

About our DCC columnist



Bruce Petrarca is a well-known expert on all things DCC.

[Click here](#) to learn more about Bruce.

DCC Impulses: Back to Basics

Getting to know DCC!



Welcome to my new column - DCC Impulses!

Welcome to the first DCC Impulses column in Model Railroad Hobbyist.

We hope this will be a long and fun adventure! Some of you may know me from my association with Litchfield Station.

I was talking with the SoundTraxx folks at the NMRA convention in Sacramento. They said they are seeing a need to remind folks of the basics of DCC – decoder operation and programming. While this isn't the sexiest aspect of modeling, it is helpful to understand as you move along with DCC. Perhaps you will come back to this column when you are puzzled.

Think of this as a refresher if you've been around for a while, and maybe the source of an "AHA!" moment for newer folks.

As DCC matured, some new features became available. But what I'll discuss here will relate to currently available decoders and systems. Older units may or may not have all these features.

NMRA and DCC

There have been many model train command control systems over the years, for example, Keller "On-Board". These systems died from lack of support when the manufacturer ceased to exist.

Bernd Lenz patented the DCC system in the early 1990s. To create a broad-based market, he assigned his basic patents, which they adopted as a standard, to the NMRA. The success of DCC can be linked directly to this standardization which encouraged multiple vendors to build conforming systems.

The NMRA created a set of Standards and Recommended Practices for DCC. Standards describe the track interface: voltages, pulses, data and waveforms. Recommended Practices (RP) related to CV (configuration variable) values, communication, Manufacturer ID, etc.

To be NMRA DCC compliant, a decoder or system must conform to the Standards, but the Recommended Practices are only that – recommendations. However most vendors follow the recommendations – good news for decoder / system compatibility!

If you'd like to learn more, the NMRA documentation is online at www.nmra.org/standards/DCC/index.html

DCC track signal

A DCC track signal is computer data sent in packets. Don't get all hung up

by this, just think of a packet as a single message sent to a specific recipient.

It works a lot like a text message sent to a cell phone number. The message goes only to the phone at a specific number. Other phones on the same carrier won't respond to the message, but the target phone receives and displays it.

Similarly, a DCC system sends a packet down the rails. Because each packet has an "address", only the decoder with that address (phone number) will respond to it.

In the modern DCC world, these packets of data can do many things: activate functions, adjust loco speed, and change parameters in the decoder.

CVs – what are they?

CV stands for Configuration Variable. Just think of CVs as little pigeon holes a decoder uses to keep track of the personality traits you want it to have.

NMRA RPs cover some CV values but leave many to the discretion of the designer. Things like Start Speed (CV2) are recommended, while volume controls for a sound decoder vary between manufacturers.

CVs are programmed two ways:

- On a programming track
- Programming on the main.



Figure 1

Figure 1: Using the programming track with an NCE Power Cab.



Figure 2

Figure 2: Programming on the main. In this mode you can't easily read back CV values without special equipment.

Programming Track

A programming track (for service mode programming) is used to program ONE loco at a time. The programming track (and loco being programmed) must be totally isolated from the rest of your layout. Any connection between the programming track and the DCC track signal (even a metal wheel bridging a gap) may destroy the programmer. A programmer can write or read-back CV values from a loco on a programming track.

To write, a packet is sent to the decoder telling a value and which CV to write. The decoder acknowledges the write completed by drawing a pulse of current. This pulse of current must go somewhere. Frequently the motor will move a bit or the lights will

flash or both during the acknowledgement pulse.

Reading is more laborious. Think of trying to communicate with a person who can only blink his eyes. You need to ask a bunch of yes/no questions to know what they are thinking. The decoder can only “blink” by creating an acknowledgement pulse, as described above.

To read a value, the DCC system asks the decoder a series of questions:

Is CV 2 = 0?

Is CV 2 = 1?

Is CV 2 = 2?

The decoder then sends an acknowledgement pulse.

The programmer now knows that CV 2 has a value of 2.

Since a CV can have values from 0 to 255, a programmer may need to ask a lot of questions before getting to 200 or more! After each question it needs to wait to see if there is an acknowledgement pulse. Reading CVs can be slow.

A major benefit of the programming track is its current limiting feature. That is, it cannot put a lot of current through anything connected to it. Prudent folks take a new DCC installation to the programming track first to test it. If the programmer doesn't detect a short circuit, and can read and write to the decoder, it's highly likely the installation was done properly, at least as far as motor isolation from the track, without decoder damage.

The programming track is the safest place to change loco addresses. So,

when I finish an install, I put the loco on the programming track and read the short address, which should be 3 for a new decoder. Then I set the desired address. Just to be sure, I read back the new address. That way, I know that I probably don't have a short and can read and write to the decoder.

Programming on the Main

Once you have verified the installation on the programming track and set the decoder address, you can switch to programming on the main. POM is useful when fine-tuning motor operation or sounds. Let's look at how it works.

Suppose you wanted to program CV2 to a value of 10 in loco 1234. You tell this to your DCC system – each system has a different user interface.

The system sends out a packet of data addressed to loco 1234. The packet is similar to one that tells a loco to move at a certain speed. But this packet contains different data. It will say:

“Loco 1234, set CV 2 =10”.

The decoder in loco 1234 will receive this packet. Just like a “set speed and direction packet” is only recognized by one loco, the decoder with the correct address will be the only one to act upon the programming packet.

Programming on the main does not provide a mechanism for a decoder to communicate back to the DCC system, so there is no way in the DCC standards to read back a CV value. Digitrax Transponding and NMRA RailCom are methods that allow bi-directional communication but they only work with decoders that implement that feature.

In general, programming on the main is write-only. No reads are possible.

JMRI – DecoderPro

JMRI, the Java Model Railroad Interface package, includes a program called DecoderPro. You are likely reading this column on a computer, so do yourself a favor and go download JMRI DecoderPro from:

jmri.sourceforge.net

Your computer plus DecoderPro plus, perhaps, an interface between your

computer and your DCC system will allow you to forget CV numbers forever. Simply tell DecoderPro your desires through a graphic interface and it sets all the necessary CVs for you. Once you are done programming a specific loco, you save the CV settings in a file on your computer. If anything happens to that loco, such as the decoder ‘forgets,’ it’s simple to reprogram the decoder with the CV values in the saved file.

The screen shot (figure 3) shows the DecoderPro page for setting the volume levels of a SoundTraxx Tsunami decoder. Just move the sliders, then click “write changes on sheet” and

it’s done. Much easier than remembering a zillion CV addresses and the magic numbers that go in them. And if you are programming on the main, you can hear the changes as you make them!

Blast Mode

Some vendors offer Blast Mode Programming. This is a modification of Service Mode programming that does not rely on hearing the acknowledgement back from the decoder. It is used to program decoders that the system will not otherwise recognize.

It frequently uses the main track, but this is very dangerous as it will program ALL locos on the track being “blasted”. Be sure to remove any locos that you don’t want programmed before you start.



Figure 3

Figure 3: Decoder Pro makes child’s play of complex CV programming chores. No more converting between binary and decimal. No more trying to remember which CV address to use for which function. What you see, is what you get! And it’s FREE!

Programming Track Boosters

One of the most misunderstood and improperly named DCC devices is the Programming Track Booster.

The short story is that, if you are doing a lot of programming, you should get one and put it in line with your programming track. It won’t hurt any decoders and will probably fix it so that you will be able to read all decoders, sound and non-sound.

For more information, see my website:

www.mrdccu.com/curriculum/ptb.htm

Programming Track Modes

I mentioned previously that a programmer uses Service Mode when programming a decoder on the programming track. Service mode has sub-modes, the most common of which are Direct and Page. It can be somewhat confusing!

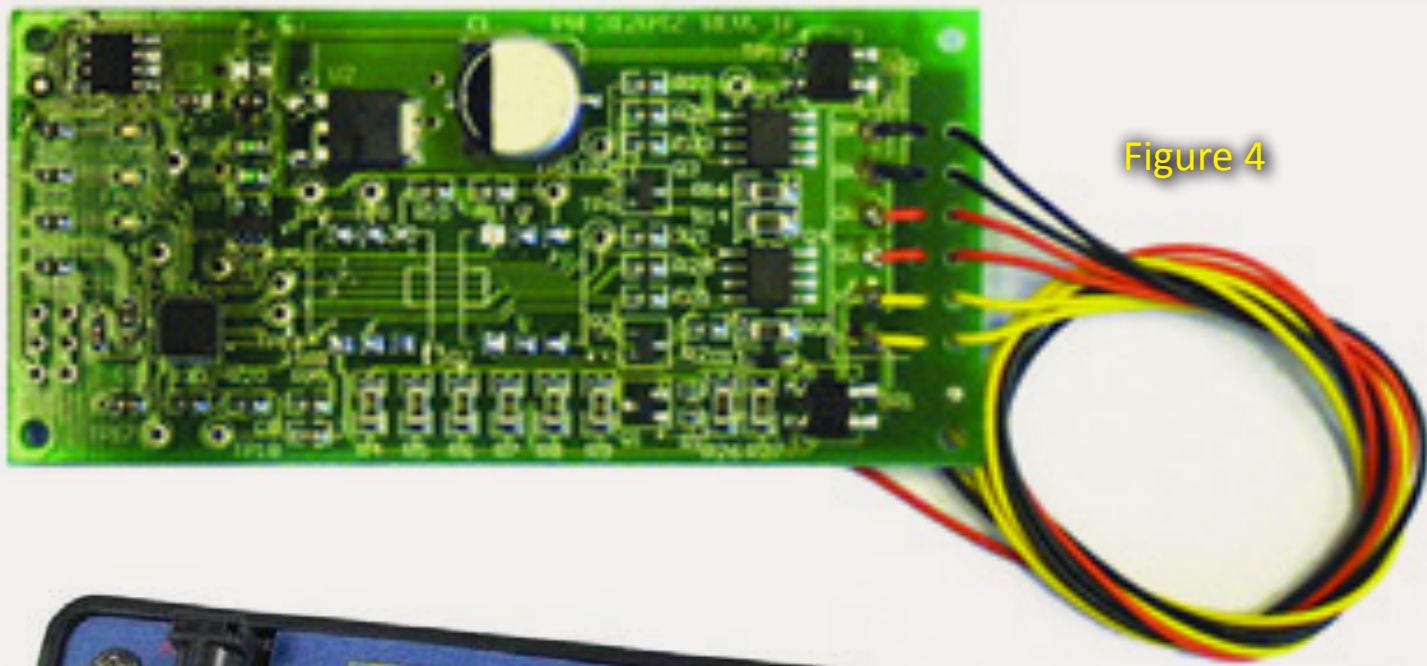


Figure 4



Figure 4: Programming track boosters from SoundTraxx (above) and DCC Specialties (below).

Different manufacturers' decoders prefer different service modes and your DCC system may ask you to choose one of these modes.

DecoderPro simplifies this a bit. Once it knows which decoder you are programming, it will choose the appropriate mode automatically.

- Digitrax decoders prefer Page mode.
- Most other vendors' decoders prefer Direct mode.

If you are using a program, such as DecoderPro, where you are writing or reading many CVs at once, Direct mode is faster.

Future columns

I'll be discussing lighting, decoder installation, DCC systems, sound (my special interest), decoder comparisons and lots more in future columns. If you'd like to suggest a topic you can contact me at:

www.mrdccu.com/contact.

I hope this column interested you and perhaps has shown you something you didn't know. Thanks for reading! Until next month, happy modeling!



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