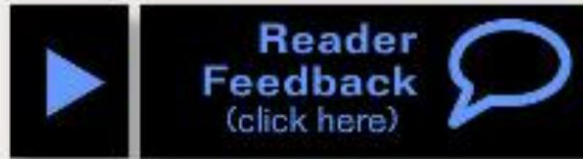




# Unraveling DCC Addresses



## **DCC Impulses Column**

by Bruce Petrarca

photos and illustrations by the author

## **How to talk to your locomotive!**

Decoder equipped locomotives can be like obstinate children. You have to talk to them using the name (address) they are prepared to hear. Children have a habit of deciding on a new name with a whim and not responding unless you use the correct name. Frequently this goes something like “Tom” suddenly becomes enthralled with that cartoon loco and insists on being “Thomas”. At least with decoders, you have the option to select the name you want them to respond to. Well, fortunately, decoders change their minds fairly infrequently, unlike like children. But it does happen. When it does, it helps to know what the options are.

As DCC systems have become more sophisticated, address confusion has diminished. However, a bit of understanding as to DCC history and applications may reduce throw some light in a few corners. There are only a few CVs that come into play, so knowing what they are and how to understand what they are telling you can help to troubleshoot errant decoders.

## **Types of Addresses**

There are three types of addresses:

- Short – stored in CV 1

- Long – stored in CVs 17 & 18
- Consist – stored in CV 19

Initially, DCC systems only recognized addresses from 1 to 127 and they were stored in CV 1. Storing a value of 0 in CV1 will force the decoder OUT of DCC mode and into using an alternate power source defined by CV 12. Usually that is DC mode.



**1: Loco with a short cab address of 4 – can run as a long address on NCE by programming it as a long address and selecting it as 04**

Quickly it was realized that limiting the system to 127 rather arbitrary numbers was a serious limitation and the concept of the long, or extended, (sometimes incorrectly called 4-digit) address came about. Why is “4-digit” incorrect? There are at least 871 3-digit addresses that fall in to the long address realm. Addresses from 128 to 999 must be **long addresses**, but only have three digits.

*Addresses above 128 must be long addresses, whether they have three or four digits.*

However, the designers didn’t make it as simple as it could have been and put two digits in CV 17 and the other two digits in CV 18. No, there is a complicated formula for what is stored in the two CVs so the decoder knows its name. NMRA Recommended Practice (RP)

9.2.2 allows long addresses from 0 to 10239. I don’t know of a system that currently addresses locos above 9999, though. More on this later.

The decoder needs to know what name (address) to respond to: the short address in CV 1 or the long address in CVs 17 & 18. This is sort of like my Tom and Thomas analogy above. Enter the all-purpose CV number 29. Bit 5 of CV 29 tells the decoder whether it is to respond to the short or long address. If bit 5 = 0, the decoder listens to the short address. If the decoder is to respond to the long address, bit 5 needs to be 1, raising the number in CV 29 by a value of 32. Thus, if you read CV 29 and get a value of 32 or more – frequently 33 to 39 – the decoder is responding to a long address. If it is less than 32 you know that it is responding to the short address.



**2: 268 is a long address on any system, even though it only has three digits**

There is a fine online calculator available to determine the values to put in to CVs 17 & 18, if you want to do it yourself. It also calculates CV 29, for those so inclined. Check it out (<http://www.2mm.org.uk/articles/cv29%20calculator.htm>). Thanks to the *2 MM Scale Association* in the UK for permission to recommend their site. You may use DecoderPro similarly: go to the basic panel and make your selections and go to the CV panel and see what the resulting values are.

The consist address (CV 19) is a bit less confusing. If CV 19 = 0, there is no consist address stored and the loco will respond to either the short or long addresses as dictated by CV 29, above. If CV 19 is anything other than zero, that will override whatever CV 29 dictates and become the operational name. So, now we have the option of “Tommy”, in addition to “Tom” and “Thomas”. Allowed consist addresses are 1 to 127. If the loco is to run in reverse when it is in a consist (think of locos running back to back), then 128 gets

added to the consist address, making allowable values for CV 19 to be 1 to 255, when the loco is in a consist or zero when it is not in a (decoder based) consist.



**3: Two diesel locos making up a consist – this is train 103 from the PCMRC layout after it has run around its train and is ready to run back home. Loco #2016 has a value of 103 in CV 19; #2035 has 231 (102 + 128) in CV 19 – see figure 7.**

## **How does this help me?**

Well, I always think that knowledge of inner workings and history helps, but only if you know how to apply it.

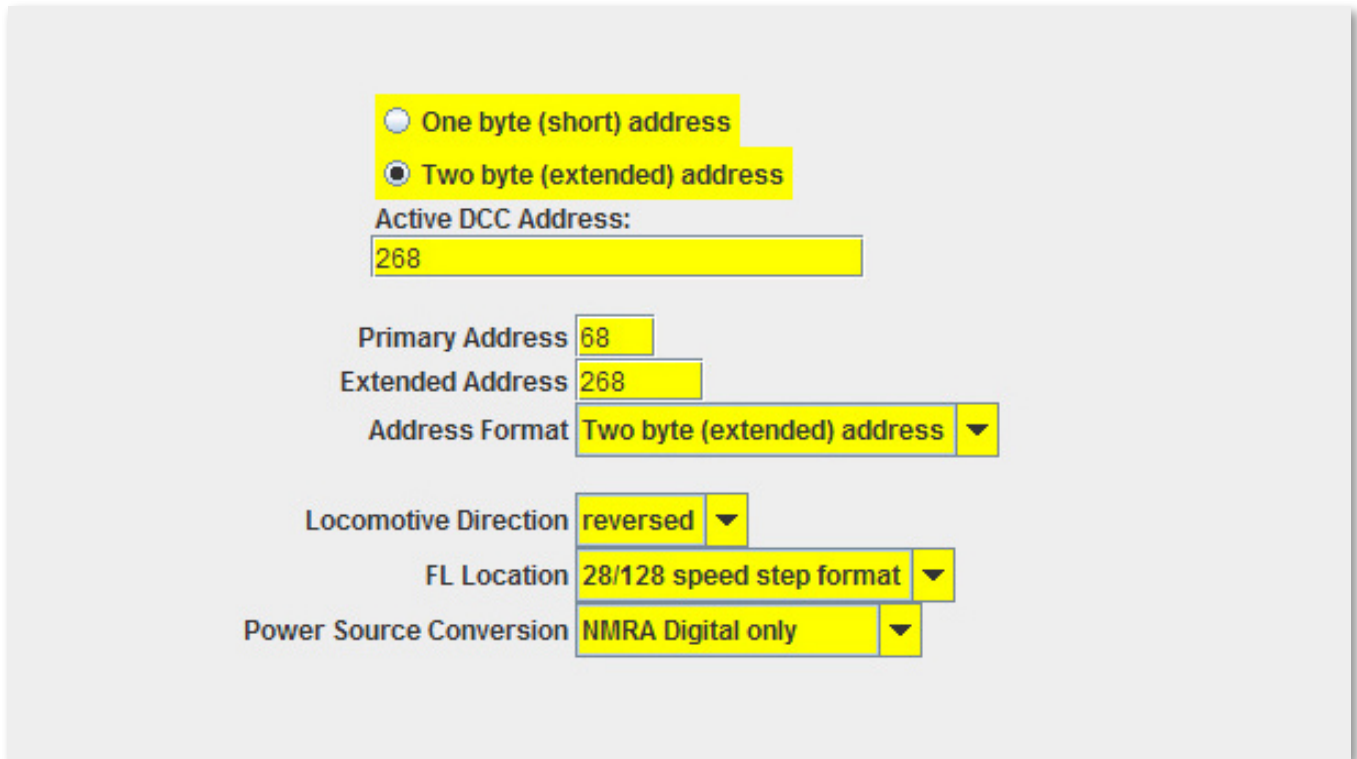
Let's look at a situation I had recently. One of my garden locos (2) was running just fine. There was a derailment and I re-railed rolling stock. Must have had a static discharge to the track that corrupted the decoder. The loco refused to run on its address (268) afterward. When I read CV 19 and found a non-zero number (166), I knew why I couldn't control it. It had changed its name and wanted to be talked to as 38 and run backwards

*If your loco isn't responding to direction, speed and function commands, try setting CV 19 to zero and see if order is restored.*

(38 + 128 = 166). Just for fun, I did run it on 38 before I reset CV 19 to zero. If your loco isn't responding to direction, speed and function commands and it is not intended to be in a consist, try setting CV 19 to zero and see if order is restored.

The rest of this information becomes a bit system specific, so let's talk about some systems. I'm not going to cover the entire history of DCC systems, but just discuss the current (2013) status of several systems. I'm not going to tell you how to set up your decoders for each system; just how they treat the addresses you set. Modern systems set CV 29 appropriately when you use them to set the address.

As frequent readers know, I favor DecoderPro to set up my locomotives. It will allow you to program any address from 1 to 127 as short and any from 0 to 10239 as long in the same decoder at the same time. You then tell it which address you want to use and it will set CV 29 accordingly.



**4: DecoderPro screen shot for the loco from figure 2. This is the basic pane setting short and long addresses and selecting one the long (extended) address. The loco direction is reversed, as this is an Aristo-Craft garden loco, where the direction of motion is reversed from the NMRA standards.**

Here we go, alphabetically.

## Digitrax

Digitrax reserves address 0 for running locos without decoders. While this mode is not recommended, it is still there. So, no decoders on address zero will work with Digitrax.

No matter how you select an address on a Digitrax throttle, if it is between 1 and 127, the system will speak to it as a short address. You cannot override this behavior. Similarly, an address between 128 and 9983 will be spoken to as a long address. Addresses from 9984 to 10239 are not accessible.

## ESU

The ECoS system (50200) can address locos from 1 to 9999. It considers 1 to 127 short addresses and those from 128 to 9999 as long addresses. Addresses from 10000 to 10239 are not accessible with the current firmware.

## Lenz

Lenz reserves address 0 for running locos without decoders. Lenz considers addresses from 1 to 99 as short addresses and those from 100 to 9999 as long addresses. Addresses from 10000 to 10239 are not accessible.

## MRC

While documentation for the Express and Elite systems state that they recognize long addresses from 1 to 9999, they don't include any information on how to talk to a long address less than 128. They also say that CV 29 is set automatically. So, I infer that they work just like the ESU ECoS.

## NCE

NCE allows you to decide whether an address in the lower range is short or long. Since NCE doesn't reserve address 0 for locomotives without decoders, even zero is allowed as a long address. NCE is the only system I know of that allows you to use the entire range from 0 to 9999 as long addresses. If you make all your locos run on long addresses, you have the entire range from 1 to 127 (short) available for use in consisting – see *Mr. DCC's Workbench* at the end of this column for more on consisting. Addresses from 10000 to 10239 are not accessible.

*NCE is the only system I know of that allows you to use the entire range from 0 to 9999 as long addresses.*

## The problem addresses: 100 to 127

Okay, these addresses can be a pain if you move between brands of systems. NCE will allow you to address locos in this range as either long or short. This allows NCE to run any decoder set up on any NMRA compliant system. Digitrax, ESU and MRC call these short addresses. Lenz calls them long addresses. So, if you set them up as short addresses, you will be able to move between any system but Lenz. If you call them long addresses, you will be able to use them on NCE and Lenz only. See, there is no way to satisfy everybody. I had a set of Santa Fe FTs that I finally moved from their cab number of 127

to 27 just to get them out of the “danger zone.” But I had to remember that I had done that, since it wouldn’t respond to its cab number exactly.

## My recommendations

I don’t like to try to remember what addresses I’ve used for my locos. The older I get, the harder it is to remember what I had for dinner yesterday, let alone these technical details.

I use the entire cab number for my loco address. This works, as I only model American railroads and all loco numbers have between one and four digits.



**5: Inputting a long address for loco #4 (figure 1) on a NCE PowerCab by using a leading zero**

For my friends who model railroads with more than four digits in the cab number, I suggest that you use the same four digits all the time – the first four or the last four, but the **same** four.

The ESU ECoS system helps with these longer loco identifiers. The system will remember some 16,000 locos and you can use many alpha-numeric characters as the identifier. When you set up the database (6), you can call the loco almost anything you wish and can even load a photo of it. The system will associate the NMRA compliant address you select with the loco name you input. Calling up a loco is as simple as walking through the database (possibly filtered by loco type) until you find the loco name and photo you want. Then with a button press, you have it selected.



**6: ECoS system loco selection pane, calling up SP NW2 1315 on address DCC address 1315**

I use only NCE systems at my house, so I make all my locos have long addresses. When I'm programming an address of 100 into a loco, I give the system the address of 0100 as I program it and the command station sets the correct number into CVs 17 & 18 and sets CV 29 accordingly. All I have to do is remember to put the leading zero into the loco number when I'm calling it up to run it.

For a look at consisting methods, keep reading for *Mr. DCC's Workbench*, to follow after a short commercial break.

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.

Until next month, I wish you green boards.

# MR DCC'S WORKBENCH

## A short guide to consists

What is a consist? I was discussing this column with my wife, Linda, and she said, “Do your readers know what a consist is? I really don’t, but I hear the term all the time.”

So, lets get this out of the way. Prototype practice refers to the make up of a train as the consist. Model railroaders refer to two or more locomotives that are running together as “a consist” or as being “consisted”.

Okay, you want some locos to run together. How do we do this? There are several ways:

### Basic Consisting – brute force

If you have a set of locos that you want to run together, you can give all the decoders the same address (whether it is a short or long address). If you have a loco to run backwards, change its direction of operation by adding one to CV 29, if it is even or subtracting one, if CV 29 is odd.

This doesn’t require any special features in the decoders and creates a consist that is virtually bulletproof. It will work on any system and doesn’t require any special input to the system. Just dial it up and run. It only uses one location in the system memory, no matter how many locos are in the consist. This will work with any collection of decoders made, as long as all the decoders in the consist understand the same speed step setting. This ever

*While command station consisting is easy, there are some drawbacks, too.*

The downside is that the setup is a bit complex, having to set the addresses and running directions in each of the locomotives. Also, it is not easy to add or subtract a locomotive from the consist, so you can’t easily run one of the locos outside the consist.

### Advanced Consisting – decoder based

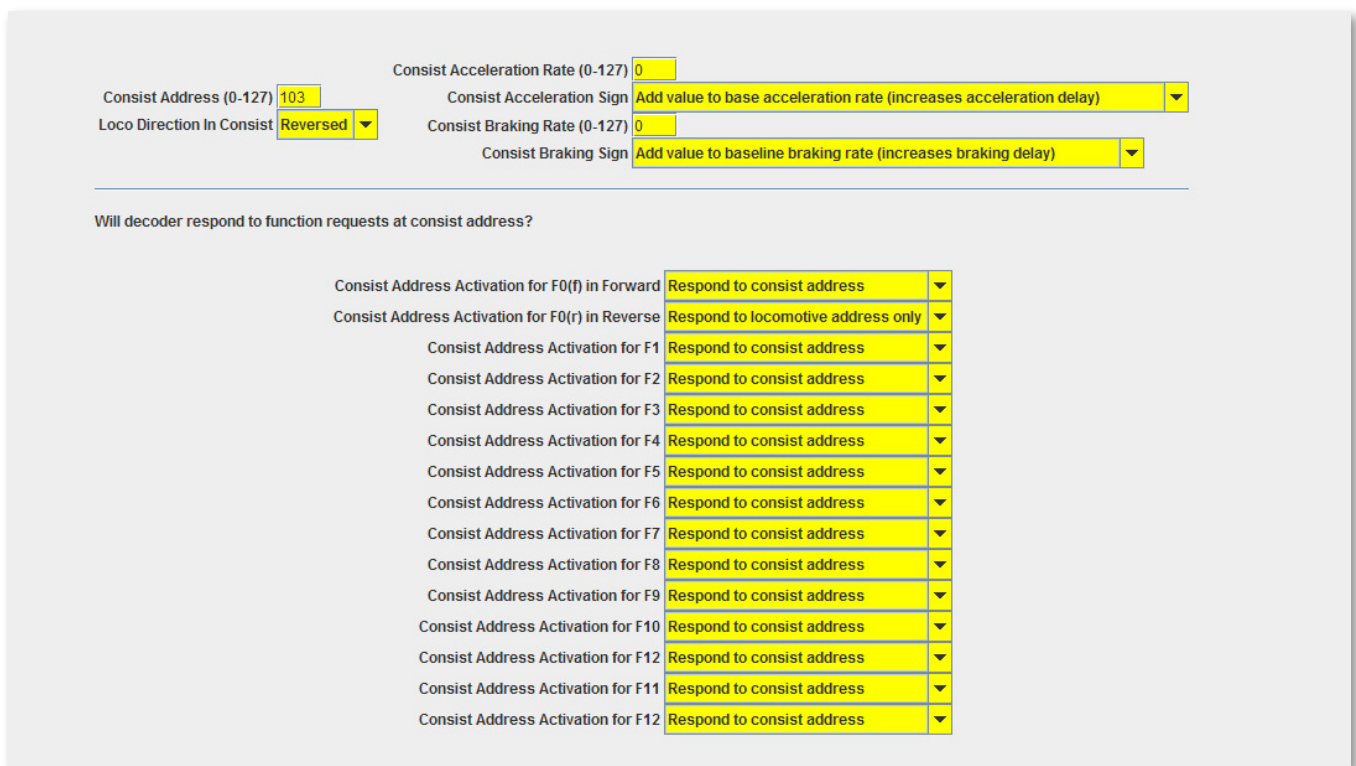
Modern decoders support the use of CV 19 as a way for the decoder to know that it should run on a consist address and which direction it should run. Most of these decoders also support the use of CVs 21 & 22 to tell each locomotive which functions it should respond to. This is a most elegant way to run.

For example, we have double headed power on the through trains on our club layout ([www.pcmrc.org](http://www.pcmrc.org)). They have train numbers that are less than 127. So we’ve used the train number as a consist address and programmed it into CV 19 – see figure 7 for the rear loco on train 103. If the loco runs backwards in the consist, we tell the decoder that

in CV 19, too. Then, in CVs 21 and 22, we tell each loco what function commands they should respond to. For example, we tell the loco at each end of a doubleheader not to respond to the F0R (reverse light) function. That way, we don't have the lights on between units.

*Decoder based Advanced Consisting is a most elegant way to run consists.*

Units that are set up this way take only one system location and they can be moved between systems with impunity, just like the basic consisting. Once CVs 21 and 22 are setup, locos can be added to or taken out of the consist by merely programming CV 19 on the main. However, older decoders may not support this consisting method.



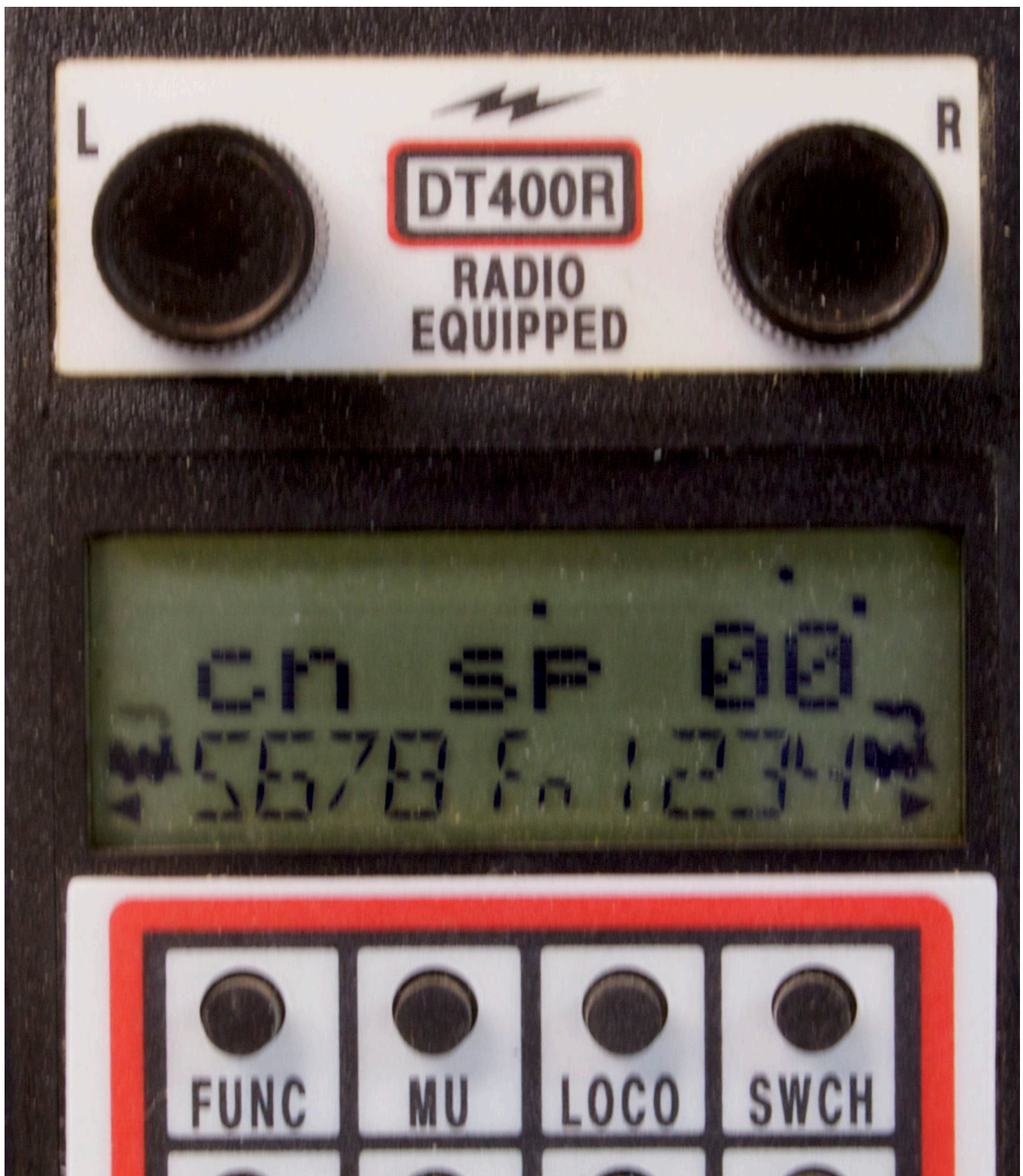
7: DecoderPro screen shot – setting up CVs 19, 21 & 22 within the Consist panel – loco # from the PCMRC layout.

## Command Station Consisting

Here is where things get more complicated. Some command station manufacturers offer a quick way to set up a consist (or multiple unit block – MU). While command station consisting is easy, there are some drawbacks, too. Let's look at two systems:

### Digitrax

Digitrax uses what it calls UniVersal (yes, that's the way they capitalize it) consisting. It is easy to set up on their DT40x series throttles.



**8: UniVersal consisting on a Digitrax DT400 throttle – 1234 is in the lead with locos facing away from each other**

You select the lead loco on the right knob and the next loco on the left. You adjust the direction of each loco until both are going the same direction on the track. Then you press the MU button then the + button. To add more locos, select the new loco on the left knob

and set its direction and repeat the MU and + button presses. The command station remembers which locos are running together and sends the appropriate commands to each loco. To remove a loco from the consist, select the consist on the right knob and the specific loco to be removed on the left knob and press MU then the – key.

While this is simple to use, it takes up a system slot for each loco in the consist, so if you have a limited system like the Zephyr, you can run out of slots quickly. Also, the consist is unique to the system where it was created. If you set it up at home and then take it to the club, you have to start over and set it up again. Since there is no memory of the consist in the decoders, you don't have to do anything special on the second system to undo what was done on the first. But you do have to start over educating the new command station.

## NCE

NCE has what it calls Advanced consisting. It automates the setup of an Advanced (decoder based) consist. If CVs 21 & 22 are already set up, they will help control the functions the decoders respond to. It uses a single slot for the consist address, which it assigns automatically.

However, here is the slick part. If you have a consist with 1234 on one end and 5678 on the other, you don't need to know the consist address. If you select 1234 and say "go" the consist will move together with 1234 in the lead. If you reach the end of your turn and run around the train and get set to run back, then you select 5678 and the train will run forward (the opposite direction from earlier) when you select forward.

You can press the Kill Consist buttons and then enter 1234 or 5678 and the consist will be removed, as long as the locos are still on the layout.

Consists set up this way and moved from layout to layout can become problematic. I recommend that you kill the consist on the layout where it was created before you remove it. If you forget and move the locos without killing the consist, then take the locos to the programming track and set CV 19 to zero on all of them. You can then use them solo or rebuild the consist on the new system.

With either the Digitrax or NCE scenario, loss of command station memory (changing battery, for example) will drop the consist information. In this case, it is just as if you took the consist to a new layout, you start over from scratch.

This is why I favor **Advanced Consisting – decoder based**. It is system independent and transportable. It only uses one system slot for the consist, no matter how many locos are in it.