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# Simple Train Order Board Controller

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## Introduction

This document describes the Simple Train Order Board Controller and how to assemble and install it.

## Revision History

v0.1 Initial draft

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# 1 INTRODUCTION

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This board is a very simple set of switches and connectors for controlling 3 pairs of train order boards from a single location. The board can be stuffed with components for 1,2 or 3 set of order boards.

This product came about because model railroads running under Time Table and Train Order rules often control multiple Train Order offices from a single location, staffed by a single operator due to lack of space for an operator at each station. Wiring panels can be time consuming and result in a lot of wires behind the fascia which can become fouled or fall out. PC board production has become very easy with the rise of low cost CAD programs and production shops that can produce small volumes quickly, at low cost. We developed this board because it looked to be a lot easier way to control panels than laying out the switches on Plexiglas.

The board provides 3 pairs of switches, each of which can set CLEAR (Green) or STOP (Red) indication, and pads for resistors to limit current and set LED brightness, or just wire across the resistor pads to control LED or Semaphore type Train Order Boards.

All components are through-hole technology for ease of assembly and repair for the casual electrical modeler of a certain age (that is: too old to see to solder surface mount parts).

Output connection pads are standardized on .100" centers. This supports a wide range of interconnect options. Connection options include screw terminal blocks (offered on assembled and tested – A&T -- boards), header pin connectors (male and female), soldered right angle headers, and direct soldered wires.

Power connections are either via 2.1x5mm "barrel" connector or 0.100 connector. Our A&T standard is 5V and our standard resistors are selected to provide equal light levels on Red and Green using our Simple Signals. You can select any resistor value to work with your favorite signal and supply voltage. Resistor pads are spaced at 0.400" for ¼ W resistors.

If you want a TOB Controller with a connector we don't list, please contact us [sales@modelrailroadcontrolsystems.com](mailto:sales@modelrailroadcontrolsystems.com) for a quote.

## 2 IDENTIFICATION AND INFORMATION

### 2.1.VERSION 1.0

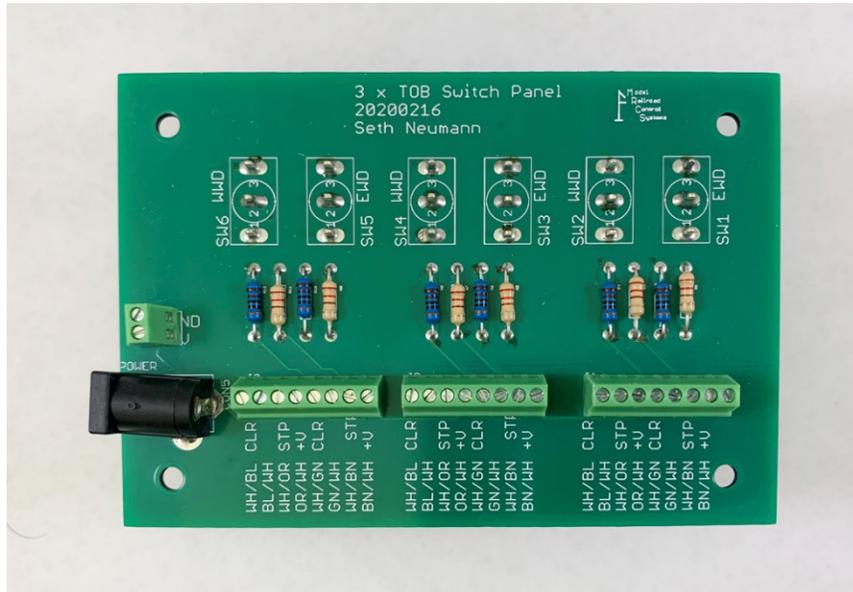
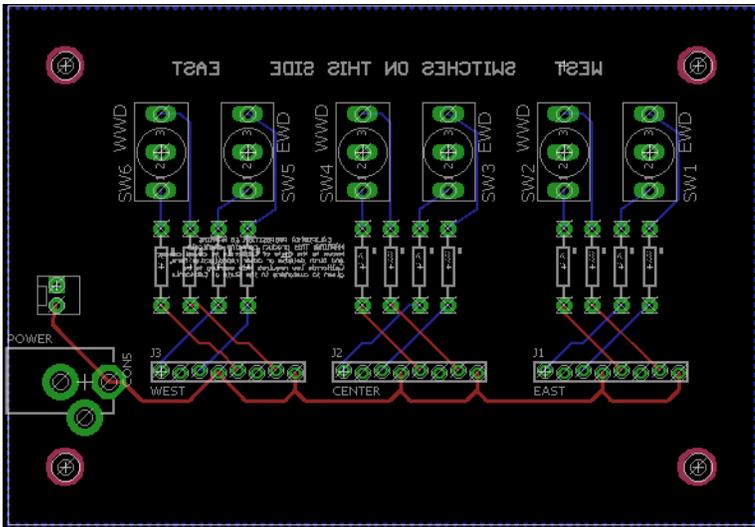


Figure 1 - Rev 1.0 Component Side



Figure 2 - Version 1.0 Switch Side



**Figure 3 - Circuit Board Layout**

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### 3 ASSEMBLY

Qty	Value	Device	Package	Parts	Description	Vendor	Part
1	TOB	PCB	7x10	pcb	pcb	MRCS	TOB-BB
6	220	RPTH04	AXIAL-0.4-RES	R1, R3, R5, R7, R9, R11	Resistor 220 ohm 1/4W	Jameco	691420
6	3.3K	RPTH04	AXIAL-0.4-RES	R2, R4, R6, R8, R10, R12	Resistor 3.3K ohm 1/4W	Jameco	690988
3	W,C,E	CONNECTOR-M08FEMALE_LOCK	1X08_FEMALE_LOCK	J1 J2 J3	8 Pin screw term 0.100	Amazon, eBay	
6	Toggle	SWITCH-SPSTPTH-508	SWITCH-SPDT-508	SW1, SW3, SW5	SPST Switch	Jameco	26315
1	POWER	CONNECTOR-DC-POWER-RA	DCJ0202	CON5	DC POWER JACK	Jameco	101178
1	POWER	CONNECTOR-M02MOLEX-1X02-LOCK	MOLEX-1X2_LOCK	CON4	2 Pin screw term 0.100	Amazon, eBay	

Table 1- Bill of Materials Rev 1.0

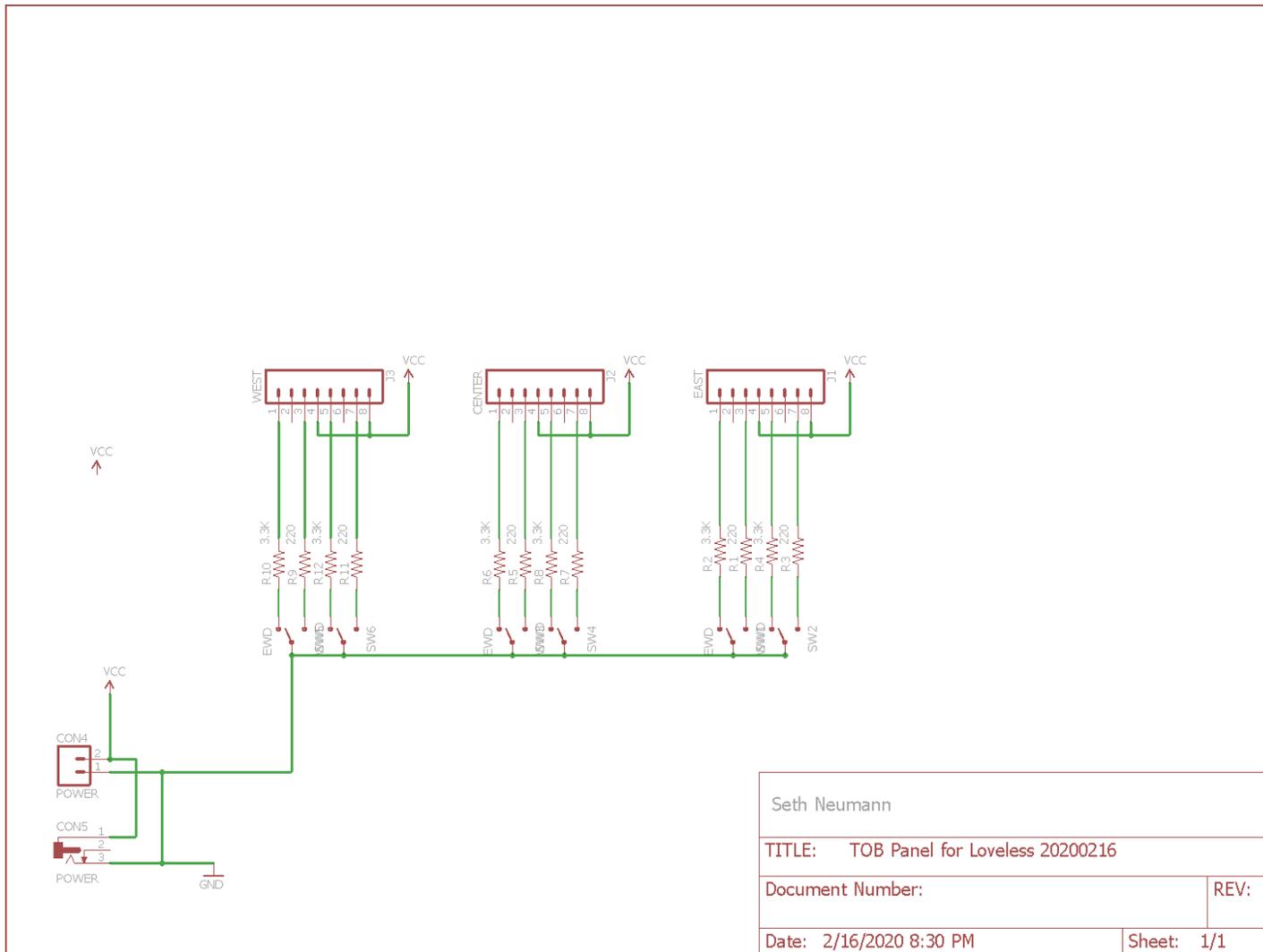


Figure 4 - Rev 1 Schematic

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## 3.1 CONNECTORS

- The input connectors are on 0.100 centers (staggered slightly to hold the connectors in place during assembly). While our standard connector is the 0.100 screw terminal, you may substitute any other 0.100 connector you prefer. If ordering an assembled and tested unit from MRCS and you would prefer a different connector, please contact us at [sales@modelrailroadcontrolsystems.com](mailto:sales@modelrailroadcontrolsystems.com) and indicate your preference and we'll provide a quotation.
- We've provided a 2.1 mm, center positive, barrel jack for power. Check your power supply as there isn't much standardization around what voltage goes on this connector, it could be anything from 5 – 24VDC or AC. Most modelers will use 5V or 12V.

## 3.2 DETAILED ASSEMBLY

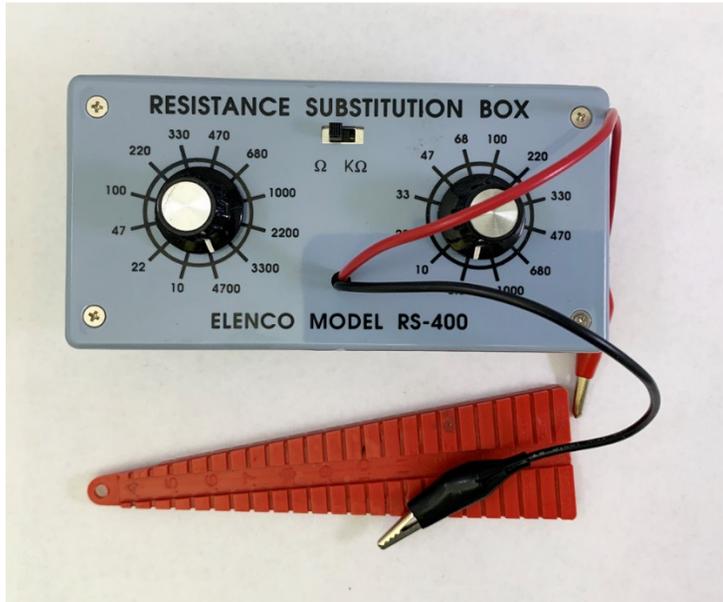
[ ] All of the components are through-hole with wire leads. A lead bender is a useful tool for forming the leads at 90 degrees for easy insertion into the pad holes. Start with inserting the lower height components. The general rule is to install the lowest components first, working towards components that are higher off the board. This enables you to support the low components as you solder them.

Start on the component side.

### [ ] Resistors

[ ] If you are using LEDs prepare the ¼ W resistors by bending them on a component bender using the 0.400 grooves. Install Resistors R1, R3, R5, R7, R9, R11 and R2, R4, R6, R8, R10, R12 in the center left of the boards. Try to keep the gold tolerance band on the same side for easier reading of values. The values of these resistors (odd is STOP, Even is CLEAR) set the brightness of your LEDs. We recommend you obtain a substitution box and use it to select resistor values to your liking. Since about 25% of males have some degree of color weakness this value maybe unique to you.

We use an Elenco Model RS-400 substitution box which is an affordable kit and should be findable with an internet search.



**Figure 5 – Tools: Elenco RS-400 and a component bending jig**

If you are using signals with their own limiting resistors, or driving servo controllers just install pieces of 22-24 GA wire, the hole spacing is 0.400

**[ ] Screw Terminals and Power Jack**

[ ] Install Con5 (2.1 mm barrel jack) unless you will not be using a 2.1mm plug to power your TOB system

[ ] Install Con4, screw terminal alternate. **TIP** if you're going to use multiple TOB controllers, you can share 1 power supply among them, just daisy chain your supply from one terminal block across to the terminal on the next TOB Controller and so on

[ ] Install Con4

[ ] Install the 8 position screw terminals you will be using (1 per Train order Station) J1, J2, J3 (or your favorite 0.100 8 position connectors)

**[ ] Switches**

[ ] flip the board over to the Switch side

[ ] install the switches you will be using (1,2 or 3) **NOTE while the switches are electrically the same in either orientation, there is a notch on one side of the barrel and you should align them all the same way. We mount them with the notch down.**

Clean the board to remove any flux: we use 91% Isopropyl alcohol and an old toothbrush and cotton swabs to get any goo off the backs of the components.

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## 4 INSTALLATION AND CONNECTIONS

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[need to make a drilling/mounting template]

### 4.1 MOUNTING

Determine where the Operator will sit. If you are building a workstation for the operator (place to write and keep “Station Record of Train Movements,” various forms (19 or 31, Clearance Form A etc.) you will want to have place to mount one or more Train Order Board Controllers. Use the corner holes to mount the board, or you can use the switches to secure the whole assembly from the front, assuming the face material is strong enough. If you need more than 3 stations, just gang more TOB Controllers side to side.

We intend to offer a service to make front panels out of 40 mil aluminum signs as soon as our sign supplier is back in operation. We’ll provide a template and you can add your station names and there will be room for your railroad’s herald. You can also make your own, in the past we’ve generally used 1/8” (0.125) Plexiglas with printed graphics from any program you’re comfortable with. There is hardware on the switches to handle any panel thickness up to about 0.250”

### 4.2 CONNECTIONS

Connections are made to the component side of the TOB Controller.

The board label is set up for CAT 5 (or CAT5e) data cable, use whatever you find that’s in stock and affordable, there is no benefit to a higher grade of cable, although I prefer solid wire over stranded as it easier to work with. Note the wire designations are also on the board. One CAT5 goes to each station. Of course the electrons don’t care if you use something else but use at least 3 pair and note the mapping of your color code to the table below, if you choose to use something else.

Conductor	Aspect	Indication
White/Blue	Clear -East	Green
Blue/White	Not used	
White/Orange	Stop - East	Red
Orange/White		+ Voltage
White/Green	Clear - West	Green
Green/White	Not used	
White/Brown	Stop - West	Red
Brown/White		+ Voltage

Note the top two pairs are the western most TOB, which is telling an Eastward train to Proceed or Stop. At the TOB end, White Orange is the +V supply (usually 5 or 12V) and the White/Blue wire will ground the Green (Clear) signal, and White/Orange wire goes to the Red (Stop) signal.

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## 4.2.1 MRCS SIMPLE SIGNALS



**Figure 6 - MRCS Simple Signal**

Connect these (pads are 0.100 spacing, so you can solder onto the board or use your favorite 0.100 (2.54 mm) inexpensive signals (a John Plocher Design) to the CAT5 from the TOB Controller. The square pad is +V, but on some of the signals the GYR label is reversed, the real order is : G-Y-R-+V.

## 4.2.2 MRCS SERVO CONTROLLER

If you are using semaphore style train order signals, servos are an inexpensive way to drive them. We and other manufacturers make servo controllers and you can also make single or multichannel servo controllers from Arduinos. In the case of our servo controller (a Mark Schutzer design) you only need one side of the circuit as it is a simple on/off switch. Set the jumper in slide switch mode – see the documentation

<http://www.modelrailroadcontrolsystems.com/content/Servo%20Controller%20Instructions%20v0.1.pdf>

The servo controller and SG90 servo run on 5V, so use 5V power. The Servo Controller needs a ground so apply aground to the unused Blue/White or Green/White lead and power the servo from the +V and Ground, and the use one of the control leads to ground the “Slide” input. You may want to use the Clear or Stop lead depending on the physical orientation of the servo.

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### 4.2.3 OTHER DEVICES

The TOB Controller is a set of single-pole-double-throw switches with the common (center pin) grounded, so it can control a wide variety of LEDs, lamps, Motors and electronic devices.

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