PURDUE UNIVERSITY

THE DAUCH CENTER

Digital Supply Chain
Manufacturing & Suppy Chain

3D PRINTER HANDBOOK

2025 Edition

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INTRODUCTION

ULTIMAKER S7

3D printing or additive manufacturing

It’s a technology that enables the creation of three-dimensional objects from a digital design. It works by depositing successive layers of material, such as plastic, metal, or resin, until the desired object is formed. This process is controlled by software that translates the digital model into instructions for the printer.

UltiMaker S7

What can 3D printing do?

- Rapid prototyping
- Custom parts
- Low-volume production
- Educational models

The Ultimaker S7 is a high-performance 3D printer designed for precision and reliability. It features an advanced print core system, auto-bed leveling, and smart sensors to ensure consistent print quality with minimal user intervention.

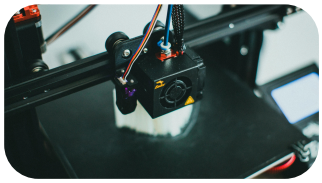
Compatible with a wide range of materials, including PLA, ABS, and Nylon, it supports both standard and engineering-grade filaments.

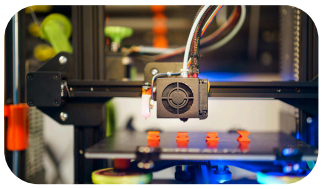
What will I find here?

This user manual provides all the essential information for using the UltiMaker S7 3D printer, including setup instructions, safety guidelines, material handling, printing processes and troubleshooting tips.

SAFETY RECOMMENDATIONS

1. The print head can exceed 200°C, and the heated bed can reach over 100°C. Avoid touching these parts with bare hands.





2. Always let the printer cool down before performing any maintenance or adjustments.

3. Wear thermal gloves when cleaning the nozzle, as it remains hot during these procedures.

4. Always keep an eye on the printer while it's in operation. Never leave it running unattended for extended periods.

5. Keep filament spools stored in a dry, cool environment to prevent degradation.

6. Always check the filament before use for any signs of moisture or damage.

MATERIALS

MATERIALS

For optimal print results, it is recommended to use UltiMaker materials, which have been extensively tested and come with optimized profiles in UltiMaker Cura. This ensures the best performance and reliability.

While the Ultimaker S7 is compatible with a wide variety of materials, the following materials are currently available in the lab:

1 **ABS (Acrylonitrile Butadiene Styrene):**

A strong, durable material commonly used for functional parts and prototypes. ABS has high impact resistance but requires a heated bed and can emit fumes during printing, so proper ventilation is essential.

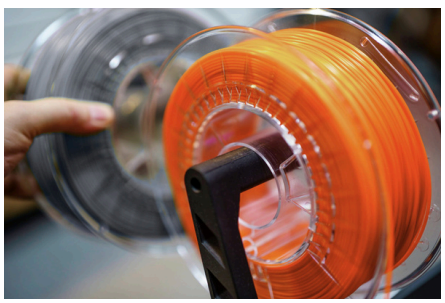
2 **PLA (Polylactic Acid):**

A biodegradable, easy-to-use material suitable for beginners. PLA offers a lower printing temperature and produces less odor compared to ABS, making it ideal for aesthetic models and educational purposes.

3 **PVA (Polyvinyl Alcohol):**

This water-soluble support material is often used in dual-extrusion 3D printing, where one extruder prints the main object and the other extruder prints the support structures. After printing, the PVA support can be dissolved in water, leaving the main print intact.

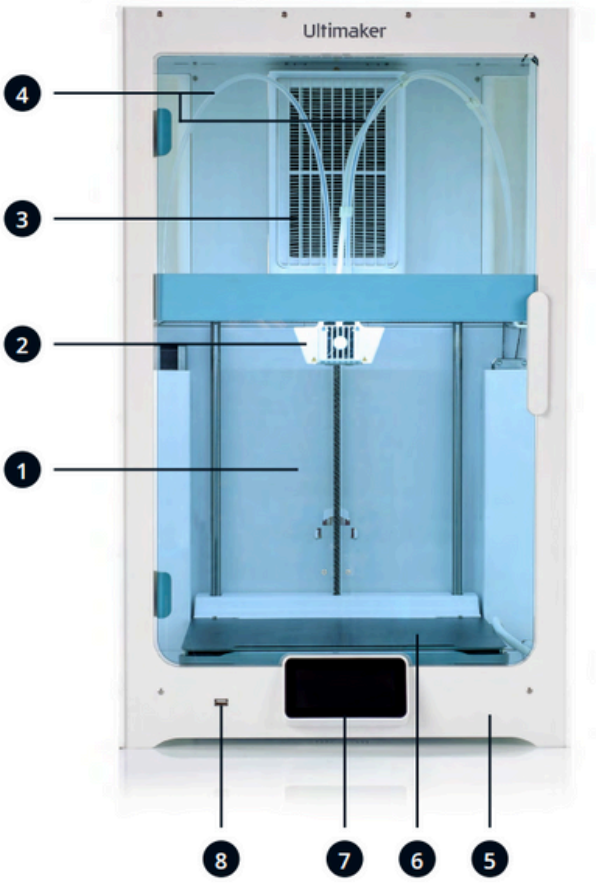
4 **Metallic filament:** **only for the lab manager use**



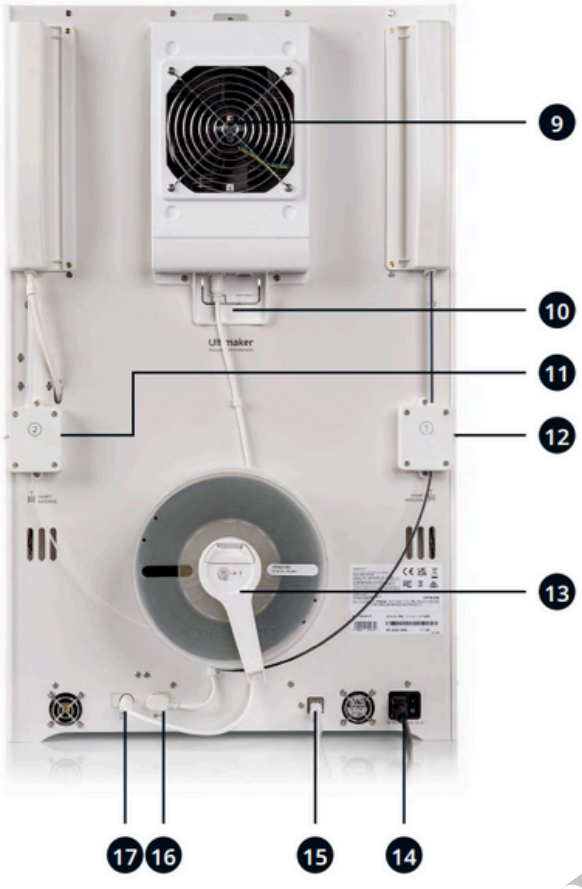
Note: Store filament in a dry, cool place to avoid degradation. Keep it away from direct sunlight or heat sources. Always store the material inside the bag it was before and keep the material box organized.

PARTS

MACHINE



1. Glass door
2. Print head
3. Air Manager filter
4. Bowden tubes
5. Z-stage
6. Flexible build plate
7. Touchscreen
8. USB port



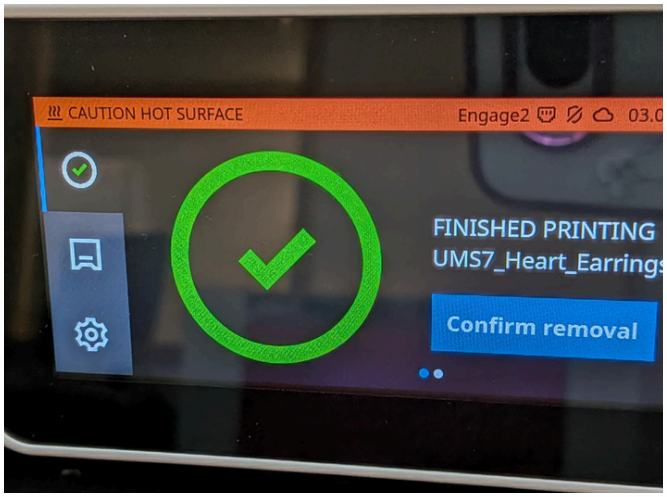
9. Air Manager fan
10. Air Manager cable
11. Feeder 2
12. Feeder 1
13. Spoolholder
14. Power socket and switch
15. Ethernet port
16. NFC port
17. UMB OUT port

TOUCHSCREEN

Status Overview

Configuration Overview

Preferences Overview



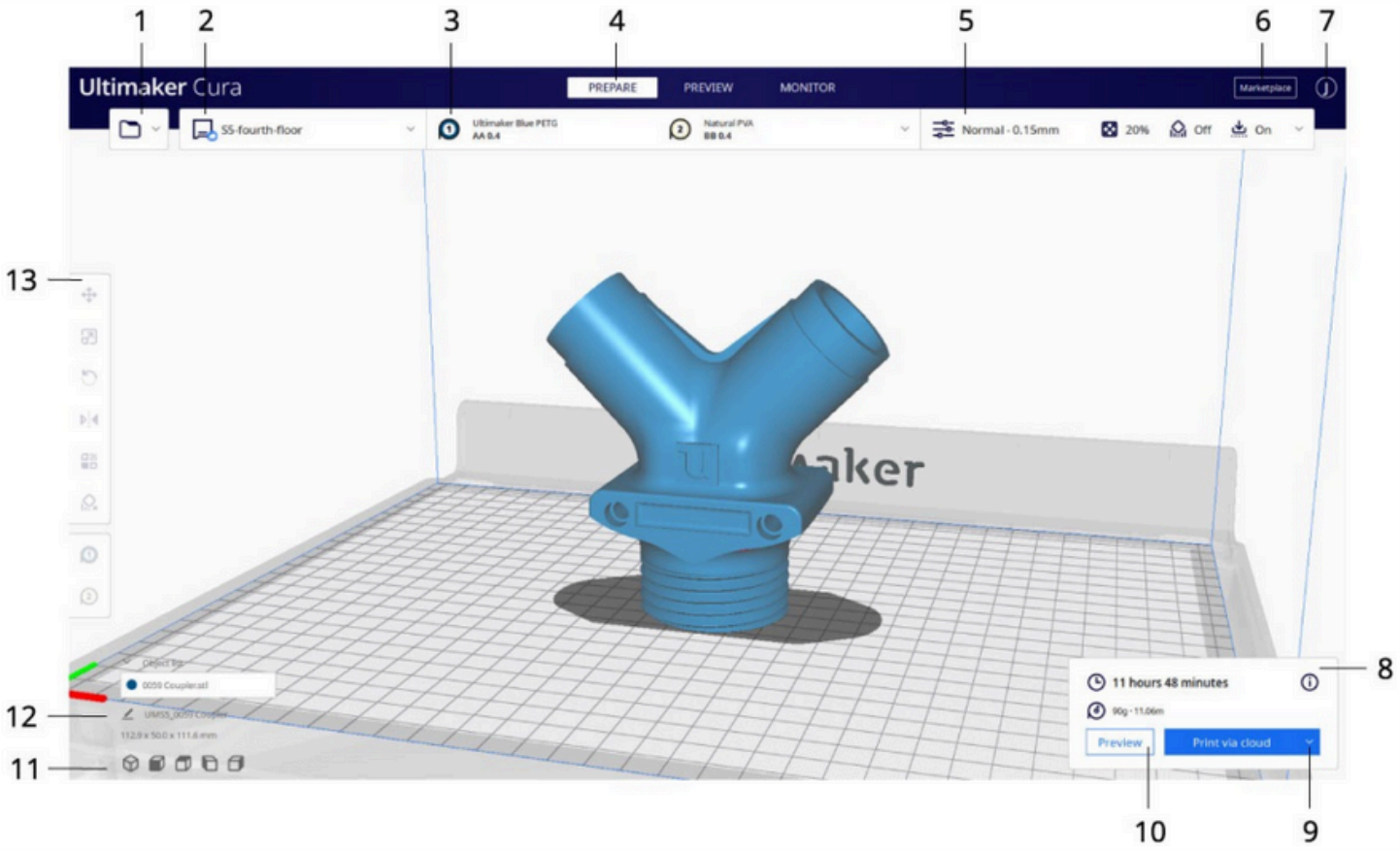
The main menu on the touchscreen has three options represented by icons:

- **Status Overview:** This shows the print progress and allows you to start a print from USB.
- **Configuration Overview:** Here, you can see the current printer settings, including which print cores and materials are installed. You can also change configurations if needed.
- **Preferences Overview:** This menu has three sub-menus:
  - Settings: Change general settings, such as the language.
  - Maintenance: Perform calibration and other maintenance tasks. You can also save diagnostic logs here.
  - Network: Change Wi-Fi or network settings.

ULTIMAKER CURA

It s the software you'll use to prepare and slice your 3D models before printing.

It converts your 3D model into a set of instructions for the printer



1. Open file
2. Printer selection
3. Configuration panel
4. Stages
5. Print settings panel
6. Marketplace
7. Ultimaker Account
8. Action panel
9. Print
10. Preview
11. Camera position tool
12. Model information

13. Adjustment tools

USER GUIDE

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USER GUIDE

3D MODELS

Before printing, you need to select or create the 3D model you want to use. There are several software tools and websites available depending on your needs:

DOWNLOAD MODELS

Access a large library of free 3D models on **Thingiverse**. These models can be downloaded and printed directly or used as a base for further customization.

DESIGN YOUR OWN MODEL

Use **Fusion 360** to design precise, custom 3D parts. This CAD software is ideal for creating detailed models from scratch with exact dimensions. If you don't have a license, you can use a similar software online like **OnShape**.

MODIFY EXISTING DESIGNS

- Use **Meshmixer** to clean, sculpt, or trim a 3D model.
- Use **Blender** to edit, combine or separate components of more complex models.

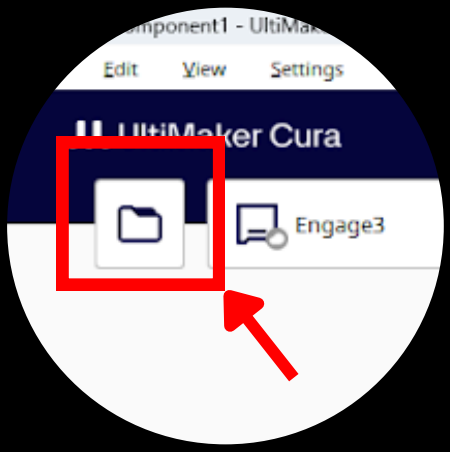
Note: You might need to install these programs or maybe obtain a license, as they are not available on the Dauch Center computers.

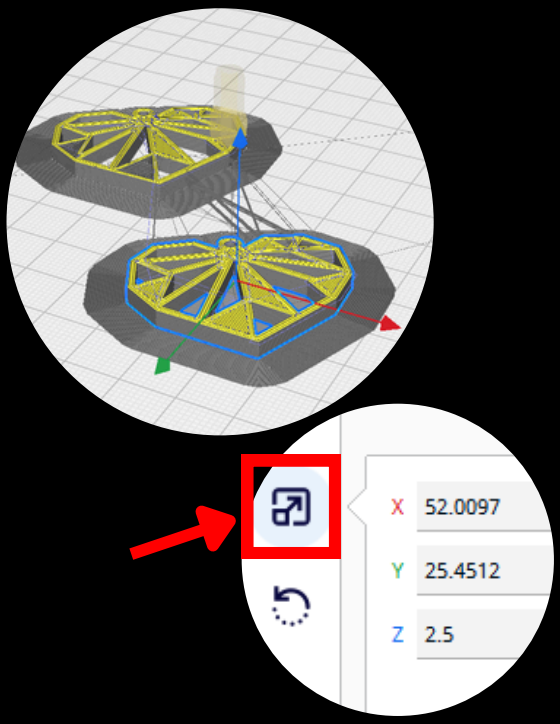
USER GUIDE

PREPARING TO PRINT

1. Launch Ultimaker Cura on the lab computer

2. Click **Open File** to load your 3D model file.
The supported formats are STL, OBJ, X3D and 3MF





3. Scale your model to adjust the size of your print. You can easily resize the model in Cura by:

- Select your model on the workspace.
- Click on the **Scale** button on the left-hand toolbar.
- Use the sliders or input specific dimensions to scale the model as needed.

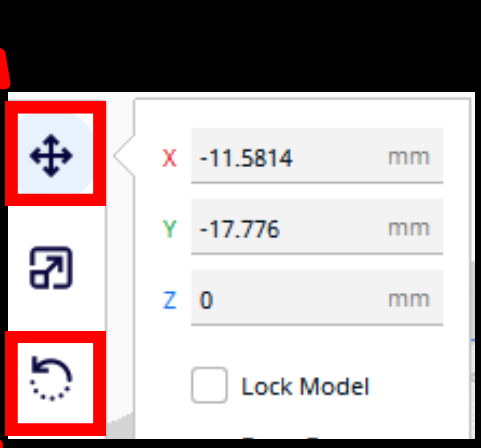
For a detailed guide on scaling, watch this video: **How to Scale in Ultimaker Cura**

USER GUIDE

PREPARING TO PRINT

4 Position your model and ensure your model is located correctly on the print bed.

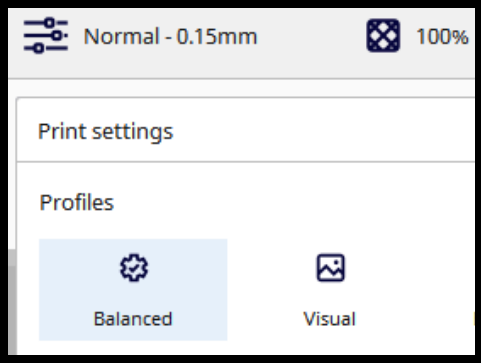
Use the **Move** and **Rotate** options to align the model to fit properly.



5 Choose the print settings on the menu on the right:

- Select the desired material (PLA, ABS, etc.)
- Choose layer height, infill density, and support structures if needed.

The default settings for each material used to be good for the printing.



Layer height: Determines print resolution (lower values for finer prints).

Infill: Controls the internal structure (higher values give strength but use more material).

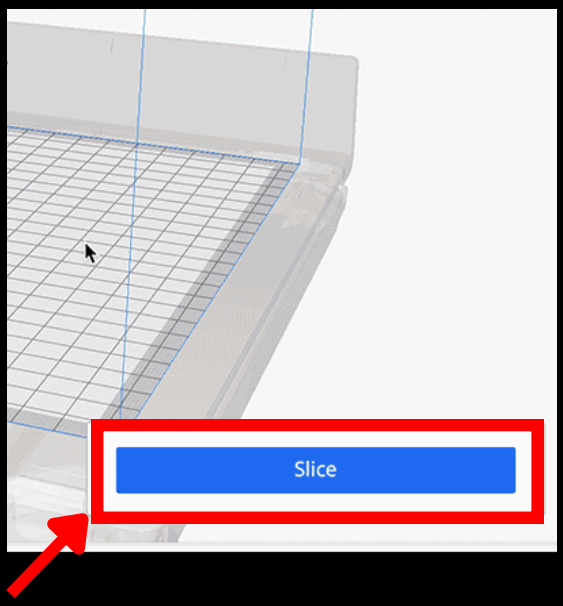
Supports: Activate if your model has overhangs or needs extra support.

USER GUIDE

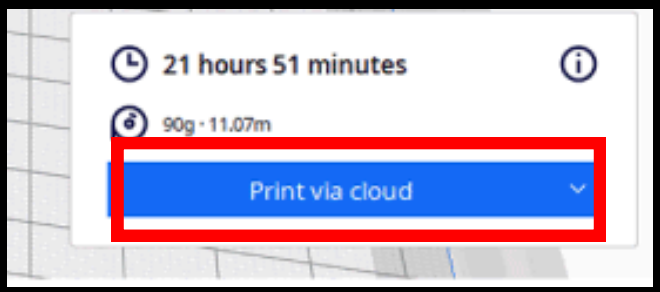
PREPARING TO PRINT

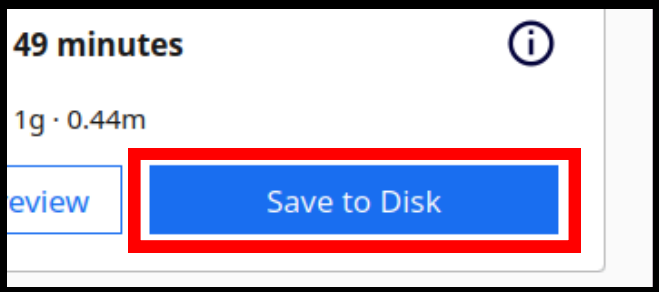
6 After configuring the settings, click **Slice** to prepare the print file. The software will generate a preview of the print and the estimated print time

On the **preview** there's a slider where you can look at each individual layer the printer is going to do. It gives you a good idea of what's going to happen when you hit print on the machine.



7 Save the sliced file to a USB drive clicking **"Save to File"** or send it directly to the printer clicking **"Printing via cloud"**





In the last case, the UltiMaker S7 will automatically prepare for printing. After the preparation is complete, the printer will begin the print job.

USER GUIDE

PRINTING VIA USB

Once you have your 3D model file on the USB, follow the next steps to print directly on the UltiMaker S7:

1. Insert the USB drive containing your print file into the USB port on the UltiMaker S7.

2. On the printer's touchscreen, go to the **Main Menu**. Select **Print from USB** and browse the list of available print files on the USB drive and select the desired file.

   Note: it is recommended to not save the files inside folders on the USD drive.

3. Once you've selected the file, the printer will automatically start the preparation process: preheating and active leveling.

   You can monitor the progress of the print directly on the touchscreen.

   The **Status Overview** shows the remaining print time and the percentage of completion.

4. Once the print is complete, the printer will notify you, and you can safely remove the printed object from the build plate.

Note: Wait for the build plate to cool down. The display of the UltiMaker S7 will indicate when it is safe to remove the build plate.

USER GUIDE

REMOVING THE PRINT

1. Once the plate has cooled, open the printer's glass door.

2. Hold the tabs at the front of the flexible build plate, then lift it up and slide it out of the printer.

3. Carefully bend the build plate to lift the print off. If it doesn't come off easily, use a spatula or scraper. Gently slide it under the print and lift.

Note: Wear gloves to avoid injury when handling the print or build plate, especially for sharp edges or hot components.

4. Once the print is removed and the build plate is back in place, select Confirm removal on the printer's display to prepare for the next print.

LOAD/UNLOAD MATERIAL

LOAD

1 Unpack the Material

- Remove the spool from its packaging.
- Cut off the end of the filament to ensure you have a short, sharp tip for easy feeding.

2 Place the Spool

- Place the PVA spool onto the correct spool holder on the printer.
- Ensure the material end points clockwise to allow it to feed into the respective feeder from the bottom

3 Confirm Material Selection

- On the printer touchscreen, select the respective material from the list of materials.
- Press Start, and follow the prompts on the screen.

4 Load Material into Feeder

- Insert the end of the material into the respective feeder.
- Gently push the filament into the feeder until you feel it being gripped.
- Select Confirm once the material is visible in the Bowden tube.

5 Wait for Printer to Heat

- Wait for the UltiMaker S7 to heat up Print Core.
- Once heated, the printer will load the material into the print head.

6 **Confirm Consistent Extrusion**

- Watch as material extrudes from Print Core.
- Once extrusion is consistent, confirm it on the touchscreen.

7 **Cool Down Print Core**

Wait for Print Core to cool down before proceeding.

UNLOAD

1 **Select the Material to Unload**

- On the touchscreen, choose Unload Material.
- Select the material you want to unload (either Material 1 or Material 2).

2 **Eject the Material**

- The printer will heat the print core and automatically retract the filament.
- Once the material is fully retracted, you can remove the filament from the feeder.

3 Once removed, store the filament properly in a cool, dry place to avoid moisture absorption and degradation.

4 Confirm the unload process on the touchscreen to complete the operation.

TROUBLESHOOTING

TROUBLESHOOTING

Print Not Sticking to the Build Plate

Symptoms

- First layer peels off
- Print detaches mid-print

Causes	***Fixes***
Unleveled build plate	Run the automatic bed leveling

Touchscreen: Maintenance > Build Plate > Start Leveling

Dirty or greasy build plate	Clean with isopropyl alcohol or warm water with dish soap

No Filament Extruding

Symptoms:
Print head moves but nothing comes out

Causes	***Fixes***
Filament not loaded correctly	Re-load filament: Material > Load Material
Feeder not gripping filament	Check for filament grinding and clean feeder wheel if necessary

Stringing or Oozing

Symptoms:

- *Fine hairs between parts*
- *Blobs at travel points*

Causes	***Fixes***
Retraction settings not optimized	Adjust retraction distance/speed in slicing software
Nozzle too hot	Lower nozzle temp by 5–10°C

Grinding Noise or Sudden Stops

Symptoms:

- Loud mechanical noises
- Print halts unexpectedly

Causes	***Fixes***
Obstruction in axis movement	Power off and check for physical blockages
Firmware or communication error	Restart the printer and update firmware via the Ultimaker interface

REFERENCES

3D PRINTER SOURCES

If you want to go deeper into 3D printer knowledge, the following resources will be helpful:

Library of 3D designs
https://www.thingiverse.com/

OnShape
https://www.onshape.com/en/

Blender
https://www.blender.org/download/

Fusion 360
https://www.autodesk.com/in/products/fusion-360/free-trial

Meshmixer
https://apps.autodesk.com/FUSION/en/Detail/Index?id=4108920185261935100&appLang=en&os=Win64

How to Scale in Ultimaker Cura
https://youtu.be/7V8E91UaUwc?si=lEa0HqulczAtrqgW