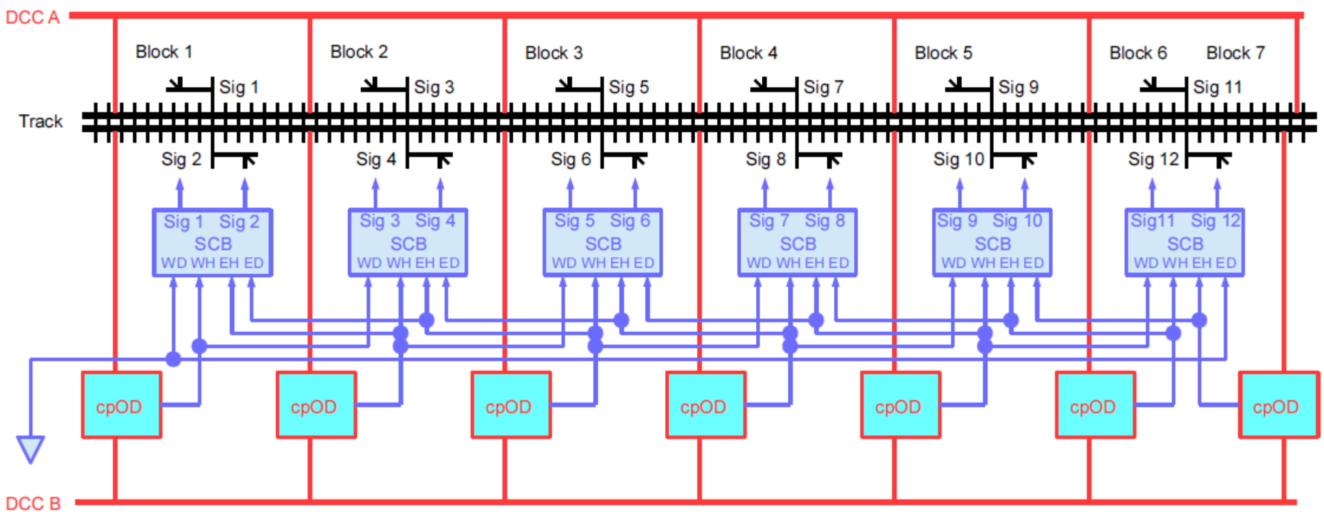
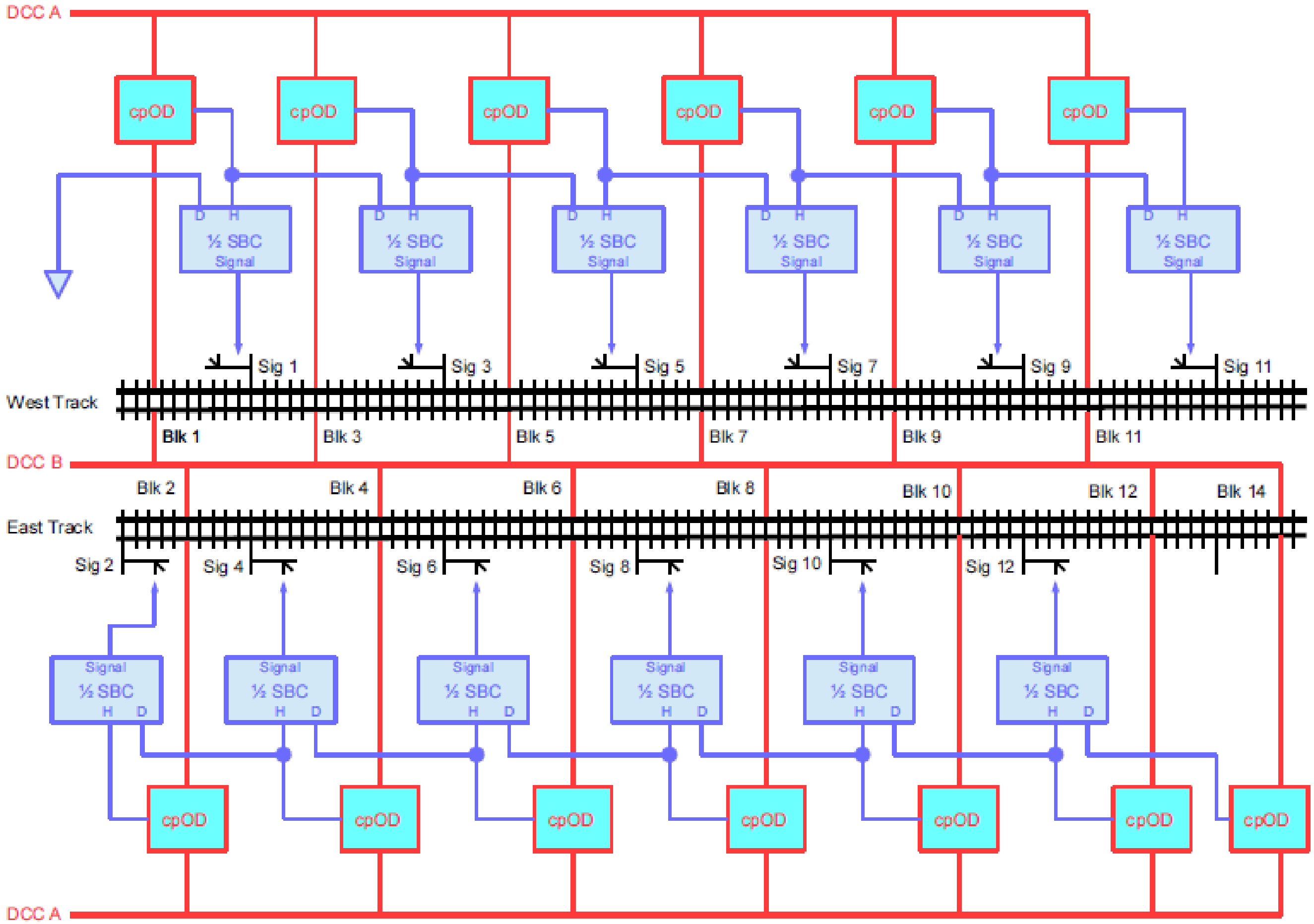
Dual ABS Control Board
by Dennis Drury

System block diagram and theory of operations. The Dual ABS Controller Board (DACB, also called the SBC, or Signal Control Board) receives inputs from current sensing block detectors and uses internal logic to drive a pair of three color signals to provide the correct aspect. This can be used to implement either single track or double track ABS systems. The system block diagram for a single track installation is shown below.



You'll see each block is fed from the two wire DCC bus marked DCC A and DCC B. It doesn't matter which side of the DCC signal is used as long as it's consistent throughout the layout. In the case of the diagram above DCC A feeds the track directly while the DCC B signal goes through a current detector before it's connected to the track. The current detectors shown above are the cpOD detectors available from Model Railroad Control Systems but any current detector can be used as long as it provides a TTL logic output. The output from the detector is fed to the Signal Control Board, or SBC. Each detector board feeds into the inputs on the SBC called WD, WH, EH and ED. These stand for the West Distant, West Home, East Home and East Distant inputs. The outputs of the SBC boards connect to the signals themselves. In operation the SBC provides the signal aspects as follows. If the West Home input is logic low the west signal will be red. If the West Home input is logic high and the West Distant input is low the west signal will be yellow. Finally, if both the West Home and West Distant inputs are high the signal will display a green aspect. The same logic holds true for the east signals using the East Home and East Distant inputs. It should be noted that even though there is only one arrow going from the SBC to the signals that arrow represents four wires, one for each color and the positive supply voltage. This makes it very easy to use a length of CAT-5 cable to feed two signals. You can also use a length of CAT-5 for the cabling between SBC boards. Four wires will be for the East and West Home and Distant connections and the other four will be ground connections to reduce noise. Use one of each colors for the connections and the mating colors in the twisted pair for the grounds.

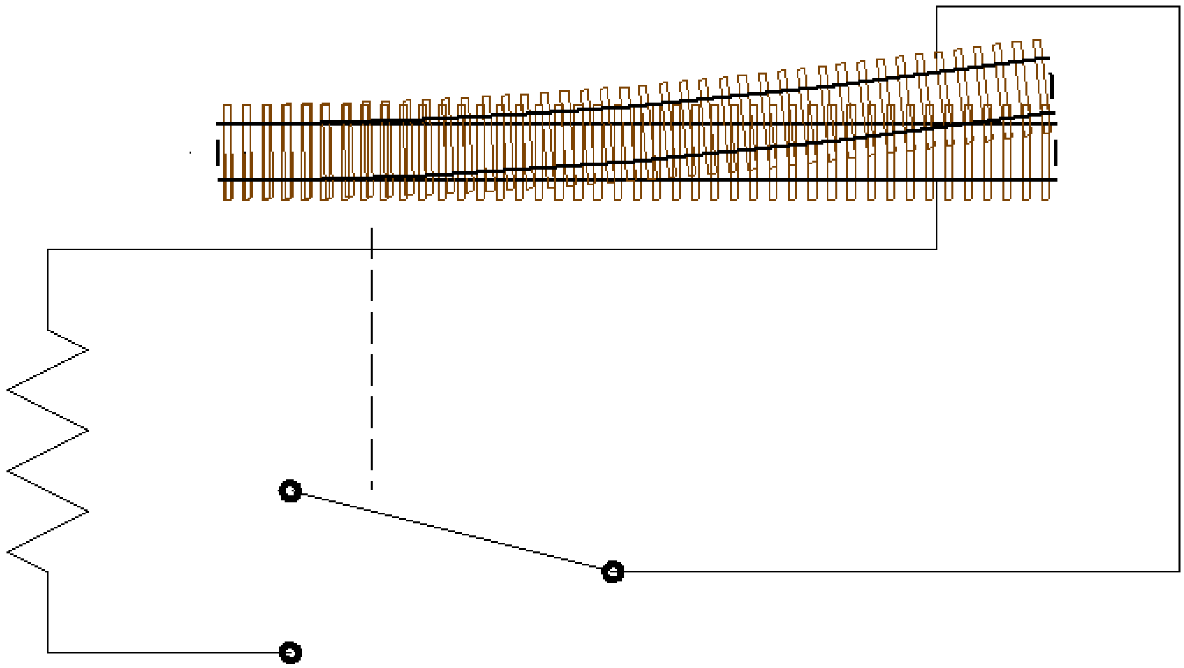
Figure 2 shown below shows the block diagram for setting up signals on double track.



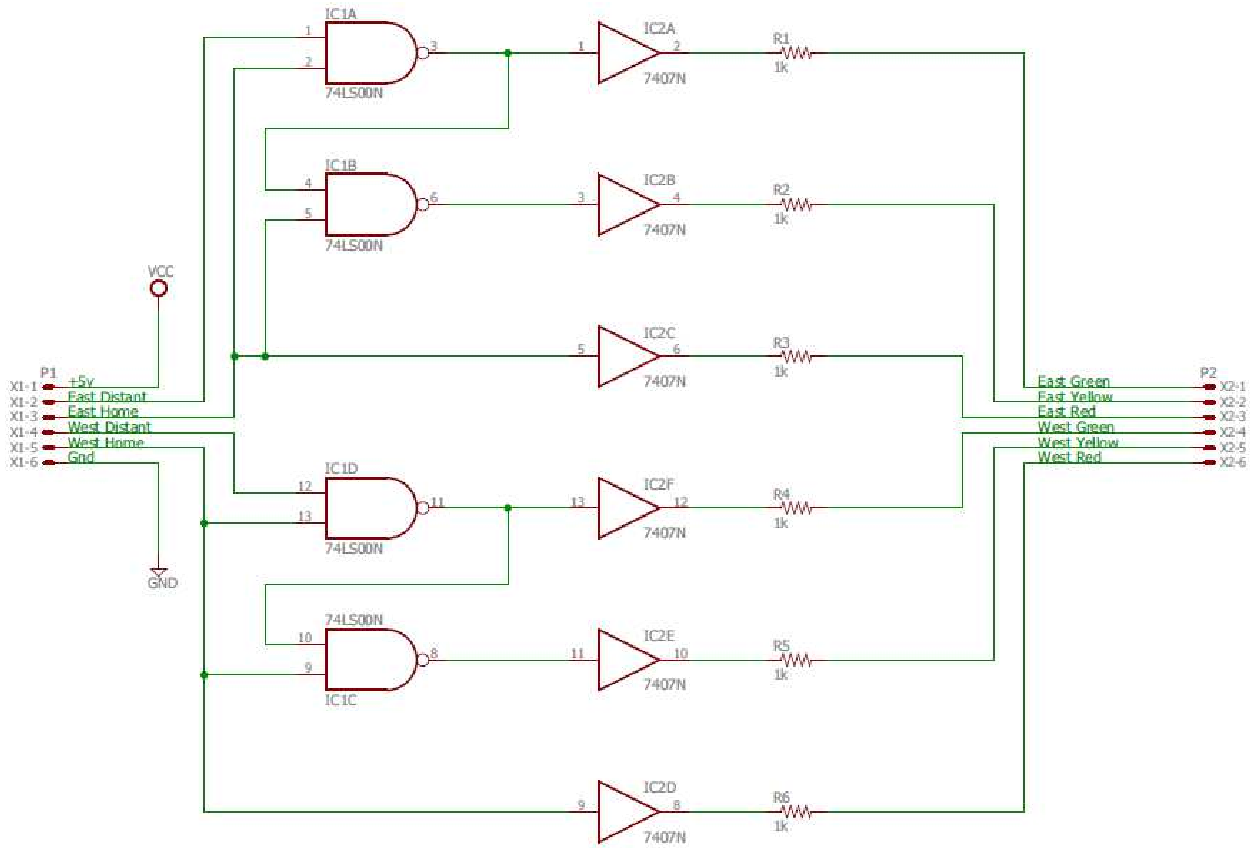
The major difference between single and double track is you're only using half of the SBC for each signal. This doesn't mean you need to use twice as many SBC's but simply that each half of the SBC is independent of the other so there is added flexibility in how you set up your signal system. The other difference is you only need two wires between SBC's instead of the four required in the single track version.

You may notice there are no turnouts shown in the block diagrams. What then you may ask are turnouts handled? On the prototype if a turnout is thrown against the main line the block signals in ABS territory are set to stop governing movement over that section of track. On the model it's extremely easy to implement this feature. All that's needed is one set of contacts from whatever turnout controller you happen to be using as well as a resistor. The controller can be a Tortoise, Blue Point, or even a slide or toggle switch. In the drawing shown on the next page you can see that if the turnout is set for the main (as shown) the resistor will be out of the circuit and the detector will function as it normally does. If the turnout is thrown for the main line the contacts shown in the diagram will place the resistor across the track. This will draw a small amount of current through the detector which will trigger it to show the track as occupied. The block showing occupied will trigger the SBC to put the home signals to stop and the distant signals to approach. In practice it's just that easy, but it should be noted that if you use a manual method of throwing your turnouts, IE Caboose Industries ground throws, this method will not work. In that case you may need to put in some sort of optical detector to provide a means of sensing which position the throw lever is in. The resistor value will most likely be in the

10k ohms range but you may need to determine the final value by trial and error.



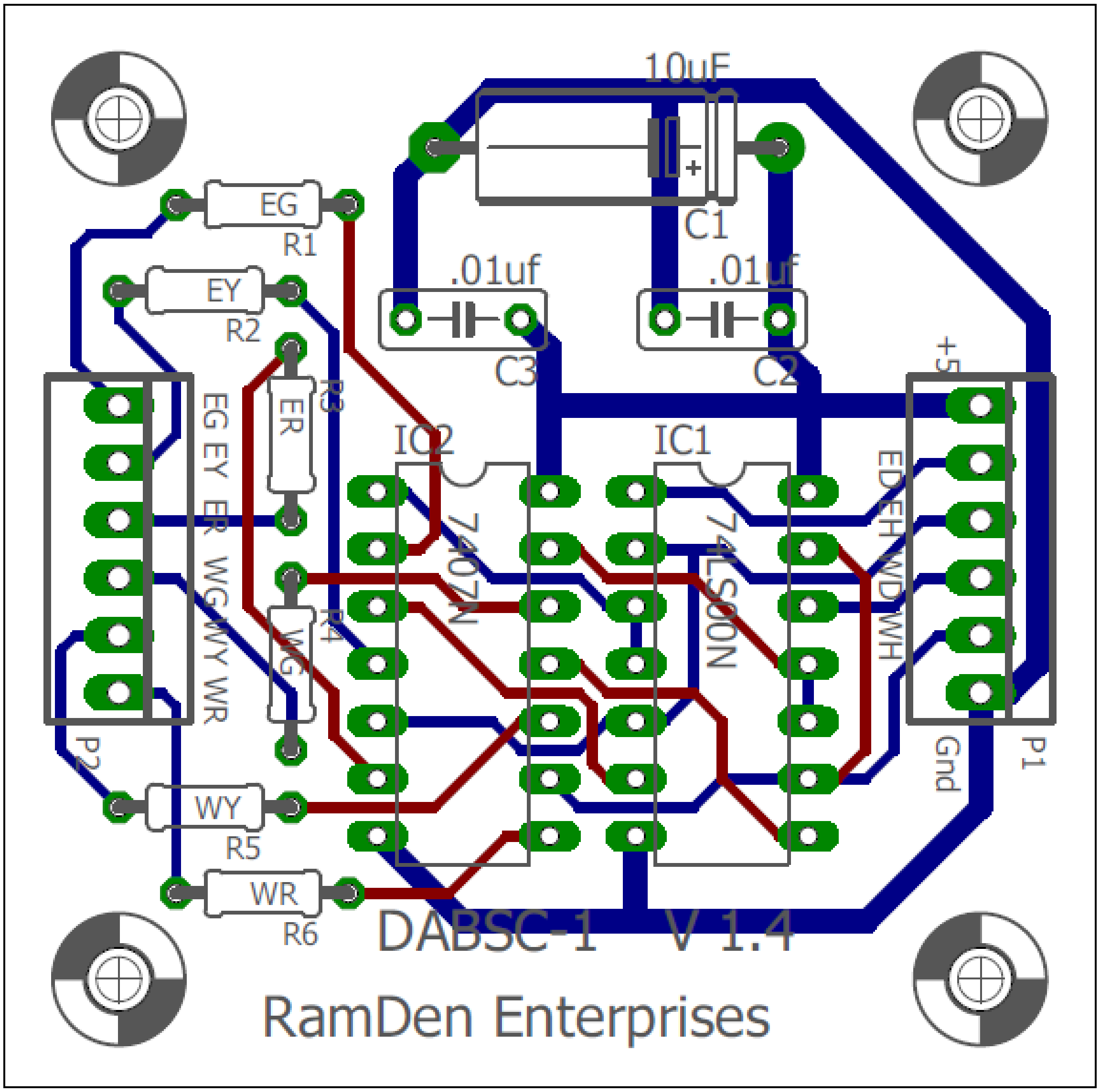
DABS schematic and theory of operations. Now that we've covered the overall theory it's time to delve deeper into the operation of the DABS board itself. Looking at the schematic diagram on the next page you can see that P1, on the left, is the input connector and P2, on the right, is the output to the signals. P1, pins 1 and 6, provide the +5 and Ground connections for the board. Pins 2 thru 5 are the home and distant inputs from the detectors. You'll note there are two integrated circuits, or IC's, on the board. These are IC1 with four sections and IC2 with six sections. IC1 is a quad NAND gate and IC2 is a hex buffer/driver. IC1 requires both inputs (pins 1 and 2 as examples) to be a logic high for the output (pin 3) to go low. If either of the input pins of each section of IC1 goes low the output will be driven high. IC2's output pins will mirror the inputs but will provide a higher current output capability for driving the signals. Now if we look at the board inputs, if both the home and distant inputs are high pin 3 of IC1a will go low, which will make IC2, pin 2 go low which will illuminate the green LED. IC1, pin 3 being low will force pin 6 high which will turn off the yellow LED. The home input being high will turn off the red LED. Now, if the distant input goes low, it will force IC1, pin 3 high which will turn off the green LED. Since pin 3 is high, pin 4 will also be high and that, along with pin 5 being high will turn on the yellow LED. Finally, if the home input is low it will force both the green and yellow LED's to off and will illuminate the red LED. You'll see the resistor values are listed as 1k ohms but you may need to adjust these values based on what LED's are used in your signals. Note that the each section of the board is completely independent of the other.



Now, it is possible to build this circuit yourself on a breadboard, but there is an easier way. I have created a printed circuit board that you can buy directly from any PC board fabrication house. The PC board is shown in the image on the next page. All you need to order the bare boards are a set of Gerber files which can be downloaded from the following website: www.ramdenenterprises.com

You can find a large number of PCB manufactures by searching for “prototype PCB fabrication”. Some of the fabrication houses listed in a recent poll on the subject of fab houses are Seeed Studios, OSH Park, ExpressPCB, Advanced Circuits, PCBWAY or FX Circuits. To order the boards simply go to the websites of the respective company and upload the Gerber files. You'll then be given a quote based on the number of boards you need. Note that most of these companies are in China so shipping times can be several weeks unless you're willing to pay extra for expedited shipping.

But, what if you don't want to build the boards yourself? In that case, you can order either board kits or assembled and tested boards directly from the author. Simply go to www.ramdenenterprises.com to place your order.



Note that in this view the inputs (P1) are on the right and the outputs (P2) are on the left. The circles with crosses in the four corners are actually mounting holes. Any PC board traces in blue are on the bottom of the board and the red traces are on the top side. Once you have the boards you can install components you have purchased yourself based on the Bill of Materials (BOM). Just follow the labeling on the board as an installation guide, but please be aware that C1, IC1 and IC2 need to be installed with the correct orientation.