

### How does CNC milling work?

CNC (Computer Numerical Control) mills can be thought of as computer-controlled carving machines. A cutting tool, similar to a drill or routing bit, is spun at very high speeds and moved to cut/carve the material to be machined. This is a 'subtractive' manufacturing process where the process starts with a block of solid material and results in a finished piece along with waste material (sawdust, plastic chips, metal filings, etc.).

There are two basic styles of milling on the CNC desktop mills: 2D (sometimes called 2.5D) milling and 3D milling. Generally 2D milling is considered similar to routing or etching, where a flat surface is machined with relief marks or cut out in a flat shape (the cutting tool only moves left-right and forward-back while cutting). In 3D milling the cutting tool also moves in the up-down direction while cutting to form a complete three-dimensional shape.



Example of 2D Milling (routing)



Example of 3D Milling

### What materials and tooling can I use?

In general, small desktop mills can work with wood, plastics and machinable foams and waxes. Under certain conditions, the mill can also machine non-ferrous metals such as aluminum, copper, brass and others. Patrons are expected to provide their own materials to be used in the CNC desktop mill.

The library will supply a limited selection of cutting tools (e.g., 1/8" square end mills and 1/8" ball end mills), but patrons can supply their own tooling at the approval and discretion of branch staff. Patrons are expected to supply any tooling used to cut metals, double-sided tape to hold workpieces and other common consumables as covered in the orientation class.

### What software is used to create designs?

For cutting and engraving shapes (2D milling), the CNC mill requires a 'vector' file. Vector shapes can be created and modified using [Inkscape](#) (free), or with a variety of CAD (Computer Aided Design) programs, including the free, browser-based [Tinkercad](#). Adobe Illustrator and CorelDRAW are popular commercial programs used to create vector art.

3D milling uses mesh files (STL or OBJ), the same style of files used for 3D printing. These files can be designed using 3D CAD software or downloaded from a variety of sites. *3D milling can be a complex process and is best approached by advanced users who are already experienced with 2D machining.*

## How can I use a CNC desktop mill at a HCPL branch library?

Patrons who wish to use a desktop mill are expected attend a free orientation class (check the [Events Calendar](#) for dates and times) and earn a “CNC Desktop Mill” badge created on HCPL’s [Maker Central](#) site for the machine you wish to use. The orientation class covers the basic operation of the CNC mill, the tools and techniques to create the d files and HCPL’s CNC Desktop Mill policy. After earning the badge, patrons may reserve time on that machine.

Patrons must be present to supervise the CNC mill job at all times. Use of the desktop CNC mill is free, but patrons must supply their own supplies. Patrons under age 16 must be accompanied by an adult.

[Click here to access or create your Maker Central account.](#)

## I’ve taken the orientation class – now what?

- Access HCPL’s Maker Central site at: [hcpl.beanstack.org](http://hcpl.beanstack.org)
- Either register for your free account (if you are a new users) or sign in to your existing account. (This may be the same account you have used for HCPL’s Summer Reading Program or other activities.)
- Under the “Programs” tab, click on “Maker Central”.
- Click on your “CNC Milling Orientation Badge”
- If this is your first time using this badge after taking the orientation, please enter the “Secret Code”.
- Return to the previous screen and click on your machine-specific badge and enter the secret code. For example, if you’ve taken the orientation class for the Carbide3D mill, then click on the Carbide3D icon and enter the secret code to earn the “Carbide3D Mill” badge.
- If you have already earned a badge, click on “Rewards” and then click the link to “Book a Desktop CNC Mill”
- Completely fill out the Desktop CNC Mill Equipment Reservation Form and click “Submit”. You will receive an initial email confirming receipt of your request. Within a business day you should receive an email confirming or denying your request.
- If you have any questions, [please contact the branch library for assistance.](#)

## Which HCPL branches have CNC desktop mills available for patron use?

- **Clear Lake City-County Freeman Branch Library**
  - Carbide3D Nomad 883

## *Equipment Description*

### **Carbide3D Nomad 883**



- 8 x 8 x 3 inch machinable area
- 1/8" and 1/4" ER-11 Collets available
- Spindle Speed: 2000 – 10000 RPM (50 W)
- A limited selection of tooling (cutters) and fixturing is available for patron use