



Assembly Guide



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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. 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:

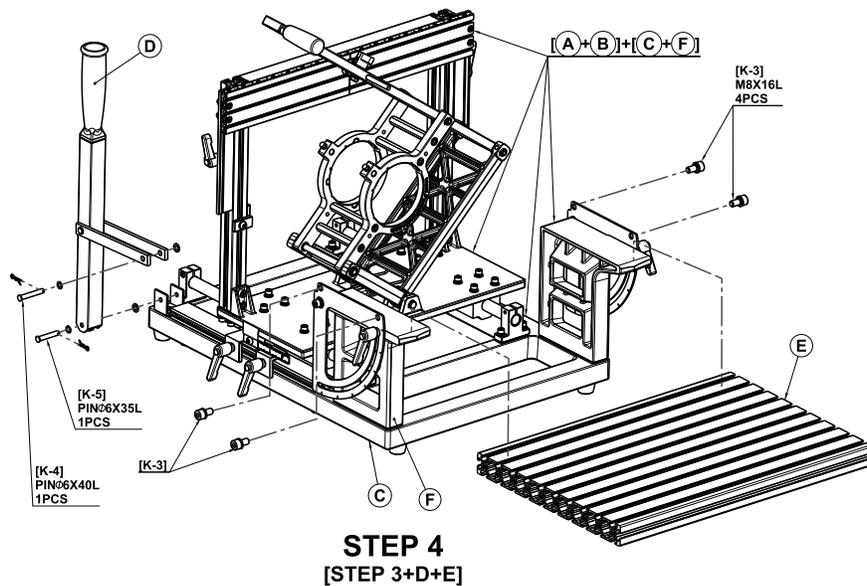
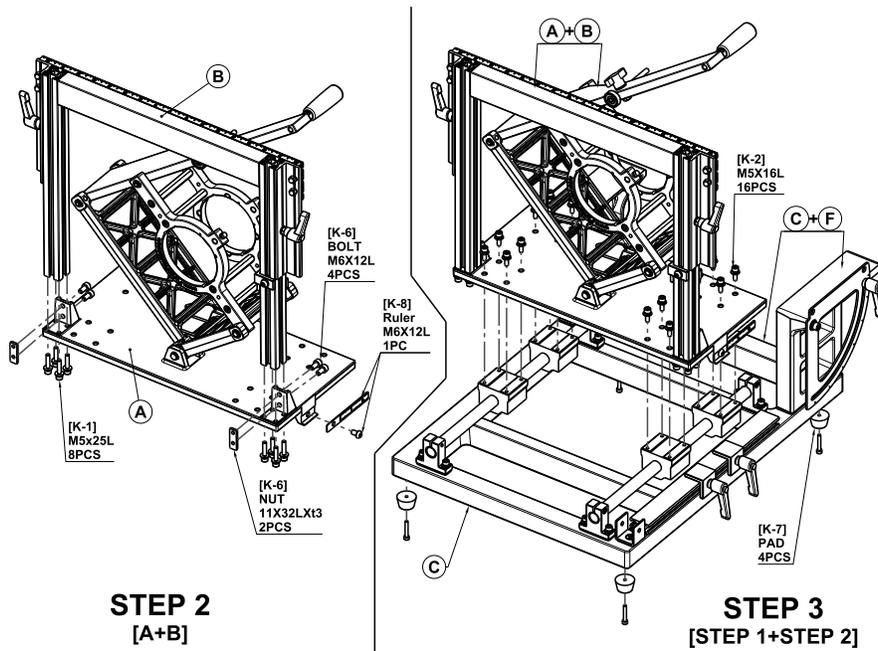
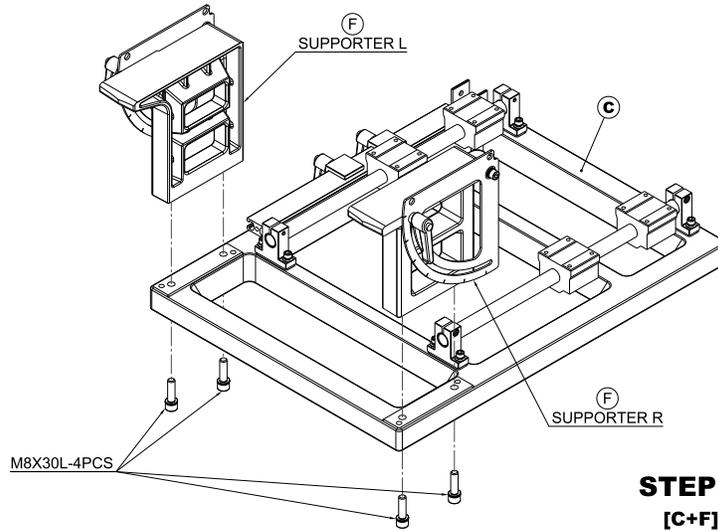
- READ AND UNDERSTAND THE OPERATING GUIDES BEFORE OPERATING PRODUCT.
- WEAR EYE PROTECTION, EARPLUGS AND DUST MASK.
- DO NOT WEAR GLOVES, NECKTIES, JEWELRY OR LOOSE CLOTHING. CONTAIN LONG HAIR.
- KNOW HOW TO SHUT OFF ROUTER IN AN EMERGENCY.
- DISCONNECT ROUTER FROM POWER SOURCE BEFORE SERVICING OR CHANGING 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

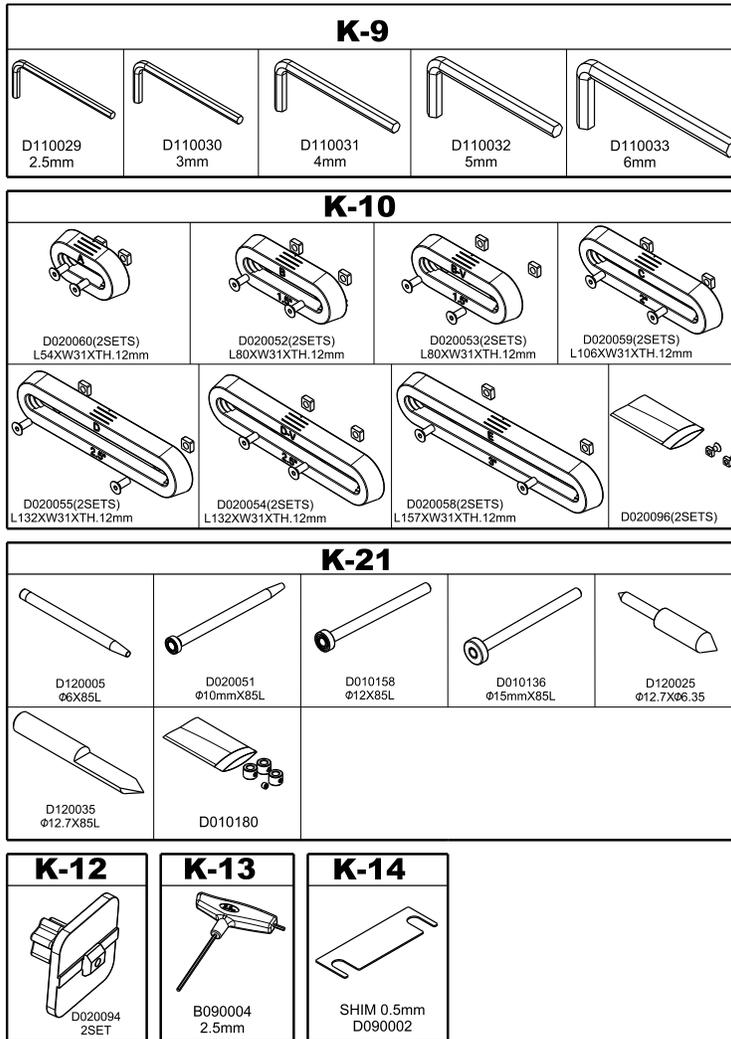
Basic Components of the PantoRouter™



1. Table
2. Centering Scale Fence
3. T-Slot Lever Clamps
4. Template Holder
5. Thickness Gauge
6. Template Holder Locking Lever
7. Template Holder Support Frame
8. Depth Stops
9. Pantograph Carriage
10. Pantograph

General Assembly Diagram





The KITS box contains the hardware, small parts and hex wrenches needed to assemble the PantoRouter™. You will also need an accurate square for checking alignment and a 5/16" or 8mm end wrench, socket or nut driver. A digital or analog caliper will help to dial-in the Thickness Gauge for ultimate precision. We recommend not using a battery-operated drill or impact driver for assembling the PantoRouter™.

You'll notice we use mostly recycled and recyclable cardboard for packaging and we ask that you re-use or recycle when you're finished with your assembly. We're always available by phone or email if we can help in any way!

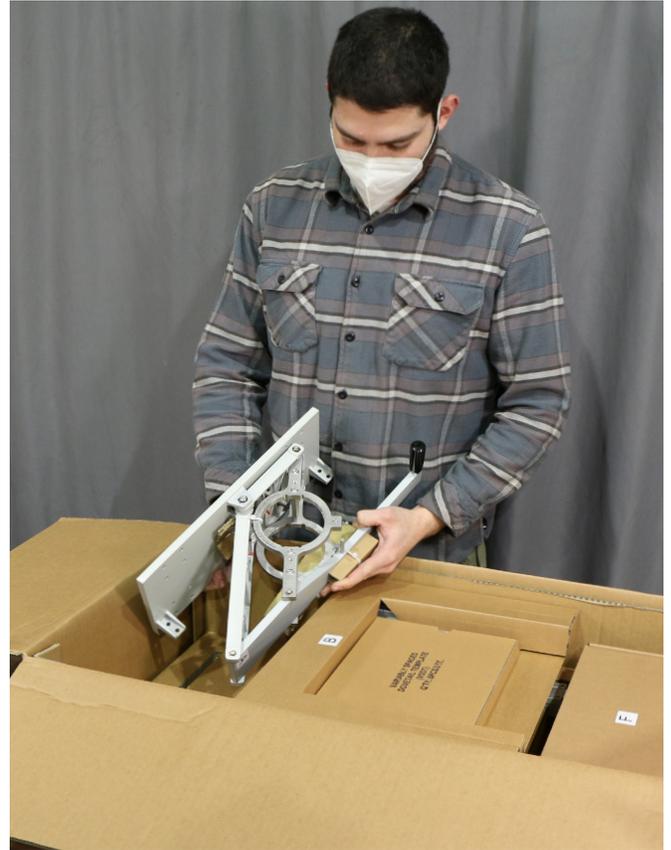


PantoRouter™ Assembly Guide

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We thank you for your PantoRouter™ purchase and we hope you find great pleasure in creating all kinds of traditional and innovative joinery. There's no better jig for mortise and tenons, box joints and machine-cut dovetails, but this is just the beginning of the tasks you can master with the PantoRouter™.

Your PantoRouter™ experience starts with a few minutes of assembly then grab our How-To Guide for basic instruction and some ideas to help you get started.



Inspect the pieces for any possible shipping damage then lay them out and refer to the diagram to get a good idea of how they'll all fit together.

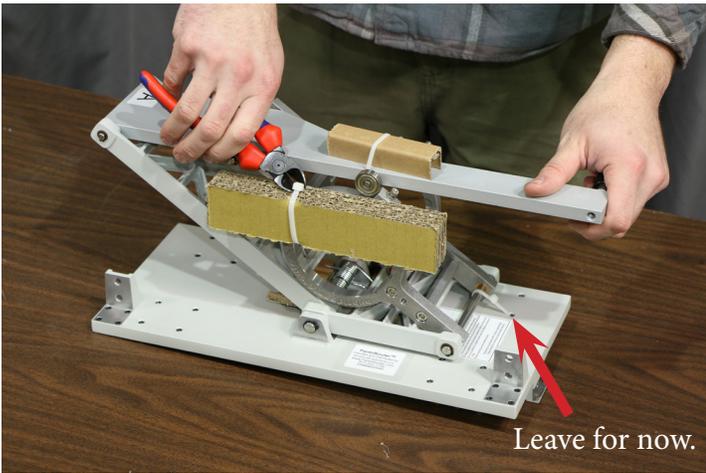
First, open the KITS box where you'll find all of the fasteners and hex wrenches. Together with this guide, you should be up and PantoRouting in short order.

Kits K-1 and K-6 contain the screws for mounting the template holder frame to the pantograph carriage, and K-2 contains the screws to secure the carriage to the glide-shaft bearings.

Open K-1, K-2, K-6 and K-9; the hex wrenches you'll need for assembly.



We recommend using the supplied hex wrenches or similar hand-held wrenches. Using a drill or impact driver for assembly can over-drive screws or strip threads.



Cut the straps holding the padding material but don't cut the nylon tie straps holding the pantograph to the carriage base yet.



Check the machined surfaces to make sure they're clean and smooth. If needed, remove paint but don't use sand cloth. A sharp blade will clean the surface in a few seconds.



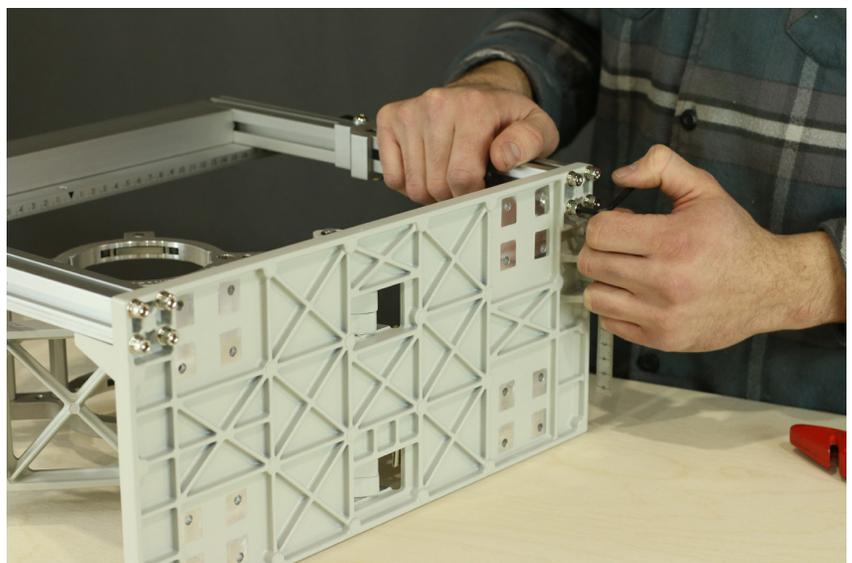
Loosely thread the K-6 cap screws into the nut plates on both sides.



Slide the template holder frame (B) into place with the nut plates in the slots on both sides then snug but don't tighten the cap screws.

Hand-thread the eight K-1 cap screws through the pantograph carriage (A) and into the template holder support frame (B).

Tighten the cap screws using the hex wrench provided.





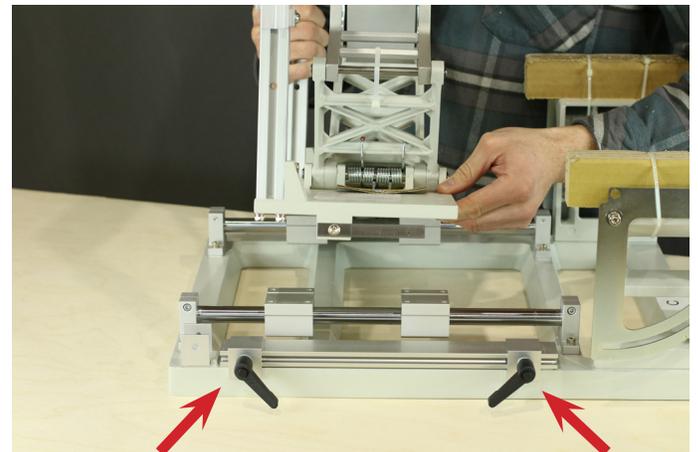
Using the hex wrench provided in Kit-9 tighten the cap screws to the plate nuts to secure the template holder frame. Clip the wire ties to access these cap screws.



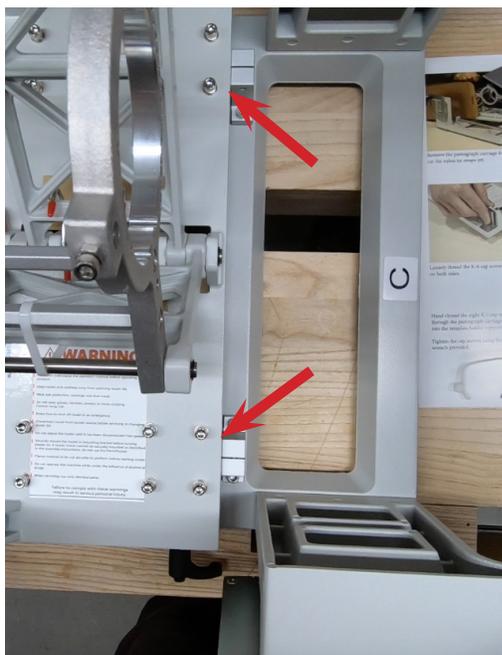
Install the rubber feet to the bottom of the base frame without over-compressing the rubber.



Clean the machined landing pads from the underside of the pantograph carriage if needed.



Relocate the depth stop angles to the ends of their track for the depth stop scale-holder post to clear. Position the pantograph carriage on the glide-shaft bearings and align the screw holes.



Hand-thread the 16 screws through the pantograph carriage into the glide-shaft bearings but leave them loose.

Move the carriage forward until the carriage contacts the glide shaft mounts. Press forward to align the pantograph carriage, then tighten all 16 screws to secure the pantograph carriage to the glideshaft bearings.

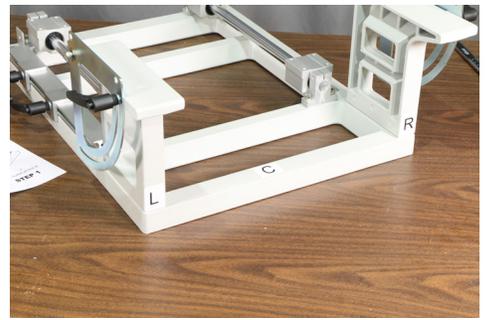
The carriage should now move freely on the glide shafts.



Insert pin K-5 through the plunge lever bracket as shown with a washer on both sides. Secure with locking clip. Note the K-5 pin is shorter than K-4.



Insert K-4 through the plunge lever arms and template holder support post using a washer on both sides and lock with the clip.



Install both table supports from Box-F. The Left and Right supports are not interchangeable and both have locating pins to align the support to the base frame.



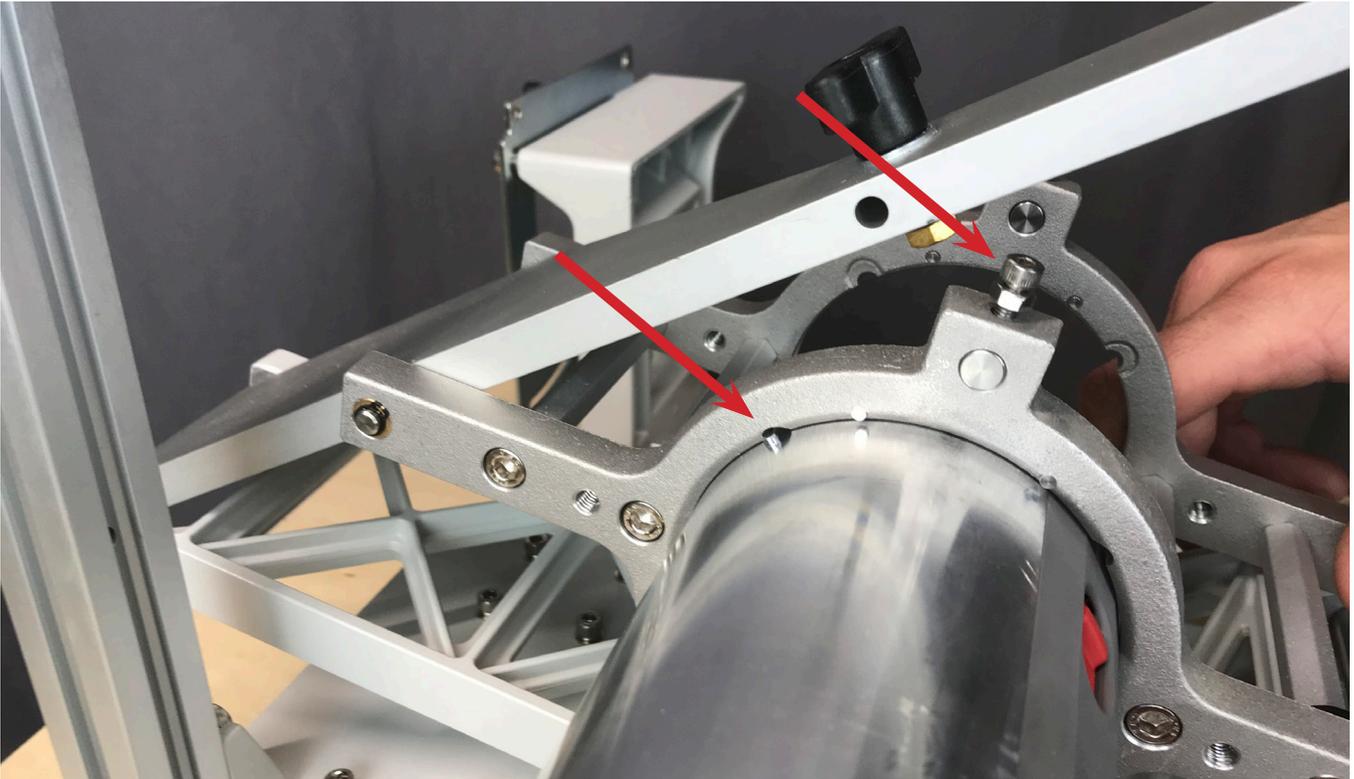
Check the two table supports to be sure they're clean and no debris is between the table and the support then hand-tighten all four table mounting cap screws (K-3) Next, secure the table to the protractor by tightening the four screws.

You can now loosen both protractor lever knobs and test the tilting table.

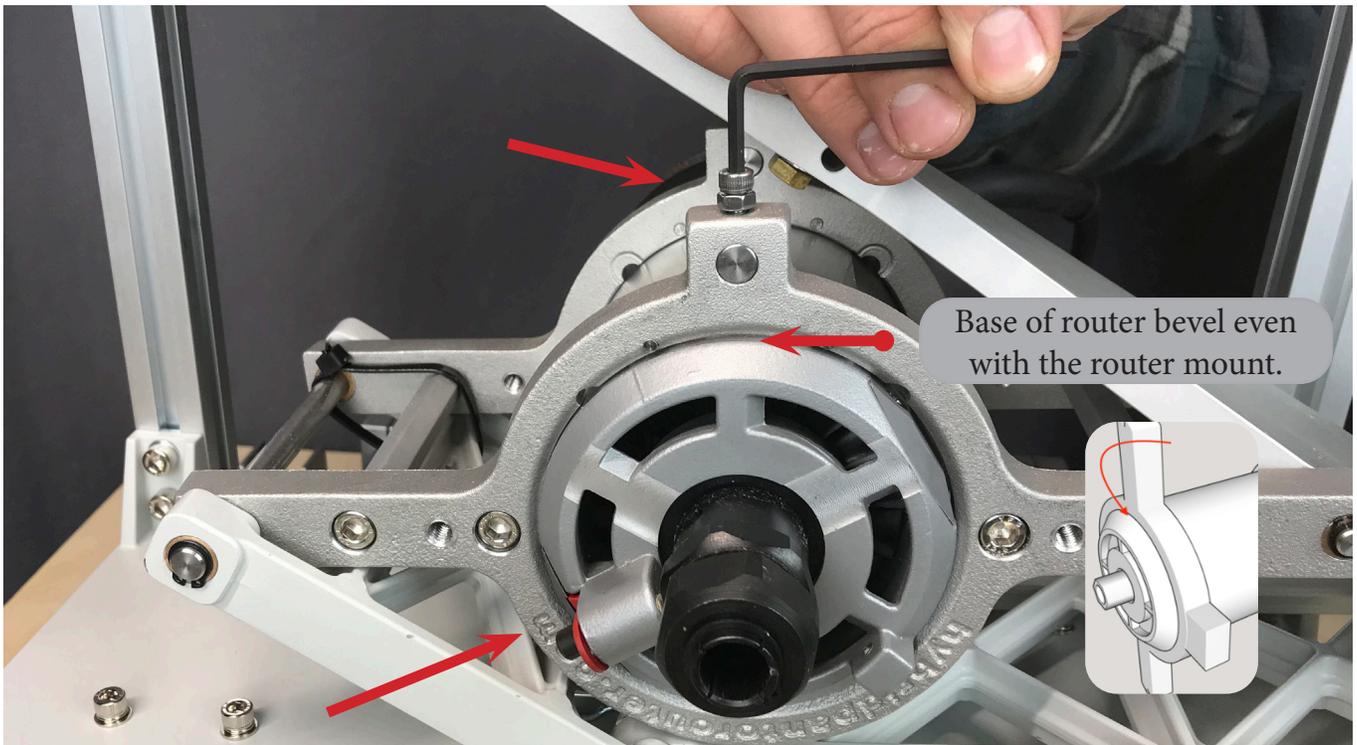


The Porter Cable 8902 router supplied with our Pro-Pack and All-In packages has a rack gear that is not used with the PantoRouter™. To remove the two small screws and the gear, place the router on a solid surface and use significant downward pressure while removing the screws. A well-fitting screwdriver is also very important. If the screw heads are stripped they will need to be drilled out to free the rack gear.

Do not remove the two pins pressed into the side of the router. The router mounts have notches to allow the router to pass through with the pins in place.



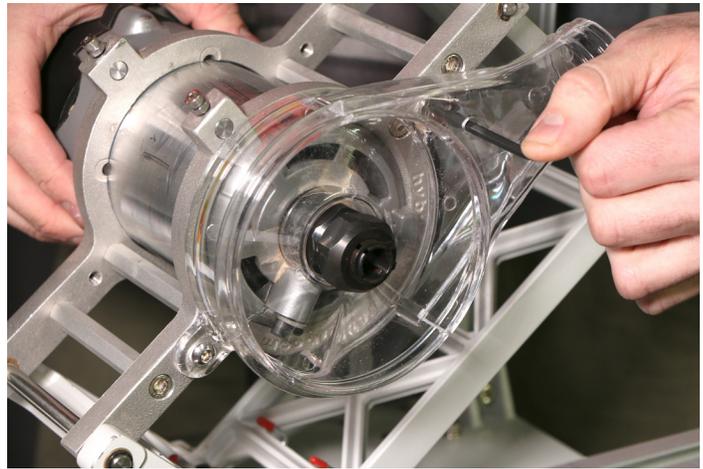
Loosen the two router mount cap screws but don't remove them. Align the pin with one of the slots in the first router mount and slide the router through both router mounts. There are slots in the router mount closest to the table, but the router pins will not go that far.



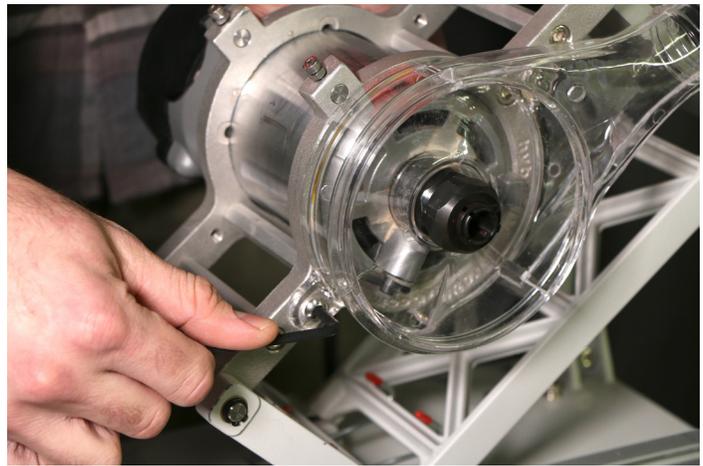
Push the router forward until the base of the bevel on the router is aligned with the front face of the router mount.

Rotate the router so the rotor lock button is aligned with the “m” in www.pantorouter.com cast into the router mount. Tighten both router mount cap screws and locking nuts.

The dust collector hood attaches using two different screws. The countersunk screw goes on the discharge port side of the router mount. Use a hex driver through the access hole to tighten it.



The round head machine screw (hex) secures the other end as shown. If the router is mounted correctly the operator can access the router rotor lock button through the opening for single-wrench bit changes.



We recommend using a hose that fits over the discharge port, not inside it. It sometimes helps to soften the hose cuff by holding it under hot tap water. It should slip right on to the dust collection hood and as it cools it will grip tenaciously.

You can now remove the cardboard cushions from the pantograph assembly.



Choose the inch or metric side of the depth stop scale then mount it on the depth stop using a business card or four thicknesses of paper for clearance over the depth stop angle.

Now that the basic assembly of the PantoRouter™ is complete, continue on for directions to:

1. Calibrate the Template Holder
2. Setup and use the Thickness Gauge
3. Scribe the Centerline on the table
4. Assemble the Centering-Scale Fence.

Happy PantoRouting!

Calibrate the Template Holder

The template holder frame assembly is aligned at the factory but can shift slightly in transit so the following procedure might be necessary to bring it back into perfect alignment. Check alignment using a square before loosening the screws to see if adjustment is needed.

Many people can feel variation of about a thousandth of an inch (0.025mm), so aligning by touch is often adequate.

If adjustment is needed, loosen the screws holding the template holder frame cross rail to the frame posts. There are two holes on each side to access these screws.

Flush the top, front and back of the cross rail to the post and be sure the assembly is square. Re-tighten the screws on both sides.

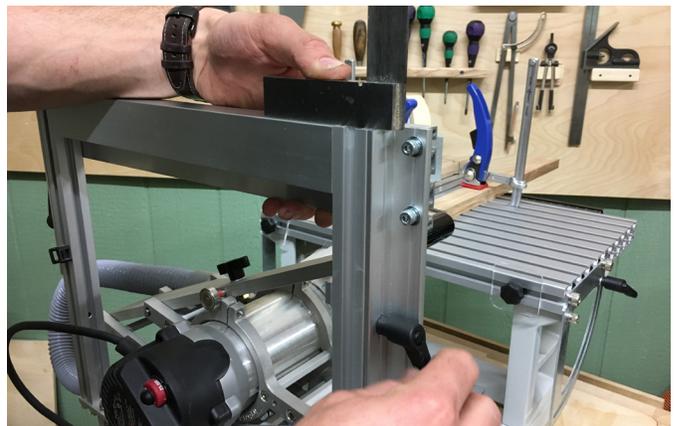
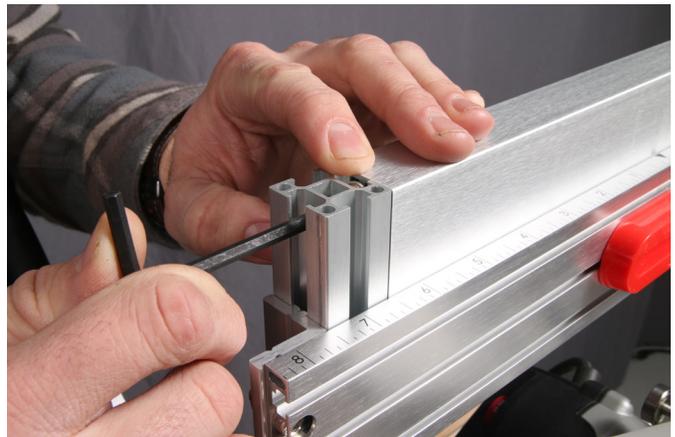
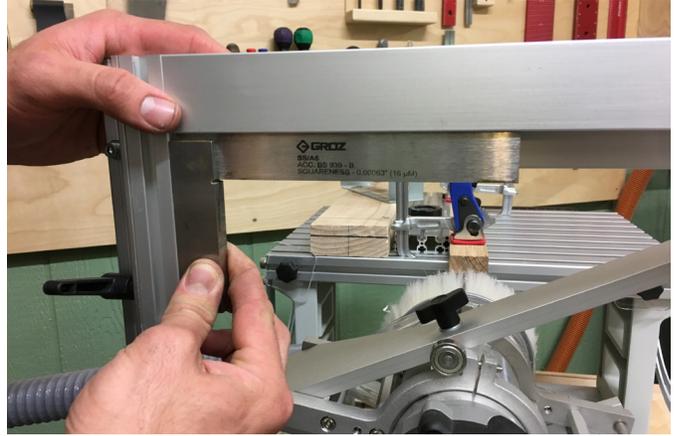
Alignment of the template to the pantograph and table is critical for accurate joinery. The template holder must be perfectly square to the frame and must slide freely on the posts. Adjusting it is quick and easy using the following method.

Inspect the template holder, checking for any sharp edges. Relieve edges with very fine sand cloth or a diamond file if necessary and you can wax the surfaces to lubricate.

Mount the template holder with the four screws on the sliders loosened. Tighten the lever knobs when the sliders are flush with the top of the posts.

Align the template holder to the top of the posts then tighten the four screws. The small cap nuts can be held with either an 8mm or 5/16" wrench or nut driver.

The template holder should now slide up and down freely and it should stay aligned to the template holder support frame.



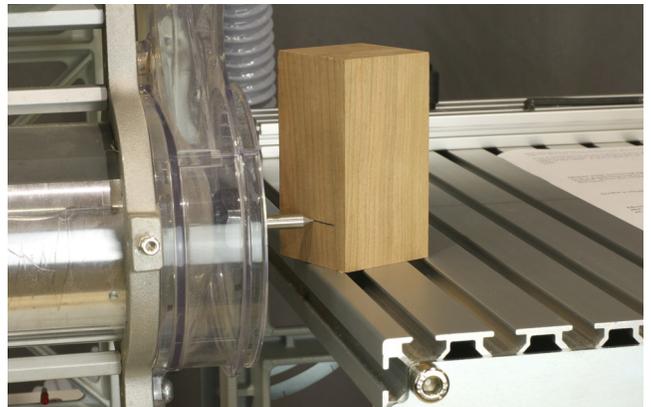
The template and template holder must be coplanar to the table and the workpiece in order to produce high quality joinery. This can be quickly checked after the template holder support frame and template holder have been squared and trued.

Cut a setup block from a piece of fine grain wood so it's square on the end then stand it up on the operator's side of the table. A piece about 1.5" X 1.5" X 3" works well.

Mount your centering jig (full-round pointer) in the router and lock a guide bearing so it rides the top of the template holder. Lock the template holder on both sides with the centering jig about an inch (25mm) above the table.



Scribe a small line (1/2" long or so) in the setup block as shown. We highlighted the line with pencil for clarity. It's easiest to see the line when you're scribing across the side grain.



Move the guide bearing to the far side of the template holder, which moves the centering jig across the table. Scribe a second line next to the first.



The two scribe marks should be identical or very nearly so. If they are off by more than the width of the scribe line, shims will be required under the glide shaft mounts on the low side.

Shims are provided in the Kits box (K-14). If additional shims are needed for perfect alignment, let us know and we can send you some, or you can use standard machine tool shims. Always shim under both glide-shaft mounts on the glide-shaft needing to be raised.



CALIBRATE THE PANTOROUTER™ FOR ULTRA PRECISION

If your centering jig test indicates a difference from one side of the table to the other, please follow the procedure here to calibrate your PantoRouter™ for precision operation every time. This only needs to be done once.

Please go back to the first assembly steps to be sure the paint was removed if there was any. Paint between the machined surfaces could lift them slightly.

Next, recheck the alignment of the template holder and template holder support frame. The frame ends are milled to very close tolerance so again, if all of the milled surfaces are mating well, they should be aligned and square.

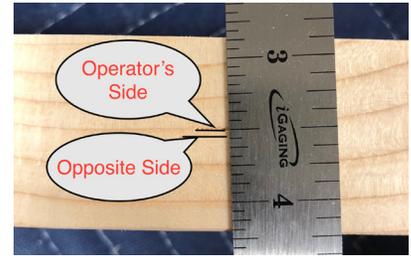
Provided the machined surfaces are mating correctly, there are two common reasons the PantoRouter™ might need to be adjusted when first assembled.

- 1- The table could be slightly high on one side
- 2- The router motor is not perfectly concentric

Loosen all four cap screws on the table and loosen the locking knobs and the protractor bearing screws. Make sure there's nothing between the table and the two side supports, then carefully re-tighten all of the screws and locking knobs. It's good practice to go around the table snugging all screws half way then go around again to tighten them fully.

Router motors do not need to be perfectly concentric for normal router functions so it's not a high priority for the manufacturer. For our use, we need to keep it centered to the table and templates so there's an easy way to fix it.

Loosen the Glide Shaft Mounts on the low side and slip a shim under each mount. Always use the same number under each mount to be sure the panto-graph is raised evenly. Retest and it should be dead-on! We have provided a set of stainless steel shims (K-14) but if more are needed, brass or any other durable material can work. It's best to avoid plastic shims that could compress.



Setting the Thickness Gauge



Cut a test piece about 1-1/2" square and about 18" long. Make sure the sides are parallel and there is no snipe on the ends. Mark one side "TOP". Cut a 1" long section and about a 4" long section that we'll use later for clamping. Mark the same side of the 1" piece top also.



Insert one of the non-tapered 6mm guide bearing shafts into the center hole of the template holder. You can use a template, as long as the shaft goes all the way through the template into the center hole of the template holder.



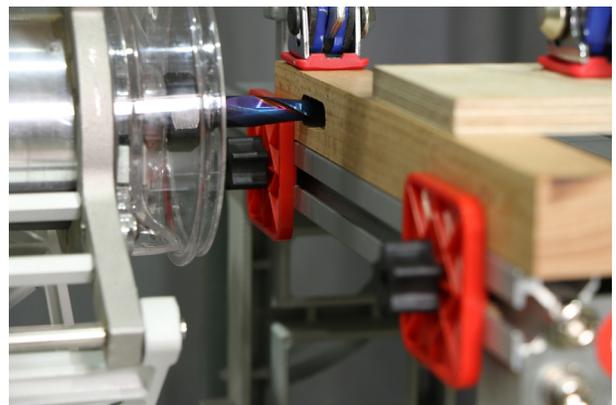
Mark the center of the workpiece then set the pointer at the center mark by adjusting the template holder up and down. Lock the template holder on both sides.



Hold either the workpiece or the 1" representative sample of the workpiece up against the template holder then move the thickness gauge up to the piece and tighten the thickness gauge.

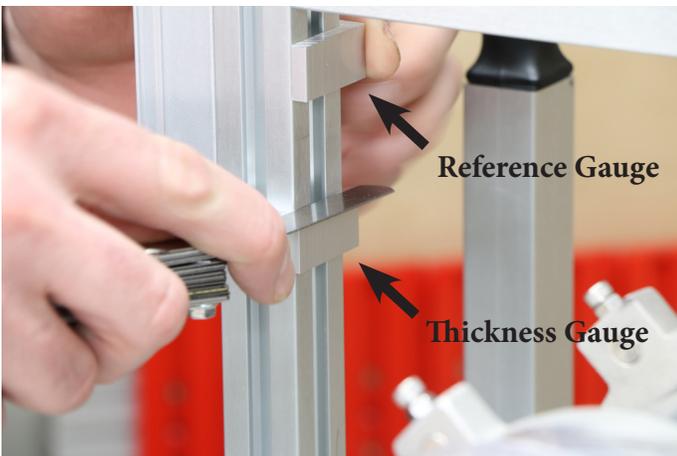


Using the 1-1/2" template and a 1/2" bit, cut a mortise about 3/4" deep.





Measure the shoulders of the workpiece and note which is higher, the top or bottom shoulder. The thickness gauge needs to be moved the full difference between the two measurements. In this case it's 0.46 mm.



Raise the thickness gauge reference angle on the back of the support post and insert feeler gauge(s) as close to the desired move amount as possible. Lock the reference gauge (top angle).



Loosen and move the thickness gauge up to the reference angle and lock it.



Loosen the template holder and move it up. Insert the workpiece or the representative sample then lower the template holder to squeeze the workpiece against the thickness gauge then lock the template holder.



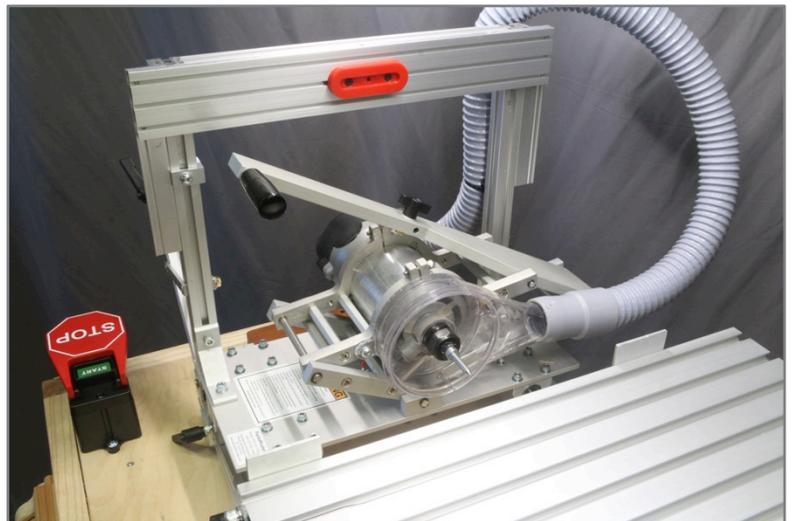
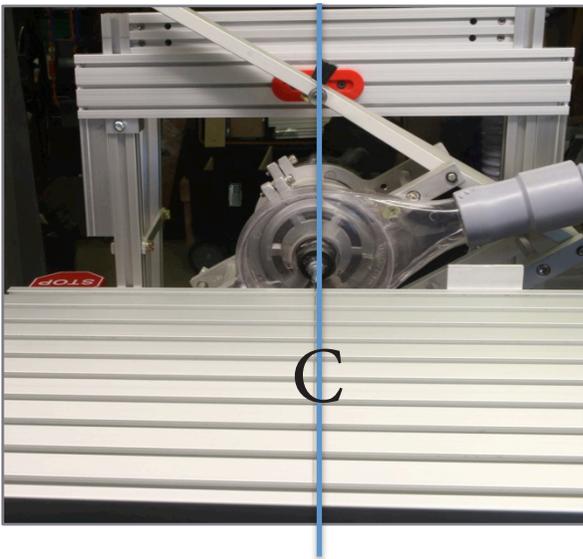
Cut another mortise using this new setting.



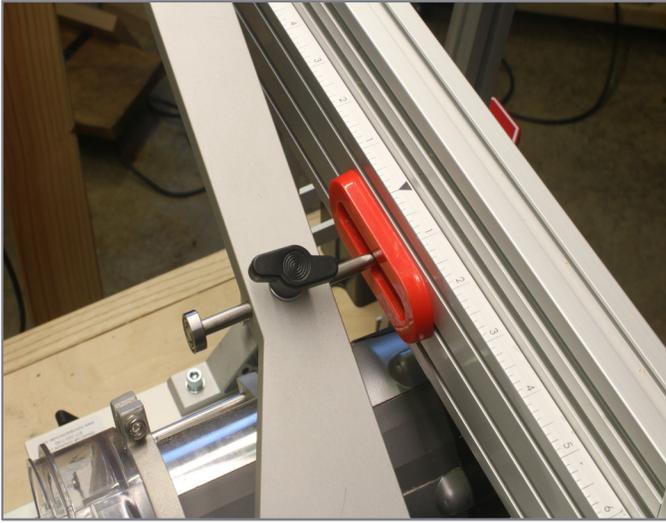
Remeasure and adjust as necessary until you are satisfied with the result. We can typically get it within a hundredth of a millimeter or less than a thousandth of an inch.

It's rare that you would need to move your thickness gauge, but if you do it will be downward to get it out of the way of a low cut on a dovetail or box joint array. If you do move the thickness gauge, don't move the reference gauge so when you're done with the unusual operation, you can slide the thickness gauge back up to the reference gauge and lock it without needing to recalibrate.

Finding and Marking the Table Centerline

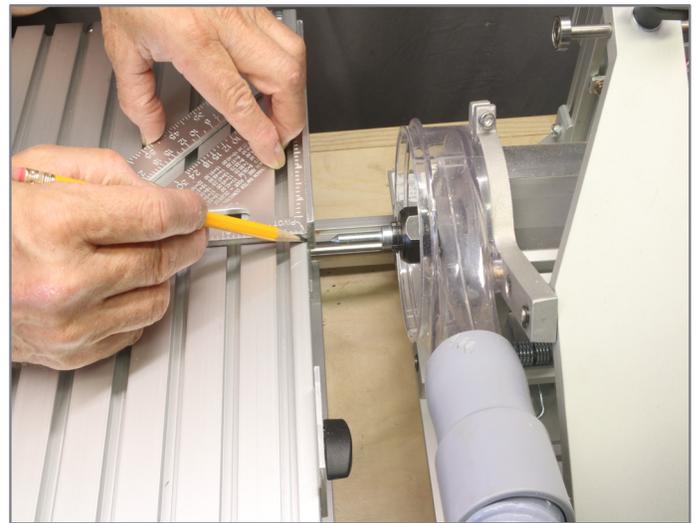
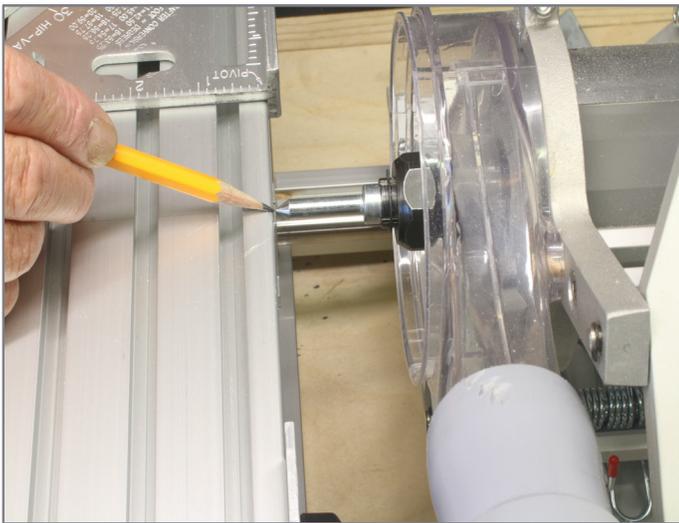


The PantoRouter™ transfers the shape of the template mounted on the template holder to the workpiece located on the table. Aligning the template, router bit and workpiece are essential to accurate joinery, and this is made fast and easy using the Centerline and Centering Scale Fence.



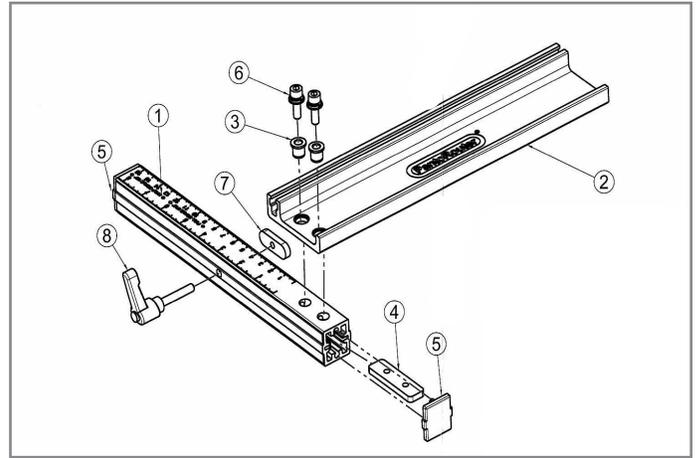
Insert the non-tapered 6mm guide bearing shaft through the center hole of a template and into the centering hole in the template holder then mount either centering jig (full-round pointer or split-shaft) in the router collet. Plunge the pantograph carriage forward and lower the template holder so the tip of the centering jig rests gently on the top edge of the table.

Lock the pantograph carriage using the two depth stops on the operator's side.



This is dead center of the table relative to the center of the template and router, so carefully mark this position and use a square to draw a line from this point across the center of the table. This mark can be in pencil for now until you're confident in your setup then you can scribe it into the aluminum.

Setting up the Centering Scale Fence



Setting up the centering scale fence is super easy and due to the precision-machined centering pins, the fence will be dead-on 90° without any adjustment.



Before assembly you'll need to decide which scale to use. We recommend using the metric (CM) scale since you don't really care the size when centering (the size was determined when you milled your wood), you just want to find the middle. It's way easier to measure 8.7cm or 87mm than $3\text{-}\frac{7}{16}$ inches.



To center your workpiece on the table, first measure the width using the outer scale then set that value on the inner scale at the centerline. Lock the fence and Boom....You're Centered!

MORTISE AND TENON GUIDE BEARING AND BIT SELECTION

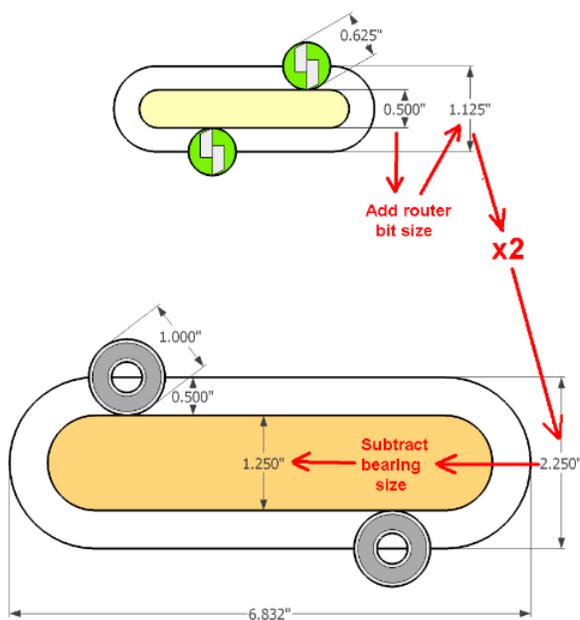
Tenon Size	GB	Bit	
		GB	Bit
1/8"	6	1/2	
	10	1/2	
1/4"	22	3/4	
	35	1	
3/8"	10	3/8	
	15	1/2	
1/2"	10	1/4	
	15	3/8	
	22	1/2	
	35	3/4	
3/4"	48	1	
	22	1/4	
	35	1/2	
1"	48	3/4	
	35	1/4	
	48	1/2	

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.

Note: Use a 12mm Guide Bearing and 1/2" bit to make 5/16" tenons

FORMULA TO CREATE CUSTOM TEMPLATES:

$$2(\text{TENON THICKNESS} + \text{BIT DIAM}) - \text{GUIDE BEARING}$$



Bit mm	Guide Bearing mm	Tenon Thickness mm
12	19	12
12	15	10
12	10	8
12	6	6

MM	Decimal Inch	Fraction Inch
3.175	0.125	1/8
6	0.236	
6.35	0.250	1/4
10	0.394	
12	0.472	
12.7	0.500	1/2
15	0.591	
19	0.748	3/4
22	0.866	
25.4	1.000	1
35	1.378	
48	1.890	

Accessories Available in the Online Store

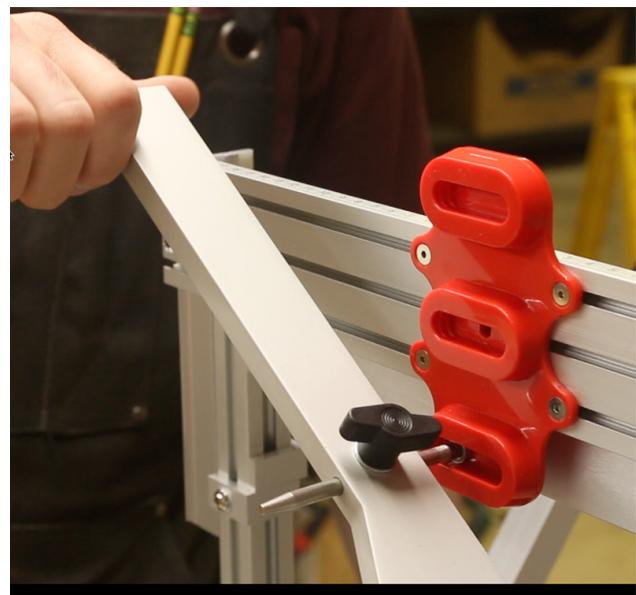
The auxiliary fence is very useful for setting and repeating angles. Set the angle using a sliding bevel gauge, lock it down and it'll stay put for all of your cuts.



The Monster Mortise and Tenon set is especially useful for outdoor projects using construction lumber and for applications where big mortise and tenons are needed like the stretcher on a trestle table. You can make 3/4" and 1" mortise and tenons with widths of up to nearly 7" using our Segmented Mortise and Tenon set.



The Triple Mortise and Tenon Template below is especially useful for joining two pieces at a 90° angle and in the same orientation. If a single M&T was used, the mortise would cut across the grain, destroying the strength of the mortise piece. With the Triple, three smaller M&Ts are aligned with the grain direction making an incredibly strong and attractive joint.

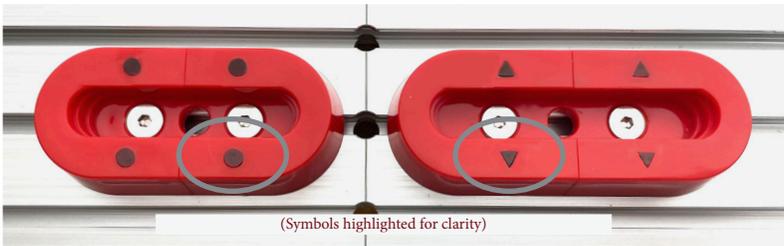


Segmented Mortise and Tenon Templates

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	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					
Guide Bearing	6mm	10mm	15mm	22mm	35mm	48mm	All tenons use the 1/2" bit and guide bearings listed to left					
Mortise and Tenon Width (Rounded to 1/16")	3/4	7/8	1	1 1/8	1 3/8	1 5/8	●	●	Circle marked round-end pieces only			
	1	1 1/8	1 1/4	1 3/8	1 5/8	1 7/8	▲	▲	Triangle marked round-end pieces only			
	1 1/4	1 3/8	1 7/16	1 1/2	1 5/8	1 7/8	●	1/2"	●	End vari... with segments of nations		
	1 1/2	1 5/8	1 3/4	1 3/4	1 7/8	2 1/8	▲	1/2"	▲			
	1 3/4	1 7/8	2	2	2 1/8	2 3/8	●	1"	●			
	2	2 1/8	2 1/4	2 1/4	2 1/2	2 5/8	▲	1"	▲			
	2 1/4	2 3/8	2 1/2	2 1/2	2 5/8	2 7/8	●	1 1/2"	●			
	2 1/2	2 5/8	2 3/4	2 3/4	2 7/8	3 1/8	▲	1 1/2"	▲			
	2 3/4	2 7/8	3	3	3 1/8	3 3/8	●	1"	●			
	3	3 1/8	3 3/16	3 1/4	3 3/8	3 5/8	▲	1"	▲			
	3 1/4	3 3/8	3 7/16	3 1/2	3 5/8	3 7/8	●	1"	1/2"	1"		
	3 1/2	3 5/8	3 11/16	3 3/4	3 7/8	4 1/8	▲	1"	1/2"	1"		
	3 3/4	3 7/8	3 15/16	4	4 1/8	4 3/8	●	1"	1"	1"		
	4	4 1/8	4 3/16	4 1/4	4 3/8	4 5/8	▲	1"	1"	1"		
	4 1/4	4 3/8	4 7/16	4 1/2	4 5/8	4 7/8	●	1"	1 1/2"	1"		
	4 1/2	4 5/8	4 11/16	4 3/4	4 7/8	5 1/8	▲	1"	1 1/2"	1"		
	4 3/4	4 7/8	4 15/16	5	5 1/8	5 3/8	●	1 1/2"	1"	1"	1/2"	
	5	5 1/8	5 3/16	5 1/4	5 3/8	5 5/8	▲	1 1/2"	1"	1"	1"	
	5 1/4	5 3/8	5 7/16	5 1/2	5 5/8	5 7/8	●	1 1/2"	1"	1"	1"	*
	5 1/2	5 5/8	5 11/16	5 3/4	5 7/8	6 1/8	▲	1 1/2"	1"	1"	1"	*
5 3/4	5 7/8	5 15/16	6	6 1/8	6 3/8	●	1 1/2"	1"	1/2"	1"		
6	6 1/8	6 3/16	6 1/4	6 3/8	6 5/8	▲	1 1/2"	1"	1"	1/2"	1"	



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.



Add the center segments according to the chart above either the 1" end pieces or 1-1/4" end pieces to make hundreds of different sizes of mortise and tenon!

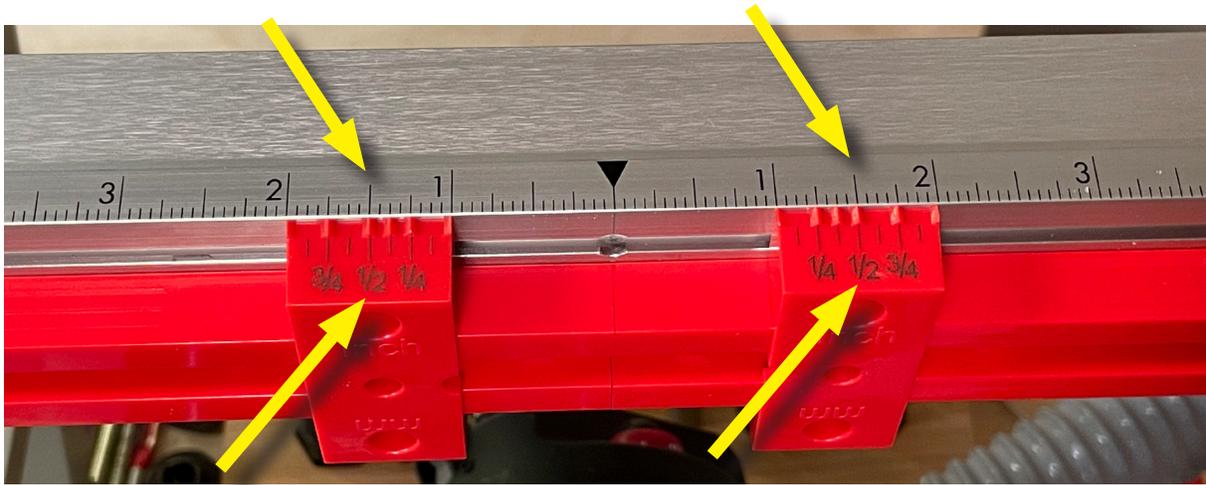


Please see the Segmented Mortise and Tenon How-To Guide on the PantoRouter website for complete instructions on set-up and use of this template system.

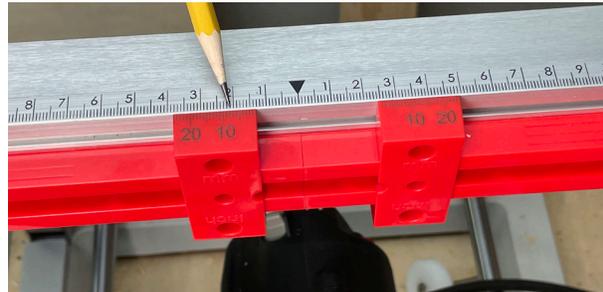
Slot Mortise Template

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.

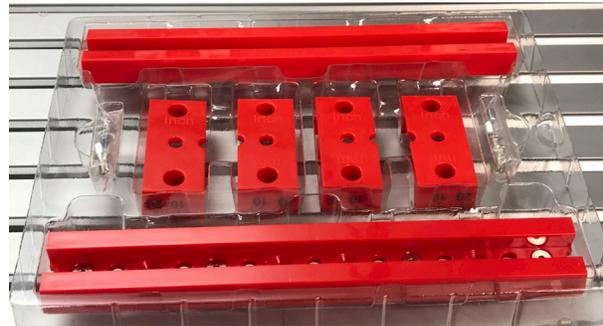
Example: To cut a ½” thick mortise 1½” wide, align the mark for bit diameter (½”) engraved on both left and right sliding stops with the desired mortise width (1½”) on both sides of the centerline on the template holder (marked by the triangle).



Metric sizes like an 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.



Please see the Slot Mortise How-To Guide on the PantoRouter website for complete instructions on set-up and use of this template system.



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