INSTALLING STALL MOTOR SWITCH MACHINES
CIRCUITRON TORTOISE
AN EXTREMELY VERSITILE MACHINE

- It is Rugged.
- Enough power to control two or more turnouts
- Contacts to wire frogs
- More Contacts for signals
- Easy to mount in several positions.
ONE SLIGHT MODIFICATION

• The one drawback to the Tortoise is that wiring the points can be critical on the earlier versions of this machine.
• I take the machine apart to make a few modifications.
• Yes, this does void the guarantee but it is simple and the ease of installation is worth it.
WIDEN THE GAP

Simply cut away the copper trace to widen the gap as shown to make mounting easier and more forgiving of exact alignments.
So what is inside the motor?

Just in case you are wondering, here is the bottom half of the motor containing the armature.

And here is the upper half containing brushes.
ELECTRICAL CONNECTIONS

• Commercial edge connectors are available to fit the Circuitron edge connector but they are expensive.
• The headers shown here come in a strip that can be cut apart and are much less costly.
• The smaller connector is for the motor.
95% Of all wiring on the North River is done at the front of the table as shown for ease of maintenance. Only the actual connections to signals, track feeders, and trackside turnout controls are further under the table.
‘Standard’ Mounting Brackets

• The Bracket is made from three pieces of wood.
• The square block is made from a short piece of 1” x 2” and is screwed to a support or the benchwork.
• The other two pieces are made from 2” x 3/8” lathboard.
• The shorter panel has (4) holes used to mount the machine.
ANOTHER VIEW OF BRACKET

- Both “left” and “right” hand brackets can be made.
- One bracket can hold two machines but usually support only one.
Both left and right-hand brackets are used.
Rods extending back to turnouts can be seen in the top center.
Virtually all wiring connections are made at front of the table.
Telescopic tubing is used to simplify the connections between the turnouts and the switch machine. Soldering the two sizes of tubing allows for easy adjustment from either end.
• The horizontal tube on the far right leads to the turnout.
• The tube from the lower left corner leads to the machine.
• The switch stand that is used to throw the turnout is above.
Switch Stand Above the Table Top

• This is a table top view of the switch stand used to control a turnout
• The upper throw-rod used to move the points is also visible between the rails.
• Operating turnouts in this manner allows the train crew to watch the train, not the control panel
The BEST of BOTH WORLDS

- Electric switch stands add the convenience of track side controls.
- Because they operate the stall motors, contacts are available to wire the frog and any auxiliary signals that might be involved.
Two Types of SWITCH STANDS

- A common pin is used in both types of stand
- The paddle board is simply a bit of stripwood drilled to fit the pin
- The lamp is a bit of telescopic brass tubing drilled to accept the (4) “jewels” used to simulate the lens.
SWITCH STAND BASE

• Use telescopic brass tubing to form the base of the switch stand.
• The assembly is glued under the sub-roadbed.
• The block under the switch stand rests against the edge of the right-of-way.
• The exact dimensions are arbitrary but should be consistent between all switch stands.
MAKING THE BASE

• The central pivot is made from one size larger than the stand’s stem.
• The four surrounding holes are made such that the spacing of two holes is slightly different than the others.
• The base of the switch stands can now be drilled as required.
UNDERSIDE OF SWITCH STAND

- Install the (4) terminals that will be used for the electrical connections to throw the turnout.
- The stand itself will extend down through the base.
THE SWITCH

- A common ground connects two of the terminals.
- The other terminals are connected to the circuit used to throw the turnout.
- The phosphor-bronze wire is formed to bend slightly to short between the two terminals.
- The springing action of the wire holds the connections normally open.
THE SWITCH STAND INSTALLED

• Look carefully for the .020 brass wire soldered through the base of the switch stand.
• This wire “shorts” between (2) pairs of pins.
• This performs the same functions as two push-buttons on a control panel and can in fact be wired parallel to such buttons if present.
A MORE COMPLEX INSTALLATION

- This slip switch is controlled by (4) stall motors and (2) switch stands
One LAST VIEW

- Note the closely spaced throw rods connected to the (2) sets of points.
CONTROL PANEL PUSH BUTTONS TO CONTROL STALL MOTOR SWITCH MACHINES
A Simple, Push-Button Switch

This faceplate can be mounted on the side of a table or, with a spacer, on a control panel.

The switches are mounted on a “floating” piece of perf board and the whole assembly is glued to the back side of the faceplate.
TEMPLATE FOR INSTALLING PUSH BUTTONS

• This is a template used to make the switches.
• It represents where the switch is to be installed.
• It can be a control panel or the side of a table.
• The switch can be mounted in any thickness of material.
SWITCHES ARE MADE TO A STANDARD SIZE

- The switches will be made to fit loosely within the template.
- This will insure that switches are interchangeable.
ASSEMBLING THE BODY

• The body of the switch starts with (4) pieces as shown.

• A spacer slightly wider than the actual switch can be used to build it up.

Spacing Strips for mounting the Switch assembly are added. More on this in a minute.
PROTOTYPING BOARDS

• Prototyping boards, Vectorboard, Keyboard and Perf board are all names for the same type of board used in electronics for prototyping circuits.

• It is made of materials such as phenolic or epoxy glass and is about 1/16” (.062) thick.

• Hole patterns vary greatly but a .100 x .100 pattern fits most components.

• Chose a pattern that fits the switches to be used.
MOUNTING THE ELECTRICAL SWITCHES

• Phenolic or epoxy glass keyboard can be used to mount the switches.
• Keyboard switches will provide long and dependable operation.
• Caps for the switches come in a variety of colors.
MOUNTING THE SWITCH ASSEMBLY

• The switch is assembled to the body.
• Note the very loose fit.
• This floating action will help prevent the action of the buttons from binding on the faceplate.
COMPLETEING THE SWITCH BODY

- Two last strips are added to hold the switch assembly in place and the key caps are added.
- Note the terminals (barely visible) where the electrical connections will be made.
MAKING THE FACEPLATE

- The faceplate can be made any size and shape.
- The hole for the switches must be large enough to allow buttons to move freely.
- Drill the (4) corner holes as required.
A small template like this can make the accurate drilling of holes fast and easy.

This template is about an inch long and was constructed from scraps.
DRILLING THE HOLES

- Simply position at each corner of faceplate and drill.
- Then use faceplate to drill holes in panel or table.
- Finally, use a slightly larger drill again in the faceplate.
ADDING A TRACK DIAGRAM

• Glue a thin layer of stripwood to faceplate.
• Apply thin layer of paint to small flat piece of wood.
• Rub this piece of wood over track diagram to “paint” the lines.
FINISH THE SWITCH

- The body is glued to the faceplate.
- The switch is now complete and ready to be mounted to a control panel or the side of the layout.
AN EXAMPLE

This is a small example of a completed mini-panel.
A LARGER PANEL

This larger panel controls (3) motors at one end of Bobston Yard.
REQUIREMENTS FOR CONTROLLER

• Low Cost at about $3.00 per unit.
• Flexible and Interchangeable. One basic design should be Customizable for single or clusters of switch motors.
• Complete computer control. Circuit should have provisions for throwing turnout by computer and reporting current position of turnout back to computer.
• Integrated signal control. Up to three red/green signals can be connected directly to circuit without added components.
• Integrated ladder track control for yards.
• Keep circuitry as simple as possible.
CONTROLER for STALL MOTORS

• One advantage of using stall motors is that they can be controlled with push-buttons or toggle switches.
• They can also be controlled directly by computer.
• This Simple controller is compatible with all three methods.
ELECTRONIC CONTROL

$15 Control for (3) turnouts plus a 12v power supply
“FOIL” SIDE OF A SINGLE MACHINE CONTROL

- Wiring is #32 insulated magnet wire.
- The insulation breaks down and becomes a soldering flux when heated.
SCHEMANTIC OF BASIC CONTROL

FEATURES:

- Toggle switch or push button control
- Provisions for direct signals lights output
- Provision for yard ladder track control
- Opto-isolated computer interface
  - Set Control position
  - Read current position
LADDER TRACK CONTROL

• A small diode matrix board can be added to control ladder tracks in a yard.

• Jumpers then connect the boards so that when one turnout is thrown, then all other turnouts in ladder required to set up a route are also thrown simultaneously.
CONTROL a 3-TRACK LADDER WITH (1) BOARD

Controller board for (3) Turnouts configured for a ladder track. Note the (2) daughter boards used to chain turnout operation together.
DIODE MATRIX FOR LADDER TRACK

• Only one or two diodes are normally used
• The unused diodes add flexibility to ladder configuration
## Parts LIST

<table>
<thead>
<tr>
<th>QUAN</th>
<th>PART*</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>1</td>
<td>LM556</td>
<td>Dual Timer</td>
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<tr>
<td>1</td>
<td>LTV846</td>
<td>Optical Isolator (optional)</td>
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<tr>
<td>1</td>
<td>LM7812</td>
<td>12v Voltage Regulator</td>
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<td>GBPC602-E4/51GI</td>
<td>1-amp bridge rectifier</td>
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<td>478-1831-ND</td>
<td>.01 mfd. @ 16v capacitor</td>
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<tr>
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<td>P974-ND</td>
<td>4.7 mfd. @ 16v capacitor</td>
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<td>P970-ND</td>
<td>100 mfd. @ 16v capacitor</td>
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<tr>
<td>2</td>
<td>100KEBK</td>
<td>100k @ 1/8w resister</td>
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<tr>
<td>3</td>
<td>1.5MEBK</td>
<td>1.5k @ 1/8w resister</td>
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<td>6</td>
<td>1N014BCT</td>
<td>Small signal diode (optional for ladder tracks)</td>
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<td>1</td>
<td>V1004-ND</td>
<td>Vector punchboard/Keyboard,.1”x.1” spacing</td>
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<tr>
<td>2-4”</td>
<td></td>
<td>Heat Sink (or a bit of aluminum will do</td>
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<td>4</td>
<td></td>
<td>#4-20 Screws (length to suit)</td>
</tr>
<tr>
<td>8</td>
<td>891K-ND</td>
<td>#4 washers (optional)</td>
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*Part numbers are from Digikey Catalog*
For More Information...

Circuitron  http://www.circuitron.com/index.htm
Electronic Hobby Products including stall motors for turnout control

Digikey  http://www.digikey.com/
Source for wide variety of electronic related parts and hardware

Datasheet for LM556 Dual Timer used in stall motor control

Walthers  http://www.walthers.com/
Largest single supplier of model railroad supplies including stripwood.
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