



DCC Impulses Column

by Bruce Petrarca

Photos & illustrations by the author, unless otherwise indicated

Bring your layout to life.

When one mentions signals, it seems that everyone has a different idea in their mind. Some folks think of traffic lights; others think grade crossing gates or wig-wags. Yet others think of signaling the track on their layout.

As for track signals, thoughts range from simple units with no lights to full computer control and technically correct signals. Adding life to your layout can fall somewhere in between. This column is designed to introduce you to some of the arenas available to you. There are a lot of ways to skin this cat. Here are some suggestions for future investigation.

Full signaling of a layout revolves around whether or not a block is occupied and, perhaps, the positions of several turnouts.

Model railroaders like to signal the position of turnouts. This can help operations and give some awe-factor for guests. Very few prototype railroads actually signal turnout position.

Static structures

Regardless of your control system, if all you want is some eye-candy for the track side, consider a simple non-operating display, like the Bachmann unit shown in figure 1. These guys run about \$10 for a package of four and they help set the stage. These signals provide a quick bit of scenery if this style of signal is approximately correct for the railroad and era you are modeling.

The down side to these signals is that there is no life in them. They just sit there.

In figure 1, the foreground signal is the basic one from Bachmann. The background is the same signal, that has had a ladder added and has been painted. This shows what you can accomplish with a bit of "signal bashing."

Statically Lit Signals

I've seen folks overcome the non-operating signal by installing a lit signal that doesn't change aspect (color). For example, one that is green on all the time. The Tomar signal shown in figure 2 is an example.

The advantage here is that there are many different styles of signals available from many different manufacturers: BLMA Models, Integrated Signal Systems, NJ International, Oregon Rail Supply, and Tomar are some of the more popular. The one to fit your pike and era is probably available. If one of the many production units available doesn't fit your desires, then some of the same folks are willing to custom build signals for you.



1: Bachmann non-operating HO signal - Eye candy on our club layout



2: Tomar H-857 set to permanent green — nice light, but the fact that it never changes will bother some folks — www.pcmrc.org

Non-modelers will tend to be impressed with the lighted signal look. Rail enthusiasts will notice that the signal is always green. Some folks may find it disconcerting for the signal to remain green when there is a train in the block (as shown in figure 2). But this is a quick and easy way to get some pizzazz on the layout.

Some folks will argue that setting the signal permanently red would be better.

Installing the correct signal and wiring it constantly one color and getting power from the DCC rails is a quick way to get something on the layout and can be a stepping stone to more correctly activated signals.

Which way is my turnout?

Displaying turnout status (closed or thrown) is one way that signals can help the model train operator. It is nice to stand several yards (meters) away and see clearly which direction the turnout is set.



3: A bi-level LED assembly suitable for a track-side signal as is — photo courtesy of All Electronics

Tortoise controlled turnouts

Whether DC or DCC controls the trains, if one is using Tortoise switch motors, or other similar products, the contacts in the motor can be used to activate two colors of signal.

The signal shows which direction the turnout motor is set, not which way the turnout actually is thrown. For example, assume that some scenery work has gotten the turnout glued in the diverging route position. Even if the turnout motor is unable to move the turnout it will set the switch inside it. The signal will show the straight route when the turnout is still set for the diverging route.

Operators seem most comfortable with yellow and green LEDs for diverging turnouts and red and green for combining turnouts. This way, green means that you are lined for the main, yellow means that you will take the turnout, and red means that the turnout is thrown against you. Prototypically, the green (clear) signal is on top. Many engineers were color blind and just ran from the position of the lit signal, not its color.

The display for such a scenario is immaterial and can be anything from an LED in the fascia, to a dwarf signal next to the turnout, to a signal bridge (8) over a bunch of tracks.



Dwarf signals can be scratch built or be a factory unit. They may be as simple as an LED or two in a plastic housing, like the inexpensive LED-212 from All Electronics, as shown in figure 3. Many of the plastic LED holders can have the LEDs removed, so adjusting what color is where is not a big deal.

Many companies make dwarf signals, such as shown in figure 4. These are available for about \$10. If you choose to make your own, you may find some ideas at **NEED TINY URL FOR [### **4: A dwarf signal in HO from Oregon Railroad Supply**](http://www.model-railroad-</p></div><div data-bbox=)**

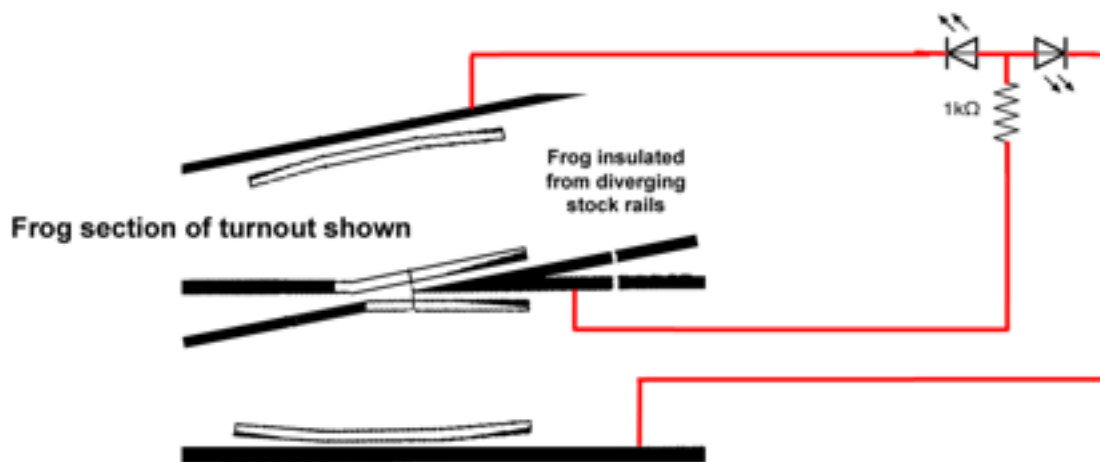
NOTE: JIM DUNCAN IS WORKING ON A REPLACEMENT PHOTO - THE CAPTION WILL HAVE TO BE ADJUSTED TO MATCH

Live frogs and DCC

How about an arrangement where the turnout will tell you which way it is actually set? You can do it if you use DCC and live frog turnouts, such as the Peco Electrofrog. The signal is built out of two LEDs and a resistor.

This scheme will work with just about any style LED you have available: two LEDs or a single bi-color LED with three leads, either common cathode or common anode. The LED package shown in figure 3 would work nicely.

If you are using two LEDs, connect the same side together, either the anodes or cathodes. You may wish to review my web site for information on LED lights ([TINY URL for www.mrdccu.com/curriculum/Lighting/LED.htm](http://www.mrdccu.com/curriculum/Lighting/LED.htm)). There is a link to my LED column near the bottom of that page, too. Then you connect this junction (or the common one for a single LED) through a resistor (1000 ohms at 1/10 watt or greater) to the frog. You connect the two other leads to the rails. Adjusting which rail is connected to which LED to achieve the desired color with the turnout thrown. Figure 5 is the schematic diagram.



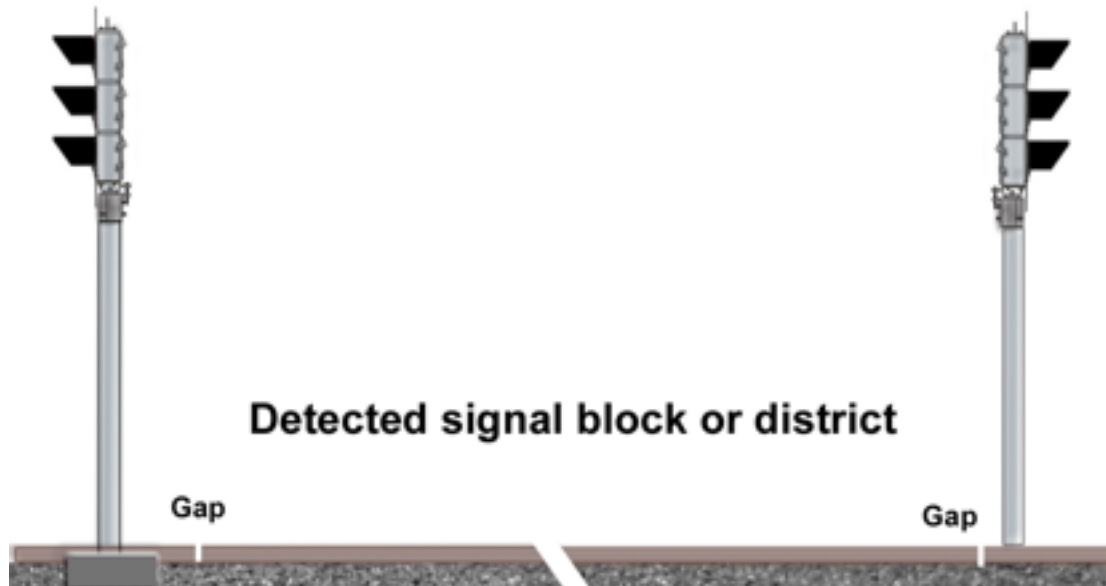
5: Schematic diagram of two LED signal for turnout position using a live frog turnout — it is easy to swap leads between the LED leads to achieve the desired signal

Besides its simplicity, this style of signaling shows for a fact that the frog is actually connected to a specific rail. Throwing the turnout shorts out one of the LEDs. So, if only one LED is lit, you know there is physical and electrical contact between one

stock rail and the points. If both are lit, the turnout is not making electrical contact, it may be physically in the correct position.

Is the block occupied?

The other major reason for signals is to tell the engineer whether the way forward is clear or not. The most common setting is where there is a signal facing outward at each boundary of a signaled section of track, see figure 6.



6: Drawing of a detected track block with signals outside each end – the split in the middle represents the missing portion of a long block – if DCC detection is used, gaps will be needed just inside the signals.

There are two ways to detect a train in the signaled section of track:

- Optical sensors that work for DC or DCC
- DCC block detection (see my August 2013 column - [TINY URL for http://model-railroad-hobbyist.com/magazine/mrh-2013-08-aug/di_where-is-my-train](http://model-railroad-hobbyist.com/magazine/mrh-2013-08-aug/di_where-is-my-train))

Optical detectors are available in available-light and infrared versions. Since they are not dependent upon DCC for their operation, I'll venture away from the strictly DCC-related world and touch on them briefly. Many manufacturers offer products in this arena. A few are:

- Azatrax (www.azatrax.com/ir-model-train-detector.html) offers several products
- Circuitron offers the BD1
- Logic Rail Technology (www.logicrailtech.com) has several products

Electronic hobbyists can find schematics and kits to build their own.

Detecting the entire block becomes an issue with optical sensors. They can easily tell that there is a train *exactly* where they are located. To report an entire block occupied requires some fooling around.

One method is time. Once the train uncovers the optical sensor, a timer starts and some seconds later, the block is deemed clear and the signal logic proceeds normally. If the train stops just after it uncovers the detector, the situation pictured in figure 2 can occur: a green (or yellow) signal with a train just past it.

Increased accuracy requires increased complexity. Two (or more) sensors along with sophisticated electronics will more accurately report the block occupied. The Azatrax MDR2 (7) is an example of this type of board.

With that short introduction into the world of optical detection, it will be easy to understand why DCC block detection is an elegant a solution. DCC block detection reports whenever current is being consumed inside the isolated block. That current can be powering a decoder-equipped locomotive, whether it is moving or not, or lighted cars (passenger or caboose), or cars with resistor wheel sets. For more details, see my August 2013 column, referenced above.



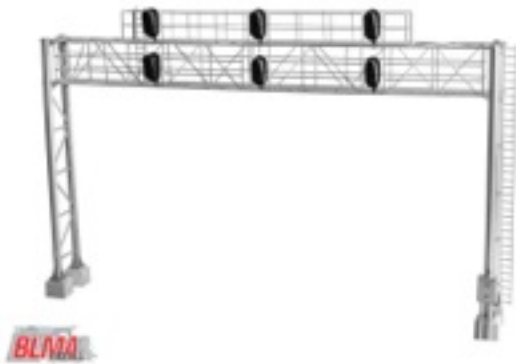
7: Azatrax MRD2 optical detector — senses two places in the block — photo courtesy of Azatrax

So DCC block detection, coupled with resistor wheel sets and lighted cars, will very accurately tell you that the block is occupied until the very last car exits the block. There is one hitch. You need to make sure there are no ongoing current loads on the detected bus, like: stationary decoders, lit buildings, panel displays, etc.

OK, now we've got a way to tell that the block is occupied. What do we do with this knowledge?

Signal Animator

A signal animator is a relatively simple timer circuit activated by the block detector. When the block is occupied, the animator sets the signal to the stop (red) aspect. When the block clears, the approach (yellow) aspect is set. After the approach aspect has been displayed for a period of time (usually user adjustable) the signal moves to clear (green).



8: BLMA signal bridge (4025a) in HO-scale - photo courtesy BLMA

An operator running a through-train and following traffic can use these signals to know with relative certainty that the block ahead is clear (yellow or green). In the real world, a green would assure that the second block ahead was clear, as well. With a signal animator, information from the second block ahead is not shared. Thus, the engineer doesn't have 100% certainty that he has two clear blocks.

As great as the concept seems, today there are not a lot of choices in ready-built hardware to implement it. A tinkerer could always build his own

timer circuit and activate it with an off-the shelf DCC block detector.

Atlas has a nice system, that even has even some realistic signal heads ([TINY URL for www.atlasrr.com/Trackmisc/hosignals.htm](http://www.atlasrr.com/Trackmisc/hosignals.htm)). This system seems to have been lost in the Made-in-China issues over the last few years. It is reasonably priced, but not currently available. Hopefully, it will soon be available again.

NCE promised a system (SIG 12) many years ago. As I understand it, the signal animator portion of the SIG 12 worked just fine. However, the folks at NCE wanted to include the sophistication of an easy-to-install system that would signal that second block ahead, too. Thus, a clear signal (green) would guarantee that the next two blocks were clear. Getting all this to work under a lot of conditions hasn't yet happened and the unit remains on the shelf.

Signaling the entire pike

Sophisticated signaling systems take into account more than just occupied blocks. Turnout position comes into play, too. Consider a scenario where the main track in the next block is occupied. A signal animator would give a stop (red) signal. However, if you have a scheduled meet and your partner is already in the block on the main, you both will see stop signals at the boundary. What you really need is a caution or approach signal, if the passing siding is free and the turnout is set to allow you to move into the siding.

Here is where a lot of data crunching and system planning comes into play. This usually means a computer and software and block detectors and signal control modules and feedback from the turnout controllers and lots of wire and . . .

Whew! It can be daunting. This level of discussion could be its own eBook. I'm going to just mention a couple of things that are out there. Be ready to devote a lot of time

and other resources to take a system from the signal *animation* level to the signal *automation* level.

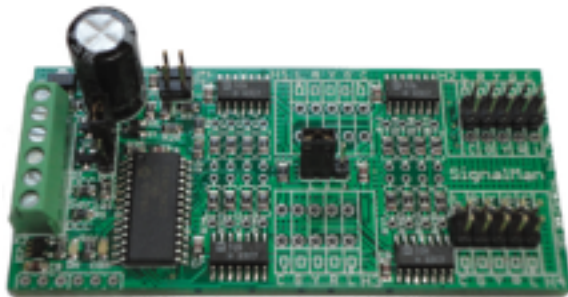
Personally, I don't see the return on investment. But many folks do. But then I only model railroads with dark territory (no signals).

Digitrax has many components of a signal system ([TINY URL for](#)



8: Digitrax SD8C Signal Decoder board — photo courtesy of Digitrax

www.digitrax.com/products/detection-signaling/): signal decoders; signal heads, cables and occupancy detectors. However, one should take to heart a note on their web site: "A **computer** and **third party software** are necessary to realize the full feature potential of the SE8C". So, while it sounds like a complete system, it will require a fair amount of additional time and expense to achieve the results you are probably seeking.



9: SignalMan board from RR-CirKits to interface between a computer and your on-layout signals — photo courtesy RR-CirKits.

The JMRI software has a module that will allow you to control your layout and automate all your signals.

One of the driving forces behind JMRI is Dick Bronson. Through his RR-CirKits company (<http://www.rr-cirkits.com>) he provides many of the interface modules, like the SignalMan (9) that work with the JMRI software and the Digitrax LocoNet communications system. RR-CirKits is a new MRH advertiser, as of this month.

If you found this column helpful, please click on the Reader Feedback link here and rate it **awesome**. Please join in the conversation that invariably develops there about the topics presented in the column. Share your experiences. Thanks.

Check back next month. Until then, I wish you green boards, or clear signals, whichever you prefer to consider.

Mr. DCC's Workshop

DCC compatibility between systems

I see and get a lot of questions about DCC compatibility, so let's spend a bit of time talking about it. First, there are NMRA standards that are based upon Bernd Lenz' basic patents. I'm going to talk about DCC components that conform to NMRA standards. If they don't conform, all bets are off. Many components conform but are not certified. A list of tested and certified components is available on the NMRA web site (**Need Tiny URL for www.nmra.org/standards/candi/warrants.html**). But just because a component is not listed doesn't mean that it doesn't conform. It may not have been tested.

Okay, let's start with a basic question: "I've been using system X and I am converting to system Y, will I have to reprogram all my locomotives?" The answer is, "Probably not."

One case revolves around the situation I discussed in my February column, (**TINY URL for www.model-railroad-hobbyist.com/magazine/mrh-2014-02-feb/di_unraveling-dcc-addresses**). Systems vary widely in how they handle addresses between 100 and 127. If all your locos fall in this range, you may have to change all their addresses. However, I don't think folks are concerned with this when they ask the question.

What I believe they are asking really is, "I've spent a lot of time working on my locos and getting the sound volume and sounds and momentum, etc., just right. Will I have to change those settings?" And the answer is no. There are some decoders who don't meet the NMRA specs on some things like momentum. However, they will react the same regardless of the system issuing the commands.

Another area that bugs folks frequently revolves around programming sound decoders or other decoders with large energy storage capacitors on board. It frequently goes like this: "I have a DCC system (like the NCE PowerHouse Pro) that has a NMRA warrant (issued in 2005). I cannot read my SoundTraxx Tsunami equipped locomotive with it. Why?" The capacitors in a lot of modern decoders exceed the specifications on the original programming track



10: PTB-100 Programming Track Booster from SoundTraxx

outputs. Many of the current generation DCC systems were designed before the NMRA issued enhanced Recommended Practices (upgraded to Standards in 2012). The latest designs will read all decoders. System that were designed prior to about 2005 will probably need a programming track booster (mrhmag.com/url/mrdccu-ptb) to read these new decoders.

The keystone of DCC is the fact that it is a standardized system, supported by many manufacturers. So, if one manufacturer goes away (as with Wangrow), there are others to step in and fill the void.