

Theory of Operation – Staging C and D Yards

We got a big surprise in the Summer of 2018, the company that supplied our Routing Controllers for staging obsoleted the new Rev SRC16 products 6 weeks after introduction, we had bought 5 and need two more, out of production and not available. Long term this meant that the SRC16's (routing controllers) are obsolete and at end of life.

Construction of the Diode Matrix control board

I decided to build a large diode matrix routing controller [32 turnouts x 38 routes] for C Yard and D Yard staging. The diode matrix parts are cheap and been in use for 50 years. It uses a total of 70-556 IC's plus sockets (\$80), 700-1N4148 diodes plus decoder wire (\$100) and 2-5Amp power supplies (\$10).

We built it on a 3'x 4' piece of plywood with white styrene covering the wood for insulation. The left side has the tortoise drivers (32) with T1 R/G LED's with a series resistor and the right side has the route LED drivers (38) with a Blue T1 LED with a series resistor.

Then two rows of finishing nails for each tortoise and route driver (Clear and Set for the 556 latch).

The 32 tortoises connect to Euro-Blocks on the left side using two wire stranded alarm cable. The 38 Route drivers connect to Euro-Blocks on the right side and then connect to the control panels via 50 wire ribbon cables. Across the bottom are the Euro-Blocks for the Route buttons, they run to the panels via 50 wire ribbon cables. Each Route can have many diodes depending on how the tortoises get set. Each route uses different color decoder wire to make is easy to see the diodes for a route. Yes, we did make about 5 mistakes out of the 800 diodes installed. You can troubleshoot or change the programming by taking two clip leads and separating the wires to the left and right leaving only the one route or color you want to work on. The diode goes to the Clear or Set bus based on the route design. The colors repeat every nine wires. It is very visual. The controller powers up with all 556's in a Clear state (PON). I have a master clear set of diodes to do this. There is also a master clear button on the panel if needed. We added a plexiglass cover to protect the wiring. A momentary push buttons on the panels are used to select a route.

We have two control panels, one for C Yard and one for D Yard. They both work the same way and use the same electronic design. Each was printed by This Creative in Fort Myers. A T1 Blue LED shows route selection. The siding tracks use a Yellow T 1-3/4 LED's show occupancy and a Red T 1-3/4 LED's tell you when to stop. Each siding is long enough for two trains and is broken into two section, each has separate occupancy and stop detectors. Each C Yard siding/yard track (11 total) has two stop warning lights, the first will not turn on unless a train is on the forward stop track. This encourages the operator to pull forward. Tracks in D Yard also support two trains each. D Yard has the same Stop protection logic as C Yard. The C Yard arrival track has 19 Occupancy detectors. These 19 Occupancy LED's are managed by an Arduino Mega to give a 4-block chase effect. This way you will know where your train is at all times. It will work in reverse. It is very hard to see this area. All occupancy detection uses DBD22's.

A Word document (Staging Routes Diode Matrix) shows the programming of all the 38 routes. Also include the Power On reset logic and the group reset logic I use to reduce the number of diodes.

A Excel document (Staging panel wire list) shows the wiring of the route buses, Blue LED's and the cables to the tortoises and ribbon cables to the panels.

Operational Summary

There is a separate Operational training document. For the most part you can only use one route selection at a time in C and D Yards as they share common track. The one exception is once you select an Entry ladder route in C Yard and get well into the Arrival track (clear detector 4) you can then select an Exit ladder route. The Entry ladder turnouts will not change but the Entry route light will go out. The Lower Helix enables access to and from C and D Yard staging. D yard has 5 function routes, 9 ladder routes, 4 sidings and a return exit loop. The Entry and Exit ladder routes in D Yard are independent routes and do not change when the other routes are selected. The turnout at the bottom of the Lower Helix is auto-throw and is protect from accidental throw. Flow in C and D Yards is counter clockwise. The turnout for the C Yard return loop is auto-throw as well and is protected.

D Yard has a power switch and a separate DB150 for power. C Yard has a power switch and will have two separate DB150's for power. We may add a power switch for each C Yard circuit breaker.

Two reversing loop controllers support C and D Yards. The D Yard reversing loop is about 15' long. Will handle the longest train. To make it longer I had to include the first two turnouts going into Entry D Yard to make the reversing loop long enough. Make sure you pull the train far enough forward not to have the last car on the wrong side of the double gaps. The C Yard reversing loop is 40' long, all the way down the back side entering C Yard. Two or three trains will fit on the reversing loop at the same time, make sure one is not trying to enter and leave the reversing loop at the same time.

Cameras

We have 6 cameras showing staging, Lower Helix and Rock Island. They are RJ45 POE cameras and connect to the router in the Dispatcher area. The Samsung tablet is Wi-Fi.

