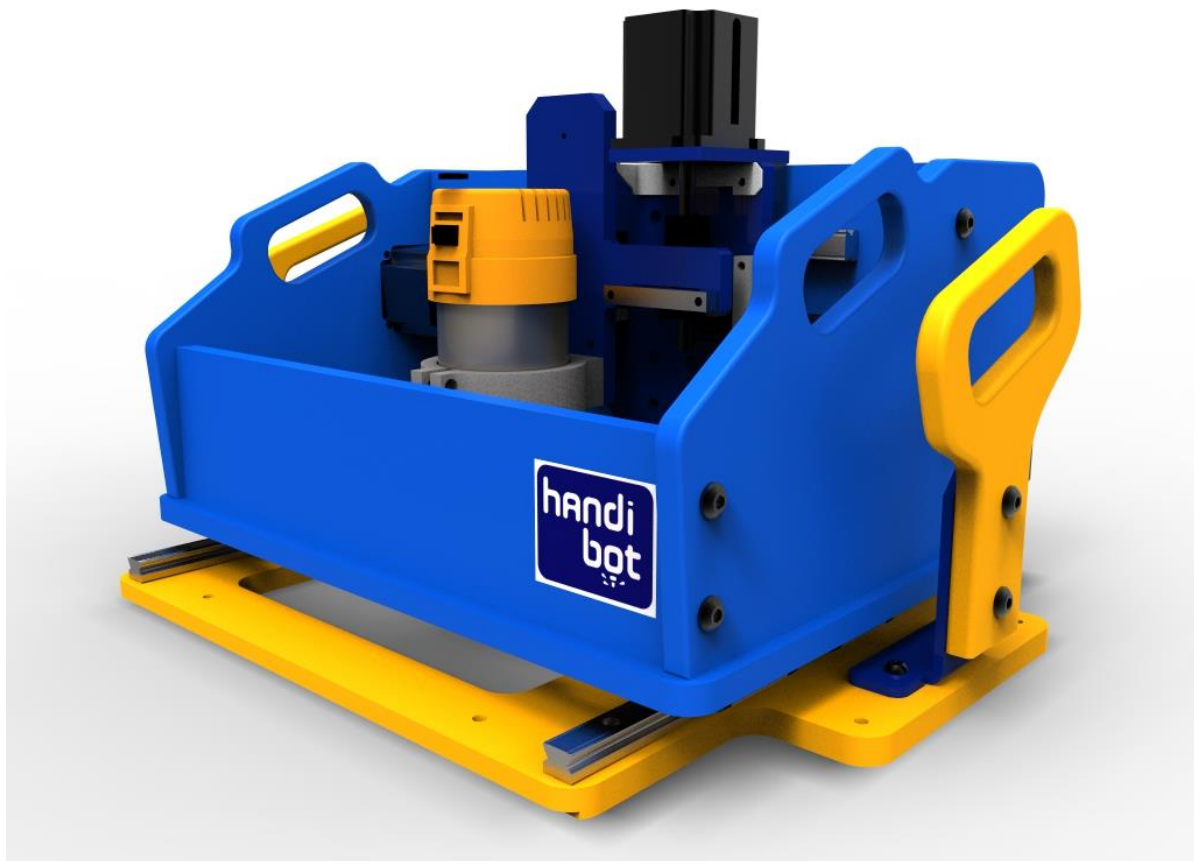# Handibot User's Guide

This is a guide for app developers, and other "first adopters" of our HandiBot Tool. It provides an introduction to our control software and the basic functions of the Tool.

©2013 ShopBot Tools, Inc.

Handibot User's Guide
Table of Contents

1. Handibot Setup Guide

> *Please note: this document was written for our full-size tools, some hold-down methods may not apply to use with a HandiBot*

HandiBot Setup Guide

Written By: ShopBot Tools

Step 1 — Safety

- As with any power tool, there are inherent risks to using the Handibot. Following these safety rules can reduce your risk of injury.

- **Eye and ear protection MUST be worn at all times** by the operator and anyone in the area.

- **Keep hands away from the cutter at all times**. Turn off the power switch at the top of the router before changing bits or placing your hands near the router.

- **Never wear gloves when operating the Handibot.** Gloves can get caught in rotating parts and pull your hand into the cutter.

- **Never leave the machine running and unattended.** A spinning cutter generates friction, which is a fire hazard. Keep a fire extinguisher in your work area.

- **Take time to learn about and understand this tool before using it.** Do not allow untrained individuals to operate the tool without supervision.

shopbot.dozuki.com

Step 2 — Handibot anatomy
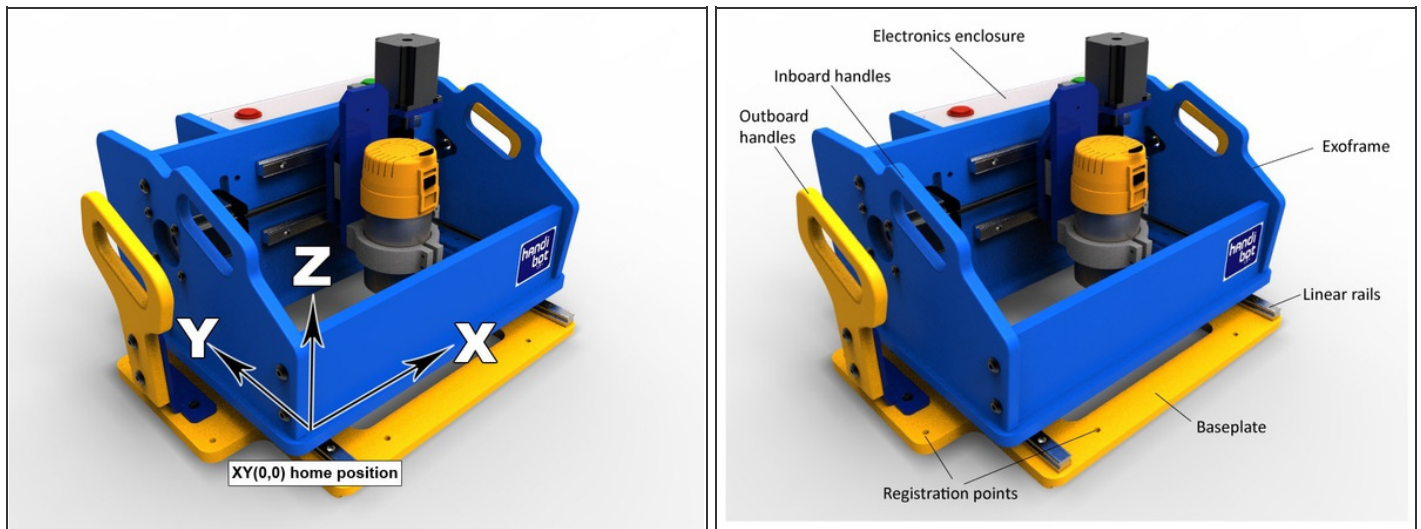
- Take a moment to familiarize yourself with the major components of your Handibot. We will refer to the tool using these terms, so they are helpful to know.
- It is very important to understand the axis orientation of your tool, as well as the location of XY(0,0). This is also referred to as the *home position*. We'll explain this further once you have the software installed and can control the machine using your computer.

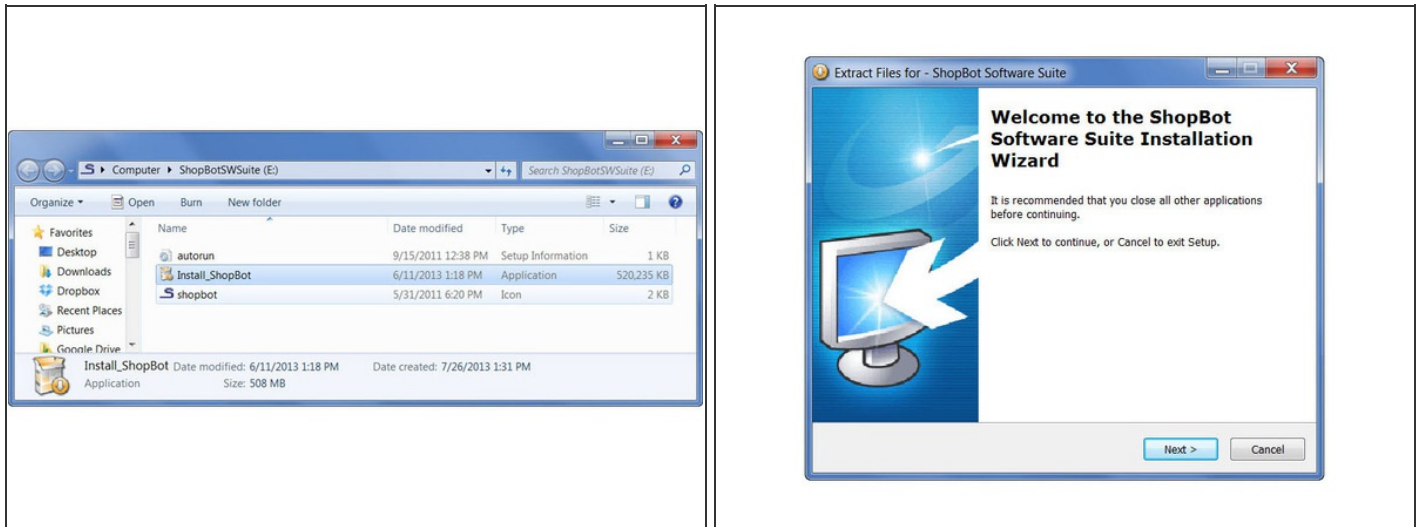## Step 3 — Handibot anatomy (rear)
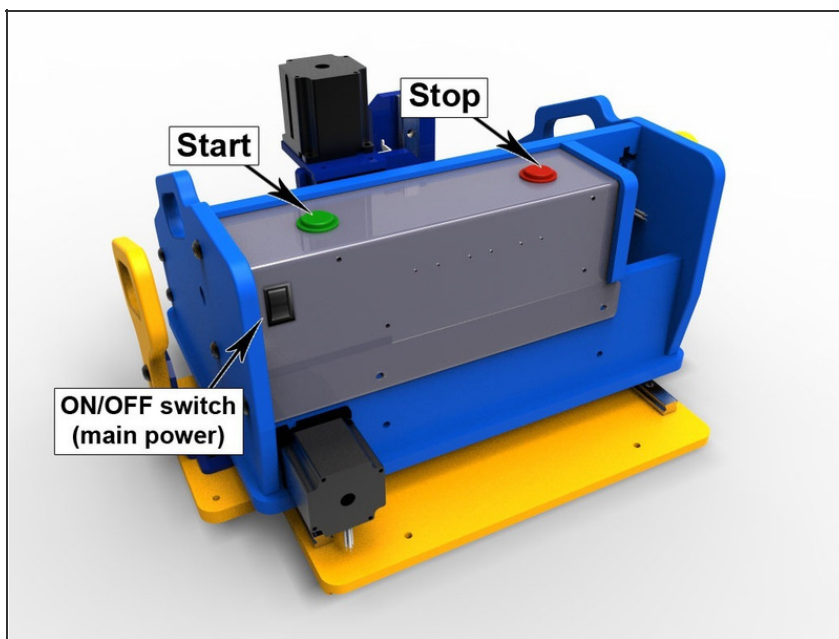
- Take a moment to familiarize yourself with the major components of your Handibot. We will refer to the tool using these terms, so they are helpful to know.

Step 4 — Loading the software

- **Computer requirements:** You'll need a PC running Windows XP Pro or later, with a minimum of 2GB RAM. The HandiBot requires one USB 2.0 port for connection (USB 3.0 is not currently supported).
- USB 3.0 ports can often be identified by looking for a blue outline or SS (SuperSpeed) logo near the port.
- Locate the ShopBot USB drive that came with your HandiBot and plug it into your computer. Alternatively, you should have received an email containing a link to download the software.
- Do not plug the USB cable from your Handibot into your computer until instructed to do so in Step 5.
- Open the *install_shopbot.exe* file
- Follow the on-screen prompts

shopbot.dozuki.com

Step 5 — Software installation - con't.
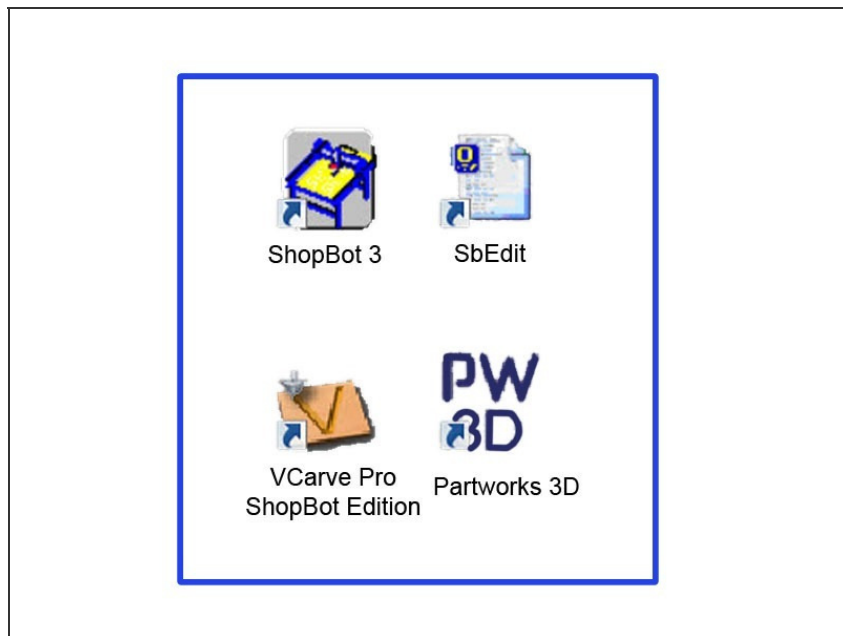
- You should now have these four icons on the desktop of your computer
- ShopBot 3 is the Control Software- the main interface between your computer and the HandiBot.
- ShopBot Editor (SbEdit) allows you to read and directly edit ShopBot part files
- VCarve Pro ShopBot Edition is a 2D CAD/CAM program that enables you to design parts, import vectors, apply toolpaths, and create part files that your Handibot can cut.
- Partworks 3D is a 3D CAM program. It allows you to import a 3D model that was created in another program, and apply toolpaths to create a part file.

Step 6 — Connect to your computer

- Your Handibot runs on 110V / 15A power like any other portable power tool. Simply plug into the wall and you're almost ready to go.

- **However, we do not recommend plugging it into a GFCI** (ground fault circuit interrupter) outlet. These are commonly found in kitchens, bathrooms, garages, and outdoors.

- Plug the Handibot's USB cable into your computer.

Step 7
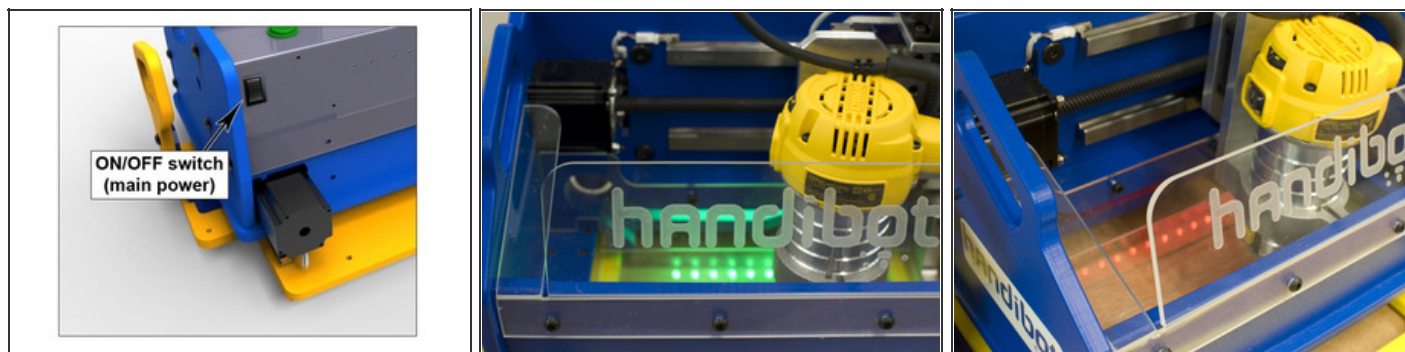
- Turn the Handibot on using the main power switch on the back of the machine. Keep in mind that there is also a power switch on top of the router, which will need to be turned on before you cut anything.

- With the main power switch on, you should see a line of green LED lights inside the work area. This indicates that the Handibot is "ready to work."

- When the motors are moving, you will see a line of rapidly blinking red LEDs. This is a warning light to keep hands and stray objects away from the work area.

- When the router is activated by a part file or in keypad mode, the red LEDs will start blinking slowly.

Step 8 — Launch the software
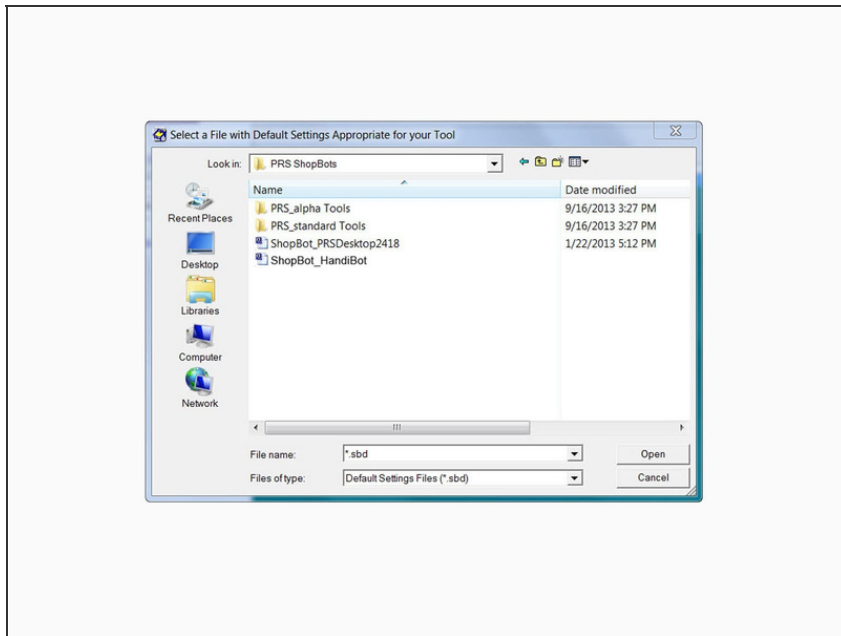
- The latest version of ShopBot control software can always be downloaded for free from the Shopbot website.

- Double-click on the ShopBot 3 icon to launch the ShopBot control software.

- The first time you open the program you will be prompted to load a settings file for the machine. Click OK when prompted, then select **Handibot** and click **Open.**

- This will load all the correct settings for your Handibot.

Step 9
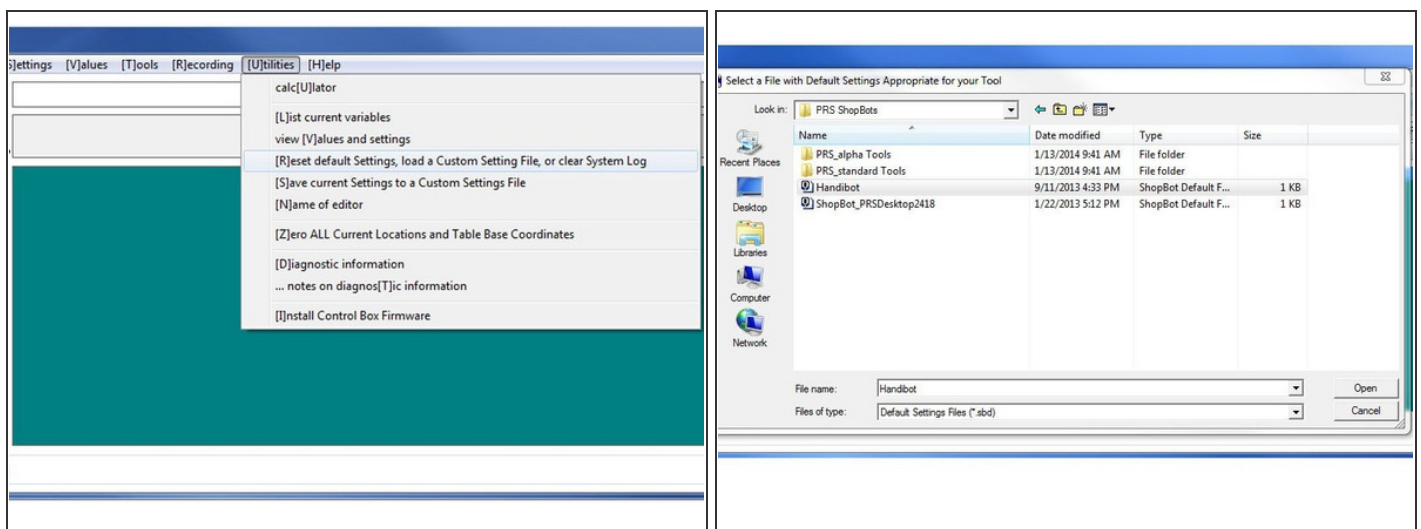
- If you aren't prompted to load your settings file or if you need to reload them in the future, you can do so by navigating to the Utilities drop-down menu and choosing Reset Default Settings.

Step 10 — Calibrate Proximity Switch Offset
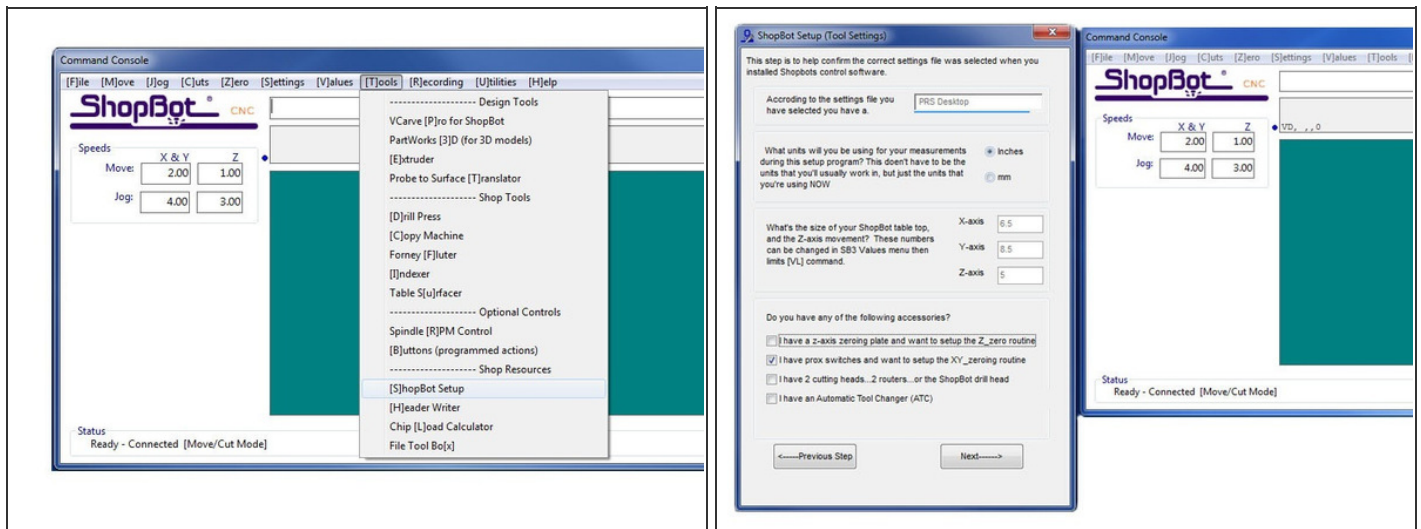
- You are able to set the offset distance between your proximity switch trigger point and home location for the X and Y axes. Making this distance .05" allows you to use your full cutting area.
- Navigate to the Tools drop down menu and select ShopBot Setup.
- When the popup box appears, click next. At the bottom of the next window, check the box next to " I have prox switches..." and uncheck all the others.

Step 11
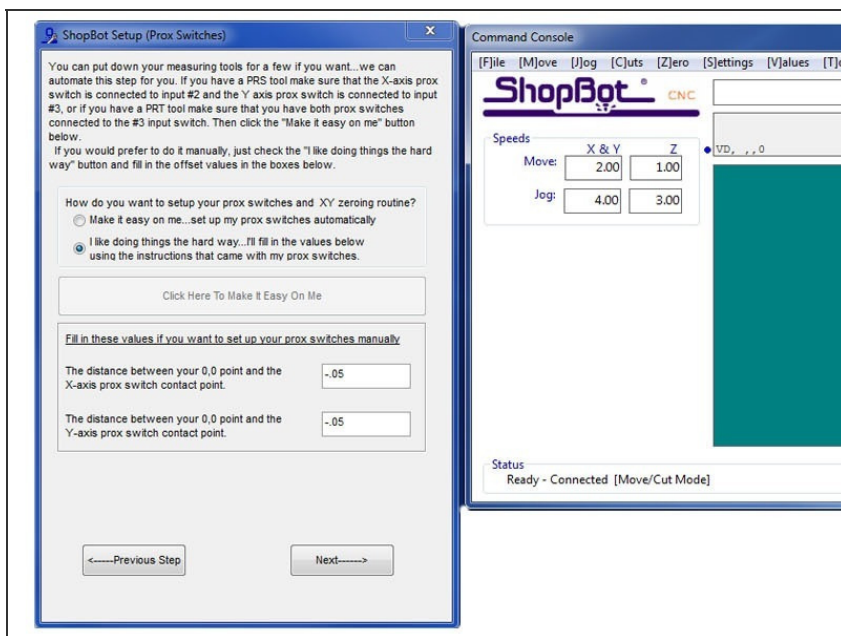
- Select the option "I like doing things the hard way..."
- Toward the bottom of the page, change the values for the X and Y switch offset distances to -.05"
- Click "Next" then on the subsequent screen click "I'm done"

Step 12 — Switch to FULL mode

"Help" button

Switch to Full Mode
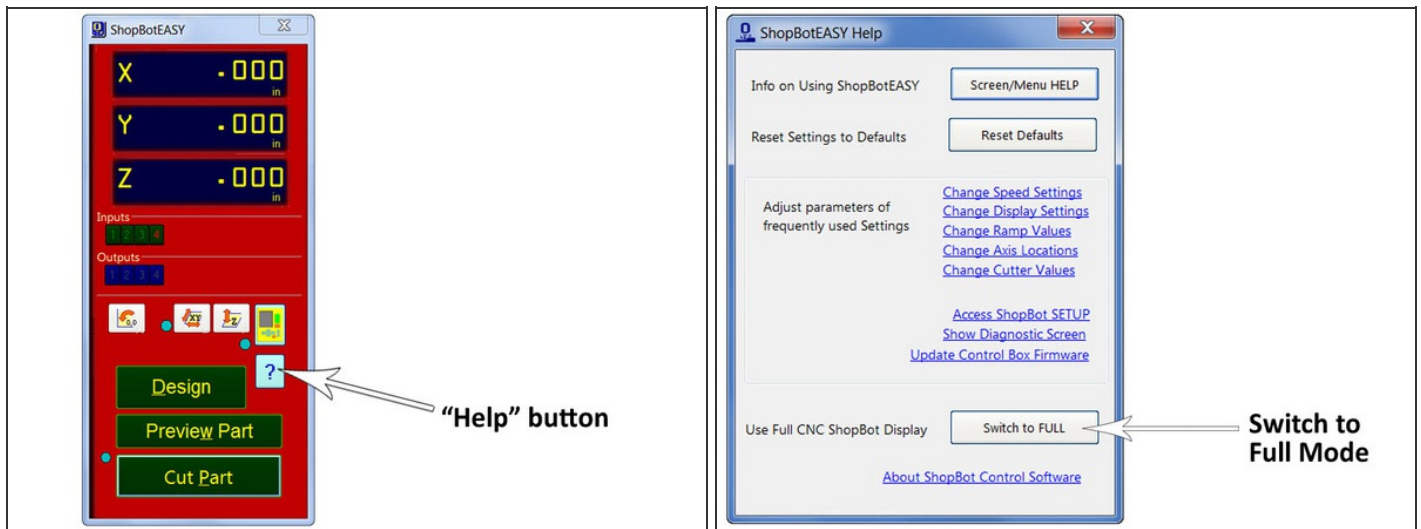
- By default, ShopBot 3 opens up in "Easy Mode." This offers a streamlined interface that makes it easier for beginners to use the software. Full mode can be used to fully explore the functionality of the software for the coming steps.

- Click the blue question mark button shown here, then choose "Switch to FULL."

Step 13
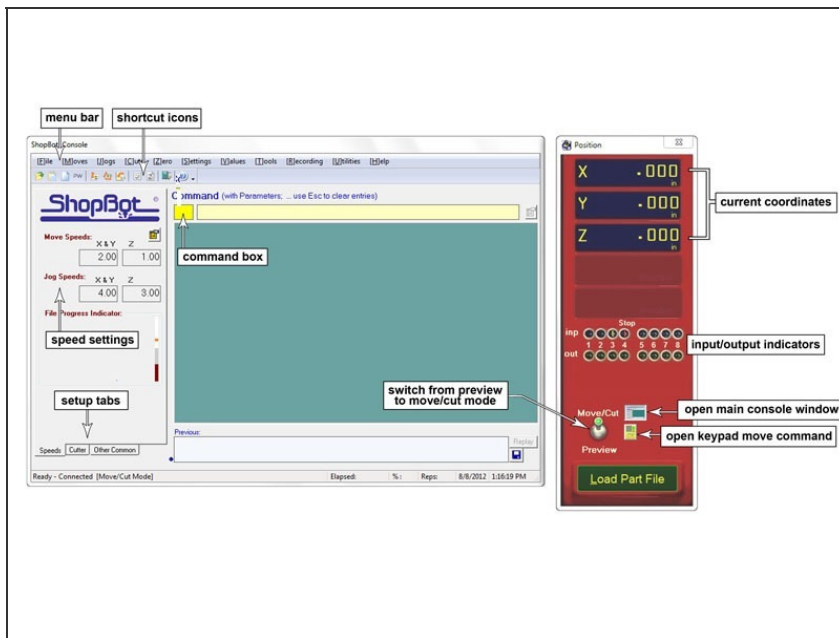
- Once you enter Full Mode, you will see the console window appear. Notice the Menu bar at the top, and the command line below it. You will use the command line frequently to type simple commands and keyboard shortcuts.

Step 14 — Software fundamentals

→	X axis positive (away from zero)
←	X axis negative (towards zero)
↑	Y axis positive
↓	Y axis negative
page up	Z axis up
page down	Z axis down

- The ShopBot Control Panel: this gives you access to essential machine information and controls. Start by clicking on the yellow button shown here. This will bring up the Keypad panel.

- The Keypad panel allows you to manually move the X, Y, and Z axes of your machine. Give it a try. Click the blue buttons to move your machine in each axis.

- These buttons correspond to the arrow keys on your keyboard. You can use either method at any time.

- Close the Keypad by clicking the X in the upper right corner, or hit ESC on your keyboard.

© 2014 shopbot.dozuki.com Page 11 of 15

Step 15 — Insert a router bit

- Before inserting or changing a router bit, turn off the power switch at the top of the router. ⚠

- Use the Keypad to move the router to the center of the work area so you can reach the yellow spindle lock button. Carefully move the Z down so that the base of the router is just above the clear dust shield

- Flip the Handibot over so that the base plate is facing you.

- You may need to loosen the collet nut before inserting a bit. Hold down the spindle lock (the yellow button shown here) and use the included collet wrench to loosen the nut.

- If inserting a V-bit, slide the bit all the way into the collet, then pull it back so that about 1/2" of the shank is exposed. If inserting an end mill bit, insert just until the machining for the cutting edges starts.

- Hold down the spindle lock button and tighten the collet nut.

- Use the Keypad to move the router bit up above the base plate before flipping the Handibot back onto its base.

Step 16 — Zero the Z axis

Hold cardstock under router bit
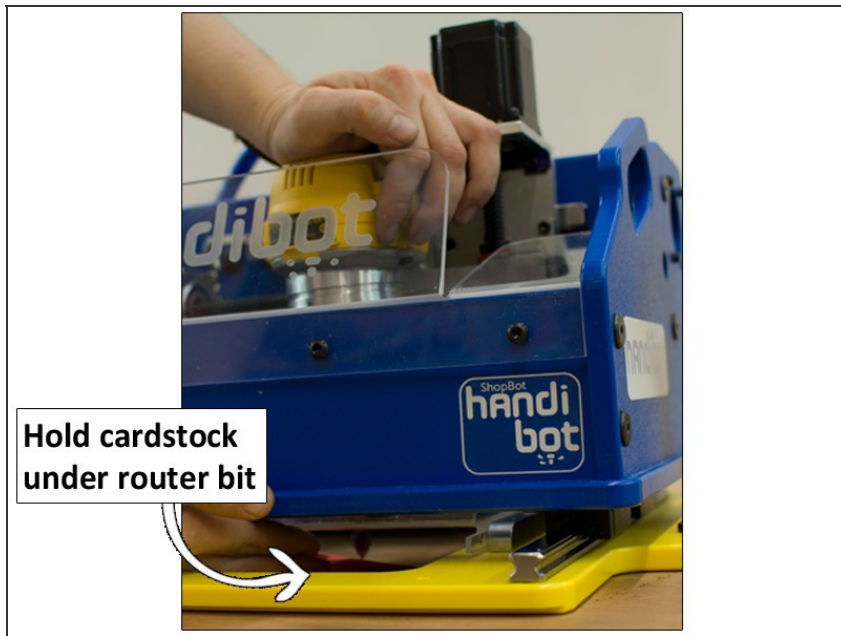
- For safety, you should turn your router's power switch OFF.

- Position the Handibot on the material that you will be cutting. Use the Keypad to move the router bit (X and Y axes) towards the center of the work area. Place a piece of cardstock (like a business card) under the router bit.

- Use the Keypad to move the Z down just until the tip of the bit touches the cardstock. When you get close, you can click on the "fixed" button on the Keypad to move the Z in small increments. With your other hand, move the cardstock back and forth until you can feel the router bit "catch" the cardstock. Stop here.

- Click on the blue Zero button on the Keypad and check that you wish to Zero the Z axis. Click OK. OR, close out of Keypad and use ZZ from the menu.

- Remember to turn on the power to the router before you start cutting.

Step 17 — Zero the X and Y axes
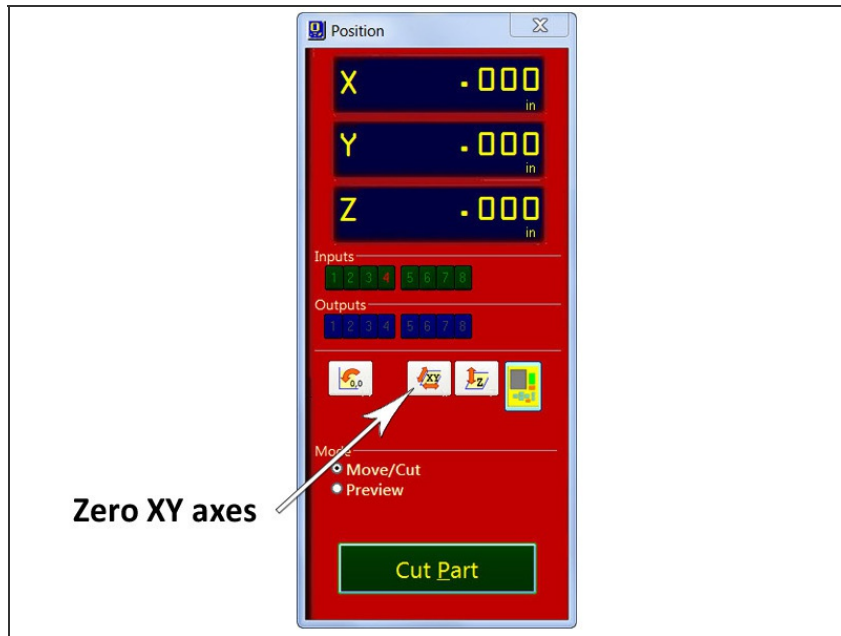
Zero XY axes

- Click the "Zero XY axes" button shown here (you can also type a **C3** command from your keyboard).
- The tool will touch off each proximity switch twice before coming to rest at XY(0,0).
- You should perform this step each time your turn your Handibot on to ensure accurate cuts.
- If you wish to check that you have full travel in the X and Y axes before you try cutting a file, use the Cut Rectangle (CR) command in the ShopBot Menu. Enter a value of 6 for the X axis and 8 for the Y axis, and Start the file. If you do not hear the motors stalling in either axes, move on to the next step.
- If you do hear the motors stalling, you may have to do a one-time set up to change the offset from the proximity switches. See step 10.

Step 18 — Ready to cut

- For light jobs (shallow engraving, etc), the weight of the Handibot is enough to keep it from shifting.

- For deeper cuts, you will either need to clamp the Handibot to the material or hold it using the outboard handles.

- Make sure that the router's power switch is on.

- With the X/Y and Z axes zeroed, you are ready to load a cut file. On the top menu bar, click on File > Load Part File (or type an **FP** command from your keyboard). Follow the on-screen prompts, and your Handibot will begin cutting.

This document was last generated on 2014-02-10 12:19:06 PM.

menu bar **shortcut icons**

ShopBot Console

[F]ile [M]oves [J]ogs [C]ut [Z]ero [S]ettings [V]alues [T]ools [R]ecording [U]tilities [H]elp

ShopBot ®

Command (with Parameters; ... use Esc to clear entries)

command box

Move Speeds:
X & Y   Z
2.00   1.00

Jog Speeds:
X & Y   Z
4.00   3.00

File Progress Indicator:

speed settings

setup tabs

**switch from preview
to move/cut mode**

Speeds Cutter Other Common

Previous: Replay

Ready - Connected [Move/Cut Mode]   Elapsed: % :   Reps: 8/8/2012 1:16:19 PM

Position

X .000 in

Y .000 in   **current coordinates**

Z .000 in

Stop
inp 1 2 3 4 5 6 7 8   **input/output indicators**
out 1 2 3 4 5 6 7 8

Move/Cut   **open main console window**

open keypad move command

Preview

Load Part File

Spindle Control

open RPM control settings   RPM PreView   **current RPM**

SHOPBOT SCREEN REFERENCE CHART FOR VERSION 3.6.44 (UPDATED 08/2012)

Selecting the right bit for your project

Bit material: Router bits are made from a variety of materials. The most common are solid carbide, carbide-tipped steel, and high-speed steel. Both solid carbide and carbide-tipped are good choices.   We do not recommend using high-speed steel bits as they dull quickly and must be re-sharpened.

Flute type: There are four basic flute types: Straight, spiral up-cut, spiral down-cut, and compression. Each type has its own advantages and disadvantages, which are outlined in the chart below.

Straight flute   Spiral up-cut   Spiral down-cut   Compression
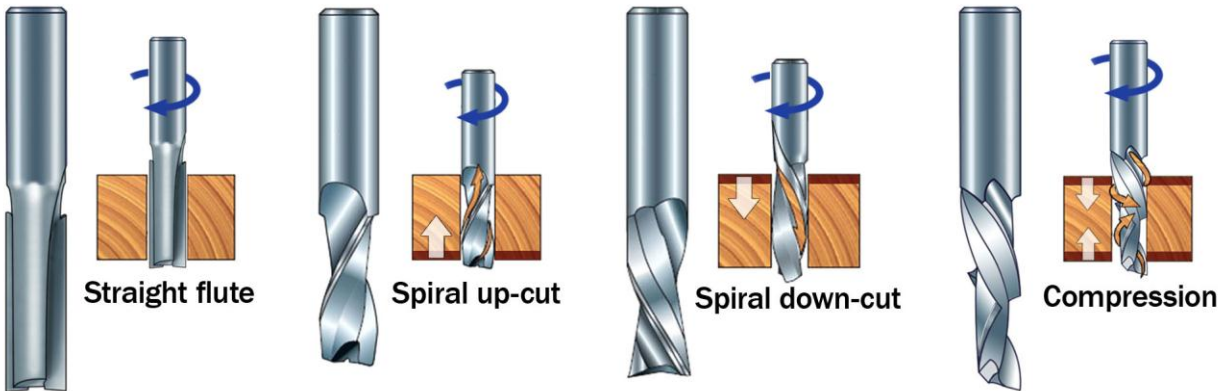
|			
Good edge quality on most materials	May chip or fray top face, good quality on bottom face when through-cutting	Best edge quality on top face, may chip or fray bottom face when through-cutting	Clean edge on both top and bottom face
Moderate chip clearing abilities	Excels at clearing chips and dissipating heat, especially with "o-flute" bits	May compact chips in a groove	Designed to cut veneered or laminated materials at full depth in one pass
	Upwards force may cause part lifting	Downwards force may help with cutting thin sheets	
Ideal for: general-purpose cutting	Ideal for: plastics, aluminum, or any material where heat buildup is a concern	Ideal for: plywood and laminates (pocketing)	Ideal for: plywood and laminates (profile cutting)

What's the difference between a square-end bit and an end mill?

An **end mill** has cutting flutes that extend across the bottom (end) of the bit. It is designed for plunge-cutting as well as lateral cutting.

"**Square-end**" is simply a description of end shape. Square-end bits are not always end mills, and end mills do not always have square ends.

The first image below shows a true end mill, and the second shows a straight-fluted, square-end bit that is **not** an end mill. A ramp-in must be applied to a toolpath when using this type of bit.
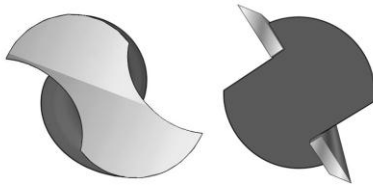
Number of flutes: The number of flutes on a bit is essential to calculating proper feed and speed rates. For most applications you can use a bit with 1, 2, or 3 flutes, but you must adjust your reed rates and RPM accordingly to maintain proper chip load.

End shape: Straight and up-spiral bits come in a variety of end shapes**. Square ends** are most common, and are a good choice for creating pockets and grooves, profile cutting, simple lettering, and drilling operations. **Ball (or rounded) ends** are best for 3D carving. **V-carve** bits are often used to create complex letters for sign making. They can also be used to chamfer edges and create countersinks for screw holes.

Calculating feeds/speed with Chip Load:

Chip load refers to the actual thickness of the chip cut by each revolution of the cutter. It is the measurement that all feed/speed calculations are based on.

A spinning bit generates friction and heat as it moves through the material, and part of this heat is pulled away by the flying chips. A larger chip load pulls away more heat, but also puts more stress on the cutter. Each material has its own ideal chip load range that balances heat dissipation with cutter stress.

A basic chart for common materials is available in the SB3 software. Click on Tools > Chip Load Calculator, then click on Chip Load Help. You can use this chart along with the Chip Load Calculator to determine a good starting speed for each toolpath. More detailed chip load charts are available online at Onsrud's website (www.onsrud.com).

When calculating feeds/speeds for a toolpath, **do not rely on the defaults in your tool database**. Those values are only placeholders and are not intended for any particular material.

Holding down material for cutting

Choosing the right hold-down method for your project can be challenging, but it is an important part of project planning. Not only does the work piece need to be held securely, but you need to be aware of what will happen to parts as they are cut from the surrounding material. Small parts can be caught by the cutter and thrown across the room, causing serious injury or damage.

The following information is a brief overview of different methods to help you get started.

Screws

If you have a spoilboard set up, you can screw the workpiece directly to the table. This is a quick and easy method that works well for most materials. However, this requires careful planning to make sure that all the screws are clear of the cut path.

With larger jobs you may want to create a hold down toolpath based on the location of other toolpaths in the file. This will create clearance holes for the screws in locations that you know are safe. When using an end mill for drilling, there is very little lateral force on the piece so less holding power is needed. One clamp on each end of the material is enough.
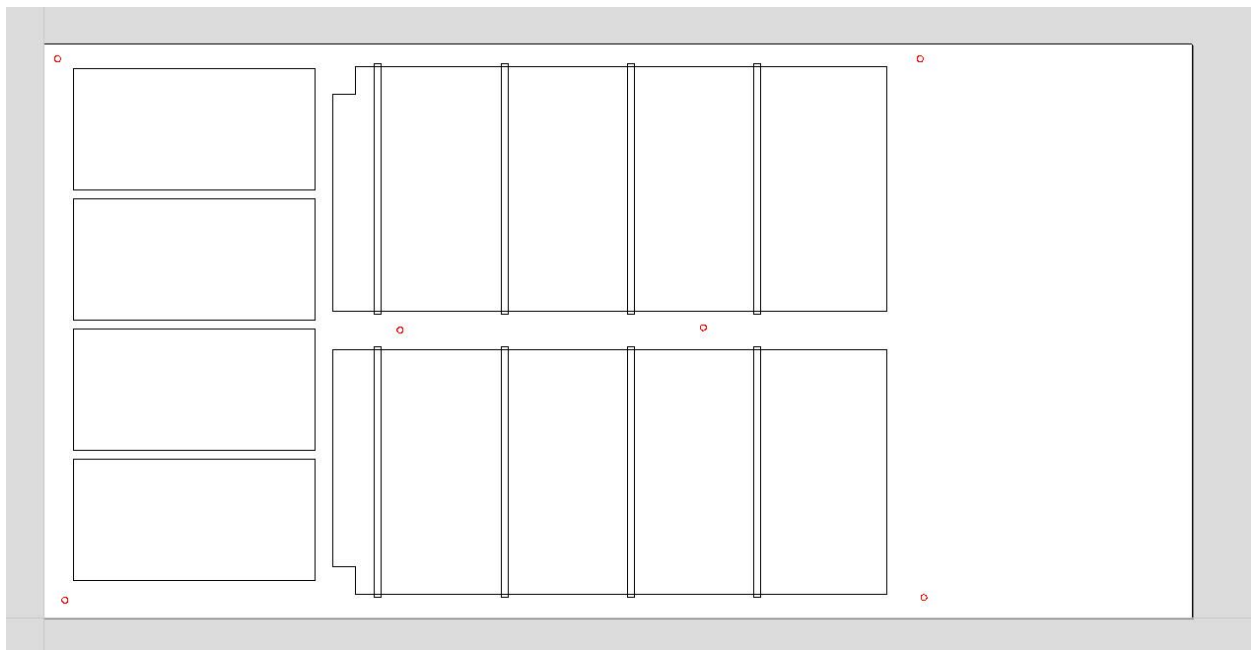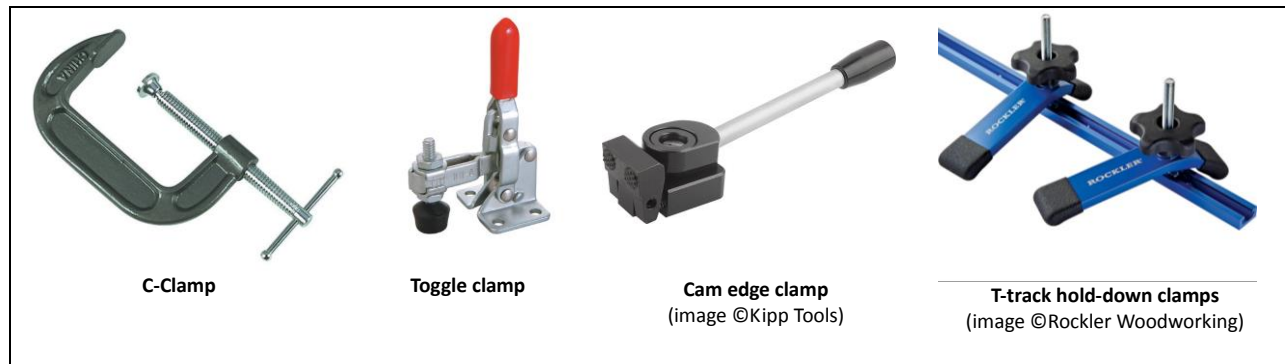

Shown here: In our CAD/CAM software, we used the circle vector tool to place several hole locations around the parts. The drilling toolpath is saved as a separate part file so it can be run first. Then the material is screwed down through these holes, and the main cut file can be run safely.
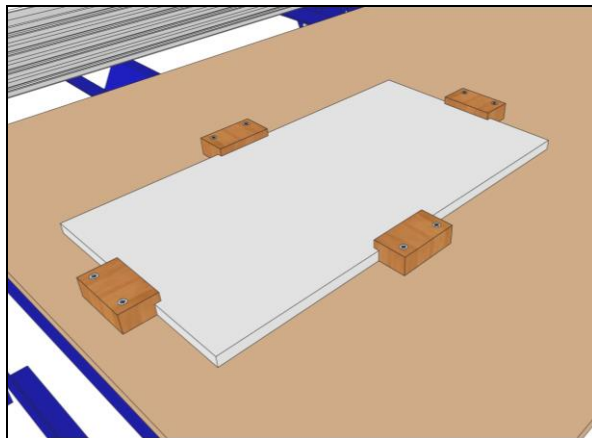
T-track tables and rails

The Shopbot Buddy and Desktop Tools have an aluminum table base that is ideal for setting up moveable clamps and fixtures. On full-size machines, you can set up your own system using T-track rails (available from woodworking supply stores), inlaid into the MDF deck. If you use this method, be sure that the rails sit low enough below the surface that they are out of the way when through-cutting.

Clamps

Whether you are working with a metal T-track table or a spoilboard, there are a variety of clamps that you can use to secure your material. Clamps offer strong holding power and are ideal when you do not have excess material to drive screws into. However, they require careful planning to avoid running the tool into the clamps.

| **C-Clamp** | **Toggle clamp** | **Cam edge clamp**
(image ©Kipp Tools) | **T-track hold-down clamps**
(image ©Rockler Woodworking) |

You can also create clamps using scraps of wood. Here are two examples:

A block of wood with a *rabbet* (groove on one side) can be used on each side. The rabbet height should be slightly less than the material height, allowing it to pull down tightly when screwed in place.
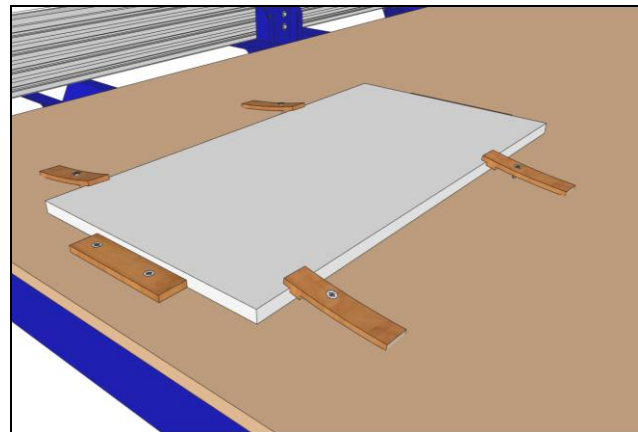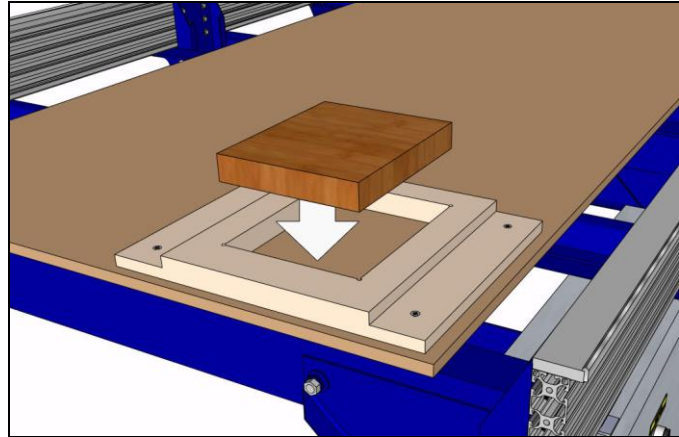
A thin, slightly flexible strip of wood can be used on varying material thicknesses. Glue a smaller strip across it, which will butt against the material to prevent slipping.
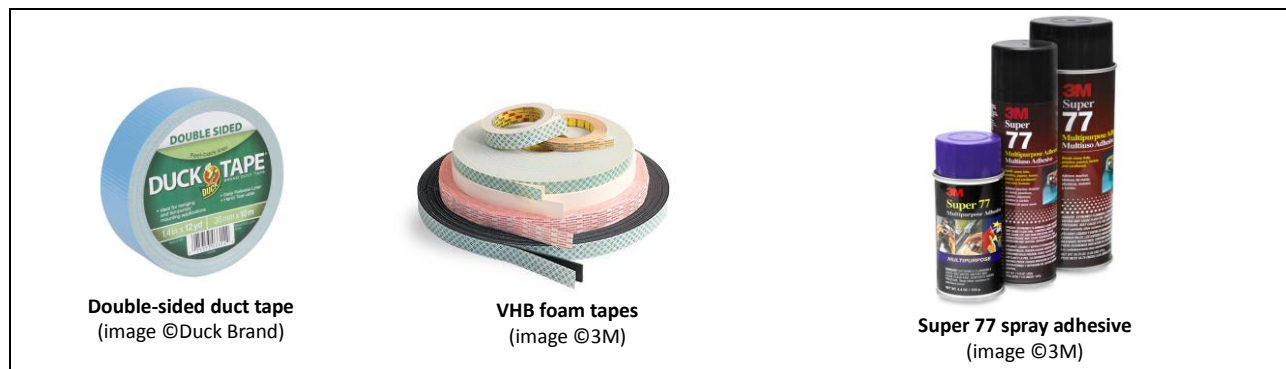
Press-fit jigs

A tight press-fit jig provides good holding power and can be made quickly and accurately using your Shopbot.

This is a good solution for holding small work pieces, extra-thick stock, or if the material has already been cut to its final size and there is no room for screws.

Shown here: two pieces of MDF have been glued together and pocketed out to hold this piece of hardwood. The jig is screwed to the table, then the workpiece is pressed in.

Adhesives

Double-sided duct tape
(image ©Duck Brand)

VHB foam tapes
(image ©3M)

Super 77 spray adhesive
(image ©3M)

Adhesives can be more difficult to work with, but they offer some advantages over other methods. This can work well for thin materials that cannot be held by a press-fit jig. More surface area = more holding power, so small projects will require additional hold-downs.

To use tape adhesive, both the table and work piece must be clean, flat, and dust-free. If you plan to cut all the way through the material, keep the tape away from the planned toolpath if possible (it may gum up the cutter, reducing cut quality for the rest of the part).

For spray adhesive, we recommend a 3M product called Super 77 which forms an extremely strong bond within minutes. To avoid damaging your table, bond the workpiece to a scrap board that is clean and flat, then clamp or screw this board to your table. Some people prefer to glue a layer of paper between the workpiece and support board. This can weaken the bond, but it makes removal easier.   Try both methods on some scrap so that you can compare for yourself.

Vacuum hold-down systems

A well-sealed vacuum system can be one of the most convenient and effective hold-down methods. It is ideal for repetitive cutting of plywood and other large sheet materials.

Shopbot offers several kits for full-table vacuum systems on our Gantry tools. For other models (or small projects) it is possible to build your own. This document is only meant as an introduction to hold-down systems, so we won't get into the details of that here. There are many resources online for both commercially available and DIY vacuum systems. A google search for "CNC vacuum hold-down" will get you started.
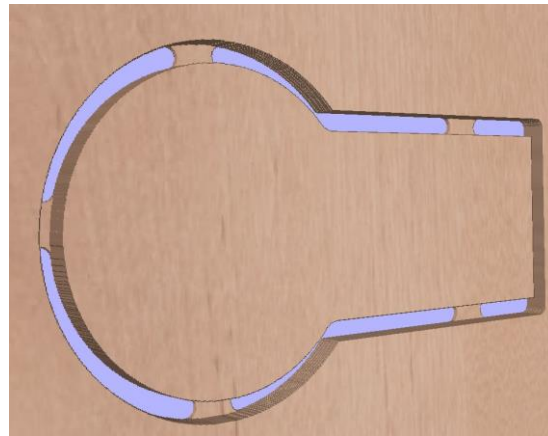
Holding small parts within the material

Once you secure your material, you still need to consider what will happen to parts as you cut them out. Large parts may shift as they are cut free, leading to a small gouge or notch along the edge. Smaller parts can be destroyed or thrown by the cutter.

There are two ways that you can handle this from within the software. The first option is to create tabs, or leftover "bridges" of material between the part and its surrounding area. Most CAM programs will have an automated feature for this. The feature for Partworks/ V-Carve Pro / Aspire is shown here.
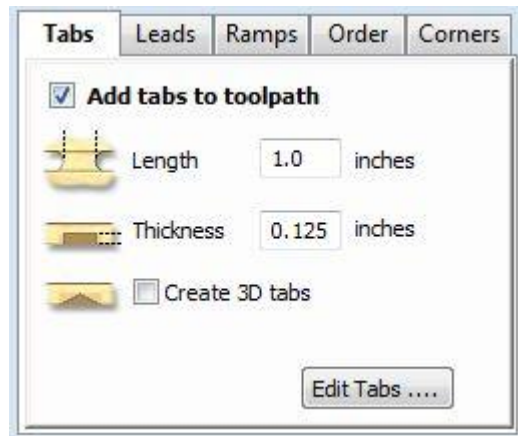
| Adding tabs in V-Carve Pro | Example of tabs on a part |

A second option is to leave an "onion skin," or very thin layer of material at the bottom of a profile cut. Just set the final cut depth at slightly less than the thickness of your material (typically .010" - .030", depending on material and size). The advantage is that the onion skin provides better hold and can be easier to trim/sand away than a series of thick tabs. However, if there is a lot of variance in the thickness of your material, or if your table is not flat, then you may end up cutting too deep or too shallow and this method will not work correctly.