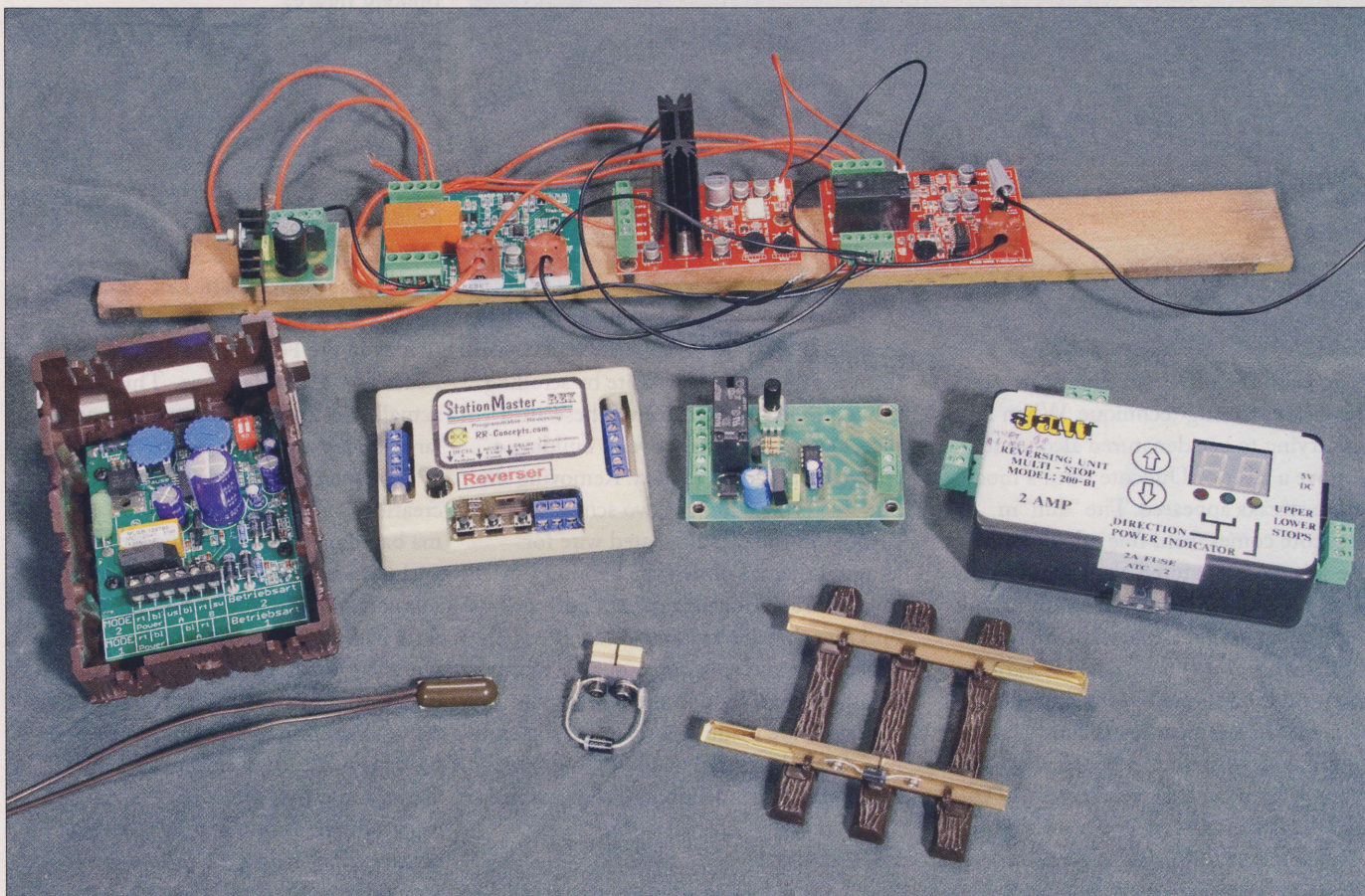




# Automation in the garden: Part 1 — the “Out and back”



If you want your trains to go back and forth automatically, one of these devices may work for you. From left to right: LGB, RR Concepts, Dallee's simple back-and-forth board, and Split-Jaw. The four components that make up Dallee's momentum back-and-forth system are along the top. (See the sidebar for specific part numbers.)

I come from a background of prototypical operations on the railroad. I'm usually happiest with the throttle in my hand, stopping at stations and sidings, picking up and dropping off cars as I go. But there are days when I want nothing more than to set a train in motion and watch it trundle around the garden while I work. Therein lies the genesis for this series—automation in the garden. In my next few columns, I'm going to showcase some of the most common situations in which we would want some level of automatic control, and highlight some of the products on the market that make this possible.

I'm limiting the scope of this discussion to products aimed at what I call

“traditional” DC operation—that is, operation that uses a typical throttle to control the voltage to the rails, as opposed to DCC or any other command-control protocol. I'm also not going to delve into computer control or high-level automation of entire railroads. The scope of this series will be to teach fundamentals so that readers can build upon them later.

When it comes to model-railroad design, there are no plans simpler than either a circle or a straight line. The circle is easy—you just hook your throttle up to the track, turn it on, and the train runs around for hours on end. What about a straight line of track? Without constant attention, the train will run off the end or

hit the bumper and spin its wheels. If you're an operator like me, the “constant attention” is all part of the fun. After all, few prototype railroads are continuous loops. You've got to stop and change direction at some point. How do you do that automatically?

When it comes to automation, a fundamental thing is knowing where the train is so that you can tell the controls what to do with the train at that particular point. There are different ways of accomplishing this outdoors. The most common is to use a magnetic sensor. You attach a magnet to the locomotive, then place magnetic sensors (typically reed switches that close when a magnet passes over

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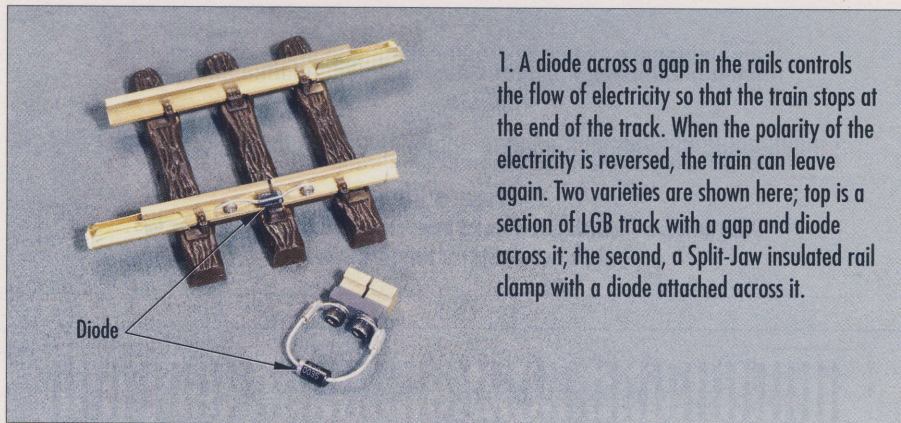
them) along the track at strategic points. You must place a magnet on each train you want to detect.

Alternatively, you can use some kind of electronic detection. These systems monitor the current going to a section of track. Any change in that current lets the system know a train is at that particular point on the track.

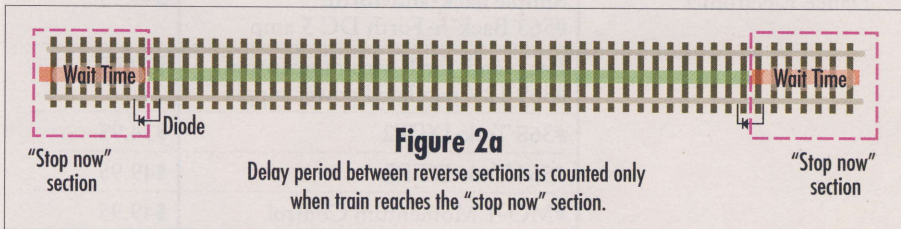
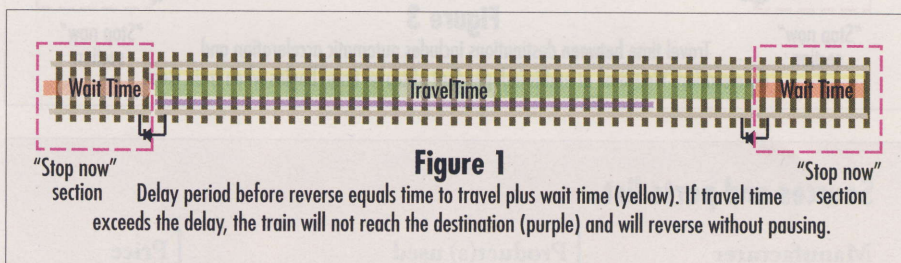
In this article, I'll look at "auto-reverse" systems offered by four different manufacturers: Railroad Concepts, LGB, Dallee Electronics, and Split-Jaw. Railroad Concepts and Dallee offer different levels of controllability with different products.

You may ask, "What's so complicated about making a train stop, change direction, and go back to the other station?" The first difference lies in how the various controls actually start and stop the train. At the simplest level, the reversing control merely flips the direction of the current after a prescribed period of time. These abrupt changes in direction don't allow for a train to actually stop at a station. To do this, many systems rely on a break in the track bridged by a diode; what I'll call a "stop now" section. The diode acts as a one-way gate for electrons (photo 1). When the train is approaching the "stop now" section, the diode keeps the electrons from flowing to the rail on the far side of the gap, so the train stops when it reaches that section (hence the "stop now" moniker). When the circuit reverses the polarity, electrons will flow through the diode and the train then moves in the opposite direction. This is what, on some systems, provides station stops at either end. The length of the station stop is determined by the delay setting on the reverser, minus the time it takes to travel from end to end. For instance, if your delay is set at 90 seconds and it takes one minute to travel the distance, your effective station stop would be 30 seconds (figure 1). LGB and Dallee's basic reverse circuits work on this principle.

Another way to "start the clock" is to monitor the current going to the track. When a train hits the "stop now" section, the electrons stop flowing and the current drops to zero. Systems like the Split-Jaw reverser use that drop in current to time the station stop. The train can take as long



1. A diode across a gap in the rails controls the flow of electricity so that the train stops at the end of the track. When the polarity of the electricity is reversed, the train can leave again. Two varieties are shown here; top is a section of LGB track with a gap and diode across it; the second, a Split-Jaw insulated rail clamp with a diode attached across it.



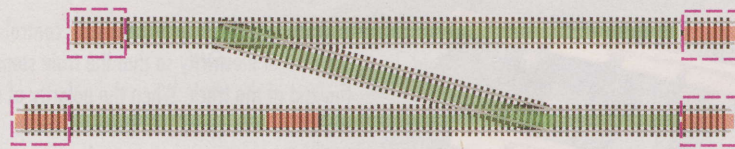
### Comparison of features

Product	Momentum slow-to-stop program	Intermediate station stops	Independent travel/delay	Track sensors
LGB Reverser Mode 1	No	No	No	Diode
LGB Reverser Mode 2	Partial*	No	No	Gap and diode
Dallee simple back-and-forth	No	No	No	Diode
Dallee momentum back-and-forth	Yes	Yes	Yes	Gap
Split-Jaw 100-B1	No	No	Yes	Diode
Split-Jaw 200-B1	No	Yes	Yes	Diode
Stationmaster Reverse (non-sensor)	Yes	No	Yes	Diode
Stationmaster Reverse (sensor)	Yes	Yes	Yes	Magnet

\*In "mode 2," the train travels at a reduced speed over a "transition" section of track, but does not gradually slow down all the way to a stop.

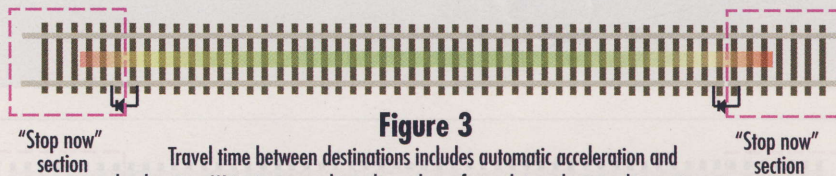
as it wants to get from end to end (including multiple station stops along the way—more on that next time), and the station stops at the end will always be the same length of time, as determined by the

setting on the control box (figure 2a). The advantage of sensing a drop in current is that you can use the controller to automate a train traveling to multiple destinations, such as a switchback where the



**Figure 2b**

Delay periods are counted only when the train enters stop sections, which allows for multiple station stops and multiple destinations.



**Figure 3**

Travel time between destinations includes automatic acceleration and deceleration. Wait time at end is independent of travel time, begins when train stops.

### Sources and parts list

Manufacturer	Product(s) used	Price
Dallee Electronics	Simple back-and-forth: #563 Back-n-Forth DC 5 amp	\$49.95
	Back-and-forth with momentum: #369 12V regulated power supply	\$19.95
	#368 Trak-DTT2	\$34.95
	#566 Trak-DTRL	\$49.95
	#MO-1 Momentum Control	\$49.95
LGB	10340 Automatic Reversing Unit	\$249.98
Split-Jaw Products	Model 100-B1	\$135.00
	Model 200-B1 (w/intermediate stops)	\$185.00
RR Concepts	Stationmaster Reverser	\$89.00

### Contact information for product sources:

<b>Dallee Electronics</b> 246 W. Main St. Leola PA 17549 717-661-7041 <a href="http://www.dallee.com">www.dallee.com</a>	<b>LGB (Wm. K. Walthers Inc., distributor)</b> 5601 W. Florist Ave. Milwaukee WI 53218 <a href="http://www.walthers.com">www.walthers.com</a>	<b>Split-Jaw Products</b> PO Box 90146 Portland OR 97290 877-762-4822 <a href="http://www.splitjaw.com">www.splitjaw.com</a>	<b>RR Concepts</b> 1357 Hodges Rd. Oceanside CA 92056 <a href="http://www.rr-concepts.com">www.rr-concepts.com</a>
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distance between points A and B is different than that between points B and C. The Split-Jaw unit has auxiliary outputs tied to the change in direction that can be used for a number of functions, including lights and automatically throwing switches along the route (**figure 2b**).

The weakness of these systems is the abruptness of the starts and stops. The

“stop now” section is not a “slowly drift to a stop” section. If the diode blocks the electron flow, the motor stops immediately. That’s not ideal for the gears in our trains, especially if you’ve got a long train between your locomotive (unlikely on a point-to-point line but not unheard of).

Railroad Concept’s Stationmaster Reverser handles this problem by timing

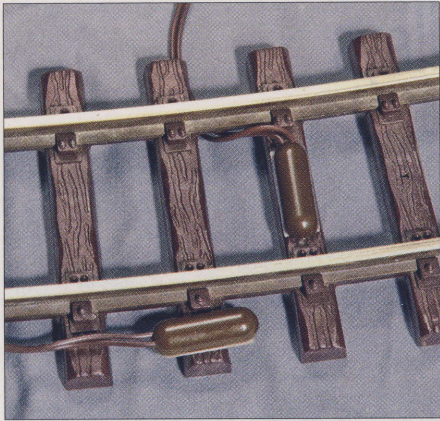
how long it takes the train to travel from each end, then mathematically figuring out how long to run the train at full voltage, based on acceleration and deceleration parameters that you program into the controller (**figure 3**). The “stop now” sections are still there as a safety net but the controller will have slowed and stopped the car (or train) just prior to entering that section of track. The train will then sit at either end for whatever length of time you have programmed in as well. (Acceleration, deceleration, top speed, and delay are all independently programmable.) With that nuance added to the equation, though, you’re back to a system that’s based on timing, so you’re back to being limited to just two destinations—you can’t stop in between or change destinations.

For all features combined (slow starts and stops, multiple station stops, and multiple destinations), you need an automation system that’s based on the specific location of the train being controlled. For that, sensors are required that can detect the presence of the train, then relay that information back to the central “brains” to make things happen.

The Stationmaster controller operates in two modes: either the “non-sensor” mode, as described above, or the sensor mode, where any changes in state (direction, acceleration, and/or deceleration) are dictated by magnetic switches.

In the case of an out-and-back railroad, you’d place two sensors near the stations. As the train travels over the sensor (**photo 2**), a magnet attached to the train (**photo 3**) triggers the sensor and the controller decelerates the train, pauses for however long you have programmed, changes the direction, then accelerates. The box “ignores” the sensor as the train passes over it leaving the station, so the train will continue at a constant speed until it hits the next sensor, at which point it will slow down, pause, change direction, then speed up again (**figure 4**). Multiple station stops can be added by adding additional magnets. (Again, more on this next time.)

Similar in terms of functionality to the Stationmaster, Dallee Electronics offers a more complex controller in addition to their simple back-and-forth unit. Much of what they produce is various components



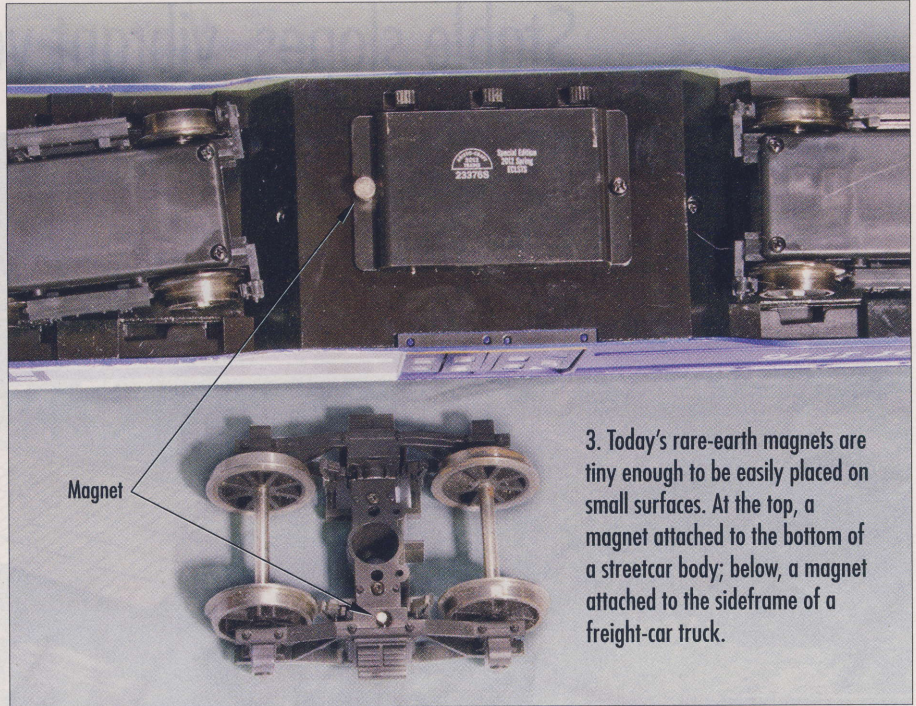
2. Magnetic reed switches can be used to detect the train location along the track. These can be placed between the rails or beside them, depending on need.

that can be combined in different ways for a wide range of functions. Dallee's products work by breaking the track up into individual segments, then sending track voltage to each segment separately, monitoring whether current is being drawn on that segment via a sensor that detects the magnetic field created when electricity passes through a wire.

The train starts at one end, which triggers the board to slowly increase the speed to full speed over the "transition" section of track, then runs at full speed until it gets to the next "transition" section of track in advance of the next station (figure 5). The control board senses current being drawn in this section of track, then slows the train until it passes to the "stop" section of track, at which point the train waits for the programmed amount of time, changes direction, moves back into the "transition" section, where it speeds up and continues back to the first stop. (This system also allows for multiple station stops along the way.)

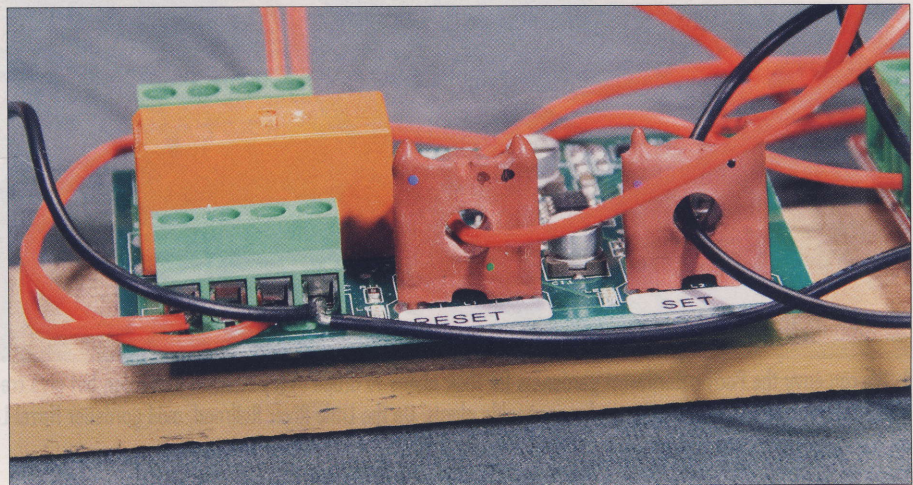
These latter two systems are somewhat more complex, in that you're running a lot of wires to individual blocks of track or to trackside sensors, whereas the systems described first require mostly just two wires to the track and the "stop now" diode-controlled sections. The system that is best for you depends on what you're trying to achieve.

In the next issue, I'll discuss adding station stops to out-and-back operations, and different means of alternating trains in and out of stations. ▀



Magnet

3. Today's rare-earth magnets are tiny enough to be easily placed on small surfaces. At the top, a magnet attached to the bottom of a streetcar body; below, a magnet attached to the sideframe of a freight-car truck.



4. The Dallee Electronics system uses electronic sensors that detect magnetic fields emitted by wires.

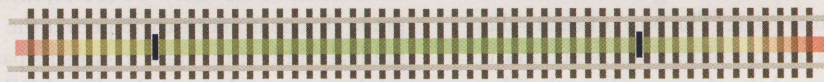


Figure 4

Magnetic sensors in track trigger deceleration to stop at station. Delay starts counting once train is stopped.

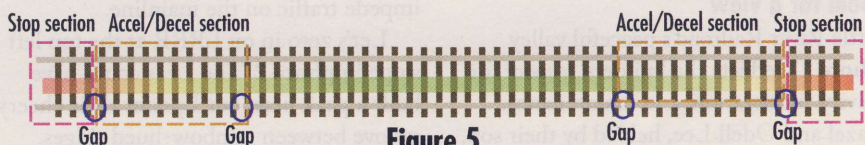


Figure 5

Each isolated section serves a distinct function, as dictated by the controller.