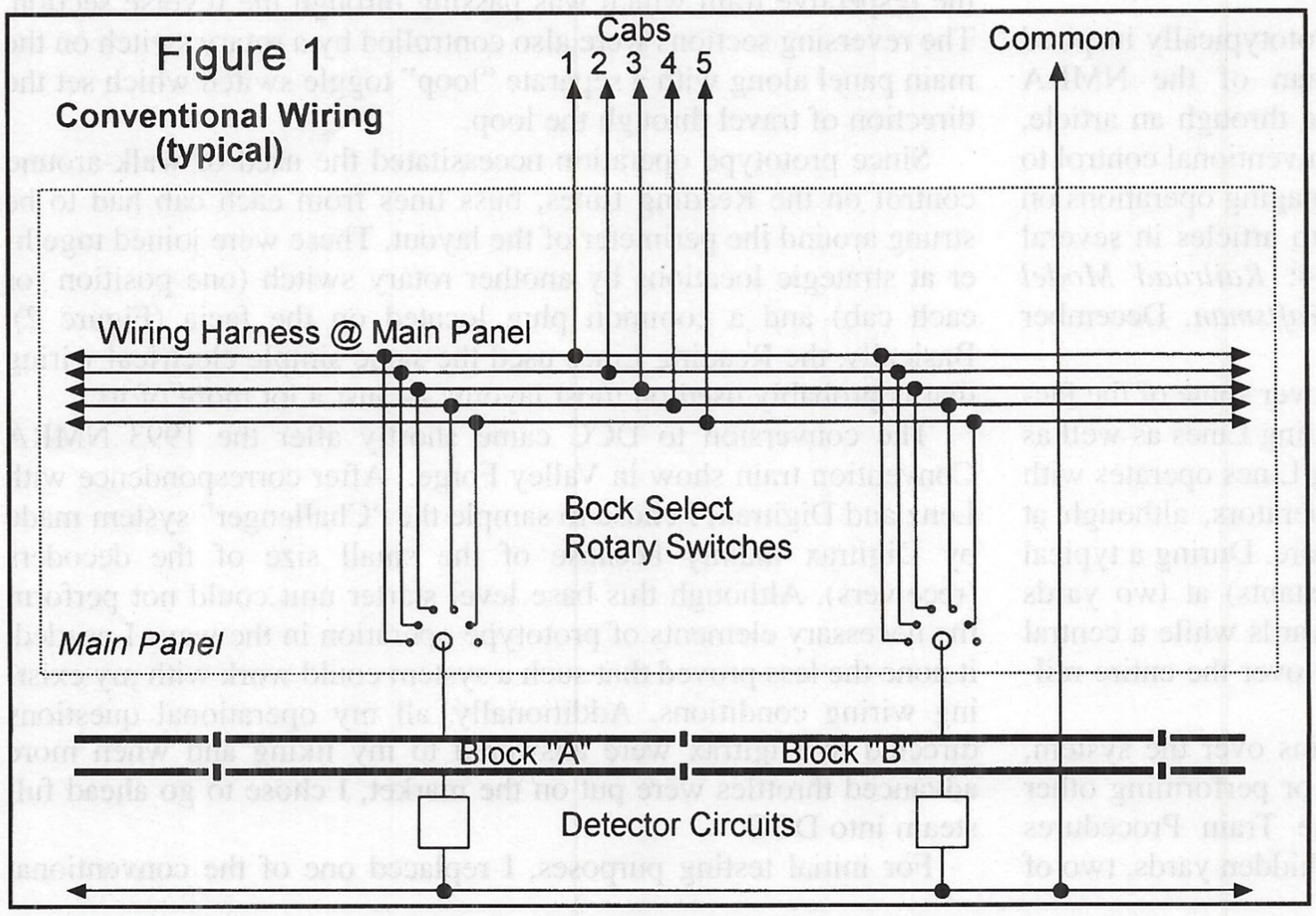
The Reading Lines goes DCC

Meets like this are easier on operators with DCC.



BY BILL GRUBER, MMR,
PHOTOS AND DRAWINGS
BY THE AUTHOR

Over the past several years, many articles have been written about Digital Command Control (DCC) and the NMRA Standards and Recommended Practices for DCC. While the need for these standards would greatly benefit consumers and manufacturers alike, few, if any, articles describe how to "convert" from conventional throttles and power supplies to DCC (or for that matter, any of the other numerous command or carrier control systems).

My knowledge of electronics comes only from the pages of model railroad publications and the building of several "projects" from these pages. While I admit to knowing how some electronic components work, this wouldn't have been possible without the

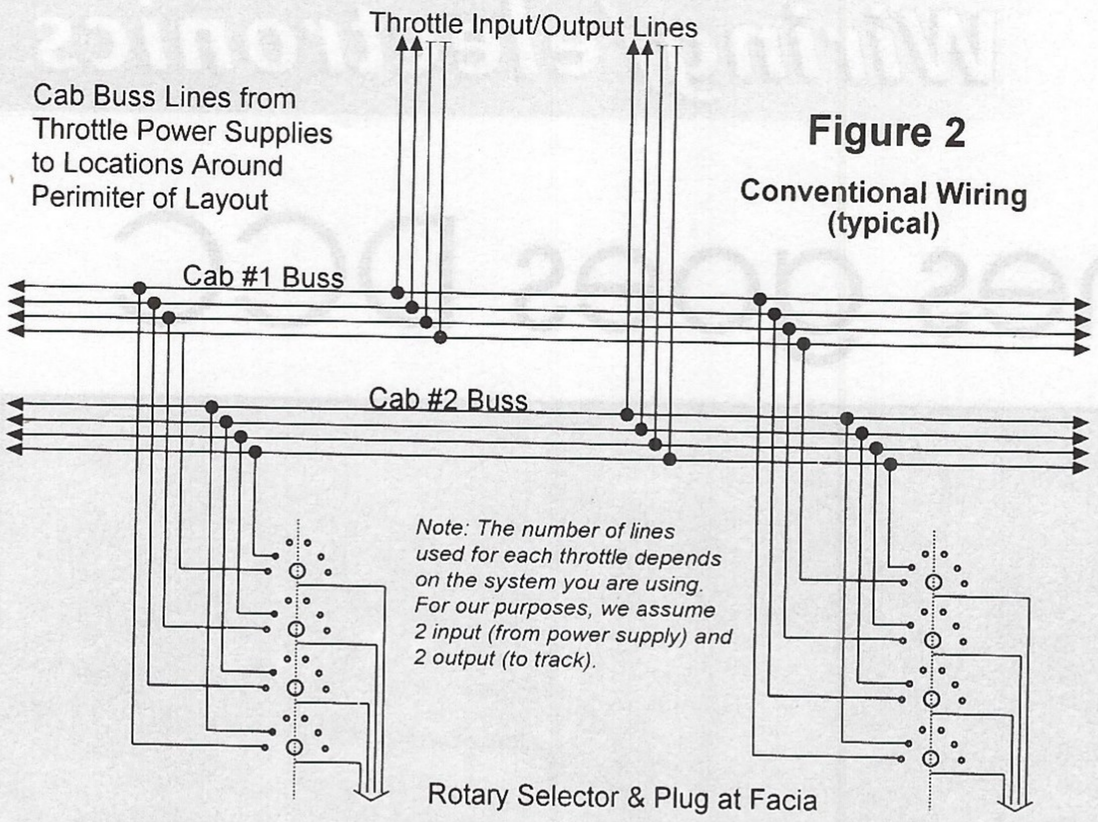
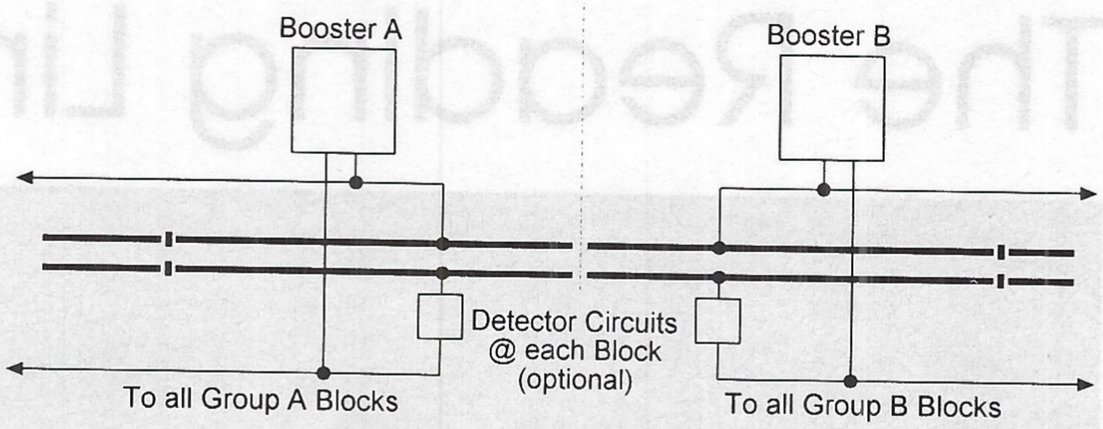


Figure 2

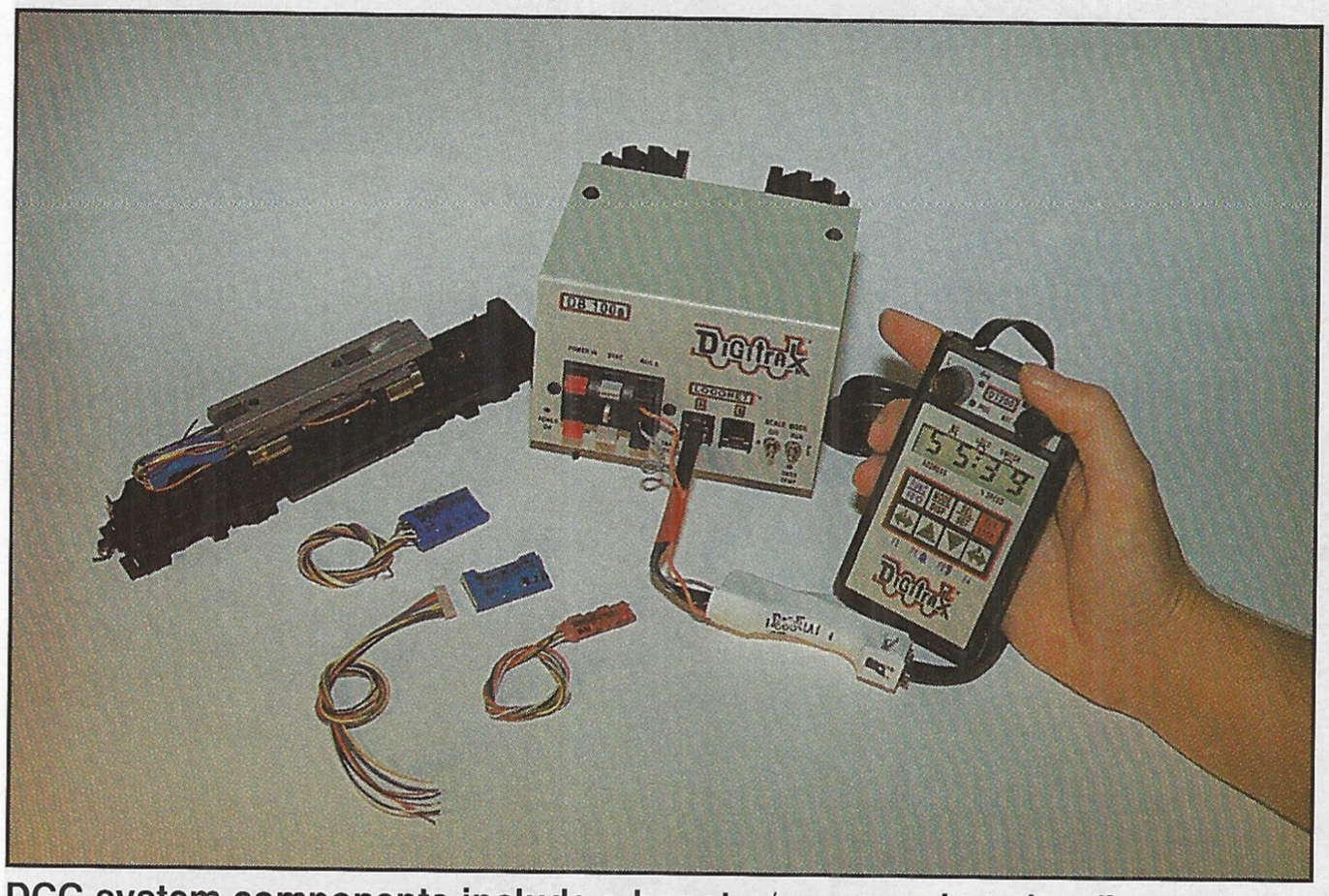
Conventional Wiring (typical)

Figure 3

DCC Wiring (typical)



"Groups" of Blocks Isolated from Each Other



DCC system components include a booster/command station (Large box), decoders (small blue modules), and a hand-held throttle. Photo courtesy of Digitrax

hobby of model railroading and the advances it has made over the last decade or so. Fortunately, very little knowledge is needed to convert from conventional control to DCC.

Since my Reading Lines is a rather large, prototypically inspired and operated railroad, Ron Gaines, chairman of the NMRA Technical Department, suggested I demonstrate through an article, just how I converted the Reading Lines from conventional control to DCC. To get an idea of what is required in managing operations on the Reading Lines, I would suggest referring to articles in several magazines (*Model Railroader*, August 1994; *Railroad Model Craftsman,* January 1990; *Railroad Model Craftsman,* December 1989; *NMRA Bulletin,* October, 1992).

Before I explain my switch to DCC let me cover some of the factors that come to mind when operating the Reading Lines as well as some of its electrical background. The Reading Lines operates with a minimum of seven and maximum of 12 operators, although at times I've broken my own rules and allowed more. During a typical operating session, yardmasters (and their assistants) at two yards coordinate the arrivals and departures at their yards while a central dispatcher controls the movements of all trains over the entire railroad.

Road crews are called to navigate their trains over the system, picking up and setting off cars along the way or performing other duties as prescribed by the dispatcher or the Train Procedures Directory. Trains are pre-staged in one of three hidden yards, two of which are contained in reverse loops. As you can probably imagine, the Reading Lines required vast amounts of "conventional" electrical wiring and gadgetry just to portray some semblance of prototype operation. With this in mind, we felt the Reading Lines might serve as an example for others looking to convert to DCC.

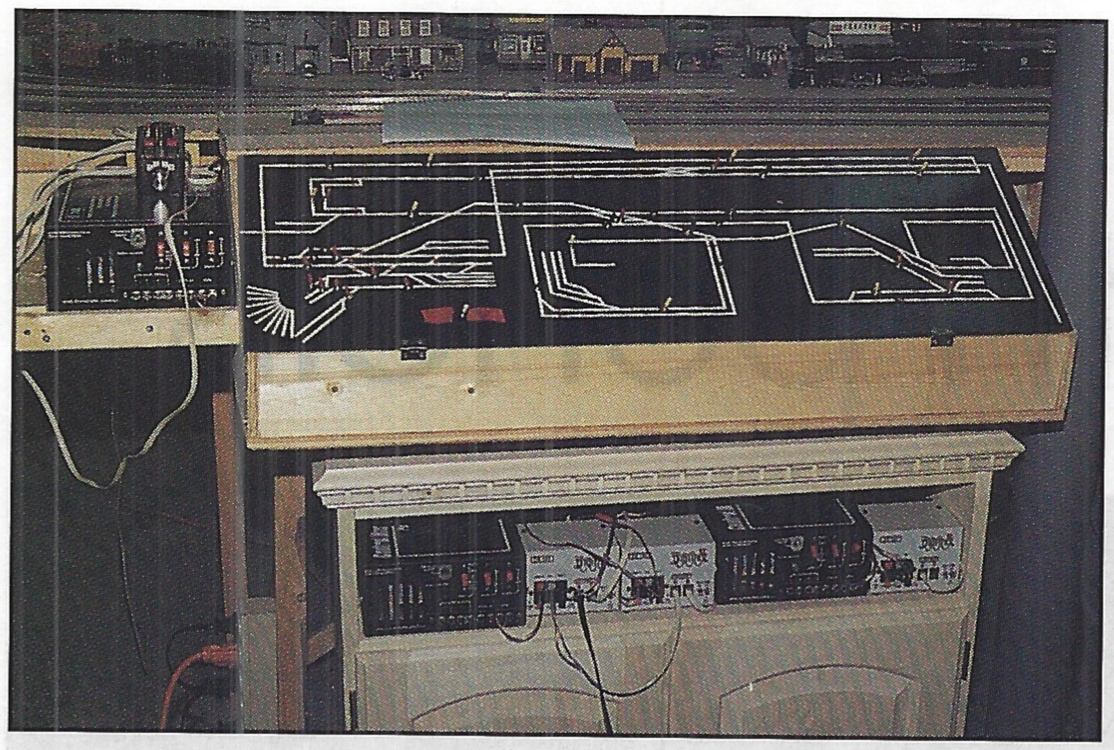
In building and wiring the Reading Lines, electrical blocks were established with their electrical feeders converging to a central terminal strip. At the terminal strip, common wires from each track segment were tied to a common buss after passing through their individual block detection circuit (Bruce Chubbs' C/MRI, which can be optional). The respective wire from each block ran to a rotary switch on the main dispatcher's control panel, sometimes a fair distance away. On the Reading Lines, there are over 50 separate electrical blocks. A wiring harness was made at the main control panel by attaching one line from the power supply of each cab to the same position on each rotary switch (one for each block) while the commons were combined and joined at the common buss (Figure 1).

The reverse loops were controlled with some simple electronic circuitry so that polarity was reversed for each block connected to the respective train which was passing through the reverse section. The reversing sections were also controlled by a rotary switch on the main panel along with a separate "loop" toggle switch which set the direction of travel through the loop.

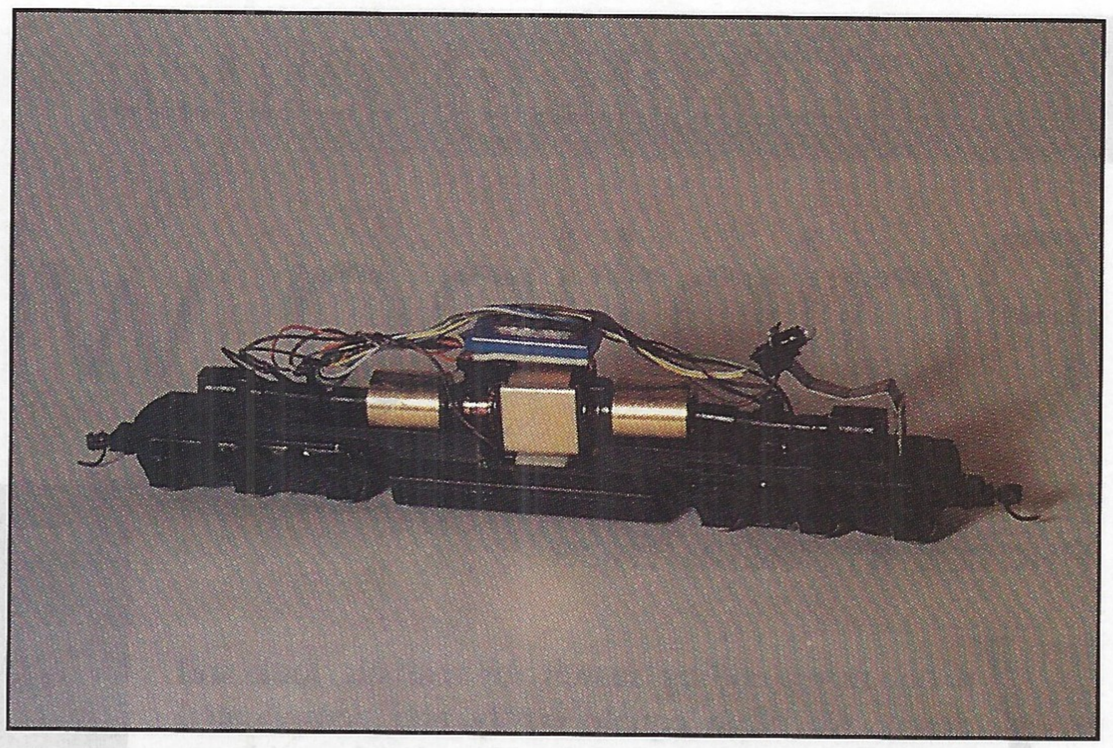
Since prototype operation necessitated the used of walk-around control on the Reading Lines, buss lines from each cab had to be strung around the perimeter of the layout. These were joined together at strategic locations by another rotary switch (one position for each cab) and a common plug located on the facia (Figure 2). Basically, the Reading Lines used the same simple electrical wiring that is probably used on most layouts — just a lot more of it!

The conversion to DCC came shortly after the 1993 NMRA Convention train show in Valley Forge. After correspondence with Lenz and Digitrax, I chose to sample the "Challenger" system made by Digitrax mainly because of the small size of the decoders (receivers). Although this base level starter unit could not perform the necessary elements of prototype operation in the ways I needed, it none the less proved that such a system could work with my existing wiring conditions. Additionally, all my operational questions directed to Digitrax were answered to my liking and when more advanced throttles were put on the market, I chose to go ahead full steam into DCC.

For initial testing purposes, I replaced one of the conventional



Although different than Bill Gruber's installation, this view shows a typical DCC installation in a cabinet below a control panel. Photo courtesy of Digitrax.



DCC decoders are fairly easy to install. This one is mounted in an Athearn diesel. Photo courtesy of Digitrax.

power supply leads with the track outputs from the Digitrax booster unit (used to boost the DCC signal for output to the track). This enabled me to keep my conventional throttles while checking out the various Digitrax components. Also, it was determined that, with all the "miles" of wiring used in conventional control (the harness at the main panel, rotary switch contacts and the length of some of the wires to the terminal strips), if DCC could perform as well with this arrangement then it would be even better after full conversion.

A second booster was purchased from Digitrax and used in its' "auto reverse" phase for each reverse loop. Although one booster is recommended per reverse section, I wired this booster to both reverse sections since only one train would be in any reverse loop at a time. A second "auto reverse" booster was eventually added later which gave independent control to each loop.

Operating sessions continued for a while under conventional control even after many of the locomotives had been equipped with decoders (DCC equipped locomotives can still run with conventional throttles). Unfortunately, operating came to a halt for a while until the balance of DCC components were installed and wired. Most of the conversion work involved the removal of the many wires to and from the main control panel, the harness at the panel and the five cab busses and related power supplies, etc.

Contrary to many comments I've heard about DCC (and other types of command control systems), most model railroads I've seen cannot be hooked up with just two wires! Two wires can be used for demonstration loops but layouts with more than one block still require good wiring practices.

My existing wiring from each track connection to the terminal strips remained in place (in fact, much of it was "beefed up" with heavier wire). Only the "out and back" (power supply to cab buss back to main panel then to track terminal strip) wiring shown in Figures 1 and 2 was eliminated. On even an average size layout this can amount to a good bit of wiring (and resistance!).

Individual power supplies and boosters were used for each group of electrical blocks (Figure 3). That is, sections of existing blocks were grouped together under one booster. As with other command control systems, segmenting the railroad into groups of blocks allows more trains to be operated at a time (due to the limited output from one booster/power supply) and makes for easier trouble shooting should shorts occur. Existing electrical blocks were kept intact and used only for signaling purposes instead of block isolation. Unfortunately, since existing detection circuitry was powered by one power supply through the common buss, detectors common to one block group (one booster) had to be isolated from other groups (powered by other boosters) and additional detector power supplies added.

Finally, one buss (six-conductor telephone line) was installed around the perimeter and plug-ins were attached at various locations on the facia. Digitrax refers to this as its "loconet." In layman terms it is simply the daisy-chaining of all boosters, throttles and other DCC devices together within the system for the sending or receiving of DCC information. Larger wiring isn't needed here as the buss is for sending DCC information only; heavier wiring is used from the booster to the track.

On the operating side of DCC, several changes were made in how the Reading Lines keeps track of locomotives. With conventional power, all that had to be done to start a train was to power on the block section, align appropriate switches and check to see that the proper direction was set. It didn't matter what locomotives were used or what direction it faced, it would start when the throttle was advanced. With DCC, and the numerous hidden staging tracks on the Reading Lines, a little more "prototype" discipline was in order.

To start off, every locomotive on the Reading Lines is equipped with its own decoder (receiver) and programmed "channel" number. For simplicity, I programmed the last two digits of the locomotive number as its channel number (when accessing a loco, just dial up its number!). In a few instances, I had to change numbers to stay within the prototype numbering system used by the Reading. When setting up more than one locomotive (referred to as "consisting" in DCC terms; MUing [multiple unit] in railroad terms) for a trip to a staging yard, a chart was devised to show the train symbol, locomotives used, its' MU position, and the direction it faced for each train. The purpose was to accurately access each locomotive (or MU) when it would come back "on line" the next operating session.

DCC allows the use of one non-decoder equipped locomotive to be used on the system and still be controlled with the DCC throttles. I took advantage of this by assigning Reading Yard the use of a Kato NW-2 No. 100 (00 is the analog address for DCC). Also, yard and terminal operations have become a bit easier now that hostlers can assume control of arriving and departing locomotives with just a few key strokes. As with other Command Control systems, the benefits are really perceived when three trains converge on a junction at once!

The DCC system on the Reading Lines has been in service for over two years now with virtually no problems. Any problems and questions that have occurred have been solved, usually with a call to Digitrax or a good night's sleep. The near future calls for the computer to keep track of all the various MU and single locomotive capabilities from session to session. To make things more complicated, my conversion to DCC took place concurrently with the installation of the C/MRI (Computer/Model Railroad Interface by Bruce Chubb) and a prototype based CTC panel. Talk about troubleshooting! If a railroad such as the Reading Lines, with its numerous operators, control systems, etc., can be converted to DCC and still conduct prototype operating sessions, then yours can too!•