Standard Operating Procedure for 3D printing using:

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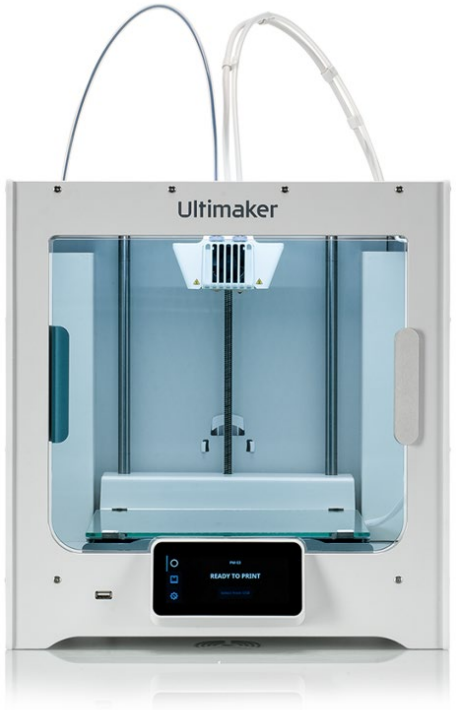
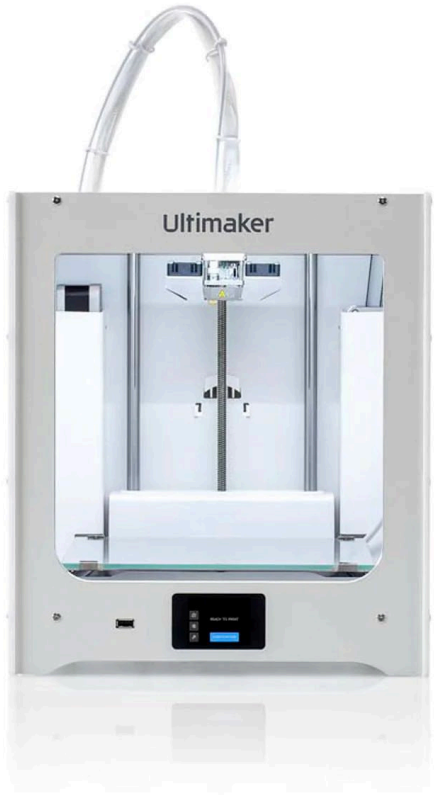


Ultimaker S3

Ultimaker S5



Ultimaker 2+ Connect

CAD graphics

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What you need to bring:

- A laptop with Ultimaker Cura slicing software installed: https://ultimaker.com/software/ultimaker-cura/
- Your CAD model exported as an STL, SMF, or OBJ file.

What you need know:

- The 3D Printer Farm consists of communal access machines for James Watt School of Engineering student work.
- You must understand how to set up and operate the 3D printers safely and effectively before use.
- You must adhere to the Standard Operating Procedure that follows, and the read the 3D Printer Farm Policy.
- If you are interested in using the Ultimaker S5 / S7 machines or Bambu P1S machines for exotic engineering materials, speak to the Laboratory Technician present, or contact cadgraphics@glasgow.ac.uk
- If you are interested in using the Bambu machines, see the Bambu P1S Standard Operating Procedure.

www.gla.ac.uk/schools/engineering/informationforstaff/technicalservices/aboutechnicalservices/ourteam/cadandgraphicsservices/3dprinterinformation

Cura Software:

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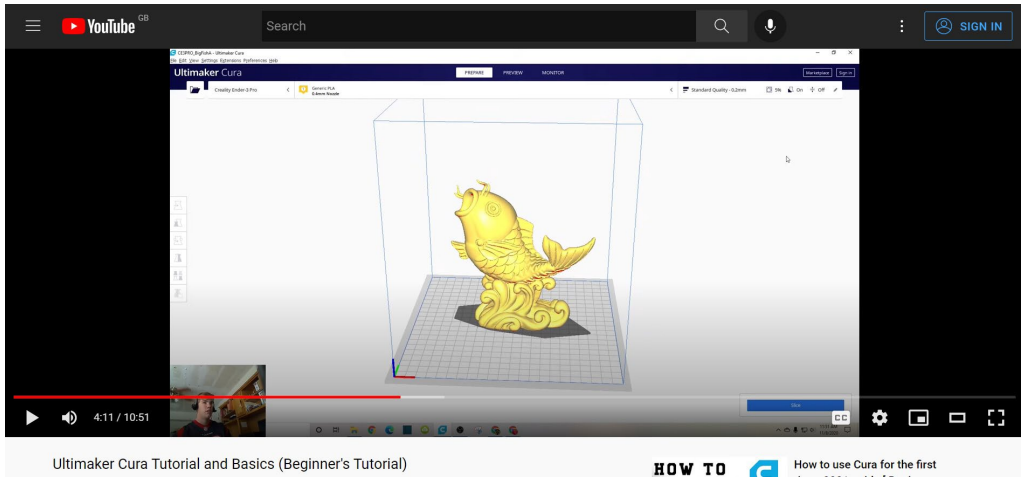
Watch this Cura beginner's tutorial:

www.youtube.com/watch?v=NsGOoi3677M

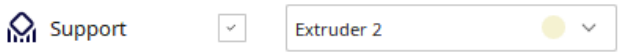


- If your file needs support material, we recommend using an S3 or S5 printer, which can use dissolvable PVA support. If no support is required, use a 2+ Connect printer. However, both printers can build support structures.
- Orientate your file to eliminate or minimise the support material required.

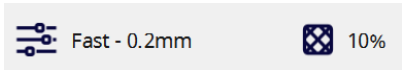
The material / nozzle settings should be set to:

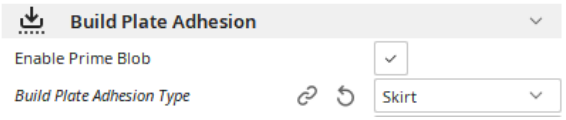
Ultimaker 2+ Connect	1 Generic PLA **0.4 mm**	
Ultimaker S3	1 Generic PLA **AA 0.4**	2 Ultimaker Natural PVA **BB 0.4**
Ultimaker S5	1 Generic PLA **AA 0.4**	2 Ultimaker Natural PVA **BB 0.4**

The nozzle used for providing support material on an S3 or S5 can be adjusted in the "support" option when clicking on the settings ribbon:



- You should use layer height settings of 0.15mm or 0.2mm.
- The infill density can be set as required, but in most cases should be between 5% and 15%.
- A 'brim' can be replaced with a 'skirt' in most cases where the model is unlikely to fall over or . This can be set in custom settings: Build Plate Adhesion.





Step 1

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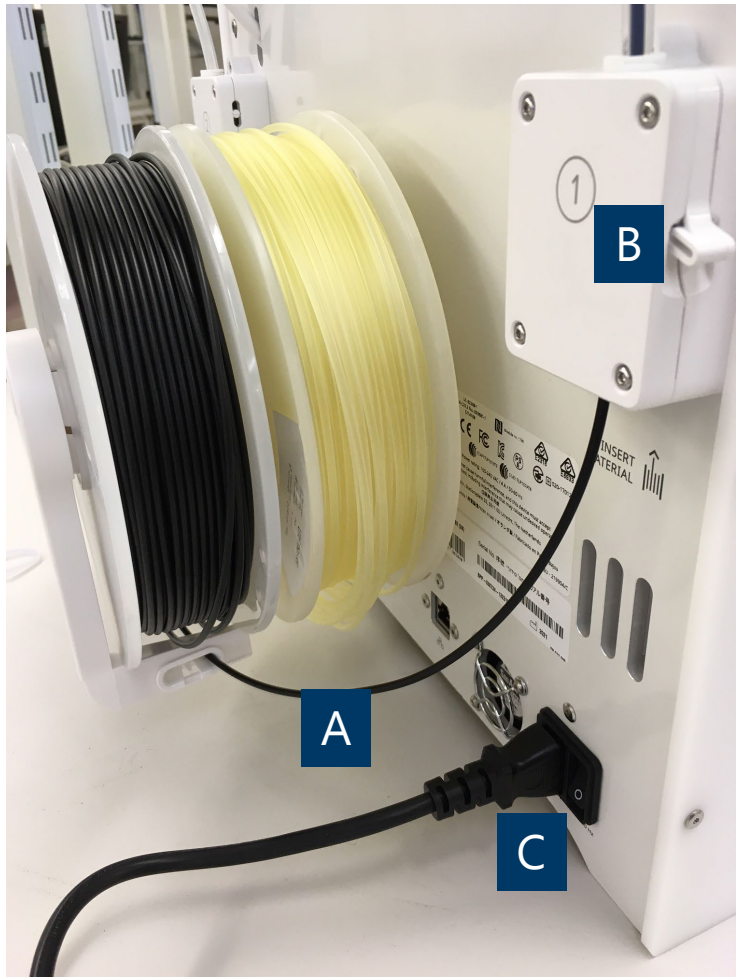

A – For S3 and 2+ Connect printers, check that the filament is untangled and feeds continuously from the spool into the feeders. For all printers, check whether the spools are empty or near empty. If there doesn't appear to be enough material for your model, use another printer.

B – Check that the clamp(s) are in a down position on the feeders.

C – Switch on the printer, and wait until "ready to print" appears on the touch screen.

Do not attempt any maintenance or material changes unless you have discussed this with technical staff. For assistance, training, or troubleshooting → Speak to the Technician present, or contact cadgraphics@glasgow.ac.uk

Step 2

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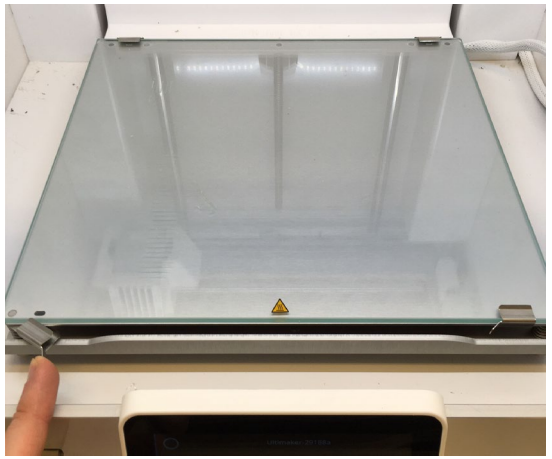
A



Leave a note with your name and student email address using the labels and pens provided, so you can be contacted if necessary.

A – The bed is fully secured if the clips close parallel with the glass bed. Check that the glass bed is secured and clear of debris (if not clean, see step 4B). A clean build plate is vital for preventing print failures.

(B)

(B) – If you wish to minimise the chance of warping, apply a light, single layer of glue to the bed, only on areas where you have placed models in the slicing software. Glue is found in the communal tools box.

C

C – Put your .ufp or equivalent gcode file onto a personal USB or the printer’s shared USB. Plug this into the port left side of the touch screen. Press “select from USB”.

Do not change any settings or attempt to perform mechanical maintenance. Report issues to the Technician present.

Checklist: Before you start

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- Printing a large box or plate? → Consider redesigning for laser cutting and submit your DXF file to
- Does your file take >36 hours to print? → It is not suitable for these printers. Adjust infill and layer height settings to reduce time, or submit your STL/3MF file to be printed on our industrial machines
- Do your settings match the material and nozzle on the printer?
- Have you checked that the spool on the back of machine has enough filament for your print?
- Do not use more than two printers at one time if your models take more than 2 hours to print.
- Ensure the glass build plate is secured by closing the clips fully.
- Wait for the first layer of filament to print before leaving. Put your details on the labels provided.

Service Request System

www.gla.ac.uk/schools/engineering/informationforstaff/technicalservices

Step 3

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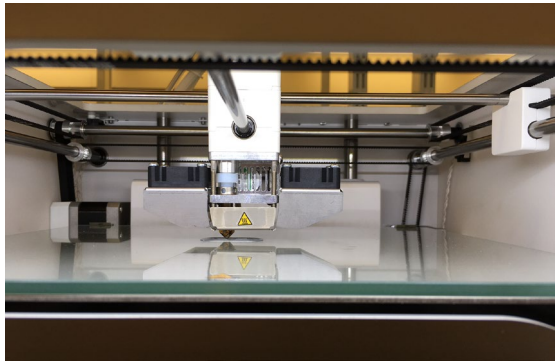
A

A – Select your file from the list. Scroll to page 2 once the file is selected to see and check an image of the file. Select Print.

B



B – Wait at the machine until your file begins to print. This takes a few minutes. Notice any on-screen issues that arise during the printer's start up procedure. Caution: the bed and nozzles heat up and become hot to touch during printing.

C

C – Note the time it will take to print the file. Return as soon as possible after the file has been printed. This will make it easier to remove the printed models from the glass bed and frees up the printers for others to use. If you have used the printer's USB, clear your file off the stick.

If there is a problem during printing, 'pause' or 'abort' buttons should be selected. Follow the on-screen instructions to complete the chosen action. Do not place your hands inside the printer while the printer head is in motion across the gantry.

Step 4

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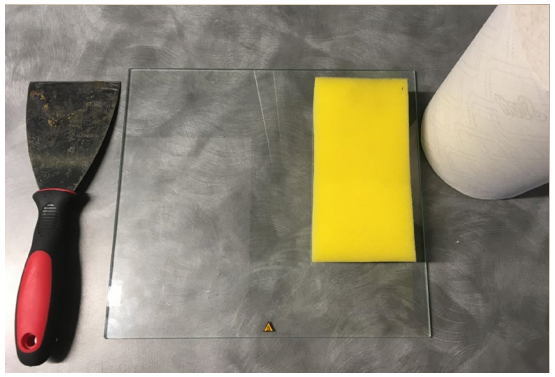
A

A – When the print is complete, carefully remove the glass bed from the printer. Peel away the model from the bed or carefully use a provided scraper to assist. Do not excessively finish or remove build material from your model in the lab – take your model away and do this elsewhere.

B

B – Put any waste Filamentive brand material into the recycling box provided, and Ultimaker material into the general waste. Follow the onscreen instructions until the printer is returned to its “ready to print” screen. Turn off the printer using the switch on the back.

C



C – Use warm water and the sponge and paper provided to clean the bed of glue and build material. Do not return the bed to the printer wet. When clean and dry, return the bed to the printer. Clean away waste into the bin. The printer and surrounding area should be left in the same condition as you would like to find it.

If your model supports were printed using Natural PVA material, this can be removed either by breaking it away, placing the model in warm water, or using the support removal bath provided. Speak to the Technician present to access the support removal bath.

Checklist: When you are finished

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- Leave the machine and work area in the condition you would like to find it.
- Take the glass build plate out of the machine when removing. Do not remove printed objects from the plate when it is in the machine. This disrupts the printer's calibration.
- Clean all glue from the glass build plate with water using the sink, sponge, and paper provided. **Do not leave build plates covered in glue.**
- Place the build plate back in the machine with clips secured.
- Put any waste Filamentive brand material into the recycling box provided. Ultimaker material should go into general waste.
- Put any tools used back in the boxes. Put any remaining waste the bin using the dustpan and brushes provided.
- Do not store private materials at the 3D Printer Farm. Unattended materials may be deemed fair use. Remove private spools from the facility after use.

Useful Information

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Service Request System

www.gla.ac.uk/schools/engineering/informationforstaff/technicalservices

3D Printer Farm Standard Operating Procedures and Policy

www.gla.ac.uk/schools/engineering/informationforstaff/technicalservices/abouttechnicalservices/ourteam/cadandgraphicsservices/3dprinterinformation/

For enquiries, training, or troubleshooting

1. Speak to the Laboratory Technician present

2. Contact: cadgraphics@glasgow.ac.uk

- Ultimaker troubleshooting: https://support.makerbot.com/s/topic/0TO5b000000Q4uRGAS/3d-printers
- Bambu troubleshooting: https://wiki.bambulab.com/en/home
- Print quality guide: https://www.simplify3d.com/resources/print-quality-troubleshooting/
- Bambu material table: https://bambulab.com/en/filament-guide
- Filamentive material table: https://www.filamentive.com/3d-printer-filament-materials-guide/
- Ultimaker material table: https://core-electronics.com.au/guides/ultimaker-printing-material-comparison/
- Ultimaker marketplace – material profiles: https://marketplace.ultimaker.com/app/cura/materials