

A photograph of a railroad track with gravel and two glowing red dwarf signals. The text "Making Dwarf Signals" is overlaid in large white letters with a black outline.

# Making Dwarf Signals

*Marshall D Abrams*

Visit the Abrams Railroad Empire at  
[http://mywebpages.comcast.net/abrams\\_railroad/](http://mywebpages.comcast.net/abrams_railroad/)

# About Dwarf Signals

## ◆ Definitions

- A ground mounted signal
- A low home signal (protecting the entrance of a route or block of track)

## ◆ Why are dwarf signals used?

- There isn't room or clearance for a full-sized signal
- Cost

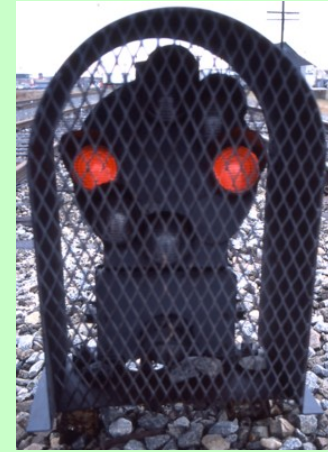
## ◆ When are dwarf signals used?

- Minor trackage within interlockings
- Starting signals in passenger terminals
- To signal little-used sidings
- In yards, sidings and other places so as not to be confused with block signals.
- This clinic shows indication of how turnout is thrown

## ◆ The dwarf signal usually indicates slow speeds only

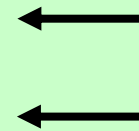
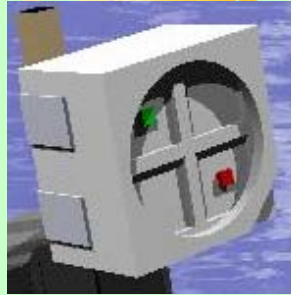
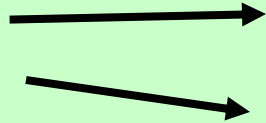


# Prototype Dwarf Signals



# LED Features

Solder pads



Green LED  
Red LED

- ◆ Entire circle appears illuminated

Digi-Key Part #	350-1357-1-ND	350-1357-1-ND	<u>Price break</u>	<u>Each</u>
Dialight Part #	597-7701-207	597-7721-207	1	.85
Description	red/green	yellow/green	25	.71
			100	.568

- ◆ Manufacturer (search for specifications): <http://www.dialight.com/>
- ◆ Distributors (prices may vary)
  - Digi-Key (parts search): <http://www.digikey.com/>
  - Mouser: <http://www.mouser.com/catalog/625/38.pdf>
- ◆ Alternative mfg (lower price): <http://www.ledtronics.com/ds/smd-plcc/#bc>



# What Else You Need



**Optivisor**



**Low wattage solder iron**



**Black permanent marker**



**Black coffee stirrer  
(optional)**

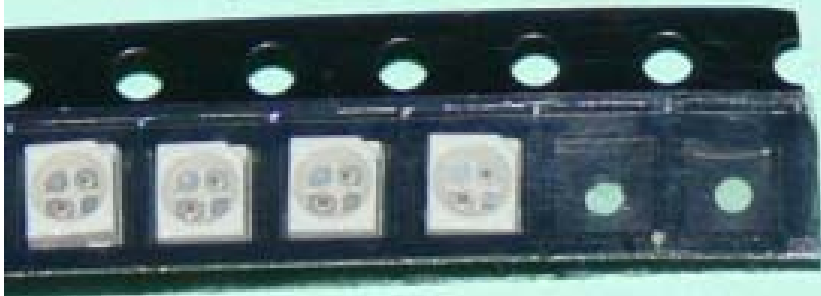




# Relative Sizes

Real world (1:1)	N (1:160)	HO (1:87.1)	S (1:64)	O (1:48)
.1	16	8.71	6.4	4.8

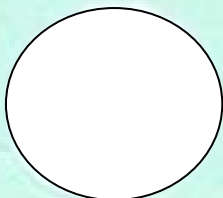
LEDs packaged in plastic strip



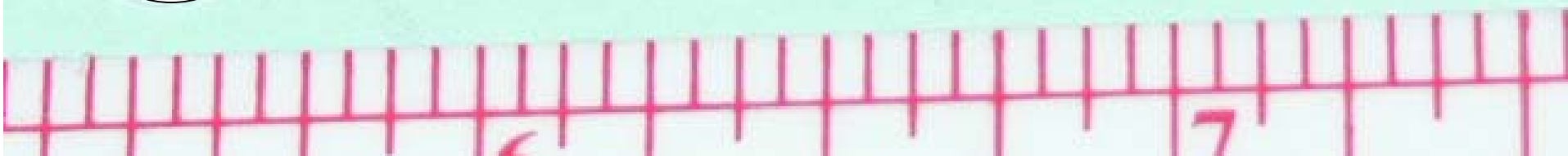
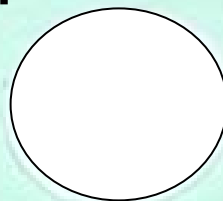
Coffee stirrer



Paper punch  
chad  
.25 in diameter



LED Approximately  
.1 inch square



# Ready to Solder

LED face down

4 solder pads

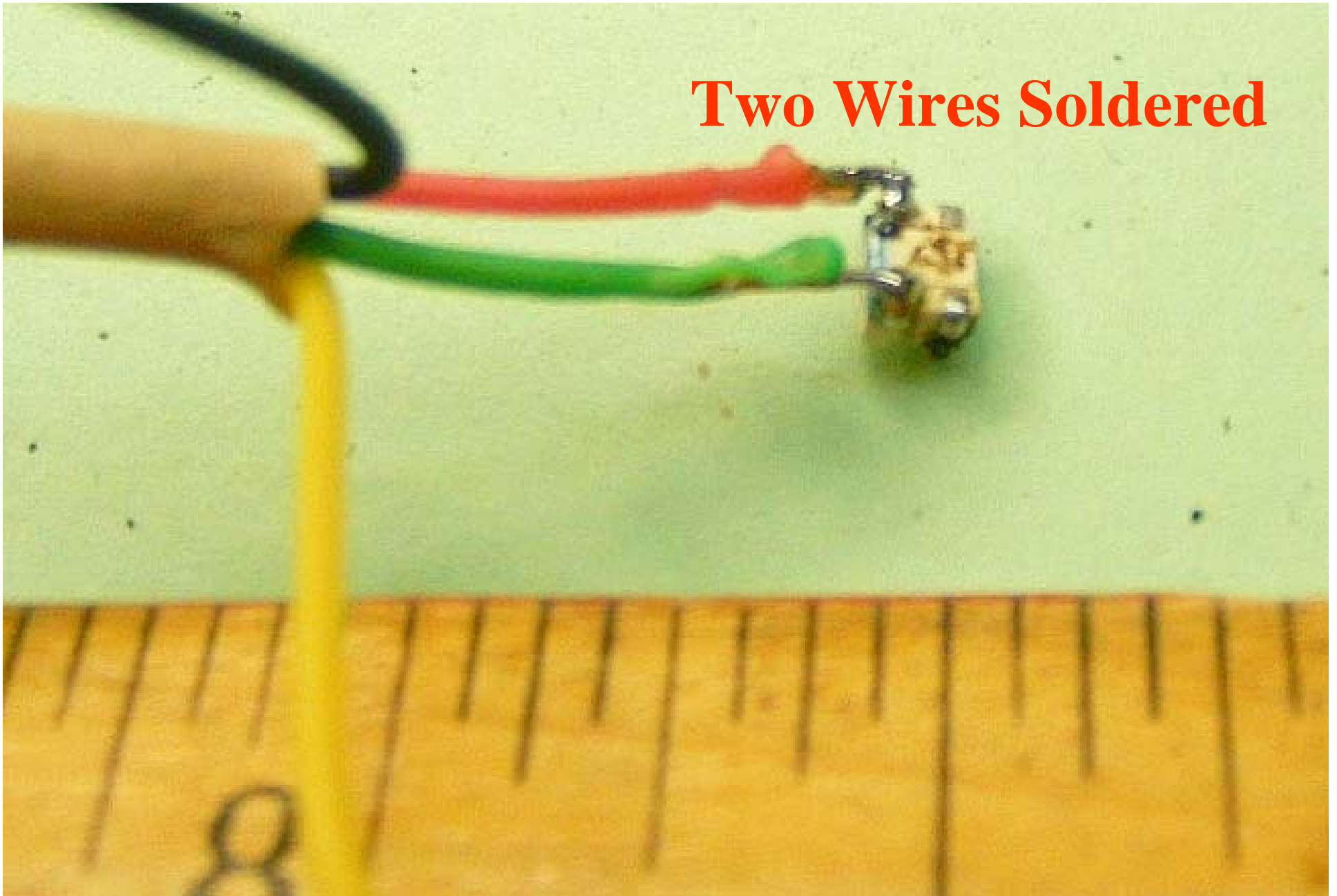


- ◆ 4-wire cable tinned
- ◆ Solder to 4 pads

- ◆ Individual wires may be easier to solder, especially
  - Wire-Wrap® wire
  - Magnet wire

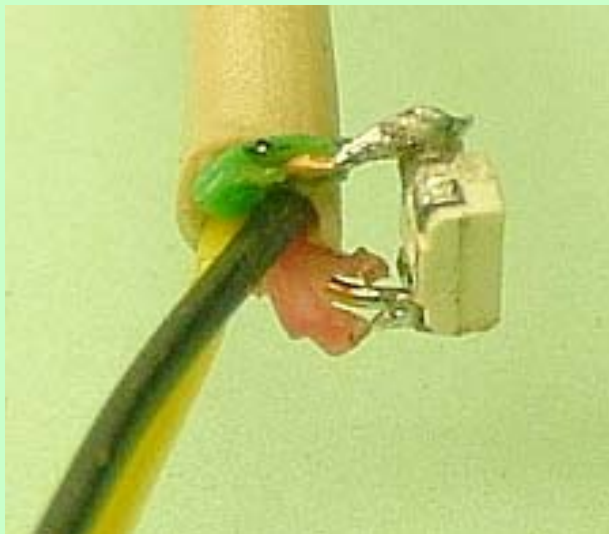
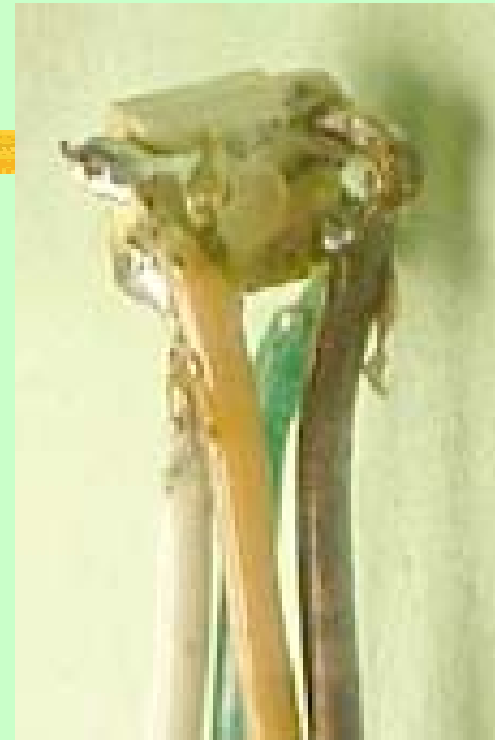
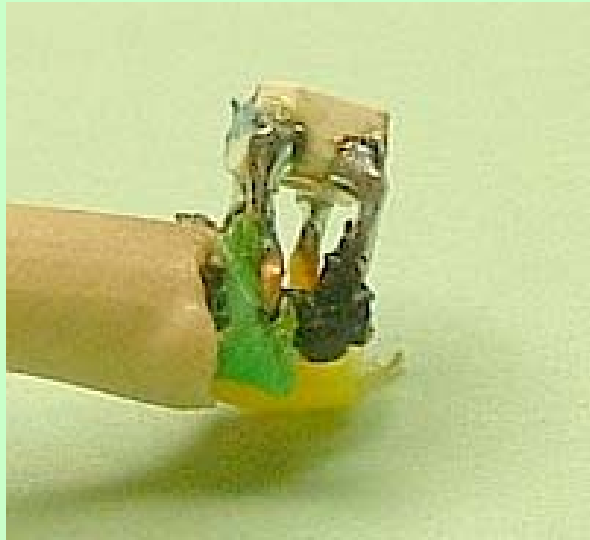


## Two Wires Soldered

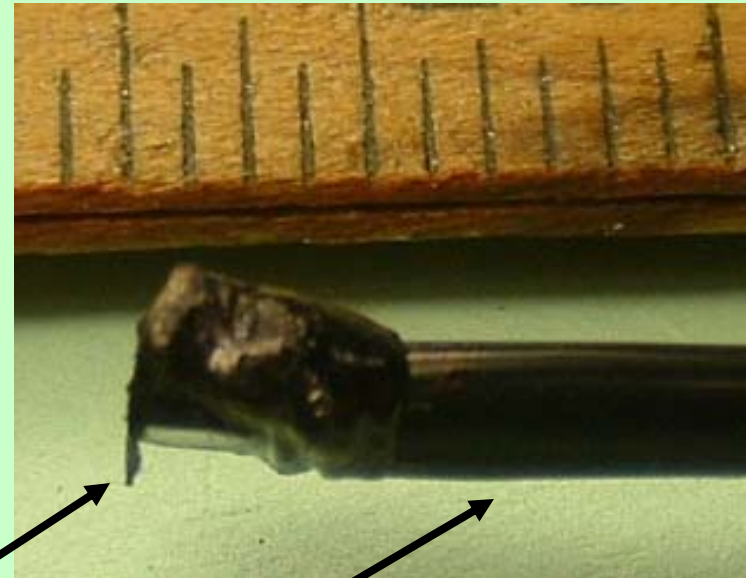
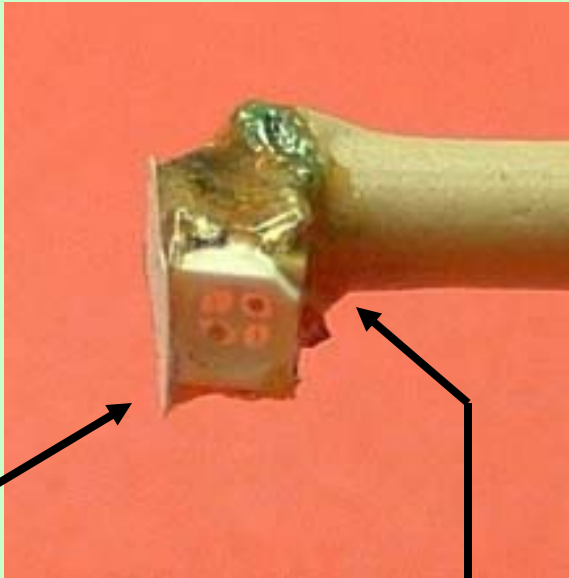




# Views of Soldering



# Finishing

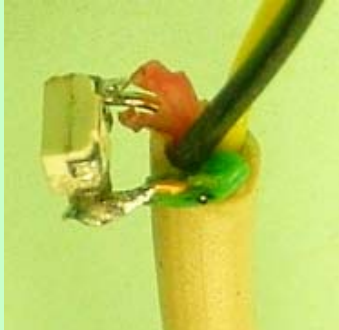


- ◆ Fill space with Goo
- ◆ Add shade made from punched paper
- ◆ Color black with marker
- ◆ Add coffee stirrer post (optional)



# Cable or Individual Wires

- ◆ When you use a cable, the signal tends to be L shaped, especially if the wires are arranged to the rear



- ◆ Individual wires can be arranged to give a vertical profile

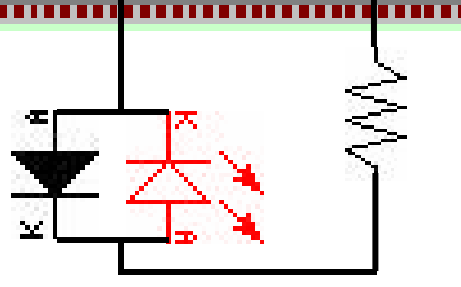


- ◆ Use brack straw if you want the signal above ground on a post
- ◆ Tilt the head back 15° for visibility



# Powering the LEDs

- ◆ DCC signal can be used to directly power LED



- ◆ Protect LEDs against reverse voltage and spikes (optional)
  - Use 1N4148 diodes (Digikey 1N4148MSCT-ND)
  - Don't use 1N400X since they are too slow for DCC
- ◆ I used protective diodes, but I'm told that they are unnecessary



# Determining Ballast Resistance

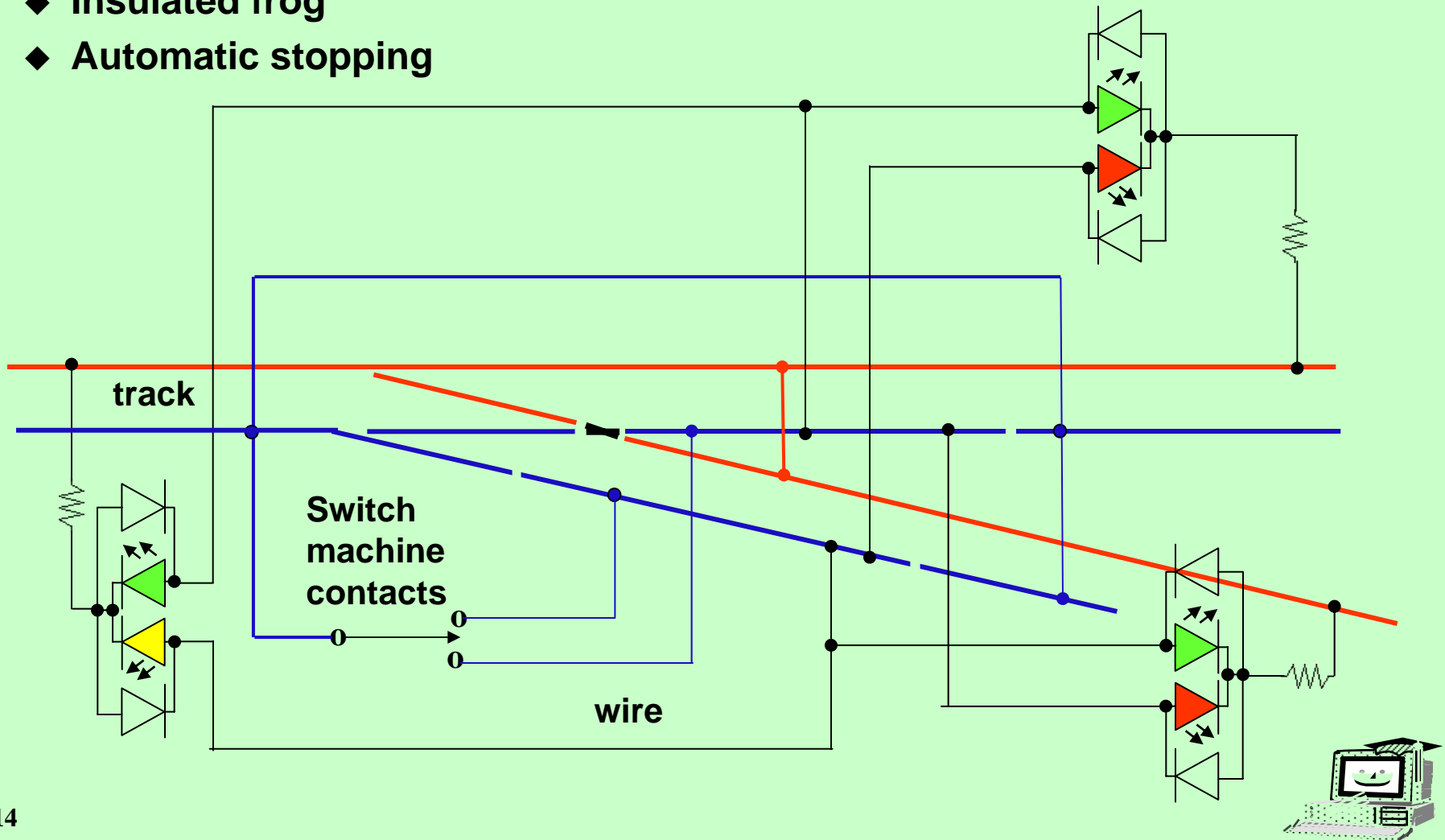
- ◆ Purpose of ballast resistor is to limit current through LED
- ◆ Don't operate at maximum ratings
- ◆ Experimentally increase resistance to achieve satisfactory appearance
  - Purpose is to be visible in normal operating conditions
  - Overdriving LED can shorten life
  - You can get yellow from red-green LED by turning on both, but experiment to get satisfactory color
  - DCC is half-wave symmetric; LED on only 50% time
- ◆ Operating on DC
  - Increase resistance because duty cycle increased from 50% to 100%
  - DC is on 100% of time

Ratings / values	red-green	yellow-green
Max forward current (ma)	30 / 30	20 / 30
Forward voltage	2 / 2.1	1.8 / 2.1
DCC track voltage 12v (N)		
Experimentally determined ballast resistor (K ohm)	1.5 / 1.5	1.0 / 1.5



# Wiring Signals to Show Turnout Position (1/3)

- ◆ DCC
- ◆ Insulated frog
- ◆ Automatic stopping

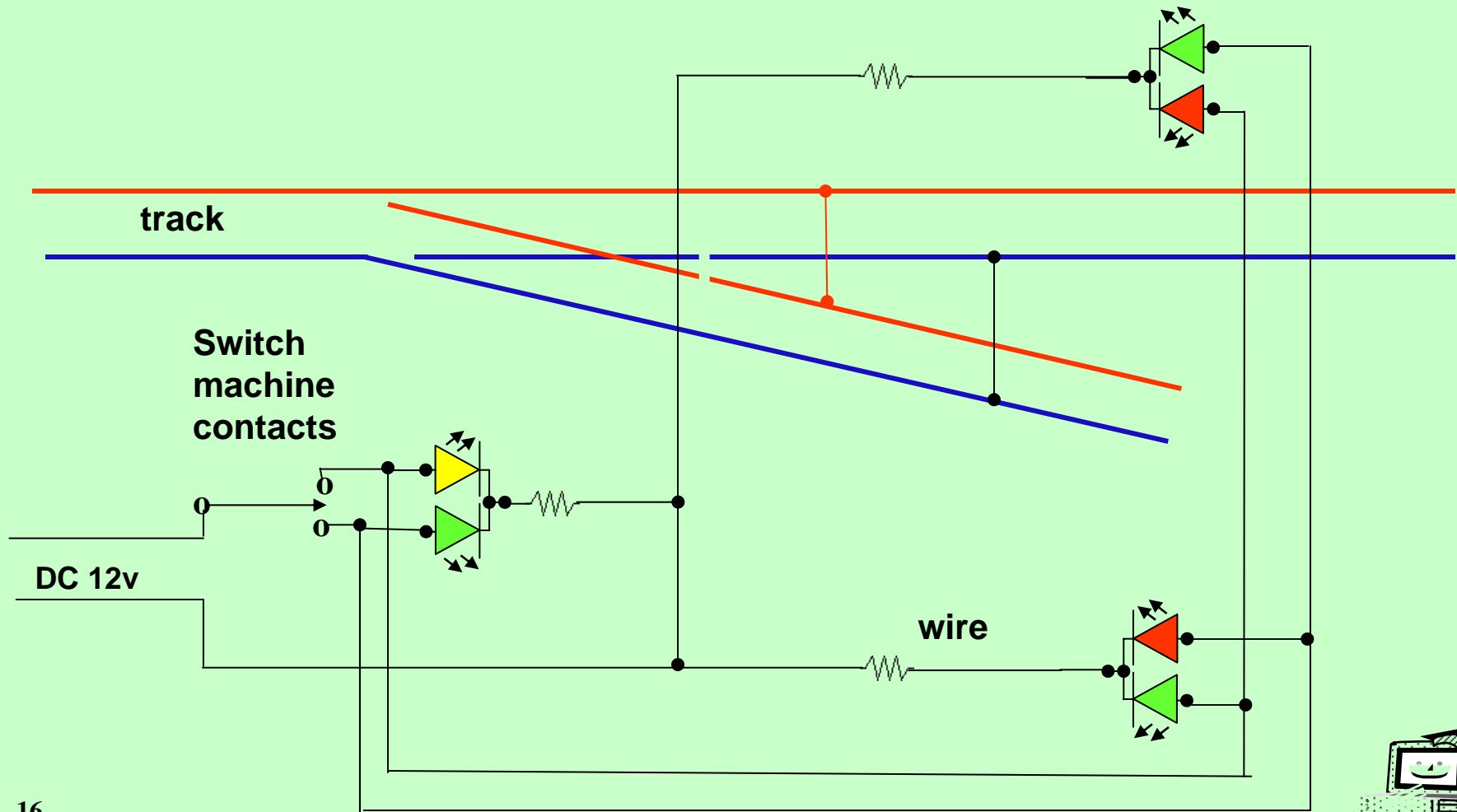






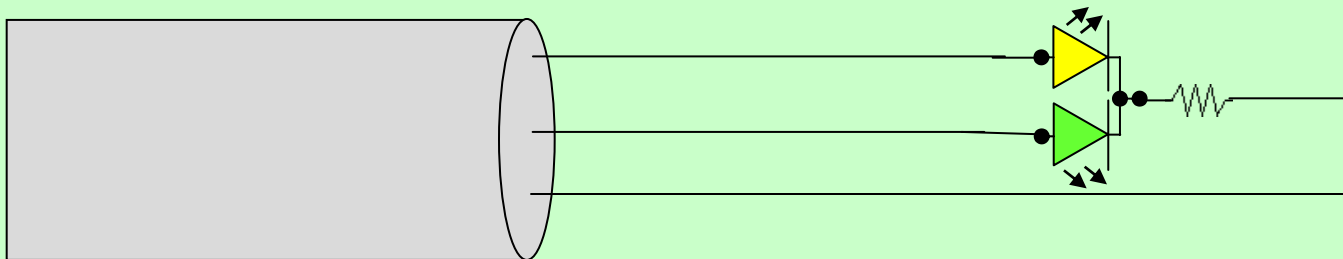
# Wiring Signals to Show Turnout Position (3/3)

- ◆ DC
- ◆ Signals not connected to track

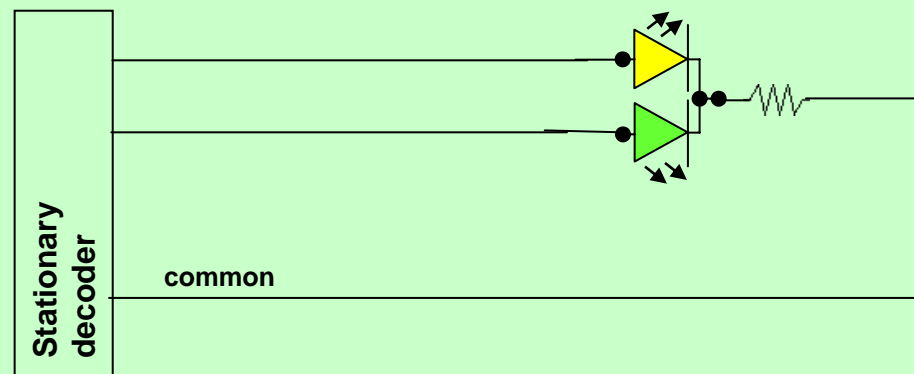


# Wiring Signals for Centralized Control

- ◆ Signals not connected to track
- ◆ Conventional cable



- ◆ DCC stationary decoder



# Plant Signals in Layout





# More Pictures



# Links and References

## ◆ Model techniques

- Originator of using Dialite, with alternate mounting technique  
<http://omniport.dpharris.ca/index.pl/signals>
- Wiring inspiration and other dwarfs  
[http://nietzsche.mems.duke.edu/~auro/trains/tech/DCC\\_DWARFS/](http://nietzsche.mems.duke.edu/~auro/trains/tech/DCC_DWARFS/)
- Dwarf Signals From Styrene  
<http://www.nyx.net/~jpurbric/railroads/dwarfs/>

## ◆ Prototype information

- CROR (Canadian Railway Operating Rules) signals  
<http://www.technology.niagarac.on.ca/people/mcsele/railroad.htm>
- North American railroad signaling -- explain how operational and safety rules interact with signaling systems to build an operational and safe railroad  
[C:\My data\Model RR\Signals & detection\www.lundsten.dk\us\\_signaling\index.html](C:\My data\Model RR\Signals & detection\www.lundsten.dk\us_signaling\index.html)

