**Mark4 Printer**

**User Guide**

# Overview

The "Mark4" is a 3D printer designed and built by BARN members. This user guide has recommended and required steps for making a print, from power on to shut-down, and for preparing the print job using PrusaSlicer.

This version of the user guide is written around the current (as of May 2023), single extruder version of the printer. If we are successful in implementing a tool changer for this printer, major changes in the process will be needed.

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| **Safety Considerations**   1. **Never leave the printer unattended during homing operations. If something bad seems to be happening during homing, power off and unplug the printer.** 2. **Like most 3D printers, this printer has a heated bed and a heated nozzle for melting the plastic filament. The nozzle can get hot enough to cause burns. Use caution when working near the nozzle.** |

**Running the Mark4 Printer**

The steps you'll go through when printing on the Mark 4 are very similar to those on the other 3D printers in the TechLab, but the user interface is completely different. The Mark4 uses a touch screen interface and some of the steps you'll take will require you to navigate through different screens.

# Clean the build Plate

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| **1** | Clean the surface of the build plate to remove dust, bits of old plastic, etc left from previous jobs. We've had the most success with Windex, but you can also try alcohol or water.  Put the build plate back if you took it off for cleaning. | The Mark4 uses a magnetic build plate. One side has a plastic surface and is normally used. The other side is bare metal. Best results:  PLA – Plastic side up, clean with Windex  PETG – Plastic side up, clean with Windex  TPU – metal side up. Clean with water, then apply  light coat of hair spray |

# Power on

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| **1** | There is a power switch on the back left corner of the Mark4, just below the power cord. Turn it on. | If the power cord is not connected to the printer, it's most likely in the top drawer of under of the printer cabinet. |
| **2** | Watch the Z probe to be sure it initializes correctly. Correct initialization has the following steps:   1. The probe drops down and retracts twice. It ends in the retracted position. This happens as soon as the power switch is flipped on – watch quickly. 2. The probe will turn RED. 3. Look to see that the probe is not broken off. You should see a bit sticking out the bottom of the housing.   If the three things above aren’t right, hang the "out of order" sign, log it in the book and shut the printer off. | The probe is designed to break if it accidentally gets caught in the print. If this happens, the printer can't be used until we replace the probe tip . |
| **3** | When the Mark4 is powered on, it will load its firmware and several messages screens will flash by (including one that says the WIFI is not connected. When these are done, you will see the message on the right.  Select YES to start the process of heating the bed, homing all the axes, leveling the bed and creating a compensation mesh.  If you select CANCEL, you'll need to perform some of those steps manually. | C:\Users\ms\AppData\Local\Microsoft\Windows\INetCache\Content.Word\Prep_printer - 1.jpg |

# Level the Bed, home axes, etc – if you didn't Cancel

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| **2** | ***Heat the bed -*** The first step is to heat the bed. The following steps that probe the distance to the bed get the best readings if the bed is heated first.  You can choose to skip this step if you want. |  |
| **2** | ***Home the axes*** – The second step is homing the X Y and Z axes. During this step the print head will move to the edges of the front and right sides of the printer, then the bed will move up. Be sure there's nothing on the bed and keep your hands out.  Important! - You should monitor the printer closely during the homing process. If any of the limit switches have broken, the printer will try to break itself. You'll know by the loud grinding sounds. If this happens, power off the printer immediately, and report the issue to the monitor. |  |
| **3** | ***Level the bed***  – The third step is leveling the bed. The printer will probe the build plate at the four corners and adjust the two front "Z" motors to make it as even as possible. |  |
| **4** | ***Create the compensation mesh***  – The fourth step is to probe the bed at 100 points across its surface. This data is used by the printer controller to make fine height adjustments while printing to get the best possible first layer. |  |
| **5** | When this process is complete, the display will show the "Control Screen" at right. The green highlighted button at the bottom tells you this.  There is also a "Status" screen used during printing.  The Console Screen and Setup screens are not used during printing and should be left alone. | C:\Users\ms\AppData\Local\Microsoft\Windows\INetCache\Content.Word\Control screen.jpg |

# Manually preparing the printer

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| **1** | You can start, or redo any of the printer prep steps by touching the prep\_printer.g button on the Control screen.  Then skip the steps you don’t want to do. | C:\Users\ms\AppData\Local\Microsoft\Windows\INetCache\Content.Word\Control screen.jpg |
| **2** | ***Manually heating the bed –***  This button on the **Control** screen, and the column of temperatures below it are for manually controlling the bed temperature. If the button is red, the bed heater is active and trying to heat to the ***Active*** temperature below it.  Touch the button next to "***Active C***" to change the target temperature. This brings up a set of buttons for raising and lowering the bed temperature. When you touch ***Set*** on that pop-up, the printer will start heating the bed. |  |
| **3** | ***Manually homing the axes –*** These buttons on the **Control** screen are used to home any or all of the axes.  Note that there is a required order to homing the axes (Y, then X, then Z). If you ask to home in the wrong order, the printer will home the pre-requesite axes first. | Home All Home X Home Y Home Z |
| **4** | ***Manually Leveling the bed*** - It’s a good idea to level the bed after the printer is turned on because someone might have given one of the Z-screws a twist when the printer was off and leveling the bed will fix that.  This button on the Control screen will perform the bed leveling routine. Be sure there is nothing on the bed before you start. |  |
| **5** | ***Manually creating a compensation mesh*** – We have measured a 0.1mm variation between a compensation mesh created on a cold bed and one created on a hot bed. This is why we heat the bed first in our printer prep process. You should heat the bed before manually creating a mesh for the best results.  There isn't a button on the control screen for creating a mesh, so our recommendation is to run prep\_printer.g and skip the unwanted steps before the mesh creation step. |  |

# Load or unload a filament

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| **1** | Select the **Load or unload filaments.g** button on the **Control** screen to start the process.  This brings up the dialog at the right where you can choose to **Load** a filament, **Unload** a filament, or **Cancel** the whole process. |  |
| **2** | **Load a filament** - If you selected **Load** in the initial screen, AND there is no filament currently loaded, you'll see the dialog at the right. Select your filament type and follow the instructions on the following screens.  The extruder will heat up, then ask you to insert the filament into the extruder and say OK (just like the Prusa printers)  If there is already a filament in extruder (or the printer things there is), you'll see a message telling you this. In this case, you can select "Unload" to unload it, or Cancel.  IMPORTANT NOTE: The filament needs to be manually threaded through a tube from the back of the printer to other end just above the top of the extruder, then inserted into the extruder. |  |
| **3** | **Unload a filament** - If you selected **Unload** in the initial screen, AND there is a filament in the extruder (or the printer things there is) you'll see a dialog telling you the tool number and the filament in the extruder.  When you say OK, follow the instructions on the screen. The extruder will heat up and then tell you when it's ready to eject the filament. After it does, you pull it out.  If you selected Unload and the printer thinks there is no filament in the extruder, you'll see a dialog box asking you to pick an extruder temperature to use for unloading. |  |

# Starting your print job

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| **1** | Insert your SD card into the slot on the side of the touch screen housing. |  |
| **2** | Go to the card selection screen by touching this goofy looking button on the **Control** Screen.  The next screen shows the printable files - usually on "card 0" (which is permanently installed on the controller board) and where there are no files to print. You need to switch to "card 1" by touching the same little button on this screen.  You should now see this screen and all the files on the SD card. File folders are shown with an asterisk before the name.  Touch any file to print it, or select a folder. |  |
| **3** | A screen like the one at the right will pop up. You can verify you picked the right file by looking at the name on the first line.  Touch **Print** to start it printing. The estimated Print time is the time estimated by the slicer.  Touch Simulate to have the Mark4 run through the file and give you its estimate of the print time.  Touch the garbage can to delete the file from the SD card.  If you don’t want to start the print, touch the X in the corner of the window to return to the previous screen. |  |
| **4** | If you touched **Print**, the Mark4 will now start printing your part and the ***Status*** screen will be shown on the display. If the extruder is not already at temperature, you can watch its temperature rise before the print starts.  The status screen shows you the bed and extruder temperatures, the position of the extruder as it moves, and the time left to complete the print. |  |

# Adjusting your print on the fly

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| **1** | ***Baby Steps*** – It's easy to make adjustments to the first layer thickness, just touch the  ***Baby Step*** button to pop up the baby steps control.  Use these buttons to move the bed closer to or farther from the nozzle by tiny amounts to improve your first layer. If the first layer lines look very wide, move the nozzle away from the bed. If they are not sticking, try moving the nozzle closer.  Normally, this is not needed.  Be careful with moving the nozzle closer to the bed. It is possible to use the baby steps button to crash the nozzle into the bed and damage it. |  |
| **2** | Temperature adjustments  Touch the bed or Nozzle Active temperature buttons on the Status screen to adjust these temperatures up or down.  Normally, this is not needed. |  |
| **3** | Speed adjustment  You can increase or decrease the print speed or fan speed by touching the these buttons on the Status Screen. |  |
| **4** | Pause or cancel  You can pause or cancel your print job by touching these buttons on the Status screen. | Note: these buttons work even if you touch them by accident. |

# When your print is done

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| **1** | Remove the build plate and take off your part.  Put the build plate back on the printer, checking that there is no gunk under it. |  |
| **2** | Be nice to the next user and Return to the **Control** screen and remove your filament. Some users just cut it off above the extruder, which is also OK. |  |
| **3.** | Power off the printer using the power switch. |  |