BUILDING AN AUTOMATED SWITCHBACK

By
Jeff Mitulla

For the December 2000 Greenberg Show at the Capital Expo Center in Chantilly, I designed a switchback layout as the main focus of the display. The train would shuttle back and forth up the mountain automatically controlling switch position and locomotive direction. This layout simulated operations as they occur on the famous tourist railroad, the Cass Scenic Railroad. Swithchbacks were a relatively low cost approach for mining and logging railroads to gain altitude in a short distance without going to the expense of building long approaches, trestles, and or bridges. We had an overwhelming response to this layout with many questions as to how the layout operated. Many of the questions came from our own club members. So, this article will reveal all secrets...

My first approach in automating the switchback was to use LGB's MTS components under computer control. But lack of enough time to become familiar with the software and hardware, lack of availability of some of the MTS components and an ever approaching show date, forced me to reconsider this approach and come up with an analog alternative. The upside to the analog approach was that no longer did the locomotives have to be modified with an MTS decoder. The only modification that locomotives needed to run the switchback, was the addition of a magnet under one of their trucks.

There are two main issues that affect the successful design of the switchback layout. The first issue concerns the selection and connection of the electrical components and is split into two sections. The second issue concerns the physical layout of the track and switches. First I will discuss the selection and placement of the electrical components.

The automatic operation of the switchback is divided into two sections. The first section of the switchback electrical design controls the operation of the switches. For each switch you will need the following LGB components: (3) 1700 or 17100 [EPL Track Contact], (1) 12030 or 12070 [EPL Supplementary Switch], (1) 12010 [EPL Switch Drive] and a 12000 or 16000 series electric drive switch of your choice. You will also need a 51750 Momentary Switch Control Box (orange), a 52750 EPL Booster Unit (red), and a 0-24VDC power supply with an AC output for accessories. The benefit of using a 52750 EPL booster unit is that the switch closures will be more positive

and that this unit will compensate for longer wire runs to the switches. Wire the power supply's AC terminals to the input of the 52750 EPL Booster Unit and plug the 51750 Momentary Switch Control Box into the output of the 52750 EPL Booster Unit. Your AC for all of your EPL connections marked "3" & "4" will be connected to the terminals marked "3" & "4" on the 51750 Momentary Switch Control Box. Please pay close attention to the symbols on the schematic as they represent the symbols used on the actual components. You will need these components for every leg of the switchback. So if your layout has 4 legs, you will need 4 sets of components. The components shall be placed and wired per the schematic in figure 1.

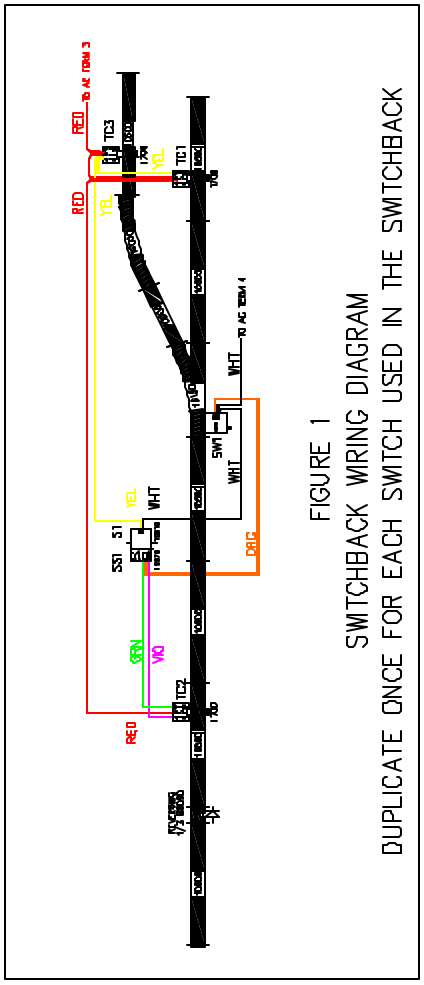

FIGURE 1
SWITCHBACK WIRING DIAGRAM
DUPLICATE ONCE FOR EACH SWITCH USED IN THE SWITCHBACK

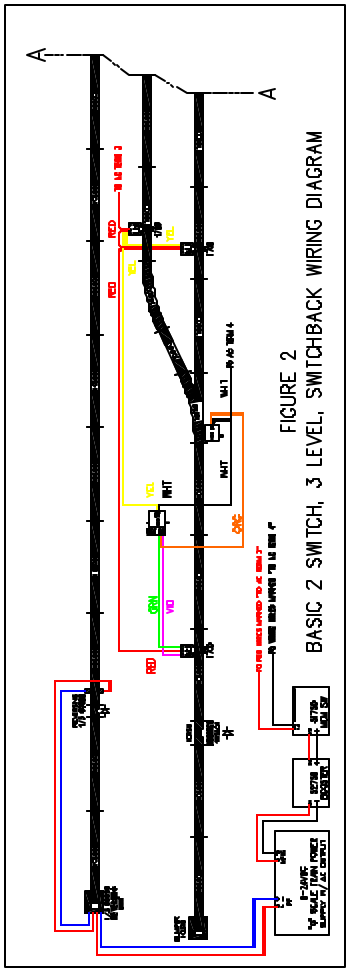

FIGURE 2
BASIC 2 SWITCH, 3 LEVEL, SWITCHBACK WIRING DIAGRAM

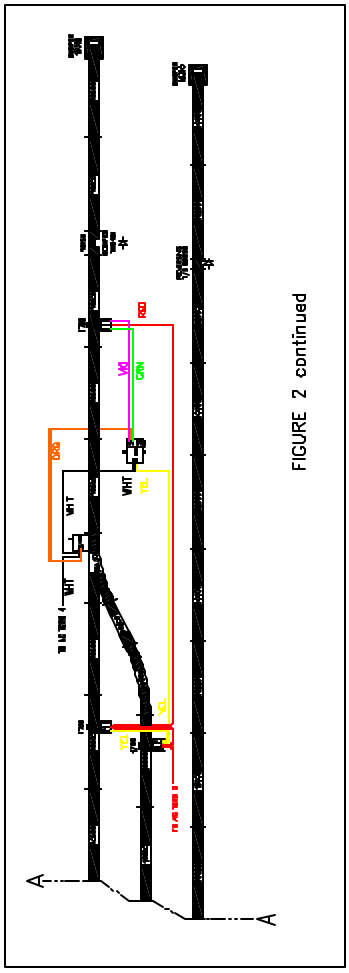

FIGURE 2 continued

The placement of the 17100 EPL track contacts in relation to each switch shall be such that the longest train that you intend to run on the switchback can fit into the spacing between the 17100 and the switch, completely clearing the switch. This is true for all three 17100's for any given switch. As each switch and its associated components are completely wired, check for proper operation. Connect AC power from your terminals "3" & "4" of the 51750 Momentary Switch Control Box to the wires marked "3" & "4" of each switchback section. Using a 17010 magnet, hold it approximately ¼" inch over the rail and pass it slowly over TC1 and you should hear only S1/SS1 activate. If it did not, physically change the position of S1 and try it again. You should have heard only S1/SS1 activate. Now use the magnet and pass over TC2 and you should hear only SW1 activate and see the switch move. If not, set the switch, SW1, to its opposite position

and pass over TC2 again. This time you should have heard and seen only SW1 activate. Now pass the magnet over TC3 and hear only S1/SS1 activate. These extra manual steps may be necessary when the layout has first been built for checkout purposes only. In actual operation, after the layout has not been run for a while, not hearing a certain single action within a switchback should not be cause for alarm, as that component may have been reset manually at some previous time. After an initial run on the layout, all components should behave normally. If any of these steps did not function properly, go back to the schematic and troubleshoot your wiring. Wire only one switchback circuit at a time to avoid confusion. As an example, a basic 2 switch, 3 level switchback is shown in the diagram in figure 2. (shown above)

The second section of the switchback electrical design powers the locomotive and controls the direction. For the whole switchback layout you will need one LGB 80090 EPL Automatic Reversing Unit. The 80090 comes with the reversing electronics built into a bumper and (2) pieces of special 10070 length track that has a gap on one side of the track and a diode installed across the gap. It is this piece of track on either end of a shuttle track, which stops the engine and starts it up again when the voltage reverses its polarity. It is important that when using the 80090 automatic reversing unit that all track sections with the gap and diode be installed so that the gap and diode are on he same side of the rail. For a 4 switch (6 level) switchback like the one displayed at the Chantilly show, you need 6 of these diode equipped track sections. Since the 80090 is sold with only two pieces of this special track and they are not available separately, I will describe how to build alternate diode equipped track sections.

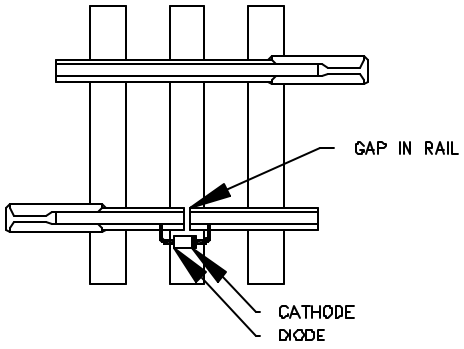

FIGURE 3
EXAMPLE OF DIODE EQUIPPED 10070 TRACK SECTION
(2) SUPPLIED WITH 80090 AUTOMATIC REVERSING UNIT

Simply take a LGB 10153 (old #1015U) track section, in which one rail is continuous and the other rail is split, remove its cover, and add a 1N5401 diode as shown in figure 4.

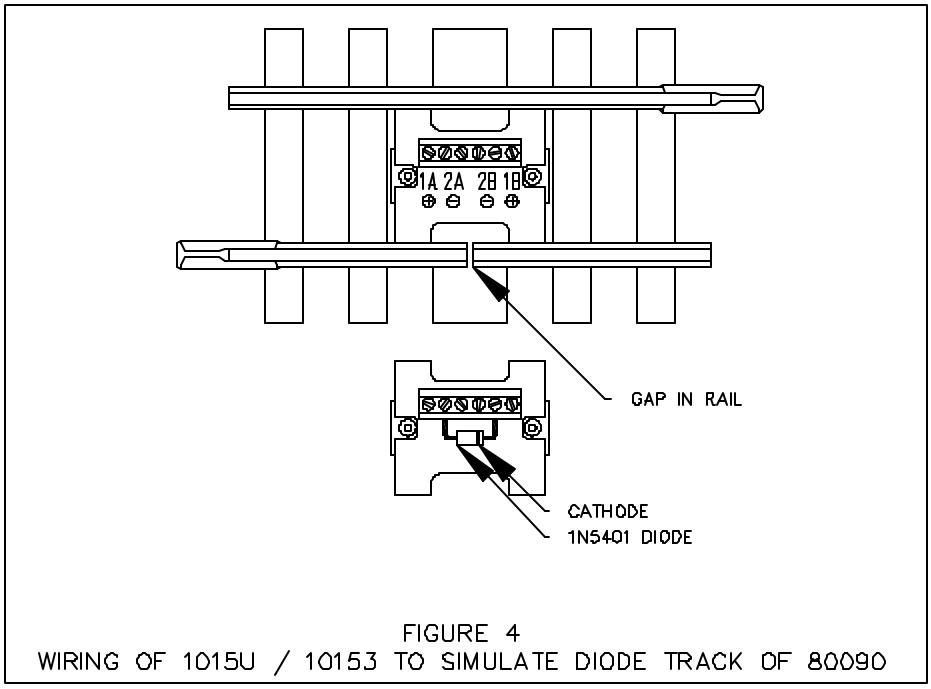

FIGURE 4
WIRING OF 1015U / 10153 TO SIMULATE DIODE TRACK OF 80090

As an alternative, a LGB 10152 (old #1015T) section of track, which contains 2 split rails can also be used, by adding a wire jumper and 1N5401 diode as shown in figure 5.

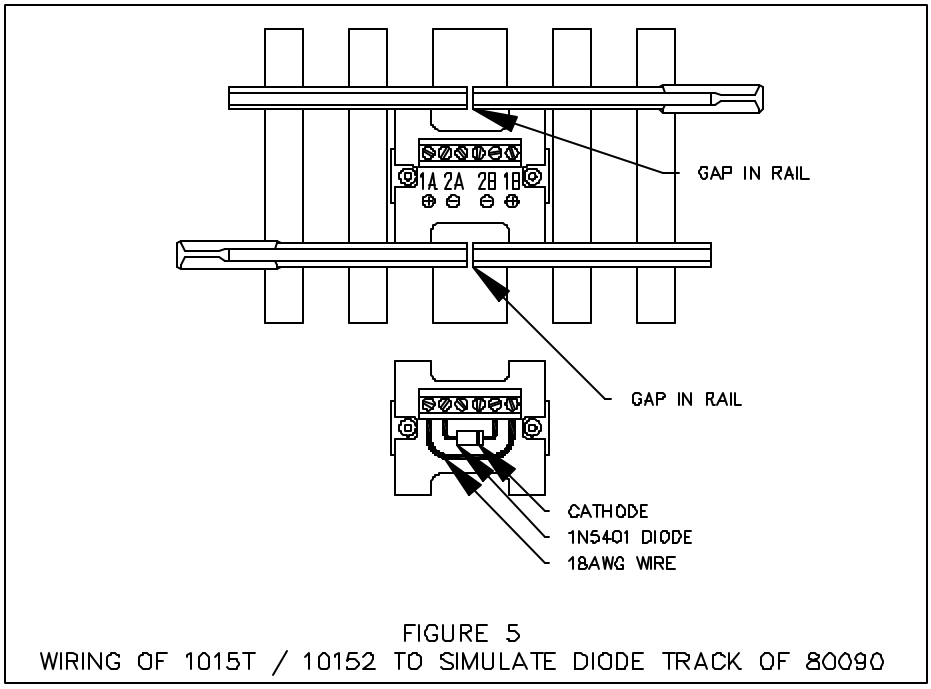

FIGURE 5
WIRING OF 1015T / 10152 TO SIMULATE DIODE TRACK OF 80090

A drawing of the special 10070 diode equipped track, supplied with the 80090 Automatic Reversing Unit, is shown in figure 5 for comparison. 1N5401 diodes are general purpose diodes that have a 3 amp capacity and are available from Radio Shack, as catalog number 900-2877, or any similar supplier.

I have not yet tried to use the new LGB 10340 EPL Automatic Reversing Unit with prototypical acceleration & braking. I noted in its instructions, that for prototypical acceleration & braking, electrical switches in the controller are set for this mode of operation, and the track sections with the split and diode be installed so that the split and diode are on the opposite side of the rail at either end of a shuttle layout. I also noted that the units wiring is more complex, so I need to experiment if the 10340 EPL Automatic Reversing Unit could also be used for a switchback.

The physical design of the track and switches is as important to the success of the switchback layout as the proper connection of the electrical components. As already mentioned previously, the placement of the 17100 EPL track contacts in relation to each switch shall be such that the longest train that you intend to run on the switchback can fit into the spacing between the 17100 and the switch, completely clearing the switch. In addition, the track length from the diode equipped track section to the end of the track shall equal the longest train length, plus enough track length to allow for a sliding stop from maximum anticipated train speed. Some experimentation may be necessary to come up with the appropriate length. Adding a LGB 10310 Bumper, to each track stub end would be a good idea, just to be on the safe side, to keep a potential runaway piece of rolling stock from rolling too far on your layout. I would also recommend that the switch, 300mm of track leading into the switch and the stub track be on level or near level terrain. Try to keep the grade to 3 – 4% to make for reliable operations, but your backyard conditions may require a different grade. The track for the grade should be straight or use larger radius curves. I would avoid tight radius curves as they impart more friction on the train and its ability to pull.

So, your ready to start running trains. To have your locomotive command the track contacts, which in turn control the switches on the switchback, you will need to add a LGB 17010 magnet to the bottom of you loco. If your loco is a LGB product, you should be able to either clip it onto the gearbox or remove the metal clip from the magnet and permanently adhere it to the gearbox using the attached doublesided tape. For non-LGB products the magnet may have to be adhered using doublesided foam tape, and you may have to experiment with different magnets to get one that will work. Keep the magnet away from any mounting holes on the bottom of the gearbox, which may be needed for maintenance access. Please make sure that any magnet does not hang too low underneath the locomotive so that it will not hit any of the insulated track housings or switch components.

There is a thumbwheel potentiometer inside the housing of the 80090 Bumper, which is accessible through the rectangular opening in the front of the bumper. Set this pot to its halfway range. Set your DC power supply to a voltage that powers your locomotive to a realistic speed. Observe if your train travels from isolated track section to isolated track section, stops for a short period and reverses its travel. If it does, then the chosen delay is perfect. If the train never reaches the other isolated track and reverses partly up the last incline, increase the cycle time by turning the pot to the right a small amount, as viewed from the front of the bumper. If the delay is too long at the bumper, decrease the cycle time by turning the pot to the left a small amount, as viewed from the front of the bumper. The delay is adjustable with the pot from approximately 8 seconds to 90 seconds and by turning on the switch on the circuit board delays of up to 10 minutes can be achieved. The proper setting of the delay will allow for differing complexities in switchback layouts. The only thing to keep in mind is that the delay will be the same for all segments of the switchback, there cannot be a separate delay for the starting / ending segments versus the middle segments.

Now after all of this hard work, the only thing that remains is to run your trains, sit back and enjoy the fruits of your labor, and accept all of the oohs and ahhs from your family, friends and visitors.

I hope you'll have fun building this interesting layout.

Components used: (quantities dependent upon number of switchback stubs)

0-24VDC power supply with an AC output for accessories.
51750 – EPL Momentary Switch Control Box (orange)
52750 – EPL Booster Unit (red)
80090 – EPL Automatic Reversing Unit

1700 or 17100 – EPL Track Contact: Figure 1 reference designator TC1, TC2, TC3
17010 – EPL loco magnet
12030 or 12070 – EPL Supplementary Switch: Figure 1 reference designator SS1
12010 – EPL Switch Drive: Figure 1 reference designator S1
10310 – Bumper
10152 or 10153 – Isolation Track
1N5401 General Purpose Diode from Radio Shack, catalog number 900-2877 or similar

16050 or 16150 – Electric Switch: Figure 1 reference designator SW1