Automation in the garden: Part 5—Two trains in one loop

PHOTOS BY THE AUTHOR EXCEPT AS NOTED

Jeb, tired of actually having to work for a living, decided that having his trains run automatically would be more beneficial to his sense of what life should be like. Consequently, he ordered a bunch of newfangled e-lec-tron-ic devices to help him achieve his goal of full automation.

In the last installment, I discussed running multiple trains on one loop of track, but with only one train moving on the loop at a time. However, if you've got a particularly large loop, having only one train in motion at any given time can be boring. The obvious solution is to run multiple trains on the loop at the same time. Simple, right? Put two identical locomotives on the track at the same time, with nearly identical trains, and, in theory, they should run at the same speed. You'll be able to set them far enough apart that one train will never catch the other.

Unfortunately, things don't work that way. No matter how evenly matched one train may be with another, you simply cannot expect two trains to run on a single loop of track without one eventually catching up to the other. To automate this task, you need some means of making sure the trains stay a set distance apart.

To do this, you'll need to divide your railroad into two sections. Not individual blocks—one rail can be continuous through the loop—but you'll need one section of track that I'll refer to as the "speed control" section and another part of the loop that I'll call the "locate the other train" section (**figure 1**). The idea is that Train A enters the speed-control section, then slows down/stops until such time that Train B is safely in the locate-the-other-train section. Once that sensor knows Train B is there, it can allow Train A to leave the speed-control section. With this arrangement, two trains can always be kept a given distance apart and can never run into each other.

Making this happen takes a little thought. **Figure 2** shows a simple way of doing it using an LGB switch machine

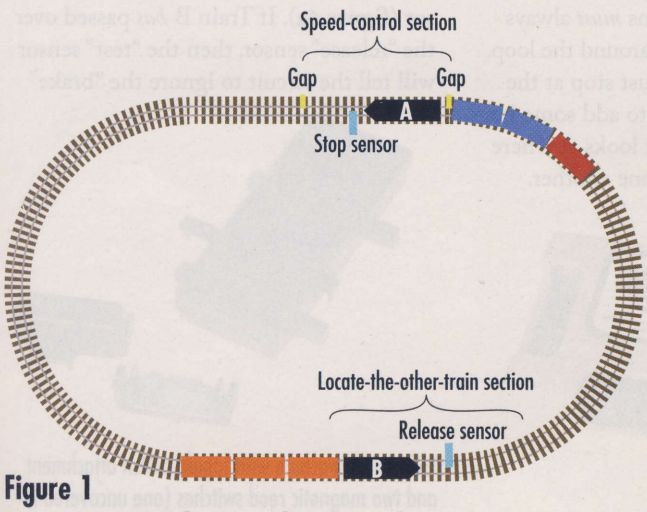

Figure 1
Two trains simultaneously on one loop

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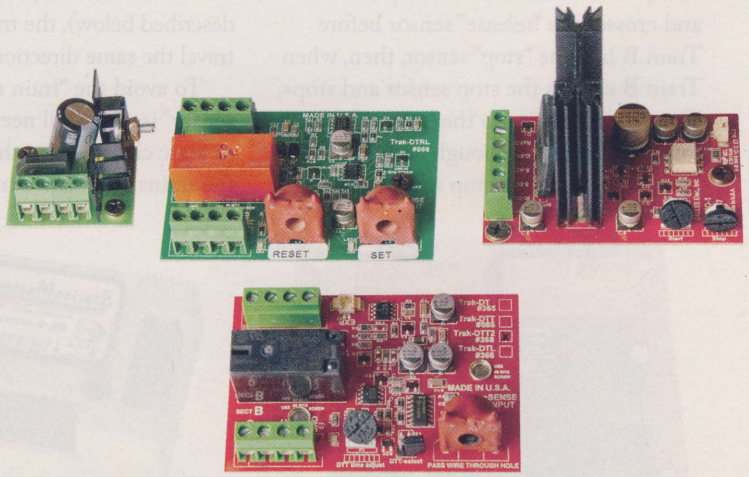


Dallee Electronics products. Top row, left to right: 12V power supply, Trak-DTRL, Momentum control; bottom row: Trak-DT.

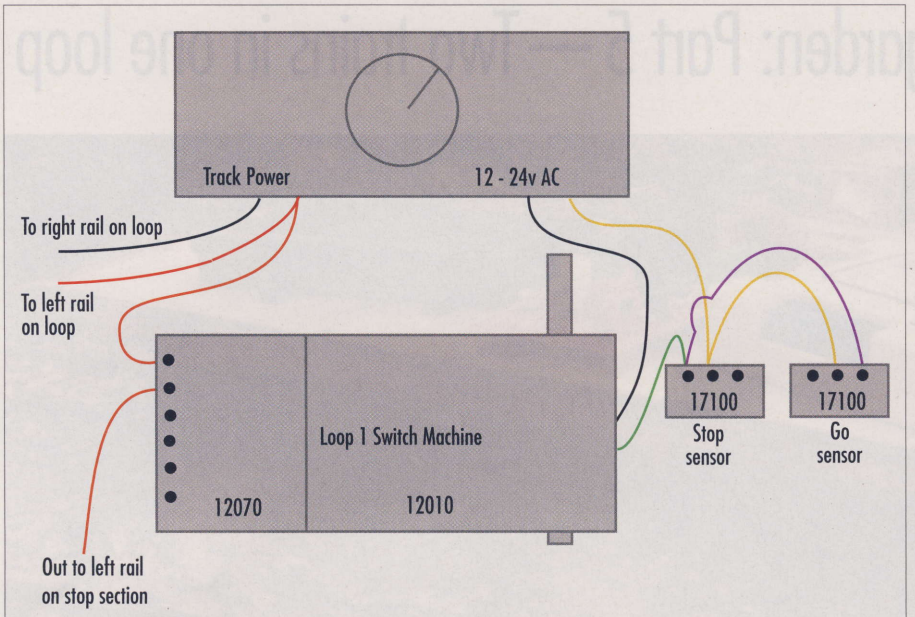
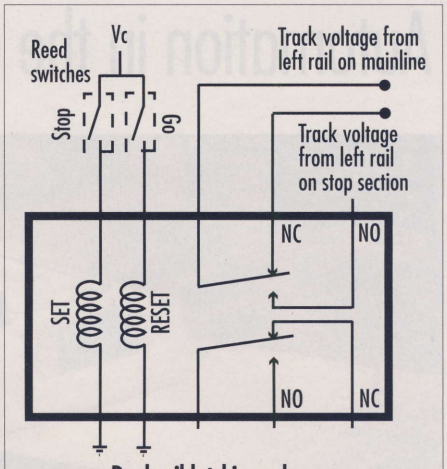


Figure 2—LGB component wiring



Dual coil latching relay

NO = Normally open
NC = Normally closed
Vc = Coil voltage

Relay coil voltage—Dependent on your power supply, typically 5-30V DC or AC

Contact current—1-10 amps available. Choose a value capable of handling the load of your train

Relays available from online retailers

Figure 2a—Dual coil latching relay circuit for automatic train spacing

and electrical contact attachment. (A latching relay, **figure 2a**, would perform similarly.) The system consists of a loop of track with a small section of track that has one isolated rail and two magnetic sensors: "stop" and "release." When Train A crosses the "stop" sensor, it throws the switch machine, opening the electrical switch and isolating the rail, thus causing the train to stop. It won't move again until Train B crosses the "release" magnet, closing the switch and allowing electricity to flow into the isolated section.

This is about as basic as you can get, but it comes with some significant caveats. First, if Train A leaves the stop section and crosses the "release" sensor before Train B hits the "stop" sensor, then, when Train B crosses the stop sensor and stops, Train A will hit it. So the "release" sensor must be placed far enough around the loop, away from the stop section, to ensure that, no matter what, the train that trips the "release" sensor will always arrive at the "stop" sensor before the next train hits the "release" sensor (**figure 3**).

Often, the "stop" sensor is placed in front of a station where the train would prototypically stop. Alternatively, the train could stop inside a tunnel or other hidden area of the railroad so the viewing public would never see the trains actually stop.

This arrangement also means that the trains will *always* stop at the stop sensor—there's no provision for keeping them in continuous motion if the trains are far enough apart. It's also important to note that in this scenario, (and all scenarios described below), the trains *must* always travel the same direction around the loop.

To avoid the "train must stop at the sensor" issue, you'll need to add some kind of logic circuit—one that looks at where the trains are relative to one another.

DCC BitSwitch's Block Detector does this. As Train A enters the speed-control section, it passes over two sensors instead of just one. The first is a "test" sensor; the second is a "brake" sensor. The "test" sensor is the logic sensor. If Train B has not crossed the "release" sensor, then Train A will stop when it crosses the "brake" sensor until Train B crosses the "release" sensor (**figure 4a**). If Train B *has* passed over the "release" sensor, then the "test" sensor will tell the circuit to ignore the "brake"

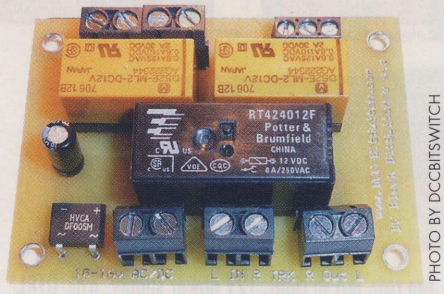
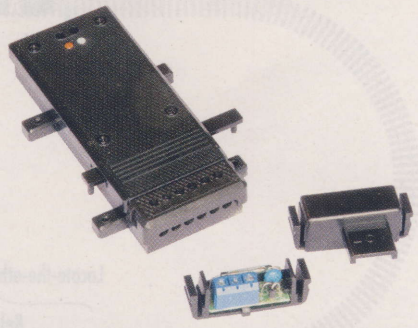


PHOTO BY DCCBITSWITCH

DCCBitSwitch's DC Block BitSwitch.

RR Concepts' StationMaster.



LGB switch machine with toggle-switch attachment and two magnetic reed switches (one uncovered to show switch and hook-ups).

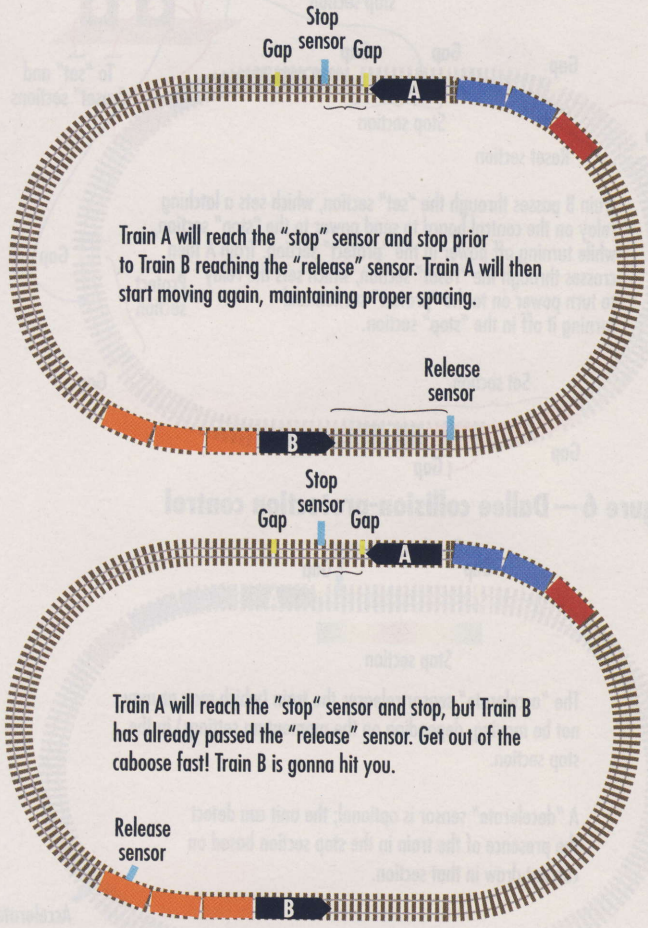


Figure 3—Release Sensor Placement

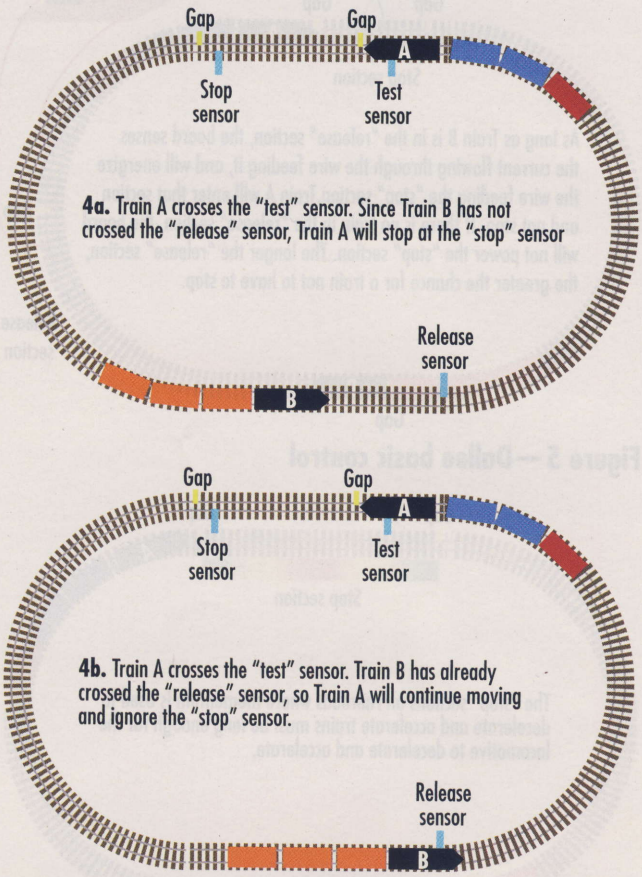


Figure 4—DCC BitSwitch Block Control

sensor and Train A will roll through without stopping (**figure 4b**).

Dallee Electronics offers a few different ways to approach this. They don't use magnetic sensors; rather, their devices sense the current flowing to isolated sections of rail. In the most basic set-up, a detector circuit powers the speed-control section of track only when there's a train in the locate-the-other-train section (**figure 5**). The longer the locate-the-other-train section is, the longer the period of time the speed-control section has power, and trains may run continuously through that section without stopping. The only caveat here is that the speed-control section needs to be fairly short so that Train A leaves that section before Train B, in the locate-the-other-train section, leaves that part of the track, as, once it does, the power stops flowing to Train A (if it's still in the speed-control section) and you'll have a collision.

In a step up from that system, **Dallee** has a different control board that offers protection against that danger of collision.

Sources and parts list

Manufacturer	Product(s) used	Price
RR Concepts	StationMaster *Optional—needed for slow start/stop only*	$89.00
LGB	#12010 Switch Machine	$39.98
	#12070 EPL Turnout/Signal controller	$39.98
	#10260 Insulated rail joiners (4/pk)	$9.98
	#17100 Track contact *Two needed*	$20.98
Dallee Electronics	#369 12V regulated power supply	$19.95
	#365 Trak-DT	$29.95
	#566 Trak-DTRL	$44.95
	#MO-1 Momentum control *Optional—needed for slow start/stop only*	$49.95
DCC BitSwitch	DC Block BitSwitch	$49.95

Contact information for product sources:

RR Concepts
1357 Hodges Rd.
Oceanside CA
92056
www.rr-concepts.com

LGB (Wm. K. Walthers Inc., distributor)
5601 W. Florist Ave.
Milwaukee WI 53218
www.walthers.com

Dallee Electronics
246 W. Main St.
Leola PA 17549
717-661-7041
www.dallee.com

DCC BitSwitch
31190 Eagle Crest Ln.
Evergreen CO 80439
303-674-3114
www.dccbitswitch.com

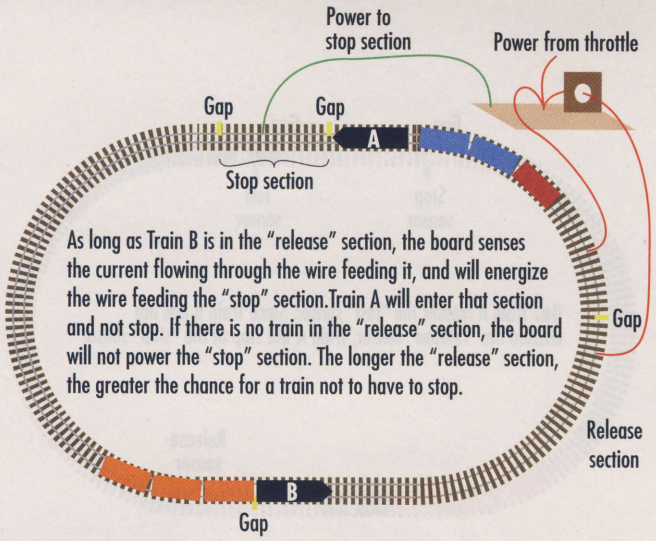


Figure 5—Dallee basic control

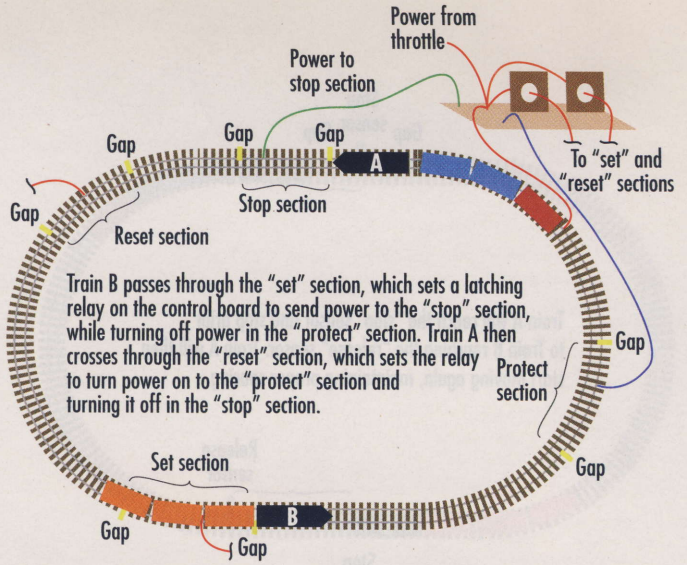


Figure 6—Dallee collision-protection control

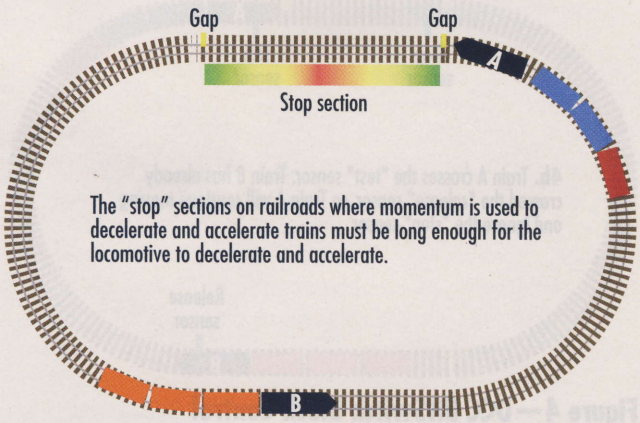


Figure 7—Momentum-control stop sections

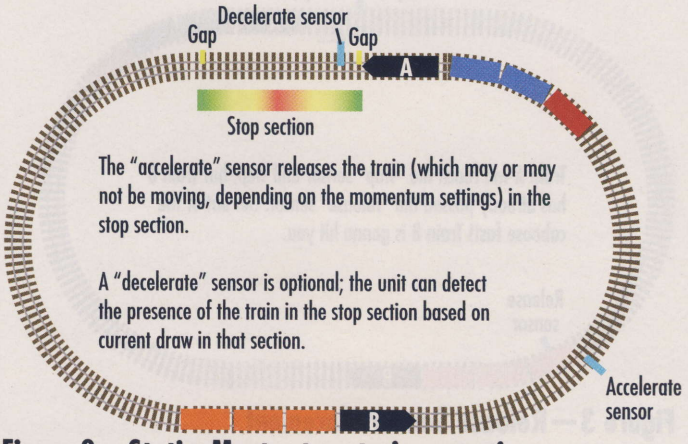


Figure 8—StationMaster two-train operation

It uses a latching relay to alternate power between "stop" and "protect" sections of track (**figure 6**). If Train A hasn't gotten to the "reset" position yet, the "protect" section of track remains unpowered, protecting the rear of Train A. Once it gets to that "reset" section, power is applied to the "protect" section and shut off to the "stop" section. Train A will then travel to the "set" section, which energizes the "stop" section and isolates the "protect" section.

Up to this point, there's a common drawback to all of these systems—they all instantly turn the power to the speed-control sections of track on or off. As I mentioned in previous installments, quickly applying or killing power to locomotives is not ideal. It's bad for the gears and, with long trains, can lead to coupler issues and derailments. It's better for the train to slowly accelerate and decelerate. The second Dallee system I described will work in concert with the company's momentum start/stop module, which allows for this. With these additional components, your "stop" and "protect" sections must be much longer than with the non-momentum systems. Without momentum, the isolated sections of track need only be slightly longer than the locomotive. With momentum, they must be long enough for the locomotive to slow to a stop and accelerate back to full speed (**figure 7**).

Railroad Concepts' "StationMaster" control also allows for momentum starts and stops in its two-train operation control. It uses either two sensors (an "accelerate" sensor and a "decelerate" sensor) or just an "accelerate" sensor and an automatic sensing of a train in the isolated section by detecting the voltage when a train enters is (**figure 8**). The isolated section, like Dallee's set-up above, must be long enough to accommodate the distance it takes the locomotive to slow to a stop and speed up again. The rate of acceleration and deceleration is programmable.

As described, all of these systems are designed to run only two trains on one loop at a time. In most cases, additional trains can be accommodated by adding additional modules to the set-up. I refer you to the manufacturers' documentation for specific wiring diagrams, as they can get fairly complex as more trains are added to the mix. That's part of the fun of automation—piling on features and functions. While the nitty-gritty details of those kinds of installations are outside the scope of this beginners' column, they do bear mention, and there are a number of resources available to help you plan and design your automated empire. I'll cover those in the next (and final) installment of this series.

About this series

August 2012: Auto-reverse systems
October 2012: The station stop
December 2012: Reverse loops
February 2013: Alternating trains in/out of sidings
June 2013: Combining features and advanced concepts in automation