

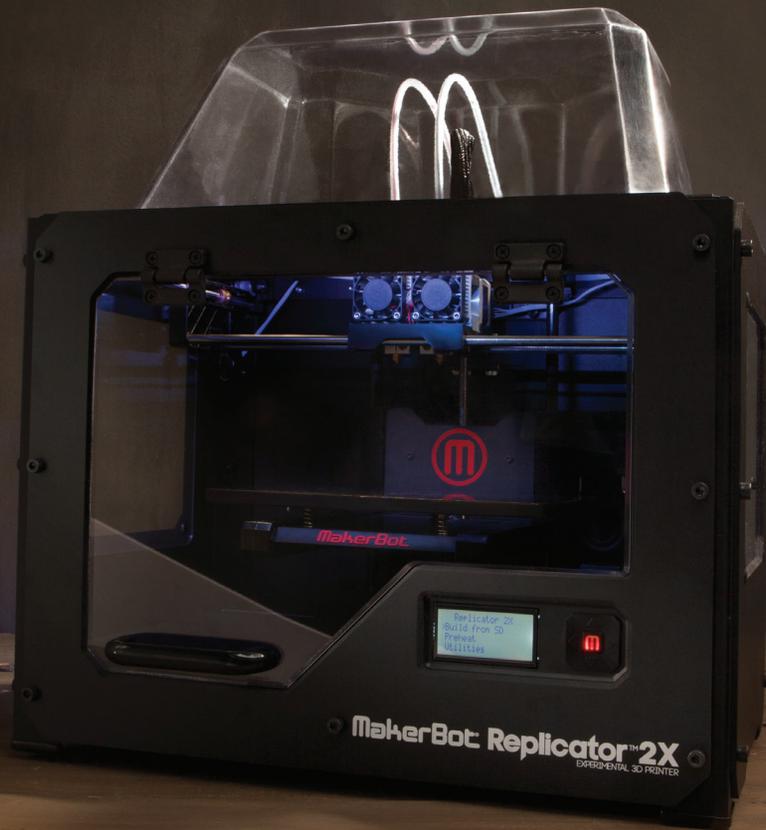


MakerBot®

Replicator® 2X

EXPERIMENTAL 3D PRINTER

USER MANUAL | DUAL EXTRUSION

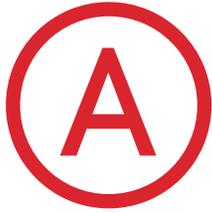




MakerBot®

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MakerBot

Welcome,
Let's get started.



This User Manual is designed to start your journey with the MakerBot® Replicator® 2X Experimental 3D Printer in the right direction. Your MakerBot Replicator 2X is optimized for ABS, a traditional thermoplastic that can be tricky and unpredictable. In order to achieve great results, you will need to experiment and tinker. That's why it's so crucial to take the time to learn about your new machine.

In this User Manual, you will learn the basics of the MakerBot Replicator 2X, as well as how to unbox it safely and get it set up. Chapters C through E will take you through calibration, printing, maintenance, and troubleshooting.

We are so excited to welcome you to the MakerBot community. Let's get started!

WARNING: The MakerBot Replicator 2X Experimental 3D Printer generates high temperatures and includes moving parts that can cause injury. Never reach inside the MakerBot Replicator 2X while it is in operation. Always allow the MakerBot Replicator 2X to cool down before reaching inside.

WARNING: Do not leave the MakerBot Replicator 2X unattended during operation.

CAUTION: If opening the MakerBot Replicator 2X for service, ensure that the power supply is turned off and the cord is disconnected.

SPECIFICATIONS

PRINTING

Print Technology:	Fused Filament Fabrication
Build Volume:	9.7"W x 6.4"L x 6.1"H [24.6 cm x 16.3 cm x 15.5 cm]
Layer Resolution Settings:	High 100 microns [0.0039 in] Medium 270 microns [0.0106 in] Low 340 microns [0.0133 in]
Positioning Precision:	XY: 11 microns [0.0004 in]; Z: 2.5 microns [0.0001 in]
Filament Diameter:	1.75 mm [0.069 in]
Nozzle Diameter:	0.4 mm [0.015 in]

SOFTWARE

Software Bundle:	MakerBot MakerWare™
File Types:	.stl, .obj, .thing
Supports:	Windows [XP/7], Ubuntu [11.10+], Mac OS X [10.6+]

PHYSICAL DIMENSIONS

Without Spools:	19.1 x 12.8 x 14.7 in [49 x 32 x 38 cm]
With Spools:	19.1 x 16.5 x 14.7 in [49 x 42 x 38 cm]
Shipping Box:	22.75 x 22.75 x 16.75 in [57.8 x 57.8 x 42.5 cm]
Weight:	27.8 lbs [12.6 kg]
Shipping Weight:	40.0 lbs [18.1 kg] [All packages]

TEMPERATURE

Ambient Operation Temperature:	15°–32° C [60°–90° F]
Storage Temperature:	0°–32° C [32°–90° F]

ELECTRICAL

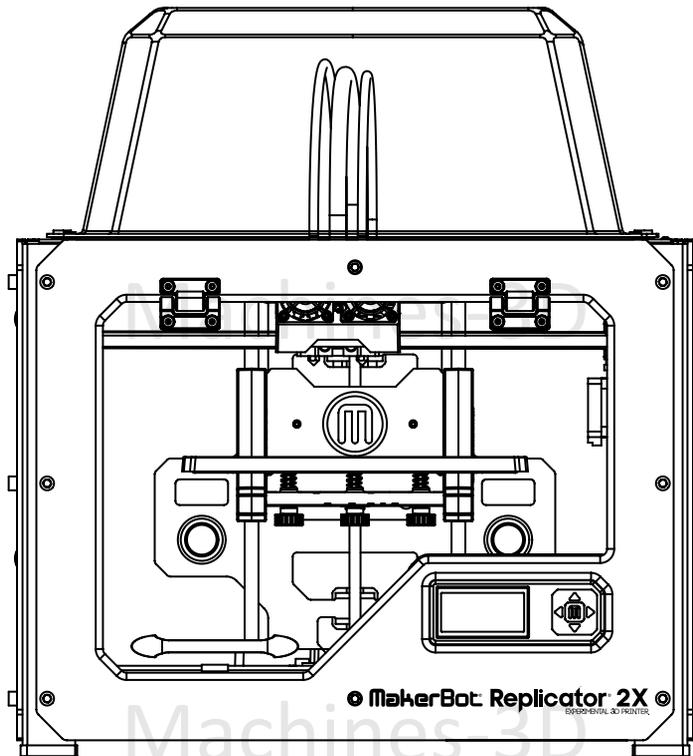
AC Input:	100–240V, ~4 amps, 50–60 Hz
Power Requirements:	24V DC @ 9.2 amps
Connectivity:	USB, SD card [FAT16, max 2 GB]

MECHANICAL

Chassis:	Powder-coated steel
Body:	PVC Panels
Build Platform:	356 aluminum
XYZ Bearings:	Wear-resistant, oil-infused bronze
Stepper Motors:	1.8° step angle with 1/16 micro-stepping

HOW IT WORKS

The MakerBot Replicator 2X Experimental 3D Printer makes solid, three-dimensional objects out of melted MakerBot Filament. Your 3D design files are translated into instructions for the MakerBot Replicator 2X and sent to the machine via USB cable or SD card. Then the MakerBot Replicator 2X heats the MakerBot Filament and squeezes it out through a nozzle onto a heated surface to build a solid object, layer by layer. This method is called Fused Filament Fabrication [FFF].

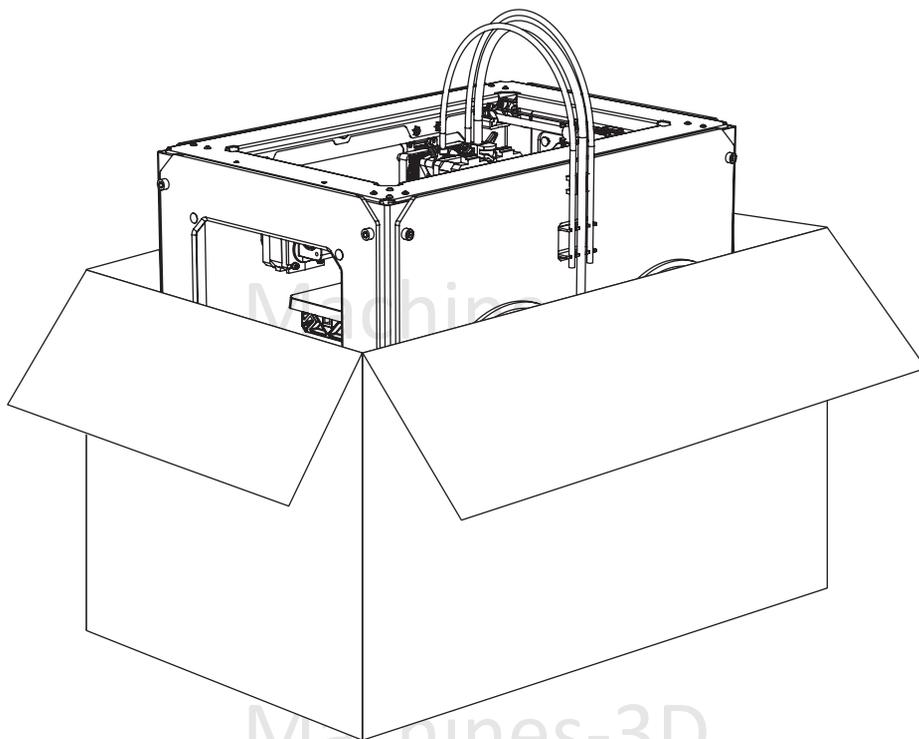




MakerBot

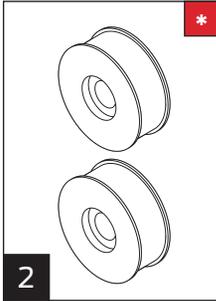
Setting Up Your MakerBot® Replicator® 2X Experimental 3D Printer

When you set up your MakerBot® Replicator®2X Experimental 3D Printer, remember that it was built and packaged very carefully at the MakerBot factory. We hope you'll take your time and be just as careful unpacking it and getting set up.

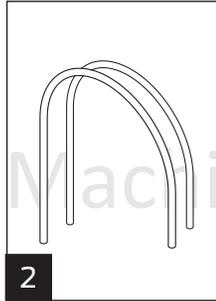


NOTE: Do not force or tear anything during unpacking and setup. This may damage the MakerBot Replicator 2X.

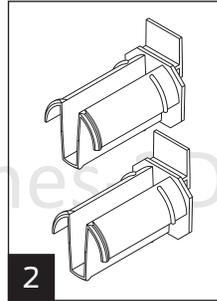
WHAT'S IN THE BOX



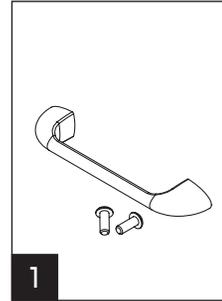
2
MakerBot ABS
Filament [1lb Spools]



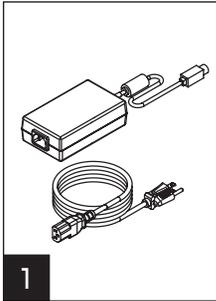
2
Filament guide
tubes



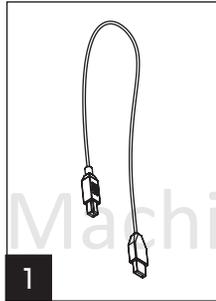
2
Spool holders



1
Handle and bolts



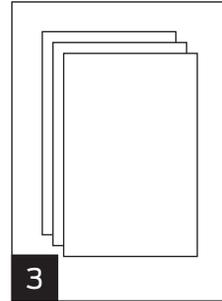
1
Power supply
and cable



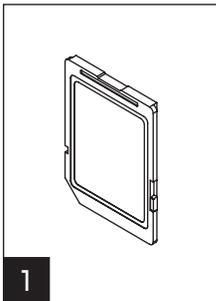
1
USB-A to
USB-B cable



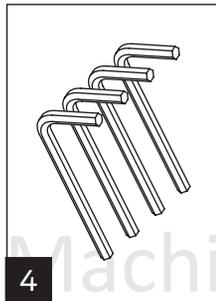
1
MakerBot tape
applicator



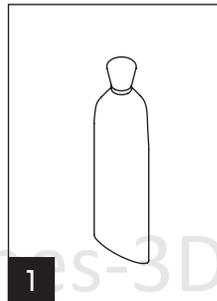
3
Kapton tape sheets



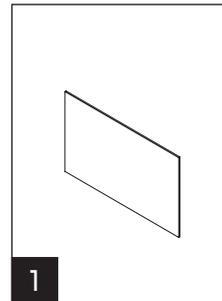
1
SD card



4
Hex wrenches



1
PTFE-based grease

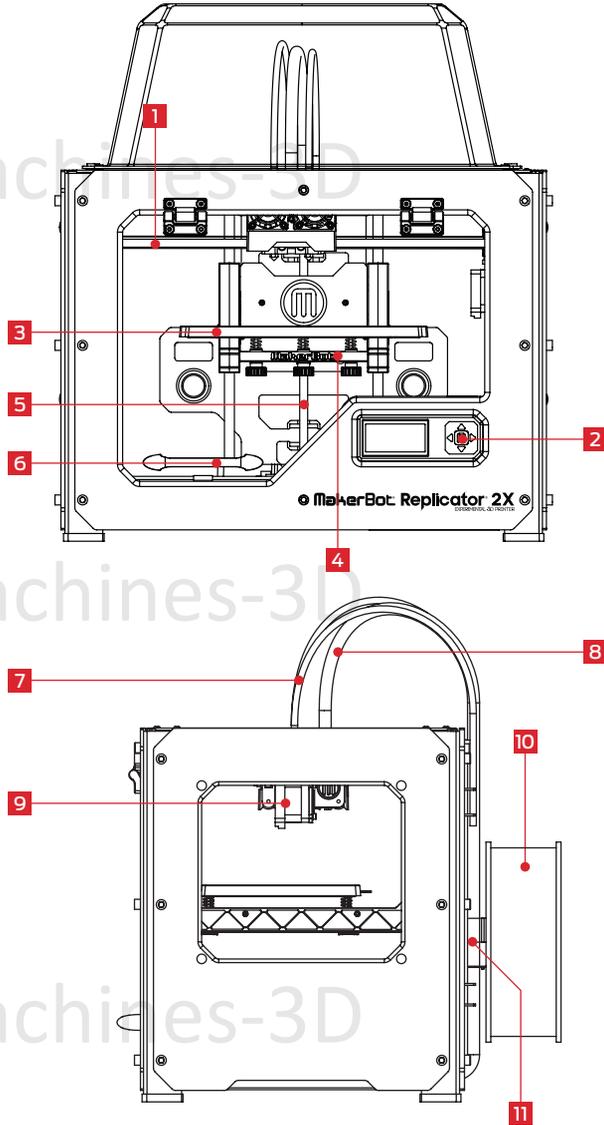


1
Support card

* More options available at makerbot.com/store

MAKERBOT REPLICATOR 2X DIAGRAMS

- [1] GANTRY SYSTEM
- [2] LCD PANEL
- [3] HEATED BUILD PLATE
- [4] BUILD PLATFORM
- [5] THREADED Z-AXIS ROD
- [6] ENCLOSURE DOOR HANDLE
- [7] FILAMENT GUIDE TUBES
- [8] EXTRUDER CABLE
- [9] EXTRUDERS
- [10] FILAMENT SPOOLS
- [11] SPOOL HOLDERS



MAKERBOT REPLICATOR 2X DIAGRAMS CONTINUED

[1] FAN GUARDS

[2] EXTRUDER FANS

[3] EXTRUDER NOZZLES

[4] EXTRUDER LEVER ARMS

[5] FAN BOLTS

[6] CARTRIDGE HEATERS

[7] THERMAL CORES

[8] DRIVE BLOCKS

[9] EXTRUDER CABLE MOUNT

[10] MOTOR CABLE CONNECTORS

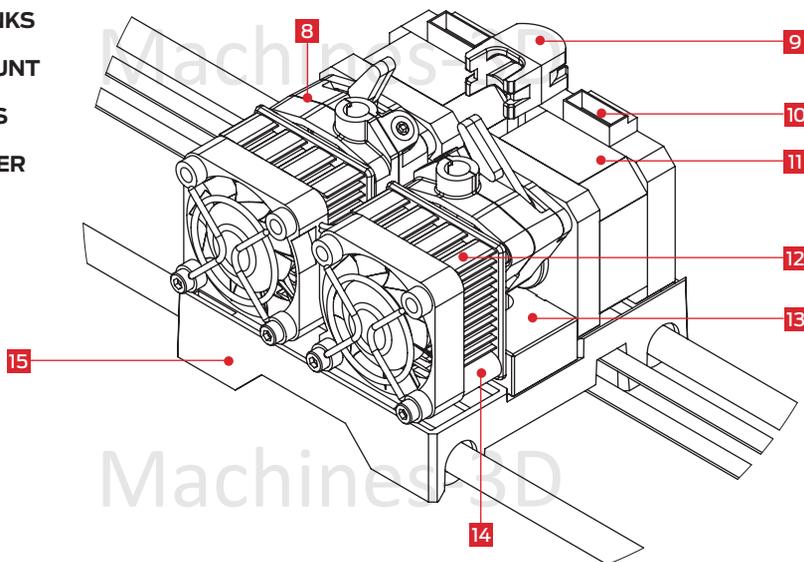
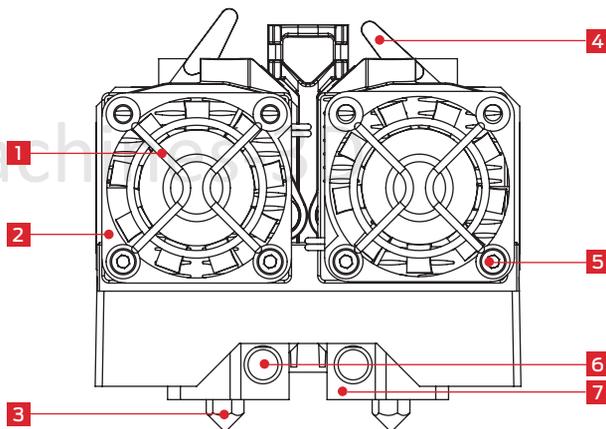
[11] EXTRUDER MOTORS

[12] HEAT SINKS

[13] BAR MOUNT

[14] SPACERS

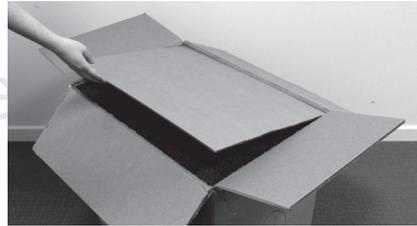
[15] EXTRUDER CARRIAGE



UNPACKING YOUR MAKERBOT REPLICATOR 2X

1 Opening the Box

1a. Place the MakerBot Replicator 2X box on the ground. Open the box and remove the top cardboard sheet.



1b. Remove the MakerBot Replicator 2X User Manual. We recommend that you review the manual to guide you through the setup process and keep it handy as you unpack the contents of the box. If you find that anything described in the manual is missing, email us at support@makerbot.com.



1c. Remove the layer of foam and the sheet of cardboard underneath.

1d. Remove the two protective foam pieces from the sides of the MakerBot Replicator 2X.



2 Removing the MakerBot Replicator 2X from the Box

2a. Open the plastic covering and firmly grasp the frame of the MakerBot Replicator 2X. Be careful not to grip the rods and belts of the gantry system. Lift it out of the box and place it on a stable surface.



UNPACKING YOUR MAKERBOT REPLICATOR 2X CONTINUED

3 Removing the Accessory Box

3a. Remove the two remaining protective foam pieces from the bottom of the MakerBot Replicator 2X's box.

3b. Lift out the accessory box. This box contains the remaining items from the "What's in the Box" section.

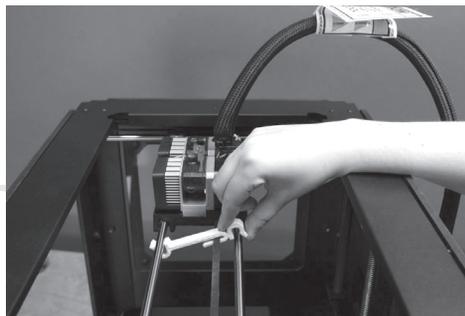
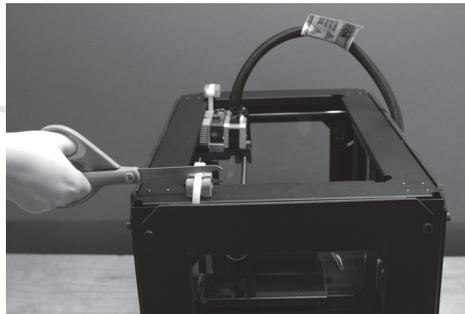


4 Freeing the Extruders

4a. Use strong scissors or a wire cutter to cut the zip ties holding the gantry system in place. Discard the zip ties and the plastic pieces holding them in place.

NOTE: Operate scissors with care.

4b. A small plastic piece attached to the X-axis belt and gantry rods prevents the extruder from moving. Carefully snap the piece off of the rods and tilt it to slide it off of the belt.



INSTALLING THE ENCLOSURE DOOR HANDLE

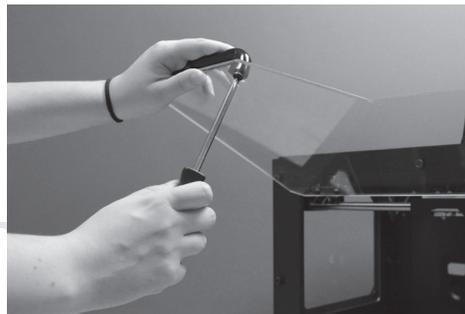
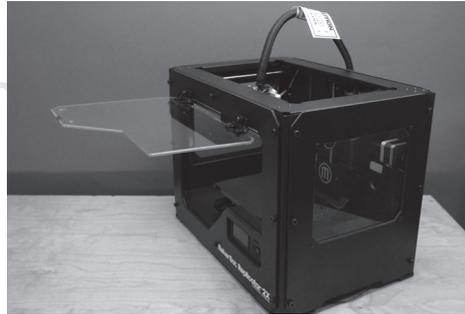
5 Installing the Enclosure Door Handle

5a. Locate the handle kit in the Accessory box. The kit includes your enclosure door handle and two buttonhead bolts.

5b. Open the enclosure door. To do this, reach through the top of the MakerBot Replicator 2X, push the door outward, and raise it to a 90° angle.

5c. Place the handle on top of the enclosure door. Align the holes in the ends of the handle with the pre-drilled holes in the enclosure door.

5d. Use your fingers to thread each bolt through the holes in the enclosure door and the handle. Use a Phillips head screwdriver to tighten the bolts. Close the enclosure door.



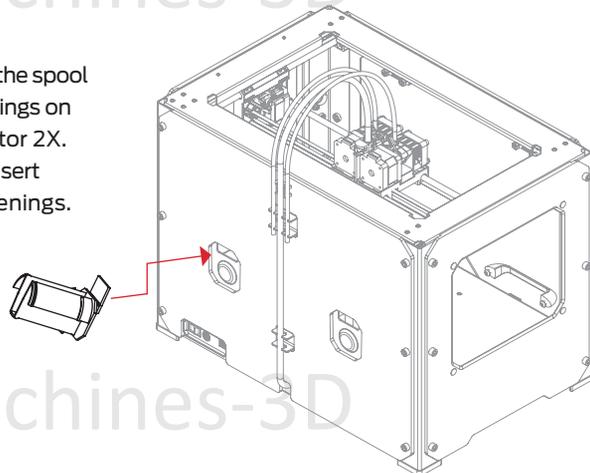
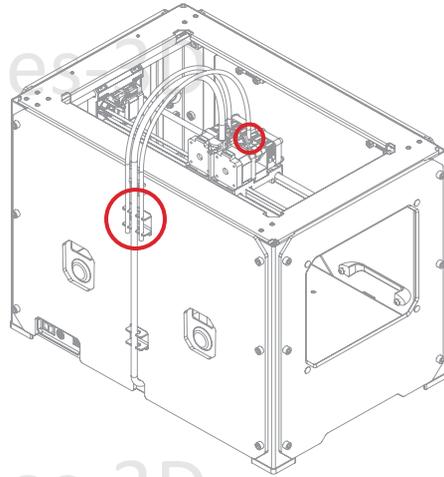
INSTALLING GUIDE TUBES & SPOOL HOLDERS

6 Installing the Filament Guide Tubes and Spool Holders

6a. Locate the two filament guide tubes. Insert one end of a filament guide tube into the hole in the top of one of the extruders. Push the filament guide tube in as far as it will go. Insert the end of the other filament guide tube into the hole on the top of the second extruder. Push the filament guide tube in as far as it will go.

6b. Insert the other end of one filament guide tube into the corresponding guide tube holder on the back of the MakerBot Replicator 2X. Make sure that the end of each filament guide tube is flush with the bottom of its guide tube holder. The filament guide tube should not hang down past the bottom of the guide tube holder. Repeat this process for the second filament guide tube.

6c. Locate the spool holders. Install the spool holders in the two rectangular openings on the back of the MakerBot Replicator 2X. To install a spool holder, tilt it and insert the square end into one of the openings.

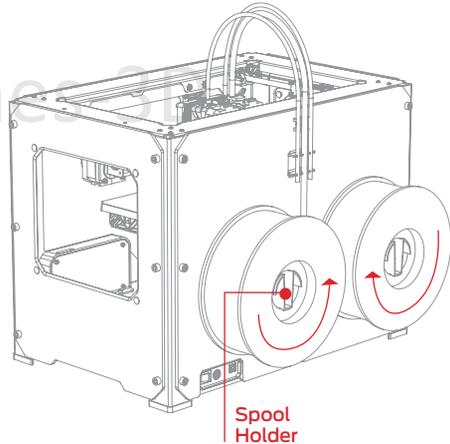


MOUNTING FILAMENT SPOOLS & ATTACHING USB CABLE

7 Mounting the Filament Spools

7a. Open the boxes containing the MakerBot ABS Filament. Remove the spools from their bags.

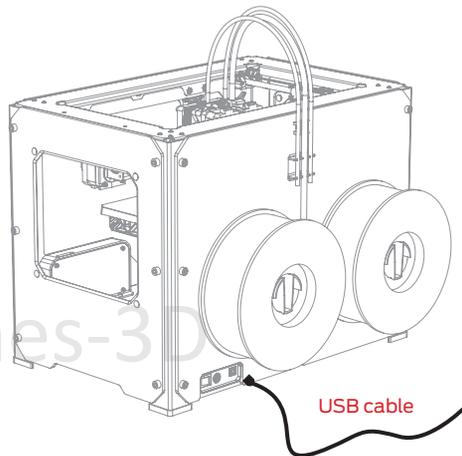
7b. Fit each spool onto a spool holder. Ensure that the spool on the right [when viewed from the back] will unwind clockwise and that the spool on the left will unwind counterclockwise. To install a filament spool, squeeze the spool holder and push the spool on until it locks. Do not let the filament uncoil or tangle as you load the spools onto the back of the MakerBot Replicator 2X. Both spools should spin so that the MakerBot ABS Filament will unwind from the bottom of the spool.



8 Attaching the USB Cable

8a. Locate the USB-A to USB-B cable. Insert the USB cable into the USB-B port on the back of the MakerBot Replicator 2X. Do not attach the other end of the USB cable to anything yet.

8b. Do not plug the AC power cord into an electrical outlet until step 11 of this section.



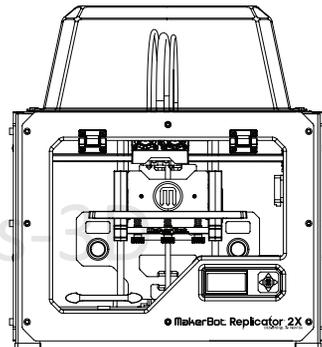
INSTALLING ENCLOSURE LID

9 Installing the Enclosure Lid

9a. Locate the box containing the acrylic enclosure lid. The enclosure lid is shipped in a separate box and is not included in the same box as your MakerBot Replicator 2X. The box containing the enclosure lid should have arrived with the box containing your MakerBot Replicator 2X.



9b. Unpack the enclosure lid and place it over your MakerBot Replicator 2X so that it covers the top of the MakerBot Replicator 2X, the extruder cable, and the filament guide tubes. The small indentations at the corners of the lid should line up with the bolt heads on the top of the MakerBot Replicator 2X's frame.



ATTACHING POWER SUPPLY AND POWERING ON

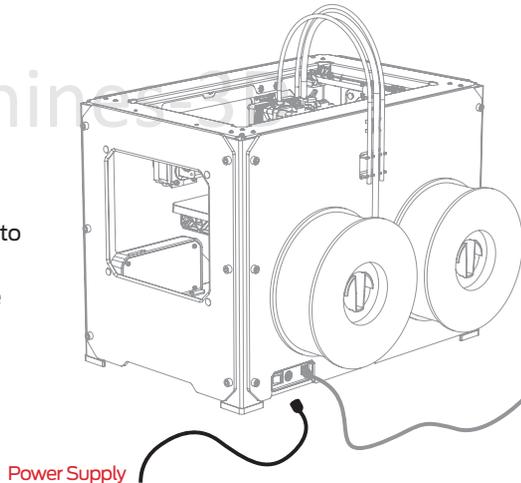
10 Attaching the Power Supply

10a. Locate the power supply and cable.
Attach the cable to the power supply.

10b. Ensure that the power switch on the MakerBot Replicator 2X is set to the OFF position.

10c. Insert the power supply connector into the power input port on the back of the MakerBot Replicator 2X. Ensure that the flat side of the connector faces down.

NOTE: If at any time you need to unplug the MakerBot Replicator 2X, pull on the connector itself to release it from the power input port.



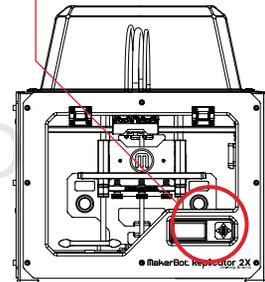
11 Powering On the MakerBot Replicator 2X

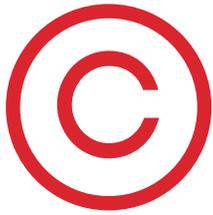
11a. Plug the AC power cord into an electrical outlet.

11b. Set the power switch to the ON position.

11c. The MakerBot Replicator 2X will display welcome text on the LCD panel. This is the beginning of the startup script that will guide you through initial calibration and your first 3D print.

NOTE: The socket-outlet shall be installed near the equipment and shall be easily accessible.





MakerBot

Startup Process:
Leveling,
Loading,
Testing

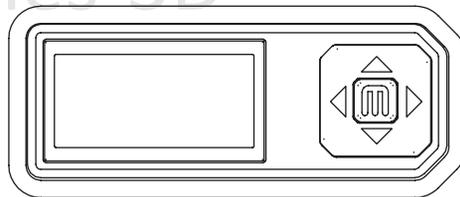
After you power on the MakerBot® Replicator® 2X Experimental 3D Printer, the LCD panel will light up and display text. This is the beginning of the Startup Script. The Startup Script will guide you through leveling the build plate, loading MakerBot ABS Filament, and creating your first 3D print.

Welcome! I'm
The Replicator 2X
Press the red M to
Get started!

A blinking 'M' means
I'm waiting and will
continue when you
press the button...

THE LCD KEYPAD

- Four Arrow buttons surround a central M button. Use the arrows to navigate through the LCD menus and the M button to make selections.
- The left arrow often allows you to go back or cancel an action.
- A solid red M means the MakerBot Replicator 2X is working.
- A blinking red M means the MakerBot Replicator 2X is waiting for user input.



NOTE: If you don't see the Startup Script, use the up and down arrow buttons to scroll through the top level menu on the LCD panel and use the M button to select Utilities. Scroll to Run Startup Script and select it. You can use these menus to return to the Startup Script at any time. You can view videos of the startup process on the MakerBot Replicator 2X video page at makerbot.com/support/replicator2x/videos. If you have any problems or questions, refer to the troubleshooting chapter of this manual or contact MakerBot Support by emailing support@makerbot.com.

LEVELING THE BUILD PLATE

After the initial welcome message, the Startup Script will display the following:

```
Our next steps will
Get me set up!
First, we'll restore
my build plate...
```

```
so it's nice and
level. It's probably
a bit off from
shipping...
```

! Why Leveling Is Important

- If the build plate is too far from the extruder nozzles, or if one part of the plate is farther away from the nozzles than another part, your 3D prints might not stick to the build plate.
- If the build plate is too close to the extruder nozzles, the build plate can block the MakerBot Filament from extruding from the nozzles. This can also scratch the build plate and tear the Kapton tape.
- Leveling your build plate often will help ensure that objects adhere well to the plate.

⚙️ How to Level the Build Plate

To level the build plate, you must adjust the three knobs under the build platform. These three knobs lower and raise the build plate.

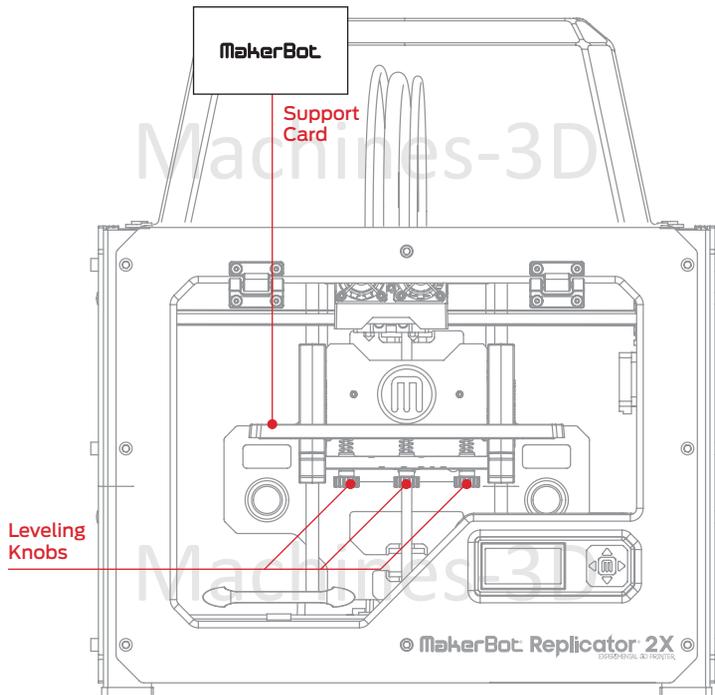
- Tightening the knobs [turning them to the right] moves the build plate away from the extruder nozzles.
- Loosening the knobs [turning them to the left] moves the build plate closer to the extruder nozzles.
- The distance between the extruder nozzles and the build plate should be about the thickness of the MakerBot Support card included with your MakerBot Replicator 2X.

NOTE: To view a video of the build plate leveling process, go to the MakerBot Replicator 2X video page at makerbot.com/support/replicator2x/videos.

LEVELING THE BUILD PLATE CONTINUED

1 Make Some Room Between the Build Plate and the Nozzle

When directed by the LCD screen, tighten each of the three knobs underneath the build platform approximately four turns. To do this, you will need to raise the build platform. Grasp the black plastic arms at the sides of the build platform and gently push the platform up towards the extruder.



LEVELING THE BUILD PLATE CONTINUED

2 Adjust the Knobs as Directed

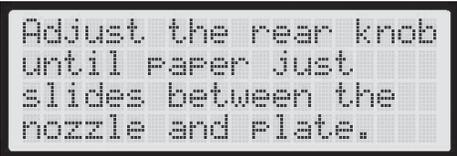
The script will prompt you to adjust the knobs individually. As you adjust each knob, make sure the MakerBot Support card just slides between the nozzles and build plate. You should feel some friction on the support card but still be able to easily pass the card between the plate and the extruder nozzles without tearing or damaging the card.



```
Adjust the rear
knob until paper
just slides between
nozzle and plate
```

3 Adjust Each Knob Again

The script will prompt you to adjust each knob again. This allows for fine tuning. This time, the Support card should slide between the build plate and nozzles with more friction.



```
Adjust the rear knob
until paper just
slides between the
nozzle and plate.
```

4 Confirm your Adjustment

After the second set of adjustments, the nozzles will move to the center of the build plate. Confirm that the MakerBot Support card slides between the nozzles and plate with a moderate amount of friction.



```
Now let's triple
check— paper should
just slide between
nozzle and plate
```

NOTE: If you have problems with this process or if you need to level your build plate again, you can use the up and down arrows to scroll through the top-level menu on the LCD panel and use the M button to select Utilities. Scroll to Level Build Plate and select it. You can use these menus to return to the leveling script at any time.

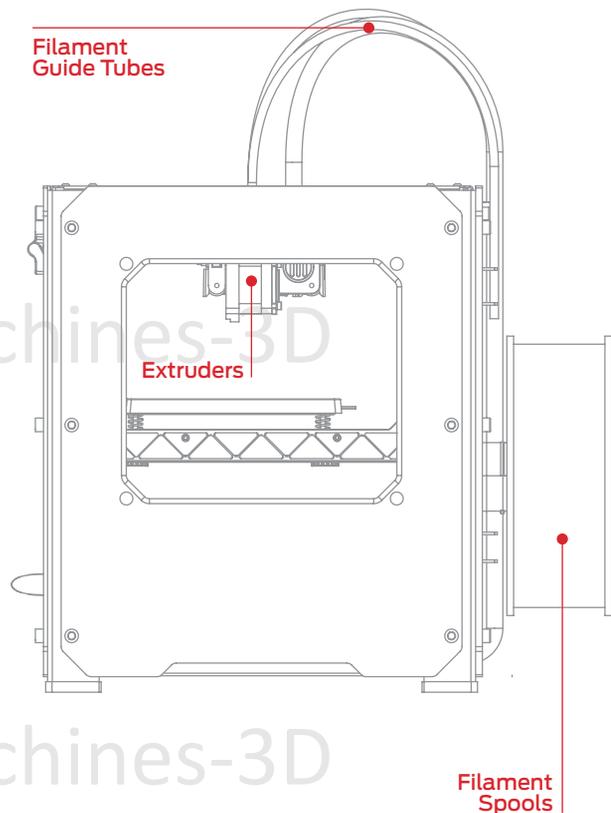
LOADING MAKERBOT FILAMENT

When you have completed the initial leveling tasks, the LCD menu will display the following text: “Aaah, that feels much better. Let’s go on and load some plastic!” Before 3D printing, you must load the MakerBot ABS Filament into the extruder. The extruder will heat the MakerBot ABS Filament and use the melted material to build things.



What You Will Do

- Remove the enclosure lid.
- Remove the ends of both filament guide tubes from the holes in the top of the extruders.
- Feed the free ends of the MakerBot ABS Filament from the spools into the ends of the filament guide tubes where they attach to the back of the MakerBot Replicator 2X.
- Push the MakerBot ABS Filament all the way through the filament guide tubes.
- Insert the free ends of the MakerBot ABS Filament into the holes in the tops of the extruders.
- Wait for the MakerBot ABS Filament to heat and extrude from both extruders.
- Return the filament guide tubes to the holes in the tops of the extruders.
- Return the enclosure lid to the top of the MakerBot Replicator 2X.



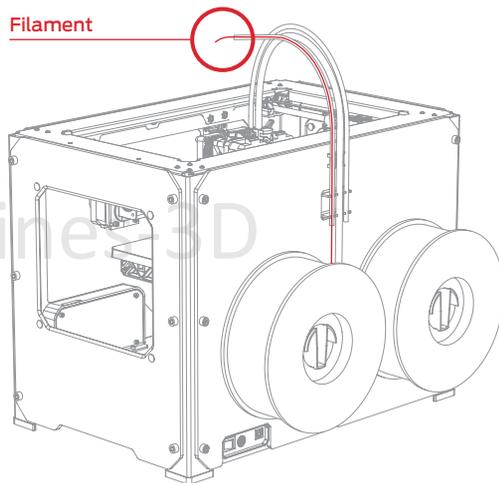
LOADING MAKERBOT FILAMENT CONTINUED

1 Remove the Enclosure Lid

Lift the enclosure lid from the top of the MakerBot Replicator 2X and set it aside.

2 Detach the Filament Guide Tubes

Locate where the filament guide tubes attach to the extruders. You must remove each filament guide tube from its hole in the top of the extruder. To remove the tubes, gently pull them out of the extruders.



3 Feed the Filament Through the Filament Guide Tube

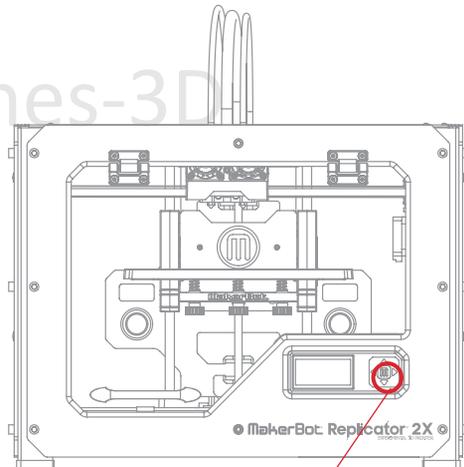
Free the ends of the MakerBot ABS Filament from the filament spools. With a pair of scissors, cut a clean edge on each filament end. Feed the ends of the MakerBot ABS Filament into the ends of the guide tubes where they attach to the back of the MakerBot Replicator 2X.

LOADING MAKERBOT FILAMENT CONTINUED

3 Feed the Filament Through the Filament Guide Tube | Continued

Ensure that you feed the filament from the spool on the right side of the MakerBot Replicator 2X into the filament guide tube on the right side, and that you feed the filament from the spool on the left into the filament guide tube on the left. Feed the filament through the guide tubes until it emerges from the other end of each tube.

NOTE: To avoid filament jams, ensure that the MakerBot ABS Filament feeds from the bottoms of the spools toward the tops of the spools. Ensure that the filament mounted on the right spool holder [when viewed from the back] unspools clockwise and that the filament mounted on the left spool unspools counterclockwise.



Press the M

4 Press the M to Begin Heating the Extruders

After you feed the ends of MakerBot ABS Filament all the way through the guide tubes, press the M button on the LCD menu. The MakerBot Replicator 2X will start to heat the extruders.



WARNING: Do not touch the extruders while they are heating — they heat to 230° C.

LOADING MAKERBOT ABS FILAMENT CONTINUED

5 Press the M to continue

After the extruders reach 230° C, the LCD panel will prompt you to load the MakerBot ABS Filament into the right extruder. Click through the message until your MakerBot Replicator 2X asks you to press the M when you see plastic extruding.



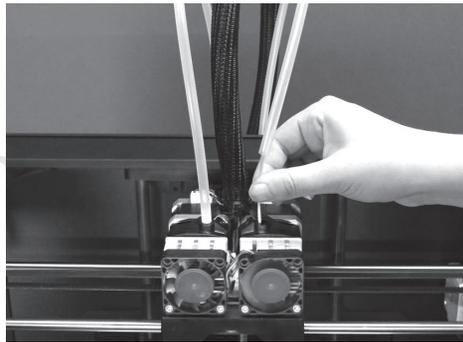
When filament is extruding out of the nozzle, Press 'M' to stop extruding.

6 Push the Filament into the Right Extruder

Take the end of the MakerBot ABS Filament emerging from the tube closest to the right extruder and firmly push it into the hole in the top of the right extruder. Ensure that the filament goes into the center of the opening and doesn't get caught at the edge of the opening.

Maintain pressure on the filament and continue pushing it into the opening.

After about five seconds, you should begin to feel the motor pulling in the filament. Maintain pressure for another five seconds and then let go.



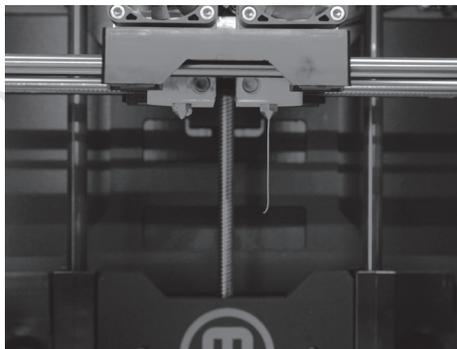
Machines-3D

LOADING MAKERBOT ABS FILAMENT CONTINUED

7 Stop Extrusion

Watch the right extruder nozzle. After a few moments, you should see a thin string of the MakerBot ABS Filament that you loaded come out of the nozzle. Press the M button to stop extrusion.

NOTE: Don't be surprised if the filament that initially comes out of the nozzle is not the color you expected. There's probably some filament inside the extruder left over from our testing process at the MakerBot factory. Wait until you see the color that you loaded come out of the nozzle before you press the M button.



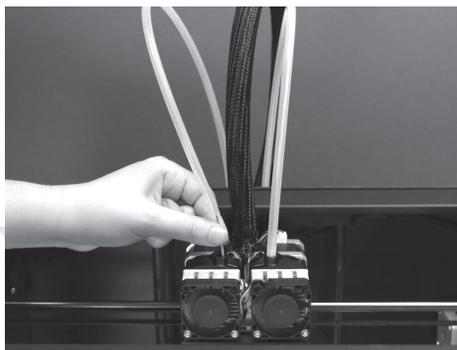
8 Press the M to Continue

After the MakerBot ABS Filament is loaded into the right extruder, the LCD panel will prompt you to load filament into the left extruder. Click through the message until your MakerBot Replicator 2X asks you to press the M when you see plastic extruding.

9 Push the Filament into the Left Extruder

Take the end of the MakerBot ABS Filament closest to the extruder and firmly push it into the hole in the top of the extruder. Ensure that the filament goes into the center of the opening and doesn't get caught at the edge of the opening.

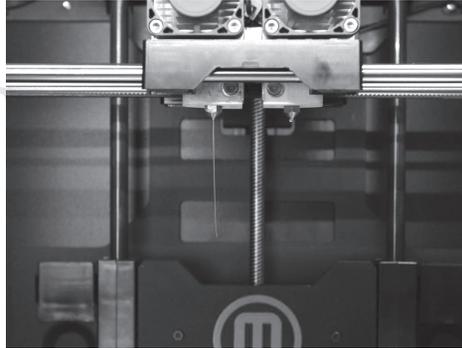
Maintain pressure on the filament and continue pushing it into the opening. After about five seconds, you should begin to feel the motor pulling in the filament. Maintain pressure for another five seconds and then let go.



LOADING MAKERBOT ABS FILAMENT CONTINUED

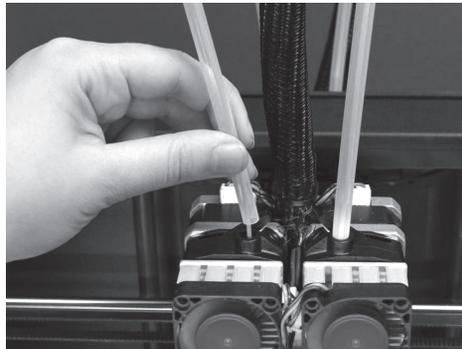
10 Stop Extrusion

Watch the left extruder nozzle. After a few moments, you should see a thin string of the MakerBot ABS Filament that you loaded come out of the nozzle. Press the M button to stop extrusion.



11 Return the Filament Guide Tubes

Push the guide tubes back into the openings on the tops of the extruders.



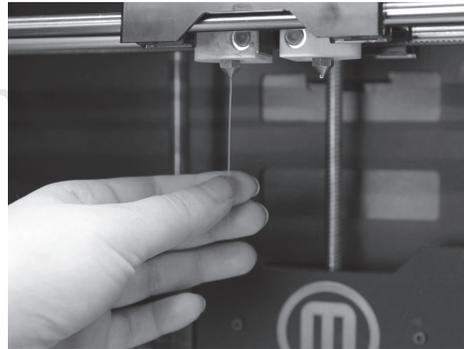
LOADING MAKERBOT ABS FILAMENT CONTINUED

12 Remove the Extruded Plastic

Wait a few minutes for the extruded ABS plastic to cool, then pull it away from the nozzles. You can discard this extra plastic.

Don't touch the nozzles; they may still be hot.

Don't leave plastic clinging to the extruder nozzles. This can cause newly extruded plastic to stick to the nozzles instead of the build platform.



NOTE: If you have problems or need to load MakerBot Filament again, you can use the up and down arrows to scroll through the top-level menu on the LCD panel and use the M button to select Utilities. Scroll to Change Filament and select it. Then select Load Right or Load Left. You can use these menus to return to the load scripts at any time.

Unloading MakerBot ABS Filament

If you need to unload the MakerBot ABS Filament, the LCD menu will walk you through the process. To run the script for unloading the filament from either extruder, go to the LCD panel and select Utilities > Filament Options > Unload.

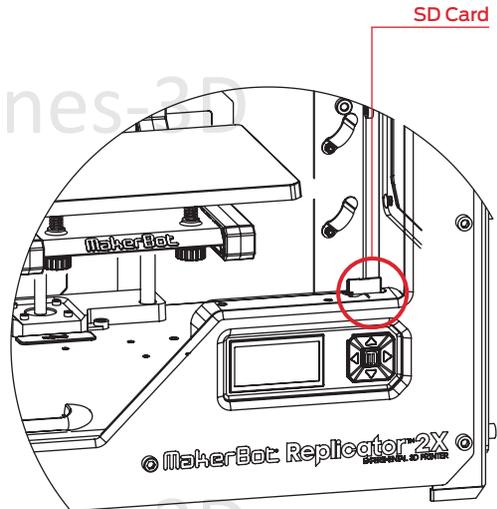


```
>Load right
Unload right
Load left
Unload left
```

MAKING A TEST OBJECT FROM THE SD CARD

1 Locate the SD Card

The MakerBot Replicator 2X package includes an SD card pre-loaded with files for making test objects. The SD card is located in the SD port directly behind the LCD panel. Make sure the SD card is pushed all the way into the SD port.



2 Select a Test Object from the SD Card

After you have successfully leveled the build platform and loaded the MakerBot ABS Filament into the extruders, the LCD panel will ask you: “How’d it go? Ready to make something?” Select “Yes” and the LCD panel will display: “Awesome! We’ll go to the SD card menu and you can select a model!”

2a. Use the up and down arrow buttons to navigate through the list of files on the SD card.

2b. To select a file, press M.

2c. The MakerBot Replicator 2X Experimental 3D Printer will begin to 3D print your object. You can use the LCD panel to monitor the temperature of the extruders and build plate and the status and progress of your object.

MAKING A TEST OBJECT FROM THE SD CARD CONTINUED

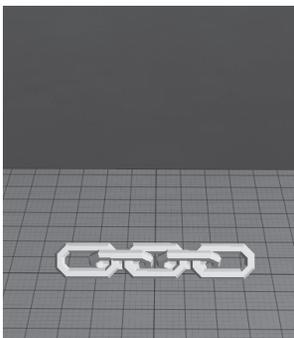


Test Objects Available on the SD Card

CHAIN LINKS

File Name: Chain Links
Make Time: 12 Minutes

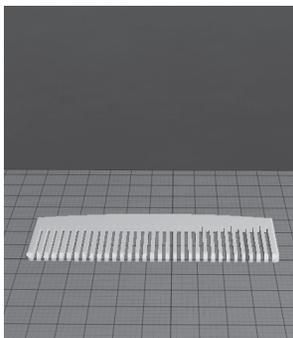
Design By: Sal
Thingiverse:28405



COMB

File Name: Comb
Make Time: 14 Minutes

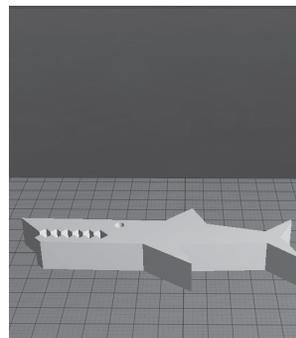
Design By: repraprook
Thingiverse:1140



MR JAWS

File Name: Mr Jaws
Make Time: 18 minutes

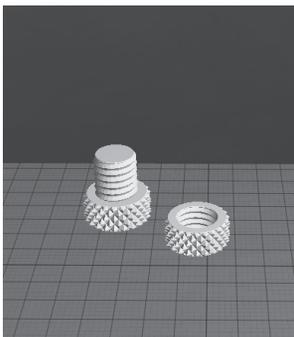
Design By: Mahoney
Thingiverse:14702



NUT AND BOLT SET

File Name: Nut and Bolt
Make Time: 27 minutes

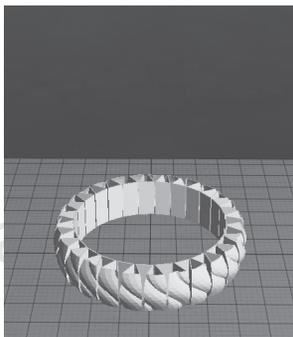
Design By: aubenc
Thingiverse:9095



STRETCHY BRACELET

File Name: Stretchlet
Make Time: 16 minutes

Design By: Emmett
Thingiverse:13505



CUPCAKE

File Name: Cupcake
Make Time: 52 minutes

Design By: Will Langford
Thingiverse:16824



MAKING A TEST OBJECT FROM THE SD CARD CONTINUED

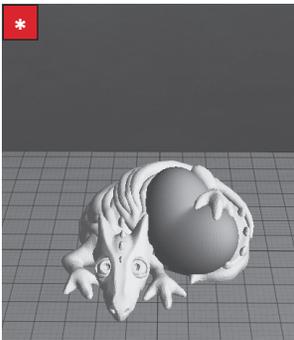


Projects Available on the SD Card | Continued

PET MONSTER VALENTINE

File Name: Heartless Dragon
Make Time: 40 minutes

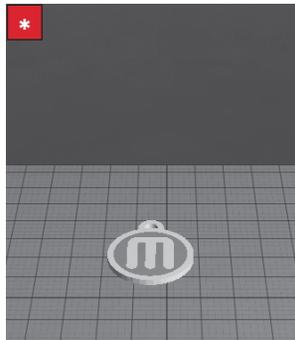
Design By: andreas, tbuser
Thingiverse:29088



MAKERBOT PENDANT

File Name: pendant
Make Time: 8 minutes

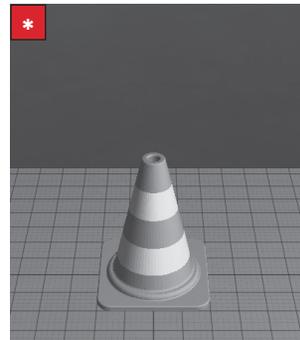
Design By: Todd
Thingiverse:25556



TRAFFIC CONE

File Name: Traffic Cone
Make Time: 42 minutes

Design By: CocoNut
Thingiverse:21773

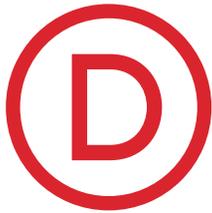


* Dual extrusion print



How to add files to the SD card

1. Insert the SD card into an SD card reader on or attached to your computer.
2. Open a .stl, .obj or .thing file in MakerWare, as detailed in the following chapter.
3. Click the Make button and select your desired print settings.
4. Ensure that the “Export to a File” radio button at the top of the Make dialog is selected.
5. Click Export! and save the resulting .x3g file to the SD card.



MakerBot

Making an Object with MakerBot MakerWare

How to make an object using a computer and
MakerBot® MakerWare™.

Machines-3D



MACHINES-3D

USING MAKERWARE

i

MakerBot MakerWare is software that prepares 3D models for 3D printing and sends them to your MakerBot Replicator 2X Experimental 3D Printer.

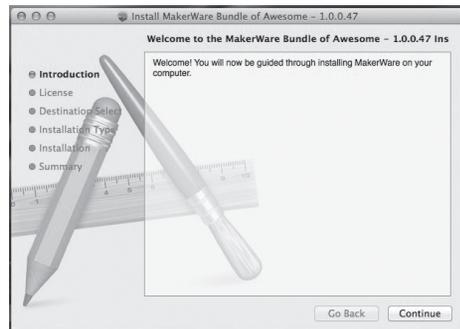
1 Download and Install MakerWare

1a. Go to the computer you plan to connect to your MakerBot Replicator 2X and open a browser session.

1b. Enter the URL makerbot.com/makerware and download the correct MakerWare installer for your operating system.

1c. Open the installer and follow the directions to install the software.

1d. Use the supplied USB cable to connect your MakerBot Replicator 2X to your computer.



USING MAKERWARE CONTINUED

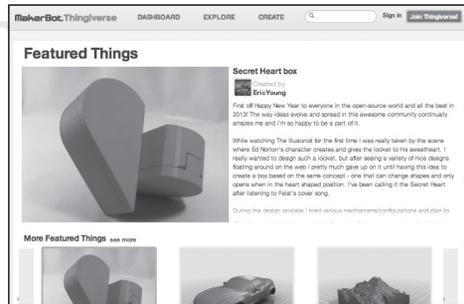
2 Download an Object From Thingiverse

Thingiverse is a website where MakerBot users and others can share design files.

2a. Open a browser session and go to thingiverse.com. Use the search field at the upper right to search for “Minimalist NYC buildings.” Your search results should include “Minimalist NYC buildings by JonMonaghan.” Click on the link.

2b. At the right of the page you will see a button that says “Download This Thing!” Click this button to open the Downloads window.

2c. For this example we chose the Flatiron Building and the Woolworth Building. In the downloads window, find “FlatIron.stl” and “Woolworth.stl” and click the file names to save them to your computer.



Object Name	File Size	Last Updated	Downloads
40WallStreet.STL STL file	293 kb	11-10-21	257
FlatIron.stl STL file	99 kb	11-10-21	390
Citicorp.STL STL file	517 kb	11-10-21	195
Woolworth.STL STL file	242 kb	11-10-21	372

USING MAKERBOT MAKERWARE CONTINUED

3 Open MakerWare

[1] CAMERA HOME: Resets MakerWare to the default view of the object.

[2] +/-: Zoom in and out. You can also use the scroll wheel on your mouse to zoom in and out.

[3] LOOK: Click the Look button or hit the L key to go into Look mode. In this mode, click and drag with your mouse to rotate the plate and the object. Use the arrow at the side of the selected Look button to open the Change View submenu for Top, Side and Front views.

[4] MOVE: Click the Move button or hit the M key to go into Move mode. In this mode, click and drag with your mouse to move an object around the plate. Use the arrow at the side of the selected Move button to open the Change Position submenu and move an object by a specified distance and direction.

[5] TURN: Click the Turn button or hit the T key to go into Turn mode. In this mode, click and drag with your mouse to rotate the object. Use the arrow at the side of the selected Turn button to open the Change Rotation submenu and rotate an object by a specified angle and direction.

[6] SCALE: Click the Scale button or hit the S key to go into Scale mode. In this mode, click and drag with your mouse to enlarge or shrink your object. Use the arrow at the side of the selected Scale button to open the Change Dimensions submenu and scale by a percentage or to a specific measurement.

[7] OBJECT: Click to open the Object Information submenu.

TIP: The Object Information submenu allows you to choose which extruder will print each item on your build plate. For more information on dual extrusion, go to makerbot.com/support/makerware/documentation/dual.

[8] ADD: Click this button to add an object to your build plate. You can add as many objects as you can fit on the plate.

[9] MAKE IT: Click this button to open the Make dialog, where you can specify print resolution and other printing options and send your object to your MakerBot Replicator 2X for 3D printing.

[10] SAVE: Allows you to save the current plate as a file for later use.

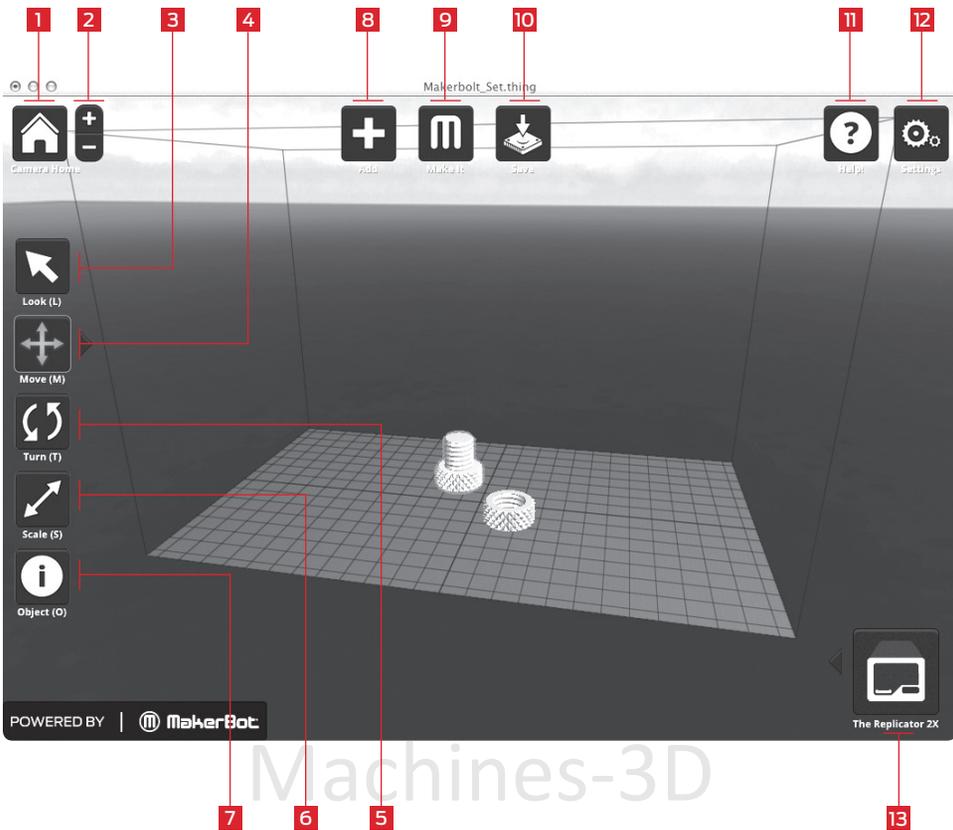
[11] HELP: Opens a guide to MakerWare's basic functions.

USING MAKERBOT MAKERWARE CONTINUED

3 Open MakerBot MakerWare | Continued

[12] SETTINGS: Opens a menu that allows you to assign a display color to each extruder.

[13] STATUS: Displays the status of your connection to your MakerBot Replicator 2X.



NUT AND BOLT

Design By: aubenc

Thingiverse: 9095

USING MAKERBOT MAKERWARE CONTINUED

4 Open the .stl files in MakerBot MakerWare

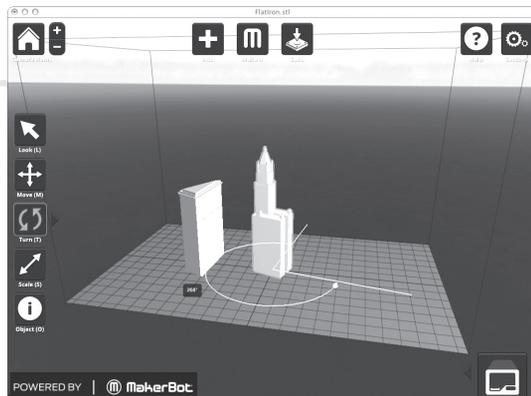
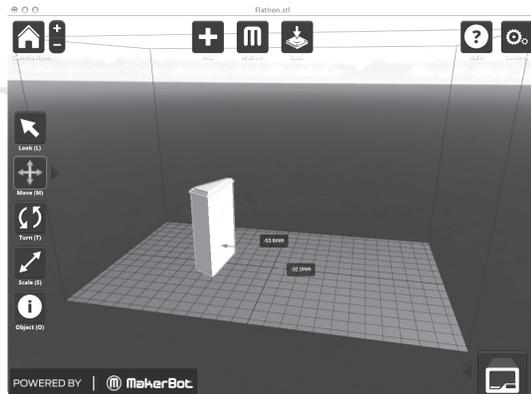
4a. Click on the Add button. Navigate to the location of the file FlatIron.stl and select it. The file will open in the center of the build plate.

4b. Select the Move button and click and drag the FlatIron Building to the left.

4c. Click on the Add button again. Navigate to the location of the file Woolworth.stl and select it. Now you should see both the FlatIron Building and the Woolworth Building models in your virtual build space.

4d. With both models open, you can manipulate them separately or together. Select one of the models, then click the Turn button or use the T key and rotate it.

TIP: You can also duplicate objects by using the Add button. Instead, select the object and use Ctrl/Command+C to copy and Ctrl/Command+V to paste.



Minimalist NYC buildings

Design By: JonMonaghan

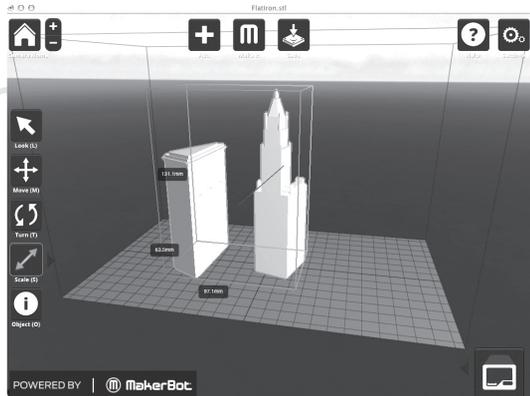
Thingiverse: 12762

USING MAKERBOT MAKERWARE CONTINUED

4 Open the .stl files in MakerBot MakerWare | Continued

4e. Click on the Flatiron Building to select it. Hold down the shift key and click on the Woolworth Building. Then release the shift key. Both models should be selected.

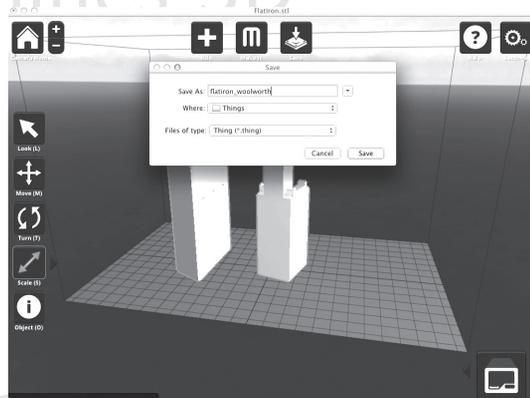
4f. Select the Scale button. Click and drag to change the size of both models together.



5 Save and make your file

5a. Select the Save button. The save dialog allows you to save your plate as an STL or a .thing file. STLs can be opened by a wide range of programs, but .thing files allow you to continue to edit the components of a plate separately.

Specify a name and location for the file. For example, you could name the file flatiron_woolworth.thing.



USING MAKERBOT MAKERWARE CONTINUED

5 Save and Make Your File | Continued

5b. Select the Make It button. The Make dialog will appear, with the following options:

[1] MAKE WITH: Select The Replicator 2X if it is not already selected.

[2] MATERIAL: Choose the type of plastic filament you're printing with.

[3] QUALITY: Specify the quality of your build. Smaller layer heights result in more detailed models and longer build times.

[4] RAFT: Select this to have your object built on a raft. Rafts provide a foundation for supports and help your object stick to the build plate if the build plate is not level.

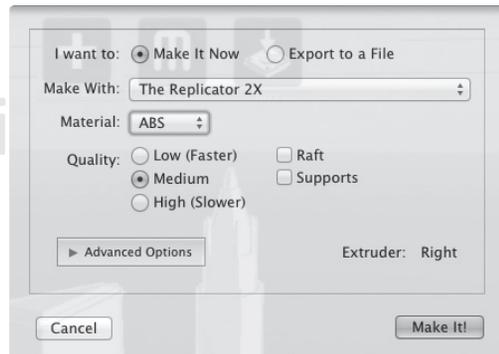
[5] SUPPORTS: Select this to have your object include easily removable support structures for overhanging parts of the object.

[6] ADVANCED OPTIONS: Click here to open up a menu with more options. For information on how to use these options, go to makerbot.com/support/makerware/documentation/advanced.

[7] EXTRUDER: Choose which of your two extruders will print the object. Choose between Right and Left.

[8] CANCEL: Click here to cancel this process.

[9] MAKE IT!: Send the file to the MakerBot Replicator 2X for building.



TIP: If you plan to print from an SD card instead of directly from MakerWare, select "Export to a File" at the top of the Make dialog instead of "Make it Now." If your MakerBot Replicator 2X is not connected to your computer, "Export to File" will be selected automatically.

USING MAKERBOT MAKERWARE CONTINUED

5 Save and Make Your File | Continued

5c. Accept the default settings and click the Make It! button. MakerWare will slice your model and send it to your MakerBot Replicator 2X for 3D printing.

TIP: You can cancel a slice or print by clicking the X at the corner of the slicing progress bar or the cancel button in the Status submenu.

Updating MakerBot MakerWare

We're always working to make MakerWare better. Update your copy of MakerWare to the latest version to ensure that you always have access to the newest features.

A pop-up will appear in MakerWare when a new version is available for download. To download a new version of MakerWare, go to makerbot.com/makerware and follow the installation instructions from Chapter D.

USING REPLICATOR G

You can also use the open source ReplicatorG software to view and manipulate files from thingiverse.com and to send files to your MakerBot Replicator 2X.

To download the ReplicatorG software, go to replicat.org/download.

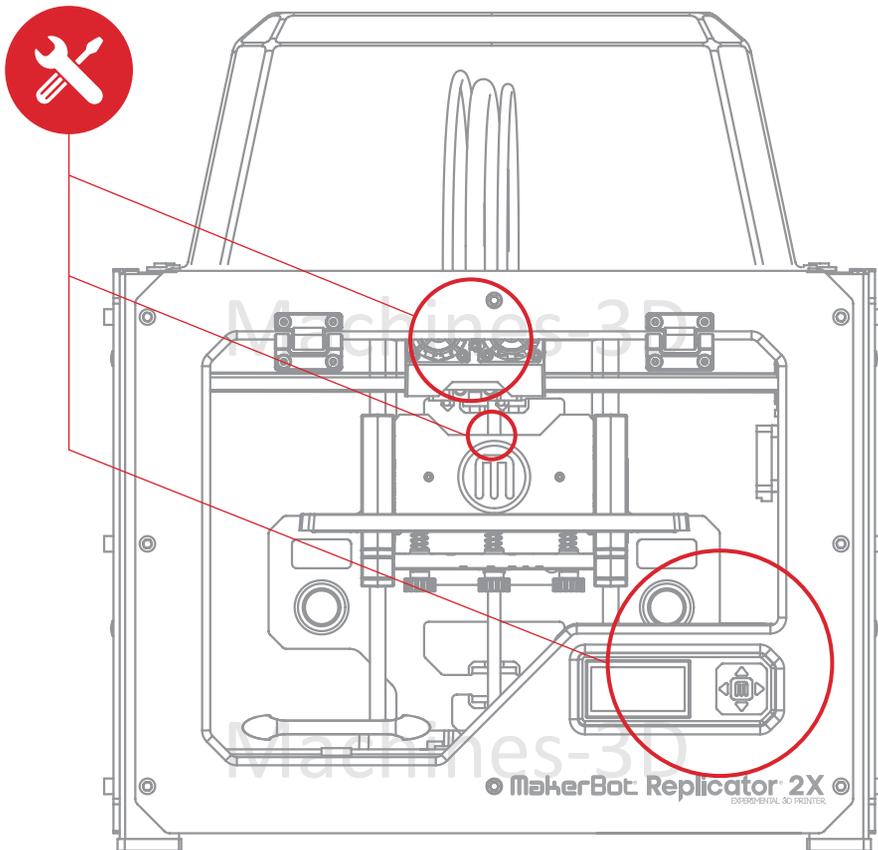
To configure the ReplicatorG software to work with your MakerBot Replicator 2X, go to makerbot.com/support/replicatorg/documentation/usage.



MakerBot

Troubleshooting, Diagnostics, and Maintenance

This chapter describes basic troubleshooting and maintenance tasks. For details on more advanced troubleshooting and maintenance tasks, go to makerbot.com/support.



TROUBLESHOOTING

PROBLEM

Can't load MakerBot Filament into the extruder(s)

SOLUTION

Run the Unload script to heat your extruder and set the extruder lever arm to the open position. The extruder lever arm is open when it points out towards the side of the MakerBot Replicator 2X and closed when it points in towards the other extruder. Make a fresh cut at the end of the filament. It is important that the filament have no bends in it.

Insert the filament into the hole at the top of the extruder. Keep pushing it in until you start to see plastic come out of the nozzle. You may have to push hard.

If plastic never emerges from the nozzle, remove the filament. If there is now a bend at the end, it is possible that the filament has slipped under the extruder bearing instead of going straight down into the heater. Use the Extruder Disassembly instructions later in this chapter to remove the fan and heatsink. Then try to load the filament again, watching to make sure the filament goes straight down through the extruder.

When the filament is loaded, set the extruder lever arm to the closed position.

First layer of object is very thin, and then extrusion stops

Your build plate may be so close to the extruder that it is preventing plastic from coming out of the nozzle.

Tighten each knob on the bottom of the build plate by a quarter turn to move the platform farther from the extruder nozzle.

If you continue to have problems, you can run the leveling script from the LCD menu at Utilities > Level Build Plate.

TROUBLESHOOTING CONTINUED

PROBLEM	SOLUTION
Extruder makes a clicking noise when loading MakerBot Filament	This may mean your extruder is blocked. Try unloading and reloading your MakerBot Filament. If you have trouble reloading, you may have a piece of filament stuck in the extruder. Use the Extruder Disassembly instructions later in this chapter to remove it.
Can't remove MakerBot Filament from extruder when unloading	This may mean that a portion of the filament has expanded inside the extruder. With the extruder heated and the extruder lever in the open position, push a short length of filament through to clear the blockage. Then try pulling the filament free again. The extruder lever arm is open when it points out towards the side of the MakerBot Replicator 2X and closed when it points in towards the other extruder.
Object is stuck to build plate	Wait for the build plate to cool down. Objects will detach more easily when both the plastic and the plate are cool. If the object is still stuck, take a metal craft spatula and carefully work the blade under the edge of the object. When the blade is most of the way under the object, twist the handle slightly. The object should come free.
Object won't stick to build plate	Re-level your build plate by going to Utilities > Level Build Plate. Inconsistent plate height will lead to inconsistent adhesion. If any one part of your object does not adhere well to the plate, the whole object might peel off the plate. Ensure that the plate is clean. Bubbles, scratches, dust, and oil from your hands can prevent objects from sticking to the Kapton tape. Wipe down the build plate with a clean, lint-free cloth.

TROUBLESHOOTING CONTINUED

PROBLEM

Object won't stick to build plate (Continued)

SOLUTION

If you continue to have adhesion problems, loosen each of the plate-leveling knobs about a quarter of a turn to bring the plate slightly closer to the nozzles. You can also try raising the heated build temperature by five degrees. You can change build plate temperature in the Advanced Options section in the Make dialog in MakerWare.

NOTE: For more detailed troubleshooting information, see the [MakerBot Replicator 2X Troubleshooting page at makerbot.com/support/replicator2x/troubleshooting](http://makerbot.com/support/replicator2x/troubleshooting). For video walkthroughs of troubleshooting issues, see the [MakerBot Replicator 2X video page at makerbot.com/support/replicator2x/videos](http://makerbot.com/support/replicator2x/videos).

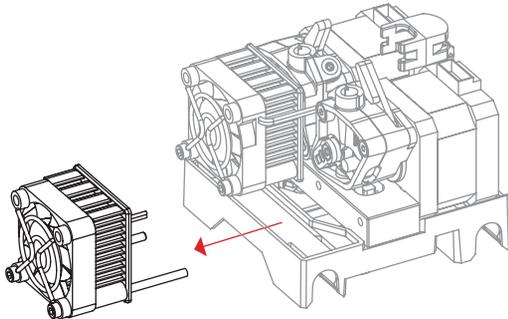
EXTRUDER DISASSEMBLY

Occasionally you may need to take an extruder apart for troubleshooting purposes. This is a simple process that will require no tools other than the 2.5mm hex wrench you received with your MakerBot Replicator 2X.

1. Unload the MakerBot Filament from the extruder. To run the script for unloading filament, go to the LCD panel and select Utilities > Filament Options > Unload.

2. Switch off the power on the MakerBot Replicator 2X and unplug the power supply. Pull on the connector to release it from the power input port.

3. Unscrew the two bolts at the lower corners of the fan guard using your 2.5mm hex wrench. As one piece, remove the fan guard, the fan, the heat sink, and the spacers. Keep these pieces assembled and move them out of the way.

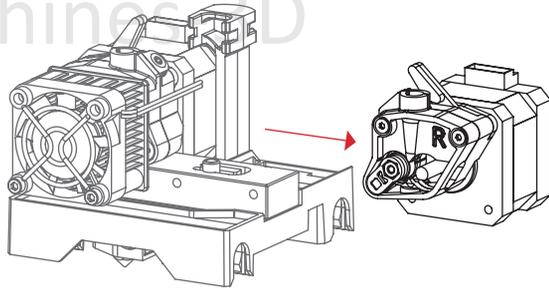


EXTRUDER DISASSEMBLY CONTINUED

4. Set the extruder lever arm to the open position. The extruder lever arm is open when it points out towards the side of the MakerBot Replicator 2X and closed when it points in towards the other extruder.

5. Unplug the motor wire harness from the top of the extruder motor and slide the motor assembly out of the extruder.

6. The extruder is now broken down into its main assemblies. To remove any filament stuck in the thermal barrier tube, run the Unload script to heat the extruder and use a pair of pliers to pull the filament free.



DIAGNOSTICS LCD PANEL | TOP-LEVEL MENU



LCD: The Top-Level Menus

BUILD FROM SD	Displays the list of models on the SD card. Select one to start a 3D print.
PREHEAT	Allows you to preheat the extruder.
UTILITIES	Tools that allow you to configure and maintain your MakerBot Replicator 2X.
INFO AND SETTINGS	Optional settings and information about the MakerBot Replicator 2X.

UTILITIES

Monitor Mode

Displays the current temperature of the extruder and build plate. When printing an object, displays the percent completed.

Change Filament

Scripts that walk you through tasks associated with the MakerBot Filament. Load Right and Load Left walk you through the process of loading MakerBot Filament and Unload Right and Unload Left walk you through unloading it.

Level Build Plate

Script that walks you through the process of leveling the build plate.

Home Axes

Moves the build plate and the extruder to the default “home” positions.

Jog Mode

Allows you to control the movements of the extruder and platform via the LCD panel.

Run Startup Script

Script that walks you through the initial tasks to configure the MakerBot Replicator 2X for your first 3D print.

Enable Steppers

Engages the stepper motors. You cannot manually move the build platform or the extruder when the stepper motors are engaged. This option appears only when the stepper motors are disengaged.

Disable Steppers

Disengages the stepper motors. You can manually move the build platform or the extruder only when the stepper motors are disengaged. This option appears only when the stepper motors are engaged.

Blink LEDs

Blinks the LED lights on the MakerBot Replicator 2X at about 4 blinks per second. When the LED lights are blinking, this option is replaced by Stop Blinking.

Calibrate Nozzles

Allows you to set the correct alignment for the two extruder nozzles.

INFO AND SETTINGS

Bot Statistics

Displays the estimated total hours and minutes of building in the lifetime of your MakerBot Replicator 2X and the duration in hours and minutes of the last build.

General Settings

Optional settings and information.

SOUND: Turns the MakerBot Replicator 2X's indicator sounds on and off.

LED COLOR: Allows you to turn off the LED lights or select a color. Choices are Blue, Green, Pink, Orange, Purple and White.

ACCELERATE: Allows you to turn acceleration on and off. Acceleration allows your MakerBot Replicator 2X to operate more smoothly, and is turned on by default. Note that with acceleration turned off, you should not use printing speeds faster than 45 mm/s.

HEAT HOLD: Specifies a time period for your heated build plate and extruders to continue heating when a 3D print is canceled.

HELP TEXT: Specifies whether you want verbose help text [On] or abbreviated help text [Off].

HEAT LEDs: Changes LED colors when the MakerBot Replicator 2X is heating. When this option is set to On, the LED color will change from blue to red during the heating process and return to the default color when the heating process is complete.

TOOL COUNT: Specifies whether your MakerBot has one extruder or two. The MakerBot Replicator 2X has two extruders.

HEATED PLATE: Specifies whether your MakerBot has a heated build plate. The MakerBot Replicator 2X has a heated build plate.

INFO AND SETTINGS

Preheat Settings

Allows you to change the preheat temperature settings for the extruders and build plate. Use the up and down arrows to select a temperature and press the M button to save your setting. The preheat settings also set load and unload temperatures.

Version Number

Displays the version number of the firmware.

Restore Defaults

Returns all the settings on the MakerBot Replicator 2X to factory settings. This will not affect firmware updates. When you select this option, a new menu appears. Choose Yes or No.

MAINTENANCE



Updating Your Firmware

Keeping your firmware up to date will ensure that your MakerBot Replicator 2X always operates at its best. When MakerWare tells you that there's a new firmware release, click the MakerBots menu and select Upload Firmware.



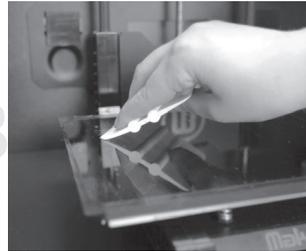
Applying Kapton Tape

Over time, the Kapton tape on your build plate will be scratched and torn and you will need to replace it with one of the die-cut Kapton sheets that came in the MakerBot Replicator 2X package.

1. Peel off the old Kapton tape and discard it.
2. Take out a new sheet of Kapton tape. On one of the short sides of the sheet, peel back the plastic backing approximately 1/4 inch from the edge, so that 1/4 inch of the sticky side of the Kapton tape is exposed.
3. Lay the exposed strip of Kapton tape along one of the short sides of the build plate. Use your finger to apply pressure and adhere the Kapton tape to the build plate.

MAINTENANCE CONTINUED

Applying Kapton Tape | Continued



4. Peel off the plastic backing bit by bit, smoothing the newly exposed Kapton tape as you go. Use the tape applicator from the MakerBot Replicator 2X package to remove bubbles. If you don't have the tape applicator, use a credit card to remove bubbles.

5. Continue smoothing the tape down bit by bit until you have covered the entire plate. If there are still bubbles under the Kapton tape, lift the edge of the tape that is nearest to the bubbles and use the tape applicator to smooth the tape from the center out.

6. When the Kapton tape is applied as smoothly as possible, trim the edges of the sheet or fold them over the sides of the build plate.

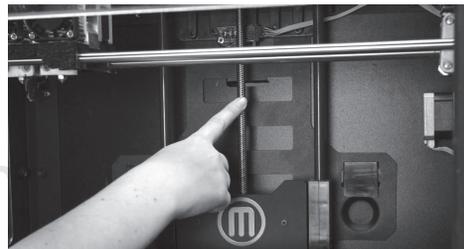
Lubricating the Threaded Rod and the X-Axis Idler Pulley

After approximately 50 hours of build time, you should lubricate the threaded rod on your Z-axis and the X-axis idler pulley. To lubricate the threaded rod and the idler pulley:

1. Find the tube of PTFE-based grease from the MakerBot Replicator 2X package.

2. Grasp both sides of the build platform and push it gently to the bottom of the MakerBot Replicator 2X.

3. Use a clean, lint-free rag [or your finger] to spread the PTFE-based grease onto the top section of the threaded rod.

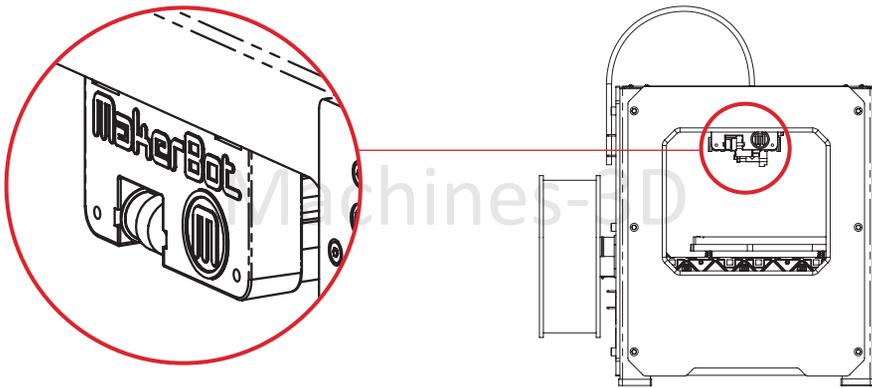


MAINTENANCE CONTINUED



Lubricating the Threaded Rod and the X-Axis Idler Pulley

4. Make sure you get the grease inside the threads themselves.
5. Grasp both sides of the build platform and move it to the top of the MakerBot Replicator 2X.
6. Use a clean, lint-free rag [or your finger] to spread the PTFE-based grease onto the bottom section of the threaded rod. Make sure you get the grease inside the threads themselves.
7. Locate the X-axis idler pulley. If you are facing the front of the MakerBot Replicator 2X, the idler pulley is at the top left side. The idler pulley is one of the pulleys that allow the rubber belt to move the extruder from left to right, or along the X-axis. The pulley at the other side of the gantry is called the timing pulley and does not require lubrication.



8. Squeeze a small amount of the PTFE-based grease directly onto the exposed area of the dowel inside the idler pulley and manually move the pulley back and forth to spread the grease.



GLOSSARY OF TERMS

ABS: Acrylonitrile butadiene styrene is a widely used thermoplastic, and the primary material used for making things on the MakerBot Replicator 2X.

BUILD PLATFORM: The support for the heated build plate. The build platform includes knobs for manual leveling.

DRIVE GEAR: The gear that pushes the MakerBot Filament into the heated part of the extruder.

DUAL EXTRUSION: A process in which two extruders loaded with two different colors or kinds of plastic work together to 3D print an object.

ENCLOSURE LID: The clear acrylic hood that helps keep warm air inside the MakerBot Replicator 2X. The enclosure lid is shipped separately.

EXTRUDER: The assembly that draws the filament from the spool, melts it, and pushes it through a nozzle onto the heated build plate. Your MakerBot Replicator 2X has two extruders.

EXTRUDER FANS: The fans that keep the MakerBot Replicator 2X extruder motors cool and disperse heat from the heat sinks.

EXTRUDER LEVER ARMS: The levers on the MakerBot Replicator 2X's extruders. These move the bearing inside the extruder away from the drive gear, allowing for easier loading and unloading of filament.

FAN GUARDS: The grills that protect the extruder fans and protect the user from the fans.

FILAMENT GUIDE TUBES: The plastic tubes that guide the MakerBot Filament from the filament spools to the extruders.

GANTRY: The metal rods that allow the MakerBot Replicator 2X's extruders to move on the X and Y axes.

GCODE: The computer language used to describe the toolpath your MakerBot Replicator 2X will use to 3D print an object. GCode is converted to .x3g before being sent to your machine.

HEAT SINKS: The components that dissipate heat from the cartridge heaters. They look like aluminum plates with fins.

HEATED BUILD PLATE: The heated surface on which the MakerBot Replicator 2X builds an object.

KAPTON TAPE: A heat-resistant film that adheres well to ABS plastic at high temperatures. Use it to cover the heated build plate so that objects will stick to the plate during the build.

LCD CONTROL PANEL: The liquid-crystal display at the front lower right corner of the MakerBot Replicator 2X. This control panel provides status information about the MakerBot Replicator 2X and includes control menus and diagnostics.

GLOSSARY OF TERMS CONTINUED

MAKERBOT FILAMENT: 1.75mm diameter plastic welding rod. This is the feedstock for your MakerBot Replicator 2X. MakerBot Filament comes in ABS, PLA and PVA plastics. The Replicator 2X is optimized for ABS.

MAKERWARE: Free software created by MakerBot that allows you to load, rotate, scale and move 3D models and send them to the MakerBot Replicator 2X to be 3D printed.

MOTOR ASSEMBLY: The stepper motor and the drive block that push filament into the extruder. Each extruder contains a motor assembly.

MOTOR WIRES: The bundle of electrical wires that provide power to the motors.

NOZZLES: The openings on the ends of the extruders from which heated MakerBot Filament emerges to be spread onto the build plate.

PLA: Polylactic acid is a renewable bioplastic, and one of the materials from which MakerBot Filament is made.

PVA: Polyvinyl alcohol is a water-soluble plastic that is sometimes used for dissolvable support structures.

POWER SUPPLY: The A/C power supply for the MakerBot Replicator 2X. It includes a block and two plugs.

REPLICATORG: Free, open source software that allows you to manipulate and edit .stl files and GCode files and send them to the MakerBot Replicator 2X.

SD CARD: Secure Digital memory card that can store digital data and be read by the MakerBot Replicator 2X. The SD card used with your Replicator 2X must be formatted FAT16 with a maximum capacity of 2 GB.

SPACERS: The plastic pieces that keep the extruder fans and heat sinks secure and in place.

SPOOL HOLDERS: The plastic pieces that attach to the back of the MakerBot Replicator 2X and hold the spools of MakerBot Filament. The spool holder ensures that the MakerBot Filament is fed evenly to the extruders.

.THING: A file format used by MakerWare that allows you to print multiple 3D models on the same build plate.

THINGIVERSE: A website for uploading and downloading 3D model files for use with the MakerBot Replicator 2X.

THREADED ROD: The long metal rod behind the build platform that is threaded along its entire length. This rod allows the build platform to move up and down along the Z-axis.

.STL: A widely used file format for 3D models.

USB CABLE: A cable that allows the MakerBot Replicator 2X to communicate with a computer using the USB interface on the computer.

.X3G: A compact format for describing the toolpath your MakerBot Replicator 2X will use to 3D print an object.

CONTACT US

SUPPORT

makerbot.com/support

Our website has extensive documentation and troubleshooting information about your MakerBot Replicator 2X Experimental 3D Printer. It's a great resource when you want to try to solve issues quickly on your own.

support@makerbot.com

If you ever need help resolving an issue with your MakerBot Replicator 2X, send an email to the address above to open a ticket with the MakerBot Support Team. To help us understand your problem from the start, it is very helpful to include pictures or a video as attachments on your email.

SALES

sales@makerbot.com

To learn about other MakerBot products, including MakerBot Filament, please email the address above, or call our Sales Team at 1-347-334-6800.

FEEDBACK

thoughts@makerbot.com

For general questions, or to tell us what's on your mind, send an email to the address above. We love to hear from you, and using this email address helps keep our Sales and Support lines free for customers in need.

Machines-3D

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