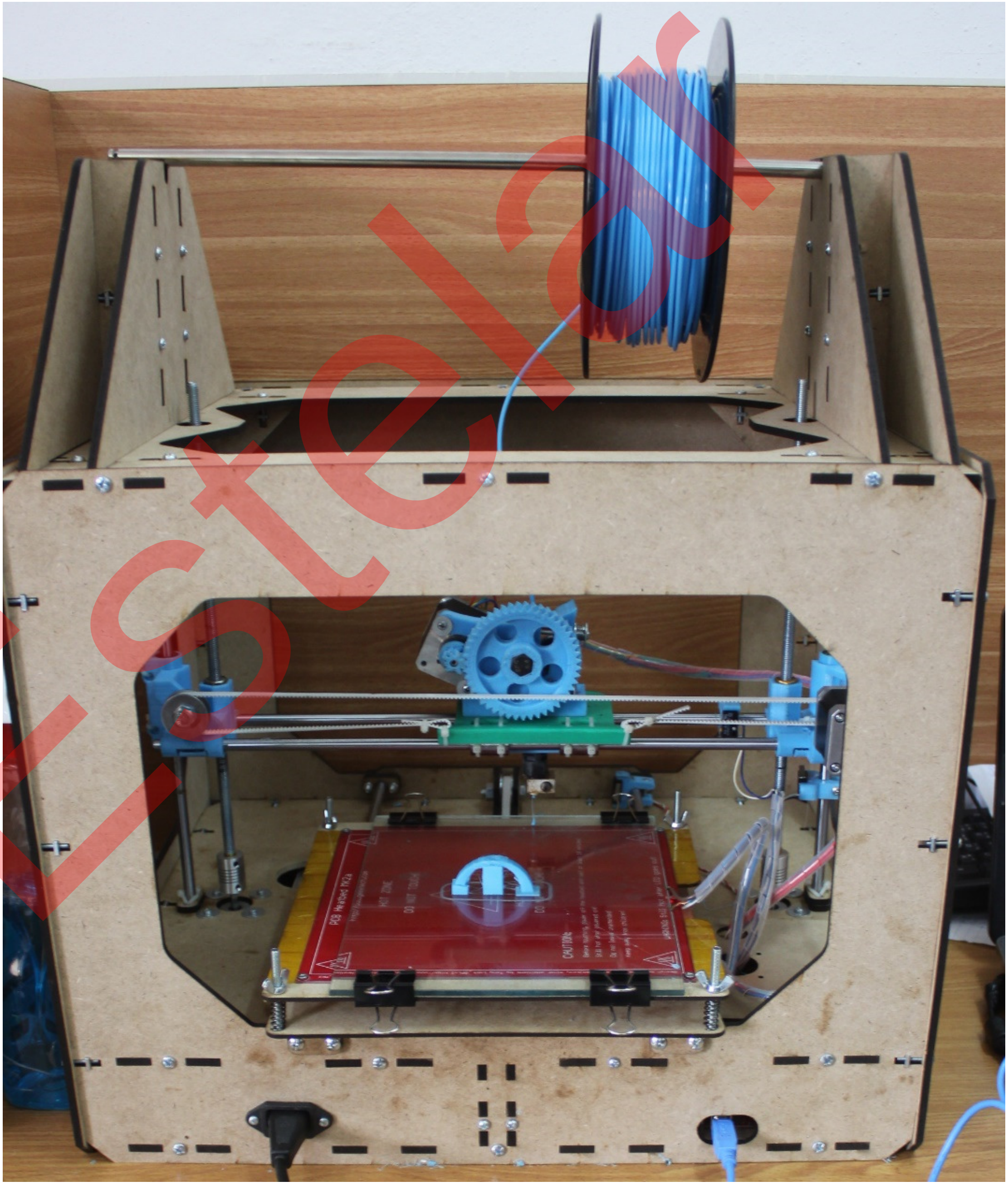
Digital Object Maker

FDM 3D Printer

User Manual



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Introduction

This User manual is designed to start using Digital Object Maker 3D Printer in the right direction. Even if you are familiar with other 3D printers, it is essential that you read through this manual.

Specifications

Printing

Print Technology: Fused Deposition Modeling
Print Volume: 20 x 20 x 20 cm.
Layer Resolution: 100-250 micron
Filament Diameter: 3mm
Nozzle Diameter: 0.45mm

Software

Interface software: Pronterface
Slicing software: Slic3r
File Types: STL

Electrical

AC Input: 220 V, 50 Hz
Power Requirements: 12 V DC and 30 Amps
Connectivity: USB

Mechanical

Chassis and body: MDF wood
XYZ Bearings: LME8UU Linear bearing
Stepper Motor: $1.8°$ step angle
1/16 micro stepping

General

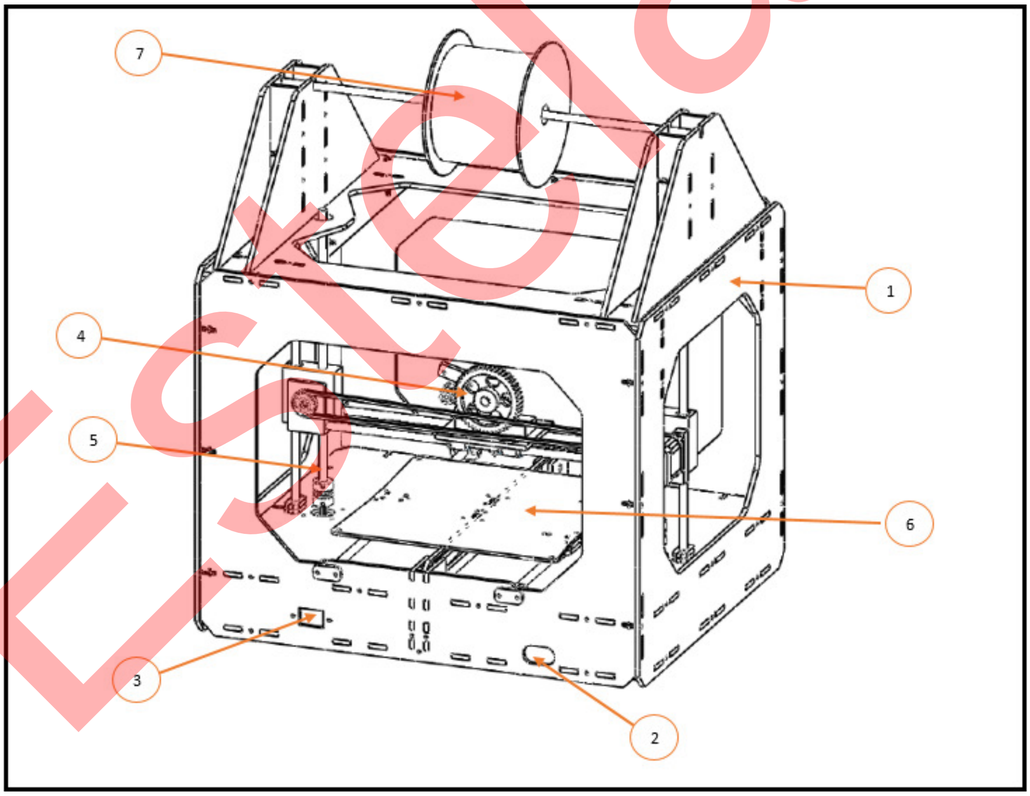
Frame Dimensions: 49x42x55 cm^3
Printing Material: PLA
Filament Diameter: 3mm

How it is work

The DOM makes solid, three-dimensional objects out of melted PLA Filament. Your 3D design files are translated into instructions for the DOM and sent to the machine via USB cable. Then the DOM heats the PLA Filament and squeezes it out through a nozzle to make a solid object layer by layer. This method is called Fused Deposition Modeling [FDM] [23].

Printer components

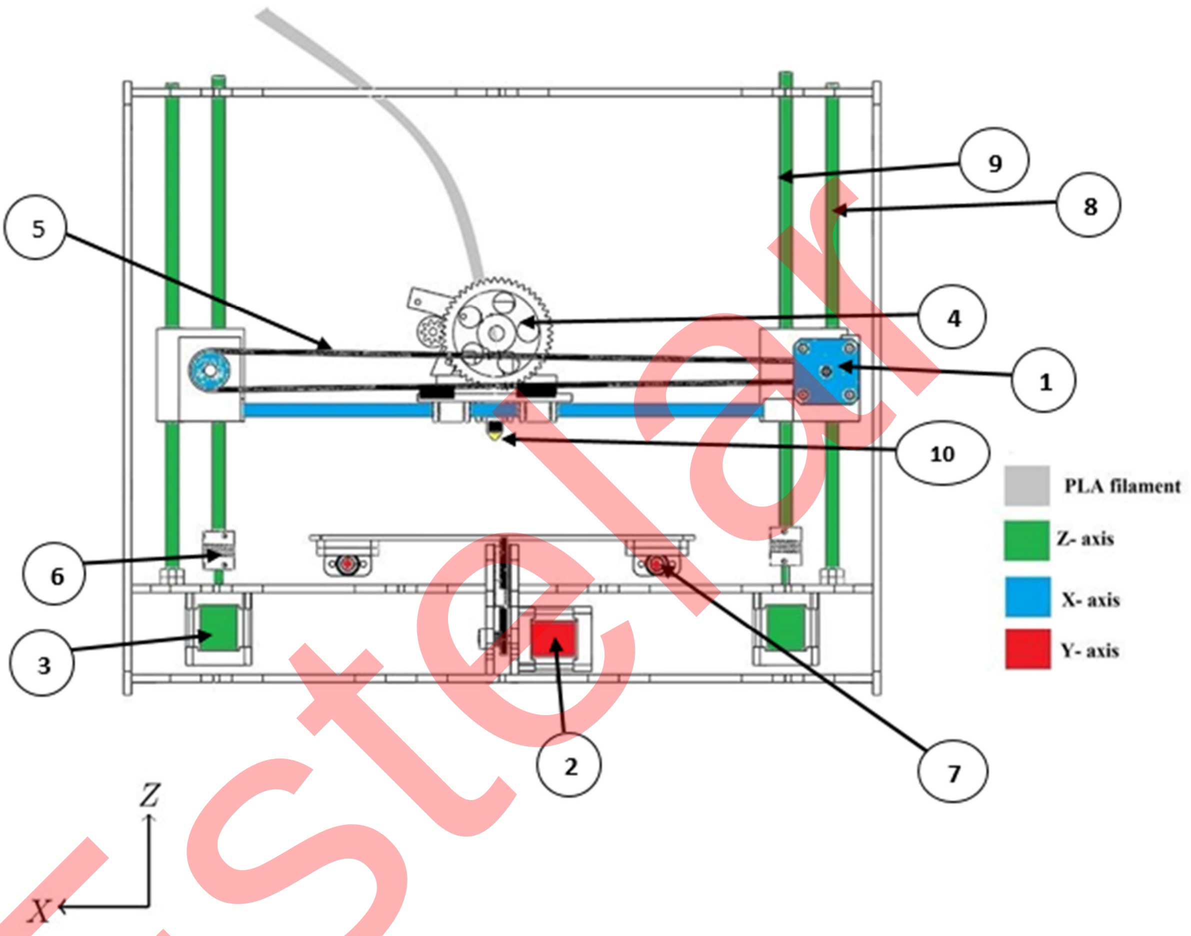
Main diagram



1. **Frame**
2. **USB cable inlet**
3. **Power cable inlet**
4. **Extruder**
5. **Z axis threaded rod**
6. **Print bed**
7. **PLA filament**

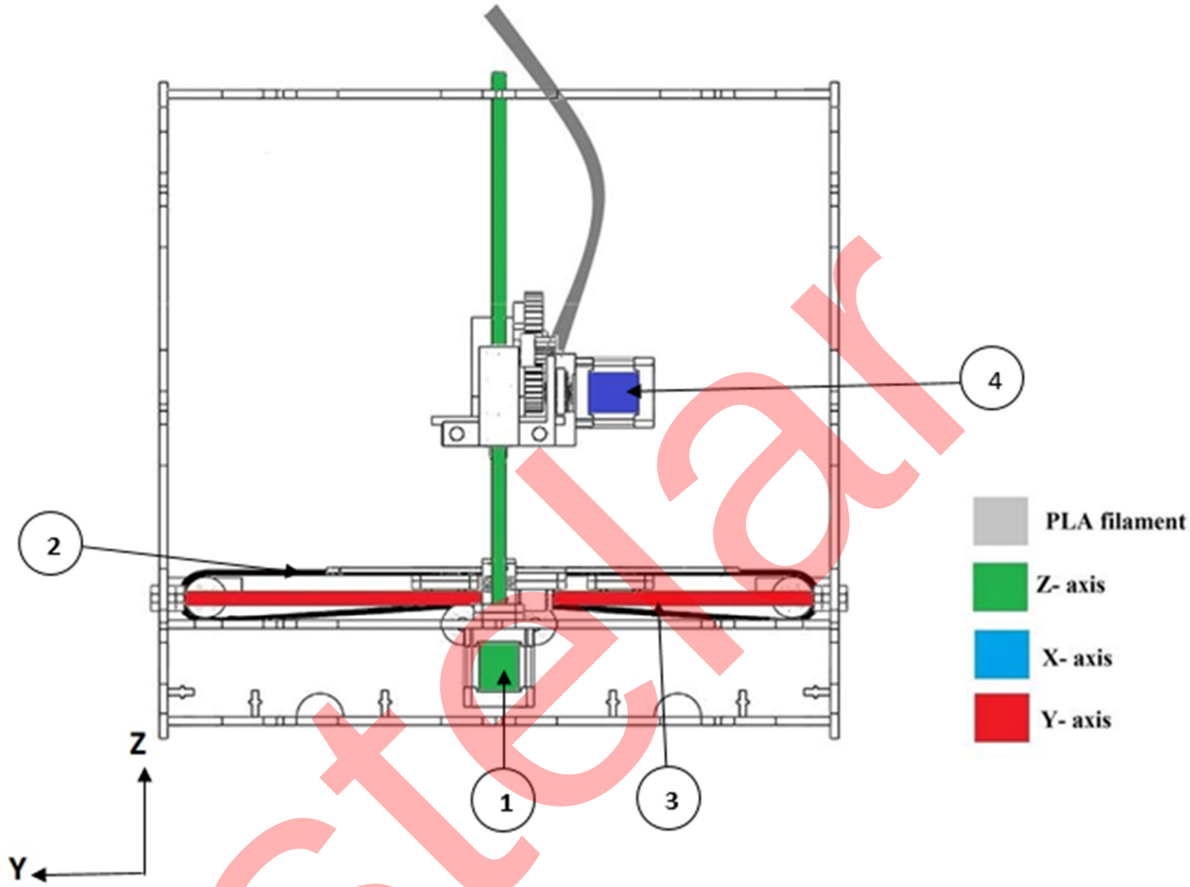
More detailed diagrams

- **Front view**



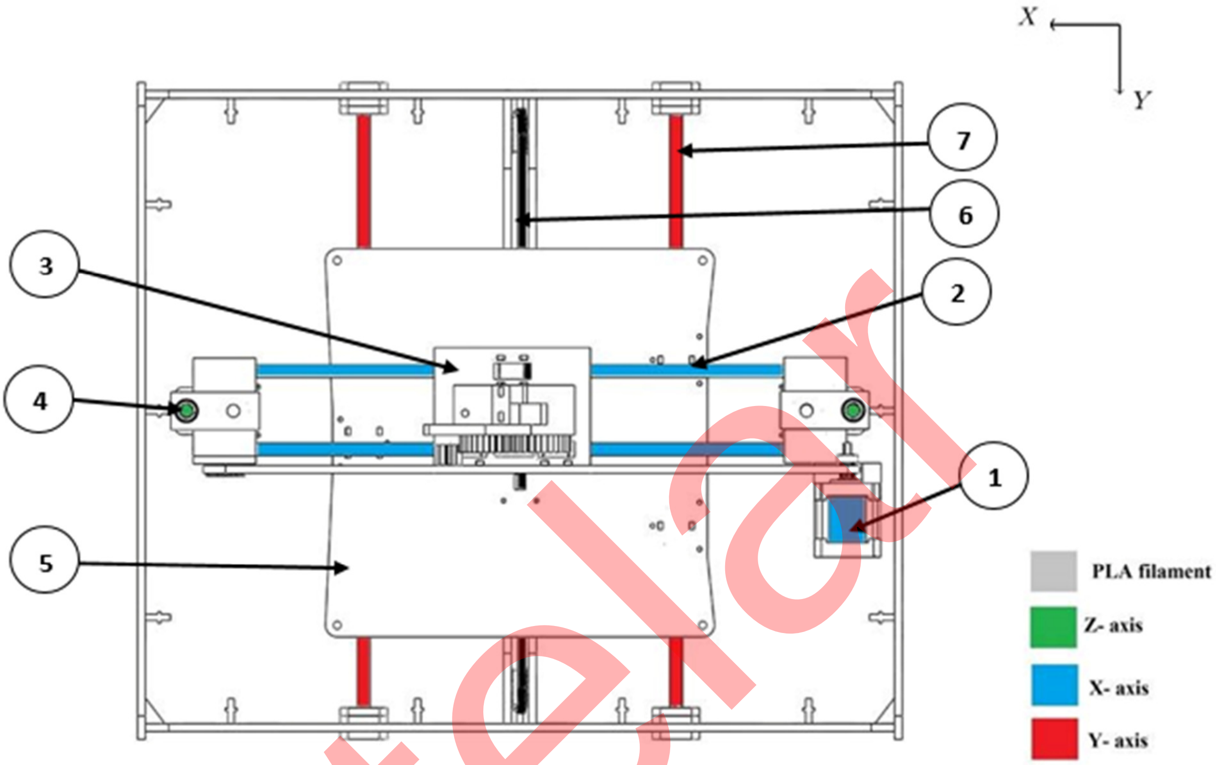
1. **X axis motor**
2. **Y axis motor**
3. **Z axis motors**
4. **Extruder**
5. **Timing belt**
6. **5/8 mm coupler**
7. **Y axis linear bearing**
8. **Z axis smooth rods**
9. **Z axis threaded rods**
10. **Nozzle**

- **Side view**



1. **Y axis motor**
2. **Timing belt**
3. **Y axis smooth rod**
4. **Extruder motor**

- **Front view**

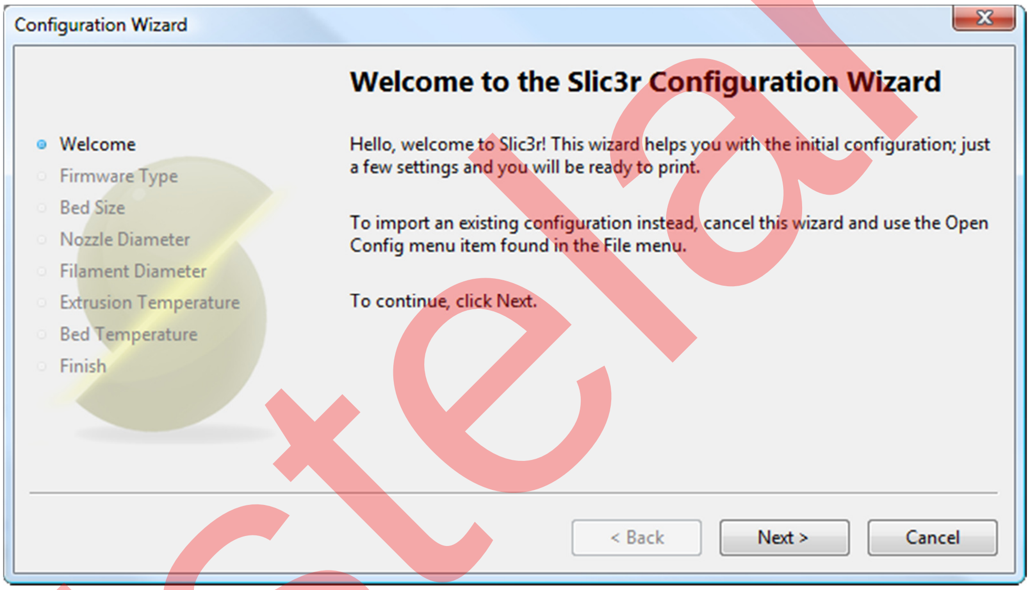


1. **X axis motor**
2. **X axis smooth rod**
3. **Extruder**
4. **Z axis linear bearings**
5. **Print bed**
6. **Y axis timing belt**
7. **Y axis smooth rod**

Software downloading

- Slic3r

Download “Slic3r” software from this link (it is an open source software): http://slic3r.org/download. Notice that when you setup “Slic3r” and open it for the first time. The configuration wizard asks a series of questions and creates a configuration for Slic3r to start with.



For this printer choose these values respectively:

- Firmware Type: “RepRap (Marlin/Sprinter)”
- Bed size: x 200 y 200 mm
- Nozzle Diameter: .45 mm
- Filament Diameter: 2.85 mm
- Extrusion Temperature: 200 C
- Bed Temperature 80 C

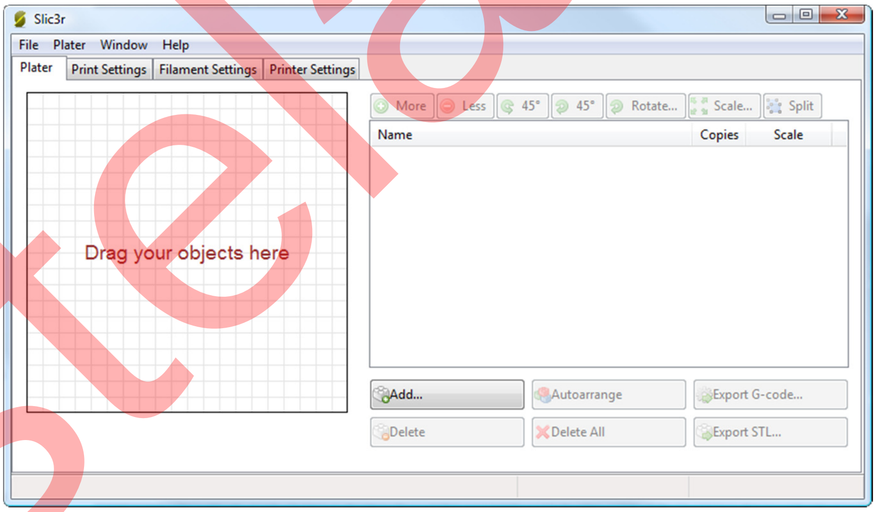
Notice that you can change these settings from inside the software at any time (if you see that the temperature should be higher or lower for example).

- Pronterface

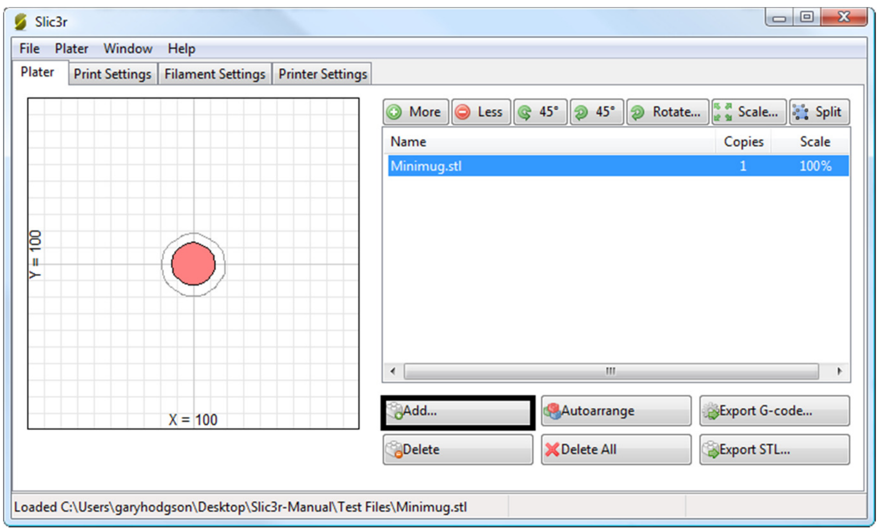
Download the latest version of “Pronterface” software from this link (it is an open source software): http://koti.kapsi.fi/~kliment/printrun/ .

Printing Procedure

1. Connect the printer to the computer using USB 2.0 cable.
2. Prepare you printer by:
    - Ensure that the print bed is clean.
    - Ensure that the print bed is flat, if not adjust it using four wing nuts.
    - Manually adjust the position of Z-axis limit switch to satisfy a suitable distance between the nozzle and the print bed (check it by pass a thin piece of paper between them).
3. Prepare 3D model in ".stl" file format you can download it from an online websites, such as "Thingiverse" or "GrabCAD", or create it using any CAD program such as "SolidWorks" or "SketchUp".
4. Open **"Sli3re"** software

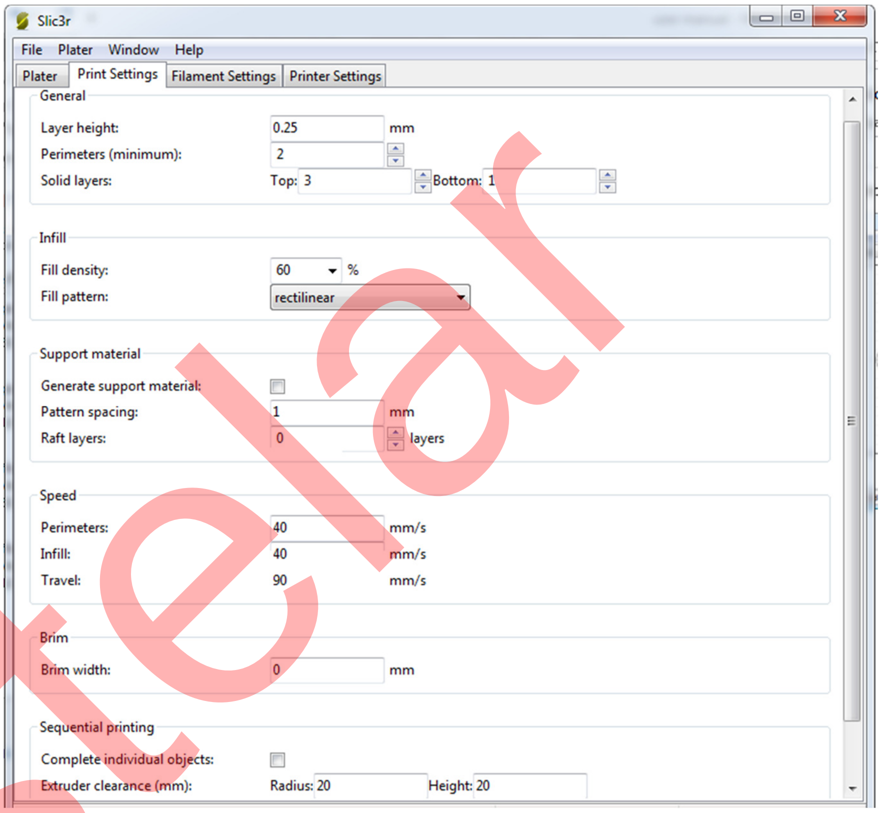


5. Load the 3D model to the Plater window from "Add" icon

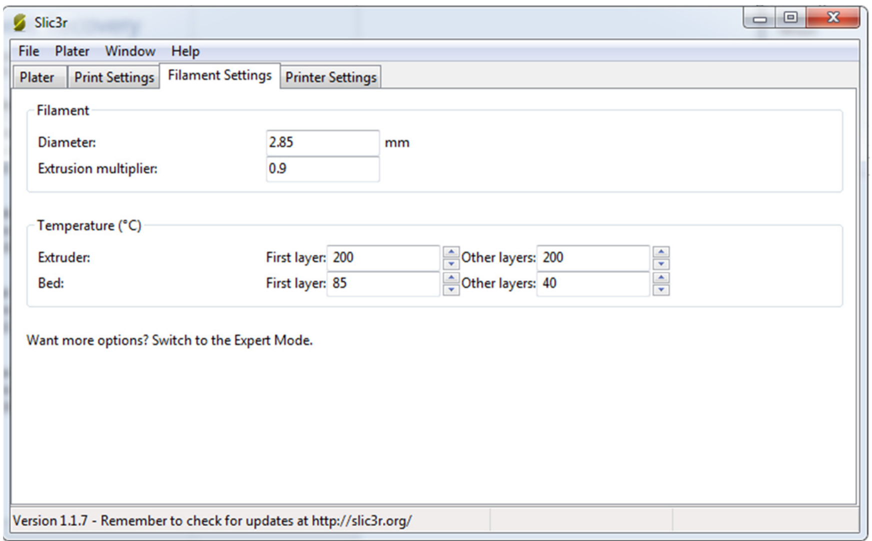


6. Adjust **Print Settings** as shown

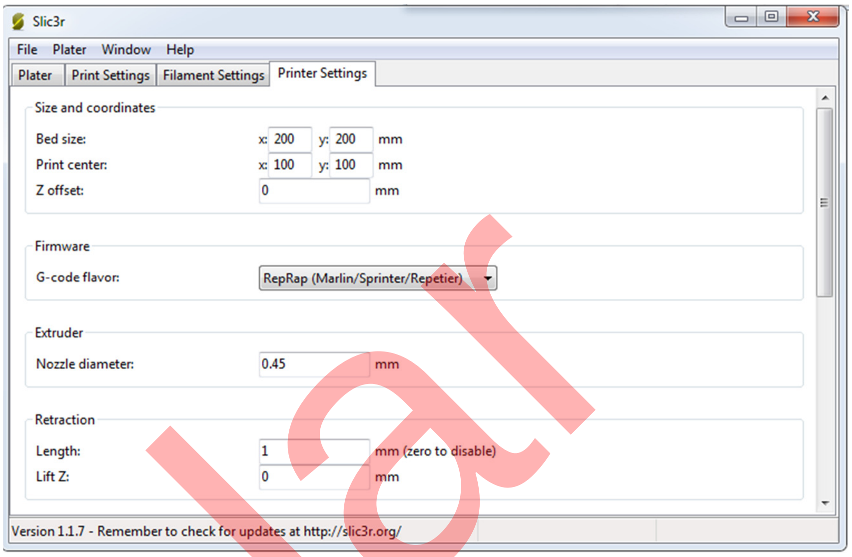
(The majority of these settings is chosen and tested by trial and error, so if it is needed you can change them to achieve better results, and this is the same for settings shown in next steps except the physical setting that relates to the dimensions of the printer and the filament).



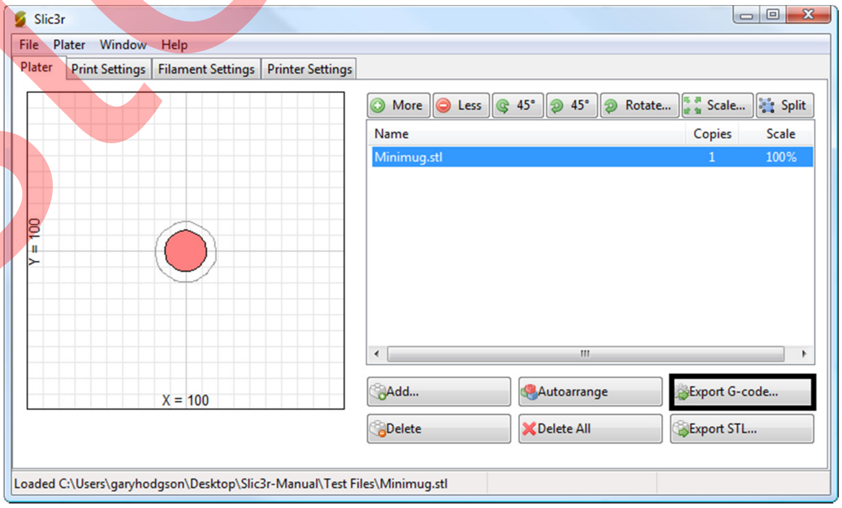
7. Also adjust **Filament Settings** as shown



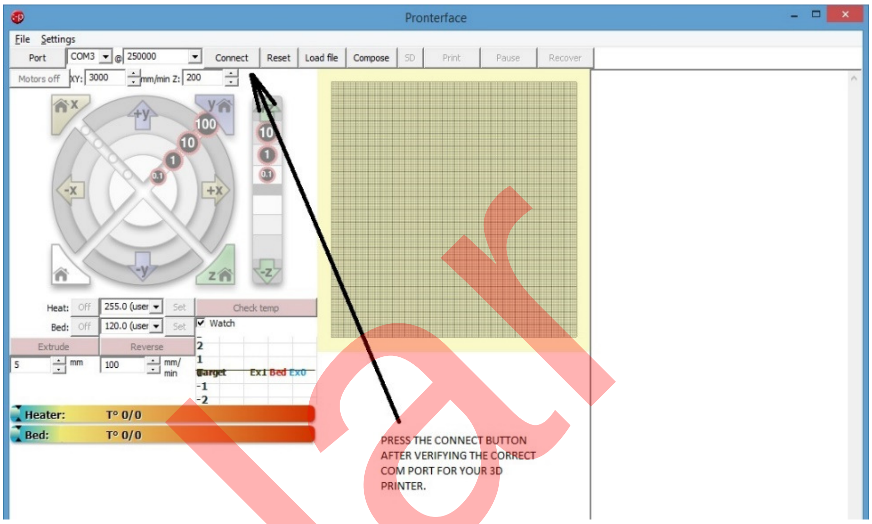
8. Finally adjust **Printer Settings** as shown



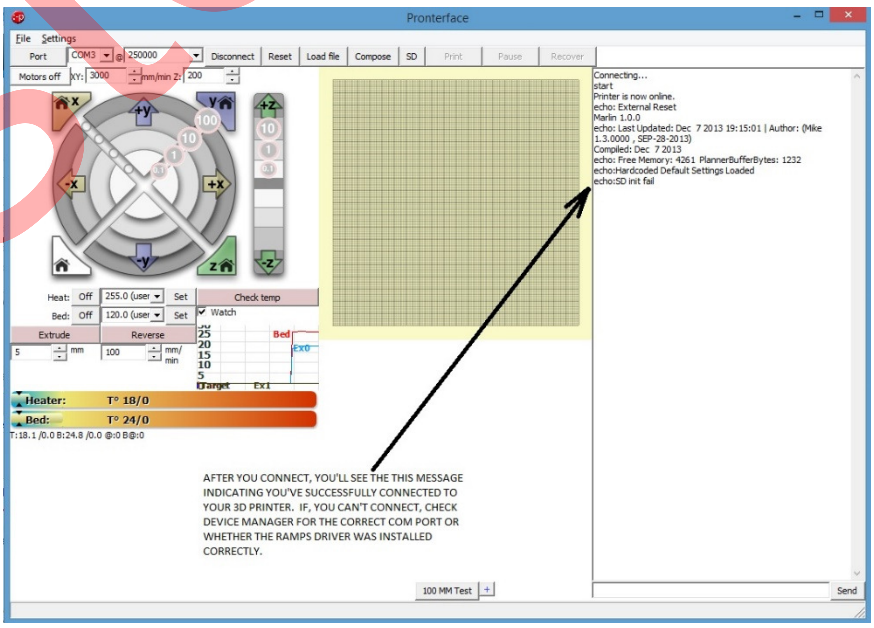
9. Export G-code



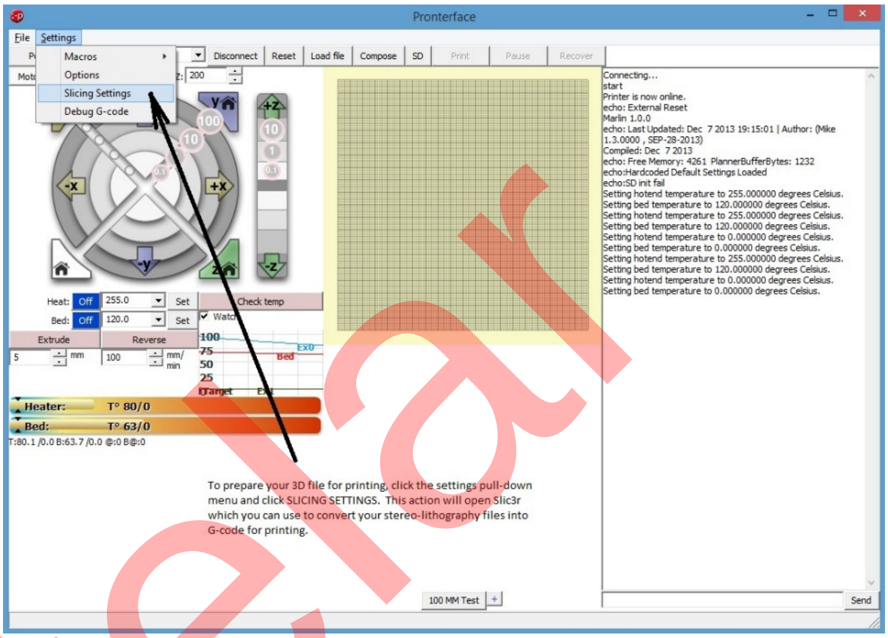
10. Open **"Pronterface"** software and connect it to your printer



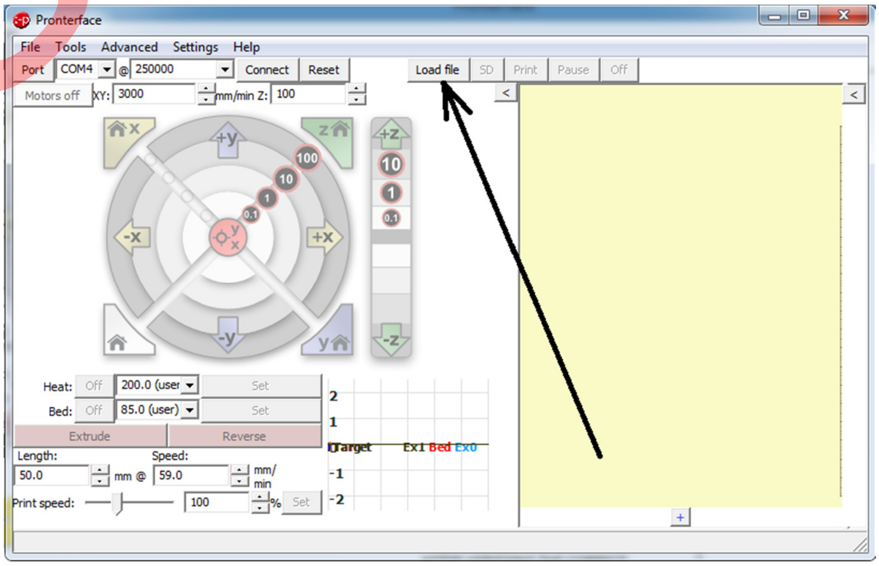
(You will see a message in the right column of Pronterface indicating that the printer has successfully connected)



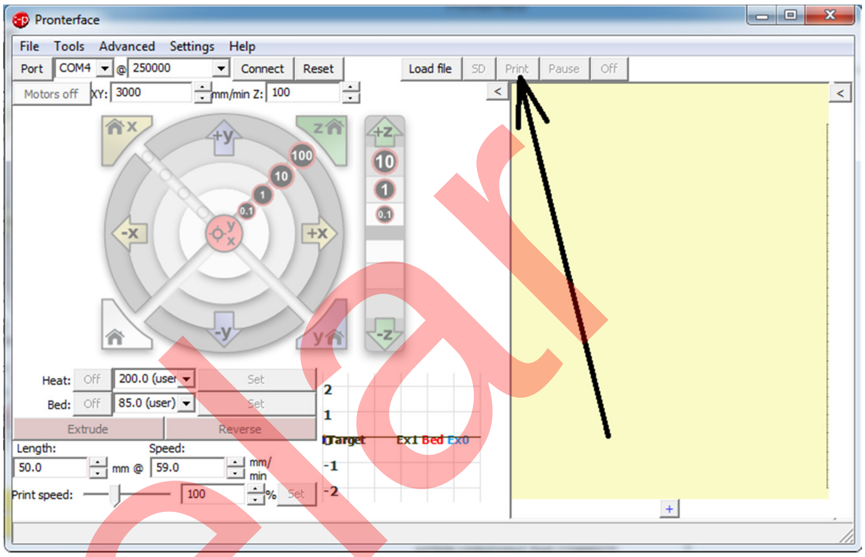
11. From **settings list** Adjust settings as the same of “slic3r” settings (not as numbers shown in figure)



12. Load the G-code of 3D model which was exported form slicer



13. Click print icon to start printing (it will be enabled if the printer is connected and G-code is loaded)



Troubleshooting

Introduction

In this part there are some common problems may happen in the printing process using DOM 3D printer and some suggested solutions to these problems.

1. Object do not stick on the print bed

When a printed object is not stuck on the glass above the print bed either at starting or while printing, try these solutions [23]:

- Ensure that the glass is clean. Because dust and oil from hands can prevent sticking on the glass.
- Ensure that the distance between the nozzle and the print bed is suitable (check it by passing a thin piece of paper).
- Increase the bed temperature by 5 degrees.
- You can add some adhesives on the print bed like hair spray or any other.

2. Difficulty in removing the printed object from print bed

Printed object sticks on print bed and cannot be removed after complete printing. Solutions for this problem [23]:

- Wait for the print bed to cooling down so the object will remove easily.
- Use metal craft spatula or small screw and carefully put it under the edge of the object, then twist it slightly.

3. Leaning prints or shifted layers

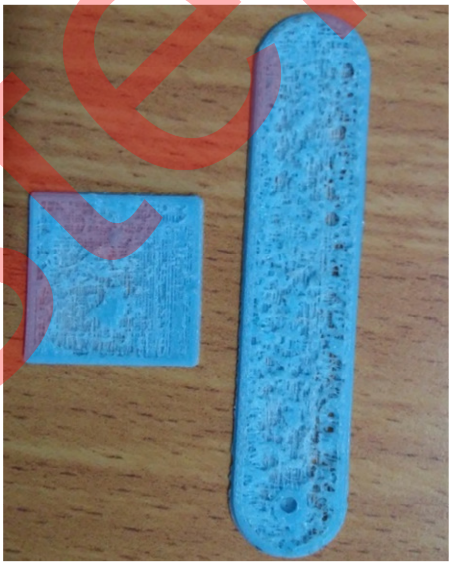
A leaning print (as shown in the figure below) is usually caused by one motor moves a shorter distance than expected due to friction or slipping in one of the motors or wrong step per millimeter factor in marlin software [24]. Solutions:

- Ensure that all the pulleys on X and Y axes are tied properly.
- Ensure that there is no touching between the timing belts and frame or any other parts while moving because this will generate friction.
- Put some lubricant on the bearings and rods to decrease frictions.
- In marlin software there is a file called “configuration.h” contains a step per millimeter factors for all motors try to change it to suitable numbers.

4. Under extrusion

That means the printer cannot supply the needed amount of PLA. This will cause missing layers, or layers that have random dots and holes (as shown in the figure below). There are many causes of this problem such as:

- Printing speed is higher than the capability of the printer.
- The temperature is not enough to milt the PLA so it requires higher pressure to push it.
- The nozzle is blocked or partially blocked by dirt or burned material.
- There is a problem in extruder mechanism.



Try these solutions:

- Decrease printing speed.
- Increase printing temperutar, but not more than 215 C°.
- If there is a jamming in extruder increase the temperature, then extrudes some material if it is still blocked you should clean it.
- Check that the screws on the extruder is tight well. Then check if extruder mechanism work probably by giving it an order to extrude a certain length of PLA then measure the distance of filament entered the extruder if the is a significant difference that means there is a problem in the mechanism.

5. Over extrusion

This problem is the opposite of the under extrusion problem and it means that the extruded material is more than required (as shown in the figure below) it can be caused if the temperature is too high, so the filament become like liquid, or if the filament diameter sets in Sli3er is too low value than its real value.

Solutions:

- Decrease printing temperature.
- Ensure that the filament diameter value is the same in settings and reality.

6. Axis sticking problem

This problem happens when axis does not move smoothly or one motor stalls (stop rotating) while printing process.

Solutions:

- Make sure rods are clean and linear bearings run smoothly.
- Ensure that belt alignment is correct, and the belt is not contact unduly with belt guides or anything else.
- Ensure there is no mechanical obstruction to the movement of the belt, or bearings on the smooth rods.

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