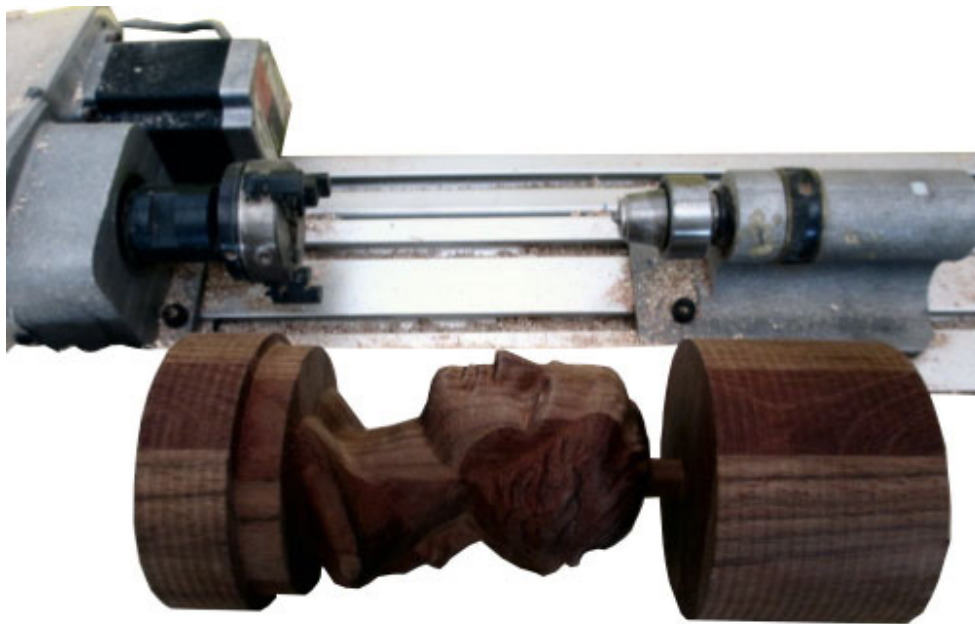


Setting Up a Wrapping File for the ShopBot Rotary Indexer



Introduction to the Rotary Indexer:

A “regular” ShopBot file runs in three axes: X, Y and Z

- All three axes are linear, and their units are inches or mm
- The code for a “regular” ShopBot file is a series of commands:
- The first letter is usually a Move (M) or Jog (J) command, followed by the axis or number of axes to move.
- An M3 command is followed by the values of the location to move to. The order of the values of the locations is ALWAYS
 - X location
 - Y location
 - Z location
- A comma delineates the value of one location from the next

Therefore, a “regular” .sbp file will include something like:

```
JZ,0.800000
J2,0.000000,0.000000
J3,5.231410,0.382730,0.200000
M3,5.231410,0.382730,-0.125000
M3,0.136795,0.382730,-0.125000
```

A rotary file also runs in three axes, but one of the linear axes (the X or the Y) is replaced with a rotary axis

- The units are not inches/mm, but degrees of rotation
- 360 degrees = one full rotation of the rotary axis
- In a ShopBot with a Rotary Indexer, the Rotary indexer is assigned to the B-axis
- Even though there are only three axes coordinating with each other, the commands will be M5 or J5 commands
- The order of the values for the location to move to will ALWAYS be
 - X location
 - Y location
 - Z location
 - A location
 - B location
- In the .sbp files, some of the values will be blank, but there will still be commas delineating the values of one location to from the next

A rotary .sbp file will include something like:

```
M5,,0.000000,0.250000,,0.000000
M5,,48.000000,0.250000,,0.000000
M5,,48.000000,0.250000,,2.080925
M5,,0.000000,0.250000,,2.080925
M5,,0.000000,0.250000,,4.161850
M5,,48.000000,0.250000,,4.161850
```

In this file, the X value (linear) is blank (nothing between the commas), the Y and Z values are linear, the A value is blank, and the B value is the degrees of rotation of the Rotary Axis.

The following documentation goes through the steps to successfully design and execute a file for the Rotary Indexer. Before tackling an intricate file like above, it is important to understand how a simple smoothing file works.

Set up the Rotary Indexer:

- Decide how the Rotary Indexer will be aligned on the ShopBot
 - Along the X-axis (parallel to the X)
 - Along the Y-axis (parallel to the Y)
- Make sure the motor cable for the Rotary Indexer is plugged into the correct driver in the control box.

WARNING: ALWAYS turn off the Control Box before plugging in and unplugging motor cables to the drivers.

Set up the ShopBot Control software for Rotary Indexing instead of for 3-axis Machining

- Change the Value of the Display from 3-axes to 5-axes

Load the Post Processors for Rotary Indexing into the CAD/CAM software

- Find the correct Post Processors in SBParts and load them into VCarve Pro or Aspire

Set up for an individual file BEFORE opening the CAD software

- Decide how long the blank will be, and how much of the blank will be machined
- Measure the diameter of the blank at the thickest point, and determine how much of that material will be removed
- Think about whether to Zero the Z at the surface of the blank (top) or at the rotational center of the blank (bottom)

Create a smoothing file In the CAD/CAM software (V Carve Pro or Aspire)

- Set up the job for indexing instead of 3-axis machining (Gadgets)
- Create the Wrapped Toolpath (Gadgets)
- Export the file for a Rotary Indexer instead of 3-axis machining (Post Processor)

Zero the active Axes to reflect other CAD files

- Zero the active linear axis (X or Y) at the end of the blank or in the middle (side to side) of the blank
- Zero the inactive linear axis (X or Y)
- Zero the Z-axis
 - at the surface of the blank, or
 - at the rotational center of the blank
- Zero the B-axis (Rotational) in the ShopBot software (ZB)

Setting up the Rotary Indexer:

Decide which way the Rotary Indexer will be aligned on the ShopBot

- Along the X-axis (parallel to the X)
- Along the Y-axis (parallel to the Y)

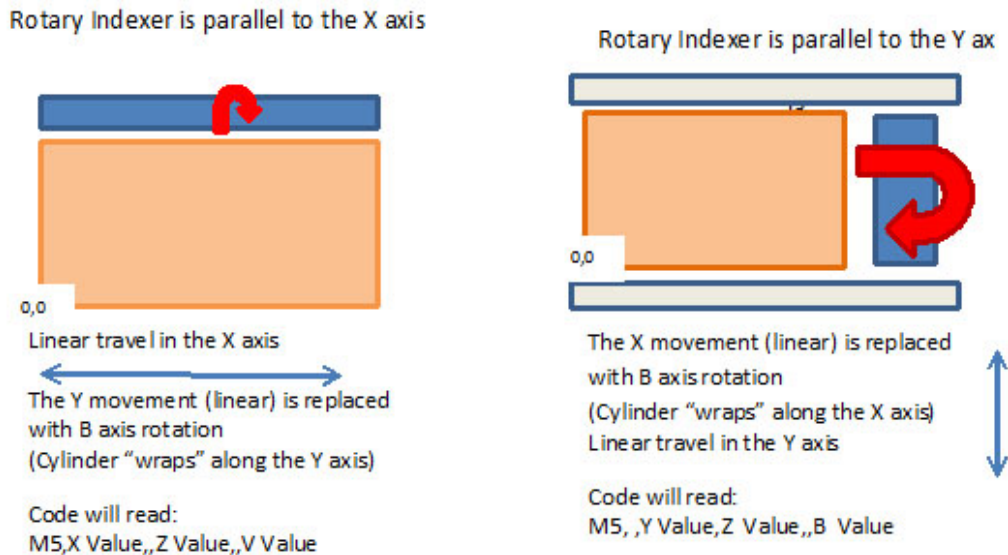
The correct decision is determined by the physical layout. This document does not include how to mount the indexer.

Make sure the motor cable for the Rotary Indexer is plugged into the correct driver in the control box.

WARNING: ALWAYS turn off the power to the Control Box before plugging in and unplugging motor cables into the drivers.

If a separate “driver” is not available in the control box for the Rotary Indexer motor cable, check the installation documentation or contact ShopBot support for instructions on how to swap control box motor cables from a linear drive to the Rotary Indexer.

If unsure as to which axis the Indexer is parallel to, use the keypad control (K) to move the ShopBot in the X-axis and the Y-axis. The axis that moves along the length of the Rotary Indexer is the one that it is parallel to, and the axis that moves across the short side of the Rotary Indexer will be replaced with B-axis rotation. See visuals below.



Setting up the ShopBot Control software for Rotary Indexing instead of for 3-axis Machining

- Change the Value of the Display from 3-axes to 5-axes



- In Keypad Control (K), move the ShopBot around using the Arrow Keys on the Keypad or the keyboard.

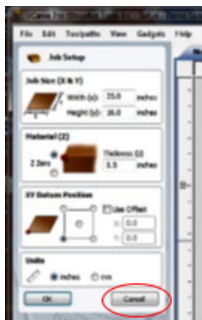
- The Move (or Jog) command plus the axis (axes) will move to the location entered.
- Zero the axes at the current location of the bit by using the Zero command from the toolbar, or the Zero button on the Keypad Control.
- In Keypad Control (K), Rotary Axis can be moved by holding down the Shift Key while using the PageUp/Page Down keys on the keyboard or the Z axis arrow keys on the KeyPad.
- The Move (or Jog) B command will rotate the Rotary Indexer the number of degrees entered.
- 360 degrees = 1 complete rotation. If the actual rotation differs from that expected, the Unit Values for the system are incorrect. Contact ShopBot if the correct unit values are not available.
- The ZB command will Zero the Rotary Indexer in its current location.

Loading the Post Processors for Rotary Indexing into the CAD/CAM software

- The PostProcessors (also called the Posts) for Rotary Indexing are found in the folder C: SB-Parts>PartWorksPosts>PartWorksPosts_Archive*
 - ShopBot_Indexer_X_Inch.pp
 - ShopBot_Indexer_Y_Inch.pp
- These two posts should be copied into the CAD/CAM software.
 - The easiest way to find the location to copy them to is to open the CAD/CAM software .
 - Under File, click on Open Application File Data.
 - Copy the two Indexer Posts into the PostP folder.
 - Close the CAD/CAM software to allow the Posts to be added to the list of posts.

*VCarve Pro ShopBot edition was called PartWorks before recent upgrades. Same software, different name.

Setting up for a smoothing file in VCarve Pro or Aspire

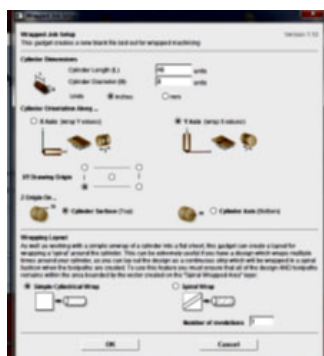


Open up the VCarve Pro or Aspire CAD/CAM software

- Choose: Create a new file
- At the Job SetUp Screen
- Choose Cancel

When the Opening Screen returns

- Click on Gadgets
- Choose Wrapped Job Setup



A screen will appear that looks like the example to the left.

The examples below explain each of the next areas to set up.

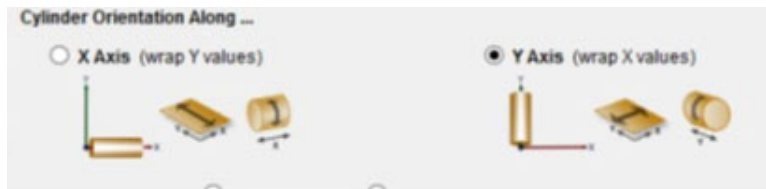
Setting the size of the FINISHED Cylinder



- Enter the length of your blank to be rounded.
 - This value may be less than the total length of the blank or log chucked into the rotary indexer.
 - For example, if chucking a 48” log into the rotary indexer, leave an inch at each end to keep the log attached and/or avoid machining the indexer parts themselves - enter 46” in this box.
- In the Cylinder Diameter box, enter the size of the FINISHED diameter of the blank. If starting with a rough log 6” in diameter at the widest point and 5” in diameter at its narrowest, enter 5 in this box.
- Units: inches or mm.

Setting up Cylinder Orientation

The way the indexer is set up determines which axis is “wrapped”.



Rotary Indexer is parallel to the X axis

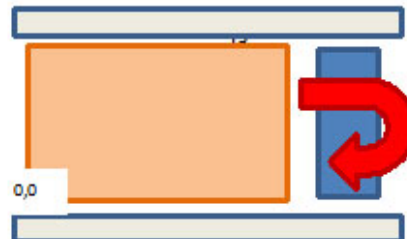


0,0
 Linear travel in the X axis

 The Y movement (linear) is replaced with B axis rotation
 (Cylinder “wraps” along the Y axis)

Code will read:
 M5,X Value,,Z Value,,V Value

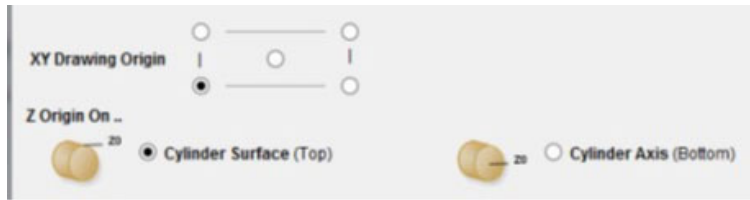
Rotary Indexer is parallel to the Y axis



The X movement (linear) is replaced with B axis rotation
 (Cylinder “wraps” along the X axis)
 Linear travel in the Y axis

Code will read:
 M5,,Y Value,Z Value,,B Value

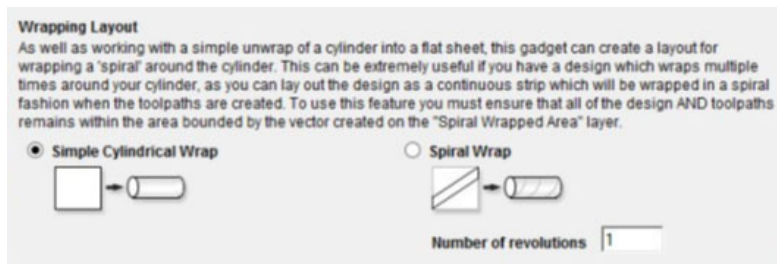
Setting up the Origins of the X,Y and the Z



- Set up XY origin.
 - Remember to set up the ShopBot the same way as setting this design file.
 - If setting the XY drawing origin to one of the corners, zero the bit towards one end of the cylinder being machined.
 - If setting the XY drawing origin to the middle, zero the bit at the middle (side to side) of the cylinder.
- Set the origin (0) of the Z to either the surface of the cylinder or the axis of the cylinder.
 - For unfinished logs with diameters that vary across the length of the log, set the surface to the top of the log (if air cutting during some of the passes, this will avoid plunging the bit too deeply in a single pass and breaking the bit).
 - When setting up the ShopBot, zero the Z at the thickest diameter of the log.

Determine the Wrapping Layout

- Just go with the Simple Cylindrical Wrap to practice.

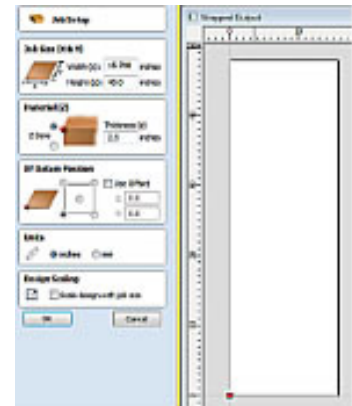


- Click on OK to open the Virtual Representation of the Wrapping Job.

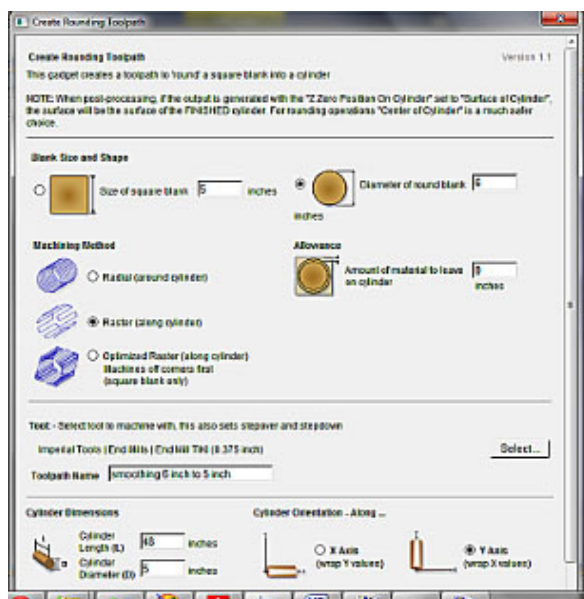
The Virtual Representation of the Rotary File will not be displayed in the round

Rather, the Display will show:

- The circumference of the rotary axis (in this example, $X = 5''$ diameter x $3.1415 = 15.708$).
- The true length of the linear axis (in this example, $Y = 48''$).
- This image shows the Job Setup screen open.
- To open the Job Setup screen, go to Edit>Job Size and Position or click on the icon under File Operations. Cancel to close the Job Setup Screen without making any changes.



Creating a Rounding Toolpath

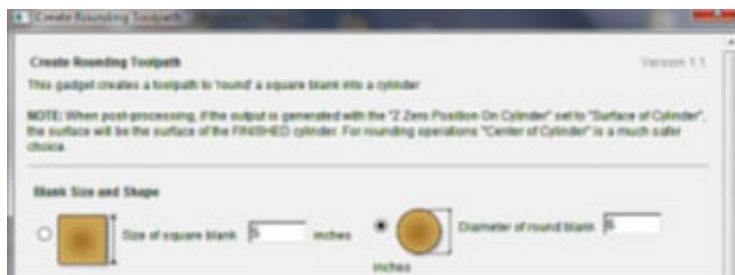


- From the Menu, click on Gadgets.
- Open Wrapping>Create a Rounding Toolpath to get the screen on left.
- Fill in each of the boxes as required. An example of each section follows.

Determine the shape of the blank (square or round) and the size of the blank BEFORE IT HAS BEEN MACHINED

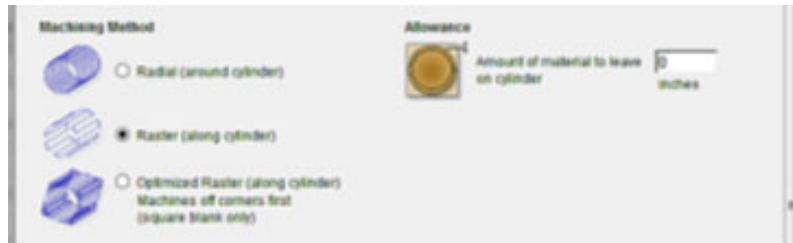
Remember: The finished size of the blank was entered on the Wrapped Job Setup screen.

- This is where the diameter of the raw blank before machining is entered.



Determine how the blank will be machined

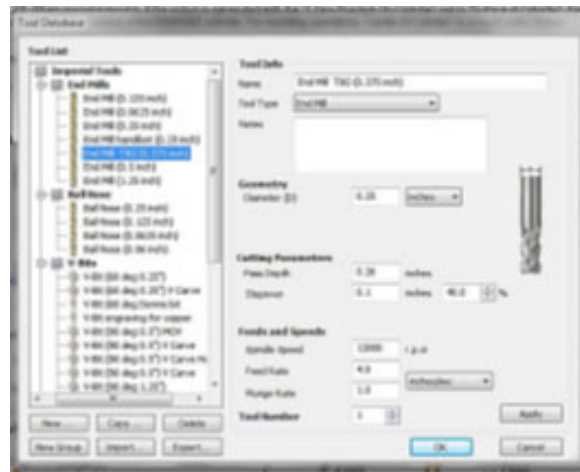
- When smoothing a log that is of uneven dimensions, a raster strategy might be the best technique. Even if aircutting a section of some of the passes, there will be less chance of breaking a bit by plunging too deep in a single pass.



Select the bit and Name the toolpath



- Click on the Select button to open up the Tool Library.
- The Tool Library is where all the characteristics of the bit, including the diameter and shape of bit, the stepover and stepdown, feed rate, etc., is entered.



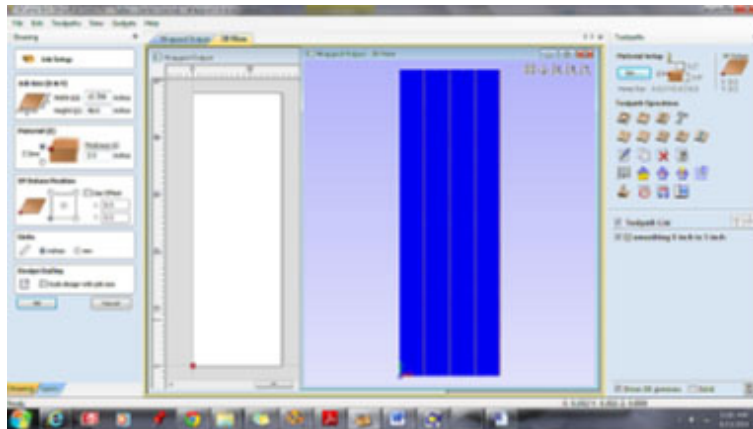
- The name entered in the box will show up in the Toolpath list.

Information brought in from the Wrapped Job Setup

Click OK:

- Nothing will change on the 2D Screen displaying the Virtual Representation of the material.
- However, when opening the Toolpath Tab, the name of the toolpath will be listed.
- The 3D view will show the direction of the raster, along the length or the circumference.

Recap

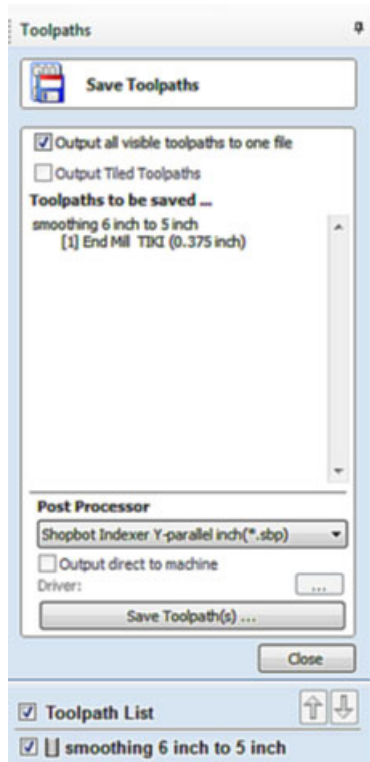


- On the CAD or Drawing side of the screen (left), the Job Setup Screen shows the job as if it were a linear (flat) job, even though it will be machined in the round.
 - The Width (x) is the circumference of the finished diameter (5" x 3.1415).
 - The Height (y) is the total length (linear) of the blank to be machined.
 - The Z is zeroed at the top of the blank.
 - The thickness is the radius of the size of the blank at the widest point (5"/2).
 - The XY Origin is at one side of the blank (the end closest to 0 in the Y).
 - The job is in inches.
- The 2D screen (open behind the 3D screen) shows the Wrapped Output as if it were a linear design (to be able to see both the 2D and 3D screens at the same time, go to View>Tile Windows Vertical).
- The 3D screen shows the toolpath as if it were a linear design. The tool will travel the length of the Y-axis, take one step along the X (one unit of rotation in the B), and travel back along the Y.
- The toolpath named in the Create Rounding Toolpath screen shows up in the list of Toolpaths on the Toolpathing or CAM (right) side of the software.
- Simulating the toolpath will show it as a flat machining.

Creating the toolpaths for the Rotary Indexer



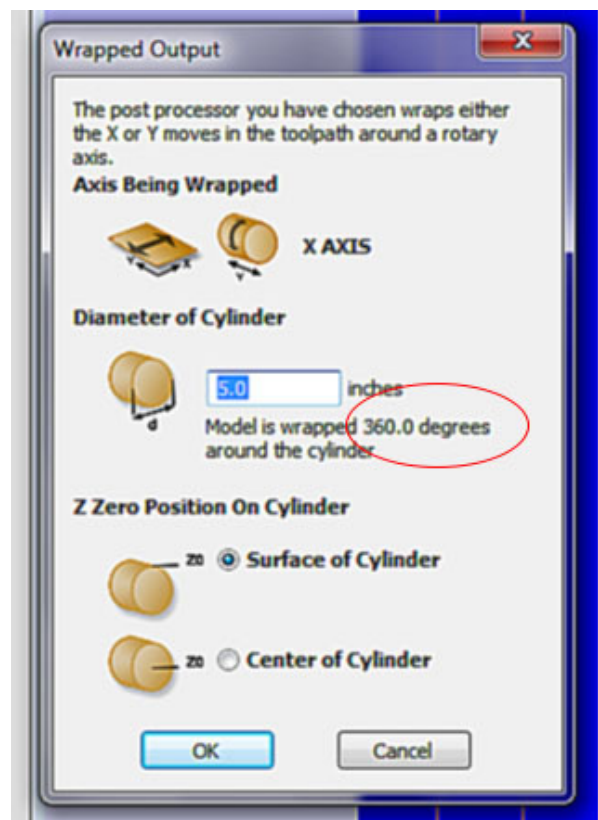
- Click on the Save Toolpaths icon



- Select the toolpath to be converted to an .sbp file.
- Select the correct Post Processor for creating a Rotary file.
- To see the list of Post Processors, click on the down arrow at the right of the Post Processor box.
- In this example, the Rotary Indexer is set up parallel to the Y-axis, so the X linear will be replaced with B rotational.
- If the correct Post Processor is not on the list, review the earlier section of this document called Loading the Post Processors for Rotary Indexing into the CAD/CAM software or, save this CAD/CAM file, close it, and re-open it so that the Post Processor list can be re-populated.
- Click on Save Toolpath(s).

Setting up the Wrapped Output

- The red oval indicates the important information on this screen: that the model will wrap 360 degrees or one full rotation.
- The Value in the Diameter of Cylinder box is imported from the Wrapped Job Setup screen when specified the FINISHED size of the Cylinder. If the value in the box is changed, the degrees that the model wraps changes to more or less than one full rotation.
- If the value of the diameter (finished cylinder) in this box needs to change, change it on the Wrapped Job Setup screen or start over completely.
- The Z Zero Position on Cylinder is imported from the earlier set ups.
- Click OK.
- At the prompt, Save the .sbp file with a name and in a location that is easy to find.



Checking the code to ensure the Rotary File is correctly generated

- From the ShopBot Control software, click on File Edit and open the .sbp file that was just generated OR from ShopBot Editing icon, open the .sbp file that was just generated .
- Look at the code (an example is shown below).

```
'Diameter = 5.0000 Inches
'Wrap X Values around Y axis
'X Values are output as B
SO,1,1          'Turn on router
PAUSE 2         'Give router time to reach cutting rpm
&Diameter=5.0000
&FeedRate=3.98
&RotationalFeedRate=&Feedrate/(&Diameter*3.14159/360)
MS,,1.00
VS,,,&RotationalFeedRate
JZ,0.700000     'Jog Z axis to safe height'
```

(continued below)

- Anything with an apostrophe (') in front of it is a comment that the software will not read.
- An ampersand (&) is a variable defined by the user (often simply done by filling in the boxes correctly).

(continued from above)

```
-----
M5,,0.000000,0.250000,,0.000000
M5,,48.000000,0.250000,,0.000000
M5,,48.000000,0.250000,,2.080925
M5,,0.000000,0.250000,,2.080925
M5,,0.000000,0.250000,,4.161850
M5,,48.000000,0.250000,,4.161850
M5,,48.000000,0.250000,,6.242774
M5,,0.000000,0.250000,,6.242774
M5,,0.000000,0.250000,,8.323700
```

This is where the actual M5 moves that define where the ShopBot goes next start

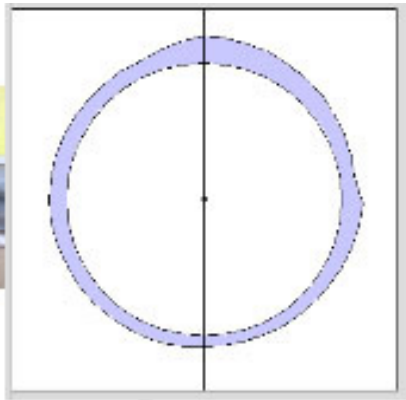
- The Value of each Location is (for example 3rd line)
 - X: Blank (two commas with nothing between them)
 - Y: 48 inches
 - Z: .25". If the Z value were 0.000, something would be wrong with the Job Setup and/or Toolpathing Fill-ins. For example, is the size of blank set up in the Toolpathing screen larger than the finished blank size entered in the Wrapped Job Setup screen?
 - A: Blank (two commas with nothing between them).
 - B: Degrees of Rotation in the Rotary Axis. By the end of the file, the Value for the Degrees of Rotation should be 360.

If the code only had M3 moves, or the wrong axis was blank, the Post Processor was wrong, or the wrapped job set is incorrect.

Setting up the ShopBot to run the Rotary Indexer

Zeroing the Linear and Rotary Axes:

- The indexer in this photo is set up parallel to the X-axis, so the Y-axis linear would be replaced with the B-axis rotary.
- The live motor end is at the left side of the picture and the tail stock is on the right.
- The Linear Axis (X) would be zeroed at the left side or live motor end of the stock.
- The actual area machined can be less than the length of the blank.



- Even though it is not being used, the second linear axis (the Y in these images) needs to be zeroed above the rotational center point of the indexer (and the stock.) Imagine that the drawing on the left is the stock, looking at it from the end.

- One way to find the center of the indexer is:
 - Before putting the material in place, move the bit to the point of the tail stock.
 - Zero the inactive linear axis at that location.
- Move the Z up and chuck the stock in the Indexer so that it is centered. Rotate it until the highest point is below the bit. Enter ZB to Zero the B-axis at that location.

Zero the Z-axis

- In the Wrapping Job Setup screen, it was determined whether the Z was zeroed at the highest point in the blank once it is in place.

OR

- At the Rotational Center of the blank before putting the blank in place,
- If Zeroing the Z at the Rotational Center of the blank, it might be worthwhile to establish another place to Zero the Z that is the same height as the tip of the indexer tail so that it is not necessary to remove the blank to re-zero the Z.
- ZZ is the command to Zero the Z at the bit's current location.

