Contents

Basic system and DCC capabilities

Digital Command Control allows independent control of multiple trains on a layout without regard to electrical blocks. Throttles (cabs) are available in tethered (plug-in) versions as well as wireless, as with this NCE ProCab throttle on Kalmbach's Milwaukee, Racine & Troy HO scale club layout. *Lisa Schroeder*

Digital Command Control (DCC), has been a revolutionary development in model railroad operation since its introduction in the mid-1990s. It allows multiple locomotives to be controlled independently of each other within the same electrical block, with no need for the toggle switches and separate block wiring of old DC (direct-current) cab-control systems (see page 7).
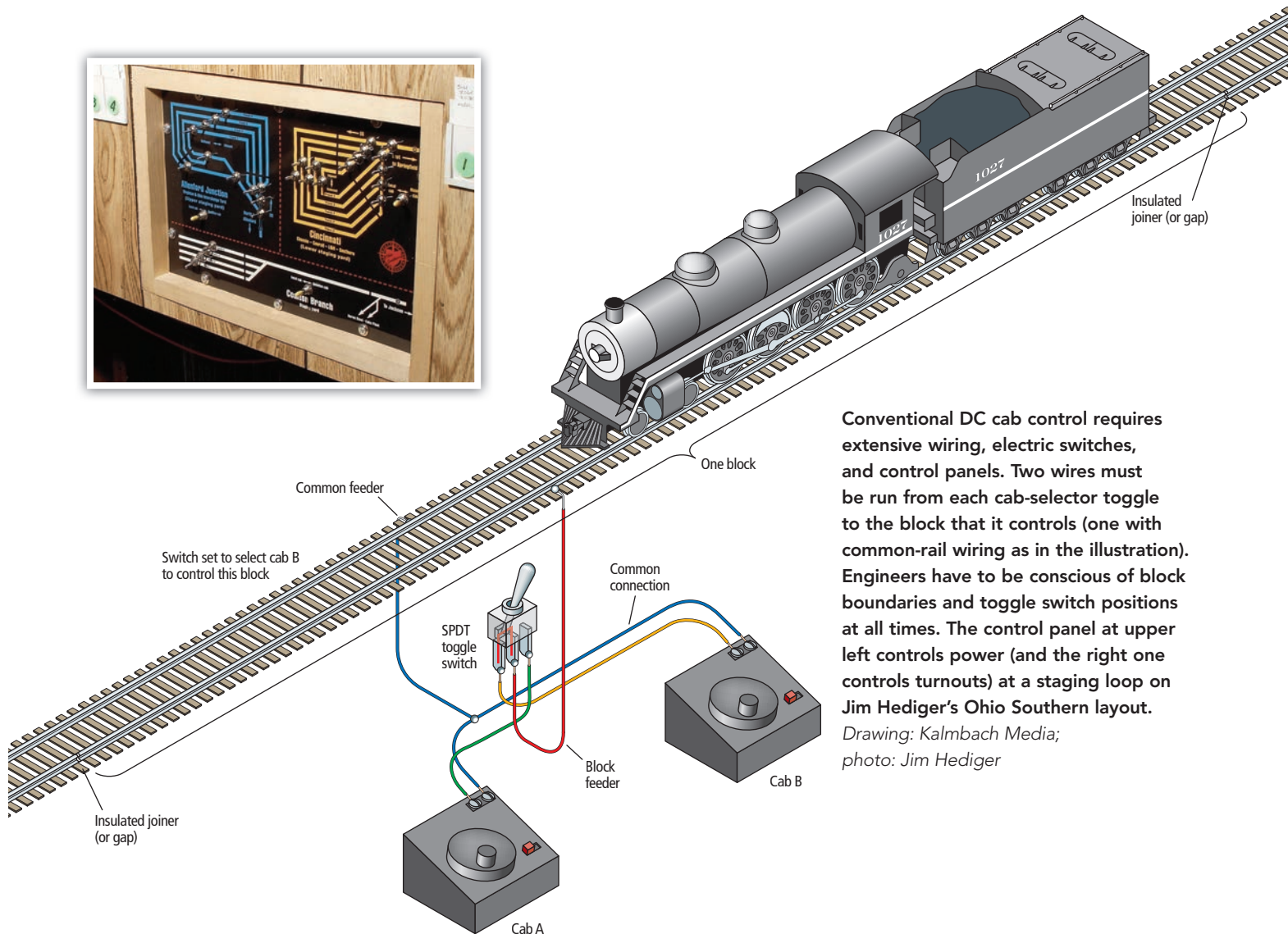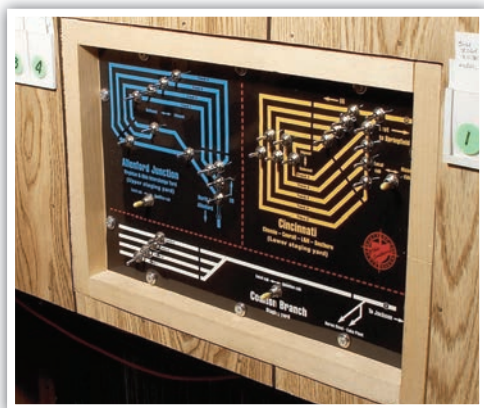
Conventional DC cab control requires extensive wiring, electric switches, and control panels. Two wires must be run from each cab-selector toggle to the block that it controls (one with common-rail wiring as in the illustration). Engineers have to be conscious of block boundaries and toggle switch positions at all times. The control panel at upper left controls power (and the right one controls turnouts) at a staging loop on Jim Hediger's Ohio Southern layout. *Drawing: Kalmbach Media; photo: Jim Hediger*

Insulated joiner (or gap)

One block

Common feeder

Switch set to select cab B to control this block

SPDT toggle switch

Common connection

Block feeder

Cab B

Insulated joiner (or gap)

Cab A

And although standard DC systems are still viable and used by many modelers, DCC has evolved significantly since its beginnings in the early 1990s. Early DCC systems were a vast improvement over earlier proprietary carrier systems such as GE's 1960s Astrac system, which — although revolutionary for its time — was expensive, limiting (only eight channels available), and cumbersome, with large (and often unreliable) receivers.

Today, a wide range of DCC products are available (especially locomotives with factory-installed decoders), sound effects have become fantastic, and components are simpler, smaller, easier to install, and have more features, making DCC more appealing to beginners as well as experienced modelers. Wireless cabs allow complete freedom of movement and are easy to install.

General Electric's Astrac was a pioneering carrier-control system in the 1960s; its receivers (right) were large and required ample space in locomotives. Modern DCC decoders (bottom) are small and versions are made to fit almost any locomotive, including N scale. *Jeff Wilson*
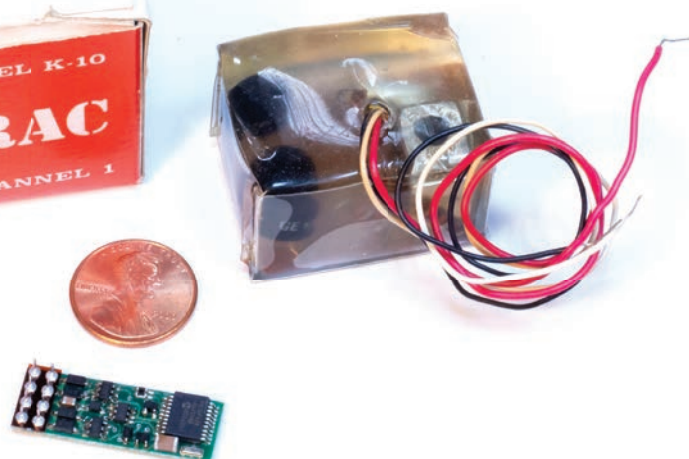
Sound decoders and speakers

1 Many speakers are available that will work for sound-equipped locomotives. The TCS speaker (left) was the largest speaker that I found that would fit inside an HO diesel. The SoundTraxx cube speaker at right, next to an N scale boxcar, was the tiniest one that I looked at; it would fit inside some N scale equipment.

I've found no other feature that adds as much realism to a model railroad as sound. Specific diesel engine sounds, steam chuff, and a variety of horns, bells, whistles, and other effects create a mood and set a scene just like the appearance of a realistic model. Many locomotives now come with factory-installed DCC and sound, and a wide variety of decoders and speakers are available to fit most other locomotives, including N scale, **1**.

General sound decoder selection

There's a wide variety of sound decoders on the market. You can select one based on your manufacturer preference, a manufacturer that offers a specific locomotive sound you want, or you can pick one based on specific features you're looking for. SoundTraxx probably offers the biggest selection. Each decoder it sells includes several different locomotive sounds. Be sure to look at each of them and see which best meets your needs.

Sound decoders look pretty much like standard decoders, but with two additional output wires for the speaker: These will be the same color (frequently purple). Some decoders provide a two-pin connector for connecting a speaker. The wires can be hooked to either speaker connector. The key is to make sure your decoder doesn't have a higher power output than your speaker's rating, or you can blow the speaker.

All prototype whistles, horns, and bells are not alike — there's a tremendous variety in sound among various types. Most decoders come with a selection of whistles, horns, and bells, often to match specific prototypes. You can change the rate and characteristics, and you can often tweak other sound effects as well.

It's the same with diesel engines: An EMD 567 prime mover sounds quite different than an Alco 244 or a modern GEVO engine. If there's a specific locomotive sound that you want (a particular diesel prime mover, for example) that's not currently offered, Digitrax and ESU both allow users to load their own sound files (using each company's sound programmer). If you want to tweak the sound using a built-in equalizer and reverberation, then look at SoundTraxx decoders.

If you want to be able to control your locomotive with a smart phone or tablet and want an on-screen description of the various sounds in your decoder, look at the SoundTraxx Blunami. It can also be configured without needing to know CVs.

The Train Control Systems WOW line of sound decoders uses audible prompts to enable setting up the decoder on your main line, freeing you from knowing CVs. The locomotive literally talks you through the change menu, much like an automated phone menu.

If you have DecoderPro loaded onto your computer (see Chapter 5), most sound decoders can be programmed and set up without needing to know CVs.

Sound decoder manufacturers are adding new and improved features all the time. Be sure to check their websites and YouTube channels, especially to see their videos — these allow you to actually hear their latest and greatest options in operation.

Speaker selection

Speaker selection is very important to get the best, most-realistic sound effects. Generally, the bigger the speaker, the better the sound. Speakers in models (especially in N scale, but even in HO) are necessarily very small, so at best speaker size is a bit of a compromise. I've found it's worth the effort in trying to squeeze all the speaker you can into your locomotive.

In choosing speakers, be aware of two important parameters: Impedance (in ohms) and wattage rating.

Ideally, the audio amplifier's impedance should match the speaker's. It is okay if the speaker impedance is higher, but not lower; otherwise the decoder and speaker could both be damaged. Most decoders are rated for an 8-ohm speaker impedance. But be aware that wiring two 8-ohm speakers in parallel will present a 4-ohm impedance to the amplifier — avoid doing this. A telltale sign is extreme sound distortion — if you hear this, shut it down immediately.

The wattage rating indicates how much power the speaker can handle. Exceeding the rating in the short term will cause audible distortion, and if not stopped immediately, will destroy the speaker. Many small speakers are rated for 1 watt or less, but some decoders are rated for 2 watts, so you need to be aware of both.

The instructions for SoundTraxx's Mini Cube speakers, for example, warn
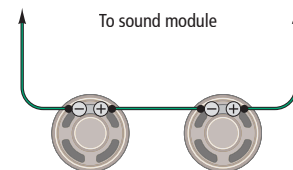
When using multiple speakers in series, it is imperative that you wire them as shown: The positive terminal of one speaker needs to go to the negative terminal of the other. This will ensure the speakers work together to maximize the sound of each. Many small speakers are not marked "+" and "-" — that's OK, just wire them as shown.
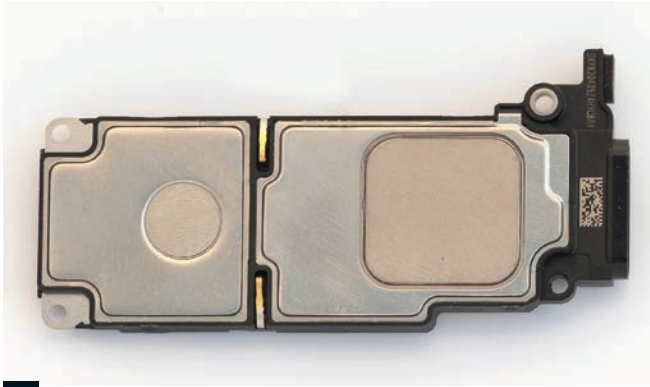
2

3

The SoundTraxx Mini Cube 3 (No. 810162) is tiny. Without baffle, it is 3mm x 5.5mm x 12mm. With its deepest baffle, it's still just 8.6mm thick.

4

Here's the fully assembled Train Control Systems No. 1717 speaker, including a baffle, wired with a connector to a decoder. It measures 8mm x 14mm x 28mm.

5 Cell phone speakers can be an option. The iPhone 8+ speaker (left) is 49.4mm x 18mm x 3mm with its upper right tab trimmed off. The Samsung S5 speaker (right) measures 17mm x 15.1mm x 4.4mm.

you of this and recommend you put two of them in series, **2**. Do this! You will get twice as much sound (and better quality). Two speakers in series increases the combined impedance to 16 ohms, and doing this reduces the maximum power of a 2-watt sound decoder to ½ watt to each speaker.

It's tempting to deal with this issue by using one speaker while setting the master volume control to half. Although this works, there are simply too many ways an operator can inadvertently turn the volume up above half (such as doing a factory reset on your decoder, or — if the master volume is adjusted using a function key — accidentally setting the volume too high).

A better solution if you can't fit two speakers into a locomotive is to wire a resistor in series with the single speaker to limit the maximum power to the speaker. A 10-ohm, ½-watt resistor works well for this. It will not improve your sound, but will keep you from damaging the speaker.

The SoundTraxx Mini Cube 3, **3**, is rated for 0.3 watts with an allowable peak of 0.5 watts. Resist the temptation to push the speaker too much, especially in diesels, which contain a lot of bass in the sound. Avoid setting the volume of the decoder to maximum. Damage to your speaker can occur faster than you can press buttons to correct it.

Consider using oval speakers to get a bigger speaker in a narrow locomotive. If you want an assembled speaker with a baffle and attached wires, take a look at the Train Control Systems No. 1717, **4**. It's long and narrow and will fit into a diesel hood. It even has a connector and can be plugged into a sound decoder with a socket on it.

Cell phone speakers, for their size, can put out a lot of sound. However, it can be challenging to figure out which portion of them are the speaker's terminals. It can also be tough to determine their impedance and power rating. If you are up for the challenge, pay a visit to your local cell phone repair store or search online, **5**.

Speaker baffles and gaskets

When a speaker cone moves forward, it compresses the air in front of it. At the same time, it creates a vacuum behind it. If unenclosed, the compressed air in front of a speaker then races around to fill the vacuum behind it. Unfortunately this largely cancels out the sound and results in disappointing performance, even from what is technically a high-quality speaker.

To solve this problem, we can mount the speaker in a box that prevents the pressurized air in front of the speaker from rushing directly to the back, **6**. The effect is very noticeable even with a tiny speaker. To demonstrate it to yourself, try an experiment on a speaker with and without a baffle. If you're modeling steam and plan to use the tender as the baffle, first power up your decoder and speaker without the tender shell on it. Then put on the shell and notice the difference — you will be amazed.

You can either buy a speaker baffle, **7**, or fabricate one, **8**. Several sound decoder manufacturers offer baffles for speakers they sell. Before you com-

Unbaffled
Speaker
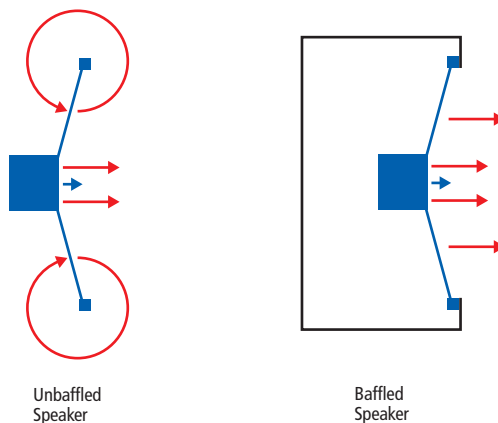
Baffled
Speaker

These cross-section views show how a baffle or speaker enclosure helps project the air pressure (and sound) in one direction (right), resulting in a louder, fuller sound than the speaker at left. The red lines and arrows show the direction of the air being forced.

6

7 Many speakers are available with baffles/enclosures specifically designed for them, including these from ESU. *Kalmbach Media*
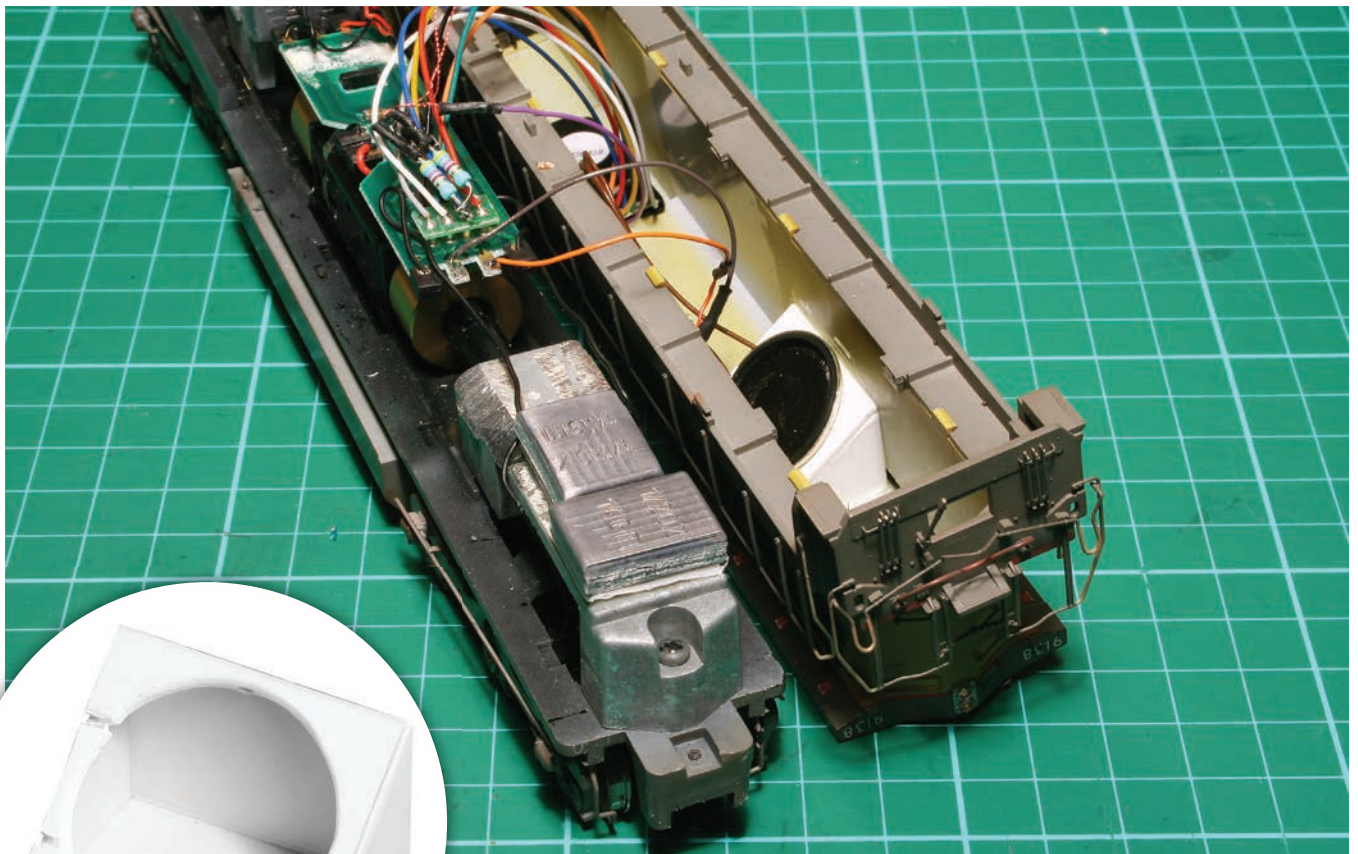
8 Pelle Søeborg made a speaker enclosure from .040" styrene (left) for this HO Atlas Dash 8-40C model. He mounted the ESU LokSound speaker at an angle, which allowed a larger speaker than possible for a flat installation. The two slots in the baffle at left allow the speaker wires into the enclosure. He had to file away part of the weight (above) to allow room for the speaker, and he added peel-and-stick weights to compensate. *Two photos: Pelle Søeborg*