# Train Order Semaphores for the Nicasio Northern

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My Nicasio Northern is a late 1920's "rails in the mud" northern California railroad. As such, it relies on TT&TO scheduling with a dispatcher. There are a couple of places on the railroad where the dispatcher might want to provide orders to a train in addition to the usual places like point of origin. On the Nicasio, those towns are Wittils and Skalville where there are significant junctions or interchanges. In addition, there is a need at the entrance to the Bayside terminus for the yardmaster to give instructions to arriving trains.

*1 Prototype tower showing train order lower quadrant semaphores (tower2.jfif)*

Lower-quadrant semaphores are the era-compatible solution to the problem. I selected two double-blade and one single-blade semaphores to solve my problem. Here's how I installed them.

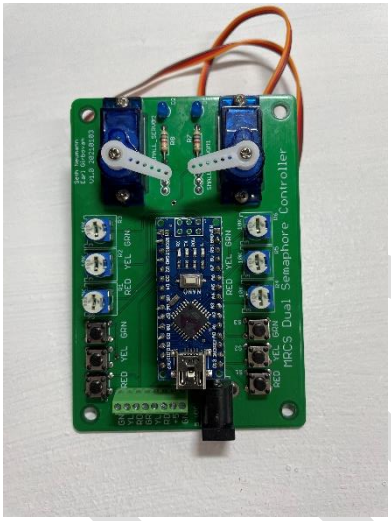
I selected the Tomar Lower Quadrant semaphores. They come in both single- and double-blade versions. I had bought one several years ago, and it included an incandescent bulb. The more recent ones use LEDs. But the major question was how to move the blades. There are several solutions out there, but I chose the solution from Model Railroad Control systems (https://www.modelrailroadcontrolsystems.com/dual-semaphore-servo-controller/). Full disclosure: I did the sketch for this Arduino-based board.

I also wanted the controls for the semaphores to look prototypical so I selected CTC-style rotary switches and panel lights.

Here's the parts list:

- Semaphore
- MRCS semaphore controller
- Corner braces
- Resistors
- Rotary switches
- Indicator lights
- Switch plates
- Cabling – 8-conductor for a dual semaphore
- Project box if needed
- Various screws, etc
- 5-volt power supply or a 12-volt to 5-volt converter.


*2 img 2727*




*3 img 2724*


*4 img 2726*

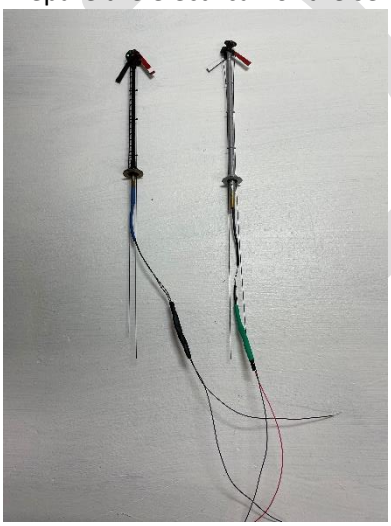
*5 img 2727*


*6 img 2728*


*7 img 2729*

*8 Parts*

Prepare the electrical for the semaphore lamp. We will power the light from the 5-volt output contacts from the MRCS board, but we need to add a resistor and lengthen and protect the leads to the bulb/LED inside the semaphore. The wires are tiny, and they don't reach far enough to connect to the terminals on the bottom of the board. If your semaphore uses LEDs, add a 680-ohm resistor to protect the lamp. If it uses an incandescent bulb, use a 150-ohm resistor. Tomar provides resistors if you prefer to use a 12-volt source for the lamp.

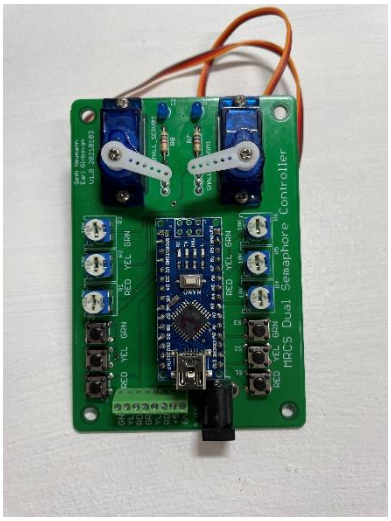


*9 Semaphores with resistor and shrink wrap added (img 2734)*

There is a single lamp in the semaphores which shines in both directions, so there are only one set of leads. Add the resistor to one lead, and solder it in. Add 6 inches or so of small gauge wire to each lead, and solder. Cover each lead's solder joints with shrink wrap or some other insulation.

Decide where the semaphore is to be positioned. It should be near the tower or agent's office, and at least 10 feet from the near rail. It must also have clearance underneath the layout for the board and access to the adjusting side of the board. Drill a hole for the semaphore which clears the central tube and the two actuating rods. Make sure that the hole is clean of splinters.

Now set up the MRCS board for installation.



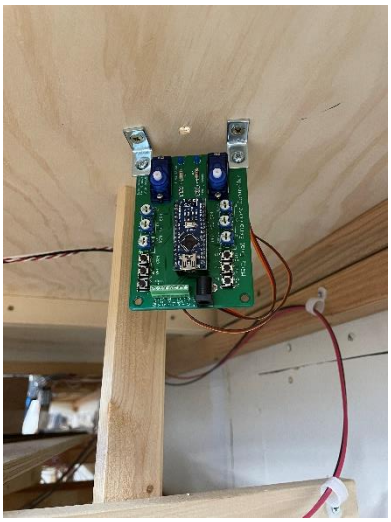

*10 The MRCS board (img 2723)*

Remove the servo arms from the servo shafts (don't remove the servos).

Plug a 5-volt source into the board. The LEDs on the board will flash rapidly indicating that the positioning cycle is active. Use a small screwdriver to move a pot and confirm that the associated servo moves. The servos will move to what they know as a center position determined by the pot. Set all the pots to their center point. After 15 seconds from the last pot move the LEDs will flash in a slower pattern indicating operation mode. Remove power from the board.

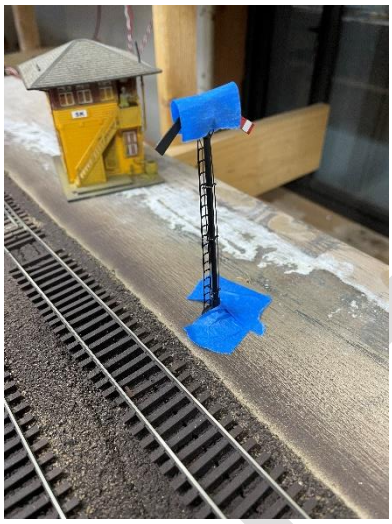
Now install the MRCS control board. I found that 3/4 inch corner braces from the local hardware store will fit the board. I used 6x32 screws, nuts, and washers to attach the corner braces to the board. The corner supports may be installed on either side of the board. I chose to install them on the servo side so that all the installation activity occurs on one side of the board.

Place the board into position centering it on the previously-drilled hole, and setting it back from the hole such that the actuating rods of the semaphore line up with the end of the servo shafts. Mark the position of the screw holes of the corner supports. Remove the board and drill pilot holes for the screws for the corner supports. Position the board and install it with corner support screws.



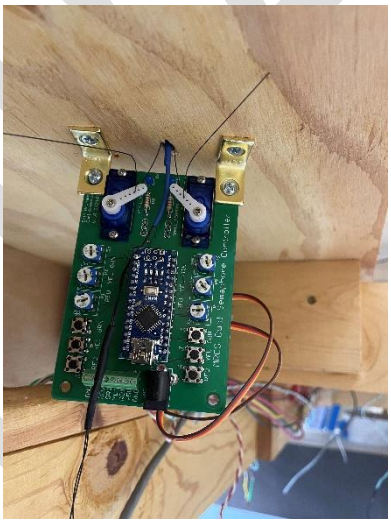
*11 MRCS board mounted and with servo arms removed. (img 2735)*

Now connect the semaphore arms. Manually position the semaphore blades to a “catch” position, half-way between stop and clear.  I suggest using a non-gummy tape like a piece of blue painter’s tape to hold the blades in position.



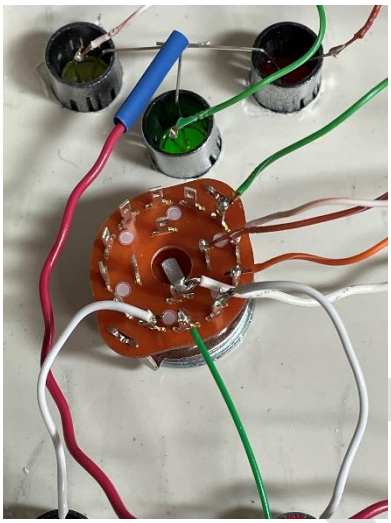
*12 Blades in "clear" position, midway between stop and proceed. (img 2737)*

Now underneath the railroad, at the board, bend the rod for the arm 90 degrees at a point opposite the shaft of the servo. Thread the servo arm onto the bent rod, and again bend the rod so that the arm is secure on the rod. With the blade at the half-way or catch position, place the servo arm on the servo and secure it. Repeat for the other blade. Trim the rods.



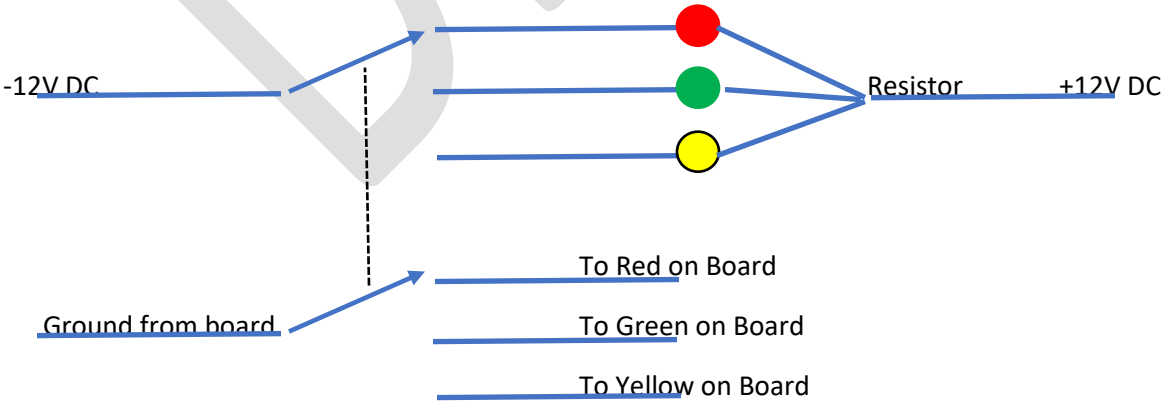
*13 Rods attached to servo arms, in proceed position, before trimming the rods.(img 2739)*

Plug a 5-volt supply into the board. The board allows lots of time to set the stop, catch, and proceed indications. Stop, of course, is a horizontal blade; proceed is a dropped or low blade; catch is somewhere in between. When the board is powered up, or after the reset button on the Arduino is pushed, the user has 15 seconds to begin moving the various pots. As each pot is moved, the blade will move to that position. Keep adjusting the pots for each position until you're satisfied. After 15 seconds of no pot movement, the board will go into normal operation mode. Note that the pots may be adjusted at any time and the board will use the new pot position.

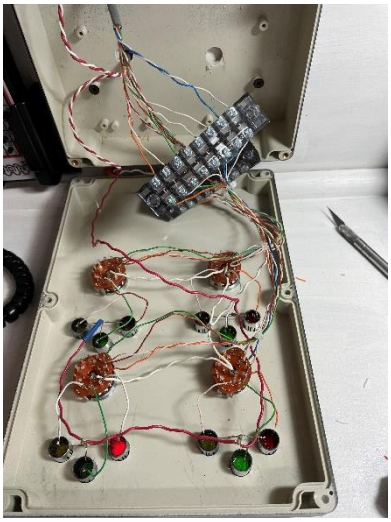


*14 Wiring side of rotary switch (img 2761)*

The connection to the controlling switch is next. The CTC panel switch I use is a 4-pole, 3-throw rotary. We will use one pole for the indicator lights, and one pole for the semaphore control. The circuit diagram for the control is given below.



There are several options within the sketch which affect how the semaphore operates and reacts to the switch.  Refer to the MRCS documentation for details.



*15 Two towers, two semaphores, four blades (img 2759)*


*16 Control panel completed for two towers (img 2764)*

The pictures below show the two towers with semaphores installed, ready for scenery.

*17 HL Tower (img 2789)*

*18 SK Tower (img 2790)*