Invention Studio CAMaster CNC Walkthrough
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Reading a setup sheet

1. Read each operation to ensure that each cutter used in the program is installed in the correct tool holder.

2. Check the overall dimensions of the cut and ensure that the stock material being used is sufficiently large.

3. Check the origin in the picture for use when zeroing in X and Y.

CAMaster startup

1. Turn on the machine using the power switch on the left of the electronics cabinet. Make sure the Emergency Stop is pulled out.

2. Turn on and log into the computer, and launch WinCNC (blue icon on desktop).
3. Ensure that the gantry can move without interference and that there is no material hanging over the edge of the table.

4. Clear the hazard zone of people and debris.

5. Enter the command “G28” in the command line and press enter to home the machine.
a. If there is a servo fault in the output window, turn the servos on, or off and back on, using the “Servo On/Off” button. Enter “G28” when finished.

Jogging the machine

1. Select a speed or step size using the buttons at the bottom of the control screen.

2. Clear the hazard zone of people and debris.
3. Use the arrow keys to jog the spindle head in X and Y, and PgUp and PgDn to jog in Z. On our keyboard, you must hold the Fn key to use PgUp or PgDn. Alternatively, simply use the onscreen x, y, and z arrow keys.

Changing current tool in machine

1. To have the machine pick up a tool, type the tool number (T1, T2, etc.) into the command line and press enter.
2. To change tools, simply type the tool number you would like and press enter. The machine will already know what tool it has, and will put it away before it gets the next tool.

3. To put a tool away, type “T0” and press enter.

Changing tools in the collet

1. Select the tool which you wish to change by entering the tool name (eg. to select T7, enter “T7” in the command line).

2. Jog the spindle head to the front of the machine near the computer, within reach.

3. Hold the tool holder in one hand and press the green button on the spindle with the other hand to release the tool holder.

4. Place the tool holder in the jig on the right of the machine, cutter facing up. The tool holder has two chamfered edges which line up with the two black bars in the jig.
5. Push the black knob in to lock the tool holder in place. You should feel the tool holder drop down into the jig.

6. Use the large red wrench (top drawer in the black organizer) to loosen the collet nut. Only loosen the collet nut until the bit can be removed, do not unscrew all the way unless the collet size needs to be changed (see below).

7. Remove the bit and place it in the correct location in the top drawer of the organizer.

8. Check that the collet in the tool holder matches the shank of the desired tool.
a. If you must change collets, completely remove the collet nut from the collet.

b. Carefully press sideways on the narrow end of the collet to pop it free of the nut (this requires some force, but don’t go crazy).

c. Replace the collet in the organizer and select the desired collet.

d. Install the desired collet by “levering” it into the nut at a diagonal angle until it pops into place (this requires some force, but don’t go crazy).

e. Screw the collet nut back on to the tool holder.
9. Insert the cutter into the collet, ensuring that there is enough sticking out for the operation so that the tool holder will not collide with the stock.

10. Tighten the collet nut with the wrench.

11. Remove the holder from the jig, place it into the spindle as far as it goes, then press the green button to reinstall the tool.

12. Press “Measure Tool”.

![Image of cutter and control panel]
Stock holdown

1. We prefer to use the hot glue gun method for holding parts down. It allows for a wide range of cuts to be performed and reduces setup time. If you feel this may not work for your part, please contact a master at cnc@inventionstudio.gatech.edu.

2. For most cuts, only Zone 1 will need to be used. There are stickers to indicate where each zone is on the table. For cuts that have stock that spans more than two zones, please contact a master.

3. The preferred method is to glue the stock to be cut to one of our sacrificial stock pieces, which span either one or two entire zones and provide ideal surface area for hold-down suction. The one zone size can be found behind the computer and the two zone size can be found underneath the CAMaster.

4. Place the piece of sacrificial stock over an entire one or two zones.
5. Using the ball valves on the far side of the machine, open the appropriate zone(s) and close all other zones (See zone labels on machine).

6. Activate the vacuum pump using the black button on the control box above Shapeoko.
7. Use the hot glue gun in the bottom drawer of the black bin organizer to glue three or four dime-sized globs to the bottom of your stock. Quickly set it on top of the sacrificial stock. Ensure that the bit will not run through the glue during your cut. Then, glue a bead around the edge of your stock in three or four places.

8. Test your hold-down: you should not be able to move the stock in any axis with a moderate shove.

Zeroing X and Y

1. Press “Laser On” to turn on the laser crosshair.
2. Jog the spindle such that the laser crosshair is over the program origin.

3. Press “Laser X0 Y0”. Careful not to press “Zero XY”, which will zero incorrectly.

Zeroing Z

1. Change tools to a medium-sized flat end mill by entering the name of the tool (ie. T2).
2. Jog until the bit is over a flat area at the Z origin height (usually this is the top of the stock).

3. For many simple cuts, it is sufficient to zero the Z by eye.
   a. Slowly and carefully jog the spindle down until the bit is touching the top surface of the material.
   b. Press “Zero Z”.

4. If more precision is required, you can use the paper method.
   a. Place a piece of paper under the bit on top of the surface.
   b. While sliding the paper back and forth on the surface, slowly and carefully lower the spindle. For the best accuracy, use the .001 step when near the surface.
c. As soon as the bit pinches the paper, press “Zero Z”.

5. Jog the spindle up and away from the stock.

Running the cut

1. Load a gcode file using the file icon in the top toolbar.

2. Alert people in the room that you are starting a cut, and that they might want ear protection. Everyone in the CNC corner during a cut must use ear protection.

3. If you’re cutting a light material (e.g., foam, MDF) it is recommended that everyone in the CNC corner wear masks. These can be found in the wood room by the safety glasses.
4. Clear the hazard zone of people and debris.

5. Start the cut by pressing the green dot in the top left corner of the screen.

6. In the event of unexpected behavior that does not pose an immediate threat to the machine or workpiece, stop the job in WinCNC by pressing the red square near the top of the window. If an immediate threat is presented, turn the machine off by pushing the red E-stop button located next to the on switch of the CAMaster.

Clean up

1. Vacuum or sweep all dust and chips from the CNC area

2. Remove all hold-down clamps and bolts and put them back in the drawer
CAMaster shutdown procedure

1. Clear the hazard zone of people and debris.

2. Press the “Park” button and wait for the spindle to return to the middle of the table.

3. Turn off the machine using the power switch on the left of the electronics cabinet.

4. Turn off the computer and monitor.

- There is also a laminated print-out of this walkthrough located on the side of the CAMaster computer.