

# PantoRouter®

## How-To Guide

**Mortise & Tenon, Box Joints  
Dovetails, and Much More!**



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# SAFETY:

Woodworking is inherently dangerous. There are hazards inherent to using the PantoRouter™ and many other tools in the shop, whether operated by hand or electric power. Some of these hazards are discussed below. Use common sense when operating the PantoRouter™ and all woodworking tools, and use this tool in accordance with the instructions. **YOU ARE RESPONSIBLE FOR YOUR OWN SAFETY.**

Read and understand the Assembly Guide, the How-To Guide and the Warning Label on the PantoRouter™. Failure to follow instructions or heed warnings may result in electric shock, fire, serious personal injury or property damage. Save these instructions and refer to them whenever necessary.

Warning: This product can expose you to chemicals including wood dust, which is known to the State of California to cause cancer. The exposure can come from drilling, sawing, sanding or machining wood products. For more information go to [www.P65Warnings.ca.gov/wood](http://www.P65Warnings.ca.gov/wood). In addition, some types of dust created by sawing, sanding, grinding, milling, drilling and other construction and woodworking activities also contain chemicals known to cause cancer, birth defects or other reproductive harm. In addition, wood dust has been listed as a known human carcinogen by the U.S. government. The risk from exposure to these chemicals and to dust varies depending on how often you do this type of work. To reduce your exposure, work in a well ventilated area and work with approved safety equipment including dust collection, properly fitted dust masks or respirators designed to filter out such dust and chemicals.



**YOU ARE RESPONSIBLE FOR YOUR OWN SAFETY.**

**TO REDUCE THE RISK OF INJURY, THE USER MUST:**

- READ AND UNDERSTAND THE OPERATING GUIDES BEFORE OPERATING PRODUCT.
- WEAR EYE PROTECTION, EARPLUGS AND DUST MASK.
- DO NOT WEAR GLOVES, NECKTIES, JEWELRY OR LOOSE CLOTHING. CONTAIN LONG HAIR.
- KNOW HOW TO SHUT OFF ROUTER IN AN EMERGENCY.
- DISCONNECT ROUTER FROM POWER SOURCE BEFORE SERVICING OR CHANGING ROUTER BIT.
- DO NOT ADJUST THE ROUTER UNTIL IT HAS BEEN DISCONNECTED FROM POWER.
- SECURELY MOUNT THE ROUTER IN MOUNTING BRACKET BEFORE TURNING POWER ON. IF ROUTER MOTOR CANNOT BE SECURELY MOUNTED AS DESCRIBED IN THE ASSEMBLY INSTRUCTIONS, DO NOT USE THE PANTOROUTER.
- CLAMP MATERIAL TO BE CUT SECURELY TO TABLE BEFORE STARTING ROUTER.
- NEVER USE A BIT NOT SPECIFICALLY DESIGNED FOR USE IN A WOODWORKING ROUTER.
- KEEP HANDS AND CLOTHING AWAY FROM SPINNING ROUTER BIT.
- DO NOT OPERATE THIS MACHINE WHILE UNDER THE INFLUENCE OF ALCOHOL OR DRUGS.
- WHEN SERVICING, USE ONLY IDENTICAL PARTS.
- FAILURE TO COMPLY WITH THESE WARNINGS MAY RESULT IN SERIOUS PERSONAL INJURY

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# Matching mortise and tenons in minutes

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With its 2-to-1 movement and 2-in-1 templates, the PantoRouter™ makes faster, better-fitting mortises and tenons than any other method. The templates are the key, capturing the guide bearing in their center slot to make the mortise, and then guiding the guide bearing around the outside for foolproof tenons too. A tapered perimeter guide surface allows incredibly fine adjustments to tenon fit, for perfect results right off the machine.

The standard package includes an array of templates for various joint sizes and orientations, the Pro-Pack and All-In Packages have even more, and all are available à la carte from our online store.

The genius of the system doesn't stop at the templates. Setting up the template holder, fences and depth stop is just as fast and easy. And once they are set, you can make stacks of joints in minutes, dead-accurate and dust-free thanks to our patent dust-collection attachment.

Follow the process shown here, and you'll make better joints than ever before, in a fraction of the time.

## Setup steps

**Choose your template.** The thickness of your mortise is determined by the size of the router bit used to cut them. By changing the bit and guide bearing, you can make the corresponding tenon, so all that matters here is length (the 2-to-1 pantograph ratio means joints are always half the length of a given template). All templates have tabs on the back that keep them aligned with the template holder, and small nuts that slide into T-slots. The templates marked B-V and D-V have tabs on the back that are perpendicular to the template so they hold the template in a vertical position.



**Center the template side to side.** Insert a 6mm round guide bearing shaft through the template and through the center hole in the template holder. That's all there is to it! Your template is now centered.

Note: Older template holders don't have the centering hole so the following procedure is used to center the template:

Insert the pointed centering jig in the router chuck. Then insert the 6mm round guide bearing shaft into the hole in the center of the template and move the template side to side until the point of the centering jig is aligned with the table's centerline. Lock the template in that position and it's centered too. Older templates require the tapered shaft for centering since their center hole is a bit smaller than newer versions.



**Center the template vertically.** This step is just as easy. Once you've properly set the thickness gauge below the template holder (see the assembly and setup instructions for the PantoRouter™), all you need to do is place a cutoff from one of your workpieces, or the workpiece itself, between the template holder and thickness gauge to know you have centered the template and router bit on the stock. Lock the template holder in that position.



**Measure the tenon piece to set the fence.** Even though you'll be mortising first, use the tenon piece here if your M&T joint will be on the end of your workpiece. Measure the width then adjust the fence to that same dimension. The inner ruler on the fence is half-scale, making the fence self-centering.



## Mortises first

**Insert the mortise guide bearing.** Choose the 10mm guide bearing and insert it into the mortise slot of the template. Also, insert the bit for the mortise you are cutting. See the reference chart later in this guide.



**Clamps and clamp helpers.** The standard clamps work in most situations, but for mortising, make simple clamp helpers like the one shown to get pressure where you need it. Avoid clamping directly over the area to be mortised, as the clamp could end up deforming the mortise wall.



**Set the depth of cut.** The excellent solid carbide bits included with your PantoRouter cut crisp, clean mortises.

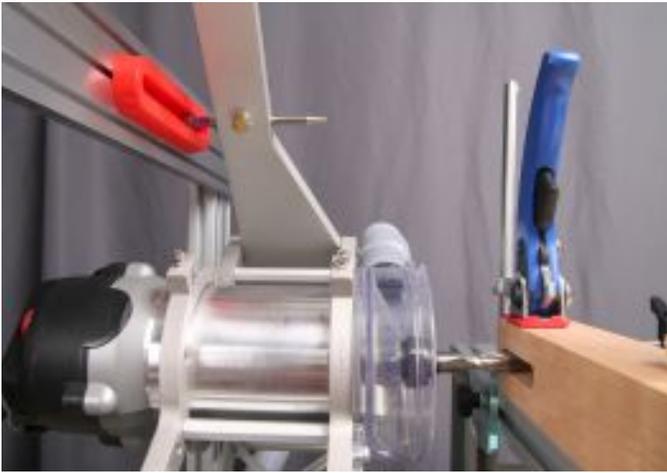
Simply touch the bit to the workpiece and slide the depth stop just past the length of the tenon you'll cut next. We want a little room for excess glue at the bottom of the mortise. About an 1/8" or 3mm is plenty.



**Dust shroud brush goes back on.** The highly effective and convenient dust collection hood has a brush-style shroud that comes off easily for setup and goes back on just as quickly.

Note: If the brush ever gets smushed, go to our website in the Support section and find the Tech Tip called "Bad Hair Day" for an easy way to straighten the bristles. [www.PantoRouter.com](http://www.PantoRouter.com)

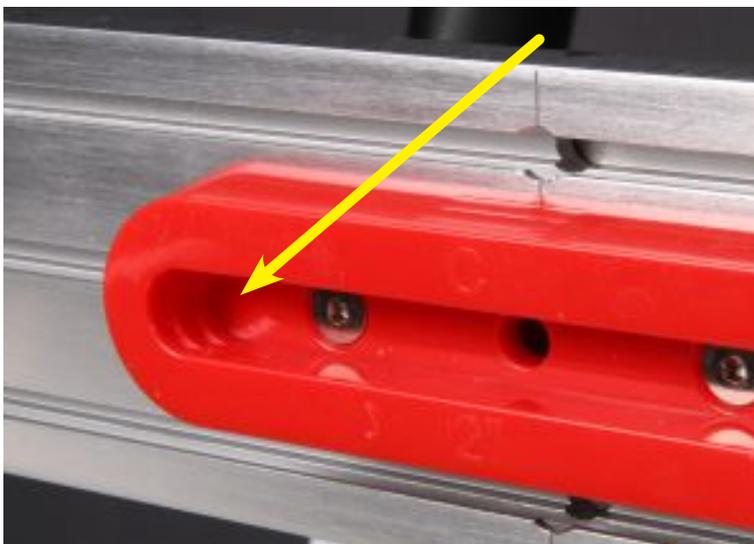




**Mortising is fast and foolproof.** Take shallow passes, moving the router back and forth with one hand and gently pushing forward with the other, until the depth stop bottoms out. That's it! We've removed the dust shroud for these photos but you'll definitely want to keep it on for mortise and tenon work.

Note the two Fence/Stops on the table that align the workpiece to the front of the table. They're ABS plastic to make it a little easier on the bit if one gets accidentally nicked. Once the workpiece is clamped in place the front stops can easily be slid out of the way.

**Magic in the mortise slot.** In the ends of the mortise slots there are three steps to make the mortise a little longer than the tenon if you prefer a little wiggle room for adjustment during glue-up. Following the bottom of the mortise pocket with your guide bearing makes a perfect fitting mortise and tenon joint, which is always a good idea for through mortises. The second and third steps allow a little more room at the ends of the tenons. Both ends of the mortise are end grain so there's much less strength in that part of the joint than the glued side grain so a little extra room doesn't significantly weaken the joint.



## Tenons second

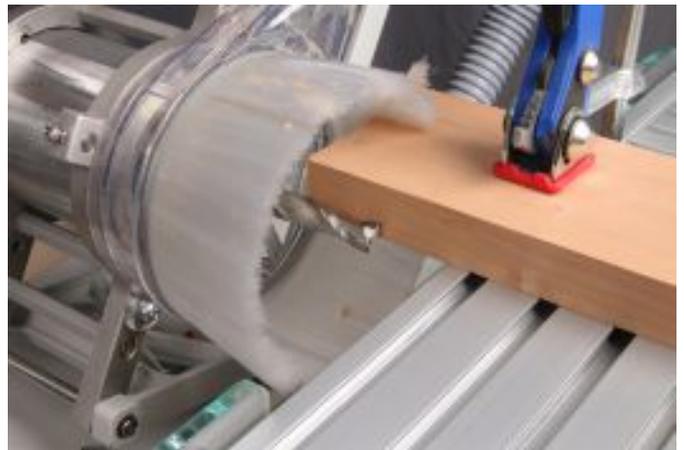
Trace the outside of the template for tenons. You might be able to use the same bit for tenons as you used for mortising. Check the chart later in this guide to find the best combination. Also, push the guide bearing to the back edge of the template for your first tenon attempt.

The template is thicker toward the back so the tenon cut using that position will be thicker as well, usually too thick for the mortise, but it's the best place to start.

Note: While some M&T sizes have several possible combinations, it's best to use the largest bit and bearing combination listed on the chart for the desired tenon thickness. The 1/2" bit works for every tenon size and since it makes good, clean cuts, it's our recommendation.



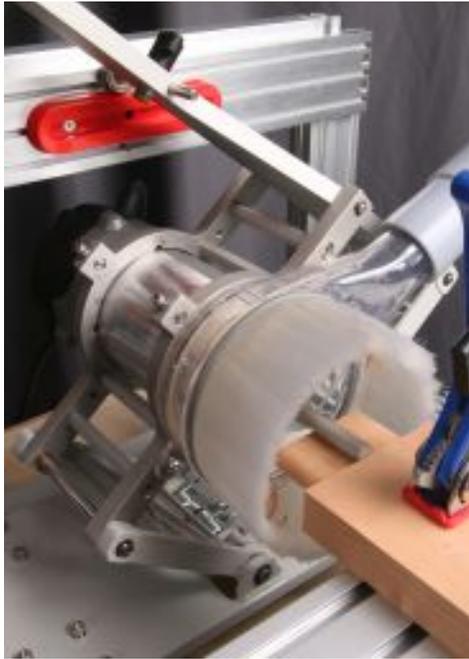
**Reset the depth stop.** Touch the end of the workpiece with the bit then set the depth stop as before but the tenon must be slightly shorter than the mortise is deep.



**Safety check.** Check that you've extended the workpiece far enough so the bit will clear the table at its full cutting depth.



**Tenoning is just as fast and foolproof.** Use climb cuts for a clean shoulder, working your way deeper and farther down the tenon as you go, until the bearing is riding the template and the depth stop is bottomed out.



**Control over the router.** The mechanical advantage ratio is about 2.5:1 at the handle, so you'll have perfect control, even though you are climb-cutting all the way.

**Check the fit.** The tenon could be just a bit fat at this point.



**Adjustments are amazingly easy.** The templates have a slightly tapered outer edge, so moving the guide bearing outward (down the taper) slightly adjusts the fit by a few thousandths of an inch. Once you dial in the fit, you can crank out piles of cleanly cut, deadly-accurate tenons in minutes.

Once you've identified the best fit for your bit and guide bearing, note the position of the guide bearing relative to the three index marks so you can quickly repeat that size M&T the next time you need it for your work.



## Multiple tenons are just as easy.

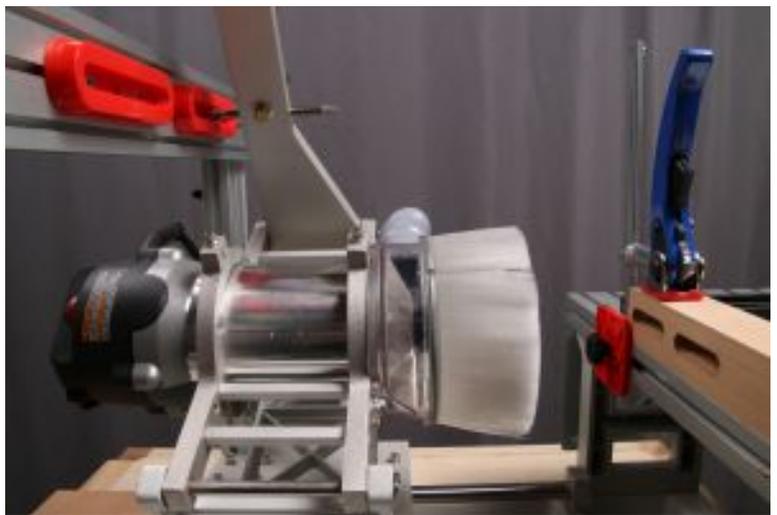
**For wide workpieces, combine templates.** Use a square and the scale on top of the template holder to align the templates. Make sure to leave room between them for the guide bearing to pass through (remember the 2-to-1 scale again as you select your guide bearing and space the templates).



**Make a test run.** To be sure the mortises and tenons will fall in the right place, cut mortises in some scrap.



**Two mortises are almost as fast as one.** You just need to stop to pull the guide bearing out of the center slot of one template and put it into the other.



**Two tenons in one minute.** Like before, use climb cuts to make a series of shallow passes, working your way toward full depth, and adjust the guide bearing outward, down the taper to dial-in the fit.





Perfection. You will get perfect alignment and a perfect press-fit right off the machine.

## Mortise and tenon joinery examples

The mortise and tenon are mirror images so position the workpieces with indexing against the fence accordingly. Cut the mortise first then adjust the fit of the tenon. Move the guide bearing down the tapered template, away from the template holder, to make the tenon smaller.

Notice in the combinations for each size below, the 1/2" bit is possible for every size. It's always a good idea to use a larger bit when possible and 1/2" is the sweet spot for ease and quality of cut for most sizes.

		GB	Bit
Tenon Size	1/8"	6	1/2
		10	1/2
	1/4"	22	3/4
		35	1
	3/8"	10	3/8
		15	1/2
	1/2"	10	1/4
		15	3/8
		22	1/2
		35	3/4
	3/4"	48	1
		22	1/4
		35	1/2
	1"	48	3/4
		35	1/2
		48	1/4

48mm    35mm    22mm    15mm    10mm    6mm

It's best to use larger guide bearings and bits where possible.  
The 1/2" spiral upcut bit works with every size.

The 35mm (yellow) and 48mm (orange) guide bearings come with the Monster Set along with 3/4" and 1" straight cut bits.

## Box joints in minutes, with no fitting

Even easier than it cranks out mortise and tenon and dovetails, the PantoRouter uses segmented templates to make immaculate box joints in two sizes, with perfect joints right off the machine—no sample boards or fitting required. For 1/2-in. fingers, use the 1/2-in. bit supplied and follow the slots over the top of the templates. For 1/4-in. box joints on smaller projects, use the 1/4” bit and follow each slot from the bottom of the template. The 10mm guide bearing is the same for both.

There isn't much more to say, other than the fact that when the segments are all pushed together the spacing is fixed, meaning only certain board widths will give perfect fingers on the ends of a joint. Stock that's a multiple of 1/4” or 1/2” will have full fingers on the ends but if you don't mind partial fingers, you can use workpieces of any width. Also, the tall box joint template lets you cut joints in stock up to a hefty 1-1/2 in. thick.

You can add a space in your box joint array by sliding the segments apart. For instance, if you want to make a box and glue-up all 6 sides then cut the top off at the table saw, you can add 2X your saw blade kerf at the appropriate place then when you cut the lid off, your box joints will again be perfectly spaced. Check out the Video Tech Tip on this on our website.

Soon you will be finding all sorts of reasons to use these clean-looking box joints, from shop trays and cabinet drawers to quick gifts for clients, friends and family.

### Cut one side of the joint

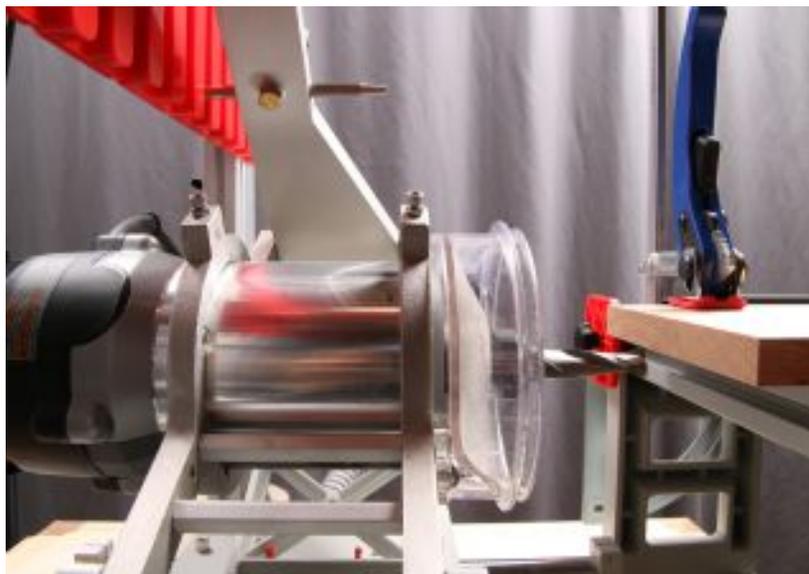


**Set the depth.** Just as you do with dovetails, scribe the thickness of the parts on the ends of two mating boards, and use those lines to set the bit depth, locking the depth stop that limits the router's forward travel. You'll also want to center the board on the table by adjusting the fence as you do for mortise and tenon and the dovetailing process.

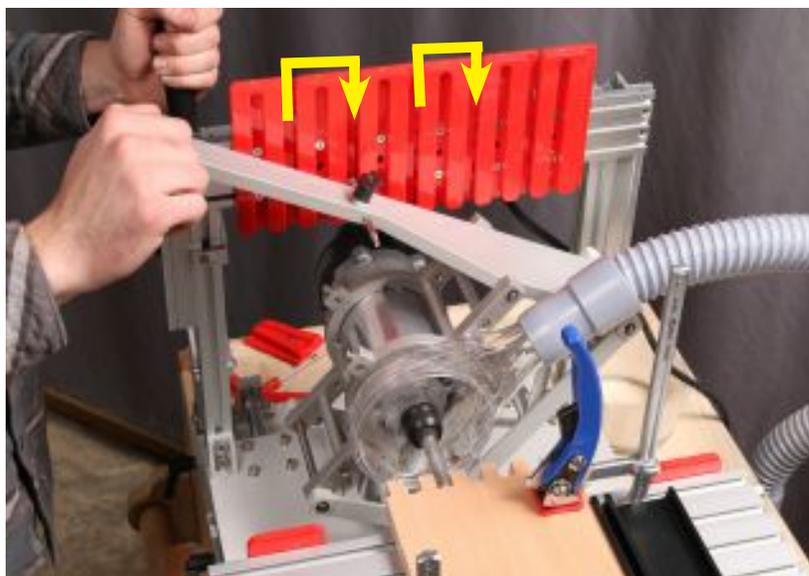
**Center the workpiece using the Centering Scale Fence.** The PantoRouter fence includes a half-scale ruler, letting you simply measure any board and align the corresponding dimension on the fence with the center mark on the PantoRouter's table.



**Check your clearance.** Adjust the height of the template so at least half the bit clears the bottom of the workpiece before the bearing bottoms out in the slot. Make sure the router doesn't hit the bottom of the templates and adjust so the guide bearing reaches all slots. With thicker stock, a maximum of seven template segments will be possible.



**Cut the first side.** You can cut a stack of parts at this point. Note how the bearing goes over the top of the templates for 1/2" box joints.



For 1/4" box joints you'll cut up from the bottom using each of the slots.

**Tip:**

To get tighter box joints, "trace" only one side of the template. Use a light touch and don't go back over the cut. Routing is subtractive so every pass of the bit over the wood will remove slightly more material. Generally, whatever you do to any one cut should be done to all.



**Another dust-free process.** Paired with a powerful vac or dust collector, the PantoRouter's dust collection system grabs every chip.



Measure the bit with dial calipers and rip or plane a spacer to the exact same width. The spacer goes between the workpiece and the fence, offsetting this half of the joint so the edges of the workpieces will line up.

(The aluminum fence shown to the left is an older model. The current version is black and no longer needs the round knob to stay square.)



**Cut with confidence.** Now you can cut stacks of boards for the other half of the joint, knowing the fit will be perfect.



# Variably spaced dovetails are fast and foolproof

Your PantoRouter™ package comes with 2-in-1 dovetail templates that cut both pins and tails with no change of setup, just like the templates for mortises and tenons. The template for each pin/tail is a separate unit and they can be attached along the template holder in any array, to create a pleasing layout for workpieces up to 8 inches wide.

So get ready to make beautiful through-dovetails in minutes, with the custom spacing that is the hallmark of fine dovetails, and a perfect fit every time.

The PantoRouter can cut through-dovetails in boards up to 1¼ inch thick.

Setup is straightforward. You can simply place the guide bearing against the template and the bit against your actual workpiece to plan the perfect array, and off you go. The following photos will take you through the steps, including the process for cutting asymmetrical dovetails, useful on certain boxes and drawers.

## Setup is simple

**Center the workpiece using the Centering Scale Fence.** The PantoRouter fence includes a half-scale ruler, letting you simply measure any board and align the corresponding dimension on the fence with the center mark on the PantoRouter's table.



**Dovetailing starts with scribing.** Use a marking gauge to scribe the baseline on one tails board and one pins board. Always cut the tails first.



**Set the depth.** Load the high-quality dovetail bit supplied with your PantoRouter or an 8° bit of your own, align the end with your scribe line, and set both the front and rear depth stops to lock the pantograph carriage in place. Make sure enough of the board is overhanging the table so the bit doesn't hit and damage the bit or table.



**Set the end templates.** Start by placing the guide bearing in the template groove and positioning the center of the bit over the edge of the board to create a half-pin there. With tapered tabs on their back face, the templates lock onto the template holder straight and square.

Also set the template holder height so the bit will be engaged in the template slots before it hits the wood. The bit needs to come at least half way through the workpiece in order to cut a complete tail.

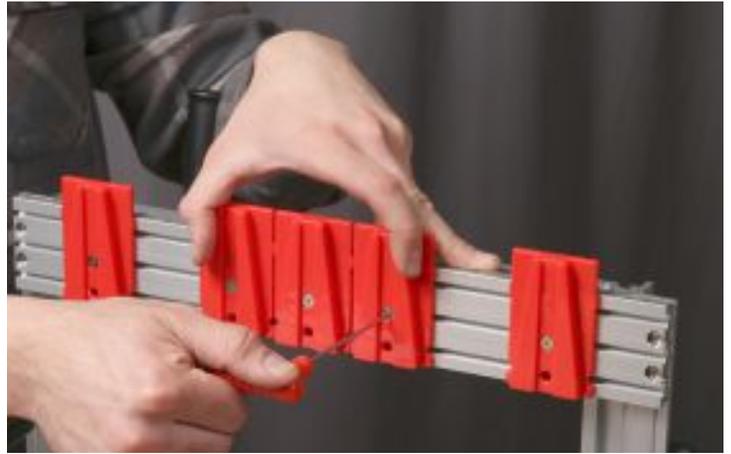


**Set the rest.** To create a symmetrical array, center one template on the template holder and align the template center splines on the backs of the templates to the scale on top of the template holder.

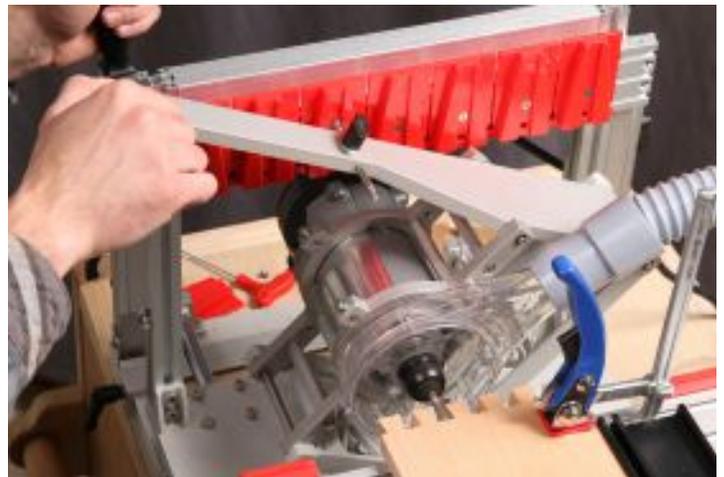
Be sure the templates are far enough apart to allow the bearing to pass between the templates when riding the outside of the templates to cut the pins. For most bit and bearing combinations the 10mm or 15mm bearings are used so this is generally not a problem.



Chose an array that's pleasing based on the bit size and material thickness as well as the overall dimensions of your piece.



Fixed-space dovetails are easily cut by pushing the template segments together.



## Cut stacks of tails

Tails are fast and easy. You can machine stacks of boards in minutes, with the PantoRouter's dust shroud grabbing every bit of waste. The bearing goes in the template's center slots for cutting tails. Follow gently along each side of that slot to be sure you are making full cuts, and slow down when breaking through the bottom of the board to prevent tear-out.

Gentle and even pressure is the key to making consistently accurate dovetails with the PantoRouter™.



## The secret to Dovetail Success

Cut a sample board about 6" long and milled to the same dimensions as your workpieces. Cut tails in this board as you cut the rest of your workpieces. This sample tails board will be used to dial-in your fit for perfect pins. Since your sample tails board is short, you can use it to adjust the fit of your pins while the first pins board is still clamped to the table. Record your bits, bearings and final distance from the top of the template holder to the top of the template holder support post so you can quickly repeat the process in the future.

## Setup trick for perfect pins

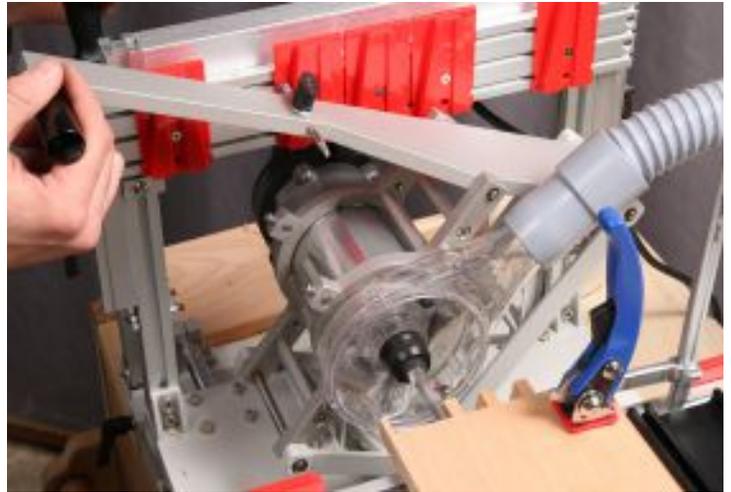
**Transfer the tails layout.** You change the fit of the pins by moving the template holder up (tighter) or down (looser), which moves all the templates along with it. To dial in the fit from the get-go, try the following. Clamp a tails board to the top of the PantoRouter™ table as shown, and use the supplied clamps to attach pins test board vertically, aligned with the board above. Then scribe part or all of the tails layout onto the pins board test piece.



**Mount the pins test piece on the table then dial in the template height.** Holding the bearing against one side of a template, move the template holder up and down until the router bit is perfectly aligned with part of your pins layout. Lock the template holder at that height.



**Cut test pins.** It is still important to use a test board for your first pins attempt, but the fit will be extremely close, if not dead-on. If you need to adjust the templates up or down, record the height of the template holder with a simple pencil mark so you can repeat the process next time you make dovetails.



**Don't forget to set the depth.** Set the depth stop so the straight bit ends up right at your scribed baseline, or just past it for pins that are slightly proud.



## Cut pins with confidence

**Nothing changes.** For perfect-fitting pins, the templates stay right where they are, and you simply ride the outside edges. The fence also stays put. Once again, slow down when breaking through the bottoms of your cuts, and tearout will be virtually eliminated.

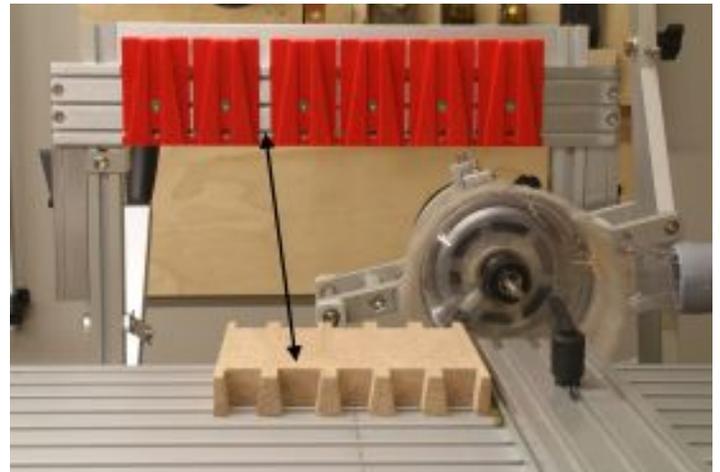
## Proof is in the pudding

**Stacks of perfect dovetails.** The 2-in-1 templates ensure a perfect fit, no matter how you space the pins and tails



## Variably Spaced Dovetail Tip:

This box was fully assembled then the lid cut off on the table saw. Since the templates were spaced to accommodate for the saw kerf, the dovetail spacing returned to symmetrical after the lid was removed. Very Cool!



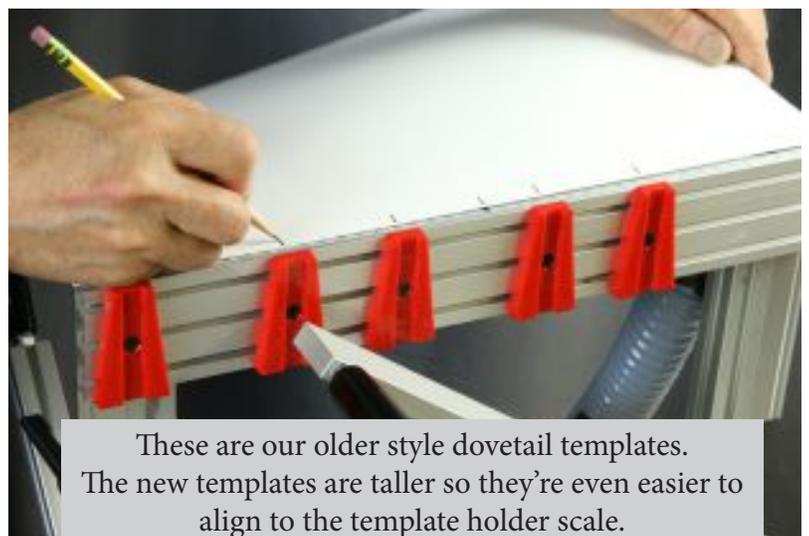
A 1/4" spacer was used to account for the 1/8" blade since most everything on the PantoRouter is 2:1. Once the lid was separated from the body, the dovetails are evenly spaced.



## Great trick for asymmetrical dovetails

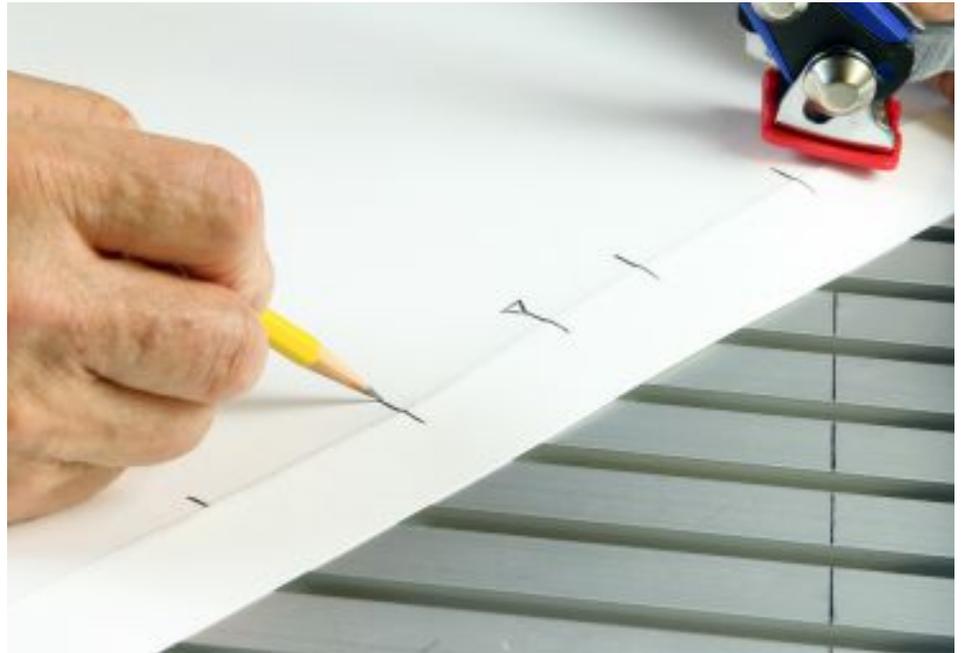
For some boxes and drawers, you'll want an asymmetrical array, which will need to be reversed for opposite corners of the box. Here's how to reverse any template array.

**Record it.** Get the templates where you want them for one of the joints, and use a long folded piece of paper as a story stick for marking the centers of the templates as well as the center of the template holder. Then cut pins and tails as usual.



These are our older style dovetail templates. The new templates are taller so they're even easier to align to the template holder scale.

**Reverse the array.** To create the same array in reverse, just unfold the paper and extend your marks a little. Now you can fold and flip your paper ruler, and use the marks to re-center the array on the template holder and reset all of the templates.



**Happy  
PantoRouting!**



# Special Shape Templates and Accessories

## Diamond

Finished diamond shaped mortise and tenon is about 3/4" X 2-1/2"



Diamond shown with a wedge and dowel adornment. See the video on our website about making Krenov-style sawhorses so see how we did this.

## Bowtie

Finished bowtie mortise and tenon is about 3/4" X 2-1/2"



Bow Tie shown with round plugs made with our dowel templates.

## Monster Mortise and Tenon Set

Make 3/4" and 1" mortise and tenon with our standard mortise and tenon templates. These are best suited to construction lumber or larger projects. The set includes the two large bits for the mortises and the two large guide bearings for the tenons. Tenons are cut with the 1/2" upcut spiral bit so they can be up to 2" long.



## Dowel Templates

Dowels can be cut from the same wood as your workpiece and used as floating dowels (traditional method) or as integral dowels or round tenons. The dowel templates use the 10mm guide bearing on the inside to make the dowel mortise, hole or pocket and the same sizes as our mortise and tenon templates for the dowels (tenons).



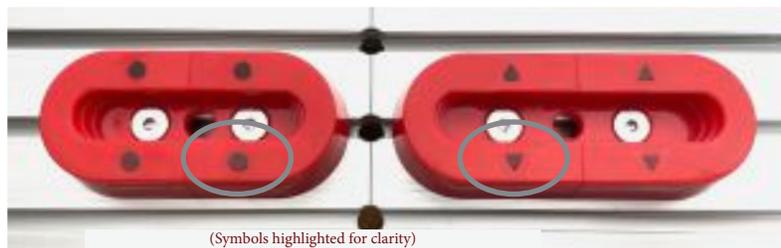
The dowel templates are now red and come in packs of four.

# Segmented Mortise and Tenon Templates

Three steps to selecting any of 154 sizes of round-end M&T plus another 77 sizes of square-end tenons.

1. Select the M&T thickness (mortise bit diameter)
2. Choose the desired width or length
3. Find the combination of end pieces and segments

Mortise Bit Size Guide Bearing	1/8" M&T		1/4" M&T		3/8" M&T		1/2" M&T		3/4" M&T		1" M&T		Segment Combinations	
	6mm	10mm	16mm	22mm	28mm	35mm	48mm	64mm	80mm	96mm	112mm	128mm	144mm	All tenons use the 1/2" bit and guide bearings listed to left
3/4	7/8	1 1/8	1 1/4	1 3/8	1 5/8	1 7/8	2 1/8	2 3/8	2 5/8	2 7/8	3 1/8	3 3/8	3 5/8	Circle marked round-end pieces only
1	1 1/8	1 3/8	1 7/16	1 1/2	1 5/8	1 7/8	2 1/8	2 3/8	2 5/8	2 7/8	3 1/8	3 3/8	3 5/8	Triangle marked round-end pieces only
1 1/4	1 3/8	1 5/8	1 1/2	1 3/4	1 7/8	2 1/8	2 3/8	2 5/8	2 7/8	3 1/8	3 3/8	3 5/8	4 1/8	End with segments of various
1 1/2	1 5/8	1 7/8	1 3/4	2 1/4	2 3/8	2 5/8	2 7/8	3 1/8	3 3/8	3 5/8	3 7/8	4 1/8	4 3/8	
1 3/4	1 7/8	2 1/8	2 1/4	2 3/4	2 5/8	2 7/8	3 1/8	3 3/8	3 5/8	3 7/8	4 1/8	4 3/8	4 5/8	
2	2 1/8	2 3/8	2 3/4	3 1/4	3 3/8	3 5/8	3 7/8	4 1/8	4 3/8	4 5/8	4 7/8	5 1/8	5 3/8	
2 1/4	2 3/8	2 5/8	3 1/4	3 3/4	3 5/8	3 7/8	4 1/8	4 3/8	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	
2 1/2	2 5/8	2 7/8	3 1/2	3 3/4	3 5/8	3 7/8	4 1/8	4 3/8	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	
2 3/4	2 7/8	3 1/8	3 3/4	4 1/4	4 3/8	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	5 7/8	6 1/8	6 3/8	
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3 1/4	3 3/8	3 5/8	3 7/16	4 1/2	4 3/8	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	5 7/8	6 1/8	6 3/8	
3 1/2	3 5/8	3 7/8	3 11/16	4 3/4	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	5 7/8	6 1/8	6 3/8	6 5/8	
3 3/4	3 7/8	4 1/8	3 15/16	4 3/4	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	5 7/8	6 1/8	6 3/8	6 5/8	
4	4 1/8	4 3/8	4 3/16	4 1/2	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	5 7/8	6 1/8	6 3/8	6 5/8	
4 1/4	4 3/8	4 5/8	4 7/16	4 1/2	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	5 7/8	6 1/8	6 3/8	6 5/8	
4 1/2	4 5/8	4 7/8	4 11/16	4 3/4	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	5 7/8	6 1/8	6 3/8	6 5/8	
4 3/4	4 7/8	5 1/8	4 15/16	5	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	5 7/8	6 1/8	6 3/8	6 5/8	
5	5 1/8	5 3/8	5 3/16	5 1/4	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	5 7/8	6 1/8	6 3/8	6 5/8	
5 1/4	5 3/8	5 5/8	5 7/16	5 1/2	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	5 7/8	6 1/8	6 3/8	6 5/8	
5 1/2	5 5/8	5 7/8	5 11/16	5 3/4	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	5 7/8	6 1/8	6 3/8	6 5/8	
5 3/4	5 7/8	6 1/8	5 15/16	6	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	5 7/8	6 1/8	6 3/8	6 5/8	
6	6 1/8	6 3/8	6 3/16	6 1/4	4 5/8	4 7/8	5 1/8	5 3/8	5 5/8	5 7/8	6 1/8	6 3/8	6 5/8	



The two end pieces marked with the circle make a 1" M&T at 3/8" thick.

The two end pieces marked with the triangle make a 1-1/4" M&T at 3/8" thick.

After selecting the size, find center of your combination of segments and use one of the non-tapered guide bearing shafts to center the template array on the template holder. This works for either the round end or square end templates.



To center an array of segments that does not have a center hole option, use a square to locate each end equidistant from the center of the template holder. The metric scale on the template holder is easiest for this.

A mortise and tenon 1/8" larger or smaller than the chart can be made using one circle end piece and one triangle end piece. Center the combination of segments using this measuring method since the centering holes will be off by 1/8".



The three steps in the mortise slot allow three widths of mortise. Use the lowest step when you need a perfect fit side-to-side such as for through mortise and tenon. Use the second or third step if you prefer a little side-to-side adjustability. This can sometimes be helpful during glue-up. Using the third step also allows room to wedge the tenon.



### Segmented Mortise and Tenon Templates for the PantoRouter™

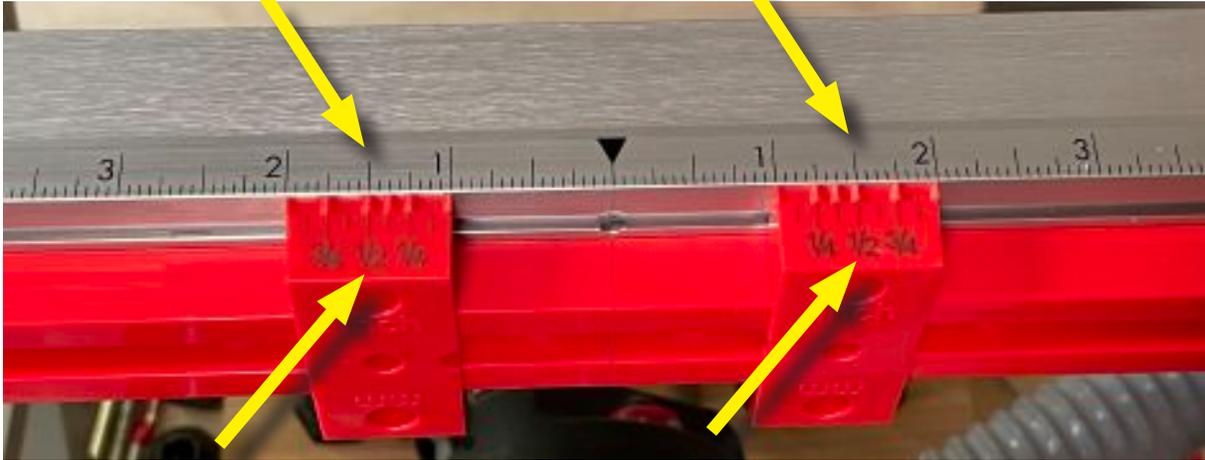
Mortise Bit size Guide Bearing	1/8" M&T	1/4" M&T	5/16" M&T	3/8" M&T	1/2" M&T	3/4" M&T	1" M&T	Segment Combinations											
	6mm	10mm	12mm	15mm	22mm	35mm	48mm	All tenons use the 1/2" bit and guide bearings listed to left											
Mortise and Tenon Widths (Rounded to 1/16")	3/4	7/8	15/16	1	1 1/8	1 3/8	1 5/8	●	●	Circle marked round-end pieces only									
	1	1 1/8	1 3/16	1 1/4	1 3/8	1 5/8	1 7/8	▲	▲	Triangle marked round-end pieces only									
	1 1/4	1 5/8	1 7/16	1 1/2	1 5/8	1 7/8	2 1/8	●	1/2"	End pieces with segments of various combinations									
	1 1/2	1 5/8	1 11/16	1 5/4	1 7/8	2 1/8	2 5/8	▲	1/2"										
	1 3/4	1 7/8	1 15/16	2	2 1/8	2 3/8	2 5/8	●	1"										
	2	2 1/8	2 3/16	2 1/4	2 3/8	2 5/8	2 7/8	▲	1"										
	2 1/4	2 5/8	2 7/16	2 1/2	2 5/8	2 7/8	3 1/8	●	1 1/2"										
	2 1/2	2 5/8	2 11/16	2 5/4	2 7/8	3 1/8	3 5/8	▲	1 1/2"										
	2 5/8	2 7/8	2 15/16	3	3 1/8	3 5/8	3 7/8	●	1"	1"									
	3	3 1/8	3 5/16	3 1/4	3 5/8	3 7/8	4 1/8	▲	1"	1"									
	3 1/8	3 5/8	3 7/16	3 1/2	3 5/8	3 7/8	4 1/8	●	1"	1 1/2"	1"								
	3 1/2	3 5/8	3 11/16	3 5/4	3 7/8	4 1/8	4 5/8	▲	1"	1 1/2"	1"								
	3 5/8	3 7/8	3 15/16	4	4 1/8	4 5/8	4 7/8	●	1"	1"	1"								
	4	4 1/8	4 3/16	4 1/4	4 1/4	4 5/8	4 7/8	▲	1"	1"	1"								
	4 1/4	4 5/8	4 7/16	4 1/2	4 5/8	4 7/8	5 1/8	●	1"	1 1/2"	1"								
	4 1/2	4 5/8	4 11/16	4 5/4	4 7/8	5 1/8	5 5/8	▲	1"	1 1/2"	1"								
	4 5/8	4 7/8	4 15/16	5	5 1/8	5 3/8	5 5/8	●	1 1/2"	1"	1"	1/8"							
	5	5 1/8	5 3/16	5 1/4	5 1/4	5 3/8	5 5/8	▲	1 1/2"	1"	1"	1/2"							
	5 1/8	5 5/8	5 7/16	5 1/2	5 5/8	5 7/8	6 1/8	●	1 1/2"	1"	1"	1"							
	5 1/2	5 5/8	5 11/16	5 5/4	5 7/8	6 1/8	6 5/8	▲	1 1/2"	1"	1"	1"							
5 3/8	5 7/8	5 15/16	6	6 1/8	6 3/8	6 5/8	●	1 1/2"	1"	1"	1/8"	1"							
6	6 1/8	6 3/16	6 1/4	6 1/4	6 3/8	6 5/8	▲	1 1/2"	1"	1"	1/2"	1"							
Mortise and Tenon Widths (Rounded to 1/16")	3/4	7/8	15/16	1	1 1/8	1 3/8	1 5/8	■	■	Square-end pieces only									
	1 1/8	1 5/8	1 7/16	1 1/2	1 5/8	1 7/8	2 1/8	■	1/2"	End pieces with segments of various combinations									
	1 3/4	1 7/8	1 15/16	2	2 1/8	2 3/8	2 5/8	■	1"										
	2 1/4	2 3/8	2 7/16	2 1/2	2 5/8	2 7/8	3 1/8	■	1 1/2"										
	2 5/4	2 7/8	2 15/16	3	3 1/8	3 5/8	3 7/8	■	1"	1"									
	3 1/8	3 5/8	3 7/16	3 1/2	3 5/8	3 7/8	4 1/8	■	1"	1 1/2"	1"								
	3 5/8	3 7/8	3 15/16	4	4 1/8	4 5/8	4 7/8	■	1"	1"	1"								
	4 1/4	4 5/8	4 7/16	4 1/2	4 5/8	4 7/8	5 1/8	■	1"	1 1/2"	1"								
	4 5/8	4 7/8	4 15/16	5	5 1/8	5 3/8	5 5/8	■	1 1/2"	1"	1"	1/8"							
	5 1/8	5 5/8	5 7/16	5 1/2	5 5/8	5 7/8	6 1/8	■	1 1/2"	1"	1"	1"							
5 3/8	5 7/8	5 15/16	6	6 1/8	6 3/8	6 5/8	■	1 1/2"	1"	1"	1/8"	1"							

\*Note: On the 5 1/2" and 5 3/4" round end M&T and the 5 1/2" square end M&T, there is not a centering hole. Align the ends to be equidistant from center using a square for these sizes. (Indicates the round-end pieces with the circle mark. These together make a 1" M&T X 3/8" thick (other sizes according to the chart above))

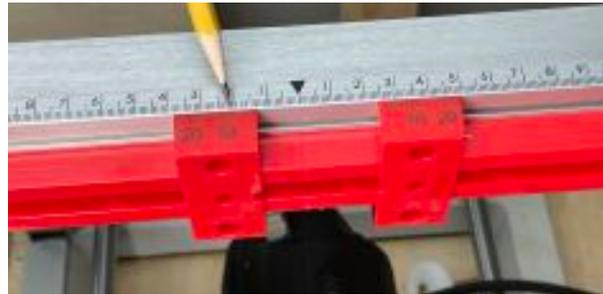
# Slot Mortise Template

The Slot Mortise Template is fast and easy to set up for either inch or metric sizes. Simply align the bit size with the desired width to cut a perfect mortise. The template can also be used for bridle joints and many other uses where a wide, side-to-side movement is desirable.

Example: To cut a  $\frac{1}{2}$ " thick mortise  $1\frac{1}{2}$ " wide, align the mark for bit diameter ( $\frac{1}{2}$ " ) engraved on both left and right sliding stops with the desired mortise width ( $1\frac{1}{2}$ " ) on both sides of the centerline on the template holder (marked by the triangle).

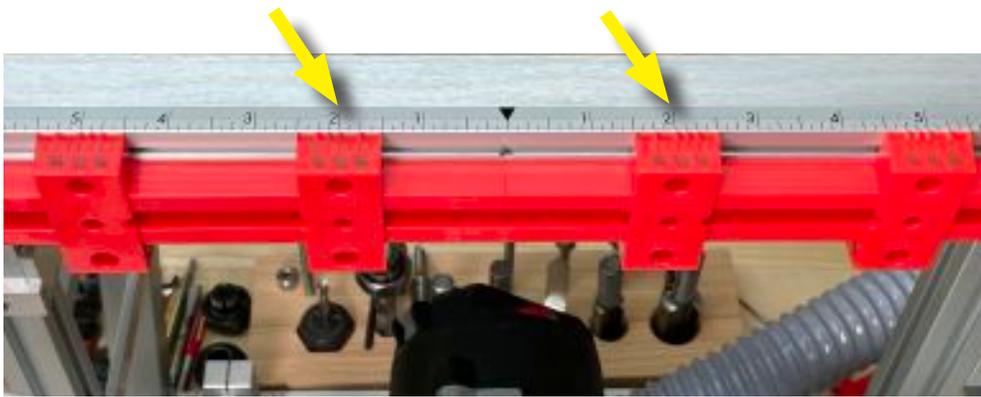


Metric sizes like this 8mm x 22mm mortise are set up the same way on the metric side of the template holder.



Each template set includes two long bars and two pairs of sliding stops. The half-circle cutout on the inside edge of each sliding stop accepts exactly half of the guide bearing, allowing the quick, accurate, math-free setups illustrated throughout this guide.





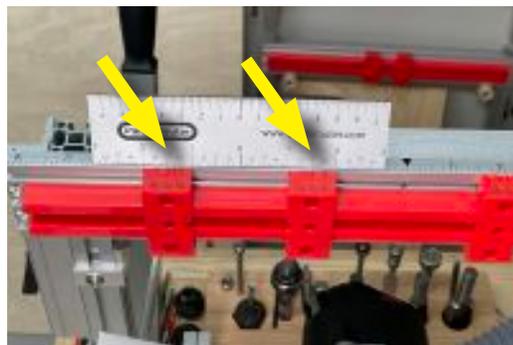
**Double mortises.** For double mortises, align the bit-diameter mark on the two sliding stops closest to the centerline with the desired distance between the two mortises.

In this case the 1/2" thick mortises are set to be 2" apart.



Use the centering ruler to space the mortise widths for each side.

This setup is for the 1 1/2" mortise shown above.



**Using floating tenons.** To use factory-made floating tenons, simply measure the thickness and width of the tenon. They can be made super-tight side-to-side or looser according to your needs.



Align the bit diameter engraved on the sliding template with the mortise width on the template holder.

Tip: Metric bits are available with inch-size shanks or with metric shanks, which require a collet adapter for each metric shank size.



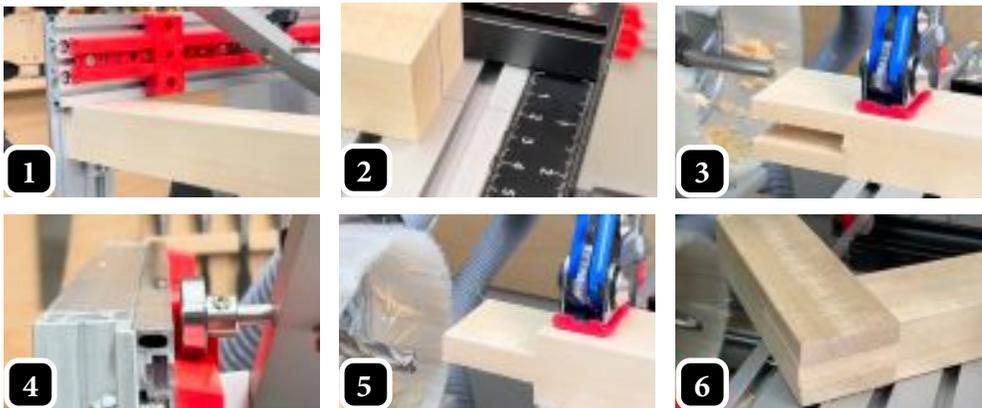


A  $\frac{5}{16}$ " bit makes a nice snug fit for the 8mm floating tenon in this mitered joint example.



Double floating tenons in the angled workpiece on the PantoRouter™ took only a couple of minutes longer than a single tenon in a non-angled piece; the fit was perfect.

**Bridle joints** use the same easy setup and cutting method as mortise and tenon. From start to finish, the joint is ready for glue in about three minutes.



- 1- Center the bit to the workpiece thickness using the thickness gauge.
- 2- Center horizontally on the table using the centering scale fence.
- 3- Cut the mortise first using the bit selected for the thickness of the cut.
- 4- Adjust the thickness of the tenon piece using the tapered template bar.
- 5- Cut the tenon, sized to perfectly fit the mortise.
- 6- The bridle joint fits perfectly with no handwork required.

### **A world of other slots and details**

Long mortises, grooves, and decorative features like this fingerhold are fast, easy, accurate and repeatable.

A  $\frac{1}{2}$ " round-nose bit was used to make the groove exactly 5" long.



# Appendix

From time-to-time we discover yet more amazing functions, tips and tricks for the PantoRouter. We include some of those here in this Appendix until the next edition of the How-To Guide is written. These are often additional ways and techniques to those functions that are already documented in the How-To Guide, and sometimes these are even a little faster than the original method. Enjoy!

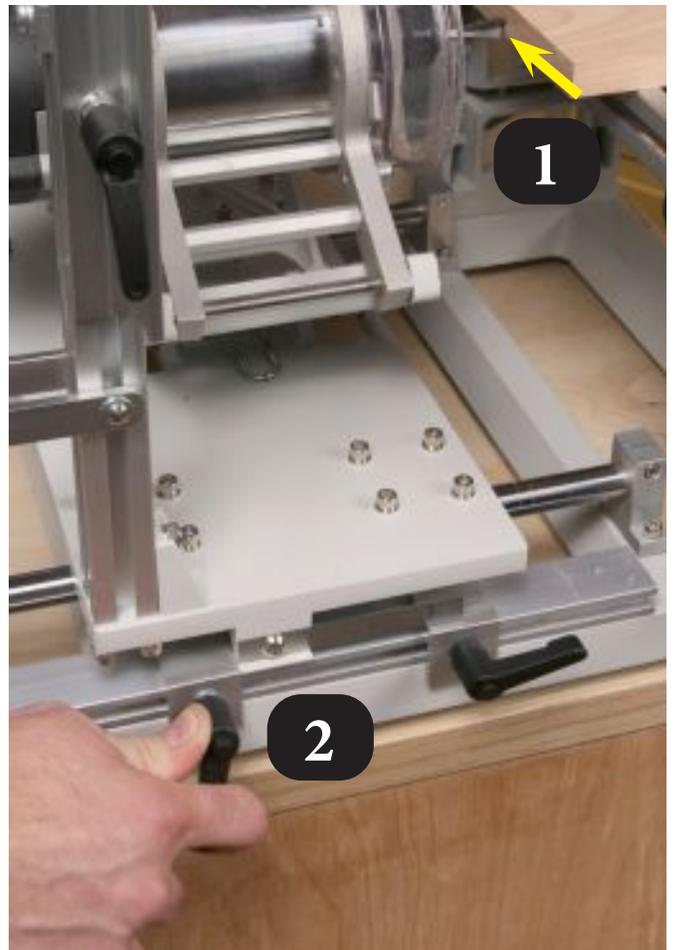
## ALTERNATE METHOD OF DETERMINING DEPTH OF CUT FOR BOX JOINTS AND DOVETAILES

The traditional method of determining depth of cut is to scribe a line on the workpiece then align the bit to cut to that depth or a little beyond if you prefer the tail, pin or box joint to be a bit proud. The idea is to set the marking gauge to the thickness of the piece then transfer that depth to the workpiece. There's another way to do this more quickly and still as accurately on the PantoRouter.

Step 1 - Clamp the workpiece far enough forward of the table that your bit will clear, then bump the bit to the front of your workpiece.



Step 2 - Move the back depth stop to the depth gauge and lock the lever.



Step 3 - Squeeze a sample of the workpiece between the depth gauge and the front stop then lock the lever.

Now your bit will plunge only as deep as the thickness of the workpiece. If you want to make the cut a little proud, you can add some space at this step. This is the one operation on the PantoRouter that is not 2:1, so add only as much as you want the joint to be proud.



# KEEPING TRACK OF THE DOVETAIL PIECES

**Asymmetrical Array.** The PantoRouter can be used to make asymmetrical arrays of dovetails and when doing so it's especially important to keep track of which sides of the piece you're cutting.

It helps to layout the joint with marks showing which edge will be registered to the operator's side.

The tails piece will be cut upside-down so it will have the arrow pointing toward the table. The pins side will have the arrow pointing up.

**Always start with the tails.** Reference the A-Edge toward the operator's side of the table and the outside face down against the table, then cut the tails.

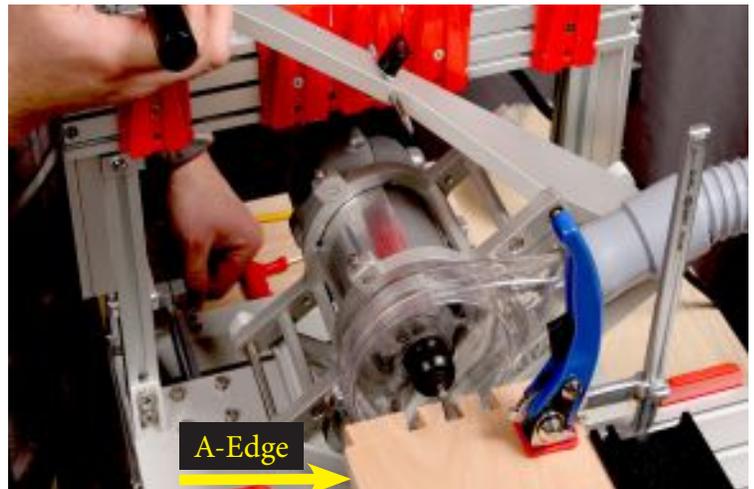
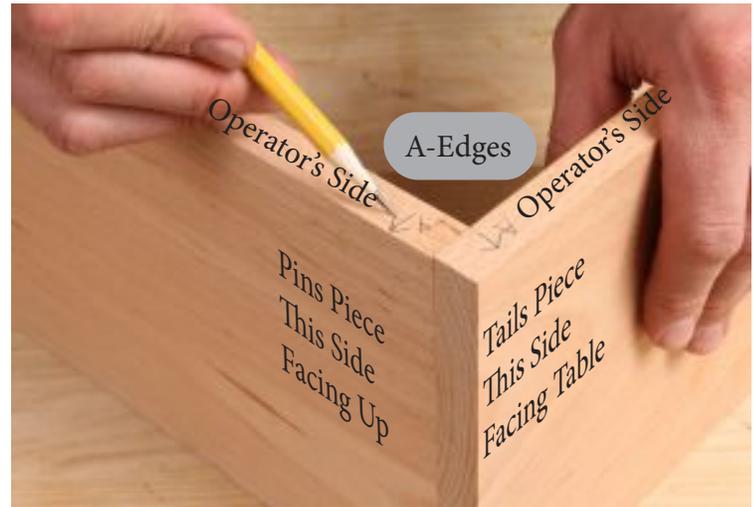
Cut a sample piece of the tails so you can fit the pins while the pins piece is still on the PantoRouter™ table. The sample piece should be in the same stock as the workpiece and about 6" long.

Cut all of your tails exactly the same. Remember that routing is a subtractive operation so if you go back over a cut it will take at least a tiny bit more off the piece. Whatever you do to one cut should be done to all of the others.

**Cut the Pins.** Cut the pins and fit them to your sample tails piece. Once the fit is perfect, cut all the pins pieces at once.

It's important with dovetails to glue them up right away. We recommend milling the wood to rough dimension and letting it rest for as long as it takes to minimize movement. Do your final milling just before cutting dovetails or box joints, then immediately glue it up to minimize board warp and make your joints tighter and easier to finish.

Please watch our Dovetail How-To Video in the Support Tab on our website to see more tips and tricks for making perfect dovetails on your PantoRouter™.



# Setting-Up the Template Holder

Assembling and aligning the template holder is fast and easy. Using the template holder, with its centering holes and centering scale is even easier than ever. Just push the guide bearing shaft through the template into the hole in the template holder and it's lined-up dead center



Decide whether to use the inch or metric scale for centering. Place that side of the template holder up.



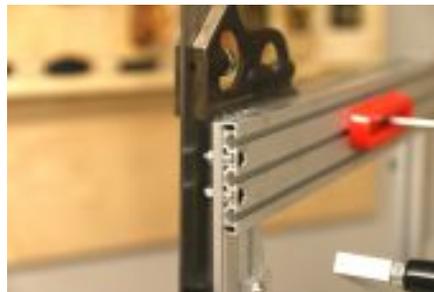
Stick a piece of the UHMW low-friction tape on either side of both slide rails.



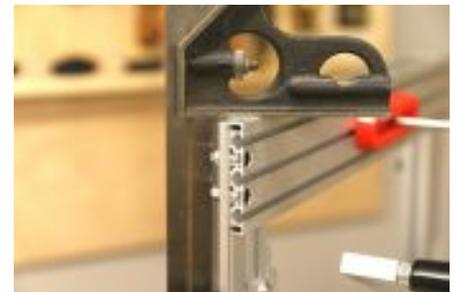
Assemble the holder keeping all screws loose. They'll be tightened after the assembly is aligned to the support frame.



Place the smoother side of the stamped slider nuts (lower in photo) facing the lever knob.



Align the slide rail to the top of the support post then tighten the lever knob.



Align the template holder extrusion to the slide rail then tighten the screws.



Use a 4mm or 5/32" hex wrench for the cap screws.



Use an 8mm or 5/16" end wrench for the acorn nuts.



The intersection of the template holder support post, the slide rails and the template holder extrusion should be flush.



# PantoRouter®

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