



SHAPER



v1.0

---

# ORIGIN & WORKSTATION

CLASSROOM GUIDE



## WELCOME!

At Shaper, we believe that hands-on learning is key to a successful education. Critical thinking, problem solving, and the practical application of knowledge are increasingly important in order to provide students with a bright future.

With Shaper Origin in the classroom, the traditional shop class experience can be safely adapted to a variety of subjects, effectively teaching digital design skills, creative thinking, and problem solving. Origin also brings new life to traditional woodshops and makerspaces.

# SHAPER ORIGIN + WORKSTATION



Shaper Origin is an easy-to-use handheld CNC router that brings digital precision to the craft of woodworking. With automatic cut correction and an intuitive touchscreen interface, Origin allows you to accurately create a huge variety of woodworking projects. Combined with Shaper Workstation, you can quickly align and clamp your work to open up a world of joinery, fine furniture, and more.

Adding Origin to your shop or classroom is a great way to build on existing tools that you may already have. Machines like 3D printers or laser cutters combine with Origin to further expand your students capabilities and broaden their experience.

## WHAT TEACHERS SAY



*With Origin, the process is truly hands-on. Nothing happens without the individual having their hands on the machine, and guiding it. And in terms of student engagement, that's the gold standard.*

**Mel Goodwin, PhD**

STEM Coach Laing Middle School of Science and Technology



*Origin highlights the skills that we're trying to develop in our students to get them ready for post-secondary life, and to work with industry standards from companies looking to hire.*

**Brian Reed**

Coordinator of STEM & Digital Learning Rockwood School District

## CLASSROOM GUIDE

We've assembled a handful of projects and training resources to get you and your students productive on day one. These projects are designed to easily adapt to your existing curriculum. Be sure to check out our [Forum](#) to engage with other educators using this guide in the classroom.



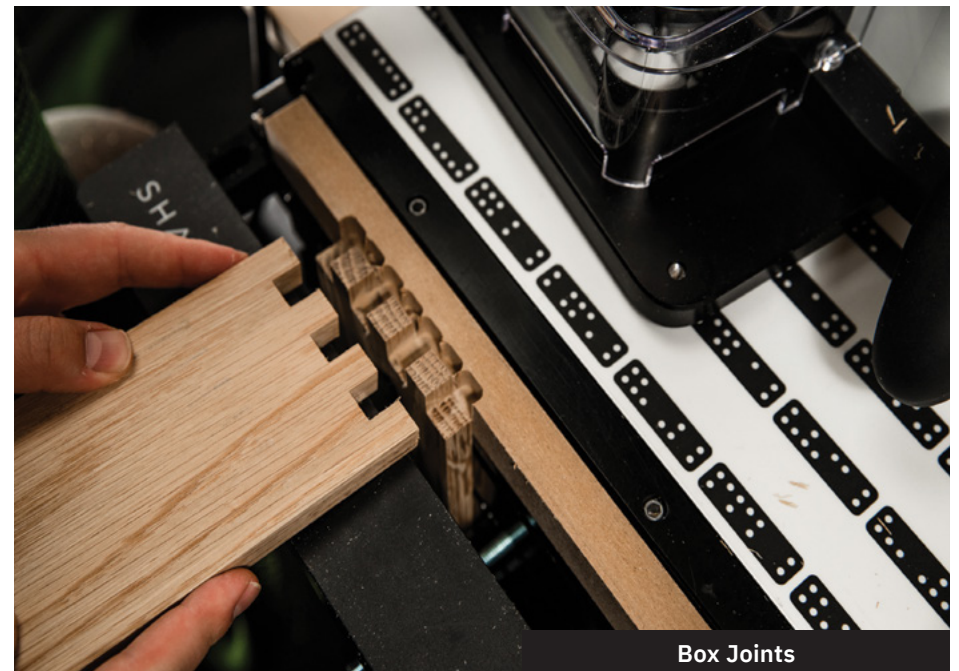
Shaper Origin



Nameplate



Passive Phone Amp



Box Joints

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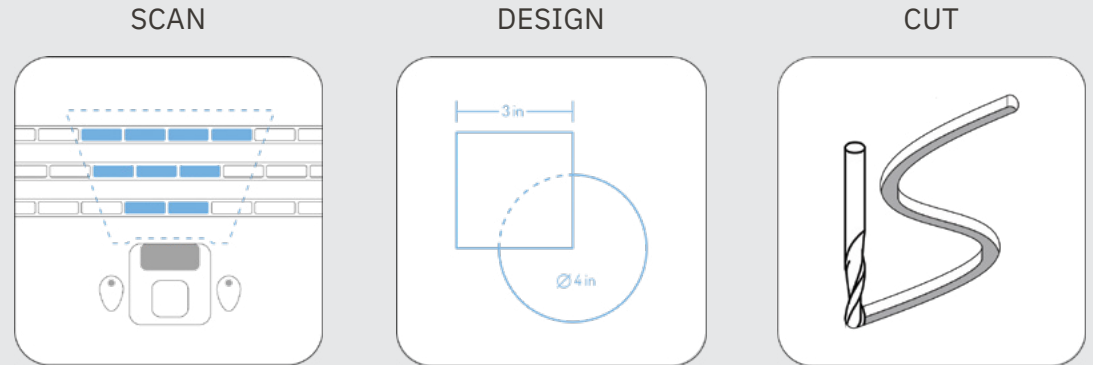
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# USING ORIGIN

With Origin, we try to keep things simple. There are three basic steps that you'll follow for every project: Scan, Design and Cut.






## SCAN

Origin uses ShaperTape to understand its position in your Workspace. After you have added ShaperTape, you will need to scan your project to create a new Workspace.

Workspaces are a fundamental building block of any project you cut with Origin.




*Every time you create a **New Scan**, a new Workspace is created.*

To Create a New Scan, select **Scan Mode**  on the right side of the screen, then tap the **New Scan**  button on the left, and finally tap the **Start Scan**  button to begin scanning. Carefully move Origin around the entirety of your project so that the camera sees all dominoes.

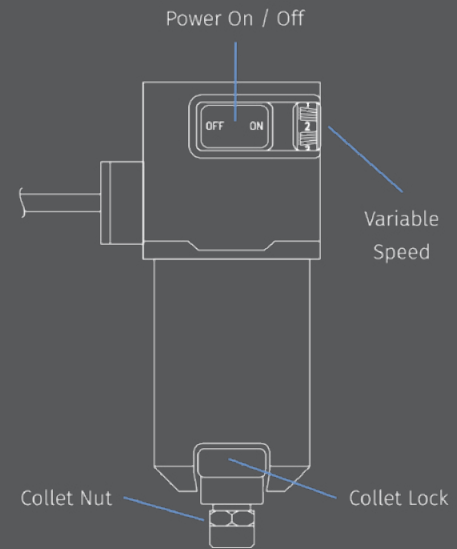
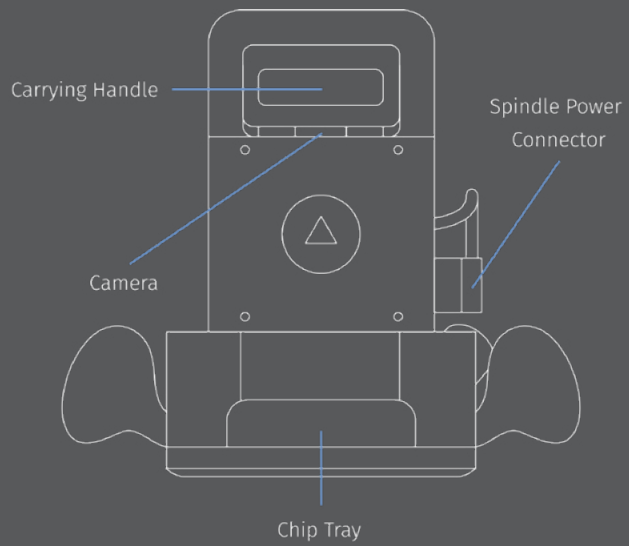
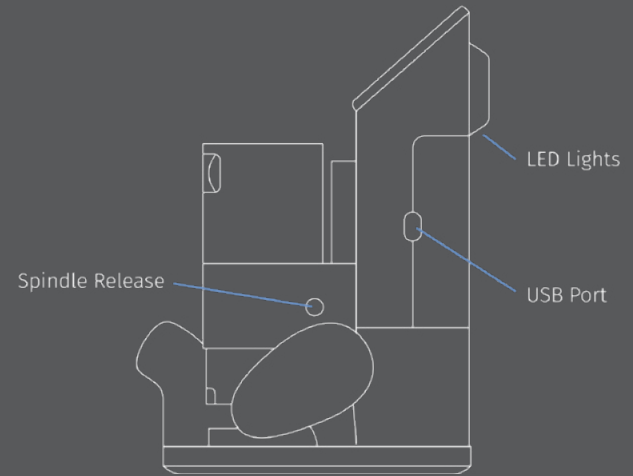
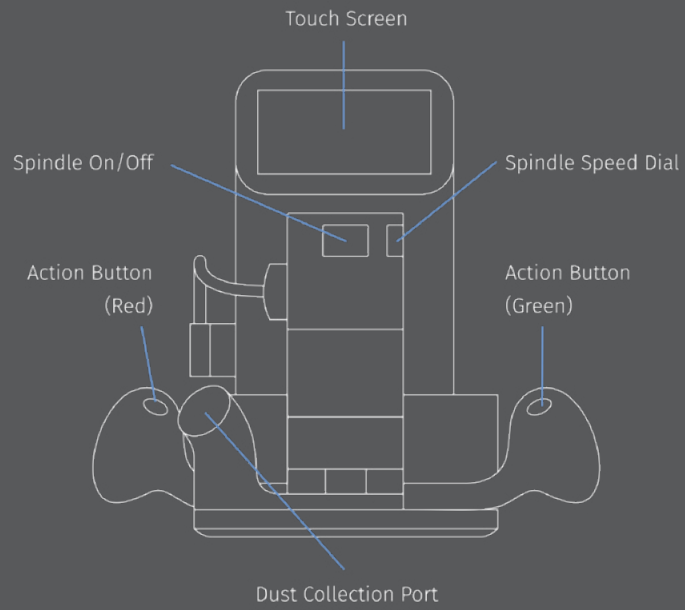


*Dominoes will turn blue onscreen once Origin has registered them. If a domino is ripped, damaged, or can't be scanned, it will remain black.*

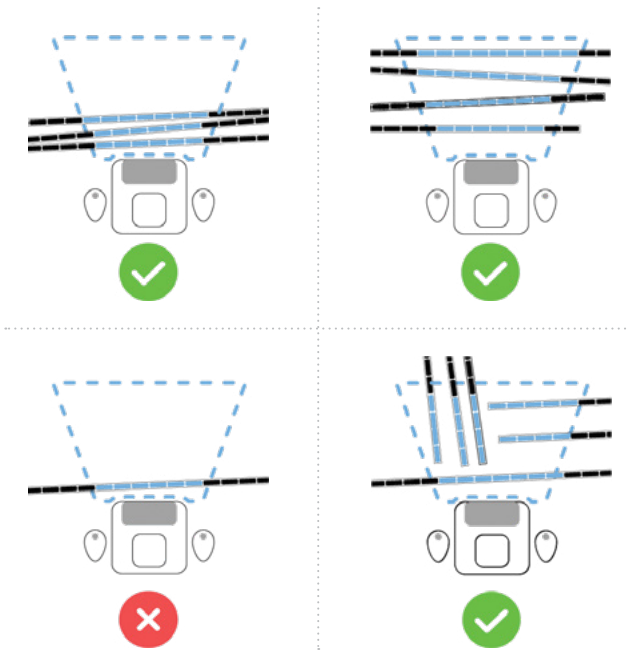
Be sure to include the area where you plan to cut in your scan, even if that area does not have ShaperTape. Origin will add this area to your Workspace image, allowing you to align your designs to features on your material such as wood grain.

When you have completed your scan, tap **Finish**  .

For additional Workspace and Scanning assistance, visit our [Help Center](#)



# USING SHAPERTAPE



Origin uses ShaperTape to map your Workspace and to track its position while you are designing and cutting. If you are not using a Workstation, you will need to apply ShaperTape directly on your workpiece or on separate material of the same thickness.

It is best to apply ShaperTape to the area you plan to cut, as well as an area 6" - 12" in front of the cutting area. This way, you will have plenty of ShaperTape visible, even after you have cut through some of the dominoes.

Lay out the ShaperTape so that there is about three inches of space between each strip. We find that laying out the tape in roughly parallel lines is easiest, but there is no need to be exact as the strips do not need to be parallel to one another. The orientation of ShaperTape in reference to your project is not important; you can lay out your tape horizontally, vertically, or diagonally in your workspace.



*Strips of ShaperTape must all be applied on the same plane, and should never overlap.*

ShaperTape cannot be moved after you have scanned, as this can cause serious issues with cut accuracy. Make sure that your workpiece and any surface with ShaperTape on it is well secured!

## TAPE VISIBILITY INDICATOR


At the top right of the screen, you'll see a domino icon. This is an indication of the amount of ShaperTape that Origin can see in its current orientation.

## INDICATOR GUIDE

| Display | Visual Health | # of Dominoes |   |
|---------|---------------|---------------|---|
|         | Great         | 15+           | Origin can see a sufficient amount of tape for high quality cuts.                             |
|         | Good          | 8-14          | Some dominoes are missing, obscured by debris (sawdust, etc) or scratched.                    |
|         | Yikes!        | <7            | Very few dominoes are visible. Origin may fail to cut in this state or retract while cutting. |



To troubleshoot a low Tape Visibility Indicator, you can try the following steps:

- Rotate Origin to face more ShaperTape while cutting.
- Clear away any loose debris or dust in front of Origin.
- Add more ShaperTape, and then use **Add to Scan**  to map the new tape.

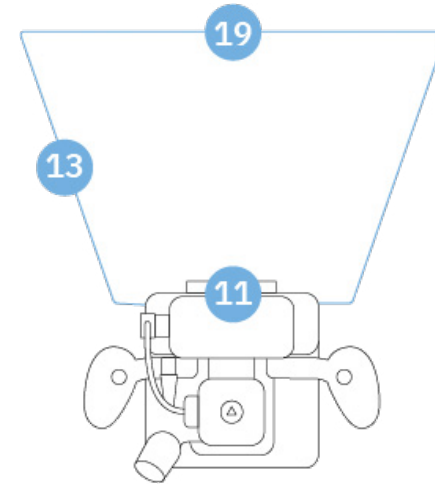
## COMMON ERRORS MESSAGES

### Tape Movement Detected

- ShaperTape or workpiece is moving or not properly secured.
- ShaperTape is not properly adhered to the worksurface and is peeling up.
- A domino is overhanging an edge of your workpiece.

### Tape is Not Coplanar

- Check for other readable tape around your work area that isn't coplanar to your workpiece.
- Origin's Base is not coplanar to the scanned ShaperTape.
- Non-parallel worksurfaces



# DESIGN

There are three ways to design a project for Origin. You can design entirely on-tool (no computer required), download a project from ShaperHub, or import your own design from a number of popular design programs like Sketchup or Fusion360.

## ON-TOOL DESIGN

Use Origin to create designs wherever you work. Create simple shapes, cut box joints, or engrave text. You can also make adjustments to your designs on the fly, no computer required.

## SHAPERHUB





ShaperHub is a continuously growing community with an expanding library of downloadable designs and projects. You can browse ShaperHub for inspiration, store your own designs and share them with other users.








## IMPORTED DESIGNS

It's easy to import designs from your preferred design software with quick file transfers via ShaperHub or with the provided USB drive. Origin files must be formatted correctly in order to work. Use whichever design software you're most comfortable with, so long as you're able to export or convert your file to an SVG (Scalable Vector Graphic). Check out our [design resources](#) for more information.

## VECTOR DESIGN SOFTWARE

| VECTOR DESIGN     |  | COST              |
|-------------------|--|-------------------|
| Adobe Illustrator |   | Subscription      |
| Affinity Designer |   | One-time Purchase |
| Inkscape          |   | Free              |
| Vectr             |  | Free              |

## 3D CAD SOFTWARE

| 3D CAD               |   | COST  |
|----------------------|---|---|
| Solidworks           |  | Subscription                                |
| AutoCAD              |  | Subscription                                |
| Fusion 360           |  | Free for Education<br><i>Shaper Plug-in</i> |
| SketchUp for Schools |  | Free<br><i>Third Party Plug-in</i>          |
| TinkerCAD            |  | Free  |

## PLACEMENT TOOLS

Whether you want to place your cut files by eye, or in an exact location, Origin comes with built-in tools to suit a variety of projects.

A **Grid** can be created to precisely align your designs to real world objects. Learn more about Grid [here](#).

**Scale**, **Rotate** and **Mirror** your designs and see the changes in real time, or use **Grid** and **Position** to precisely align your design in reference to an edge of your workpiece.

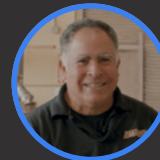
## WHAT TEACHERS SAY



*For years there's been a demand for us to teach CNC. We had 35 kids in the class with one kid learning how to program the CNC and 34 kids watching. That doesn't work very well. With Origin, multiple students can be working at the same time.*

**Joe Campbell**

CTE Instructor Glendale High School



*When you want to give kids a real world experience, this is probably the best thing that you can come up with.*

**Anthony Agundes**

Shop Teacher Cunha Middle School

# CUT

Once you've scanned the workspace and placed your designs, you're ready to switch to **Cut Mode**.

## CUT SETTINGS

On the left-hand Menu, you'll have access to all of the settings that control each cut with Origin.

### CUT DEPTH

Use this setting to set a precise depth of cut that will be maintained throughout the cut.


For router bits up to 1/4" diameter, we recommend cutting in passes no greater than the bit's diameter. In other words, make passes no deeper than 1/8" depth when cutting with a 1/8" cutter.


*If your inputted depth exceeds Origin's maximum travel capability, you will receive an error message. The depth setting will be updated to match the maximum travel. If this doesn't seem right, you may need to perform another Z-Touch.*


### CUT TYPE


Cut types tell Origin where to place the cutter in reference to your design. Cut type is assigned either in your design file or on-tool.




|                     |   |   |
|---------------------|---|---|
| <p><b>Guide</b></p> | <p>A Guide is not cuttable. You can use it to align a design with another object, a grid marker, or an element on the workpiece itself, such as wood grain.</p> |  |
|---------------------|---|---|

|                       |   |   |
|-----------------------|---|---|
| <p><b>Outside</b></p> | <p>An outside cut places the cutter on the outside of the design.</p> |  |
|-----------------------|---|---|

|                      |   |   |
|----------------------|---|---|
| <p><b>Inside</b></p> | <p>An inside cut places the cutter on the inside of the design.</p> |  |
|----------------------|---|---|

|                      |  |  |
|----------------------|--|--|
| <p><b>Pocket</b></p> | <p>A pocket cut acts like a traditional router, so you can remove material from the inside of a profile.</p> |  |
|----------------------|--|--|

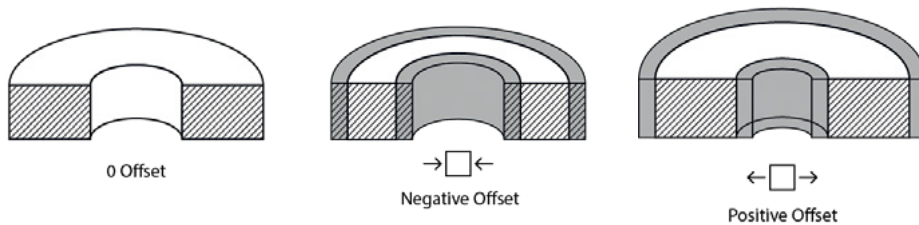
*Auto Mode will not work in a pocket. Pocket cuts also have an automatic offset as a safety buffer. For best results, we recommend you switch to an inside cut to make the final pass on every pocket.*

|                       |  |   |
|-----------------------|--|---|
| <p><b>On-Line</b></p> | <p>An On-Line cut places the center of the cutter over the center of the cut path.</p> |  |
|-----------------------|--|---|

*Engraving is a common use for an On-Line cut. Offsets are not an option when making an On-Line cut.*

**OFFSET** 

Offset specifies the distance between your design and the cutpath. This is a very important tool for fine-tuning fitment between two objects, or when cutting roughing and finishing passes.



You can set a positive offset to add material to your cut profile, or negative offset to subtract material from your cut profile.

*With offsets, you can easily cut multiple roughing passes followed by a single finishing pass (with a zero offset). This will keep the cuts clean and accurate and ensure tight, reliable fits between pieces.*

**BIT DIAMETER** 

1/4" Up-Cut Spiral



1/8" Up-Cut Spiral



V60 Engraving Bit

The Bit Diameter setting allows you to specify the diameter of the cutter installed in Origin's collet. Three different bits are provided with Origin.

*All three stock bit sizes appear as presets in the Bit Diameter Menu for reference.*

**Z-TOUCH** 

Every time you change bits, Origin needs to measure the distance from the surface of your workpiece of your bit. This allows it to accurately calculate the depth of your cuts. Make sure that the base of Origin is completely supported on a flat surface, remove both hands from the handles, and then tap the Z-Touch button.

A green checkmark indicates success. A red 'X' indicates that you need to try again.

**COMMON ERRORS**

- The spindle clamp screw is loose.
- The collet is loose.
- The front edge of Origin's base is not well supported.
- Origin can't see any ShaperTape during Z-Touch.

**SPEED**

Because every cutting operation is unique, there is no one-size-fits-all combination of cut settings. We suggest that you approach each project in an iterative fashion, testing and adjusting as you work.



## POINTS OF ADJUSTMENT

### Auto Speed

The rate at which the cutter tracks along a path when Auto Mode is engaged.

### Plunge Speed

The rate at which the cutter travels in the Z-Axis while plunging into a cut.

### Spindle Speed

The rotational speed of the cutter. Use the dial on Origin's spindle to adjust this speed. Start slow and work your way up to find the right speed.

### Feed Rate

The rate at which the user is moving Origin across the workpiece.

*Move at your own pace, but always adjust the Spindle Speed accordingly. Mismatched speed and feed combinations will lead to poor cut quality.*

## Rules of Thumb

- Your material shouldn't be burning or melting.
- Your chips should be chips—neither chunks nor dust.
- Listen to your tool—if it doesn't sound right, it probably isn't.
- Sharp, clean bits will yield the best results.
- Match your Plunge and Auto speeds to the conditions of your project; hard materials or delicate cutters require slower speeds, and vice versa.

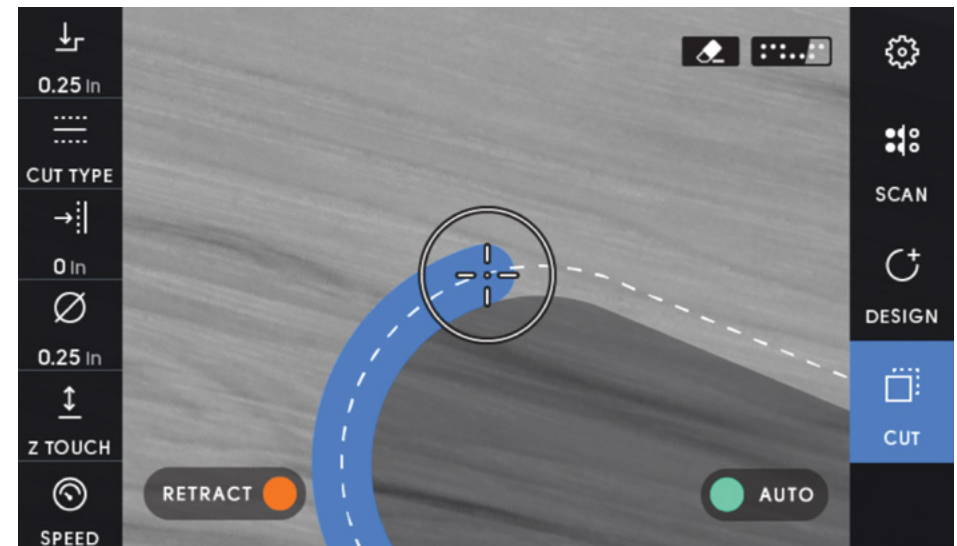
## CUTTING

Move Origin over the path you intend to cut. Turn the spindle on, and ensure the speed settings are correct for the material. Tap the Green Handle Button to begin cutting.

When Origin begins cutting, it plunges the spindle down to the requested depth. Wait for the red progress bar to disappear before moving Origin. Guide Origin along the path in the direction of the dashed lines.

*Origin will only allow cuts in one direction. This reduces the likelihood of grabs and helps keep you safe.*

The small white dot indicates the center of your cutter, and the large white circle indicates Origin's corrective range. Always keep the small dot inside the corrective range. Straying outside will abort your cut and retract the bit to preserve your workpiece.



## Auto Mode

While using Auto Mode, Origin will maintain a constant feed rate. This is especially useful when cutting around sharp corners or navigating complex paths.

Auto Mode can be turned on by holding down the Green Handle Button during your cut, or locked on by double-clicking the Green Handle Button when starting a cut.

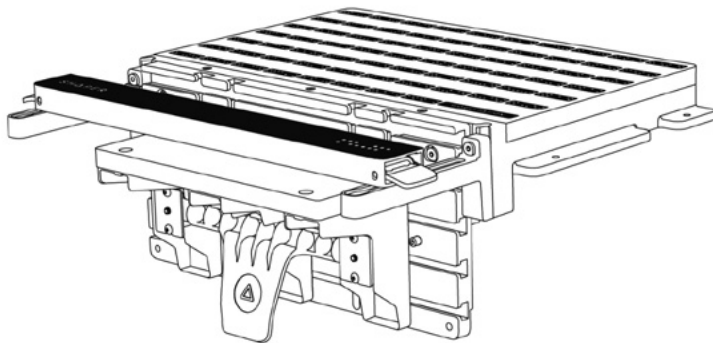
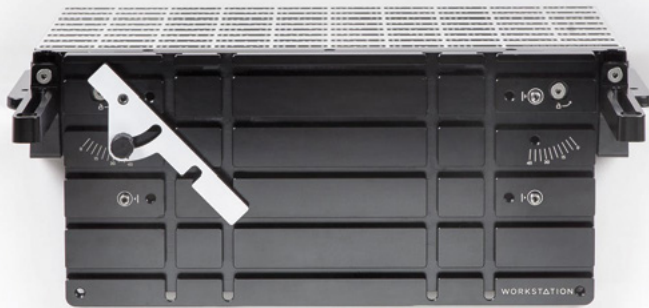


## WORKSTATION

The Shaper Workstation is a versatile fixturing tool that makes project setup fast and repeatable. Two of the three Classroom projects in this guide utilize the Workstation, so it is important to get familiar with its

functionality. Take a moment here to get familiar with the anatomy of the Workstation by reading through the detailed information included in the Product Manual.

 [The Shaper Workstation Product Manual can be found here.](#)



### A COMPLETE SYSTEM

Combine with Origin for a precision cutting system that makes even the most demanding projects approachable and intuitive.

Pre-applied ShaperTape surface allows Workstation to integrate with Origin's computer vision system for simple setup and unrivaled production capabilities.

Compact and portable for on-site usage.

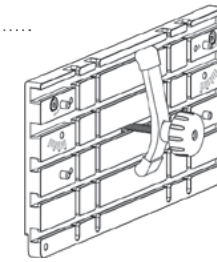
## KEY FEATURES

### Versatile Clamping Face

Vertical alignment pins for reliable 90° joints.

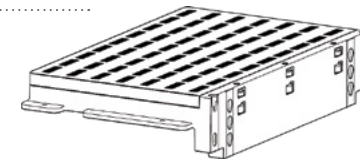
A grid of t-slot rails that allow for the included clamps to be easily configured to get the perfect hold.

Height adjustable to accommodate your work.



### Pre-Applied ShaperTape Surface

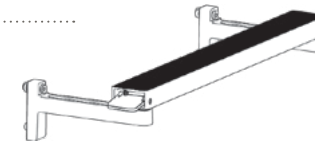
Extra durable ShaperTape surface greatly reduces project setup time and ShaperTape consumption.



### Support Arms & Bar

Adjustable support for the front edge of Origin.

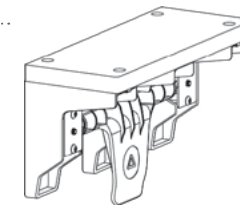
Support Bar can be used as vertical end stop for aligning work to the top surface of the Workstation.



### Height Adjustable Shelf

Work on material of almost any thickness using Shelf's easy height adjustment system.

Perform detailed cuts on small or difficult-to-fixture workpieces.



### Variable Angle Fence

Cut tenons at any angle from 0° to 45°.





## WORKSHOP CART



Keep your Origin, Workstation, dust extraction, safety equipment, and all your cutting accessories near to hand with this convenient mobile storage solution. The Shaper Cart is a great way to introduce your classes to cutting with Origin + Workstation while introducing basic principles of cabinetry at the same time. You can find complete build plans and cut files on ShaperHub.

All you need to get started is three sheets of  $\frac{3}{4}$ " plywood and your new Origin + Workstation Education Package.



Explore the project on ShaperHub.  
Scan the QR Code or go to:  
[shapertools.com/workshopcart](https://shapertools.com/workshopcart)



## NOTES &amp; TAKEAWAYS

## WRAP UP

When all the Nameplates are complete, set up a gallery around the shop so that everyone can see each other's creations. Share the creative process and ideas behind your Nameplate. Your experience will be different from everybody else's and is worth sharing with the class.



## CLASSROOM PROJECTS

The following projects will serve as an introduction to Origin + Workstation and are designed to build a foundational knowledge of digital fabrication.



PROJECT

# 001 NAMEPLATE

PROJECT DIFFICULTY: BEGINNER

# 001 NAMEPLATE

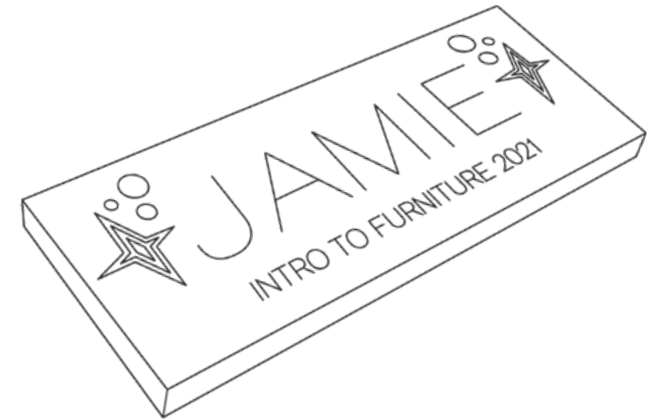
PROJECT DIFFICULTY: **BEGINNER**

## BRIEF

In this lesson, students will use Origin's on-tool design features, in conjunction with Workstation, to design and create a personal Nameplate. It's a simple hands-on project with immediate gratification.

## GOALS

- Learn how to use Workstation to fixture a workpiece.
- Build familiarity with Origin's on-tool features to create a unique design.
- Understand basic engraving techniques.



## PREPARATION

### PROJECT MATERIALS

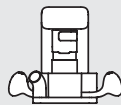


10" x 4"  
workpiece for  
each student

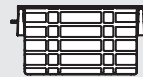


Wood stains  
and finishes

### TOOLS & CONSUMABLES



Shaper Origin



Shaper  
Workstation



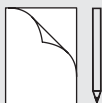
60° V Engraving  
Router Bit



Double-sided  
tape



ShaperTape



Pencil & paper  
*optional*



Application  
cloth  
*optional*



Rubber gloves  
*optional*



*This is a great project to use up your shop's scrap wood.*

## WORKSPACE SETUP

Secure each Workstation to its bench, set the Clamping Face to its 0mm position and install the Shelf, Support Arms, and Support Bar.



*A well-prepared workspace is critical to any trade or craft. To ensure a great end result, use the checklist located on page 50 of this guide.*

## STEP INSTRUCTIONS

### 1. SETUP

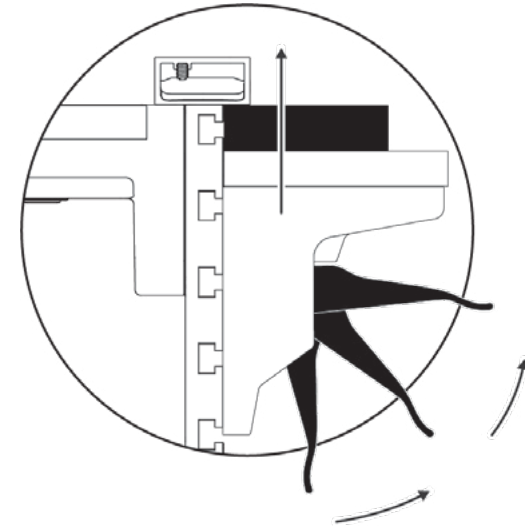


Use a piece of double-sided tape to adhere the workpiece to Workstation's Shelf. Then, level the workpiece to the top surface of Workstation by moving the Shelf up or down and locking it in place.

Place the Support Bar on the Support Arms and secure it against the edge of the workpiece.



*Use the Support Bar in its end stop position to easily align your workpiece to the top surface of Workstation. SEE BELOW*




### 2. SCAN

**Scan**  the workspace, including both Workstation's Body and the workpiece.



### 3. DESIGN

Select **Design**  on the right side of the screen. The on-tool CAD tools allows you to create:

**Circle**  - diameter

**Rectangle**  - W x H and corner radius adjustments

**Pen**  - design on the fly or trace another object

**Text Basic**  - scalable text with a single-line font



Let students explore the different on-tool design features, creating at least one object with each of the four tools.


Design your Nameplate using paper and pencil. Discuss each of the CAD tools on Origin and how each could be used to create a unique design.



*Think creatively! Use the shapes, the pen tool and a grid to create customized text and complex shapes.*

### 4. CUT



Select **Cut**  on the right side of the screen, and install the provided 60° V Bit.

The 60° V Bit can cut very fine lines with shallow cutting depths. Use the **Engrave** preset for both **Depth** and **Bit Diameter**. Start with a **Spindle Speed** of 3 when engraving wood and adjust from there.



*If this is a first project for students, consider allowing test cuts on some scrap before proceeding with engraving on the final workpiece. Have students use the Project Cut Settings Worksheet on page 51 to record the results of each test cut.*

Once you are confident with your design and test cuts, use on-tool CAD to finalize the design and then complete the engraving work.



## 5. FINISH

Stain or finish can really make or break a project. Choose a finishing product that will complement your Nameplate.









PROJECT

# 002 PASSIVE PHONE AMP

PROJECT DIFFICULTY: INTERMEDIATE

# 002 PASSIVE PHONE AMPLIFIER

PROJECT DIFFICULTY: **INTERMEDIATE**

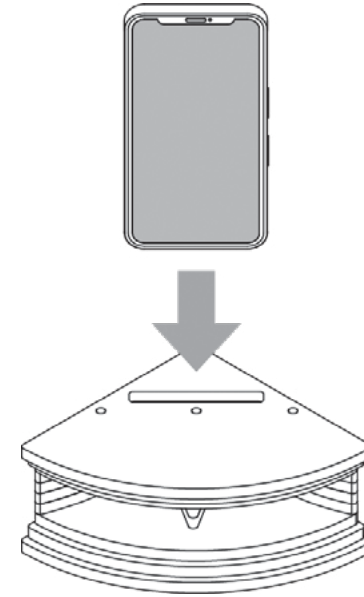
## BRIEF

A passive amplifier increases the sound volume without the use of external electrical power or additional energy.

In this project, you will build a passive smartphone amplifier to better enjoy your favorite tracks.

## GOALS

- Learn how to accurately cut at different depths.
- Develop offset techniques for cleaner cuts.
- Get familiar with setting up workspaces with ShaperTape.
- Understand how to adjust fit using offsets.

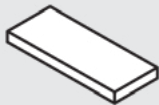


## PREPARATION

### PROJECT MATERIALS



30" x 24" x 1/4"  
Plywood

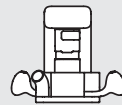


48" x 24"  
Plywood or MDF  
Spoilboard



1/4" Wood  
Dowel

### TOOLS & CONSUMABLES



Shaper Origin



Wood glue



Double sided  
tape



ShaperTape



1/4" Up-Spiral  
Router Bit

## TOOLS &amp; CONSUMABLES (cont.)



1/8" Up-Spiral  
Router Bit



Clamps



Flush trim  
saw

💡 Spoilboards  
can be  
reused  
for many  
projects!

## WORKSPACE SETUP

Place your spoilboard on top of your work table.

Apply double-sided tape about 1/2" apart on the back of your workpiece. Remove backing from the double-sided tape and affix it to your spoilboard.

Clamp the material and spoilboard together securely to the work table.

## INSTRUCTIONS


## 1. SCAN



Apply ShaperTape to your workpiece. For this design, we recommend an area of 30" x 24" (about 8 rows) of taped work surface in front of your cut area.

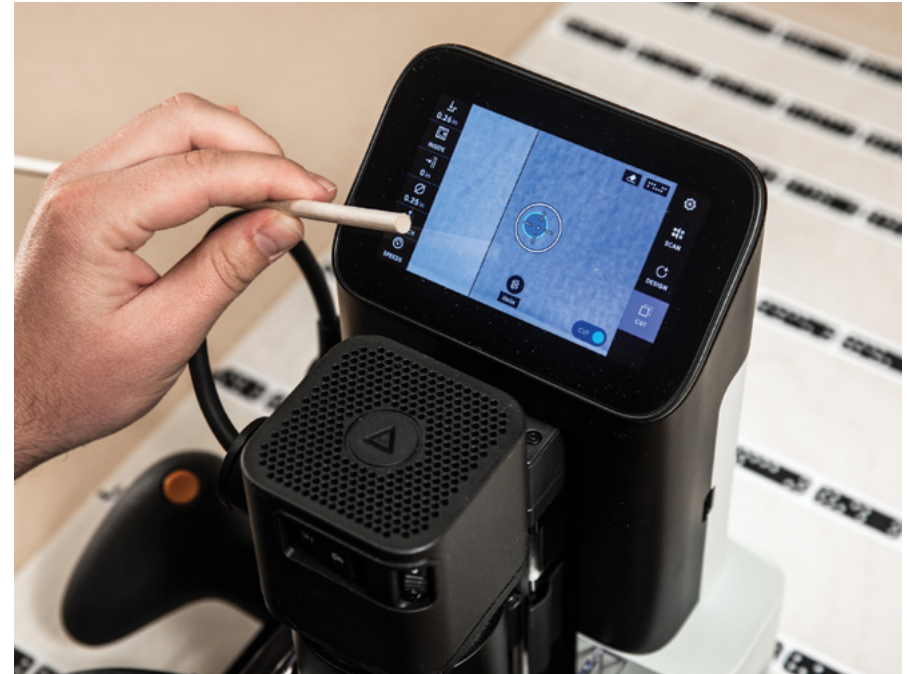
Once ShaperTape is applied, **Scan**  your work surface.

## 2. DESIGN

**Place**  the design files in the Workspace along the bottom long edge of your material.

💡 *Once you have placed your design, test its placement by moving Origin over the farthest edges of your design to make sure you will be able to complete all cuts without running into clamps, edges, or losing view of sufficient ShaperTape.*





### 3. CUT

Carefully follow the Cut Strategy Worksheets below to complete this step.



*Start with cutting one dowel hole to a 0" offset. Test-fit your dowel and adjust using small negative offsets (-0.002" at a time) until the dowel slides in and out with ease, but does not rattle around. Once you have figured out your offset for one, you can cut the rest of the holes using the Helix function.*

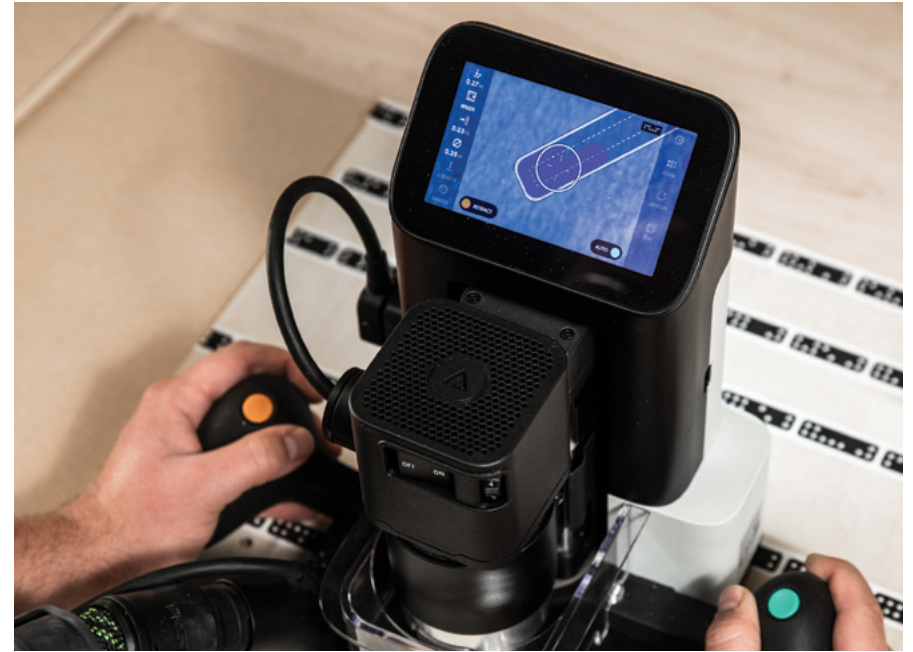
## Design Option 1 - The Stage

| Phone Opening |      |               |       |        |
|---------------|------|---------------|-------|--------|
| Pass          | Bit  | Spindle Speed | Depth | Offset |
| 1             | UC ¼ | 5             | 0.26  | 0.03   |
| 2             | UC ¼ | 5             | 0.26  | 0.03   |

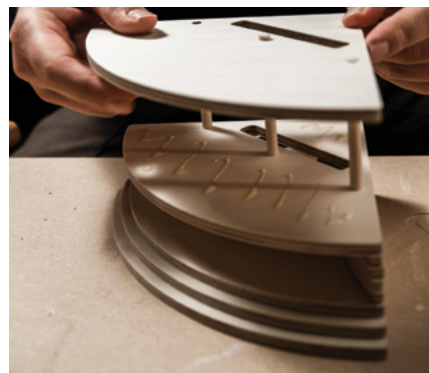
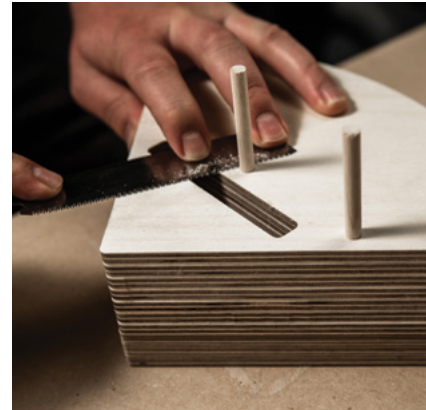
| All Dowel Holes (Helix On) |      |               |       |         |
|----------------------------|------|---------------|-------|---------|
| Pass                       | Bit  | Spindle Speed | Depth | Offset  |
| 1                          | UC ¼ | 5             | 0.26  | 0.00    |
| 2                          | UC ¼ | 5             | 0.26  | -0.005* |

\*Depending on your test-fit (see previous page)

| All Outside Cuts |      |               |       |        |
|------------------|------|---------------|-------|--------|
| Pass             | Bit  | Spindle Speed | Depth | Offset |
| 1                | UC ¼ | 5             | 0.26  | 0.03   |
| 2                | UC ¼ | 5             | 0.26  | 0.00   |





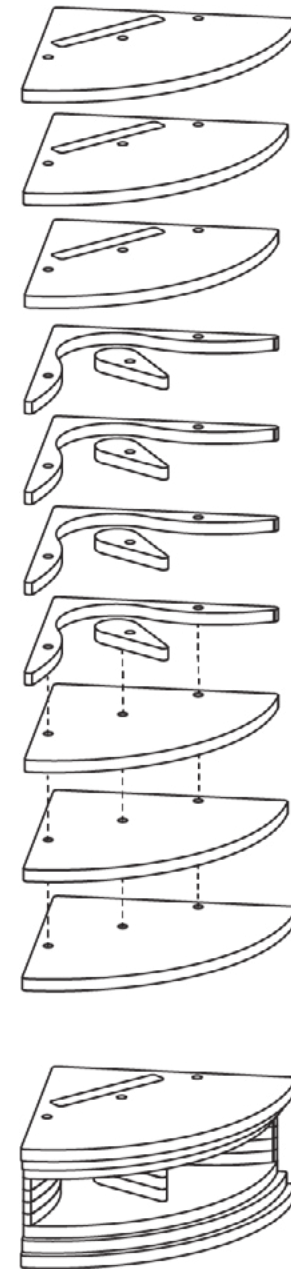




#### 4. ASSEMBLE

Use the diagrams as a guide to help assemble the project. Apply wood glue in between each layer, starting with the first six. Line up the holes and drive in the dowels. Continue to slide the remaining layers onto the dowels and apply clamp pressure until the glue is dry. Once dry, use a flush trim saw to cut the dowels down and sand the surface.

*Be careful of glue squeeze-out in hard to reach/internal areas. Blobs of dried glue could affect the final performance of the amplifier.*



## WRAP UP

Prepare a 2-3 minute explanation reflecting on the build process, and the decisions you made throughout. How will sound travel through the passive amplifier? Did you make any modifications to the design and were they successful?

### NOTES & TAKEAWAYS

A large white rectangular area with a scalloped top edge, containing horizontal blue lines for writing notes and takeaways. The lines are evenly spaced and extend across the width of the area.



PROJECT

# 003 BOX JOINTS

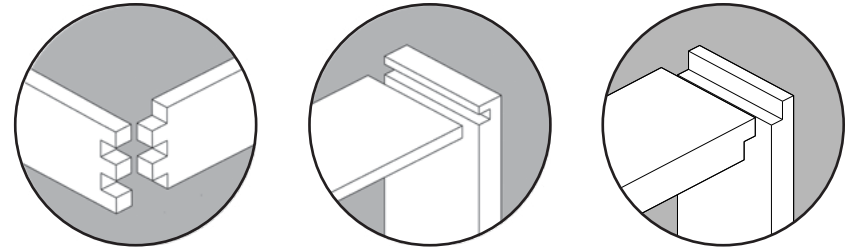
PROJECT DIFFICULTY: ADVANCED

# 003 BOX JOINTS

PROJECT DIFFICULTY: **ADVANCED**

## BRIEF

Box building is a foundational skill for every maker to understand. Principles learned here are broadly applicable to almost every other type of fabrication project. This project will cover three important types of wood joinery: box joints, dados and rabbet.



## GOALS

- Understand the use of Grid for precise placement.
- Get familiar with tolerances and fit.
- Learn the importance of 90° joinery.

## PREPARATION

### PROJECT MATERIALS



10" x 3 1/2" x 1/2"  
Hardwood –  
Side A Parts  
(Long Sides)



5" x 3 1/2" x 1/2"  
Hardwood –  
Side B Parts  
(Short Sides)



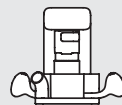
10" x 5" x 1/2"  
Hardwood –  
Lid



9 1/2" x 4 1/2" x 1/2"  
Hardwood –  
Bottom

Refer to Appendix page 50 for more information on stock preparation.

### TOOLS & CONSUMABLES



Shaper Origin



Wood glue



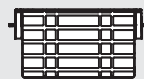
Double-sided  
tape



ShaperTape



1/4" Up-Spiral  
Router Bit



Shaper  
Workstation



60° V Engraving  
Router Bit



Sanding  
Materials



Clamps

## WORKSPACE SETUP

Securely fasten Workstation to the work table and have the Clamping Face, Shelf, Support Arms, Support Bar and a 25mm spoil board nearby.

## INSTRUCTIONS

### 1. STOCK PREPARATION

Exact preparation of materials is integral to the success of this project.

Stack all side pieces (A and B) together and mark an X of the edge of each piece. This marks your reference face that will always be against the reference pins on your Workstation.



### 2. SETUP – SIDE A, BOX JOINTS

Set the Clamping Face to the 25mm (middle) height position and install the smaller spoilboard.



Clamp Side A Material into Workstation, making sure that you are firmly registered against the left Vertical Alignment Pins. Use the Support Bar in its zeroing position (flat with the top surface of Workstation) to ensure that the top of your material is aligned with the top of Workstation.



### 3. SCAN – SIDE A, BOX JOINTS

Scan  your workspace, making sure to include your workpiece.



### 4. DESIGN – SIDE A, BOX JOINTS

Create a ½" Grid by probing off of the front face and left edge of your workpiece. Click [here](#) for more information on creating a Grid for precise placement.



In **Create**,  select **Box Joint Basic** and input these settings

- **Bit Diameter:** 0.25"
- **Thickness:** 0.5"
- **Width:** 3.5"
- **Total Pins:** 9
- **Glue-gap:** 0.005" (default)



You can use as many or as few Pins as you like, but the more Pins you use, the smaller your bit will need to be to fit between them. If you have fewer Pins, you will need to **Pocket** out material first and then finish with an **Inside Cut** between the Pins.

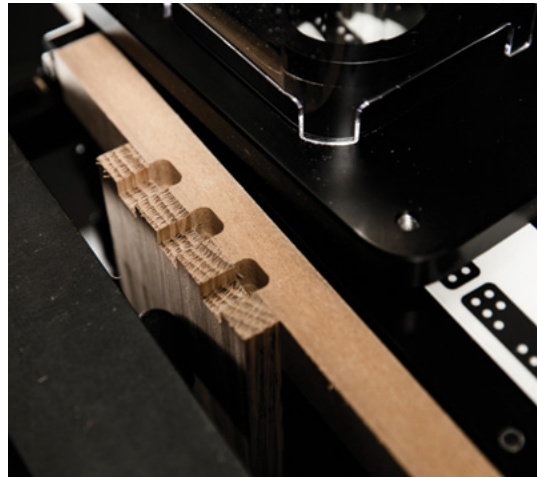
Place the Box Joint design at **x = 0" y = 0"** and confirm that you have the **A Side** selected on the screen.



### 5. CUT – SIDE A, BOX JOINTS

Make sure the Support Bar is far enough away from your material so that you do not accidentally cut into it (~1").

Your cut depth should be slightly deeper than your material thickness. In this case, we will use 0.51".



It is easier to sand the pins flush with the sides than to try to sand the faces flush to the pins.

Use the Project Cut Settings Worksheet below to set up each pass.

| Pass | Bit  | Spindle Speed | Depth | Offset |
|------|------|---------------|-------|--------|
| 1    | UC ¼ | 5             | 0.25  | 0.02   |
| 2    | UC ¼ | 5             | 0.51  | 0.00   |

Be sure to flip your material end-over-end to maintain the same reference edge marked with an X.



## 6. SETUP – SIDE B, BOX JOINTS

With the Clamping Face still in the 25mm (middle) position, clamp the shorter Side B Material into Workstation, making sure that you are firmly registered against the left Vertical Alignment Pins. Use the Support Bar in its zeroing position (flat with the top surface of Workstation) to ensure the top of your material is aligned with the top of Workstation.

No need to re-scan your workspace. Tap the **Eraser** button in the top right hand corner of the screen to clear cut history. It is good practice to do this between each part.



Repeat the cut process as explained above for the other end. You do not need to rescan and Grid every time you flip. However, it is good practice to recalibrate the Z-touch each time you re-fixture your workpiece.





## 7. DESIGN – SIDE B, BOX JOINTS

In the Design tab, hover over the box joint design and tap **Swap**.



## 8. CUT – SIDE B, BOX JOINTS

You will now be cutting the mating parts of the box joint. The process is identical to Side A.

| Pass | Bit  | Spindle Speed | Depth | Offset |
|------|------|---------------|-------|--------|
| 1    | UC ¼ | 5             | 0.25  | 0.02   |
| 2    | UC ¼ | 5             | 0.51  | 0.00   |

Before you remove the first Side B part from Workstation, be sure to test the fit with Side A. If the fit is too tight, make another pass with a small negative offset (-0.003") and adjust accordingly. Maintain that final offset for the rest of the B sides.

## 9. SETUP – SIDE B, BLIND DADO

Dry fit your box, making sure that the edges initially marked with X are all facing the same way. If it all fits correctly, roughly mark the inside bottom edge for where your dado is going to end up.

Move the Clamping Face into the 0mm (top) position. Remove your clamps and slide the Shelf into position on the Clamping Face.

Set the height of the Shelf using one of your side pieces and the Support Bar in its zeroing position. Using double-sided tape, secure one of your A Sides to the Shelf. With the dado marking oriented closer to you, place the long edge firmly against the Clamping Face. Align the short edge on the left side to be flush with the edge of the Shelf for repeatable alignment.



## 10. SCAN – SIDE B, BLIND DADO

Scan  the new workspace.



## 11. DESIGN – SIDE B, BLIND DADO

Set up a New Grid. Start by probing points **1** and **2** along the front edge, then probe point **3** on the left edge.

Create a **Rectangle** that is 9.75" wide by 0.5 high". Use the **Position** tool to place the bottom left anchor point of the rectangle at **x = 0.125" y = 0.125"**. Double-check that the design is in set ⅛" from the left, right and bottom edges.





## 12. CUT – SIDE B, BLIND DADO

Make an Inside Cut around the rectangle using the cut settings below. Repeat for both Side A parts.

| Pass | Bit  | Spindle Speed | Depth | Offset |
|------|------|---------------|-------|--------|
| 1    | UC ¼ | 5             | 0.27  | 0.02   |
| 2    | UC ¼ | 5             | 0.27  | 0.00   |

Test-fit the bottom material and creep up on an easy fit with -.003" incremental offsets.



## 13. DESIGN – SIDE B, BLIND DADO

In **Design**, hover over the Side A rectangle and tap **Delete**. Create a new 4.75" wide by 0.5" high rectangle. Position the bottom left anchor point in the same location as before, **x = 0.125"** **y = 0.125"**. Double-check that the design is set in 1/8" from the left, right and bottom edges.

## 14. CUT – SIDE B, BLIND DADO

Follow the same steps used on the Side A parts to cut Side B.

| Pass | Bit  | Spindle Speed | Depth | Offset |
|------|------|---------------|-------|--------|
| 1    | UC ¼ | 5             | 0.27  | 0.02   |
| 2    | UC ¼ | 5             | 0.27  | 0.00   |

Use the same final offset you determined on Side A for the final passes on the Side B parts.




## 15. SETUP – LID

Move the Clamping Face to its 25mm (middle) position and install the 25mm (small) spoilboard. Set the Shelf height using the Top Material. Then, attach the Top Material to the shelf using double-sided tape.



## 16. SCAN – LID

Scan  in the new workspace.



## 17. DESIGN – LID

Set up a New Grid. Start by probing points **1** and **2** along the front edge, then probe point **3** on the left edge.

Create a **Rectangle** that is 9" wide by 4" high. Using the **Position** tool, place the bottom left anchor point of the rectangle at **x = 0.5" y = 0.5"**

Create another **Rectangle** measuring 2" wide by 0.75" high, with a corner radius of 0.375". Position the center anchor point of the slot at  $x = 5"$   $y = 2.5"$ .



### 18. CUT – LID

This cut will create a Rebate, an offset shoulder that will allow the lid to mate perfectly into the box. All cuts will be at a 0.25" depth with varying offsets. Use the Projects Cut Setting below.

| Pass | Bit    | Spindle Speed | Depth | Offset |
|------|--------|---------------|-------|--------|
| 1    | UC 1/4 | 5             | 0.25  | 0.30   |
| 2    | UC 1/4 | 5             | 0.25  | 0.10   |
| 3    | UC 1/4 | 5             | 0.25  | 0.02   |
| 3    | UC 1/4 | 5             | 0.25  | 0.00   |



Create the handle using an inside cut, using the Project Cut Settings below.

| Pass | Bit  | Spindle Speed | Depth | Offset |
|------|------|---------------|-------|--------|
| 1    | UC ¼ | 5             | 0.25  | 0.02   |
| 2    | UC ¼ | 5             | 0.51  | 0.02   |
| 3    | UC ¼ | 5             | 0.51  | 0.00   |



Without removing the top from the Shelf, turn the dry fit box upside down and test-fit the top. Adjust the fit using negative offsets until you achieve the desired feel.

The second rectangle placed on the workpiece is for a handle. This step is optional.



## 19. ASSEMBLE

Prep the sides and bottom for glue-up. Consider sanding the bottom and insides of each side part before final assembly.

Apply glue and lightly clamp the sides together to ensure a snug fit. Double-check that each interior corner is square.

Wipe away any excess glue.

When the glue has set, sand the pins of each box joint flush with the sides. Sand the top, making sure it fits well with the box.

Complete the keepsake box with a wood stain and/or wood finish.



## NOTES &amp; TAKEAWAYS

## WRAP UP

This project may seem lengthy, but after making a box or two, it will become second nature.

Like any other project, it is important to share your creations and experiences with each other. Did everything go as planned? What, if anything, went wrong and how could you avoid mistakes next time?



# LEARNING RESOURCES

## HELPFUL VIDEOS

|                                |   |  |
|--------------------------------|---|--|
| Origin – Overview              | <a href="https://www.youtube.com/watch?v=QxjE5WOAGi4&amp;t=1s">https://www.youtube.com/watch?v=QxjE5WOAGi4&amp;t=1s</a>   | Quick 3-minute overview of Origin  |
| Origin – Overview, basics      | <a href="https://www.youtube.com/playlist?list=PLEHMLsAENuk9a28zFV9mvXsAt_pjQLKpx">https://www.youtube.com/playlist?list=PLEHMLsAENuk9a28zFV9mvXsAt_pjQLKpx</a>     | Getting started with Origin: unboxing and first cuts                             |
| Workstation – Overview, basics | <a href="https://www.youtube.com/playlist?list=PLEHMLsAE-Nuk--gYLFZQwQiRYZ0CI-UKUz4">https://www.youtube.com/playlist?list=PLEHMLsAE-Nuk--gYLFZQwQiRYZ0CI-UKUz4</a> | Getting started with Workstation: unboxing and overview                          |
| Designing for Origin           | <a href="https://www.youtube.com/playlist?list=PLEHMLsAENuk-NcuDpjtAzmui-2tYV4Gokm">https://www.youtube.com/playlist?list=PLEHMLsAENuk-NcuDpjtAzmui-2tYV4Gokm</a>   | Designing or Origin with Fusion360, Adobe Illustrator and Vectr                  |
| Origin in Action               | <a href="https://www.youtube.com/playlist?list=PLEHMLsAENuk8awNN0w7TaYjaWW1a-OdNev">https://www.youtube.com/playlist?list=PLEHMLsAENuk8awNN0w7TaYjaWW1a-OdNev</a>   | Application examples: customers show how they use Origin in their workflows      |
| Shaper Sessions                | <a href="https://www.youtube.com/playlist?list=PLEHMLsAENuk-8jA3-S9PQkvoUm6LFDvlHs">https://www.youtube.com/playlist?list=PLEHMLsAENuk-8jA3-S9PQkvoUm6LFDvlHs</a>   | Recordings of bi-weekly live streams from Shaper. Deep dives into various topics |
| Software Updates               | <a href="https://www.youtube.com/playlist?list=PLEHMLsAENuk-9TLKHjyAek04G0MS6VkrZ_">https://www.youtube.com/playlist?list=PLEHMLsAENuk-9TLKHjyAek04G0MS6VkrZ_</a>   | Overview of all software updates on Origin                                       |

## HELPFUL LINKS

Shaper Tools Help Center

[support.shapertools.com](https://support.shapertools.com)

# APPENDIX

## SAFETY RECOMMENDATIONS

| DO                             | DON'T   |
|--------------------------------|---|
| Wear closed toe shoes          | Wear loose clothing or jewelry                          |
| Wear eye protection            | Wear gloves while operating machine tools               |
| Wear hearing protection        | Use Origin for anything other than its intended purpose |
| Wear respiratory protection    |   |
| Tie back long hair             |   |
| Roll up long sleeves           |   |
| Keep distractions to a minimum |   |
| Safely unplug Origin           |   |

**Note:** These are recommendations only! You must read and understand all product manuals and adhere to the safety standards set by your institution.

## WORK AREA

- Students should always have safety gear within an arm's reach. Proper eye, ear, and respiratory protection are necessary when operating any power tool, including the Shaper Origin.
- Workspaces should be clear of clutter, both on the work surface and in the area that the student is standing.
- A dust extractor or shop vac will help keep the chips and dust to a minimum. Any debris on the ShaperTape can interfere with what Origin sees when scanning or cutting.

## Setup Checklist

- Is the material surface secure?
- Is the correct cutter installed? Is the collet tight?
- Is the spindle securely installed in the spindle mount?
- Have I performed a Z Touch since changing the cutter?
- Are the cut settings correct? Double check your bit size and cut depth.
- Are you wearing personal protective equipment, e.g.: eye, ear, and respiratory?
- Have you removed or tied back any loose clothing, jewelry, or hair?

## PROJECT CUT SETTINGS WORKSHEET

Getting the right cut settings for each material takes trial and error. As you work with different materials and bits, it is helpful to record your learning so that you don't make the same mistakes later. The table below is an example of a Project Cut Settings Worksheet. This can be used to record the settings of each pass.

### Rules of Thumb

- Work within the limits of your cutter.
- Use an appropriate spindle speed setting.
- Properly use rough and finish offsets.

### PROJECT CUT SETTINGS

| Pass | Bit | Spindle Speed | Depth | Offset |
|------|-----|---------------|-------|--------|
| 1    |     |               |       |        |
| 2    |     |               |       |        |
| 3    |     |               |       |        |
| 4    |     |               |       |        |

**ESSENTIAL TOOL RECOMMENDATIONS**

(in addition to the class kit)

| Tool                    | Notes | Quantity |
|-------------------------|-------|----------|
| Extra ShaperTape        |       |          |
| Double-sided tape       |       |          |
| Additional milling bits |       |          |
| Eye protection          |       |          |
| Hearing protection      |       |          |
| Respiratory protection  |       |          |
| Spoil board             |       |          |
| Workbench               |       |          |
| Dust extractor/vacuum   |       |          |
| Bench brush             |       |          |



## CONTACT US

Have questions about Origin or anything else Shaper-related?

You can go to our [Education page](#) to get further informations or send us an email. We'll get back to you within one business day!

[education@shapertools.com](mailto:education@shapertools.com)

