The Modular Signal System (MSS)

An Overview

In 2005 Gregg Fuhriman developed the Modular Signal System, designed to allow Automatic Block Signals to be easily installed on nodular layouts. Two important features of the MSS are the use of a combination of optical and current detection to eliminate the requirement for resistance wheel sets, and the Modular Signal Buss for connecting modules.

Signal Detection

To add a signal system to a model railroad it's necessary to have some way to detect trains. The prototype uses the all metal wheels of cars and locomotives to "shunt" the rails and provide an electrical path between the rails. One approach to detection on a model railroad is current detection, an electronic circuit placed in series with the feeder to the track which can sense the flow of electricity to the train. This works fine for locomotives, but since model cars have insulated axles they will not be detected, and the block will clear as soon as the locomotive exits. The usual time consuming solution is to replace at least on wheel set on *every* car with a resistance wheel set that will draw enough current to activate the current detection.

Others have tried to activate model signals using optical detection. Some optical detectors rely on room light, but these are finicky and unreliable. There are good detectors, using reflective infrared light. These use an infrared LED to generate an invisible beam that is reflected off the bottom of the train and detected by a phototransistor. These work great, but are limited to detecting the presence of a train at a single point on the layout. Before the MSS no one had found a way to reliably relate the point detection to the blocks a signal system uses.

How Does the Modular Signal System Work?

Let's look at how the MSS combines current and optical detection to eliminate the need for resistance wheel sets. In fig. 1 the train has just entered block B. Optical detector AB has detected the train, and current detector B has also detected the locomotive, both setting Block B to occupied.

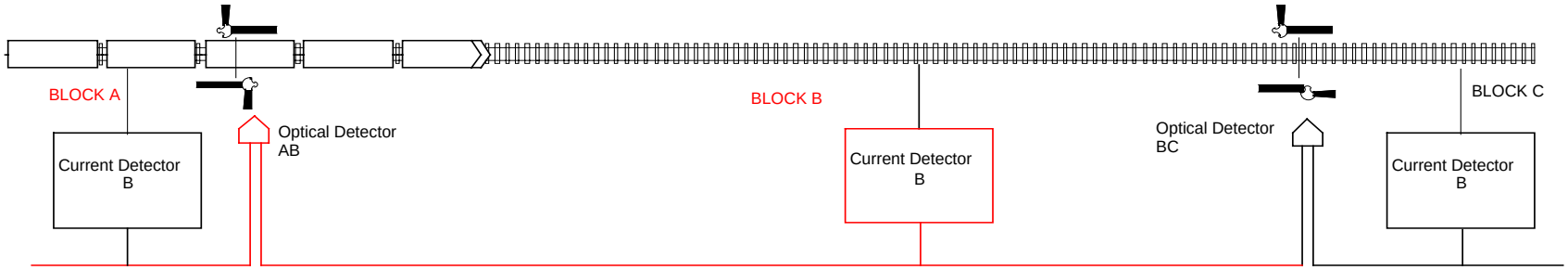


Fig. 1

In fig. 2 the train has cleared optical detector AB, but current detector B detects the locomotive and keeps Block B at occupied.

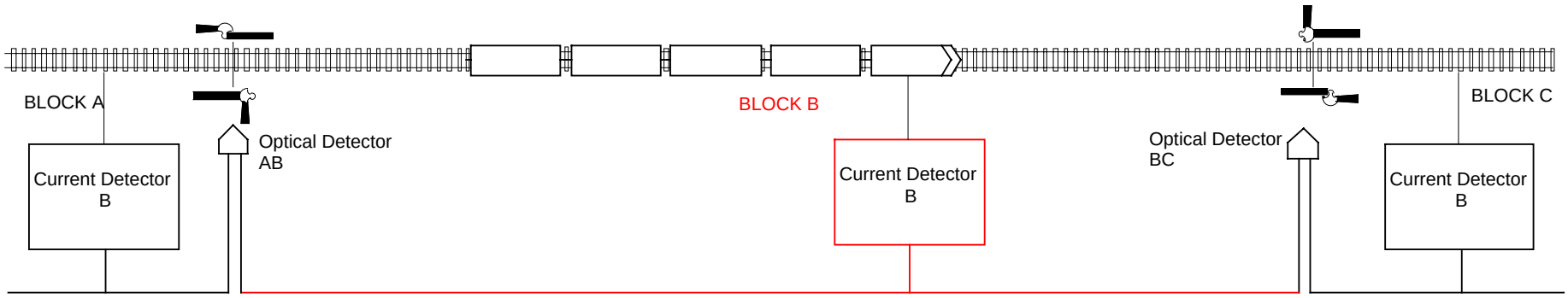


Fig. 2

In fig. 3 the locomotive has left Block B, and the standard insulated cars are not detected by current detector B, but Block B is properly kept at occupied by optical detector BC.

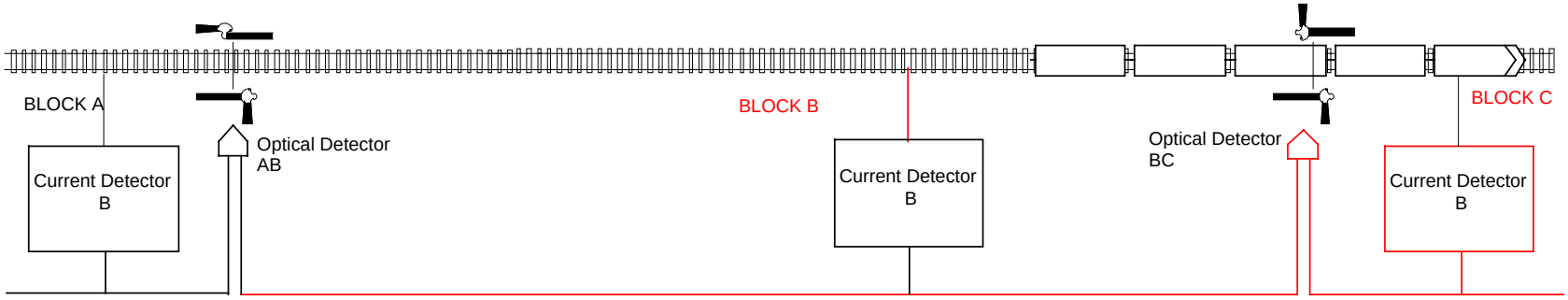


Fig. 3

In fig. 4 the train has now left Block B and all three detectors have cleared, as has Block B. Note that optical detector AB really only serves to keep Block A occupied until the train has cleared. Optical detector AB also becomes necessary for Block B with a train moving to the left.

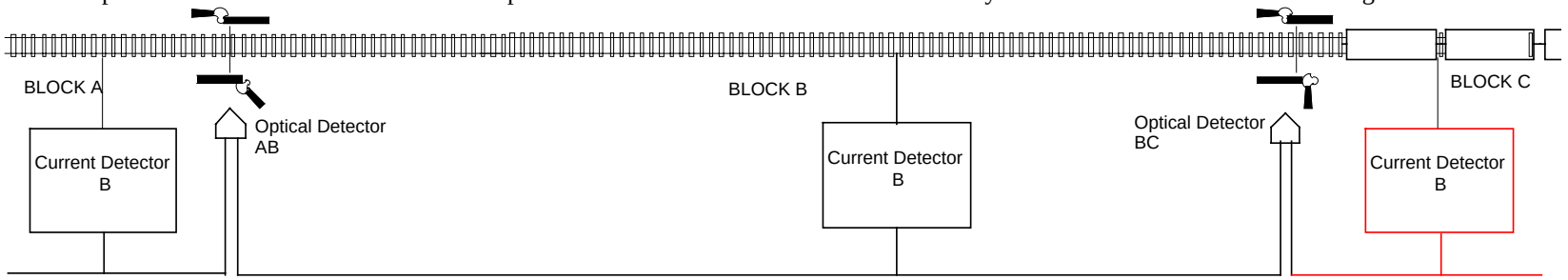
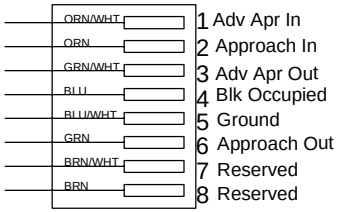


Fig. 4

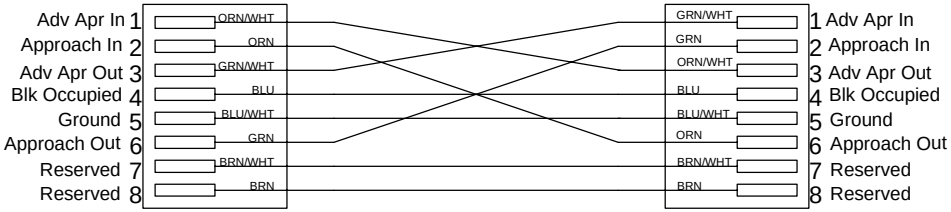
The Modular Signal Bus

The Modular Signal Bus is designed to allow the quick and easy connection of signaling between modules. It uses standard 8 pin RJ45 Ethernet cables and connectors, which are readily available from computer networking suppliers. The MSS standard takes advantage of the cross-over cables to eliminate the problem of left and right (or East and West) ends of the modules. Both ends of each module are wired the same, and the cross-over cable takes care of correctly connecting outputs to inputs. The beauty of the bus is that the user doesn't need to understand what each pin and wire does, it is plug-and play, just connect the module and it works.

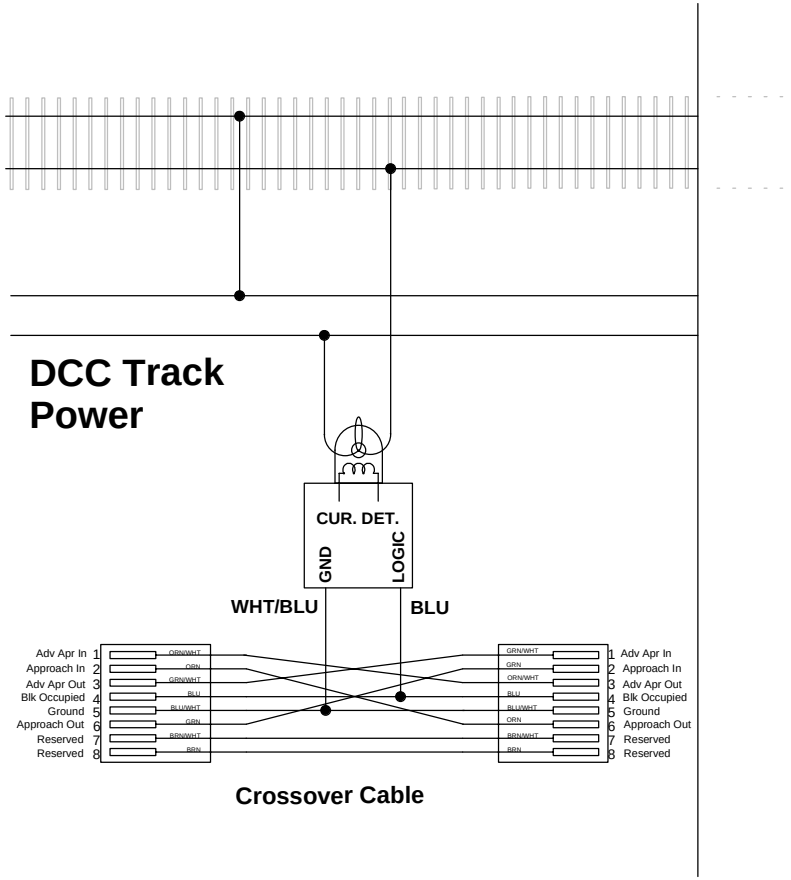
Modules built to this standard can be quickly connected together in any combination and still have a working Automatic Block Signal (ABS) system that is acceptably close to prototype operation. The following drawings show the pin assignments and color code for the Modular Signal Bus, as well as the wiring for applying it to modules, both unsignaled (called Crossover Modules), and signaled modules (called Cascade Modules).



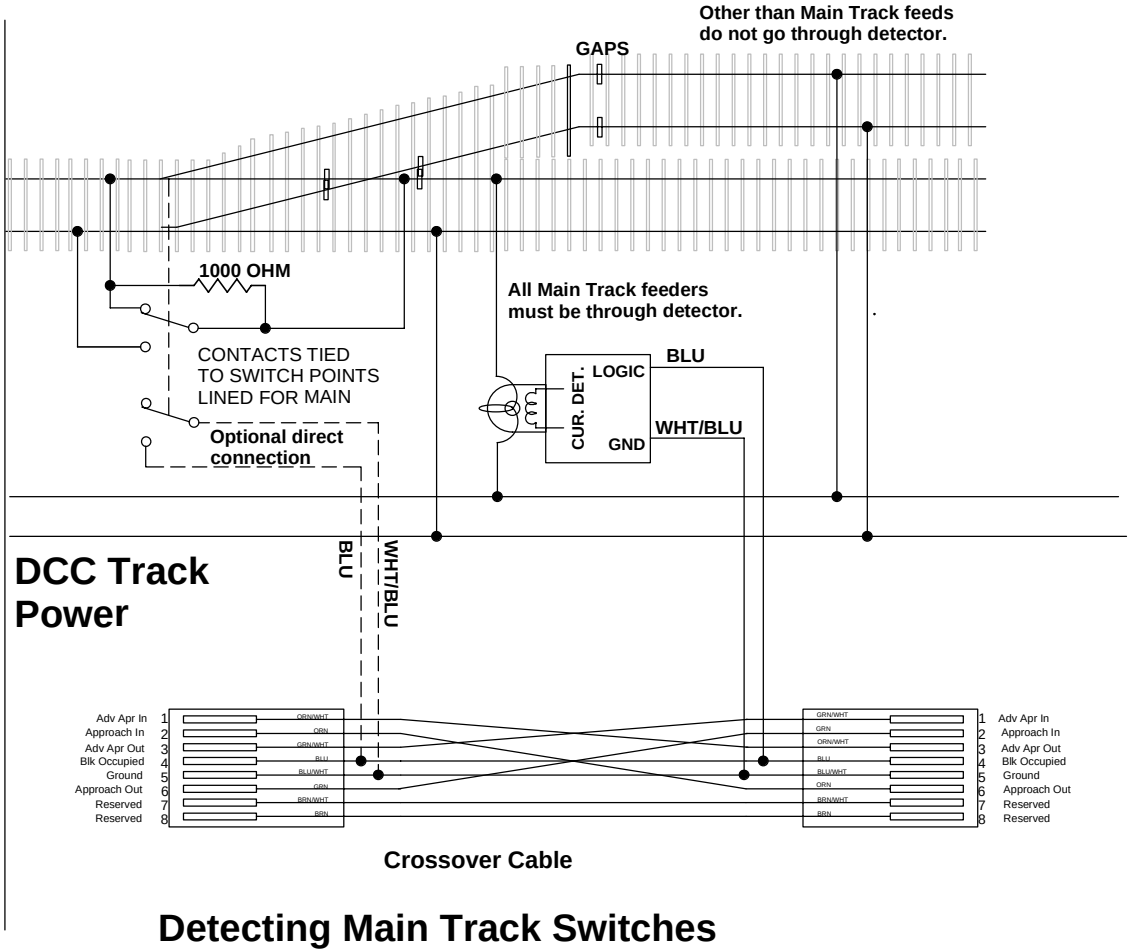
MSS Bus pinout and color code for straight-through cables



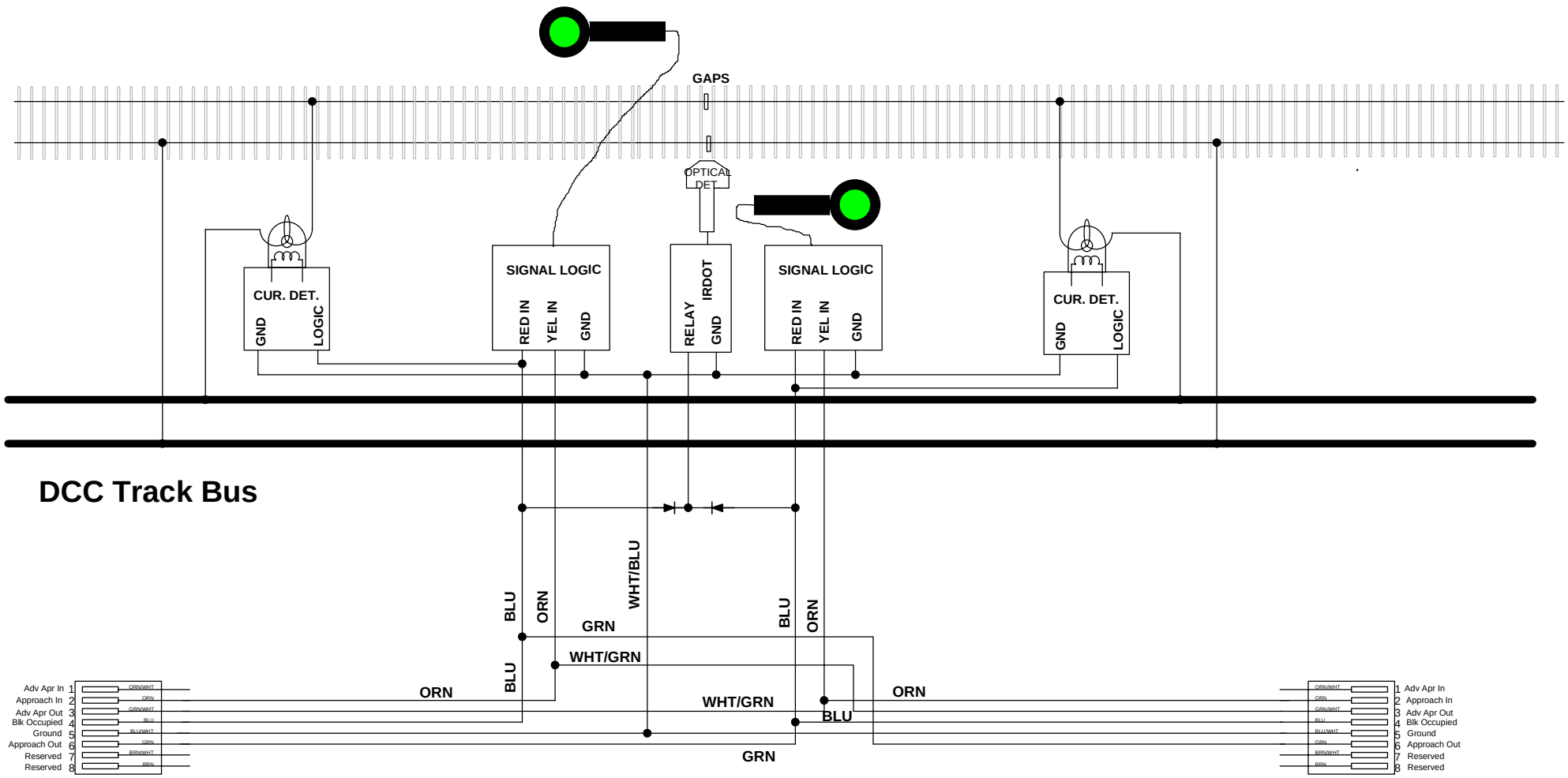
Crossover Cable Wiring



Crossover Module Wiring

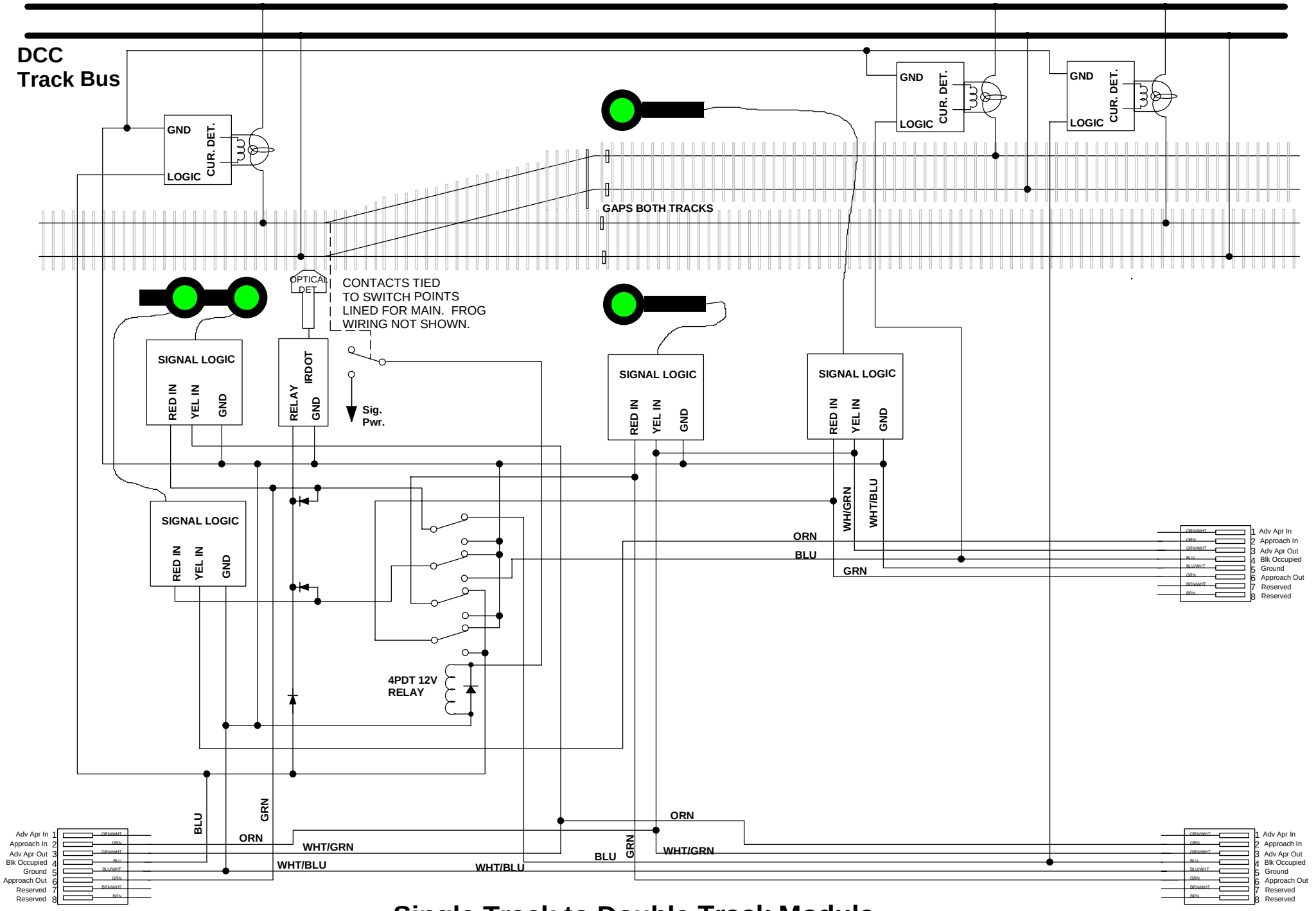


Detecting Main Track Switches



Signaled Module Wiring (a.k.a. Cascade Module)

All Main Track switches must have detection to their block.



Single Track to Double Track Module

Parts Sources for the MSS

Signal Logic:
Tractronics Inc. AutoBlock and AutoSearch Signal Logic, Signal Products at
http://users.rcn.com/weyand/tractronics/ttinchom.htm

Atlas HO Signal Control Board, Signal System at **http://atlasrr.com/** also available through dealers.

Infrared Detector:

Heathcote Electronics IRDOT-2DEW Products at http://www.heathcote-electronics.co.uk/
Also available from Micro Mark **http://www.micromark.com/** search for IRDOT-2DEW

Current Detectors:

Any current detector that has an open collector output is suitable, for DCC the NCE BD20 works well and requires no power input. See **http://www.ncedcc.com/** Available from any DCC supplier.

RJ-45 (CAT-5 network) Cable Supplies:

Many sources, I use PCH Cables Inc., **http://www.pchcables.com/** Look under Network Cables and Supplies (left side) RJ-45 couplers are listed separately with Keystone Jacks.

Other Parts:

Tie replacement IR sensor pair, Mouser Elect. **http://www.mouser.com/** Part number 828-OPB704WZ
1N 4006 general purpose diode, Mouser PN 625-1N4006-E3/73
4PDT 12 VDC relay, Mouser PN 653-MY4-DC12

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