



Model Railroad Hobbyist |

DCC IMPULSES

column

BRUCE PETRARCA



[Click here for reader comments](#)

Demystifying DCC CV 29

There is a lot of DCC terminology I'd like to change. For example, programming should be something like "setting the personality." Along that line, Configuration Variables wouldn't be abbreviated as CV, but called "traits."

1. Tuning a DCC locomotive is like weathering rolling stock. Here is a treasured scene on Larry Smith's (Lite & Narrow MRH columnist) layout



Just as you can take a ready-to-run loco or car out of the box and put it on your pike and run it, you can take a decoder equipped loco and run it, usually on address 3.

Think of the basic programming (address and lights) as the equivalent of taking a car out of the box and tuning it up. The equivalent tune-up might include adjusting the weight to NMRA standards, changing out plastic wheels, and replacing or tweaking the couplers.

The more you form (program) the personality of your DCC equipped loco, the more it begins to resemble a fully detailed and weathered piece [1] of cherished rolling stock.

► DCC TIPS, TRICKS, AND TECHNIQUES

Pivotal to the basic personality adjustments is CV 29, sometimes called the master CV.

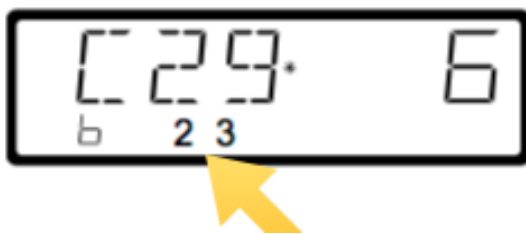
Those who don't study history are doomed to repeat it, so let's take a trip back in our time machine and see when CV 29 was born. Then, I'll try to answer all your questions about the master CV.

Back in the early 1990s . . .

When DCC was being formed, the geeks who created it got what seemed to be a smart idea. In those days, memory and microprocessors were expensive and very limited by today's standards. Since there were only a handful of CVs used, they decided to make one CV a place to control the basic traits of the decoder. It was positioned way out there in the boondocks at CV 29.

Some of the systems (mostly the high dollar units) [2] back then allowed folks to easily see the individual bits within a CV on the throttle. That's geek talk for: your throttle would show you what bits were set by a decimal number. The flagship Lenz product at the time was the Set 100 with the LH100 throttle.

2. Lenz LH100 throttle displaying the contents of CV 29 (a value of 6) with bits 2 and 3 set - captured from the LH100 manual.



The value in the CV is read and shown. In the lower row the displayed digits show you which bits are set in this CV. In this example bits 2 and 3 are set.

As throttles and systems became more advanced, more and more CVs were added. The neighborhood has run way past CV 29 and even the rest of the originally anticipated maximum of 256 CVs. Today, some decoders have 2000+ CVs.

Most of these new CVs used actual human-understandable numbers for setting traits, not geeky bits. So, the throttles evolved away from displaying the bits set in a given CV.

But we were still saddled with CV 29, which must be there to achieve NMRA compliance and has one foot in the deep, dark past.

What does CV 29 control?

CV29 answers six questions about your decoder & locomotive system. When you place a 1 in a specific bit, you are answering of "yes" to the question. A 0 is "no."

Will the locomotive run reversed? Does the loco go one direction or the other when you say "go forward"? If you install the decoder correctly (orange wire to the motor plus) this

trait will always be off. When properly implemented, this trait will reverse both the direction of travel and any directionally dependent lights. This trait was intended for reversing operation in a quasi-consist, not for fixing wiring issues. Note: if you wire the motor backwards and the lights correctly do not use this trait to change direction, flip the motor wires [3]. Otherwise you will be chasing lights and motor direction forever, it will seem. This is bit 0 of CV 29 and has a value of 1 if on.

3. TCS T1 decoder installed in blue-box Athearn locomotive - if you wire the motor backwards, fix the wiring, don't change CV 29 - see text.



Does this decoder speak 28 speed steps? I'd love to change this name, too. It defines a whole protocol that the decoder recognizes, not just something to do with speed steps. For virtually any decoder you can find functional any more, the answer is 28/128 speed steps, or setting this trait on. That's the simple answer. I'll offer a bit of insight into this whole issue at the end of this article. This is bit 1 of CV 29 and has a value of 2 if on.

Will the decoder operate on DC? If you aren't going to use DC, turn this off to minimize runaway locos. If I need DC operation for testing or for running on a special occasion, I turn it on, use it, and turn it off. This is bit 2 of CV 29 and has a value of 4 if on.

Will the decoder respond to Railcom? Unless you know exactly what Railcom (bidirectional communication) is and if you have it, leave this off. This is bit 3 of CV 29 and has a value of 8 if on.

Will the decoder respond based on the 28-point speed table? There is a catch behind this. Many decoders use another CV (frequently CV 25) to select which table you want. The manufacturers frequently offer a choice of several packaged curves, a straight line and none. Usually, the default is none. So, you select "using the table" from CV 29 and merrily are tweaking the 28 CVs that make up the table, but nothing changes. You didn't

change the manufacturer specific CV to enable the user table. This is bit 4 of CV 29 and has a value of 16 if on.

Will the decoder respond to a long (2 byte) address? There are a lot of nuances of addressing which I discussed in my February 2014 column: **Unravelling DCC**

Addresses. We won't belabor them here. If you are wanting the loco to respond to a long address you've already programmed in CVs 17 and 18, then you want this on. This is bit 5 of CV 29 and has a value of 32 if on.

How do I get the value into CV29?

I recommend that CV 29 be programmed on a dedicated programming track. Why? Well, you are potentially adjusting the address (name) of your loco, say from 3 to 1234, by changing it from a short address to a (pre-loaded) long address.

If you are using a programming on the main (Ops mode for Digitrax users) method, you are relying on communication based on the loco's address and changing the address in the middle. Just to avoid any possible confusion, use the programming track.

Yes, I know this is against what some folks, including some manufacturers, recommend. It's just my belt-and-suspenders mentality. I know it will work on the programming track. It most likely will work on the main.

What values are frequently found in CV 29?

Let's hit a few values that you will probably see over and over. If the loco is running backwards, expect to see an odd value, one number higher; if DC operation is enabled, expect a number four higher:

2 - This loco responds to 28 or 128 speed steps

34 - This loco has a long address and responds to 28 or 128 speed steps.

50 - This loco has a long address and responds to 28 or 128 speed steps and a user-defined speed table.

How do I decide what value to give CV 29?

As the guy says in the bad movie, "We can do this the easy way or we can do it the hard way."

The hard way is to calculate it yourself. Let's follow through a couple of methods.

You can go back to the earlier section and dig my values out of the text and write them down on a sheet of paper. You can calculate it there.

A good idea, in my mind, is to have some organization. I've created a sheet that should help a lot. It is here [4]. Answer the questions and write down the numbers. Add them up.

4. Table to calculate a value for CV 29

DCC CV 29

Characteristic	Value	Total
Direction of operation is reversed	1	
Operates on 28 or 128 speed steps *	2	2
Operates on DC as well as DCC	4	
Uses Railcom	8	
Uses speed table	16	
Uses long address	32	
	Total	

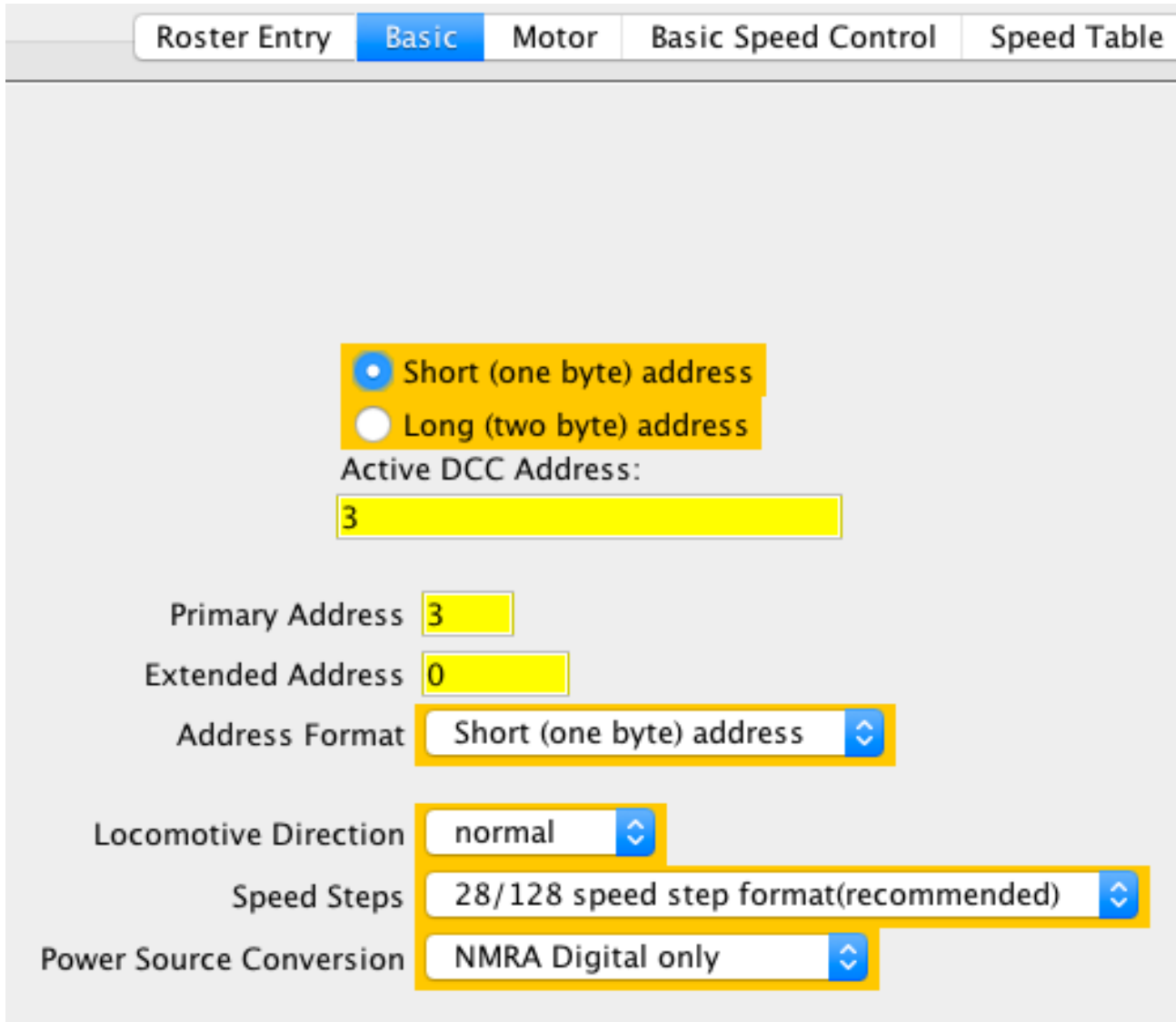
A better idea is to have a calculator available to work for you. The 2 mm Scale Association in the UK has made one for you. Just go to their web page (2mm.org.uk/articles/cv29%20calculator.htm), answer the questions and it will calculate the CV 29 value for you. The same page also has a calculator for the long address and the corresponding values for CVs 17 and 18.

Regardless of how you come up with the number, then you program it with your system.

Okay, what's the "easy way?" DecoderPro keeps track of all your choices and adjusts the value for CV 29 as you make changes. The difference between calculating it yourself by any means and programming it vs. using DecoderPro is like the difference between cleaning your own house and having "staff."

For example, figure [5] shows the basic pane of Decoder Pro with the place to set the short and long address. There are other boxes that deal with some of the CV 29 items, like speed steps and DC power and loco direction. As soon as you change any of these items, all the others turn orange, letting you know that they are interrelated. When you to a **Write All Changes** command, CV 29 will be set as necessary. That's all, folks!

5. DecoderPro Basic panel (partial screen shot). Items in orange (plus the use of the speed table on the Basic Speed Control panel) are related to CV 29 and tracked by DecoderPro as you make changes. You don't have to do anything but tell DecoderPro to **WRITE CHANGES ON ALL SHEETS** and you are golden.



Yes, some systems assist you in setting CV29, but none that I know of watches your back like DecoderPro. I have a NCE PowerCab (one of the most user-friendly ways to program) on my workbench track. I do almost all my programming using DecoderPro on a MacBook Pro. That way, I don't have to keep track of CV 29.

Where can I get DecoderPro?

DecoderPro is part of a shareware package called JMRI. It is free to download and use. That said, I recommend that users donate \$10 per year. A cadre of volunteers worldwide

does all the work, but there are legacy legal expenses to be retired and ongoing expenses for web servers, etc.

Since JMRI works under runtime Java, it will work equally well under Windows, Mac OS X or Linux. The primary builds are done on Macs, so the possibility of injected Windows malware is very small. You may need to install, or upgrade, Java on your computer. Currently, JMRI is at version

The JMRI production version is at 4.2.1 (even second digit = production). There is a test version with updates 4.3.4 (odd second digit = test) also available. Be sure to download the version for your operating system (jmri.sourceforge.net/download). There are links to operating system specific installation guides on that page. For full functionality, you will also need a way of connecting your computer to your DCC system. Information about them also resides on that “download” page.

You may donate to JMRI via PayPal, go to jmri.org/donations.shtml.

What are “speed steps” and why does Bruce call them a language?

A bit more history from the geeks. Early on, the communication between the command station and the decoder over the track became a language, called (unfortunately) “14 speed steps.” As decoders evolved, a new language was needed, which became called “28 speed steps.” Even later, came “128 speed steps.” By then, the developers were a bit more clever, and made decoders and most command stations that could speak and understand the 28 language or the 128 language equally well. This is why you have settings of “14 speed steps” or “28/128 speed steps” in DecoderPro.

What happens if you set CV 29 to “14 speed steps” and try to talk to it with a DCC system set to “28 speed steps” or “128 speed steps”? On newer decoders, not much. They have been designed to listen and respond correctly to “14 speed steps”. With older decoders, the loco will run, sort of, and the lights will be doing some very odd things, changing every speed step. So, if you see this strange behavior [6], go check CV 29, I’ll bet that CV 29 does not have bit one (value of 2) set.

Folks always seem to have additional ideas to share. Just click on the Reader Feedback icon at the beginning or the end of the column. While you are there, I encourage you to rate the column. “Awesome” is always appreciated. Thanks.

Until next month, I wish you green boards in all your endeavors.

6. Video of my test loco with an older Digitrax (DH121) decoder. CV 29 is set for "14 speed steps" and my PowerCab is set for "28 speed steps". The headlight is on for even speed steps above 1.

