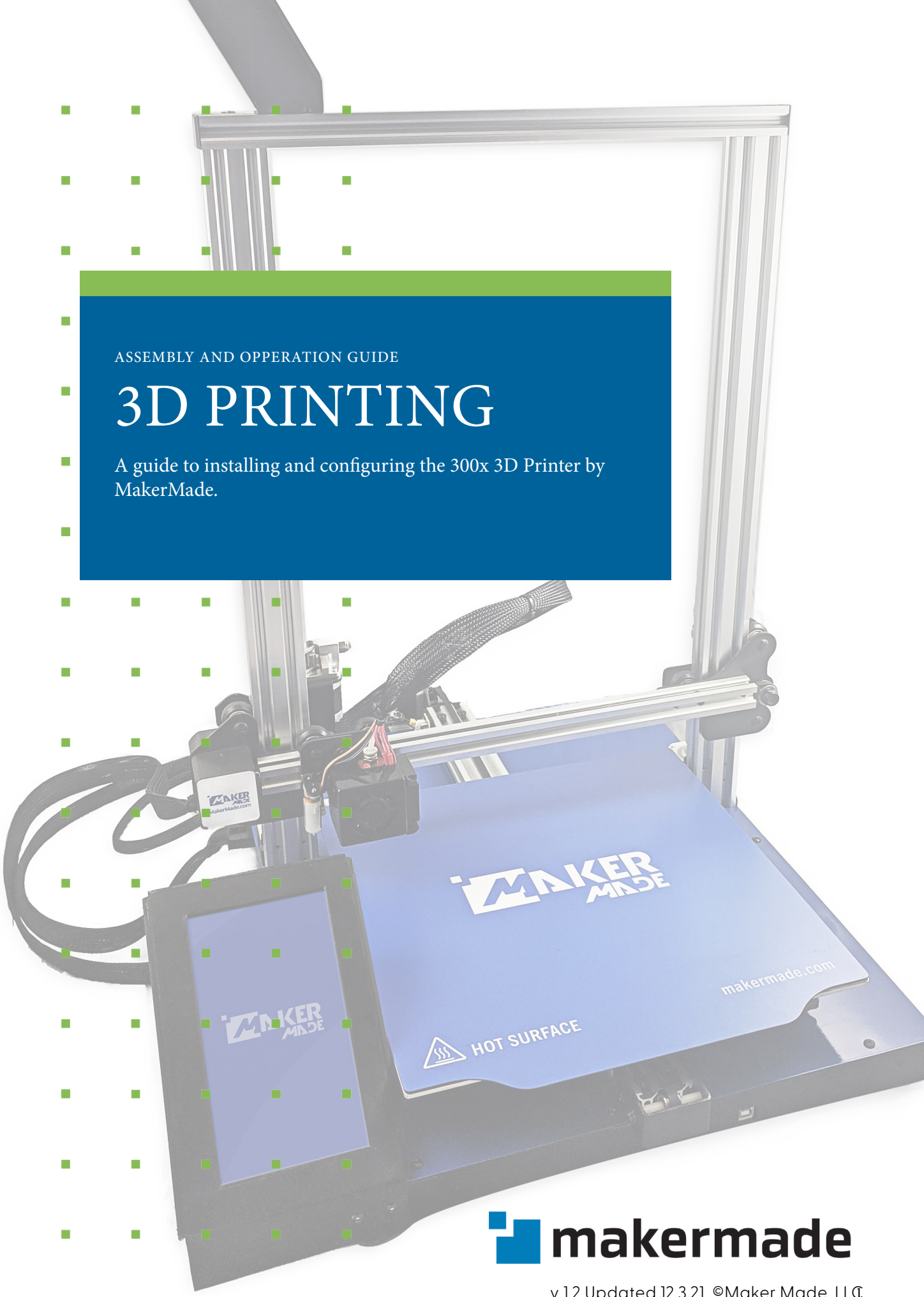
ASSEMBLY AND OPPERATION GUIDE

3D PRINTING

A guide to installing and configuring the 300x 3D Printer by MakerMade.



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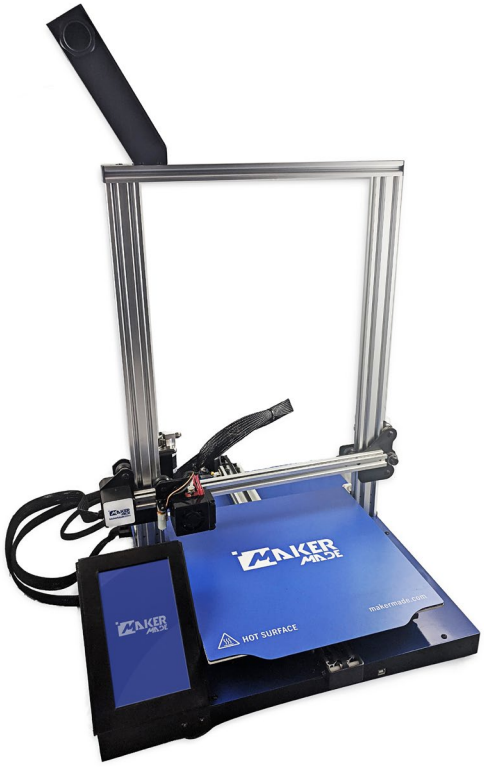
SETTING UP YOUR 300X

TABLE OF CONTENTS

SECTION 1. INTRODUCTION



Thanks for buying the 300x 3D Printer by Maker Made, with practical features for creative creatures! The following instructions are intended for beginners - with no prior 3D printing experience.

Here are some notes on the layout:

1. First off, I'm Drew and I took the lead on creating this guide. My notes are tips and tricks to help you along. They are in a different font, blue, and look like this:

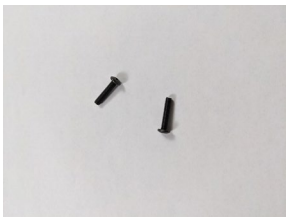
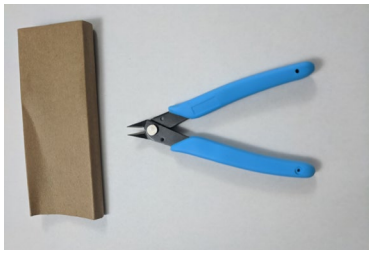
Drew's Note: Let us know how this guide can be improved. We love to hear from you!

They are meant to answer some of the "why" questions you might have and give you tips to get started. We suggest printing the guide in color, if you want a paper copy to go along with the quick start guide.

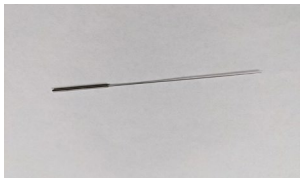
2. 300x setup can be broken down into two main parts: building the 300x and starting your first print. There are a few steps involved, so let's get started!

3. If you need any help, join us in one of our weekly 3D Printing videoconference Q&A sessions, or send us an email at support@makermade.com.

WHAT'S IN THE BOX?

X-AXIS GANTRY 	Y-AXIS BASE WITH MAGNETIC BUILD SURFACE 	SPOOL HOLDER (3 PARTS) 
BLACK M3 SCREEN MOUNT BOLTS (X2) 	BLACK SPOOL HOLDER SCREWS (X2) 	SILVER M4 GANTRY BOLTS (X4) 
SCREEN AND MOUNT 	ADJUSTABLE PHILLIPS/FLATHEAD SCREWDRIVER 	2mm, 2.5mm, 3mm ALLEN WRENCHES 
200g PLA ROLL 	PRINT REMOVAL SCRAPER 	USB A-B CORD FOR WIRED COMPUTER CONNECTION 
FILAMENT CLIPPERS 	POWER CORD 	EXTRA ZIP TIES FOR CORD MAINTENANCE 

WHAT'S IN THE BOX?

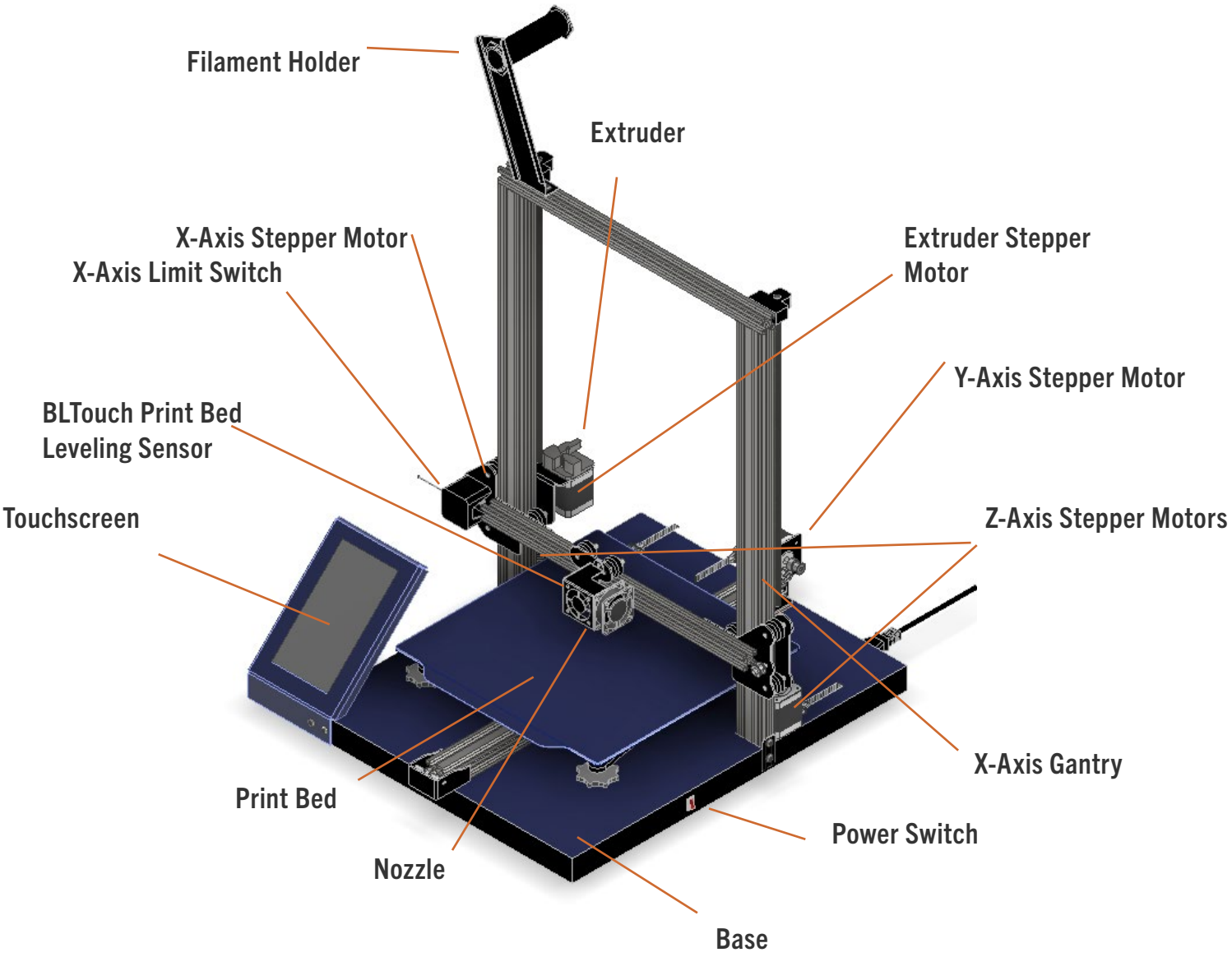
NOZZLE UNCLOGGING TOOL	MICROUSB FOR SCREEN POWER	USB DRIVE
		

Drew's Note: Also included is a welcome letter and a quick start guide. We are so excited that you have chosen to 3D print with us!

ASSEMBLING YOUR 300X

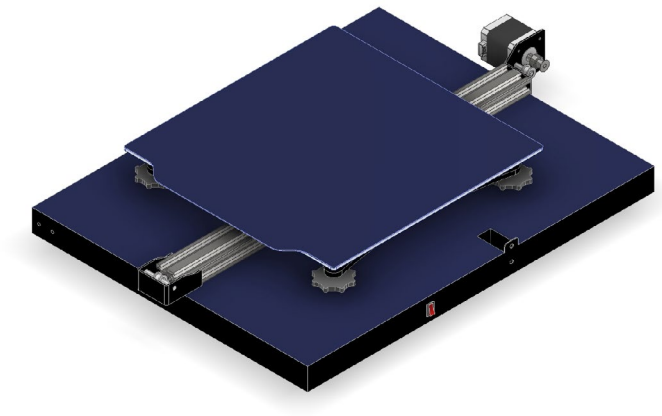
The 300x 3D Printer comes in several pieces to assemble.

Drew's Note: Here is a layout of the practical features of the 300x!

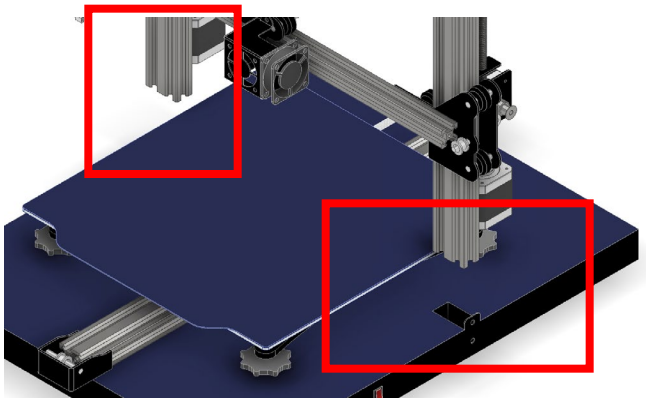


3D PRINTER ASSEMBLY

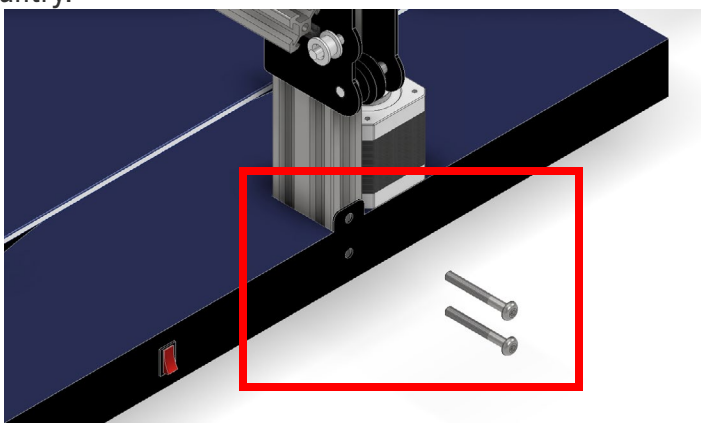
1. Unbox 300x and remove all foam from the base.



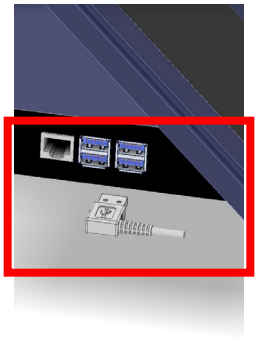
2. Place X-axis gantry into ports on top of the base, with the silver and black stepper motors toward the back and the nozzle toward the front.

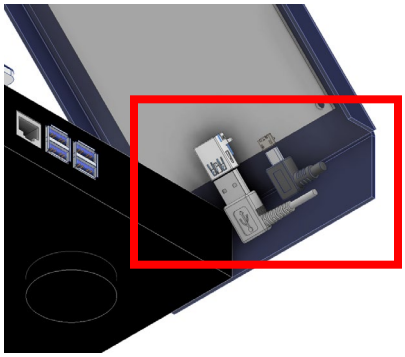


3. Use a 3mm Allen wrench (largest) to screw 2 long silver M4 bolts into each side of base to secure the gantry.

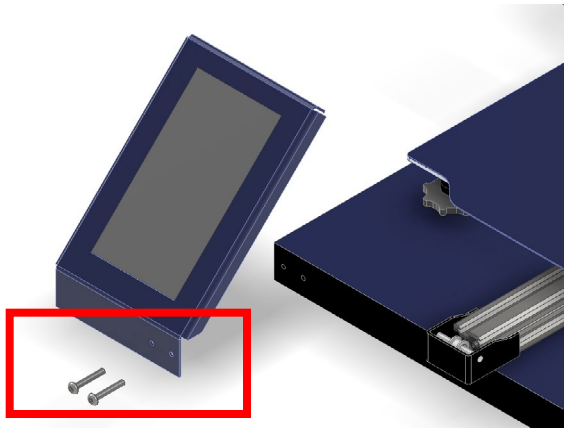


4. Plug in microUSB (into either port) and HDMI into back of screen. It is a tight fit, so ensure that the HDMI is plugged in completely. Plug the other end of the USB into one of the Raspberry Pi USB ports.

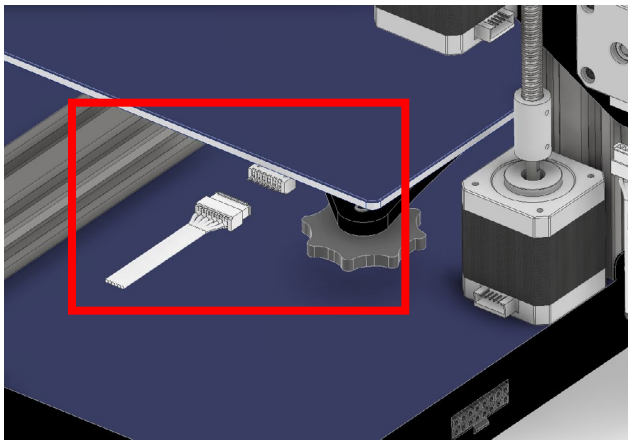




5. Attach the screen mount to frame using 2.5mm Allen wrench (middle sized) and two black M4 bolts.

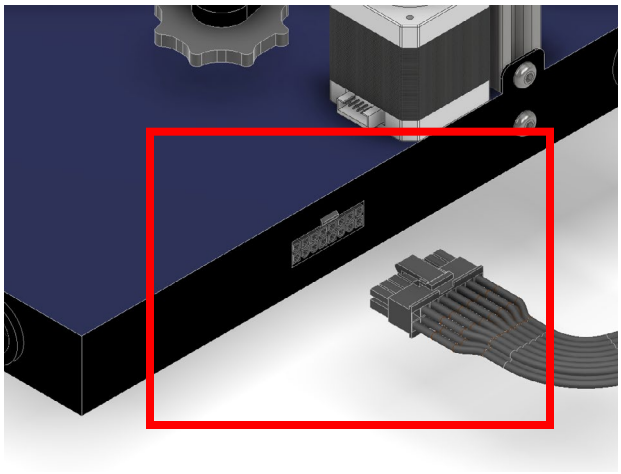


6. Plug in print bed to base, with connector clip on top.

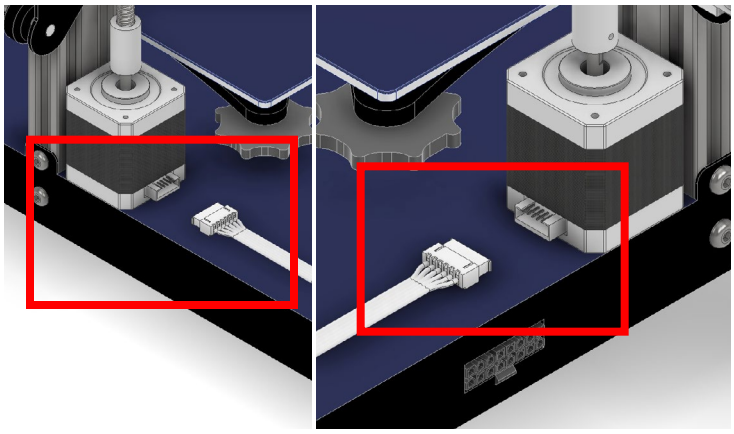


3D PRINTER ASSEMBLY

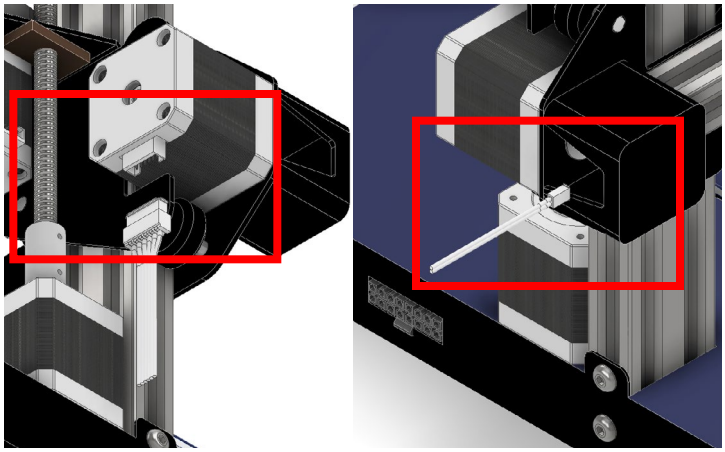
7. Plug gantry into base, with connector clip on top.



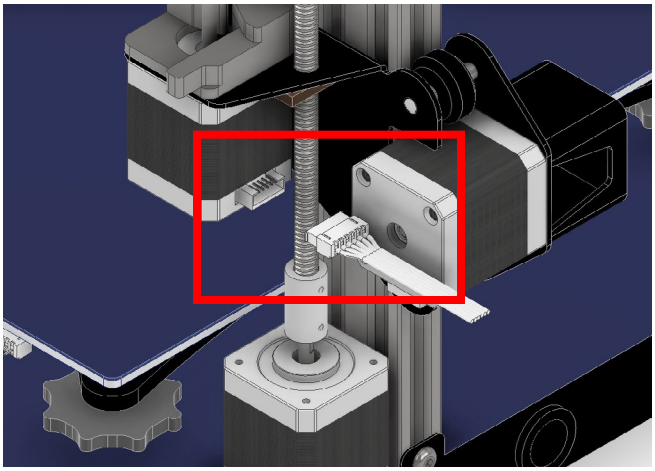
8. Plug in both Z-axis stepper motors from the back of the printer. The connection will only fit one way.



9. Plug in X-axis stepper motor and smaller limit switch. The wires are labeled with an “X”.

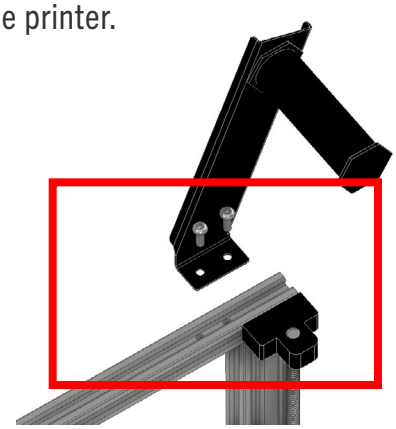


10. Plug in extruder stepper motor, the wire labeled “E”.



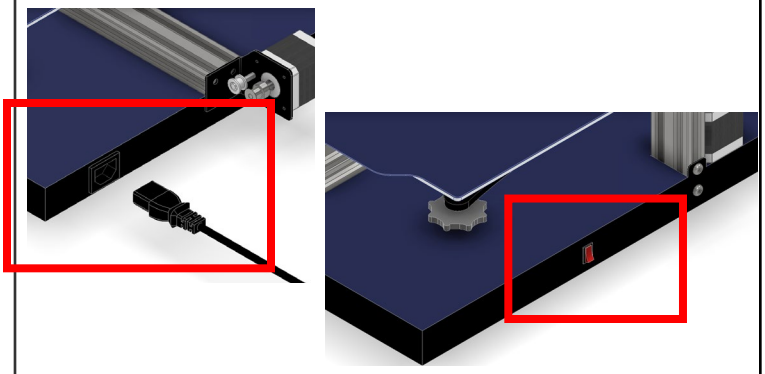
11. Attach filament axel to mount by inserting axel threads through the mounting hole. Hand thread to tighten the nut on the opposite side of the slanted L-bracket.

12. Use two long Phillips screws to attach filament holder to the top left of the gantry. Face the axel toward the back of the printer.



YOUR FIRST PRINT

13. Plug in the power in the back and flip the switch on the right side to turn it on. It will take about a minute for the internal Raspberry Pi computer to boot.



14. Choose Mode.

The 300x comes with two different modes: Home/Office and Education.

One is for hobbyists and businesses, while the education mode includes tutorials and extra on how to 3D print.

You can change your mode and other settings at any time by tapping menu at the bottom of the screen.

15. Follow the on screen instructions for the initial setup, Wi-Fi, and calibration settings for your new 3D printer.

Follow the instructions to download the latest printer firmware and update to the newest features.

The name you give to your printer will be used to connect to it over a web browser.

The on screen tutorials will walk you through how to calibrate and 3D print on the 300x.

No downloaded software is required to slice files or operate the 300x!

16. To connect to the 300x wirelessly using a web browser, either connect the printer to your Wi-Fi, ethernet, or connect to the Wi-Fi network on your computer named “Maker Made” that the printer broadcasts until it connects to your network.

Then, open any web browser and go to:

http://[your-printer-name].local
OR
http://192.168.[the IP address found in the Menu > settings screen, under your Wi-Fi information]

Note: Bonjour Print Services must be installed for the printer page to load on a Windows computer.

To install Bonjour, install any Apple program (such as iTunes) on your computer or find the newest stand-alone version at support.apple.com.

ABOUT 3D PRINTING

You built your 300x 3D printer! Now let's learn how to print.

Drew's Note: To better understand 3D printing, here is a brief overview of the process, materials, and how to troubleshoot. More pictures coming soon!

THE 3D PRINTING PROCESS

The 3D printing process is usually split into three main parts: creating or finding a digital file, converting the digital file for your printer, and printing!

PART 1: CREATE OR FIND A DIGITAL .STL FILE

You can create a 3D model—a digital geometry—using any CAD (computer- aided design) software program. We recommend free programs, such as TinkerCAD and OnShape. Autodesk's Fusion360 is my favorite and free for education. These programs take some time to learn, and can be challenging. But they are also rewarding, especially when you watch your own creation being printed on your 3D printer! There are also many websites with premade file libraries. Check out the Maker Marketplace, to find and post your creations!

Every CAD program allows users to save or export digital files for 3D printing. You want to save your file as an STL file ("filename.stl"). The STL file is the standard file format for 3D printing. In some programs, it's as easy as the Save command. In others, you need to select the File > Export option, and choose the STL format. OBJ files can also be sliced and 3D printed. If your file is not designed properly or is corrupted, it will not print properly. If the print fails, this is where digital troubleshooting will begin.

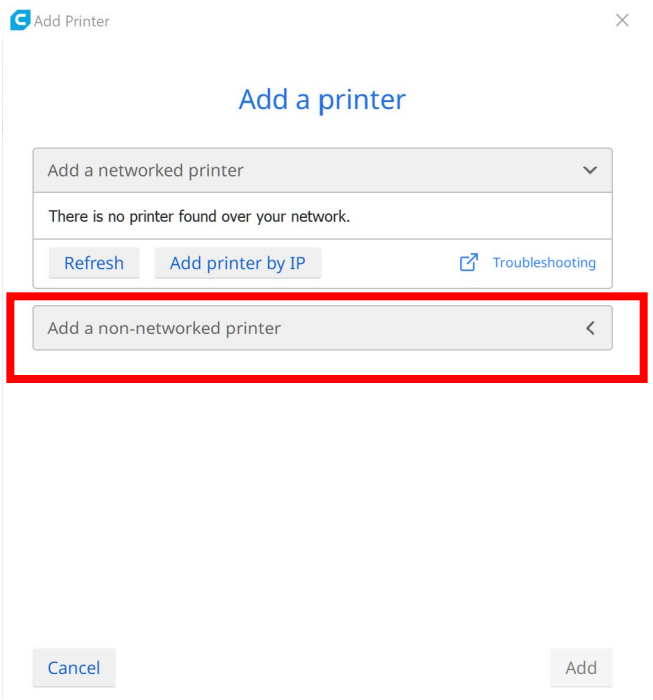
PART 2: CONVERT YOUR DIGITAL FILE FOR YOUR 3D PRINTER (SLICING)

Slicing is the process of converting your design to Gcode that the printer can read. On the 300x, slicing is easy, because it includes Cura, a popular slicer engine! However, the 300x is pending as one of the pre-selected non-networked machines in Cura, if you want to download it on your computer.

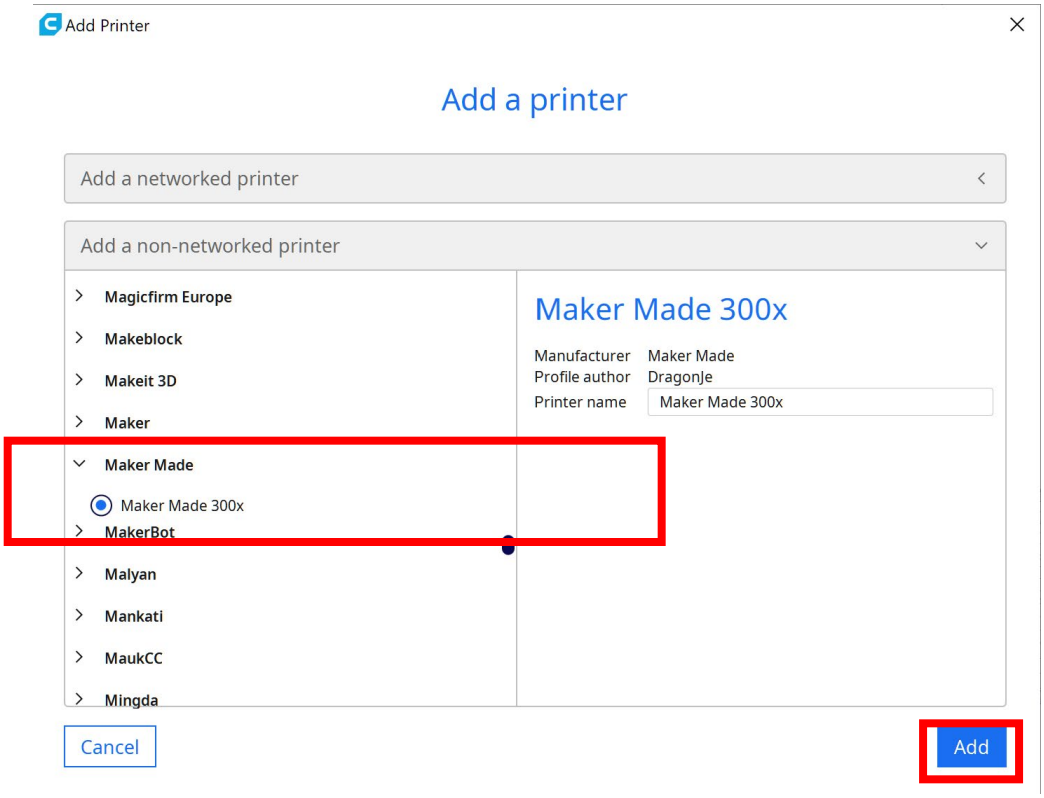
To print on your 300x, just tap on your STL file (or click it, if connected through a web browser). Then you need to choose the physical properties of how your model will print. You can change the print profile to "High Quality" for a smoother, higher quality part, although the build will take longer, or "Fast Quality" to print at a lower quality in less time. You may also need to check "Generate Support" if your model needs to print with support, change the infill if you want a stronger, more dense model.

The following is an introduction to Cura and how to set up your machine on your computer. When you are satisfied with the slicing settings and have chosen the filament you are using, you are ready to begin printing!

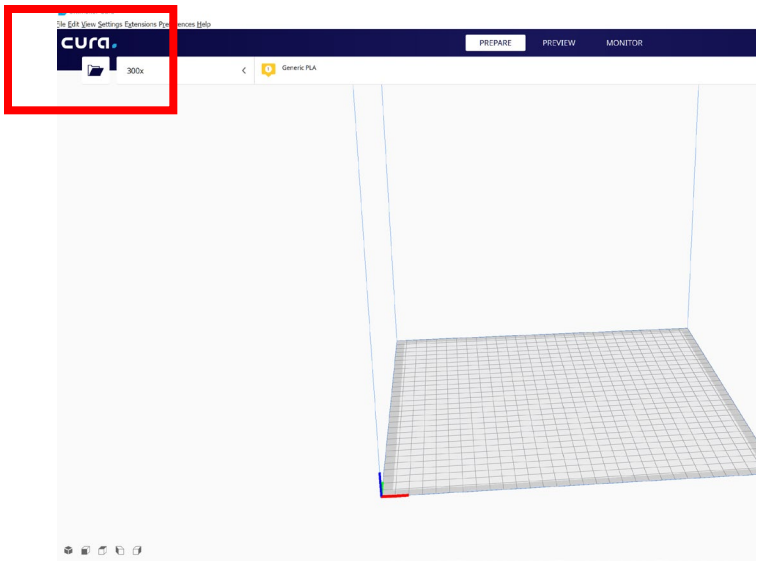
1. Once Cura is installed, you need to add your 300x. If you already have a machine in Cura, click on its name and choose “Add a non-networked printer”.



2. Scroll down the list and select the MakerMade 300x from the list. Select “Add”.

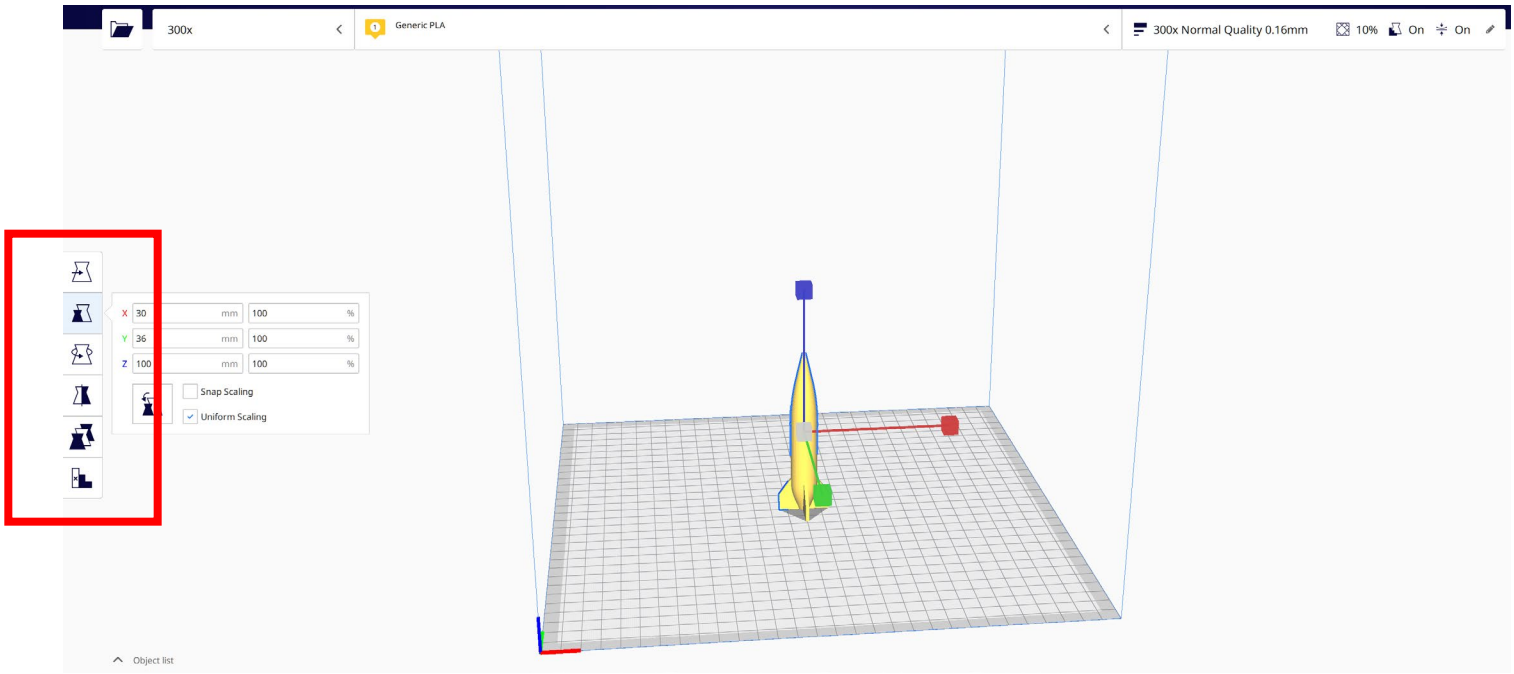


3. Now, we're ready to import a model. From Part 1, you learned that .STL files are the best for 3D printing. Import a .STL file by clicking "File" > "Open File" or the folder in the top left. You can create a . STL file or use one from the USB drive that was included with your printer.

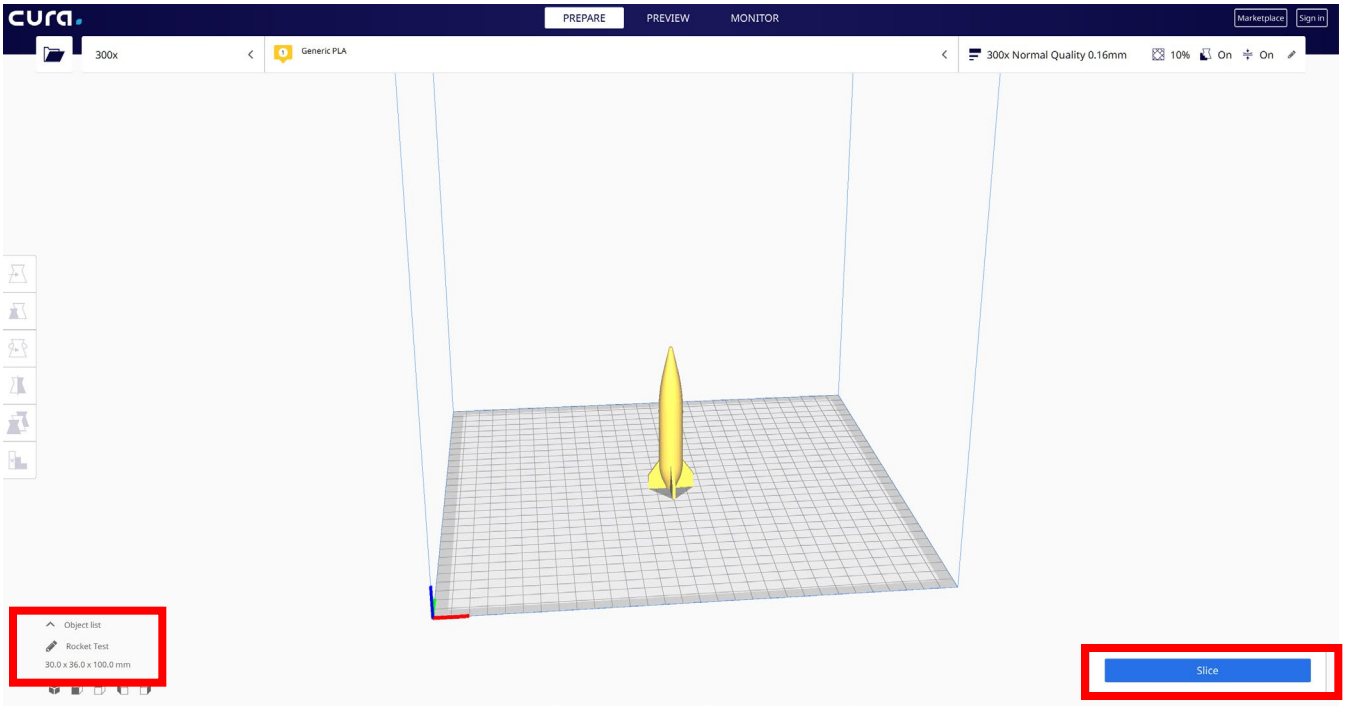


4. Now we can modify our model for printing! Click on your STL file and the left modification menu will appear. You can move (move the model to another place), scale (change the size), or rotate (to rotate the flattest side on the build surface) with the menu options.

Drew's Note: These features are also coming very soon to the 300x onboard slicer!

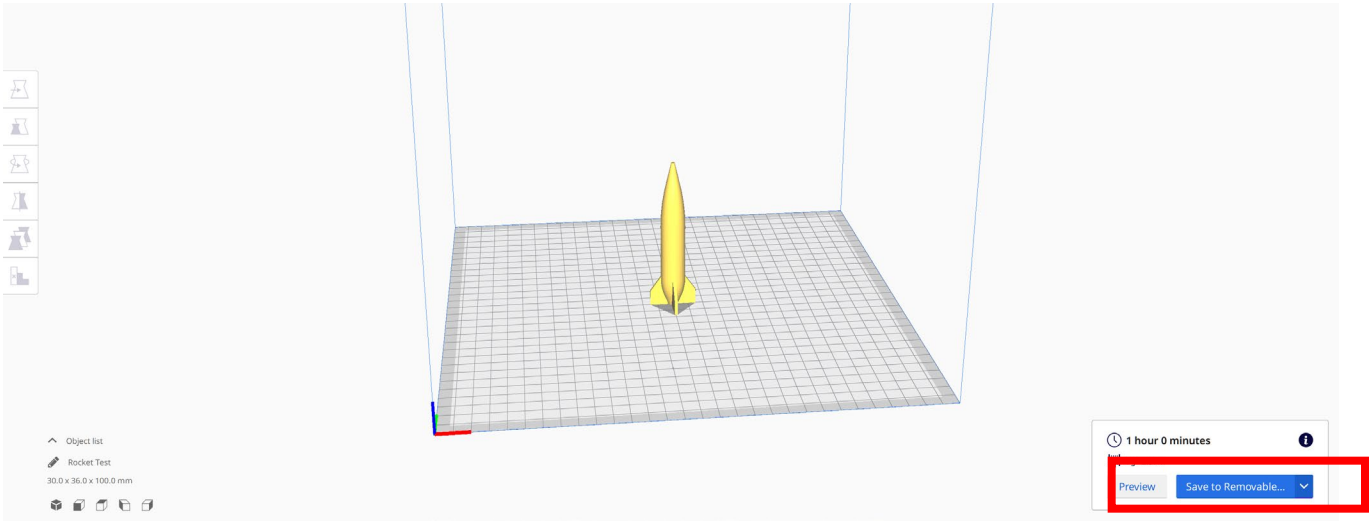


5. We are now ready to slice! To rename your file, click on the name in the bottom left. To slice, click “Slice” in the bottom right corner.



6. Once your model is sliced, you are ready to send it to the printer. Plug in your USB drive in your computer and select “Save to Removable Drive” or “Save to FIle” for the web update. Plug the USB drive into your printer and select your print!

Drew’s Note: Our web uploading update is coming very soon! When it does, select “Save to File” instead, navigate to http://300x.local to upload the file to the printer on your network.



PART 3: PRINT!

The last and most fun step is printing! Once you choose your file to print and slice it, your 300x will heat the nozzle and build plate to melt the filament. When it's heated, the printer will run the print bed calibration and begin!

Make sure your filament is fully loaded and the print sensor is calibrated to the correct height. If your print curls up or pops loose, the nozzle is too far away. If the first layer of your print is barely showing up, or the extruder is making a popping noise, then your nozzle is too close.

Adjust the knobs under your printer to raise or lower your bed, or re-run the print bed calibration again to reset your Z-Offset. The Z-Offset is the distance your BLTouch print bed sensor uses to calibrate - it is the distance your nozzle is programmed to be from the print bed. See the troubleshooting section for more information.

PART 4: DIFFERENT FILAMENT TYPES

Filament is the material a 3D printer uses to create your model. It is a thermoplastic formed into a continuous wire and wound onto a spool so it is compatible with a 3D printer's extrusion system.

The 300x has a dual-geared extruder and can print in several different materials. The three we recommend beginning with are:

PLA (polylactic acid) is a biodegradable thermoplastic polymer derived from the starch in plants (normally corn) that is used for 3D printing. It's easy to print with and inexpensive. It's the main one we print with!

TPU (thermoplastic urethane) is a semi-flexible plastic that is used in 3D printing. It's like flexible rubber!

PETG (polyethylene terephthalate glycol) is a thermoplastic polymer that is chemical resistant and durable. Most water bottles are made of PETG. It is an excellent impact and temperature-resistant material, that perfect for when you need something more Durable than PLA!

Drew's Note: I don't recommend printing in ABS. ABS is better suited for injecting molding and produces harmful fumes. It is also hard to print with and requires a bed temperature of 110C. Although the 300x print bed can reach 100C, the default magnetic print surface will demagnetize.

PART 5: THE TROUBLESHOOTING PROCESS

Whether you are using a CNC, laser cutter, or 3D printer, all digital manufacturing requires some troubleshooting.

Here are some quick tips to help you determine what is wrong:

Step 1: Diagnose the problem. This may seem obvious, but many problems can be solved if you take a step back and see exactly what the printer is doing incorrectly.

Step 2: Determine if the problem is mechanical or digital. Mechanical problems are in the actual operation of the printer, such as the motors that drive the X, Y, and Z axes, the motor that pushes the filament, the nozzle heater, and the calibration of the build plate. The most common mechanical problem is caused by a build plate that is not calibrated correctly. Other mechanical problems include under-extrusion, a clogged nozzle, and an unplugged connector on a motor or limit switch.

Digital problems are in the slice file that you prepare in Cura or another slicing program. Important slice file settings include layer height, print (nozzle) temperature, and print speed.

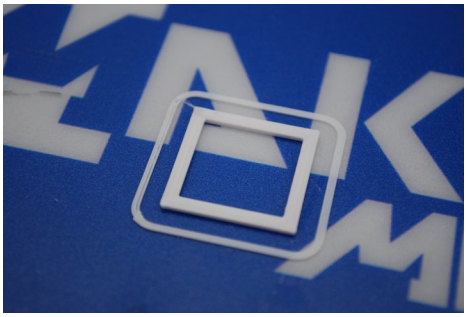
Once you narrow down the problem, you can start trying things to fix it!

APPENDIX - CALIBRATION

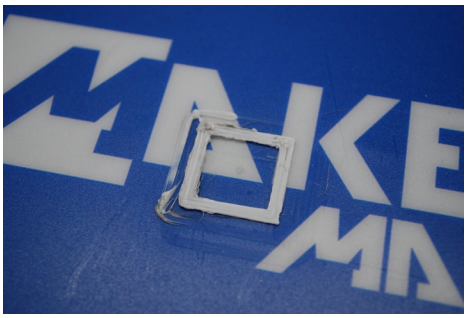
You'll want to calibrate the BLTouch sensor for successful printing. The BLTouch helps to keep the consistent layer height between the nozzle and the build plate for printing.

If your print doesn't match the test print in the box below, your BLTouch is not calibrated correctly. On your printer, go to the Menu > Tutorials > Calibrate BLTouch Sensor to raise or lower the nozzle for printing. Detailed instructions can also be found in the user manual.

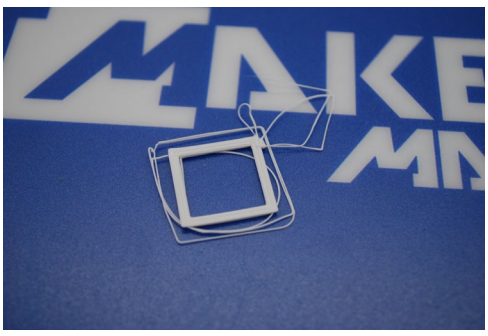
This is what your print should look like when finished! Notice the 90° angle of the square and the consistent layer lines.



If the nozzle is not close enough, the layers will not stack correctly. Here is an example print from a nozzle that is too far away. If model comes loose while printing, the nozzle should be lowered.



If the nozzle is too close, your print will look smashed like this example. The nozzle can also be so close that it drags into the build filament didn't extrude. In this case, it should be raised.



APPENDIX - LINKS

Support: support@makermade.com

Cura (Slicing Engine): https://ultimaker.com/software/ultimaker-cura

300x Resources: https://makermade.com/3dp-resources/

Makerverse: https://makermade.com/resources/

Marketplace: https://makermade.com/marketplace/

Weekly Beginner Training Link: https://makermade.com/resources/

YouTube Playlists: https://www.youtube.com/c/MakerMadeCNC

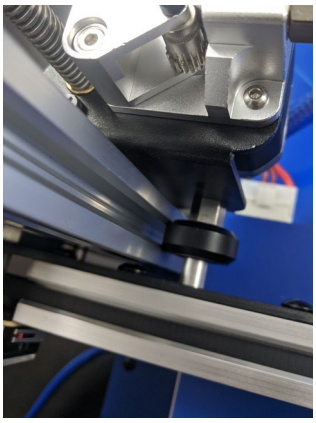
300X TROUBLESHOOTING: DOUBLE CHECK 3D PRINTER SYSTEM

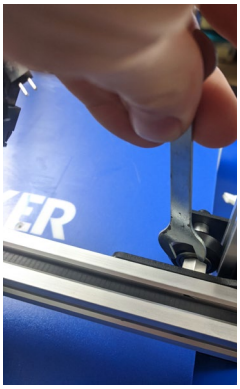
Drew's Notes: Eccentric nuts are cool. They are nuts designed with a hole that is off center, so that when the nut is rotated, it moves side to side. It will get tight and then loose again as it turns. It's perfect for attaching wheels to the frame of 3D printers and ensuring that they don't wobble when moving.

To check if they need to be tightened, use your finger to try to spin a wheel. If the wheel spins freely with little pressure, the nut needs to be tightened. The wheels should be snug to the frame, so that the corresponding axis is not wobbly.

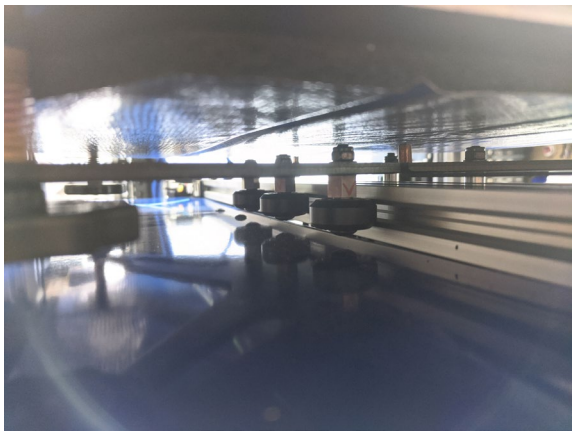
(Need simple rendering that shows how they turn)

1. Check X-axis wheels on both sides and tighten Eccentric Nuts if needed.

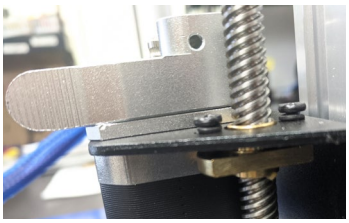




2. Check Y-axis and build plate



3. Check Z-axis couplers



4. Check the tension X and Y belt tension. The belts should be taut, similar to a guitar string. If they are loose