



Electronics for Model Railroads

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TC-3, TC-4

TORTOISE TURNOUT CONTROLS

GENERAL DESCRIPTION: The CIRCUITRON **TC-3** and **TC-4** will provide automatic activation of the TORTOISE Switch Machine when used in conjunction with a CIRCUITRON Detection Circuit such as the **DT-4**. Both units may be powered from any 12-18 volt DC source and the output terminals directly connect to the TORTOISE machine.

The **TC-3** has two control terminals and may be used to independently control both directions of a turnout. In this way, the output from one detection circuit may be used to throw the TORTOISE one way, and the output of another detection circuit used to throw it back. The **TC-3** is also ideal as an interface circuit when it is desired to activate TORTOISE Switch Machines from momentary panel pushbuttons or through diode matrix control. One **TC-3** is required for each TORTOISE to be thus controlled.

The **TC-4** is CIRCUITRON's TORTOISE Turnout Direction Alternator. It contains only one control terminal. When the control terminal is connected to a detection circuit, the TORTOISE will be thrown one way the first time a train is detected, and then will be thrown the opposite way the next time a train is detected. In this way, trains can be made to automatically travel alternate routes each time around a layout.

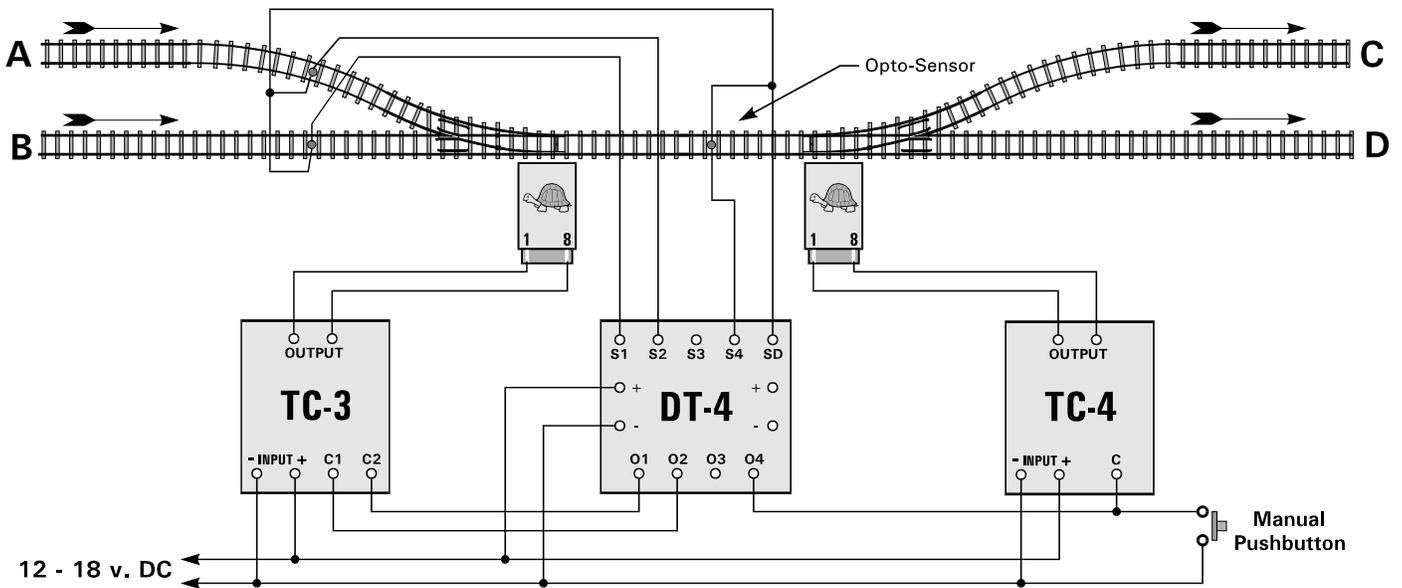
CIRCUIT DESIGN: Both the **TC-3** and **TC-4** utilize CMOS logic circuit outputs to directly drive the TORTOISE Slow Motion Switch Machine. An input diode provides reverse polarity protection and the DC is filtered and regulated to 12 volts by an on-board IC regulator. The **TC-3** uses a quad NAND gate package wired as a set-reset (R-S) flip-flop. A ground on either control terminal will set or reset the flip-flop. The output is buffered by the remaining two gates and applied to the output terminals where reverse series wired zener diodes clamp any high voltage transients from the TORTOISE motor and prevent damage to the IC. The **TC-4** utilizes a dual D flip-flop package with one flip-flop configured in the toggle mode and the second acting as a slave R-S flip-flop to buffer the output. Additional conditioning is provided on the Control terminal input of the **TC-4** by a schmitt trigger package to prevent false triggering of the circuit. Outputs are zener protected as on the **TC-3**.

INSTRUCTIONS: The **TC-3** and **TC-4** can be connected with .110" x .032" solderless connectors (available from CIRCUITRON) or by soldering leads directly to the terminals on the printed circuit board. If soldering, use a small pencil-type iron and electronics-grade rosin core 60/40 solder (available from Radio Shack). Use only as much heat as necessary to obtain a good joint and do not wiggle the terminal until the solder has cooled completely. A section of CIRCUITRON'S **PCMT** can be used for simple, snap-in mounting of the circuit board or you may drill holes in the mounting pads in the corners of the board and mount the **TC-3** and **TC-4** with screws and standoffs.

- 1) Mount the circuit board in a convenient location. Connect two light (22-24) gauge stranded wires to terminals 1 and 8 on the TORTOISE and run them to the [OUTPUT] terminals on the **TC-3** or **TC-4**. If you are wiring a **TC-3**, make the connections at the circuit board temporary at this time.
- 2) Connect the Control Terminals ([C1] and [C2] on the **TC-3**, [C] on the **TC-4**) to the output of any CIRCUITRON Detection Circuit (the **DT-4** is ideal for this application) using the same type wire as above. The Opto-Sensor supplied with the Detection Circuit should be located at the point where it is desired to have the TORTOISE activated. **CAUTION:** Allow enough distance between the sensor and the turnout so that the TORTOISE can complete its throw before the train arrives.
- 3) Connect a source of 12-18 volts DC to the [INPUT] terminals. Observe proper polarity.
- 4) If your input voltage is from a regulated 12 volt source such as our **PS-2** or **PS-2A**, losses in the Turnout Control Circuit will result in an output voltage to the TORTOISE of 9 volts or less. If the reduced speed of the TORTOISE is objectionable, the on-board voltage regulator may be bypassed by connecting a short length of wire between the two terminals labelled [BYPASS]. **WARNING:** DO NOT make this connection unless you are ABSOLUTELY certain your power supply is REGULATED at 12 volts DC. The DC accessory terminals on a power pack are NOT regulated. Making this connection will subject the CMOS IC(s) to the full supply voltage without protection and damage to the IC(s) is not covered by warranty under these conditions.
- 5) Test the operation under power and confirm that the turnout is being thrown in the correct direction (**TC-3**). If not, reverse the leads connected to the [OUTPUT] terminals. Finally, firmly attach the leads to the terminals.

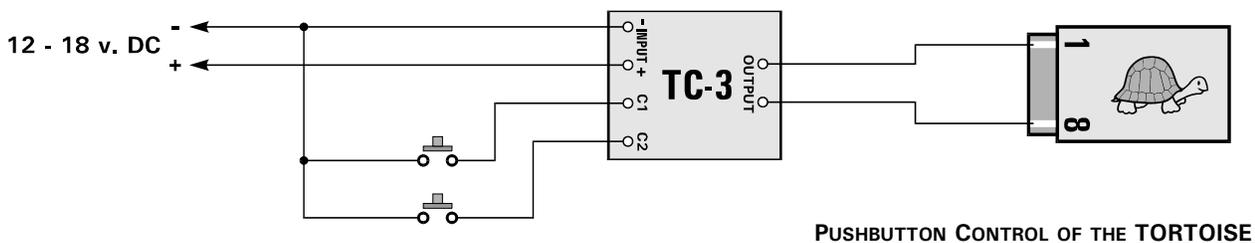
NOTE: When power is first turned on, the **TC-3** and **TC-4** will randomly select one direction. Use of manual pushbuttons as shown below will allow the operator to set the initial direction after power-up, if this is necessary for operations.

In this application, a train approaching the turnout on Track **A** would throw the points automatically so as to prevent derailment. Similar action would occur for trains approaching on Track **B**, but the points would be thrown the opposite way. As the train proceeds and approaches the second turnout, the **TC-4** would throw the points to direct the train onto Track **C** or **D**. The next train to approach this turnout would activate the **TC-4** again, throwing the points the opposite way. This action will continue with each successive train taking Track **C** and **D** alternately.



NOTES: Input must be filtered DC for use with the **DT-4**. Pushbuttons may be added to the **TC-3** in similar fashion by connecting between the [-] power supply terminal and [C1] or [C2] (see below). The **TC-3** and **TC-4** may be triggered by reed switches mounted in the roadbed and activated by a magnet mounted beneath the locomotive or rolling stock. Connect the reed switch in the same fashion as the manual pushbuttons. The Detection Circuit is not needed with reed switch operation. In addition, both the **TC-3** and **TC-4** can be activated without a detection circuit when used with 3-rail track power. Send \$1.00 and request Application Note: AN-5615-01.

*Please note the direction of train traffic necessary with the **TC-4**. Travelling in the opposite direction will cause derailments. This is not a factor with the **TC-3** and bi-directional travel is permissible.*



WARRANTY

CIRCUITRON warrants this device against defects in materials and workmanship for a period of one year from the date of purchase. This warranty covers all defects incurred in normal use of the device and does not apply in the following cases:

- a) damage to the device resulting from abuse, mishandling, accident or failure to follow operating instructions.*
- b) if the device has been serviced or modified by other than the CIRCUITRON factory.*

EXCEPT AS MENTIONED ABOVE, NO OTHER WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED INCLUDING MERCHANTABILITY, ON THE PART OF THE UNDERSIGNED OR ANY OTHER PERSON, FIRM OR CORPORATION, APPLIES TO THIS DEVICE.