Modular Layouts and DCS
by ToyTrains1

By their nature, modular layouts use bus wiring while star wiring is recommended for DCS. However, I've found that the bus wiring scheme as used in a modular layout can work very successfully with DCS as long as a few caveats are followed. Let's start with the basics. Under each module is a wiring harness running from a barrier terminal strip at one end of the module to a barrier terminal strip at the other end of the module. From each barrier terminal strip, hot and common drops go to the tracks. From each barrier terminal strip hangs a wiring harness that, at one end, goes to a Molex-type plug and at the other end goes to a matching Molex-type socket. When modules are connected to each other, the pins in the track are for the purpose of ensuring track alignment and are not intended for electrical continuity. That's achieved by plugging the plug of one module into the socket of the connected module. When you have constructed a modular layout in the usual closed loop shape, the mated plugs and sockets along with the bus wiring under each module create a closed loop bus. Caveat: this loop MUST be closed and must be continuous. All connections must be made and the loop must be complete. Just one open connection can send your DCS signal strength straight to hell.

At one point on this closed loop, there should be a second wiring harness dangling from a barrier terminal strip. This wiring harness will connect to the output side of the TIU. It doesn't matter where in the bus loop it is, just that it's at one and only one place in the loop. Since a typical modular layout has three tracks, three of the TIU channels will be used. I recommend using Fixed 2, Variable 1, and Variable 2, and powering the TIU via the auxiliary power connector. In this way, you don't have to worry about having a track powered all the time in order to keep the TIU powered. I use a small Radio Shack transformer to power the TIU. Also in this way, two of the three tracks can be controlled for conventional operation via the TIU, with the third track (Fixed 2) being variable from the transformer. I power each track via a separate transformer to keep the heat load down on any given transformer. It's very important, given locomotives with traction tires that prevent electrical contact, that the two outer rails of each track be wired together on each module. The only exception is when you're going to use one insulated outer rail to trip an accessory (discussed later). In this case, ensure that the outer rails on either side of the insulated section are wired together.

If any of the modules have sidings on them coming off of one of the three main tracks and you want to control those sidings with DCS, you need to ensure that you have a lighted bumper at the end of the siding. The lighted bumper will act to damp the DCS signal on the dead-end track and keep it from interfering with itself. (If you don't want to use a lighted bumper, you need to install an 18 volt light bulb between the hot and common for the track at the barrier terminal strip at the end of the siding.) You also need to ensure that you have electrical continuity between the sidings and the main line track that they connect to so

that the DCS signal can reach them. If the sidings are to be independent of DCS, ensure that they are electrically isolated from the main lines (via either gaps or insulating pins in the middle and both outside rails) and power the sidings with an auxiliary power supply. As long as we're talking about such things, if you have crossovers between main lines, you need to keep them electrically isolated from each other, as explained above, to keep the signals from multiple DCS channels from mixing.

On the modules that I have made, which meet the hirail module standard, the commons from all three tracks are brought together at the barrier terminal strips and there is only one wire for the common going from barrier terminal strip to barrier terminal strip. This was a wiring standard developed in the days before digital command control. Now that we have digital command, if I were able to change the wiring standard, I would ensure that the commons for each track were not mixed and would have three separate common wires in the bus, one for each track. With this, I would use either a Rev. H1 or Rev. I TIU that has separate commons for each channel. This would ensure that each track is completely isolated from the others and would make troubleshooting much easier. It also ensures that a problem on one track cannot affect operation on the other tracks. If you are going to have auxiliary power lines in the bus (to power, for example, accessories on the modules), then those lines should also have their own commons. If possible, the wire pairs in the bus (Track 1 hot and Track 1 common, etc.) should be twisted together. It's something that isn't much bother and can help with digital signal transmission.

Since I mentioned accessories, it's quite common to activate them using an insulated outer rail with a relay. Most relays have DC coils, so the insulated outer rail is actually connected to one of the AC leads of a full-wave bridge rectifier, whose DC leads are connected to the coil of the relay. The hot lead from the transformer to the other AC lead of the rectifier must be from the transformer powering that particular track as the circuit will be completed to the common of that same transformer with the wheels and axles of the train hit that insulated rail. My experience is that, even though this winds up routing the DCS signal through the rectifier, things still work OK though you will see a lowering of the signal strength while the train is on the insulated rail section. I've had only one experience with a relay that had an AC coil hooked directly to the insulated rail section; it was a disaster! Passing the DCS signal through the coil destroys it; it sent the signal strength on the entire layout to hell every time that relay was activated. Caveat: this holds true for turnouts that are powered via track power; always power turnouts from an auxiliary power source and not track power!

If there are problems with signal strength on a particular module, check the wiring on that module. In particular, make sure the connections at the Molex plug and socket are well-soldered and that things are making good contact. In the event that one module is problematic, an 18 volt light bulb installed between hot and

common for each track at one of the barrier terminal strips can sometimes help improve the signal strength.

Modular layouts see a lot of use in a short period of time. As a result, grime tends to build up on the rails, especially if you run a lot of steamers with their mineral oil-based smoke. It settles on the track, picks up dust, and forms a non-conductive layer. In a period of several days of heavy running, you can build up enough grime to affect the signal strength. Before the start of each day's activities, you should clean the track with a solvent (I use Goo Gone) and a plastic scrubbing pad to remove all such grime, followed by a clean dry cloth. This ensures the best possible signal strength.