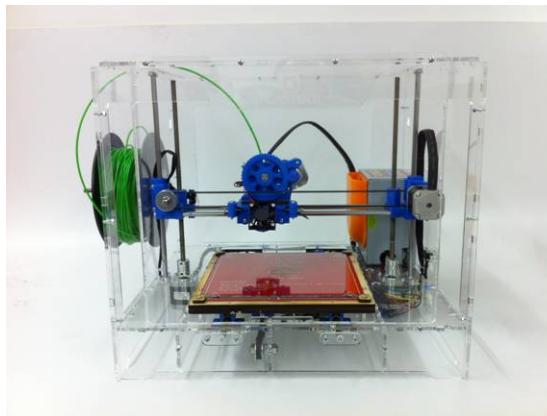




PLASTIBOT®

Build Your Own 3D Printer!

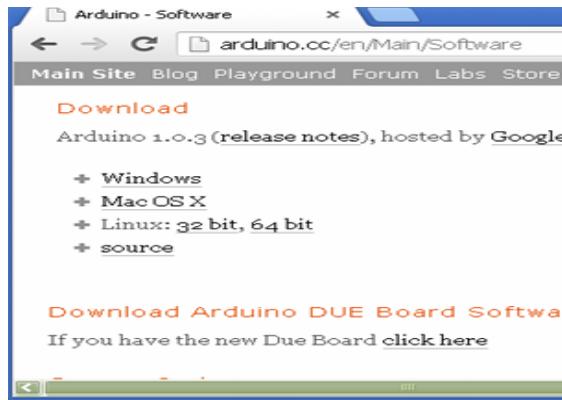
Mendel 3D Printer Assembly



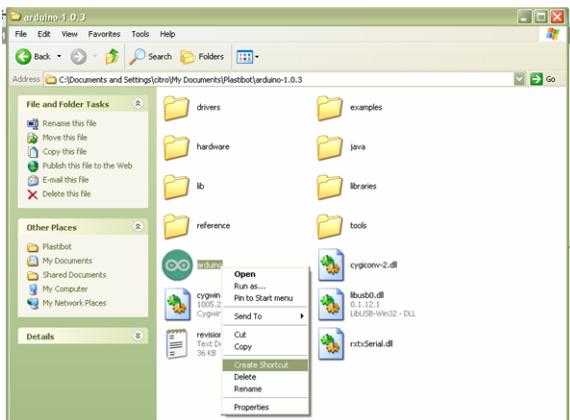
Section 7

Tuning Up the Printer

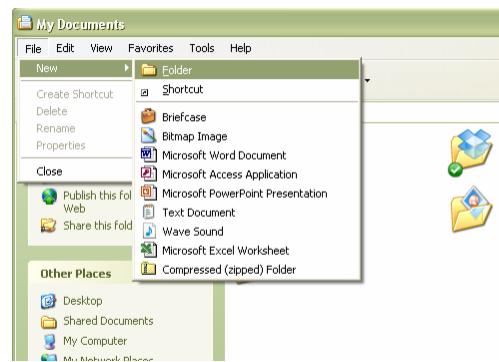
Step 1: Installing Arduino IDE



Go to <http://arduino.cc/en/Main/Software> and download the latest arduino version for your OS.



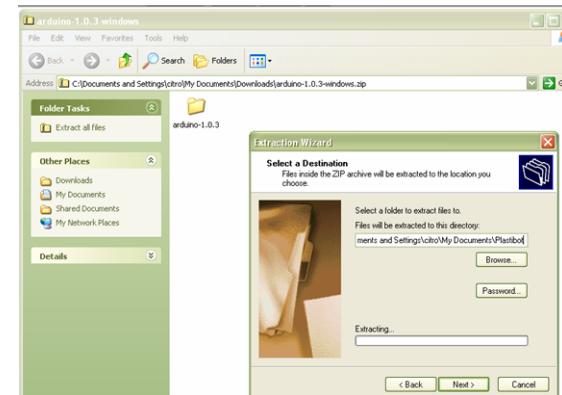
That should create a folder called Arduino. Navigate to that folder and right click the file "arduino.exe". Then from the menu select to create a shortcut and move the shortcut to your desktop.



Create a Plastibot folder in your computer anywhere you want.



Plug the USB cable into the USB port on your card and into your computer. A new hardware window should pop-up.



Double click on the file you downloaded and extract to the Plastibot folder.



Windows will pop-up a window saying new drivers are required.

Parts Needed:

- Plastibot Mendel Printer
- Computer

Tools Needed:

- Your hands

Step 2: Installing Arduino IDE (Cont.)



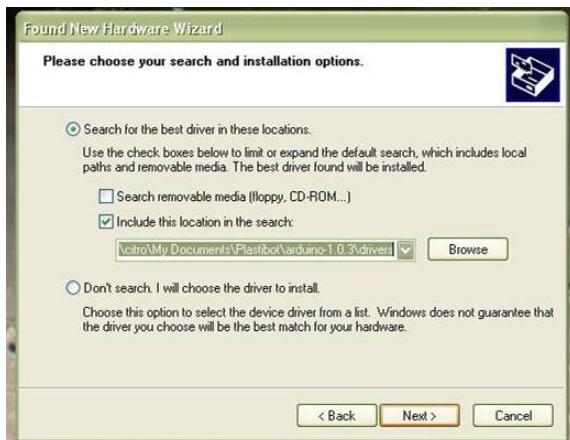
Select “No, not at this time” and click next



Select to install from specific location and click next



Browse to plastibot/arduino/drivers and click ok



Click next.



The computer will proceed to install the driver and show you a window about the driver not being verified by Windows. Click “Continue Anyway”.



Click Finish.

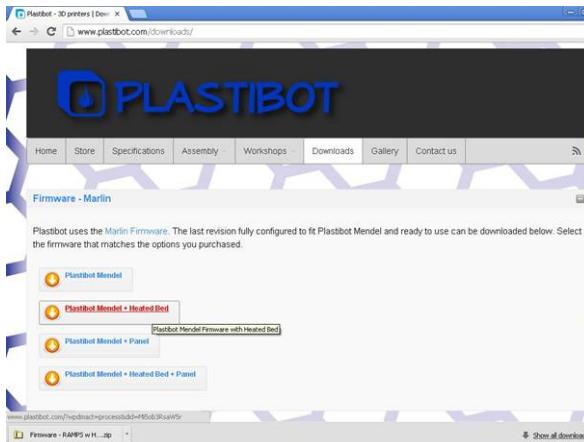
Parts Needed:

- Plastibot Mendel Printer
- Computer

Tools Needed:

- Your hands

Step 3: Loading the Firmware



Go to www.plastibot.com/downloads and download the latest firmware corresponding to your setup (ie. Standard, heated bed, etc)

```

Marlin | Arduino 1.0.3
File Edit Sketch Tools Help
Marlin Configuration.h Configuration_adv.h EEPROMwrite.h Marlin.h MarlinSerial.cpp
#ifndef CONFIGURATION_H
#define CONFIGURATION_H

// This configuration file contains the basic settings.
// Advanced settings can be found in Configuration_adv.h
// BASIC SETTINGS: select your board type, temperature sensor type, axis scaling, an

// User specified version info of THIS file to display in [Prontorface, etc] terminal
// Implementation of an idea by Prof Brano to inform user that any changes made
// to THIS file by the user have been successfully uploaded into firmware.
#define STRING_VERSION_CONFIG_H "2012-05-02" //Personal revision number for changes
#define STRING_CONFIG_H_AUTHOR "erik" //Who made the changes.

// This determines the communication speed of the printer
#define BAUDRATE 250000
#define BAUDRATE 115200

// The following define selects which electronics board you have. Please choose th
// Gen7 custom (Alfons3 Version) = 10 "https://github.com/Alfons3/Generation_7_Elect

```

That should open a bunch of files. Look for the tab called "Configuration.h" and click on it.

Parts Needed:

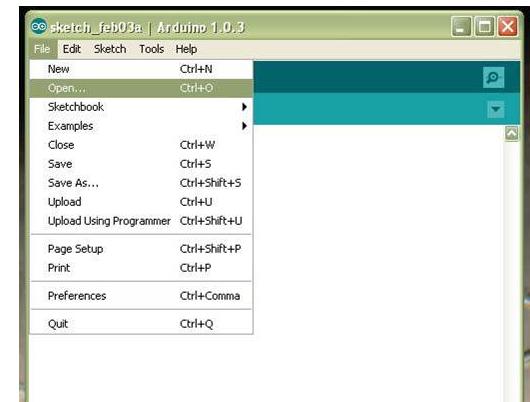
- Plastibot Mendel Printer
- Computer

Tools Needed:

- Your hands



Go to the plastibot folder you created earlier and create a subfolder called Firmware. Click the file you downloaded and extract to the firmware folder.



Open Arduino and from the menu select File/Open, Go to your plastibot folder and select the following file: plastibot/firmware/marlin/marlin.pde

```

Marlin | Arduino 1.0.3
File Edit Sketch Tools Help
Marlin Configuration.h Configuration_adv.h EEPROMwrite.h Marlin.h MarlinSerial.cpp
#ifndef CONFIGURATION_H
#define CONFIGURATION_H

// This configuration file contains the basic settings.
// Advanced settings can be found in Configuration_adv.h
// BASIC SETTINGS: select your board type, temperature sensor type, axis scaling, an

// User specified version info of THIS file to display in [Prontorface, etc] terminal
// Implementation of an idea by Prof Brano to inform user that any changes made
// to THIS file by the user have been successfully uploaded into firmware.
#define STRING_VERSION_CONFIG_H "2012-05-02" //Personal revision number for changes
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// This determines the communication speed of the printer
#define BAUDRATE 250000
#define BAUDRATE 115200

// The following define selects which electronics board you have. Please choose th
// Gen7 custom (Alfons3 Version) = 10 "https://github.com/Alfons3/Generation_7_Elect

// Additional Features
// =====
// EEPROM
// the microcontroller can store settings in the EEPROM,
// M500 - stores parameters in EEPROM
// M501 - reads parameters from EEPROM (if you need rese
201
Line number shows here
start  Plastibot - 3D p... 3-4 configuratio...

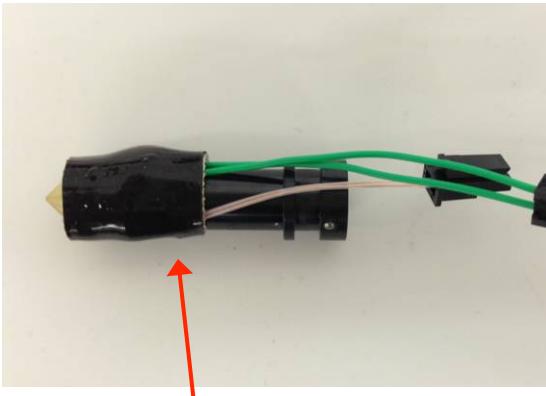
```

A red box highlights line 201, which contains the code '#define DEFAULT_AXIS_STEPS_PER_UNIT {44.4444, 44.4444, 2560, 767}'. A red arrow points from this line to a note on the right: 'Write down the value shown on your arduino screen. It may differ from 767'.

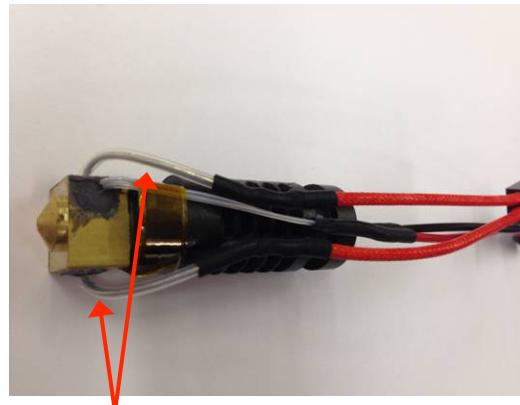
Scroll down to line # 201. It should read like this: #define
DEFAULT_AXIS_STEPS_PER_UNIT
{44.4444, 44.4444, 2560, 767}

The last value of 767 is the default number of steps per 1mm of extrusion. Write down that number. You will need it later on.

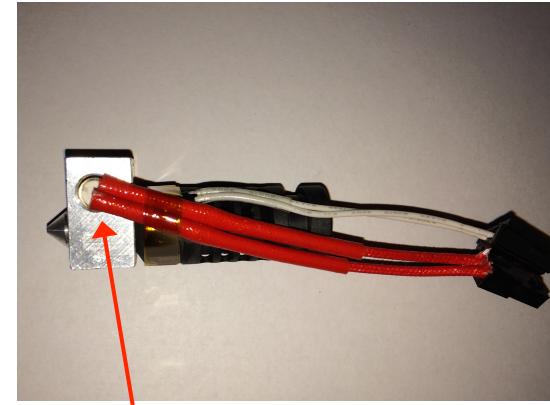
Step 4: Hotend Identification



Makergear Hotend has a black fiberglass insulator sleeve covering the nozzle



The Resistor J-Head Hotend has a bare square brass nozzle with resistor leads coming out on both sides



The Heat Cartridge J-Head Hotend has all leads coming out of the same side of the aluminum nozzle and covered with kapton tape (kapton tape removed on picture above).

```
=====
=====Thermal Settings =====
//-----NORMAL IS 4.7kohm PULLUP!-- 1kohm pullup can be used on hotend
//
/// Temperature sensor settings:
// -2 is thermocouple with MAX6675 (only for sensor 0)
// -1 is thermocouple with AD595
// 0 is not used
// 1 is 100k thermistor - best choice for EPCOS 100k (4.7k pullup)
// 2 is 200k thermistor - ATC Semitec 204GT-2 (4.7k pullup)
// 3 is mendel-parts thermistor (4.7k pullup)
// 4 is 10k thermistor !! do not use it for a hotend. It gives bad
// 5 is 100k thermistor - ATC Semitec 104GT-2 (Used in ParCan) (4.
// 6 is 100k EPCOS - Not as accurate as table 1 (created using a f
// 7 is 100k Honeywell thermistor 135-104LAG-J01 (4.7k pullup)
//
```

Each hotend uses a different Thermistor therefore need different tables on the firmware in order to provide accurate temperature readings.

```
// 52 is 200k thermistor - ATC Semitec 204GT-2
// 55 is 100k thermistor - ATC Semitec 104GT-2
#define TEMP_SENSOR_0 8
#define TEMP_SENSOR_1 0
#define TEMP_SENSOR_2 0
#define TEMP_SENSOR_BED 1
```

On your firmware, scroll down to line 92

```
// 52 is 200k thermistor - ATC Semitec 204GT-2
// 55 is 100k thermistor - ATC Semitec 104GT-2
#define TEMP_SENSOR_0 8
#define TEMP_SENSOR_1 0
#define TEMP_SENSOR_2 0
#define TEMP_SENSOR_BED 1
```

Enter a 1 if you have a MakerGear hotend.
Enter a 5 if you have a Resistor J-Head
Enter an 8 if you have a Heat Cartridge J-Head

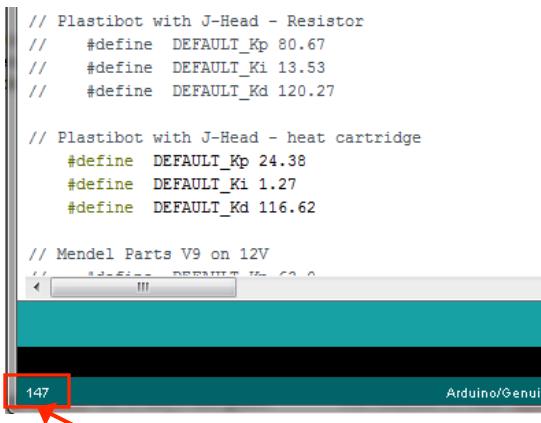
Step 4a: Hotend Profile

```
// Makergear
// #define DEFAULT_Kp 7.0
// #define DEFAULT_Ki 0.1
// #define DEFAULT_Kd 12

// Plastibot with J-Head - Resistor
// #define DEFAULT_Kp 80.67
// #define DEFAULT_Ki 13.53
// #define DEFAULT_Kd 120.27

// Plastibot with J-Head - heat cartridge
#define DEFAULT_Kp 24.38
#define DEFAULT_Ki 1.27
#define DEFAULT_Kd 116.62
```

Each hotend uses a different heating element therefore needs different PID Profiles in the firmware in order to keep temperature in check.



```
// Plastibot with J-Head - Resistor
// #define DEFAULT_Kp 80.67
// #define DEFAULT_Ki 13.53
// #define DEFAULT_Kd 120.27

// Plastibot with J-Head - heat cartridge
#define DEFAULT_Kp 24.38
#define DEFAULT_Ki 1.27
#define DEFAULT_Kd 116.62

// Mendel Parts V9 on 12V
// #define DEFAULT_Kp 62.0
```

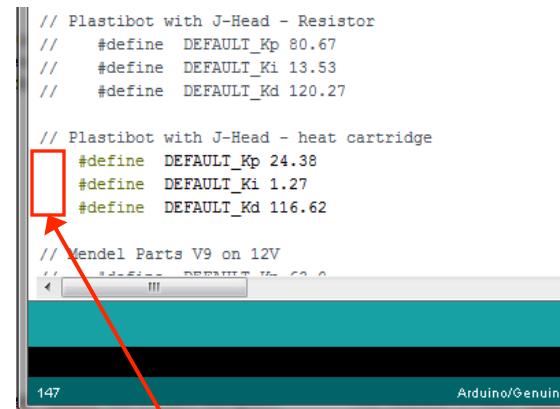
On your firmware, scroll down to line 147

Parts Needed:

- Plastibot Mendel Printer
- Computer

Tools Needed:

- Your hands



```
// Plastibot with J-Head - Resistor
// #define DEFAULT_Kp 80.67
// #define DEFAULT_Ki 13.53
// #define DEFAULT_Kd 120.27

// Plastibot with J-Head - heat cartridge
#define DEFAULT_Kp 24.38
#define DEFAULT_Ki 1.27
#define DEFAULT_Kd 116.62

// Mendel Parts V9 on 12V
// #define DEFAULT_Kp 62.0
```

Enable the corresponding profile for your hotend by removing the “//” for all 3 lines.
Ensure the other profiles have “//” characters.

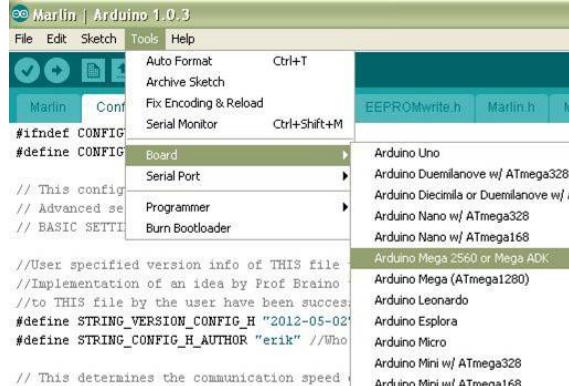
Step 5: Loading the Firmware (cont.)

Parts Needed:

- Plastibot Mendel Printer
- Computer

Tools Needed:

- Your hands

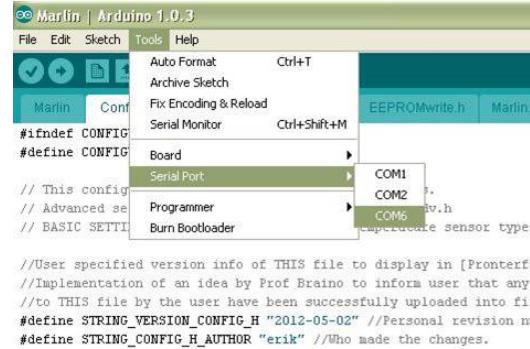


```

Marlin | Arduino 1.0.3
File Edit Sketch Tools Help
Marlin Conf
Auto Format Ctrl+T
Archive Sketch
Fix Encoding & Reload
Serial Monitor Ctrl+Shift+M
#ifndef CONFIG
#define CONFIG
Board
Arduino Uno
Arduino Duemilanove w/ ATmega328
Arduino Diecimila w/ Duemilanove w/ A
Arduino Nano w/ ATmega328
Arduino Nano w/ ATmega168
Arduino Mega 2560 or Mega ADK
Arduino Mega (ATmega1280)
Arduino Leonardo
Arduino Explora
Arduino Micro
Arduino Mini w/ ATmega328
Arduino Mini w/ ATmega168
//User specified version info of THIS file
//Implementation of an idea by Prof Brano
//to THIS file by the user have been success
#define STRING_VERSION_CONFIG_H "2012-05-02"
#define STRING_CONFIG_H_AUTHOR "erik" //Who
// This determines the communication speed

```

From the Arduino menu, select “Tools
→Board → Arduino Mega 2560

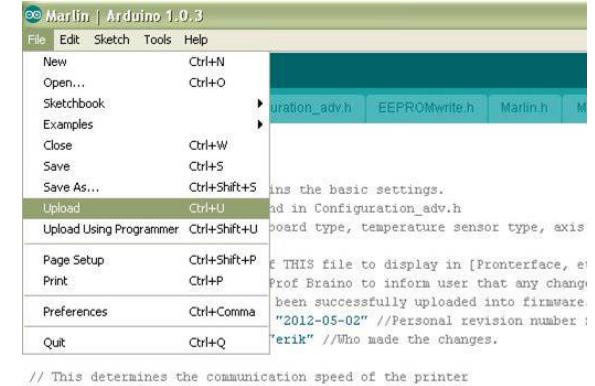


```

Marlin | Arduino 1.0.3
File Edit Sketch Tools Help
Marlin Conf
Auto Format Ctrl+T
Archive Sketch
Fix Encoding & Reload
Serial Monitor Ctrl+Shift+M
#ifndef CONFIG
#define CONFIG
Board
Serial Port
Arduino Uno
Arduino Duemilanove w/ ATmega328
Arduino Diecimila w/ Duemilanove w/ A
Arduino Nano w/ ATmega328
Arduino Nano w/ ATmega168
Arduino Mega 2560 or Mega ADK
Arduino Mega (ATmega1280)
Arduino Leonardo
Arduino Explora
Arduino Micro
Arduino Mini w/ ATmega328
Arduino Mini w/ ATmega168
//User specified version info of THIS file to display in [Fronterface
//Implementation of an idea by Prof Brano to inform user that any c
//to THIS file by the user have been successfully uploaded into firm
#define STRING_VERSION_CONFIG_H "2012-05-02" //Personal revision num
#define STRING_CONFIG_H_AUTHOR "erik" //Who made the changes.

```

On the arduino menu, select “Tools → Serial Port → COMxx, where xx is the port # that was assigned to your printer, usually a number higher than 4.



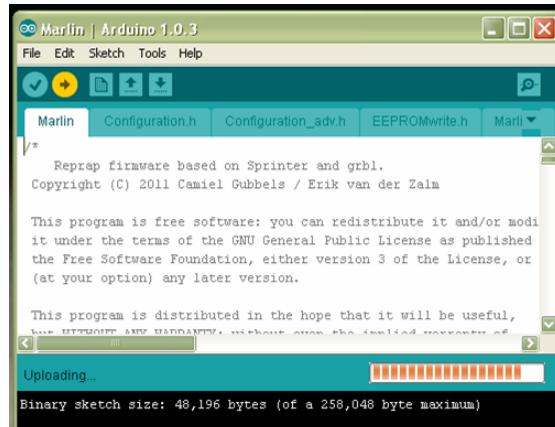
```

Marlin | Arduino 1.0.3
File Edit Sketch Tools Help
New Ctrl+N
Open... Ctrl+O
Sketchbook
Examples
Close Ctrl+W
Save Ctrl+S
Save As... Ctrl+Shift+S
Upload Ctrl+U
Upload Using Programmer Ctrl+Shift+U
Page Setup Ctrl+Shift+P
Print Ctrl+P
Preferences Ctrl+Comma
Quit Ctrl+Q

```

// This determines the basic settings.
// Implementation of an idea by Prof Brano to inform user that any changes
// to THIS file by the user have been successfully uploaded into firmware.
#define BAUDRATE 250000
//#define BAUDRATE 115200
/// The following define selects which electronics board you have.
// Gen7 custom (Alfons3 Version) = 10 "https://github.com/Alfons3/G

From the Arduino menu select File → Upload to I/O board. Alternatively you could use the icon to upload.



```

Marlin | Arduino 1.0.3
File Edit Sketch Tools Help
Marlin Configuration.h Configuration_adv.h EEPROMwrite.h Marlin
/*
Reprap firmware based on Sprinter and grbl.
Copyright (C) 2011 Camiel Gubbels / Erik van der Zalm

This program is free software; you can redistribute it and/or modify
it under the terms of the GNU General Public License as published
by the Free Software Foundation, either version 3 of the License, or
(at your option) any later version.

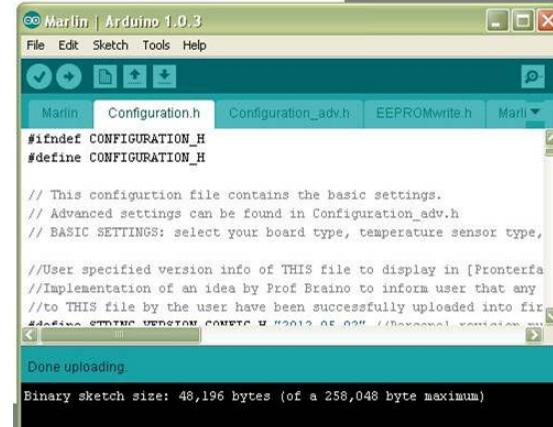
This program is distributed in the hope that it will be useful,
but WITHOUT ANY WARRANTY; without even the implied warranty of
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the
GNU General Public License for more details.

You should have received a copy of the GNU General Public License
along with this program. If not, see <http://www.gnu.org/licenses/>.

Uploading...
Binary sketch size: 48,196 bytes (of a 258,048 byte maximum)

```

The bottom section will show “Uploading to I/O board”



```

Marlin | Arduino 1.0.3
File Edit Sketch Tools Help
Marlin Configuration.h Configuration_adv.h EEPROMwrite.h Marlin
#ifndef CONFIGURATION_H
#define CONFIGURATION_H

// This configuration file contains the basic settings.
// Advanced settings can be found in Configuration_adv.h
// BASIC SETTINGS: select your board type, temperature sensor type, etc.

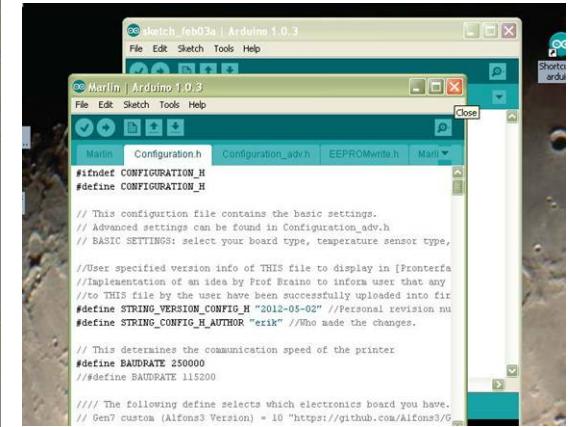
//User specified version info of THIS file to display in [Fronterface
//Implementation of an idea by Prof Brano to inform user that any changes
//to THIS file by the user have been successfully uploaded into firmware.
#define STRING_VERSION_CONFIG_H "2012-05-02" //Personal revision number
#define STRING_CONFIG_H_AUTHOR "erik" //Who made the changes.

// This determines the communication speed of the printer
#define BAUDRATE 250000
#define BAUDRATE 115200
/// The following define selects which electronics board you have.
// Gen7 custom (Alfons3 Version) = 10 "https://github.com/Alfons3/G

Done uploading.
Binary sketch size: 48,196 bytes (of a 258,048 byte maximum)

```

Then after a couple of minutes it will change to “Done Uploading”



Marlin | Arduino 1.0.3
sketch_leb03a | Arduino 1.0.3
Marlin Configuration.h Configuration_adv.h EEPROMwrite.h Marlin

```

Marlin | Arduino 1.0.3
File Edit Sketch Tools Help
Marlin Configuration.h Configuration_adv.h EEPROMwrite.h Marlin
#ifndef CONFIGURATION_H
#define CONFIGURATION_H

// This configuration file contains the basic settings.
// Advanced settings can be found in Configuration_adv.h
// BASIC SETTINGS: select your board type, temperature sensor type, etc.

//User specified version info of THIS file to display in [Fronterface
//Implementation of an idea by Prof Brano to inform user that any changes
//to THIS file by the user have been successfully uploaded into firmware.
#define STRING_VERSION_CONFIG_H "2012-05-02" //Personal revision number
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// This determines the communication speed of the printer
#define BAUDRATE 250000
#define BAUDRATE 115200
/// The following define selects which electronics board you have.
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Marlin | Arduino 1.0.3
File Edit Sketch Tools Help
Marlin Configuration.h Configuration_adv.h EEPROMwrite.h Marlin
#ifndef CONFIGURATION_H
#define CONFIGURATION_H

// This configuration file contains the basic settings.
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// BASIC SETTINGS: select your board type, temperature sensor type, etc.

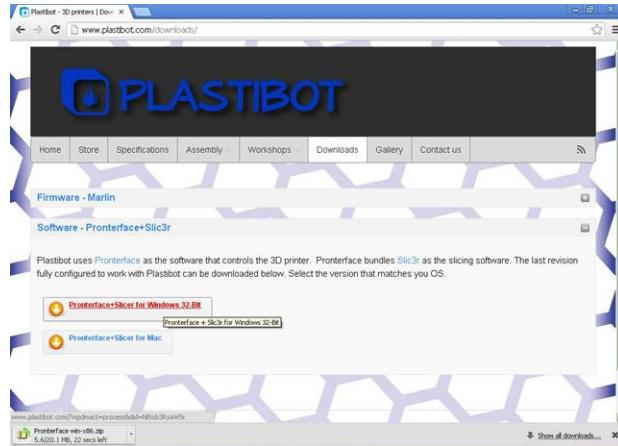
//User specified version info of THIS file to display in [Fronterface
//Implementation of an idea by Prof Brano to inform user that any changes
//to THIS file by the user have been successfully uploaded into firmware.
#define STRING_VERSION_CONFIG_H "2012-05-02" //Personal revision number
#define STRING_CONFIG_H_AUTHOR "erik" //Who made the changes.

// This determines the communication speed of the printer
#define BAUDRATE 250000
#define BAUDRATE 115200
/// The following define selects which electronics board you have.
// Gen7 custom (Alfons3 Version) = 10 "https://github.com/Alfons3/G

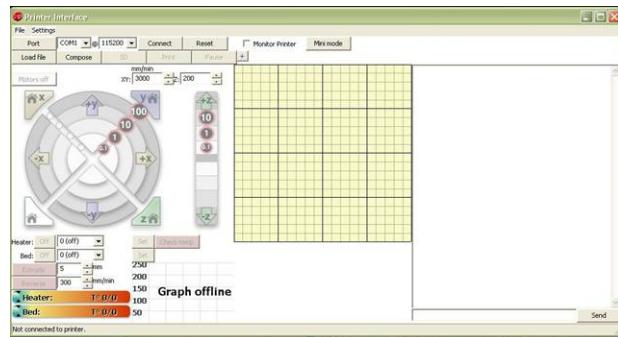
```

That's it. Save and Close the arduino program. Note that there may be more than one session open. Close all of them.

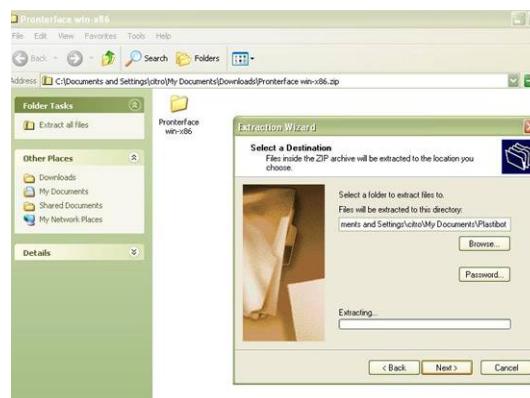
Step 6: Installing Pronterface



Go to www.plastibot.com/downloads and download pronterface corresponding to your OS (i.e Windows or Mac)



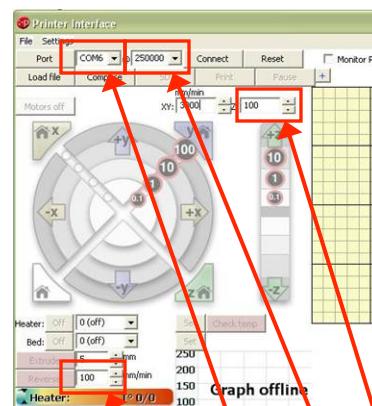
Click the pronterface shortcut you just created. The following screen should open up.



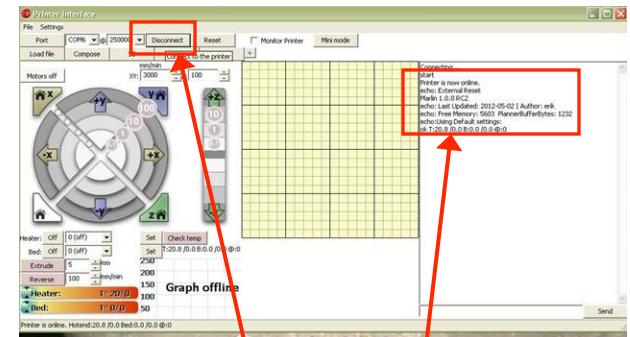
Click on the file you downloaded and extract into the Plastibot folder.



That should create a folder called Pronterface. Navigate to that folder and right click the file "pronterface.exe". Then from the menu select to create a shortcut and move the shortcut to your desktop.

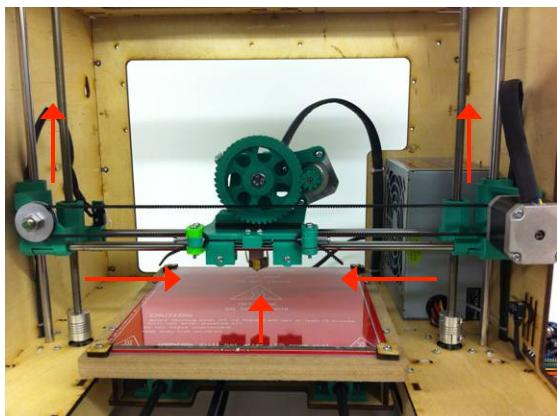


Make sure Port shows COMxx where xx is the port assigned to your printer. Make sure the communication speed is 250,000. Change Espeed to 100 and Zspeed to 100

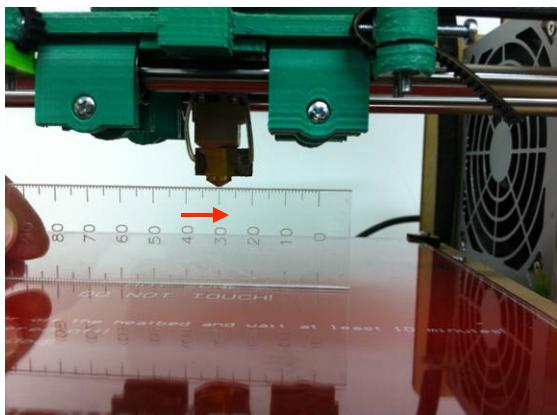


Click "connect". The status section will show you are connected. Proceed to plug the power cable on your printer to the electrical outlet and turn on the switch.

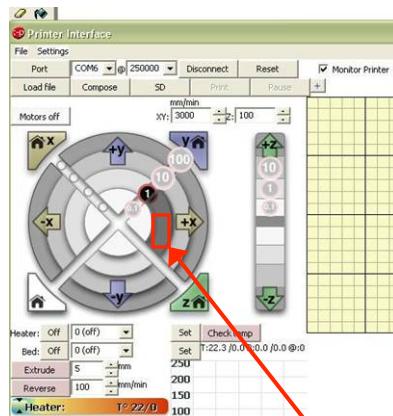
Step 7: Validating Motors and Endstops function



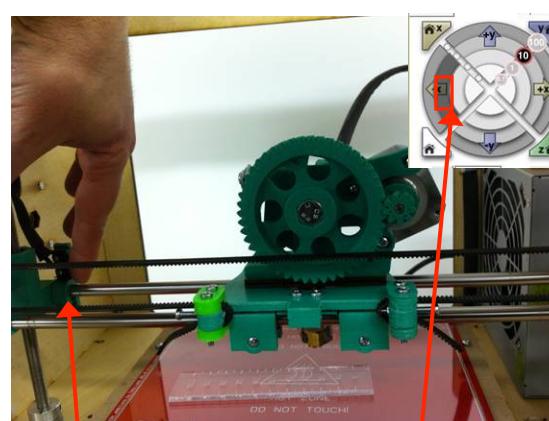
Move your carriages by hand so that they are around the middle. This will avoid hitting the ends if they are wired to move on the opposite direction.



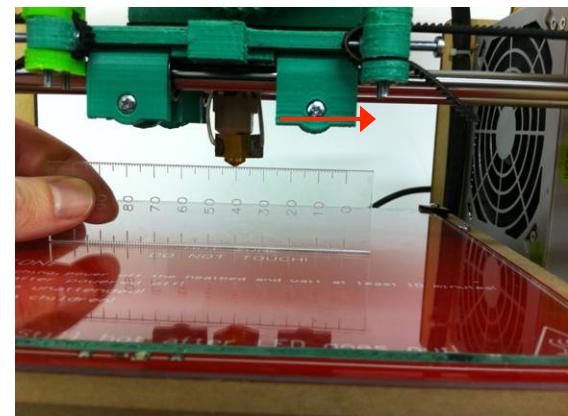
Now click on the ring showing 10, and verify that it actually moves 10mm to the right by using a ruler. I should move the right distance but is good to check.



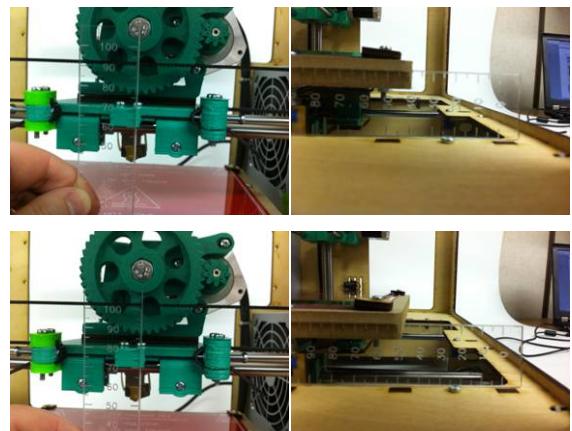
On Pronterface click on the right +X arrow for the ring that shows a value of 1. that should move the X Carriage by 1mm to the right.



Repeat for -X. clicking the ring with -10. It should move 10mm to the left. Now keep pressed the endstop switch with your finger, and click on -10 once again. At this time there should be no movement. If there is movement take note and we will troubleshoot on the next step.



If movement direction is NOT correct then take note of that. We will fix on the next step. If there is no movement at all also take note and we will fix on the next step.



Repeat the previous steps for the Y and Z carriages. Document your findings

Parts Needed:

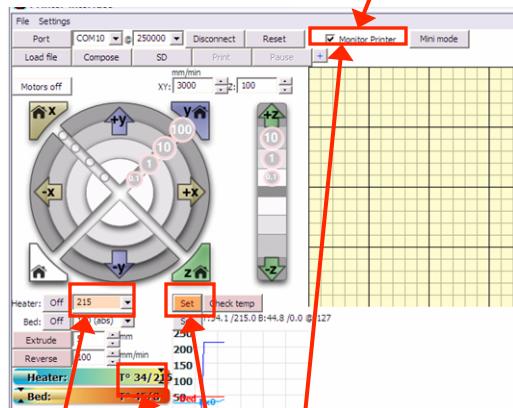
- Plastibot Mendel Printer
- Computer
- Pronterface

Tools Needed:

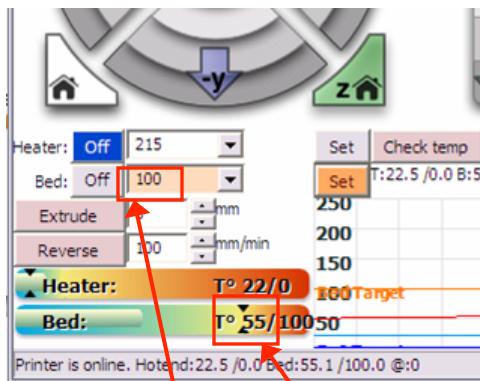
- Your hands
- Ruler

Step 8: Validating Heaters and Extruder motor

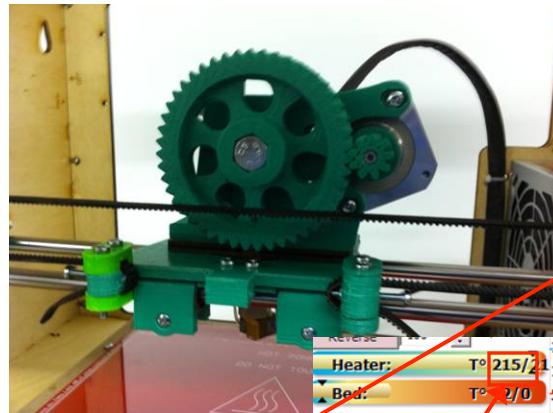
NOTE: Make sure “Monitor Printer” is selected otherwise temperature won’t update on Thermometer.



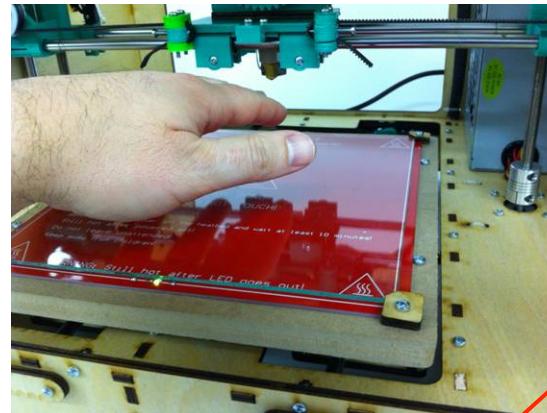
On Pronterface, set the heater temperature to 215 and click set then wait a couple minutes until the Heater thermometer shows 215. Make sure “Monitor Printer” is selected otherwise thermometer won’t update.



Set the Bed Temperature to 100 and click set. Check the Thermometer to see if it’s raising. It will take about 10 min to reach temperature.



Once the heater reached temperature, click on the extrude button. The big gear on the extruder should turn counterclockwise. If it turns the other way take note.



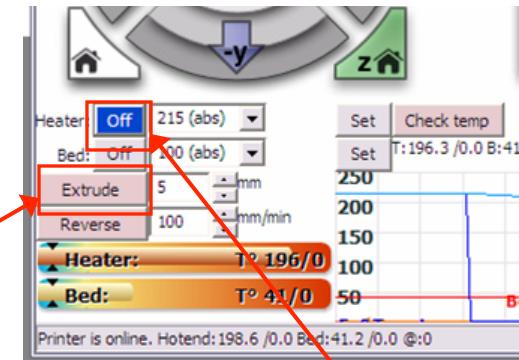
Put your hand close to the build platform and verify it is warming up. Do not touch it as you can burn yourself. Turn the bed off once it has reached temperature

Parts Needed:

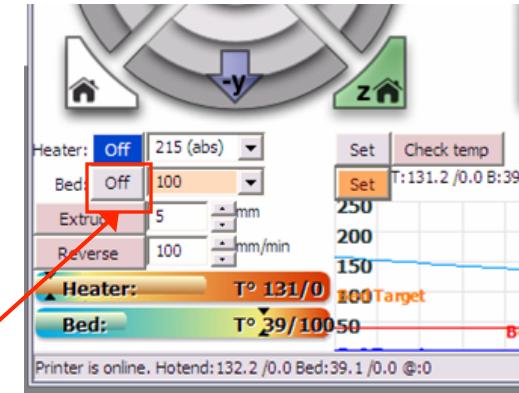
- Plastibot Mendel Printer
- Computer

Tools Needed:

- Your hands



Click the heater off.



That’s it. You have tested all the motors, endstops and heating elements. If everything worked the way is supposed then you can skip the next slide, otherwise check the next slide for troubleshooting and repeat steps 6 and 7.

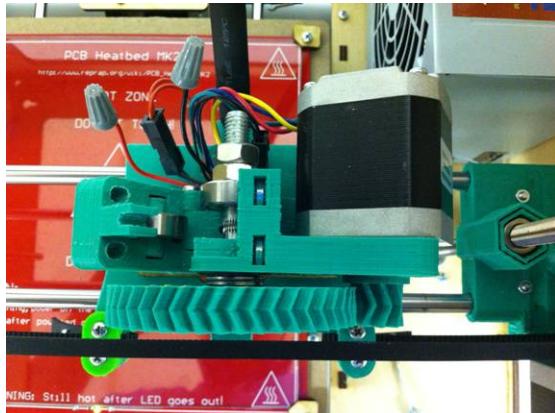
Step 9: Troubleshooting Motors, Endstops and Heaters.

The following matrix shows common problems, it's root cause and possible solutions. Use it to solve any problems found on the 2 previous steps. Make sure the printer is turned off and unplugged before doing any change.

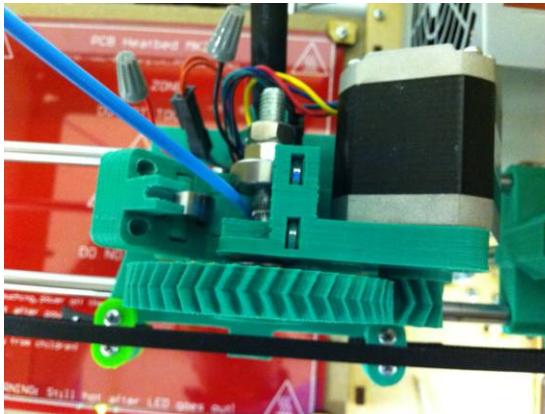
Category	Problem	Possible Root Cause	Possible Solution
X, Y, Z, E Motors	Motor spins in the opposite direction	Connector is connected backwards	Disconnect, turn the connector 180 degrees and reconnect.
	Motor doesn't move at all	Cable disconnected or connected in the wrong place?	Connect properly
	Motor is connected but it doesn't move at all	One of the wires in the connector could not be making contact	Verify all 4 cables on the connector to ensure the crimps are all the way into the plastic receptacle. Use a multimeter (if available) to check continuity on the motor wire. Each set of adjacent wires on the connector should read between 1.4 and 4 Ohms.
	Motor makes like it tries to move but it doesn't	One of the wires in the connector could not be making contact	Verify all 4 cables on the connector to ensure the crimps are all the way into the plastic receptacle. Use a multimeter (if available) to check continuity on the motor wire. Each set of adjacent wires on the connector should read a couple Ohms.
Hotend or Bed Heating Element	Heater is not heating up.	Cable disconnected or connected in the wrong place?	Connect properly
	Heater is properly connected but still not heating up	One of the cables on the connector might not be making contact	Use a multimeter (if available) to check continuity on the heater wires (red to red wires on the Hotend, Green to purple wires on Heated Bed). It should read around 6 Ohms for hotend and ~2 Ohms for Heated Bed.
	Heater is properly connected, measures continuity, yet is not heating up.	Thermistor properly connected?	Connect properly
	Heater is properly connected, measures continuity, Thermistor is connected, yet is not heating up.	Thermistor connector not making contact.	Use a multimeter (if available) to check continuity on the Thermistor wires (grey/grey wires) It should read around 100 KOhms.

Step 10: Tuning Up the Extrusion volume

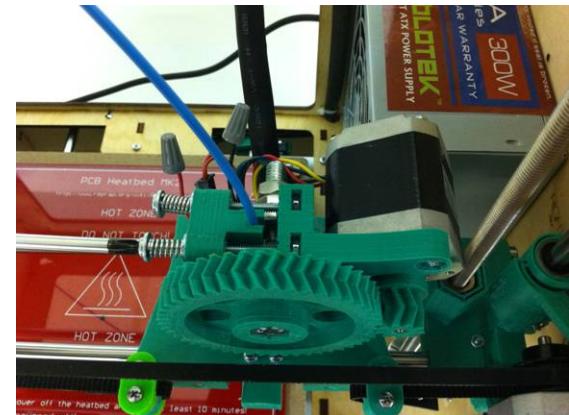
NOTE: To continue with this step your Printer needs to have successfully completed Steps 6 and 7.



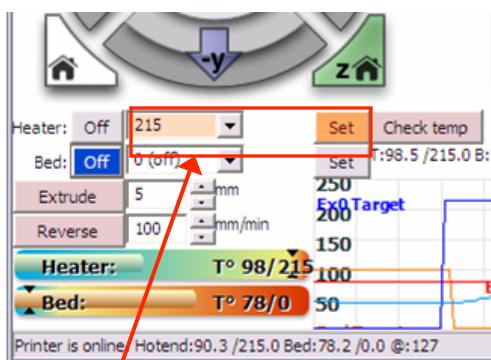
Remove the idler screws from the extruder.



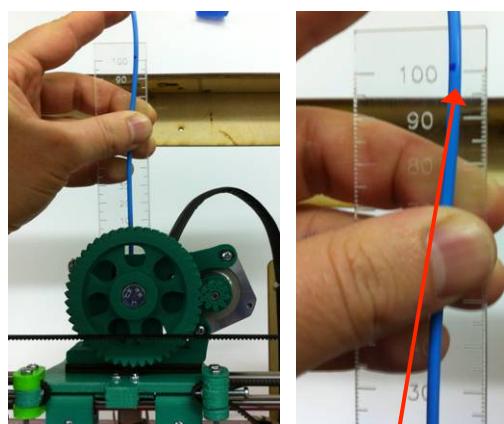
Take the 3mm plastic spool that came with your printer and insert into the extruder, all the way down thru the hotend. It should take around 100mm of plastic in.



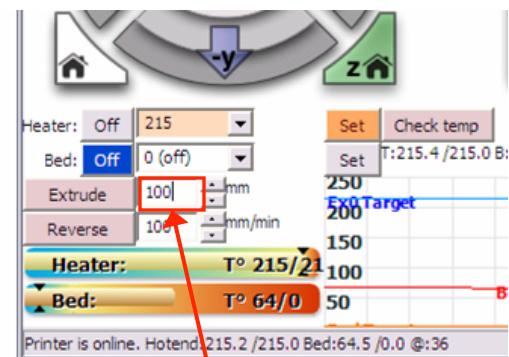
Put back the idler screws and screw in until the sprigs are almost fully pressed.



On prонterface, set the heater temperature to 215 for ABS or 162 for PLA plastic.



While it reaches temperature, use a ruler as shown and using a sharpie mark at 100mm.



On prонterface, set the extrude distance to 100mm and press extrude.

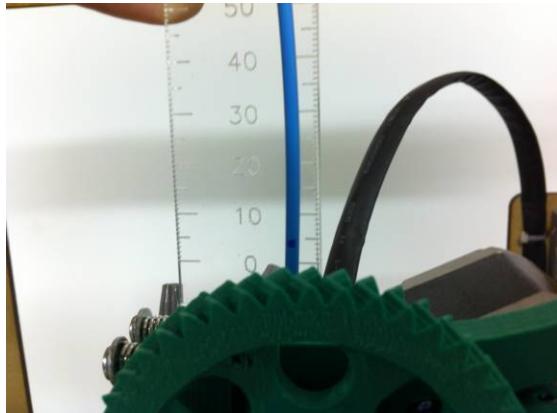
Parts Needed:

- Plastibot Mendel Printer
- Computer
- 3mm Plastic

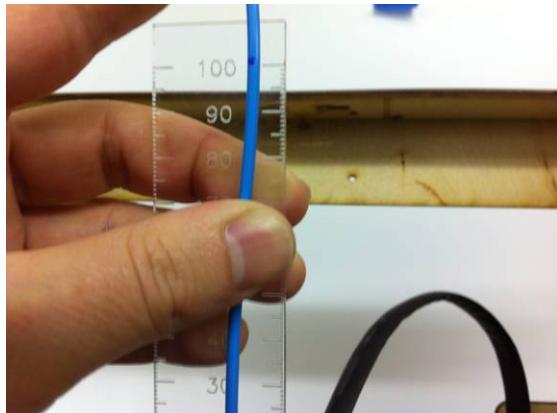
Tools Needed:

- Your hands
- Philips screwdriver
- Sharpie
- Ruler (metric)

Step 11: Tuning Up the Extrusion volume (cont.)



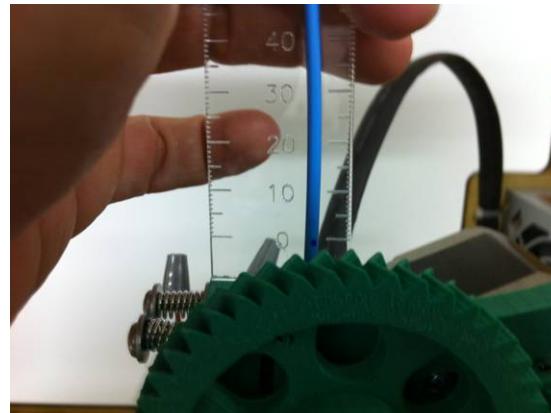
Wait for the printer to finish extruding and take the ruler and validate how much it actually extruded. In this case it extruded 95 instead of 100.



With the new firmware installed, press “Connect” on prонterface, turn on the printer and repeat step 10 and validate it is now extruding what it is supposed to. If not, do another ratio, calculate new value and reload the firmware.

FIRMWARE VALUE (steps/mm)	EXTRUSION VOLUME (mm)
767	95 mm
?	100 mm
$? = 767 * 100 / 95 = 807$	

Use ratios, calculate the correct value for the extruder steps per mm. If you recall on step 3 we wrote down the default value of 767 and 767 resulted on 95mm extruded.



Once it extrudes the amount that is supposed to, then you are good to go

Parts Needed:

- Plastibot Mendel Printer
- Computer
- 3mm Plastic

Tools Needed:

- Your hands
- Ruler (metric)

```
// Marlin | Arduino 0022
File Edit Sketch Tools Help
Marlin Configuration.h Configuration_adv.h EEPROMWrite.h Marlin.h MarlinSerial.cpp pins.h
// default settings
#define DEFAULT_AXIS_STEPS_PER_UNIT { 78.7402, 78.7402, 20.0, 95.7601 } // default steps
#define DEFAULT_AXIS_STEPS_PER_UNIT { 44.4444, 44.4444, 25.0, 80.0 } // default steps per unit

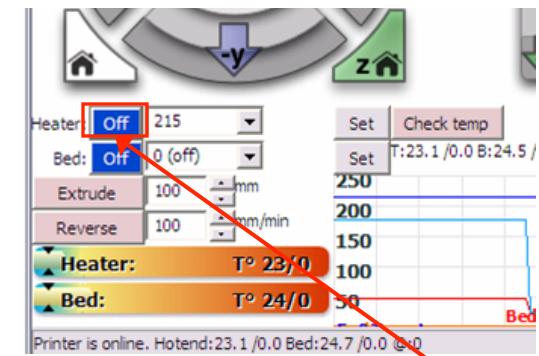
#define DEFAULT_MAX_FEEDRATE { 500, 500, 2, 45 } // mm/sec
#define DEFAULT_MAX_ACCELERATION { 9000, 9000, 100, 10000 } // X, Y, Z, E maximum start

#define DEFAULT_ACCELERATION 3000 // X, Y, Z and E max acceleration in mm/s^2
#define DEFAULT_RETRACT_ACCELERATION 3000 // X, Y, Z and E max acceleration in mm/s^2

// XYJERK
#define DEFAULT_XYJERK 20.0 // (mm/sec)
#define DEFAULT_ZJERK 0.4 // (mm/sec)
#define DEFAULT_EJERK 5.0 // (mm/sec)

// Additional Features
//
```

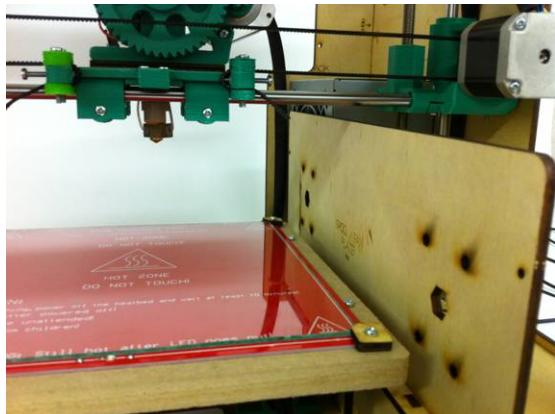
Take the new value you calculated and reload the firmware as you did on steps 3 and 5 but changing the value from 767 to the value you calculated. Press “Disconnect” on Pronterface and turn off the printer before going to step 3



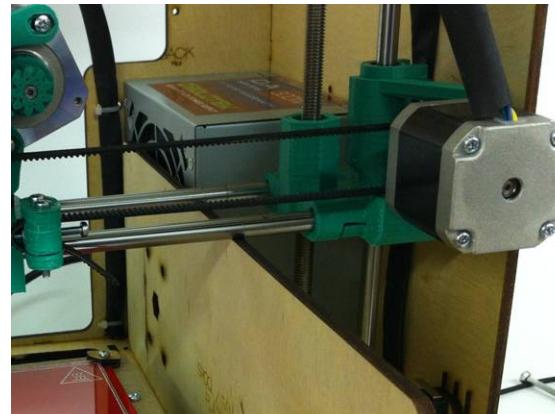
Go to prонterface, turn the heater off. You have completed calibration of the extruder volume.

Step 12: Leveling the Z Carriage

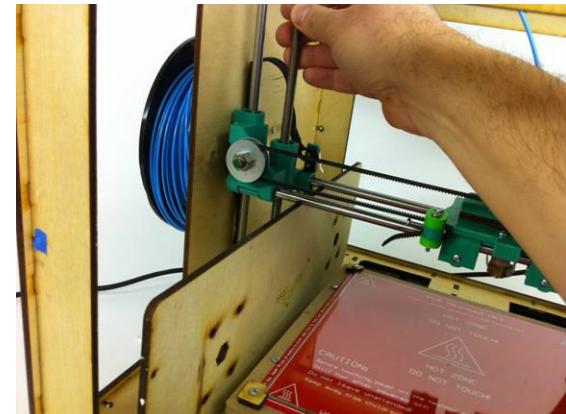
NOTE: Both Z motors are connected together. When one motor is rotated by hand sometimes that will generate enough EMF (Electro Magnetic Feedback) to move the other motor. If that happens hold the shaft with your other hand so that it doesn't rotate.



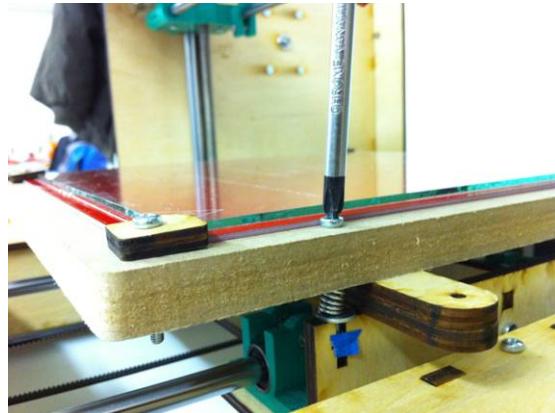
Using prонterface raise the Z carriage so that you can have enough room to insert the spool plate on the right side as shown



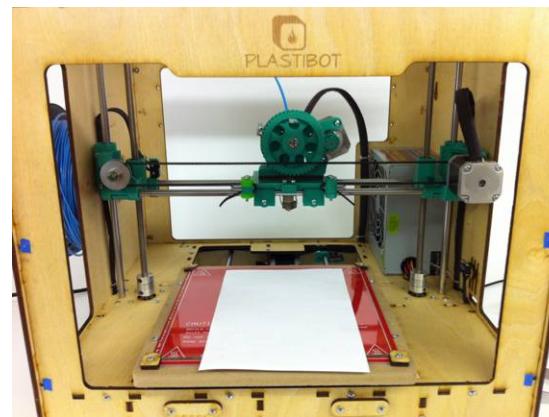
Lower the Z carriage until it is flush with the spool plate. Make sure the spool plate is as perpendicular as possible to the Bottom panel.



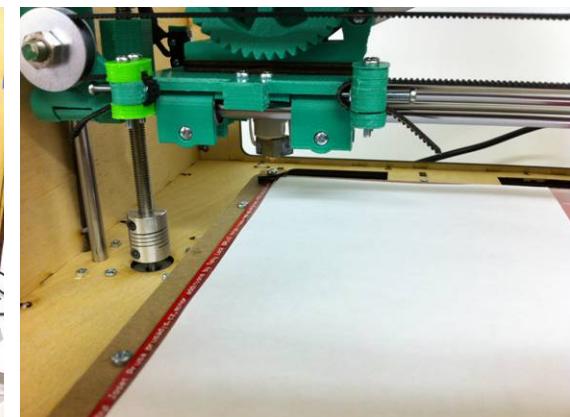
Remove the spool plate and insert into the left side. Turn the threaded rod manually to raise/lower the carriage on that end so that it is flush with the spool plate.



Your Z carriage should be level now. Next step is to level the Build platform. Use a couple of endcaps piled together to set all 4 screws to about the same height as shown.



Take a sheet of paper and put it on top of the build platform.



Use prонterface to position the extrusion head tip to the left corner away from you of the build platform right next to the build platform screw.

Parts Needed:

- Plastibot Mendel Printer
- Computer
- spool plate plywood

Tools Needed:

- Your hands
- Ruler (metric)
- Sheet of paper
- philips screwdriver

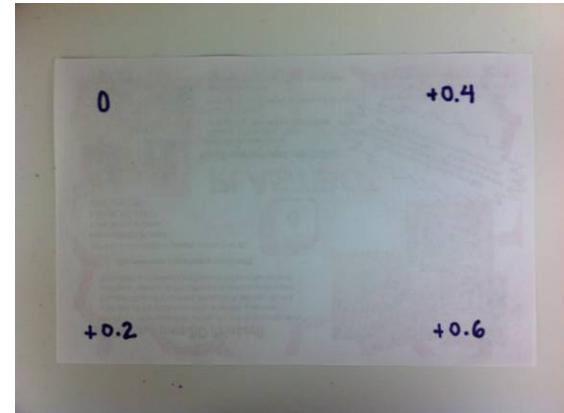
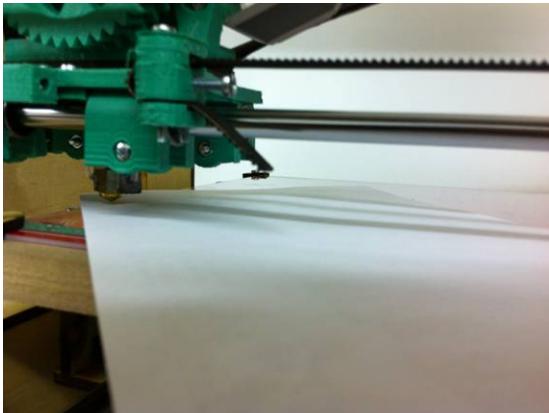
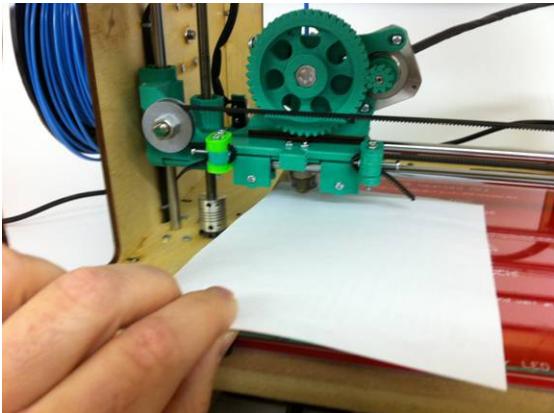
Step 13: Leveling the build platform.

Parts Needed:

- Plastibot Mendel Printer
- Computer

Tools Needed:

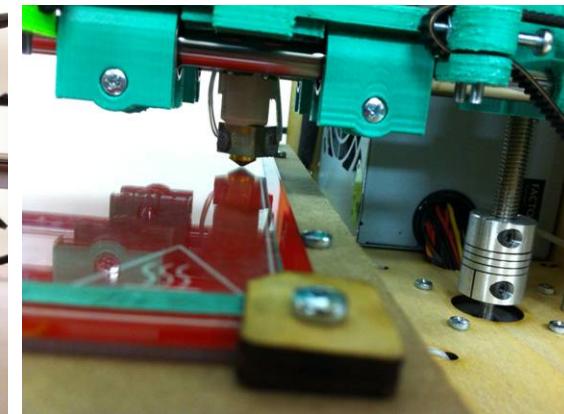
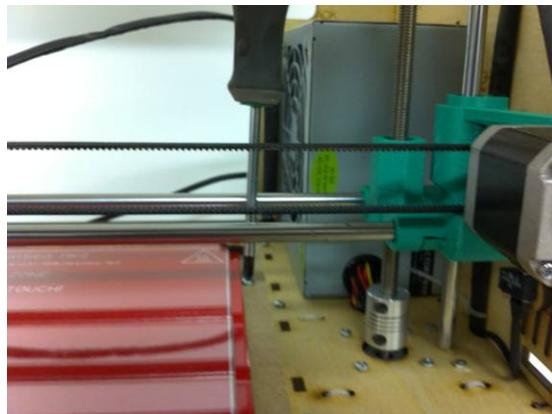
- Your hands
- Philips screwdriver



Lower the Z carriage 0.1mm at a time until the hotend tip barely grabs the sheet of paper. You can move the paper sheet around while lowering to find out when it grabs. Register that corner value as 0.

Raise the Z carriage 1mm and move clockwise to the next corner. Lower 0.1mm at a time counting until it grabs the piece of paper. Register the balance to 1mm

For instance if you only went down 0.1mm for 6 times (0.6mm) before it grabbed, then write down +0.4 (the balance to 1mm) on that corner. Then raise 0.6mm to reset to 1mm and move to the next point and repeat



Screw in/out the screws on the build platform based on your findings. A full turn of the screw yields 0.5mm so turn accordingly. For instance +0.4 means you need to screw-in (clockwise) 5/4 of a turn.

Run the 4 corners one more time and register your findings to validate the build platform is leveled.

Now go to the center of the build platform and repeat. If the center is higher by +0.3mm or more it may be that the thermistor between the pcb and plate is not fully sitted into the plate and is protruding causing the pcb and glass to warp.

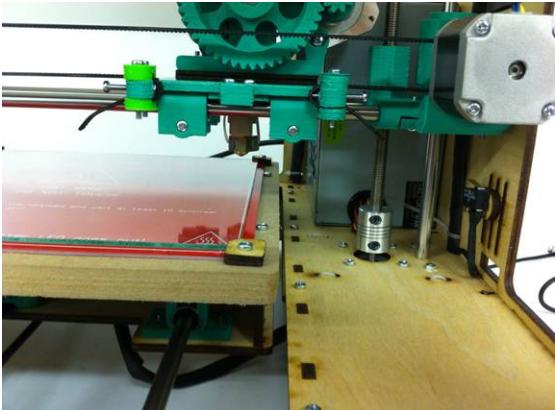
Step 14: Adjusting the Z origin.

Parts Needed:

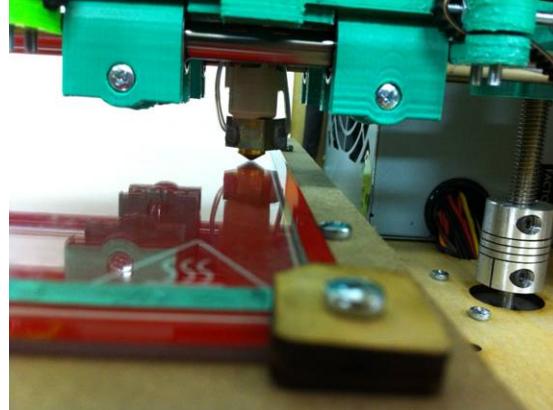
- Plastibot Mendel Printer
- Computer

Tools Needed:

- Your hands
- Philips screwdriver



Position your extruder tip on the right side and half way between back and front.



Lower the Z carriage a little bit a a time until the hotend tip is flush with the build platform



Set the fine adjustment screw so that its spring is half compressed.



Move the endstop up so that it gets pressed by the tip of the fine adjustment screw and it clicks.

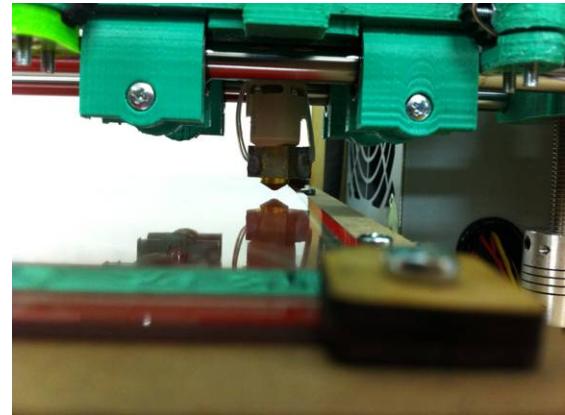


Secure the endstop in place by tightening the screws.

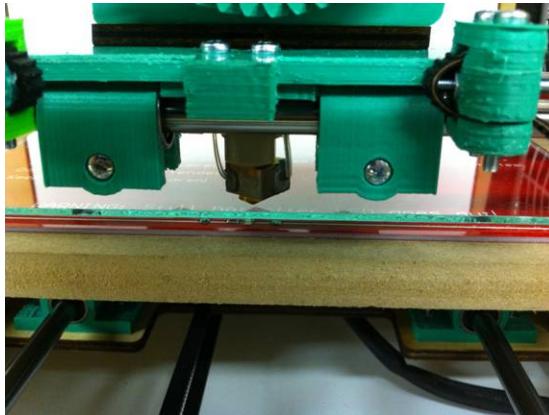


Raise the Z carriage 1 mm, then lower it 0.1mm at a time and count to see if after 10 times the endstop activates. If it is less or more, screw in/out the fine adjustment and repeat until correct. 1 turn = 0.5mm

Step 15: Adjusting the X and Y origins



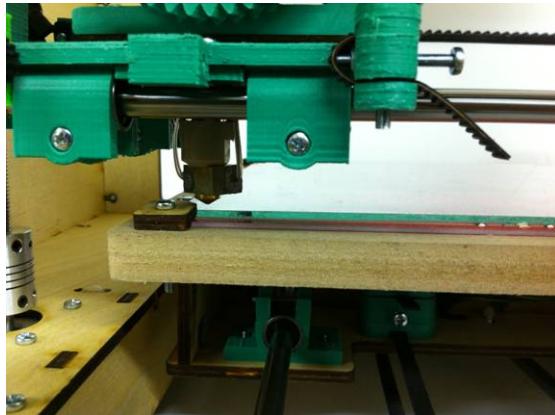
Move the Z Carriage so that the hotend tip is about 1mm above the build platform.



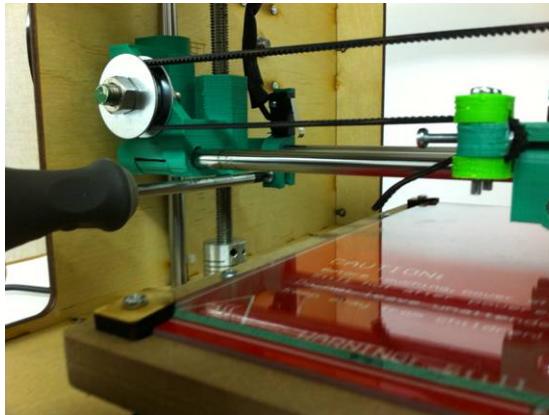
Move the Y Carriage so that the hotend tip is near the edge closer to you of the build platform.



Move the Y Endstop holder towards the carriage until the endstop level is pressed (it should click when pressed). Tighten the endstop in place.



Move the X Carriage to that the hotend tip is at the left corner closer to you. Ensure the hotend tip will not be hitting the corner clip when fully lowered.



Move the X Endstop holder towards the X carriage until the endstop level is pressed (it should click when pressed). Tighten the endstop in place

Parts Needed:

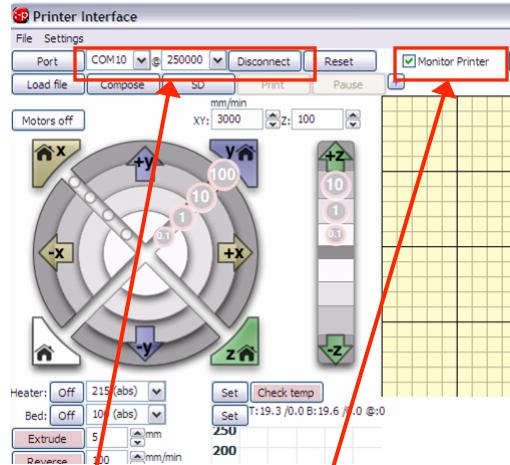
- Plastibot Mendel Printer
- Computer

Tools Needed:

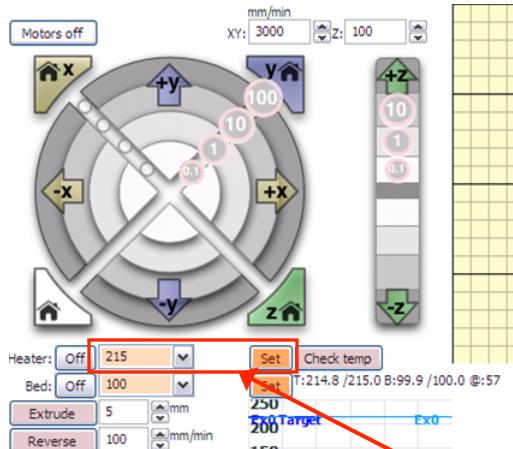
- Your hands
- Philips screwdriver

That's it... your printer should now be fully configured and ready to use. Let's begin printing. Download the Herringbone gear Gcode from the Downloads section.

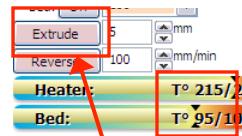
Step 16: Printing your first part



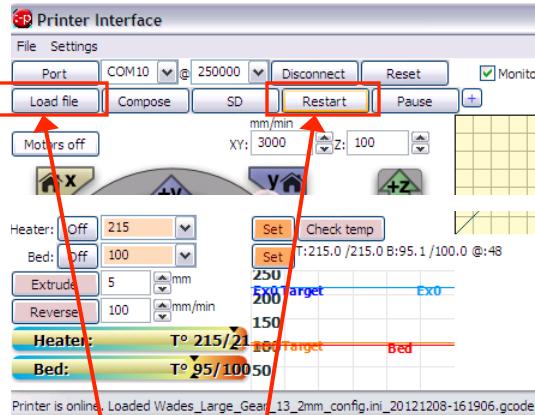
Connect to the printer, Turn the printer on, click on monitor printer.



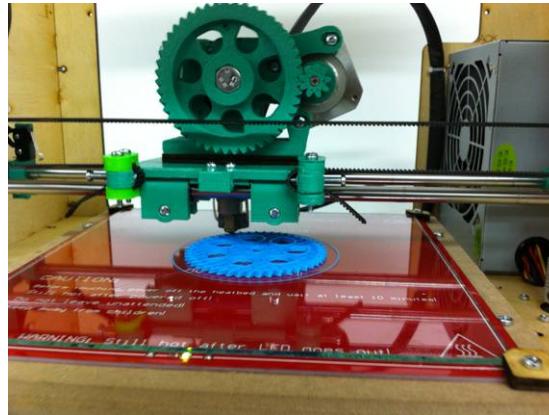
Set printer to temperature: Extruder at 215 for ABS or 162 for PLA. Bed (if applicable) at 100 for ABS or 60 for PLA.



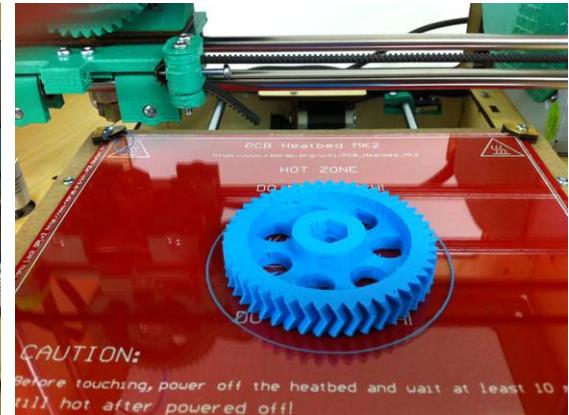
Once the printer has reached temperature proceed to prime the extruder by clicking extrude until plastic comes out of the nozzle. Wipe the extrusion using Nose pliers.



Load the Gcode corresponding to the big herringbone gear and proceed to click print.



The printer should go to the origin on all 3 axis and then move to the center and start printing.



Make a set of spare gear parts for your machine in case they wear out.

Parts Needed:

- Plastibot Mendel Printer
- Computer
- 3mm plastic spool

Tools Needed:

- Your hands
- Nose pliers

Credits / Attributions

Plastibot Mendel exists thanks to the hard work of many people around the world that has shared their work as part of RepRap.org - an open source project. Attributions for all parts used on Plastibot Mendel are listed below. Omissions are unintentional and if you believe we've missed to name or miss represented any of the authors please contact us at support@plastibot.com and we will be more than happy to correct our records.

Plastibot Mendel derivative parts are being released under the same license as the original work listed below. As such, all source files can be downloaded from our Github at <https://github.com/plastibot/Plastibot-Mendel>

Hardware / Part	Attributions / Credits	Derivative Changes	License
Prusa Mendel 3D Printer	Prusa Mendel by Josef Prusa - Josef Prusa - josefprusa@me.com reprap.org/wiki/Prusa_Mendel	Used overall design structure as basis for Plastibot Mendel motion Axis	GPL
Ultimaker Laser Cut Frame	www.ultimaker.com	Used the Laser Cut Frame from ultimaker as inspiration to Develop a Lasercut Frame for PrusaMendel. Used the stackable top an bottom design from Ultimaker to help stack up machines to save space. Used the T-slot and Tab joint design.	Non Commercial Use - Creative Commons
Plastibot Mendel Laser Cut Frame	Designed by Plastibot, LLC - Luis.Freeman@plastibot.com inspired by the need to make Prusa Mendel easier to assemble, square and level.	None	Non Commercial Use - Creative Commons
Hot End	Designed by MakerGear - makergear.com	N/A	GPL ?
Heated Bed	Designed by Josef Prusa - josefprusa@me.com	N/A	GPL V2
Electronics Card - RAMPS	Designed by Johnny Russell - Johnny@ultimachine.com	N/A	GPL
Plastic Parts			
Y-Bearing Holder	Derivative of Jonas Kuehling < mail@jonaskuehling.de - http://www.thingiverse.com/thing:18384 - LM8UU Holder Slim	Modified LM8UU holder slim for vertical print to eliminate breakage.	Attribution - Share Alike - Creative Commons
Y-belt-clamp	Derivative from Gregs Prusa Mendel - https://github.com/GregFrost/PrusaMendel	Used x-carriage belt clamp as basis to create a belt clamp that could be attached to the Frog plate	GPL V2
Y-belt-socket	Derivative from Gregs Prusa Mendel - https://github.com/GregFrost/PrusaMendel	Used x-carriage belt channel as basis to create a belt tensioner with a nut trap	GPL V2
Y-belt-channel	Derivative from Gregs Prusa Mendel - https://github.com/GregFrost/PrusaMendel	Used x-carriage belt channel as basis to create a longer belt channel that could be attached to the Fog Plate.	GPL V2
X Carriage base	Derivative of Jonas Kuehling < mail@jonaskuehling.de - http://www.thingiverse.com/thing:18657	Complete redesign of X-Carriage to allow for bearing holders to be printed vertically to eliminate breakage. Also added nut traps on bracket piece to allow clamping of Extruder wiring for stress relief.	Attribution - share Alike - Creative Commons
X Carriage Bearing holder			Attribution - share Alike - Creative Commons
X Carriage brackets			Attribution - share Alike - Creative Commons
X-belt-clamp	Derivative of Jonas Kuehling < mail@jonaskuehling.de - http://www.thingiverse.com/thing:18657	no change	Attribution - share Alike - Creative Commons
X-belt-channel	Derivative of Jonas Kuehling < mail@jonaskuehling.de - http://www.thingiverse.com/thing:18657	no change	Attribution - share Alike - Creative Commons
X-end idler	Designed by Jonas Kuehling < mail@jonaskuehling.de - http://www.thingiverse.com/thing:18384	Changed diameter for screw head recess.	Attribution - share Alike - Creative Commons
X-end motor	Derivative of Jonas Kuehling < mail@jonaskuehling.de - http://www.thingiverse.com/thing:18384	Modified to accept a 32 teeth Pulley. Also added screw mount for Z-endstop microadjustment.	Attribution - share Alike - Creative Commons

Credits / Attributions (cont.)

Hardware / Part	Attributions / Credits	Derivative Changes	License
Extruder body	Design of Jonas Kuehling <mail@jonaskuehling.de - http://www.thingiverse.com/thing:18379	Changed idler nut traps to take 6-32 nuts	Attribution - share Alike - Creative Commons
Extruder idler	Derivative of Jonas Kuehling <mail@jonaskuehling.de - http://www.thingiverse.com/thing:18379	Closed the idler screw tensioning holes.	Attribution - share Alike - Creative Commons
Large Herringbone Gear	Derivative of Nicholas C Lewis - http://www.thingiverse.com/thing:4305	changed holes on gear to droplet shape.	GPL
Small Herringbone Gear	Derivative of Nicholas C Lewis - http://www.thingiverse.com/thing:4305	Adjusted hole sizes	GPL
Extruder washer (bearing spacer)	Designed by Jonas Kuehling <mail@jonaskuehling.de - http://www.thingiverse.com/thing:18379	no change	Attribution - share Alike - Creative Commons
Endstop holder	Derived from Prusa Mendel - Josef Prusa - josefprusa@me.com rereprap.org/wiki/Prusa_Mendel	Added nut trap to clamp.	GPL V2
Fan Holder	Designed by Frederick Hubinette - http://www.thingiverse.com/thing:29999	no change	GPL
Spool Bushing	Derivative from Generic - http://www.thingiverse.com/thing:8697	Modified bushing to fit 1Kg Ultimachine Spool.	Attribution - share Alike - Creative Commons

Software	Attributes	Derivative Changes	License
Firmware - Marlin	Programmed by Erik Zalm - http://www.reprap.org/wiki/Marlin	Changed configuration settings to work with Plastibot Mendel	GPL V3

Software	Attributes	Derivative Changes	License
Printrun (Pronterface)	Programmed by Klimet - http://www.reprap.org/wiki/Printrun	Packaged with latest version of Slic3r	GPL V3
Slic3r	Programmed by Alessandro Ranellucci - http://www.reprap.org/wiki/Slic3r	Packaged with latest version of Pronterface	AGPL V3
Netfabb Studio Basic	http://www.netfabb.com	No Change	Shareware
Meshlab	Paolo Cignoni - http://www.meshlab.org/	No Change	GPL