

Next Wave Automation



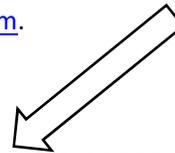
4th Axis OWNERS MANUAL



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To Our Customers

Thank you for purchasing the CNC Shark 4th Axis Table Top Accessory! Your CNC Shark 4th Axis Table Top Accessory brings enhanced CNC machining capabilities to your CNC Shark system.

This manual tells you how to install and use your CNC Shark 4th Axis Table Top Accessory. Please read the manual carefully. The manual also includes warranty and important safety information.

This manual has been written with the assumption that the owner is familiar with the basic operation of a computer as well as the basic techniques for the safe operation of woodworking power tools. Information in this manual is subject to change without notice.

This manual is also written under the assumption the owner has spent time learning design tutorials and projects on www.Vectric.com (the makers of the designing software that is supplied with your machine) Please understand our support is designed around making sure your machine is running correctly and the designing piece is really a personal preference and complicated design questions should be first directed via email to support@vectric.com

If you have any questions or comments, feel free to contact us at the address below.

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For faster support service please email us at

Support Email – support@nextwaveautomation.com

Include your machine model, date of purchase, and any pertinent information you might think would be helpful. Files, pictures etc.

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CNC Shark 4th Axis Registration Information

Record your CNC Shark 4th Axis Table Top Accessory, registration codes here for safe keeping and central record keeping.

Shark 4th Axis Table Top Kit: _____

Contents

To Our Customers.....	3
CNC Shark 4 th Axis Registration Information	4
Warranty.....	5
Safety	6
4 th Axis Overview	6
In the Box	7
Additional Requirements	7
Workflow.....	7
Create the Design and Toolpath(s)	8
Rotary Post Processors	8
Install the CNC Shark Rotary Post Processors.....	9
Mounting the Chuck	9
The remaining instructions are broken into two distinct machine differences.	10
• Section 1 – Earlier CNC Shark non-pendant machines (must have one piece controllers)	10
• Section 2 - Pendant models starting with CNC Shark HD4 including the HD4 Extended	10
Section 1.....	11
Earlier CNC Shark non-pendant machines (must have one piece controllers) Pendant Machines (HD4 and above) go to Section 2 of this manual	11
Machining the Part.....	11
First Use Setup Steps	11
Installing the A-Axis Controller Module.....	11
Install the SCP 2.x and Register.....	12
Check Gantry Height	12
A 4 th Axis Preferences	12
4 th Axis Physical Setup	12

Motor/Chuck and Tailstock Positioning.....	12
Aligning the Tailstock with the Motor/Chuck Assembly - One Method	13
SCP 2.x A 4 th Axis Preferences	14
Distance from Motor Tap Off to Cut Position	15
Establishing Tool Location Relative to the 4 th -axis	15
Load and Run GCode	17
4 th Axis Setup Test and Skills Development	17
4 th Axis Test Project.....	17
Section 2 CNC Shark Machines with Pendant (HD4 and Above)	18
First Use Setup Steps	18
4th Axis Driver Card Installation Steps.....	18
Updating Firmware for CNC Shark LCD Pendant	20
Updating Firmware for CNC Shark Controller.....	21
4th Axis Pendant Setup.....	25
Alignment Procedure	27
Procedure #1:.....	27
Design Creation.....	32
Adding a Post Processor to VCarve Pro/Aspire.....	33
Appendices	38
4 th Axis Layout, SCP2 Preferences and Post Processor	38
Carriage Facing the Table Axis Motor	38
Carriage Not Facing the Table Axis Motor	39
4 th Axis Setup and Use Tips.....	40
The following sections are applicable to all Shark machine models	40
Determining the Chuck Radius.....	40
Positioning Along the Centerline	41

Warranty

Next Wave Automation warrants to the original retail purchaser of a CNC Shark 4th Axis Accessory and purchased from an authorized CNC Shark distributor will be free from defects in material and workmanship

for ONE YEAR from the date of purchase. This warranty is for parts and labor to correct the defect, and does not cover the cost of shipping the defective item(s) to Next Wave Automation for repair.

This warranty does not apply to defects arising from normal wear and tear, misuse, abuse, negligence, accidents, unauthorized repair or alteration, or lack of maintenance. This warranty is void if the CNC Shark 4th Axis Accessory or any portion of the CNC Shark 4th Axis Accessory is modified without the prior written permission of Next Wave Automation, LLC, or if the CNC Shark 4th Axis Accessory is located or has been used outside the country of residence of the authorized CNC Shark distributor.

Please contact Next Wave Automation to take advantage of this warranty. If Next Wave Automation determines the CNC Shark 4th Axis Accessory is defective in material or workmanship, and not due to normal wear and tear, misuse, abuse, negligence, accidents, unauthorized repair or alteration, or lack of maintenance, then Next Wave Automation will, at its expense and upon proof of purchase, send replacement parts to the original retail purchaser necessary to cure the defect. Next Wave Automation will repair the CNC Shark 4th Axis Accessory provided the necessary components are returned to Next Wave Automation, shipping prepaid, with proof of purchase and within the warranty period.

Next Wave Automation disclaims all other express or implied warranties, including fitness for a particular purpose. Next Wave Automation shall not be liable for death, injuries to persons or property, or incidental, consequential, contingent or special damages arising from the use of the CNC Shark machine.

Safety

The CNC Shark 4th Axis Accessory, along with a router or other power tool, is a computer-numerically-controlled (CNC) routing system. As such, it is a powerful system that can reduce your woodworking risks by providing a method of cutting wood and other materials without having to interact with the cutting tool(s) or material during the fabrication process. As with all power tools, your care and attention are required to ensure that you use your CNC Shark 4th Axis Accessory safely. Next Wave Automation assumes you will use your CNC Shark 4th Axis Accessory and follow accepted safety precautions and practices for woodworking and machining.

4th Axis Overview

The CNC Shark 4th Axis gives you the ability to create precision turned spindles or columns that include intricate carvings and designs that will astonish your clients. The CNC Shark 4th Axis easily bolts to your existing Shark bed. It comes complete with a Nova Precision Midi 4 jaw Chuck and features a standard 1" x 8 TPI drive shaft to allow you to use just about any of your lathe accessories.

This manual assumes you are an existing CNC Shark owner, have reviewed the material found in the CNC Shark Family Owner's Manual and Shark Control Panel 2.1 User's Manual (if applicable), and are

knowledgeable in the use of both. It also assumes a level of understanding and confidence in using VCarve Pro to create the design and toolpaths.

In the Box

The CNC Shark 4th Axis Table Top Accessory Kit includes an axis motorized mount, Nova Precision midi lathe chuck, tail stock, mounting hardware. The 4th axis motor driver card is sold separately.



Additional Requirements

CNC Shark owners will also need to install the axis motor controller chip for use with the Shark Control Box (SCB). While the Shark Control Box has been shipped with an optional expansion port, the motor control chip was not mounted on the board and must be installed in order to control the 4th axis.

Workflow

Unlike other wood working and machining tools, utilizing a rotary axis employs intermediate and advanced machining techniques. It is easiest to think of the workflow in two distinct components:

1. Create the design and toolpath file (also called TAP file) - using VCarve Pro.
2. Machining the part - using the CNC Shark Control Panel, establish the tool position, then load the toolpath file and run the project.

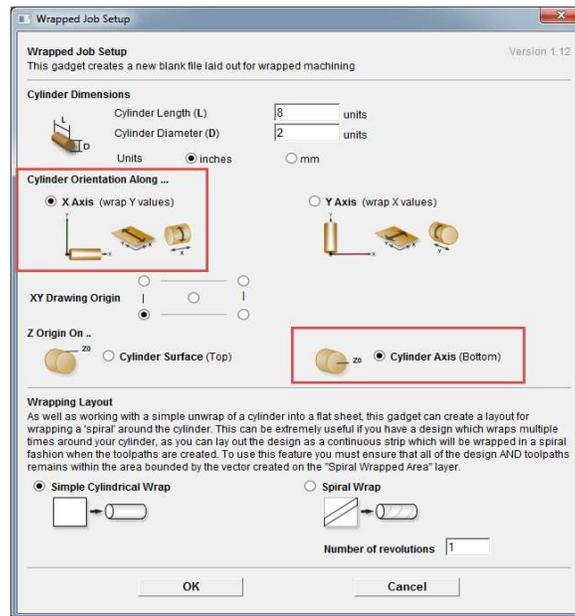
Create the Design and Toolpath(s)

Vectric's VCarve Pro, or Aspire is required to create the design of the part you want. There is a **distinctly different workflow** when creating a 4th-axis project as compared to a standard VCarve project. You are strongly encouraged to review the training material found on the Vectric support site. The most recent 4th-axis machining tutorial can be found online at - <http://www.vec tric.com/support/gadgets.html>

When creating a new 4th-axis project for use with the CNC Shark, instead of selecting 'Create new file', select Gadgets > Wrapping > Wrapped Job Setup. Then select:

- Cylinder Orientation Along X Axis
- Z Origin on Cylinder Axis (Bottom)

You can choose either 'Wrapping Layouts'.



Rotary Post Processors

You must also use the appropriate post processor when saving the toolpath file. There are currently 2 post processors associated with the 4th Axis –

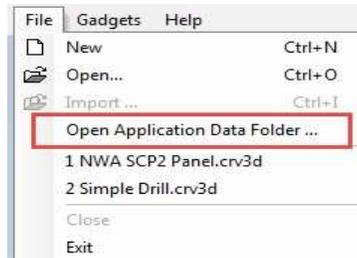
- CNCShark-RY2AX-in.pp and CNCShark-RY2AX-mm.pp ○ These show up in VCarve/Aspire as CNCShark Rotary – Wrap Y (inch) – Orient X and CNCShark Rotary – Wrap Y (mm) – Orient X
 - Use this if your 4th Axis hardware is setup along your machine's X axis, or within 45° of the X axis.
 - If the outcome is a reverse image, open the Preferences, A|4th Axis tab, check the 'Mirror Image' box, hit 'Ok', and reload your tap file.
- CNCShark-RY2AY-in.pp and CNCShark-Ry2AY-mm.pp ○ These show up in VCarve/Aspire as CNCShark Rotary – Wrap Y (inch) – Orient Y and

CNCShark Rotary – Wrap Y (mm) – Orient Y ○ Use this if your 4th Axis hardware is setup along your machine’s Y axis, or within 45° of the Y axis.

- If the outcome is a reverse image, open the Preferences, A|4th Axis tab, check the ‘Mirror Image’ box, hit ‘OK’, and reload your tap file.

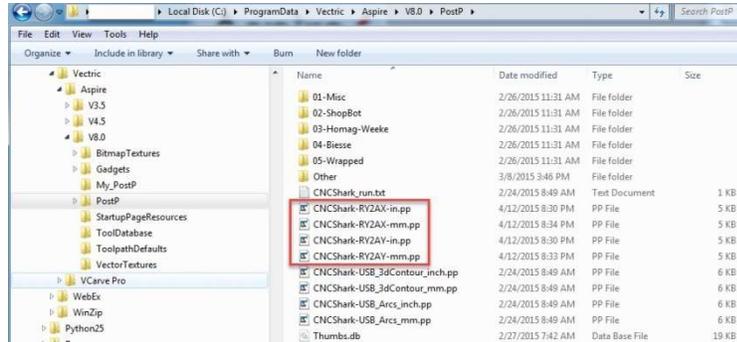
Install the CNC Shark Rotary Post Processors

You can download the CNC Shark Rotary post processors from the Next Wave Automation web site (Downloads section). Open VCarve Pro and select ‘File’, then ‘Open Application Data Folder...’.



Opening the VCarve Application Folder

This will open a Windows Explorer panel. Tap on the ‘PostP’ folder, and copy the 4 rotary post processors into this folder. You will have to close VCarve Pro and restart it before you will see these as choices when generating a toolpath.



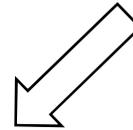
Mounting the Chuck

Carefully align the chuck with the motor drive shaft and hand tighten.

The remaining instructions are broken into two distinct machine differences.

- Section 1 – Earlier CNC Shark non-pendant machines (must have one piece controllers)
- Section 2 - Pendant models starting with CNC Shark HD4 including the HD4 Extended

NOTE: We highly recommend watching the setup video found on our download page under 4th axis.



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Section 1

Earlier CNC Shark non-pendant machines (must have one piece controllers) Pendant Machines (HD4 and above) go to Section 2 of this manual

Machining the Part

The material to be machined is placed in the 4th-axis , with the tailstock and chuck properly securing the material. The proper cutter tool is secured in the router. Using the Shark Control Panel 2.x (SCP2), the 4th Axis tap off points are established, and the job is ready to run.

You are strongly encouraged to 'ramp up' your understanding, knowledge, and skill in using the A-axis by creating and running simple projects before creating and running complex jobs.

First Use Setup Steps

When you first receive the CNC Shark 4th Axis Table Top accessory, there are a few steps you'll need to take before you 'set it up' and run a project.

- Installing the A Axis Controller Module in the Shark Control Box
- Mounting the Nova chuck on the 4th axis motor assembly
- Install the Shark Control Panel 2.x and register
- Install the CNC Shark rotary post processors into your VCarve configuration
- Check gantry height
- A|4th Axis Preferences

Installing the A-Axis Controller Module

The A Axis driver card must be added to the electronics board inside the CNC Shark Control Box. You should establish an area to work on that is free from electrostatic shock risks, and provides enough room to set small parts on. Be sure to ground any tools used to discharge any existing static charge that may be present. Installation varies by machine, please follow the instructions that came with your A-Axis Control Module.

Install the SCP 2.x and Register

You must install the Shark Control Panel 2.x and register. These steps are covered in detail in the Shark Control Panel 2.x User's Manual. This can be found in the CNC Shark 2.0/Documents folder after the installation is complete, as well as from the SCP 2.x Help, Control Panel Help tool.

Check Gantry Height

As a precaution, ensure the gantry height is high enough to enable the carriage to clear the 4th-axis motor/chuck assembly. As this height is chosen by the user, you may have to raise the gantry to enable the carriage to clear the 4th-axis motor/chuck assembly. Set the 4th-axis motor/chuck assembly on the table, and jog the gantry to confirm that the clearance is adequate. Make adjustments to the gantry as required.

A|4th Axis Preferences

The A|4th Axis preferences must be set up in the Shark Control Panel. This step is discussed in detail in the 4th Axis Physical Setup, [SCP 2.1 A|4th Axis Preferences](#) section of the manual.

4th Axis Physical Setup

Motor/Chuck and Tailstock Positioning

Position the motor/chuck and tailstock assembly within the safe travel limits of your machine. One way to ensure this is to jog the gantry to each edge of the table surface and place a piece of tape to mark the limit. You can place the axis of the 4th-axis accessory along the X axis, the Y axis, or angled. It is best to have the material you are going to use so that you can position the tail stock at an appropriate distance from the motor/chuck the 'first time'. A more detailed discussion of the physical setup options you can use, along with the associated SCP 2.x settings can be found in the [4th Axis Layout, SCP2 Preferences and Post Processors](#).

Position the gantry out of the way of the setup area. Place the motor/chuck assembly on the table, and use the hardware to secure this to the table. You may find that you are using a bolt on one side, and a clamp for the other side. Be sure to attach the grounding cable to a grounding point on the machine. You will find these at each of the axis motor mounting points. Extend the grounding cable as necessary to ensure that the motor/chuck assembly is properly grounded.

With the SCB powered off, connect the 4th axis cable to the A-axis output on the back of the SCB.

Note: Always have the SCB powered off when connecting or disconnecting axis cables.

Once the motor/chuck assembly is in place, secure the material in the chuck – snug, not tight – and position the tailstock. Ensure there is enough travel distance for the tailstock to be tightened against the material end before attaching the tailstock to the table.

Once you have established the general location of the tailstock, remove the material. You will find that rotating (jogging) the chuck to a position where a small square can be lightly held by the chuck so that the base of the square is flat on a table, and using a framing square set against the chuck side of the motor/chuck assembly will make positioning the tailstock easier and result in the 'best' position of the tailstock in relation to the motor/chuck assembly (See image). You may find that you are using a bolt on one side of the tailstock, and a clamp for the other side.



Aligning the Tailstock with the Motor/Chuck Assembly - One Method

Mount the material in the chuck; snug the chuck on the material. Then position the tailstock to the material, and snug the tailstock to the material. Tighten the chuck and then tighten the tailstock to the material. Rotate (jog) the axis to ensure the material moves with no binding of the 4th-axis axis, and that the material is not 'wobbling'. This process is no different than positioning material in a lathe. The exception is that the chuck and tailstock are not permanently mounted on a chassis. In addition to ensuring you've positioned the material properly regarding the chuck and the tailstock, you must confirm that the tailstock is positioned properly with respect to the motor/chuck assembly.

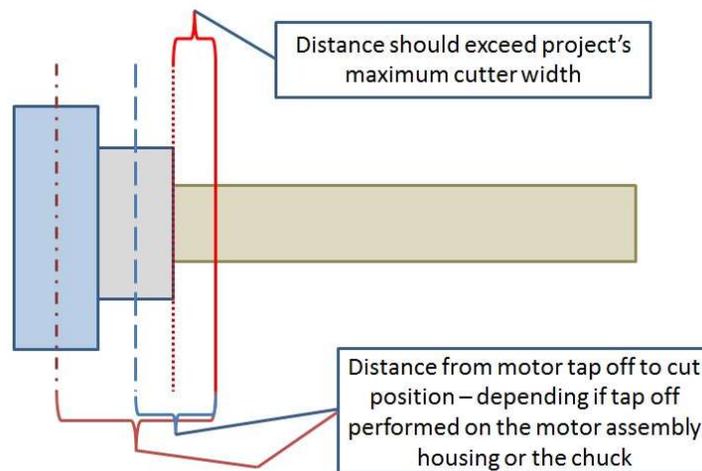
SCP 2.x A|4th Axis Preferences

With the SCP2 running, open the Preferences panel, and select the 'A|4th Axis' tab. The A|4th Axis tab has several parameters that control the behavior of the SCP2 4th Axis.

- Default Step Value A Axis – set the default value for jogging the A Axis when in the Step mode.
- A Axis Safe Height - this sets the height above the front end tap off point at which the SCP2 will raise the tool prior to making any lateral moves when responding to SCP2 commands Detect Touch Plate and Move Offset.

Note: If the material radius is larger than the radius at the front tap off point, you will want to ensure you have set an appropriate A Axis Safe Height.

- Lathe Front/Left (Motor End) Chuck Radius – this sets the radius of the lathe chuck along the circumference line that the tool is tapped off of. Be sure to enter the radius and not the diameter.
- Distance from Motor tap off to cut position – this is the distance from the location on the chuck that you use to touch off of to a safe position to cut into the material – without engaging any of the chuck components with the tool.



If 4th Axis Model B is utilized (for an explanation of differentiating between Model A and B, please see page 27), please set the 4th Axis step increment using the following steps:

- 1) Open CNC Shark Control Panel 2.1
- 2) Press Ctrl + G
- 3) In the displayed dialog box, type '787'
- 4) The 'Edit CNC Shark Configuration' screen will display. In the 'Steps Per Degree' field for the A axis, change the number to '24.24'
- 5) Click Save

The control panel is now configured to properly control the 4th Axis.

Distance from Motor Tap Off to Cut Position

- Lathe Rear/Right (tailstock) Chuck Radius – this sets the radius of the lathe tailstock along the centerline that the tool is touched off of. Be sure to enter the radius and not the diameter.
- Lathe Cut Depth Offset - you can set a value here that will result in a global change of depth in the calculated cut when using the 4th axis setup. For example, if you are always finding the depth of cut is consistently 0.03 too deep (low), you can set a value of 0.03 in this preference and save it.
- Router Mount Position
 - Vertical (Top-Down) – the correct setting when using the Shark 4th Axis Table Top Kit.
 - Horizontal (Sideways) – future capability when support for using a mini-lathe as the 4th axis is fielded.
- Lathe alignment – choose one of two settings
 - Front to Back (along Y) if you have setup the Shark 4th Axis Table Top Kit oriented along the Y axis.
 - Left to Right (along X) if you have setup the Shark 4th Axis Table Top Kit oriented along the X axis.
- Mirror Image (Reverse Cut A) – you can check this flag if you find your carving coming out in a reverse image. There is no need to adjust the post processor in this case – just set or unset the flag as appropriate for use in your setup.

Be sure to hit 'Ok' to save your changes. If you hit 'Cancel', no changes will be saved. It is a good idea to open the preferences panel after closing to ensure you have in fact committed (saved) the desired preference settings.

Note: Anytime you change any of the A|4th Axis preferences, you must perform the 'Set Front' and 'Set Rear' tasks.

Establishing Tool Location Relative to the 4th-axis

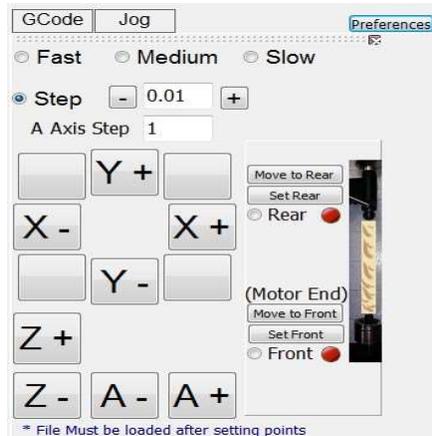
You use the A-axis jog panel and the commands within it to establish the tool location and resulting offset position. This is sometimes referred to as 'tapping off'.

Note: You must perform this step with every tool change, and BEFORE you load the tap file.

When the A-Axis is enabled, the Jog panel is configured to support the use with a 4th-axis setup. You typically use the Jog Controls to move the gantry to:

- Position the tool at the head or tailstock to touch off and establish the zero point at each end of the 4th-axis.
- Move the cutter tool to the offset.

- Move the gantry to a position on the table to enable material placement and chucking or removal from the 4th-axis.



Jog Panel – A-Axis Mode

You will note that in addition to the ability to jog the XYZ axes, the 4th axis jog is now available. The 4th Axis Step default value is defined in the Preferences, 4th-Axis tab.

To the right of the axes jog buttons is a layout of the 4th-axis centerline. Each end of the 4th-axis has 2 buttons –

‘Move to’ and ‘Set’. You must establish the zero at both the Motor (chuck) end of the 4th-axis and the Rear (tailstock) end of the 4th-axis. Once these are set, you will see a green gumball with a check mark, and when you tap the ‘Move to’ button, the gantry will move to that position. Until you ‘Set’ an end, there will be no response to a ‘Move to’ command.

Position the tool above the desired tap off point, at the centerline of the Motor (chuck) End of the 4th-axis, along the circumference line of the motor assembly or chuck (this is the circumference line you are using as a reference for the ‘Distance from Motor tap off to cut position’ A|4th Axis preference setting). Tap on ‘Set Front’. The Point Collector panel will appear on the screen. Once you have set one end, you can repeat the steps on the other end.

At this point (green gumballs with check marks), when you tap on ‘Move to Offset’, the gantry will position the tool at the A-axis safe height (unless the tool is higher than that already), and along the centerline at the ‘Distance from Motor tap off to cut position’ set in the A|4th Axis preferences from the ‘Motor End’ tap off point used. If the Z axis was above the A-axis safe height, a second tap of the ‘Move to Offset’ will move the tool to the exact offset point in Z as well.

Likewise, once the front and rear are set (tapped off), tapping ‘Move to Front’ or ‘Move to Rear’ will move the tool to the respective tap off positions at the A-axis safe height.

Just as you do in 3 axis use, you must perform a 'Set' task with any tool change.

Load and Run GCode

Loading and running the job is the same whether you are in 4th axis mode or 3 axis mode. Once you've selected the file and it is loaded in the SCP2, hit 'Run'. On 'Run', the gantry will immediately move to the generated offset (the cut start location). After finishing the move, the SCP will load the gcode onto the SCB. Once that is loaded, you will be presented with a confirmation message. Press 'OK' if you are ready to run the tap file.

In some configurations, you may need to start the router/spindle and let it get up to speed before clicking on 'OK' to start the job.

The Run controls – Run File, Continue, Pause, E-Stop – all perform in the same manner as when running a 3-axis job.

When the job is finished, the gantry will return to the offset position with the Z axis at the A-axis safe height.

You can also preview the resulting A-Axis Virtual code from the View, View A-Axis Code tool. A separate panel will pop up.

4th Axis Setup Test and Skills Development

4th Axis Test Project

A VCarve Pro project file has been provided in the Samples folder of the SCP2 installation. This project is based on a 1-1/2" diameter dowel rod that you can readily purchase at a neighboring hardware store. You'll want to cut a 9" length and setup the table top 4th-axis to support this use. You'll need a 60° v-bit.

You'll also find 2 tap files in the Samples folder of the SCP2 installation. If you don't want to load the project into VCarve, and generate your own toolpaths (or haven't yet copied the rotary post processors to your installation, use the one that is appropriate for how you setup your table top rotary.

- 4th Axis Test Project Orient Along X Axis.tap – use this tap file if you have setup the 4th-axis along the X axis – or at an angle that is closer to the X axis than the Y axis.
- 4th Axis Test Project Orient Along Y Axis.tap – use this tap file if you have setup the 4th-axis along the Y axis – or at an angle that is closer to the Y axis than the X axis.

This kind of simple project is also useful to determine if you need to check the A|4th Axis preferences Mirror Image. If the text is mirrored (backwards), check this preference, hit 'Ok' to save it, reload the tapfile and run the project again to confirm that the project is no longer being carved in a mirrored fashion.

Section 2 CNC Shark Machines with Pendant (HD4 and Above)

First Use Setup Steps

This section of the manual illustrates the setup process for the first use of the 4th Axis accessory. The steps to the setup process are:

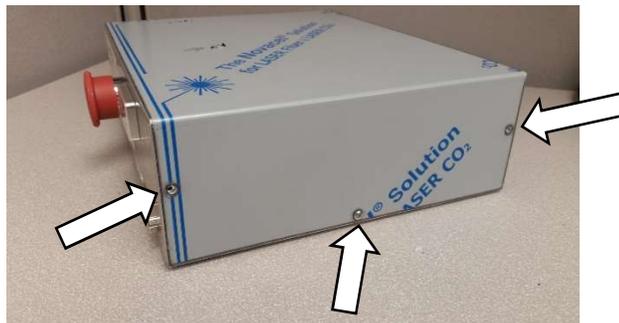
- Installing the 4th Axis Controller Module in the Shark Control Box
- Mounting the Nova chuck on the 4th axis motor assembly
- Install the CNC Shark rotary post processors into your VCarve Pro configuration
- Check gantry height

4th Axis Driver Card Installation Steps

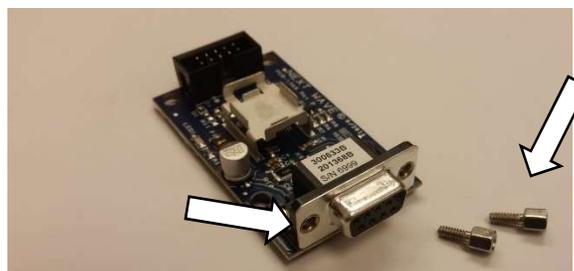
Install the 4th axis driver card into the optional expansion port of the CNC Shark HD 4.

Follow the steps and figures below to ensure the driver card is installed properly.

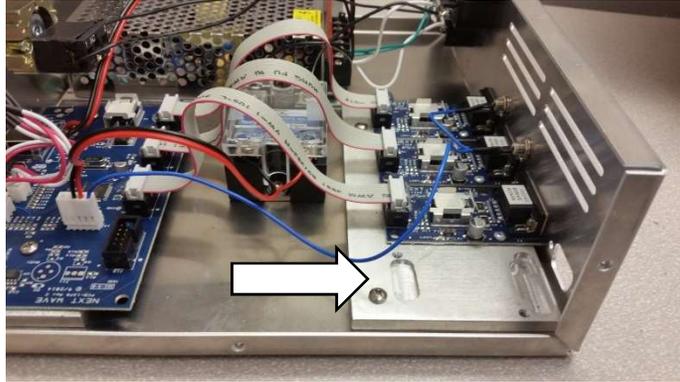
1. Ensure the Shark HD4 controller is powered OFF and that all cords/cables are removed from the controller.
2. Use a Phillips screwdriver to remove the 6 screws (3 on each side) from the controller so the top cover can be removed freely.



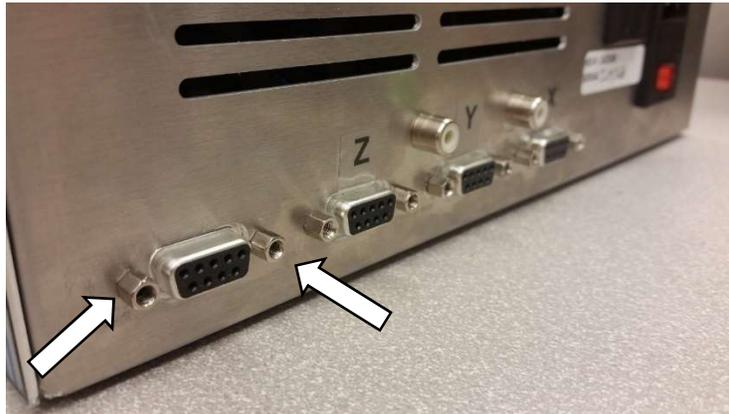
3. Remove the 2 hex bolts with a 3/16th nut driver from the front of the driver board.



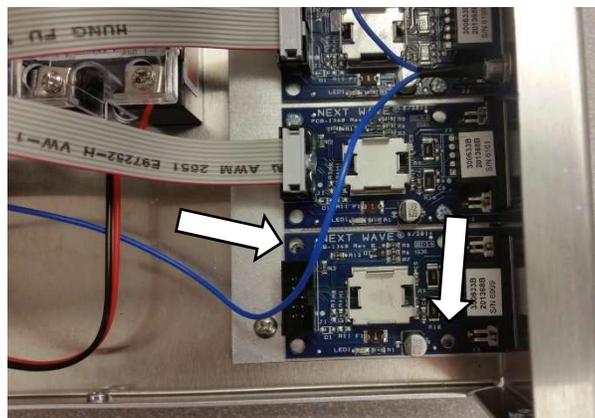
4. Remove the sticker that reads, "OPTIONAL EXPANSION PORT" on the controller, in order to uncover the 4th axis driver board port.
5. Place the 4th axis driver board on the aluminum heat sink, adjacent to the other 3 driver boards.



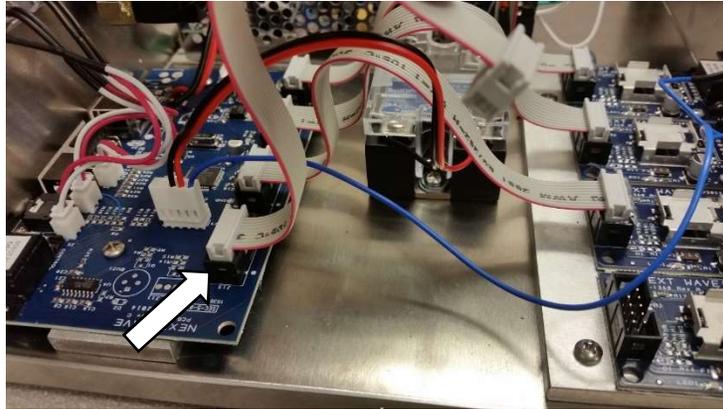
6. Reattach the 2 hex bolts to the 4th axis driver board, securing it to the back of the HD4 controller. DO NOT fully tighten the 2 hex bolts.



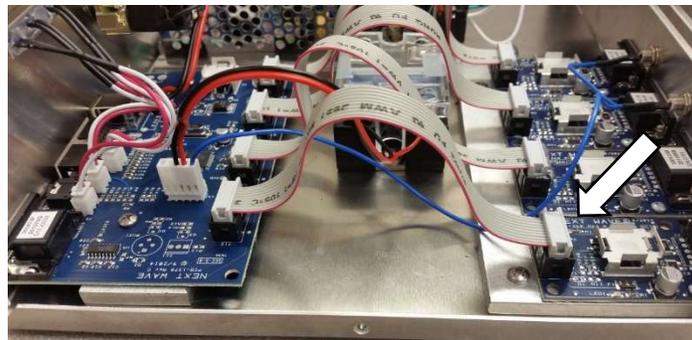
7. Use the 2 included screws to attach the 4th axis driver board to the aluminum heat sink using the 2 screw holes. Once these screws are in place, fully tighten the 2 screws and the 2 hex bolts attaching the 4th axis driver board to the back of the HD4 controller. (Optional: add a dab of heat transfer compound in between the driver board and heat sink)



8. Attach one end of the ribbon cable to the circuit board opposite the driver board. Push down gently on the end of the ribbon cable to affix it to the circuit board.



9. Attach the remaining end of the ribbon cable to the driver board. (Optional: add a drop of hot glue using a hot glue gun, to each end of the ribbon cable connection)



10. Place the top cover back on the HD4 controller and reattach the 6 screws.

Updating Firmware for CNC Shark LCD Pendant

Most CNC Shark HD 4 systems have been manufactured with the necessary firmware to operate the 4th axis. However, some users with older versions of the CNC Shark HD4 controller firmware may need to update their systems. 4th Axis users should utilize CNC Shark Controller Firmware v3.94 or higher and LCD firmware 4.64 or higher. To check this, press 'Apps' then 'About Controller' and 'About LCD' then look for the corresponding version information. If both components list the version information listed above. It will not be necessary to update the system.

If either component should be updated, please follow these steps. The LCD component and the controller component will be updated in two separate steps.

The files for the LCD update can be found at NextWaveAutomation.com -> Downloads -> 4th Axis -> LCD Firmware Update.

1. Copy the files from the website onto the root directory of a flash drive. Please make sure the flash drive is no larger than 8GB.
2. With the unit powered off, plug the flash drive into the LCD pendant then power the unit on. The pendant will beep twice. The LCD will automatically enter the update mode and go through a series of beeps. The update mode may take up to 3 minutes.

3. After the update is complete, the LCD will beep and the screen will illuminate with the Touch Screen Calibration function. NOTE: using a stylus for this function is recommended to ensure touch screen accuracy.
4. After the calibration is complete, the main jog screen of the pendant will display.
5. Select Apps -> Factory Restore. Press OK

Make sure to remove the firmware update files from the flash drive once this process is complete.

Update Firmware for CNC Shark Controller

Most CNC Shark HD 4 systems have been manufactured with the necessary firmware to operate the 4th axis. However, some users with older versions of the CNC Shark HD4 controller firmware may need to update their systems. 4th Axis users should utilize CNC Shark Controller Firmware v3.94 or higher and LCD firmware 4.64 or higher. To check this, press 'Apps' then 'About Controller' and 'About LCD' then look for the corresponding version information. If both components list the version information listed above. It will not be necessary to update the system.

If either component should be updated, please follow these steps. The LCD component and the controller component will be updated in two separate steps.

- 1) The files for the controller firmware update can be found at NextWaveAutomation.com -> Downloads -> 4th Axis -> Controller Firmware Update. Plug the control unit into the computer via a USB A/B cable

- 2) Short the 3.5mm jack to command the unit to enter update mode.

Do either A or B

- a. Insert a shorting pin such as the shank end of an 1/8" drill bit into the 3.5mm jack on the controller unit (NOT the 3.5mm jack on the LCD). Now power the unit on. The green light on the control unit will begin to blink rapidly for a short period, then change to solid green. (Fig 1.0)

The green light on the control unit will begin to blink rapidly for a short period. (Fig. 1.5)



(Fig 1)

- b. Connect the touch plate to the 3.5mm jack on the control unit (NOT the 3.5mm jack on the LCD). Hold the magnet to the aluminum touch plate, or connect the magnet to the banana plug of your touch plate cord. Now power the unit on.



(Fig 1.5)

- 3) Navigate to where HEXLoader.exe is saved and double click on the program to open it.
- 4) If the unit is in updater mode it will display the message below (Fig 2.0). If this message is displayed, please proceed to #5 in this guide.

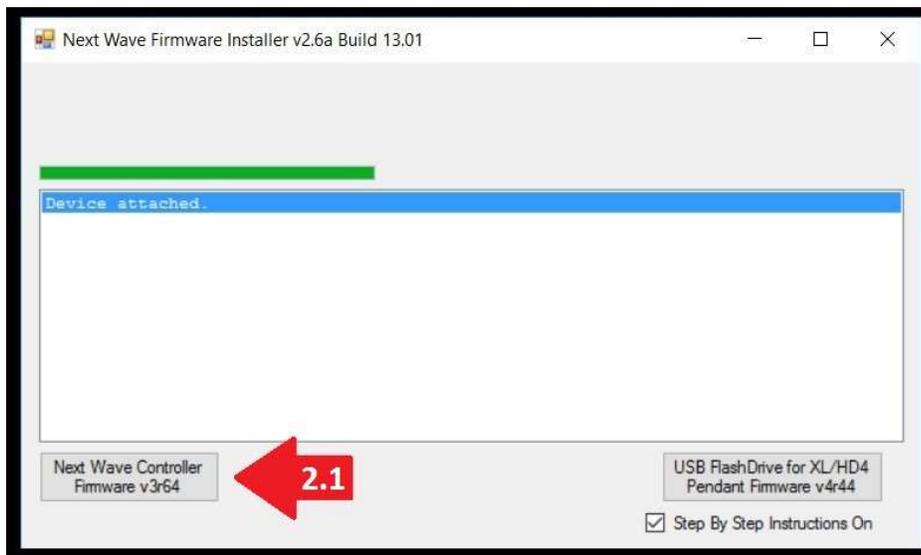


Figure 2

- a. If this message is displayed (Fig 3.0) stating “device not detected” the control unit did not enter update mode, please power the unit off and repeat steps 2 & 3. If the message in Fig 2.0 does not display, please contact Support@NextWaveAutomation.com for assistance.



Figure 3

5. Click the “Next Wave Controller Firmware” button (Fig. 2.1)
6. After this, the system will install the firmware update and will display this message. **(See Figure 4)**



Figure 4

The update is now complete and your firmware will be set up for 4th axis.

4th Axis Pendant Setup

To set the system to operate the 4th axis, make sure that it is in 4th Axis mode.

1. Power unit on and click Apps.
2. Choose 4th Axis and then Press to Open. **(See Figure 1)**



Figure 1

3. Press 3D mode and then Press the box in the upper right-hand corner. This will bring up a numerical keypad. **(See Figure 2a and 2b)**



Figure 2a



Figure 2b

4. Enter 0 for OFF and then Press OK. Your unit is now almost set up for 4th Axis Mode.

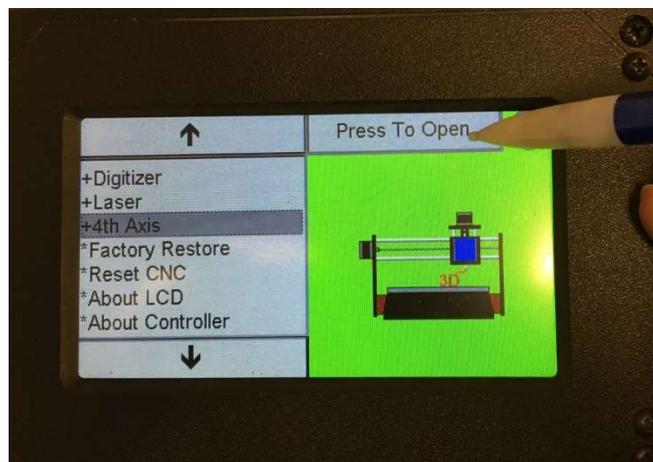
There are two styles of 4th axis for the Shark units. The difference is most notable by looking at the tailstock for the 4th axis unit. If the tailstock looks like the one pictured on the right, it is Version A. If the tailstock looks like the one pictured on the left, it is Version B. **(See Picture Below)**



Tailstock Versions

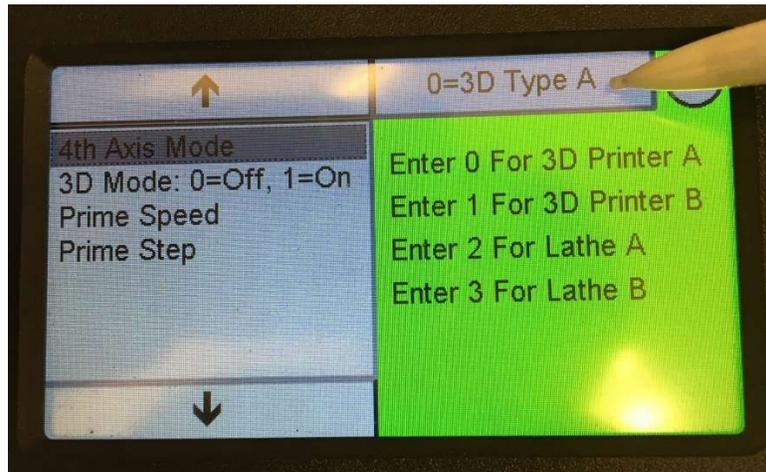
Set the appropriate value for the 4th axis:

1. Power unit on
2. Press 'Apps'.
3. Choose '4th Axis'
4. Select 'Press to Open.' **(see picture below)**



5. Select "4th Axis Mode"

6. Select the text box in the upper right-hand corner. This will bring up a numerical keypad. **(See picture below)**



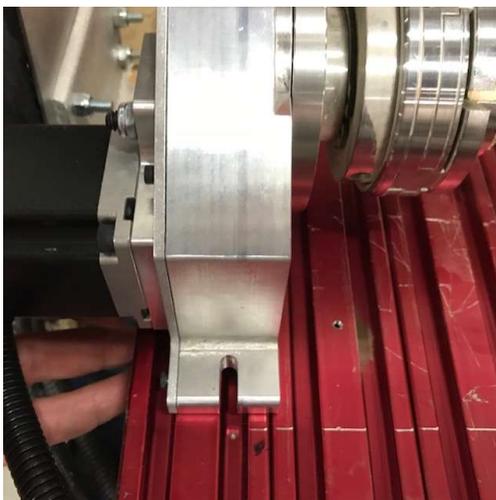
7. If using Tailstock Version B, Enter 3 and then press OK.
 - a. If using Tailstock Version A, Enter 2 and then press OK.

Alignment Procedure

Use procedure #1 or procedure #2 to align the two ends of the 4th axis.

Procedure #1:

After attaching the Nova Chuck to the 4th axis main unit, place it onto the bed with the motor oriented to the left of the machine. Align it to the tracks and mount it down. This can be mounted either of two ways. One way to attach is with the provided bolts and nuts and the other way is to clamp it with table hold down clamps. **(see pictures below)**



You will need to place a piece of wood that is level and uniform into the chuck for the alignment procedure. The material should easily fit into the Nova Chuck and the center of the material should be marked on the opposite end, so that it can be aligned with the tailstock. In the figure below (**see picture below**), a 2" piece of wood stock is being used to show the full set up. By placing it in this position and tightening it down with the Nova Chuck, it should give you a roughly aligned set up along the X-axis. Now we are going to do the final alignment.



Rough Alignment Position

Place a V-bit into the chuck of the router, as you will be using the point of the bit as a centering tool to help visualize the alignment along the wood shaft.

On the pendant, set zero for the Y-axis. Once zero has been set for the Y-axis, move the router until it is over the main housing (Nova Chuck) and line it up over the oil fill plug (**see picture below**). This will give you the center line at this end of the 4th Axis.

- You do not want to be exactly on the center. You can be slightly left or right (0 - .01 inch) and still get the results you want. Placing the bit directly on the line can create chatter.



Alignment over Oil Fill Plug

Once you have the bit aligned over the main housing, jog the router over your material until you reach the tailstock. Once at the tailstock, you may notice that the bit is not exactly aligned. **(See picture below)**. To align the bit with the tailstock, loosen the clamps and adjust the main housing and tailstock with slight nudging until it is in the correct position. Once in the correct position, tighten the clamps back down.



Alignment over Tailstock

Move the router back to the main housing and see if it is still positioned over the oil fill. If it is slightly out of alignment, then repeat the procedure again until it will position over the oil fill port. Use the LCD Pendant to rotate the material and confirm that it rotates well and that all components are tightened down.

The X & Y alignment procedure is now complete.

Now with the zero set, we still need to set up the center point within the piece of material and subtract the difference to this centerline. This process assumes the design file will be set up using the center of the cylinder as the Z zero position. If the surface of the cylinder has been selected, please proceed to the “Machining the part” section for instructions to set the Z zero.

1. On the pendant click on the Z axis to go into the keypad screen. **(see Figure 1)**



Figure 1

2. Enter Zero and click the Move button. **(see figure 2)**



Figure 2

3. The bit should be right at the top of the tailstock
4. Once the bit has moved into position, click on the Z axis to go back to the keypad. On this screen, enter in 0.627 and click the Set button. **(See figure 3)**



Figure 3

5. After you have chosen to Set, a final screen will appear warning you that you are about to change your Z-axis. Choose OK to finish the process and give you the exact center of your material. **(See Figure 4)**

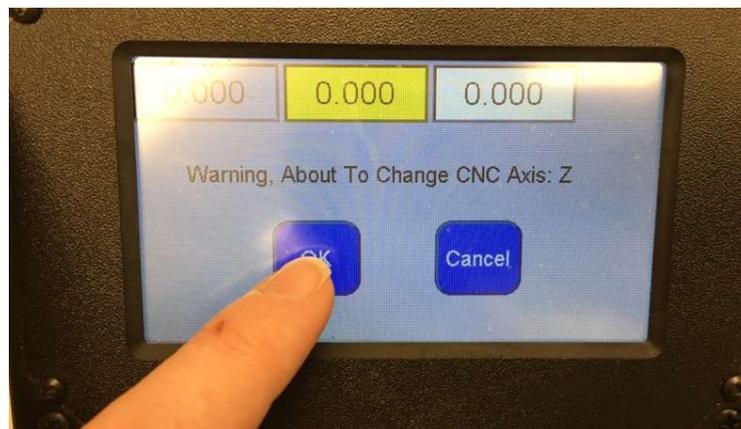


Figure 4

Now that the centerline is zeroed, you have completed the alignment procedure but you still have one axis to adjust.

You will need to move the X-axis to wherever the zero start point is set up in the VCarve Pro/Aspire software. This is usually either at the end of the material or the center of the material.

Make sure that measurements are taken of the material to ensure you have adequate distance so that the bit will not crash into the Nova Chuck or the tailstock.

Alignment Procedure #2:

It is important to align the motor chuck and the tail stock as accurately as possible. If they are not aligned, the workpiece will not rotate properly.

To do this, follow these steps:

- 1) Roughly align the 4th axis motor into position. Clamp it down
- 2) Place a carpenter's square (or any long straight edge) along the 4th axis motor
- 3) Roughly align the 4th axis tail stock into position using the carpenter's square. Clamp it down
- 4) Insert a V-bit into the router
- 5) Insert a V-bit into the 4th axis motor chuck.
- 6) Align the tips of the two V-bits so they touch.
- 7) If the 4th axis is in Orientation 1 (Figure 1, p.33), Press X+ to move the router toward the tailstock.
- 8) When the router is near the tailstock, align the tip of the tailstock to the bit in the router
NOTE: Do not move the router in the Y direction at all while aligning the tailstock.
- 9) When the tip of the tail stock and the tip of the V-bit are aligned, tighten the clamps holding both the motor and the tail stock.
- 10) Remove the V-bit from the motor chuck and insert the workpiece.

NOTE: If Orientation 2 (Figure 1a, p.33) is utilized, aligning the tailstock will require the use of the Y jog buttons instead of the X.

Workflow Overview

Unlike other wood working and machining tools, utilizing a rotary axis employs intermediate and advanced machining techniques. It is easiest to think of the workflow in two distinct components:

3. Create the design and toolpath file (also called TAP file) - using VCarve Pro.
4. Machining the part - using the CNC Shark HD4 LCD Pendant, establish the tool position, then load the toolpath file and run the project.

Create the Design and Tool path(s)

Do not use the center origin for the A/4th-axis, use any corner.

Design Creation

- Open the VCarve Pro/Aspire software. NOTE: Do not click "Create New File." A new file will be created after the Wrapped Job Setup is complete.
- Select Gadgets
- Select Wrapping, then select Wrapped Job Setup
- Enter the work material information, material orientation and wrapping layout, then click OK
- Create the desired artwork and apply toolpaths
- Click Save Toolpaths
 - If the 4th Axis is oriented like Orientation 1 (**Figure 1**), use Wrap Y Orient X for the post processor
 - If the 4th Axis is oriented like Orientation 2 (**Figure 1a**), use CNCShark-RX2AY_NWAwrap.pp for the post processor

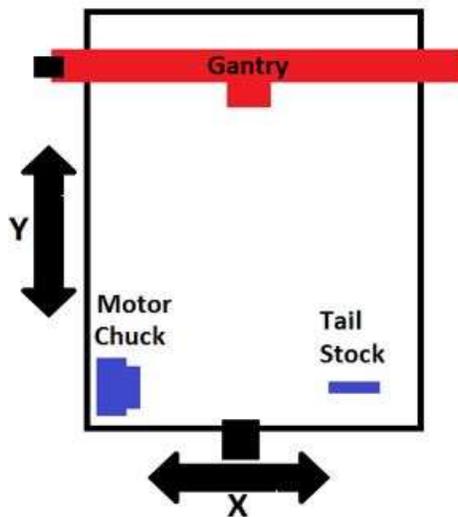


Figure 1

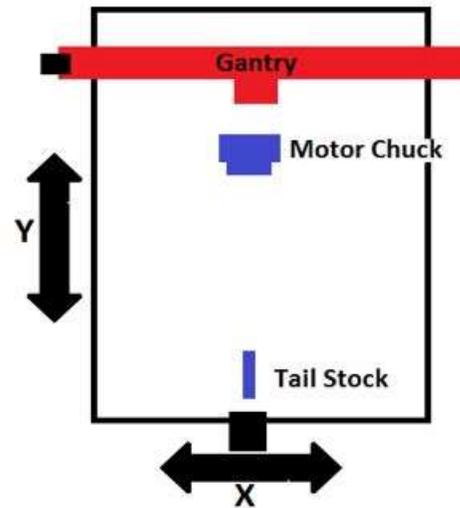


Figure 1a

Adding a Post Processor to VCarve Pro/Aspire

If the design software does not have the 4th axis post processors already installed, please follow the steps below to add these to the design software.

1. Download CNCShark-RX2AY_NWAwrap.pp and CNCShark-RY2AX-in.pp post processors from our website to your computer. (nextwaveautomation.com ->downloads -> 4th Axis)
 - NOTE: Save the post processors directly to the desktop so they are easy to find for the upcoming steps.
2. Open your VCarve Pro or Aspire software
3. Click the File menu
4. Choose "Open Application Data Folder"
5. Copy CNCShark-RX2AY_NWAwrap.pp and CNCShark-RY2AX-in.pp post processors and paste them into the PostP and My_PostP folders
6. Close VCarve Pro or Aspire design software
7. When the design software is re-opened, the rotary post processors will now be displayed in the post processors dropdown box.

Machining the Part

Set origin positions after calculating the centerline on the tail stock.

- 1) Jog the router to the centerline on the tail stock.
- 2) Jog the router to the end of the cylinder that corresponds with the design's origin position.
- 3) Press the number readout above "X+"
- 4) Set the value to "0"
- 5) Press Set
- 6) Jog the router to the side of the cylinder the job will start from and place the bit on the edge of it.
- 7) Press the number readout above "Y+"
- 8) Set the value to "0"
- 9) Press Set

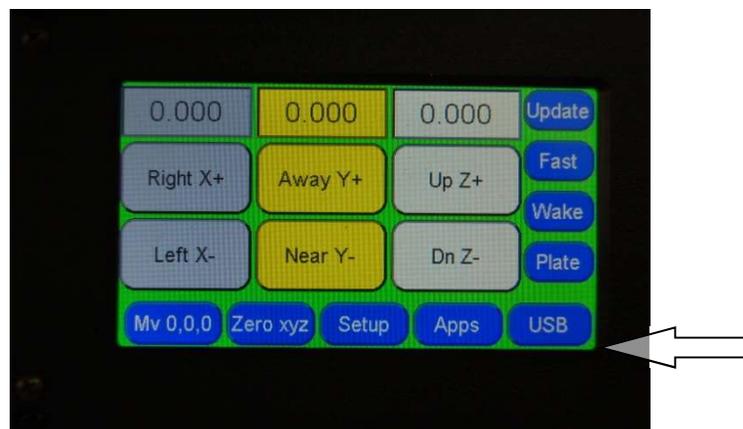
(The following steps assume the Z origin is set for the surface of the cylinder. If the Z origin is set for the center of the material, please proceed to the next section)

- 10) With the bit resting on the top of the cylinder press the number readout above "Z+"
- 11) Set the value to "0"
- 12) Press Set

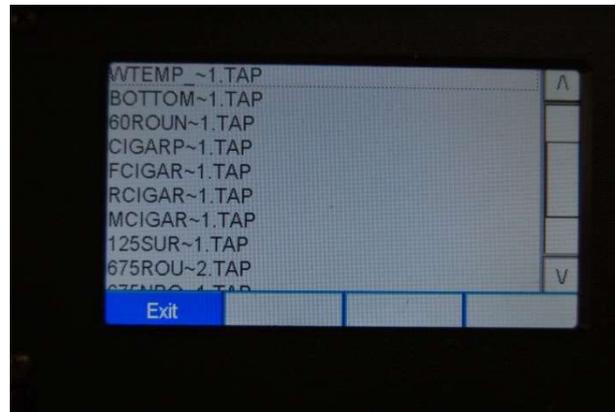
Set up using cylinder center as Z origin:

- 1) Measure the diameter of the cylinder
- 2) Place the workpiece in the 4th axis
- 3) Jog the router bit to the surface of the material
- 4) Click the number readout above the "Z+" jog button
- 5) Enter the radius value (50% of the diameter) and click "Set"

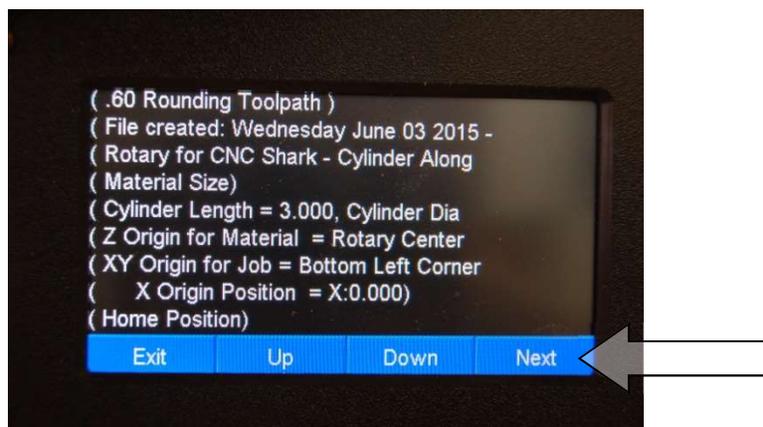
Next, plug the thumb drive containing the *.tap file into the LCD Pendant using the USB port on the right hand side of the pendant. The USB button will change from gray to blue. Select the USB button to select the .Tap file to run. (See Figure below)



Next select the appropriate tap file. (See Figure below)



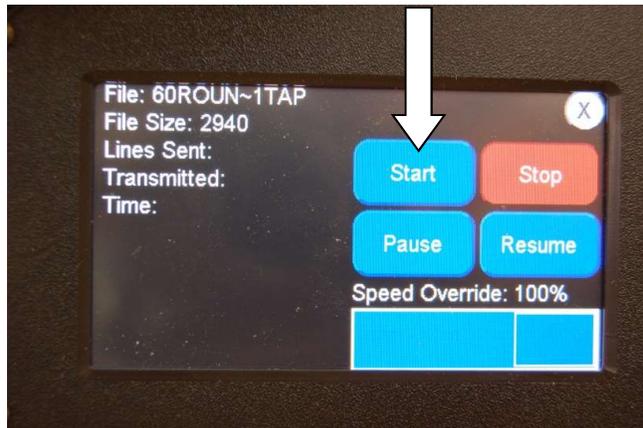
Verify the correct file is selected. If everything is correct press, Next. (See Figure below)



File Information

Next select the 'Start' button and the CNC Shark HD4 will start to machine the part. The operator has complete control to pause and resume operation should it be necessary (remember to turn router off if adjusting the workpiece). The slide bar for Speed Override controls the real-time feedrate of the router. The E-Stop function will immediately cease file transmission and the router will stop once the most recently transmitted line of commands are complete. We do not recommend using the small X to stop the cutting as it can confuse the machine, it is only used to back out to the previous page). (See Figure below)

When the job is finished, the gantry will return to the home position with the Z axis at the preprogrammed safe height.

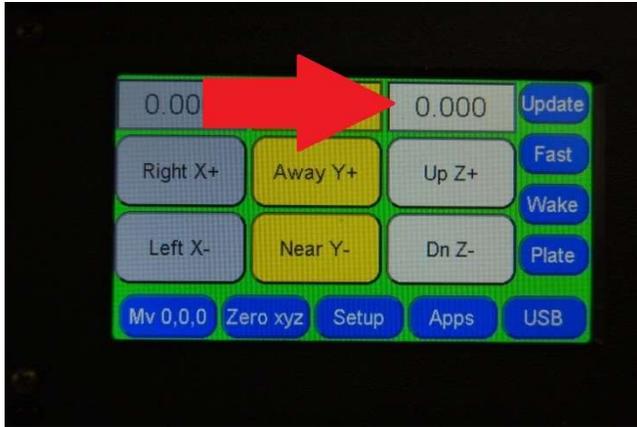


Select Start button

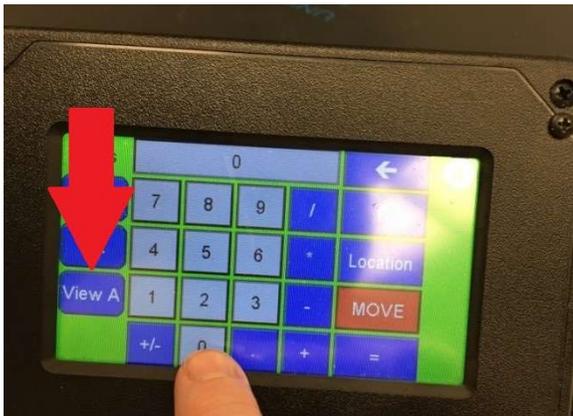
Jog 4th Axis via Pendant

To jog the 4th Axis using the pendant, please follow these steps:

- 1) Click the number readout above the Z jog buttons.



- 2) Select 'View A'



- 3) Select 'OK'

The buttons once labeled 'Z+' and 'Z-' will now be labeled A+/A-.

To change back to Z axis control, repeat these steps and select 'View Z' where applicable.

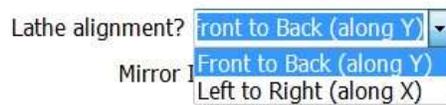
Appendices

4th Axis Layout, SCP2 Preferences and Post Processor

The following sections are applicable to Shark Control Panel 2.1 and legacy machines.

While you do not have to setup the rotary assembly explicitly parallel with either the X or Y axis, you do have to set the SCP2 A|4th Axis preference appropriately for the setup. Each of the figures below shows the motor/chuck assembly positioned 'closest' to the upper left corner of the table (as defined by the location of the table axis motor location), you can choose the opposite.

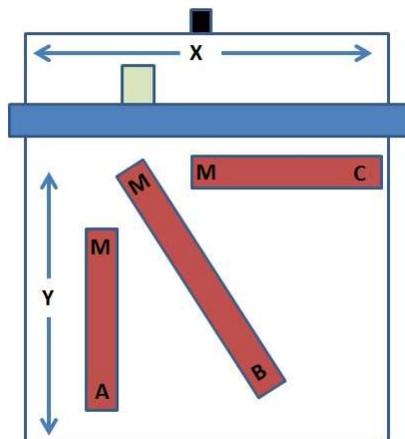
Once you have finished setting up the rotary assembly, you must open the A|4th Axis preferences, and set the 'Lathe alignment?' preference to either 'Front to Back (along Y)' or 'Left to Right (along X)'.



In all cases, you will want to run a simple test project to ensure that the carved image is not being mirrored (image is 'backwards'). If it is mirrored, open up the A|4th Axis preferences and check the 'Mirror Image' preference. Hit 'Ok' to save the preference setting, and reload the tap file.

Carriage Facing the Table Axis Motor

This is the standard configuration of a CNC Shark machine. The router carriage is on the side of the gantry closest or facing the table axis motor.



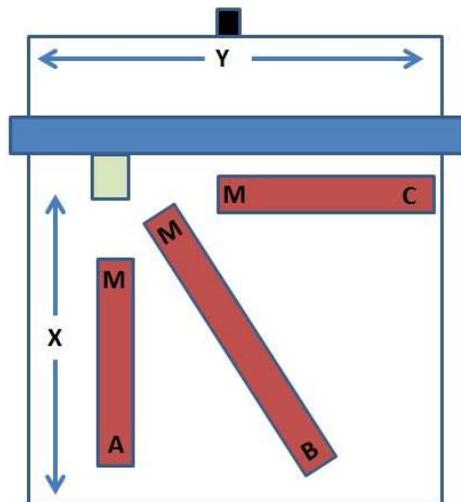
Axis Orientation - Standard Gantry Configuration

The table below states the 'Lathe alignment' preference you should use for each case in the figure above.

Rotary Setup	Lathe Alignment Preference	Post Processor	Comments
MA	Front to Back (along Y)	CNCShark Rotary – Wrap Y (inch) – Orient Y or CNCShark Rotary – Wrap Y (mm) – Orient Y	
MB	Front to Back (along Y)	CNCShark Rotary – Wrap Y (inch) – Orient Y and CNCShark Rotary – Wrap Y (mm) – Orient Y	If the angle from the Y axis is 45° or less
MB	Left to Right (along X)	CNCShark Rotary – Wrap Y (inch) – Orient X or CNCShark Rotary – Wrap Y (mm) – Orient X	If the angle from the X axis is 45° or less
MC	Left to Right (along X)	CNCShark Rotary – Wrap Y (inch) – Orient X or CNCShark Rotary – Wrap Y (mm) – Orient X	

Carriage Not Facing the Table Axis Motor

This is a configuration of the CNC Shark that some users have in place. They did this so that the X axis from a project perspective is along the non-motor edge of table. This is sometimes referred to as 'reversed gantry.' The router carriage is on the side of the gantry opposite the side facing the table axis motor.



Axis Orientation - Reversed Gantry Configuration

The table below states the 'Lathe alignment' preference you should use for each case in the figure above (reversed gantry).

Rotary Setup	Lathe Alignment Preference	Post Processor	Comments
MA	Front to Back (along X)	CNCShark Rotary – Wrap Y (inch) – Orient X or CNCShark Rotary – Wrap Y (mm) – Orient X	
MB	Front to Back (along X)	CNCShark Rotary – Wrap Y (inch) – Orient X or CNCShark Rotary – Wrap Y (mm) – Orient X	If the angle from the X axis is 45° or less
MB	Left to Right (along Y)	CNCShark Rotary – Wrap Y (inch) – Orient Y or CNCShark Rotary – Wrap Y (mm) – Orient Y	If the angle from the Y axis is 45° or less
MC	Left to Right (along Y)	CNCShark Rotary – Wrap Y (inch) – Orient Y or CNCShark Rotary – Wrap Y (mm) – Orient Y	

4th Axis Setup and Use Tips

The following sections are applicable to all Shark machine models

Determining the Chuck Radius

You can close the chuck jaws to a point where the caliper is 'held' snug by the chuck mechanism. Manipulate the caliper to get an accurate measurement of the diameter of the chuck assembly. In most cases, this will give you the most accurate reading of the chuck diameter for use in 'tapping off' when you 'Set Front'.



Positioning Along the Centerline

When you've positioned the rotary along the X or Y axis, you can use the lubrication point on the top of the motor assembly as a reference when setting the tool along the centerline prior to tapping off. Position (jog) the tool at the 'center' of the lubrication point, and then jog along the axis to the desired tap off point.



Positioning Along Centerline for X or Y Axis Configuration

When you have positioned the motor/chuck assembly at an angle to either the X or Y axis of travel, you can use a small square and 'L' bracket to provide a centerline reference to a tap off point on the chuck. Rotate (jog) the chuck to a position where a small square can be lightly held by the chuck so that the base of the square is flat on a table. Remove the square and place an 'L' bracket in the chuck and tighten it down to hold the 'L' bracket in place. Position (jog) the tool so that it is centered on the edge of the 'L' bracket and above the tap off point. Remove the 'L' bracket from the chuck and perform the 'Set Front' tap off task. For increased accuracy in position, use a small gauging square in lieu of the 'L' bracket.

