

PRUSA
RESEARCH
by JOSEF PRUSA



ENG

ORIGINAL INSTRUCTIONS



3D PRINTING HANDBOOK

FOR THE ORIGINAL PRUSA XL 3D PRINTER

Original Prusa XL: Official Instructions

Welcome to the world of 3D printing! Our 3D printers are designed to be as easy to use as possible. Most situations will be covered by the intuitive menu on the screen, but for proper initial setup and configuration, it is necessary to carefully study this manual. It won't take long and in a few minutes, you will be printing!

Some texts may be accompanied by additional instructions in colored boxes - please pay special attention to these texts.



Tips, advice or important information that will help you when working with the printer.



This part of the text is very important, please read it carefully! It depends on both the correct operation of the printer and its safe operation.



This information applies to the Original Prusa XL 3D printer kit.

How to contact Prusa Research technical support:

First, check the last sections of this manual that deal with common problems, or go to help.prusa3d.com where you will find a complete list of the most common problems and their solutions. If your problem is not listed here, or the solution does not work, please send an email to info@prusa3d.com and/or use our chat at prusa3d.com. Try to describe your problem as accurately as possible - ideally include pictures or videos.

XL Official Instructions / User's Manual v1.00 - February 12th, 2023

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About the Author

Josef Průša (*23. 2. 1990) developed an interest in 3D printing when he began studying at the University of Economics in 2009 - it started off as a hobby, a new technology open to modifications and improvements. The hobby quickly became his passion, and Josef became one of the main developers of the international open-source (all works are freely available for any use) RepRap project by Adrian Bowyer. Today, Prusa's design in various versions can be seen all over the world; it is one of the most used printer designs. The goal is to increase public awareness of 3D printing technology.

All of Josef Průša's 3D printers are open-source. In the spirit of the RepRap project, you can use your printer to produce parts for other 3D printers.

The Original Prusa product range is constantly being expanded with new models and improvements. The main goal is to make 3D printing technology more understandable and easier for ordinary users.

Josef Průša also holds workshops for the public, participates in professional conferences, and promotes 3D printing. He has lectured at TEDx conferences in Prague and Vienna, at the World Maker Faire in New York, at the Maker Faire in Rome, and at the Open Hardware Summit at MIT. He has also taught the Arduino course at Charles University and was a lecturer at the Academy of Arts, Architecture and Design in Prague.

In his own words, he envisions a not-so-distant future where 3D printers will be available in every household. If anything is needed, you can easily print it out. The boundaries in this field are being pushed every day... We are glad you are part of it!



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Safety symbols and their meaning



Careful: strong magnetic fields



Careful: mechanical parts. Take care to avoid injury to hands when in close proximity to the device with mechanical parts.



Further information regarding function and service can be found in this user (service) manual or online at help.prusa3d.com.



Before any service intervention, it is necessary to first disconnect the 3D printer from the power source and familiarize with the instructions.



Take extra care when handling or touching parts marked with this symbol, and avoid further risks specified by specific symbols, such as hot surface hazards — burns may occur.



Hot surface! The marked object may be hot and extra care should be taken when touching it.



Unprotected moving mechanical parts can cause injuries, please take extra care.



Do not print directly on this surface.



High electrical currents are being switched on and off in the immediate proximity of parts marked like this. Persons with an implanted cardiac stimulator or other devices for controlling and regulating heart functions must take extra care and consult their doctor before using the 3D printer.



This device is composed of components that must be disposed of in accordance with the Directive on Waste Electrical and Electronic Equipment.



Product Information

Name:	Original Prusa XL
Manufacturer:	Prusa Research a.s., Partyzánská 188/7a, Holešovice, 170 00 Prague 7, Czech Republic
Contacts:	Phone: +420 222 263 718, e-mail: info@prusa3d.com
EEE category:	3 (IT / Telecommunications Equipment), device usage: indoor use only
Power supply:	100-240 VAC, 10 A max., 50-60 Hz
Frequency band:	2400.0-2483.5 MHz
Maximum radio-frequency output power:	< 100 mW e.i.r.p.
WLAN standard:	IEEE 802.11 b/g/n
Operating temperature range:	18 °C (PLA)-38 °C
Maximum air humidity:	85%, non-condensing
Printer dimensions:	Width (incl. Wi-Fi antenna and filament side sensor): 580 mm
	Depth: 700 mm
	Height (incl. cables to extruder): 910 mm
Installed nozzle diameter:	0.6 mm
Weight (with packaging / without packaging):	35.0 kg max. / 25.3 kg max. (without filament)

The product serial number can be found on the type label located on the back of the printer and on the outer packaging.

This device is intended for use in indoor environments only and is protected against external influences.

Operating conditions according to CEPT/ERC/REC 70-03

Declaration of Conformity

Manufacturer Prusa Research a.s. hereby declares that the product Original Prusa XL is in compliance with Directive 2014/53/EU applicable in the European Union and the Statutory Instruments 2017 No. 1206 applicable in the United Kingdom.

The full text of the Declaration of Conformity is available at: prusa.io/xl-documents.

Warranty

The Original Prusa XL 3D printer is covered by a 24-month warranty for end customers in the EU, and a 12-month warranty for business customers and end customers in the rest of the world. Consumables and parts subject to wear and tear are excluded from this warranty.

The warranty period starts on the day the customer receives the goods. The seller is not liable for any damage caused by improper handling of the purchased product, or damage caused by handling in violation of the information and recommendations given in the official manuals and instructions. The warranty also expires in the event of unskilled interventions and the use of unofficial hardware and software modifications.

Safety Instructions and Disclaimer

Acting in contravention of the information provided in the manual may lead to injury, poor print results, or damage to the 3D printer. Make sure that everyone working with the printer is familiarized with the content of this handbook and understands it correctly. As we cannot control the conditions under which the Original Prusa XL printer is assembled, we do not assume any responsibility and expressly disclaim any liability for losses, injuries, damages or expenses arising out of or in connection with the assembly, handling, storage, use or disposal of the product. The information in this manual is provided without any warranties, expressed or implied.

Be very careful when handling the 3D printer. It is an electrical device with moving and heated parts.

Placement and Basic Use

- Make sure that the printer is located and operated in a safe place to avoid potential risks.
- This device is intended for indoor use only. Do not expose the device to water or snow. Contact with water and other liquids may lead to damage to the electronics, short circuits, and other types of damage. Always operate the printer in a dry environment.
- Place the printer in a safe dry place on a horizontal and stable surface - e.g., a work table. Around the printer should be at least 30 cm of space. If there are obstacles close to the printer, it may affect its operation or cause excessive wear of the textile cable sleeves or even the cables themselves. Worn cables can pose a risk (electric shock, fire).
- Make sure that none of the exhausts/fans is blocked. The printer has a built-in fan speed monitoring, but in some cases (incorrect assembly, damage to components, unofficial firmware) the monitoring may not work correctly. Insufficient cooling can lead to overheating and serious damage to the printer (risk of damage to electronics, fire).
- Make sure that the printer is placed so that it cannot be toppled over or dropped to the ground. If the printer has suffered physical damage, do not use it - damaged parts of the printer may pose a safety risk.
- The power cable must be placed so that it cannot be tripped over, stepped on, or otherwise damaged. Place it on a stable, solid surface (e.g., a work desk). If the printer is damaged, stop using the device, turn it off immediately and replace the cable. Damaged cables pose a safety risk - there is a risk of electric shock or fire.
- Do not leave the printer switched on without supervision! The printer has temperature monitoring and a number of smart features for increased safety, but in the case of use contrary to the instructions in this manual or failure of components, there is a risk of fire.
- Never place anything into the printer under the heatbed - the heatbed is a moving part and could crash into objects underneath it!

Electrical Safety

- The printer should only be powered through a standard 230 VAC, 50 Hz or 110 VAC, 60 Hz outlet. Never use alternative power sources as they can cause problems or damage the printer.
- Do not use the printer if the power cord is damaged in any way – damaged cords can lead to electric shock.
- When disconnecting the power cord from the outlet, pull the plug, not the cord, to reduce the risk of damaging the plug or outlet.
- Never disassemble the power source of the printer as it contains no parts that can be repaired by an untrained worker. Always take the printer to a qualified service technician for repairs. Improper interventions in the power source may lead to damage to the printer and an increased risk of electric shock.
- The device is disconnected from the power supply by pulling out the plug. The electrical outlet must be easily accessible.

The printer is equipped with a replaceable fuse located in the fuse holder near the connecting connector of the power source and it protects the entire printer. Before replacing the fuse, switch off the printer and disconnect the power supply by pulling out the power cord from the outlet. Push the fuse holder out using a flat screwdriver, remove the fuse and insert a new one. Push the fuse holder back in place. Always make sure the new fuse has the same value as stated on the label (F10AH/250V). If the fuse blows repeatedly, contact the service.

Mechanical Risk

Moving mechanical parts of the printer can cause injury.

- Never interfere with the inner components of the printer when it is connected to the power supply or running – there is a risk of injury from mechanical parts or electric shock.
- Prevent children from manipulating the printer without the supervision of an adult – even when the printer is not printing.

Burn Risk

- Do not touch heated parts of the printer – heatbed, print plate, and parts of the printhead. There is a risk of burns.
- Warning! During printing, parts of the printhead and the print plate can heat up to very high temperatures! Do not touch them until the printing ends and the printer cools down – otherwise, you may get burned.

Proper Use of Double-Sided Print Sheets

Each type of print sheet requires slightly different maintenance. Improper handling and use can lead to damage to the print sheet, heatbed or other parts of the printer. Print sheets are consumable and subject to wear.



The surface of the textured and satin print sheet must not be cleaned with acetone!

- Please refer to the **Flexible Print Sheets chapter** for maintenance instructions.
- To degrease the sheet's surface, use highly concentrated isopropyl alcohol (90% or higher).
- Do not use products that contain IPA as one of the components (e.g. hand sanitizers) - these products usually contain other additives that may negatively affect the properties of the printing plate.
- Do not wash under running water - the sheet may start to rust.
- Do not remove the PEI film from the plate surface.
- Before printing, clean the sheet's surface with an isopropyl alcohol-dampened wipe.
- Printing sheets are held in place on the heated bed with strong magnets - be careful when placing the sheet on the heatbed to avoid injury.
- Do not slide the sheet when it is attached to the heatbed with magnets - the friction may lead to damaging the heatbed.

Working with Filaments

When handled correctly, working with filaments is straightforward and safe. Please read the following recommendations.

- Always use the recommended temperatures for the selected material.
- Beware of molten plastic - it can cause burns! If there is molten plastic stuck in the nozzle, do not remove it by hand - use pliers or other tools.
- Some materials may emit a strong odor when printing - regularly ventilate the room.
- Handle the filament according to the instructions on the following pages of the manual.
- Always make sure that the end of the filament is properly secured (either in the extruder or in the spool). If you accidentally release the end of the filament, it may easily tangle up and create knots.

1. Introduction

Thank you for purchasing the Original Prusa XL 3D printer from Prusa Research! Your support allows us to invest in further development of 3D printers and other 3D printing products. The Original Prusa XL is a great option for beginners, hobbyists, companies, and even for setting up a 3D printing farm.



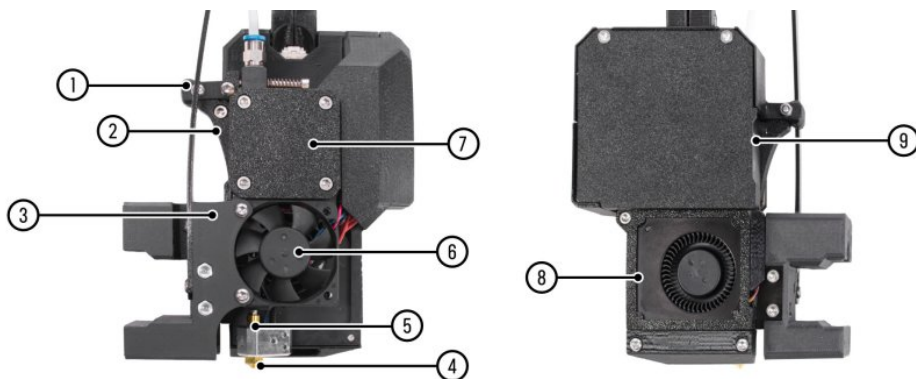
i The latest version of this handbook can be found at prusa3d.com/drivers in PDF format.

If you encounter any problems while using the printer, do not hesitate to contact us at info@prusa3d.com. We will be happy to answer your questions or hear your ideas for improvement. You can also visit our Knowledge Base at help.prusa3d.com or the user discussion forums at forum.prusa3d.com.

2. Original Prusa XL Overview and Glossary



1. Extruder (Nextruder)
2. Filament sensor / Filament insertion point (on the side)
3. Spoolholder (with a spool installed)
4. Print sheet
5. LCD
6. Control Knob and Reset Button
7. USB port
8. Heatbed (moves along the Z-Axis)
9. PTFE tube / Extruder cables
10. Extruder cables and PTFE tube



1. Idler Nut
2. Idler
3. Nextruder body
4. 0.6mm nozzle
5. Heater Block (part of the Hotend assembly)
6. Heatsink Fan
7. Gearbox and extruder motor
8. Print fan
9. Control buttons (extrude / retract filament - works only when the nozzle is preheated)

2.1. Contents of the Package and Accessories

Your Original Prusa XL printer package includes:

- USB drive with sample prints (G-codes)
- XL Tools
- Silicone sock for the nozzle (see help.prusa3d.com for installation instructions)
- Alcohol-saturated wipes, acupuncture needle
- Double-sided Satin Print Sheet
- 1 kg spool of Prusament filament

These are the basic tools necessary for assembly and basic maintenance. We recommend purchasing a few extra accessories, such as: cutting pliers (for cutting the end of filament), isopropyl alcohol, paper wipes, and a plastic spatula (for removing plastic from the print sheet).



Not the standard 0.4mm nozzle!

The Original Prusa XL comes with a 0.6mm nozzle preinstalled. The larger nozzle diameter offers a great detail-to-print speed ratio. If you need to print more detailed objects, you can easily replace the nozzle with a smaller diameter model, or use an adapter and choose any V6-compatible nozzle (available in our e-shop at prusa3d.com)

2.2. How to Move the Printer

If you want to move the Original Prusa XL printer, use the recommended method - **pick up the printer using the integrated holders on the sides**. Due to the weight of the printer, **we recommend moving it with the help of a second person**. Never lift the printer by the cables, filament holders, and profiles on the Y-axis or the X-axis.



2.3. Disconnecting the Power Source



Always pull the connector, do not pull on the cable itself! Incorrect handling can lead to damage to the connector or cable.

If you encounter any issues with your 3D printer, we recommend first going through the last chapters of this manual, general print troubleshooting guides or visiting our Knowledge Base at help.prusa3d.com. If you cannot find a solution to your problem, contact our customer support via email at info@prusa3d.com or via chat at prusa3d.com - the Live Chat window is located in the bottom right corner.



2.4. Error Screens

If the printer encounters a critical error, **an error screen will be displayed with a description of the error**. The information on the screen is intended to facilitate easy identification, diagnosis and resolution of the error. **Pay special attention to the text on the screen**. Most error messages are supplemented with a QR code - scanning them (e.g. using a camera on a mobile phone) will take you to a relevant article with instructions on how to proceed.



3. Your First Print

To get your printer up and running, please pay attention to the information in the following chapters. We will go through the basics together - you'll be printing in no time!

In this chapter you will learn how to:

- Control the printer
- Prepare the print sheet for the first print
- Perform initial calibration
- Insert filament
- Start the first print
- Remove the print
- Troubleshoot basic issues
- Update the firmware

3.1. Basic controls

All configuration steps and overall control of the printer are done with one control element - a rotary knob. **Rotate it to select items on the screen and press it to confirm your selection.**

The reset button is located under the rotary knob. Pressing the reset button is the same as quickly turning the printer off and on again. It is useful in cases where it is necessary to immediately stop an action that the printer is currently performing.



3.2. Selftest Calibration (Wizard)

When you first power on the Original Prusa XL, the Selftest calibration wizard will start. **The wizard will walk you through the initial calibration and all necessary tests to start printing.** Completing the entire checklist is mandatory. But don't worry, it's gonna be super easy, barely an inconvenience!



The purpose of the calibration is to check whether your printer is in a good shape. It's a one-time process that doesn't need to be repeated before every print. Run it again if you encounter issues with your printer (more on that in the advanced sections of this handbook).

The Wizard will provide you with text descriptions and illustrations of the individual steps. It is designed to make the process as automated and understandable as possible. For clarity, some actions are further described in the following lines.

You can also start the Wizard manually using the *LCD menu - Calibration*. The Wizard will require you to install a print sheet - we will look at the correct handling in the next chapter. A comprehensive explanation of print sheets and proper maintenance along with an explanation of which ones are suitable for which purpose can be found in the **Regular Maintenance chapter**.

One of the things the Wizard will require to do is to **place the print sheet onto the heatbed**. Let's do it now.

3.3. Preparing Flexible Print Sheets



Make sure there are no obstacles or objects under the heated bed, otherwise the heatbed could crash into them when moving down.



Do not drag the print sheet across the heatbed, especially when it is attached with magnets - you might damage the heatbed.

The Original Prusa XL comes standard with a double-sided satin print sheet. If you have a different type, we recommend that you **carefully study how to properly treat the surface**. For the initial calibration, it is enough to only wipe the bed using the supplied cleaning wipes soaked with isopropyl alcohol. How to properly maintain different types of print beds can be found in the **Regular Maintenance** chapter.

There are high-temperature magnets embedded into the heatbed that hold the removable flexible print sheets in place. On the back of the heatbed, you will find two pins that fit exactly into the cutout of the print sheet. **Before installing the sheet onto the heatbed, make sure that it is perfectly clean. Never print directly on the heated bed!**



Attach the sheet by first aligning the rear cutout with the locking pins on the back of the heated bed. (marked in orange in the picture above). Hold the sheet by the front two cutouts and slowly lay it down onto the heated bed - **watch your fingers!**



Important: It is absolutely essential that the print sheet is properly attached to and aligned with the heatbed - the cutout must match with the two pins on the rear and the bed must not be skewed, otherwise the risk of hitting the end stops of the Z-axis arises. Be careful of your fingers, the magnets are strong!

Before you proceed, open the packet containing the cleaning wipes soaked with isopropyl alcohol and wipe the print bed with it.

3.4. Running the Selftest



During the Printer Selftest, do not manipulate or touch the printer. If the printer is placed on an unstable surface or if there is another running 3D printer next to it, it may affect the accuracy of the calibration negatively. The printer should be placed on a stable surface.

For the Selftest and the filament sensor calibration, **you will need at least 130 cm (4.5 ft.) of filament.**

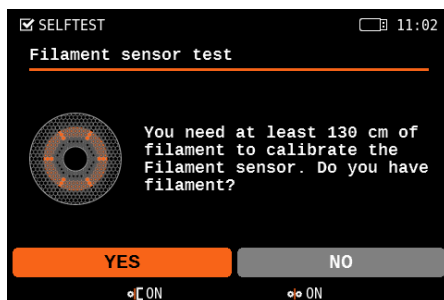
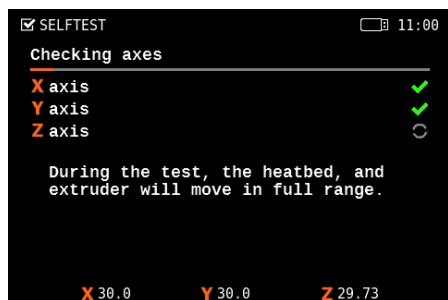
The Selftest is a set of **various tests that serve as a diagnostic tool**. With their help, you can detect the most common problems, such as **incorrect wiring of cables**. The progress and results of each test will be displayed on the LCD. If the Selftest detects an error, the testing will be interrupted and the cause of the error will be displayed on the screen.

The Selftest includes:

- Test of the extruder and the print fan
- Test of the X, Y, and Z axis
- Proper connection of the heated bed and the hotend
- Loadcell test
- Setting up the filament sensor - more info on inserting filament is in the two paragraphs below

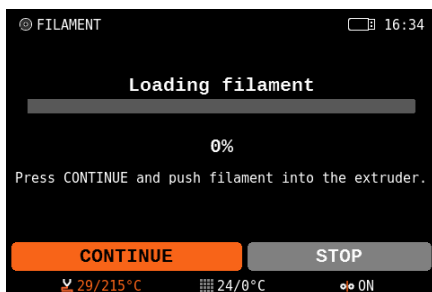
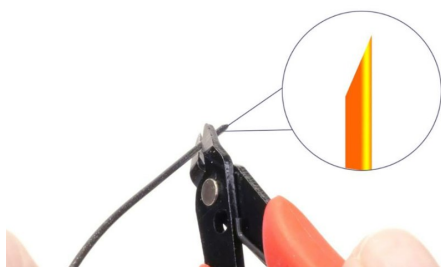
When the Selftest is completed, you can insert the filament from the spool you want to use for the first print. If you are starting with the printer, **we recommend choosing PLA** for the initial print, as this material is easy to work with and does not require complex pre-print preparation. If you don't have PLA, read the **Materials chapter** carefully to learn how to properly prepare the print surface. Whenever you insert the filament, make sure that its end is sharp and that there are no bumps or other anomalies on the filament that would prevent it from passing through the PTFE tubes easily.

Before you insert the filament, **start by placing the filament spool on the side holder**. Be careful **not to let go of the end of the filament strand** - the spool could easily tangle up.



3.5. Inserting filament

1. **Cut the end of the filament into a sharp point.** Insert the filament into the PTFE tube on the side. If the filament sensor is on, the filament will be automatically fed. If the filament sensor is off, proceed to step 2.
2. Select the *LCD Menu - Filament - Load Filament* and confirm with the button.
3. The Preheat menu will automatically appear. Select the **material of the filament you want to insert** and confirm the selection with the rotary knob.
4. Wait until the nozzle reaches the desired temperature.
5. Press the rotary knob to start feeding the filament. Push the filament into the PTFE tube lightly until you feel that the extruder gear grabbed the filament and is pulling it in.
6. The feed wheel in the extruder will then feed the filament further into the extruder. Once it heats up fully, it will push out a bit of material from the nozzle. **The printer will ask if the color of the extruded filament is okay.** The message on the screen will say: Yes / Purge More / Retry. Check if there is filament extruded from the nozzle, then select:
 - If the filament is extruded and the color is correct, select YES
 - If the filament is not extruded or is contaminated with another color, select: PURGE MORE (you can repeat this step)
 - If the filament is not extruded and PURGE MORE doesn't help, repeat the loading procedure by choosing RETRY

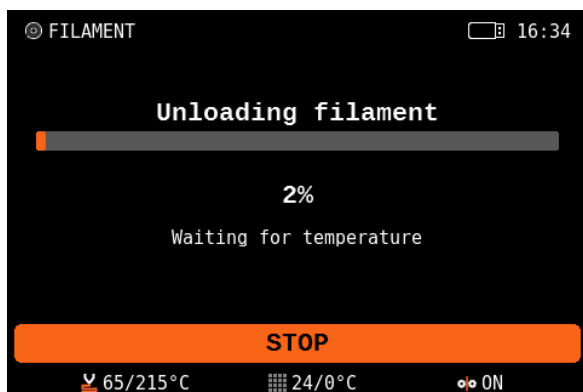


The printer remembers which filament is inserted into it even when you turn it off. The type of filament is displayed in the lower section of the LCD menu.

For the next step (Start the First Print), leave the filament inserted in the printer. If for any reason you need to change the filament, the procedure is as follows:

3.6. Removing Filament

1. Select *LCD Menu - Filament - Unload Filament*
2. The printer will preheat automatically. As soon as it reaches the right temperature, the filament will be unloaded from the extruder in a few seconds.
3. Once the extruder stops extruding the filament, remove it from the PTFE tube by hand. The filament needs to be wound up on the spool carefully so that it does not tangle up.

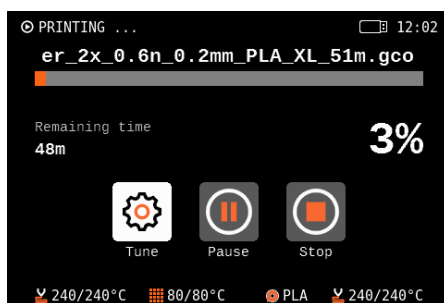
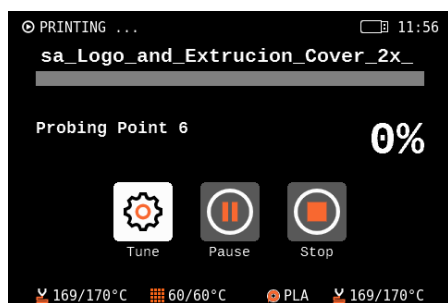


3.7. Starting the First Print

If you haven't done it already, clean the print sheet with the enclosed wipes saturated with isopropyl alcohol and select one of the test objects from the Print menu (only appears if a USB drive is inserted). Confirm the selection with the button. Watch the printer closely during the first print. We recommend **selecting the PRUSA logo or First Layer Test**. These give you the best and fastest overview of whether everything is properly set up.

The nozzle will first preheat to 170 °C independently of the selected filament - the temperature is lower to prevent the filament from dripping from the nozzle. Then, the printer performs **Mesh Bed Leveling** - the nozzle will check the distance to the print sheet in several places to **create a virtual height map of the surface**. This allows the printer to lay down a perfect first layer every time.

Subsequently, the printing of the object or objects will take place.



Carefully observe the quality of the first layer. The Original Prusa XL is equipped with very accurate LoadCell technology, which measures the distance between the nozzle and the bed with perfect accuracy. However, it may happen that **due to, e.g., traces of grease, the print may not hold well**. If you find that the plastic is peeling off the bed, **stop the print by selecting the Stop print icon on the screen**. Clean the bed and try again. If the first print fails repeatedly, go to the **First Print Troubleshooting chapter**, where you will find useful tips and tricks.

3.8. Removing a Printed Object from the Print Sheet

Once the printing is finished, wait until the print sheet cools down. The print plate and heated bed may exceed 100 °C, depending on the settings - contact with unprotected skin can cause burns. Check the heatbed temperature in the footer of the LCD screen.

Depending on the type of material, it may happen that the print will separate from the print sheet automatically by itself after cooling. If not, remove the print plate and carefully bend it on both sides. Then turn it by 90° and repeat the bending. **Be sure to remove all pieces of plastic** - don't forget the introductory line on the edge of the plate.



! If there are plastic remnants on the plate, do not remove them with your nails, you could get injured. Use a plastic spatula to remove the remaining plastic.

i Try not to touch the print surface with your fingers - fingerprints are greasy and can reduce adhesion.

3.9. First Print Troubleshooting

The calibration and pre-print setup of the Original Prusa XL are fully automated - the filament is automatically inserted, axes checked and the first layer precisely measured. If a printing issue does occur, it usually falls into one of the following scenarios:

3.9.1. First layer peeling off from the bed

Solution: The most common cause is **grease on the bed** or an unsuitable combination of material and print surface (e.g. PLA and textured sheet). Make sure that the sheet is sufficiently **degreased using isopropyl alcohol** - more information can be found in the Preparing Flexible Print Sheets chapter. In the Materials chapter, you can find information on how to properly print specific filament types. Water with a bit of dish soap is also an option if you don't have access to IPA - **make sure to clean and dry the sheet thoroughly to prevent rusting**.

3.9.2. Nozzle moves too high/low, or extrudes plastic outside the print area

Solution: Make sure that the print sheet is properly mounted. Due to its size, it may be mounted incorrectly on the heatbed, causing it to hit the end stops of the Z axis (affecting the axis calibration) or it may be shifted outside the print area. **Make sure that nothing is obstructing the movement of the axes** and that all packaging material and transport fixations have been removed from the printer. Run the Auto Home calibration from the menu to test all three axes.

3.9.3. The nozzle does not start extruding, even after multiple attempts

Solution: Make sure that the PTFE tube is not blocked and that the filament can freely pass through to the extruder. The filament must have a sharp tip. The extruder has a clamp at its front. Unclamp it and flip the doors open - this will give you access to the feed wheel. Make sure that the filament strand can reach the edge of the feed wheel.

3.9.4. After a few hours of printing, the nozzle stops extruding filament

Solution: Remove the hotend from the extruder (see help.prusa3d.com for exact instructions) and check if the steel filament guide is deformed. This might happen when you overtighten the nozzle assembly.

3.10. Updating the Firmware

The Original Prusa XL is ready to print once assembled and powered on. To make sure you have the most up-to-date version of the firmware with the latest features and settings, we recommend checking prusa3d.com/drivers. You can perform the firmware update after you perform the initial Selftest.

To check your firmware version, navigate to Info - Version info.

Follow these instructions:

1. Download the correct version of the firmware from prusa3d.com/drivers and unzip the file.
2. Copy the .BBF file to a USB drive formatted with FAT32 - you can use the USB drive that comes with your Original Prusa XL printer.
3. Insert the USB drive into the printer.
4. Restart the device using the reset button (located under the rotary knob).
5. The update process should begin automatically. Confirm flashing by selecting FLASH and pressing the knob.
6. Wait until the process is completed.



To force a firmware installation (e.g. if you need to load an older firmware), insert the USB drive containing the desired .BBF file, restart the printer, wait for the logo to show up and press and hold the control button during the system startup until the firmware installation screen appears.

3.11. Sample Models

The USB drive that came with your Original Prusa XL 3D printer contains a number of sample files (G-codes). We recommend keeping them on the flash drive. These files have been prepared (sliced) and thoroughly tested by us. If you encounter issues with print quality at any time, try loading and printing one of the sample files - especially the Prusa Logo and the First Layer Test. These sample files are designed to test the basic functionality of your Original Prusa XL.

If your print fails and the sample files are printed correctly, it means there's probably an issue with the way your files are sliced. Try reslicing them again with the default PrusaSlicer settings and check for the basic issues:

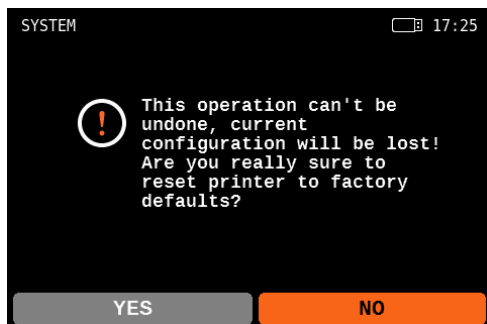
- Incorrect printer/nozzle profile (the Original Prusa XL is equipped with a 0.6mm nozzle by default)
- Incorrect material settings
- Missing supports
- Incorrectly configured infill
- The model is not in contact with the print sheet

If the sample files are not printed correctly, check the Troubleshooting section, our Knowledge Base at help.prusa3d.com or contact our tech support.

3.12. Factory Reset

If you feel like you changed settings that have negatively affected your 3D printer, you can always revert to factory default values and try again.

Factory Reset can be done via *LCD Menu - Settings - System - Factory Reset*. This will reset all the saved values to their default state.



4. Advanced User Guide

This part of the handbook covers everything you need to know once you manage to successfully print your first sample object. Network connection, printing your own models, slicing - all this (and more) is covered on the following pages.

4.1. Prusa Academy Courses

Become an expert in 3D printing! Our Prusa Academy offers **comprehensive online courses on various 3D printing-related topics**. Each course features easy-to-read texts with many pictures and short videos, links for inspiration and further study, quizzes for testing your knowledge, a certificate of completion and more! With our online courses, you can quickly learn how to model your own models and master advanced 3D printing techniques. Visit academy.prusa3d.com to join!

Design Principles for 3D Printed Parts

100% complete

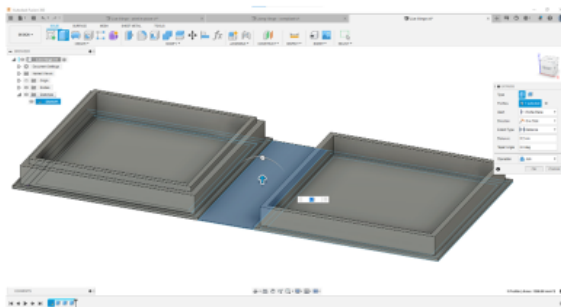
- 1 Getting started
- 2 3D printing limitations
- 3 **Applied design**
 - ✓ 3.1. Vertical holes
 - ✓ 3.2. Sacrificial columns
 - ✓ 3.3. Sacrificial layers
 - ✓ 3.4. Staggered layers
 - ✓ 3.5. Fillets and chamfers
 - ✓ 3.6. Embedding items mid-print
 - ✓ 3.7. Threads
 - ✓ 3.8. Print in place mechanisms
 - 3.9. Compliance and living hinges
 - ✓ 3.10. Splitting model into multiple parts
 - ✓ 3.11. Multiple assembled parts
 - ✓ 3.12. Integrated part strength
 - ✓ 3.13. Quiz: Applied design
- 4 What's next?

☐ Share your feedback

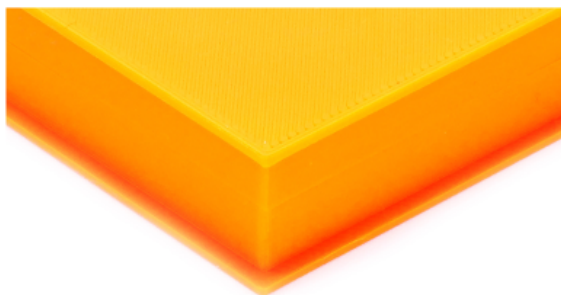
☐ Need help?

Box with a living hinge

The design process is extremely easy, simply extrude a rectangular shape connecting your two objects and extrude it to the desired height.



Since the square will connect both the base and the lid, you need to make sure you have enough distance to allow the hinge to flex without breaking or additional bending stress. The total height of the box once closed, in this case, is 16mm from base to surface:



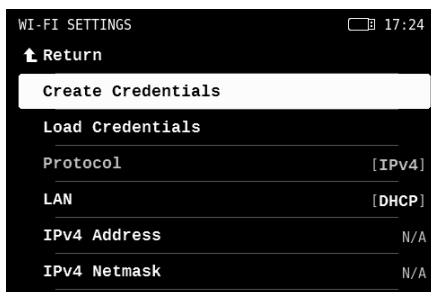
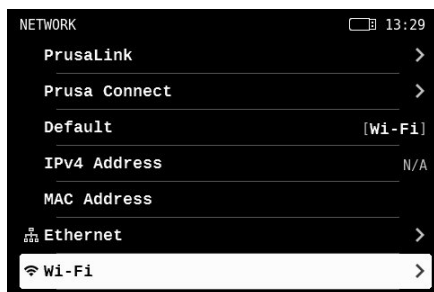
Closed box with a height of 16 mm

4.2. Network Connection

Original Prusa XL has an onboard Ethernet (RJ45) interface and a Wi-Fi module for connecting to the network.

Please be aware that some of the network functions may not be fully implemented in the shipped firmware version. Please check our website prusa3d.com and social media for information on the latest firmware versions.

Original Prusa XL can be connected to a local network (LAN/Wi-Fi), which allows you to have an overview of various functions of the printer through the web interface called PrusaConnect. The printer has DHCP enabled by default. If you need to check if the printer was assigned an IP address correctly, you can check it in *LCD Menu - Settings - Network*.



To connect the printer to a wireless network, please navigate to the *Network* menu and select *Wi-Fi*.

1. Make sure a USB drive is inserted and recognized by the printer.
2. Select the Create Credentials option. This will create a `prusa_printer_settings.ini` file on the USB drive.
3. Remove the USB drive from the printer and insert it into your computer.
4. Open the `prusa_print_settings.ini` file in a text editor.
5. You will see two parameters: `ssid=` and `psk=`. It is necessary to enter your Wi-Fi network information after the "=" sign. For example `ssid=My_Network`, `psk=MyWiFiPassword_1138!`. Use the correct login details for your Wi-Fi network, this name and password are for demonstration only.
6. Save the file.
7. Put the USB drive back into your printer and select Load Credentials. This will upload the Wi-Fi network login information into your printer.
8. You should be connected to Wi-Fi in a couple of seconds.

Subsequently, on a computer or mobile phone connected to the local network, open a web browser and go to connect.prusa3d.com and log in with your Prusa Account. You will be taken to Connect, our web UI for remote printer management.



For more information about connecting to Wi-Fi networks and activating Prusa Connect online features, please check our website help.prusa3d.com.

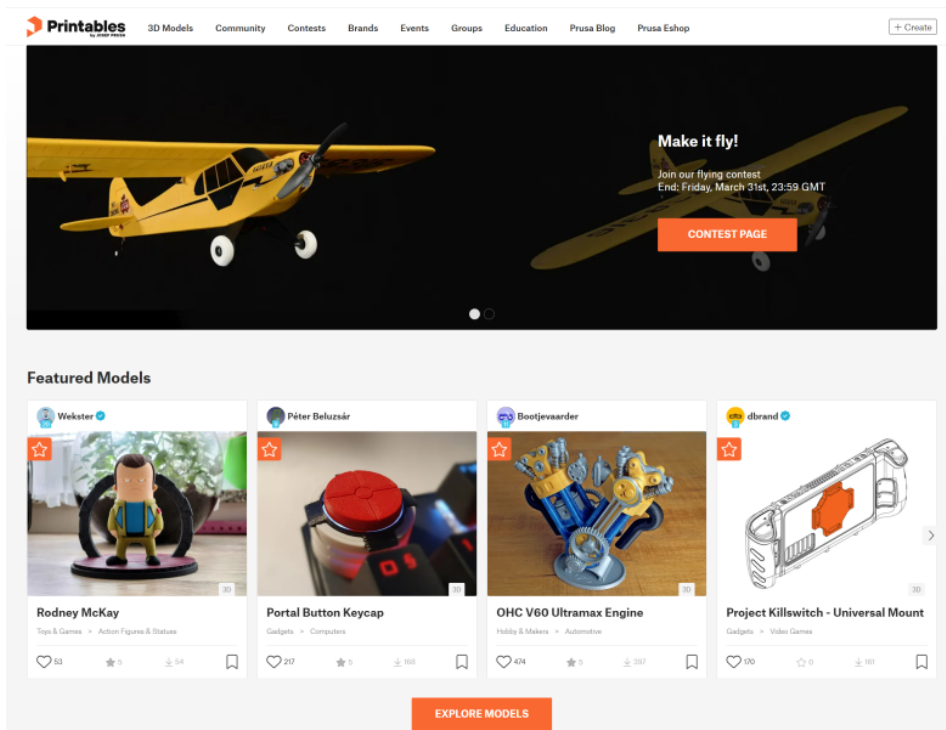
4.3. Obtaining Printable Models

The easiest way to start with 3D printing is to **download models from the internet** - they are usually in .3mf, .stl or .obj formats. Luckily, there are many enthusiasts in the 3D printing world, so **a large number of 3D models are available for free**. You can download anything from a simple die to detailed figures from your favorite games, movies, and series; mechanical parts, RC accessories, various household items, and even massive complex projects.

Get the best models at Printables.com!

One of the best places for free 3D models is [Printables.com](https://www.printables.com), a large online library **full of high-quality 3D models** managed by Prusa Research. Its main goal is to bring together a large community of designers, creators, and 3D printing enthusiasts - regardless of the brand of 3D printer they prefer. There are **regular community contests with 3D printers and filaments as main prizes**, and there is also a rewards system with virtual and physical goods - simply by being an active member, you can collect points and exchange them for a spool of Prusament or other cool stuff.

Thanks to its focus on high-quality, unique, and useful 3D models, you are only a few clicks away from discovering something new and amazing to print. And before you actually download and print something, you can use the advanced built-in 3D model viewer, which works with STL and 3MF files as well as G-codes. Visit [Printables.com](https://www.printables.com) and discover all kinds of activities, contests, events, groups, collections, and more!



Models are usually available to download either for free under the Creative Commons - Attribution - Non-Commercial License (models cannot be used commercially and must always include the author's name), or for a small fee. We have selected the most interesting websites for you:

- www.printables.com
- www.thingiverse.com
- www.myminifactory.com
- www.pinshape.com
- www.youmagine.com
- www.shapeways.com
- www.gambody.com



Keep in mind that models in .stl, .obj, etc. formats cannot be printed directly. First, these files need to be "sliced" (prepared for printing), which results in a G-code file. This file contains the actual instructions for the printer. You place the G-code on a USB disk and then insert it into the printer. Then you just start printing. You will find out more in chapters What is a G-code file? and PrusaSlicer.

4.4. Create Your Own Model

To create your own 3D model, you need a special program - a 3D editor. There is a wide range of different programs available, so you can choose the one that best meets your needs.

To get started, the best option is Tinkercad (www.tinkercad.com) - an online editor which runs in your browser window, with no installation required. It is free, intuitive and there are a lot of tutorials available online. Tinkercad is mainly focused on the creation of less detailed and larger (mechanical) parts, ideal for FFF/FDM printing. Your XL will have no problems printing them. Another popular tool is Autodesk Fusion 360 (www.autodesk.com/products/fusion-360) for PC, Mac and iPad. On the web, there is a simple guide available along with a lot of detailed video tutorials, making it an ideal choice for both beginners and professionals. Check out our Prusa Academy for some great beginner tutorials at prusa3d.com/category/prusa-academy!

4.5. What is a G-code File?

3D models you have either created or downloaded from the internet need to be converted from their original format (.stl, .obj, .3mf, etc.) into a file containing specific instructions for the printer - the G-code. This is the format that 3D printers can understand. This file contains instructions about the movement of the nozzle, the amount of filament to be extruded, temperature settings, fan speeds and more.

There are dozens of different slicers available, each with its own advantages and disadvantages. We suggest using our PrusaSlicer.

4.6. PrusaSlicer

As the name suggests, PrusaSlicer is our own in-house developed slicer software based on the open-source project Slic3r. PrusaSlicer is an open-source, feature-rich, frequently updated tool that contains everything you need to export the perfect print files for (not only) your Original Prusa XL. The standout features of PrusaSlicer are:

- Clean and simple UI
- Fine-tuned print and material profiles with automatic updates
- Precise print time/feature analysis
- Customizable supports and modifiers
- Built-in shape gallery
- Variable layer height
- Color painting
- Various print settings

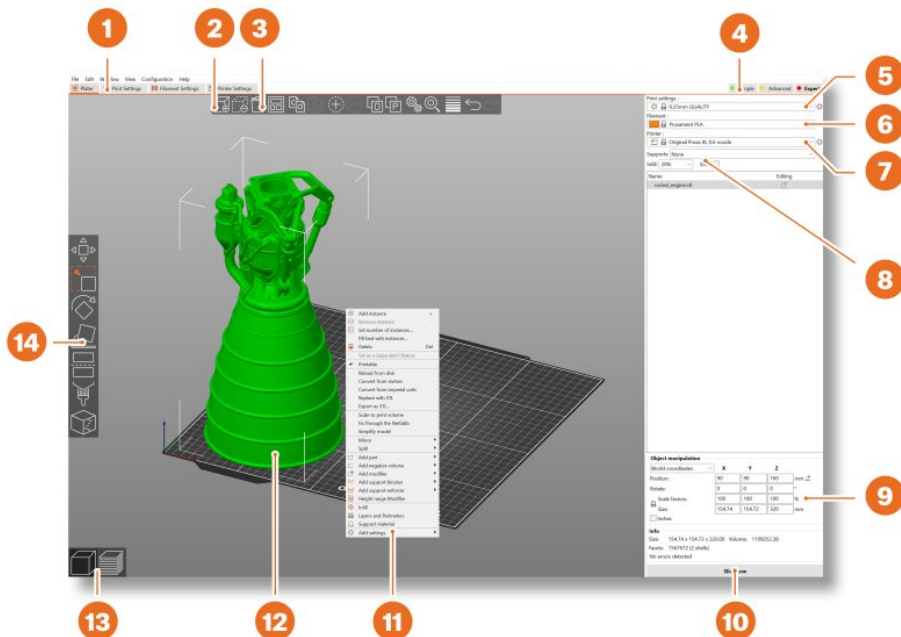
Thanks to the strong community and a dedicated team of developers in Prusa Research, PrusaSlicer is **constantly evolving** with new features and improvements based on community feedback. From print quality improvements to reducing print time and minimizing filament usage, even small updates can have a significant impact on your 3D printing experience. Best of all, **PrusaSlicer is completely free for everyone** (it even includes profiles for 3rd party printers) and is frequently considered the best slicer on the market by independent reviewers.

PrusaSlicer comes with a G-code Viewer, a lightweight application, which you can use to quickly preview G-codes from all popular slicers. Its behavior is identical to the preview in PrusaSlicer (the same code is used), however, you can load an external G-code file. We currently parse, and up to some level interpret, G-code from PrusaSlicer, Slic3r, Slic3r PE, CURA, ideaMaker, Simplify3D, Craftware and KISSlicer. PrusaSlicer G-code Viewer is part of the PrusaSlicer installer package. Simply download the latest PrusaSlicer and the standalone G-code Viewer will install together with it automatically.



The latest stable version is always available at prusaslicer.com. Development alpha/beta versions can be downloaded from github.com/prusa3d/PrusaSlicer - these are unstable builds with the latest features.

4.7. PrusaSlicer Interface Explained



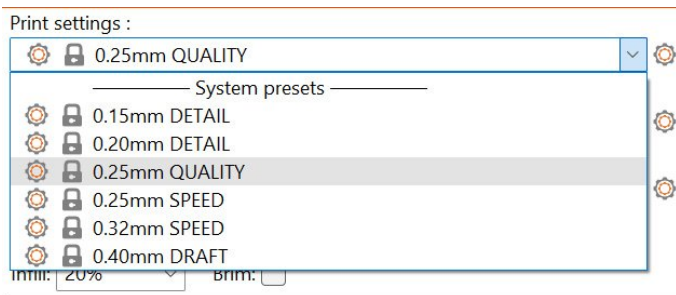
1. Opens detailed Print, Filament and Printer settings
2. Add button to import a 3D model into the scene
3. The Delete and Delete All buttons remove the model(s) from PrusaSlicer
4. Switching between Simple, Advanced and Expert modes
5. Settings for printing speed and quality
6. Material selection
7. Printer selection
8. Quick settings for Infill density, Supports and Brim
9. Information about model size / printing time (after slicing)
10. Slice / Export button
11. Right-click the model to open a context menu
12. Model preview in 3D
13. Switch between 3D editor and Preview mode
14. Move, Scale, Rotate, Cut, Paint-on Supports, Seam Painting tools

4.7.1. Initial Setup and General Workflow

Upon launching PrusaSlicer, select Original Prusa XL from the Printer drop-down menu on the right (no. 6 in the illustration above)

If you don't see the Original Prusa XL in the list, **you need to add it either by using Add Printer-Add Presets menu item** (in the same menu), **or by using Configuration - Configuration Wizard** from the top menu bar. Then select the layer height, infill and the material you intend to use. **If you are not sure about the layer height, stick with 0.20 or 0.25 mm profiles as they give generally good results.**

Recommended infill values are between 5-20 % but it heavily depends on the model and how durable it needs to be. More infill means a more durable model, however, it will take longer to print and more material will be consumed. For general use, there is no point in going above 40% infill, unless your project really requires it.



i Please note that the default profiles have a tested specific setting for each type of filament. If you choose a different profile, it may affect the print quality negatively.

PrusaSlicer allows you to import objects in STL, OBJ, AMF, STEP and 3MF formats - these are the most common types of 3D files you can find on the internet. You can either drag them directly into the 3D editor window, or use the Add... button from the top bar.

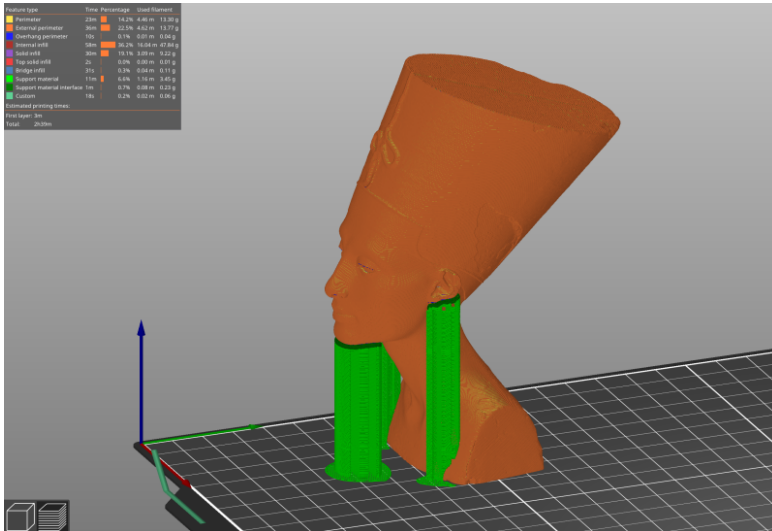
To modify the model, use the tools on the left side bar, i.e. Move, Scale and Rotate. If an object is blue, it means it does not fit into the print bed and it needs to be moved or scaled down. There is no universal way to place the model on the bed, it always depends on the specific shape. However, a general rule is that the bigger the flat surface of the model that touches the bed, the better it will hold - so try to orient the largest flat surface of the model downwards.

4.7.2. Using Supports



Supports are printed structures resembling scaffolding. They are used for printing complex objects. After printing, they can be easily separated from the output.

You can find a large number of objects that can be printed without supports - just place them in the right orientation on the bed, slice them and you can print. **Not all objects, however, can be printed without supports.**



If you are printing an object with walls that rise at an angle less than 45°, these overhangs will cause issues with print quality. **Also, keep in mind that the printer cannot start printing mid-air.** In such cases, supports are necessary.

How to tell whether an object needs supports?

The shortest answer is: it comes with experience. With your first prints, stick to default PrusaSlicer values. Once you feel comfortable with printing complex shapes using default support settings, try playing around with the Overhang threshold option in the settings. We have an extensive list of detailed tutorials available at <https://help.prusa3d.com/category/prusaslicer>

You have three options to choose from when selecting support generation:

- **Support on Build Plate Only** - generates supports only in the space between the object and the print bed
- **For Support Enforcers Only** - generates supports only where enforced by placed modifiers
- **Everywhere** - generates supports everywhere

The default support pattern usually works correctly, but **if you need to modify the places where the supports will be generated**, just go to the **Print Settings** tab and select **Support Material**.

- Check the Generate Support Material box.
- The Overhang Threshold allows you to set the minimum angle for printing the support material. Setting the value to zero will enable an automatic calculation. Try generating supports with different angle settings to see which value works best for your object.
- Enforce Supports is an option mainly used for small models or models with a small base to prevent them from being broken or detached from the print bed during the printing process.
- Wherever the supports touch the model, they are usually associated with a lower surface quality. Try to reduce or even avoid the need for supports by rotating or shifting the model accordingly.

4.7.3. Speed vs Print Quality

A small object can be printed in a few minutes but printing bigger models can take a lot of time - sometimes even dozens of hours. **The printing speed is affected by several factors.** Primarily, it depends on the layer height. This can be set in PrusaSlicer in the **Print Settings** drop-down menu in the upper right corner. 0.20mm DETAIL is pre-set, but you can speed up the printing by choosing 0.32mm SPEED or even 0.40 DRAFT. Models printed like this will have less detail and more visible layers. **If you care more about quality than speed, choose 0.15mm (DETAIL).** The appearance of the models will improve, but at the cost of a **significant decrease in printing speed.**

Some profiles may have two variants.

Quality - slower perimeter and infill printing, improves the surface quality

Speed - faster perimeter and infill printing, without too much impact on the surface quality

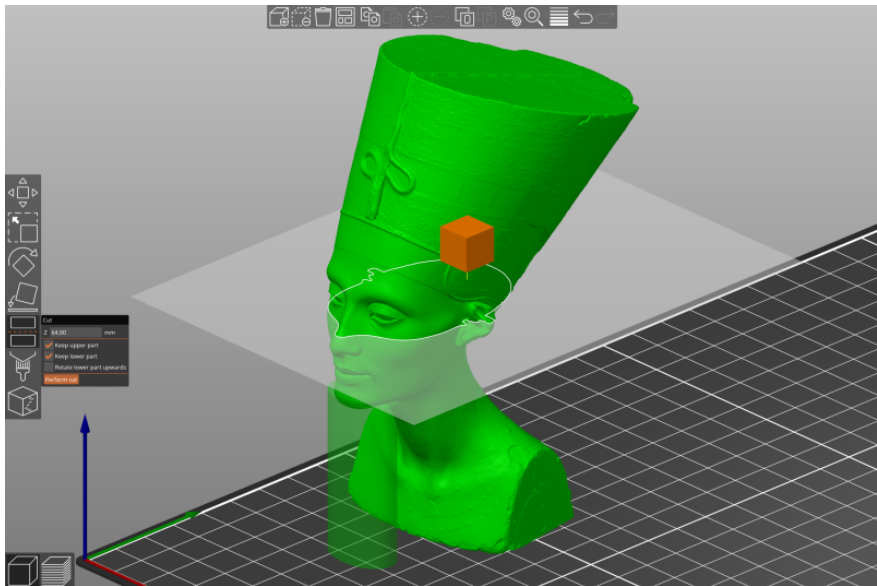
The speed can be adjusted during printing, via the *LCD Menu - Tune - Speed*. Then use the knob to adjust the speed up or down. Observe the effect of the speed change on the print quality and choose the settings that suit you best. Remember that this setting does not affect the acceleration of the printer, so the printing time will not be shortened proportionally to the speed setting change.

4.7.6. Printing Objects Larger than the Print Volume

The Original Prusa XL printer has a huge print volume of 360 x 360 x 360 mm. If even this is not enough, you can play around with settings to be able to print truly gigantic models. Don't let the size of the print bed be a limitation – at blog.prusa3d.com you can find tips on how to assemble large models from several smaller parts.

Of course, you can also resize the imported model to fit the bed. The Scale tool is there to help you with that.

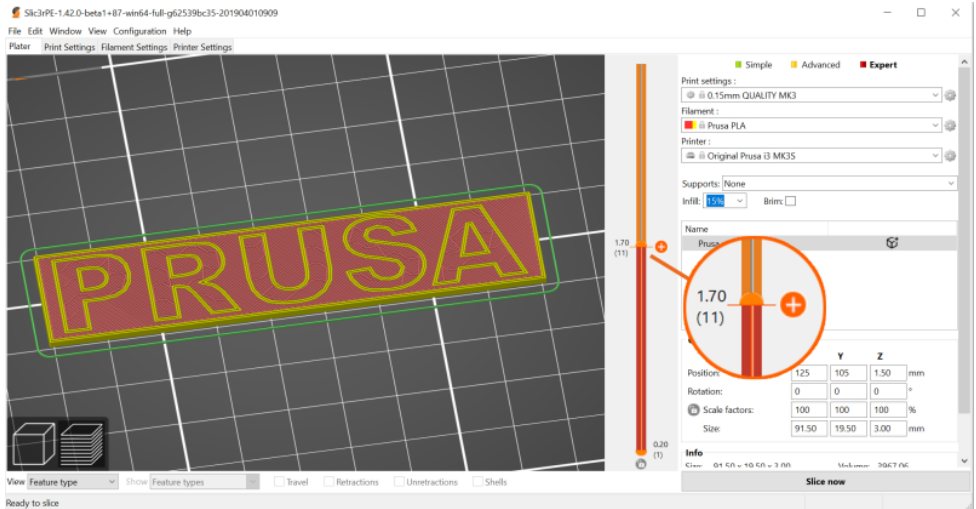
If you want to print an object which is too large in its original size for the print bed, **you can cut it into several smaller parts**. Use the **Cut tool** from the left menu (or press the letter C). Either place the cutting plane manually or set an exact height using the Cut tool dialog. Choose whether you want to keep only the part above the cut, below it, or both.



4.7.7. Printing Multicolored Objects (Single-Tool XL)

If you want to have a print with layers in different colors, it can be easily set up directly in PrusaSlicer - follow the instructions below.

1. Switch to the layer view (Preview) using the button in the left bottom corner
2. Use the slider on the right to select the layer in which you want to change the color
3. Click on the orange icon with the plus sign
4. An immediate preview will appear. You can undo the color change by clicking on the gray cross which will appear instead of the orange plus sign
5. Export the G-code and you can start printing!



Once the printer reaches the layer, where the color change should happen, **the printer will pause and display a prompt on the screen.** Follow the instructions on the screen to finish the filament change.

4.7.8. Slicing and Exporting

One of the most important phases of the slicing process is the final check of the sliced object in the Preview. Using the slider on the right, you can **review all the print layers** of the object one by one. This will help you **identify problematic spots** - for example, if the bottom of the object doesn't stick well to the bed or if some of the parts are missing supports and are "hanging in the air".



Before you export the model as G-code and upload it to the USB drive, always check it in the Preview first. It's the best way to avoid mistakes during printing.

To summarize:

1. Find a suitable 3D object for printing and download it (usually in .stl or .obj format)
2. Import the object into PrusaSlicer
3. Use the built-in tools to scale, move and rotate the object. Find the optimal orientation: large flat base, minimal overhangs
4. Add supports if necessary. If you're printing, e.g., a figure with a face, try to rotate the object so that the supports don't connect with the face or other areas that need to have pristine print quality
5. Select the infill type and density
6. Select the nozzle diameter (default is 0.6mm) and layer height
7. Slice the object
8. Inspect the preview
9. Export the G-code and print it

4.8. Using Nozzles with Various Diameters

The Original Prusa XL comes equipped with a **0.6mm nozzle by default**. This nozzle offers a great quality-speed ratio which comes in handy when you print huge objects.

However, for some projects, a nozzle of a diameter might be more suitable. The Original Prusa XL uses special nozzles with a metal filament guide, making them easy to swap and highly reliable.

We offer a wide range of nozzles of various diameters on our e-shop, ranging from 0.25mm to 0.8mm nozzles.

To give you even more options for your 3D printing projects, we developed a Nextruder to V6 nozzle adapter. When you install it, you can easily use any type of V6-compatible nozzles, including high-flow models. More information on alternative nozzles and their installation can be found at prusa3d.com and help.prusa3d.com.

5. Material Guide

A full table of materials is available online! Due to limited space within this guide, we can only provide a brief overview of popular materials here. Visit help.prusa3d.com/materials to find a **full overview of a wide range of printing materials**. The Original Prusa XL 3D printer is compatible with almost all filaments available. Individual materials may differ not only in color but also in mechanical and optical properties, or even in printing difficulty. If you have no experience with 3D printing, **we recommend starting with PLA**. Only if PLA filament is limiting you in any way, consider other materials such as PETG or ASA.

Print with Prusament!

Prusament is our in-house made line of high-quality filaments. We were not satisfied with the quality of filaments on the market, so we decided to make our own! The whole manufacturing process is closely monitored and tested – string diameter, color consistency, and mechanical properties – to make sure that **every spool is perfect**. We are the only manufacturer that gives customers **the option to fully inspect the parameters of every filament spool**. Just scan a QR code on the spool to see all details online. We offer an entire range of various materials at prusa3d.com and it keeps growing every day!

5.1. PLA

PLA is the most commonly used material for 3D printing. It prints easily and prints from PLA are very hard. Perfect choice for printing large objects due to low shrinkage (prints don't warp on the bed) and for printing detailed small models.

Advantages

- Easy to print, suitable for beginners
- Easily print small detailed models
- Trouble-free printing of larger objects
- Almost odorless
- Affordable
- Wide range of colors

Disadvantages

- Brittle and inflexible
- Low temperature resistance (50-60 °C)
- Difficult post-processing
- Not suitable for outdoor use (low UV and temperature resistance)

Typical uses: Prototypes, toys, action figures, jewelry and small detailed models in general, architecture models and more!

Prints best on a smooth (or satin) print sheet. When post-processing PLA prints, it is best to use wet sanding to achieve better results. If you use sandpaper dry, the heat generated by friction can start to deform the printed object. PLA can only be dissolved in chemicals such as chloroform or heated benzene. For gluing, a good quality superglue is sufficient, certain types of PLA can also be glued with acetone.

- **Nozzle temperature:** 215 °C
- **Heated print bed temperature:** 50-60 °C
- **Print surface:** Make sure the print bed is clean, as per instructions in about Sprint steel print sheets.

5.2. PETG

PETG is one of the most popular materials for 3D printing. It is a great choice for parts that will be subject to mechanical stress. Compared to PLA, it has a higher temperature resistance, it is more flexible and less brittle. Thanks to its low thermal expansion, it holds well to the bed and does not warp. Printing with it is almost as easy as with PLA, but unlike PLA it offers much better mechanical properties. Parts of our printers are printed with PETG!

Advantages:

- High temperature resistance
- Easy printing
- Low thermal expansion
- Durable and tough
- Easy machining (sanding)
- Printing almost without smell
- Glossy surface
- Good adhesion of layers.

Disadvantages:

- Not suitable for printing small/highly detailed models
- Nozzle can leave thin filaments (stringing)
- Problematic bridging and overhangs
- Strong adhesion to the bed
- Cannot be smoothed with commonly available solvents, soluble only in dangerous chemicals
- Removal of supports can be difficult.

Typical use: Mechanical parts, Holders and cases, Waterproof prints (flower pots).

Tips and tricks:

PETG requires a higher heatbed temperature (85 °C). PETG usually has worse results when bridging two points, plus PETG tends to string - this means it's leaving fine plastic strings on the surface of the print (which can be relatively easily removed). Stringing can be reduced by setting appropriate retraction and using lower printing temperatures - we recommend sticking to the values in PrusaSlicer profiles. The print must be well cooled - it has better details and stringing can be prevented to some extent. However, if you want the most durable print, try turning off the print fan. A higher temperature will cause the layers to stick better to each other, resulting in better mechanical resistance. Generally, we recommend printing the first few layers with the fan turned off (for adhesion) and then turning it on at 50% power.

- **Nozzle temperature:** 240 °C
- **Bed temperature:** 70-90 °C
- **Print surface:** A textured print sheet and a satin print sheet do not require any special preparation, just keep them clean and free of grease. For a smooth print sheet, you should apply a thin layer of glue stick, as PETG may adhere too strongly to the sheet surface, making it difficult to remove prints from the sheet.

5.3. ASA (ABS)

ASA and ABS are very similar materials. In some respects, ASA is better than ABS. ASA is UV-stable compared to ABS and shrinks slightly less during printing. When it comes to post-processing, ABS and ASA can be similar, but the latter is currently more popular, so we will focus mainly on it.

ASA is a strong and versatile material. A higher melting temperature than PLA gives ASA good thermal resistance, so your prints will not show signs of deformation up to temperatures around 100 °C. Unfortunately, compared to PLA, ASA has a very high thermal expansion, which complicates printing, especially larger models. Even with a heatbed set to 100 °C, the print can start to warp and detach from the bed. ASA also produces a noticeable odor during printing.

Advantages:

- High impact and wear resistance (lower than PETG)
- Very good thermal resistance
- Suitable for outdoor use - UV stable
- Soluble in acetone - can be used for gluing
- Possibility of smoothing with acetone vapors
- Detailed prints without stringing (leaving fibers on the print)
- Easy post-processing (e.g. sanding, cutting, etc.)

Disadvantages:

- Difficult printing
- Tendency to warp (printing in an enclosed box is recommended)
- Unpleasant smell when printing (contains styrene)

Typical uses:

- Cases and protective covers
- Prototypes
- Spare parts
- Toys and figures
- Parts suitable for exterior use

Tips and tricks:

Printing with ASA/ABS is much easier if the printer is placed inside an environment with increased stable temperatures. This significantly reduces both deformation and layer separation. Thanks to acetone, it is easy to join several prints together. Just lightly rub the contact surfaces and press the parts together. In addition, it is possible to smooth the prints with acetone vapors and get a perfectly glossy surface. Be careful when handling acetone!

- **Printing temperature:** 220-275 °C
- **Bed temperature:** 90-110 °C (larger objects require higher temperature)
- **Print surface:** ASA and ABS materials work best with a satin print sheet, which requires no special preparation - just keep it clean and free of grease. However, if you are printing ABS/ASA on a grainy/smooth print bed, it is necessary to apply a glue stick.

5.4. PC (polycarbonate) and PC Blend

Polycarbonate (PC) is a technical material boasting excellent strength, tensile strength, and resistance to high temperatures. It is however quite demanding to print, thus making it suitable mainly for advanced users. This of course does not apply to our Prusament PC Blend, which is much easier to print compared to other polycarbonates. Polycarbonate surpasses all of the aforementioned materials in its mechanical, chemical, and thermal resistance.

Advantages

- High-temperature resistance
- High strength and tension resistance
- Clear polycarbonate is transparent
- Good electrical insulation properties

Disadvantages

- Pure polycarbonate is highly hygroscopic
- High nozzle and bed temperatures
- Strong warping, especially for large models
- Mild smell during printing
- Separating layer application recommended
- High price

Typical uses: Polycarbonate is mostly suitable for technical components, for which we require a higher resistance to mechanical wear and tear and high temperatures.

Tips and tricks: Consider printing in a closed box - to prevent warping of the printed objects; enable the "Brim" feature in PrusaSlicer - set it higher than the default outline, ideally to the whole height of the print; add a "Skirt" in PrusaSlicer around small objects; do not print in low-temperature zones;

- **Nozzle temperature:** 270-275 °C
- **Bed temperature:** 110 °C for the first layer, 115 °C for the following layers
- **Print surface:** Textured print sheet and smooth print sheet with a layer of stick glue offer the best adhesion properties. Although the textured print sheet offers good adhesion properties on its own, we recommend applying a separating layer of glue to prevent wear/damage of the surface.

5.5. PVB

Polyvinyl butyral (PVB) is a material that can be easily smoothed with isopropyl alcohol (IPA). Prints, when properly set up, are clear and transparent, thus making PVB a suitable material for printing vases, lamp shades, and other decorative models. The printing settings are similar to those for PLA, but the mechanical properties of PVB are slightly better.

Advantages

- Similar printing settings to PLA
- Transparent filament
- Suitable for decorative models - vases, lamp shades, etc.
- Chemical smoothing with IPA
- Good toughness
- Good tensile strength (similar to PETG and PLA)
- Less prone to warping (less than PLA)
- Suitable in combination with 0.8mm nozzle

Disadvantages

- Lower adhesion between layers
- Hygroscopic material (absorbs moisture)
- Higher price

Typical uses: PVB finds its best use when printing transparent (translucent) models – e.g. jewelry, vases, lamp shades, etc.

Tips and tricks: PVB has good adhesion to clean smooth or satin print sheet, while textured print sheets have rather poor adhesion. If you want to print translucent prints which you will later smooth with isopropyl alcohol, we recommend using a bigger nozzle (0.8mm) and enabling the "Spiral vase" mode in PrusaSlicer. When printing with multiple perimeters, the individual layers will be clearly visible even after smoothing with isopropyl alcohol. Store the filament in a dry environment – PVB is a material prone to absorbing moisture, which can negatively affect the quality of the print. Always return the filament to its plastic bag with silica gel, or let it dry for 4 hours at 60 °C before printing with it.

The main advantage of PVB material is that it can be smoothed with isopropyl alcohol (IPA). Models printed from PVB can be smoothed in IPA vapors, by immersing into an IPA bath, or by directly applying IPA on the object surface (by using a sprayer or brush). Detailed instructions can be found on our blog at blog.prusa3d.com.

- **Nozzle temperature:** 215±10 °C
- **Bed temperature:** 75 °C
- **Print surface:** Do not use the standard grainy print bed. PVB will better adhere to the clean smooth or satin print bed. Textured print sheets may not have sufficient adhesion properties.

5.6. Flexible Materials

Flexible filaments are typically very strong and elastic materials. In many cases, the classic hard plastic (PLA, PETG) may not be ideal or even completely unsuitable for certain models. Whether you are printing a phone case, a housing for an action camera or even wheels for an RC car, it is better to use a flexible material. These materials are often expensive and not very common and are not suitable for beginners.

Before you start printing with Flex, clean the nozzle from the previous material by inserting PLA into the preheated extruder and pushing out all the previous material. For Original Prusa 3D printers, we recommend using Semiflex or Flexfill 98A, or Filatech FilaFlex40, for which we have tuned profiles in PrusaSlicer. Feeding flexible filament into PTFE tubes is more demanding - feed the filament gradually and don't apply too much pressure.

Advantages:

- Flexibility and elasticity
- Minimal shrinkage
- Excellent adhesion of layers
- Great resistance to wear

Disadvantages:

- Requires a special procedure for inserting filament
- Very poor bridging and overhangs
- Requires lower print speed
- Higher price
- Absorbs moisture - must be stored in a dry environment

- **Nozzle temperature:** 220 - 260 °C
- **Bed temperature:** 40 - 85 °C. (larger objects require higher temperature)
- **Print surface:** If you are printing on a smooth or satin print sheet, apply a separation layer to it! A glue stick is ideal. Textured sheets with a powder-coated PEI surface do not require a separation layer - the print will hold well and can be easily removed from the sheet after cooling.

5.7. PA (Polyamide) / PA11CF

Polyamide (also known as Nylon) is a versatile material known for its durability and is commonly used for 3D printing special models due to its high difficulty in printing (not applicable to PA11CF) and higher costs. There are several types of polyamide, which differ in properties such as temperature resistance, water absorption and adhesion to different types of surfaces.

Prusament PA11CF has great temperature resistance (up to 192 °C), strong resistance to a range of chemicals, and prints easily. Some polyamides, including the PA11CF, are reinforced with carbon fibers to reduce shrinkage, often at the expense of mechanical strength. We recommend the PA11CF for printing extremely stressed parts, such as plastic engine components, etc.

Advantages:

- High temperature resistance (up to 192 °C)
- Resistance to a range of chemicals
- Hard and resilient in thick layers, flexible in thin layers
- Smooth glossy surface of clean PA
- Excellent layer adhesion
- Suitable insulation material

Disadvantages:

- Not suitable for printing small/highly detailed models
- Prone to warping (not applicable to PA11CF)
- Challenging bridging and overhangs
- Strong (or too weak) adhesion to the surface
- Cannot be smoothed with commonly available solvents, dissolvable only in dangerous chemicals
- Difficult to remove supports
- Highly hygroscopic material

Typical use: Mechanical parts, holders and housings, electrical insulation parts, movable parts, and parts requiring high temperature resistance.

Tips and tricks:

It is absolutely essential to keep the filament dry, otherwise its adhesion and overall printing quality will significantly worsen. Therefore, we recommend drying the filament for at least 4 hours at a maximum temperature of 90 °C before printing. The print from a dried polyamide should have a smooth and glossy surface, while materials reinforced with carbon fibers have a matte surface.

When printing polyamides, we recommend using an enclosed printer with active filtration or keeping the printer in a well-ventilated room. Not only are potentially hazardous particles released when printing (all) PA, but the higher ambient temperature also reduces warping and improves layer adhesion. Carbon-reinforced polyamides can be printed without a covered printer, but due to the internal tension caused by the sudden temperature change, the finished prints may have slightly worse mechanical properties.

- **Nozzle temperature:** 240 - 285 °C
- **Bed temperature:** 70 - 115 °C
- **Print sheet surface:** For printing most polyamides we recommend using our special PA Nylon print sheet, which ensures ideal adhesion even when its only cleaned with water. However, the adhesion of some types of polyamide may be too high, leading to damage to the sheet, so we recommend checking the compatibility in our material table (help.prusa3d.com/materials). We do not recommend printing polyamides on a smooth print sheet, and when using a textured or satin sheet a layer of paper glue (glue stick - Kores) must be applied.

6. Regular Maintenance

The Original Prusa XL was designed from the beginning as a true print "workhorse". Despite its high reliability, it is still a device with mechanical components that require more or less regular maintenance. Follow the instructions below to keep your printer in perfect condition for as long as possible.

6.1. Flexible Print Sheets

To achieve the best adhesion of the print surface, it needs to be kept clean. Choose the right cleaning agent depending on the type of print sheet (see below). Drop a small amount of the agent onto a clean paper towel and wipe the print surface. Best results will be achieved when the print sheet is cold, otherwise, you may burn yourself on the nozzle or heated bed. Also, the alcohol will evaporate before it has a chance to clean anything. Details can be found in the chapter **Your First Print** in this manual.


The effect of various print sheets on the first layer can be seen below. From left to right: smooth, satin and textured powder-coated print sheet.




The print surface does not need to be cleaned before every print, just be aware of not touching it with your fingers.

Recommended cleaning agents differ slightly depending on the type of print sheet. Instructions for the use of specific materials (e.g. the need to use a separation layer to avoid damaging the surface) can be found in the previous chapter.

	Correct usage:	Risks and dangers:
Print sheet with smooth PEI surface	<ul style="list-style-type: none">• Isopropyl alcohol 90%+ (IPA) is the best option for degreasing. Do not use dermatological hand products which may contain isopropyl alcohol - they contain other additives (ointments, hydrating ingredients).• Warm water with a few drops of dish soap (in case IPA does not remove residues like sugar from the bed)• Acetone - occasionally for thorough cleaning of the print sheet• When printing with Flex material you need to apply glue stick (Kores)	<ul style="list-style-type: none">• Prints from PETG would stick too strongly to the sheet cleaned with isopropyl alcohol (IPA) and removing it could damage the surface. Materials such as PETG, ASA, ABS, PC, CPE, PP and FLEX should only be printed with a separating layer (glue stick).
Print sheet with a textured powder-coated surface	<ul style="list-style-type: none">• Isopropyl alcohol 90%+ (IPA) - best for degreasing	<ul style="list-style-type: none">• Do not use acetone
Satin print sheet	<ul style="list-style-type: none">• Suitable for PLA and PETG• 90% isopropyl alcohol (IPA) is the best degreaser• For printing flexible filaments you need a separating layer of glue (Kores)• Broad spectrum of supported materials; including advanced materials such as PC Blend and others	<ul style="list-style-type: none">• Never use acetone!• For printing ASA and PC Blend you need to add a brim, outline or shield around the print• Do not use sharp objects to remove the print from the bed!



Consumable materials such as print sheets are not covered by our warranty unless they arrive damaged or incorrectly manufactured. Print sheets are consumables and the warranty only applies to defects that appear immediately after unpacking.



All original print sheets made in Prusa Research are double-sided.

6.1.1. Double-Sided TEXTURED Print Sheet

- Surface resistant to damage and scratches
- Texture on the surface of the sheet is transferred to the bottom side of the printed object
- Simpler Z-axis calibration
- FLEX does not require glue (Kores) application to the print bed
- After the print sheet cools down, the print usually detaches itself
- PLA prints with small contact area may require a brim
- Large PLA prints may warp
- **Never clean with acetone**

The textured powder-coated surface applied directly to metal allows us to create a print sheet that is highly resistant to damage. If a heated nozzle hits it, the metal is able to quickly dissipate heat. **The textured powder coating also gives the bottom surface of the print a unique, interesting texture.**

The textured surface is able to mask most scratches and similar types of damage caused by various tools. One can only scratch the highest points of the texture, yet this type of damage will not be visible on the print.



Never clean the textured powder surface with acetone! This will cause micro-cracks in the PEI layer, which will eventually lead to a significant deterioration of the surface quality.

6.1.2. Double-Sided SMOOTH Print Sheet

- Excellent for PLA
- Great adhesion to almost all materials
- Smooth bottom layer of prints
- Even small prints will hold well
- Occasionally clean with acetone

For printing materials such as PETG, ASA, ABS, PC, CPE, PP, Flex and others, it is necessary to apply a glue separation layer. More information can be found in the Materials Guide.



The industrial adhesive used to attach the PEI layer to the print sheet tends to soften at temperatures above 110°C. The adhesive can then move beneath the surface, creating small bumps.



If you notice small bubbles appearing beneath the PEI layer on the flexible print sheet, just flip it over and print on the other side. After a few days or weeks, the bubbles should disappear. The bubbles have no effect on the print quality.

6.1.3. Double-Sided SATIN Print Sheet

- Suitable for PLA and PETG
- Soft texture on the bottom part of the print
- **Only use quality isopropyl alcohol (90+ %) to clean**
- FLEX requires the use of a glue separation layer (Kores) on the print sheet
- Wide range of supported materials, including advanced materials such as PC Blend and more
- Easy maintenance and good adhesion
- **Do not use acetone! Acetone will damage the surface of the print sheet!**
- When printing with ASA and PC Blend, a brim or a raft may be required around the print, depending on the model height
- When changing the print sheet, it is necessary to adjust the Z height (more in the Print Sheet Profiles chapter)
- **Do not use sharp metal objects to remove prints from the sheet (e.g. a metal spatula)**

6.1.4. Improving the Adhesion

In certain special cases, such as printing a very tall object that touches the print sheet with a very small area, it may be necessary to **improve the adhesion**. PEI is fortunately a chemically very resistant polymer, so it is possible to **apply various substances to improve adhesion without risking damage to the surface**. This also applies to various materials whose adhesion to PEI would be very weak under normal circumstances. More information can be found on the website help.prusa3d.com/materials.



Before applying anything to the print sheet, consider using the Brim feature in PrusaSlicer to increase the area of the first layer.

6.2. Keeping the Printer Clean

After several hours of printing, various kinds of debris may start to accumulate inside the printer under the heatbed - pieces of filament, dust, scraps, broken supports, etc. Always make sure that the internal parts of the printer are clean. You can use a brush, small broom or a vacuum to remove debris from the inside of the printer.

6.3. Linear Rails

Depending on the dustiness of the environment, you should **wipe the linear rails with a dry tissue every few dozens or hundreds of hours of printing** - never use wet wipes, sponges, etc. - linear bearings must not come into contact with water and degreasers.

This is all that is required for regular maintenance of the linear rails. It is not necessary to apply any sort of lube or grease onto the rails.

6.4. Fans

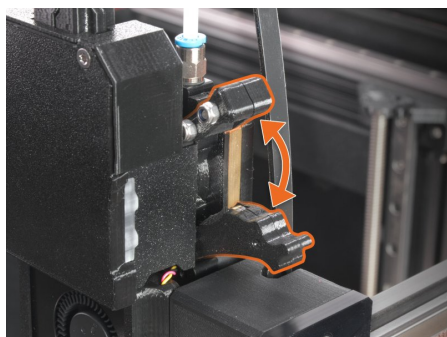
The RPM (revolutions per minute) of both fans is constantly measured. This means that the printer will **report an error if the fan suddenly slows down**, for example due to a piece of filament

stuck in it. In such a case, check and remove any dirt from the relevant fan. Do not try to bypass the RPM check - this could damage the printer!

Both fans should be checked and cleaned after a few hundred hours of printing. Dust can be removed with compressed air in a spray can, small plastic threads can be removed with tweezers. **Do not blow compressed air on the running fan.**

6.5. Extruder Feeding Gear

The feeding gear in the extruder does not need any lubricant. Over time, **a filament powder deposit may form in the grooves**, causing poor extrusion of filament. Remove the debris using compressed air in a spray, small plastic threads can be removed with tweezers. Use the access opening on the side of the extruder. Clean as much as possible, then turn the wheel (LCD Menu - Control - Axis) and continue.



Warning: Never, under any circumstances, open the gearbox itself. Tampering with the gearbox may lead to voiding your warranty.

6.6. Extruder is Clogged or Jammed

Clogged extruders can cause issues when printing or when loading new filament. On the top of the extruder, there is a pair of screws directly next to the filament inlet. You can adjust the idler pressure by loosening or tightening these screws. By unlocking the top clip, you can open the hinged door (the so-called idler) and check the filament track for any blockages.

When you open the idler, you can easily clean the feed wheel of all filament remnants. We recommend regularly cleaning the wheel.

6.7. Cleaning the Nozzle



Do not touch the nozzle during this procedure - it is hot and there is a risk of burning yourself! To better access the extruder during cleaning, lower the heated bed as far as possible in the LCD menu - Control - Movement - Z Axis.

The filament does not come out of the nozzle

If the filament does not pass through the extruder and no plastic is being extruded, check the following:

- Open the idler on the side of the extruder to see if the filament strand reached the extruder gear and continues down into the nozzle
- See if the temperatures are set correctly (215 °C for PLA, 260 °C for ASA, etc.)
- Check if the fan on the side of the extruder is spinning

If the filament strand is not visible (does not reach the extruder wheel), the problem is likely in the PTFE tubes. Take advantage of the fact that the tubes are transparent and check where the filament currently is and if it reaches the extruder. If the filament does not pass smoothly and gets stuck, make sure that there is no debris in the PTFE tubes and that your filament has the correct diameter and quality - various bumps, etc. can cause the filament to get stuck. Try to cut off a roughly 130 cm (4 ft.) long piece and repeat the filament insertion attempt.

The filament does not come out of the nozzle or only a small amount comes out

If you see that the filament passes across the extruder gear but does not come out of the nozzle, it means that the nozzle is probably clogged. You can clean it as follows:

1. Heat the nozzle to the appropriate temperature for the filament material you are printing with or slightly above. First, feed the filament, then insert an acupuncture needle (included in the package) or thin wire (0.3-0.35 mm) into the nozzle from the bottom to a depth of about 1-2 cm. Use protective gloves in case material suddenly starts to come out of the nozzle.
2. Select the Load Filament option from the LCD menu and check that the nozzle is actually extruding the filament.
3. Again insert the wire or acupuncture needle into the nozzle and repeat the whole procedure several times. If the filament is being extruded correctly, the nozzle is clean.

6.8. Troubleshooting Faulty Sensor Readings and Removing Errors

If you encounter problems with the filament sensor, such as incorrect (or random) readings, make sure the sensor is correctly wired. If the problem persists, please contact our tech support.

6.9. Filament Sensors

Original Prusa XL is equipped with two filament sensors: the first one is located on the side, close to the input of the PTFE tube where you feed the filament. The second one is located in the extruder. Both filament sensors are necessary for the correct filament retraction - when the sensor on the side detects that the filament has run out, the filament will be retracted in time. If everything depended just on the filament sensor in the extruder, it would not be possible to easily retract the filament.

6.10. Flashing an Unofficial (Unsigned) Firmware:

We take security seriously. Before each firmware update, we rigorously test it to ensure that all of its security features are working correctly. **If any of the sensors detect an unexpected reading, the heater will be immediately disconnected to prevent any damage to the printer or its surroundings.** We cannot guarantee the same level of security with unofficial (community) firmware.



Official firmware is signed with a private key and the printer verifies the key before updating. To flash your own (or unofficial) firmware to the printer, **you must first break the seal on the mainboard** and place a jumper in the correct position. **Doing this voids the electronics warranty.** To break the seal, you must open the electronics box and locate a safety fuse. Then, **take a small flathead screwdriver or very thin sharp pliers and break off the thin middle part of the fuse.** **Before attempting this procedure, carefully review the photos in this chapter!** Breaking the seal is **irreversible** and is recommended only for very experienced users. Afterward, **focus on the three pins above the seal** – it is necessary to place a jumper on two of the pins closer to the center of the board. If the jumper is on different pins, move it. Without the jumper, the board cannot boot.



Breaking the seal on the mainboard of the Prusa XL is **IRREVERSIBLE** and leads to the **VOIDING OF THE WARRANTY ON ELECTRONIC PARTS OF THE PRINTER**. If you break the seal, we disclaim any responsibility for any damage to the printer and/or its surroundings (e.g. in case of a fire).

7. FAQ - Frequently Asked Questions and Basic Troubleshooting

In case of a critical failure, the Original Prusa XL may display an error screen with short instructions on how to proceed. This screen contains a link to a detailed article on our Knowledge Base at help.prusa3d.com as well as a QR code that can be scanned by a mobile phone to quickly access the link.

7.1. Mesh Bed Leveling Fails

In case the automatic bed leveling (Mesh Bed Leveling) fails, the cause is likely to be either the Loadcell sensor or a misaligned Z axis. Run the Auto Home and Z axis calibration from the Control menu and see if the issue goes away.

If the issue persists you can manually inspect whether the Z-axis (heatbed) is correctly aligned. Disable the stepper motors in the settings (Disable Stepper Motors) and manually move the print head from left to right and watch if the nozzle maintains a constant distance from the bed.

Small deviations are allowed as the printer is able to compensate with Mesh Bed Leveling. If the nozzle is scraping against the print sheet on one end and is several millimeters above the sheet on the other end, then the Z-axis is misaligned.

7.2. Printer Does Not Recognize the Inserted USB Drive

If the printer does not recognize the USB drive, try restarting the printer first. In case the error "Error mounting USB drive" appears, the most probable cause is an incompatible file system (e.g. exFAT). Use a smaller USB drive (4-16GB) formatted with the FAT32 file system. More information on formatting and using USB drives can be found on our Knowledge base at help.prusa3d.com.

Once the USB drive is inserted, one of two situations may occur:

Cannot access the Print menu after inserting the USB drive

1. Restart the printer first
2. Use a USB drive formatted to FAT32 with a single partition
3. Try using a different USB drive

If you have tried multiple USB drives and none of them can be read, there may be a problem with the mainboard. Contact our technical support.

USB drive is recognized but no files are visible in the file browser:

1. Make sure you are using compatible G-code
2. Make sure the file is correctly written to the drive (in Windows use the "Safely remove" function before ejecting the drive)
3. Try a different USB drive and a different G-code file
4. Try renaming the file to something simpler, e.g. model.gcode

7.3. Loose Belts

Check both belts to make sure they are properly tensioned. Loose belts can cause printing errors or prevent the printer from starting up. The easiest way to check the belt tension is to print a circular object. If the result is not perfectly round, you need to adjust the belt tension. Instructions can be found at help.prusa3d.com.

7.4. Homing Failed

This issue is usually caused by a blockage in one or more axes. Perform the Auto Home calibration from the LCD Menu and observe the movements of the printer. Make sure the cables and PTFE tube leading to the extruder are not touching anything (a wall, shelf, etc.) If there is no visible block preventing the axes from moving, try adjusting the Crash detection sensitivity in the Settings menu.

If you assembled the Original Prusa XL as a kit, make sure that the cables running from the electronics to the extruder are not blocked by anything.

7.5. Heating Error

If the printer stops and the screen is red with a heating-related error, please check the connections of the heating element and thermistors. Detailed descriptions can be found at help.prusa3d.com.

7.6. Fan Error

If your printer stops and displays a fan-related error message, check both fans on the print head. It is possible that they are not spinning because they got clogged up. If the problem is elsewhere (e.g. cables connectivity) visit help.prusa3d.com for more information.

7.7. Reverting to an Older Firmware

Sometimes it is necessary to reinstall an older version of firmware. Upload a file containing the older firmware onto a USB drive formatted with the FAT32 system. Insert the drive into the printer, press the restart button and once the Original Prusa XL logo appears on the screen, press and hold the knob. This will activate the firmware update screen. Select "Flash" to reinstall the current firmware with the version from the USB drive.

7.8. Nozzle Hitting the Sheet / Other Z-axis Issues

If you are having issues with first-layer calibration or Mesh Bed Leveling procedure, first make sure everything is properly wired - check the connectors on the Dwarf board in the extruder. Next, perform Auto Home calibration on all axes to make sure that everything is properly aligned (especially the heatbed). Run the Loadcell calibration again.

8. Advanced Hardware Troubleshooting

Due to the length of the articles, it is not possible to include detailed troubleshooting guides in this handbook. However, the Original Prusa XL will display an error screen with a short recommendation on how to proceed further if it runs into a problem. This screen will also contain a link to a detailed article in our Knowledge Base at help.prusa3d.com. Additionally, there is a **QR code that you can scan with your mobile phone** for quicker access to the link.

Troubleshooting guides for component replacements and advanced hardware issues can be found online at help.prusa3d.com.

9. Troubleshooting Print Quality Issues

If prints are not quite up to your expectations or even having major flaws (shifted layers, ghosting, under-extrusion), it is necessary to find the cause of the issue and address it. On our website help.prusa3d.com you will find troubleshooting guides for 3D printing quality issues, including pictures and specific advice for different types of printers (some of which may still be in English only).



Printables

by JOSEF PRUSA

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