A Cheap and Easy-to-Install Automatic Block Signal System For Your Layout.
By
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Title photo by Walt Schedler. Used with permission

Additional photos by Eric Haas, Seth Neumann and Dennis Drury. Used with permission

Clinic Purpose

This clinic will show you how to configure and install a prototypical ABS (Automatic Block Signal) system on your layout. There will be two methods covered. The only computer involvement will be to program the Arduinos if you go that route, otherwise there is no computer used. Cost is about $15 per node but can be cheaper if you build your own. The clinic includes the information on how to order the parts you'll need if you choose to go this route. It also includes information how to order assembled and tested boards.

Background Information

- What are Automatic Block Signals (ABS)?

- Automatic Block Signals are by definition "Automatic," in other words there is no direct human interaction with them. What this means is that ABS are not under the control of a dispatcher or tower operator. It's also important to note that ABS does not convey any authority to occupy the main track but instead is a simple "Safety Overlay." Authority to occupy the main track is granted by timetable, train order, track warrant, or DTC block authorization.

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Background Information Continued-- Definitions

- ABS - Automatic Block Signals

- APB - Absolute Permissive Block

- CTC - Centralized Traffic Control

- TCS - Traffic Control System

- Aspect - The properties of the signal, i.e. color or position of the blade if a semaphore

- Indication - The information conveyed by the aspect, i.e. Stop, Approach, Clear.

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Background Information Continued— More Definitions

- Block – A section of track, isolated from all other tracks, containing a method of detecting the presence or absence of trains or rolling stock used to activate a signal system.

- Signal – A fixed appliance used to convey information to the crew of a train and other railroad employees. Signals can come in many forms: Color Light, Position Light, Searchlight, Semaphore and others. It's important to note that even though two signals might appear identical they may be conveying different information. It's therefore important to study your prototype to see how they've implemented their signal system.
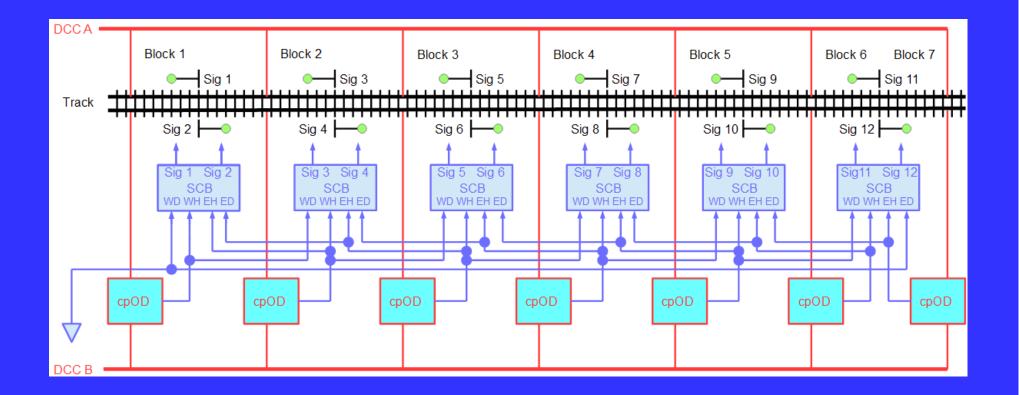
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Background Information Continued

Automatic Block Signals do not include diverging aspects. This does not mean there are no diverging signals but they are instead part of a CTC or Interlocking system. On the SP you might see an "SA" plate on an interlocking signal. The SA means it's a "Semi-Automatic" signal. In other words, the interlocking signal also has an automatic component. These signals can include a diverging aspect. You might also see an "A" plate, a number plate, or no plate at all. Only signals with a number plate are true ABS signals.
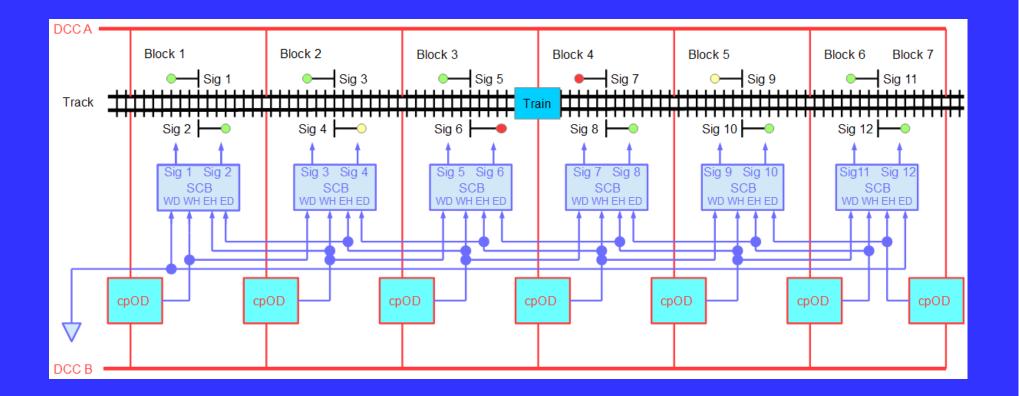
System Does Not Include

- Advance Approach unless using an Arduino

- Approach Lighting unless using an Arduino

- Signal Overlap

- Arduinos or computers can be used to implement all the above, and will be covered later in the presentation. As always, Google can be your friend. Or, you can join the Arduini or JMRIUsers Yahoo group, or contact me directly using my email address at the end of the presentation.
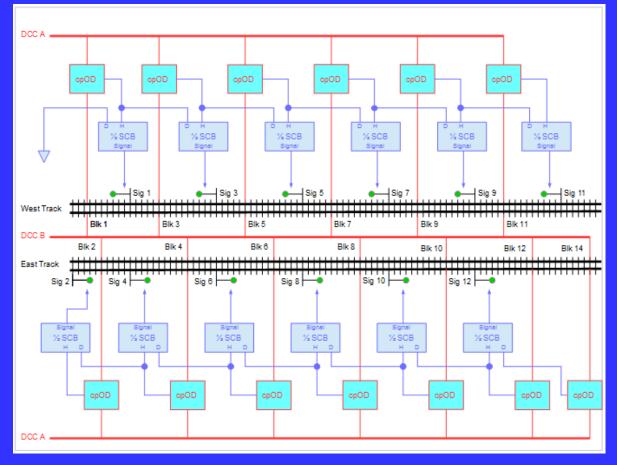
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Block Diagram for Single Track using the SCB hardware

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Train in the Block using the SCB hardware

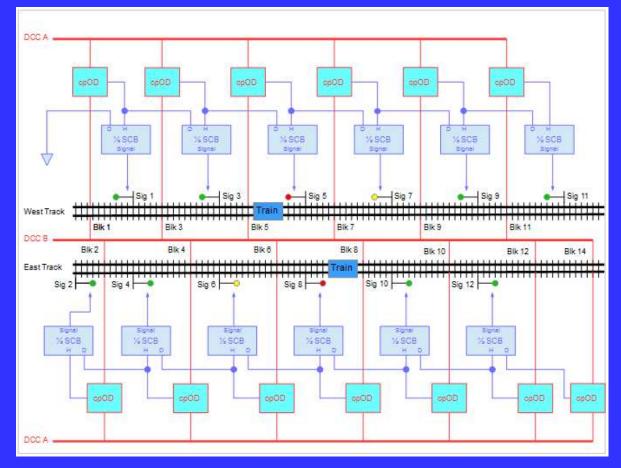PCR Diamond Rails Forever 2019

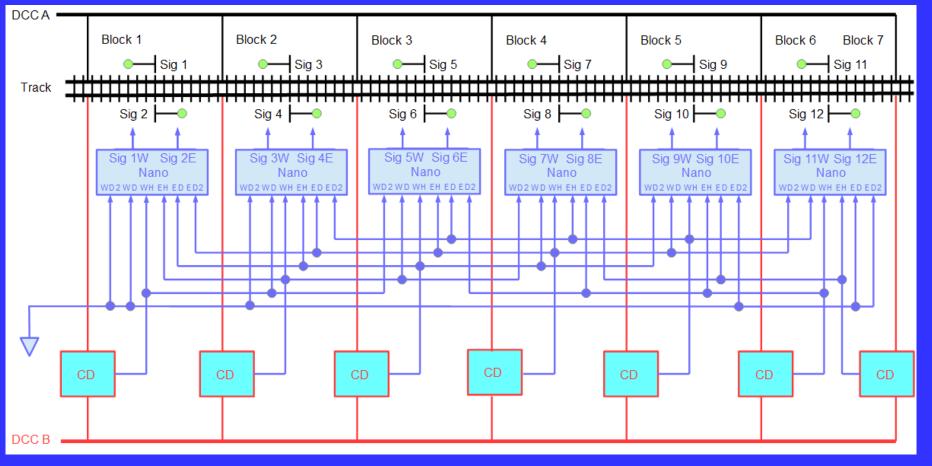# Double Track Block Diagram using the SCB hardware

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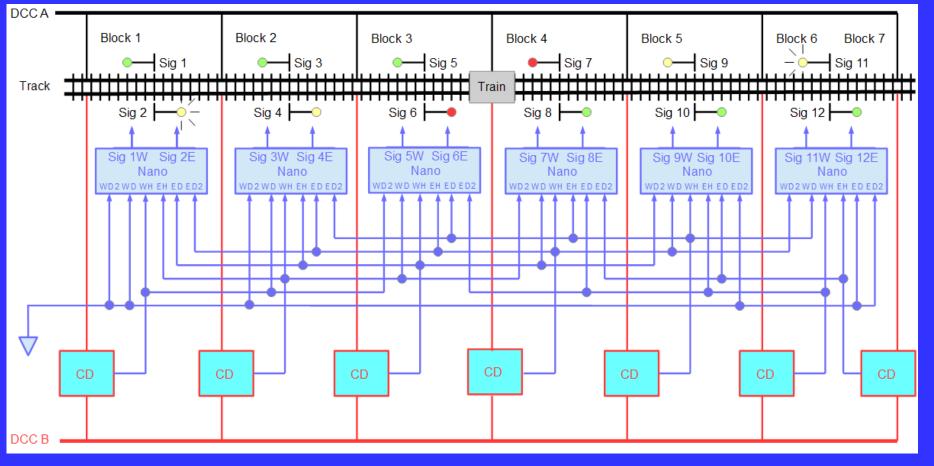
Double Track with Trains Present using the SCB hardware

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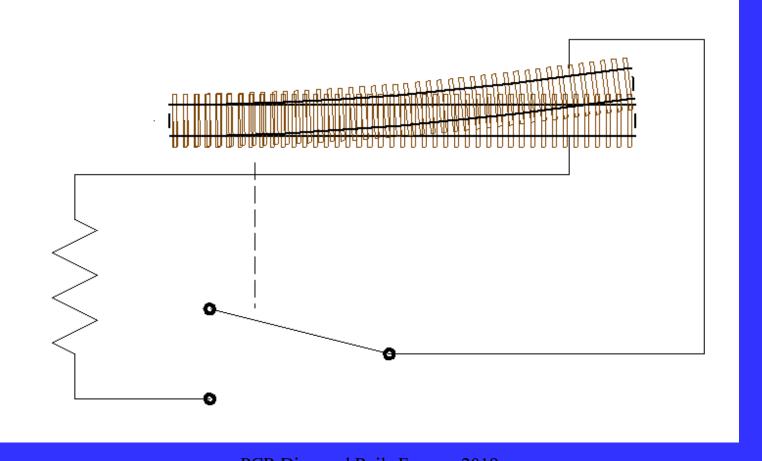# Block Diagram for single track using the Arduino Nano

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Block Diagram showing a train in the block using the Arduino Nano

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Turnout Wiring in ABS

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Schematic of the SCB

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Printed Circuit Board Layout

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Photo of Assembled SCB

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Bill of Materials

Component	Reference	Type	Quantity	DigiKey Part	Digikey Cost	Mouser Part	Mouser Cost	Jameco Part	Jameco Cost
0.01 uF Cap	C1		1	399-4208-ND	.21	594-D103Z25Z5VF63L6R	0.10	15270	0.19
10 uF Cap	C2		1	399-4545-ND	.98	80-T322B106M010	0.67	1571876	1.29
0.01 uF Cap	C3		1	399-4208-ND	.21	594-D103Z25Z5VF63L6R	0.10	15270	0.19
CONN_6	P1		1	ED10565-ND	1.35	651-1725698	4.27	n/a	
CONN_6	P2		1	ED10565-ND	1.35	651-1725698	4.27	n/a	
1k Resistor	R1	Green	1	CF14JT1K00CT-ND	.04	279-CBT25J1K0	0.26	690865	0.10
1k Resistor	R2	Yellow	1	CF14JT1K00CT-ND	.04	279-CBT25J1K0	0.26	690865	0.10
1k Resistor	R3	Red	1	CF14JT1K00CT-ND	.04	279-CBT25J1K0	0.26	690865	0.10
1k Resistor	R4	Green	1	CF14JT1K00CT-ND	.04	279-CBT25J1K0	0.26	690865	0.10
1k Resistor	R5	Yellow	1	CF14JT1K00CT-ND	.04	279-CBT25J1K0	0.26	690865	0.10
1k Resistor	R6	Red	1	CF14JT1K00CT-ND	.04	279-CBT25J1K0	0.26	690865	0.10
74LS00	U1		1	296-1626-5-ND	1.02	595-SN74LS26N	0.94	46252	0.79
7407	U2		1	296-1436-5-ND	.78	595-SN7407N	0.86	49120	0.79
					6.14		12.77		3.85

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Arduino Nano

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Arduino Programming example

```
// Set signal 1 Green

 if (West_H == HIGH && West_D == HIGH && West_D2 == HIGH)

 {digitalWrite(Sig_1r, HIGH); digitalWrite(Sig_1y, HIGH); digitalWrite(Sig_1g, LOW); }


// Set signal 1 Yellow

if (West_H == HIGH && West_D == LOW)

{digitalWrite(Sig_1r, HIGH); digitalWrite(Sig_1y, LOW); digitalWrite(Sig_1g, HIGH);}


// Set signal 1 Red

if (West_H == LOW)

{digitalWrite(Sig_1r, LOW); digitalWrite(Sig_1y, HIGH); digitalWrite(Sig_1g, HIGH);}
```

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User Supplied Components

- Detectors

- Power supply +5 volt regulated

- Signals

- CAT-5 cable or wires

- Miscellaneous hardware

Websites

Signal photos by Eric Haas

http://redoveryellow.com/signals/index.html

To order bare boards, assembled and tested boards, or to download the Gerber files so you can order your own bare boards, as well as instructions and a bill of materials visit:

http://www.modelrailroadcontrolsystems.com/

Look for the Community Designs link on that page.

Websites continued

Arduino programming software (IDE) can be downloaded from the Arduino website:

https://www.arduino.cc/en/Main/Software

Arduinos can be purchased from multiple sources such as Amazon, Adafruit, Digikey, or Sparkfun. Again, Google can be your friend.

If you'd like to purchase Arduinos that are already programmed or tested please contact me via the email address on the next page.

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That's All, Folks

That's all there is to it. The hardware and software is all open source and the information on ordering your own circuit boards is available as is a bill of materials along with assembly instructions. You can also order assembled and tested boards.

If you have any questions or need more information or would like a copy of the Arduino program file, please contact me at cowrr1984@gmail.com

Thanks for coming.

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