

Under-the-table Manual Turnout Control

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I. What the clinic is about

- a. Concealed turnout throw vs visible, out-of-scale control
- b. Flexible linkage design to throw turnout can be installed after turnout is laid
- c. Manual unit has electrical contacts for more reliable current flow and to drive signals or position lights

2. Why these can be valuable

- a. Protect scenery
- b. easy installation and adjustment
- c. Provide electrical contacts
- d. Spring wire connection puts constant pressure on point to stock rail

3. List of materials

Linkage

- a. 1/8' and 3/32" brass tubing
- b. 3/16" or 1/4" square brass tubing
- c. 2-56 bolt and nut
- d. Paper clip
- e. 0.032 or 0.039 spring wire

Manual Turnout link

- a. Radio Shack DPDT heavy-duty slide switch, with detent
- b. 1.5" metal angles; 2-56 bolts and wood screws
- c. 2-56 nuts
- d. Metal coat hanger wire to operate the switch
- e. Plastic-head push pin (color optional)

Special Tools

- a. 2-56 die for threading wire
- b. #61 drill bit

4. Linkage parts

- a. 3/32" actuating rod with paperclip crank
- b. 1/8" outer pivot tube
- c. 2 1/2" long square tubing lever to clamp on actuating rod
- d. Music wire connecting link

Linkage construction

- a. File a small notch in the end of the 3/32" tube (actuating rod)
- b. Cut a piece of paperclip about 1.0" long and bend an "L" at one end with the short length about 1/4" long.
- c. Solder the short piece of the "L" into the notch on the 3/32" tube. Get the tube hot enough so that the solder flows into the tube around the paperclip wire. If you have it, silver solder is best. Once soldered, make another bend in the paperclip about 3/8" from the actuating rod down to parallel that tube. Clip off the excess so that the downward "L" is about 1/16" long. This will fit into a hole in the switch tiebar. Or you can wait and bend/cut the crank during installation.
- d. File smooth any solder on the outside of the tube so that it will fit all the way into the 1/8" pivot tube.
- e. Cut a 2.5" piece of the 3/16" or 1/4" square tubing. Smooth the cut edges.
- f. Drill a 3/32" hole through one end of the tube, about 3/16" from the end. Roll the tube 90 deg and drill a second 3/32" hole about 1/4" further in from the first. (measurements are to the hole's center.)
- g. With a razor saw, cut a slit from the end of the tube through the second hole. The slit will NOT pass through the first hole which should be perpendicular to the second.
- h. Solder a 2-56 brass nut on one side of the tube, centered on the first hole. I generally place flux on the tube and then fasten the nut in place with a steel 2-56 bolt before soldering so the nut is correctly centered. Don't use a brass bolt, or you will solder the bolt to the nut. When the final bolt, brass or steel, is inserted, it will clamp the square tube to the 3/32" actuating tube.
- i. Finally, drill a series of 3 or 4 holes in the other end of the square tube with a #61 drill. These holes must be in line with the second hole at the other end of the tubing. I usually start about 3/16" in from the end, and then every 3/8". This provides a range of adjustment for the actuating wire going between the switch machine and the linkage.
- j. The actuating spring wire will be bent to a "Z" shape and have either a loop or "L" at the switch machine end, and an "L" at the linkage end. The wire will be bent after the machine and linkage are installed.

Manual turnout throw construction

- a. Drill two holes through the DPDT switch thumb button. One will be horizontal (centered) for the actuator rod to throw the switch, the other vertical at the end of the button for the actuating wire. Use a $7/64$ " drill for the horizontal hole and a #61 drill for the vertical hole.
- b. Solder 4 " leads to the DPDT switch terminals. I color code the leads, with black wire at the center terminals and red & green wires at the respective end terminals.
- c. Fasten the "L" angles to the DPDT switch with 2-56 machine screws through holes drilled in the angles. You can tap these holes for the screw thread, or make them oversize and use nuts to secure the screws. The base of the "L" should be on the terminal side of the slide switch.
- d. Prepare an actuating rod from medium-size straightened coat hanger wire. With the 2-56 die, thread the rod on one end for about $3/4$ ". Place a 2-56 nut on the rod and run up to the end of the threads. The rod will pass through the horizontal hole in the DPDT switch, and be clamped by a second nut. The $3/4$ " of thread allows adjustment of the throw. Length of the rod should be enough to be fastened firmly to the switch at one end and pass through the front fascia board at the other, with a inch or so of extra length on the outside of the fascia to allow for installation of the actuating knob.

Linkage installation

1. Measure exactly the length of the soldered throw crank and drill a $1/8$ " hole in the roadbed which is that exact distance from the circular hole in the switch tiebar. Note that this hole can be on either side of the tiebar, either on the centerline of the track or on either side of the track. I normally place the hole on the same side as the headblock ties surrounding the tiebar, but the exact placement can depend on any under-table obstructions from benchwork or wiring. Before marking the hole position, center the switch points and place the hole so that the switch crank will be parallel to the straight rails. Option is to drill about $3/8$ " to $1/2$ " from the tiebar hole and bend the crank to fit on installation.
2. Place the $1/8$ " tubing in this hole. The top of the tube should be at the same height as the throwbar, and the bottom of the tube should extend between 1' and 2' from the bottom of the benchwork. Insert the actuating tube into the pivot tube. If the hole has been placed accurately, the downward "L" will fit exactly into the hole in the tiebar, and the crank will move the points smoothly from side to side. If not, you can usually adjust the "L" slightly in or out to fit. Or bend the paperclip crank to fit in the tiebar hole.
3. Cut the actuating tube so that about $3/4$ " extends from the pivot tube. Slide the square tube onto the actuating tube up to the pivot tube and tighten the bolt. There should be a

very small but definite amount of play between the square tube and the pivot tube so that the actuating tube moves freely. The square tube should be placed with the bolt head on the side that provides the best access for the tightening screwdriver. I normally align the square tube parallel to the paperclip crank and on the same side of the actuating rod, so that the motion of the bottom tube follows the motion of the crank above, but if you are driving the linkage with a switch machine, the square tube can be aligned however it fits best.

4. A spring wire will connect the linkage to the actuating mechanism, either a machine or the manual slide switch. Place the wire into the hole in the square tube that will give a slight amount of spring pressure on the points in either direction.

Manual throw installation

- I. First, install the linkage for the turnout as per above. Make sure that the square tube is parallel with the crank throwing the turnout and on the same side of the actuating tube.
- II. Install the slide switch on the underside of the subroadbed with screws through the holes in the angle (one on each angle is normally sufficient) so that the throw of the switch is perpendicular to the fascia and the button is about 2" from the linkage previously installed. The vertical hole in the button should be in line with the center actuating hole in the square tube.
- III. Run the wires attached to the switch to a terminal board following your standard wiring practices. One set of contacts can feed power to the frog while the second can be used for a panel light position indicator or to drive signals/CTC.
- IV. Bend and install a "Z" shape spring wire connection between the linkage and slide switch button. Place the wire in the hole on the linkage square tube that provides sufficient throw so that the points are pressed firmly against the stock rail. You can make fine adjustments by bending the "Z" slightly, or adjusting the position of the square tube on the vertical actuating tube. Spring wire is always inserted into the top of the switch button or linkage.
- V. Cut the actuating rod to length so that it will protrude about 1/8" to 1/4" from the switch button after placing the locking nuts on either side of the button. The other end should protrude about 1" from a hole drilled in the fascia. Tighten the lock nuts and insure that the turnout throws smoothly.
- VI. Heat the pin in a pushpin so that the plastic softens and you can pull the head off the pin. Push the actuating rod in so that the turnout throws in that direction. Cut

the rod to extend about 3/4" from the fascia. Remove the rod and flatten the fascia end slightly so that the pushpin head can grip the flattened end. Reinstall the rod. Heat the rod end with a soldering iron so that you can install the pushpin head on the rod. When the plastic cools, it will grip the rod. Note that you can color code the pushpin heads for different turnout types if you need to differentiate the turnouts.

- VII. If the actuating rod is short (18" or less), it will probably need no midpoint support. For a longer run, you may need to place an eyebolt or screw to support the guide the rod in the middle.

Switch Machine Installation – Tortoise

1. Install the linkage on the turnout.
2. Remove and discard the supplied actuating wire and support from the Tortoise.
3. Mount the machine about 2" to 3" from the linkage with the throw in line with the square tube movement.
4. Bend the wire linkage. Make a loop at one end to fit the Phillips screw on the Tortoise throwbar. After the "Z", bend the other end into a downward "L" about 1/2" long. This will fit into one of the holes in the square tube. Select the hole that allows some linkage spring pressure on the points in either direction.
5. Wire the Tortoise using your standard procedure.





