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# **ADVi3++ User Manual**

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## ADVi3++ User Manual

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### Introduction

**ADVi3++** is a custom firmware for **Wanhao** Duplicator i3+ printers (and their clones like the Monoprice Select Plus). It is based on the latest stable release of Marlin (1.1.6) and adds some new specific features. It has the following features when compared to the stock Wanhao firmwares:

- Based on Marlin 1.1.6 (Wanhao firmware is based on a fork of Marlin created in 2014)
- New LCD screens in color (yes, your LCD display is able to show colors)
- Access on the LCD display to more printer parameters like Feedrate, Acceleration and Jerk settings

- Calibration of the X, Y, and Z motors and of the extruder
- Temperature graphs
- 3 preheat presets
- 5 points manual bed leveling
- Display of messages (M117 code) from external software such as OctoPrint (Detailed progress plugin for example)
- An up to date User Manual

## Source Code

The full source code of ADVi3++ is available in the following GitHub repositories:

- ADVi3pp-Marlin
- ADVi3pp-LCD
- ADVi3pp-User-Manual

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- Copyright © 2016 MarlinFirmware
- Based on Sprinter and grbl.
- Copyright © 2011 Camiel Gubbels / Erik van der Zalm

### ADVi3++ User Manual

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### ADVi3++



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## ADVi3++ User Manual

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## How to Flash

There are two parts to flash:

- The LCD resources
- The mainboard (custom Marlin firmware)

It is recommended to flash first the LCD resources.

### Part 1 - Flashing the LCD resources

**Note:** *The LCD resources are hosted on their own GitHub project: ADVi3pp-LCD.*

#### LCD Step 1 - Prepare a microSD card

**IMPORTANT:** You have to use a microSD card with a maximum capacity of **8GiB**. If you use a microSD card with a greater capacity, the results are **unreliable** (sometimes it flashes, sometimes not). This is a limitation of the LCD display itself.

You have two possibilities to flash:

### LCD Step 1 - Option 1 - Manual copy

- Download the LCD resources: ADVi3pp-LCD-x.x.x.zip
- Unzip the file somewhere
- Copy manually all the files and folders in the uncompressed zip file to the root of a microSD card. The microSD card **has** to be formatted with the following parameters: FAT32, 4096 bytes per cluster (i.e. 8 sectors).
- To format under Linux (and macOS with the `dosfstools` Homebrew package):

```
1 mkfs.fat -F 32 -n SD -s 8 -v /dev/disk2
```

Of course, replace `/dev/disk2` with the right value.

- To format under Windows (Command Prompt):

```
1 format G: /FS:FAT32 /V:LCD /A:4096
```

Of course, replace `G:` with the right volume letter.

### LCD Step 1 - Option 2 - SD image

- Download the microSD card image: ADVi3pp-LCD-x.x.x.img.zip
- Unzip the `.img.zip` file and use either `dd` (Linux, macOS) or Etcher (Windows, Linux, macOS). For example with `dd`:

```
1 unzip ADVi3pp-LCD-1.0.0.img.zip
2 sudo dd if=ADVi3pp-LCD-1.0.0.img of=/dev/disk2 bs=64K
```

Of course, replace `/dev/disk2` with the right value.

If you prefer graphical applications, Etcher is a great multi-platform tool.

### LCD Step 2 - Install the new version

- Disconnect the printer from power
- Remove the two screws located on the front and loose the two M3 screws on the top



Figure 1: *front-panel-screws*

- Remove the front panel carefully (don't break the flat cable)
- If you are lucky, you can insert the microSD card on the left of the panel (this is the case on the Monoprice clone)
- Otherwise, remove the four M3 screws and remove the cover
- Insert the microSD card in the slot

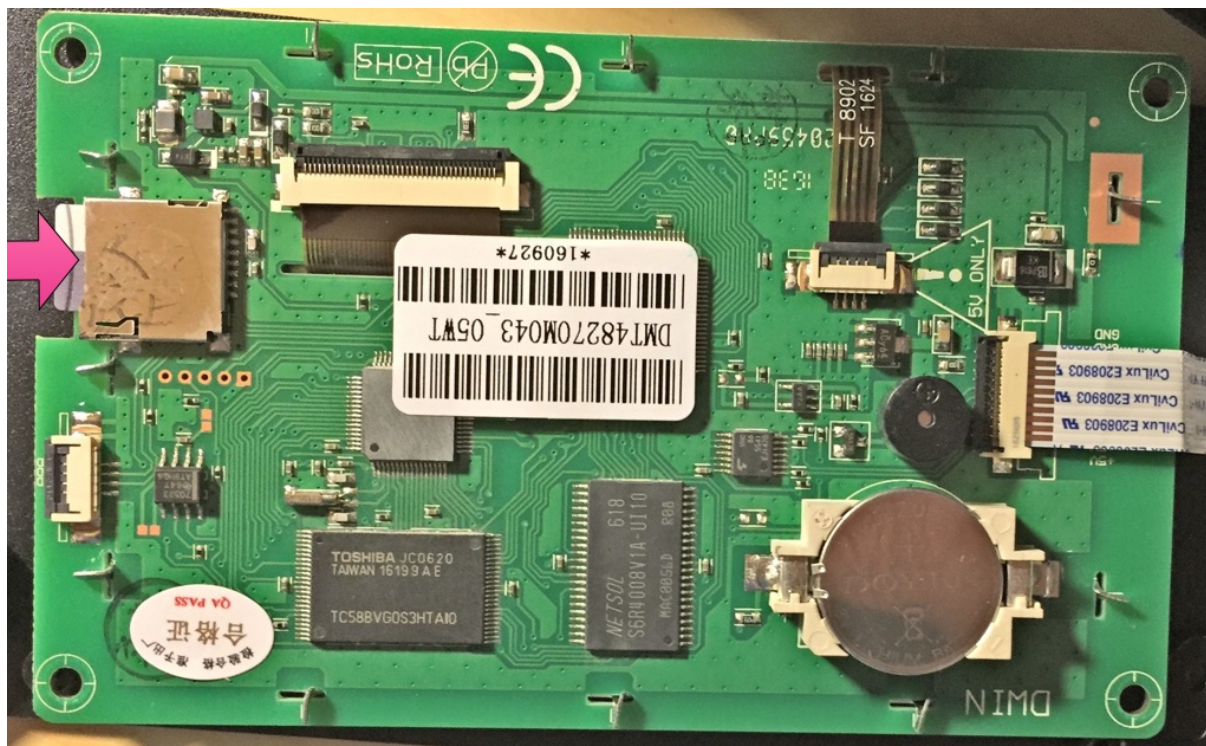
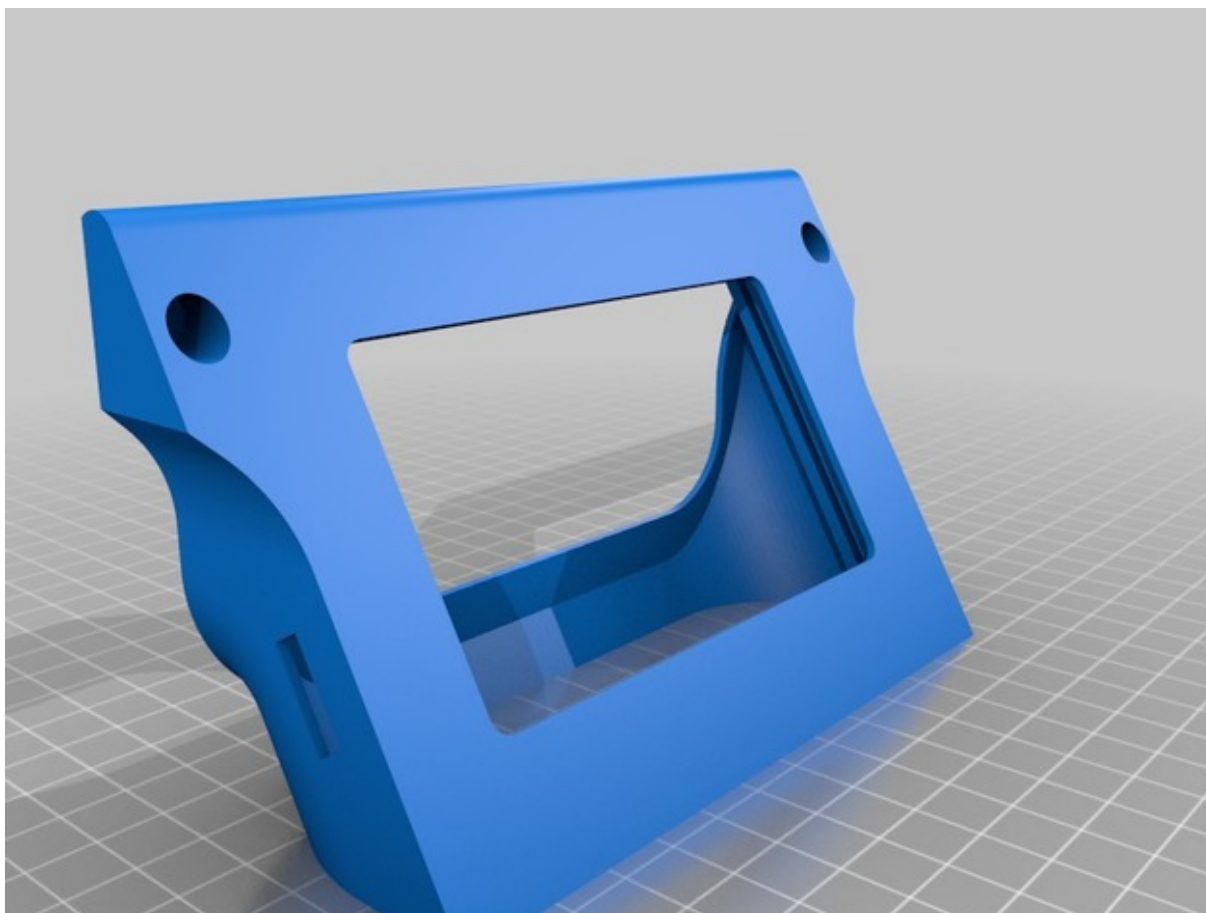


Figure 2: lcd-board-microsd

- Turn on the printer (either by connecting it to power or by connecting the USB slot to the computer)
- The screen turns blue and then every image will appear one by one
- After around 2 or 3 minutes, the screen turns black
- Turn off the printer and remove the microSD card
- Re-assemble the front panel, do not forget the two M3 screws on the top
- Turn the printer on. You know have the new version of the LCD images

## LCD Enclosure



From Thingiverse “Wanhao Duplicator I3 Plus LCD enclosure” by bosbessenbasje:

The standard enclosure puts the LCD in a 90 degrees angle towards the table and that makes it hard to read. This enclosure will put the LCD in 60 degrees angle which improves readability at the cost of a slightly large space on the table.

Note that the new enclosure allows you to insert a **micro SD in the LCD to upgrade the LCD firmware** if you want to. You will probably need some pliers to do it though.

I highly recommend this LCD enclosure. It will simplify a lot your life.

## Part 2 - Flashing the mainboard firmware

There are several ways to flash the mainboard firmware. The first step is to download the firmware from the **Releases** page on GitHub:



ADVi3pp-Mainboard-x.x.x.hex

Then choose the option you are the most comfortable with.

**Note:** *It is not possible to flash the mainboard using the SD card slot of the printer.*

### Mainboard Option 1 - Flashing using Cura

- if not yet done, download Cura. I recommend either Cura for Wanhao (if you directly connect the printer to your computer with a USB cable) or Ultimaker Cura 3 (if, for example, you are using OctoPrint to print)
- Start **Cura**
- In the top menu, under **Settings** → **Printer**, select **Manage Printers**
- Select your printer or **Add** your printer if it is not already done
- Select **Upgrade Firmware** and then **Upload custom Firmware**
- Select the downloaded file `ADVi3pp-Mainboard-x.x.x.hex` and click on **Open**

### Mainboard Option 2 - Flashing using OctoPrint

You need `avrdude` and the development build of the **Firmware Updater** plugin.

To install `avrdude` on a Raspberry Pi:

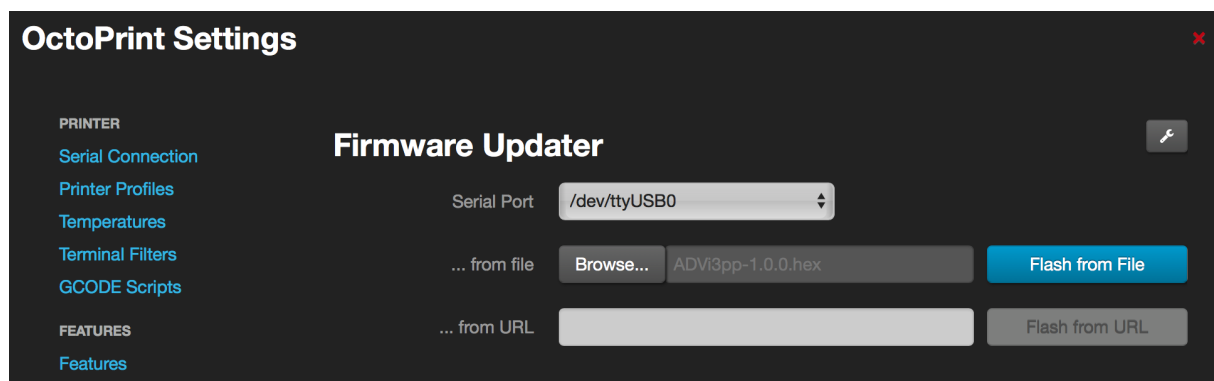
- Connect to the Raspberry (for example through SSH) and enter the command:

```
1 sudo apt update; sudo apt install avrdude
```

To install the development build of the **Firmware Updater** plugin

- Open a navigator and connect to **OctoPrint**
- **Login** and click on the wrench icon in the toolbar
- Select **Plugin Manager** → **Get More...**
- Under **from URL** enter `https://github.com/OctoPrint/OctoPrint-FirmwareUpdater/archive/devel.zip` and click on **Install**
- Restart **OctoPrint**

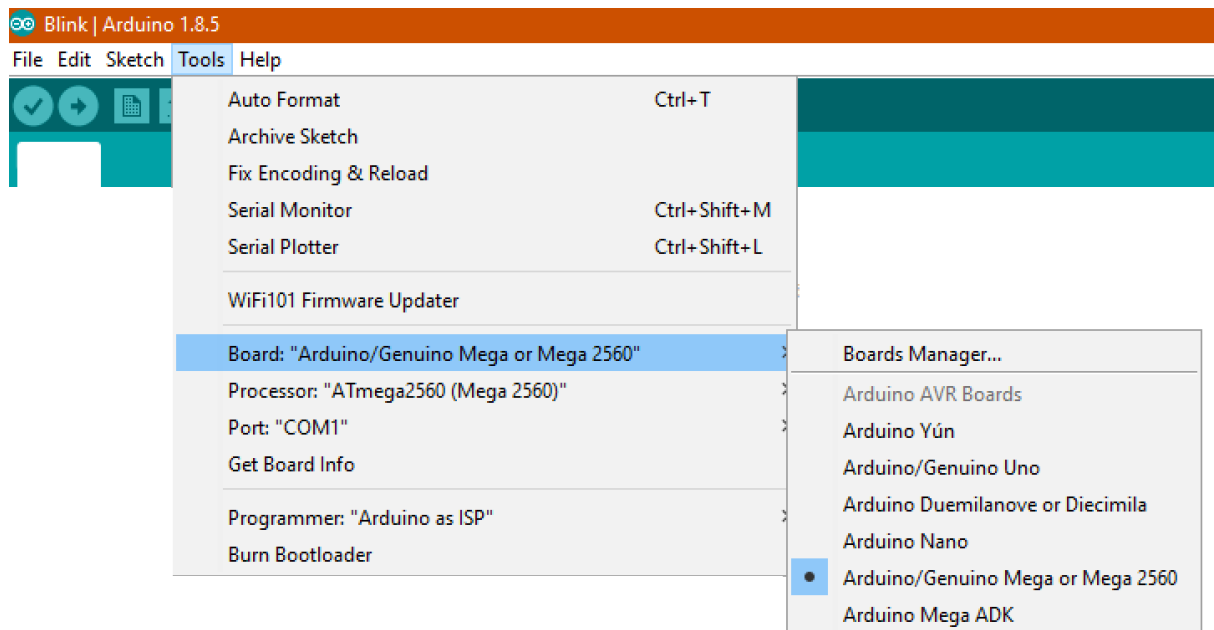
To flash the firmware:

Figure 3: *firmwareupdater*

- When **OctoPrint** is rebooted and the UI reloaded, click on the wrench icon in the toolbar
- Under **Plugins**, choose **Firmware Updater**
- Click on the wrench icon, and after **Path to avrdude**, enter `/usr/bin/avrdude` and click **Save**
- Be sure your USB port appears after **Serial Port**
- After **... from file**, click on **Browse** and select the firmware you have downloaded such as `ADVi3pp-Mainboard-x.x.x.hex`
- Click on **Flash from File**
- The flashing process may take around 30 seconds
- When it is finished, a message appears saying “Flashing successful”. Click on **Save**
- Reconnect the printer

### Mainboard Option 3 - Flashing using Arduino IDE

- Connect your printer to your PC using the USB cable
- Download Arduino IDE
- Open Arduino IDE
- Under **Tools** → **Board**, select **Arduino/Genuino Mega or Mega 2560**
- Under **Tools** → **Processor**, select **ATMega2560 (Mega 2560)**
- Under **Tools** → **Port**, select the port your printer uses



- Under **File** → **Open**, select `Marlin.ino` located in the **Marlin** folder
- Click on the **Upload** button, on press `Ctrl + U`

The firmware is compiled and uploaded. When the uploading is finished, the printer reboots.

#### Mainboard Option 4 - Flashing using avrdude

All the previous options are using `avrdude` underneath. `avrdude` is an utility to download/upload/-manipulate the ROM and EEPROM contents of AVR microcontrollers. It can be downloaded from your favorite repository or from Savannah Non-GNU web site.

- For Debian/Ubuntu:

```
1 sudo apt install avrdude
```

- For macOS (Homebrew):

```
1 brew install avrdude
```

- For Windows, download `avrdude-6.3-mingw32.zip` or a higher version.

The command line is the following:

```
1 avrdude -v -p m2560 -c wiring -P <printer_port> -U flash:w:<firmware.hex>:i -D
```

Replace `<printer_port>` and `<firmware.hex>` with the right values. For example (Windows):

```
1 avrdude -v -p m2560 -c wiring -P COM3 -U flash:w:ADVi3pp-Mainboard-2.0.0.hex:i -D
```

or (Linux):

```
1 avrdude -v -p m2560 -c wiring -P /dev/ttyUSB0 -U flash:w:ADVi3pp-Mainboard-2.0.0.hex:i -D
```

## LCD Touch Screen



Figure 4: *Boot*

*Boot animation*

## Main panel

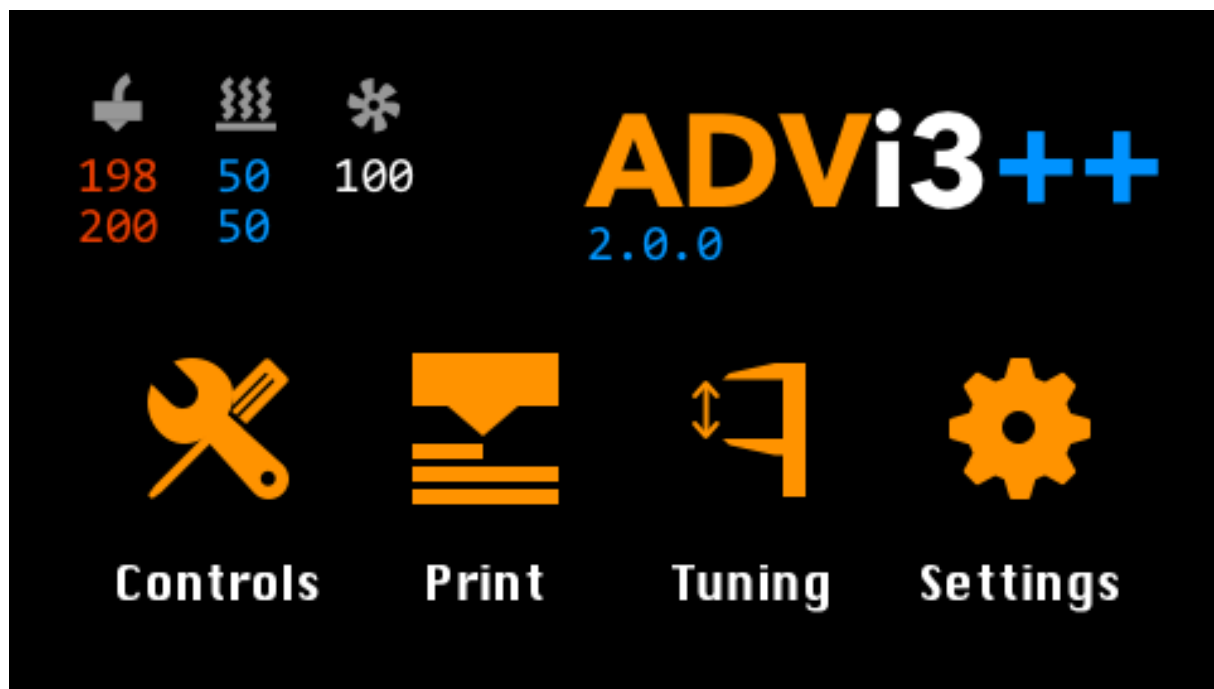


Figure 5: Main

- **Temperatures:** Displays the current temperature of the extruder and of the bed. Displays also the current speed of the extruder's fan. Tap on this area to show a graph of temperatures.
- **Version:** Displays the version number of ADVi3++. Taps on this area to show an About panel with information about the release installed.
- **Controls:** Taps on this button to display the **Controls** panel with tools such as Load and Unload Filament, Move, etc.
- **Print:** Taps on this button to display the **Print** panel (if your are printing) or the Temperature graph (if you are not).
- **Tuning:** Taps on this button to display the **Tuning** panel with tools to help you adjust some parameters of your printer.
- **Settings:** Taps on this button to display the **Settings** panel. In this panel, you can view and modify several parameters of the printer.

## Controls

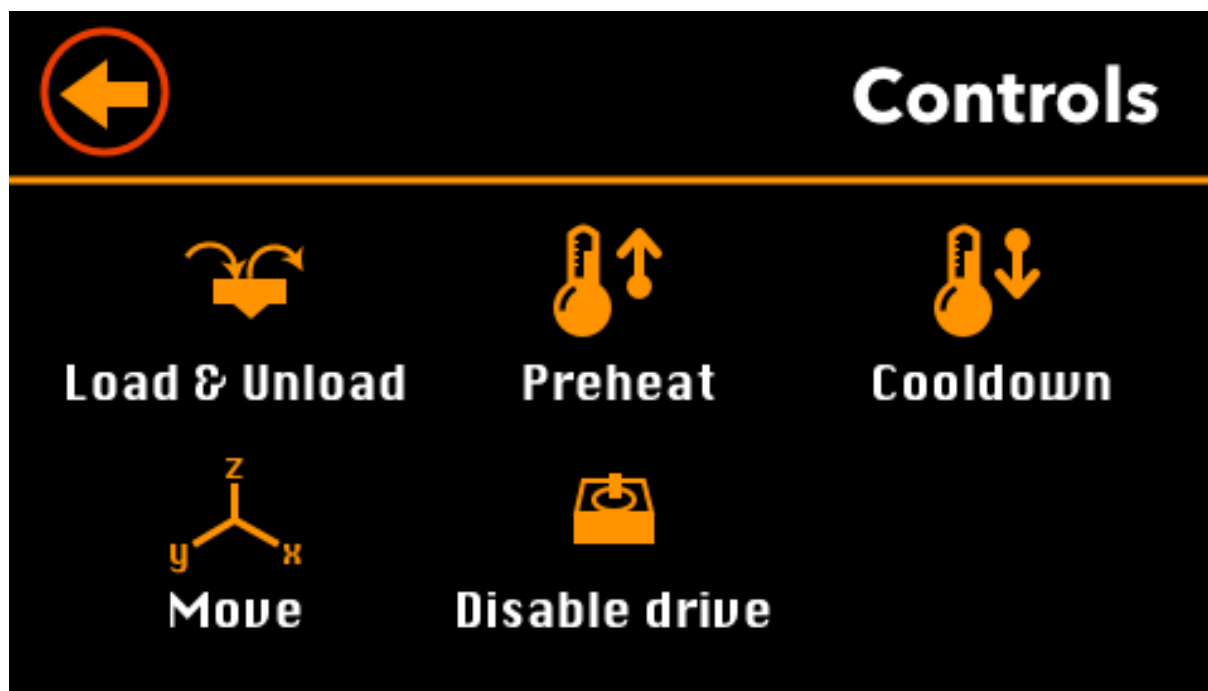


Figure 6: Controls

This panel gives you access to tools to control your printer.

- **Load & Unload:** Tools to Load or Unload Filament (see below).
- **Preheat:** Set of preheat settings (both Hot-end and Bed - see below).
- **Cooldown:** Disable both heated bed and Hot-end.
- **Move:** Tools to move the head of the printer, and to extrude or unextrude filament (see below).
- **Disable drive:** Disables all motors so you are able to move the head manually.

## Load & Unload

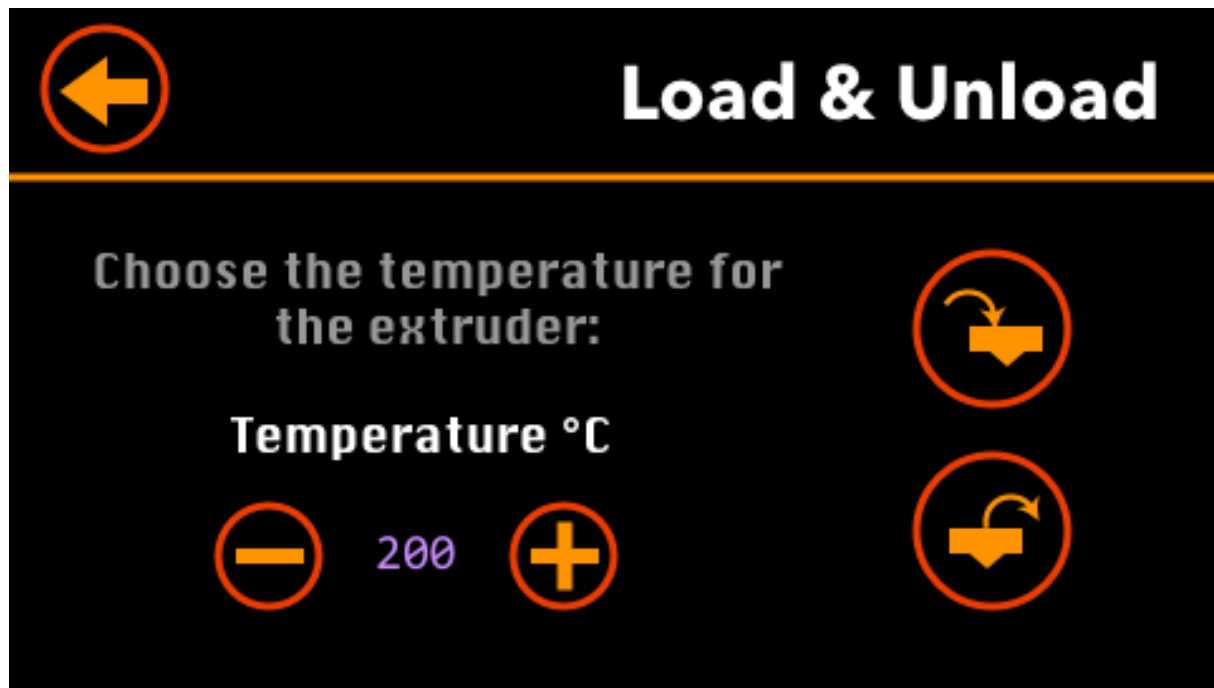


Figure 7: Load & Unload

Select the extruder's target temperature you want to use (with the plus and minus buttons) and press either the **Load** or **Unload** button.

**Tip:** Keep the button pressed to quickly increment or decrement the temperature.

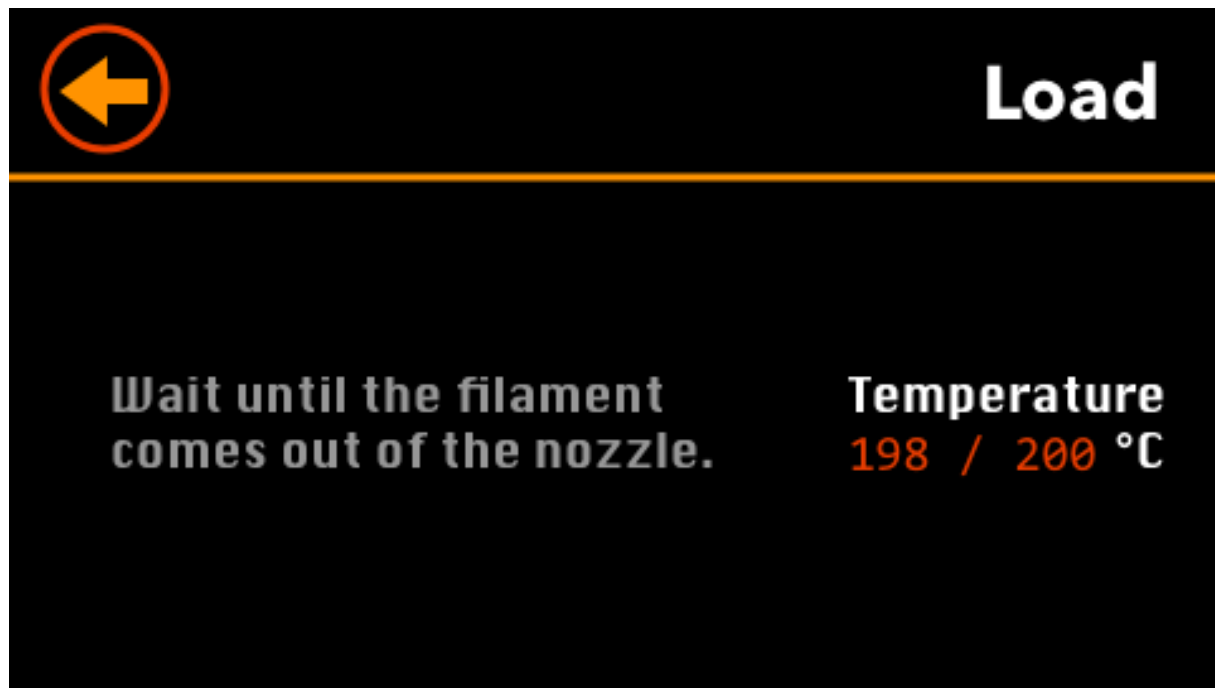


Figure 8: *Load & Unload*

When the target temperature is almost reached, the extruder motor starts extruding filament. When the filament comes out of the nozzle, press the **Back** button.



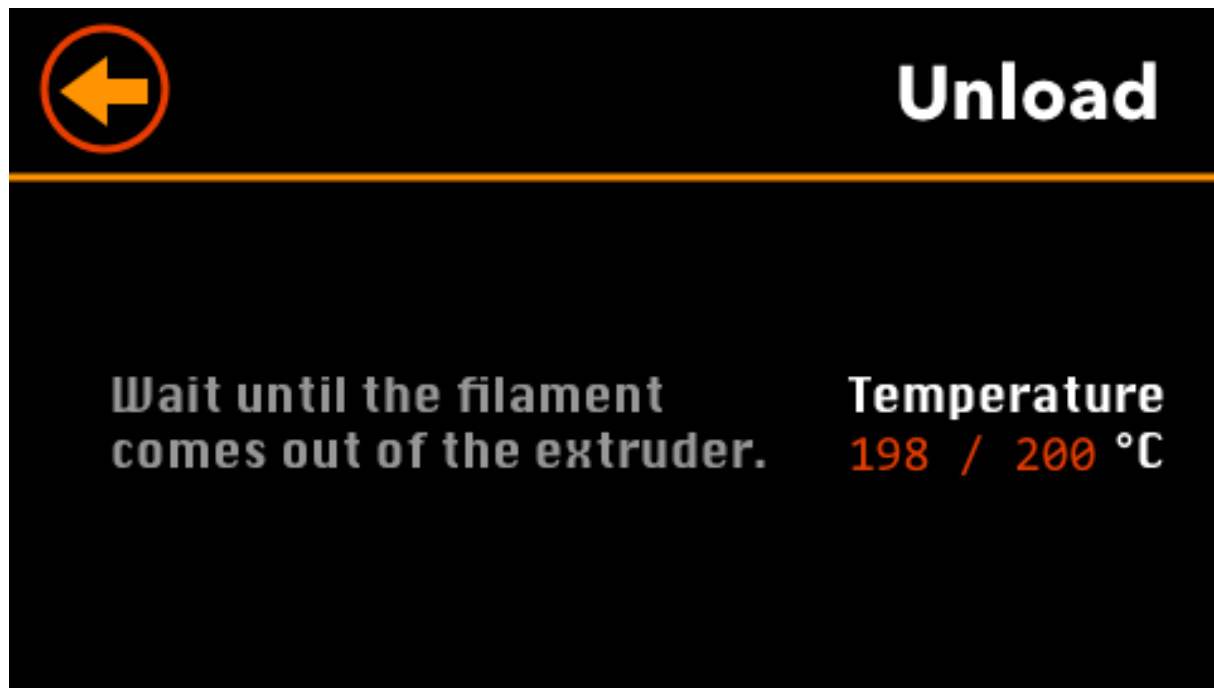
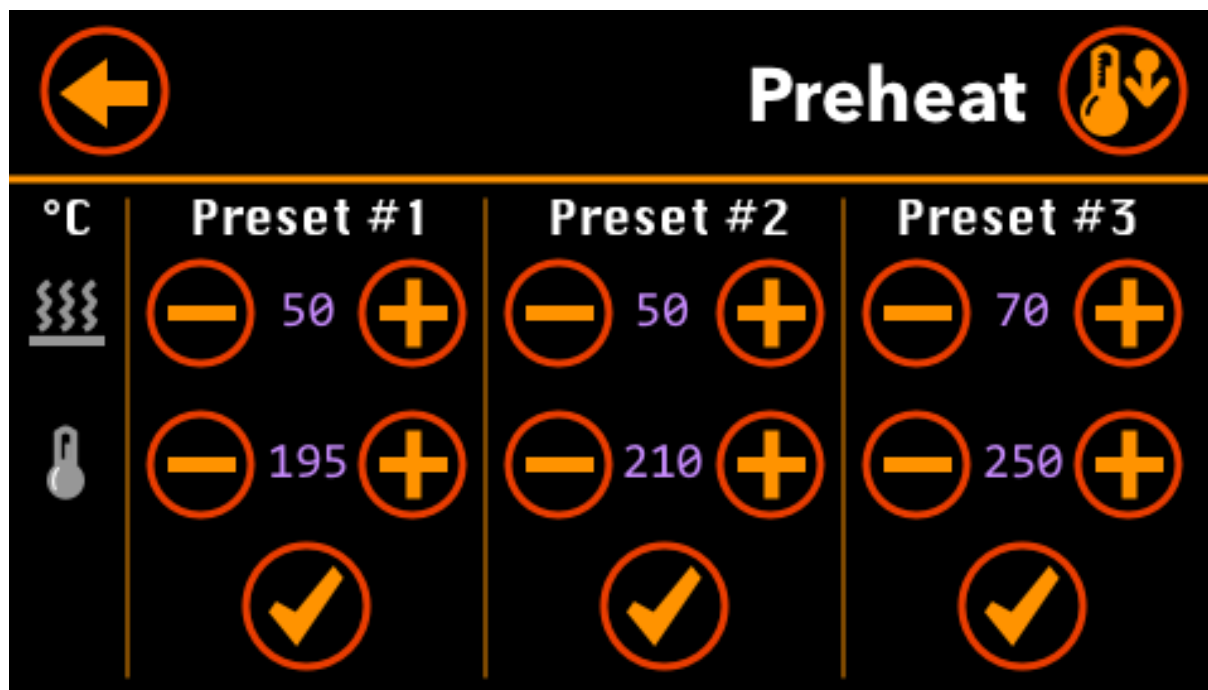


Figure 9: Load & Unload

When the target temperature is almost reached, the extruder motor starts unextruding filament. When the filament comes out of the extruder, press the **Back** button.

## Preheat

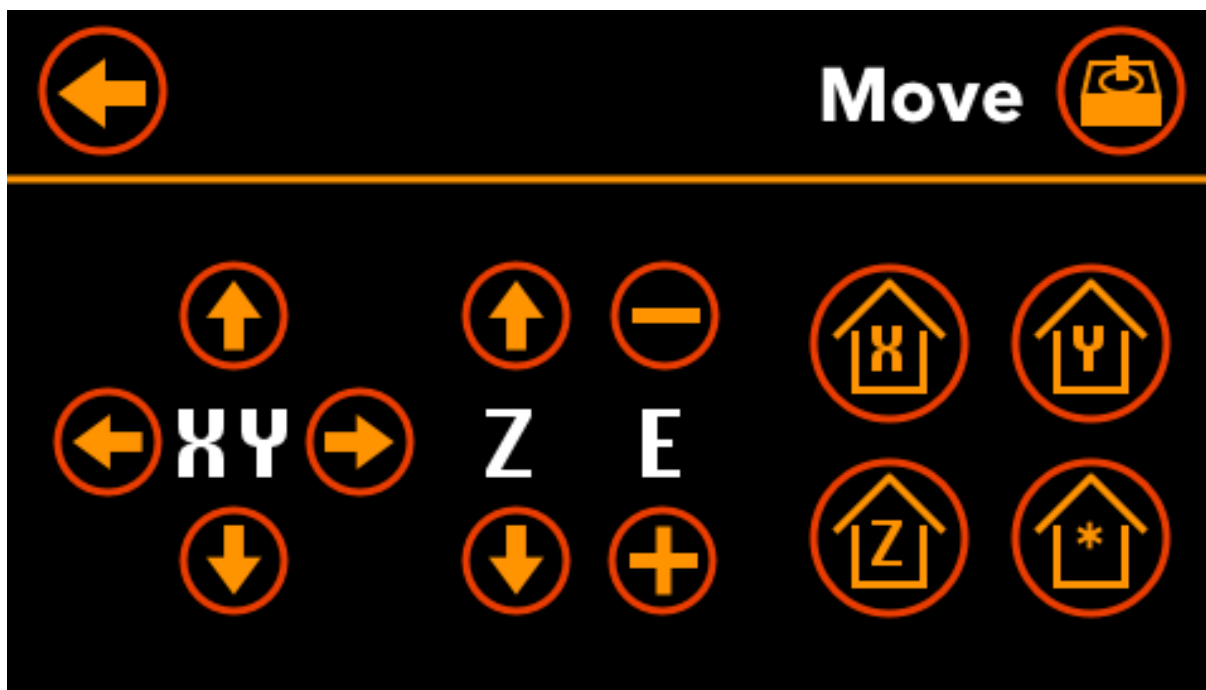


You have the choice of three presets (both bed and hot-end temperatures). You can adjust each value by pressing the plus and minus buttons. To start heating bed and hot-end, press one of the checkmark button. To stop heating, press the cooldown button on the top right corner.

**Tip:** Keep the button pressed to quickly increment or decrement a temperature.

**Important:** If you press the **Back** button, the printer continues to heat the bed and the hot-end. Press **Cooldown** on this screen or on the **Tools** screen to stop heating.

## Move



- You can move the head (X & Z) and the bed (Y) by pressing the buttons with arrows.

**Tip:** Keep the button pressed to quickly move the head or the bed.

- Press the **E** + button to extrude some filament; press the **E** – button to un-extrude.

**Important:** The printer will extrude or un-extrude only if the temperature of the hot-end has reached a minimal value.

- Press a button with a house icon to home the head (X & Z) or the bed (Y). Press the button with the star (\*) to return both bed and hot-end to their home positions.
- Press the button with the motor icon (top-right corner) to disable all motors so they are free to move by hand.

## Print

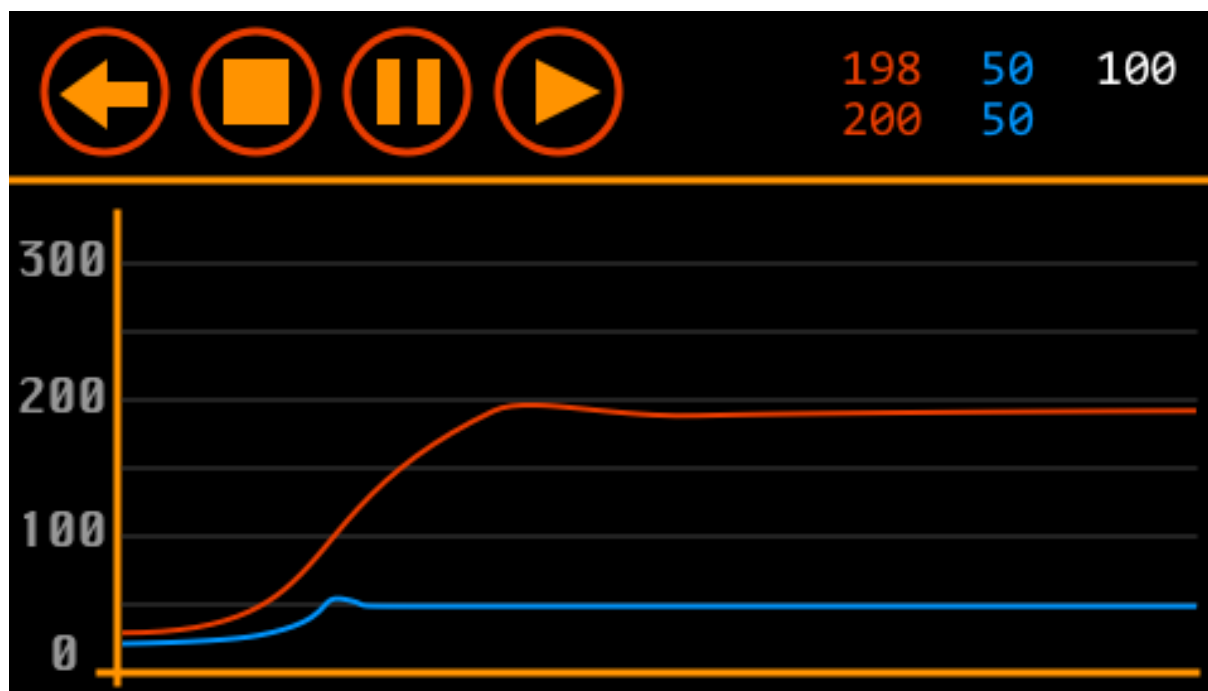


Figure 10: *Print*

The exact screen displayed is dependent of the context (in this order):

- If you are printing from the SD card, the **SD Print** screen is displayed (see below).
- If you are printing through USB (i.e. from Cura, OctoPrint, ...), the **USB Print** screen is displayed (see below).
- If you are not printing and a SD card is inserted in the SD slot (and readable), the **SD Card** screen is displayed (see below).
- Otherwise, the **Temperature Graphs** is displayed (see below).

## SD Card

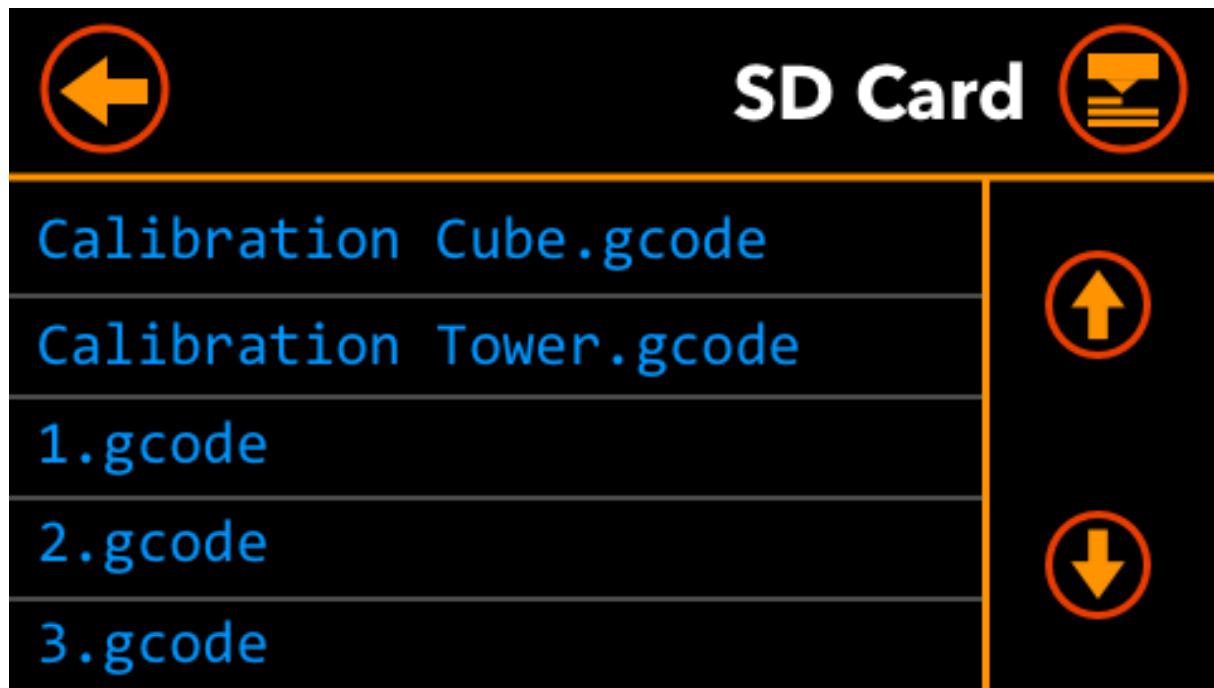


Figure 11: *SD Card*

The **SD Card** screen is displayed only when a SD card is inserted in the SD slot of the printer and is readable. It displays all the files in the root of the SD card.

- If there are more than 5 files, use the two arrow button to display the files page per page.
- To print a file, press its name. The **SD Print** is displayed and the printing starts.

## SD Print

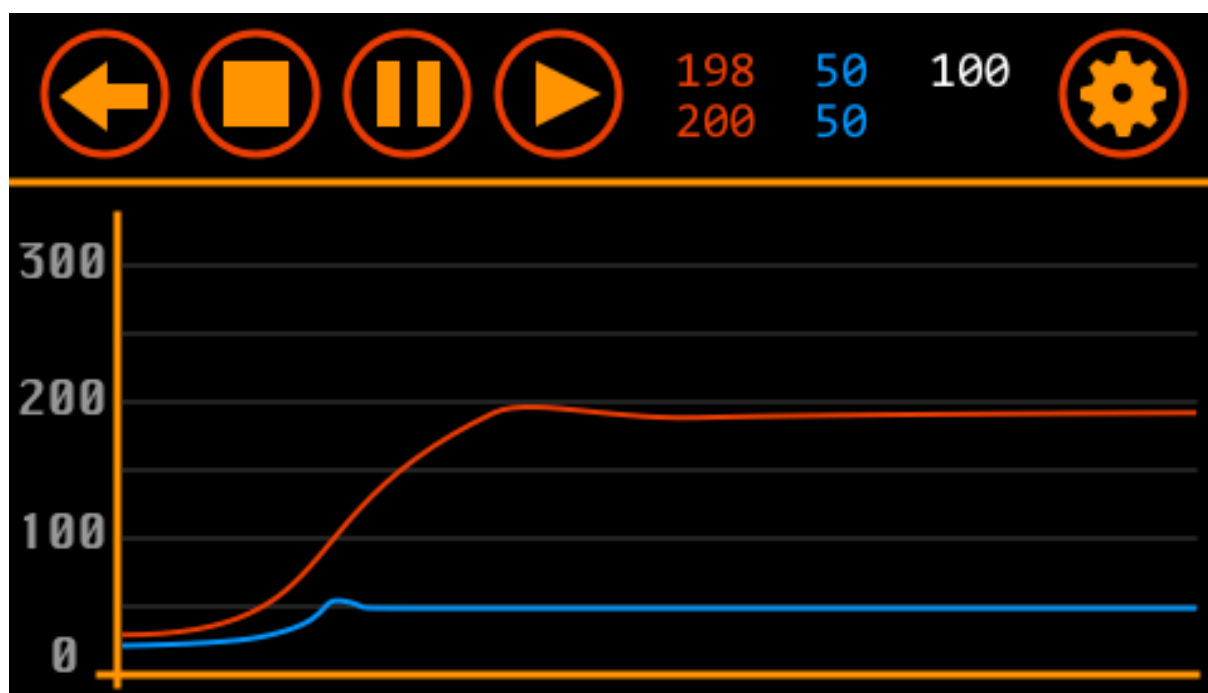


Figure 12: *SD Print*

The **SD Print** screen is displayed only when a print is running from the SD card.

- It displays a graph of the temperatures (bed in blue, hot-end in red).
- **Stop**: Press the **Stop** button to stop the current printing. It also goes back to the previous screen (**SD Card**).
- **Pause**: Press the **Pause** button to temporary stop the printing.
- **Resume**: Press the **Resume** button to resume a paused printing.
- **Print Settings**: Press on the gear button to display and modify the **Print Settings** like the temperature, the fan speed, etc.
- **Back**: If you press the **Back** button, the printing continues and it goes back to the previous screen (**SD Card**).

## Print Settings

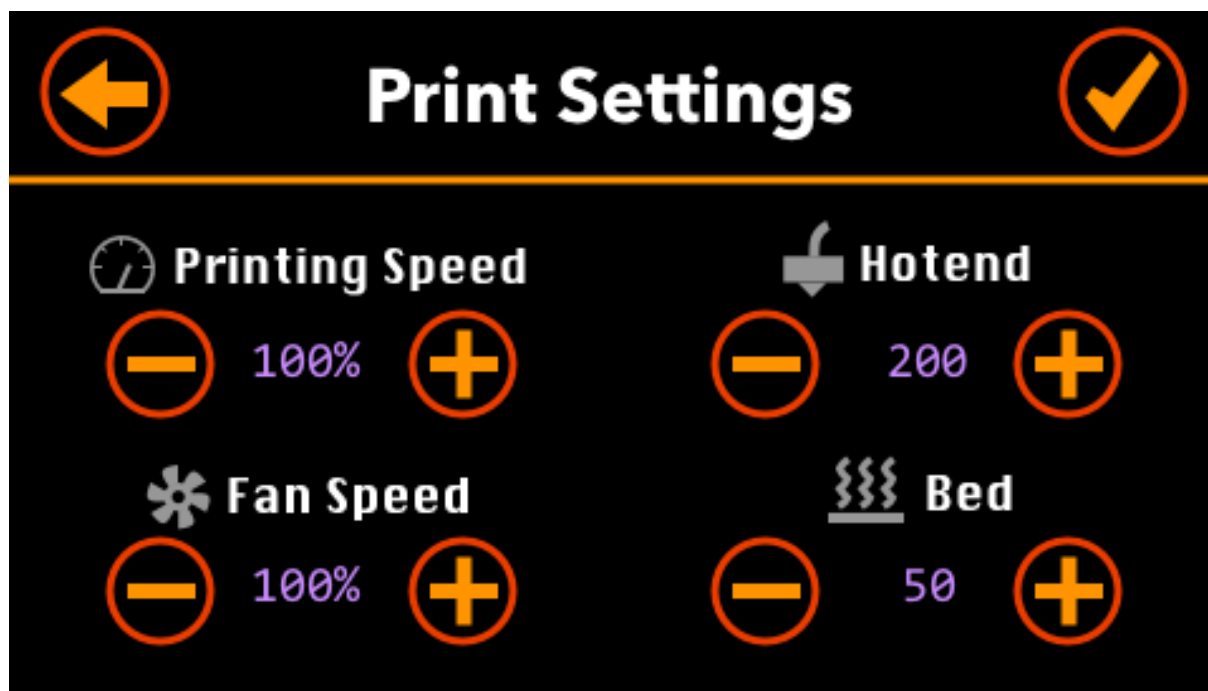


Figure 13: *print Settings*

In this screen, you can adjust print parameters during a SD card printing:

- **Printing Speed:** The motor speed multiplier. Speed of motors is multiplied by this rate.
- **Fan Speed:** The fan speed multiplier. Speed of the fan (in the front) is multiplied by this rate.
- **Hot-end:** Temperature of the hot-end.
- **Bed:** Temperature of the bed.

## USB Print

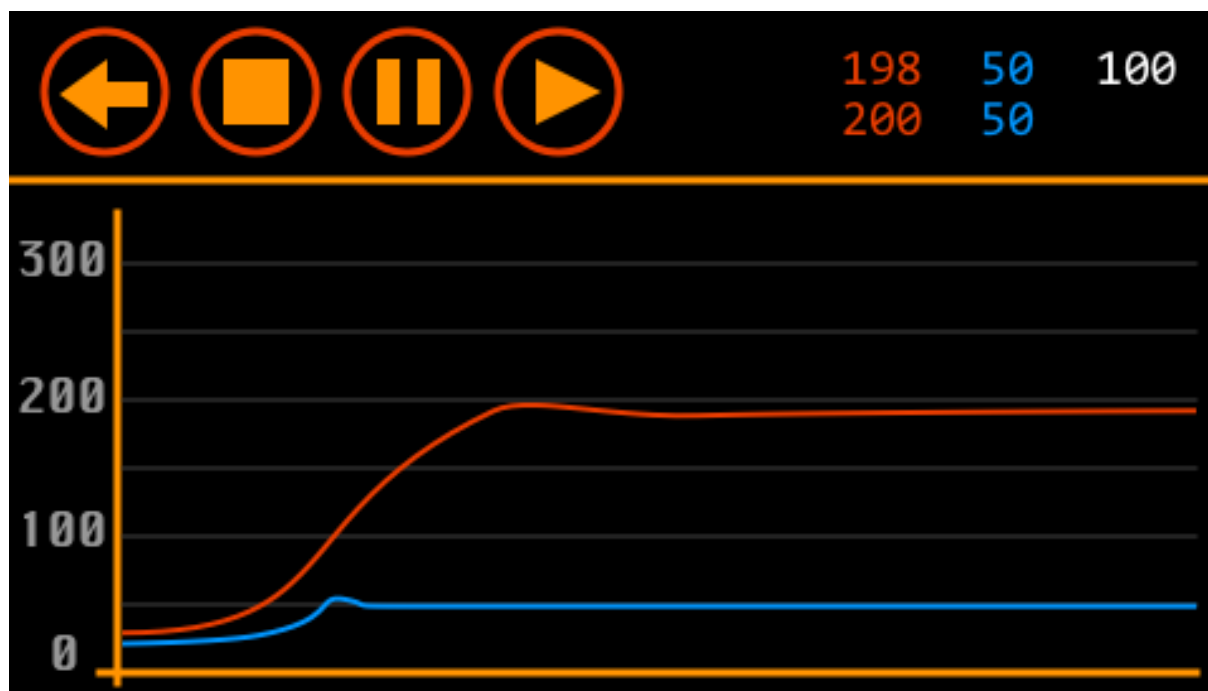


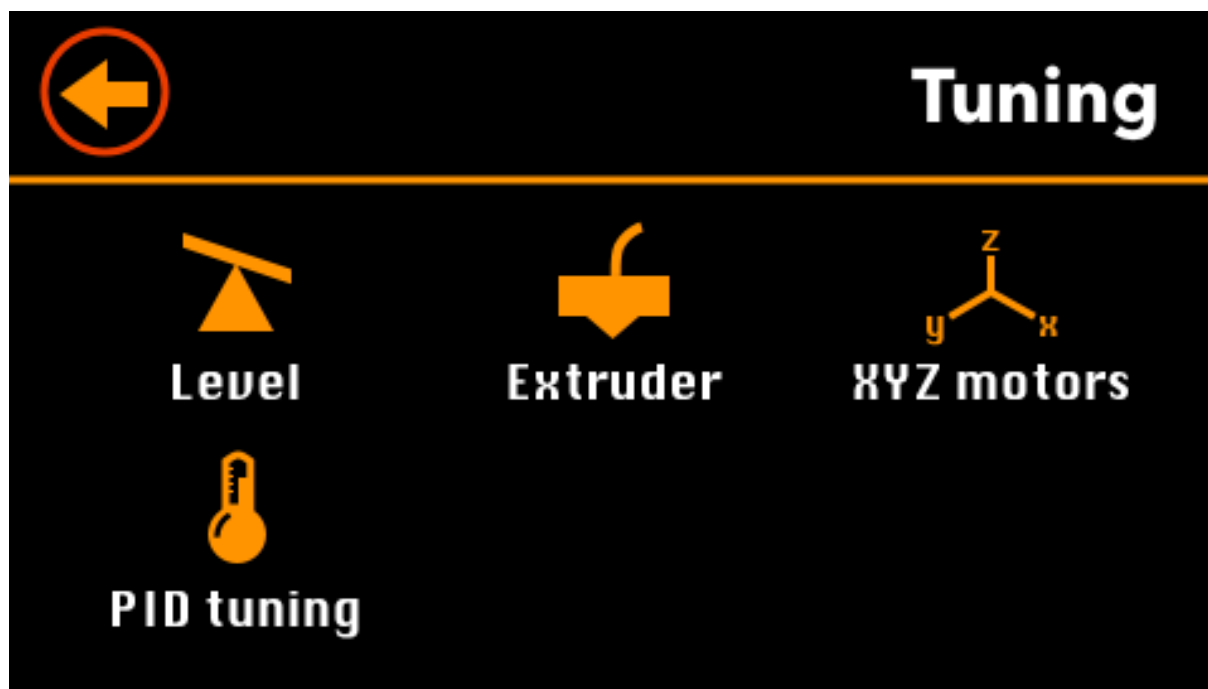
Figure 14: *USB Print*

The **USB Print** screen is displayed only when a print is running through the USB cable (i.e. from Cura, OctoPrint, etc)

- It displays a graph of the temperatures (bed in blue, hot-end in red)
- **Stop**: Press the **Stop** button to stop the current printing. It also goes back to the previous screen.
- **Pause**: Press the **Pause** button to temporary stop the printing.
- **Resume**: Press the **Resume** button to resume a paused printing.
- **Print Settings**: Press on the gear button to display and modify the **Print Settings** like the temperature, the fan speed, etc.
- **Back**: If you press the **Back** button, the printing continues and it goes back to the previous screen.



## Tuning



This panel gives you access to tools to help you adjust some parameters of your printer.

**Important:** Some parameters are directly derived from the mechanical parts of the printer. Unless you change these parts (like the step motors), there is no need to change them.

- **Level:** Tool to help you level your bed.
- **Extruder:** Tool to help you adjust the number of steps per millimeter for the extruder motor.
- **XYZ motors:** Tool to help you adjust the number of steps per millimeter for X and Y motors.
- **PID tuning:** Tool to help you adjust the PID parameters (proportional-integral-derivative control algorithm).

### Level

This tool helps you level your bed.

- First, the head and bed return to their home position.

## Leveling

**Please wait until autohoming finished.**

- Then, press one of the button with a number to go to each position:

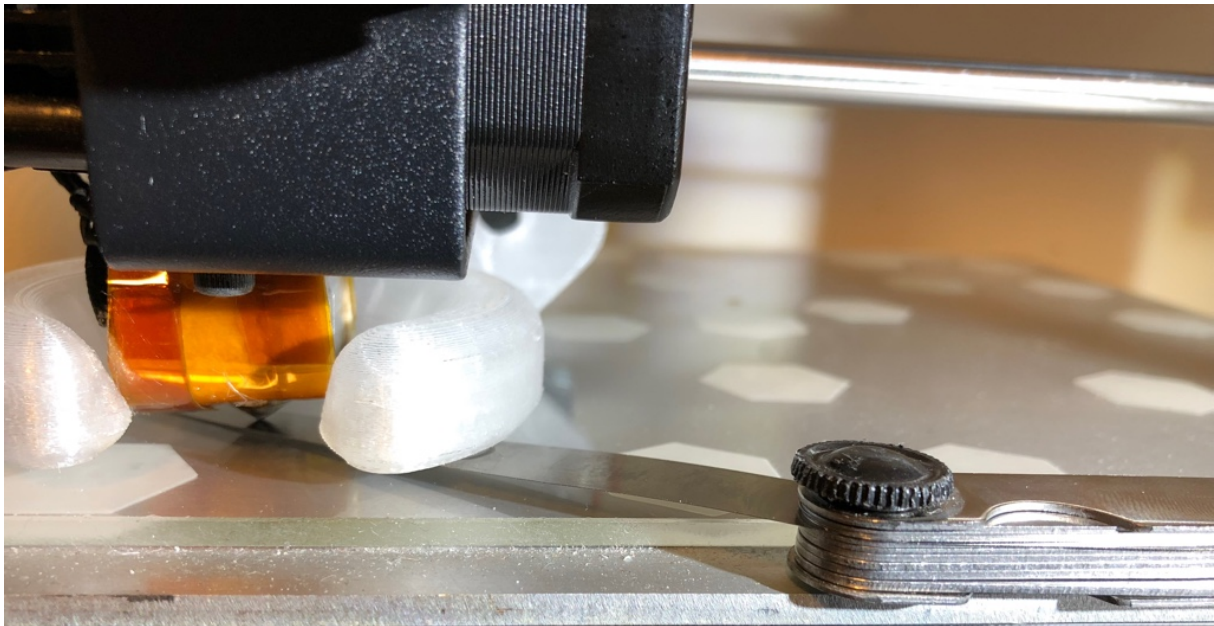


## Leveling

**Press the buttons in order and adjust the thumb nuts so a feeler gauge can move between the nozzle and the bed with just a tiny bit of friction.**



- Adjust each thumb nut so a feeler gauge (0.1 mm) can move between the nozzle and the bed with just a tiny bit of friction:



- If you do not have a feeler gauge, you can also use a sheet of paper but it is less accurate.
- Press the 5th button to check that your leveling is good. Press any of the other button to level again the corresponding corner.
- Once you are satisfied with the leveling, press the **Back** button.

**Tip:** A feeler gauge are cheap and you can buy one for a few dollars on Amazon, Banggood, etc. For example (randomly chosen items):



[amazon.com](https://www.amazon.com)



banggood.com

## Extruder

This tool helps you adjust the number of steps per millimeter for the extruder motor. There is no need to do this more than once, except if you change some mechanical parts.

**Important:** *This parameter (number of steps per millimeter) is directly derived from the mechanical parts of the printer (the step motor, the gear, ...) Unless you change these parts (like the gear), there is no need to change this parameter. Its default value is 400 . 5.*

←

Extruder

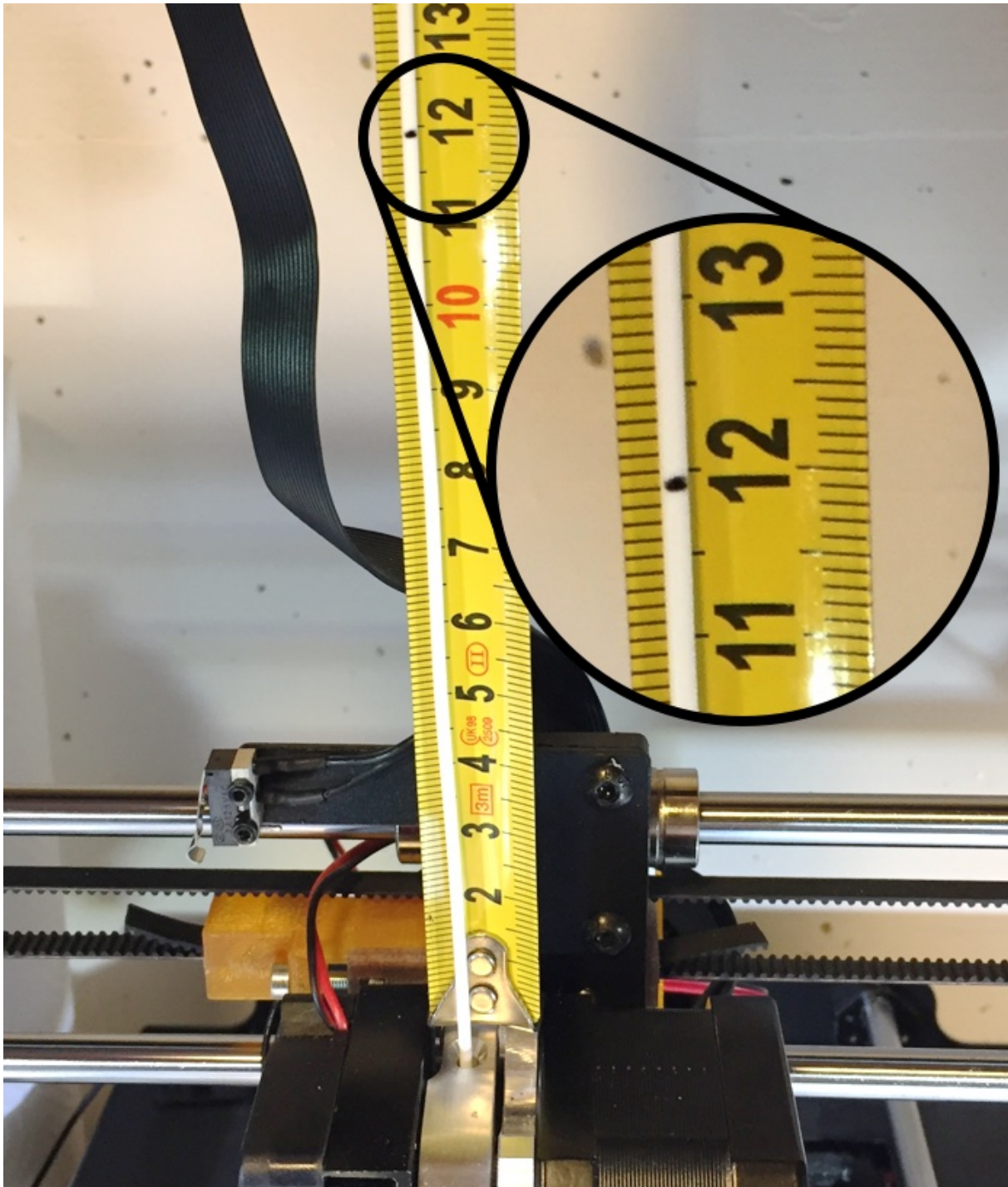
→

Temperature °C

— 200 +

Measure 120mm of filament above the extruder and set a mark as shown in the picture.

- Measures 120 mm of filament above the extruder and set, with a pen, a mark on the filament:

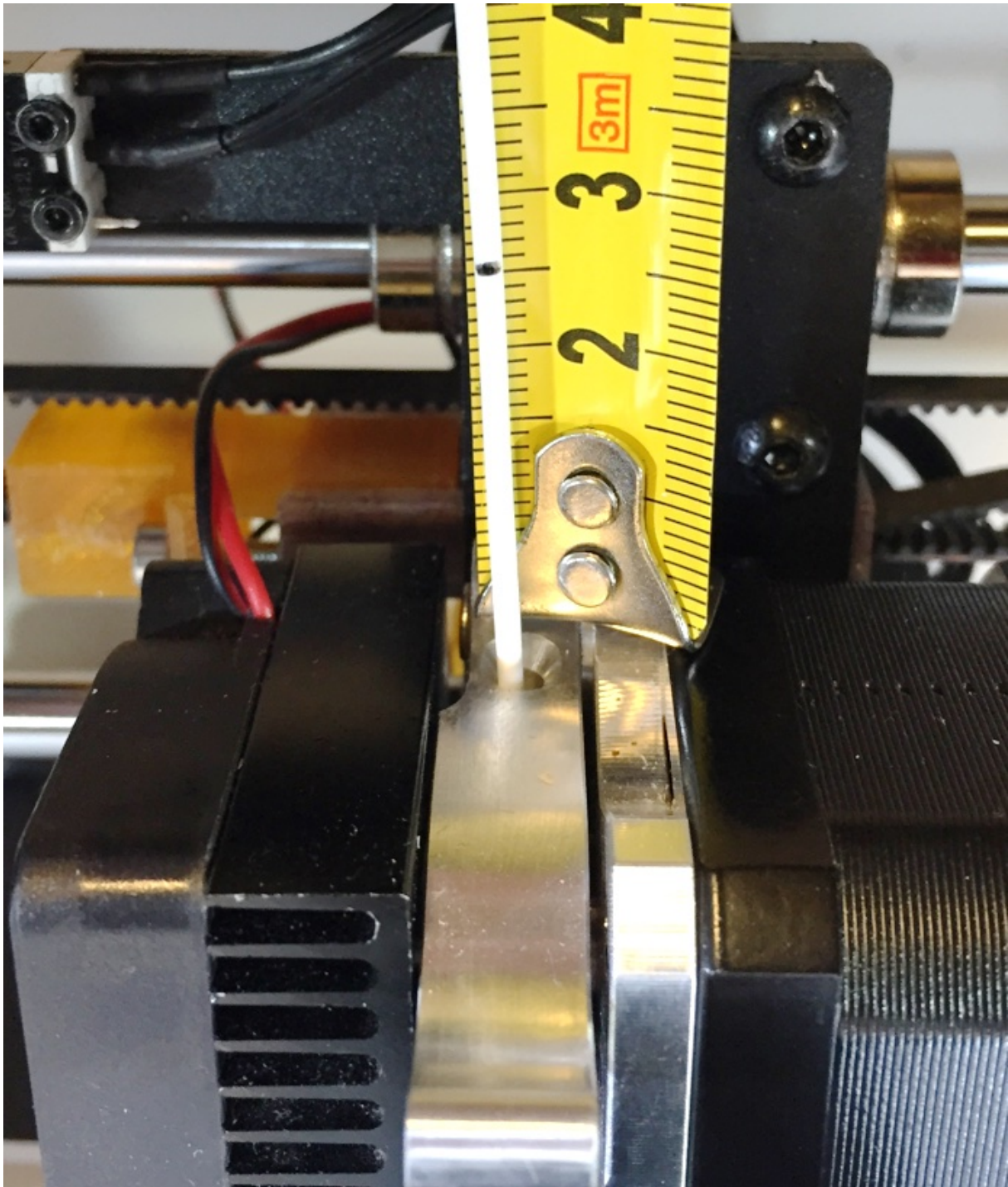


- Select the extruder's target temperature you want to use (with the plus and minus buttons) and press the arrow button (top-right corner).

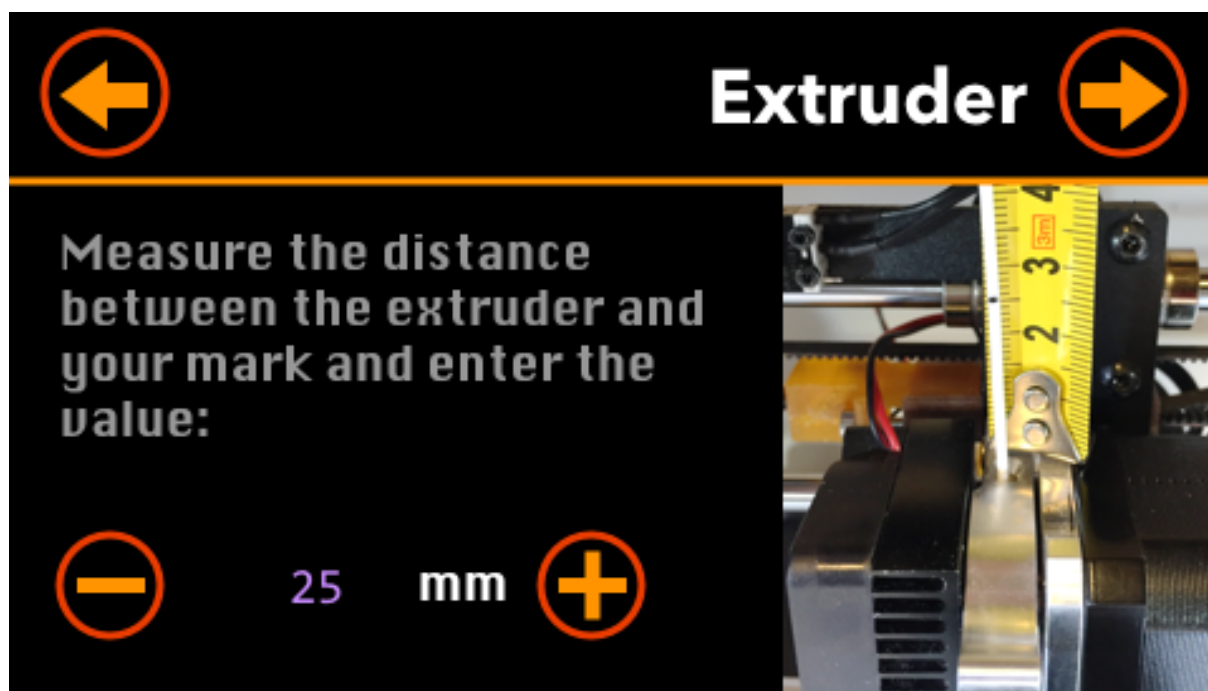
**Tip:** Keep the button pressed to quickly increment or decrement the temperature.



- The printer starts heating the hot-end and when the target temperature is reached, it extrudes 100 mm of filament.
- Once the extrusion is finished (it takes around a minute), measures the filament remaining between the extruder and your mark:

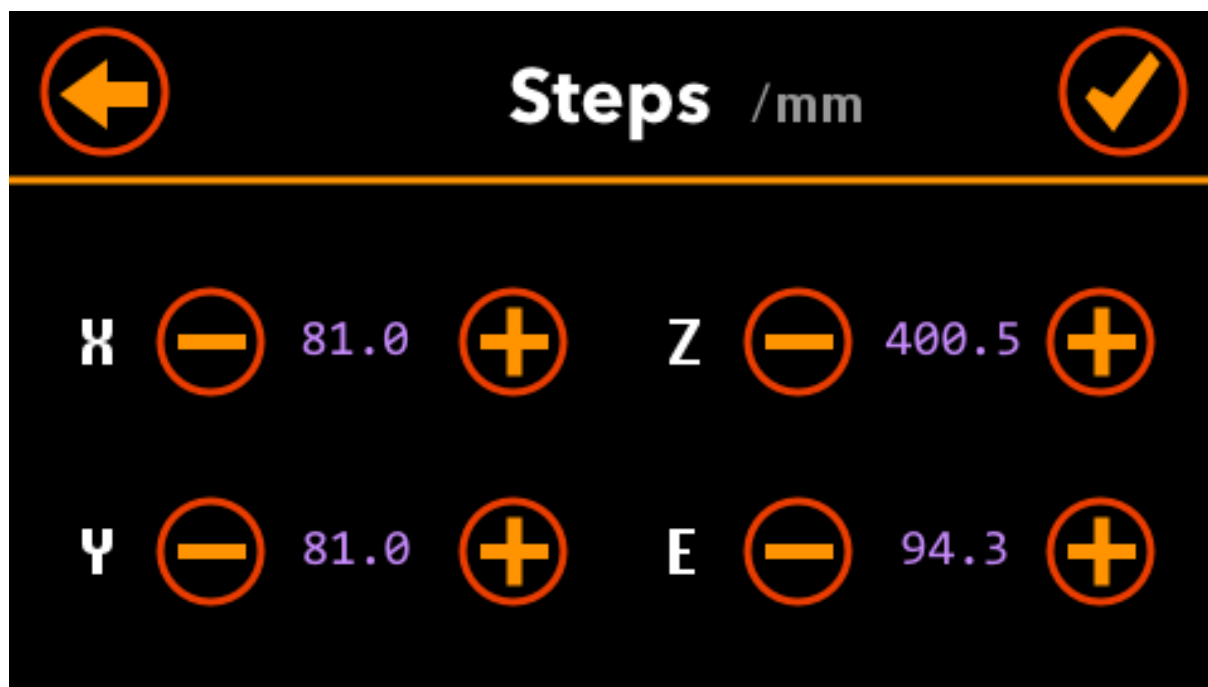


- Enter the value in mm:



**Tip:** Keep the button pressed to quickly increment or decrement the value.

- The computed value (E) is displayed and you can adjust it manually if you want:



- Press the **Back** button the restart the process, or on the **Checkmark** button to save the settings.

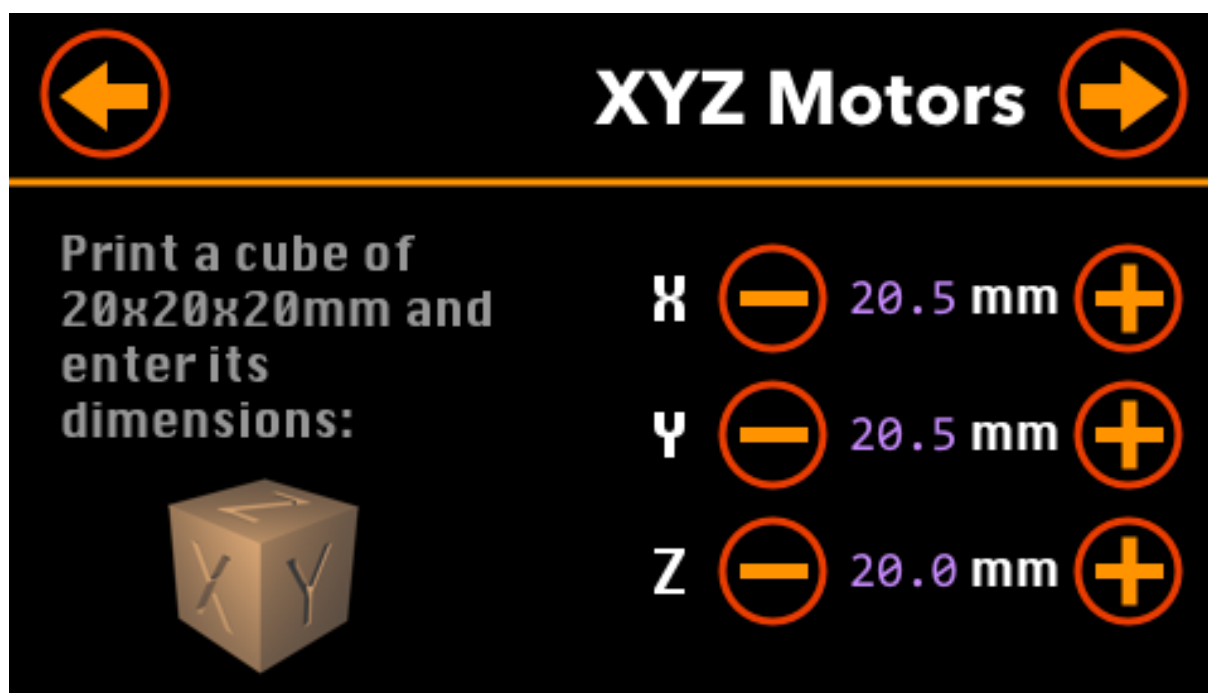
They are saved in the EEPROM memory of the motherboard.

## XYZ motors

This tool helps you adjust the number of steps per millimeter for the X, Y and Z motors. There is no need to do this more than once, except if you change some mechanical parts.

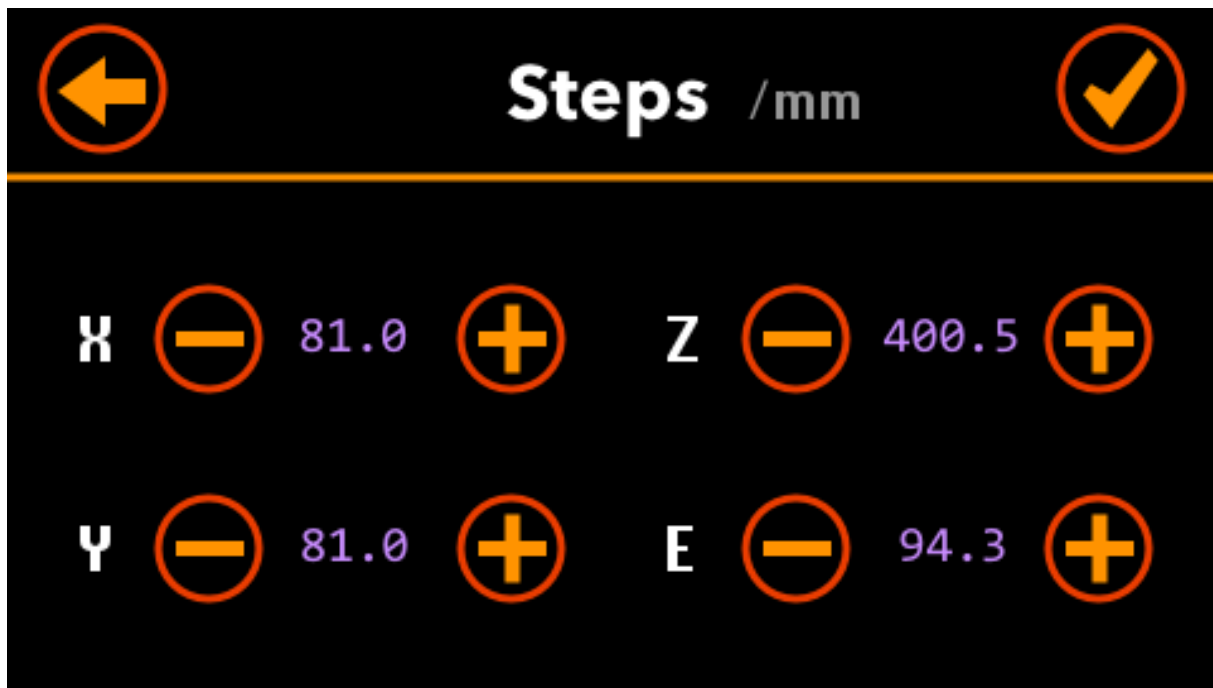
**Important:** *These parameters (number of steps per millimeter) are directly derived from the mechanical parts of the printer (the step motor, ...) Unless you change these parts (like the motors), there is no need to change this parameter. The default values are 81, 81, and 400 . 5.*

- Print a cube 20x20x20 mm and enter its actual dimensions (make more than one measure for each side and take the average):



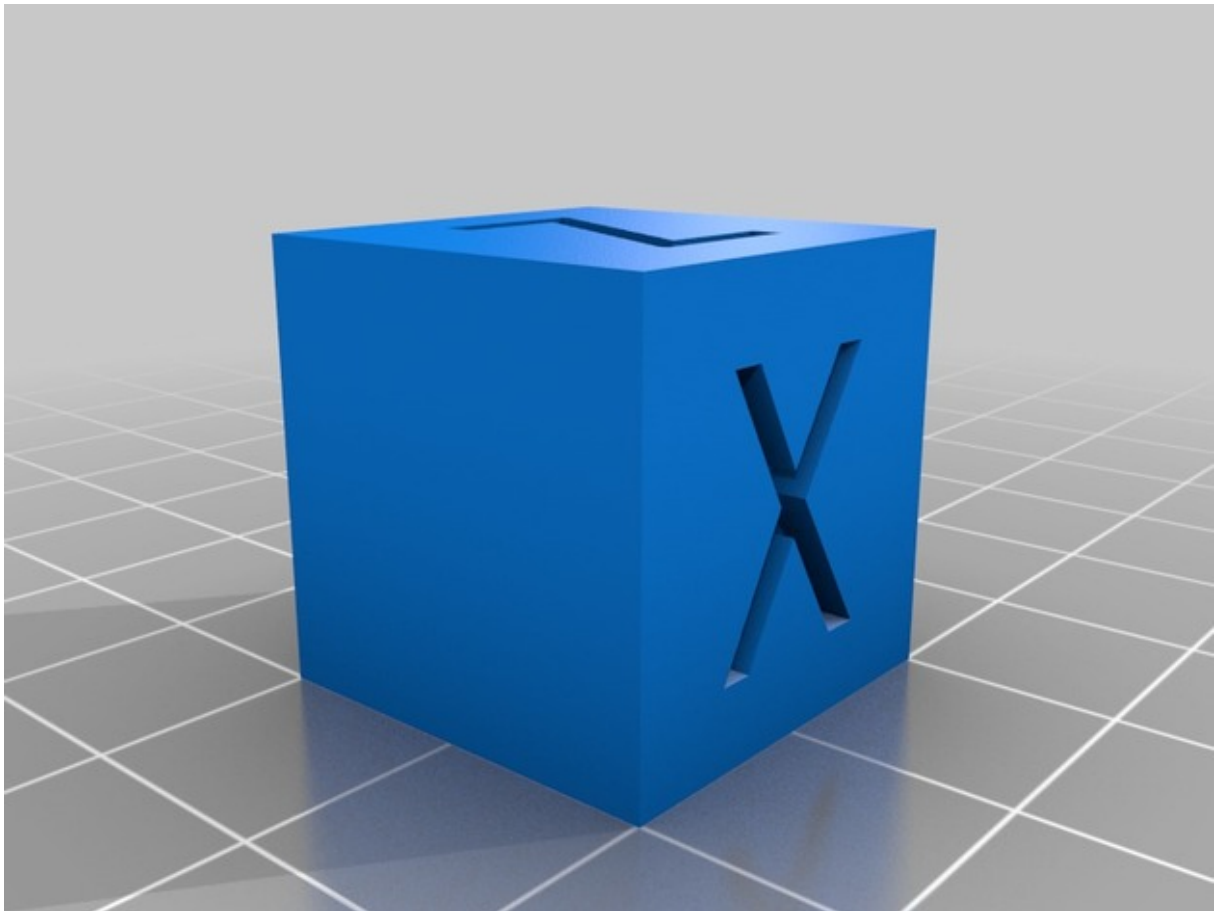
- The computed values (X, Y and Z) are displayed and you can adjust them manually if you want:





- Press the **Back** button to restart the process, or on the **Checkmark** button to save the settings. They are saved in the EEPROM memory of the motherboard.

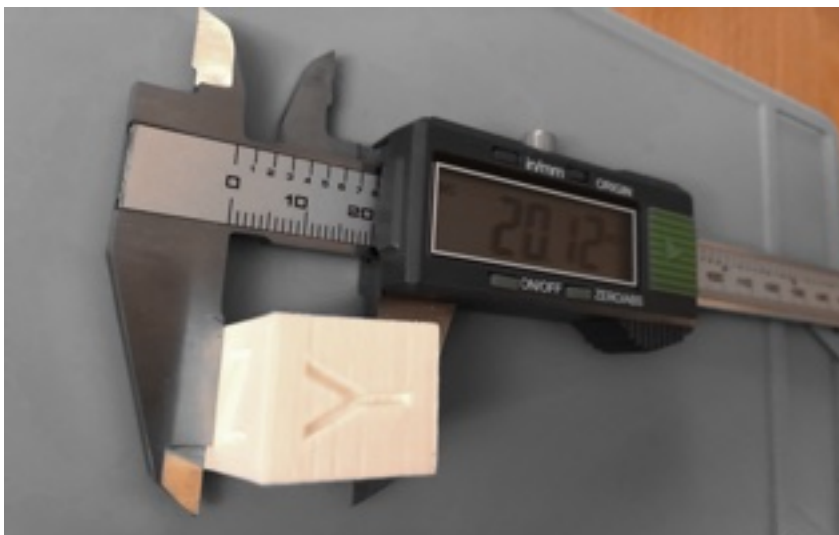
**Tips:** *There are several calibration cubes on Thingiverse. For example:*



XYZ 20mm Calibration Cube by iDig3Dprinting



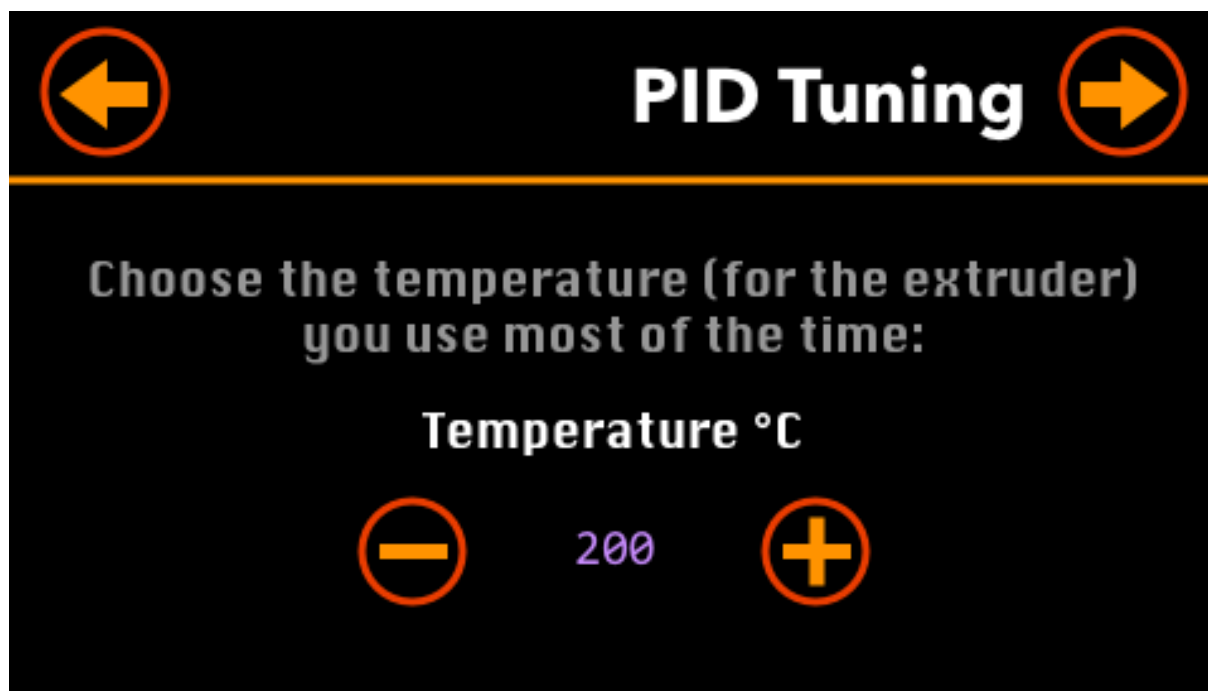
*Measure X*

*Measure Y**Measure Z*

## **PID tuning**

PID tuning refers to the parameters adjustment of a proportional-integral-derivative control algorithm used in most reprints for hot ends and heated beds.

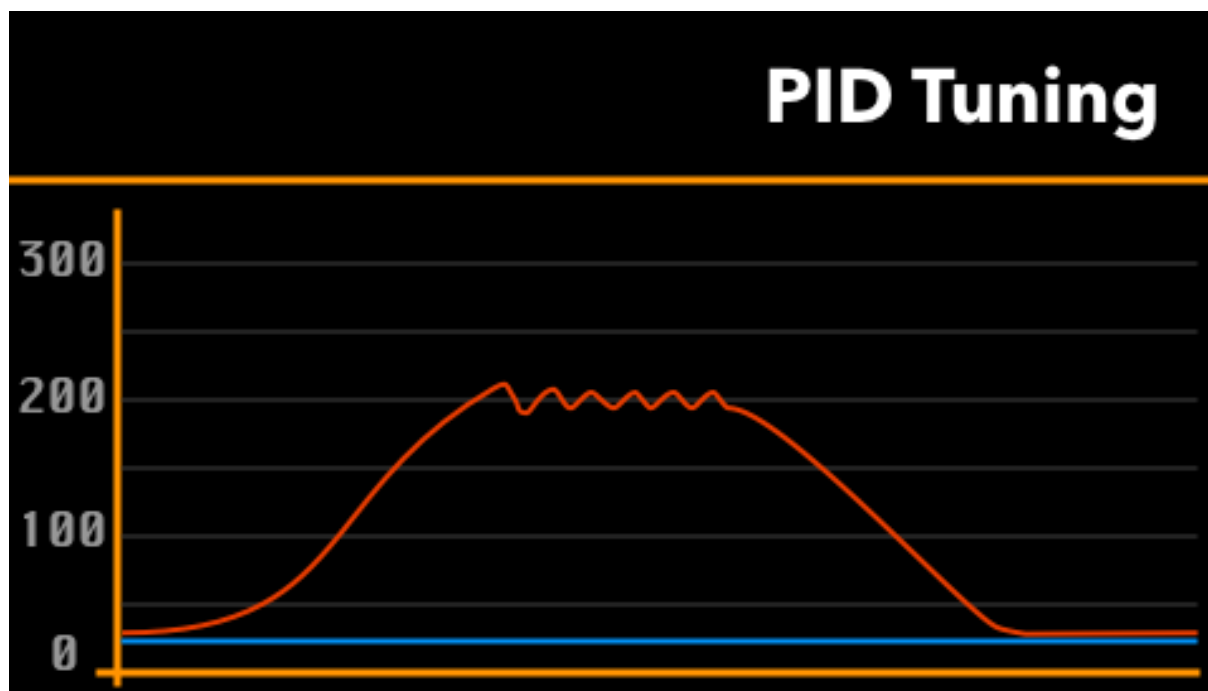
RepRap web site



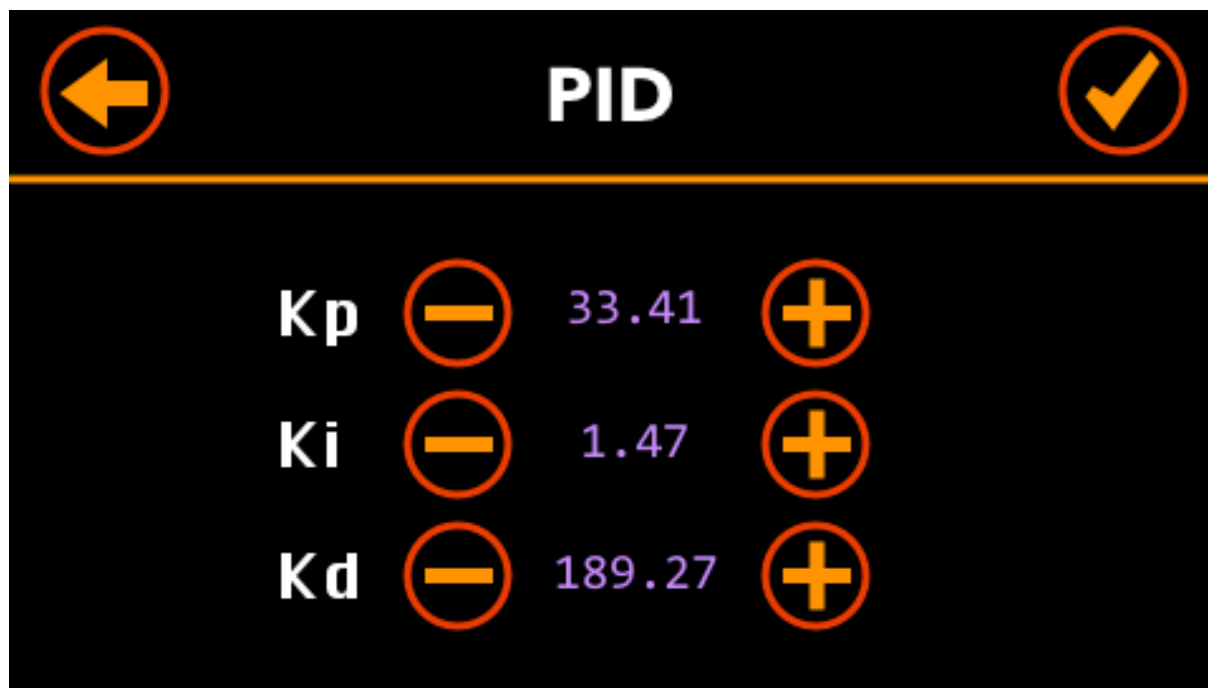
- Select the extruder's target temperature you want to use (with the plus and minus buttons) and press the arrow button (top-right corner).

**Tip:** *Keep the button pressed to quickly increment or decrement the temperature.*

- The PID tuning process starts. The printer increase and decrease the temperature of the hot-end around the target value:

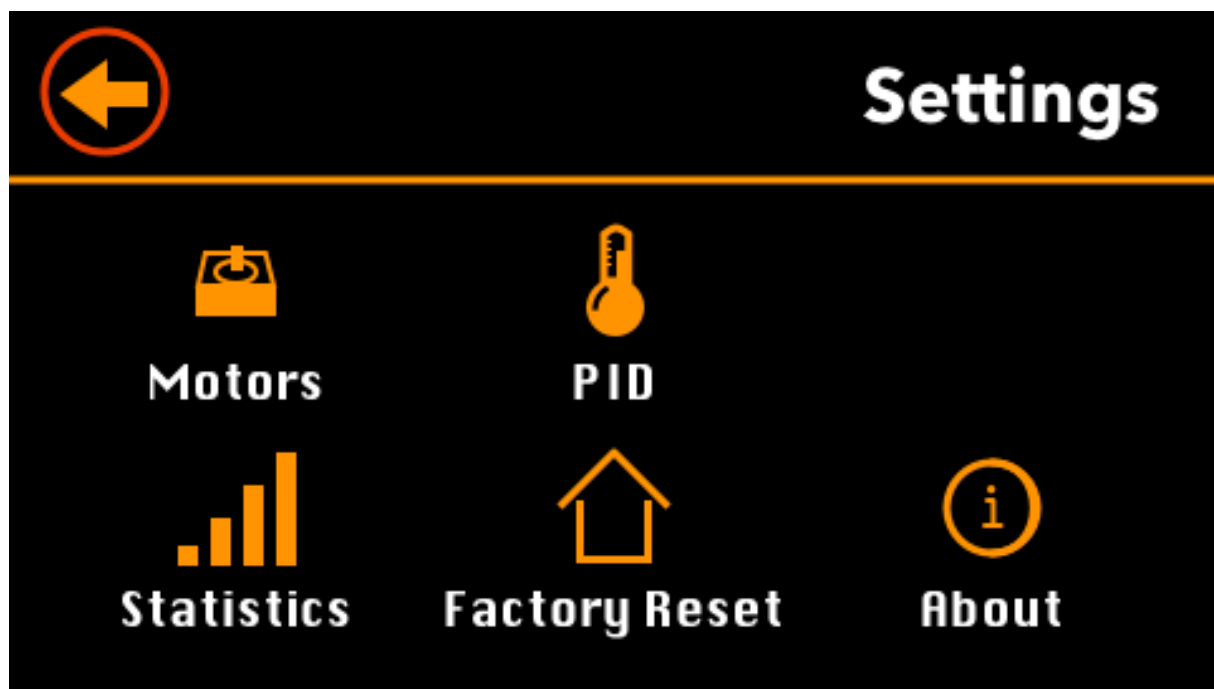


- When the PID tuning is finished (after some minutes), the new PID values are displayed:



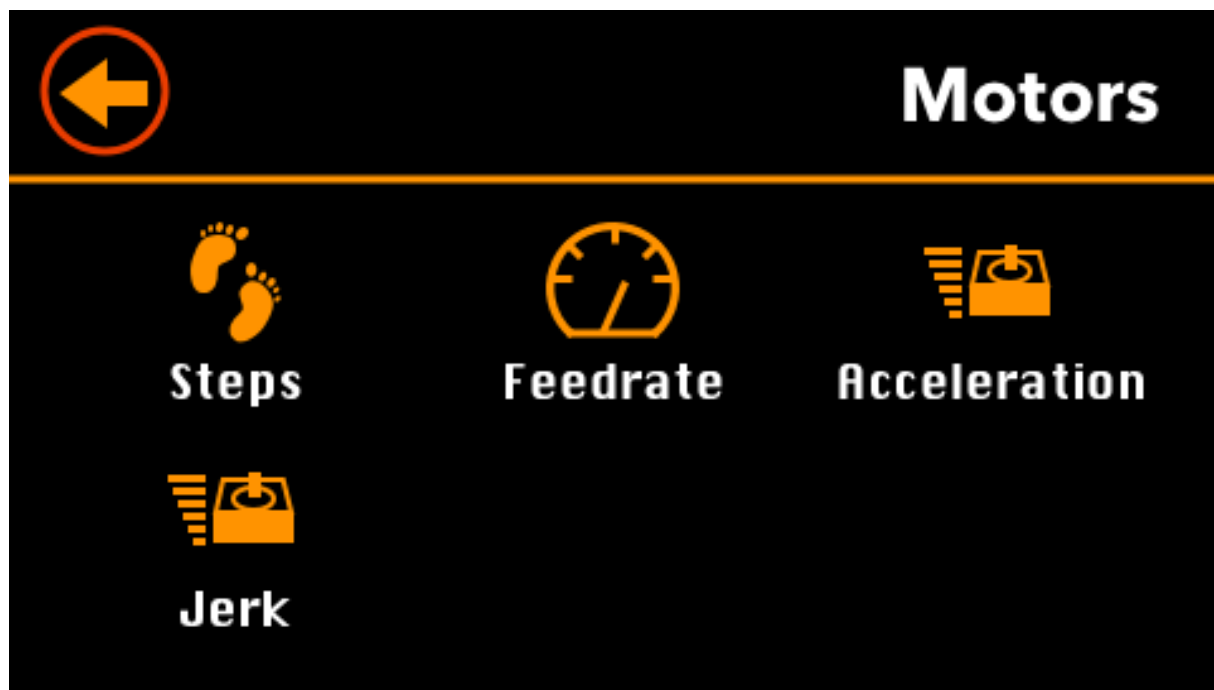
- Press the **Back** button to restart the process, or on the **Checkmark** button to save the settings. They are saved in the EEPROM memory of the motherboard.

## Settings



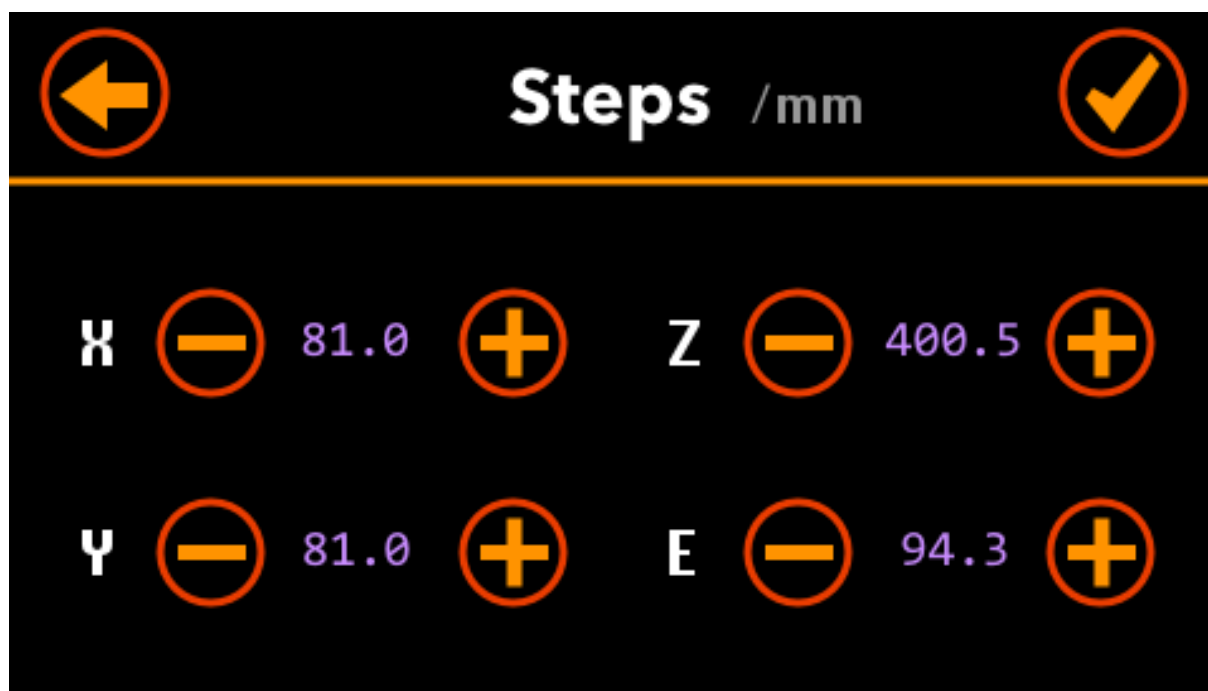
- **Motors:** Displays several settings related to the step motors (see bellow).
- **PID:** Displays the current PID settings.
- **Statistics:** Displays printing statistics.
- **Factory Reset:** Resets the various settings to their default values.
- **About:** Displays information about the different software components.

## Motors



- **Steps:** Displays step settings of the motors.
- **Feedrate:** Display feedrate (speed) settings of the motors.
- **Acceleration:** Displays acceleration settings of the motors.
- **Jerk:** Displays jerk settings of the motors.

## Steps



This screen display the step settings of the motors.

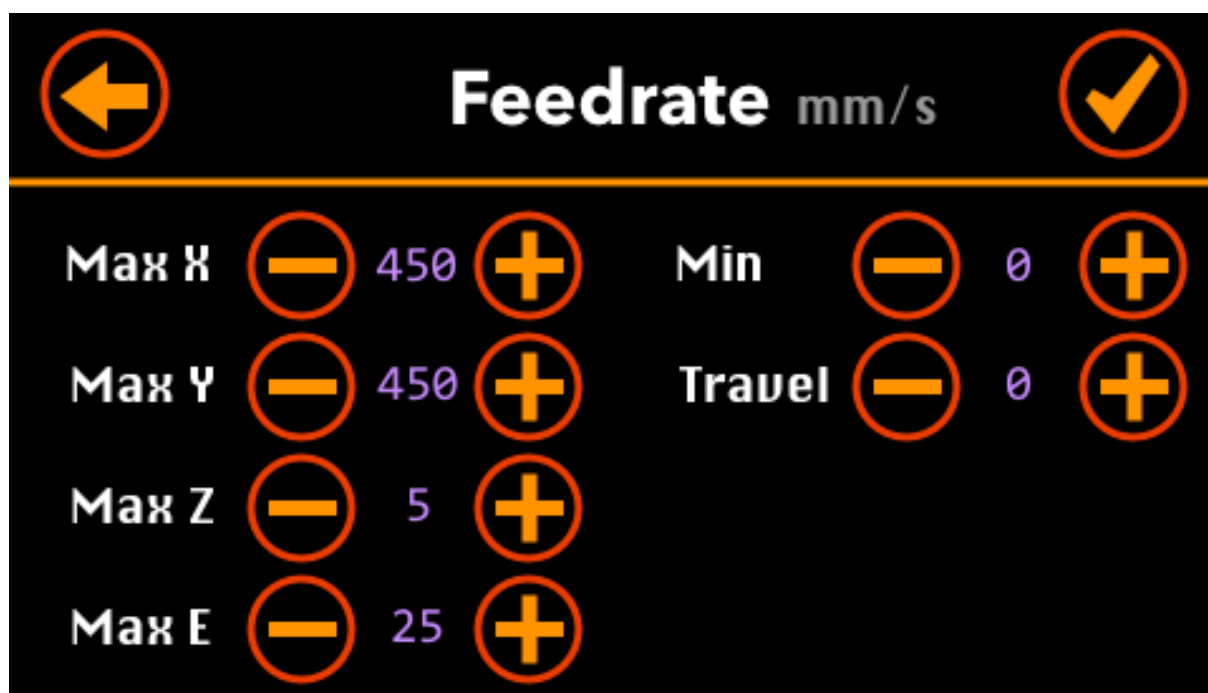
- To adjust them manually, press the minus or plus buttons.

**Tip:** Keep the button pressed to quickly increment or decrement the temperature.

- To save them, press the **Checkmark** button. The settings are saved in the EEPROM memory of the motherboard.
- The cancel any changes, press the **Back** button. It goes back to the previous screen.



## Feedrate



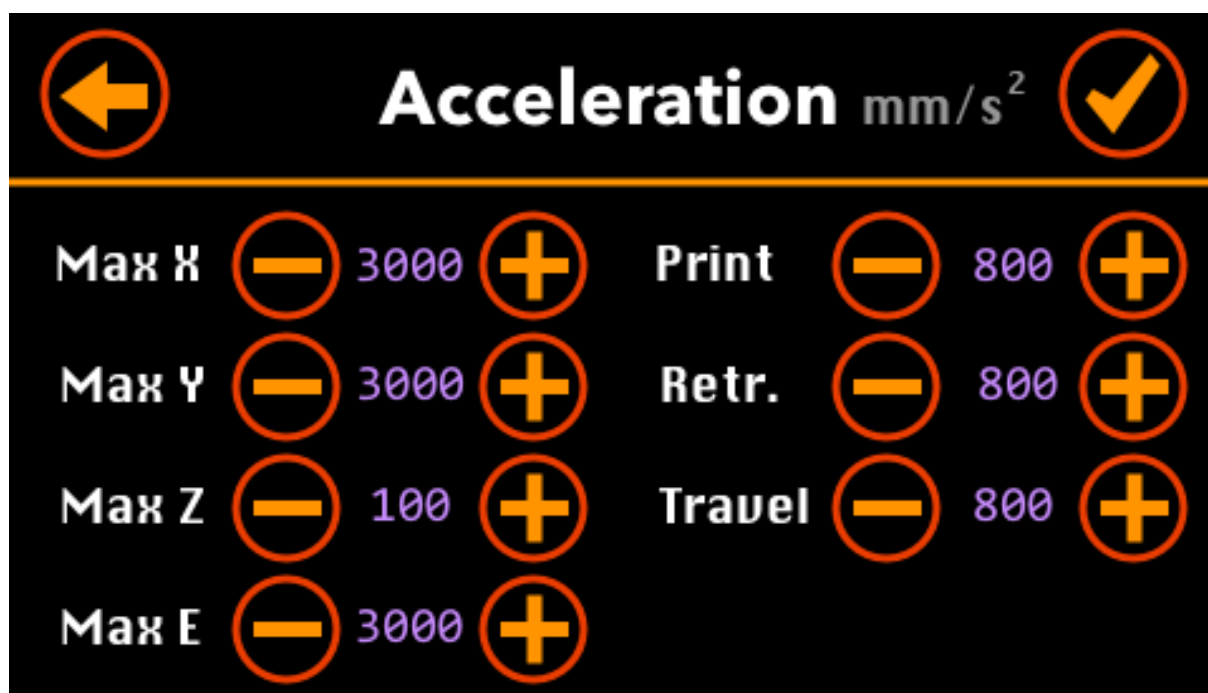
This screen display the feedrate (speed) settings of the motors.

- To adjust them manually, press the minus or plus buttons.

**Tip:** Keep the button pressed to quickly increment or decrement the temperature.

- To save them, press the **Checkmark** button. The settings are saved in the EEPROM memory of the motherboard.
- The cancel any changes, press the **Back** button. It goes back to the previous screen.

## Acceleration



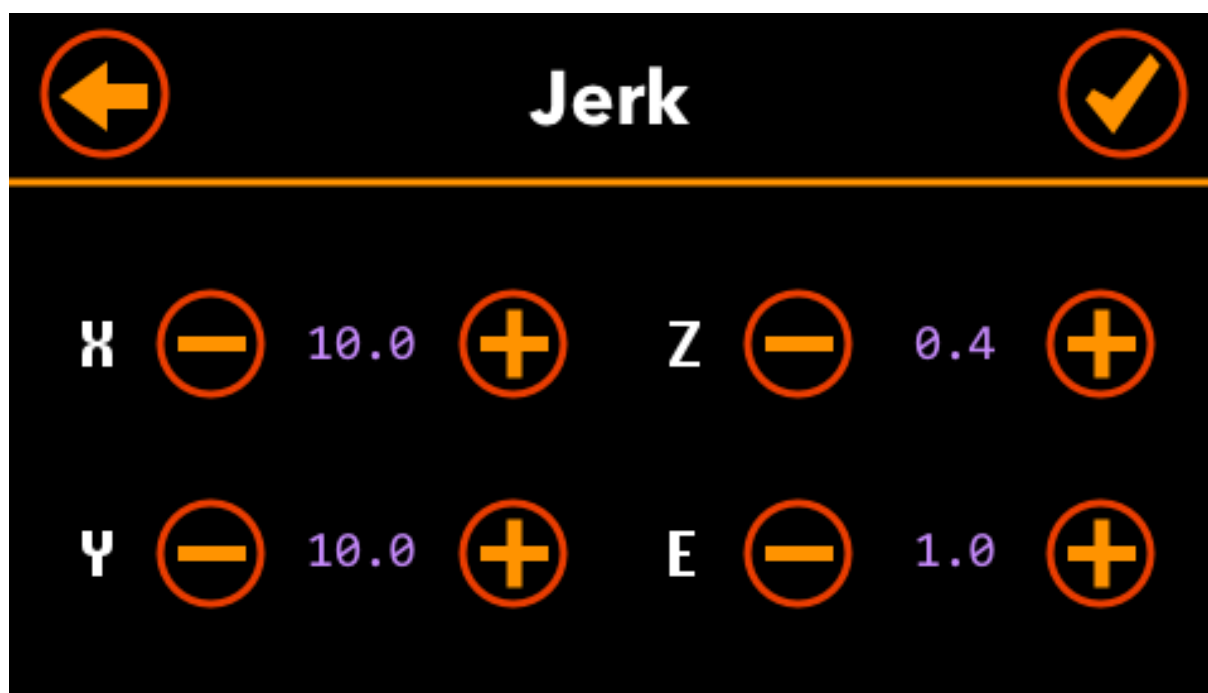
This screen display the acceleration settings of the motors.

- To adjust them manually, press the minus or plus buttons.

**Tip:** Keep the button pressed to quickly increment or decrement the temperature.

- To save them, press the **Checkmark** button. The settings are saved in the EEPROM memory of the motherboard.
- The cancel any changes, press the **Back** button. It goes back to the previous screen.

## Jerk



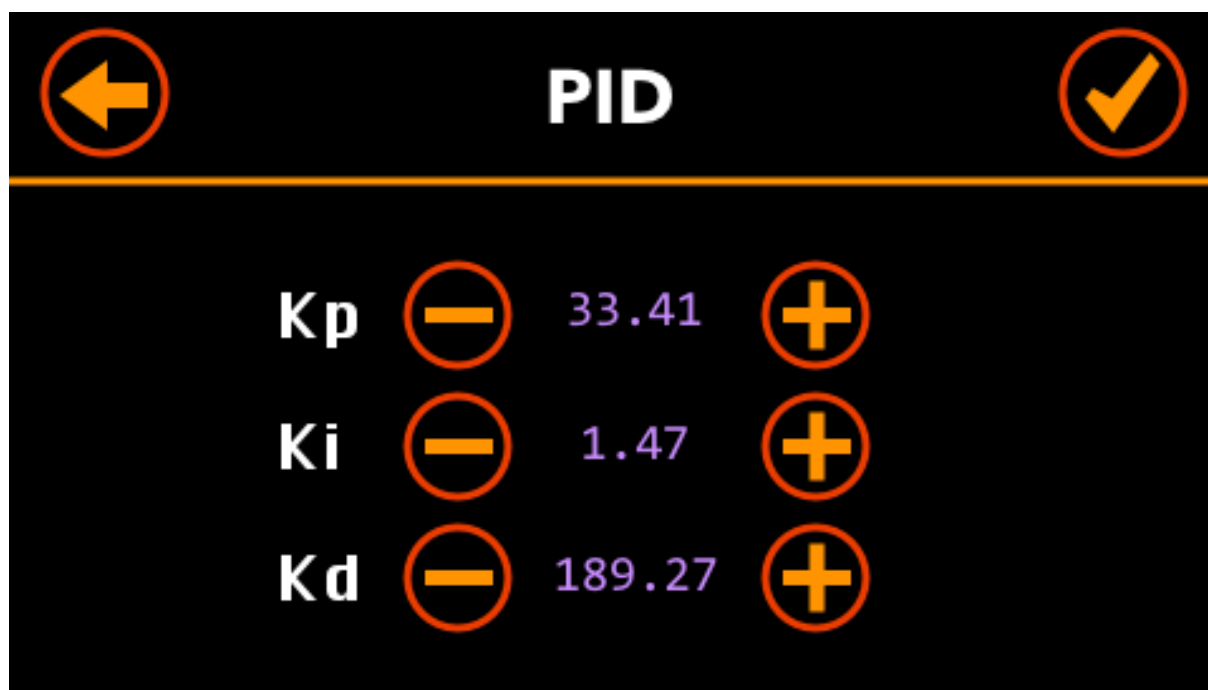
This screen displays the jerk settings of the motors. The (maximum) jerks are the instantaneous change of speed that can be made. In other words, it is the (maximum) speed that the printer will immediately jump to before taking acceleration into account.

- To adjust them manually, press the minus or plus buttons.

**Tip:** Keep the button pressed to quickly increment or decrement the temperature.

- To save them, press the **Checkmark** button. The settings are saved in the EEPROM memory of the motherboard.
- To cancel any changes, press the **Back** button. It goes back to the previous screen.

## PID



PID tuning refers to the parameters adjustment of a proportional-integral-derivative control algorithm used in most reprints for hot ends and heated beds.

RepRap web site

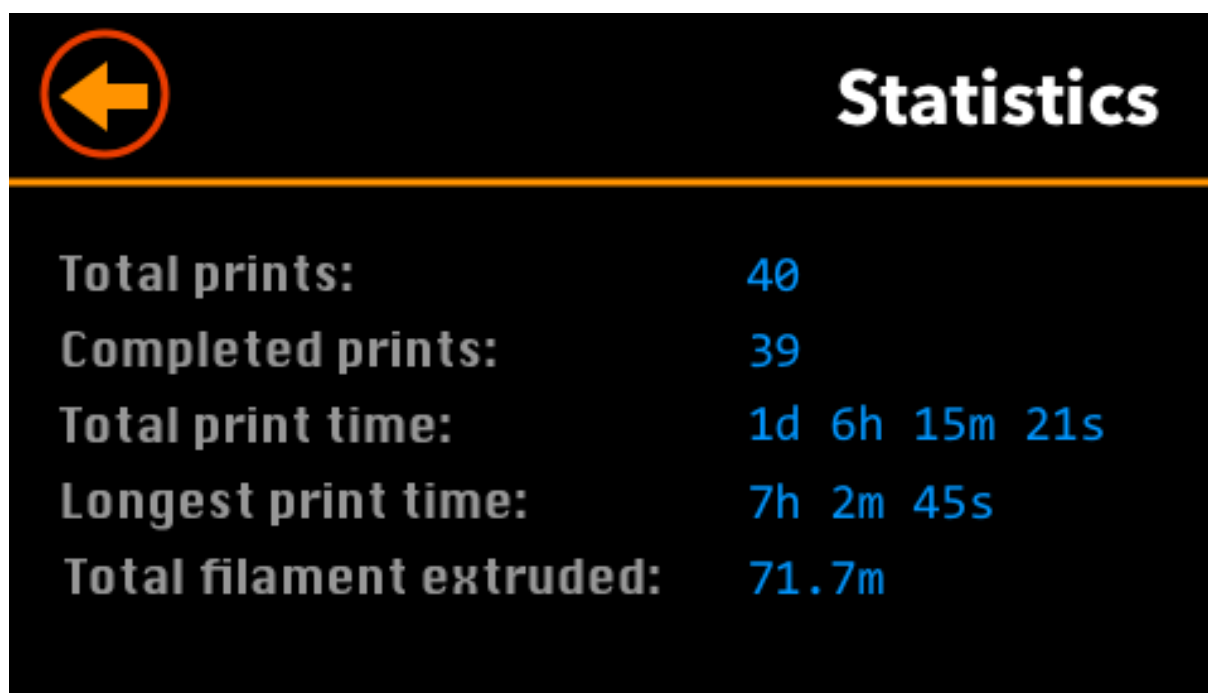
This screen displays the jerk settings of the motors. The (maximum) jerks are the instantaneous change of speed that can be made. In other words, it is the (maximum) speed that the printer will immediately jump to before taking acceleration into account.

- To adjust the PID settings manually, press the minus or plus buttons.

**Tip:** Keep the button pressed to quickly increment or decrement the temperature.

- To save them, press the **Checkmark** button. The settings are saved in the EEPROM memory of the motherboard.
- To cancel any changes, press the **Back** button. It goes back to the previous screen.

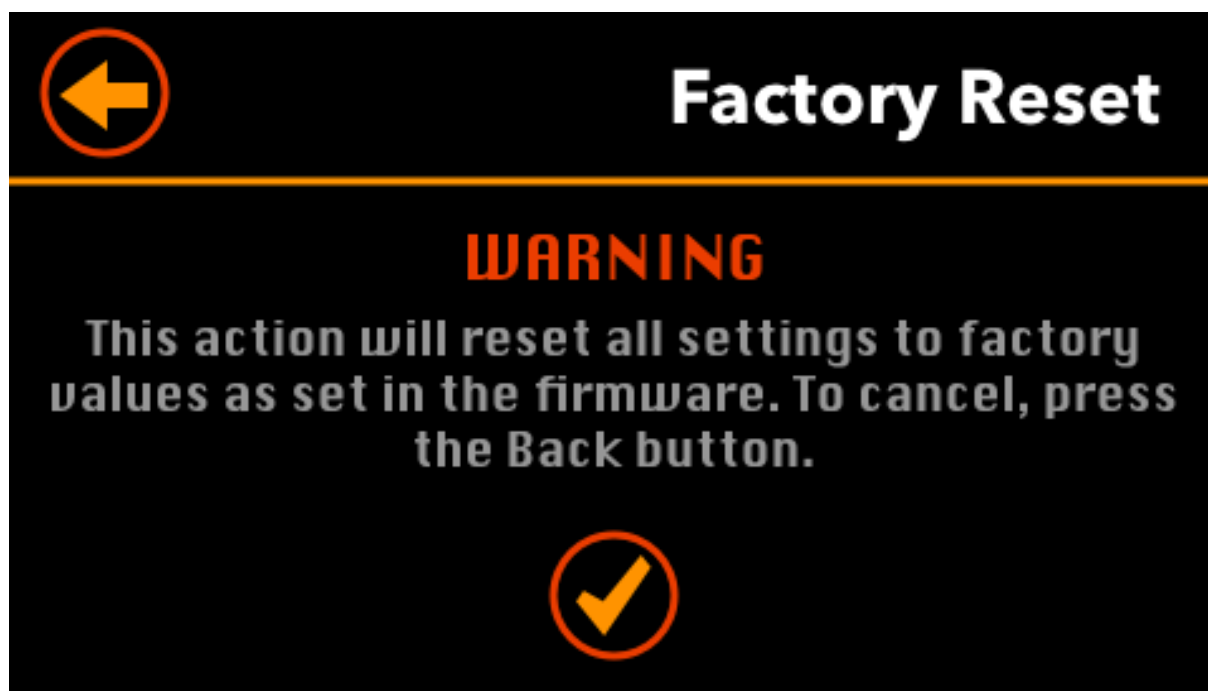
## Statistics



This screen display various statistics:

- **Total prints:** The number of prints send to the printer.
- **Completed prints:** The number of prints completed.
- **Total print time:** The total time spend on printing.
- **Longest print time:** The longest print.
- **Total filament extruded:** The total number of meters of filament extruded.

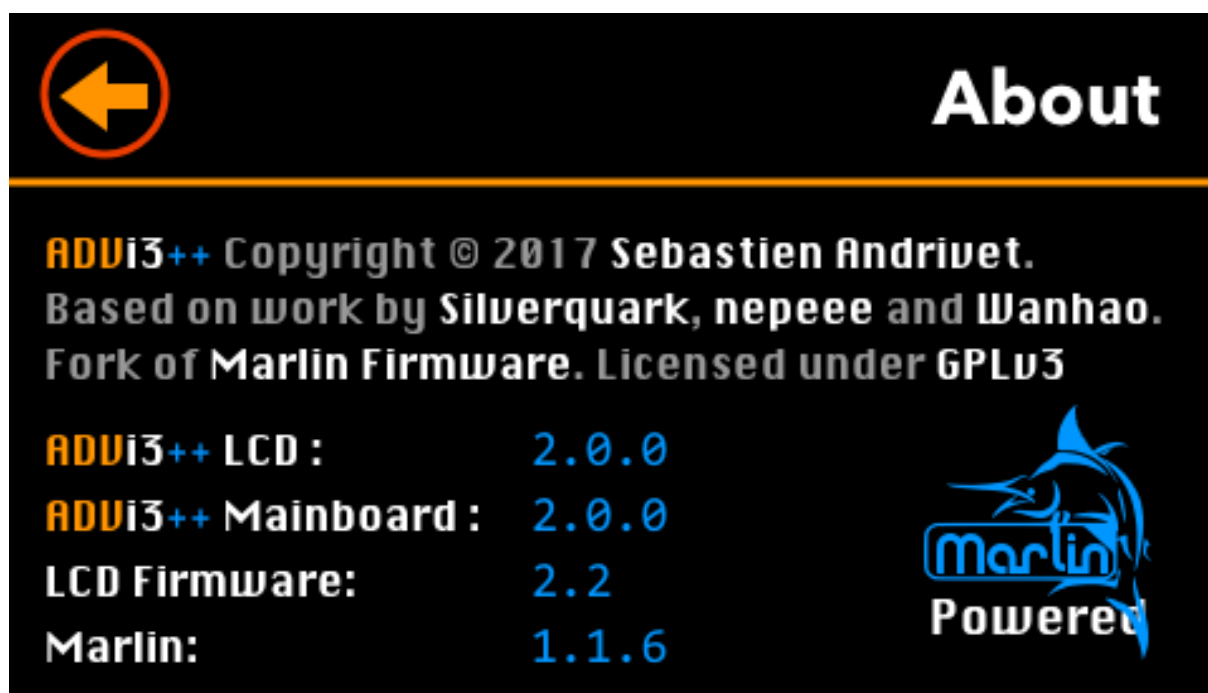
## Factory Reset



- Before resetting all the settings to their default, you have to confirm it by pressing the **\*\*Check-mark\*** button.
- If you do not want to reset the settings, press the **Back** button.

Once confirmed, all settings are reset to their default and save in the EEPROM memory of the motherboard.

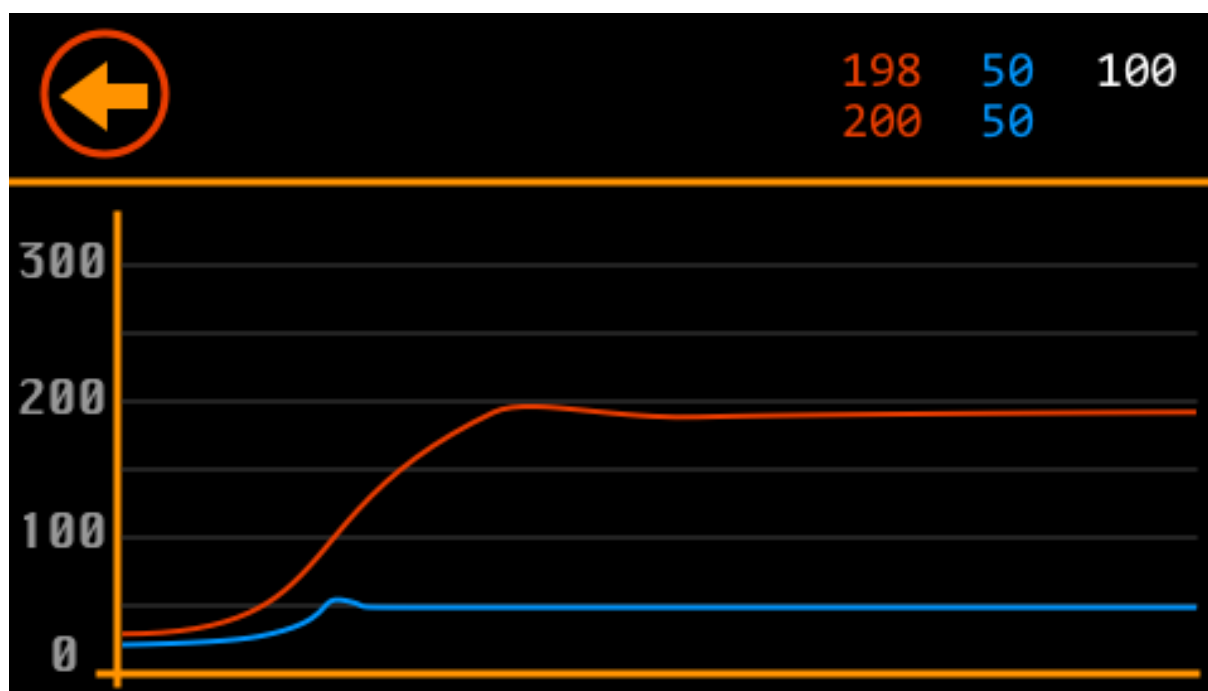
## About



This screen display the version of several software components:

- **ADVi3++ LCD:** The version of the LCD part of **ADVi3++**.
- **ADVi3++ Motherboard:** The version of the Motherboard part of **ADVi3++**.
- **LCD firmware:** The version of the (internal) LCD touch screen display.
- **Marlin:** The version of the Marlin sources used by **ADVi3++**.

## Temperature graph



This screen displays a graph of the temperatures (bed in blue, hot-end in red).

- Press the **Back** button to go back to the previous screen.

## Default Configuration

The default parameters of this firmware are the following:

Settings	Default values
<b>Step Settings</b>	
X	81
Y	81
Z	400.5
E	94.30
<b>PID Settings</b>	
P	33.41
I	1.47



Settings	Default values
D	189.27
<b>Feedrate Settings</b>	
Max X	450
Max Y	450
Max Z	5
Max E	25
Min	0
Travel	0
<b>Acceleration Settings</b>	
Max X	3000
Max Y	3000
Max Z	100
Max E	3000
Print	800
Retract	800
Travel	800
<b>Jerk Settings</b>	
X	10
Y	10
Z	0.4
E	1.0

## Resources

- [ADVi3++ Source Code](#)
- [Marlin - Open Source 3D Printer Firmware](#)
- [RepRap](#), humanity's first general-purpose self-replicating manufacturing machine.
- [Duplicator i3 Plus Facebook Group](#)

- PrusaPrinters Calculator

**Note:** *In the past, it was possible to download the following resources directory from the [dwin.com.cn](http://dwin.com.cn) website. It is no more the case (you get plenty of errors) so I copy them into the **ADVi3++** repository.*

- DMT48270M043\_05W (LCD Touch Display) Datasheet
- DWIN DGUS Display Development Guide version 4.0 - 2014
- DGUS SDK User Guide 5.1
- DGUS SDK 5.1 Setup - Windows only