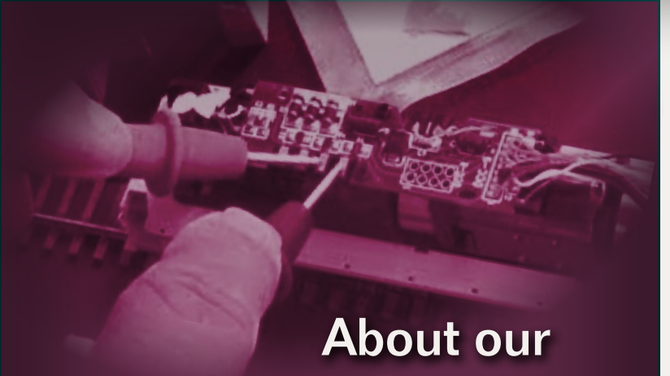


About our DCC columnist

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

Click here to learn more about Bruce.

DCC Impulses: DCC System Comparison Part 2

DCC Systems from a User's Perspective

Reader Feedback (click here)

More about what's really inside DCC systems ...

Last month (model-railroad-hobbyist.com/magazine/mrh-2012-09-sep/dcc_impulses) I started analyzing the difference between Digitrax and NCE systems from my perspective.

We pretty much covered the throttles and starter systems there. If you didn't read that, I suggest you start with it, as some of the threads we will discuss here began there.

Analyzing some of the internals may not be as sexy as the throttles and what you can do with them. However, you may find something here that you didn't know about your system or something to help your choices, based on the "givens and druthers."

Folks who read last month's column may realize by now that I'm taking them in alphabetical order, so as not to play favorites.

System Amps

Each manufacturer looks at amperage ratings differently. Consider if you will, their five-amp systems.

1

1: Digitrax' five-amp system box – photo courtesy of Digitrax.

DCC Specialties, in the process of specifying their MF615 transformer, wanted to assure that it would work with all systems on the market. They tested several samples of both manufacturers' system.

Digitrax may put out five amps for a fraction of a second. A large sample of their boosters shut down with continuous current loads of about 4.5 amps. When loaded just below their shutdown current, the boosters ran fine for extended periods with adequate ventilation.

NCE doesn't shut down until somewhere north of six amps, and will supply 5+ amps all day with adequate ventilation.

As a side note, Digitrax boosters don't like surge current. Surges occur when the booster is first turned on or recovers from a short. A few sound-equipped locos will draw enough surge current so the booster won't reset. It will start, see the surge, shut down, wait, start again, see the surge, shut down, etc.

2

2: NCE's five-amp system box.

Remember, the booster shutdown feature protects the booster more than it protects your rolling stock. Circuit-protection boards protect your rolling stock. The PSx series were designed to help Digitrax boosters over the trauma of starting a bunch of sound locos. Be sure to select what they call the "weak booster" setting by jumper or CV when installing a PSx on a Digitrax system.

I recommend a circuit-protection board downstream of any booster larger than a couple of amps. I even

have a PSx on my PowerCab (two-amp) system.

3

3: PSx Circuit Breaker – photo courtesy of American Hobby Distributors.

Network

DCC system manufacturers generally design their networks to enhance their system philosophy. This makes them incompatible among different manufacturers. Digitrax and NCE are about as far apart in their network architecture as any two manufacturers out there.

Digitrax uses one network for everything. Called LocoNet, it uses 6-conductor direct-wired RJ-style cables.

NCE uses two networks.

Its Cab Bus runs around the layout connecting all the throttle panels that provide a place to plug in to control trains.

The Control Bus connects the command station to boosters. If you use only one booster – the one built into the Power Pro five-amp system – your entire Control Bus will be a short cable that NCE supplies going between two connectors on the system box.

NCE uses six-position RJ cables for the Cab Bus and four-position ones for the Control Bus. This makes incorrect cross wiring difficult to do. They need "direct wired" cables, not telephone cables.

Okay, that covers the physical differences, what is actually going on with the networks?

Digitrax' LocoNet features Ethernet type communication. Any device on the LocoNet can control or retrieve data from any other device. This includes boosters, throttles, interface boards, signals, etc.

NCE's Cab Bus contains only data necessary to run between the cabs and the command station on one pair of wires and +12 volts and ground on another pair. The third pair is used for track power, but only on the cable between the PowerCab and its PCP power panel.

NCE's Control Bus has DCC data on one pair of wires and two signals that are no longer used by NCE on the other pair.

Throttle Panels

You need places to plug your throttles into your DCC system. Throttle panels are usually mounted strategically around the layout on the fascia.

I highly recommend using the panels manufactured by your DCC system designer. They know what is needed to function reliably with their system.

The ***Digitrax UP5*** is the only offering for their system.

It features three connectors behind the panel and two in front. This allows

4

4: UP5 LocoNet panel from Digitrax – photo courtesy of Digitrax.

T-style wiring without the need for extra splitters. The UP5 features heavy-duty RJ-style sockets. They are much more reliable than the phone-style RJ connectors available at your local hardware store.

If you connect track power to the two terminals on the rear of the UP5, the LED on the front will show track status.

The UP5 includes a power jack that allows a 12-volt DC power supply to feed power to any throttle plugged into the front. While this will not recharge the batteries in the throttle, it will keep them from being discharged. If the auxiliary power is kept on 24/7 the throttle batteries won't run down, as long as the throttles are plugged in.

There is a connection provided between the two RJ connectors on the rear. If it is connected between various UP5 panels, the auxiliary power applied to one will be available to all, keeping the plugged-in throttles from discharging. This is important, as the Digitrax radio throttles have no way to be shut off, short of opening the battery door.

Street price for the UP5 is under $15.

NCE offers several options for throttle panels. They all have a street price around $16.

5

5: NCE UTP, their basic panel.

The ***NCE UTP*** is similar to the Digitrax UP5, but with fewer features. It has four RJ connectors: two each, front and rear. Like the UP5, these connectors are heavy-duty to withstand the rigors of plugging and unplugging throttles from them.

The UTP also has a power jack for a +12 volt DC supply to augment the power in the Cab Bus. NCE recommends providing this power every half-dozen or so panels.

NCE doesn't need to supply backup power to the throttles when they are idle. The NCE radio throttles have a front panel shutdown capability. Also, if they don't hear from the command station for a few minutes, they shut themselves off.

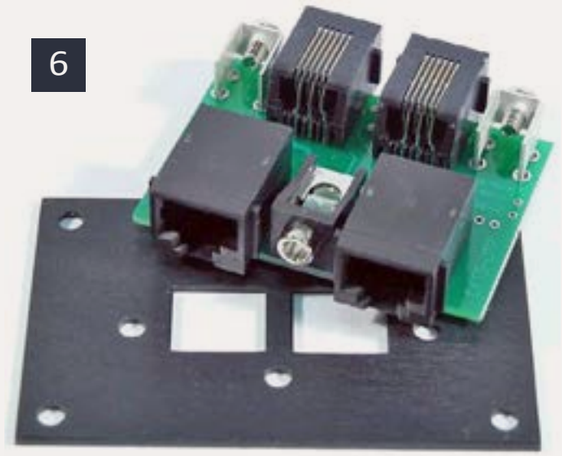
To enhance data reliability, especially on large layouts, NCE offers the ***UTP-Cat5***.

The front panel includes two RJ jacks, just like the UTP, but the rear is wired with Ethernet Cat-5 cable. These boards may be jumpered such that all signal and power wires are duplicated, reducing the loss from long runs and increasing reliability due to the use of two parallel contacts in the connectors.

Cat-5 cables, being shielded with larger-than-RJ wire, are already less susceptible to interference and resistive loss.

NCE makes an adapter board to transition from the RJ Cab Bus on the command station to the Cat-5-style bus on the layout.

6



6: UTP-Cat5 Cab Bus panel from NCE – photo courtesy NCE.

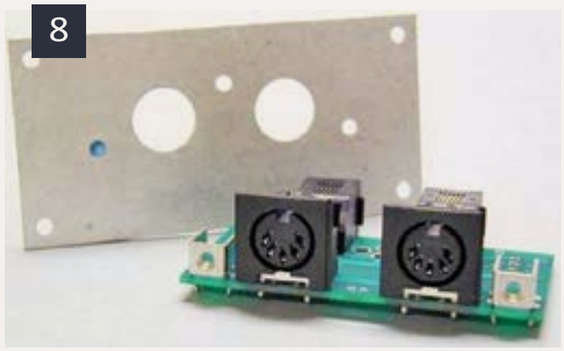
The NCE ***UTP-CAT5 Adapter*** has a street price about $8. Typically one is all that any layout will need.

7

7: UTP-Cat5 adapter from NCE – photo courtesy NCE.

In their bid to enhance the reliability of the throttle connection, NCE offers the UTP-DIN. It is a panel with two RJ connectors on the rear and a pair of DIN-style connectors on the front.

8



8: UTP-DIN Cab Bus panel from NCE.

Clubs and other high-usage groups usually prefer these panels. They are willing to deal with the higher insertion force of the DIN connectors for the long-term reliability over RJ connectors. NCE offers optional DIN cables to work with their throttles and these panels.

Delete loco from roster

When you are done running a loco, it is good housekeeping to tell the system that you are finished.

Digitrax requires that the user remember to "dispatch" the loco.

NCE's system handles these chores automatically with no user intervention.

Wireless systems

Folks seem to love the freedom of wireless DCC, walking around the layout without plugging in. Even in my small HO switching layout, I prefer not to be worrying about a cable all the time.

Infrared wireless operation

As I mentioned last month, the ***Digitrax*** DT series and the UT4 series of throttles have an infrared wireless mode.

Because it is line-of-sight, like a TV remote, I find infrared less satisfactory than radio wireless. It is the only game available in countries where the radio system is not approved. The receiver for this system is the Digitrax UR90. It looks very much like the UR92 (10). The UR90 has a street price around $40.

NCE does not offer infrared wireless options.

Digitrax simplex radio

For years Digitrax had the upper hand in radio due to their system design. Their throttle talks to the system only when it has something to say, like a change in loco speed.

9

9: UR91 simplex radio receiver from Digitrax – photo courtesy of Digitrax.

So, Digitrax's original radio system was simplex: the throttles talk and the system listens. This allowed for higher transmitter power without issues around battery life or the "average transmitter power" regulations for non-licensed operation.

In order for the system to talk to the throttle, the throttle must be plugged into the LocoNet. The throttle needs to listen to the system only when selecting or dispatching a loco or when programming a loco. New Digitrax sets come only as duplex radio. Separate throttles and control panels continue to be available for the simplex system. The simplex radio system operates in the 900 MHz band.

NCE Radio

NCE's system design requires an ongoing dialog between the throttle and the command station. This is called duplex communication. NCE radio also operates in the 900 MHz band.

A decade ago, NCE's radio was inferior to Digitrax' in terms of range and reliability. There were some design and technical issues behind these limitations.

NCE kept working on it.

With the release of radio version 1.5, they have a long-range system with rock-solid performance.

The fact that NCE required duplex communication gave their users an advantage in the radio world, even when they were suffering the range limitations. They could acquire, release and program locos wirelessly.

Digitrax duplex radio

Digitrax wasn't one to let NCE have this advantage and they announced their own duplex radio system a few years ago. There have been some issues with battery life and other shortcomings of the Digitrax duplex system. Digitrax has been working on it and things are improving. Digitrax allows user installation of new duplex radio software for the fascia-mounted transceiver and their throttles.

The Digitrax duplex system operates in the 2.4 GHz range, along with Bluetooth devices, cordless phones, WiFi and microwave ovens. I don't believe interference from these other devices on similar frequencies has anything to do with the shortcomings of the Digitrax duplex system.

All new Digitrax radio sets come with the duplex, not simplex, pieces.

There is some confusion with the two Digitrax systems. They are not interchangeable with each other. However, they can operate shoulder-to-shoulder (9).

Digitrax radio hardware

Digitrax uses a fascia-mounted ***UR-91*** receiver (street price about $120) with its simplex throttles, those

10: UR92 radio transceiver from Digitrax – photo courtesy of Digitrax.

having an R as the last character in their part number, such as DT402R.

Digitrax throttles with a D suffix, such as the DT402D, are for the duplex radio system and require a ***UR92*** radio transceiver (street price about $130).

While these two fascia-mounted units look very similar, especially after they are mounted, they are very different.

The strength of the LocoNet comes to the fore in that you can have as many of either unit that you want on your system. User's throttles will talk to the base unit closest to them and that unit will interface with the command station. So, you can have a mixture of R and D throttles on your system, as long as you have at least one UR91 and one UR92 base unit connected to the LocoNet.

One note on the UR91 receiver (9). There are two green wires between the two RJ connectors at the rear of the board. They are the receiving antennas. For maximum range they should not be twisted together, but extended in a V like the old TV "rabbit ears" antenna, remember them?

NCE radio hardware

Converting to NCE radio is as simple as plugging a NCE RB02 radio base unit (street price about $125) into your Cab Bus. If you have a radio throttle, you are ready to go.

To achieve maximum range, the radio base unit should have its antenna vertical with a minimum of obstructions between the throttles and the antenna.

Yes, operators' bodies count as obstructions. So, the best place is upside down on the ceiling in the center of

11: RB02 radio base unit from NCE.

the layout. If you have a dropped ceiling, this is easy – punch a hole in one of the tiles so that the antenna can extend below the tile and run the Cab Bus cable above the tiles. I'll have some mounting suggestions in this month's SMP sidebar on page 42.

With version 1.5 of the NCE radio system, range has improved so much that the new NCE radio throttles have no external antenna. The only way to tell them from the non-radio throttles is by their extra red LED on the top of the case. Older NCE radio units have an antenna sticking out the top of their case. Either version will work just fine with the RB02 radio base.

When they were having issues, NCE came up with what they called a radio repeater (***NCE RPT1*** – street price about $100) to augment the range. With the version 1.5 radio system, the need for this is greatly diminished. However, they are still available for those pesky situations where you have a dead spot on the layout. They look like and are cabled directly to the RB02. They are not connected to the Cab Bus or Control Bus. They mount just like the radio base units. See this month's SMP sidebar on page ?.

Radio interference

Sharp-eyed readers will see that both the Digitrax simplex system and the NCE radio system are in the 900 MHz band. Yes, they are on the same frequency. As I learned with the Litchfield Station layout, if you have both in close proximity, the NCE system probably will work just fine – you may see an occasional missed command. The Digitrax simplex system probably will never hear its throttles calling to it.

Throttle Addresses

For the command station to keep track of what to do with each loco in the roster, it needs to know who is controlling it. Associating a throttle address with a locomotive address in a database or table, called a roster, keeps this straight. Okay, but that means that each throttle must have a unique name or address. Once again, Digitrax and NCE have different ideas of how to do this.

Digitrax uses a four-digit number that is factory preset to some seemingly random number. It can be read and changed following the instructions in the manual for the DT series. The UT series can be set with the JMRI software. There are a lot of numbers in this scheme, and Digitrax seems to think that it is unlikely that the same number will show up twice on any particular layout. Both Digitrax clubs that I've been associated with have had to go through all of the members' throttles and record the addresses. Some duplicates were found and reset. Once this was done, some of the "gee, that's weird" issues vanished!

NCE, on the other hand, allocates a finite number of throttle addresses (64) and expects the users to adjust

them as needed. Toward that end, they make it very easy to change them – very much like how Digitrax expects you to select a loco with its UT4 – by holding down a button when you plug into the fascia panel.

Consisting

One of the great things with DCC is the ability to run locos together in a consist.

Basic consisting has been around since the early days of DCC. Just assign the same loco address to two or more decoders and let them run together. It is very easy and effective. Makes hostling very difficult. Basic consisting has nothing to do with the command station and will work on any system or decoder, even the most basic.

As systems became more sophisticated, a new method emerged where the ***command station*** kept track of what you wanted to run together. This made for easy operations, as the hostler could run the locos out of storage, assemble a train and consist them with a programming-style throttle. This takes a roster entry (or slot) for every loco, but doesn't require any special features in the decoders. This is the primary method of consisting on Digitrax systems, which they call UniVersal Consisting. NCE also supports it, calling it "old-style" consisting.

12: Two locos consisted on Rob Biddison's Moffat Line.

Decoder-based consisting is the way that decoder manufacturers, such as SoundTraxx, recommended today.

This requires a decoder with the consisting feature (CV19) supported. It is most effective if the decoder also supports CV21 and CV22, which are designed to tell the decoder which commands being sent to the consist it should respond to.

CV19 is the consist address. It can be any two-digit address (1 to 127). Using three- or four-digit addresses above 127 for your locos will help prevent overlap and confusion, even if you need to add leading or trailing zeros.

Digitrax does not automate decoder-based consisting. You manually set the CVs and command the group from the consist address. If you want to change the functions on any of the locos in the consist, you can do so by addressing that loco by its own address – a good use for the two sides of a DT400 series throttle. If your decoders support CV21 and

CV22 consist function mapping, you probably will be able to access the functions from the consist address.

NCE automates this process with their "advanced" consist operation.

On the ProCab, NCE walks you through setting up the consist, including what is the lead loco, the trailing loco and intermediate locos. Once the consist is established, you can run it from the consist address or the lead loco's address or the trailing loco's address. The advantage of using a specific loco's address is that your function commands will go to that loco.

Imagine an ABA consist. You use one of the A units' address, depending upon which direction you are going. The headlight and other functions sent while you are running the loco will go only to that A unit, not the trailing A unit. So, on a turn, you can run out commanding the lead A unit and control its headlight, bell and horn. Coming back, with the other unit in the lead, you can address the consist through that unit's number and control its headlight, bell and horn.

Fast clock

Model railroading is about compression. We compress space, so why not time?

Operations folks frequently do exactly that with what they call a fast clock. Running as much as 12 times faster than reality, a fast clock allows modeling a whole shift or an entire day in a reasonable-length operating session.

13: NCE fast clock display from Logic Rail Technologies – photo courtesy of Logic Rail Technologies.

Both Digitrax and NCE have a fast clock built into their systems. Logic Rail Technologies sells external displays to wall-mount so everybody can see the time.

The programming throttles from both vendors allow the engineer to have the fast clock time displayed on his throttle.

The DT400 series from Digitrax, requires the user to press the CLOC button to see the time.

The ProCab or PowerCab from NCE has enough display room to show the fast clock as one is running the loco.

Turnout control

Some folks want to throw turnouts from their throttles. So let's look at how each system handles this task.

Digitrax's DT series throttles are their only offering that will control turnouts. I prefer the DT400 series for turnout control.

14: DT402 from Digitrax – photo courtesy of Digitrax.

You press the SWCH button and the cab becomes a turnout controller and doesn't revert until you tell it to do so. You can still control loco speed with the knob, but cannot access any functions, such as lights, while in the SWCH mode. It takes fewer keystrokes to activate a series of turnouts than either NCE throttle.

Once the desired turnout is selected, the T and C buttons (two with silver colored background at the bottom of the throttle) select Thrown or Closed.

The ***NCE ProCab*** (and the PowerCab, too) requires a few more keystrokes than the Digitrax DT400 series to do the same job.

15: ProCab from NCE – photo courtesy of NCE

Once one becomes proficient with the NCE system, it is usable, just a bit more cumbersome – about half again as many keystrokes as the DT400 series. You forgo any loco control, including speed and direction, while you are in entering the keystrokes necessary to move a turnout as it comes from the factory.

The ***NCE Cab06*** is the only "user" level throttle from either manufacturer that will throw turnouts, as it comes from the factory. The other intermediate

16

16: Cab06 from NCE – photo courtesy of NCE.

throttles can be programmed to do so on individual layouts.

Here you pay for the small keypad. You need to use the shift key to change the function of some of the buttons to accomplish the job. On a test job, the Cab06 took twice as may keystrokes to spot a car on a spur as the DT400 series. Again, you cannot change a loco's speed or direction while you are controlling a turnout.

What system do I use?

What I personally use should have no bearing on your choice.

My grandmother said, "It's a good thing folks like different things, or every woman would be in love with my husband."

Both companies make good systems. As I said in last month's column: "The 'givens & druthers' come to the fore. Some things you must have and others you are willing to forgo. All systems seem to have some drawbacks."

The three closest layouts to me use Digitrax, including our club, where I'm currently the President. They are all operations-oriented layouts, so I spend a lot of time with a Digitrax throttle in my hand, and I own a UT4R for that reason.

My choice was NCE for my HO and Fn3 layouts. Here's why:

- I don't plan to throw many, or any, turnouts with DCC.
- I want the 10-amp power for my Fn3 layout.
- NCE radio version 1.5 works as well as any non-licensed system can, with enough range to cover my yard and no need for a lot of Cab Bus wiring to acquire locos.
- There are no wires or antennas extending out of the current NCE radio throttles.
- I like the ergonomics of the ProCab and the Cab06.
- The railroads I model are all dark territory, so signals are not an issue.
- The PowerCab makes a very useful tool on my workbench, with a USB adapter connected to JMRI on my computer.

I recommend you look at your own "givens and druthers" and make up your own mind.

For example, if you are planning a lot of signaling or DCC turnout control, you would probably be happier with the Digitrax system. The SurroundTraxx system currently supports only Digitrax Transponding, which is easier with a Digitrax system.

I've worked very hard to lay out the positive and negative aspects of both systems, as I best know them.

Hopefully you find this data useful. If so, please click the Reader Feedback button here and vote "awesome". You can also leave your comments or questions on the blog by pressing the same button.

I wish you green boards until next month! ☑

Reader Feedback
(click here)

SMP* from Mr. DCC – NCE Radio Base Mounting Ideas

The Digitrax radio base units mount in the fascia, just like regular throttle panels. This leads to a mixed bag of results: easy to mount, but hard to optimize. Low to the floor and surrounded by electronics and bodies is not the best place for radio reception.

NCE's RB02 radio base unit allows flexibility of mounting. This allows the user to optimize radio reception, if necessary.

Firstly, radio signals like to have an antenna above a ground plane, so mounting the RB02 on a metal plate, or even better, through a metal plate is very good. I know folks who have used old aluminum pie pans to make a ground plane. Or you can update your electric stove's drip pans and use one of the old ones – it already has the hole.

If you have a suspended ceiling, you can really optimize the reception. You can just punch a small hole in one of the tiles near the center of the layout and stick the antenna down through the hole. An aluminum pie plate on top of the tile between it and the RB02 provides a ground plane.

This option also works with a dry-wall ceiling, but folks are reluctant to punch holes in their ceiling. I show a photo of this just because we had a sample piece of wallboard and didn't have a ceiling tile.

Starting with these ideas, you can let your imagination run wild. Just remember, the best reception occurs when the antenna is vertical (pointing down or up, doesn't matter) and high up (keeps the bodies out the path) and near the center of the operating area.

** SMP comes from the Amtrak world and is short for Standard Maintenance Procedure.* ■

17: NCE RB02 with a pie pan ground plane.

18: NCE RB02 through ceiling from above.

19: NCE RB02 through ceiling from below.