

Tortoise Switch Machines, Mounted Horizontally

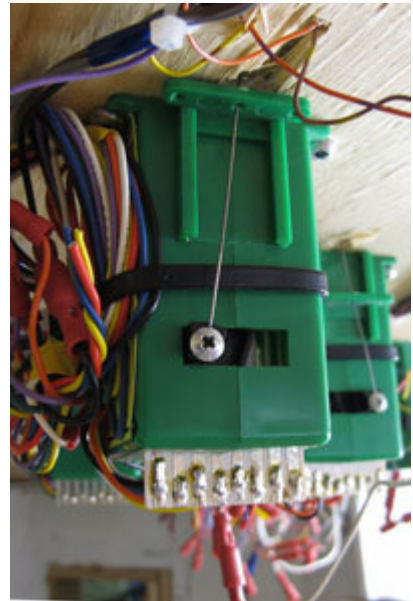
by David King

Have you ever used the Tortoise Switch Machines manufactured by Circuitron™. These are a wonderful stall motor slow motion switch machine that will operate at a low DC voltage. I have found that these units are very reliable and trouble free for many years. Because of this I have been using them for many years on both portable and fixed location layouts without any issues except one. It is that exception that has prompted me into writing this article and include a solution that works for me and may work for you.

You ask, what is that exception? Well on my Colorado & Wyoming Railway I have found that if you mount the Tortoise Switch Machine in the standard vertical orientation the connection board and sometimes part of the machines housing sits below the edge of the fascia. This is both a visual distraction as they are easily seen but also there is a possibility of damage when someone reaches across the lower level and can catch an arm or shirt sleeve on the connection board. If the connection board is damaged or broken off the unit may need to be replaced or repaired, neither of which is fun, also the person who got caught is embarrassed or hurt and you feel bad because you know this is preventable. I have found I feel stupid if I'm the one who causes the damage but even worse if it happens to one of my guests.

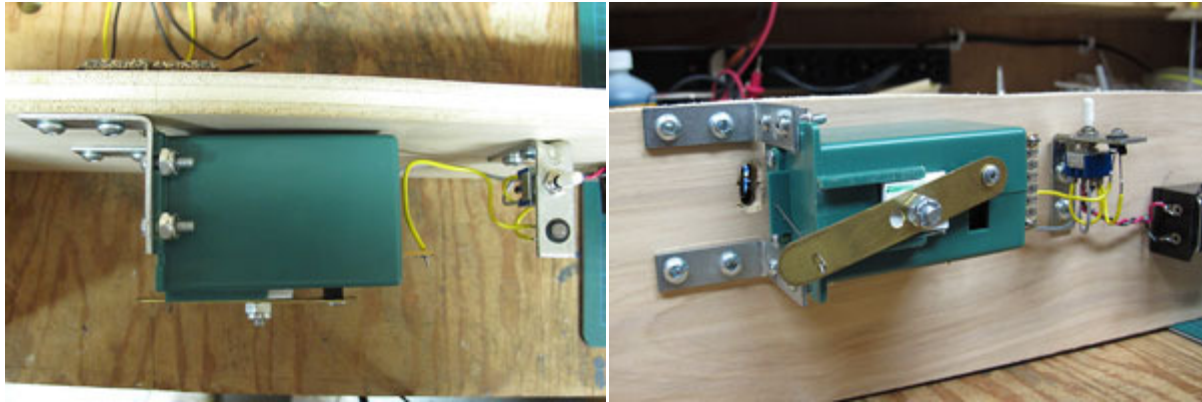
Traditional Mounting

We need to take a quick look at the traditional mounting so that we can see what the Tortoise looks like when mounted and in operation. In the image below we can see that the Tortoise is attached to the underside of the layout and that the height required for clearances below is about 3-1/4". In most conditions this would be fine but when the layout is portable or you just don't have the height this is not the best choice. As shown in the image on the right we can see that a plastic tie has been added to keep the wires from hanging too low below the layout level.



Horizontal Mounting

This method of mounting was borrowed from my friend Justin, with permission, and only needed a minor modification to work on my layout compared to his. Justin models in N scale where I model in On30. As you will soon see that this mounting method should work in most scales. The finished device is shown in the images below.



Parts Needed

In order to build this horizontal mount we will need to acquire the necessary parts from at least two sources. Here is the list of parts and the required number of pieces to convert one Tortoise Switch Machine.

Quantity	Description	Source
2	1-1/2" L brackets, Stanley #30-3165	Hardware Store
4	#6-32 x 1/2" round headed screws	Hardware Store
4	#6-32 nylon insert nuts	Hardware Store
4	#8 x 1/2" pan head wood screws	Hardware Store
2	#4 x 3/8" pan head wood screws	Hardware Store
1	#8-32 X 1/2" flat head screw	Hardware Store
1	#8-32 nylon insert nut	Hardware Store
1	K&S brass strip #3512419, 1/2" x 12" (makes 4 brass bars)	Hobby Shop
1	0.025" steel wire (various lengths as needed)	Hobby Shop
	0.060" styrene sheet (cut into small pieces)	Hobby Shop

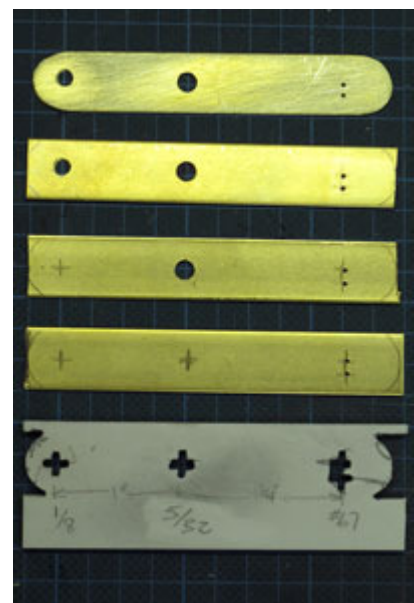
This list may look long and if need you may substitute any of the items as you see fit. Also you can save some money if you need to do this numerous times as buying in quantity should save you a little bit of cash.

Custom Fabrication

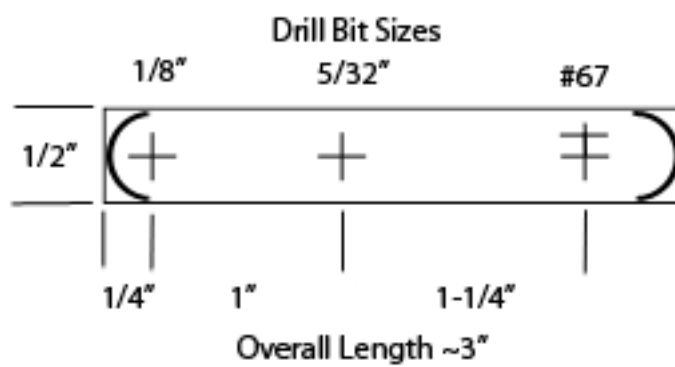
The custom fabrication of parts is minimal and really there are only two items that need to be fabricated. These are the brass strip lever arm and the styrene pivot mount. The brass lever is the most complicated of the items so we will cover that first.

As shown here in the image on the right we walk through each step.

Step 1, Using the K&S brass strip we will need to cut the 12" strip into four lengths of approximately 3" each, I just used a hacksaw. **Step 2**, Since I made many of these I set myself up as if this was an assembly

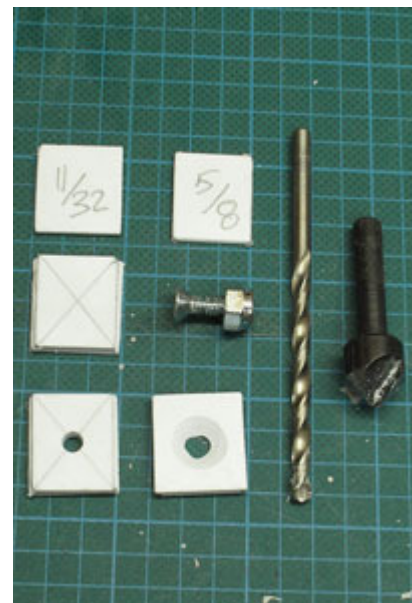


line and created a jig made from styrene as shown in the bottom of the image. In the jig I cut out the rounded ends and also cut out slots so that I could mark cross hairs where holes need to be drilled. A detailed drawing with all of the measurements is located below. **Step 3**, Once all of the brass strips were marked I drilled the two small holes on the right side using a #67 drill bit. This is where the throw wire will attach later. **Step 4**, Next I drilled out the center hole using a 5/32" drill bit. This is the pivot point on the lever. **Step 5**, I drilled out the far left hole using a 1/8" drill bit. This is where the movable arm of the Tortoise will be attached. A video of this step is located on my website. **Step 6**, is to round off the two ends of the brass strip. I used a vertical bench sander for this operation. I like the rounded shape so that no sharp edges are left to catch on anything. Again a video of this is located on my website. **Step 7**, This is the final step and all I did was sand down all of the surfaces to get rid of any metal burrs and sharp edges.



This template with these measurements is used for my On30 layout. For N scale use exchange the 1" and 1-1/4" measurements to move the 5/32" pivot hole closer to the #67 throw wire holes.

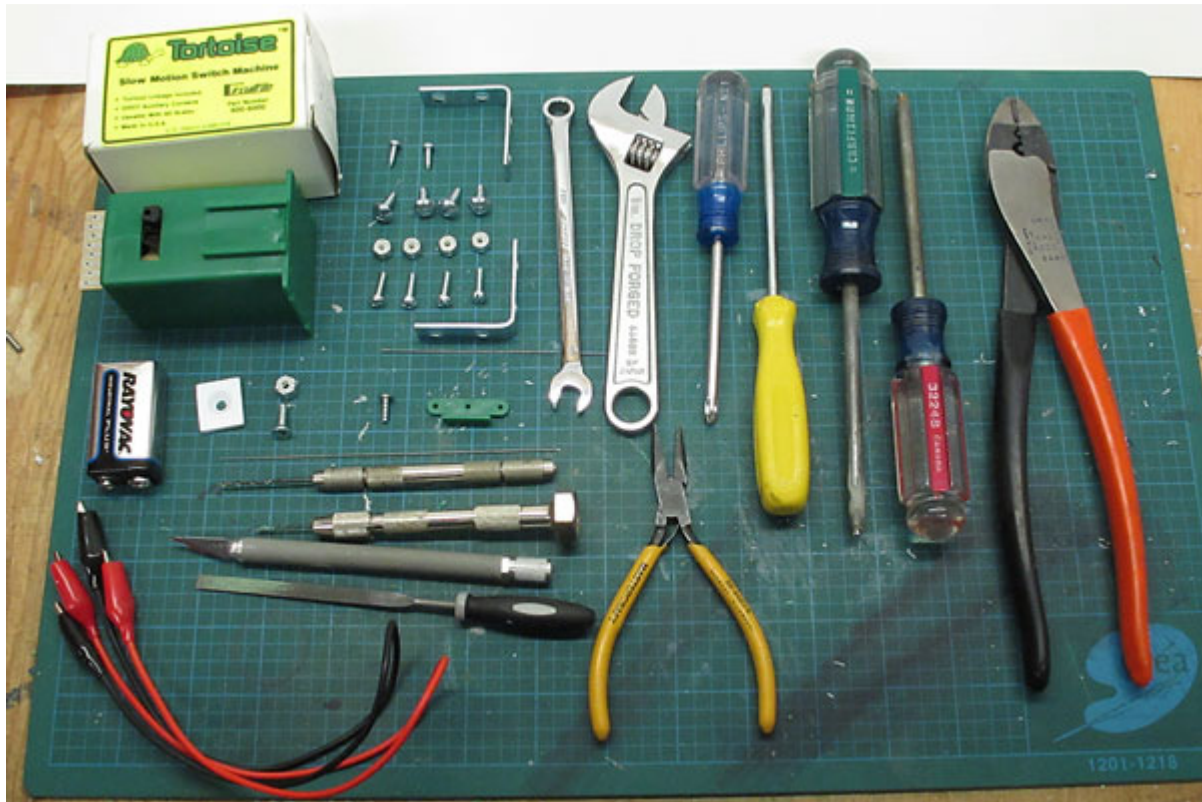
To fabricate the styrene pivot block as shown in the image on the right. **Step 1**, Take your sheet of 0.060" styrene and cut out a long 3/4" wide strip. **Step 2**, From this strip cut out a piece 15/16" long and file or sand off the edges of this piece so they are slightly rounded. **Step 3**, From the strip of styrene cut out another piece 5/8" long and file or sand off the edges of this piece so they are slightly rounded. **Step 4**, glue together the two pieces so that the 3/4" sides are lined up and the smaller piece is centered on the larger piece. **Step 5**, Mark a center point on the top of the smaller piece and drill a 5/32" hole through both pieces. **Step 6**, Now turn the piece over so the larger piece is facing you. You now need to use a countersink bit and drill into 5/32" hole in the pivot block and create a counter sink deep enough for the #8-32 flat head screw so it sits flush with the styrene pieces.



Assembly

That's it for the major fabrication of pieces for this project. Now we need to assemble all of the pieces into a completed unit ready for mounting under the turnout on the layout. As shown in the following image I have all of the pieces and tools laid out. I find this a useful step as it makes sure I have all of the

pieces needed to complete the assembly without the need to start searching and wasting time looking for something when in the middle of a project.

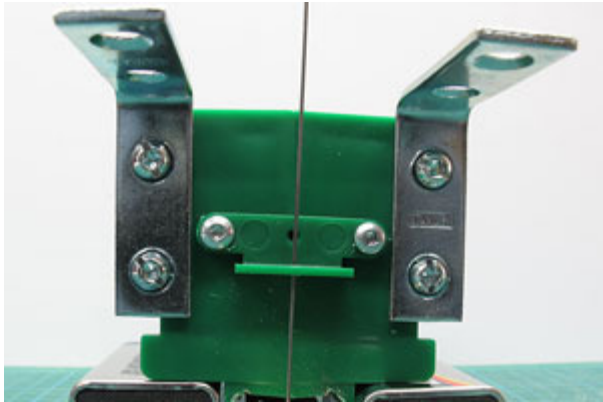


This image of the pieces and tools may look a little intimidating as there seems to be a lot of items here but there is one tools missing. Not shown is my cordless drill with a 7/32" drill bit and a brass lever arm. The final assembly can be done in any order that works for you but here are my steps. To make each of these steps clearer a video for each of the assembly steps is located on my web site.

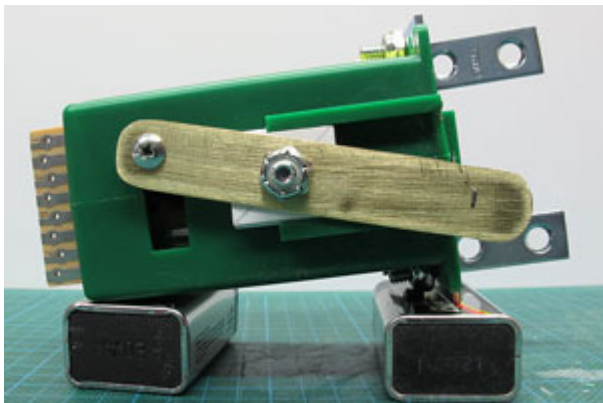
Step 1a, I install the green plastic guide that is supplied with the Tortoise Switch Machine to the face but first I need to make a couple of modifications to the guide. I drill a #47 hole into the small clip in the middle as this will be the hole for the throw wire when installed at the end of the assembly. **Step 1b**, I then increase the size of the two outside pre-manufactured guide using the 7/16" bit, this will allow for the two #4 x 3/8" pan head wood screws to be used. **Step 1c**, now hold the plastic guide against the Tortoise and drill a pilot hole with the pin vice and a 1/16" bit. **Step 1d**, Using the proper screwdriver install one of the #4 screws snugly. **Step 1e**, Drill the second pilot hole and install the second screw.



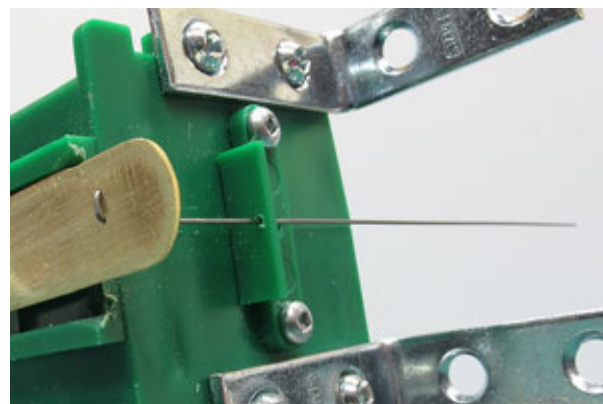
Step 2a, I next install the two L brackets to the mounting feet of the Tortoise using the four #6-32 x 1/2" round headed screws and the four #6-32 nylon insert nuts. **Step 2b**, using one of the #6 screws and the proper screw driver insert this screw into one of the holes near the middle of the L bracket and start threading on one of the #6 nuts. **Step 2c**, Place this against the mounting foot on the Tortoise and tighten the screw and nut, you will need a wrench to hold the nut while tightening, until the bracket is snug. **Step 2d**, Align the bracket so the hole beside the one you just used is lined up the mounting foot. **Step 2e**, There will not be a hole in the plastic foot so you will need to use the drill with the 1/8" bit to make a hole for the screw. **Step 2f**, Now you can install the second #6 screw and nut as you did the first one. **Step 2g**, Repeat steps 2b to 2f for the other L bracket.



Step 3a, Now I attach the pivot arm and start by assembling the brass arm to the styrene pivot block I built earlier. Start by using the #8-32 X 1/2" flat head screw and inserting it into the pivot block, make sure the screw head is flush with the bottom of the block. **Step 3b**, Now I add the brass lever to the screw, I usually find that the clearance is so small that I hold the screw with the proper screwdriver lightly thread it onto the brass lever. **Step 3c**, Next I thread on the #8-32 nylon insert nut and using a wrench and the screwdriver I tighten this down all the way and then back off the nut about 1/2 a turn to allow the lever to move freely. **Step 3d**, I then cut, using a small hobby knife, and file away the green plastic on the Tortoise to open up the top or the pivot slide channel and insert the assembled pivot arm. **Step 3e**, Using the supplied screw with the Tortoise I attach the brass lever using the 1/8" hole to the movable arm of the Tortoise.

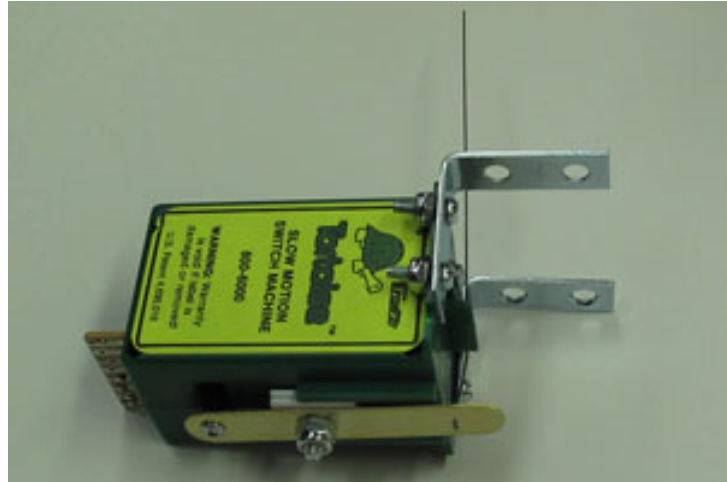


Step 4a, I cut a piece of the 0.025" steel wire using a good pair of pliers, don't use flush cutting pliers or rail nips as the steel wire will damage the cutting blade of these tools, to a length a little longer than I will need when installing this finished unit under my turnout. **Step 4b**, I now bend a small squared off hook into the bottom of the wire to fit the spacing of the two #67 holes that were drilled into the brass lever earlier. I use a small pair of needle nose pliers for this. **Step 4c**, I now



insert the wire into the bottom of the brass lever and guide it through the plastic guide. **Step 4d**, Once the wire is fully inserted I bend the end of the hook to secure the wire so it will not fall out of the brass lever. **Step 4e**, I usually put a small kink in the steel wire between the brass lever and the plastic guide so that the wire extends straight up parallel with the original mountain face of the Tortoise.

Believe it or not you should now have a fully assembled Tortoise Switch Machine ready for horizontal mounting under your layout. The final assembly is shown on the right.



Testing Your Assembled Tortoise

Before installing the new assembly I like to test its operation so that I know it will operate smoothly without any binding of the assembled parts. To perform this test I just use a nine volt battery and a couple of jumper leads. All you need to do is connect one of the jumper leads to one of the outside terminal strips, #1 or 8 on the Tortoise, and the other test lead to the other outside terminal. Than connect the leads of the two jumpers to the terminals on a nine volt battery. Once the arm has moved fully reverse the two leads on the battery and the Tortoise will now swing in the other direction. Make any final adjustments if anything is binding and now you can mount the Tortoise under your layout.

Tools I Used

Cordless Drill

Vertical Sander

#67, #47, 1/16", 7/64", 1/8", 5/32"

Colet (for the #67 bit)

Two Pin Vices

Hobby Knife

Small Flat File

Wrenches

#1 Philips, #0, #1, #2 Robinson Screwdrivers

Needle Nose and Wire Cutting Pliers

Sandpaper

Two Jumper Leads

Nine Volt Battery

Wrap Up

That's it for now I hope you enjoyed this and if you have a need to mount a Tortoise Switch Machine in a horizontal position here is the possible solution for you. Remember that I have a number of supporting videos for this on my website at www.kingerland.com in the *Model Railroading* page listed in the *Clinics, Tips and How-To* section.