Ultimaker S5

Installation and user manual

Disclaimer

Please read and understand the contents of this installation and user manual carefully. Failure to read the manual may lead to personal injury, inferior results or damage to the Ultimaker S5. Always make sure that anyone who uses this 3D printer knows and understands the contents of the manual to make the most out of the Ultimaker S5.

The conditions or methods used for assembling, handling, storage, use or disposal* of the device are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, injuries, damage, or expense arising out of or in any way connected with the assembly, handling, storage, use or disposal of the product.*

The information in this document was obtained from sources which we believe are reliable. However, the information is provided without any warranty, express or implied, regarding its correctness.

Intended use Ultimaker S5

Ultimaker 3D printers are designed and built for fused filament fabrication with Ultimaker materials within a commercial/business environment. The mixture of precision and speed makes Ultimaker 3D printers a perfect machine for concept models, functional prototypes and small series production. Although we achieved a very high standard in the reproduction of 3D models with the usage of Ultimaker Cura, the user remains responsible to qualify and validate the application of the printed object for its intended use, especially critical for applications in strictly regulated areas like medical devices and aeronautics. While being an open material platform, the best results will be achieved with Ultimaker materials, while effort has been made to match material properties with machine settings.

* We comply to the WEEE-directive.

Table of contents

Preface

This is the installation and user manual for your Ultimaker S5. This manual contains chapters about the installation and use of the 3D printer.

The manual contains important information and instructions on safety, installation and use. Please read all information and follow the instructions and guidelines in this manual carefully. This ensures that you will obtain great quality prints and that possible accidents and injuries are prevented. Make sure that everyone who uses the Ultimaker S5 has access to this manual.

Every effort has been made to make this manual as accurate and complete as possible. The information is believed to be correct but does not aim to be all inclusive and shall be used only as a guide. Should you discover any errors or omissions, please bring this to our attention, so that we can make amendments. This will enable us to improve our documentation and service to you.

Certifications

Ultimaker
RYK-WUBA171GN

This device may not cause harmful interference, and this device must accept any interference received, including interference that may cause undesired operation.

UL 60950-1
CSA C22.2 No. 60950-1
E114168

CE

NFC

CCAF17LP0190T0

R 201-170319

IS 13252
R-41068071

For the latest version of the CE document go to www.ultimaker.com

1. Safety and compliance

It is very important to work safely with your Ultimaker S5.

This chapter is about safety and hazards. Please read all information carefully to prevent possible accidents and injuries.

1.1 Safety messages

This manual contains warnings and safety notices.

Provides additional information that is helpful to do a task or to avoid problems.

Warns of a situation that may cause material damage or injuries if one does not follow the safety instructions.

General safety information

The Ultimaker S5 generates high temperatures and has hot moving parts that can cause injury. Never reach inside of the Ultimaker S5 while it is in operation. Always control the printer with the touchscreen at the front or the power switch at the back. Allow the Ultimaker S5 to cool down for 5 minutes before reaching inside.

Do not change or adjust anything on the Ultimaker S5 unless the change, or adjustment is authorized by the manufacturer.

Do not store items inside the Ultimaker S5.

The Ultimaker S5 is not intended for use by persons with reduced physical and/or mental capabilities, or lack of experience and knowledge, unless they are supervised or have been given instruction concerning the use of the appliance by a person responsible for their safety.

Children should be under constant supervision when using the printer.

Intentional radio

This device may not cause harmful interference, and this device must accept any interference received, including interference that may cause undesired operation.

1.2 Hazards

Electromagnetic compatibility (EMC)

This equipment has been tested and found to be compliant with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

An electrostatic discharge in some metallic parts of the device may cause the interruption of the NFC communications, affecting the initial detection of the material spool. In these cases, a device restart should solve the problem.

Electrical safety

The Ultimaker S5 has been tested according to the IEC 60950-1. Every printer has passed Hi-pot testing before shipment. This test guarantees the right level of insulation against electrical shock. An earthed mains socket must be used. Be sure that the building installation has dedicated means for over-current and short-circuiting. For more information, please look at our website for the CB-report. The printer is powered by mains voltage, which is hazardous when touched. This has been marked with a high-voltage symbol on the bottom cover. Only trained staff should remove the bottom cover.

Always unplug the printer before doing maintenance or modifications.

Mechanical safety

The Ultimaker S5 complies to the Machine Directive 2006/42/EU. The EC declaration of conformity can be found on our website. The Ultimaker S5 contains moving parts. No damage to the user will be expected from the drive belts. The force of the build plate is big enough to give some damage, so keep hands out of the reach of the build plate during operation.

Always unplug the printer before doing maintenance or modifications.

Risk of burns

There is a potential risk of burns: the print head can reach temperatures up to 280 °C, while the heated bed can reach temperatures of 140 °C. Do not touch both with your bare hands.

Always allow the printer to cool down for 30 minutes before performing maintenance or modifications.

Health and safety
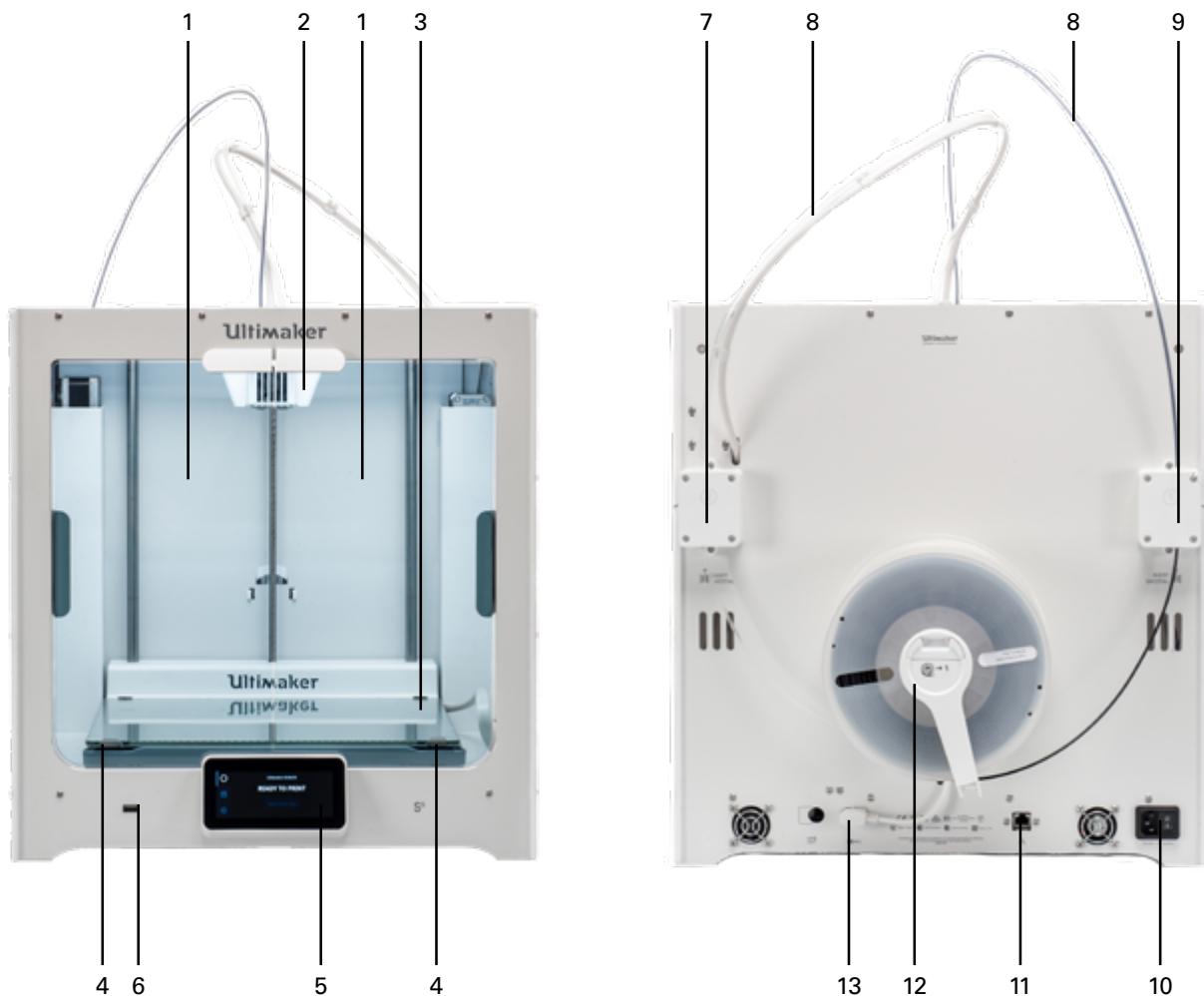
The Ultimaker S5 is designed for Ultimaker material. These materials can be printed safely if the recommended temperatures and settings are used. We recommend to print all Ultimaker materials in a well-ventilated area. Please check the SDS of each specific material for more information.

Third-party materials can release VOCs (volatile organic compounds) above regulated threshold limit values when processed in Ultimaker 3D printers (not covered by warranty). These can cause headaches, fatigue, dizziness, confusion, drowsiness, malaise, difficulty in concentration, and feelings of intoxication. Usage of a fume hood is recommended. Look at the SDS of these materials for more information.

2. Introduction

Meet your new Ultimaker S5 and learn what's possible with this 3D printer.

2.1 Main components Ultimaker S5

1. Glass doors
2. Print head
3. Build plate
4. Build plate clamps
5. Touchscreen
6. USB port

7. Feeder 2
8. Bowden tubes
9. Feeder 1
10. Power socket and switch
11. Ethernet port
12. Double spool holder with NFC cable
13. NFC socket

2.2 Specifications

Printer and printing properties		
	Technology	Fused filament fabrication (FFF)
	Print head	Dual-extrusion print head with an auto-nozzle lifting system and swappable print cores
	Build volume	XYZ: 330 x 240 x 300 mm (left or right nozzle, or dual extrusion)
	Filament diameter	2.85 mm
	Layer resolution	0.25 mm nozzle: 150 - 60 micron 0.4 mm nozzle: 200 - 20 micron 0.8 mm nozzle: 600 - 20 micron
	XYZ resolution	6.9, 6.9, 2.5 micron
	Build speed	<24 mm³/s
	Build plate	Heated glass build plate Heated aluminum build plate (available fall 2018)
	Build plate temperature	20 - 140 °C
	Build plate leveling	Active leveling
	Supported materials	Optimized for: PLA, Tough PLA, Nylon, ABS, CPE, CPE+, PC, TPU 95A, PP, PVA, Breakaway (also supports third-party materials) In the box: Ultimaker Tough PLA Black 750 g, Ultimaker PVA 750 g
	Feeder type	Dual-geared, abrasion-resistant (ready for composite materials)
	Nozzle diameter	0.25 mm, 0.4 mm, 0.8 mm
	Nozzle temperature	180 - 280 °C
	Nozzle heat up time	<2 min
	Build plate heat up time	<4 min (from 20 to 60 °C)
	Operating sound	50 dBA
	Power rating	500 W
	Material recognition	Auto-recognition with NFC scanner
	Connectivity	Wi-Fi, LAN, USB port
	Display	4.7-inch (11.9 cm) color touchscreen
	Language support	English, Dutch, French, German, Italian, Japanese, Korean, Portuguese, Russian, Spanish, Simplified Chinese
	Monitoring	Live camera (view from desktop or app)
Physical dimensions	Dimensions	495 x 457 x 520 mm 495 x 585 x 780 mm (with Bowden tubes and spool holder)
	Net weight	20.6 kg
	Shipping weight	29 kg
	Shipping box dimensions	650 x 600 x 700 mm
Ambient conditions	Operating ambient temperature	15 - 32 °C, 10 - 90% RH non-condensing
	Non-operating temperature	0 - 32 °C
Software	Supplied software	Ultimaker Cura, our free print preparation software Cura Connect, our free printer management solution
	Supported OS	MacOS, Windows and Linux
	Plugin integration	SolidWorks, Siemens NX
	File types	Ultimaker Cura: STL, OBJ, X3D, 3MF, BMP, GIF, JPG, PNG Printable formats: G, GCODE, GCODE.gz, UFP
Warranty and service	Warranty period	12 months
	Technical support	Lifetime support from Ultimaker's global network of certified service partners

3. Unboxing

Carefully unpack your Ultimaker S5 and set up the hardware according to the instructions in this chapter.

3.1 Unboxing

Remove the packaging

The Ultimaker S5 comes in reusable, durable packaging, specially designed to protect your 3D printer. Follow the steps below properly to unpack your Ultimaker S5.

i   We recommend removing the packaging with the box placed on the floor for safety. Please retain all packaging for warranty purposes.

1. Remove the plastic locking clips from the lower section of the box.
2. Holding the handles, lift the upper section of the box to reveal the printer.
3. Lift the top foam section away from the printer, pulling the print head cable free.
4. Remove the cardboard insert with the materials from the top of the printer.
5. Place the printer on a flat surface.

⚠   When placing the printer on a shelf or table, take proper measures to prevent the printer from falling.

6. Slide the center seal at the bottom of the glass doors to one side, and then remove all of the remaining seals.
7. Carefully open the glass doors and take out the accessory box and foam pieces from inside the printer.
8. Remove the plastic protection from the touchscreen.

⚠   If the printer needs to be transported without the outer box, be aware of the weight and dimensions of the printer. According to the UL 60950-1 definition, the printer is not portable. Use proper transport means to do this safely in order to prevent tripping.

What's in the box

Besides the printer itself, a quick start guide and test print, the Ultimaker S5 is supplied with several hardware accessories. Check if all these items are included before continuing.

Accessories
1. Glass build plate
2. Aluminum build plate
3. Spool holder with material guide
4. Power cable
5. Ethernet cable
6. USB stick
7. Print core AA 0.4
8. Print core BB 0.4
9. XY calibration sheet - glass build plate
10. XY calibration sheet - aluminum build plate
11. Calibration card
12. Nozzle cover (3x)

Consumables
13. Tough PLA (750 g)
14. PVA (750 g)
15. Glue stick
16. Oil
17. Grease

Tools
18. Hex screwdriver 2 mm
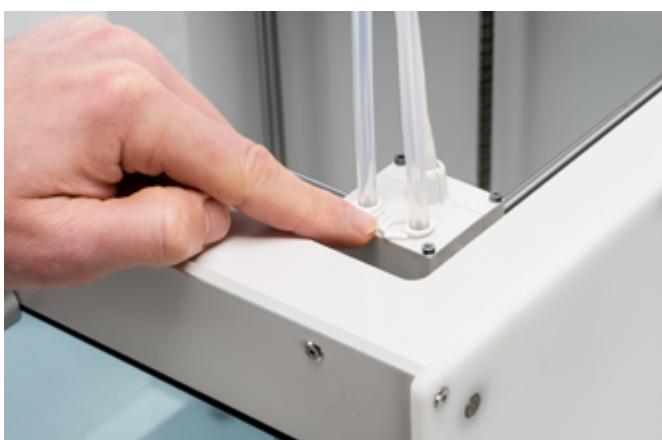
> **i** Another print core AA 0.4 is placed in print head slot 1 of the Ultimaker S5.

3.2 Installing the hardware accessories

Connect the Bowden tubes

1. Remove the clamp clips from the print head and insert the Bowden tubes. The Bowden tubes connect to the corresponding numbers on the print head.
2. Secure the Bowden tubes with the clamp clips.
3. Fit the print head cable clips onto Bowden tube 2.

Place and connect the NFC spool holder

1. Insert the spool holder into the back panel and push until it snaps into place.
2. Secure the cable from the spool holder behind the cable clips in the back panel.
3. Connect the cable to the NFC socket at the back of the printer.
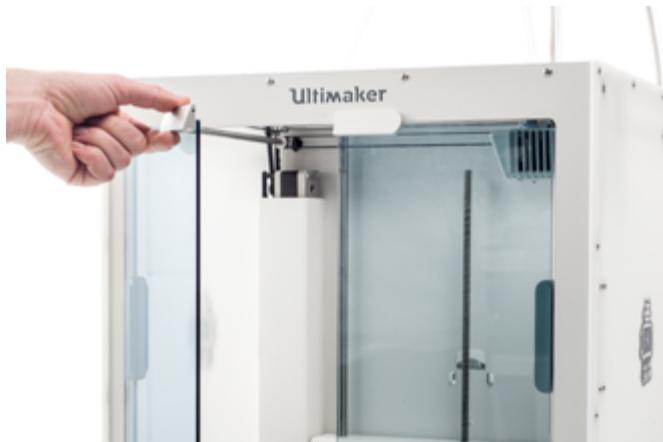
Place the glass build plate

1. Open the glass doors.
2. Open the two build plate clamps at the front of the build plate.
3. Gently slide the glass plate onto the build plate and ensure that it snaps into the build plate clamps at the back.

> **i** For the first use it is recommended to use the materials supplied with the Ultimaker S5. These should be printed on the glass build plate.

4. Close the two build plate clamps at the front to secure the glass build plate and close the glass doors.

Connect the power cable

1. Connect the power cable to the power socket at the back of the Ultimaker S5.
2. Plug the other side of the cable into a wall outlet.

4. Set up for first use

After installing the accessories, you need to set up the printer for the first use. This chapter will explain how to select the build plate, install print cores, load materials, set up a network, update the firmware, and install Ultimaker Cura.

4.1 Build plate selection

To perform the setup steps, turn on the printer with the power switch at the back. You will first be asked to select your preferred language. After this, the welcome setup will appear on the touchscreen. Follow the steps on the touchscreen and described on the next pages of this user manual.

> **i** The language on the printer can always be changed by navigating to *Preferences → Settings → Language*.

Confirm the glass build plate is installed

For the first use, it is recommended to print with the materials that were delivered with the printer: Tough PLA and PVA. This material combination must be printed on a glass build plate, which is why the glass build plate was installed in the previous chapter. In this step of the welcome setup, you must confirm that you have installed the glass build plate.

A thin layer of glue should be applied to the glass build plate to ensure reliable adhesion. More information about the recommended build plate and adhesion method per material can be found in chapter 5.2 Materials.

4.2 Print core installation

Print cores

The Ultimaker S5 uses two print cores in the print head, which are interchangeable.

There are two types of print cores:
- Type AA: for printing build materials and Ultimaker Breakaway material
- Type BB: for printing water-soluble support material

Each Ultimaker S5 comes with two print cores AA 0.4 (of which one is already installed in print head slot 1) and one print core BB 0.4. This means that it is possible to make prints with two build materials or with a build and support material.

The print cores contain information on a small chip, so that the printer always knows which print cores are installed and which materials can be used with this print core.

Install the second print core

During the welcome setup, the second print core must be installed. To do this, go to *Print core 2* and select *Start*. Follow the steps on the Ultimaker S5:
1. Carefully open the glass doors and the print head fan bracket and press *Confirm*.
2. Install the second print core (BB 0.4) in print head slot 2 by squeezing the levers of the print core and sliding it into the print head until you hear a click.
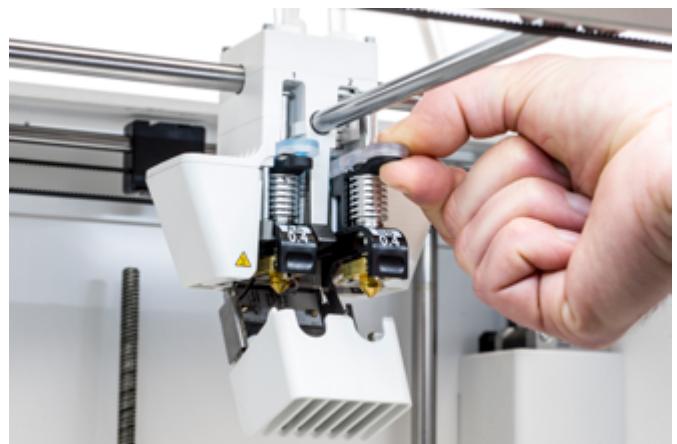
⚠️   Do not touch the contact points on the back of the print core with your fingers.

ℹ️   Make sure you keep the print core completely vertical while installing it so it will smoothly slide into the print head.

3. Carefully close the print head fan bracket and *Confirm* to proceed with the welcome setup.

4.3 Load materials

Before you can start printing on the Ultimaker S5, you need to load materials into the printer. For the first use, it is recommended to use the spools of Tough PLA and PVA that come with the Ultimaker S5.

Load material 2

Material 2 will be loaded first because this is the material that must be placed closest to the back of the printer. Select Material 2 from the list shown on the touchscreen, select *Start*, and then take the following steps to load the material.

1. Place the spool with material 2 (PVA) onto the spool holder and select *Confirm*. Make sure the end of the material points in a clockwise direction, so that the material can enter feeder 2 from the bottom.
2. Wait until the Ultimaker S5 detects the material and *Confirm*.

> **i** When using a third-party material you can select the material type manually.

3. Insert the end of the material into feeder 2 and gently push it until the feeder grips it and the material is visible in the Bowden tube. Select *Confirm* to continue.

> **i** You can straighten the end of the material a bit so it can enter the feeder easier.

4. Wait for the Ultimaker S5 to heat up print core 2 and load the material into the print head.
5. *Confirm* when the new material extrudes consistently from print core 2.
6. Wait a moment for print core 2 to cool down.

Load material 1

Material 1 will be put on the material guide first before placing it on the spool holder to avoid tangling of the 2 materials during printing. Select material 1 from the list on the touchscreen, select *Start*, and follow the steps below.

1. Take the material guide and hold it with the outer part towards you.
2. Place the material spool with material 1 (Tough PLA) on the material guide with the material in a counter-clockwise direction, and guide the end of the material through the hole in the material guide.
3. Place the material guide with material 1 on it onto the spool holder behind material 2, and select *Confirm*.
4. Wait until the Ultimaker S5 detects the material and select *Confirm*.

> **i** When using a third-party material, you can select the material type manually.

5. Insert the end of the material into feeder 1 and gently push it until the feeder grips it and the material is visible in the Bowden tube. Select *Confirm* to continue.

> **i** You can straighten the end of the material so it can enter the feeder easier.

6. Wait for the Ultimaker S5 to heat up print core 1 and to load the material into the print head.
7. *Confirm* when the new material extrudes consistently from print core 1.
8. Wait a moment for print core 1 to cool down.

4.4 Network installation and firmware update

Set up network connectivity

The Ultimaker S5 can connect to a local area network, using either Wi-Fi or Ethernet. To connect to a network, select *Network setup* from the welcome setup list. If you want to set up a wireless network connection, select *Wi-Fi setup*. If you want to use Ethernet, or don't want to set up network connectivity, select *Skip*.

Set up Wi-Fi
To connect your Ultimaker S5 to a wireless network, you will need a computer or smartphone. Start the Wi-Fi setup and follow the steps on the touchscreen:
1. Wait until your Ultimaker S5 has created a Wi-Fi hotspot. This may take a minute.
2. Use a computer or smartphone to connect to the printer. The name of the Wi-Fi network is shown on the touchscreen of the Ultimaker S5.
3. A pop-up will appear on the display of your computer or smartphone. Follow the steps to connect the Ultimaker S5 to your local Wi-Fi network. The pop-up will disappear when you have completed these steps.

> **i** If the pop-up does not appear, open a browser and go to a website that is not yet known by your browser.

4. Go back to the Ultimaker S5 and wait until the Wi-Fi setup is finished.

> **i** Within some network environments the Ultimaker S5 may experience difficulties connecting wirelessly. When this happens, repeat the Wi-Fi setup from another computer or smartphone.

> **i** If you skip the Wi-Fi setup during the welcome setup, you can start it again by going to *Preferences → Network → Start Wi-Fi setup*.

Connect via Ethernet
You can set up a wired network connection after completing the welcome setup by performing the following steps:
1. Connect one end of an Ethernet cable to the Ethernet port at the back of the Ultimaker S5.
2. Connect the other end of the cable to a network source (router, modem, or switch).
3. Enable Ethernet in the network menu by navigating to *Preferences → Network* and enabling *Ethernet*.

Update the firmware

After completing the welcome setup, the Ultimaker S5 will check if the latest firmware is installed as a final step. If an older version is detected, it will download the latest firmware and install it. This process may take several minutes to complete.

> **i** You will only be prompted to install the latest firmware if the printer is connected to a network and an older firmware version is detected.

4.5 Install Ultimaker Cura

After successfully setting up your printer, please install Ultimaker Cura – our free print preparation and management software – on your computer. You can download Ultimaker Cura at www.ultimaker.com/software.

System requirements

Supported platforms
- Windows Vista or higher (64 bit)
- Mac OSX 10.7 or higher (64 bit)
- Linux Ubuntu 14.04, Fedora 23, OpenSuse 13.2, ArchLinux or higher (64 bit)
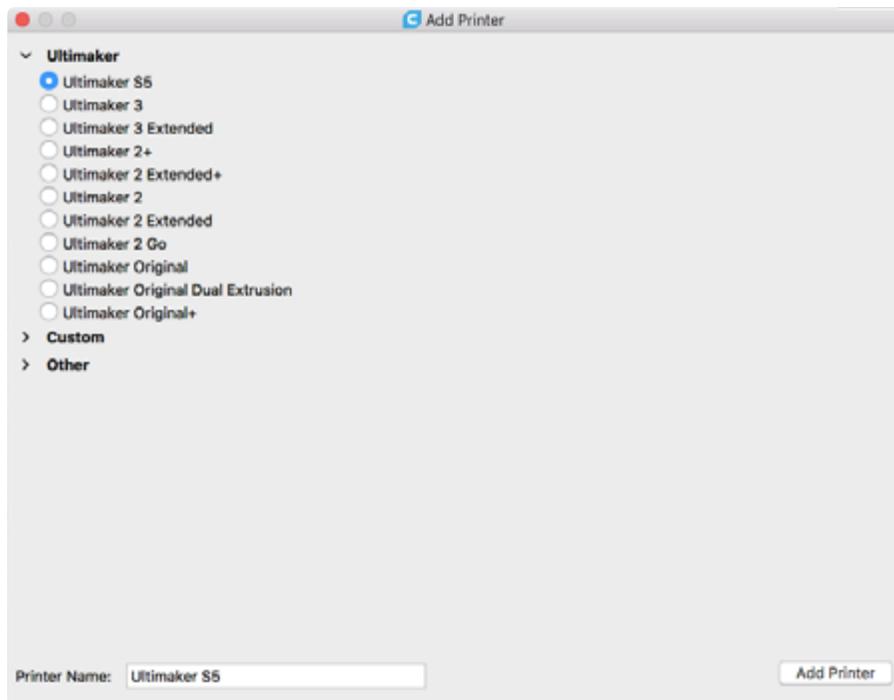
System requirements
- OpenGL 2 compatible graphics card
- Intel Core 2 or AMD Athlon 64 or newer
- At least 4GB of RAM (8GB or more is recommended)
- A 64 bit processor

Installation

After downloading, run the installer and run the installation wizard to complete the installation of Ultimaker Cura. When opening Ultimaker Cura for the first time, you will be asked to select your 3D printer. Select the Ultimaker S5 profile, and you are ready to go. You can now directly connect to the printer and start using Ultimaker Cura.

> **i** If you have installed Ultimaker Cura before, you can add the Ultimaker S5 by navigating to
> *Settings → Printer → Add printer*.

5. Operation

After installation, it's time to start printing with your Ultimaker S5. This chapter provides information about the touchscreen, materials, Ultimaker Cura, starting a print, removing the print and support material, changing the printer configuration, and calibration steps.

5.1 Touchscreen

You can control the Ultimaker S5 by using the touchscreen at the front of the printer.

When turning the Ultimaker S5 on for the first time, the printer will run the welcome setup. After this, the main menu will be shown when turning the printer on.

Interface
The main menu offers three options, represented by the following icons:

Status overview

Configuration overview

Preferences overview

Status overview
The status overview is automatically shown next to the main menu. From here you can start a print from USB, or view the progress of the print while printing.

Configuration overview
The configuration overview shows the current configuration of the printer. Here you can see which print cores, materials and build plate are installed and it allows you to change the configuration.

Preferences overview
The preferences overview consists of three sub-menus: settings, maintenance, and network. In the printer settings menu you can change general settings, such as the language. In the maintenance menu the most important maintenance and calibration procedures can be performed, in addition to saving logs for diagnostics. The network menu allows you to change network settings or to perform the Wi-Fi setup.

5.2 Materials

Material compatibility

As explained in chapter 4.2 (Print core installation), the Ultimaker S5 comes with two AA print cores and one BB print core. The AA print cores can be used for printing build materials and Breakaway support material. The BB print core can be used for water-soluble support material (PVA).

The Ultimaker S5 supports all Ultimaker materials that are currently available, of which most can be printed with all print core sizes (0.25, 0.4 and 0.8 mm). The overview below shows you which material is compatible with which print core size. This compatibility table is based on single-extrusion prints.

	Tough PLA	PLA	ABS	Nylon	CPE	CPE+	PC	TPU 95A	PP	PVA	Break-away
Print core 0.25	✓	✓	✓	✓	✓	✗	ⓘ	ⓘ	✓	✗	✗
Print core 0.4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Print core 0.8	✓	✓	✓	✓	✓	ⓘ	ⓘ	✓	✓	✓	✗

✓ Officially supported　　ⓘ Experimental　　✗ Not supported

For an overview of possible dual-extrusion material combinations take a look at the table below.

	Tough PLA	PLA	ABS	Nylon	CPE	CPE+	PC	TPU 95A	PP	PVA	Break-away
Tough PLA	✓	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓
PLA		✓	✗	✗	✗	✗	✗	✗	✗	✓	✓
ABS			✓	✗	✗	✗	✗	ⓘ	✗	ⓘ	✓
Nylon				ⓘ	✗	✗	✗	ⓘ	✗	✓	✓
CPE					✓	✗	✗	✗	✗	✓	✓
CPE+						ⓘ	✗	✗	✗	ⓘ	✓
PC							ⓘ	ⓘ	✗	✗	ⓘ
TPU 95A								ⓘ	✗	ⓘ	ⓘ
PP									ⓘ	✗	✗
PVA										✗	✗
Breakaway											✗

✓ Officially supported　　ⓘ Experimental　　✗ Not supported

Although the Ultimaker S5 has an open material system, the use of Ultimaker material on the printer is recommended. All Ultimaker materials have been tested extensively and have optimized profiles in Ultimaker Cura to ensure the best print results. Therefore it is advised to use one of the default profiles in Ultimaker Cura for the highest reliability. Using Ultimaker materials will also allow you to benefit from the NFC detection system. Ultimaker spools will automatically be recognized by the Ultimaker S5, and this information can be directly transferred to Ultimaker Cura when connected to a network, for a seamless connection between the printer and Ultimaker Cura software.

Print recommendations

Each material requires different settings for optimal results. If you use Ultimaker Cura to prepare your model, these settings are automatically set correctly if the correct print core(s), material(s) and build plate type are selected. Ensure to use the latest version of Ultimaker Cura for the most up-to-date print profiles.

For all materials that are supported on the Ultimaker S5, you either have to use the glass or aluminum build plate for adhesion. The overview below shows the recommended build plate per material.

Material	Glass build plate (+ glue)	Aluminum build plate
PLA	Yes, preferred	Yes
Tough PLA	Yes, preferred	Yes
Nylon	Yes, preferred	No
ABS	Not recommended	Yes, preferred
CPE	Yes	Yes, preferred
CPE+	Not recommended	Yes, preferred
PC	Not recommended	Yes, preferred
TPU 95A	Yes, preferred	Yes
PP	Yes (+ adhesion sheet)	Yes, preferred
PVA	Yes	No
Breakaway	Yes	Yes

> **i** If you are using the glass build plate it is also recommended to apply a thin layer of glue (using the glue stick from the accessory box) or an adhesion sheet to the glass build plate before starting a print. This will ensure that your print adheres reliably to the build plate, and also prevents the glass build plate from chipping when removing materials.
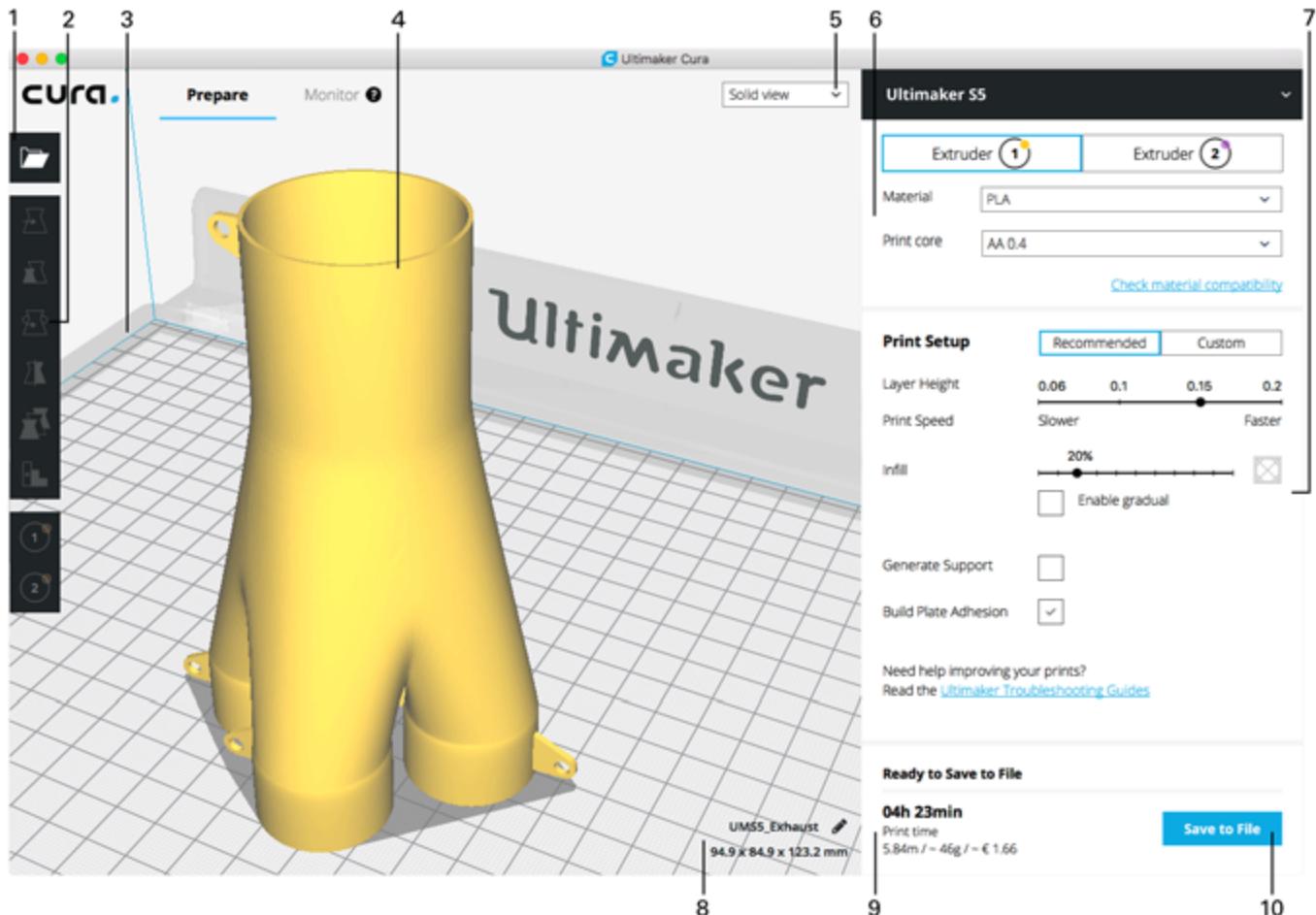
When changing the build plate you also need to change the build plate configuration on the printer (see chapter 5.7 Changing the printer configuration).

For detailed instructions on which settings and adhesion method to use per material, take a look at the material manuals on www.ultimaker.com.

5.3 Prepare a print with Ultimaker Cura

Interface

After you have added the Ultimaker S5 in Ultimaker Cura, the main interface will become visible. Here is an overview of the interface.

1. Open file
2. Adjustment tools
3. Non-printable areas
4. 3D model
5. View mode
6. Printer, material, and print core configuration
7. Print Setup (recommended mode)
8. Model information
9. Print job information (print time and material usage)
10. Print over network, or save to file or USB stick

Slice a model

To slice a model in Ultimaker Cura:
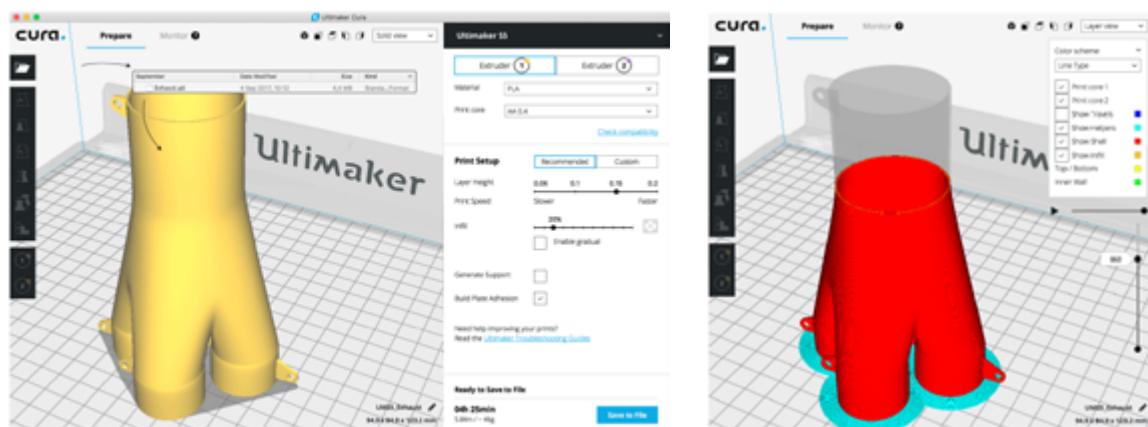
1. Load the model(s) by clicking the *Open File* folder icon.
2. In the sidebar (right side of the screen), check if the materials and print cores are correct.
3. Use the Adjustment Tools to position, scale and rotate the model as desired.
4. Select your desired settings (layer height/print speed, infill, support and build plate adhesion) under Print Setup.

> **i** When printing with support, you have the option to select the extruder that you want to use to print the support structure. This allows you to print your model with PVA support, Breakaway support or build material support on your Ultimaker S5.

5. To view the result of the selected settings, change the view mode from *Solid view* to *Layer view*.
6. In the bottom-right corner, select *Print over network*, *Save to file* or *Save to USB* depending on the printing method.

> **i** If you create a dual-color print you have to assign material colors to the models and merge the models before finishing your slice.

For more instructions on how to use Ultimaker Cura, take a look at the Ultimaker Cura manual on our website.

5.4 Start a print

Print with Cura Connect
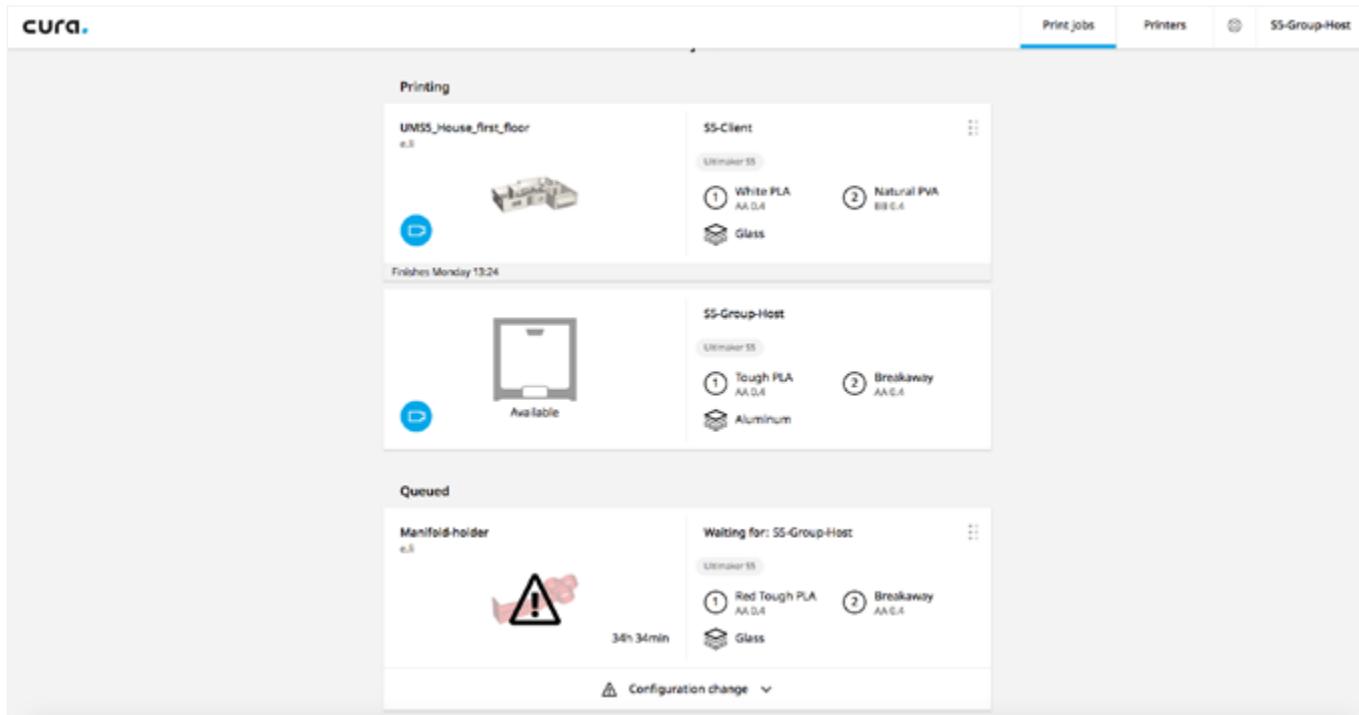
The Ultimaker S5 offers the possibility to print over a network, either via Wi-Fi or Ethernet. This can be done with Cura Connect in Ultimaker Cura when your Ultimaker S5 and computer are connected to the same network.

To start a print via Cura Connect:
1. Connect your Ultimaker S5 to a network (if not done yet) via Wi-Fi or Ethernet:
   • Wi-Fi: Install Wi-Fi by going to *Preferences → Network → Start Wi-Fi setup* and follow the steps on the touchscreen. See chapter 4.4 Network installation and firmware update for more information.
   • Ethernet: Connect the Ethernet cable to the socket at the back of the Ultimaker S5 and the other end of the cable to a router or modem.
2. Enable Wi-Fi or Ethernet in the network menu.
3. In Ultimaker Cura go to *Settings → Printers → Manage printers*.
4. Click on the *Connect via network* button.
5. Select your Ultimaker from the list of printers that are shown and click *Connect*. This printer is now the group host.
6. Slice your 3D model in Ultimaker Cura.
7. Press *Print over network* to start the print.

> **i** Once the print is running you can monitor it by opening the Monitor tab at the top of the screen in Ultimaker Cura or via the Cura Connect app. This allows you to view the progress of your prints and to control your Ultimaker S5(s) at a distance.

> **i** When sending multiple print jobs, Cura Connect will automatically add them to a queue.
> View the Cura Connect manual for a more elaborate description of all features.

Print with USB

When it is not possible to print via a network, 3D print files can still be transferred to your Ultimaker S5 with a USB stick.

1. Place the USB stick in your computer.
2. Slice your 3D model in Ultimaker Cura. Ensure that the material and print core configuration in Ultimaker Cura matches the configuration on your Ultimaker S5.
3. Save the print file to the USB stick (GCODE, GCODE.gz or UFP) using the *Save to removable drive* button.
4. Eject the USB stick in Ultimaker Cura and remove it from your computer.
5. Place the USB stick in the USB port on Ultimaker S5.
6. Go to the Status overview menu and select the file you want to print.

5.5 Remove the print

Once your 3D print is finished it must be removed from the build plate. There are several methods to do this, depending on the build plate type (glass or aluminum).

⚠️ When using a brim, be aware of the danger of cutting yourself when removing the print from the build plate. Use a deburring tool to remove the brim once the print is taken from the build plate.

Wait for cool down

If you printed directly onto the build plate without using an adhesive, simply allow the build plate and the print to cool down after printing. The material will contract as it cools, allowing you to easily remove the print from the build plate.

Use a spatula

If your print is still adhered to the build plate after cooling, you can use a spatula to remove the print. Place the spatula under the print, and keep it parallel to the build plate in order to avoid scratches on the build plate. and apply a small amount of force to remove the print. A spatula can also be used to carefully remove remaining parts of the print from the build plate, such as the brim or support structures.

⚠️ Take the build plate out of the printer to avoid damaging the build plate clamps.

Use water

If you printed on the build plate with glue and if neither of the above methods work, remove your print using water. Remove the build plate with print from the printer. Be careful not to burn your fingers if the build plate is still warm. Run cool tap water on the back side of the plate to cool it quickly. The print material will contract more than with normal cool down. Once cool, the print will pop off.

Alternatively, you can run lukewarm water over the print side of the plate to dissolve the glue. Once the glue is dissolved, it is easier to remove the print. If PVA was used, place the build plate and print in water to dissolve the PVA. This makes print removal easier.

5.6 Remove support material

Dissolve PVA support

PVA support structures can be removed by dissolving the PVA in water. This takes several hours and leaves no trace afterwards.

1. **Submerge the print in water**
   By putting a print with PVA in water the PVA will slowly dissolve. This process can be sped up by using:
- *Warm water.* Warm water will decrease the dissolving time. When using PLA for the build material, ensure that the water is no hotter than 35 °C, otherwise the PLA part may deform. Never use water above 50 °C, as this increases risk of burning.
- *Stirring.* Use stirring/running water to decrease the dissolving time. Moving water enables the PVA to dissolve more quickly (in some cases under three hours, depending on the amount of support material used).
- *Pliers.* You can also speed up PVA dissolution by placing the print in water for approximately 10 minutes, then removing most of the support with pliers. When the print is placed back in the water, only the remaining parts of PVA will need to be dissolved.

2. **Rinse with water**
   After PVA supports are totally dissolved, rinse the print with water to remove any excess PVA.

3. **Let the print dry**
   Let the print dry completely and apply additional post-processing to the build material if desired.

4. **Disposal of waste water**
   PVA is a biodegradable material, and in most cases disposing the water afterwards is easy. However, it is recommended that you check local regulations for more comprehensive guidance. The water can be disposed of down the drain, providing the waste water distribution network is connected to a wastewater treatment plant. After disposal, run hot water from the tap for approximately 30 seconds to remove any excess saturated PVA water and to avoid longer-term clogging issues.

It is possible to use the water for more than one print, however, this might extend the dissolving time. Through repeated use, the water becomes saturated by previously dissolved PVA, so for the quickest result, fresh water is recommended.

Remove Breakaway support

Prints using Ultimaker Breakaway as support material will require post-processing to remove the support structures. This can be achieved by breaking the support structures from the build material.

⚠️ It is advised to wear protective gloves when the support structure contains sharp corners or when working with bigger models.

1. **Tear the inner support structure**
    Start by removing the walls of the support structure with a gripping plier. This allows you to quickly tear away the majority of the inner support structure.

2. **Pull the Breakaway support from the build material**
    After removing most of the support structure, the remaining part(s) can be pulled from the build material. Use cutting pliers to grip the Breakaway support in a corner and try to carefully get underneath it, then bend it upwards. Repeat this for several corners, so that you can loosen the support from the model around the corners. After this, pull the Breakaway support from the model.

3. **Peel the last traces from the model**
    Sometimes a final layer of the support material remains after pulling the Breakaway support from the build material. If this happens, use cutting pliers to peel it off from a loose edge. Any leftover traces on the model can be removed with tweezers.

5.7 Change the printer configuration

Change materials

Materials can be changed easily on the Ultimaker S5 by using the procedure from the menu. Besides changing material you also have the option to only load or unload a material. Make sure compatible print cores are installed before you insert materials.

1. Go to the configuration menu, select the material you want to use and select *Change*.
2. Wait for the print core to heat up and unload the material.
3. Remove the material from the feeder and spool holder. *Confirm* to continue.
4. Place the new material on the spool holder and *Confirm*.
5. Wait until the Ultimaker S5 detects the material.

> **i** When using a third-party material, you can select the material type manually.

6. Insert the end of the material into the feeder and gently push it until the feeder grips it and the material is visible in the Bowden tube. Select *Confirm* to continue.
7. Wait for the Ultimaker S5 to heat up the print core and to load the material into the print head.
8. *Confirm* when the new material extrudes consistently from the print core.
9. Wait a moment for the print core to cool down.

Change print cores

Print cores can be changed easily on the Ultimaker S5 by using the procedure from the menu. Besides changing print cores you also have the option to only load or unload a print core.

1. Go to the configuration menu, select the print core you want to change and select *Change*.
2. Wait for the print core to heat up, unload the material, and cool down again.
3. Open the glass doors and print head fan bracket and *Confirm* when completed.
4. Remove the print core carefully by squeezing the levers and sliding the print core out of the print head.

> **⚠** Do not touch the contact points on the back side of the print core with your fingers.

> **i** Make sure you keep the print core completely vertical while removing or installing it so it will smoothly slide into/out of the print head.

5. Insert a print core by squeezing the levers of the print core and sliding it into the print head slot until you hear a click.

> **i** It is possible that the print core includes a ring around the nozzle. Remove this nozzle ring before using the print core on the Ultimaker S5.

6. Carefully close the print head fan bracket and *Confirm* when completed.
7. Wait for the Ultimaker S5 to load the material into the print core.

> **i** It is not possible to change a material and print core at the same time. If you want to change both, you must first unload the material, then change the print core and after that load the new material.

Change the build plate

When you switch from the glass build plate to the aluminum build plate, or the other way around, the build plate configuration in the printer must be changed as well.

1. Go to the configuration menu and select the build plate.
2. Press *Select type* to change the build plate type to the one placed in your Ultimaker S5.

5.8 Calibration

Build plate leveling

While using the Ultimaker S5, build plate calibration should be performed to ensure reliable adhesion of the print to the build plate. If the distance between the nozzles and build plate is too wide, your print won't adhere properly to the glass build plate. On the other hand, if the nozzles are too close to the build plate, it can prevent material from extruding.

> **i** Make sure there is no excess material below the tip of the nozzles and the build plate is clean before the start of a print or when you want to calibrate the build plate, or you might get inaccurate results.

Active leveling
Active leveling is automatically performed by the printer at the start of a print, to create a reliable first layer. During active leveling, the Ultimaker S5 will create a detailed heightmap of the build plate surface. This information is used to compensate for any inaccuracies of the build surface during the first layers of the print. It will do this by adjusting the build plate height while printing.
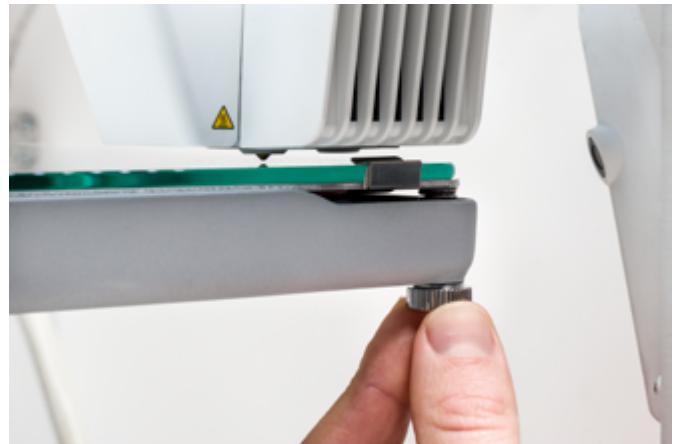
> ⚠ Do not touch the Ultimaker S5 during the active leveling procedure, as this could affect the calibration process.

Manual leveling
Perform manual leveling when the level of the build plate is too far out of range for active leveling to compensate for.

1. Go to *Preferences → Maintenance → Build plate →* Manual leveling and select *Start*.
2. Wait while the Ultimaker S5 prepares the manual leveling procedure.
3. Use the touchscreen controls to move the build plate until there is approximately 1 mm distance between the first nozzle and the build plate. Make sure that the nozzle is close to the build plate without touching it. *Confirm* to continue.
4. Adjust the front-right thumb wheel to roughly level the build plate at the front. There should be a distance of approximately 1 mm between the nozzle and build plate. *Confirm* to continue.

5. Repeat step 4 for the front-left thumb wheel and *Confirm* to continue.
6. Place the calibration card inbetween the nozzle and build plate. Use the touchscreen controls to adjust the position of the build plate until you feel some resistance when moving the card. Select *Confirm* to continue.

⚠️ Do not apply force to the build plate while fine-tuning with the calibration card, as this will lead to leveling inaccuracies.

7. Place the calibration card in between the nozzle and build plate in the front right corner. Adjust the thumb wheel until you feel some resistance when moving the card. *Confirm* to continue.
8. Repeat step 7 for the front left corner and *Confirm* to continue.

ℹ️ After calibrating the build plate with the first nozzle, the second nozzle needs to be aligned as well, to ensure the heights of both nozzles are set correctly. For this it is only necessary to set the correct height by using the calibration card.

9. Place the calibration card inbetween the second nozzle and build plate. Use the controls to adjust the position of the build plate until you feel some resistance when moving the card. Select *Confirm* to continue.
10. Wait for the printer to finish the manual leveling procedure.

XY offset calibration

Besides the vertical offset, the horizontal distance between the nozzles in the X and Y direction also needs to be configured. The print cores that are supplied with the Ultimaker S5 are already calibrated, but when the printer detects a new combination, you will need to perform an XY offset calibration again. This calibration must only be done once; after this, the information is stored on the printer. A correct XY calibration will ensure that the two colors or materials align well.

ℹ️ To perform the calibration you will need an XY calibration sheet, which can found in the accessory box or downloaded at www.ultimaker.com/XYcalibration.

Ensure 2 print cores and materials are installed before starting the calibration and that you have selected the correct XY calibration sheet.

To start the calibration:
1. Go to *Preferences → Maintenance →* Print head → Calibrate XY offset and select *Start calibration*.
2. The Ultimaker S5 will now print a grid pattern on the build plate. Wait until it is complete.
3. Once the Ultimaker S5 has cooled down, remove the build plate from the printer and align it with the XY calibration sheet. Ensure the printed grid is precisely placed on/under the two rectangles on the sheet.
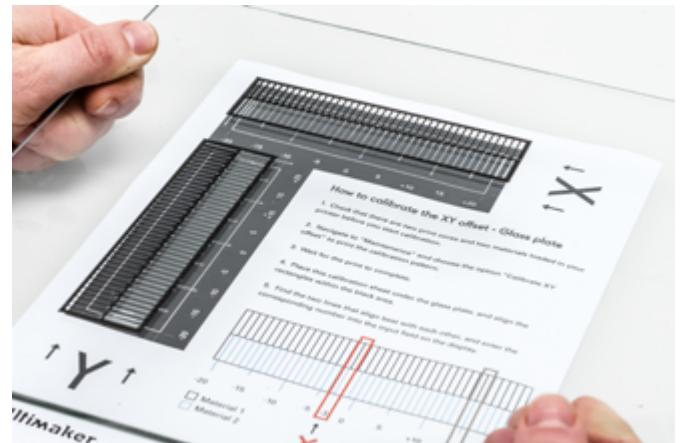
ℹ️ If you are performing the XY calibration on a glass build plate, the glass build plate must be placed on top of the paper XY calibration sheet. For the aluminum build plate, place the transparent XY calibration sheet on top of the plate.

4. Find the best aligned lines on the printed X grid and note which number corresponds to these lines. Enter this number as the X offset value on your Ultimaker S5.
5. Find the best aligned lines on the printed Y grid and note which number corresponds to these lines. Enter this number as the Y offset value on your Ultimaker S5.

It is important that the printed XY offset print adheres well to the build plate and shows no signs of under-extrusion. If it does, it is recommended to repeat the calibration print.

Lift switch calibration

The switch bay enables the second print core to be lifted and lowered. For successful dual-extrusion prints, it is important that print core switching functions well. The lift switch is already calibrated when the Ultimaker S5 is shipped, but calibration can also be performed manually if needed.

To perform the switch bay calibration:
1. Go to *Preferences → Maintenance → Print head → Calibrate lift switch* and select *Start calibration*.
2. Move the lift switch on the side of the print head to point towards you. *Confirm* to continue.
3. Move the print head so that the lift switch fits in the switching bay. *Confirm* when completed.
4. Wait for the print head to go to the home position and test the lift switch.
5. Did the lift switch lower and raise the print core? If so, press *Yes* to complete the calibration. If not, select *No* to perform the calibration again.

6. Maintenance

In order for your Ultimaker S5 to work smoothly, it is important to maintain it correctly. In this chapter the most important maintenance steps are described. Read this carefully in order to achieve the best print results.

6.1 Update the firmware

Periodically, a new version of the Ultimaker S5 firmware is released. To ensure that your Ultimaker S5 is equipped with the latest features it is recommended to update the firmware regularly. This can be performed on the Ultimaker S5 when connected to a network, or by using a USB stick.

Update over the network

To update the firmware over the network, take the following steps:
1. Connect the printer to the network via Wi-Fi or Ethernet in the Network menu.
2. Go to *Preferences* → *Maintenance* → Update firmware.
3. Choose the *Stable* version.

The Ultimaker S5 will now download the latest firmware from the server and install it. This may take several minutes.

Update using a USB stick

Firmware can also be updated without an active network connection by taking the following the steps:
1. Download the latest firmware files from www.ultimaker.com/firmware.
2. Save the firmware files on a USB stick.

> **i** There is no need to extract the two firmware files from the archive after downloading. Simply place them in the root directory of your USB stick.

3. Insert the USB stick in the USB port on the Ultimaker S5.
4. Go to *Preferences* → *Maintenance* → *Update firmware*.
5. The Ultimaker S5 will detect it if there are firmware files on the USB stick. If files are detected, you can select one to start a firmware update.

6.2 Material handling and storage

When you have multiple spools of material in use, or do not print with a material, it is very important that you store them properly. If material is stored incorrectly, it may affect its quality and usability.

To keep your materials in optimal condition it is important that you keep them:
• Cool and dry
• Out of direct sunlight
• In a resealable bag

The optimal storage temperature for PLA, Tough PLA, Nylon, CPE, CPE+, PC, TPU 95A, PP and Breakaway is between -20 to +30° C. For ABS the advised temperature is between 15 and 25° C and for PVA 0 to 30 °C. Furthermore a relative humidity of below 50% is recommended for PVA, TPU 95A, PP and Breakaway. If these materials are exposed to a higher humidity the quality of the material can be affected.

You can store the material in a resealable bag, including the supplied desiccant (silica gel). For PVA it is advised to store the spool in a resealable bag with the supplied desiccant directly after printing to minimize moisture absorption.

6.3 Maintenance schedule

To keep your Ultimaker S5 in optimal condition we recommend the following maintenance schedule, based on 1,500 printing hours per year:

Every month	Every 3 months	Every year
Clean the printer Lubricate the axles (*)	Check for play on the axles Check tension of short belts Check for debris in front fan of print head Check quality of nozzle cover Lubricate lead screw Z motor Clean the feeders Clean the print cores	Lubricate the feeder gear Replace the Bowden tubes Clean system fans Lubricate hinges

i (*) The X, Y and Z axles do not need lubrication for the first year of using the printer. After this, they should be lubricated monthly.

i If the usage frequency is higher, we recommend performing more frequent maintenance on your printer to ensure optimal printing results.

6.4 Clean the printer

For the best print results it is important to keep the Ultimaker S5 clean while using it. It is advised to not use the Ultimaker S5 in a room where it can easily be covered with dust, and to remove small pieces of material that might be in the printer. Besides this, there are a few parts in the Ultimaker S5 that might require more regular cleaning.

Clean the glass/aluminum build plate

After printing, there might be print leftovers or excess glue stuck to the build plate. This can cause an uneven print surface. Potential sources of contamination are dust or fatty substances such as finger grease. Removing a print may also reduce the adhesion quality of a layer of glue. It is advised to regularly clean the build plate and reapply glue (if applicable).

Before starting a new print, always check the surface of the build plate. At least once a month, clean the build plate thoroughly by taking the following steps:

⚠️ Always make sure that the build plate has cooled down and is lowered to the bottom of the Z axis.

1. Open the build plate clamps at the front, slide the glass or aluminum build plate forward, and take it out of the printer.
2. Use lukewarm water and a non-abrasive sponge to clean the build plate and to remove any adhesives. If necessary, some detergent can be used to remove adhesives, or alcohol gel can be used to get rid of any fatty substances.
3. Dry the build plate with a clean microfiber cloth.
4. Place the glass or aluminum build plate on the heated bed with the warning sticker facing upwards. Ensure that it snaps into the build plate clamps at the back and close the build plate clamps at the front to secure it.

Clean the glass components

All glass components of the printer (the glass doors and touchscreen) should be cleaned regularly to remove dust or fingerprints. They can be cleaned by using a dry, or if necessary, a somewhat moist microfiber cloth.

Clean the nozzles

While using the Ultimaker S5, material can get stuck to the outside of the nozzles and degrade. Although this will not damage your printer, it is recommended keep the nozzles clean in order to achieve the best print results.
Before starting a new print, always check the nozzles. At least once a month, remove the plastic from the outside of the nozzles by taking the following steps:

⚠️ During this procedure do not touch the nozzles and be careful while cleaning them as they will become hot.

1. On the Ultimaker S5, navigate to the configuration menu, select *print core 1*, then click on the icon in the top right corner and select *Set temperature*.
2. Use the controls to set the target temperature to 150 °C. Repeat this for print core 2 and make sure this print core is lowered.
3. Wait for the material on the outside to get soft. When the nozzles are hot, carefully remove the material with tweezers.

⚠️ The nozzle cover is fragile and has a sealing function. Be careful not to damage the nozzle cover when using tweezers.

ℹ️ Material may have accumulated higher up on the outside of the nozzle, above the nozzle cover. Check if this is the case by opening the print head fan bracket. To ensure the print head can close smoothly, this material should be removed using tweezers, as described above.

Clean the Bowden tubes

Particles in the Bowden tubes can impede smooth movement of the filament, or mix colors. Clean the Bowden tubes at least once a month, or after experiencing an issue with filament grinding. To clean the Bowden tubes, they must first be removed from the printer.

1. Start by removing the material. Go to the configuration menu, select the material you want to remove and then *Unload*. After this, turn off the printer.
2. Place the print head in the front-right corner.
3. Use your fingernail to remove the clamp clips from the tube coupling collets at the print head and feeders.
4. Press down on the tube coupling collet in the print head and at the same time, pull the Bowden tube upwards, out of the print head. Repeat these steps for the feeder.

i	The cable clips that hold the second Bowden tube to the print head cable do not have to be removed, you can leave them in place.

5. Cut off a small piece of sponge or ball up a piece of tissue.
6. Insert this into the feeder end of the Bowden tube and push it all the way through the tube with a length of filament. Do this for both Bowden tubes, using a clean piece of sponge or tissue for each.

i	To clean the tube most efficiently, make sure the sponge or ball of tissue is a tight fit inside the Bowden tube. Note that if it is too big it will be difficult to push through.

7. Insert the Bowden tube into the feeder by pressing down on the tube coupling collet in the feeder and pushing the Bowden tube all the way in. Secure the tube with the clamp clip. Repeat this for the other Bowden tube.

i	Pay attention to the orientation of the first Bowden tube that was completely removed from the printer. One side is chamfered for easier entry of the filament; this side should be inserted into the feeder.

8. Insert the Bowden tube into the print head by pressing down on the tube coupling collet in the print head and pushing the Bowden tube all the way in. Secure the tube with the clamp clip. Repeat this for the other Bowden tube.

Inside of the printer

Small pieces of material can gather inside the printer, such as priming blobs. Remove these regularly from the inside of the printer by taking the following steps:

1. Raise the build plate by navigating to *Configuration → Build plate* and select *Raise*.
2. Clean the inside of the printer with a microfiber cloth or vacuum cleaner. Pay extra attention to the area around the Z limit switch as obstructions here can cause print problems.

⚠️ Leaving larger objects on the bottom panel can lead to errors, as they prevent the build plate from homing properly.

6.5 Lubricate the axles

To make sure that your print head and Z stage can move smoothly at all times, it is advised to lubricate the axles every month after the first year of printing. If the axles feel dry, this can show in your prints as small ridges on surfaces. Apply some oil to the axles at least once a month.

A bottle of oil is included in the accessory box of your Ultimaker S5. This oil is specifically for the smooth axles of the Ultimaker S5. Only use the supplied oil, as using other oils or grease may affect the coating of the axles, which can affect the performance of your Ultimaker S5.

X and Y axles

Apply a small drop of oil to each of the X and Y axles as well as both print head shafts. Manually move the print head around to evenly distribute the oil.

⚠️ Do not apply too much oil to the axles, as it might drip from the axles on to the build plate, which will affect print adhesion. If a drop of oil does fall on the build plate, make sure to clean it thoroughly before printing.

Z axles

Apply a small drop of oil to each of the Z axles. In the Ultimaker menu, go to *Configuration → Build plate*. Select *Raise* and then *Lower* to move the build plate up and down in order to evenly distribute the oil.

6.6 Check for play on the axles

The four X and Y axles are locked in place by the pulleys. However, it is possible that one or more of the pulleys can become slightly loose over time, which could affect their alignment. If this is the case, there could be play on the X and/or Y axles which can cause issues with print quality.

It is recommended to check for play on the axles at least once every three months.

Start with the right X axle. Place the print head in the back-left corner of the printer to keep it out of the way. Hold the frame of the Ultimaker S5 with one hand, and firmly hold the right X axle with the other. Attempt to move the axle forwards and backwards; do not be afraid to apply too much force.

Repeat this for the other axles. Make sure to move the print head to the opposite side each time.

The axles should not move at all. If one of the axles does move, you can observe a ticking noise of the pulleys hitting the frame. In this case it is recommended to calibrate the print head. For instructions on how to do this, take a look at the Ultimaker website.

6.7 Check the tension of the short belts

Maintaining correct tension on the short belts is important to ensure good print quality. The short belts transfer the movements of the X and Y motors to the print head. If the belts are too loose, print head movement may not be accurate, which can cause print inaccuracies.

Over time, the belts may become slack. It is recommended to check the tension of the short belts at least once every three months.

Pluck the two short belts to check their tension. They should resonate, like a guitar string. It should not be possible to press the belt against itself. Furthermore, the tension of the two belts should be equal.

To restore the tension, perform the following steps:
1. Loosen the Y motor by using the hex screwdriver to loosen the four bolts that hold the Y motor to the left panel. Do not remove the bolts, but the motor should be able to slide up and down.
2. Firmly press down on the motor with one hand. This ensures maximum tension on the short belt.
3. While still pressing the motor down, tighten the four bolts of the Y motor in a cross pattern. First tighten the top-left bolt, then the bottom-right, next the bottom-left and ending with the top-right. This ensures that the motor is attached straight.
4. Perform the above steps for the X motor that is attached to the back panel. Afterwards, check the tension of both belts again.

6.8 Check for debris in the front fan of the print head

The front fan cools the print cores during a print. This helps to prevent the heat from the nozzle traveling too far upwards.

The fan takes in air from the front of the print head and directs it towards the print cores. Sometimes the airflow causes thin strands of filament to be sucked into the fan during a print. If strands accumulate in the fan, they can decrease the effective cooling and eventually obstruct the fan and prevent it from spinning. Especially high-temperature materials, such as CPE+, PC, and ABS are sensitive to this.

To check the front fan, first gently open the front fan bracket. Blow into the front fan to see if it spins smoothly. If it does not move at all, or stops spinning abruptly, carefully clear any obstructions from the front fan with some tweezers.

⚠️ Make sure that the print cores are completely cooled and the printer is turned off before performing this check.

ℹ️ Some filament debris can also be visible from the outside of the print head. Make sure to remove this too.

If the fan is still not spinning after removing visible filament debris, it should be replaced.

6.9 Check the quality of the nozzle cover

The nozzle cover shields the print cores from cold airflow from the fans, which helps the print cores to maintain a stable temperature while printing. The cover also helps to prevent backflow of material into the print head when something goes wrong during printing.

The heat of the nozzles may cause wear on the nozzle cover over time. It is recommended to check the quality of the cover at least once every three months. The accessory box of the Ultimaker S5 contains three spare nozzle covers.

Examine the bottom of the print head to see if the holes where the nozzles come through are still round and the cover still forms a good seal. Also gently open the fan bracket to check the other side of the nozzle cover.

If the nozzle cover looks like it needs to be replaced, please follow these instructions.

Remove the old cover

1. First, remove both print cores by going to the configuration overview and selecting *Unload* for both print cores.
2. Close the print head fan bracket, and manually place the print head in the front center of the printer.
3. Peel away the front corner of the nozzle cover, and pull it out of the print head fan bracket.

Place the new cover

1. Open the print head fan bracket.
2. Take the new nozzle cover and hold it in the correct orientation behind the print head fan bracket. Make sure the protruding shapes of the cover match the shapes of the holes in the bracket.

3. Insert the middle tab of the nozzle cover through the slot in the print head fan bracket. From the inside of the print head, apply pressure to the metal plate. At the same time, pull the tab through the bracket and plate until the seal locks the cover in place.

i Use flat tip or round tip tweezers to pull the tab through the metal plate. This makes this action easier, as the tab may be difficult to reach by hand.

4. Pull the right side of the nozzle cover, fold the pocket over the edge of the metal plate, and push the silicone tab under the metal tab of the print head fan bracket. Repeat this for the left side.

5. Push the front tab through the slot in the print head fan bracket, while applying pressure to the metal plate from the inside of the printer. Make sure the seal is pushed through the plate, to lock the cover in place.
6. Close the print head fan bracket and check if the new nozzle cover is correctly placed. Slide your finger across the bottom of the print head. If the nozzle cover easily detaches from the fan bracket, it is not correctly placed. Follow steps 3 - 5 again.

! If the nozzle cover is not placed correctly, it may get caught on the print. This could cause the fan bracket to open during printing.

7. Insert both print cores, following the guide in the configuration menu.
8. With the front fan bracket closed, hold the nozzle cover at both sides and slightly move it left and right. The metal place and nozzle cover will now align themselves with the print cores.

The nozzle cover should not easily detach from the fan bracket

i It is recommended to check the placement and alignment of the cover by manually lifting and lowering the second print core. To do this, move the lift switch on the right side of the print head. Check if the fan bracket remains closed as the second print core is lowered.

6.10 Lubricate the lead screw of the Z motor

The lead screw is connected to the Z motor and controls the movements of the Z stage. To ensure smooth movement of the Z stage, it is recommended to periodically apply grease to the lead screw.

Over time, grease may need to be reapplied to maintain consistent and accurate movement of the Z stage. A tube of grease is included in the accessory box of your Ultimaker S5.

1. Make sure that the build plate is positioned at the bottom of the Ultimaker S5.
2. Apply a small amount of grease to the lead screw of the Z motor.
3. In the Ultimaker menu, go to *Configuration → Build plate*.
4. Select *Raise* and then *Lower* to move the build plate up and down to evenly distribute the grease.

| **i** | Only use the grease on the lead screw of the Z motor. |

6.11 Clean the feeders

The feeders forward filament to the print head. To make sure that exactly the right amount of material is extruded, it is important that the feeder gears can turn smoothly.

After many hours of printing, or when material has been ground down, there is a chance that there are small filament particles in the feeders. It is recommended to clean the inside of the feeders after three months. In order to do this, the feeders have to be removed from the printer.

The following steps need to be performed for both feeder 1 and feeder 2:
1. Start by removing the material. Go to the configuration menu, select the material you want to remove and then *Unload*. After this, turn off the printer and remove the power cable.
2. Remove the clamp clip from the feeder-end of the Bowden tube, press down on the tube coupling collet and pull the Bowden tube upwards out of the feeder. Next, remove the tube coupling collet.
3. Reduce the tension of the feeder by turning the bolt in the top of the feeder with the hex screwdriver, until the indicator is completely at the top.

4. Use the hex screwdriver to loosen the four bolts of the feeder housing.
5. Carefully pull the front part of the feeder away from the printer and put it aside.

i	Be careful not to lose the ring that is located at the bottom of the feeder. If it falls out, place it back in the feeder housing with the widest side at the top.

6. Use a small brush to gently clean all filament particles from the knurled wheel, the flow sensor axis, and the inside of the feeder housing.
7. Place the front part over the feeder again and firmly push it into place. Insert the four bolts and tighten them in a cross pattern, starting in the top-left corner.
8. Insert the tube coupling collet into the feeder and push the Bowden tube all the way in. Secure the tube with the clamp clip.
9. Reset the tension of the feeder by turning the bolt in the top of the feeder, until the indicator is at the middle mark.

6.12 Clean the print cores

Maintenance of the BB print core should be performed once every three months. Using the Ultimaker cleaning filament is the most effective way to clean and unclog the BB print core on the Ultimaker S5. If you don't have the Ultimaker cleaning filament at your disposal, you can use PLA instead.

Cleaning filament can be used to clean the print core on an Ultimaker S5 by applying hot and cold pulls. Hot pulls are used to get the biggest parts of degraded material out of the print core and are especially necessary when a print core is clogged. With a cold pull, the remaining small particles will be pulled out, ensuring the print core is completely clean.

| i | If necessary, you can also use this method to clean an AA print core. |

Preparation

1. Go to *Preferences* → *Maintenance* → *Print head* → *Print core cleaning* and select *Start* to start the cleaning procedure.

| i | The print head will move to the front-right corner to prepare itself. |

2. Select the print core you want to clean: *print core 1* or *print core 2*.
3. Select the material you want to use for cleaning: *Cleaning filament* or *PLA filament*.
4. Wait for the printer to heat up the print core and to retract the filament until its end is visible in the Bowden tube.

| i | If the material is not retracted there is chance that the material has been ground down and is stuck in the feeder. In this case, remove the material manually as described in the troubleshooting section on the Ultimaker website. |

5. Remove the Bowden tube from the print head. First, remove the clamp clip and then push down on the tube coupling collet while pulling the Bowden tube upwards, out of the print head. *Confirm* to continue.

Hot pull

1. Insert the filament (Ultimaker cleaning filament or PLA) into the print head until you feel some resistance.
2. Hold the filament with pliers and gently apply pressure to the material for ±1 second so that it extrudes from the print core or until it cannot be pushed any further, and directly pull the filament out with a quick, firm pull.

⚠️ Use pliers to prevent injuries to your hands in case the material breaks.

3. Cut off the tip of the filament that you have just pulled out.
4. Check the color and the shape of the tip of the filament and compare it with the image below. The goal is to have a clean tip.

5. Repeat this procedure until there is no more degraded material visible on the tip of the cleaning filament. The tip of the filament should look as clean as the example on the right.
6. Once the tip of the filament is clean, manually flush some filament through the print core with pliers and take it out again. *Confirm* to continue.

Cold pull

1. Insert the filament (Ultimaker cleaning filament or PLA) into the print head until you feel some resistance.
2. Hold the filament with pliers and gently apply pressure to extrude some material. *Confirm* to continue.
3. Maintain pressure on the filament with the pliers for the duration of the progress bar.
4. Release the filament and wait until the print core has cooled down.
5. Grab the filament with pliers and pull it out with a quick, firm pull. *Confirm* to continue.

6. Take a look at the tip of the filament and see if it has a clean, cone-shaped tip like shown on the example to the right. *Confirm* to continue.

> **i** If the tip of the filament is not clean, go back to hot pull or cold pull to repeat the cleaning steps.

Reassembly

1. Insert the Bowden tube into the print head and secure with the clamp clip. *Confirm* to continue.
2. Wait for the Ultimaker S5 to finalize the cleaning procedure.

6.13 Lubricate the feeder gear

To ensure that the feeders forward the filament smoothly and accurately, the gears are lubricated. After many hours of printing, it is recommended to reapply this lubrication. As small filament particles may have stuck to the gears, it is advised to clean them first.

> **i** It is also recommended to replace the Bowden tubes after one year. While lubricating the feeder gears, follow the instructions to replace the Bowden tubes simultaneously.

The following steps need to be performed for both feeder 1 and feeder 2:
1. Start by removing the material. Go to the configuration menu, select the material you want to remove and then *Unload*. After this, turn off the printer and remove the power cable.
2. Remove the clamp clip from the feeder-end of the Bowden tube, press down on the tube coupling collet and pull the Bowden tube upwards out of the feeder.
3. Use the hex screwdriver to loosen the two bolts that hold the feeder to the back panel.
4. Carefully move the feeder away from the back panel and disconnect the filament detection cable from the flow sensor.

5. Use a clean cloth or a cotton swab to wipe all filament particles and grease residue from the feeder gears. Clean both the gear connected to the motor and the larger gear inside the feeder.
6. Apply a small amount of grease to the gear attached to the feeder motor. There is no need to spread this out; the feeder will do this automatically when it turns.
7. Hold the feeder close to the back panel and connect the filament detection cable to the flow sensor.
8. Place the feeder back on the printer and secure it with the two bolts.
9. Insert the Bowden tube into the feeder by pressing down on the tube coupling collet in the feeder and pushing the Bowden tube all the way in. Secure the tube with the clamp clip.

6.14 Replace the Bowden tubes

The Bowden tubes guide the filament from the feeders to the print head.

Forwarding improperly cut or ground down filament through the Bowden tube could scratch or damage the inside of the tube. If this happens, the filament can no longer be forwarded to the print head smoothly. This can lead to under extrusion or other print quality issues.

After removing a Bowden tube multiple times, the tube coupling collet can wear out. If this happens, the tube coupling collet will no longer have a firm hold on the Bowden tube. In this case, the Bowden tube will move up and down during prints, which can negatively impact print quality.

If the Bowden tubes are permanently damaged, they need to be replaced. To maintain optimal print quality it is recommended to replace the Bowden tubes every year.

Disassembly

1. Start by removing the material. Go to the configuration menu, select the material you want to remove and the *Unload*. After this, turn off the printer.
2. Place the print head in the front-right corner.
3. Use your fingernail to remove the clamp clips from the tube coupling collets at the print head and feeders.
4. Press down on the tube coupling collet in the print head and at the same time, pull the Bowden tube upwards, out of the print head. Repeat these steps for the feeder.
5. When removing the Bowden tube from Extruder 2 (right), loosen the four cable clips from the Bowden tube to remove it completely.

Reassembly

1. Take the new Bowden tube and note the two different sides. The side which is chamfered should be inserted into the feeder. This allows easier access of the filament into the Bowden tube. The flat side should be inserted into the print head.
2. Insert the Bowden tube into the feeder by pressing down on the tube coupling collet in the feeder and pushing the Bowden tube all the way in. Secure the tube with the clamp clip.
3. Insert the Bowden tube into the print head by pressing down on the tube coupling collet in the print head and pushing the Bowden tube all the way in. Secure the tube with the clamp clip.
4. When replacing the Bowden tube from Extruder 2 (right), click the header cable clips onto the Bowden tube. Equally divide the clips over the Bowden tube.

6.15 Clean the system fans

The system fans are positioned at the back of the printer and need to be cleaned once a year.
This can be done by blowing into the fans in order to get small filament particles out. If necessary, an air blower or compressor can be used instead.

6.16 Lubricate the hinges

To make sure the glass doors will open and close smoothly, the hinges of the glass doors have to be lubricated once a year. This can be done by putting a small drop of oil in the top hole of each hinge.

7. Troubleshooting

There are a few printer-specific issues that can occur while using your Ultimaker S5. If you run into one of these issues, you can troubleshoot it yourself using the information in the following pages.

7.1 Error messages

This list shows the most common error messages that can occur on the Ultimaker S5. For more information on troubleshooting these error messages please go to the error specific page on the Ultimaker website.

- An unspecified error has occurred. Restart the printer or go to ultimaker.com/ER27.
- Max temp. error on the print core in print head slot [x]. Go to ultimaker.com/ER28.
- Min temp. error on the print core in print head slot [x]. Go to ultimaker.com/ER29.
- Max temp. error on the build plate. Go to ultimaker.com/ER30.
- Heater error on the print core in print head slot [x]. Go to ultimaker.com/ER31.
- The Z axis is stuck or the limit switch is broken. Go to ultimaker.com/ER32.
- The X or Y axis is stuck or the limit switch is broken. Go to ultimaker.com/ER33.
- There is a communication error with the print head. Go to ultimaker.com/ER34.
- There is an I2C communication error. Go to ultimaker.com/ER35.
- There is an error with the safety circuit. Go to ultimaker.com/ER36.
- There is a sensor error within the print head. Go to ultimaker.com/ER37.
- Active leveling correction failed. Manually level the build plate or go to ultimaker.com/ER38.
- An incorrect print temperature is specified. Go to ultimaker.com/ER39.
- An incorrect build plate temperature is specified. Go to ultimaker.com/ER40.
- The motion controller failed to update. Go to ultimaker.com/ER41.
- This print job is not suitable for this printer. Go to ultimaker.com/ER42.
- The flow sensor within feeder [x] is not working properly. Go to ultimaker.com/ER43.

If you encounter an error message that is not listed here, please go to the Ultimaker website for more information.

7.2 Print core troubleshooting

Clogged print core

If material does not flow from the print core for at least 10 minutes, it could suggest that the print core is clogged with degraded material. In this case, the print core should be cleaned by performing the hot and cold pull method.

Using the Ultimaker cleaning filament is the most effective way to clean and unclog a print core on the Ultimaker S5. If you don't have the Ultimaker cleaning filament at your disposal, you can use PLA. Take a look at chapter 6.11 Clean print cores for detailed instructions.

Print core not recognized

If a print core is not recognized by the Ultimaker S5, the printer will inform you about this. The main reason for this is dirty contact points on the PCB at the back side of the print core. When this happens, clean the contact points with a cotton swab and some alcohol.

7.3 Print quality issues

Poor build plate adhesion

When you experience problems with the adhesion of a print to the build plate, the following actions can be performed:
- Ensure that the correct material settings and adhesion method were used (see chapter 5.2 Materials).
- Recalibrate by using the detailed active leveling mode (see chapter 5.8 Calibration).
- Check the Ultimaker Cura settings that were used, and try printing with one of the default Ultimaker Cura profiles.

Grinding PVA

Typically incorrect handling or storage of the material can lead to grinding of the material. PVA should be printed and stored at a low humidity to avoid problems while printing. We advise a humidity below 50% for storage and below 55% while printing. It is also recommended to keep the ambient temperature below 28 °C while printing. In a standard air conditioned office, this humidity and temperature should be easy to achieve.

When PVA is ground down by the feeder, there are three main causes.
- **Incorrect storage** PVA is a material that absorbs moisture relatively easily and therefore storing it correctly (resealable bag, with humidity below 50%) is important. If PVA absorbs too much moisture it will get soft and malleable/pliable and in some cases even sticky. This can cause problems in the feeder as it might not be able to forward the PVA properly anymore. If this happens you can dry the PVA.
- **Coated Bowden tube** The Bowden tube can get coated on the inside due to incorrect printing conditions (mainly high humidity). If the humidity of the printing environment is too high (above 55%) and temperature is too high (above 28 °C) PVA might not be able to move easily through the Bowden tube. A solution for this is to clean the Bowden tube and dry it very well.
- **Clogged print core** High humidity can affect PVA quality, and lead to clogs in the print core. As a consequence, filament might get jammed, causing grinding in the feeder. When this happens, the print core should be cleaned by following the procedure described in chapter 6.11 Clean print cores.

For more information on how to resolve grinding issues, you can take a look at this page.

Under-extrusion

In simple terms, under-extrusion is when the printer is unable to supply a sufficient amount of material. Your Ultimaker S5 is under extruding when you see missing layers, very thin layers, or layers that have random dots and holes in them.

Under-extrusion can have several causes:
- Use of low quality material (diameter inconsistency) or wrong settings
- Feeder tension not set correctly
- Friction in the Bowden tube
- Small particles of material in the feeder or Bowden tube
- A partial clog in the print core

If your Ultimaker S5 is affected by under–extrusion, it is advised to take a look at this page for detailed troubleshooting instructions.

Warping

Warping occurs due to material shrinkage while printing, causing the corners of the print to lift and detach from the build plate. When plastics are printed, they firstly expand slightly but contract as they cool down. If material contracts too much, this causes the print to bend upwards from the build plate.

When your print is warping, ensure you have done the following:
- Use the active leveling to level the build plate
- In case of a glass build plate, apply a thin layer of glue
- Use the correct temperature and other settings as in the default Ultimaker Cura profiles
- Adjust the shape of your model according to the design guidelines described on www.ultimaker.com/3D-model-assistant.
- Use another material that is less prone to warping

To troubleshoot this issue in more detail, take a look at the Ultimaker website.