



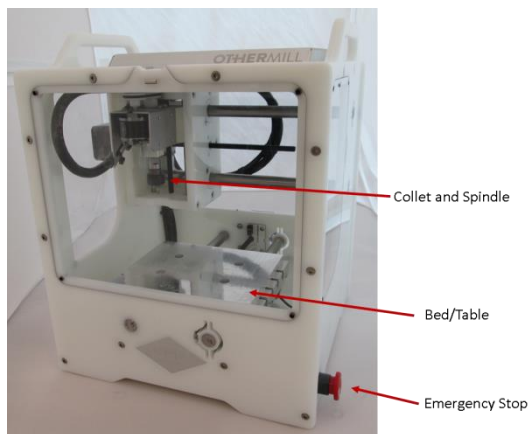
MAKER LAB Safety Instructions

Specialty Tool Training: OtherMill (Bantam Tools) CNC

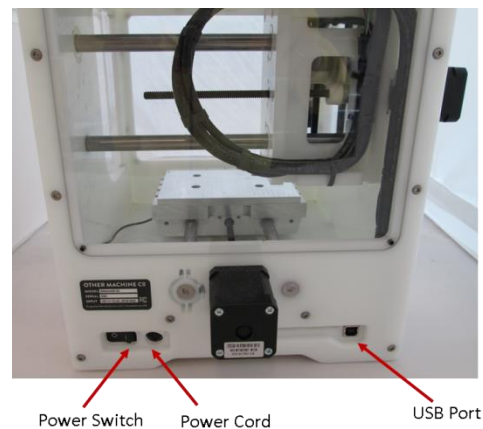
Note: All the instructions from Basic Training apply to Specialty Tool Training. If you have not completed Basic Training, do so before you complete Specialty Tool Training.

OtherMill

The OtherMill is a CNC (Computer Numerical Control) mill used mainly for milling personal computer boards (PCBs). Although it can mill soft wax material we have other machines more capable in the Maker Lab. This simple machine was based off of a Kickstarter campaign and uses many hobby class parts for its operation. The method of importing the files is by creating an Eagle file (.brd) and then importing the file into Bantam Tools.



Front View



Back View

This Maker Lab Safety Instructions and Safety Training module only covers the use of the OtherMill. Individual equipment training is performed for usage of Specialty Tool Training equipment. The full list of Specialty Tools can be found on the Maker Lab Website.

Disregarding lab rules or working unsafely will result in suspension or revocation of lab privileges depending on the severity of the infraction determined by the Maker Lab Staff.

In an Emergency:

Call 4444 from the lab phone (or 408-554-4444 from a cell phone), or 911 from a cell phone.

The Maker Lab is located in Guadalupe Hall, 3rd Floor, Room 301

Maker Lab Website: <http://makerlab.engr.scu.edu>

Maker Lab E-mail: scumakerlab@gmail.com



Specialty Tool Training: OtherMill

Emergency Information

1. **Injuries:** For immediate help notify Campus Safety at x4444 (408-554-4444) and follow their direction. Do not attempt to remove foreign objects from the eye or body; it is better to have trained medical personnel remove foreign objects from the eye or body.

Being ready to work

2. **Do not operate** equipment unless you have been properly trained to do so. If you're unsure about the safe operation of a tool or any aspect of a job – ask for help. **If you can't do a job safely, don't do it!**
3. **Never work when you are impaired.**
4. **Be prepared** and have your file ready before coming to the Maker Lab.

Personal Protection

5. **Must wear safety glasses with side shields at all times.**

Shop and Tools

6. **Always keep aisles, exits and access to emergency equipment** (fire extinguishers, fire alarms, first aid kit) clear at all times.
7. **Become familiar** with how the OtherMill works and the dangers before using it. Ask for help, even if it's just a simple question, little things can become big problems!
8. **Verify** the overall condition of the equipment (e.g., damaged power cord, debris buildup, or defects in the tool housing or anything that would compromise the safe use of the OtherMill).
9. Keep the area around the machine clean and free of clutter.
10. Keep the floor around the machines clean, dry, and free from trip hazards.
11. **Never let the OtherMill operate while it is unattended.**
12. Make sure all guards are in place and in proper working order.
13. **Inspect all tooling before use.**
14. **Never put your hand near moving machinery,** make sure to allow the machine to stop fully before trying to work inside the chamber.

Sign and date in space provided, verifying you have received a copy of and have read and understand the safety instructions.

Name: _____

Maker ID: _____

Signature: _____

Date: _____



Specialty Tool Training: OtherMill

You may not operate the OtherMill without the requisite training and approval from the Maker Lab Staff.

1. Always wear safety eye protection.
2. Keep the area around the machine clean and free of clutter, combustible materials, explosives, or volatile solvents such as acetone, alcohol, or gasoline.
3. **ONLY FR-1 PCB BOARDS ARE ALLOWED!** We have FR-1 boards for sale in the Maker Store.

Specifications

1. Workspace: 5.5x4.5x1.6 inches
2. Input Format: Eagle (.brd) or gerber files (then imported into Bantam Tools Software)
3. Approved Materials: OtherMill FR-1 boards made out of cellulose and easy on machine tools
4. Materials to **not** use: Glass, **FR-4 boards (fiberglass)**, ceramics, harder stone, wood with high-pitch content, softer rubbers and plastics. Stay away from anything that can gum up the tool, overload the machine, create irritating dust, and fling sharp shards into the machine.

Operation

A User Manual is available which goes into more detail about machine operation and settings.

1. Build your file in eagle, here are some simple design rules taken from their website (othermachine.co)
 - a. In **EAGLE**, you need to draw a closed shape around your circuits using the **Wire** tool, and it needs to be on **Layer 20**, which is the **Dimension** layer. You need to make sure the vias are on layer 17 and 18 and the traces are on layer 1 (layer 16 is bottom for double sided boards).
 - b. You need to have enough space between the components on your board that the OtherMill's tool can cut between them. For example, if you'll be using a 1/32" endmill, your traces, pads, vias, etc. need to be larger than 0.03125" apart. You can use smaller tools, like a 1/64" endmill, which will allow you to place objects closer together. Use large tooling whenever possible to complete the job more quickly. Note, smaller bits are more prone to breaking.
 - c. If you'll be using surface-mount (SMD) components, the pads need to have enough space between them for the tool to fit. Check the SMD package compatibility list to make sure. If your package isn't listed, you can test if it will work by making an EAGLE board file, importing it into Bantam Tools, and looking to see if there are cut lines between the pads.
 - d. If your board has vias (electrical connections between the front and back of the board), you'll need to create a connection between them. The simplest way is to put a piece of wire in the via hole and solder both ends, but you can also use via eyelets (aka rivets), which sit neatly in the holes as you solder them. You can also use tinned wire, which you can thread through all the holes much more quickly than eyelets or individual bits of wire.
 - e. Your holes for pads and vias need to be large enough that your tool can drill them. If you'll be using eyelets, your holes also need to be large enough for the eyelets to fit. Bantam Tools will render what it thinks the machine can cut. If it looks like something's been left out, add a smaller tool or change element sizes.
 - f. You can have the autorouter avoid certain areas and not use through-hole pins on components as vias. This is handy when you are using components that can't be soldered

easily on both sides of the board, like pin headers. Place polygons in the tRestrict (41), bRestrict (42) and vRestrict (43) layers to prevent around the places you don't want the autorouter to put traces or place vias for the top and bottom of your board.

2. Setting up equipment and software
 - a. Turn on machine, make sure it is plugged in and start the homing procedure.
 - b. Select "Open Files" on the upper right corner under "Plans" and import Eagle model into Bantam Tools software (Please do this before you come in, it will save time)
 - c. Verify that all traces, vias, outlines are cutting the way you designed it in Eagle, **if you do not see it set up correctly in Bantam Tools it will not cut correctly.**
 - d. Click the "Material" drop down button under "Configure" to select your material of choice.
 - e. Under "Plans", there are options for selecting the Traces, Holes, and Outline. Click these buttons and notice how the rendering in Bantam Tools changes to show what parts of the file will be cut into the FR-1 board. Make sure all the relevant buttons are selected (i.e., you are cutting: Traces, Holes and/or the Outline). **If your design is double sided, be sure to only cut the outline when working on the second side.**
 - f. Set up your tool selection under "Plans".
3. Setting up your tool
 - a. Under "Plans", click on "Milling Tools" drop down button to select all your tools (e.g. a 1/16" flat end mill) that you plan to use.
 - b. Under "Configure", click "change" at the tool section to change tools and follow the guided process.
 - c. Remove the collet nut, slide the flat end mill into the collet all the way, and then use the two wrenches to tighten the collet nut onto the spindle. It doesn't have to be super tight, just snug plus a little bit. Then select the new tool on the drop-down menu.
 - d. Click continue and the mill will position the tool over the bed.
 - e. It will then ask to make sure the tip of the tool is in the "safety zone" (the white horizontal housing below the spindle). At this point make sure the tool is also directly over an empty space on the bed, free of debris, your part, the bracket, or tape.
 - f. Click "Locate tool" and it will perform a touch-off to set its z-direction and then continue through with rehomeing.
4. Setting up material
 - a. Put a single layer of double sided sticky tape on the bed where your FR-1 board is going. Make sure where you are cutting an outline has some tape so once the part is free from the rest of the board, it doesn't move. (You don't need to completely cover the board as this will make removal difficult.)
 - b. Place the material in the bottom left hand corner with the edges of the board slightly hanging over the edges then press "Home" or "Re-Home" under "Configure."
 - c. Sometimes it is beneficial to have additional tape at the corners/edges to ensure the board remains flat on the bed throughout the cutting process.
5. Running the machine
 - a. Grab whatever you will need to be comfortable for the next hour or more (may I suggest some homework?)
 - b. Run the machine by clicking the "Start Milling"
 - c. If there are any issues while the machine is running, hit the emergency stop button on the side of the machine to stop it.
6. Once completed
 - a. Remove your material carefully and without damaging the build platform.
 - b. Home the machine, turn off the machine, and remove tooling.
 - c. Vacuum the inside of the machine carefully.
7. Congratulations!