

# SIGNALING FOR DUMMIES & THE REST OF US

## ***Why Signal?***

Why not! The railroads do it for good reason!

With signaling – “It’s Alive”. Signaling adds another segment of realism to a layout. This is in contrast to a layout that has no lighting or animating to indicate live action.

It’s usually the last thing a modeler tackles because it can be a pain in the neck or elsewhere. It’s up to the individual as to how much complexity he wishes to add.

Complexity can result in higher costs and frustration when things go wrong. Keeping it simple to get a reasonable semblance of a signal system has merit.



## **Analog Layouts**

Analog layouts have the advantage of being more signal ready than DCC layouts. Analog layouts are typically already divided into blocks and make the installation of detection equipment easier. Detection circuits for analog layouts have been around for a long time.

## **DCC Layouts**

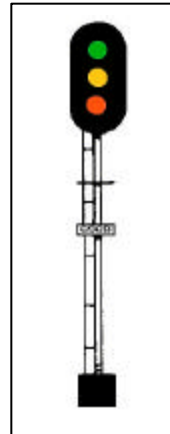
DCC layouts actually present a greater need for a signaling system since DCC permits opposing trains to be controlled in the same area. I’m sure that every DCC layout operator knows this problem intimately.

## Signal Definitions

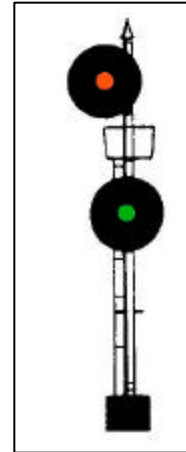
The following are common trackside signals for creating different aspects typically found on mainline trackage.

### Aspect

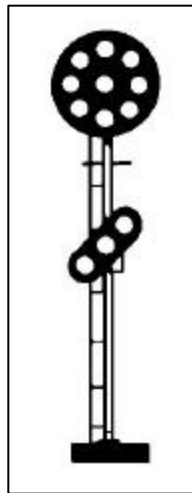
A signal aspect can simply be a red, yellow, or green light. This is the **Color Light** type. For the purpose of simplicity and utter laziness semaphore signals will be ignored for the moment. Typical signal heads are like red, yellow, and green traffic lights with the red light being on the bottom. Waving one's hands frantically to flag down a train also qualifies as a signal aspect.



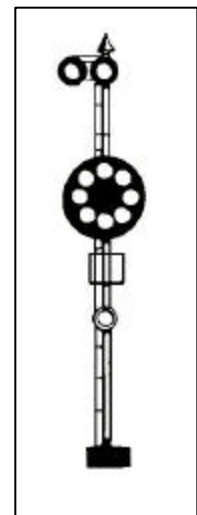
Another common signal has the ability to change color while only using a single lens head. This is referred to as **Color Searchlight**. These are commonly used in pairs one over the other. The Searchlight type allows more aspects to be defined as one color over the other. I.e. red on top green on the bottom. Having a flashing aspect for all of the foregoing can further complicate the whole mess.



Another type of aspect is a group of lights all one color but they are illuminated in a pattern. This is called **Position Light** signaling.



Another version of this using colored lights is called; you guessed it – **Color Position**.



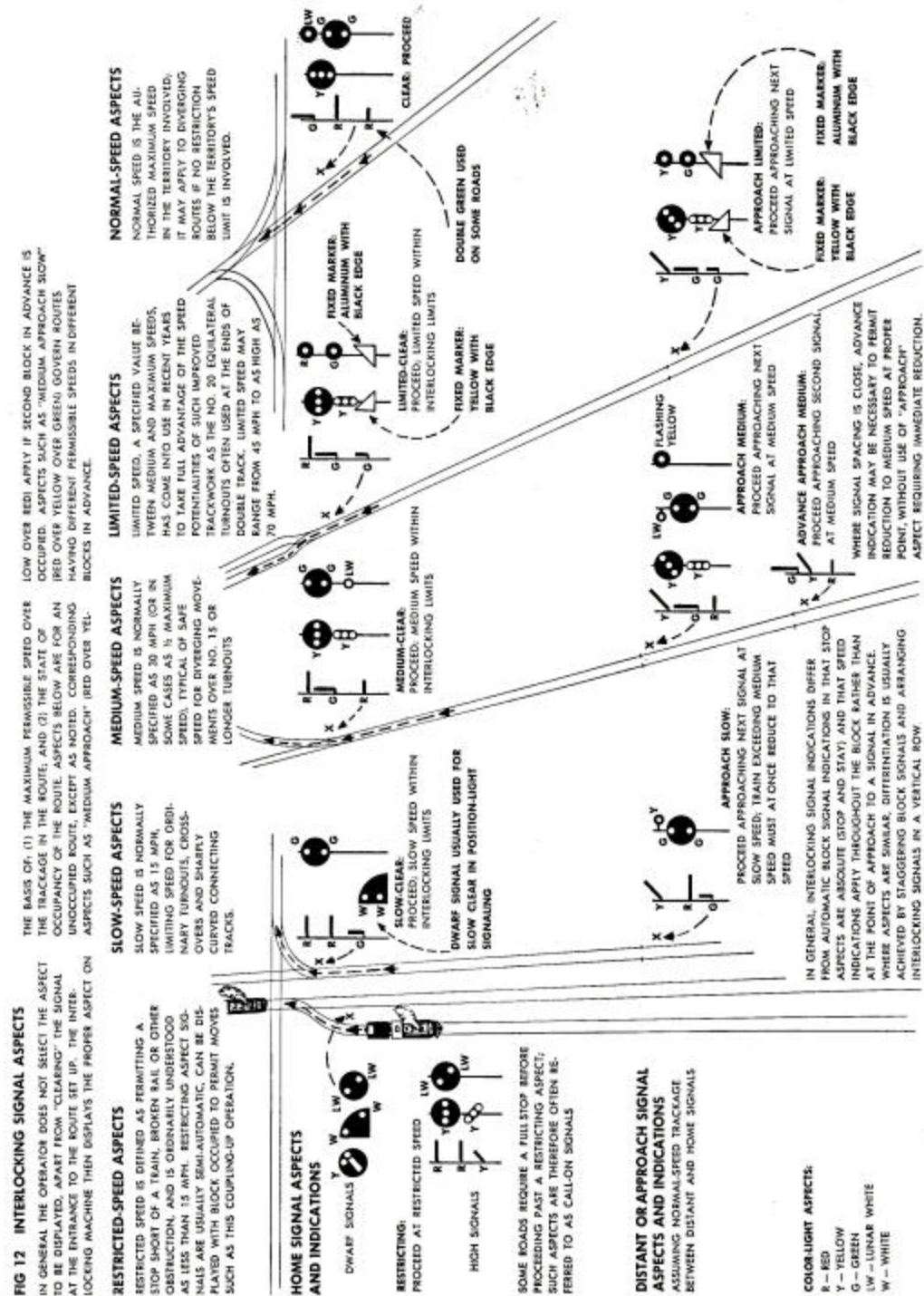
### Significance

Once the signal aspects are defined then you determine what to do about it when a train approaches. Usually red means stop but under some rules the train can be kept moving at a very slow speed to avoid stopping i.e. mountain districts. Yellow can mean anything from sub-sonic down to an exact speed or in a modeler situation a throttle setting. It's your railroad – do anything you want.

If you want to follow rules of a specific railroad, old time tables will give you a hint about speed restrictions.

## Turnout and Yard Indication

The following bit of confusion will be over whelming if you think about automating it. Turnout motor contacts come in handy for much of this type of control in lieu of detection.

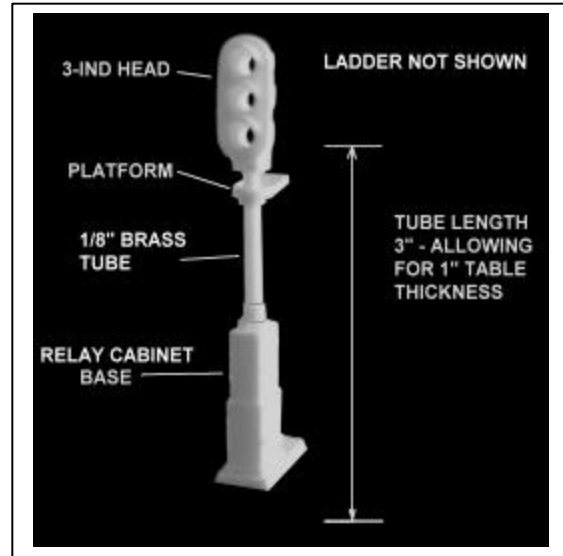


## What To Model

### Signal Heads

My preference is the three color signal head. This type of signal was used on a number of railroads. On some roads it was replaced by the Colored Searchlight type.

I've managed to collect a number of old Walthers castings for patterns and have made rubber molds and resin castings. I prefer to cast the head in black and the relay base in white. It's only necessary to paint the back of the signal head and the relay base a silver color.



### Signal Boxes and Ancillary Items

Relay Boxes – no prototype signal system is complete without a relay cabinet close by or built into the signal tower base.

Telephone Poles – prototypical signal systems are very often connected to telephone type pole for tower or dispatcher control purposes. You can all of those green threads simulating copper wire but it usually ends up as a dust collector or an easy target when reaching for something on the layout.

### How Much To Model

More than one signal project lies in the dust because of complexity and lack of good design rules. There are various things to consider:

- 1) Is it necessary to signal the entire layout?
- 2) Is it an aid to operation or merely window dressing?
- 3) Are there hidden areas that will be more easily utilized if signals are used to indicate occupancy, etc.?
- 4) Can it add to realistic appearances in different scenes?
- 5) Will any of the operators even pay attention to signals?
- 6) Do you really want to do this ?

## Control System

### Detection

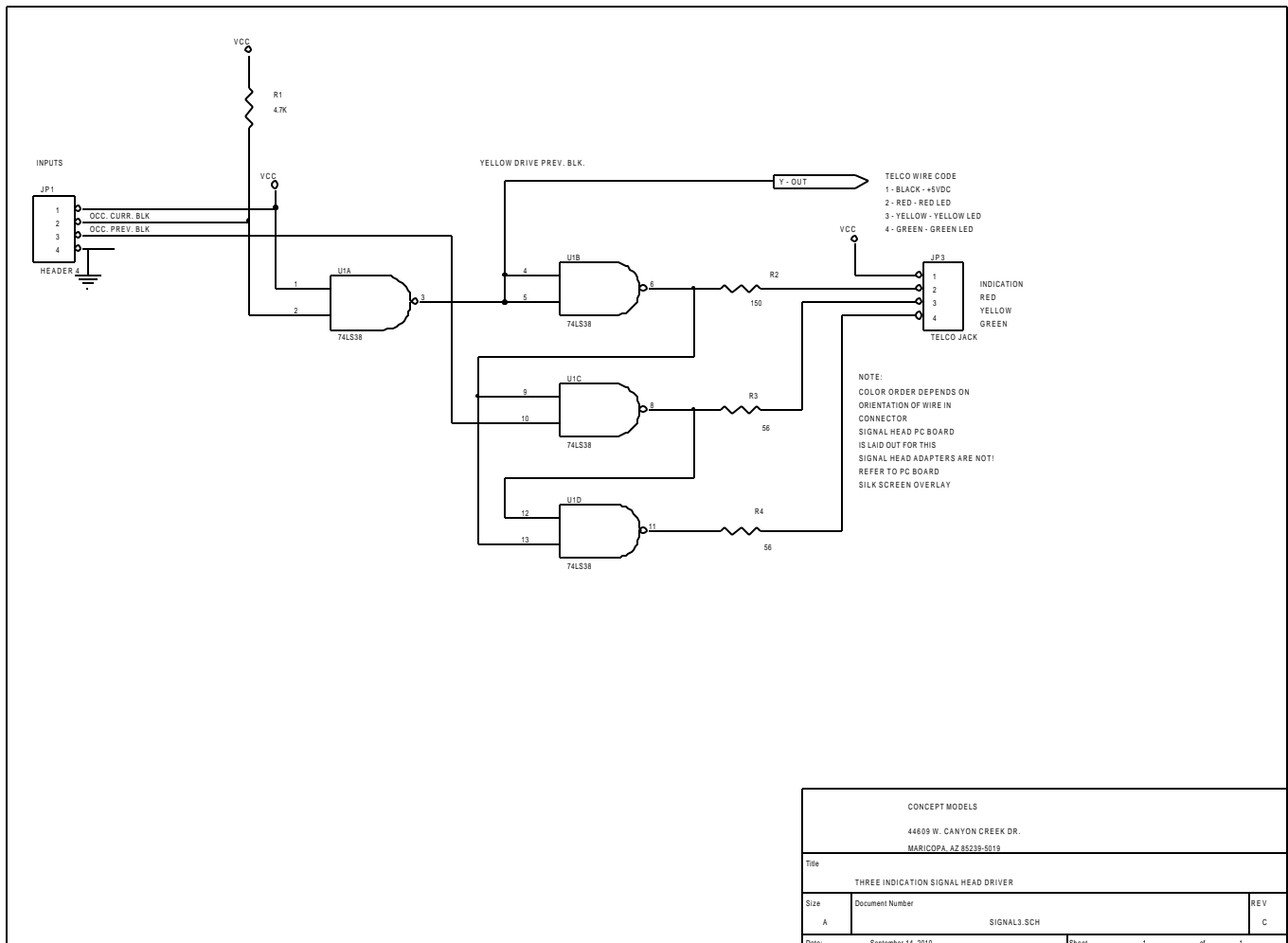
A number of commercial block detection devices are available for analog and DCC systems. The twin-T was the most popular type for analog systems and could be made to work with common rail systems.

For DCC systems I have experience with the PSX-1 from DCC specialties. This is a DCC on-the-main programmable device. I'm not thrilled about the set up technique but it does work well. There are others that work equally as well. If you want to "roll your own", the MERG group on the web has a number of solutions.

The PSX-1 unit that I use has built-in isolation from signal logic and DCC power in the form of optical isolator integrated circuit. The isolator is a very small integrated circuit that basically contains an LED and a phototransistor. When the detection circuit lights the internal LED, the LED fires the phototransistor. The two leads from the phototransistor connect to the signal logic power and the signal logic input.

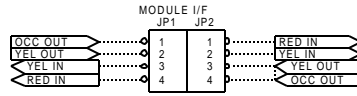
## Signal Logic

The circuitry for determining which aspect is displayed accepts input from detection devices and a dispatcher/tower control panel. Outputs go to the signal heads to drive the lights, which are now almost always LEDs since the cost is very reasonable and the colors are excellent in saturation and power. Common 3mm LEDs work well in many of the commercial signal heads available. LEDs draw so little power that it is easy to place duplicate signal indications in a remote dispatcher/tower control panel.

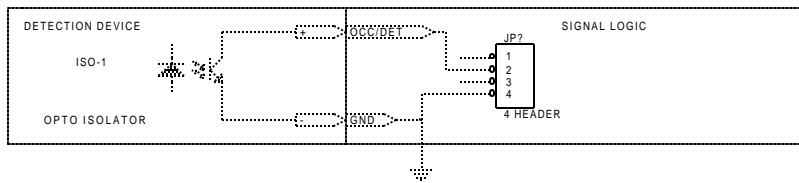
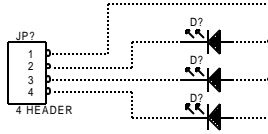


THREE INDICATION SIGNAL HEAD DRIVER      Revised: September 14, 2010  
 Bill Of Materials      September 15, 2010 14:26:46      Page 1

Item	Qty	Reference	Part
1	1	JP1	HEADER 4
2	1	JP3	TELCO JACK
3	1	R1	4.7K
4	1	R2	150
5	2	R3,R4	56
6	1	U1	74LS38



SIGNAL HEAD CONNECTIONS



CONCEPT MODELS 44609 W CANYON CREEK DR MSRICOPA, AZ 85139			
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SIGNAL INTERFACES			
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# Materials


## LEDs

Current LED technology has developed into a high light emitting product. This is different than 20 years ago when they were introduced. Also, it is common practice to use a clear plastic housing for the LED. This can be improved by using the transparent Pactra Red, Yellow and Green paints and this is easily done by dipping the LED into the paint and letting it dry. The edge of a cardboard box makes a nice drying rack.

The 3mm LEDs may be mounted directly into signal heads. A #22 drill seems to work well in boring out the holes for a friction fit. LEDs are available in bulk direct from Hong Kong through eBay at a very low cost. The encapsulating material holds up well for the time interval for applying various types of glue. The standard radial leaded LED has square leads. These are ideal for wire wrapping thus eliminating soldering.

Surface mount LED's, commonly .020" x .060"; can also be used for signal heads. It's desirable to mount them on a PC board rather than use discreet wiring.

## LED voltage data:




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electronics

We are here just for you!

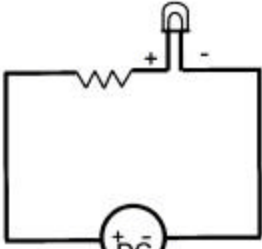
Ultra Bright LEDs, 3mm(5mm), Clear(multiple color) & Free Resistors

User Guide

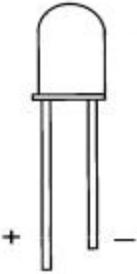


OBSERVE PRECAUTIONS  
FOR HANDLING  
ELECTROSTATIC  
DISCHARGE  
SENSITIVE  
DEVICES

Recommended Resistors (1/4 Watts) For Blue, Green, UV, White LEDs	
5V	82-100 ohm
7.2V	220 ohm
9V	330 ohm
12V	470 ohm
13.2V	560 ohm



Schematic



**Note:**  
The LED could NEVER be connected to power supply directly. It could be connect with a current-limiting resistor in serial to the power supply. The table below shows how to choose the resistor.

We just offer resistor with 5V and 12V.

LED	Color	White	Red	Blue	Green	UV	Orange	Yellow	Pink	Cyan	Infrared	
Size (mm)	Lens Color:	Clear Color										
	Peak Wave Length (nm)	N/A	625-630	460-470	520-525	400-405	600-605	585-595	N/A	500-505	850	
:	Forward Voltage (V)	3.0-3.2	1.9-2.1	3.2-3.4	3.0-3.3	3.2-3.4	1.9-2.1	1.9-2.1	3.2-3.4	3.2-3.4	1.1-1.3	
	Static Sense	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	No	
3mm	Luminous Intensity:	15000-17000	3500-4000	5000-8000	12000-15000	120-200	3500-4000	About 5000	2000-3000	4000-5000	N/A	
5mm	View Angle:	5 - 25°										
	Maximum Current	20mA Continuous, 50mA peak for 10% Pulse Width										

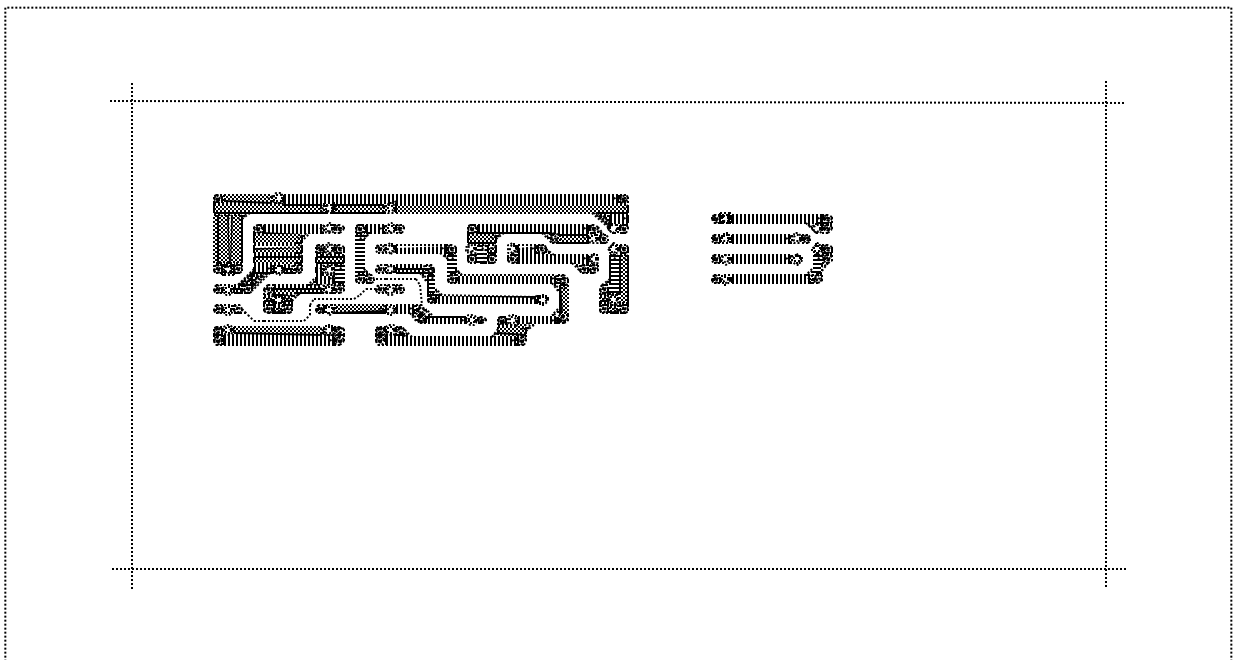
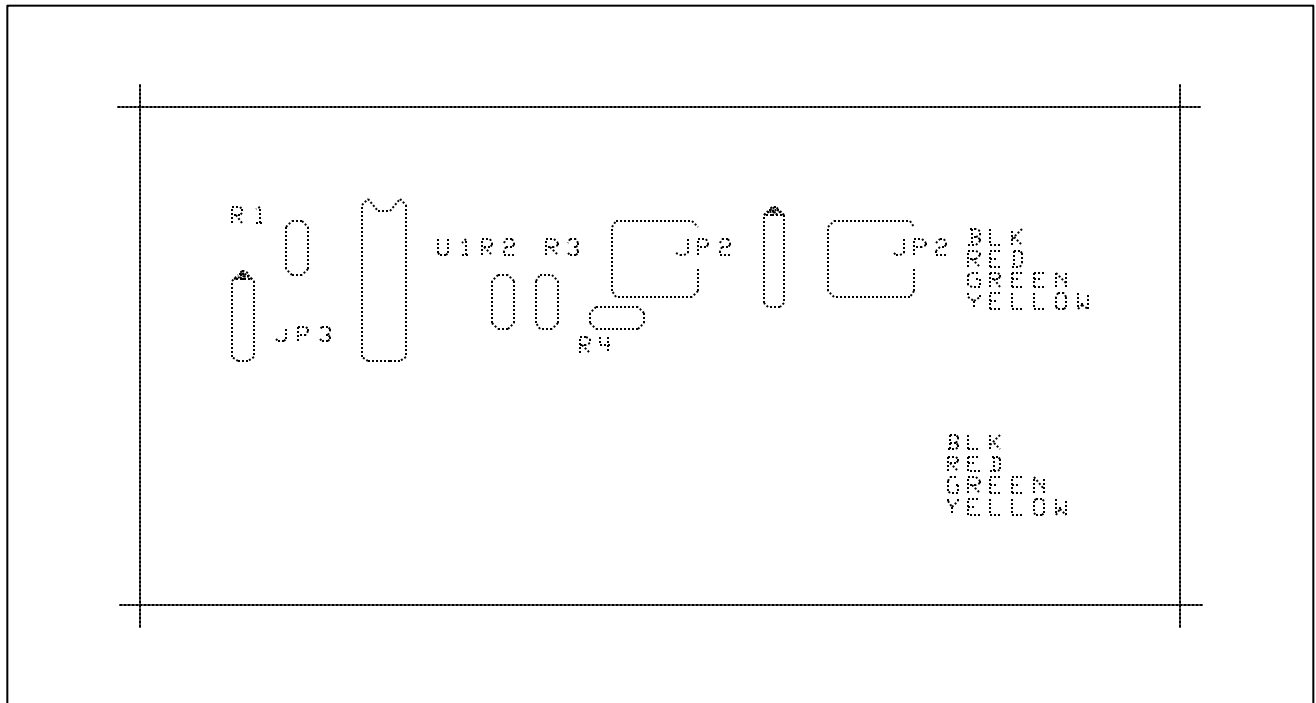
<http://www.sure-electronics.net>

[support@sure-electronics.net](mailto:support@sure-electronics.net)

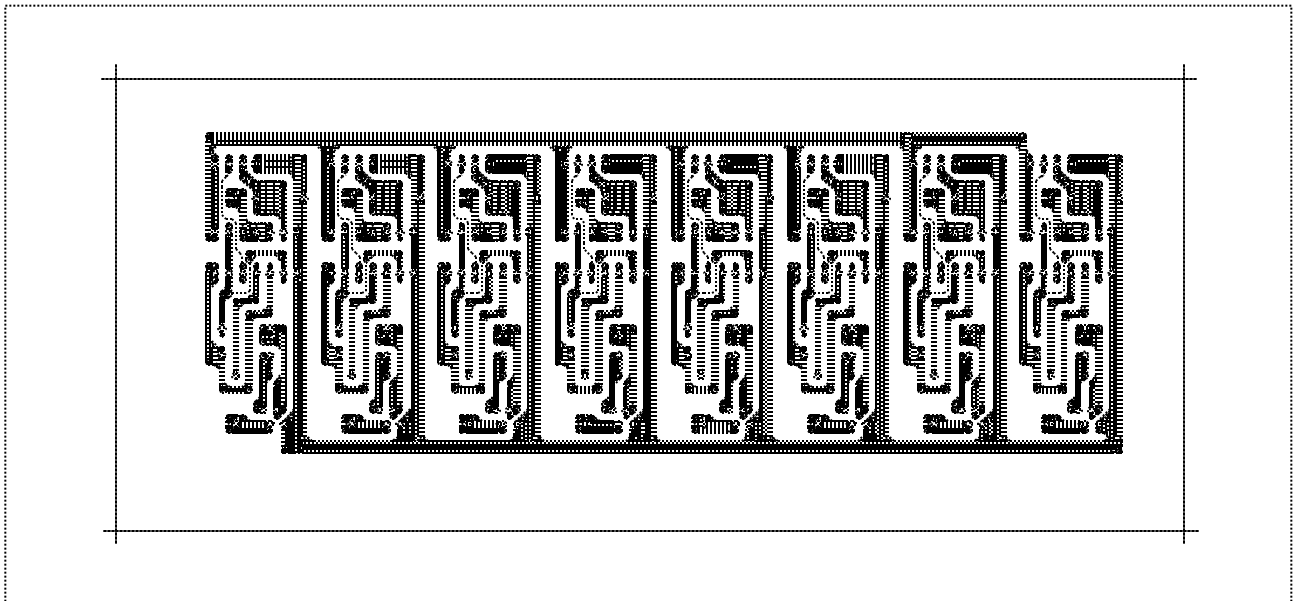
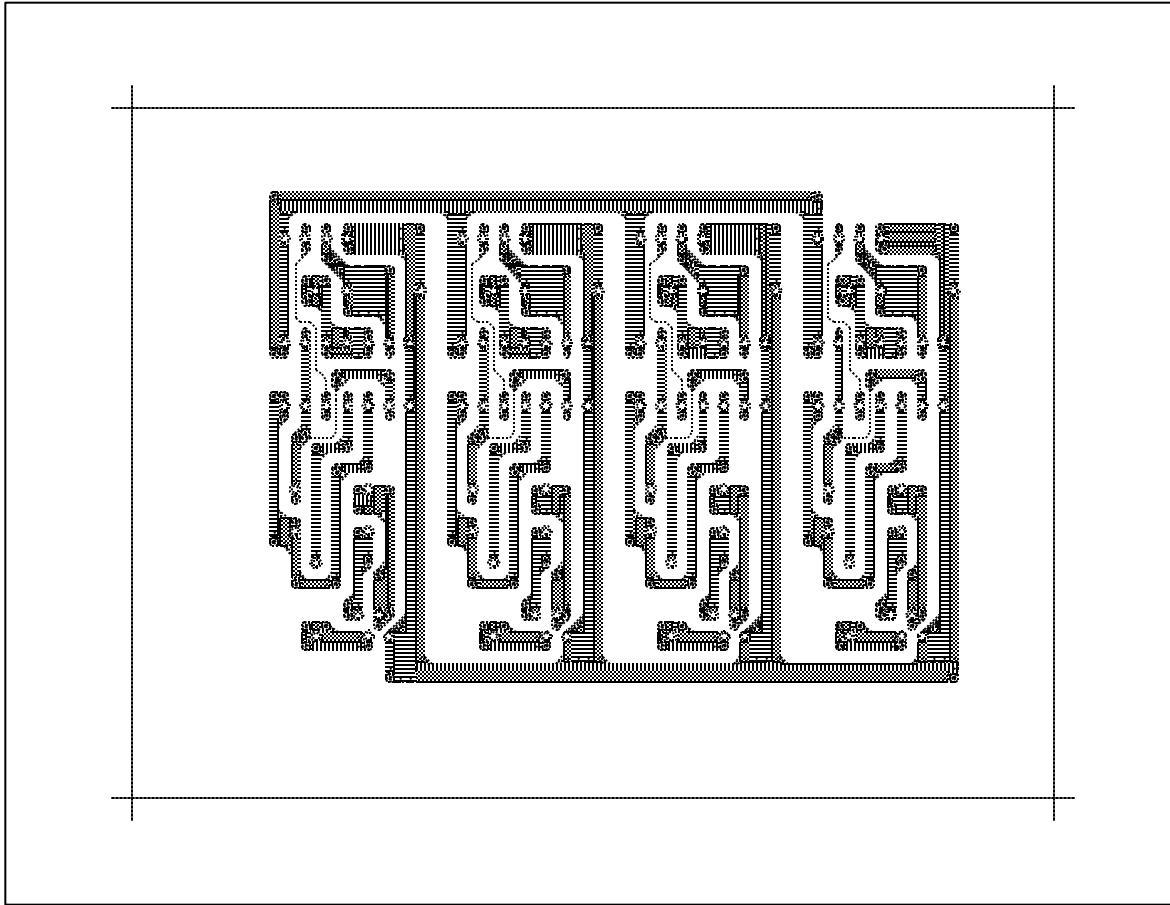
## PC Boards

PC boards for the signal logic and the signal head connections can be fitted with sockets and wire wrap leads. Telco modular connectors are also very useful. The logic boards I use have a telco modular socket mounted for each signal head. Another PC board with a telco modular connector is used for connecting to the signal heads below the train board.

I make all of my boards one sided. You can use any PC board generation software that will make a positive image. It's my preference to print out the image on clear transparency material with a laser printer. Paper Direct sells a coloring transfer material that I use to improve the image opacity. I use orange or red since it stops the UV light that exposes the PC board. Circuit Specialists sell pre-sensitized PC board which is convenient to use. For improved soldering Circuit Specialists sell a Tin conversion liquid that is used after the etched board is stripped of resist and cleaned. This literally tins all of the tracings and facilitates soldering. The following are printed circuit board layouts

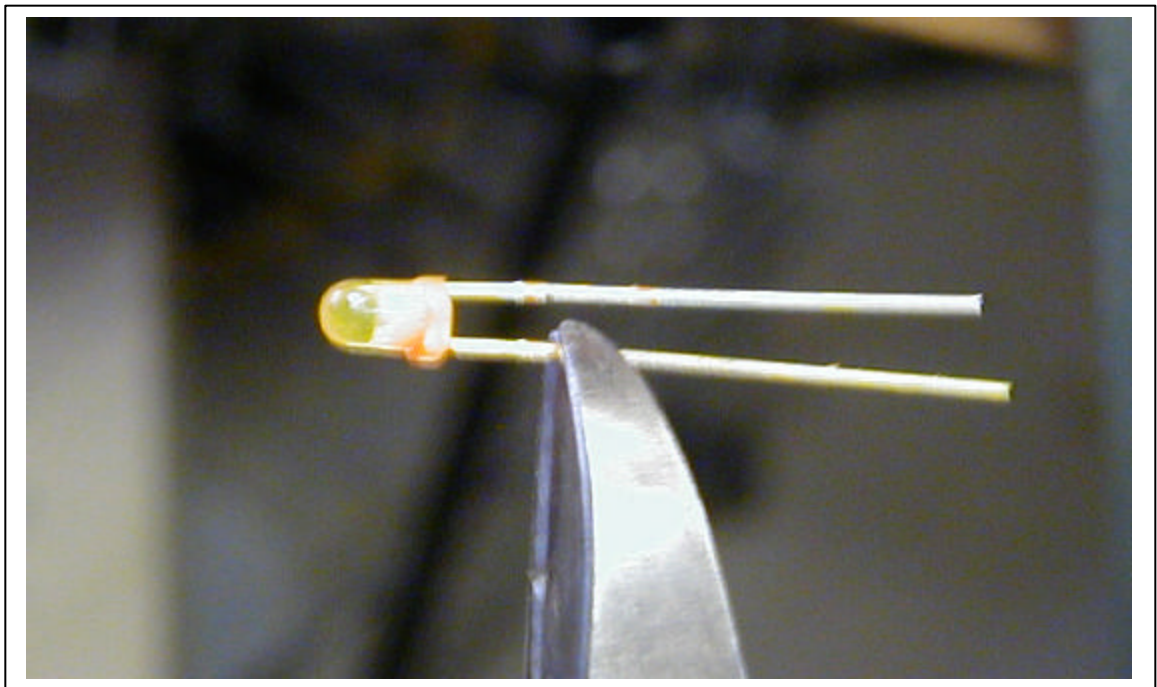
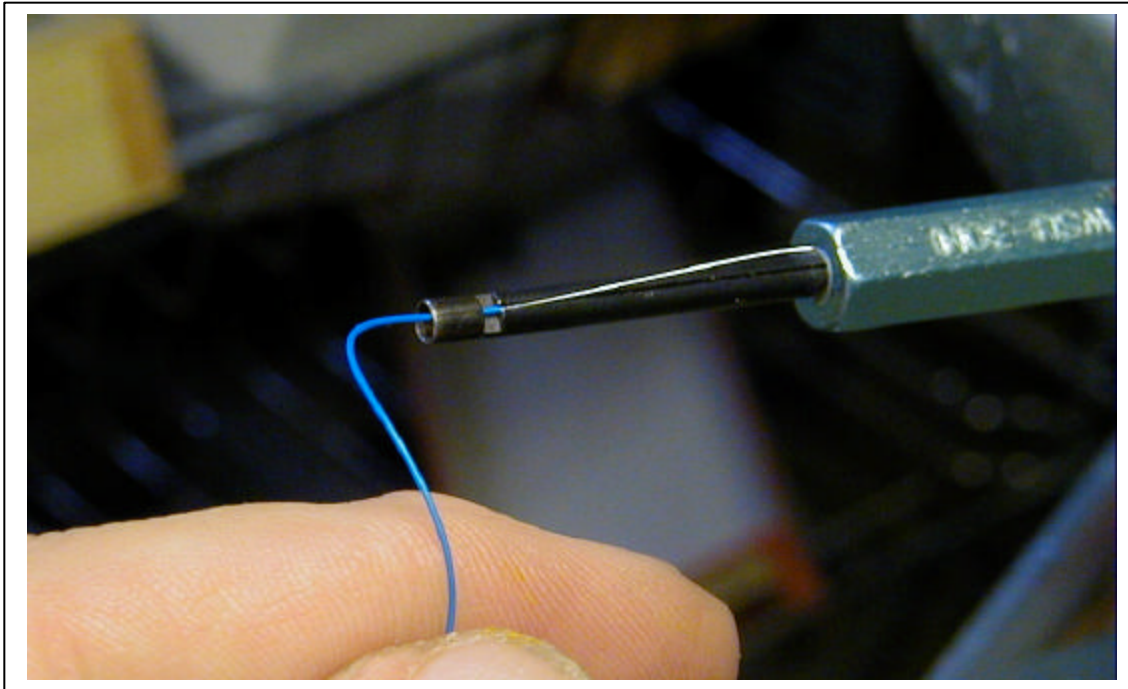


*Multiple Signal Logic Boards*



## Wire Wrapping

Wire wrapping with 30 gauge Kynar insulated wire as commonly used in the electronics industry is a great aid in making the connections to the square leads of the LEDs in the signal heads. I prefer to mount the signal heads on 3/32" brass tubing. I cut a notch below the signal head for the wires to enter. It's easy to get 4 wires through the 3/32" tubing. The tubing is extended below the train board and is wire wrap terminated onto a very small PC board that has a telco modular connector on it. A complete handout is available at: <http://www.con-sys.com/Downloads.htm>



## **References and Sources**

All About Signals by John Armstrong (Kalmbach Publishing)

MERG - <http://www.merg.org.uk/> - model railroad electronics including semaphore signals using servo controls.

Circuit Specialists <http://www.web-tronics.com/> - PC board making supplies.

DCC Specialties <http://www.dccspecialties.com/> PSX-1 for DCC detection.

PC Board Etchant – cheap - <http://www.instructables.com/id/Stop-using-Ferric-Chloride-etchant!--A-better-etc/>

ACE Hardware – Metallic Silver/Chrome paint ½ pt. Can (cut with lacquer thinner.)

Wal-Mart – Quik Grip glue found in their crafts section. This is a clear fast setting adhesive.

LEDs:

[http://stores.ebay.com/hktaiyuen-LED-store?\\_rdc=1](http://stores.ebay.com/hktaiyuen-LED-store?_rdc=1)

[http://stores.ebay.com/led-hk?\\_rdc=1](http://stores.ebay.com/led-hk?_rdc=1)

This Handout plus LED wiring are available at:

<http://www.con-sys.com/Downloads.htm>

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