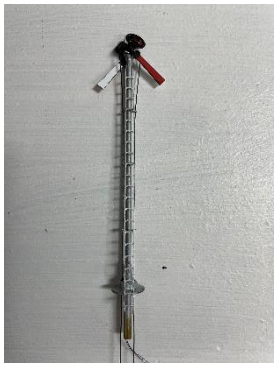
Train Order Semaphores for the Nicasio Northern

By Jon E. Schmidt

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.



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.

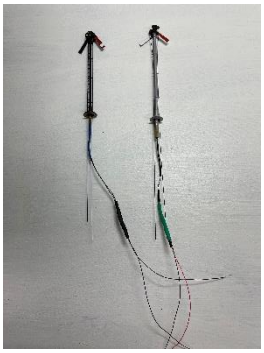
Here's the parts list:

- 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.

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.

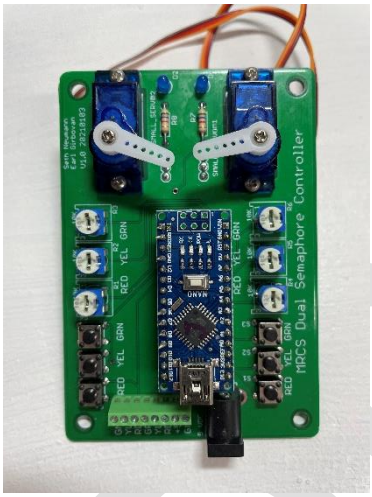


There is a single lamp in the semaphores which shines in both directions, so there are only one set of leads. Add the resistor to one lead, and solder it in. Add 6 inches or so of small gauge wire to each lead, and solder. Cover each lead's solder joints with shrink wrap or some other insulation.

Position the semaphore

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.

Set up the MRCS board for installation



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.

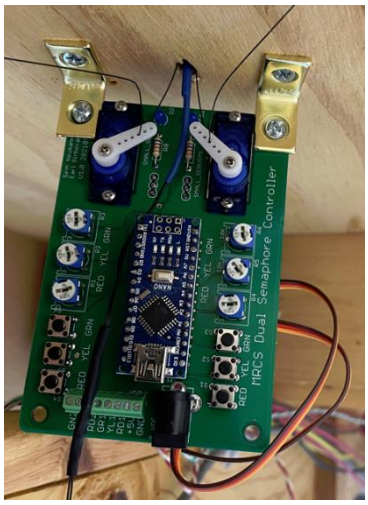
Install the MRCS board

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.

Connect the semaphore arms

There are two ways to do this. If you are comfortable that you can feel the midpoint of the blade motion by manipulating the control rods, you can do that. Otherwise manually position the semaphore blades to a middle or yellow position, half-way between stop and clear. Use a non-gummy tape like a piece of blue painter's tape to hold the blades in position.



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 using the holes in the servo arm closest to the shaft. Remove the tape holding the blades. Press fit the servo arm on the shaft without the center screw. Manually move the servo arm to confirm that the motion will move the blades as far as they need to go. If they don't move far enough remove the arm and thread the servo rod into a servo arm hole farther out and recheck. Once you are comfortable that the servo can move the semaphore arms far enough again bend the rod so that the arm is secure on the rod. With the blade at the half-way or yellow position, place the servo arm on the servo and secure it. Repeat for the other blade. Trim the rods.

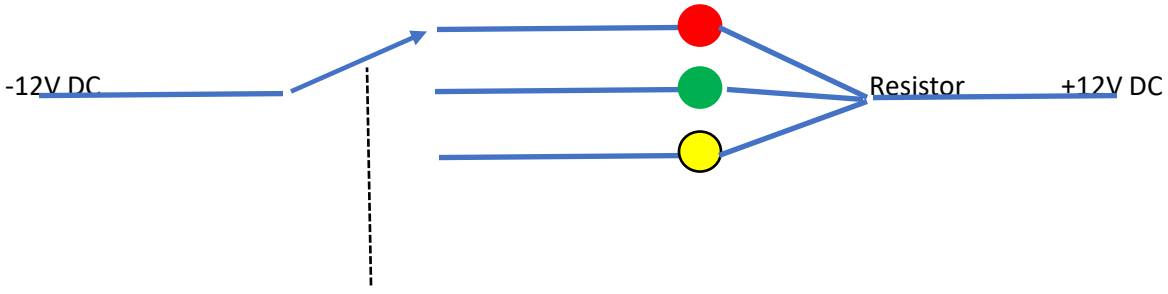
Adjust the board arm positions

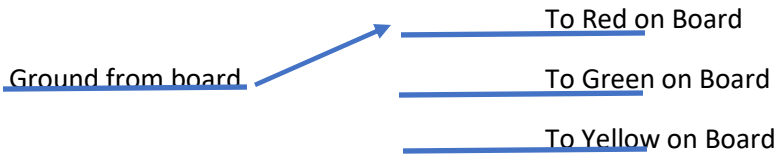
Plug a 5-volt supply into the board. The board allows time to set the stop, middle, and proceed indications. Stop, of course, is a horizontal blade; proceed is a dropped or low blade; middle is somewhere in between. When the board is powered up, or after the reset button on the Arduino is pushed, you have 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 move each blade through its three positions and then go into normal operation mode. Note that the pots may be adjusted at any time and the board will use the new pot position.

Version 3 of the sketch has a definition *UseMidYellow* which, if true, will have the sketch ignore the yellow pots and set the middle position to be halfway between stop and proceed.

Set up the control switch

The CTC panel switch I use is a 4-pole, 3-throw rotary. I use one pole for the indicator lights, and one pole for the semaphore control. The circuit diagram for the control is given below. You will need a set of these for each blade.





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