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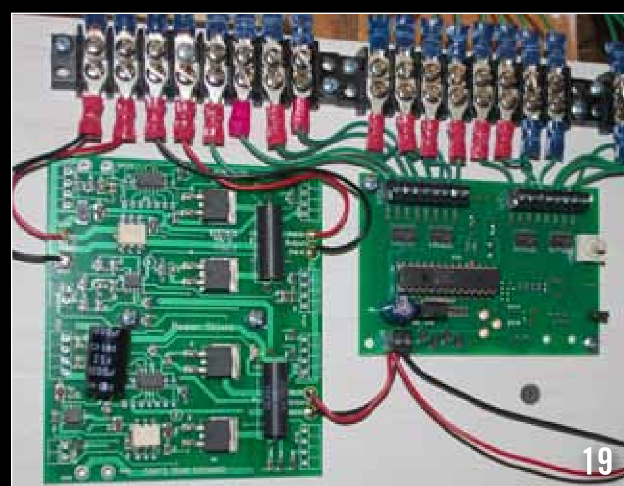

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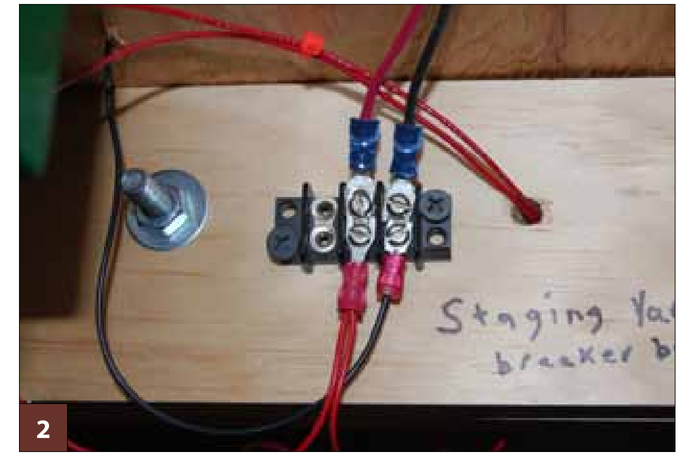
Digital Command Control allows multiple operators to run their trains independently without worrying about electrical blocks or power assignments. This scene is on David Popp's N scale Naugatuck Valley layout.

INTRODUCTION

Getting started with DCC

Digital Command Control (DCC) offers many advantages in operating large and small model railroads alike, namely that you and other modelers are free to run trains independently, without worrying about electrical blocks. DCC also opens up a world of other options, including locomotive sound effects as well as lighting effects on locomotives, passenger cars, and cabooses.

1 This DCC system from Electronic Solutions Ulm (ESU) features a command station with two built-in throttles and an LCD display.



2 Label all wires, terminal strips, and connections. You can make notes directly on the benchwork.

Layout wiring is also simplified compared to standard DC cab control, without the need for centralized control panels and dozens of toggle or rotary switches to route power from multiple power packs.

Wiring your model railroad for DCC isn't difficult, but it's something that has to be done correctly to ensure operational reliability, achieve the full benefit of DCC, and most importantly, function safely.

Decoder installation has become much easier in recent years, with plug-in and circuit-board (drop-in-replacement) decoders available for most model locomotives. A number of models are also available with decoders (and even sound decoders) factory installed.

In the following chapters, you'll learn what a DCC system is and how to wire your track, throttles, and turnouts. If you're new to DCC, you'll want to start with Chapter 1 to get a feel for what DCC does. If you're already familiar with the basics of DCC, you can skip ahead to Chapter 2.

Here are a few tips to consider whether you are wiring a DCC or standard DC layout.

Color-code it!

This applies to whatever type of wiring you install. Determine a wiring color code and stick with it. For instance, for my track power I use red for the north rail and black for the south rail. This applies to the entire railroad so the two wires will never get mixed up. It's better to wait until you can get the proper wire and wire it correctly than to wire something in a hurry and make a mistake that you'll be living with for years.

3 Good-quality pliers, wire cutters, and a wire stripper are essential tools for installing wiring.

Document it!

Color coding goes a long way toward helping you understand the wiring you did five years ago, but even with that I have found myself staring at an area of my wiring to figure out what I had done years earlier. I've been a member of clubs that had three-ring binders of schematics of every circuit on the layout. In a club environment, that's a must.

For my home layout, I have a combination of formal documentation and notes written under the benchwork. It's easy to take a marker and note what specific wires or terminal strips do rather than trying to guess later.

Get high-quality tools!

You'll need a soldering iron, digital multimeter, wire strippers and needle-nose pliers (more on these in Chapter 1). There's a saying that quality is remembered long after the price is forgotten. This is certainly true with tools. Spend an extra dollar or two for good tools, because you'll regret a low-quality tool every time you use it.

Keep wiring neat!

Neat wiring pays off in several ways. The first is that it makes it easier to install: There is no confusion as to which wire goes where. Secondly, using wire ties to bundle wires helps strain-relieve the whole group. The force of a tug on one wire is distributed to the whole group, lessening the tug on any one wire making it less likely to be damaged. Lastly, it is much easier to trace wiring when troubleshooting a problem.

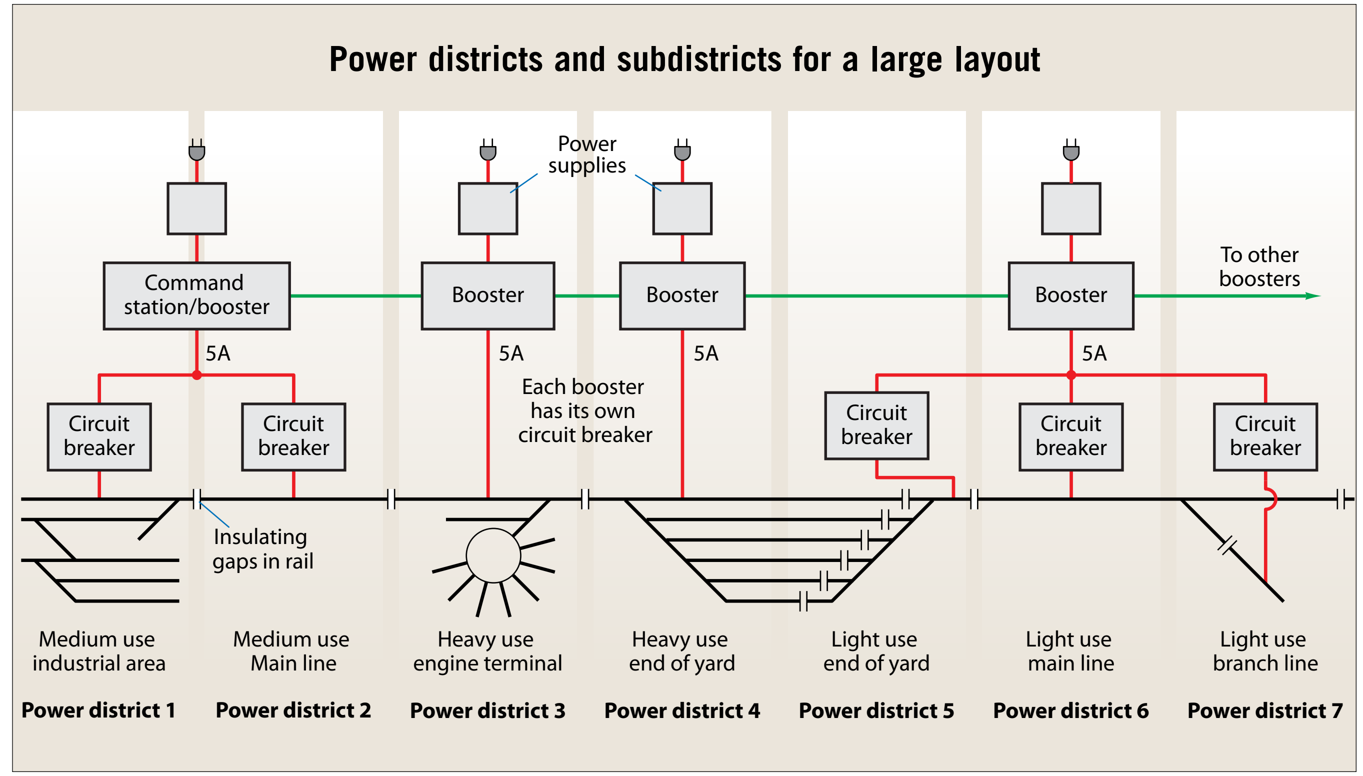
Let's move on and take a look at the various components of a DCC system.

You can add more than one booster to increase the available power on your layout. The box on the left is a combined command station and five-amp booster from NCE. The box on the right is a dedicated five-amp booster. A control bus from one to the other sends the DCC commands.

CHAPTER THREE

Boosters and power districts

By its very nature, DCC is designed to control more than one train at a time. Thus, the system must supply enough power to run all trains and locomotives in operation. One booster may be enough to power all trains on a small layout, but depending on the scale and number of locomotives you intend to run at once, you may need to add one or more boosters.



Boosters come in several sizes measured or rated by the current (in amperes) they can supply. Booster power ranges from small two- to three-amp versions to large ten-amp models.

It is important to note that if you add a second booster, each booster must provide power to its own section of track, called a power district. The track between power districts must be isolated by a gap in both rails, and the track bus below the benchwork must also be divided.

Determining current draw

To determine if you need to have additional boosters on your layout, add the current draw of everything that is connected to your track bus. This not only includes locomotives but any accessories as well, such as lighting in passenger cars, stationary decoders (more about them later), and signal systems.

Start by adding up locomotive current draw (these are estimates; individual locomotives can draw more or less power). An N scale locomotive typically draws about .25A but can draw .75A under heavy load or if sound equipped, an HO locomotive will draw anywhere from .25A to 1A, and O and large-scale locomotives draw even more. As a general rule, newer locomotives with can motors draw less current than older locomotives with open-frame motors.

Locomotives draw the most current when they are running and draw very little, even if sound-equipped, while idling. Idle current can be minimized by keeping locomotive lighting off and muting sounds on locomotives not in use.

Passenger car lighting can be another large source of current. A single light bulb can draw 10 to 100 mA.

Stationary decoders (see Chapter 4), signal systems, wayside lighting, or anything else that uses track bus power must be taken into account.

If you add up all the current your DCC system needs to supply and it exceeds the current rating of the booster that came with your DCC system, you'll want to add an additional booster or two.

Be aware that some basic entry-level DCC systems don't have the capability of adding additional boosters. If you think you'll need another booster, carefully check the system specifications (or read the manual online) before purchasing it.

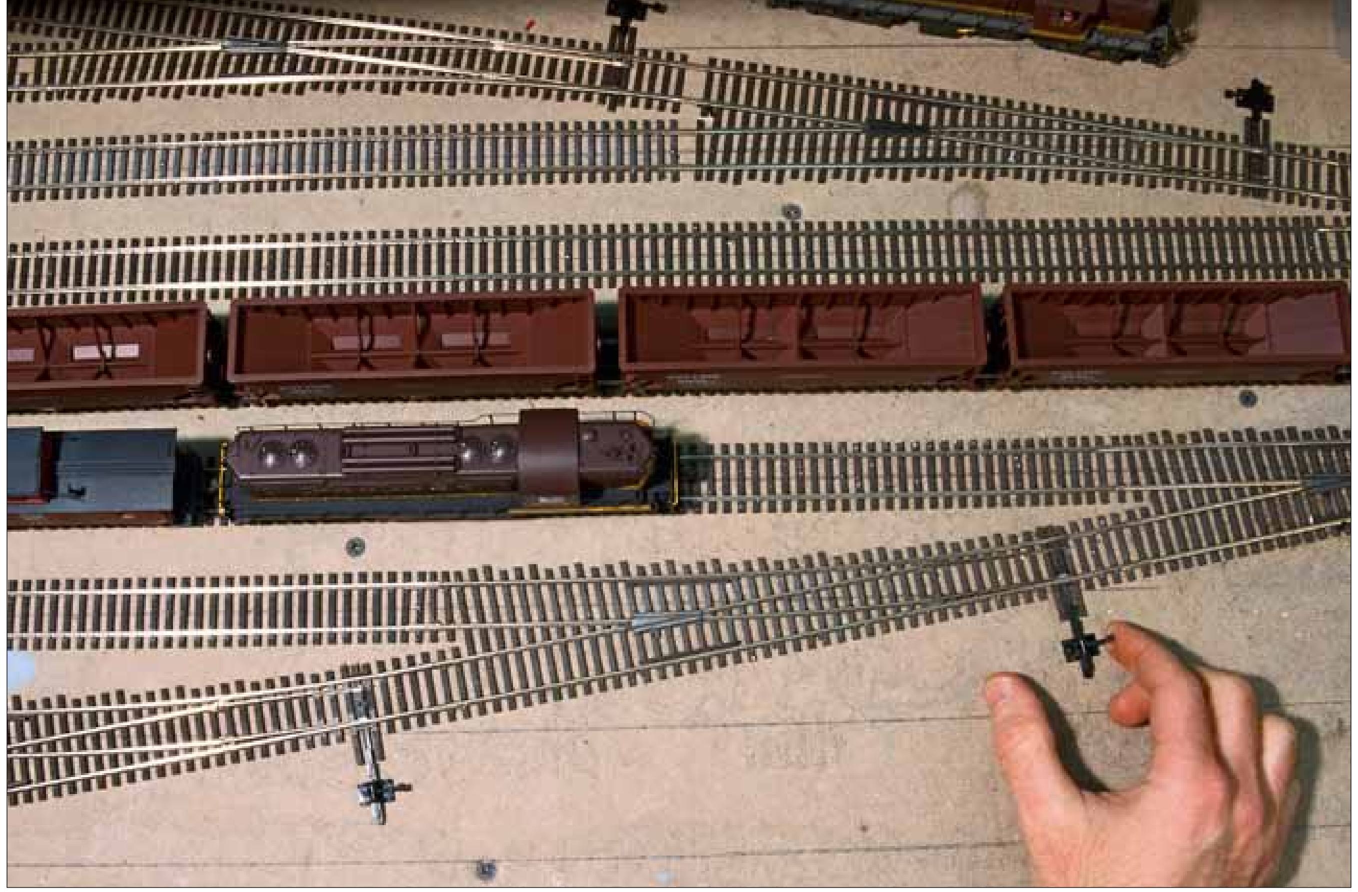
If you discover you need an extra booster or two, you need to determine how to divide your layout into sections—called power districts—to make the most of your boosters and your wiring. The drawing above shows one example of how a large layout could be divided into power districts with separate boosters and circuit breakers (more on those in a bit).

Splitting the layout into halves or thirds is a logical way to approach the problem, but you might later find you have a particular area that draws a lot of current. For instance, if you have a large intercity passenger depot that hosts multiple trains at once, each of which has several lighted passenger cars, along with platform lighting (connected to the track bus) and stationary decoders, you might choose to dedicate a booster to that area while leaving another single booster to power the rest of the layout. This might balance the power load better.

I've seen multi-level layouts with a different booster for each level and a double-track layout with each track having its own booster. All will work—what is best will depend on what's most efficient for your layout.

My layout is divided into two power districts with two boosters—one powering each district. The boosters are not in the center of the layout, so for a small section of my railroad I have two track buses under the layout.

How boosters are connected to each other and to the command station varies from system to system.

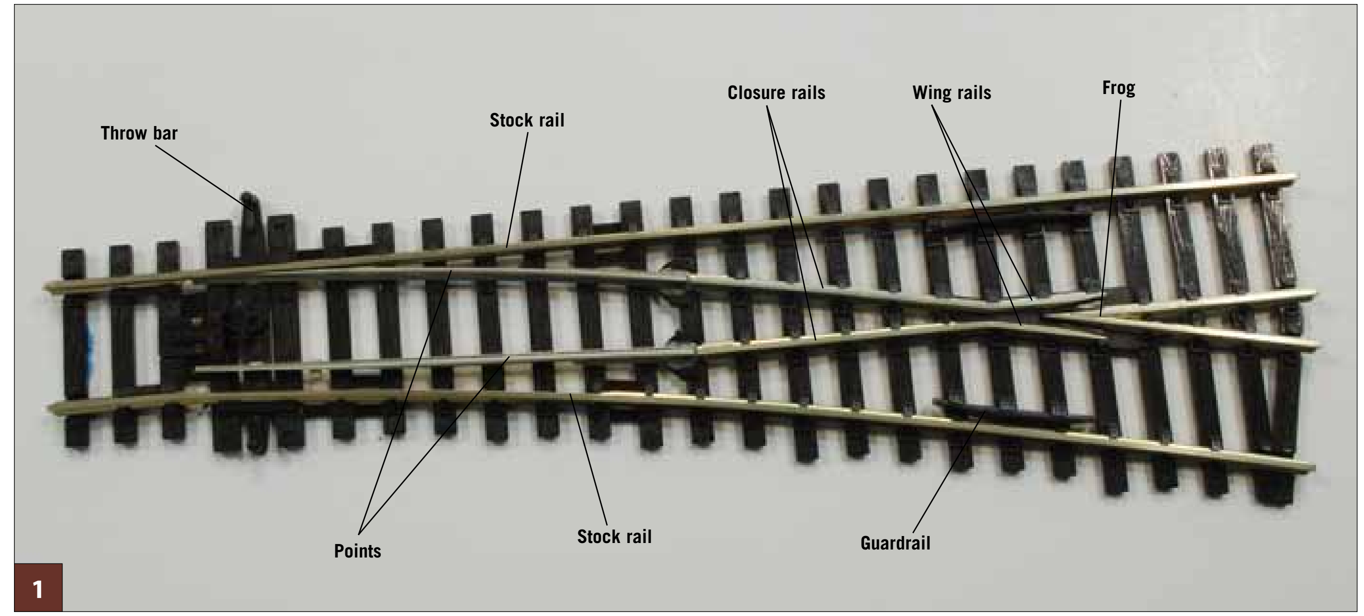


CHAPTER FOUR

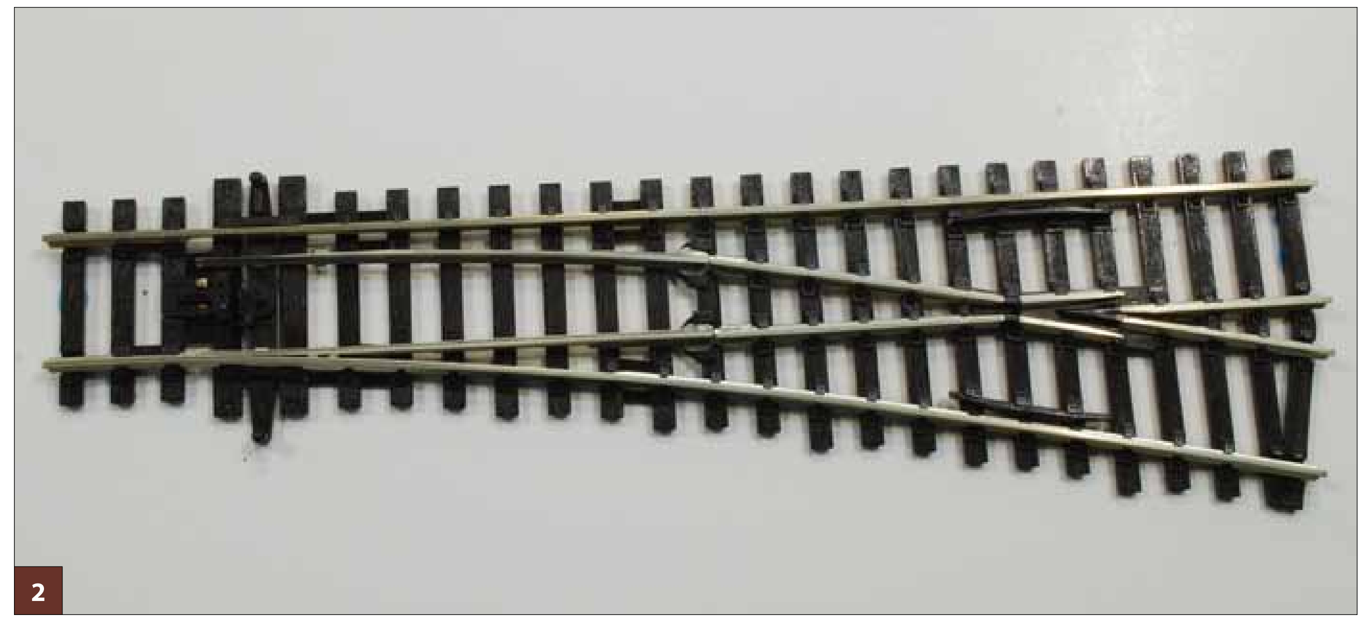
Turnouts and reversing sections

Wiring turnouts for DCC isn't difficult, but does require some special attention and consideration.

Turnouts can require special care and wiring to operate (or to operate more reliably) with DCC. Also, as with any standard DC layout, you also need to be aware of reversing sections—such as reverse loops, wyes, and turntables—as all require rail gaps to avoid short circuits.



This Peco Electrofrog turnout is an example of a live-frog (power-routing) switch. On this type of turnout, the back of an out-of-gauge metal wheel can cause a short between the open point and the stock rail.



This Peco Insulfrog is an example of an insulated-frog (all-live) turnout. Note that the frog itself is plastic. The rails that leave the frog are opposite polarity. If the tread of a metal wheel is too wide, it can bridge the gap and cause a brief short circuit.

Turnouts and DCC

You may have heard that you need special turnouts to run DCC. That's not true, but you do have to pay some attention to turnout wiring.

You might discover that locomotives stutter, stall, or cause short circuits at turnouts on your DCC layout when they didn't have problems when the layout was powered by standard DC. This is due to momentary short circuits caused by locomotive wheels (or metal wheels of rolling stock) bridging rails of opposite polarity as they pass over the turnout.

Because boosters supply much more current than a conventional DC power pack, they are equipped with fast-acting circuit breakers to protect the layout wiring and your models in the event of a short circuit. The circuit breaker automatically resets when tripped, but waits a period of time before it does. Most DC power packs are either not equipped with circuit breakers or they act slowly, so they don't trip when a locomotive causes a momentary short and the locomotive's momentum carries it beyond the location of the short. It's not that the short circuit didn't occur with DC power, it's just that it wasn't as noticeable.

So what causes the short circuits? It depends on the type of turnout.

Turnouts fall into two categories: those with live frogs (sometimes called power-routing turnouts) and those with insulated frogs (also known as all-live turnouts). On a live-frog turnout, the