>
> 📊 **Diagnostic reports**.

Then I can start **fixing — immediately, not speculating**.

Thank you for your understanding and respect for others' time.

This is not bureaucracy — it's the **only way** to make support **fast and effective**.

Create a ticket

List

A macro is a small program written in Klipper/Gcode.

It can be called from:

- A GCODE file
- The Fluidd/Mainsail console (press the c key in Fluidd).

> **Note**
>
> *Default values are shown in parentheses.*

AIR_CIRCULATION_EXTERNAL

AIR_CIRCULATION_EXTERNAL

AIR_CIRCULATION_INTERNAL

AIR_CIRCULATION_INTERNAL

AIR_CIRCULATION_STOP

AIR_CIRCULATION_STOP

AUTO_FULL_BED_LEVEL

AUTO_FULL_BED_LEVEL

BED_LEVEL_SCREWS_TUNE

BED_LEVEL_SCREWS_TUNE

BELTS_SHAPER_CALIBRATION

BELTS_SHAPER_CALIBRATION

CALIBRATE_EXTRUDERS

CALIBRATE_EXTRUDERS

CAMERA_OFF

CAMERA_OFF

CAMERA_ON

CAMERA_ON

CAMERA_RESTART

CAMERA_RESTART

CANCEL

CANCEL

CHECK_MD5

CHECK_MD5

CHECK_SYSTEM

CHECK_SYSTEM

CLEAR_EMMC

CLEAR_EMMC

CLEAR_NOZZLE

CLEAR_NOZZLE

CLOSE_DIALOGS

CLOSE_DIALOGS

COLDPULL

COLDPULL

COLOR

COLOR

DATE_GET

DATE_GET

DATE_SET

DATE_SET

DISPLAY_OFF

DISPLAY_OFF

DISPLAY_ON

DISPLAY_ON

END_PRINT

END_PRINT

FAST_CLOSE_DIALOGS

FAST_CLOSE_DIALOGS

FIX_E0011

E0011

FIX_E0017

E0017

FIX_KLIPPER

FIX_KLIPPER

FIX_LOOP

FIX_LOOP

FIX_UPDATE_MCU

FIX_UPDATE_MCU

GET_ZMOD_DATA

GET_ZMOD_DATA

GLOBAL

GLOBAL

KAMP

KAMP

LANG

LANG

LED

LED

LED_OFF

LED_OFF

LED_ON

LED_ON

LOAD_CELL_TARE

LOAD_CELL_TARE

LOAD_ZOFFSET_NATIVE

LOAD_ZOFFSET_NATIVE

LOG

LOG

M600

M600

MEM

MEM

NEW_SAVE_CONFIG

NEW_SAVE_CONFIG

NOZZLE_CONTROL

NOZZLE_CONTROL

PAUSE

PAUSE

PID_TUNE_BED

PID_TUNE_BED

PID_TUNE_EXTRUDER

PID_TUNE_EXTRUDER

PLAY_MIDI

PLAY_MIDI

PLUGINS

PLUGINS

PRINT

PRINT

REBOOT

REBOOT

REMOVE_ZMOD

REMOVE_ZMOD

REM_ZMOD

REM_ZMOD

RESET_PASSWD

RESET_PASSWD

RESTORE_TAR_CONFIG

RESTORE_TAR_CONFIG

RESUME

RESUME

SAVE_ZMOD_DATA

SAVE_ZMOD_DATA

SCREEN

SCREEN

SET_PAUSE_AT_LAYER

SET_PAUSE_AT_LAYER

SET_PAUSE_NEXT_LAYER

SET_PAUSE_NEXT_LAYER

SET_TIMEZONE

SET_TIMEZONE

SHUTDOWN

SHUTDOWN

SKEW_PROFILE

SKEW_PROFILE

SKIP_ZMOD

SKIP_ZMOD

START_PRINT

START_PRINT

START_ZMOD

START_ZMOD

STOP_ZMOD

STOP_ZMOD

TAR_CONFIG

TAR_CONFIG

TEST_EMMC

TEST_EMMC

T_INFO

T_INFO

UPDATE_FF_OFFSET

UPDATE_FF_OFFSET

UPDATE_MCU

UPDATE_MCU

WEB

WEB

ZFLASH

ZFLASH

ZLINK

ZLINK

ZLINK_OFF

ZLINK_OFF

ZRESTORE

ZRESTORE

ZSHAPER

ZSHAPER

ZSSH_OFF

ZSSH_OFF

ZSSH_ON

ZSSH_ON

ZSSH_RELOAD

ZSSH_RELOAD

ZSSH_RESTART

ZSSH_RESTART

Z_OFFSET_APPLY_ENDSTOP

Z_OFFSET_APPLY_ENDSTOP

Z_OFFSET_APPLY_PROBE

Z_OFFSET_APPLY_PROBE

Main

A macro is a small program written in Klipper/Gcode language.

It can be called from:

- A GCODE file
- The Fluidd/Mainsail console (press the English letter `C` in Fluidd)

> **Note**
>
> *The value in parentheses is the default value*

START_PRINT

Replaces the default start G-code. **For printers with a native screen**, add `M140/M190 S[bed_temp]` and `M109/M104 S[nozzle_temp]`.

Parameters:

- `EXTRUDER_TEMP` — extruder temperature (default: `245`)
- `BED_TEMP` — bed temperature (default: `80`)
- `MESH` — bed mesh profile name to load (empty = no mesh is loaded; if the profile does not exist, it will be created)
- `FORCE_LEVELING` — force bed leveling (default: `False`)
- `SKIP_LEVELING` — skip bed leveling entirely (overrides `FORCE_KAMP/FORCE_LEVELING`, default: `False`)
- `FORCE_KAMP` — build an adaptive bed mesh (KAMP, default: `False`). *Recommended to add* `SAVE_ZMOD_DATA CLEAR=LINE_PURGE` *to use purge areas for KAMP.*
- `Z_OFFSET` — set Z offset (default: `0.0`)
- INTERNAL - For the PRO version when operating without the native screen, 1 - enable internal recirculation (0)
- EXTERNAL - For the PRO version when operating without the native screen, 1 - enable external recirculation (0)

Notes:

- Any calibration (e.g., `FORCE_KAMP/FORCE_LEVELING`) triggers CLEAR_NOZZLE.
- `ZSSH_RELOAD` is called during `START_PRINT` to restore SSH if needed.

Example for Orca with native screen: Replace the start G-code with:

```
START_PRINT EXTRUDER_TEMP=[nozzle_temperature_initial_layer]
BED_TEMP=[bed_temperature_initial_layer_single]
M190 S[bed_temperature_initial_layer_single]
M104 S[nozzle_temperature_initial_layer] T{single_extruder_multi_material ? 0 :
initial_extruder}
```

Example for Orca without native screen:

```
START_PRINT EXTRUDER_TEMP=[nozzle_temperature_initial_layer]
BED_TEMP=[bed_temperature_initial_layer_single]
```

Layer tracking in Fluidd: Add to start G-code:

```
SET_PRINT_STATS_INFO TOTAL_LAYER=[total_layer_count]
```

Add to layer change G-code:

```
SET_PRINT_STATS_INFO CURRENT_LAYER={layer_num + 1}
```

Bed leveling options

Global flags (set via `SAVE_ZMOD_DATA`):

- `PRECLEAR` — pre-nozzle cleaning in `CLEAR_NOZZLE`: `0` = disable, `1` = enable (default: `0`).
- `CLEAR` — nozzle cleaning method (`LINE_PURGE`).
- `PRINT_LEVELING` — enable bed leveling for every print: `0` = disable, `1` = enable (default: `0`).
- `USE_KAMP` — use adaptive bed mesh (KAMP) where possible: `0` = disable, `1` = enable (default: `0`).
- `DISABLE_PRIMING` — disable nozzle priming: `0` = enable, `1` = disable (default: `0`).

- `FORCE_MD5` — verify file MD5 hashes and delete the file on mismatch (default: `1`). > Note: Only applies when sending G-code. Not required for 3MF.

    1. Select and download the file for your architecture and operating system:
    - zmod_preprocess-windows-amd64.exe - Windows
    - zmod_preprocess-linux-amd64 - Linux. Don't forget to run `chmod +x zmod_preprocess-linux-amd64`
    - zmod_preprocess-darwin-arm64 - macOS Apple Silicon. Don't forget to run `chmod +x zmod_preprocess-darwin-arm64`
    - zmod_preprocess-darwin-amd64 - macOS Intel. Don't forget to run `chmod +x zmod_preprocess-darwin-amd64`
    - zmod-preprocess.py - Universal Python. Don't forget to run `chmod +x zmod-preprocess.py`
    - zmod-preprocess.sh - Linux/MacOS Bash. Don't forget to run `chmod +x zmod-preprocess.sh`
    1. In Orca, you need to specify: `Process Profile` -> `Other` -> `Post Processing Scripts`.

    Here are the options for adding:

    - `"C:\path_to_file\zmod_preprocess-windows-amd64.exe";`
    - `"C:\python_folder\python.exe" "C:\Scripts\zmod-preprocess.py";`
    - `"/usr/bin/python3" "/home/user/zmod-preprocess.py";`
    - `"/home/user/zmod-preprocess.py";`
    - `"/home/user/zmod_preprocess-darwin-amd64";`
    - `"/home/user/zmod_preprocess-darwin-arm64";`
    - `"/home/user/zmod_preprocess-linux-amd64";`

- `DISABLE_SKEW` — disable skew correction: `1` = disable, `0` = load `skew_profile` (calls `SKEW_PROFILE LOAD=skew_profile`) (default: `1`).

- `AUTO_REBOOT` — auto-reboot after print: `0` = disable, `1` = enable, `2` = `FIRMWARE_RESTART` (screenless mode only; with the native screen — `REBOOT`) (default: `0`).
- `CLOSE_DIALOGS` — auto-close dialogs: `0` = disable, `1` = slow, `2` = fast (requires enabling "Local Network Only" on the printer screen: Settings → WiFi icon → Network Mode) (default: `0`).
- `STOP_MOTOR` — disable motors 25 seconds after print end/cancel: `0` = disable, `1` = enable (default: `1`).
- `MIDI_START` — MIDI file to play on print start (e.g., `"start.mid"`).
- `MIDI_END` — MIDI file to play on print end.

Bed leveling logic:

1. Load mesh from `MESH` if specified.
2. Skip leveling if `SKIP_LEVELING = True`.
3. Build KAMP mesh if `FORCE_KAMP = True`.
4. Otherwise, build a full mesh if no mesh is loaded (the native screen always loads `MESH_DATA`) or `FORCE_LEVELING = True`. The mesh itself is not saved.

END_PRINT

Replaces the default end G-code.

Global flags (set via `SAVE_ZMOD_DATA`):

- `AUTO_REBOOT` — auto-reboot after print (same as above).
- `CLOSE_DIALOGS` — auto-close dialogs (same as above).
- `STOP_MOTOR` — disable motors after print (same as above).
- `MIDI_END` — MIDI file to play on print end.

_USER_PREPARE_PRINT

Custom macro that is called before the file is sent to print.

Lets you insert your own macros and commands before the file starts printing, i.e. even before `START_PRINT` runs.

Example override in `mod_data/user.cfg`:

```
[gcode_macro _USER_PREPARE_PRINT]
gcode:
    # Your macros and commands
    RESPOND MSG="Preparing to print"
```

Note: By default, this macro is empty and can be overridden by the user according to their needs.

_USER_START_PRINT

Custom macro for user-defined actions at the start of printing.

This macro is automatically called at the end of the `START_PRINT` macro. Use it to extend the standard print initialization process with custom commands.

Common use cases:

- Add custom heating or calibration commands
- Perform additional setup before printing starts
- Enable/disable devices (fans, sensors, etc.)
- Add custom nozzle cleaning or other preparation

Example override in `mod_data/user.cfg`:

```
[gcode_macro _USER_START_PRINT]
gcode:
    # Enable additional fan
    SET_PIN PIN=my_fan VALUE=1
    # Some custom command
    G4 P1000  ; pause for 1 second
    # Other custom actions
```

Note: By default, this macro is empty and can be overridden by the user according to their needs.

_USER_END_PRINT

Custom macro for user-defined actions at the end of printing.

This macro is automatically called at the end of the `END_PRINT` macro. Use it to extend the standard print completion process with custom commands.

Common use cases:

- Perform additional actions after printing completes
- Disable additional devices
- Save statistics or logs
- Run custom cleaning or maintenance routines

Example override in `mod_data/user.cfg`:

```
[gcode_macro _USER_END_PRINT]
gcode:
    # Disable additional fan
    SET_PIN PIN=my_fan VALUE=0
    # Send notification
    M118 Print completed!
    # Or other custom commands
```

Note: By default, this macro is empty and can be overridden by the user according to their needs.

CANCEL

Cancel the current print.

CLEAR_NOZZLE

Nozzle cleaning (as in stock firmware). Parameters:

- `EXTRUDER_TEMP` — extruder temperature (default: `230`)
- `BED_TEMP` — bed temperature (default: `80`)

`PRECLEAR` *is not a* `CLEAR_NOZZLE` *parameter but a global flag set via* `SAVE_ZMOD_DATA PRECLEAR=1`*; it enables pre-cleaning. Learn more.*

Overriding the `CLEAR_NOZZLE` *macro in* `mod_data/user.cfg` *does not change the native nozzle cleaning when it is started directly from the native screen: the native screen works without Z-Mod and therefore does not use Z-Mod macros.*

LED_ON

Turn on LED lighting.

LED_OFF

Turn off LED lighting.

LED

Set LED brightness.

- `S` — brightness percentage (default: `50`).

PAUSE

Pause the print.

RESUME

Resume the print after pausing.

PLAY_MIDI

Play a MIDI file.

- `FILE` — filename (default: `For_Elise.mid`). Files are stored in `mod_data/midi/`.

REBOOT

Reboot the printer.

CLOSE_DIALOGS

Close dialogs on the native screen (slow method). Used to close the window at the end of a print or when a print is cancelled. *May cause printer freezes.*

Implementation: @darksimpson

Controlled by the `CLOSE_DIALOGS` global parameter.

FAST_CLOSE_DIALOGS

Close dialogs quickly (recommended). Used to close the window at the end of a print or when a print is cancelled. Works faster and does not freeze the printer.

Implementation: @darksimpson

Enable "Local Network Only" in printer settings: ***Settings → WiFi icon → Network Mode → Toggle "Local Network Only"****.* Controlled by the `CLOSE_DIALOGS` global parameter.

NEW_SAVE_CONFIG

Trigger `SAVE_CONFIG` without freezing the native screen. Can be used to restart Klipper without freezing the native screen.

Implementation: @darksimpson

May take ~1 minute and occasionally cause screen glitches.

SHUTDOWN

Power off the printer.

Calibrations

A macro is a small program written in Klipper/Gcode language.

It can be called from:

- A GCODE file
- The Fluidd/Mainsail console (press the English letter `C` in Fluidd)

> **Note**
>
> *The value in parentheses is the default value*

> **Tip**
>
> Printer Calibration for Beginners

BED_LEVEL_SCREWS_TUNE

Bed screw leveling calibration (guide). Parameters:

- `EXTRUDER_TEMP` — extruder temperature (default: `240`)
- `BED_TEMP` — bed temperature (default: `80`)

Measures the distance between the nozzle and bed screws, provides adjustment instructions, saves temperatures to avoid reheating, and waits for user confirmation. Users must manually reset temperatures after completion.

LOAD_CELL_TARE

Reset load cell weight. Used during bed calibration.

PID_TUNE_BED

Bed PID calibration.

- `TEMPERATURE` — bed temperature (default: `80`)

Automatically calls `SAVE_CONFIG` after calibration. See also NEW_SAVE_CONFIG.

To disable auto-save, use:

```
PID_CALIBRATE HEATER=heater_bed TARGET={temperature}
```

PID_TUNE_EXTRUDER

Extruder PID calibration. Parameters:

- `TEMPERATURE` — extruder temperature (default: `245`)
- `COOLER` — fan speed (0-100, default: `100`)

Calibrate PID at your printing temperature and cooling settings. Automatically calls `SAVE_CONFIG` after calibration.

To disable auto-save, use:

```
PID_CALIBRATE HEATER=extruder TARGET={temperature}
```

ZSHAPER

Input shaper calibration. Results are stored on the "Configuration" tab -> `mod_data`:

- `calibration_data_x.png`
- `calibration_data_y.png`
- CSV files

Read fix_scv

Graph visualization tool.

BELTS_SHAPER_CALIBRATION

CoreXY belt frequency analysis using a half-axis test.

- `SPECTROGRAM` — `0` = disable spectrogram, `1` = enable (default: `1`)

Requirements:

- 256 MB RAM
- Enabled SWAP

KAMP

> **Fast KAMP**
>
> KAMP is enabled automatically and works without slow object exclusion. For 3MF the KAMP data is available instantly, for G-code — after the file is scanned.

Adaptive bed mesh calibration with nozzle cleaning. Parameters:

- `EXTRUDER_TEMP` — extruder temperature (default: `240`)
- `BED_TEMP` — bed temperature (default: `80`)

Usage in Orca: Add as the first line:

```
KAMP EXTRUDER_TEMP=[nozzle_temperature_initial_layer]
BED_TEMP=[bed_temperature_initial_layer_single]
```

Recommended: Use START_PRINT with `SAVE_ZMOD_DATA PRINT_LEVELING=1 USE_KAMP=1` and `SAVE_ZMOD_DATA CLEAR=LINE_PURGE` to utilize purge areas.

Bed leveling options

AUTO_FULL_BED_LEVEL

Full bed leveling with nozzle cleaning. Parameters:

- `EXTRUDER_TEMP` — extruder temperature (default: `230`)
- `BED_TEMP` — bed temperature (default: `80`)
- `PROFILE` — mesh profile name (default: `auto`)
- `SAVE` — automatically save the bed mesh (default: `1`)

Usage in Orca:

```
AUTO_FULL_BED_LEVEL EXTRUDER_TEMP=[nozzle_temperature_initial_layer]
BED_TEMP=[bed_temperature_initial_layer_single]
M190 S[bed_temperature_initial_layer_single]
M104 S[nozzle_temperature_initial_layer] T{single_extruder_multi_material ? 0 :
initial_extruder}
```

Recommended: Use START_PRINT with `SAVE_ZMOD_DATA PRINT_LEVELING=1`.

When the mesh calibration is performed, the starting zero is calibrated.

Bed leveling options

LOAD_ZOFFSET_NATIVE

Move the z-offset from the native screen to screenless mode. *Not required for Creator 5 / Creator 5 Pro.*

How Z-Offset Works on Your Printer

Start/Stop/Global

A macro is a small program written in Klipper/Gcode.

It can be called from:

- A GCODE file
- The Fluidd/Mainsail console (press the English letter `C` in Fluidd)

> **Note**
>
> *The value in parentheses is the default value*

LANG

Set the language for Z-Mod operation.

- LANG - language: en (English), ru (Russian), de (German), fr (French), it (Italian), es (Spanish), zh (Chinese), ja (Japanese), ko (Korean), pt (Portuguese), cs (Czech), tr (Turkish)

Example:

```
LANG LANG=en
```

SET_TIMEZONE

Change the timezone.

- ZONE - time zone (Asia/Yekaterinburg)

More details: SET_TIMEZONE.

NOZZLE_CONTROL

Control nozzle collision with the bed or part detachment.

Emergency shutdown of the printer if a weight overload is detected (AD5M and AD5X).

- WEIGHT - weight in grams (1500)

Settings persist after reboot.

Set `NOZZLE_CONTROL WEIGHT=0` to disable this feature.

Control is disabled until the macro is first called.

After the first call, control is enabled automatically during printing.

When using the native screen, macro execution reboots the printer.

Without the native screen, restarts Klipper (configuration files are modified).

Works automatically, but additional macros are available for Gcode:

- `ZCONTROL_ON` - enable control
- `ZCONTROL_OFF` - disable control
- `ZCONTROL_STATUS` - check status
- `ZCONTROL_PAUSE` - pause on trigger (only after command queue clears; avoid using on initial layers)
- `ZCONTROL_ABORT` - abort Klipper on trigger
- `ZCONTROL_AUTO` - On trigger, stop Klipper (if Z height < `ZCONTROL_Z`) or call PAUSE if z >= `ZCONTROL_Z`
- `ZCONTROL_Z Z=10` - Set Z height.
- `SAVE_ZMOD_DATA ZCONTROL_Z=10` - Save Z height. If you don't want to enable pause, set `SAVE_ZMOD_DATA ZCONTROL_Z=230`

To enable nozzle control on initial layers, add `ZCONTROL_PAUSE` in the slicer at the layer where a pause should be used instead of aborting.

The phrase "Control is not active" means that control is not being used at that moment, but it will be activated automatically during printing.

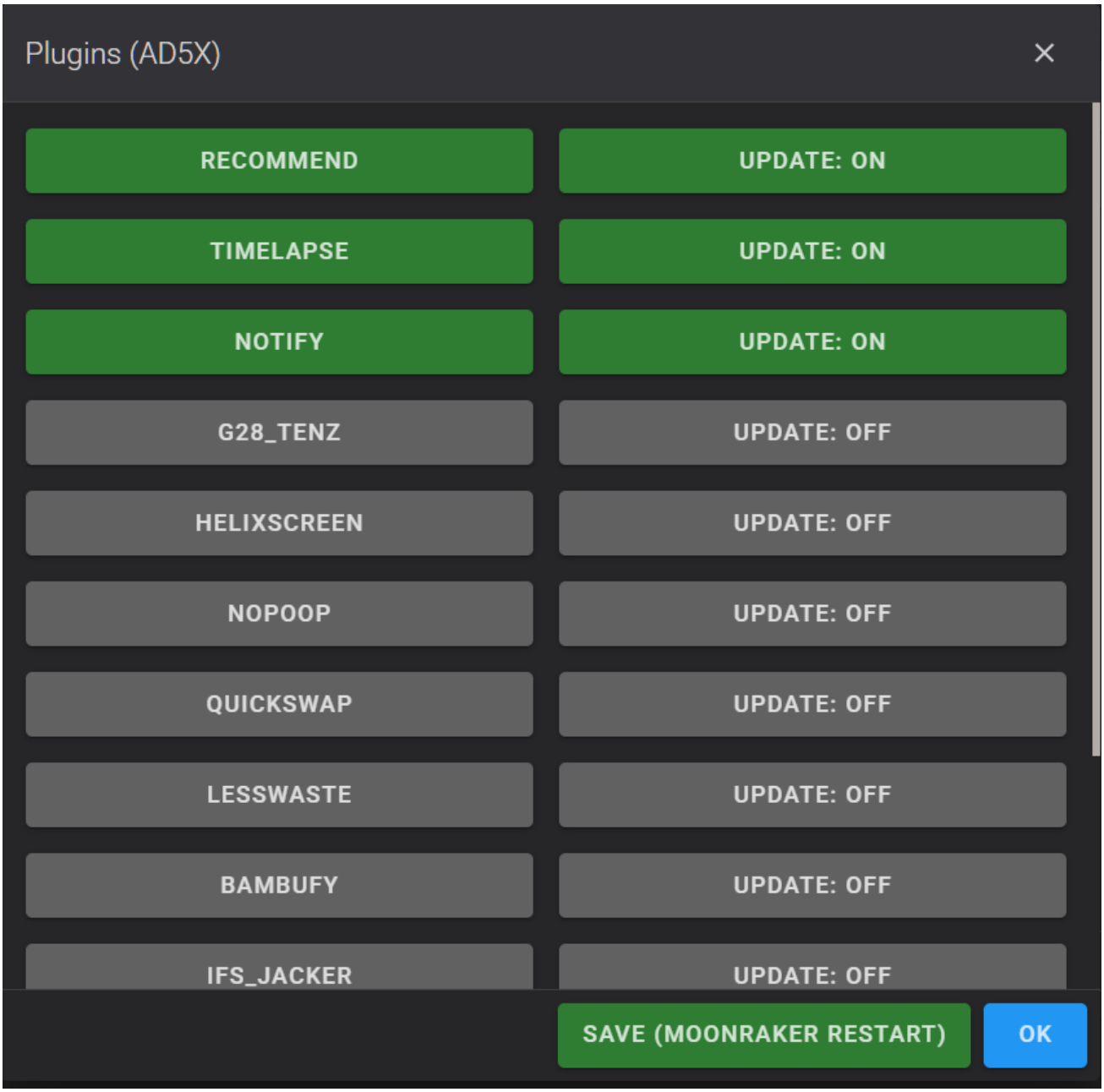
GET_ZMOD_DATA

Retrieve Z-Mod global parameters/flags. After execution, the console displays saved parameters applied at runtime.

`Fluidd` -> `Macros` -> `Main` -> `Z-Mod PARAMETERS`

PLUGINS

Displays the plugin management menu.



In this menu you can enable, disable and completely remove additional plugins.

- Left column (activation): click to enable or disable the plugin.
  - Green button — the plugin is active.
  - Gray button — the plugin is disabled.
- Right column (updates): enables or disables automatic updates via Moonraker.
  - UPDATE: ON — updates are enabled.
  - UPDATE: OFF — updates are disabled.

How to completely remove a plugin:

If you no longer need a plugin, make both of its buttons gray (disable the plugin itself and its updates), press SAVE (MOONRAKER RESTART), and then reboot the printer. The system will automatically delete its folder from `mod_data/plugins/`.

GLOBAL

Simplified management of global parameters. Only parameters that can be changed with a button click are available. Parameters that require entering a number, specifying a file name, etc. are not controlled by this macro.

After changing parameters, it is recommended to restart the printer.

SAVE_ZMOD_DATA

Save Z-Mod global parameters/flags (applied during every print).

Do not add this macro to start/end Gcode or Gcode files. Call it from the Fluidd/Mainsail console. Parameters are stored in the printer memory in `mod_data/variables.cfg` and survive a shutdown, so you do not need to enter them every time (**do not edit this file manually — you will break Klipper or the mod**).

To edit parameters:

- Go to `Fluidd` -> `Macros` -> `System` -> `SAVE Z-Mod PARAMETERS`, select the parameter, modify it, and click `SEND`.
- Alternatively, enter commands directly in the Fluidd console, e.g., `SAVE_ZMOD_DATA CLOSE_DIALOGS=2`. Check the output in the Fluidd console.

View saved parameters

Print color selection menu parameters

Color selection menu parameters are all for the AD5X only.

ALLOWED_TOOL_COUNT

Number of tools to show in the color selection menu. This refers to the T0, T1, etc commands in the gcode file, not the physical spools in your IFS.

If Z-Mod is able to successfully scan the file for used tools, this will be overridden and the tools used in the file will be shown.

This setting cannot be used when the native screen is enabled.

See preprocessing

Example: `SAVE_ZMOD_DATA ALLOWED_TOOL_COUNT=4`

SCAN_FILE_COLORS

> **3MF**
>
> For 3MF files, scanning and color mapping are instant; the preprocessor is not needed.

Enables scanning gcode files for which toolchange commands (T0, T1, etc) are used, and what colors and materials they are mapped to in the slicer: 0 (disable), 1 (enable), 2 (disable full scan, but look for data prepared by slicer script)

See preprocessing

Example: `SAVE_ZMOD_DATA SCAN_FILE_COLORS=0`

COLOR_MENU_1_BASED

Determines whether to show 0-based (T0, T1, etc) or 1-based (Color 1, Color 2, etc) labels in the color selection menu. This does not change anything other than how the buttons are labelled and is purely for convenience: 0 (0-based), 1 (1-based)

Example: `SAVE_ZMOD_DATA COLOR_MENU_1_BASED=1`

AUTO_ASSIGN_COLORS

Determines whether to attempt automatic mapping of toolchange commands (T0, T1, etc) to physical filament loaded in your IFS when starting a print. Unless you have enabled silent mode, the color selection menu will still appear; this setting only affects the default selections: 0 (disable), 1 (enable)

This setting will also apply to prints started in silent mode. You can configure it to abort the print if certain errors arise with the auto-assignment: 2 (abort if any materials cannot be matched, allow color mismatches), 30 (abort on any issues)

For custom values for error conditions in silent mode, add the following values together to determine the right setting:

- 2 (At least one material cannot be matched; eg. the gcode file specifies ABS, but you only have PLA loaded; or material data could not be loaded)
- 4 (At least one color cannot be matched at all, usually due to file scanning being disabled or failing)
- 8 (At least one color is potentially a poor match)
- 16 (At least one physical spool has been assigned to more than one tool index in the file)

See preprocessing

Example: `SAVE_ZMOD_DATA AUTO_ASSIGN_COLORS=0`

PURGE_ALL_EXTRUDERS

Creator 5 / Creator 5 Pro only

Extruder purge at print start:

- 0 - purge only the first (starting) extruder (default)
- 1 - purge all used extruders

The extruders purged are those involved in mapping the file's colors to the physical spools. If several colors are assigned to the same spool, that extruder is purged once.

When Auto PA is enabled (PRINT_AUTOPA or the `Auto PA` button in the print menu), all used extruders are already purged during PA calibration, so this parameter has no effect.

Example: `SAVE_ZMOD_DATA PURGE_ALL_EXTRUDERS=1`

UNUSED_EXTRUDERS_OFF_TIME

Creator 5 / Creator 5 Pro only

Turn off heating of idle extruders during multi-color printing after a set time (in minutes):

- 0 - do not turn off
- 5, 10, 20, 40, 60 - after how many idle minutes the extruder heating is turned off

In the menu the parameter is shown as "Turn off idle extruders in N min".

For correct operation, **Ooze prevention** must be enabled in the slicer (`Print settings` > `Multimaterial` > `Ooze prevention`).

Example: `SAVE_ZMOD_DATA UNUSED_EXTRUDERS_OFF_TIME=5`

Print start/bed mapping parameters [START_PRINT]:

MIDI_START

Play MIDI on print start (""), 0 to disable.

Example: `SAVE_ZMOD_DATA MIDI_START=Pain-Shut-your-mouth.mid`

PRECLEAR

Enable nozzle pre-clearing in CLEAR_NOZZLE: 0 (no), 1 (yes) (0).

Example: `SAVE_ZMOD_DATA PRECLEAR=0`

PRINT_LEVELING

Build bed mesh before each print (using native screen if enabled): 0 (no), 1 (yes) (0). *For native screen bed leveling, enable "Local Network Only" via the printer menu: Settings -> WiFi icon -> Network Mode.*

Example: `SAVE_ZMOD_DATA PRINT_LEVELING=1`

PRINT_AUTOPA

Creator 5 / Creator 5 Pro only

Select PA (Pressure Advance) for each print: 0-no, 1-yes (0).

For Auto PA to work from the native screen, enable "Local Network Only" via the printer menu: Settings -> WiFi icon -> Network Mode.

Example: `SAVE_ZMOD_DATA PRINT_AUTOPA=1`

USE_KAMP

> **Fast KAMP**
>
> KAMP is enabled automatically and works without slow object exclusion. For 3MF the KAMP data is available instantly, for G-code — after the file is scanned.

Use Adaptive Mesh (KAMP) instead of full bed mesh where possible: 0 (no), 1 (yes) (0). Recommended to set `SAVE_ZMOD_DATA CLEAR=LINE_PURGE` to align purge location with KAMP mesh.

Allows using KAMP when leveling is started from the native screen over the network.

Example: `SAVE_ZMOD_DATA USE_KAMP=1`

MESH_TEST

Test the bed mesh before printing:

- 0 - No
- 1 - Test WITHOUT Z-Offset auto-tuning (default)
- 2 - Test WITHOUT Z-Offset auto-tuning, if the mesh doesn't match, run KAMP
- 3 - Test WITH Z-Offset auto-tuning, with nozzle cleaning
- 4 - Test WITH Z-Offset auto-tuning, with nozzle cleaning, if the mesh doesn't match, run KAMP

Z-Offset Auto-Tuning

Algorithm for automatic Z-Offset calibration:

1. **Source data:** The printer's memory stores a bed mesh (AD5M/AD5X: 25 points, C5Pro: 100 points) obtained during the last leveling procedure.
2. **Preparation:**
    - For AD5M/AD5X the nozzle is heated to the working temperature, wiped on the bed, and cooled down to the bed probing temperature: TEMP_TEST_MAX (151 by default) if the target nozzle temperature is above 230°C, otherwise TEMP_TEST_MIN (121 by default).
    - For Creator 5 / Creator 5 Pro the active extruder is parked.
3. **Measurement point selection:**
    - The **center** point of the mesh is used.
4. **Measurement and comparison:**
    - A new probe measurement (PROBE) is performed at the selected point.
    - The obtained value is compared with the value saved in the bed mesh.

5. **Offset correction:**
    - If the discrepancy is **less than 0.3 mm**, the difference is added to the current Z-Offset value.
    - If the discrepancy is **greater than or equal to 0.3 mm**, the system considers the saved mesh outdated and, if the settings allow, automatically initiates a bed re-leveling procedure (KAMP).

Without Z-Offset Auto-Tuning

Bed mesh validation algorithm:

1. **Measurement:** A standard probe measurement (PROBE) is performed at the current point.
2. **Validation:** The obtained Z value is checked for consistency with the loaded mesh.
3. **Criterion:** The value must be within the range from (mesh minimum - 0.21 mm) to (mesh maximum + 0.21 mm).
4. **Result:**
    - **Success:** The mesh is considered correct, printing continues.
    - **Failure:** A warning is issued and printing stops or, if settings allow, a bed re-leveling procedure (KAMP) is started automatically.

Notes for the check without auto-tuning:

- This check is a rough estimate. It is intended to detect critical errors, for example, when a mesh taken for a PEI sheet is loaded for thick glass and vice versa.
- **Do not rely on this check as absolute protection.**
- When using smart cleaning (KAMP), the heating wait occurs near the cleaning location, not in the corner of the bed.
- The check is performed with a hot nozzle.

Example: `SAVE_ZMOD_DATA MESH_TEST=0`

TEMP_TEST_MIN

Lower nozzle temperature for the bed contact test in MESH_TEST modes 3/4 (with nozzle cleaning). If the target nozzle temperature is 230°C or lower, the nozzle is cooled down to this temperature before probing. Default: `121`.

Lower the value if your build plate does not tolerate the default temperature: on PC plates (glass transition point ~145-150°C) and some G10 plates a hot nozzle leaves deep imprints in the surface.

This parameter is not set via `SAVE_ZMOD_DATA` — enter the command in the Fluidd/Mainsail console (the value is stored in `mod_data/variables.cfg`):

Example: `SAVE_VARIABLE VARIABLE=temp_test_min VALUE=110`

- Recommended range: 100-150. The new value applies from the next print, no restart required.
- Only used where nozzle wiping/cleaning is performed (MESH_TEST 3/4). In modes 1/2 (default) the mesh is checked at full print temperature without cooling down.

TEMP_TEST_MAX

Upper nozzle temperature for the bed contact test in MESH_TEST modes 3/4 (with nozzle cleaning). If the target nozzle temperature is above 230°C, the nozzle is cooled down to this temperature before probing. Default: `151`.

Usage is the same as for TEMP_TEST_MIN — lower the value for temperature-sensitive build plates (PC, some G10).

Example: `SAVE_VARIABLE VARIABLE=temp_test_max VALUE=140`

FORCE_MD5

Igor Polunovskiy

> Note: Only applies when sending G-code. Not required for 3MF.

Verify file MD5 hash and delete on mismatch: 0 (disable), 1 (enable) (1).

1. Select and download the file for your architecture and operating system:

- zmod_preprocess-windows-amd64.exe - Windows
- zmod_preprocess-linux-amd64 - Linux. Don't forget to run `chmod +x zmod_preprocess-linux-amd64`
- zmod_preprocess-darwin-arm64 - macOS Apple Silicon. Don't forget to run `chmod +x zmod_preprocess-darwin-arm64`
- zmod_preprocess-darwin-amd64 - macOS Intel. Don't forget to run `chmod +x zmod_preprocess-darwin-amd64`
- zmod-preprocess.py - Universal Python. Don't forget to run `chmod +x zmod-preprocess.py`
- zmod-preprocess.sh - Linux/MacOS Bash. Don't forget to run `chmod +x zmod-preprocess.sh`

1. In Orca, you need to specify: `Process Profile` -> `Other` -> `Post Processing Scripts`.

Here are the options for adding:

- `"C:\path_to_file\zmod_preprocess-windows-amd64.exe";`
- `"C:\python_folder\python.exe" "C:\Scripts\zmod-preprocess.py";`
- `"/usr/bin/python3" "/home/user/zmod-preprocess.py";`
- `"/home/user/zmod-preprocess.py";`
- `"/home/user/zmod_preprocess-darwin-amd64";`
- `"/home/user/zmod_preprocess-darwin-arm64";`
- `"/home/user/zmod_preprocess-linux-amd64";`

Example: `SAVE_ZMOD_DATA FORCE_MD5=1`

DISABLE_SKEW

1 (disable SKEW correction), 0 (load `skew_profile` via `SKEW_PROFILE LOAD=skew_profile`) (1).

Details

Example: `SAVE_ZMOD_DATA DISABLE_SKEW=1`

LOAD_ZOFFSET

> **Creator 5 / Creator 5 Pro**
>
> On Creator 5 / Creator 5 Pro the Z-offset with the native screen and in screenless mode is the same — they are fully synchronized. If the native screen is disabled, you can change the Z-offset during printing via GuppyScreen, HelixScreen, Fluidd or Mainsail — it will be saved.

Load Z-offset from global parameters saved via SET_GCODE_OFFSET: 1 (yes), 0 (no) (1).

How Z-Offset Works

Example: `SAVE_ZMOD_DATA LOAD_ZOFFSET=0`

DISABLE_PRIMING

Disable nozzle priming via extrusion: 0 (no), 1 (yes) (0).

Details

Example: `SAVE_ZMOD_DATA DISABLE_PRIMING=0`

CLEAR

Select nozzle purge algorithm (LINE_PURGE):

- _CLEAR1 - Orca-style
- _CLEAR2 - FF group style
- _CLEAR3 - FF group alternative
- _CLEAR4 - Shreider's code (top-right to bottom-right)
- _CLEAR_TRAP - For brushes (top-right to bottom-right)
- LINE_PURGE - KAMP purge

If you use `KAMP`, the purge is forced to `LINE_PURGE` (instead of _CLEAR1, _CLEAR2, _CLEAR3, _CLEAR4).

If you use `LINE_PURGE` but have not enabled object labeling in Orca, `_CLEAR2` is used instead.

Custom purge macros can be added to `mod_data/user.cfg` — put the macro name into this parameter.

Example: `SAVE_ZMOD_DATA CLEAR=LINE_PURGE`

5M/5M Pro: This is not a replacement for the native cleaning (CLEAR_NOZZLE), where the nozzle pokes the middle of the bed and then wipes the plastic off on the bed. This is nozzle priming right before printing.

To disable nozzle priming with a line, use DISABLE_PRIMING

Print end/cancel parameters [END_PRINT]:

MIDI_END

Play MIDI on print end (""), 0 to disable.

Example: `SAVE_ZMOD_DATA MIDI_END=Pain-Shut-your-mouth.mid`

CLOSE_DIALOGS

Automatically close dialogs after print end/cancel: 0 (no), 1 (yes, slow), 2 (yes, fast) (0). *For fast closing, enable "Local Network Only" via the printer menu: Settings -> WiFi icon -> Network Mode.*

Example: `SAVE_ZMOD_DATA CLOSE_DIALOGS=2`

STOP_MOTOR

Automatically disable motors 25 seconds after print end/cancel: 0 (no), 1 (yes) (1).

Example: `SAVE_ZMOD_DATA STOP_MOTOR=1`

AUTO_REBOOT

Automatically reboot the printer after printing completes (0):

- 0 - no reboot
- 1 - reboot the printer via the `REBOOT` command
- 2 - without the native screen: reboot the firmware via `FIRMWARE_RESTART`; with the screen: reboot the printer via the `REBOOT` command

Example: `SAVE_ZMOD_DATA AUTO_REBOOT=0`

System-wide parameters:

MOTION_SENSOR

Use a filament motion sensor instead of the filament presence sensor (0):

- 0 - no (the filament presence sensor is used)
- 1 - yes (the filament motion sensor is used)

When using the filament motion sensor, disable it on the native screen; otherwise, printing will stop.

If the filament presence sensor is used in screenless mode, the following message is shown when it triggers: "Filament has run out. Pause in 30 seconds".

Example: `SAVE_ZMOD_DATA MOTION_SENSOR=1`

SILENT

AD5X only

Do not show the color selection window when starting printing

- 0 - show the window (default)
- 1 - do not show the window, use previously set colors
- 2 - do not show the window, do not use IFS

Example: `SAVE_ZMOD_DATA SILENT=0`

AUTOINSERT

AD5X Only

Automatically Load Filament

- 0 - Do not automatically load filament
- 1 - Automatically load filament (default)

Example: `SAVE_ZMOD_DATA AUTOINSERT=0`

ALWAYS_FULL_COLOR_CHANGE

AD5X only

Determines whether or not to skip the color change process if the before and after colors are mapped to the same physical spool.

- 0 - skip the process (default)
- 1 - do not skip the process

Example: `SAVE_ZMOD_DATA ALWAYS_FULL_COLOR_CHANGE=0`

USE_TRASH_ON_PRINT

AD5X only

Only when running without the native display

Use trash on color change during printing

- 0 - no purge in trash chute
- 1 - purge in trash chute (default)
- 2 - travel to trash chute after color change but do not purge

Example: `SAVE_ZMOD_DATA USE_TRASH_ON_PRINT=0`

REMOVE_FILAMENT

AD5X only

Only when running without the native display

Unload filament after print completion:

- 0 — do not unload (default)
- 1 — unload

Example: `SAVE_ZMOD_DATA REMOVE_FILAMENT=1`

FIX_SCV

Fix incorrect SCV (square_corner_velocity) when rendering acceleration graphs and calculating input shapers.

- 0 - keep the parameter as in stock (5)
- 1 - use `square_corner_velocity` from `mod_data/user.cfg` or `printer.base.cfg`

Example: `SAVE_ZMOD_DATA FIX_SCV=1`

In our printer, `square_corner_velocity: 25`, but shaper graph calculations and accelerations are based on `SCV = 5`.

This primarily affects displayed accelerations and calculated smoothing levels. `shaper_type_x`, `shaper_freq_x`, `shaper_type_y`, `shaper_freq_y` remain unchanged.

However, with correct calculations, the resulting accelerations drop by approximately half.

Recommendation: add the following to `mod_data/user.cfg`:

```
[printer]
square_corner_velocity: 9
```

This reduces cornering speeds and generally improves print quality with a slight speed trade-off.

WIFI

On some firmware versions, Wi-Fi occasionally fails to start.

To fix this, connect to a Wi-Fi network via the native screen.

1. Call `SAVE_ZMOD_DATA WIFI=1`
2. Turn off the printer
3. Turn on the printer

- 0 — use Wi-Fi from the native screen
- 1 — use Wi-Fi through Z-Mod

FIX_E0011

Common causes of E0011 error (Timer too close):

- Host did not respond within the allotted time (0.025 sec)
- MCU did not respond within the allotted time (0.025 sec)

Specific causes:

- Frozen Nations MCU mainboard or eboard. `Lost communication with MCU 'mcu'`. Solution: Reboot. Replace the mainboard (`mcu`) or extruder board (`eboard`).
- Host CPU overload (shaper calculations/graph rendering).
- EMMC overload (git operations, backups, large file uploads during printing, etc.).
- Insufficient RAM. Solution: Re-solder the CPU and upgrade to 256MB RAM.
- Damaged extruder cable. Solution: Replace/fix the cable.
- Loose extruder board cable connection. Solution: Replace the extruder board.
- SWAP data loading (SWAP resides on EMMC, which operates at 10 MB/s; SWAP data during shaper calculations can reach 25MB). Solution: Disable SWAP if you have 256MB RAM via `SAVE_ZMOD_DATA USE_SWAP=0`.
- MCU firmware crash. Solution: Reflash the MCU via factory reset or use the UPDATE_MCU mod.

Fix E0011 and `Communication timeout during homing` errors. Changing this parameter will reboot the printer. 0-no, 1-yes (0):

- 0 - keep the stock parameter (0.025)
- 1 - set the parameter to 0.1

Example: `SAVE_ZMOD_DATA FIX_E0011=1`

This error may also occur:

- Large volume of model exclusions: Solution: `Process Profile` -> `Other` -> `Output G-code` -> uncheck `Exclude models`.
- If you disabled swap on FF5M/FF5MPro.

Run the `MEM` macro and see if there is swap and what size it is.

Enable swap if it is disabled: `SAVE_ZMOD_DATA USE_SWAP=1`

- If on FF5M/FF5MPro you run a full test, i.e. PID calibration, bed mesh probing and shaper calibration at the same time.

It is better to carry out all calibrations according to this guide

- If you use Klipper 14 on AD5X. In this case you can return to the native Klipper by running `UPDATE_MCU FORCE=native`.
- If fuzzy skin is used and the CPU cannot keep up with calculating the toolpath. Disable fuzzy skin or tune its parameters.

The `Communication timeout during homing` error may occur due to high communication latency between the host and MCUs. Round-trip time should consistently stay below 10ms. Temporary latency spikes can cause homing failures.

`TRSYNC_TIMEOUT` is a Klipper parameter (default: 0.025 sec) that compensates for system delays.

Stock file `/opt/klipper/klippy/mcu.py` sets `TRSYNC_TIMEOUT = 0.025`. The patch changes it to `TRSYNC_TIMEOUT = 0.1`.

How to fix on stock firmware:

- Format a USB drive as FAT32(MBR).
- Save the `flashforge_init.sh` file to the USB:
  - Fix parameter Adventurer5M
  - Restore stock parameter Adventurer5M
  - Fix parameter Adventurer5MPro
  - Restore stock parameter Adventurer5MPro
- Power off the printer.
- Insert the USB into the printer.
- Power on the printer (it will beep loudly).
- Wait for reboot.
- Remove the USB.
- Reprint the problematic file; E0011 should no longer occur.

Manual fix on stock firmware:

- Install root.
- Use WinSCP to SSH into the printer.
- Edit `/opt/klipper/klippy/mcu.py`.
- Locate `TRSYNC_TIMEOUT = 0.025` and change it to `TRSYNC_TIMEOUT = 0.1`.
- Save the file and reboot the printer.

FIX_E0017

Fix E0017 error. Changing this parameter will reboot the printer. 0-no, 1-yes (1):

In the stock file `/opt/klipper/klippy/toolhead.py`, `LOOKAHEAD_FLUSH_TIME = 0.5`. Original Klipper uses `LOOKAHEAD_FLUSH_TIME = 0.250`. Our mod works best with `LOOKAHEAD_FLUSH_TIME = 0.150`.

- 0 - set to stock value
- 1 - set to 0.150

Example: `SAVE_ZMOD_DATA FIX_E0017=1`

How to fix on stock firmware:

- Format a USB drive as FAT32(MBR).
- Save the appropriate file to the USB:
  - Adventurer5M-e0017-4.tgz for FlashForge 5M
  - Adventurer5MPro-e0017-4.tgz for FlashForge 5M Pro
- Power off the printer.
- Insert the USB into the printer.

- Power on the printer (it will beep loudly).
- Wait for reboot.
- Remove the USB.
- Reprint the problematic file; E0017 should no longer occur.

Manual fix on stock firmware:

- Install root.
- Use WinSCP to SSH into the printer.
- Edit `/opt/klipper/klippy/toolhead.py`.
- Locate `LOOKAHEAD_FLUSH_TIME = 0.5` and change it to `LOOKAHEAD_FLUSH_TIME = 0.150`.
- Save the file and reboot the printer.

LED

LED brightness at startup (50).

Example: `SAVE_ZMOD_DATA LED=50`

WEB_SCREEN

Redirect the printer screen as a virtual `screen` camera in Fluidd/Mainsail and zmod.link

- 0 - Do not redirect
- 1 - Redirect (default)

Example: `SAVE_ZMOD_DATA WEB_SCREEN=1`

MIDI_ON

Play MIDI at startup (""). Use `0` to disable.

Example: `SAVE_ZMOD_DATA MIDI_ON=Pain-Shut-your-mouth.mid`

NEW_SAVE_CONFIG

Use alternative SAVE_CONFIG (invokes `SAVE_CONFIG` without freezing the native screen).
NEW_SAVE_CONFIG for PID calibration: 0-no, 1-yes (0).

Example: `SAVE_ZMOD_DATA NEW_SAVE_CONFIG=0`

USE_SWAP

Enable SWAP (1):

- 0 - no (*Only for upgraded 256MB RAM*)

- 1 - yes, on EMMC
- 2 - yes, if possible on USB FLASH(FAT32(MBR)) *for the brave and confident (in fact, it works 90% slower than EMMC)*

Example: `SAVE_ZMOD_DATA USE_SWAP=1`

CHINA_CLOUD

Enable Chinese cloud services: 0-no, 1-yes (1).

Example: `SAVE_ZMOD_DATA CHINA_CLOUD=0`

Disable Chinese clouds

Even if all cloud options are disabled via the screen, the printer still attempts to send photos, videos, and telemetry to Chinese servers.

Setting this parameter to 0 partially disables these "features."

If Chinese clouds are disabled, the printer will not check for stock firmware updates.

To update stock firmware, enable Chinese clouds via `SAVE_ZMOD_DATA CHINA_CLOUD=1`, reboot, and proceed with the update.

Instead, you can use:

- zmod.link - a cloud for managing printers via Fluidd/Mainsail.
- Telegram bot.

To disable Chinese clouds on stock firmware:

- Format a USB drive as FAT32(MBR).
- Place flashforge_init.sh on the USB.
- Power off the printer.
- Insert the USB into the printer.
- Power on the printer (it will reboot once).
- Remove the USB.

To enable Chinese clouds on stock firmware:

- Format a USB drive as FAT32(MBR).
- Place flashforge_init.sh on the USB.
- Follow the same steps as above (the printer will reboot once).

NICE

Set Klipper process priority: 1 (lowest) to 40 (highest) (20).

Example: `SAVE_ZMOD_DATA NICE=20`

Higher priority allocates more resources to Klipper but may cause Moonraker and camera disconnections.

For Linux users:

```
NICE=20
grep -q "^nice = " /opt/config/mod_data/variables.cfg && NICE=$(grep "^nice = " /opt/config/
mod_data/variables.cfg | cut -d "=" -f2| awk '{print $1}')
NICE=$((20-$NICE))
[ $NICE -ge 20 ]  && NICE=19
[ $NICE -lt -20 ] && NICE=-20
renice $NICE $(ps |grep klippy.py| grep -v grep| awk '{print $1}')
```

DISPLAY_OFF_TIMEOUT

Set the time (in seconds) after which the native screen is turned off when working in screenless mode. Default: 180.

Note: The native screen needs at least 5 seconds to configure WiFi.

Example: `SAVE_ZMOD_DATA DISPLAY_OFF_TIMEOUT=120`

ORCA_FF

AD5X / Creator 5 / Creator 5 Pro only

Native screen emulator for OrcaSlicer and Flash Studio when the native screen is off. Lets you choose spools for colors right in the slicer when sending a print (instead of the Fluidd print menu) and work with the printer from Flash Studio: discover it on the network, send files, monitor and control the print.

Works only when the native screen is disabled (`DISPLAY_OFF`).

- 0 - Do not use (default)
- 1 - Use

The change takes effect after the printer is rebooted.

Example: `SAVE_ZMOD_DATA ORCA_FF=1`

Connection in the slicer:

- Host type: `FlashForge`
- Hostname: `IP_printer`
- API key / password: `zmod` (or the data from the native screen)
- Serial number: `zmod` (or the printer serial number)

AFC

AD5X / Creator 5 Pro only

Show the IFS slots (AD5X) and toolheads (Creator 5 Pro) in Fluidd and Mainsail as a standard AFC panel. Works both with and without the native screen. Details: AD5X, Creator 5 Pro.

- 0 - Do not use (default)

- 1 - Use

The change takes effect after restarting Klipper.

Example: `SAVE_ZMOD_DATA AFC=1`

IDLE_MAP

AD5X / Creator 5 Pro only. Requires the AFC panel to be enabled.

Reset tool (T0, T1, etc.) to AFC slot mappings after a print completes or is cancelled.

- 0 - Keep mappings (default)
- 1 - Reset mappings (T0 → lane1, T1 → lane2, etc.)

Mappings are preserved on print errors and Klipper restarts regardless of this setting. No restart is required to change it.

Example: `SAVE_ZMOD_DATA IDLE_MAP=1`

KLIPPER_C5

Creator 5 / Creator 5 Pro only

Use shapers from Klipper 14.

- 0 - Do not use (default)
- 1 - Use

Example: `SAVE_ZMOD_DATA KLIPPER_C5=1`

PRO_POWEROFF_TIMEOUT

Set the timeout (in minutes) for FF5M Pro to auto-power off. Default: 0 (disabled).

Example: `SAVE_ZMOD_DATA PRO_POWEROFF_TIMEOUT=10`

SAVE_MOONRAKER

- 0 - Load macro button layouts from Z-Mod (default).
- 1 - Allow saving macro button changes locally in Fluidd/Moonraker.

Locally saved macros are stored in a separate section.

Example: `SAVE_ZMOD_DATA SAVE_MOONRAKER=1`

SAVE_FILAMENT_SENSORS

- 0 - Do not save the state of filament sensors after a reboot; they will always be enabled (default)
- 1 - Save the state of the sensors after a reboot. If you disable a sensor, it will also be disabled after a reboot.

Example: `SAVE_ZMOD_DATA SAVE_FILAMENT_SENSORS=1`

System

A macro is a small program written in Klipper/Gcode language.

It can be called from:

- A GCODE file
- The Fluidd/Mainsail console (press the English letter `C` in Fluidd)

> **Note**
>
> *The value in parentheses is the default value*

DISPLAY_ON

Enable the standard screen and reboot the printer.

DISPLAY_OFF

Disable the standard screen and reboot the printer. Saves 13 MB of RAM (20 MB on older firmware versions).

Use the button with a parameter selector in the "Macros" list, or a console command:

- `DISPLAY_OFF GUPPY=1 HELIX=0` — enables GuppyScreen.
- `DISPLAY_OFF GUPPY=0 HELIX=1` — enables HelixScreen + `PLUGINS`.
- `DISPLAY_OFF GUPPY=0 HELIX=0 RIVET=1` — enables Rivet + `PLUGINS` (AD5M / AD5M Pro only).

GuppyScreen (alternative screen implementation):

- Supports all native screen features except WiFi configuration.
- Uses 9 MB RAM (vs. 23 MB for the native screen).
- Does not freeze when Klipper restarts.
- Includes extra features, such as a list of all macros, including your own.
- Recommended for screenless workflows.
- Better print recovery after interruptions.
- Based on this fork, which is built on the original repository and another fork.

HelixScreen (alternative screen implementation)

Rivet (alternative screen made for the AD5M / AD5M Pro): about 10 MB of RAM, touch tuned for the printer's resistive panel, updates through Moonraker and rolls back to the previous version by itself if a new one does not start. Install: `PLUGINS` → rivet, then `DISPLAY_OFF GUPPY=0 HELIX=0 RIVET=1`.

Warning:

- Do not disable the screen unless you fully understand bed leveling, Z-offset, and the `START_PRINT`/`END_PRINT` macros.
- Do not add this macro to your start G-code.
- After a reboot the native screen keeps running for another 10 seconds, but it does not affect Z-offset because printing does not go through it.

Adjust activation timing via the `DISPLAY_OFF_TIMEOUT` global parameter.

Configure `START_PRINT` and set the required Z-offset via its parameters or via global parameters.

Learn more about screen modes.

MEM

View memory usage.

TEST_EMMC

Test EMMC performance and wear level. Parameters:

- `SIZE` — data size to write in MB (default: `100`).
- `SYNC` — `1` = synchronous mode (measure speed), `0` = asynchronous background write (default: `1`).
- `FLASH` — target storage: `0` = EMMC, `1` = USB flash, `2` = RAM (default: `0`).
- `RANDOM` — use random data: `1` = yes, `0` = no (default: `0`).

On stock firmware: download zfs.sh and run:

```
./zfs.sh 400 1
```

CLEAR_EMMC

Clear EMMC storage. Parameters:

- `LOG` — clear log files: `1` = yes, `0` = no (default: `1`).
- `ANY` — clear all files (G-code, images, videos): `1` = yes, `0` = no (default: `0`).

DATE_GET

Display current system time.

DATE_SET

Set system date and time.

- `DT` — date/time in `YYYY.MM.DD-HH:MM:SS` format.

WEB

Switch between Fluidd and Mainsail web interfaces.

After running the macro:

- Press Ctrl + F5 or Ctrl + Shift + R or Option + Command + E
- If you have a problem in Orca, press Ctrl + F5 or Ctrl + Shift + R or Option + Command + E

If using Mainsail, specify only these thumbnail sizes: `140x110/PNG, 64x64/PNG`

In Orca, `Printer Profile` -> `General Information` -> `Advanced` -> `G-Code Thumbnails`

Note that the native screen will no longer display thumbnails.

Attention! The author uses Fluidd; Mainsail is user-tested only. If you have any issues with Mainsail, please create a ticket

---

SET_TIMEZONE

Set timezone.

- `ZONE` — timezone identifier (default: `Asia/Yekaterinburg`).

Example: `SET_TIMEZONE ZONE=Europe/Moscow`. Run `SET_TIMEZONE` without parameters to list the available zones.

The timezone lets GuppyScreen calculate when the print will finish.

CHECK_MD5

Igor Polunovskiy

> Note: Only applies when sending G-code. Not required for 3MF.

It is recommended to use the global parameter FORCE_MD5 `SAVE_ZMOD_DATA FORCE_MD5=1`

Verify file integrity via MD5 checksum.

- `DELETE` — delete corrupted files: `yes`/`no` (default: `yes`).

Usage:

1. Select and download the file for your architecture and operating system:

- zmod_preprocess-windows-amd64.exe - Windows
- zmod_preprocess-linux-amd64 - Linux. Don't forget to run `chmod +x zmod_preprocess-linux-amd64`
- zmod_preprocess-darwin-arm64 - macOS Apple Silicon. Don't forget to run `chmod +x zmod_preprocess-darwin-arm64`
- zmod_preprocess-darwin-amd64 - macOS Intel. Don't forget to run `chmod +x zmod_preprocess-darwin-amd64`
- zmod-preprocess.py - Universal Python. Don't forget to run `chmod +x zmod-preprocess.py`

- zmod-preprocess.sh - Linux/MacOS Bash. Don't forget to run `chmod +x zmod-preprocess.sh`

1. In Orca, you need to specify: `Process Profile` -> `Other` -> `Post Processing Scripts`.

Here are the options for adding:

- `"C:\path_to_file\zmod_preprocess-windows-amd64.exe";`
- `"C:\python_folder\python.exe" "C:\Scripts\zmod-preprocess.py";`
- `"/usr/bin/python3" "/home/user/zmod-preprocess.py";`
- `"/home/user/zmod-preprocess.py";`
- `"/home/user/zmod_preprocess-darwin-amd64";`
- `"/home/user/zmod_preprocess-darwin-arm64";`
- `"/home/user/zmod_preprocess-linux-amd64";`

1. Add `CHECK_MD5` or `CHECK_MD5 DELETE=true` to your start G-code. If you use the `START_PRINT` macro, this is not necessary — the check runs automatically.

Note: Enabled by default via `FORCE_MD5`.

Source code: https://github.com/ghzserg/zmod_preprocess

```
Stops printing if the checksum does not match, optionally deleting the corrupted file.

The author is not responsible for any errors or problems, or for any results obtained using
this information.

The checksum is written at the beginning of the G-code file. If the file contains no
checksum, the macro does not check it and the file is sent straight to printing.
The result of the check is printed to the console.

========================================
1. On the Windows machine where the slicer is installed:
  a) Download https://github.com/ghzserg/zmod_preprocess/releases/latest/download/
zmod_preprocess-windows-amd64.exe
  b) Add the script from step 1.a to the slicer,
     replacing "disk:\patch\to\file\" with your path to the script:
    - for OrcaSlicer
      "Process"->"Others"->"Post-processing Scripts"
    - for SuperSlicer and PrusaSlicer
      "Print Settings"->"Output options"->"Post-processing scripts"
    disk:\patch\to\file\zmod_preprocess-windows-amd64.exe;
  c) Add the macro to the slicer
    - for OrcaSlicer
      "Printer Settings"->"Machine G-code"->"Machine start G-code"
    - for SuperSlicer and PrusaSlicer
      "Printer Settings"->"Custom G-code"->"Start G-code"
    * Without deleting the file:
      CHECK_MD5
    * With deleting the file:
      CHECK_MD5 DELETE=true
  d) If the START_PRINT macro is used, there is no need to add CHECK_MD5 to the start code.
The check runs automatically by default.
```

UPDATE_MCU

Updates the printer's MCU.

Changes the MCU firmware from the native Klipper version (11 for FF5M/FF5MPRO, 12 for AD5X) to Klipper 14 and back.

Klipper 14 (disabled by default).

FORCE parameter:

- `native` — install the native MCU firmware (Klipper 11 for AD5M / AD5M Pro, Klipper 12 for AD5X)
- `new` — install the MCU firmware for Klipper 14
- `11` and `12` — previous names for the native firmware, retained for compatibility
- `13` and `14` — previous names for the new firmware, retained for compatibility

Without `FORCE`, the macro switches to the other firmware version.

Examples: `UPDATE_MCU FORCE=new` installs the Klipper 14 MCU firmware; `UPDATE_MCU FORCE=native` restores the native MCU firmware.

If you don't understand how to restore the native Klipper from a USB flash drive, do not run this command. Before updating Klipper, review the changes in new versions; the stock configuration files need no edits.

If something goes wrong, the only way back is through factory.

After running the macro:

1. Wait for the melody to play (it plays even if sound was muted on the native screen)
2. Power off the printer
3. **Wait 10 seconds**
4. Power the printer back on

RESET_PASSWD

Reset the SSH `root` password to `root`.

After an update through the native screen, once it says the device needs to be rebooted, it is enough to run this macro: the mod is activated automatically (details).

CHECK_SYSTEM

Diagnose OS file integrity.

- `RESTORE` — `0` = no repair, `1` = repair damaged files (default: `0`).

Checks:

- File permissions/MD5 hashes.
- Directory permissions.
- Symbolic links.

Symbolic links and file/directory permissions are restored automatically.

The check takes about 10 minutes.

Recovery: Download intact files from here.

If the console is unavailable, connect to the printer via SSH:

```
/usr/data/zmod/zmod/.shell/zcheckmd5.sh
```

SCREEN

Get a screenshot of the printer screen.

The screenshot will be saved to `mod_data/screen.jpg`

Zmod

A macro is a small program written in Klipper/Gcode language.

It can be called from:

- A GCODE file
- The Fluidd/Mainsail console (press the English letter `C` in Fluidd)

> **Note**
>
> *The value in parentheses is the default value*

CAMERA_ON

Enable alternative camera implementation. Parameters:

- `WIDTH` — image width (default: `640`)
- `HEIGHT` — image height (default: `480`)
- `FPS` — frames per second (default: `20`)
- `VIDEO` — video device (default: `video0`)
- `FS` — `1` = enable frame size limiter for unstable cameras, `0` = disable (default: `0`)
- `STREAMER` - what streamer to use (auto, mjpg_streamer, ustreamer)
- `FORMAT` - Image format for ustreamer: YUYV, YVYU, UYVY, RGB565, RGB24, BGR24, MJPEG, JPEG; default: MJPEG

Disable the camera on the printer's screen before calling this macro.

To enable the camera, use `CAMERA_ON VIDEO=video0` or `CAMERA_ON VIDEO=video3` or `CAMERA_ON VIDEO=video99`.

```
$ CAMERA_ON VIDEO=video99
info Don't forget to turn off the camera on your printer's native
screen.
// cat:
// Camera not found video99
// Test: CAMERA_ON VIDEO=video0
// Test: CAMERA_ON VIDEO=video3
```

If the camera does not work, check the logs in `mod_data/log/cam/`

RAM usage for stock cameras:

- 640x480: 2.9 MiB
- 1280x720: 7.8 MiB

- 1920x1080: 18.1 MiB

Many AliExpress/Ozon/Wildberries cameras always consume 18 MiB.

> **Note**
>
> - What is an Alternative Camera?
> - I installed the printer, and Z-Mod hid my camera! I saw it in Orca-FF, and now it's gone!

`Camera Off Waiting...` - this message is displayed if the camera stream is not yet available. The camera starts after Klipper launches, during the global settings information display.

Camera Setup

Basic Parameters

Parameter	Description	Default Value
`WIDTH`	Image width	640
`HEIGHT`	Image height	480
`FPS`	Frames per second	20
`VIDEO`	Camera device	video0
`FS`	Fix problematic cameras (1 – yes, 0 – no)	0
`STREAMER`	Program for handling the camera stream	auto
`FORMAT`	Image format (for ustreamer only)	MJPEG

What is a Streamer?

A streamer is a program that takes the image from the camera and displays it in a browser.

Two options are available:

- **mjpg_streamer** – a simple program, works only with MJPG cameras
- **ustreamer** – more powerful but uses more memory; supports various cameras

The `STREAMER=auto` parameter will automatically choose the suitable streamer.

Image Formats (for ustreamer only)

You can choose: YUYV, YVYU, UYVY, RGB565, RGB24, BGR24, MJPEG, JPEG.

The default is MJPEG.

Command Examples

Simple start of camera video0 via mjpg_streamer:

```
CAMERA_ON VIDEO=video0
```

Start camera video0 via ustreamer with custom settings:

```
CAMERA_ON VIDEO=video0 STREAMER=ustreamer FORMAT=YUYV WIDTH=640 HEIGHT=480
```

Where to View the Image?

Open in your browser: `http://printer_ip_address:8080`

There you can adjust brightness, contrast, and other settings.

Troubleshooting

Camera not detected? Run:

```
CAMERA_ON VIDEO=video99
```

The program will show a list of available cameras.

Logs (error records) are located in the folder: `log/cam/`

CAMERA_OFF

Disable alternative camera implementation.

CAMERA_RESTART

Restart the alternative camera implementation.

REMOVE_ZMOD

Uninstall Z-Mod.

- `FULL`: `0` = keep `/opt/config/mod_data`, `1` = delete `/opt/config/mod_data` (default: `0`)

The `/opt/config/mod_data` directory stores configurations for `zmod`, `fluidd`, `moonraker`, and `mainsail`. It is not deleted by default, because people often call `REMOVE_ZMOD` by mistake.

Warning! Disable all plugins yourself and switch to the native Klipper.

SKIP_ZMOD

Reboot into the original system without starting Z-Mod. Disables Z-Mod, Moonraker, and Fluidd configurations.

Warning! Disable all plugins yourself and switch to the native Klipper.

Remaining active:

- Alternative camera
- SSH

TAR_CONFIG

Backup configuration files into an archive. Download the archive via: **Configuration → mod_data → config.tar.gz**

RESTORE_TAR_CONFIG

Restore configurations from the `config.tar.gz` archive. Upload the archive to: **Configuration → mod_data → config.tar.gz**

ZFLASH

Update firmware via network using a USB drive.

1. Insert the USB drive into the printer and power it on.
2. If using without the native screen, ensure the USB is inserted **before** powering on.
3. This macro checks for the latest release, downloads it to the USB, verifies the MD5 hash, and installs it after reboot.

STOP_ZMOD

Unload guppy, helix, rivet, moonraker, and fluidd/Mainsail from memory. The Telegram bot will also stop working.

Parameters:

- SCREEN (0 - do not unload, 1 - unload)
- MOONRAKER (0 - do not unload, 1 - unload)
- HTTP (0 - do not unload, 1 - unload)

Example:

```
STOP_ZMOD SCREEN=1 MOONRAKER=0 HTTP=0
```

If this line is added to the start code, GUPPY/HELIX/RIVET will be unloaded from memory after the print starts.

START_ZMOD

Re-enable guppy, helix, rivet, moonraker, and fluidd/Mainsail after STOP_ZMOD.

Parameters:

- SCREEN (0 - do not load, 1 - load)
- MOONRAKER (0 - do not load, 1 - load)
- HTTP (0 - do not load, 1 - load)

Example:

```
START_ZMOD SCREEN=1 MOONRAKER=0 HTTP=0
```

If this line is added to the end code, GUPPY/HELIX/RIVET will be launched after the print finishes.

ZSSH_ON

Enable SSH tunneling. Parameters:

- `SSH_SERVER` — remote SSH server IP/hostname
- `SSH_PORT` — SSH port (default: `22`)
- `SSH_USER` — remote server username
- `VIDEO_PORT` — remote server port for video streaming (default: `8080`)
- `MOON_PORT` — remote server port for Moonraker (default: `7125`)
- `REMOTE_RUN` — command to execute on the remote server (default: `"NONE"`). Example: Use the ff5m.sh script: `./ff5m.sh bot1` (located in `mod/telegram/`) to restart the Telegram bot.

Setup script (if not installed via one-command):

```
su - tbot  # Switch to the bot service user
wget --cache=off -q -O ff5m.sh https://raw.githubusercontent.com/ghzserg/zmod_ff5m/refs/
heads/main/telegram/ff5m.sh
chmod +x ff5m.sh
```

Example usage in Fluidd/Mainsail console:

```
ZSSH_ON SSH_SERVER=remote.server.ru SSH_PORT=22 SSH_USER=tbot VIDEO_PORT=8080 MOON_PORT=7125
REMOTE_RUN="./ff5m.sh bot1"
```

SSH starts 3 minutes after Klipper boots and automatically restarts at the beginning of prints (via `START_PRINT` macro).

Telegram Bot details

ZSSH_OFF

Disable SSH client.

ZSSH_RESTART

Restart the SSH client.

ZSSH_RELOAD

Reload SSH client if not running. This macro is triggered at the start of prints (via `START_PRINT`).

ZRESTORE

Resume printing after power loss or printer errors.

Requirements:

- Native screen must be disabled (native recovery conflicts with ZRESTORE).
- Printed filename **must not start with a number**.

ZLINK

Connect to the cloud zmod.link

- The cloud allows you to manage the printer via Fluidd or Mainsail from anywhere.
- Memory usage on the printer increases by 1 MB.
- Data is transmitted from the printer to the cloud using encryption.
- Access to the cloud from anywhere also uses encryption.
- The user only sees their own printers and cannot connect to others.
- Access to user printers is protected by login and password

How to get login and password:

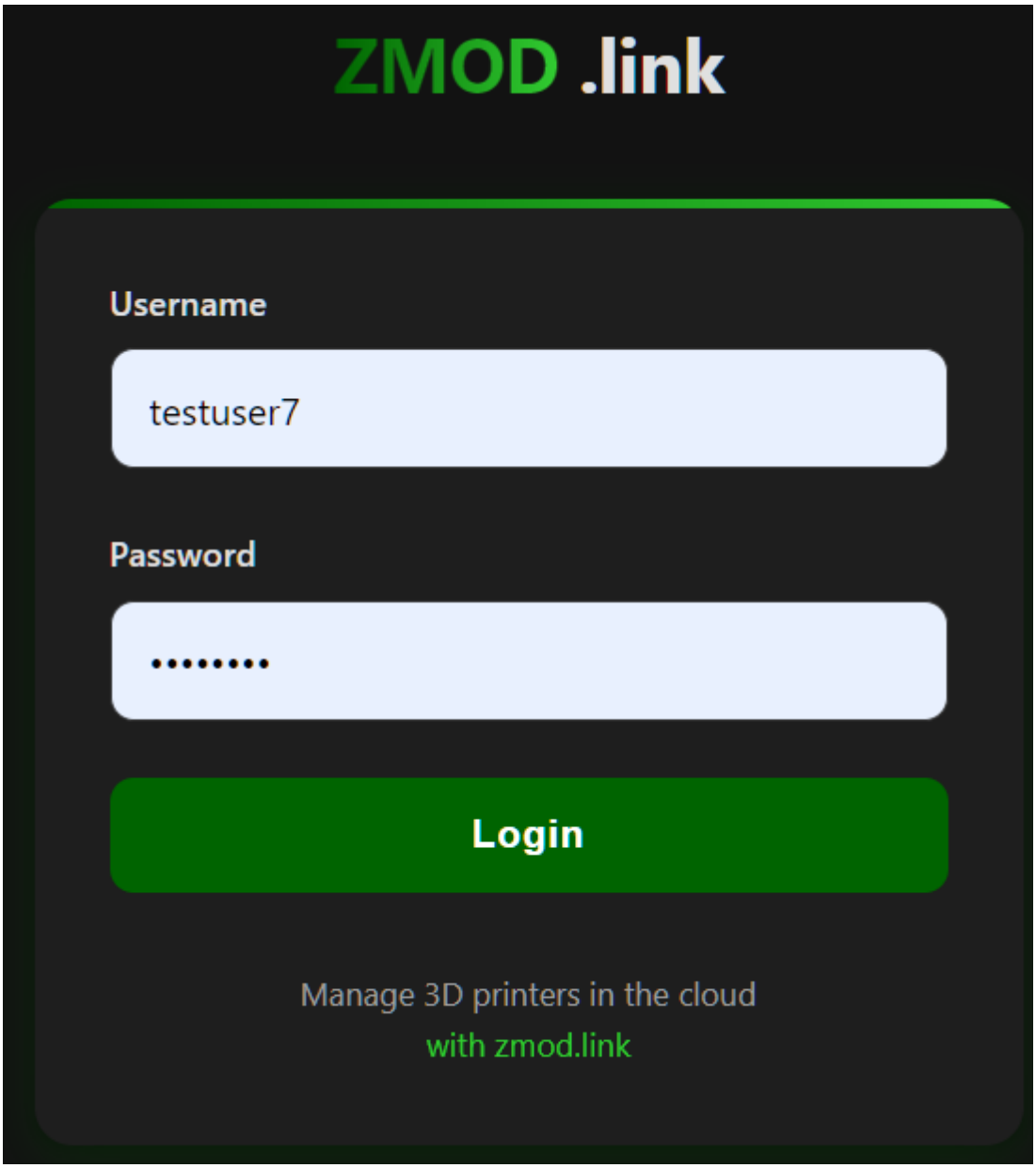
1. Connect to the bot @zmod_help_bot
2. Enter the command `cloud` - if you have registered before, it will tell you your login
3. To register a user with the name `test`, enter: `cloud register test`
4. To reset the password, enter: `cloud reset_password`
5. To remove the current user, enter: `cloud remove`

If Telegram is not available:

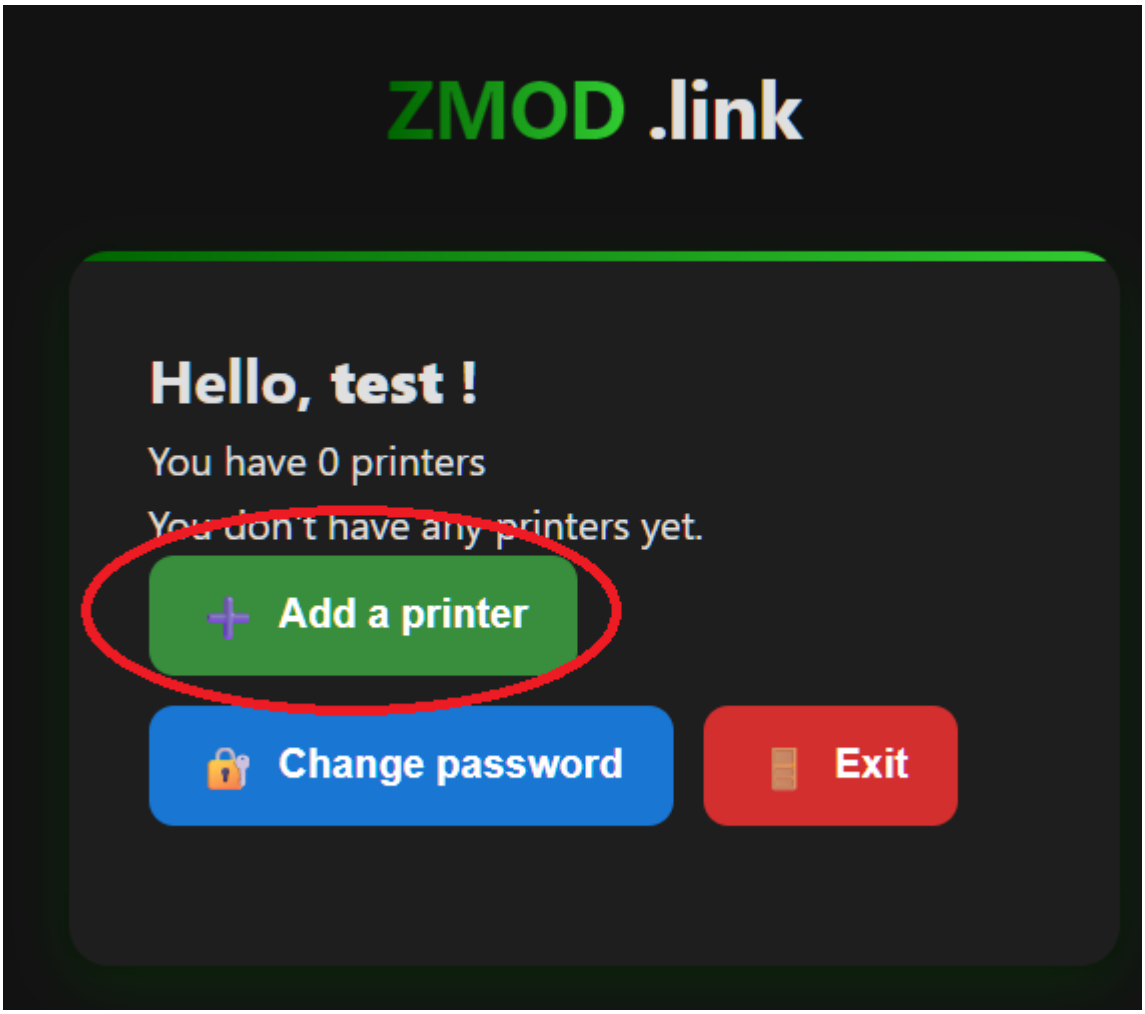
1. Open vk.com/zmod_official
2. Send a message to the group
3. Enter the command `cloud` - if you have registered before, it will tell you your login
4. To register a user with the name `test`, enter: `cloud register test`
5. To reset the password, enter: `cloud reset_password`
6. To remove the current user, enter: `cloud remove`

How to connect to the cloud zmod.link:

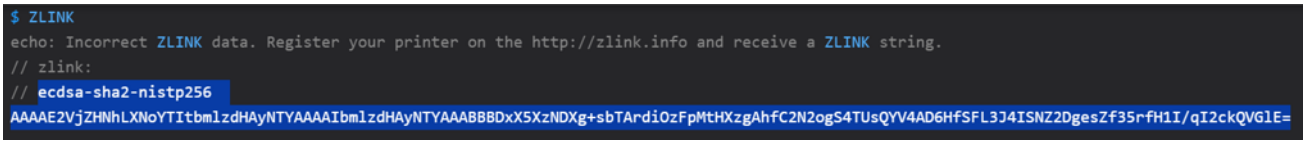
1. Go to the website zmod.link and enter your login and password



1. Click the "Add Printer" button



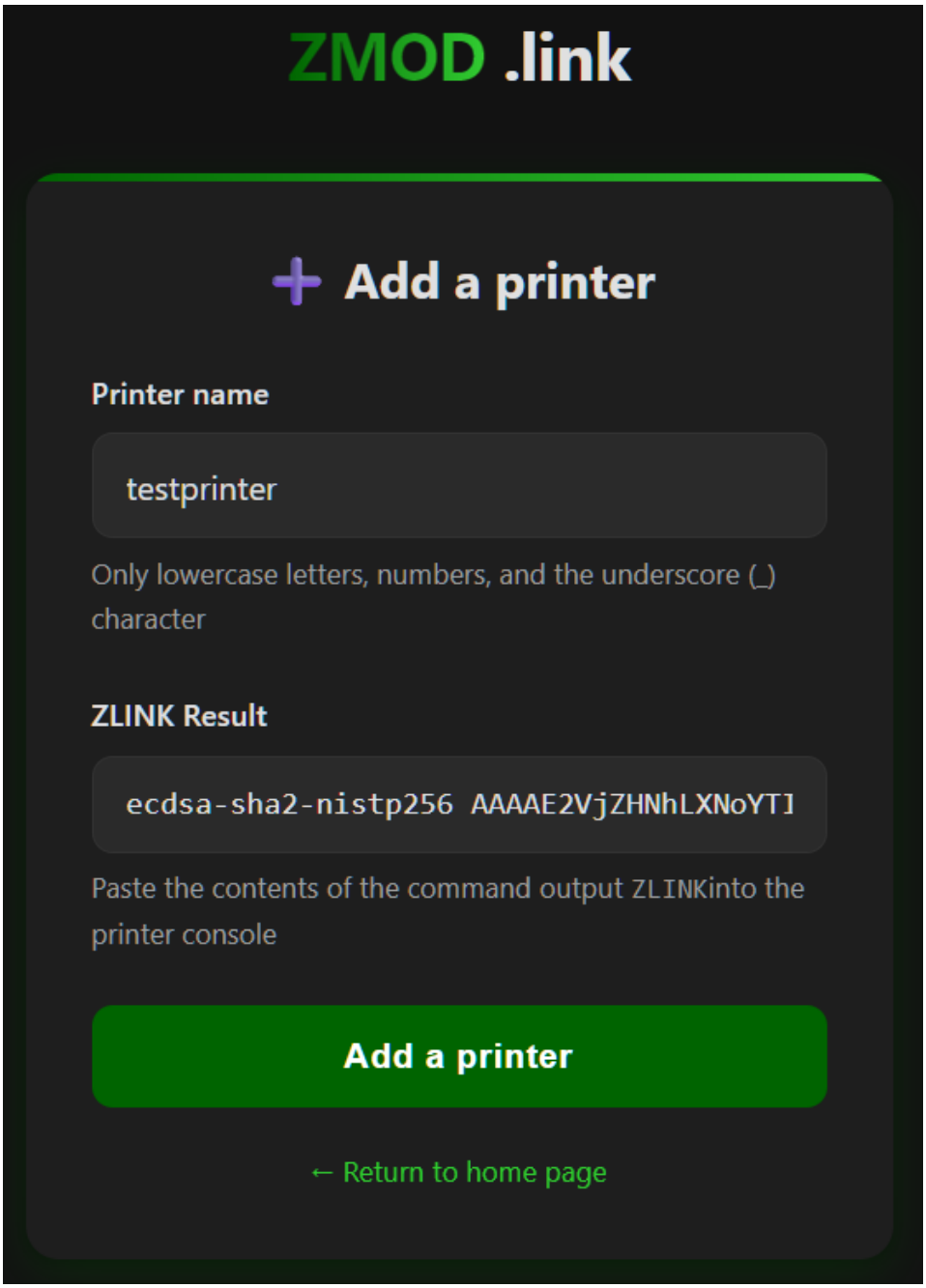
1. Open the printer in a separate tab and in the printer console, enter the command `ZLINK`



1. Copy the key to the clipboard - it is highlighted in the screenshot
2. Enter the printer name and the key you copied in the previous step

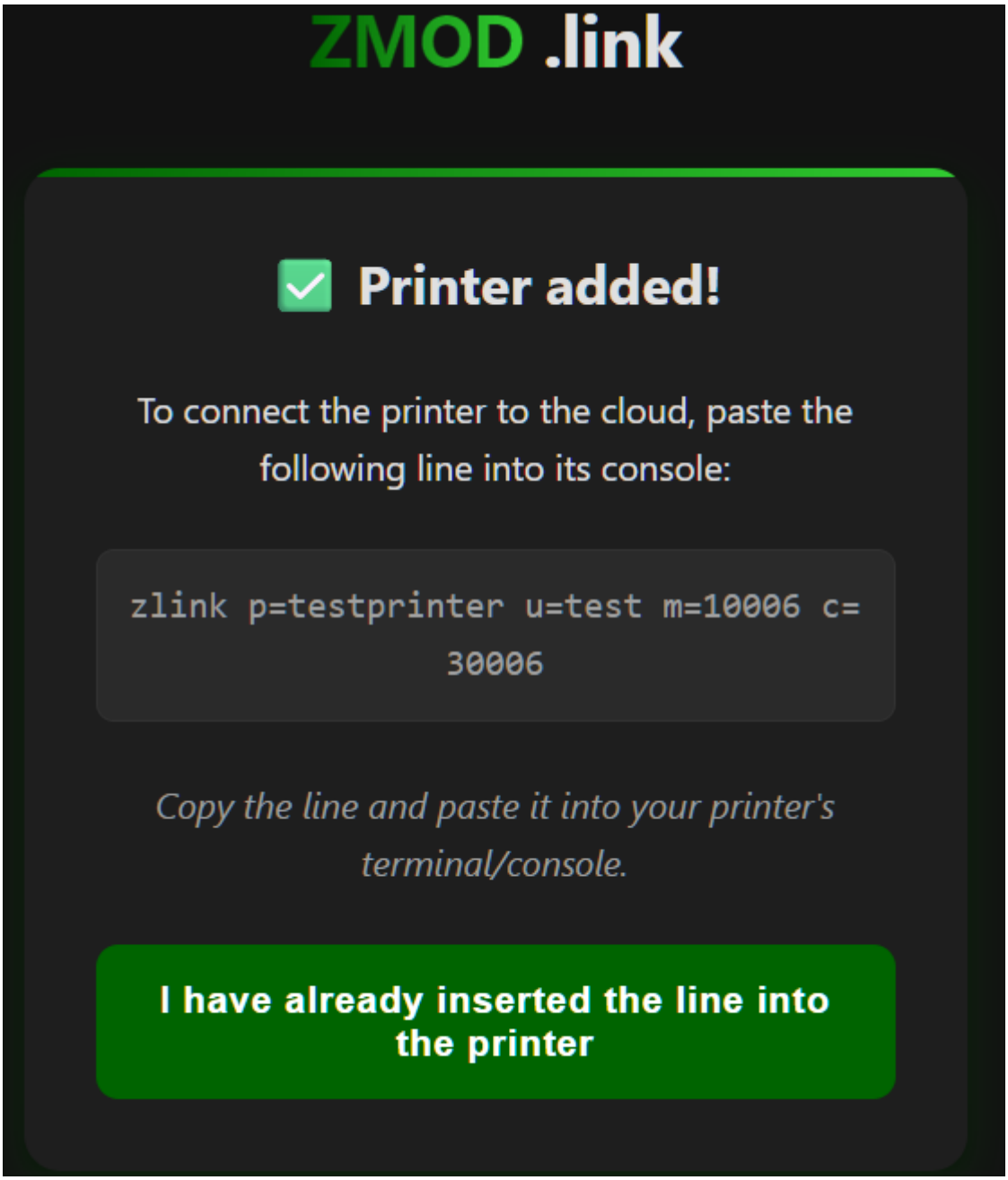
Example:

- `testprinter`
- `ecdsa-sha2-nistp256 AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBBDxX5XzNDXg+sbTArdiOzFpMtHXzgAhfC2N2ogS4TUsQYV4AD6HfSFL3J4ISNZ2DgesZf35rfH1I/qI2ckQVGlE=`



Click the "Add Printer" button

1. Copy the command provided by the website and paste it into the printer console



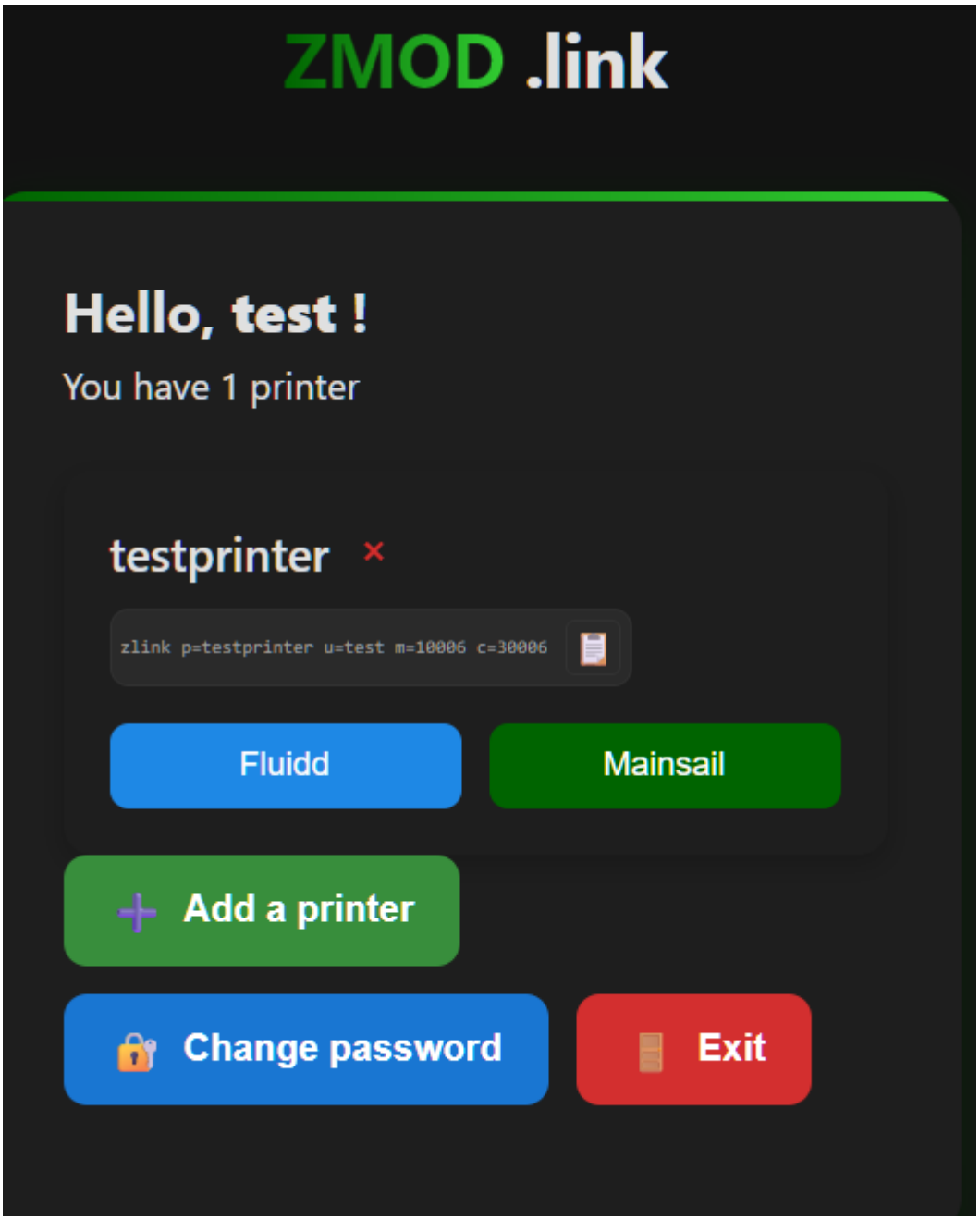
In the example: `zlink p=testprinter u=test m=10006 c=30006`

Click the `I have already pasted the string into the printer` button

After this, the printer will be able to connect to the cloud.

To disable the connection, enter `ZLINK_OFF`

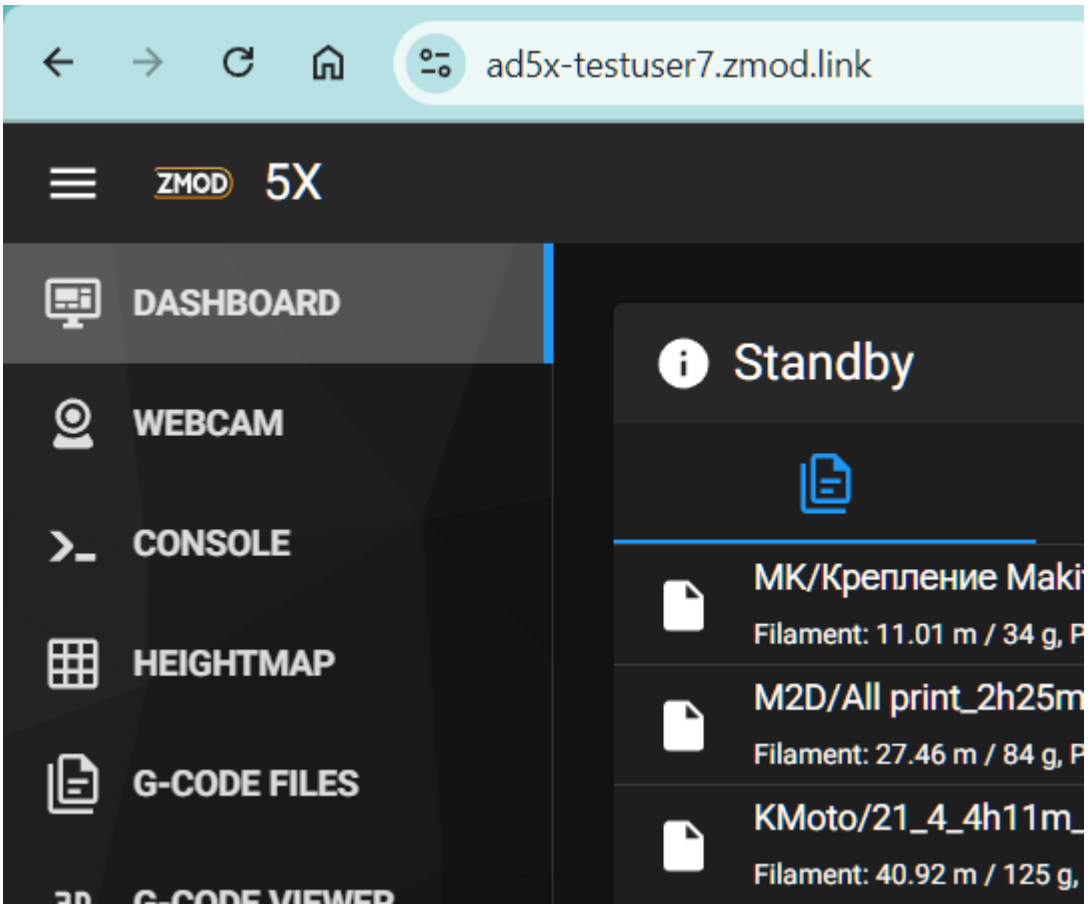
1. Now you have the ability to connect to Fluidd or Mainsail via the internet

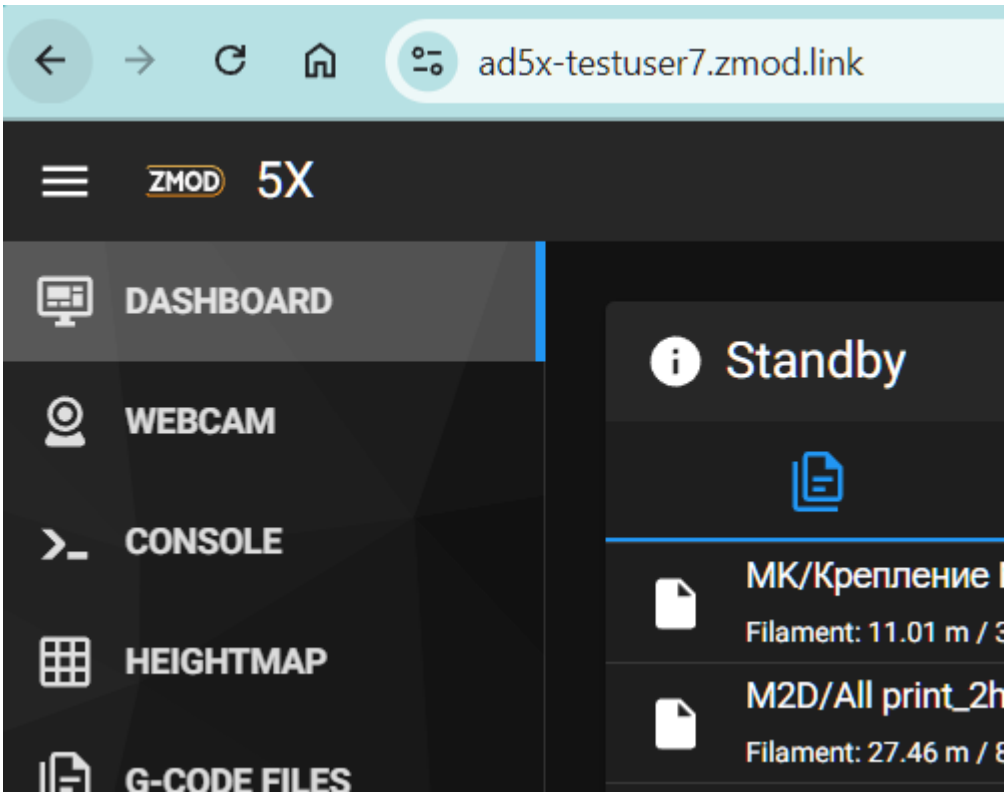


Just select the desired button.

PS: The camera may load later than the interface — this is normal.

PPS: If something is not working correctly, refresh the page with Ctrl + F5 and go to zmod.link


ad5x-testuser7.zmod.link
ZMOD 5X
DASHBOARD
WEBCAM
CONSOLE
HEIGHTMAP
G-CODE FILES
Standby
MK/Крепление Maki
Filament: 11.01 m / 34 g, P
M2D/All print_2h25m
Filament: 27.46 m / 84 g, P
KMoto/21_4_4h11m_
Filament: 40.92 m / 125 g,


ad5x-testuser7.zmod.link
ZMOD 5X
DASHBOARD
WEBCAM
CONSOLE
HEIGHTMAP
G-CODE FILES
Standby
MK/Крепление
Filament: 11.01 m /
M2D/All print_2h
Filament: 27.46 m /

Filament

A macro is a small program written in Klipper/Gcode language.

It can be called from:

- A GCODE file
- The Fluidd/Mainsail console (press the English letter `C` in Fluidd)

> **Note**
>
> *The value in parentheses is the default value*

COLDPULL

Cold pull (nozzle cleaning) without force. Implements this algorithm.

- Select cleaning material (PETG, ABS, NYLON)
- Follow instructions in the Fluidd console
- Remove residue from the nozzle

M600

Pause and filament change.

COLOR

AD5X only

Manage filament type, color, and loading/unloading of spools.

Works only when the native screen is enabled.

SET_PAUSE_NEXT_LAYER

Set pause/trigger a macro on the next layer:

- `ENABLE` — `0` = disable, `1` = enable (default: `1`)
- `MACRO` — macro to call (e.g., `PAUSE`)

SET_PAUSE_AT_LAYER

Enable/disable pause at a specific layer number:

- `ENABLE` — `0` = disable, `1` = enable (default: `1`)
- `MACRO` — macro to call (e.g., `PAUSE`)
- `LAYER` — target layer number (default: `0`)

> **Warning**
>
> To enable these features, add the following to your start code:
>
> ```
> SET_PRINT_STATS_INFO TOTAL_LAYER=[total_layer_count]
> ```
>
> Add this to the layer change code:
>
> ```
> SET_PRINT_STATS_INFO CURRENT_LAYER={layer_num + 1}
> ```

PRO

A macro is a small program written in Klipper/Gcode language.

It can be called from:

- A GCODE file
- The Fluidd/Mainsail console (press the English letter `C` in Fluidd)

> **Note**
>
> *The value in parentheses is the default value*

AIR_CIRCULATION_INTERNAL

Enable internal air circulation.

AIR_CIRCULATION_EXTERNAL

Enable external air circulation.

AIR_CIRCULATION_STOP

Disable air circulation.

Native firmware

Native firmware

Here is the native firmware for AD5M, AD5M Pro, AD5X printers

How to install native firmware

1. Before installing, it is best to reset the printer to default settings, if possible.
2. Format a USB drive (a regular flash drive) to FAT32 or FAT/FAT16 (MBR).
3. Copy the file to the root of the USB drive (no subfolders).
4. Power off the printer.
5. Insert the USB drive into the printer.
6. Power on the printer.
7. Wait until it has fully booted.
8. Power the printer off and on.
9. Perform the necessary calibrations.

AD5X native firmware

This is the Factory stock firmware for AD5X.

If you don't want the printer to probe the center of the bed before every print, install a firmware version no higher than 1.1.7.

- 1.0.2
- 1.0.7
- 1.0.8
- 1.1.6
- 1.1.7
- 1.1.9
- 1.2.0
- 1.2.1
- 1.2.2
- 1.2.3
- 3.0.3
- 3.0.9
- 3.1.0

AD5M native firmware

This is the Factory stock firmware for AD5M.

If you don't want the printer to probe the center of the bed before every print, install a firmware version no higher than 3.2.3.

- 3.1.3

- 3.1.9
- 3.2.3
- 3.2.5
- 3.2.6
- 3.2.7
- 5.0.3
- 5.1.1

AD5M Pro native firmware

This is the Factory stock firmware for AD5M Pro.

If you don't want the printer to probe the center of the bed before every print, install a firmware version no higher than 3.2.3.

- 3.1.3
- 3.2.3
- 3.2.4
- 3.2.5
- 3.2.7
- 5.0.3
- 5.1.2

Creator 5 stock firmware

This is the Factory stock firmware for Creator 5

- 1.9.7
- 1.9.9
- 2.0.0

Creator 5 Pro stock firmware

This is the Factory stock firmware for Creator 5 Pro

- 1.9.7
- 1.9.8
- 1.9.9
- 2.0.0

Unbricker

Universal unbricker for AD5M / AD5M Pro / AD5X / Creator 5 / Creator 5 Pro

1. Download the Universal.zip file
2. Format the USB drive to FAT32
3. Extract Universal.zip to the root of the USB drive
4. Turn off the printer
5. Insert the USB drive into the printer
6. Wait for the firmware to flash (up to 40 minutes)
7. Remove the USB drive from the printer

8. Turn the printer off and on

If something went wrong, check the log files on the USB drive.

Installing Full Firmware on Creator 5 / Creator 5 Pro

This is NOT the original Factory firmware, but a printer unbricking tool. It should only be installed if the printer does not start at all.

Installation takes a long time, up to an hour.

1. Copy all 3 files at once to a FAT32-formatted USB flash drive:

- Creator5-factory-1.9.7.tgz
- Creator5Pro-factory-1.9.7.tgz
- Creator5Pro-factory.tar.xz

1. Power off the printer, insert the flash drive, power it on and wait for a full reboot. A Creator 5 will become a Creator 5 Pro — this is normal.

2. After updating, if you need to reflash the MCU, install:

- Creator5
- Creator5Pro

1. To turn a Creator 5 back from Creator 5 Pro into the regular version:

- Creator5Pro-to_c5.tgz

Installing full firmware on AD5X

This is not the original firmware, but an unbricking/recovery firmware. It should only be installed if the printer does not boot up at all.

Installation takes a long time, up to an hour.

Copy both files to the flash drive at once:

- AD5X-factory-1.0.9.tgz
- AD5X-factory.tar.xz
- After the update, if you need to reflash the MCU, install AD5X

Installing full firmware on FF5M

This is not the original firmware, but an unbricking/recovery firmware. It should only be installed if the printer does not boot up at all.

Installation takes a long time, up to an hour.

1. Copy all of the following files to a USB flash drive for the AD5M:

- Adventurer5M-factory-3.1.3.tgz
- Adventurer5M-factory.tar.xz

- `config.tar`, if you previously did it via `TAR_CONFIG`

1. Copy the following files to a USB flash drive for the FF5MPro (the printer will revert to FF5M firmware version; to revert back, see instructions below):

- Adventurer5MPro-factory-3.1.3.tgz
- Adventurer5M-factory.tar.xz
- `config.tar`, if you previously created it via `TAR_CONFIG`

1. After the update, if you need to reflash the MCU, install Adventurer5M-3.1.9-2.2.3-20250807-Factory.tgz

Activator

Universal activator for AD5X / Creator 5 / Creator 5 Pro

1. Download the Universal_enable-zmod.zip file
2. Format the USB flash drive to FAT32
3. Unpack Universal_enable-zmod.zip to the root of the flash drive
4. Turn off the printer
5. Insert the flash drive into the printer
6. Wait for the firmware update
7. Remove the flash drive from the printer
8. Turn the printer off and on

If something went wrong, check the enable-zmod.log file on the flash drive

AD5X/Creator 5/Creator 5 Pro enable Z-Mod

Enabling Z-Mod on AD5X/Creator 5/Creator 5 Pro after updating the native firmware allows you to activate the mod without completely reinstalling it.

- AD5X-enable-zmod.tgz
- Creator5-enable-zmod.tgz
- Creator5Pro-enable-zmod.tgz

If the update came through the native screen, then after it says the device needs to be rebooted, it is enough to run the RESET_PASSWD macro: it activates the mod automatically.

SET XY

For those whose ~~mind~~ "home" position has shifted (parking at the poop chute). Extract the archive contents to the root of a FAT32 flash drive, turn off the printer, insert the flash drive and turn the printer on. The calibration will load. First, press Reset. Then, use the on-screen control buttons to adjust the correct head position. Press the Set button to lock this. Reboot the printer without the flash drive. Archive from official FlashForge support.

Set.XY.Offset.zip

Root

- User: root

- Password: root

- Adventurer5M-root

- Adventurer5MPro-root
- AD5X-root
- Creator 5
- Creator 5 Pro

Miscellaneous

E0011 native firmware

fix_e0011

Fix E0011 On

- Adventurer5M-e0011-on.tgz
- Adventurer5MPro-e0011-on.tgz

Fix E0011 Off

- Adventurer5M-e0011-off.tgz
- Adventurer5MPro-e0011-off.tgz

E0017 native firmware

fix_e0017

- Adventurer5M-e0017-4.tgz
- Adventurer5MPro-e0017-4.tgz

5M to 5MPro

Adventurer5M-3.1.3-2.2.3-20250107-Factory-5M2PRO.tgz

5MPro to 5M

Adventurer5MPro-3.1.3-2.2.3-20250107-Factory-PRO25M.tgz

Conversion from Creator 5 to Creator 5 Pro

Creator5-to_c5pro.tgz

Conversion from Creator 5 Pro to Creator 5

Creator5Pro-to_c5.tgz

5X IFS

IFS firmware archive

- 3.0.6
- IFS Firmware Recovery

G-code

- 3DBenchy_PLA.3mf
- FlashForge-TestModel-01.3mf
- OrcaPlug_PLA.3mf
- Earphone.support_PLA.3mf
- FISH_PLA.3mf

MD5

> Note: Only applies when sending G-code. Not required for 3MF.

- zmod_preprocess-windows-amd64.exe - Windows
- zmod_preprocess-linux-amd64 - Linux. Don't forget to run `chmod +x zmod_preprocess-linux-amd64`
- zmod_preprocess-darwin-arm64 - macOS Apple Silicon. Don't forget to run `chmod +x zmod_preprocess-darwin-arm64`
- zmod_preprocess-darwin-amd64 - macOS Intel. Don't forget to run `chmod +x zmod_preprocess-darwin-amd64`
- zmod-preprocess.py - Universal Python. Don't forget to run `chmod +x zmod-preprocess.py`
- zmod-preprocess.sh - Linux/MacOS Bash. Don't forget to run `chmod +x zmod-preprocess.sh`

CONFIG

Native configuration files

- AD5X
- AD5M/Pro
- Creator 5 Pro

FIX_LOOP

Boot Recovery

Removes leftover links from autostart

- AD5M
- AD5M Pro
- AD5X

FIX_UPDATE_MCU

Fix for Persistent MCU Updates

- AD5M
- AD5M Pro
- AD5X
- Creator 5
- Creator 5 Pro

LOG

Universal log collection for AD5M / AD5M Pro / AD5X / Creator 5 / Creator 5 Pro

1. Download the Universal-log.zip file
2. Format the flash drive to FAT32
3. Unpack Universal-log.zip into the root of the flash drive
4. Turn off the printer
5. Insert the flash drive into the printer
6. Wait for the firmware update to complete
7. Remove the flash drive from the printer
8. Turn the printer off and on

If something went wrong, check the zmd_log.log file on the flash drive

The config-x.y.z.tar file must be attached to the ticket

Allows retrieving log files if Klipper is not working

- AD5M
- AD5M Pro
- AD5X
- Creator 5
- Creator 5 Pro

REM_ZMOD

Remove ZMOD

- AD5M
- AD5M Pro
- AD5X

FIX_KLIPPER

Restore Original Klipper

- AD5M
- AD5M Pro

- AD5X

1. Download the file for your model and put it in the root of a USB flash drive (FAT32)
2. Turn off the printer
3. Insert the flash drive
4. Turn on the printer
5. Wait for the message on the screen
6. **Turn off the printer**
7. Wait 10 seconds
8. Turn on the printer

Changelog

- Version History
  - Version 1.7.7
  - Version 1.7.6
  - Version 1.7.5
  - Version 1.7.4
  - Version 1.7.3
  - Version 1.7.2
  - Version 1.7.1
  - Version 1.7.0
  - Version 1.6.6
  - Version 1.6.5
  - Version 1.6.4
  - Version 1.6.3
  - Version 1.6.2
  - Version 1.6.1
  - Version 1.6.0
  - Version 1.5.4
  - Version 1.5.3
  - Version 1.5.2
  - Version 1.5.1
  - Version 1.5.0
  - Version 1.4.3
  - Version 1.4.2
  - Version 1.4.1
  - Version 1.4.0
  - Version 1.3.1
  - Version 1.3.0
  - Version 1.1.2
  - Version 1.1.1
  - Version 1.1.0
  - Version 1.0.5
  - Version 1.0.4
  - Version 1.0.0
  - Version 0.2.4
  - Version 0.2.3
  - Version 0.2.2
  - Version 0.2.1.1
  - Version 0.2.1
  - Version 0.2.0
  - Version 0.1.8
  - Version 0.1.7
  - Version 0.1.6
  - Version 0.1.5
  - Version 0.1.4
  - Version 0.1.3

- Version 0.1.1
- Version 0.0.9-fix
- Version 0.0.9

Version History

Version 1.7.7

24.11.2026

Z-Mod

- AD5M / AD5M Pro: Added support for native firmware 5.2.0.
- AD5M / AD5M Pro: Added the alternative Rivet screen (`DISPLAY_OFF RIVET=1`). Thanks to @lDOCI.
- AD5X / C5PRO: AFC now treats unknown filament type `?` as PLA.
- AD5X / C5PRO: Added AFC mapping reset option `IDLE_MAP`.
- Fixed 3MF printing: Moonraker refreshes metadata before starting a print without blocking Klipper.
- An additional `PAUSE` is ignored if the printer is already paused.
- Fixed movements during pauses, filament changes, and nozzle cleaning.
- Added the `_RESET_Z_OFFSET` macro to reset the Z offset.
- The `PLUGINS` menu now prevents enabling incompatible plugins.
- Fixed timezone changes via `SET_TIMEZONE` in both the host system and the Z-Mod environment.
- Fixed SSH key validation and key display in `ZLINK`.
- Fixed processing of Input Shaper calibration files.
- AD5M / AD5X: `UPDATE_MCU` now accepts `FORCE=native` and `FORCE=new`; the previous numeric options remain supported.
- AD5X: Automatic filament loading no longer starts during a print.
- C5PRO: Added the `AUTOINSERT` option to control automatic filament loading.
- C5PRO: Fixed Z-offset reset for the currently installed extruder.
- C5PRO: Added the `TEMP_WAIT` parameter to `T_IN_ZCOLOR`.
- C5PRO: Updated native firmware 2.0.0 file-integrity checks.

Klipper

- AD5M / AD5X / C5PRO: Increased the homing and probing command timing margin from 100 to 300 ms.
- AD5M / AD5X / C5PRO: Fixed LED, fan and output-pin commands being scheduled in the past after Linux delays.
- AD5M / AD5X / C5PRO: Fixed Reactor wait-list cleanup when an error occurs.
- AD5M / AD5X: Replaced Klipper 13 with Klipper 14. The `klipper13` setting was renamed to `klippernew`, and old settings are migrated automatically.
- AD5M / AD5X: Fixed N32G455 MCU memory configuration (128 KB) so Flashforge board firmware can start correctly.
- AD5M / AD5X: Klipper can automatically recover an MCU left in shutdown state on Klippy startup.
- AD5M / AD5X: Increased the motion planning buffer from 1 to 2 seconds and the startup buffer from 250 to 500 ms.
- AD5M / AD5X: Removed duplicate velocity-limit messages from the log.

- AD5X: Fixed selection of the correct `virtual_sdcard` version for Klipper 14 during startup and Z-Mod updates.
- AD5X: `virtual_sdcard` yields to the Reactor approximately every 50 ms while processing G-code to avoid delaying other Klipper tasks.
- C5PRO: New Klipper shapers (`KLIPPER_C5`) are enabled by default.
- C5PRO: Previously armed endstops are released if homing initialization fails.
- C5PRO: MCU ACK waits now abort with an error if communication is lost instead of hanging.
- C5PRO: Fixed handling of the `REMOVE_PEEL` response while retaining the original log output.
- C5PRO: G-code macro errors now show the source line and cause; `delayed_gcode` template errors appear in the console.
- C5PRO: Fixed `klippy.log` rotation and debug logging after MCU disconnection.
- C5PRO: Fixed displayed velocity in Motion Report after a move completes.
- C5PRO: Fixed `PID_CALIBRATE` coefficient calculation and reduced hysteresis from 5 to 2.5 °C. Existing saved PID values are unchanged.

GuppyScreen

- AD5M Pro / C5PRO: Moved air circulation controls to the Fans screen and highlighted the active mode.
- Redesigned navigation with a permanent left-hand Home / Print / Tune / Settings bar and an always-visible Stop button.
- Home now shows sensors as tiles, adds Fine Tune and Bed Mesh, and displays a large clock while idle.
- The Print screen now has a Files button, larger values, a full-width progress bar with ETA, coordinates and a clock.
- Improved the Fine Tune, Retract and Limits layouts with step selection, Z-offset and PA reset, and highlighting of changed values.
- Extrude and PID now show nozzles and sensors using the same tiles as Home.
- On multi-extruder printers, tile stripes and the temperature chart use filament colors. Empty extruders show a grey graph line; the option is enabled by default.
- Enlarged the object-exclusion map with a square bed, +/− zoom controls and one-finger panning.
- Added confirmation for excluding objects in both the list and map views; it can be disabled in settings.
- Blocked unsafe operations while printing or paused; the Resume button is protected against repeated taps.
- Added confirmed deletion of G-code files, including files in subfolders.
- Moved screw adjustment from PID to the Bed Mesh screen, with nozzle and bed temperatures configured there.
- Fixed translations of labels, measurement units and sensor names.
- Fixed thumbnail and file-metadata errors, and the active extruder temperature display on AD5X.
- Optimized buffers, JSON handling and screen-resource cleanup. Measured on AD5M: RSS fell from 12,504 to 6,220 KB (−50% compared with Z-Mod 1.5.1).
- Added automated UI checks and before/after screenshot comparisons for C5 Pro, AD5X and AD5M.
- C5PRO: Added a Remove tile to detach the extruder from the carriage.

Moonraker

- Fixed estimated print-time parsing from G-code.

- Added `post_update_gcode` to run a macro after a web component update. GuppyScreen restarts automatically after updating.

Orca FF

- On all printers, the native-screen emulator `orca_ff` was rewritten from Python in C. RAM usage dropped from 17 to 2 MB (−15 MB).

OrcaSlicer

- Fixed uploading files with Russian and other non-ASCII characters in their names via the local Flashforge API #17254.
- Added a Flow Calibration switch before printing on Creator 5 / 5 Pro #17237.

Special thanks to @mlengle for the new GuppyScreen interface.

Version 1.7.6

11.11.2026

- AD5X / Creator 5 / Creator 5 Pro: new global parameter ORCA_FF — native screen emulator. Spools for colors are chosen right in the slicer when sending a print, not in the Fluidd menu. Also works with Flash Studio (host type `FlashForge`)
- AD5X / Creator 5 Pro: filament sync with OrcaSlicer — slots are published to Moonraker (`orca_lanes` parameter), and the "Sync filament" button pulls filament colors and types
- AD5X / Creator 5 Pro: the AFC panel is built into Z-Mod: slots, color, type and Spoolman spools in Fluidd and Mainsail, lane selection window before printing. The zmod_afclite plugin is removed, its settings, spools and weights are migrated automatically. Thanks to @DIEHARDave for the zmod_afclite plugin and panel fixes
- AD5M / AD5M Pro: eMMC speed-up — HS52 mode at 50 MHz, reading about 2 times faster (~11 → ~22 MB/s). Optional DDR52 — up to ~44 MB/s
- AD5M / AD5M Pro: +7 MB of RAM (extra_ram). Method suggested by @mlengle
- Creator 5 / Creator 5 Pro: new global parameter KLIPPER_C5 — shapers from Klipper 13
- C5Pro: the range and number of passes of Auto PA are configurable (`pa_min`, `pa_max`, `pa_count`)
- Wi-Fi: connection watchdog, fixed loss of IPv4 after a short disconnect, adapter power saving turned off on AD5M and AD5X. By @mlengle
- Camera: own mjpg-streamer for all printers. By @mlengle
- Printer screen streaming now works on AD5M / AD5M Pro too
- Z-Mod: the PLUGINS menu in 12 languages
- AD5M / AD5M Pro: the telegram_notify plugin in the plugin catalog. By @mlengle
- HelixScreen: user files are kept across Moonraker updates. By Preston Brown
- Z-Mod: KAMP — the travel speed in Line_Purge and Smart_Park is configurable (`variable_travel_speed`), halved by default
- Z-Mod: speed, acceleration and SCV limits are saved at the start of START_PRINT and restored at the end (previously only on Creator 5 Pro)
- Z-Mod: _USER_PREPARE_PRINT and `_PREPARE_PRINT` receive the call parameters
- Z-Mod: the `ping` command is available in the Z-Mod environment
- Z-Mod: 3MF — fixed plate detection for AD5M, AD5X and Creator 5, the plate number is ignored for non-3MF files
- AD5X: support for firmware 3.1.8
- Removed the MF_GCODE macro

- Bug fixes

Version 1.7.5

28.10.2026

- Z-Mod: 3MF support
- Z-Mod: With 3MF, color mapping is instant — the preprocessor is no longer needed
- Z-Mod: Fast KAMP — enabled automatically and works without slow object exclusion. For 3MF the KAMP data is available instantly, for G-code — after the file is scanned
- C5Pro: Support for up to 100 colors in a file, mapped to 4 extruders
- New macro PLUGINS — plugin management menu
- New macro _USER_PREPARE_PRINT — called before the file is sent to print
- New global parameter PURGE_ALL_EXTRUDERS — purge all used extruders at print start
- New global parameter UNUSED_EXTRUDERS_OFF_TIME — turn off heating of idle extruders after a set time
- The support Telegram bot @zmod_help_bot is now AI-powered
- Fluidd: 3MF support
- Mainsail: 3MF support
- Moonraker: 3MF support
- Bug fixes

Upstream contributions:

- Fluidd: prompt action button grouping #1977
- Mainsail: HEX colors in the third parameter of macro prompts, together with @function3d #2687
- OrcaSlicer (coming in 2.5.0, currently in beta):
  - Exclude-object outline tolerance is now a user setting #16503
  - Tolerance set to 0.2 mm for AD5M/AD5M Pro, AD5X, Creator 5 / 5 Pro — fewer outline points, more objects per plate without "Timer too close" #16687
  - Post-processing scripts are applied to G-code packed into .gcode.3mf #16464
  - Fixed the first-layer bbox in plate_N.json being shifted on every plate after the first #16860

Version 1.7.4

24.09.2026

- C5Pro: Everything that works on AD5X works here too, except for Klipper 13
- C5Pro: Added a mode without the native screen
- C5Pro: Added calibrations: extruders, VFA
- C5Pro: Printer screen broadcast
- AD5X: Printer screen broadcast
- GuppyScreen: Support for multiple extruders

Version 1.7.3

09.09.2026

- Alpha support for Creator 5 / Creator 5 Pro (no support for headless mode or Klipper 13, not all macros tested)
- AD5M: Support for native firmware 5.1.9
- AD5X: Polling cycle speedup from @ninjamida

Version 1.7.2

16.08.2026

- Updated Fluidd/Mainsail/Klipper

Version 1.7.1

14.05.2026

- Updated Fluidd/Mainsail/Klipper
- GuppyScreen config auto-restore if cleared by user
- Klipper protection against OOM-killer
- Console output for `BED_MESH` load/clear events
- `dmesg` logging to config archive
- Fixed Wi-Fi functionality
- `SAVE_CONFIG...` status indicator during saving
- Load cell freeze/stall monitoring
- Bed lowers by 5mm on pause via native screen
- `IP` macro – outputs IP address to console after startup
- Rebranding: `ZMOD` → `Z-Mod`

Version 1.7.0

15.03.2026

- Updated Fluidd/Mainsail/Klipper
- NoPoop 2 by @ninjamida
- HelixScreen - alternative screen. (`ENABLE_EXTRA_PLUGINS`, `DISPLAY_OFF HELIX=1`)
- Special thanks to @xyzroe for their great help with this release

Version 1.6.6

27.01.2026

- Updated Fluidd/Mainsail/Klipper
- Updates for Klipper, Fluidd, Mainsail, and Moonraker are independent of mod updates

Version 1.6.5

14.01.2026

- Updated Fluidd/Mainsail/Klipper
- Additional camera settings are available
- Automatic Z-Offset tuning

Version 1.6.4

11.12.2025

- Improved ease of setup and use
- Updated Fluidd/Mainsail/Klipper

- Notify plugin
- IFS crackling noise removed

Version 1.6.3

25.11.2025 — Z-Mod is one year old!

- zmod.link | ZLINK — remote printer access via cloud
- Macro SCREEN — capture a screenshot of the printer's display
- Macro LOAD_ZOFFSET_NATIVE — transfer Z-offset settings from the native screen to screenless mode
- AD5X: Added global parameter REMOVE_FILAMENT — unload filament after print completion
- Added recommended settings plugin
- Czech language support added
- MCU version check for Klipper 13 implemented
- AD5X: Added leveling button
- AD5X: Fixes for Klipper 13
- AD5X: Nozzle cleaning improvements
- AD5X: Eliminated IFS grinding noise
- `CAMERA_ON VIDEO=video99` — test all available cameras
- Update check after print completion
- When performing bed leveling via Fluidd/Mainsail, load cells are zeroed — but the user must manually clean the nozzle and preheat the bed beforehand
- Fixed `PURGE_LINE` — no longer prints over supports
- Fixed collision with frame edge on reprint
- Fixed load cell display — prevents absurd multi-ton readings
- Fixed chamber fan shutdown after print completion
- Fixed remaining time display in GuppyScreen for non-Russian locales

Version 1.6.2

27.10.2025

- Plugin Support
- g28_tenz Plugin - Z-Axis Parking Using Load Cells
- bambufy Plugin - Compatible with Bambu Studio and Orca Slicer, improves prime tower control, provides accurate time and material consumption estimates, reduces waste, supports quick color changes, and offers advanced printing features. From @function3d
- nopoop Plugin - Maximum Waste Reduction by @ninjamida
- Fluidd: Color Support
- Mainsail: Color Support From @function3d, Fixed 404 Errors After Refreshing
- Guppy: Color Support. Fixed HA Integration.
- Added automatic connection of flash drives when working with Guppy
- Added WiFi enabling directly without using the native screen
- AD5X: Solved the problem with the trash bin and filament cutting in new revisions
- AD5X: Color support when restoring print
- AD5X: Ability to create custom filament types and colors when working without a native screen
- Updated Klipper and Moonraker
- Added support for ens160.py by @minicx
- Added Portuguese language
- Bug fixes

- Improved compatibility with the latest versions of the native firmware

Version 1.6.1

06.09.2025

- AD5X - Klipper 13 support. UPDATE_MCU
- AD5X - Temperature sensor in the head
- AD5X - Work without a native screen. IFS works fully, with configurable purge amount
- Minor fixes

Version 1.6.0

14.08.2025

- AD5M - Klipper 13 support. UPDATE_MCU
- AD5M - Temperature sensor in the head
- Minor fixes

Thanks for MCU support to @darksimpson

Thanks for load cell support to @minicx

Version 1.5.4

28.06.2025

- AD5X - sound works
- AD5X - load cells and nozzle collision control work
- AD5X - Telegram bot works
- AD5X - filament presence sensor works
- AD5X - bed PID calibration works
- AD5X - nozzle cleaning during bed mesh probing is restored
- AD5X - the mod operation on firmware 1.0.9, 1.1.0, 1.1.1 has been tested
- AD5X - created a flash drive that installs screen version 1.0.7 and all other modules version 1.1.1
- AD5X - created a flash drive for resetting the printer to factory settings
- AD5X - created a flash drive for activating the mod after updating the native firmware

Version 1.5.3

03.06.2025

- Fixed Klipper bug #119, which required avoiding non-Latin characters in object names
- Nozzle control is now enabled when printing from the screen immediately
- Minor cosmetic fixes

Version 1.5.2

15.05.2025

- Documentation structure update, thanks to @TMTYD
- New RESTORE_TAR_CONFIG macro

- Guppy display fix
- **AD5X** HOME bug fix
- Moonraker update
- Parking acceleration change
- CHINA_CLOUD enabled by default

Version 1.5.1

23.04.2025

- **AD5X**: support for AD5X-1.0.8-1.0.5-20250418 firmware
- **AD5X**: fix _LINE_PURGE
- **AD5X**: support for updating the MCU IFS
- **AD5X**: fix MESH_TEST
- **AD5X**: fix _SMART_PARK
- **AD5X**: fix driver_fan
- **AD5X**: fix _HOME
- Cosmetic fixes CHECK_MD5
- Return chamber_fan to Moonraker
- Fix object exclusion
- Fix guppyscreen for different languages

Version 1.5.0

17.04.2025 Interface language support:

- Z-Mod - English, German, French, Italian, Spanish, Chinese, Japanese, Korean
- GuppyScreen - English, German, French, Italian, Spanish

Version 1.4.3

23.03.2025

- Automatic webcam configuration.
- Notification when switching web interfaces.
- **AD5X**: Fixed fast dialog closing.
- **AD5X**: Fixed parking.
- Fixed screen shutdown issue on newer printer revisions.

Version 1.4.2

19.03.2025

- Enhanced nozzle collision detection with optional pause instead of shutdown. Issue #23.
- Nozzle control does not work on AD5X, see #75
- Improved system check functionality.
- Updated Fluidd color scheme.
- Added global parameter SAVE_MOONRAKER for custom macro button layouts.
- **AD5X**: GuppyScreen support.
- **AD5X**: New COLOR macro for filament type/color management.
- Revised pre-print bed testing with MESH_TEST.

- Fixed:
    - #13 (Mid-air printing after KAMP).
    - #14 (Print recovery via stock screen).
    - #31 (GuppyScreen freezes).
    - #25 (AD5X bed calibration).
    - #26 (AD5X belt spectrogram).
    - #27 (AD5X installer errors).

Version 1.4.1

09.03.2025

- During Z-Mod installation, the MD5 checksum of the unpacked files is verified. When copying files from the flash drive to the file system, the printer occasionally corrupts files.
- The CHECK_SYSTEM macro now includes system self-check
- The power button now works on the Pro version
- Non-MJPEG cameras can be used

- Alpha support for FF5X: Known features:

- No Entware, so NEW_SAVE_CONFIG and CLOSE_DIALOGS don't work

- No music playing
- No bed PID calibration, because the bed is not PID-controlled
- When activating the camera, specify VIDEO3
- No load cells, as a result there is no bed protection and no load cell reset.
- No filament motion sensor accessible from Klipper

Version 1.4.0

04.03.2025

- Updated Moonraker, Fluidd, Python
- Print recovery after power loss
- Belt spectrogram
- Loaded plate control: checks that the bed mesh roughly matches the currently loaded plate
- Support for the filament motion sensor
- GuppyScreen: object exclusion, error output, firmware retraction, PID calibration, weight reset, FF5M Pro support
- Run a macro on the next layer or on a specific layer
- Logging of all native screen messages in Klipper and of the responses to them
- New shaper calibration algorithm; shaper graphs take SCV into account
- MUTE macro - mute sound until reboot
- New parameter - native screen off timeout
- New file `mod_data/power_off.sh` - lets you write code that runs when the printer is turned off
- Smart parking is enabled when KAMP is used
- Fixed removing, disabling and fully removing the mod
- Fixed pre-cleaning
- Fixed nozzle collision control. It works only while printing.
- Fixed moving the print head with buttons in Fluidd/GuppyScreen
- Fixed pause in screenless mode
- Fixed KAMP

Version 1.3.1

- GuppyScreen improvements: COLDPULL, PID control, firmware retraction, shaper calibration, belt calibration, cosmetic fixes
- Nozzle control now works only while printing
- BELTS_SHAPER_CALIBRATION
- Improved screenless mode
- Improved slow dialog closing and NEW_SAVE_CONFIG

Version 1.3.0

08.02.2025

- GuppyScreen support
- Klipper 12, in test mode (disabled by default). Not working in it: extruder heating, extruder temperature, load cells.
- SSH client and SSH server `dropbear` replaced with the current version.
- `mjpg_streamer` replaced with a version with Alexander's patch, reducing memory usage by 2-4 times.
- Fixed object exclusion by Igor Polunovskiy (supports are now taken into account).
- Shaper graphs take SCV into account (square_corner_velocity) FIX_SCV.
- CHECK_SYSTEM - added checks of file and directory permissions, link checks and recovery.
- Removed the SOFT_REMOVE macro.
- Updated Moonraker, Fluidd, Mainsail

Version 1.1.2

03.02.2025

- New macro CHECK_SYSTEM - check the printer operating system for file corruption.
- New macro NOZZLE_CONTROL - emergency shutdown of the printer if a part detaches or the nozzle hits the bed.
- New macro UPDATE_MCU - update the printer MCU.
- New global flag NICE - set the Klipper process priority, 1 - lowest, 40 - highest (20).
- New global flag FIX_E0011 - fix the E0011 error as well as `Communication timeout during homing`
- Cleaning deleted files from the printer file system speeds up EMMC.
- Lots of small fixes

Version 1.1.1

24.01.2025

- Fixed an ordering problem when a callback blocks in the button handler #6440, found by Alexander K - LOAD_CELL_TARE now works as intended.
- Removed global parameters: `ALTER_CELL_TARE`, `IGNORE_CELL_TARE`, `CELL_WEIGHT`
- Increased the zsend timeout. Additional messages are shown.
- G28 now homes Z first, then X and Y
- New macro CAMERA_RESTART - restart the alternative camera implementation
- Fixed print cancellation code in screenless mode
- EXCLUDE_OBJECT_DEFINE implementation by Igor Polunovskiy

- On a repeated print, the motors are not disabled and the printer does not reboot, even if this is set in the global parameters
- The TEST_EMMC macro shows EMMC wear
- Fixed disabling of the Chinese clouds

Version 1.1.0

15.01.2025

- Updated Moonraker
- Significantly faster Moonraker startup
- Hidden `level_h1`, `level_h2`, `level_h3`, `power_off`, `clear_power_off`, `level_clear`, `check_level_pin_alt`
- Load cell reset in screenless mode uses Igor Polunovskiy's implementation
- Load cell reset now only on a heated bed
- New global parameter `ALTER_CELL_TARE`. Allows working around the load cell reset error.
- New global parameter `CELL_WEIGHT` sets the weight at which load cell calibration is skipped
- New global parameter CHINA_CLOUD - allows disabling the Chinese clouds
- Rewrote the printer config update
- Cooling fans now work correctly on the Pro version. Default angles are 165/105
- Extruder calibration now sets the cooling fan speed
- Time and timezone in Moonraker now match Klipper time
- The native firmware version is shown on the `System Information` tab.
- The mod is less talkative

Version 1.0.5

13.01.2025

- Added a parameter to AUTO_REBOOT that allows restarting the firmware
- G28 in macros is called only when needed
- The MD5 algorithm has been almost completely rewritten. MD5 verification now works from anywhere and does not require heating the bed or extruder
- Improved the MEM macro: now shows the memory of Moonraker, Klipper, the screen and how SWAP is used
- The Klipper process has a higher priority than other processes
- The global parameter PRINT_LEVELING now also works in screenless mode
- The BED_LEVEL_SCREWS_TUNE macro now uses the temperature correctly
- The TEST_EMMC macro can test EMMC, USB flash and RAM.
- Swap can now (but doesn't have to) be placed on a USB flash drive
- Macro CLEAR_EMMC - clear logs and/or GCODE
- Fix for E0017

Version 1.0.4

05.01.2025

- Support for firmware retraction
- Fix for E0017
- Driver cooling fans turn on automatically when the motors are enabled. Solves calibrating shapers without driver cooling on stock.

- New macro TEST_EMMC - writes SIZE MB to EMMC and reports the read/write speed.
- New macro CLEAR_EMMC - clears EMMC.
- Automatic bot restart when working over SSH
- Automatic cleanup of videos older than 10 days in the bot.
- Setting the required timezone in the bot
- Automatic fallback from KAMP purge LINE_PURGE to _CLEAR2 if no objects are found
- Fixed SKIP_ZMOD
- Updating Fluidd/Mainsail no longer requires a reboot
- Switching from Fluidd to Mainsail no longer requires a reboot
- Z-Mod reports files that use arcs
- Fixed the `addMD5.sh` script
- Fixed driver cooling control in screenless mode
- The `auto` bed mesh is loaded at printer startup in screenless mode

Version 1.0.0

23.12.2024

- New update and installation system; almost any update can now be received over the network
- New CAMERA_ON parameter, VIDEO - video device (video0)

Version 0.2.4

21.12.2024

- Z-Mod automatically reports whether an update from a flash drive is needed - now in red
- If bed mesh probing with the native screen is used (PRINT_LEVELING=1), the FORCE_LEVELING, FORCE_KAMP, SKIP_LEVELING, MESH parameters of START_PRINT are ignored
- Pause in the far right corner, even when printing from the screen
- The PRECLEAR parameter now also works when printing with bed mesh probing from the screen
- Changed the installation algorithm: after a successful installation you no longer have to remove the flash drive - the printer reboots and deletes the installation file itself.

Version 0.2.3

19.12.2024

- Z-Mod automatically reports whether an update from a flash drive is needed
- Improved the M600 macro - filament change with pause during printing
- Improved MD5 control - a message is now shown if MD5 is not found

Version 0.2.2

17.12.2024

- New macro FAST_CLOSE_DIALOGS - quickly closes native screen dialogs. Used to close the window at the end of a print or when a print is cancelled. *For fast closing, go to "Settings" -> "WiFi icon" -> "Network Mode" on the printer screen and enable "Local Network Only".* Implementation: @darksimpson

- New macro `LEVELING_PRINT_FILE` - print a file with bed mesh probing from the native screen. *For LEVELING_PRINT_FILE, go to "Settings" -> "WiFi icon" -> "Network Mode" on the printer screen and enable "Local Network Only"*
- New macro COLDPULL - cold pull (nozzle cleaning) without force. Implementation of this algorithm
- New SAVE_ZMOD_DATA parameters:
  - PRINT_LEVELING - probe the bed mesh with the native screen for every print 0-no, 1-yes (0). *For bed mesh probing from the native screen, go to "Settings" -> "WiFi icon" -> "Network Mode" on the printer screen and enable "Local Network Only"*
  - USE_KAMP - where possible, use an adaptive bed mesh (KAMP) instead of a full bed mesh 0-no, 1-yes (0). *Allows using KAMP when the bed mesh is probed over the network from the native screen*
  - CLOSE_DIALOGS - automatically close dialogs at the end of a print and on cancel 0-no, 1-yes slowly, 2-yes quickly. *For fast closing, go to "Settings" -> "WiFi icon" -> "Network Mode" on the printer screen and enable "Local Network Only"* (0).
  - USE_SWAP - use SWAP 0-no, 1-yes (1). *If your CPU has not been re-soldered, SWAP is mandatory*

Version 0.2.1.1

10.12.2024

- Asynchronous MIDI playback algorithm
- Installation fix
- Fixed SHUTDOWN from the main menu
- New script addMD5.sh - MD5 control for macOS/Linux - thanks to Alexander
- New parameter STOP_MOTOR - automatically disable motors 25 seconds after a print ends/is cancelled.
- New parameter AUTO_REBOOT - automatically restart the printer 1.5 minutes after a print.
- New parameter PRECLEAR - use nozzle pre-cleaning in START_PRINT
- New music: BattleCity, IndianaJones, WeWillRockYou by @drmax_gc

Version 0.2.1

10.12.2024

- Shaper graphs right from the printer. Macro ZSHAPER
- Fixed an error in screenless mode

Version 0.2.0

09.12.2024

- Updated Fluidd/Mainsail
- Added mc, opkg, gdb
- Reboot via the Fluidd top menu
- Bug fixes
- Major rework of the START_PRINT macro
- Macro NEW_SAVE_CONFIG - save changes/restart Klipper without freezing the native screen. Implementation: @darksimpson

- Macro CLOSE_DIALOGS - close windows at the end of a print and on cancel. Implementation: @darksimpson
- Macro STOP_ZMOD - stop Moonraker
- Macro START_ZMOD - start Moonraker
- Macro SAVE_ZMOD_DATA - save Z-Mod parameters
    - CLOSE_DIALOGS - automatically close dialogs at the end of a print and on cancel 0-no, 1-yes (0)
    - NEW_SAVE_CONFIG - use the alternative NEW_SAVE_CONFIG for PID calibration 0-no, 1-yes (0)
    - LED - LED brightness at power-on (50)
    - MIDI_ON - play MIDI at power-on ("")
    - MIDI_START - play MIDI at print start ("")
    - MIDI_END - play MIDI at print end ("")

Version 0.1.8

04.12.2024

- Telegram bot connection support
- Macro ZSSH_ON - ZSSH_ON SSH_SERVER SSH_PORT SSH_USER VIDEO_PORT MOON_PORT
- Macro ZSSH_OFF - disable the SSH client
- Macro ZSSH_RESTART - restart the SSH client

Version 0.1.7

03.12.2024

- Many macro fixes
- Macro STOP_ZMOD - temporarily stops Fluidd/Mainsail and Moonraker

Version 0.1.6

02.12.2024

- Fixed the log location
- Fixed the LOAD_CELL_TARE macro
- Fixed the extruder and bed PID calibration macro
- Macro CLEAR_NOZZLE - nozzle cleaning, as in the native firmware
- Macro KAMP extruder_temp=[nozzle_temperature_initial_layer] bed_temp=[bed_temperature_initial_layer_single]. Adaptive bed mesh with nozzle cleaning.
- AUTO_FULL_BED_LEVEL - macro completely rewritten

Version 0.1.5

30.11.2024

- Added Mainsail. Switch via the WEB macro
- STOP macro - disables motors, added to the end gcode
- Macro ZSHAPER - shaper calibration and CSV export to /mod_data in the configuration. Further analysis via Klipper-Input-Shaping-Assistant
- Macro LOAD_CELL_TARE - load cell reset

- Fixed bed calibration. You can now set the bed and extruder temperature for calibration. Default 120/80
- Fixed turning the screen off in screenless mode. It turns off after 4 minutes.

Version 0.1.4

29.11.2024

- Added camera control from the mod. Saves memory and allows working with the camera when the screen is off. The camera resolution can also be changed. (The implementation was inspired by Pavel Mironov)
- Fixed an installer bug that in the previous version could remove [heater_bed] from the configuration files
- New installation images. Made by @drmax_gc
- Macros are sorted into categories and translated into Russian
- Macro DATE_GET - show the current time
- Macro DATE_SET - set the current time
- Macro CAMERA_ON - use the alternative camera implementation
- Macro CAMERA_OFF - disable the alternative camera implementation

Version 0.1.3

28.11.2024

- Added MIDI playback. Files are stored in mod_data/midi - accessible via the "Configuration" tab. Thanks to @drmax_gc
- Macro PLAY_MIDI. Plays a melody: PLAY_MIDI FILE=Pain-Shut-your-mouth.mid
- Macro `SOFT_REMOVE`. Removes only Z-Mod, keeps audio, md5, root
- Moonraker settings are preserved after an update
- User settings for Klipper moved to mod_data/user.cfg
- User settings for Moonraker moved to mod_data/user.moonraker.conf
- When the screen is turned off, it shows a message that the screen is off. Thanks to @drmax_gc
- Fixed bed calibration via macro. The bed now heats up.
- Fixed bed adjustment via macro. The bed now heats up.

Version 0.1.1

27.11.2024

- Support for working with the native display turned off. This saves 20 MB of RAM. To enable this mode, call the DISPLAY_OFF macro. Klipper restarts and uses alternative configuration files. It is recommended to probe the bed mesh and save it to the default profile. After a reboot, the screen becomes unavailable after 5 minutes and the bed mesh from the default profile is loaded.
- Macro MEM - shows how much memory is used and by which application.
- Macro DISPLAY_ON - returns the screen to the standard mode, the printer reboots
- Macro LED - turns the light on at 50%
- Macro LED_ON - turns the light on at 100%
- Macro LED_OFF - turns the light off

Version 0.0.9-fix

25.11.2024

- Fixed an installation error.

Version 0.0.9

25.11.2024

- Pause during printing, handled via the native screen
- Resume after pause, handled via the native screen
- Print cancellation, handled via the native screen
- REBOOT - macro to reboot the printer
- SHUTDOWN - macro to turn off the printer
- SKIP_ZMOD - macro to reboot without starting Moonraker and Fluidd
- REMOVE_ZMOD - macro to remove the mod
- Fixed: "After a pause caused by the filament motion sensor, printing resumes but prints in the air about 3 cm above where it should"

Support

Since people have been asking, I accept donations but please remember that I work on Z-Mod for fun and not for the money. I will not accept donations to work on specific bugs or features.

Support via Boosty (international Visa/ Mastercard)	
Support Mod Development: BTC `bc1qm5ukaw5svn7z7zm6ddagxw9l99mwac6zctm47e`	bc1qm5ukaw5svn7z7zm6d dagxw9l99mwac6zctm47e

Support via Boosty (international Visa/ Mastercard)	
For the development of zmod: SBP, Bank card, T-pay	

Many thanks to the FF_5M_5M_Pro community for purchasing AD5X for development represented by

- @Voron_Kor
- @solitairweb
- @katerinafotonsk
- @bennymas
- @dexter40
- @Pashteton
- @a_lexey_ka
- @AWPYNAO
- @moscowpan
- Bulat M.

BTC sponsor:

- @cackmobile
- @ck0neGit
- @xyzroe
- @emsilva

Boosty sponsor:

- @Wideopentuning
- @edzeg
- Namida Verasche
- Dave Shaw
- Sean Hinkley
- @kristian

- Idi Schmitz
- Serhii Povar

Social

Join our community! Here you'll find official support channels, discussion groups, and resources for interacting with the project.

🤖 Official Support

Help Bot

- **Help Bot**
  - Telegram Help Bot
  - Automated support: the bot finds the answer in the documentation for you

Telegram Channels

- **Official Info Channel**
  - Telegram Info Channel
  - Official news and project updates
- **Official Discussion Group**
  - Telegram Group
  - Community discussions and help

MAX

- **Official Z-Mod Group on MAX**
  - MAX Group
  - Community discussions and help

Facebook

- **Facebook Group**
  - Facebook Community
  - Official discussion group

VK

- **VK Group**
  - VK
  - Bot for zmod.link registration

🌐 Community Resources

Unofficial Groups

- **Facebook Group**
  - Facebook Community (read only)
  - Unofficial discussion group
- **Discord Server**
  - Discord Community
  - Unofficial real-time chat server

💻 Development

GitHub Repository

- **Source Code**
  - GitHub Repository
  - Project source code and documentation

📋 Quick Links Summary

Resource Type	Platform	Link	Status
Support	Telegram Bot	Help Bot	Official
News	Telegram Channel	Info Channel	Official
Discussion	Telegram Group	Discussion Group	Official
Community	MAX	MAX Group	Official
Community	Facebook	Facebook Group	Official
zmod.link	VK	VK Group	Official
Community	Facebook	Facebook Group (ro)	Unofficial
Chat	Discord	Discord Server	Unofficial
Code	GitHub	Repository	Official

🎯 How to Get Help

1. **For quick questions** – use the Help Bot
2. **For news** – subscribe to the official channel
3. **For discussions** – join the Telegram group
4. **For development** – explore the GitHub repository

📱 Stay Connected

Choose the most convenient platform for receiving updates and communicating with the community. All official resources are marked with appropriate icons.

Video

https://www.youtube.com/embed/IcCHZ4knZJM
https://www.youtube.com/embed/2sfb2OtY7wM
https://vkvideo.ru/video_ext.php?oid=-238575243&id=456239017&hash=047fa1a63cc31586&hd=3
https://www.youtube.com/embed/fWftB4ru5Fw

☁️ zmod.link Cloud

Free 3D Printer Management Service

> 🚀 **Completely free and non-commercial service**

🆓 Free Tier

Every registered user gets **2 printers for free**.

💡 How to Increase Your Printer Limit?

Need more than 2 printers? You can expand your limit using one of two support options:

Option 1: Support the Project ⭐

- Give a ⭐ **star** to the Z-Mod repository on GitHub
- Take a screenshot as proof
- One star grants you **+1 additional printer**

Option 2: Voluntary Donation 💰

Cost: **500 RUB per additional printer per year**

Available payment methods:

Method	Details	Important
🇷🇺 **Russian Rubles**	Payment link	Include your zmod.link **username** in the sender's name
₿ Bitcoin	`17wXTd9BqYp1K3zCLTxVyGLEXUDjf7XNLL`	Send the BTC equivalent of **500 RUB** per printer*
Boosty	Support via Boosty (international Visa/ Mastercard)	≈ Send the $ equivalent of **500 RUB** per printer* ≈ 5$

> * BTC amount varies with market rate. Calculate the equivalent of **500 RUB** using the current exchange rate at the time of transfer. Example (approximate): at 1 BTC ≈ 4,200,000 RUB → 500 RUB ≈ **0.00012 BTC** per printer.

Limit expansion examples:

- 500 RUB / ~0.00012 BTC → +1 printer (total: 3 printers)
- 1,000 RUB / ~0.00024 BTC → +2 printers (total: 4 printers)
- 1,500 RUB / ~0.00036 BTC → +3 printers (total: 5 printers)

- etc.

📬 How to Request a Limit Increase?

Send an email to: 📧 **add@zmod.link**

Please include:

- Your zmod.link **username**
- Chosen support method (GitHub star / RUB donation / BTC donation)
- For GitHub star — attach the screenshot
- For donations — specify amount, date, and **transaction hash** (for BTC)

❤️ Where Do Donations Go?

All contributions are used exclusively for: - 🔁 Hosting renewal and scaling - ⚡ Increasing server capacity and performance - 🛠 Ongoing development and maintenance of the project

> 💬 *This service exists thanks to community support. Thank you for being part of zmod.link!* 🙏
