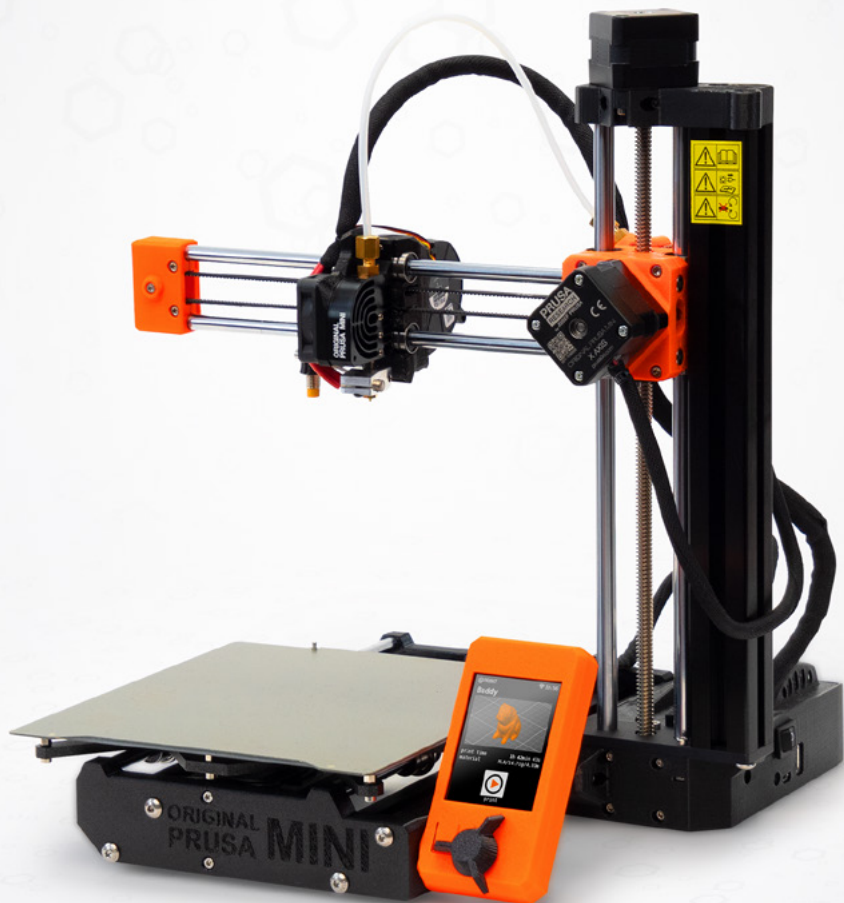


# 3D PRINTING HANDBOOK

USER MANUAL FOR ORIGINAL PRUSA MINI



**PRUSA**  
**RESEARCH**  
by JOSEF PRUSA



# Original Instructions: Basic Info

Please always refer to the [www.prusa3d.com/drivers/](http://www.prusa3d.com/drivers/) for an updated version of this 3D printing handbook (PDF download).

Translated versions of the handbook are available at:

- **Czech:** [www.prusa3d.cz/ovladace/](http://www.prusa3d.cz/ovladace/)
- **French:** [www.prusa3d.fr/drivers/](http://www.prusa3d.fr/drivers/)
- **German:** [www.prusa3d.de/treiber/](http://www.prusa3d.de/treiber/)
- **Polish:** [prusa3d.pl/sterowniki/](http://prusa3d.pl/sterowniki/)
- **Italian:** [www.prusa3d.it/driver/](http://www.prusa3d.it/driver/)
- **Spanish:** [www.prusa3d.es/drivers-y-manuales/](http://www.prusa3d.es/drivers-y-manuales/)

## QUICK GUIDE TO THE FIRST PRINT

1. Read chapter **6 Your First Print** carefully
2. Place the assembled printer on a flat and stable surface
3. Start the printer, insert the enclosed USB drive and update the firmware
4. Follow the on-screen instructions to calibrate the printer
5. Print a sample object



Important notice, tip, hint or information that helps you print with ease.



Read carefully! This part of the text has the greatest importance - either for user safety or for proper printer service.



This information is related to the Original Prusa MINI+ assembly kit.

## How to contact Prusa Research tech support:

First, check the last chapters of this handbook for troubleshooting guides, or visit [help.prusa3d.com](http://help.prusa3d.com) for a complete list of common issues, print quality troubleshooting and other guides. If your problem is not listed there, or the solution does not work, please send an e-mail to [support@prusa3d.com](mailto:support@prusa3d.com) or use the Live chat at [shop.prusa3d.com](http://shop.prusa3d.com). Try to explain your problem as thoroughly as possible - attach pictures and/or videos if possible.

Handbook version 1.07 from March 17th, 2021

JOSEF PRUSA®, PRUSA RESEARCH®, PRUSA POLYMERS®, PRUSA ORANGE®, ORIGINAL PRUSA®, PRUSA 3D®, and PRUSAMENT® are registered trademarks of Prusa Development a.s. in the United States and the European Union used by Prusa Research a.s. under the license of Prusa Development a.s. | JOSEF PRUSA, ORIGINAL PRUSA, and PRUSAMENT are registered trademarks (or registration pending) of Prusa Development a.s. in Australia, New Zealand, Israel, Mexico, South Korea, Turkey, Ukraine, Russia, Kazakhstan, Switzerland, China, Columbia, Uzbekistan, Philippines, and Norway by Prusa Research a.s. under the license of Prusa Development a.s. | Other company names and product names appearing in this publication are the trademarks and registered trademarks of their respective companies.

## About the author

**Josef Prusa** (born Feb 23rd, 1990) became interested in the 3D printing phenomenon before joining Prague's University of Economics in 2009 - at first, it was a hobby, a new technology open to changes and improvements. The hobby soon became a passion and Josef grew into one of the leading developers of Adrien Bowyer's international, open-source, RepRap project. Today, you can see the Prusa design in different versions all around the world, it is one of the most popular printers and thanks to it, knowledge about 3D printing technology significantly increased among the public.

All 3D printers by Josef Prusa are open-source and based on the RepRap philosophy - you can use your 3D printer to produce parts for building another 3D printer.

The lineup of Original Prusa devices is constantly expanded with new machines and upgrades. The main goal is to make technology more accessible and understandable to all users.

Josef Prusa also organizes workshops for the public, participates in professional conferences dedicated to the popularization of 3D printing. For example, he lectured at the TEDx conference in Prague and Vienna, at World Maker Faire in New York, Maker Faire in Rome and at the Open Hardware Summit hosted by MIT. Josef also teaches Arduino at Charles University and was also a lecturer at the Academy of Arts in Prague.

In his own words, he imagines 3D printers will be available in every home in the not-too-distant future. "If anything is needed, you can simply print it. In this field, you just push the boundaries every day... We're glad you're part of it with us!"



*Josef Průša*

# Table of contents

<b>1. Introduction</b>	<b>10</b>
<b>2. Glossary</b>	<b>11</b>
<b>3. Package contents - Accessories (bundled / optional)</b>	<b>12</b>
<b>4. Handling / Transporting the printer</b>	<b>13</b>
4.1. Disconnecting the power supply	13
4.2. How to contact tech support	14
4.3. Error screens	14
4.4. Unpacking, assembly and first start	14
<b>5. Your first print</b>	<b>15</b>
5.1. Basic controls	15
5.2. Updating the firmware	16
5.3. Preparing flexible steel sheets	17
5.4. Calibration Wizard	17
5.5. Selftest	17
5.6. Loading and unloading the filament	18
5.7. First Layer Calibration	19
5.8. Checklist	21
5.9. Starting the first print	21
5.10. Removing the print	21
5.11. After-print checks and actions	22
<b>6. Advanced features</b>	<b>23</b>
6.1. Menu structure	23
6.2. Mesh Bed Leveling explained	24
6.3. Factory reset	24
6.4. Network connections	24
<b>7. Printing your own models</b>	<b>26</b>
7.1. Obtaining a printable model	26
7.2. Creating your own models	27
7.3. What is a G-code file?	27
7.4. PrusaSlicer	27
7.5. Importing objects into PrusaSlicer	28
7.6. Using supports	29
7.7. Print speed vs Print quality	30
7.8. Infill	31
7.9. Brim	31
7.10. Large object printing	32
7.11. Print multi-colored objects	33
7.12. Slicing, exporting	34
<b>8. Material guide</b>	<b>35</b>
8.1. PLA	35
8.2. PET/PETG	36
8.3. ASA/ABS	36
8.4. PC (Polycarbonate) and PC Blend	37
8.5. PVB	38
8.6. Flexible Materials	38
<b>9. Regular Maintenance</b>	<b>39</b>
9.1. Steel sheets	39
9.2. Spring steel sheet with TEXTURED double-sided PEI	41
9.3. Spring steel sheet with SMOOTH double-sided PEI	41



9.4. Spring steel sheet with SATIN double-sided PEI .....	42
9.5. Increasing the adhesion .....	42
9.6. Steel sheet profiles .....	42
9.7. Bearings .....	43
9.8. Fans .....	43
9.9. Extruder drive gear .....	43
9.10. PTFE tubes .....	44
9.11. Clogged / jammed extruder .....	44
9.12. Nozzle cleaning .....	46
9.12.1. The filament is being extruded just a little .....	46
9.12.2. The filament is not pushed out of the nozzle .....	46
9.13. Replacing / changing the nozzle .....	46
9.14. Flashing unsigned firmware .....	48
<b>10. Filament sensor (optional accessory) .....</b>	<b>49</b>
10.0.1. Running out of filament .....	50
10.0.2. False sensor readings and debugging .....	50
<b>11. FAQ - common issues and how to solve them .....</b>	<b>50</b>
11.1. Skewed X-axis .....	50
11.2. Printer can't read the USB drive .....	51
11.3. Loose X- and/or Y-axis belts .....	51
11.4. Filament stuck in the PTFE tube .....	51
11.5. X-Axis homing fails .....	51
11.6. Heating errors .....	51
11.7. Fan errors .....	52
11.8. Downgrading the firmware .....	52
11.9. Nozzle hitting the sheet and similar issues .....	52
<b>12. Advanced hardware troubleshooting .....</b>	<b>52</b>
<b>13. Print quality troubleshooting .....</b>	<b>52</b>



Information about functionality, correct usage and maintenance of this device can be found in this handbook and online at [help.prusa3d.com](http://help.prusa3d.com).



The device must be disconnected from the power supply (power adapter) before performing any kind of service, otherwise, you may be risking an electrical injury. Consult the handbook and the Knowledge base at [help.prusa3d.com](http://help.prusa3d.com) before performing maintenance on the device.



Extra care must be taken when handling or touching parts marked with this symbol. Avoid risks specified by other symbols, e.g. dangerous hot surfaces. Touching heated parts (heatbed, parts of the print head) may lead to severe burns.



The temperature of parts marked with this symbol can exceed the ambient temperature significantly. Touching such parts by an unprotected body part may lead to burns.



Unprotected moving mechanical parts may cause a minor injury, exercise caution.



Do not touch the print head during printing. There is a risk of injury caused by mechanical and/or heated parts.



Large electrical currents are switched on and off in the immediate vicinity of parts marked with this symbol. Persons with a pacemaker or other aids for controlling and monitoring heart function must exercise caution - consult your doctor about the use of this device.



This device is composed of components, which must be disposed of in accordance with electrical and electronic equipment waste directive.

## Product details

**Title:** Original Prusa MINI+

**Manufacturer:** Prusa Research a.s., Partyzánská 188/7A, Prague, 170 00, Czech Republic

**Contact e-mail:** [info@prusa3d.com](mailto:info@prusa3d.com)

**EEE group:** 3 (IT and/or telecommunication equipment), Device use: indoor only

**Power supply:** AC/DC switching adaptor, input 100-240 VAC, 50 / 60 Hz, 2.0 A / Max output 24 V, 6.67 A, 160 W MAX

**Fuse:** min. B16A (for EU)

**Protection:** IP20

**Working temperature range:** 18 °C - 38 °C, indoor use only

**Working humidity:** 85 % or less

**Compatible filaments:** 1.75 mm only

**Package weight (gross / net):** 7.6 kg / 4.85 kg

The serial number is located on the printer frame and also on the packaging.

This device can be safely used only indoors, where the device (especially its PSU and LAN socket) is protected against external environmental risks.

### Warranty

The pre-assembled Original Prusa MINI+ 3D printer is covered by a 24-month warranty for end customers and 12 months for businesses. Wear and tear category components and consumables are excluded from this warranty.

The warranty period begins with the day when the customer receives the goods. Neither the Seller's liability for defective products nor the quality warranty applies to printers or parts damaged by handling in conflict with the instructions and recommendations in the official manuals and guides, and/or improper handling caused by unofficial modifications, such as modifications to hardware or software.

### Licensing

The Original Prusa MINI+ printer is a part of the RepRap project, the first open-source 3D printer project free to use under a GNU GPL v3 license ([www.gnu.org/licenses/gpl-3.0.en.html](http://www.gnu.org/licenses/gpl-3.0.en.html)). If you improve or alter any part of, a printer, and you are willing to sell it, then you have to publish the source code under the same license. All 3D-printed elements of the printer that can be improved upon can be found at [www.prusa3d.com/prusa-i3-printable-parts](http://www.prusa3d.com/prusa-i3-printable-parts).

## Safety and compliance

### Disclaimer

Failure to read the handbook may lead to injuries, inferior printing results, or damage to the 3D printer. Always ensure that anyone who operates the 3D printer knows and understands the contents of this Manual/Handbook. We cannot control the conditions in which you assemble the Original Prusa MINI+. For this, and other reasons, we do not assume responsibility and expressly disclaim liability for loss, injuries, damage, or expense arising out of, or in any way connected with, the assembly, handling, storage, use or disposal of the product. The information in this handbook is provided without any warranty, expressed or implied, regarding its correctness.

**Please be very cautious during any interaction with the printer. This printer is an electrical device with moving and high-temperature parts.**

## Placement and basic usage



Make sure the printer is placed in a suitable location to prevent mechanical damage and potential safety risks.

- The device is for indoor use only. Do not expose the printer to rain and snow. Contact with water and water-based substance may lead to electrical failures, short circuits and other types of damage. Always keep the printer in a dry environment.
- Place the printer in a safe, dry and horizontally stable location - e.g. a workbench. There should be at least 30 cm (1 ft.) of space around the printer. Objects in near vicinity of the printer could lead to an increased wear of the printer's cables, which could result in a safety hazard - worn cables may present an electrical and fire hazard.
- Make sure none of the vents and fans are blocked. The printer has built-in fan RPM monitoring, however, in certain cases (e.g. by installing an unofficial firmware) the monitoring may not work as intended. Insufficient cooling may lead to dangerous overheating, electrical and fire hazards, and damage to the printer.
- Make sure the printer is placed in a location, where it cannot fall or be tipped over. Using a printer that has been damaged as a result of a fall may lead to safety risks.
- The power adapter and its cord should be placed in a location where one cannot trip over the cable, step on it or stumble over it. Make sure that the cable is not mechanically or otherwise damaged. If so, stop using the damaged power cord immediately and replace it. Damaged power cord may present a safety hazard - there's a danger of an electric shock.
- Do not leave the printer unattended while it's still on! While the device has a number of safety features and temperature monitoring, issues such as (but not limited to) incorrect wiring, damaged cables, failure of components, and/or failure to follow the instructions in the official handbook and assembly manual may lead to a fire hazard.

## Electrical safety



Please follow these instructions to avoid the risk of an electrical injury.

- The printer supply is a household power outlet - 230 VAC / 50 Hz or 110 VAC / 60 Hz. Never connect the printer to a different power supply; it may cause malfunction or damage to the printer.
- Never use the printer when the power cords are damaged in any way. This includes the power cord, the power supply unit cable, and the wiring on the printer. There may be a risk of an electrical injury involved.
- To disconnect the power cord from the socket, pull the plug rather than the cord to reduce the risk of damage to the plug or to the AC outlet. Damaged plug may present a risk of an electrical injury. The plug that connects to the printer has a safety locking mechanism: first pull the cover of the plug to unlock it, then disconnect the plug from the printer.
- Never disassembled the printer's power supply: it does not contain any parts that could be repaired by an unskilled worker. All repairs must be performed by a qualified technician. Tampering with the power supply may lead to damage to the printer and/or electrical hazards.
- The plug serves as a disconnecting element. The power outlet must be easily accessible.

## Mechanical safety



Moving mechanical parts of the printer may cause an injury.

- The printer has moving parts. Do not reach inside the printer while it is still in operation - you may be risking an injury caused by the moving parts or electrical current.
- Prevent children from unsupervised access to the printer even when it is not printing.

## Risk of burns



Do not touch heated elements - the heatbed/print sheet and parts of the print head to avoid severe burns!

Caution! During operation, the heatbed and parts of the print head may get very hot! Do not touch them until the print is finished and the device cools down - temperatures are displayed on the LCD screen. Touching heated parts may lead to severe burns!

## Proper usage of double-sided spring steel print sheets



Every type of spring steel print sheet requires a different approach. Incorrect maintenance and usage may lead to damage to the print sheets and loss of warranty. Please read the following section carefully before using the sheets.



**Never clean the surface of the textured and satin sheets with acetone!**

- Read maintenance instructions in Chapter 10 - Regular Maintenance
- Calibrate Live Z when you switch sheets - sheets have different thickness. New MINI firmware versions have the option to save print sheet profiles for quicker switching (read Chapter 10 - Regular Maintenance to learn more)
- Use high-quality isopropyl alcohol only to clean (degrease) the sheet. Do not use products with isopropyl alcohol as one of the components (e.g. hand sanitizers) - these products have various additives, e.g. moisturizers, which can negatively affect the adhesion properties.
- Do not wash with running water to prevent the formation of rust.
- Do not peel off the PEI sticker from the surface
- Wipe the sheet with IPA-infused tower before the first print

## Working with filaments



Working with filaments is easy, clean and safe when handled properly. Here are some suggestions to keep in mind.

- Always use the correct temperatures for the selected material
- Be careful around melted plastic - it may cause burns. Do not remove excess filament from around the nozzle with your bare hand - use pliers or similar tool.
- Some materials may produce prominent odors - keep the room ventilated.
- Place the filament spool and prepare the filament for printing according to the instructions in this handbook.

---

## 1. Introduction

Thank you for purchasing the Original Prusa MINI+ 3D printer from Josef Prusa! Your purchase supports us in the further development of the MINI+ and other devices. Original Prusa MINI+ is our **compact, smart and affordable 3D printer, which was designed as a 3D printing workhorse and a great starter printer.** We hope you will enjoy using it! Please, **read the handbook carefully**, since all chapters contain valuable info regarding the operation of the equipment, getting-started instructions, 3D printing tips, and everything about regular maintenance.

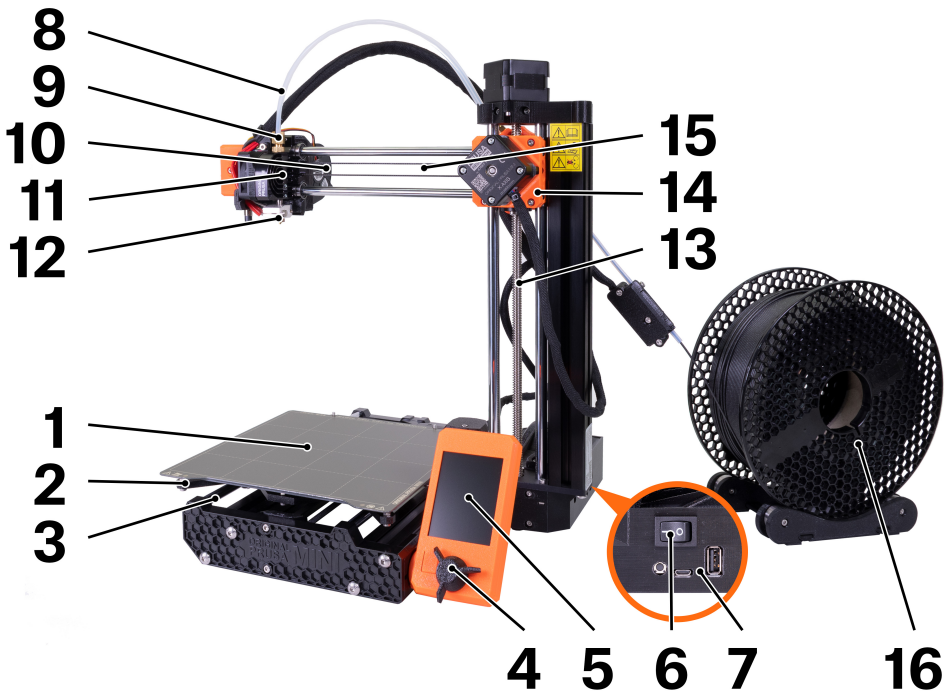
**Please check the [prusa3d.com/drivers](https://prusa3d.com/drivers) page for the updated version of this 3D printing handbook (PDF download).**

In case of any printer-related problem, do not hesitate to contact us at [info@prusa3d.com](mailto:info@prusa3d.com). We are glad to receive your valuable comments and tips. You can also visit our knowledge base at [help.prusa3d.com](https://help.prusa3d.com) and forums at [forum.prusa3d.com](https://forum.prusa3d.com).





## 2. Glossary



1. **Spring steel sheet** - comes in three variants: smooth, satin and textured. This is where the printed object appears. Please read the maintenance instructions carefully to ensure optimal conditions for 3D printing.
2. **Heatbed** - located directly under the spring steel sheet. Heatbed ensures good adhesion of the printed object. Warning: do not touch the heatbed when it's hot!
3. **Y-Axis** - the general name for the entire heatbed assembly (smooth rods, belt, heatbed...).
4. **Knob and reset button** - The knob is the main control device of the Original Prusa MINI+ 3D printer: rotate left/right to scroll through options, press the knob to confirm your selection. There's a reset switch directly next to the knob. Press it to perform a hard reset - e.g. if you need to quickly stop and cancel a running print job.
5. **LCD screen** - the display is used for the configuration of the 3D printer. Use the knob to scroll through the menus and confirm your selection with the press of the knob.
6. **Power switch** - when the printer is not in use, turn it off using the power switch.
7. **USB port and microUSB port** - USB port is **compatible with USB 2.0/3.0 flash drives (FAT32 filesystem)**. Use this port to insert a USB drive with print files (G-Codes) or firmware files for updating the firmware. The microUSB port can be used to run third-party solutions, such as Octoprint (see <https://octoprint.org> for more details).
8. **Main PTFE tube** - leads the filament strand from the extruder into the print head / nozzle. Inspect it from time to time to make sure there is no debris inside that would prevent the filament strand from reaching the nozzle.

9. **Tube fitting** - on both ends of the main PTFE tube. In case filament gets stuck in the PTFE tube, use a spanner (included with the printer) to remove the fittings and the PTFE tube to get access to the filament strand.
10. **Print fan** - cools the printed object, improves print quality. Comes with RPM monitoring.
11. **Print head** - Lightweight print head consisting of the hotend (printing nozzle), SuperPINDA probe and two fans. The heaviest parts of the extruder were moved onto the Z-axis tower to improve print quality.
12. **Nozzle** - 0.4mm nozzle, can be replaced with e.g. 0.25mm or 0.6mm E3D-compatible nozzles to achieve various effects.
13. **Z-Axis** - the entire vertical axis assembly (smooth rods, Z-axis motor...).
14. **Extruder / Extruder motor** - as opposed to 3D printers like MK2 or MK3S, the extruder motor is not moving along the X-axis. Instead, it's fixed on the side and pushes filament through the PTFE tube towards the print head.
15. **X-Axis** - allows the movement of the belt-driven print head from left to right.
16. **Spool holder** - should be placed near the printer, so the filament strand can enter the PTFE tube from below. Filament must not bend at an acute angle.

---

### 3. Package contents - Accessories (bundled / optional)

Your Original Prusa MINI+ comes bundled with:

• **USB drive with firmware files**

- Allen key
- Spanner
- Surface cleaning wipes (infused with isopropyl alcohol)
- Acupuncture needle

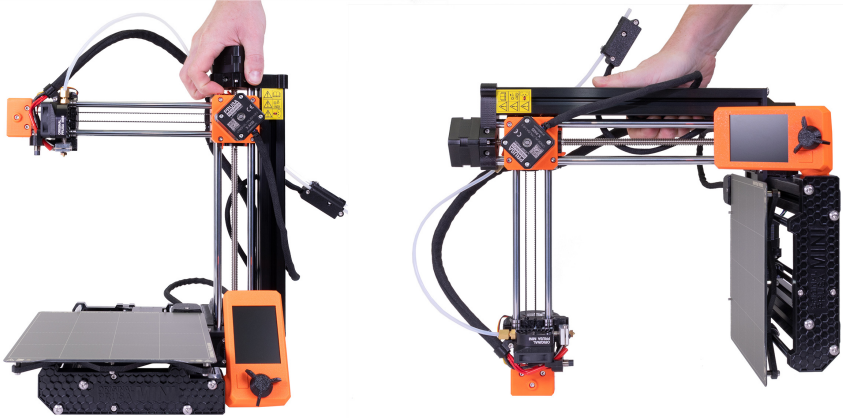
These are the basic tools required for correct assembly and basic maintenance. However, we recommend getting some extra items to improve your 3D printing experience.

- **Side cutting pliers** - for filament cutting
- **Isopropyl alcohol, Windex, paper wipes** - for print sheet maintenance
- **Metal spatula** - for easier removal of prints stuck to the **smooth steel sheet**

---

## 4. Handling / Transporting the printer

When transporting the Original Prusa MINI+, **use the recommended way of holding the device.** You can either grab it by the Z-axis motor at the top, or by the Z-Axis assembly. See photos below for reference. **Never hold it by the cables or PTFE tubes, damage to the printer could occur!**

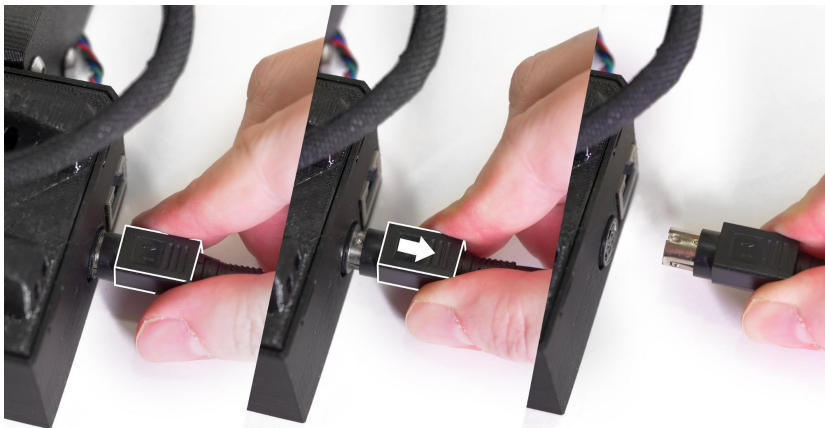


---

### 4.1. Disconnecting the power supply

The power supply plug that goes in your printer has a locking mechanism - do not pull it with force! Do not pull the cable! Incorrect manipulation may result in damage to the plug and/or cable.

First, unlock the mechanism by pulling the cover of the plug away from the printer. Once the mechanism is unlocked, you can pull the plug out of the printer.



---

## 4.2. How to contact tech support

If you encounter an issue with your MINI+ 3D printer, please check the last pages of this handbook for **general troubleshooting guides** or **visit our knowledge base at [help.prusa3d.com](https://help.prusa3d.com)**. However, in case the suggested solutions don't work, please contact our tech support via e-mail at [support@prusa3d.com](mailto:support@prusa3d.com) or via the Live chat at [shop.prusa3d.com](https://shop.prusa3d.com) - the chat is in the lower right corner.

---

## 4.3. Error screens

If the printer encounters a major issue, an error screen is shown. The information on the screen can help identifying, diagnosing and fixing the issue. Please pay attention to the following information on screen.

1. **Name of the issue**
2. **Short description** of the issue and suggested next steps
3. **QR code** - if you scan it with your phone, you'll be redirected to a relevant Knowledge base article with full instructions on how to fix the issue. The QR-code link also contains a device hash (see below).
4. **Knowledge base URL** - if you don't have a phone at hand, you can type this URL into your web browser to visit a relevant troubleshooting guide
5. **Firmware version** - may help in diagnosing the issue
6. **Device hash** - The URL link embedded in the QR code may contain an optional "device hash" (this can be enabled/disabled in the Settings). Including this information enables us to check, whether you are running the latest version of firmware and if not, we will inform you at the top of the linked article. The information provided in the URL is stored in our database to help us better understand, which errors are the most common and how many errors each printer experienced.



---

## 4.4. Unpacking, assembly and first start

The Original Prusa MINI+ 3D printer is available as a semi-assembled model, or as an assembly kit. The semi-assembled model consists of three large parts that need to be attached together. On the other hand, the assembly kit presents a unique opportunity to build your 3D printer literally screw by screw by following an online guide at [help.prusa3d.com](https://help.prusa3d.com). **Please flip this handbook to get to the Assembly instructions and pre-flight check of the semi-assembled version.** Then return here to continue with the setup process.



If you're viewing this handbook online, please head to [help.prusa3d.com](https://help.prusa3d.com) and open the online version of the assembly manual.



Before you start using the device for the first time, consider checking [www.prusa3d.com/drivers](https://www.prusa3d.com/drivers) for the latest firmware version.

## 5. Your first print

Preparing the printer for the first print takes about 15-30 minutes (not including assembly). **Please pay attention to the following steps** to ensure the machine will operate as intended.

In this chapter, you will learn how to:

1. Control the printer
2. Update the firmware
3. Prepare the print surface for the first print
4. Perform the initial calibration
5. Load filament
6. Start the first print

### 5.1. Basic controls

You can configure and control the entire device with a single control element: a **rotational knob (1)**, which can be pressed to confirm the selection.



**The reset button (2)** is placed to the left from the control knob. Pressing the reset button equates to quick toggle of the power switch. It is useful when the printer exhibits unexpected behavior, or you see a failed print that requires to be stopped immediately.

## 5.2. Updating the firmware

The printer is shipped with latest firmware available at the time of manufacturing. However, we recommend to check [www.prusa3d.com/drivers](http://www.prusa3d.com/drivers) for the latest firmware version to ensure optimal printing experience.

**To flash firmware downloaded from our website, please follow these steps:**

1. Download the correct firmware file from [www.prusa3d.com/drivers](http://www.prusa3d.com/drivers) (ZIP archive) and unpack it
2. Place the .BBF file on a FAT32-formatted USB drive - you can use the one bundled with your MINI+
3. Insert the USB drive into the printer's USB port
4. Restart the device using the restart button next to the Knob
5. The update process should start automatically
6. Wait until the process is complete



To force the firmware flashing procedure (e.g. when you need to downgrade the firmware), insert a USB drive containing the desired .BBF file, restart the printer and press and hold the knob during the start-up.





---

### 5.3. Preparing flexible steel sheets

Please follow the instructions for the sheet of your choice (see below) and prepare it for the first print.

The heatbed has embedded high curie temperature magnets inside, which hold removable spring steel sheets in place. There are **two pins at the end of the heatbed that will align perfectly with cut out edges of the spring steel sheets**. These pins aren't meant to fit into the two holes on the other side of sheet! Make sure the bed is clean and there isn't any debris on it before you put on the steel sheet. **Never print directly on the heatbed.**

**Unpack the IPA-infused cleaning wipe and clean the steel sheet before you start.**



*Heatbed and powder-coated steel sheet surface*

To achieve the best adhesion of the printed object, it is important to **keep the surface clean**. Please see the information in the chapter **10 Regular Maintenance** for more information about print surface preparation, **recommended cleaning products and warranty info**.

---

### 5.4. Calibration Wizard

Once the printer starts for the first time, the **Wizard will show up**. It will guide you through all the tests and calibrations you need to perform in order to start printing.

The Wizard can be also started manually from *LCD menu - Calibration - Wizard*. Do not forget to read chapter **10 Flexible steel sheets** before running the Wizard.

**The Calibration Wizard consists of Selftest, Mesh Bed Leveling and First Layer Calibration.**

---

### 5.5. Selftest

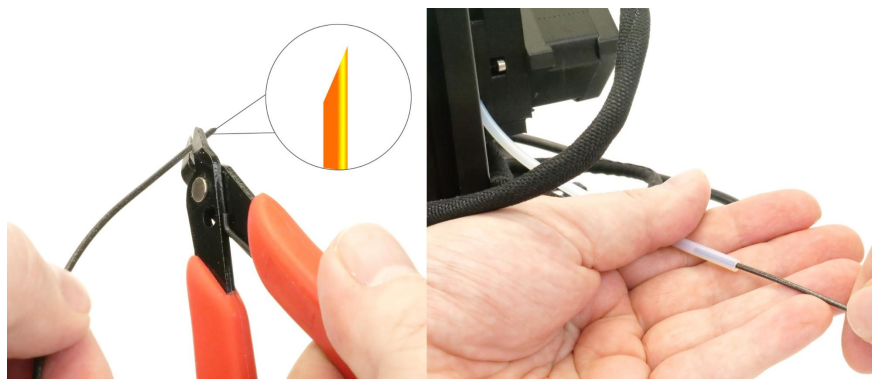
The Selftest is a diagnostic tool and consists of a series of tests. They are designed to **reveal the most common issues**, such as incorrect wiring. The progress and results of each step are displayed on the LCD. In case any issues are found, the selftest is interrupted and the **cause of the error is shown** to guide users in troubleshooting.

**The selftest consists of:**

- Extruder and print fan test
- X,Y, and Z-axis test
- Heatbed and hotend proper wiring

## 5.6. Loading and unloading the filament

Once the Selftest is finished, you can load a strand of filament. **We strongly suggest using PLA for the initial calibration and first print, because it's easier to use and does not require any extra steps (such as applying glue onto the steel sheet).** If you don't have a spool of PLA, read chapters 9 Material guide and 10 Regular maintenance carefully to learn how to prepare the steel sheet for specific materials. Every time you load a new filament, **make sure the tip of the strand is sharp** and there are no bumps or other unwanted shapes that would prevent the filament from entering the PTFE tube. Filament spools should be kept around the same level as the printer, so the filament strand can enter the PTFE tube without excessive bending.



### Loading filament

1. Cut the end of the filament strand to create a sharp tip. Insert the filament into the extruder PTFE tube (right side of the device), or into the short PTFE tube of the filament sensor (optional accessory).
2. Choose *LCD Menu - Filament - Load filament* and press the button to confirm.
3. The **preheat menu** will be automatically displayed. Select the type of filament you wish to load and confirm the selection by pressing the control knob.
4. Wait for the nozzle to **reach the target preheat temperature**.
5. Press the control knob to start loading and **push the filament into the extruder** until the extruder drive gears grab the filament.
6. The filament is then loaded into the print head by the extruder gears automatically. The printer will ask you if the color of the extruded plastic is correct. You have three options: **Yes/No/Retry**. In case the plastic is contaminated with previous filament's color, choose "No" and the printer will push some more material out of the nozzle. Choosing **Retry will repeat the loading process**. This is useful e.g. in case when the filament strand stopped mid-way in the main PTFE tube.



The printer keeps track of the currently loaded filament, even when powered off. You can check the type of the currently loaded filament in the bottom right corner of the LCD Menu.

For the next step, **keep the filament loaded**. If, for some reason, you need to change the filament before First Layer Calibration (or at any other time), follow these instructions:

### Unloading filament

1. Choose *LCD Menu - Filament - Unload filament*.
2. The printer will **automatically preheat to the correct temperature**, the beeper will notify you when the preheating finishes.
3. Press the control knob to start unloading.
4. Once the extruder gears stop unloading the filament, **pull the filament out from the PTFE tube manually**.

## 5.7. First Layer Calibration

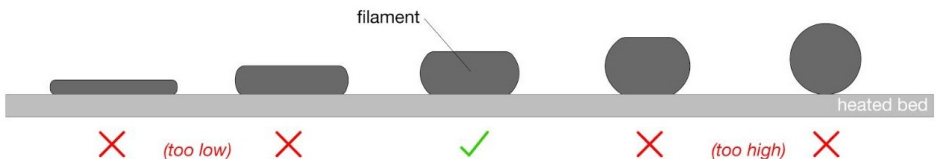
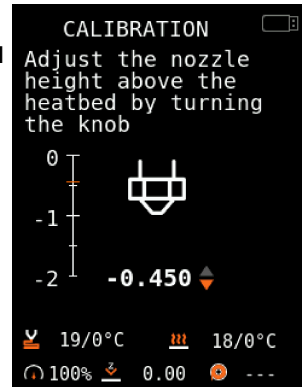
This process will calibrate the distance between the tip of the nozzle and the probe. You can launch the calibration at any time from *LCD Menu - Calibration - First layer cal*.



Make sure the steel sheet is clean and there's no grease on it, even fingerprints can cause an issue. **Use the IPA-infused cleaning wipe that came with your printer to clean it before you start.**

Once you start the First Layer Calibration, the printer will ask you whether filament is loaded. Once it is, the printer will **probe the bed using the Mesh Bed Leveling routine** (see chapter 7.2 Mesh Bed Leveling for more information) and start **printing a zig-zag pattern** on the print surface. The nozzle will be at the height defined by the SuperPINDA probe setting. **It must not by any means touch the printing surface.**

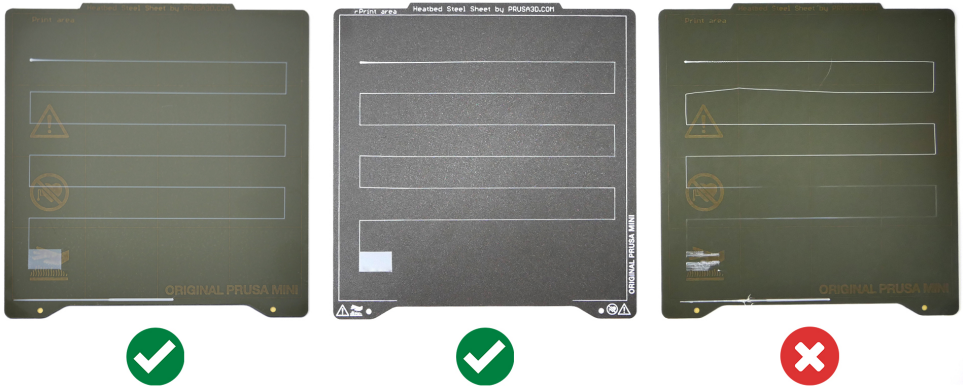
Starting with firmware 4.3.0, the nozzle height adjustment screen has a new design with a simplified depiction of the nozzle. As you adjust the height of the nozzle by rotating the knob clockwise or anti-clockwise, the nozzle on the screen will follow the same movement direction. Please note that the number on the screen is for illustration purposes only. Your Z height will be different.



Observe the line which is being extruded on the print surface. A new menu will automatically show up - use it to **tune the nozzle height in real time by turning the knob**. The aim is to adjust the nozzle height until the extruded plastic sticks nicely to the bed and you can see that it is being slightly squished.

**Make sure the testing pattern looks like the one on the left or middle picture below.** The picture on the right displays both serious issues: nozzle too high (bent lines, shifted corners) and

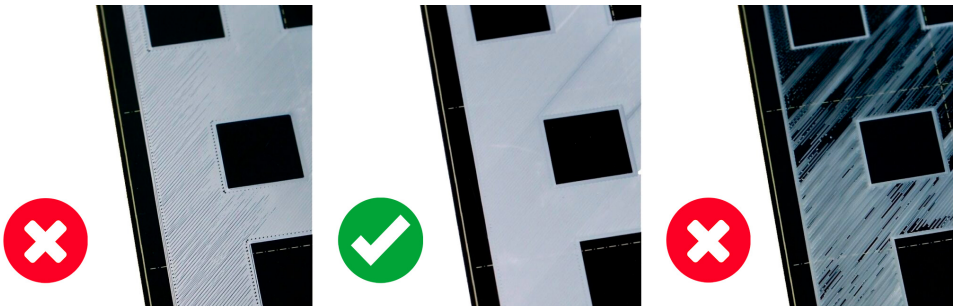
nozzle too low (plastic not extruded)



### What to check:

- The top of the extruded plastic is slightly squashed
- The corners of the zig-zag line are sharp and do not lift from the sheet
- The lines are straight and stay on the sheet firmly
- The ending box has an even surface, there are no waves or gaps

Below, you can see a close up of a print displaying quality issues caused by an incorrect nozzle height. The picture in the middle is the optimal quality.



First layer height comparison - nozzle too high (left), optimal height (middle), nozzle too low (right)



If you have the assembly kit version of the MINI+ and you have trouble reaching a consistent first layer, it might be caused by an incorrectly positioned SuperPINDA sensor. Please refer to the online assembly guide to see how the SuperPINDA probe should be positioned.

---

## 5.8. Checklist

If you followed the steps described in the previous chapter, you are now ready to start your first print. Before you start, let's go through the final checklist:

1. **MINI+ is fully assembled and placed in a suitable location**
2. **The firmware is updated to the latest version**
3. **All of the calibration procedures were successful**
4. **A clean print sheet cleaned with IPA-infused cleaning wipe is on the heatbed**
5. **Filament is loaded**

---

## 5.9. Starting the first print

Once everything is ready, you can **navigate to the PRINT menu** (available only when a USB drive is inserted). Use the knob to **select a sample object** from the list and observe the printer. We recommend choosing the **PRUSA logo**, because it gives you a great overview of how well you tweaked the first layer during First Layer Calibration.



*You should aim for this level of quality with your first layer*

**The nozzle will preheat to 170 °C independently on the selected filament** - this is to prevent oozing of the filament during the initial phase, which is Mesh Bed Leveling. Once MBL is done, the printer will preheat the nozzle to the correct printing temperature and start with the initial purging line at the edge of the print bed. Then, it will start printing the skirt around the object and the object itself.



**Pay close attention to the quality of the first layer.** Extruded plastic should stick to the sheet nicely. If, for some reason, the nozzle is too high, either **try to lower it with the Live Adjust Z function** (available through the *Tune* menu during an active print job), or stop the print completely, clean the sheet and re-run First Layer Calibration from the Calibration menu.

---

## 5.10. Removing the print

Once the print finishes, **wait for the heatbed to cool down**. Both the heatbed and the steel sheet may reach up to 100°C and cause burns if touched with naked skin. Depending on the material and steel sheet used, your print might automatically detach as the sheet cools down. If that's not the case, lift the steel sheet and **bend it both inwards and outwards carefully, rotate it 90 degrees and repeat the bending**. Don't forget to remove all leftover pieces of filament, such as the intro purge line, the skirt and the support base. If there is any leftover plastic on the sheet, do not use your fingernails to remove it - this could potentially lead to an injury. Instead, use a metal spatula on the smooth sheet or a plastic spatula on the textured sheet.

**Try to avoid touching the steel sheet surface with your fingers** - fingerprints can decrease the adhesion of the next print.



---

### 5.11. After-print checks and actions

Once the sample print is removed from the steel sheet, **inspect it closely and check for possible issues with quality**. Please note that objects printed using FDM/FFF methods are never perfectly smooth - layers are usually visible. There are ways to make 3D printed objects smoother, though. Check our blog at [blog.prusaprinters.org](http://blog.prusaprinters.org) to learn more about post-processing.



In case your print has actual quality issues (missing parts, shifted layers, under-extruded sections), please check our **Print Quality Troubleshooting** at the end of this handbook.

Make sure the steel sheet is clean and put it back onto the heatbed. You can leave the filament loaded in the nozzle. If you don't plan to print another object, wait until the nozzle cools down to 50 °C and **turn the printer off using the switch on the side**.



---

## 6. Advanced features

---

### 6.1. Menu structure

- Print
- Preheat
  - PLA
  - PETG
  - ASA
  - ABS
  - PVB
  - PC
  - HIPS
  - PP
  - Flex
  - Cooldown
- Filament
  - Load filament
    - PLA
    - PETG
    - ASA
    - ABS
    - PVB
    - PC
    - HIPS
    - PP
    - Flex
    - Cooldown
  - Unload filament
  - Change filament
  - Purge filament
- Calibration
  - Wizard
  - Live Adjust Z
  - Auto Home
  - Mesh Bed Leveling
  - Selftest
  - First Layer Calibration
  - Test Fans
  - Test XYZ-Axis
  - Test Heaters
  - Show Selftest results

- Settings
  - Temperature
    - Nozzle
    - Heatbed
    - Print fan
    - Cooldown
  - [Sheet profile] - when two or more sheets profiles are configured
  - Move Axis
    - Move X
    - Move Y
    - Move Z
    - Move E
  - Disable Steppers
  - Factory Reset
  - HW Setup
    - Sheet profiles
      - Profile name
        - Select
        - First Layer Calibration
        - Reset
  - FW Update
  - Filament sensor On / Off
  - LAN Settings
  - TZ (UTC + / -)
  - Save Crash Dump
  - Sound Mode: Once / Loud / Silent / Assist
  - Sound Volume
  - Device hash in QR On / Off
  - Language
- Info
  - System Info
  - Sensor Info
  - Version Info

---

## 6.2. Mesh Bed Leveling explained

Mesh bed leveling can be found in *LCD Menu - Calibration*. This procedure is performed before every print. It is also the same procedure performed at the start of First Layer Calibration (see next chapter)

The SuperPINDA probe goes through a **4x4 grid pattern spread across the sheet** (whether it is a powder-coated or smooth PEI does not matter) and measures the distance to the sheet. These points are interpolated and used to create a virtual mesh of the bed. If the bed is slightly warped (we're talking about tiny imperfections introduced either by manufacturing tolerances stacking up or caused by the assembly process), the **probe will still precisely follow the surface** during printing according to its measured mesh, improving the quality of the first layer.

---

## 6.3. Factory reset

A factory reset can be performed through *LCD Menu - Settings - Factory Reset*. This will reset all data to default values.

---

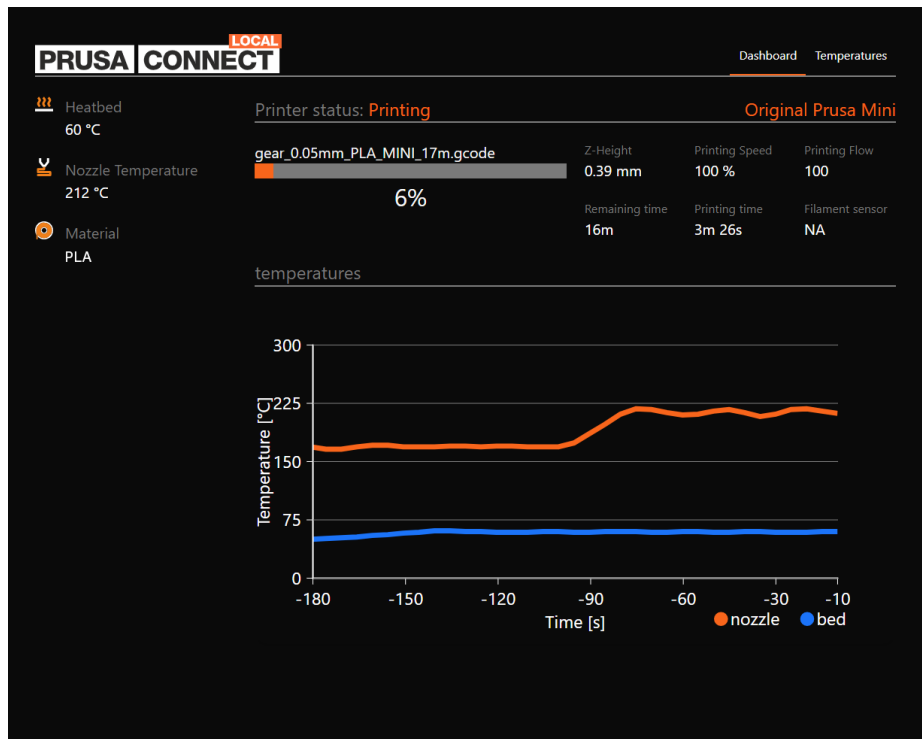
## 6.4. Network connections

Original Prusa MINI+ has an ethernet (RJ45) port onboard. You can use this port to connect your printer to your network.

Please note that certain network features may not be fully available in the factory firmware. Keep

checking our web [www.prusa3d.com](http://www.prusa3d.com) or social media profiles where we publish information about updated firmware versions.

You can connect your Original Prusa MINI+ to the local area network (LAN) and **access basic information about the printer through web-based interface called PrusaConnect**. The printer has DHCP turned on by default. Go to *LCD Menu - Settings - LAN Settings* and check whether the IP address has been assigned correctly. Then, on your PC or cell phone, open a web browser of your choice and **enter the IP address into the address field**. This will allow you to see basic information about the current print job. PrusaConnect in the current version works **only on local area network** and its features will be expanded in further releases.



Wi-Fi module (an optional accessory) is not supported in default firmware. Information about Wi-Fi module availability will be published at [www.prusa3d.com](http://www.prusa3d.com) or [blog.prusaprinters.org](http://blog.prusaprinters.org).

**i** Original Prusa MINI+ is also compatible with a third-party tool for network printing called OctoPrint. Please refer to the official OctoPrint website ([www.octoprint.org](http://www.octoprint.org)) for more information on setup and configuration.

## 7. Printing your own models

Once the printer is fully calibrated and the sample models are looking good, you will probably want to **print your own model**. You have a number of options - read the following chapters to learn more.

### 7.1. Obtaining a printable model

The easiest way to get started with 3D printing is to **find models on the internet** - they are usually in .3mf, .stl or .obj formats. Fortunately, 3D printing has many fans, so there are sites from which you can download a large variety of ready-made 3D models for free. These range from a simple playing dice to a detailed figure from a favorite movie, game or TV series. You can also download mechanical parts, RC model accessories, household items and much more. You can **visit our own community website [PrusaPrinters.org](https://PrusaPrinters.org)** - it's our ever-expanding community hub for all Prusa 3D printer owners! It has a ton of cool features and plenty of amazing models for you to print.

The screenshot displays the PrusaPrinters.org website interface. At the top, the PrusaPrinters logo is visible. Below it, a search bar indicates "29 473 prints found". The main content area is titled "Prints" and shows a grid of model listings. Each listing includes a thumbnail image, the model name, the creator's name, and a set of icons for likes, stars, downloads, and a bookmark. The models shown include:

- Bag Clip (PRINT IN PLACE CAM)** by Andrei
- Landy Mini by 3Deets**
- Desk Stranding - The Death Stranding Desk Lamp** by Nils Kal
- Cute Skull Lamp** by rayjizza
- PRUSA Spool Recycling - Sorting Tower - Vase Mode** by Fredslund
- Prusa Enclosure V2 - MMU2S** by Ondřej Střiteský
- Prusa Steel Sheet Holder** by iFreyz
- Prusa MK3 - SideBoxes for some Tools** by KalleKnall
- Gravity spoolholder for MMU2S** by Michal Fanta

On the left side, there are navigation menus for "All Models" (listing categories like 3D Printers, Art & Design, etc.) and "Design includes" (listing file formats like 3D Model, FFF Print File, etc.). Below that is a "Filter by FFF options" section with checkboxes for various Prusa printer models (MK3/S, MINI, MK2.5/S, MK2/S, MK3S + MMU2S).

*PrusaPrinters.org*

3D models are very often free to download under the Creative Commons - Attribution - Non-Commercial (Models not to be used commercially, you must always include the name of the author) or for a small fee. We have selected the most interesting sites:

- [www.prusaprinters.org](http://www.prusaprinters.org)
- [www.thingiverse.com](http://www.thingiverse.com)
- [www.myminifactory.com](http://www.myminifactory.com)
- [www.pinshape.com](http://www.pinshape.com)
- [www.youmagine.com](http://www.youmagine.com)
- [www.shapeways.com](http://www.shapeways.com)
- [www.gambody.com](http://www.gambody.com)

However, models in .stl, .obj or similar formats **cannot be 3D printed directly**. First, they need to be **“sliced” (converted) into a G-code file**, which is then placed onto a USB drive. Connect the USB drive with a sliced project into the printer and select the model to print from the Print menu. Please see the chapters **8.3 What is a G-code file?** and **8.4 PrusaSlicer** for more information.

---

## 7.2. Creating your own models

To create a 3D model, you need a dedicated program - a 3D editor. There are a number of various 3D programs and your choice will usually depend on what type of model you wish to create.

**The easiest place to start is Tinkercad** ([www.tinkercad.com](http://www.tinkercad.com)) - it's an online editor that runs in your browser's window, so no installation is required. It's free, easy to navigate, and you will find plenty of tutorials online. Tinkercad is mostly focused on creating **less-detailed and larger (e.g. mechanical) parts**, ideal for FFF/FDM printing - your MINI+ can take care of them easily. Another popular tool is **Autodesk Fusion 360** ([www.autodesk.com/products/fusion-360](http://www.autodesk.com/products/fusion-360)) for PC, Mac, and iPad. The website provides a quick guide along with detailed video tutorials so it is an ideal choice both for beginning enthusiasts and professionals.

---

## 7.3. What is a G-code file?

When you download 3D models from the internet or create your own models, you will need to convert the 3D model (.stl, .obj, .3mf and similar formats) into a **set of instructions for the printer called G-code**. G-code is a file format readable by 3D printers. The file contains information such as nozzle movement, the amount of filament to extrude, temperature settings or fan speeds.

There are dozens of slicers available, each with their own advantages and disadvantages. The three most commonly used slicers among the Prusa printer owners are:

- PrusaSlicer
- Cura
- Simplify3D

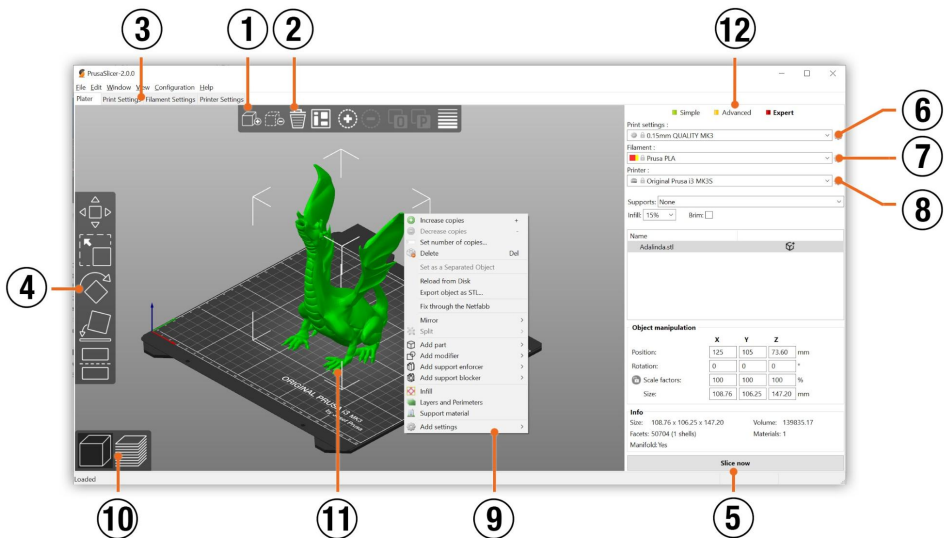
---

## 7.4. PrusaSlicer

As the name suggests, PrusaSlicer is our own in-house developed slicer based on the open-source project Slic3r. It has many useful features such as:

- Ready to print, auto-updating profiles for over 3 dozen filaments
- Variable layer height
- Custom supports and modifier meshes
- Differential print settings

You can always download the latest stable version from [www.prusa3d.com/prusaslicer/](http://www.prusa3d.com/prusaslicer/). Development alpha/beta versions are available at [github.com/prusa3d/PrusaSlicer](https://github.com/prusa3d/PrusaSlicer).



PrusaSlicer interface

1. The **Add** button loads models into PrusaSlicer
2. **Delete and Delete All** buttons remove the model(s) from PrusaSlicer
3. Opens the **detailed settings** of print, filament, and printer
4. Move, scale, rotate, Place on Face and cut tools
5. Slice and generate .gcode button
6. Quality / Speed setting of a print
7. Material selection
8. Printer selection
9. Right-click on model opens a context menu
10. Switch between 3D editor and layers preview
11. Model preview
12. Switch between **Simple / Advanced / Expert** mode

## 7.5. Importing objects into PrusaSlicer

Once you start PrusaSlicer, **select the Original Prusa MINI+ in the Printer menu on the right** side of the window. If it's not listed, you can add it either by selecting **Add a new printer** option in the same menu or by going to *Configuration -> Configuration Wizard*. Then, select the layer height, infill and the material you want to use. Please note that built-in filament profiles have pre-defined and tested settings. If you select a wrong profile, it may affect your print due to incompatible settings.

PrusaSlicer allows you to **import STL, OBJ, AMF, and 3MF object files** - these are the most common types of 3D files you can find on the internet. You can either drag-and-drop them in the *Plater* window, or you can use the *Add...* button in the top toolbar.

Next, use the tools in the left toolbar to **Move, Scale and Rotate the model**. If the object is blue, it means it's too big for the printing platform. See the next chapter for more details. Every object is different, so there's no default orientation that would work for every object. The rule of thumb here

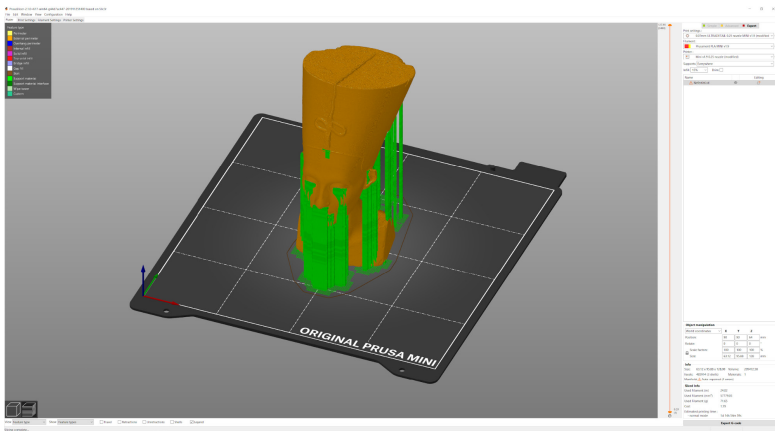
is to **select the largest flat surface of the object** as the base - the bigger the base, the better the adhesion. Select a perfectly flat side of the model for the best result.

## 7.6. Using supports

**Support material is a 3D-printed supporting structure** (similar to a scaffolding) used to print complex objects correctly - you can remove the support material after the print job is finished.

You can find many models that can be printed without supports - just place them on the print bed the right way and you can start printing. However, **not all objects can be printed without supports.**

If you print an object with a gradient lower than 45° (a steep side), the overhangs may not be printed correctly, which can lead to a failed print. You can even find objects that would require the printer to start printing mid-air - which is impossible. This is where **supports need to be used.** PrusaSlicer has this function built-in.



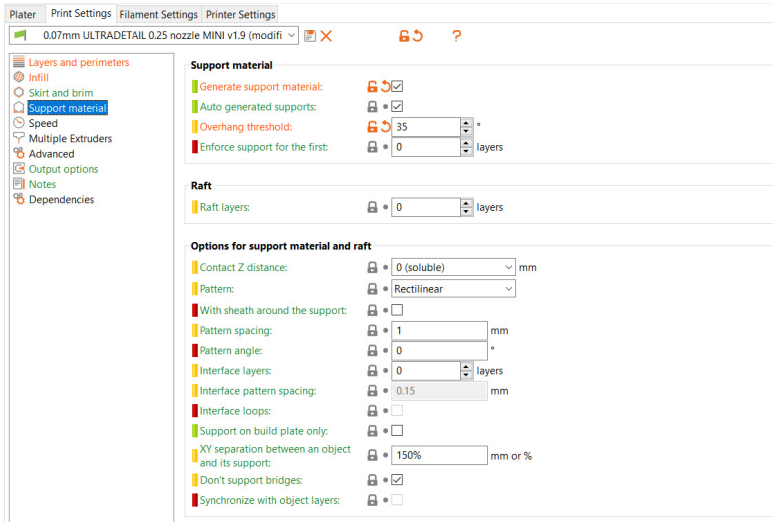
*Automatically generated supports in PrusaSlicer*

**You can select from three options:**

- **Support on build plate only** - generate supports only around the object
- **For support enforcers only** - generate supports only where enforcers are placed
- **Everywhere** - generate supports everywhere

The default values work in a majority of scenarios. However, if you need to **tweak where the supports should be generated**, follow these steps: Go to the *Print Settings* tab and click the *Support Material* option in the left column.

- Check the *Generate support material* box.
- *Overhang threshold* lets you set the minimal angle for printing the support material. Setting this item to zero lets the printer detect problematic parts automatically and print support where it is needed.
- *Enforce support* option is used mostly with small models or models with a small base to prevent the object from breaking or tearing out from the bed.



Areas above supports usually have a less-than-ideal surface quality. Before you decide to use supports, try to move/rotate the object to find an orientation that will require less or even no supports.

## 7.7. Print speed vs Print quality

Printing a small object takes a few minutes, but printing larger models are more time consuming - there are prints that will take dozens of hours to finish. There are **various elements affecting the print time**. The first way to affect the printing speed is to **change layer height** in PrusaSlicer - the upper right window shows the Print settings option. The default setting is **0.15 mm QUALITY**, but you can **speed up the printer by choosing the 0.20 mm (SPEED)** option - or even 0.25 mm DRAFT quality. Raising the layer height will result in **less detailed models** with more prominent layers. If you prefer quality over speed, choose a 0.10 mm (DETAIL) option. Printing time will increase noticeably, however, the models will look better. Increasing the printing speed may result in a less-detailed model.

Our **most used profiles 0.15 mm and 0.20 mm** come in two different versions.

- **Quality** - slower perimeters and infill, gives you better surface quality
- **Speed** - faster perimeters and infill without much sacrifice of surface quality





*Print quality vs print time*

The speed can also be changed while printing. Go to *LCD Menu - Tune - Speed*. By turning the control knob clockwise you can increase the print speed up to 150 %. Turning the knob counterclockwise decreases the print speed - the minimum speed is 50%. Watch the results of increased or decreased speed on the printed model and adjust the speed accordingly. Keep in mind that acceleration is unaffected by this value, so the change in speed is not directly proportional to the change in print time.

## 7.8. Infill

Infill is another parameter that **affects the printed object** - mainly the speed of printing, structural strength and even the look of the printed object.

Objects printed with the FFF/FDM method are not solid. Instead, you can find a certain **3D pattern inside these objects**. The patterns can range from a simple grid or honeycomb to more complex shapes. The purpose of the infill remains the same: **give the object a certain level of structural strength**. Many models can be printed with 10-15% infill, but if you require the model to be stronger (e.g. a structural part), select a denser infill.

## 7.9. Brim

A brim is used to **increase adhesion to the print bed and decrease the possibility of warping**. This is done by printing extra outlines of the first layer and it's especially useful when the footprint of the first layer is very small. You can turn it on in PrusaSlicer by ticking a checkbox in the right panel. When the print is finished, it's usually very easy to remove brim with hand. Alternatively, you can use a deburring tool or a scalpel to remove the brim.

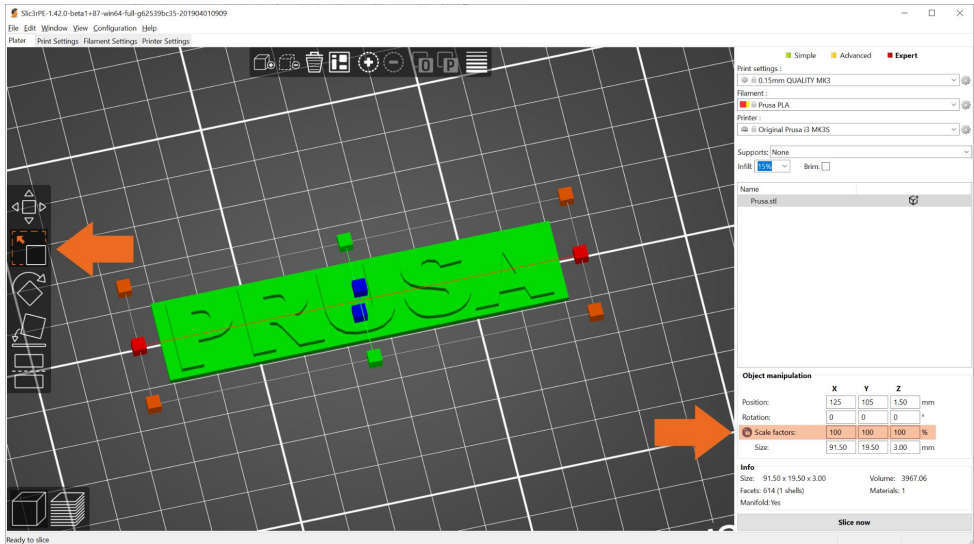
## 7.10. Large object printing



Original Prusa MINI+ has a smaller bed compared to the Original Prusa i3 MK3S, however, with some clever tricks, **you can print massive objects with the MINI+ as well**. Do not let the smaller print bed stop you - check our blog at [prusaprinters.org](https://prusaprinters.org) to learn how to assemble large models from several smaller parts.

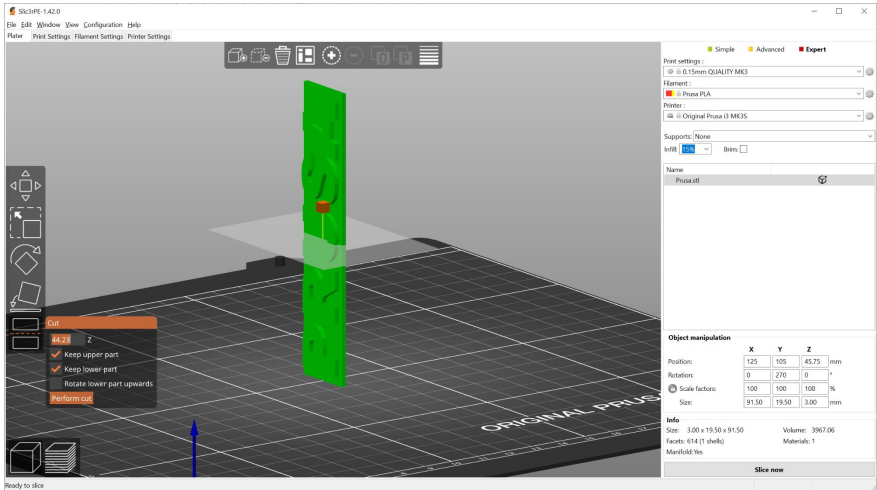
A special case is when you want to print objects larger than the heatbed. The first option is to resize the object to a printable size. Select the **Scale tool** from the left menu (or press the S key). Then use the 3D gizmo to change the scale of the object. If you want to scale the model uniformly, drag the scale gizmo by one of its corners. You can also change the size of a model along one of the axes by dragging the corresponding gizmo handles.

Alternatively, you can use the object manipulation window in the bottom right corner to type in an exact scale value.



*Changing the scale of a printed object*

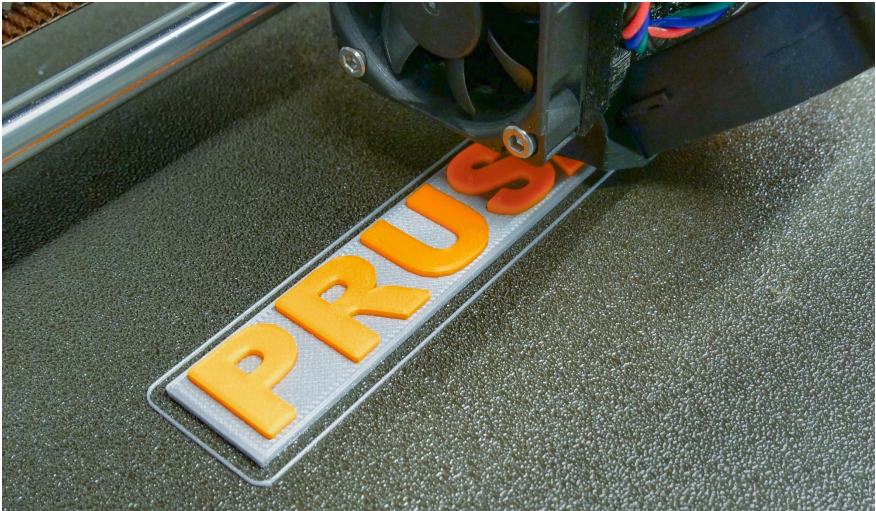
If you need to print an object that does not fit the printer at its original scale, you have to cut the object into smaller pieces. Select the **Cut tool** from the left menu (or press the C key). Position the cut plane to the desired position or enter a precise height into the Cut dialog window. You can decide whether you want to keep the upper, lower or both object parts.



*Cutting the object with the Cut option*

## 7.11. Print multi-colored objects

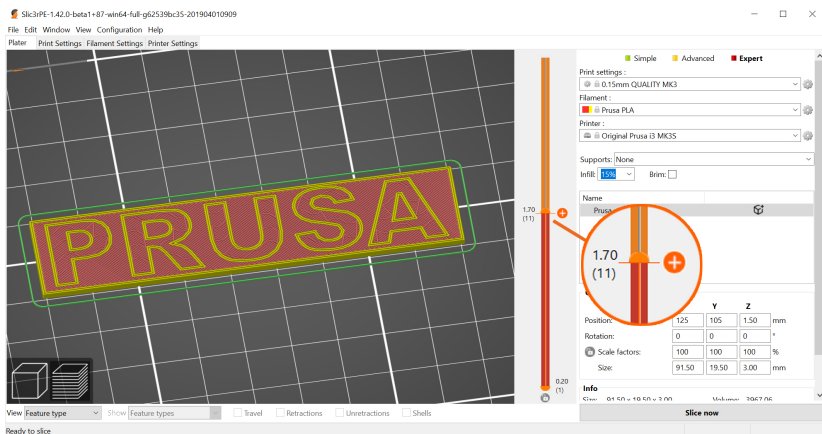
There is a simple way to create layer-based multi-colored 3D prints directly in PrusaSlicer - see the instructions below.



*Multicolored object printed using color change feature in PrusaSlicer*

## Color change in PrusaSlicer

1. Switch to the layer preview using the button in the lower-left corner
2. Using the slider on the right side, select a layer where the color change should occur
3. Click on the **orange plus icon**
4. A preview is instantly displayed. You can remove the color change by clicking on the grey cross button that is now displayed instead of the orange plus button
5. Export the G-code and you're ready to print!



*Setting up color change in PrusaSlicer*

## 7.12. Slicing, exporting

**One of the most important parts of the slicing process is the inspection of the sliced object** in the Preview window. Use the slider on the right side of the window to go through all the layers of the sliced object. This will help you to **uncover possible problematic spots** - e.g. when the bottom of the object doesn't sit directly on the bed or when there are supports missing and some parts of the object start mid-air.

Before you export the model as a G-code and place it onto a USB drive, always make sure to inspect the object in the preview mode. It's the best way to prevent possible printing issues.

## 8. Material guide



**See the full material guide online!** Please note that due to the limited space in this handbook, we can offer only a short overview of the most popular filaments. Visit [help.prusa3d.com/materials](https://help.prusa3d.com/materials) for a complete detailed overview of a vast majority of available filaments.

The Original Prusa MINI+ can print with many popular materials. Materials vary in both mechanical and optical properties as well as in the ease of use. If you're new to 3D printing, your first filament should definitely be PLA. Only when you are limited by some of PLA's disadvantages, it's time to try other filaments like PETG or ASA.

### 8.1. PLA

PLA is the most commonly used material for 3D printing. **It is biodegradable, easy to print with, and PLA prints are very hard.** It's the **perfect choice for printing large objects** due to low thermal expansion (prints do not warp on the heatbed) and for printing small detailed models. It is the only material that is well suited for printing 50-micron layers (Ultradetail resolution) and it can be also used to produce great-looking miniatures.

#### Advantages

- Easy to print, suitable for beginners
- Detailed prints of small models
- Trouble-free printing of large objects
- Almost odorless
- Affordable
- Wide color selection

#### Typical use

- prototypes
- toys
- figures
- jewelry (tiny and detailed models)
- architecture models

#### Disadvantages

- Brittle and inflexible
- Low-temperature resistance (54 °C)
- Difficult to post-process
- Not suitable for outdoor use (low UV and temperature resistance)

#### Tips and tricks

Best printed on a smooth PEI sheet. When post-processing PLA, use wet sanding to achieve a perfectly smooth surface. Without water, you'll quickly start heating the plastic by friction - the object can melt locally. PLA is only soluble in chemicals like chloroform or hot benzene. The preferred option for connecting multiple parts is superglue or acetone.

**Nozzle temperature:** 215 °C

**Bed temperature:** 50 - 60 °C

**Heatbed:** Make sure the surface is clean, as described in 10.1 Flexible steel sheet surface preparation chapter

---

## 8.2. PET/PETG

PETG is another commonly used material for 3D printing. It is a **great choice for printing mechanical components**. Compared to PLA, it has **higher temperature resistance, is more ductile and therefore less brittle**. Due to its low thermal expansion it holds well on the heatbed and does not warp. Printing with it is almost as easy as with PLA. But unlike PLA, it can offer better mechanical properties. Parts for our printers are printed from PETG!

### Advantages

- High-temperature resistance
- Easy to print
- Low warping
- Tough and durable
- Easy post-processing (sanding)
- Almost odorless
- Glossy surface
- Good layer adhesion
- Water and humidity resistant

### Disadvantages

- Not suitable for printing small/detailed models
- Possible stringing
- Poor bridging and overhangs
- Strong adhesion to the printbed
- Cannot be smoothed with acetone, soluble only in dangerous chemicals
- Supports can be difficult to remove

### Typical use

- mechanical components
- holders and cases
- watertight prints (pots)

### Tips and tricks

Unlike PLA, **PETG requires a heated bed (85°C)**. Its bridging- and overhang-behavior is usually worse, plus it is prone to stringing. Stringing can be moderated with higher retractions and lower nozzle temperature, but we suggest using the PrusaSlicer profiles. It's important to cool the PETG print - this helps to keep the model detailed and prevents stringing and oozing. But if you want the model to be as tough as possible, try to turn off the print fan. Higher filament temperature improves merging between layers, which leads to better mechanical resistance. Otherwise, we recommend printing the first few layers with the print fan off to prevent deformation, then with the fan running at half its power.

**Nozzle temperature:** 240 °C

**Bed temperature:** 80 - 100 °C

**Heatbed:** Various manufacturers suggest **using various separation (or adhesive) layers** for printing PETG, such as Kapton tape, glue stick, etc. Our print sheets work fine without these separation layers but it's important to know a few basic rules. First, keep the print surface clean. When printing on a smooth sheet, use a window cleaner instead of isopropyl alcohol. Textured powder-coated sheets can be cleaned with IPA. Once you finish printing, let the print cool before you try to remove it from the sheet.

---

## 8.3. ASA/ABS

ASA and ABS are very similar materials. ASA is many ways even better than ABS and can be considered a successor to ABS. ASA is UV stable compared to ABS (less yellowing) and shrinks somewhat less when printed. The only advantage of ABS is the easier surface treatment with acetone. Going forward, we will only talk about ASA, but the same goes for ABS.

ASA is a strong and versatile material. A higher melting point than PLA gives ASA excellent heat resistance, your prints will not show signs of deformation up to around 100 °C. Unfortunately, ASA has a very high thermal expansion compared to PLA, which complicates printing, especially for larger models. Even with a heated bed set to 100 °C, the print can begin to warp and peel off the bed. The material also produces an unpleasant odor during printing.

## Advantages

- High impact and wear resistance
- Very good temperature resistance
- Suitable for outdoor use - UV stable
- Soluble in acetone - easy to glue together
- Can be smoothed with acetone vapors
- Detailed prints with no stringing
- Easy postprocessing (e.g. sanding, cutting etc.)

### Typical use

- covers and protective cases
- prototypes
- replacement parts
- toys and figures

### Tips and tricks

Printing with ASA/ABS is much easier when done inside an enclosure. The heated bed will quickly heat the enclosure and reduce the thermal shock on the extruded filament. As a result, both warping and layer separation is decreased significantly. Acetone makes it easy to glue multiple prints together. All you have to do is rub the contact surfaces lightly with acetone and press the parts together. In addition, prints can be smoothed with acetone vapor to give a perfectly glossy finish. Be careful when handling acetone!

**Nozzle temperature:** 245 - 265 °C

**Bed temperature:** 90 - 100 °C. (a larger object requires a higher temperature)

**Heatbed:** It is recommended to **use a smooth PEI sheet** for printing with ASA. The powder-coated sheet might stick too well to your model and might get damaged when you remove the print. Smooth PEI sheet preparation is really easy: Simply clean the surface with isopropyl alcohol (IPA). After printing, **wait for the model to cool down** for much easier removal. Using an enclosure is strongly recommended.

---

## 8.4. PC (Polycarbonate) and PC Blend

Polycarbonate (PC) is a technical material with great tenacity, tensile strength, and heat resistance. However, it's very hard to print, therefore suitable mainly for advanced users. However, this doesn't apply to our Prusament PC Blend, which is significantly easier to print compared to other polycarbonates.

## Advantages

- High-temperature resistance
- High impact tenacity and tensile strength
- Pure polycarbonate is transparent
- Good electric insulation properties

## Disadvantages

- Pure polycarbonate is highly hygroscopic
- High nozzle and bed temperature
- High warping, especially with large models
- Moderate odor during printing
- Application of a separation layer is recommended
- High price

**Typical use:** The best use of PC is for printing technical parts requiring great heat and mechanical resistance.

**Tips and tricks:**

- Consider using an enclosure to prevent warping of objects being printed
- Use a Skirt in PrusaSlicer to reduce warping
- Add Brim around small objects
- Do not print in cold areas

**Nozzle temperature:** 275 °C

Bed Temperature: 110 °C for the first layer, 115 °C for ther est

**Heatbed:** Powder-coated TXT or satin sheet with a glue stick will provide the best adhesion. Note that while the powder-coated satin sheet works perfectly without a glue stick, it is recommended to use a separation layer to prevent surface wear.

## 8.5. PVB

Polyvinyl butyral (PVB) is a material designed for easy smoothing with isopropyl alcohol (IPA). Thanks to its transparency, it's suitable for printing vases, lamp shades and other design objects. Print settings are similar to PLA, while its mechanical properties are slightly better.

### Advantages

- Print settings similar to PLA
- Filament transparency
- Ideal for design parts, vases, lamp shades etc.
- IPA chemical smoothing
- Great surface adhesion
- Good tenacity (similar to CPE)
- Good tensile strength (similar to PETG)
- Low warping (lower than PLA)
- Good for using 0.8mm nozzle

### Disadvantages

- Low layer to layer adhesion
- Hygroscopic filament (absorbs moisture)
- Higher price

**Typical use:** The best use of PVB is for printing transparent models, such as jewellery, vases, lamp shades etc.

**Tips and tricks:** PVB adheres well to a clean smooth PEI sheet or satin TXT sheet. Powder-coated TXT sheet might not provide a good adhesion. When printing transparent parts that require IPA smoothing, it's good to print with a larger nozzle diameter (0.8mm) and with the spiral vase mode on. Printing with more perimeters will make layers visible even after IPA smoothing. Keep the filament dry: PVB is very prone to absorbing moisture. Always put the spool back inside the bag with silica gel or let it dry for 4 hours at 60 °C before printing!

The main advantage of PVB is the possibility of IPA smoothing. PVB models can be smoothed out with IPA fumes (smoothing box or professional smoothing station), washing in an IPA bath or direct application (brush or spray). Detailed smoothing description can be found in our dedicated article, general smoothing instructions can be found in our older article.

**Nozzle temperature:** 215±10°C

**Bed temperature:** 75°C

**Heatbed:** Do not use standard powder-coated TXT sheet. PVB adheres well to a clean smooth PEI sheet or satin TXT sheet. Powder-coated TXT sheet might not provide a good adhesion.

## 8.6. Flexible Materials

Flexible filaments are very strong and elastic materials. In many cases, classic hard plastics may not be suitable for printing a specific model. Whether you are printing a phone cover, an action



camera case, or an RC car wheel, it is better to use a flexible material. However, these materials are relatively uncommon, expensive, and suitable mostly for advanced users due to high print difficulty.

Before you print from Flex, clean the nozzle from any previous material. Start by preheating to the highest temperature you've recently printed at. Then load PLA into the extruder to push out any previous material. When inserting Flex, loosen the pressure on the idler as much as possible.

**Consider using the "Cold Pull" method** to clean the nozzle - see [help.prusa3d.com](https://help.prusa3d.com) for more details. **Print slowly.** The slower, the better. A **typical speed for flexible filaments is usually 20 mm/s**, the maximal recommended speed is somewhere between 30 and 40 mm/s. With higher speeds, you risk clogging the nozzle or tangling filament into the gears. For Original Prusa printers, **we recommend using the "Semiflex or Flexfill 98A" or "Filatech FilaFlex40" profiles** that have proper speed settings.

## Advantages

- Flexibility and elasticity
- Minimal warping
- Good layer adhesion
- Abrasion resistance

## Disadvantages

- It requires extra steps to load the filament
- More demanding to prepare and print, bad bridging and overhangs
- Must be printed slowly
- Higher price
- Hygroscopic - must be stored in a dry environment

**Nozzle temperature:** 230 - 260 °C

**Bed temperature:** 45 - 65 °C (a larger object requires a higher temperature)

**Heatbed:** If you print on a smooth sheet, **apply a separation layer on it** (glue stick or Kapton tape should work). The powder-coated sheets do not need any separation layer - the print will stick just fine and can be easily removed without damaging the surface.

---

## 9. Regular Maintenance

We have designed the MINI+ as a reliable 3D printing workhorse, however, it's still a machine with moving parts, which means it requires maintenance from time to time. Following the instructions below will ensure that your 3D printer will remain in good shape for a long time.

---

### 9.1. Steel sheets

If the printed objects have trouble adhering to the steel sheet surface, you need to wipe the sheet clean. Choose the right cleaning product for your sheet (see below), pour a small amount of it onto an unscented paper towel and wipe the print surface. The bed should be cleaned while cold to achieve the best results - cleaning the bed when hot can lead to potential injury, either from the heatbed or from the nozzle. When cleaning at higher temperatures, the alcohol will evaporate before it can clean anything. More details can be found in the **Your First Print** chapter at the beginning of this handbook.

**The surface does not have to be cleaned before every print! It is just important not to touch the steel sheet with your hands or dirty tools.**

Recommended cleaning products for different types of sheets are listed below:

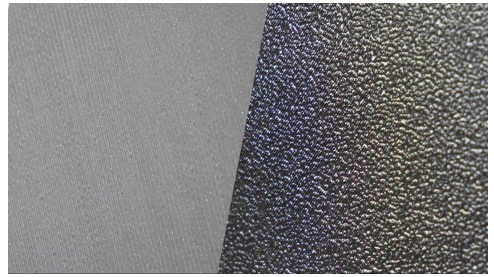
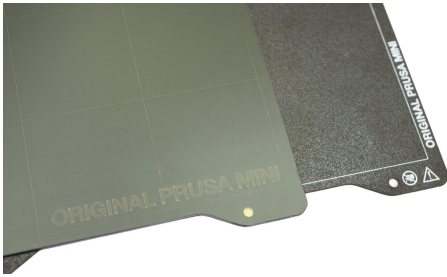
<p><b>Smooth PEI sheet</b></p>	<ul style="list-style-type: none"> <li>✔ Isopropyl alcohol 90%+ (IPA) is the best degreaser. DO NOT use hand sanitizers and similar products even though they may contain IPA, since they usually contain lubricants and moisturizers!</li> <li>✔ Windex - degreasing effect is worse compared to IPA</li> <li>✔ Warm water + few drops with dish soap (in case IPA/Windex don't remove sugar residue on the sheet)</li> <li>✔ Acetone - once in a while to rejuvenate the sheet</li> </ul>	<ul style="list-style-type: none"> <li>✔ Use Windex when printing with PETG</li> <li>✔ Use glue stick when printing FLEX</li> <li>! IPA + PETG will cause the print to adhere very strongly to the sheet. Removing it could be extremely difficult</li> </ul>
<p><b>Textured powder-coated sheet</b></p>	<ul style="list-style-type: none"> <li>✔ Isopropyl alcohol 90%+ (IPA) - best degreaser</li> </ul>	<ul style="list-style-type: none"> <li>! <b>Never use acetone</b></li> <li>! Windex - degreasing effect is worse compared to IPA</li> </ul>
<p><b>Satin powder-coated sheet</b></p>	<ul style="list-style-type: none"> <li>✔ Suitable for both PLA and PETG</li> <li>✔ Isopropyl alcohol 90%+ (IPA) - best degreaser</li> <li>✔ No need for Windex when printing PETG</li> <li>✔ No need for glue stick when printing FlexFill 98A</li> <li>✔ Wide range of supported materials; including advanced materials such as PC Blend</li> </ul>	<ul style="list-style-type: none"> <li>! <b>Never use acetone!</b></li> <li>! Prints from ASA and PC Blend require a brim / skirt / shield around the print</li> <li>! Do not use sharp objects to remove the print from the sheet's surface!</li> </ul>

**!** Calibration values might be slightly **different for different steel print sheets** because the coating thickness varies. If you just switched the steel sheets, **visually inspect the quality of the first layer and adjust the nozzle height** accordingly with Live Adjust Z when **switching between different types of steel sheets**. New firmware versions have built-in steel sheet profiles to save your calibration values.

**!** **Consumable parts**, such as PEI sheets (smooth, textured, etc.) **are not covered by our warranty** because the coatings are designed to diminish over time unless failure has occurred due to a defect in materials or workmanship. Cosmetic damage, including but not limited to scratches, dents, cracks or other cosmetic damage is also not covered by the warranty. Only sheets that are defective on arrival are covered by warranty.

**i** The surface does not have to be cleaned before every print! It is just important to **not touch the steel sheet with your hands or dirty tools**.

**i** All original print surfaces by Prusa Research are coated from both sides



Smooth PEI sheet, Textured powder-coated PEI and the effect on the first layer

---

## 9.2. Spring steel sheet with TEXTURED double-sided PEI

- Scratch-proof surface, damage-resistant
- Transfers texture onto the first layers of your prints
- More forgiving Live Adjust Z setting
- No need for Windex with PETG
- No need for glue stick with FLEX
- Prints usually detach automatically once the sheet cools down
- The first layer can be more squished (see Live Z calibration chapter) compared to smooth sheets
- PLA prints with a small contact area may need a brim
- PLA prints with a huge footprint (across the entire sheet) may warp
- Need to change Live Adjust Z if you also own Smooth PEI sheet
- **Never clean with acetone**

The powder coating applied directly onto metal helped us create a build plate that is **highly damage-resistant**. If a heated nozzle crashes into it, metal can dissipate the heat. Powder coating also gives the surface a **distinct textured look** that will be visible on your prints.

The textured surface hides most of the mechanical damage caused by various tools. Only the top of the small bumps can be scratched, however, these scratches will not affect the bottom of the model.



**Never clean the textured powder-coated sheet with acetone!** Doing so will create microfractures in the PEI texture, which will cause the surface to deteriorate over time.

This surface is used on our print farm, look at the printed parts you have on your printer for reference.

---

## 9.3. Spring steel sheet with SMOOTH double-sided PEI

- Perfect for PLA
- Great adhesion with almost all materials
- Smooth bottom of prints
- Tiny details will stick great
- Rejuvenate with acetone from time to time
- Do not clean with IPA when printing with PETG. Release agent might be necessary.
- You must apply glue stick when printing Flex
- Need to change Live Adjust Z if you also own the textured PEI sheet



**The industrial glue which holds the PEI sheet on the heatbed itself softens when temperatures greater than 110 °C are used.** If higher temperatures are used, the glue can migrate under the PEI and create slight bumps on the surface.

**i** If you notice **small bubbles forming under the PEI sheet simply flip the sheet over and print on the other side.** These bubbles do not affect the print quality and will disappear after a few days or weeks.

---

## 9.4. Spring steel sheet with SATIN double-sided PEI

- Suitable both for PLA and PETG
- Lightly textured surface finish
- Clean only with high-quality isopropyl alcohol (90%+)
- No need for Windex when printing PETG
- No need for glue stick with FlexFill 98A
- Wide range of supported materials, including advanced materials such as PC Blend
- Easy maintenance and good adhesion qualities
- Do not use acetone. Acetone causes the surface to quickly deteriorate
- Prints from ASA and PC Blend require a brim / skirt / shield around the print
- Live Z value needs to be readjusted if you switch sheets (see chapter about Steel Sheet Profiles)
- DO NOT use sharp metal objects (e.g. a metal spatula) to remove the print from the surface.

---

## 9.5. Increasing the adhesion

In some special cases, such as printing a tall object with a very small contact area (with the print surface), you might need to increase the adhesion. Fortunately, PEI is a very chemically resistant polymer and you can temporarily apply various adhesion solutions without damaging it. This also applies to certain materials that would not stick to PEI under normal circumstances. Check the material guide for material-specific instructions. Always stick to safe removal techniques described in this handbook and/or at [help.prusa3d.com](http://help.prusa3d.com).

Before applying anything onto the bed, **consider using the Brim option in PrusaSlicer** which increases the surface area of the first layer.

---

## 9.6. Steel sheet profiles

Both the smooth PEI and textured powder-coated PEI sheets have their advantages as explained in the previous chapters. It is possible that you might have both of them and **switch between them** based on your current needs. However, swapping sheets requires an extra step: **you need to calibrate the Live Z value every time you switch sheets** - this is because various sheets have various thickness.

**To avoid re-calibrating the Live Z value every time you switch sheets, we are introducing Steel Sheet Profiles** (starting with firmware 4.3.0). Navigate to *LCD Menu - Settings - HW Setup - Sheet profiles* to find a list of sheet profiles. Select a profile and **perform the first layer calibration**. This will save the Live Z value into the selected sheet profile. Do this for every sheet you own and **you can then switch between them easily**, either from the Sheet profiles menu, or directly from the Settings menu - look for the name of the sheet in brackets. Click the item to switch to another profile - only profiles with valid first layer calibration are displayed.

By default, you will see the following profiles in the Sheet profiles menu: smooth1, smooth2, textured1, textured2, custom1, custom2. Select any of them to display the following options:

- **Select** - confirms the selection of the sheet, which will then become the default
- **First layer calibration** - starts the first layer calibration process for the selected sheet profile
- **Reset** - sets the first layer calibration values back to the factory defaults.

---

## 9.7. Bearings

After a couple hundred hours of printing, the **smooth rods should be cleaned with a paper towel**. The MINI+ comes with a tube of **Prusa lubricant** and you can also buy it in our e-shop in the Accessories section. Apply it onto the smooth rods (XYZ axes). Then, move the X-axis by hand left and right a couple of times and use the printer's menu to move the Z-axis up and down. Move the heated bed back and forth on the Y-axis. For our detailed maintenance guide, please head to [help.prusa3d.com](http://help.prusa3d.com).

If you feel that one of the axes doesn't move smoothly anymore, the **bearings can be taken out and greased on the inside** (they need to be removed from axis because the plastic lip will prevent most of the grease from getting inside).

---

## 9.8. Fans

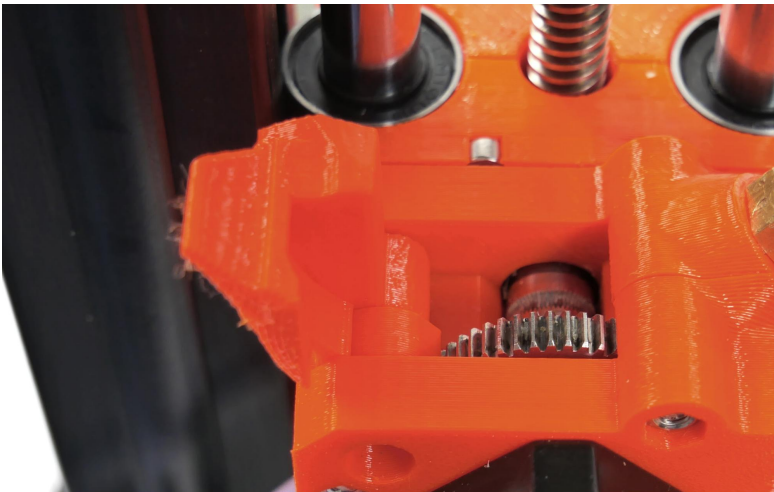
**Both fans measure current RPM** (Revolutions Per Minute), meaning they can detect when the fan suddenly slows down, e.g. due to a piece of filament getting stuck in it. If you get a fan error, check that it can rotate freely; clear any debris that may be stuck in it. Do not try to bypass the fan checks - heated parts could overheat, causing damage to the printer.

**Both fans should be checked and cleaned every couple hundred hours**. Computer cleaner spray (compressed air) will get the dust away and tweezers can be used for little plastic strands. Do not blow compressed air on running fans.

---

## 9.9. Extruder drive gear

The extruder gears do not need any lubrication. Over time, the extruder gears can **suffer from a build-up of filament shavings in the grooves**, which can cause under-extrusion. Use **compressed air** to blow the debris out or use a small brass brush to clean the grooves, a regular toothpick will do the job as well. Check and clean from the access window on the top of the extruder assembly. Clean what you can, then rotate the gear and repeat.



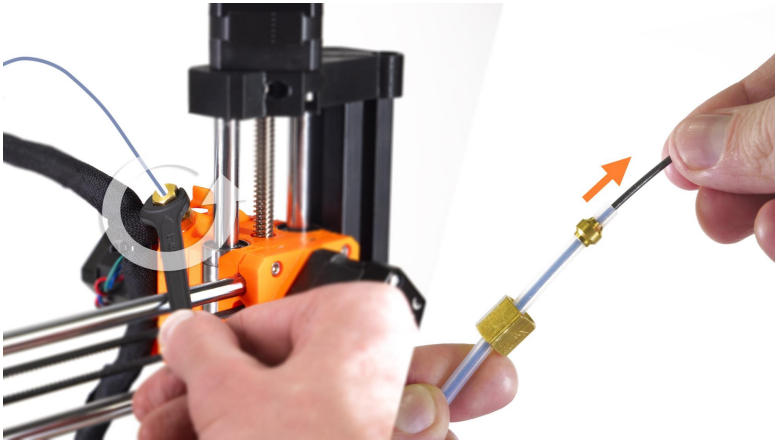
---

## 9.10. PTFE tubes

The MINI+ has **four PTFE tubes** that may need a basic level of attention from time to time. PTFE tubes are used to lead filament strand from the spool, through the extruder, all the way to the nozzle. **Over time, filament debris can accumulate in the PTFE tubes over time.**

Cleaning (or replacing) the PTFE tubes is very easy - **use a can with compressed air** to clean them.

1. The **first tube** leads to the extruder and it can be pulled out with your hand. If you have trouble disconnecting it, you might need to loosen an M3×12 screw in the extruder. **Please see the article "How to access and clean the extruder-pulley (MINI)"** at [help.prusa3d.com](http://help.prusa3d.com)
2. The **second tube** leads from the extruder to the print head. Use a spanner (size 10) to loosen the nuts - this is also useful if the filament failed to load/unload and got stuck in this tube
3. Remove the main PTFE tube (as described in Step 2) and also undo the fittings in the extruder or in the print head to access **PTFE tube three and four**. These only need to be inspected if the filament fails to pass through them.

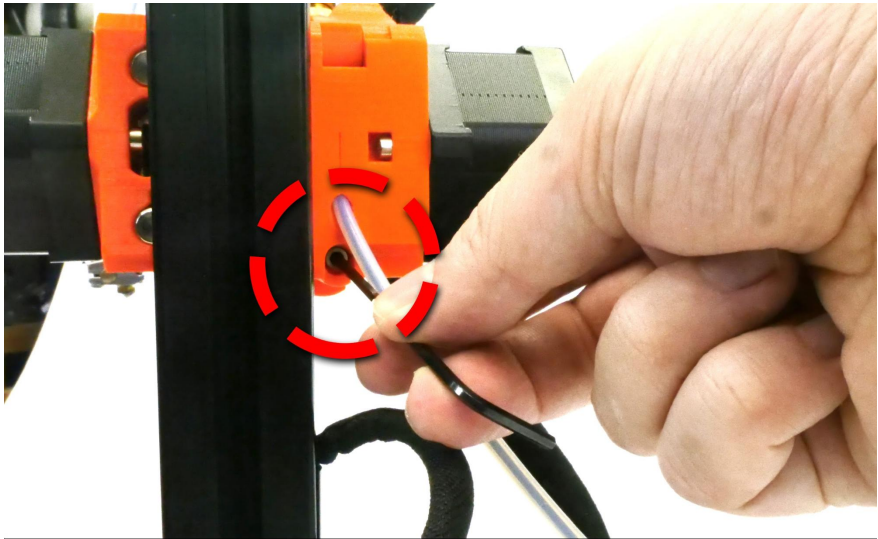


---

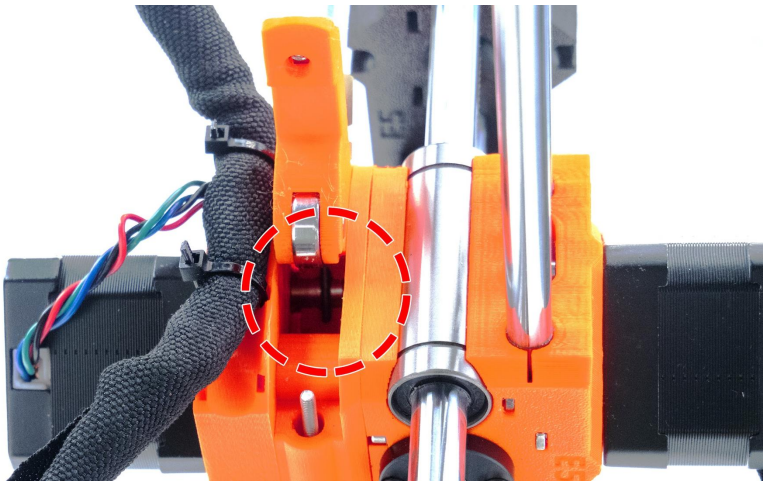
## 9.11. Clogged / jammed extruder

Material clogged in the extruder can cause problems with the printing or with the loading of a new filament.

On the right side of the extruder (when viewed from the front), there's a screw right under the PTFE tube. You can use this screw to increase or decrease the idler's pressure. If you remove the screw completely, you can open the idler door on the left side of the extruder - make sure the print head is on the opposite side of the X-axis.



Opening the idler will enable you to clean both gears easily and/or remove any filament leftovers caught in the extruder gears. It's advised to inspect the gears from time to time and remove any debris caught in the extruder



*Open idler - you can see the strand of loaded filament inside*



---

## 9.12. Nozzle cleaning



Do not touch the nozzle during these procedures - it's very hot and it may cause burns!



To make cleaning easier, move the print head all the way up in the *LCD menu - Settings - Move axis - Move Z axis*. You will gain better access to the hotend.

---

### 9.12.1. The filament is being extruded just a little

If the filament doesn't go through the extruder smoothly and only a small volume is coming out, first check if the extruder fan is working properly and that the **temperature is set correctly (PLA 215 °C; ASA 260 °C, PETG 230 °C)**. Also, check that the filament was correctly loaded into the extruder.

If that is not the case. Follow the instructions below:

1. Heat the nozzle according to the filament you want to print from. Load the filament and **push an acupuncture needle** (bundled with the printer) or a thin wire (0.3-0.35 mm) **into the nozzle from below** - between 1 and 2 cm deep. Wearing gloves is recommended - melted material may pour out unexpectedly.
2. Choose *Load filament* option from the *LCD menu* and check if the filament is extruded properly.
3. Push the acupuncture needle or wire into the nozzle again and repeat these steps several times. When the filament is extruded properly, the nozzle is clear.

---

### 9.12.2. The filament is not pushed out of the nozzle

If you can see the filament passing through the main PTFE tube, yet none of the filament is going through the nozzle, then most likely, your hotend got clogged. In order to fully clear it, please follow these instructions:

1. Heat up the nozzle to 250 °C for PLA or 270°C for ABS jams.
2. Wait 3-5 minutes and then go to *LCD Menu - Load filament*. If you cleared the clog and the filament went through, simply lower the temperature to normal and re-do load filament again.
3. If the filament loads successfully, you can resume printing.

---

## 9.13. Replacing / changing the nozzle

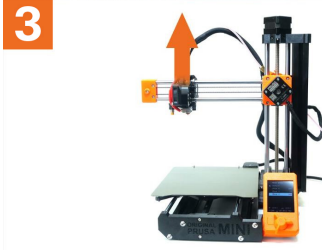


If you are replacing the **Olsson Ruby nozzle**, please visit this website for instructions, otherwise, you might damage it - [support.3dverkstan.se/article/66-the-olsson-ruby-instructions-for-use](https://support.3dverkstan.se/article/66-the-olsson-ruby-instructions-for-use)



**CAUTION: Heated parts can cause severe burns!** Be extra careful around the hotend thermistor leads. You can break them off easily





1. Preheat the nozzle to 290 °C (LCD Menu - Settings - Temperature - Nozzle). **Heating the nozzle is essential for this process!**
2. Unload any loaded filament
3. Gain better access to the nozzle by moving the extruder axis as high as possible: Go to *LCD Menu - Settings - Move Axis - Move Z*.
4. Hold the heater block with a 16mm spanner (or an adjustable wrench). Use pliers, or preferably a 7mm socket to unscrew the nozzle (counter-clockwise). **BE EXTREMELY CAREFUL, THE NOZZLE IS VERY HOT!!**
5. Carefully store the old nozzle in a safe location, insert the new nozzle and tighten it gently - do not use excessive force!
6. Insert a filament and you are ready to print.



The nozzle is hot during this whole process and can cause burns!

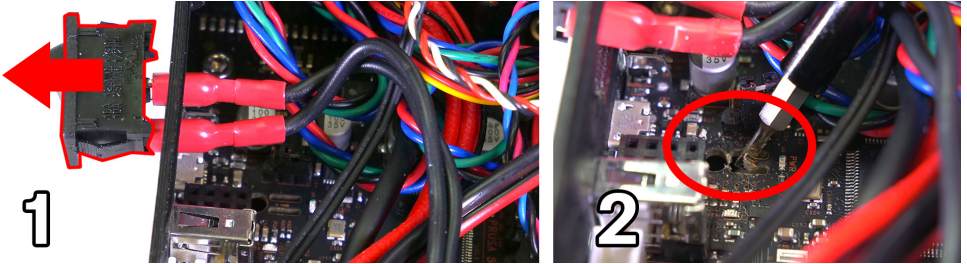


Be careful around the hotend thermistor leads, you can break them easily!

You can bend the heatbreak easily - do not use excessive force! Run First layer calibration after changing the nozzle!

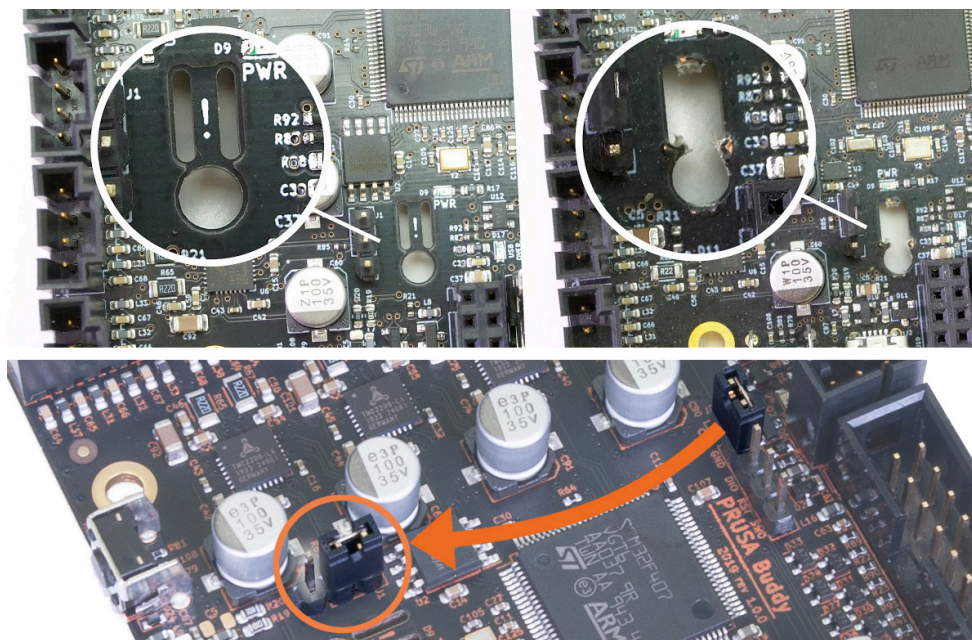
## 9.14. Flashing unsigned firmware

We take safety very seriously. Before every release, our firmware goes through intense testing to verify that **all safety features work properly**. If any of the sensor readings fall out of line, heating is stopped to **prevent any possible damage to the printer and its surroundings**. We cannot verify that these safety features are present in community-made firmwares.



Official firmware is **signed with a private key** and the printer verifies this signature before an update. **To flash your own (or a community-made) unsigned firmware, you'll have to break the appendix on the Buddy board and move the jumper into the correct position. This also voids your warranty on electronics.** First, pull out the power switch to access the appendix (1). Then take a thin screwdriver and carefully break off the middle part (2) - **see the pictures in this chapter!** Also, **check the three pins above it** - there must be a **jumper on the two pins closer to the center of the board**. It's possible that the jumper is installed on a different set of pins - in that case, **move it according to the picture below**. If the jumper is missing, add it before booting.

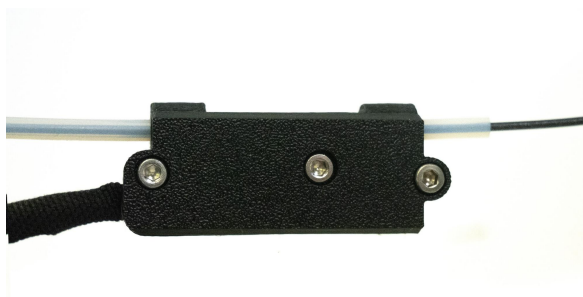
**Breaking the appendix on the Buddy board is IRREVERSIBLE and VOIDS WARRANTY OF YOUR PRINTER'S ELECTRONICS.** If you break the appendix, we disclaim responsibility for any possible damage done to the printer and/or its surroundings (e.g. in case of a fire).



Unbroken (left) and broken appendix (right), the correct location of the jumper (lower photo)

## 10. Filament sensor (optional accessory)

You can **buy a mechanical IR sensor as an optional accessory** for the Original Prusa MINI+. The sensor is **installed onto the end of the PTFE tube** where you insert the filament into the printer, and it needs to be connected to the mainboard. It uses a simple mechanism to **detect whether a strand of filament is inserted or not**. Thanks to the filament sensor, the printer can pause the print in case you run out of filament. Once you insert a new filament strand, you can resume the print.



Installation instructions can be found at [help.prusa3d.com](https://help.prusa3d.com).

---

### 10.0.1. Running out of filament

In case you have the **optional filament sensor**, running out of filament will no longer cause a print failure. If you run out of filament, the printer will automatically pause the print, unload the remaining few centimeters in the heatbreak, and move the X-carriage away from the print. You will be prompted to replace the spool and insert a new filament strand. Use pliers to remove the filament extruded during the loading process. Once this is done, you can continue in the current print.

If you don't have the filament sensor, it's possible that once you run out of filament, the remaining strand will be left in the main PTFE tube and the extruder won't be able to pull it out. **Use a spanner to unscrew the nut on the main PTFE tube** and disconnect it from the extruder. Then, manually, **pull the filament strand out** - don't forget to preheat the nozzle! See chapter PTFE tubes for exact instructions on how to remove the PTFE tube.

---

### 10.0.2. False sensor readings and debugging

If you encounter issues with the filament sensor, such as incorrect (or random) readings, please make sure that the sensor is connected properly. Follow the steps in the assembly guide at [help.prusa3d.com](https://help.prusa3d.com) (Original Prusa MINI+ assembly - Building your MINI+ - 27. Connecting the filament sensor) and open the electronics box cover. Inspect whether the filament sensor is connected correctly and that the wiring is not damaged. Contact our tech support if the issue persists.

---

## 11. FAQ - common issues and how to solve them



Starting with firmware 4.3, the MINI+ will display an error screen with a short explanation of the issue it encountered. This screen also contains a link to a relevant article at [help.prusa3d.com](https://help.prusa3d.com), and a QR code, which you can scan with your mobile phone to display the help page.

---

### 11.1. Skewed X-axis

If **Mesh Bed Leveling fails**, there are two possible causes of this: a faulty SuperPINDA sensor, or a skewed X-axis. The latter is usually the result of incorrect assembly. Loosen the three screws that connect the whole Z-axis assembly to the Y-axis (heatbed). **Re-attach the Z-axis according to the assembly manual**. Pay special attention to the correct alignment of both parts.

Once the 3D printer is reassembled, move the Z-axis (nozzle) close to the steel sheet without touching it. Then, carefully **move the print head from left to right by hand** and observe, whether the nozzle keeps the same distance from the sheet all the time.

Slight deviations are allowed, since the printer can compensate for them thanks to the Mesh Bed Leveling routine.

**A faulty SuperPINDA sensor can be recognized easily.** When you start Mesh Bed Leveling from the Calibration menu, you can see a red light at the top of the sensor. If it turns off during a certain movement or it doesn't light up at all, then the sensor or its cable can be defective. More details can be found at [help.prusa3d.com](https://help.prusa3d.com) - see **Original Prusa MINI+ - Troubleshooting - XZ-axis skew correction**.

---

## 11.2. Printer can't read the USB drive

If the printer can't read the USB drive, first try restarting the printer. In case you see an error say "Error mounting USB drive", your USB drive probably has an incompatible filesystem (e.g. exFAT) or may be too large. Try using a smaller FAT32-formatted USB drive (e.g. 4-16 GB). Please visit [help.prusa3d.com](http://help.prusa3d.com) - section **Original Prusa MINI+ - About your printer - SD cards and USB drives** to learn more about supported sizes and formatting options.

### There are two common situations after inserting the USB drive:

The Print menu is inaccessible after inserting a USB drive

- First, restart the device
- Use a USB drive with a single partition and FAT32 file system
- Try a different USB drive
- If you tried various USB drives and they are still not recognized, your motherboard might be defective. Contact our tech support.

The USB drive is recognized, but **no files are shown in the list**

- Make sure you're using a compatible G-code
- Make sure the file was written onto the drive fully and correctly (use the safe remove function in Windows before you remove the USB drive)
- Try a different flash drive and G-code file
- Try renaming the file to something simple, e.g. print.gcode

---

## 11.3. Loose X- and/or Y-axis belts

Check if both belts are properly tightened, loose belts would cause a printer malfunction and prevent proper printing. The easiest way to check is printing a round object - if any of the belts are not tightened properly the result is an irregular shape instead of a perfect circle. Y-axis belt is located under the heatbed, X-axis belt moves the print head. You can find a detailed guide at [help.prusa3d.com](http://help.prusa3d.com), section **Original Prusa MINI+ - Using the printer - Printer maintenance - Adjusting belt tension (MINI+)**.

---

## 11.4. Filament stuck in the PTFE tube

If a filament strand gets stuck anywhere in the printer, it's generally very easy to remove it. Follow the steps described in the **Clogged / jammed extruder chapter** - disconnect the main PTFE tube and inspect where the filament got stuck and proceed accordingly.

---

## 11.5. X-Axis homing fails

This is most likely caused by the cables leading from the print head to the extruder getting in the way. When the print head is about to hit the right side of the printer (the Z-axis tower), pay close attention whether there are no cables blocking the way.



If you have the assembly kit version, make sure that the cables leading from the extruder to the print head have sufficient leeway. If they are too short, they may prevent the print head from reaching the end of the X-axis.

---

## 11.6. Heating errors

If your printer stops with a red screen and error related to heating, please check the wiring of the heaters and thermistors. See [help.prusa3d.com](http://help.prusa3d.com) for more details.

---

## 11.7. Fan errors

If your printer stops operating and displays an error related to fans, please check the wiring of both print head fans (hotend fan and print fan). See [help.prusa3d.com](https://help.prusa3d.com) for more details.

---

## 11.8. Downgrading the firmware

In some cases, you might need to downgrade the firmware to an older version. To do this, place an older firmware file onto a FAT32-formatted USB drive. Insert the drive into the printer, press the restart button and once the screen shows the Original Prusa MINI+ logo, press the knob once. This will activate the firmware flashing screen. Select Flash to overwrite the current firmware with the one placed on the USB drive.

---

## 11.9. Nozzle hitting the sheet and similar issues

If you have trouble with the first layer calibration or mesh bed levelling, double-check the printer's wiring. Make sure you connected all the cables leading to the electronics box correctly.



If you have the assembly kit version of the MINI+, make sure that the SuperPINDA probe is in the correct position. If the probe is too high / too low, it can cause issues with calibration and selftest.

---

# 12. Advanced hardware troubleshooting



Starting with firmware 4.3, the MINI+ will display an error screen with a short explanation of the issue it encountered. This screen also contains a link to a relevant article at [help.prusa3d.com](https://help.prusa3d.com), and a QR code, which you can scan with your mobile phone to display the help page.

Advanced hardware troubleshooting and part replacement guides are available online through [help.prusa3d.com](https://help.prusa3d.com).

---

# 13. Print quality troubleshooting

If you feel your prints are not fully up-to-specs, or they display some serious quality issues (shifted layers, ghosting, under-extruded parts), you may need to run some troubleshooting. Head over to [help.prusa3d.com](https://help.prusa3d.com) and visit the **Original Prusa MINI+ Troubleshooting** section, where you can find detailed troubleshooting guides along with illustrations and printer-specific instructions.

**Print and share!**

Do not forget to tag your prints with #prusamini while sharing so we can find, pin and showcase them with our

***Pinterest***

<http://www.prusa3d.com/original-prusa-i3-prints/>

**Happy Printing :)**