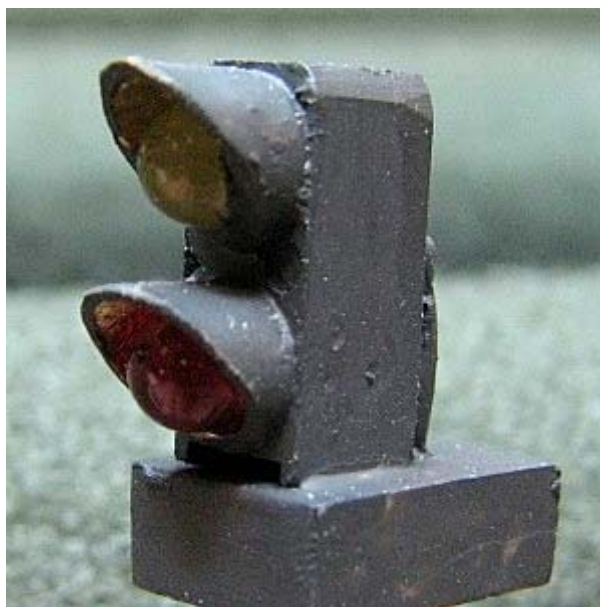
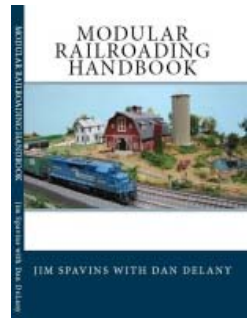




Building Inexpensive Dwarf Signals





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If you are interested in learning all about Modular Railroading, visit the [store](#) or Amazon.com to purchase your copy of the *Modular Railroading Handbook* today!

Dwarf signals are generally used by railroads for control of trains near

yards and sidings. I found that they offer considerable interest to a modular layout if they are used around turnouts in the yard or yard lead tracks. My usage of these signals on my layout is for identifying turnout position. They not only are interesting to look at, but they are also a hit with the model railroading fans.



The convention that I have adopted for my layout is as follows:

-Green over Yellow at the point of the turnout – Green denoting that the turnout is aligned to go straight through the turnout, and Yellow denoting the turnout set for the diverging track.

-Green over Red at the frog end of the straight through track – Green indicating that the turnout is aligned for straight through operation, and thus, a green signal is presented, and Red denoting that the train should stop since turnout is aligned to the other track.

-Yellow over Red at the frog end of the diverging track – Yellow denoting that the turnout is turned in the correct direction to proceed, but since this is the diverging track of the turnout, speed should be reduced. Red is a denoted above.

There are several commercial products on the market, but I decided to create my own dwarf signals. The total cost of each of these dwarf signals was less than \$2.00, and the time need to make each of these signals was about 45 minutes each. For this project I used light emitting diodes (LED's), and a positive and negative 12 volt power source. The materials, parts and tools

Materials/Parts List

- 2-color 3mm Red over Green PCB mounted LED's - Dialight P/N 553-0121F purchased from an electronic supply company (Digi-Key).
- 3mm Yellow LED – Purchase from any electronic supplier.
- 5/32" copper or aluminum tubing
- 5/32" plastic tubing
- 0.125" plastic sheeting
- 1000 ohm, ¼- watt resistor
- 22 – 26 gauge stranded wire
- Glue (both plastic and CA)
- Paint

Tools Needed

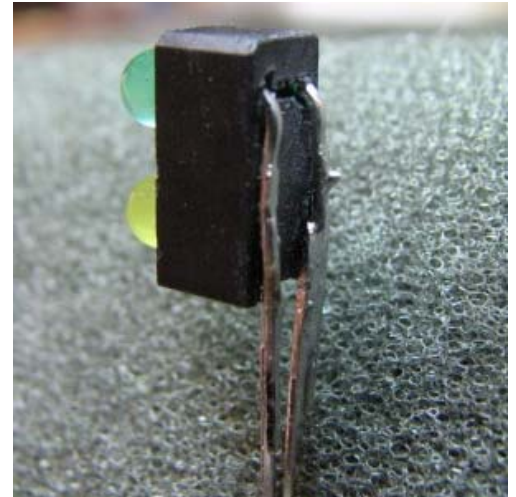
- Razor Saw
- Miter Box for razor saw (not essential, but makes job much easier)
- Needle Files – round and flat
- Pliers – side cutters and needle nose
- Soldering Iron & Rosin Core Solder

needed for the project are listed in the box on the right.

The primary objective of this project is to convert the 2-color PCB LED into a dwarf signal. The finished product has a base, a mounting tube, and necessary wiring to connect to a Tortoise turnout machine that is supplied with a positive and negative 12 volt power supply. It is very important to this project that the power supply has a positive and negative voltage, as there are only 2 lead wires used for the dwarf signal. I'll lead you through each step of the project.

1. Mark the two right side leads (as identified from the LED side of the PCB block) of the 2-color PCB LED with a marker to denote the cathode side of each LED. The cathode side is also identified by a dot on the front between and to the right of the LED's.

2. Bend the LED leads for both LED's in this block straight back, and remove the LED's from the front.



3. Cut the block in half (vertical) using a razor saw.

4. Insert 2 LED's into the block from the front with the cathodes of each LED on opposite sides of the block. Remember, the cathode for the LED's that were removed were marked with a pen. As noted above, the Dwarf signals can have several combinations of Red, Green & Yellow, so you may wish to use the Yellow lead LED as identified in the parts list. If the Yellow LED is used to the cathode side is the shortest lead of the two.

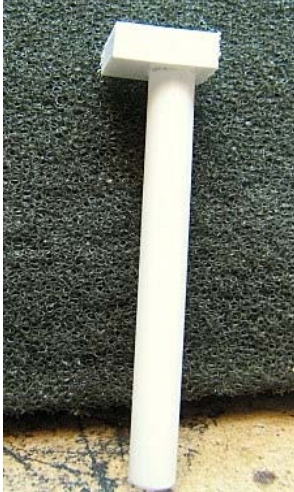


5. Bend the leads straight down on the back of the block, keeping the leads on each side parallel with each other.

6. Solder the two sets of lead together, and cut flush with the bottom of the block.

7. Attach 22 – 26 AWG wire to the LED leads.

8. Prepare the hoods for the LED's by cutting the 5/32" copper/aluminum tubing on a 45 degree angle using the miter box and a razor saw. File off the rough edges of the hood. The finished hood is inserted over each LED and glued onto the block/LED with CA.



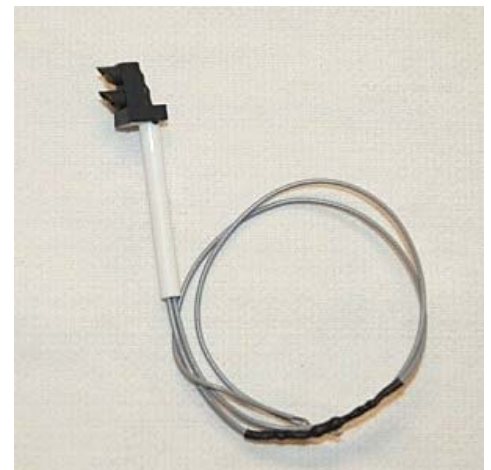
9. Prepare a mounting block and support post. The mounting flange is made from the 0.125" plastic sheet cut to 1/4" x 3/8". Drill a 5/32" hole in the mounting flange to allow a length of 5/32" tubing to be glued into it as a support post through which the wire leads pass. Glue the two parts together with good liquid plastic cement.

10. Pass the wire leads through the plastic tubing and glue the Dwarf Signal head to the top of the mounting block.

11. Solder the 1/4-watt, 1000 ohm resistor into one of the leads. This drops the current to the LED's to about 10 milliamps for a 12 volt power supply. One side of the lead is connected to a common point on the 2 power supplies, and the other is connected through the auxiliary contacts of the tortoise motor, which depending on turnout position feed either + 12v or - 12v power to the signals.

12. Paint the entire assembly your choice of colors. I used engine black acrylic paint for my signal head, but you could use silver or another black hue if you wish. On the sample pictured below, I also painted the foundation pedestal the same color, but on others I have used an Old Concrete color to represent a concrete pedestal, which I like better.

The finished product is shown below. The larger than life image highlights the thickness of the brush painted signal, but this would really not be noticeable in HO scale, as seen on the layout.



I enjoyed making this signal head and have installed six of these dwarf signals onto our clubs' staging track leads. I plan on installing about 25 of these signals on my modular layout. So, I better get moving, as this needs to be completed before our next major show.