

Turnout Position Indicator

BY BOB KENDALL

I'm sure many of us would like to have an indication on our control panel of the position of turnouts. There are different ways to do this, and each method has its advantages and disadvantages.

This month I'll show you how to remotely indicate turnout positions if your turnouts are equipped with auxiliary contacts.

Since this isn't really a construction project, just follow the diagrams to wire the indicators to your switch machine auxiliary contacts.

Power Supply

As usual, we'll use a wall-transformer A.C. adapter. To figure out how many lamps the adapter can handle, look at the packaging that the lamp is in. It may say something like "12 volts, 60 mA." This means that the lamp requires a 12 volt power source and it draws 60 milliamps of current. Now, look at the adapter. It might say "12 volts, 1,000 mA." This means it puts out 12 volts which is just right for our lamps and can supply up to 1,000 milliamps (1 ampere) of current. Take 80% of the adapter's maximum current so as not to stress it too much ($=800 \text{ mA}$). Now, divide this by the current of one lamp $=13.3$. Our adapter can handle 13 lamps, which would serve 13 turnouts (only one lamp at each turnout will be lit at one time).

Lamps will last much longer if they are operated at a slightly lower voltage, and the difference in brightness is hardly noticeable. You may wish to operate 14-16 volt lamps at 12 volts and 12 volt lamps at 10 volts.

To determine how many LEDs your adapter will handle, divide the 80% rating of the adapter by 20. Thus, the adapter in the previous example will handle 40 LED-equipped turnouts. If you plan to operate the LEDs at a lower current, say 15 mA, then divide by that number.

Since incandescent lamps don't care whether they use A.C. or D.C., you may use either type of adapter. If you are using LEDs, you must use a D.C. adapter. You'll also have to use a D.C. adapter if

you're using a relay to obtain more contacts. It doesn't matter what voltage your LED power supply is, as long as it's over three volts and you use a suitable dropping resistor for each LED. Each individual LED must have its own dropping resistor . . . you cannot use just one resistor for all the LEDs.

Check the packaging from the LED to determine which lead is the anode and which is the cathode. Normally, a single-color LED has a longer anode lead, but some are made with the cathode lead longer. If you don't know, just hook it up to a power supply with a suitable dropping resistor. If it doesn't light up, reverse it and note which lead is connected to the positive voltage. That will be the anode. You won't damage the LED by connecting it backwards. What damages an LED is not having the right value of dropping resistor.

Some dual-color LEDs require the polarity of the applied voltage be reversed for one of the colors. These can be identified by their having two leads. Determine by testing which lead makes them show red when a positive voltage is applied to it and mark that lead. A dual-polarity power supply will be required. It can easily be made with two wall-transformer D.C. power supplies of the *same voltage and current ratings*. Join the positive output of one to the negative output of the other. This becomes the common connection, leaving you with a positive wire from one supply and a negative wire from the other.

Other dual-color LEDs have three leads, one common and the other two for each of the two colors. This type requires only a standard single-ended power supply. The common lead may be either the anode or the cathode. Use the type with a common cathode.

Cut the connector off the output cable of the power supply and attach the ends to a terminal strip. Usually, the positive (+) wire will have a white stripe on it, but use a voltmeter to make sure.

General Wiring Notes

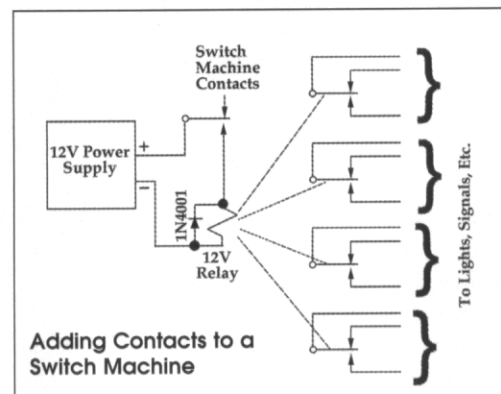
Most switch machine auxiliary contacts are of the double-throw type, in which one common contact moves between two output contacts, depending on which way the turnout is positioned. Some will have two sets of double-throw contacts. Check the instructions to determine which is the common contact and which contact it connects to for each turnout position. My diagrams show the switch machines as having one double-throw set of contacts. All the contacts are drawn in the straight-through route position.

Make the connections shown with heavier lines first. This will connect the common wiring first so that you may test each individual turnout as you wire its lamps or LEDs later.

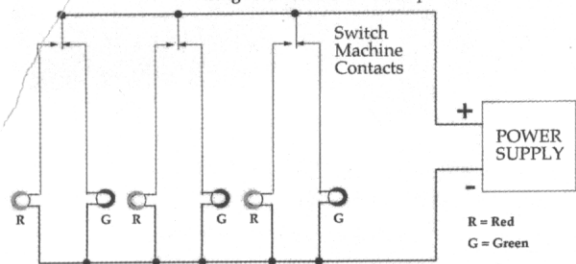
You may wish to wire the turnouts in groups so that if there is a fault somewhere, you can isolate small groups of turnouts to locate the fault. To do this, wire about five turnouts, then start again with a new positive wire back to the terminal strip from the adapter for another group of turnouts. The common (negative) wire can serve all the turnouts.

Testing

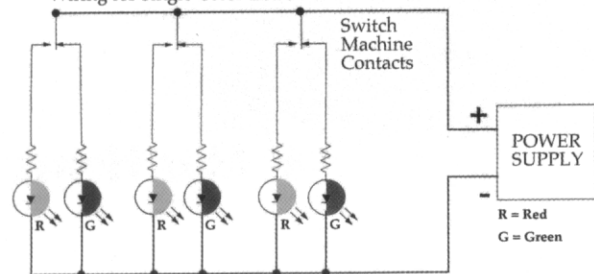
Wire one turnout at a time and test it before wiring the next one. This is why the common connection was made first. After wiring each turnout, plug in the power adapter and move the turnout back and forth, observing that the correct lamp or LED lights up for each position. Unplug the power adapter again before wiring the next set of lamps or LEDs.



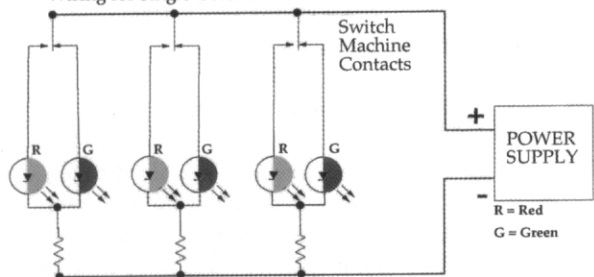
Wiring for Incandescent Lamps



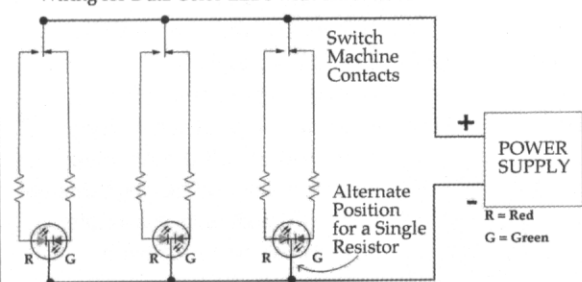
Wiring for Single Color LEDs with Individual Resistors



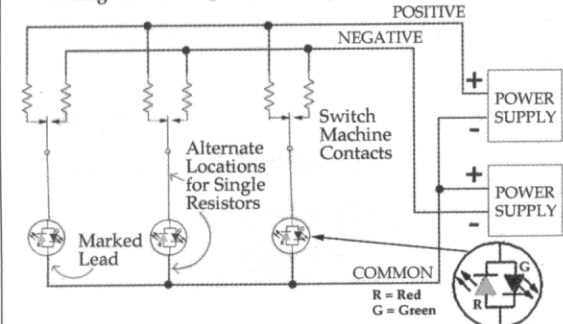
Wiring for Single Color LEDs with Common Resistors



Wiring for Dual Color LEDs with Three Leads



Wiring for Dual Color LEDs with Two Leads



Parts List

This list is a compilation. You'll need to pick out the individual parts that are appropriate for your application. Although I've specified Radio Shack parts, you can buy them at an electronics distributor or by mail order.

Lamp Assemblies

272-337/331/332/334/335 - red, green and blue 12 volt panel lamp assemblies

LEDs

Radio Shack has a wide assortment of red, green, yellow, blue and two-lead red/green LEDs in 3mm, 5mm and 10mm sizes.

276-079/080/092 - optional LED holders for mounting in a panel. Be sure to get the right size holder to match the size of the LEDs.

Wall Plug Power Adapters

Radio Shack has a wide variety of wall plug power adapters with voltages from 1.5 to 12 and currents to 1500 mA (1.5 amps).

If you are using LEDs, you may use a 12, 9, 6, 4.5 or 3 volt adapter.

If you are using relays, the adapter voltage must match the relay voltage, likely 12 volts.

LED Resistors

For a 12V supply - 560 ohms,

1/4 watt - 271-1116*

For a 9V supply - 390 ohms,

1/4 watt - 271-1114*

For a 6 volt supply - 270 ohms,

1/4 watt - 271-1314

For a 4.5 volt supply - 150 ohms,

1/4 watt - 271-1312

For a 3 volt supply - 100 ohms,

1/4 watt - 271-1311

* = part numbers are given for 1/2 watt resistors as Radio Shack does not carry these values in 1/4 watt.

Diode

1N4001 or any in the 1N400x series - 276-1101 to 276-1104

Relays

275-214 - 4 sets of contacts, no socket*

275-206 - 2 sets of contacts, socket included

275-249 - 2 sets of contacts, P.C. board mount

All these relays operate from 12 volts, have two position (double-throw) contact sets and can switch 3 to 5 amps of current.

* = you may be able to obtain a socket at an electronic distributor or you can simply glue the top of the relay cover to wherever you want it mounted and solder wires to the lugs.

Dropping Resistors

You may find that there's a difference in the brightness between the red and green LEDs whether they are single or double units. Test the LEDs before installing them to see if this concerns you. If it does, adjust the values of the resistors to get the light output more even. The parts list gives the *smallest* value resistor that should be used for each power supply voltage. Use larger value resistors to reduce the voltage of the brighter color.

If the difference in brightness doesn't matter to you, you may use only one resistor for each pair of LEDs instead of the two shown in the diagrams. Install this single resistor in the alternate location shown in the diagrams, that is in the common wire for each pair of LEDs.

More Contacts

If your switch machine doesn't have enough contacts, you can add more by using the switch machine to operate a relay and use the relay's contacts to operate lamps, power routing or trackside signals.

You can get relays with up to four sets of double-throw (two-position) contacts. Use a relay with a 12 volt coil so that it can be operated from the same supply as the lamps or LEDs. Just be sure to add in the relay's coil current when calculating the number of lamps or LEDs that the adapter will handle as that will reduce the number of lamps you can use. Refer to the relay's packaging to determine which terminal is which. Remember that relays require D.C. power, not A.C.

Each relay requires a diode across its coil. Install the diode directly onto the relay socket's coil lugs. The diode's cathode (banded end) must connect to the wire from the positive (+) terminal of the power supply.

The relays with sockets may be mounted with a #4 screw and spacer through the mounting hole and wired to a terminal strip. The P.C. board relays may be soldered to a piece of perf board along with a terminal strip.