

MAKERBOT 3D PRINTER HANDS-ON

Talking Points

PRINTER TERMINOLOGY

Build Plate

Z stage (Z-axis)

Filament

Filament drawer

Filament guide tube

Extruder

Carriage

Gantry (X- and Y-axis)

Control panel

PRINTER SETUP

1. Insert Build Plate onto Z-stage

- a. Build plate tape
- b. Build plate is flexible

2. Install Smart Extruder+

- a. Control panel, Extruder menu
- b. Hold extruder near carriage, magnets will snap into place
- c. Z-Calibrate

3. What's inside the Smart Extruder+

- a. Filament sensors to detect filament
- b. Drive gear to pull filament in
- c. Hot end to heat filament

4. Insert filament spool

- a. PLA
- b. Filament drawer
- c. Proper orientation
- d. Filament guide tube
- e. Make sure loose end is not stringy

5. Load filament

- a. Filament menu
- b. Look for consistent flow of filament

6. Test Print

- a. First Layer
- b. Raft
- c. Z-Axis Offset
- d. Remove print

MAKERBOT 3D PRINTER HANDS-ON

Script

SECTION 1 : INTRODUCTION AND OVERVIEW

Today we'll go over how to setup and print with the:

- › MakerBot Replicator+
- › MakerBot Replicator Mini+
- › and the MakerBot Replicator Z18

I'm going to do most of the demo on the Replicator+, since the process is similar on all of the printers, but I'll make sure to point out important differences for the Mini+ and Z18.

Most of this information is also applicable to the MakerBot Replicator (5th Generation) and the original MakerBot Replicator Mini.

If you want to follow along with me, make sure you have these items on hand:

- › Your printer and a spool of MakerBot filament
- › Smartphone with MB Mobile installed
- › Computer with MB Print installed

SECTION 2 : TERMINOLOGY

Before we set up the printers, let's quickly go through some important terminology so you can get familiar with your printer.

- › **Build Plate** - This is the surface on which your prints are built, and it sits on the Z-stage...
- › **Z stage** - ..which holds it in place during printing. The z-stage moves all the way up at the beginning of the print, and slowly moves downward as parts are printed.
- › **Filament** - like ink in a printer, its the thermoplastic material used to make 3D printed parts. It comes on a spool that sits in the filament drawer, fed through the filament guide tube, and loaded into the Extruder.
- › **Filament drawer** - (mentioned above)
- › **Filament guide tube** - (mentioned above)
- › **Extruder** - The "hot glue gun" of your printer. Cold filament goes in, gets heated up to about 215 degrees celsius, and extrudes out of a tiny nozzle.
- › **Carriage** - the extruder is attached the the carriage, which houses the small motor that pulls the filament into the extruder.
- › **Gantry** - The carriage is attached to the gantry, which moves it left and right (the x axis) front to back (y axis), and everything in between. As the filament is extruded,

the gantry moves the extruder around to draw out each layer, then the zstage moves down, and the process repeats over and over until a part is made.

› **Control panel** - Finally, the control panel is how you interface with the printer. Use the large dial to navigate through the menus, and press it to select. The buttons on the side of the screen allow you to go back, or see additional menus. The MakerBot Replicator Mini+ does not have a control panel, instead you'll need to use a smartphone or computer to talk to the printer.

SECTION 3: GUIDED SETUP

OK so now let's set up our printer. When you first unbox your printer, you'll be prompted to download MakerBot Mobile, which will walk you through a guided setup: you'll connect to a wifi network, name your printer, and run a test print. What we're going to do is review some of that process now.

› **First, ensure sure all packing material is removed.**

› Good idea to save this for the future, in case you need to move or ship your printer.

› **Build Plate**

› Insert the build plate onto the Z-stage and make sure it's secure so that it won't move around while printing.

› **A few notes about the build plate**

› The build plates on the Replicator+ and Z18 are flexible to allow for easier removal of large prints.

› A sheet of black build plate comes pre-installed on your Rep+ build plate, so no more need for blue painter's tape.

› **Next install your Smart Extruder+**

› On the control panel, select Extruder menu

› Select Attach smart extruder now

› Place the extruder near the carriage, and the magnets will snap the extruder into place.

› Select continue to complete the process.

› Note which kind of extruder you've installed - Smart Extruder+, ToughPLA, or Experimental - as each gives you different setting options in MakerBot Print.

› Mini+ Extruder

› If you're using a Replicator Mini+, you'll need to use MakerBot Mobile or MakerBot Print to attach your extruder, but otherwise the process is the same.

› Z18 Extruder

› On the Z18, the extruder and carriage look a bit different. The extruder has a swivel clip at the top, and does not have a cooling fan duct attached at the bottom. However the process is still the same, hold the extruder near the carriage until the magnets snap it into place.

› Z-Calibration

- › Once you've installed the extruder, you'll be prompted to run a Z-Calibration (you should do this any time you change extruders). Z-calibration sets the default starting distance between the extruder nozzle and the build plate. This distance is really important to successful printing: too close and the filament won't be able to extrude properly, which could lead to a jam, too far and the filament will not properly stick to the build plate, which could cause your prints to curl.
- › After Z-calibration is complete, you're ready to load filament.

› Insert filament spool

- › To install filament, open up the filament drawer.
- › Grab your spool of filament and make sure it's in the proper orientation. On the Replicator+, the spool should spin counter-clockwise as you load.
- › Insert the spool into the filament drawer, take the loose end of filament and feed it through Guide Tube until it comes through the other side.
- › Mini+
 - › On the Replicator Mini+, the spool sits in the filament pocket, and should also spin counter-clockwise. Load the loose end into the guide tube and into the extruder.
- › Z18
 - › On the Z18, the filament drawer is at the bottom of the printer and the guide tube travels along the inside of the front and up to the top. Insert the filament so that it spins clockwise. Insert the loose end into the guide tube, and spin the spool all the way until you see filament come out of the guide tube at the top of the printer.
- › Filament Warning
 - › Take a look at the loose end of your filament. If it's stringy or bent, take a pair of clippers and cut a fresh end. Loading stringy filament back into the extruder could end up causing a clog.

› Load Filament

- › To load filament, Select the Filament menu on the Control Panel and select Load Filament.
- › Wait until you hear the signal that extruder is at the correct temperature, you should also hear the drive gear motor start to spin.
- › Load directly down from the top, you might need to wiggle it a bit.
- › If you load it properly, you should feel filament start to be pulled into the extruder. Once it catches, you should see it start to extrude from the nozzle. Let it run for a few seconds, especially if you're changing colors.
- › If it feels like its getting stuck, take the filament out and straighten it out with your fingers.
- › Once you see a consistent flow of filament, press the dial to complete the process.

› **What's inside the Smart Extruder+**

- › Before we start a test print, let's take a look inside a Makerbot Smart Extruder+ and see what's going on in there.
- › I've disassembled this extruder so you can see what happens as you load filament
- › As you load filament through the top hole, it passed through the filament sensors, and into the drive gear, which is spun by the motor in the carriage.
- › The tension placed on the filament is controlled by this spring, so if you're ever having trouble loading filament, you can press this lever to help.
- › The drive gear pulls the filament through and pushes it down into the PTFE tube. This tube leads to the hot end, where the filament is heated and finally extruded through the nozzle.

› **Run a test print**

- › Now that the build plate and Smart Extruder+ are installed, and filament is loaded, it's time to run a test print.
- › On the Control Panel, select Print menu -> Internal Storage -> Examples and choose a print.
- › These are ready to print files that you can print right away, and are great for checking to make sure that everything is working well.
- › Choose a file and click Print.

› **Check the test print**

- › Watch to make sure first layer goes down well. It should be a nice, even layer that looks squished uniformly onto the build plate.
- › If it looks like a sparse dotted line, or if it's squiggly and doesn't look well adhered, you might need to adjust the Z-offset value.
- › The first few layers are the raft, a disposable base that helps the part adhere to the build plate during printing. Once the raft is printed, you'll see your part start to appear.

› **Finished Print**

- › Once the print is finished, take out the build plate and remove the print and take a look. You can use a small craft spatula to help if you need.
- › If everything looks ok, you're ready to begin printing your own things! If something looks off, or the print doesn't complete, check out makerbot.com/support to troubleshoot the issue.
- › Thanks for watching!