

WIRING FOR DCC

PREPARED FOR METRO NORTH

OCTOBER 2, 2010

VIN GALLOGLY

WHAT WE WILL NOT COVER

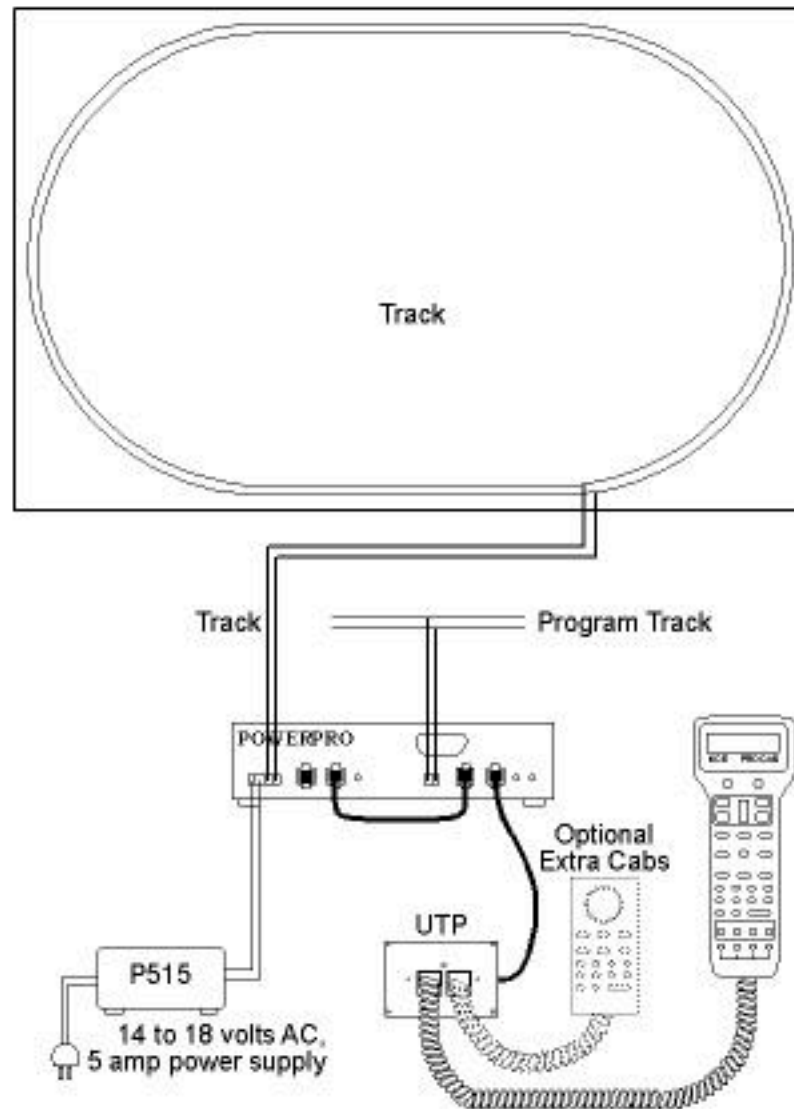
- CHOOSING A DCC SYSTEM
- DECODERS
- CV'S
- PROGRAMMING

WHAT WE WILL COVER

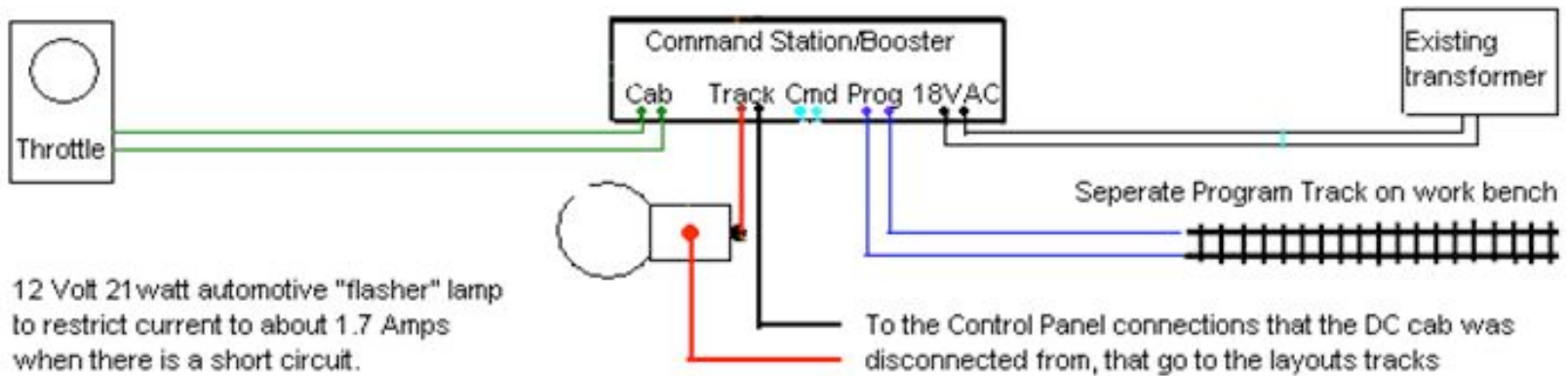
the wires under the benchwork

- POWERING THE BASE STATION – 18-24 Volts AC
- POWERING THE RAILS – Sq wave AC 14 - 22 volts
 - Districts
 - Wye
 - Reverse loops
 - Programming track
- THE COMMAND BUS – digital encoding
- The 12 volt DC supply

Typical DCC system setup



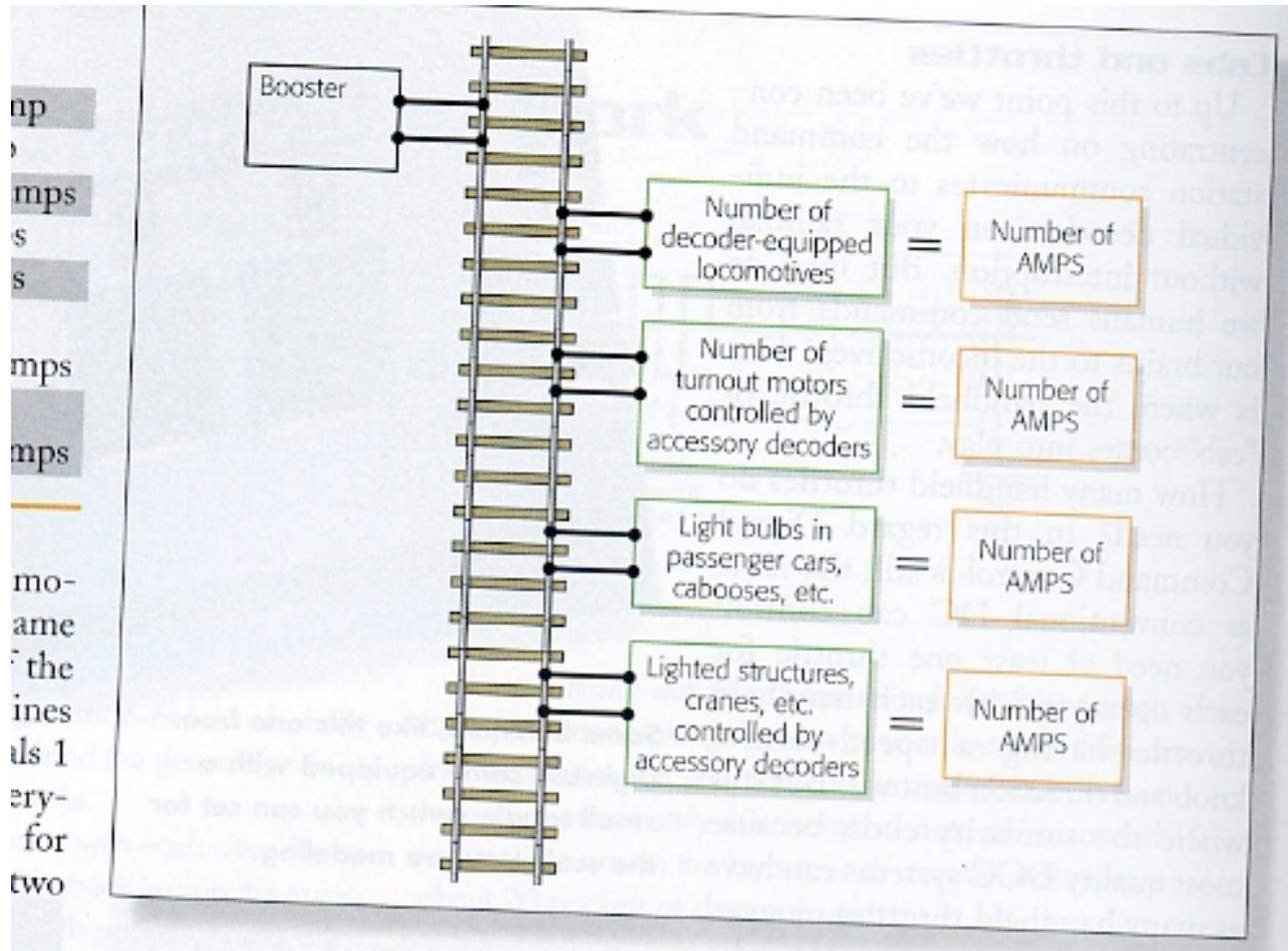
Base/Command Station



Base Station Size

- It's not layout size that determines if a base station is "big enough" it is the number of locos operating at ONE time.
- Plus the other items one will drive with the system
 - Turnouts
 - Lighted passenger cars
 - Structures

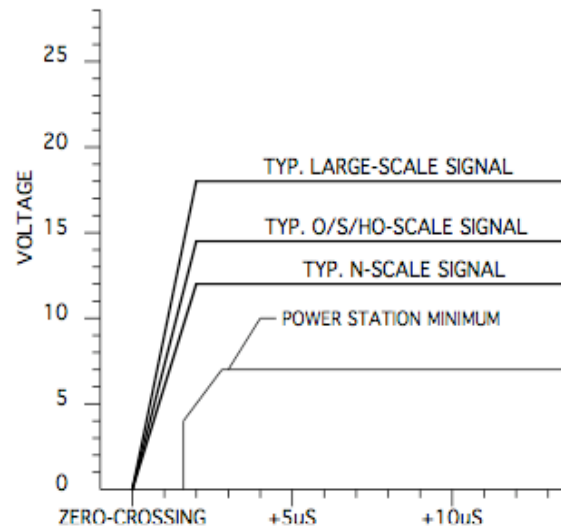
Counting Amps



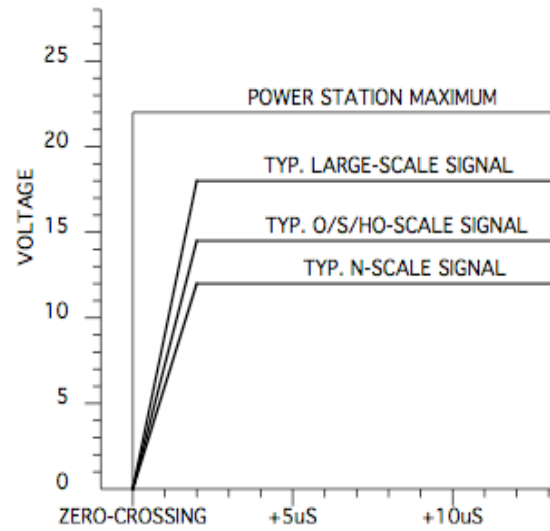
Volts Amps Ohms

- Volts - think water pressure
- Amps – think gallons per unit of time
- Ohms – think resistance to flow

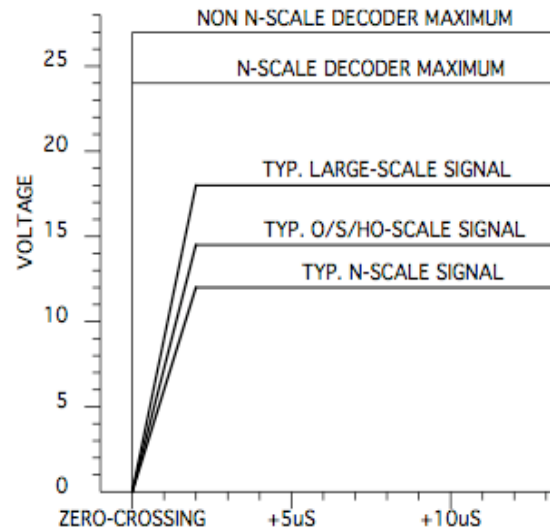
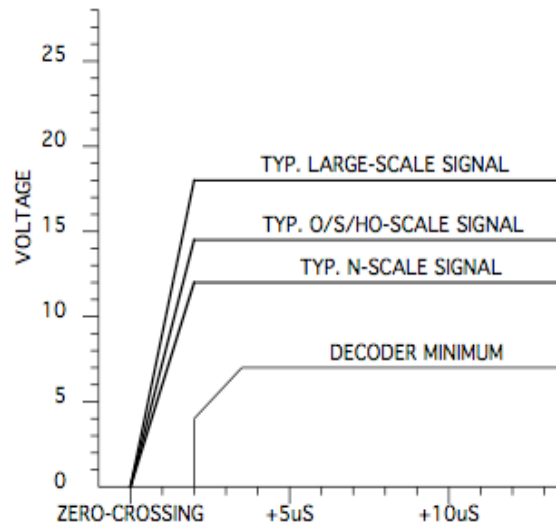
least 27 volts as measured at the track.



Minimum Voltage for Power Stations



Maximum Voltage for Power Stations



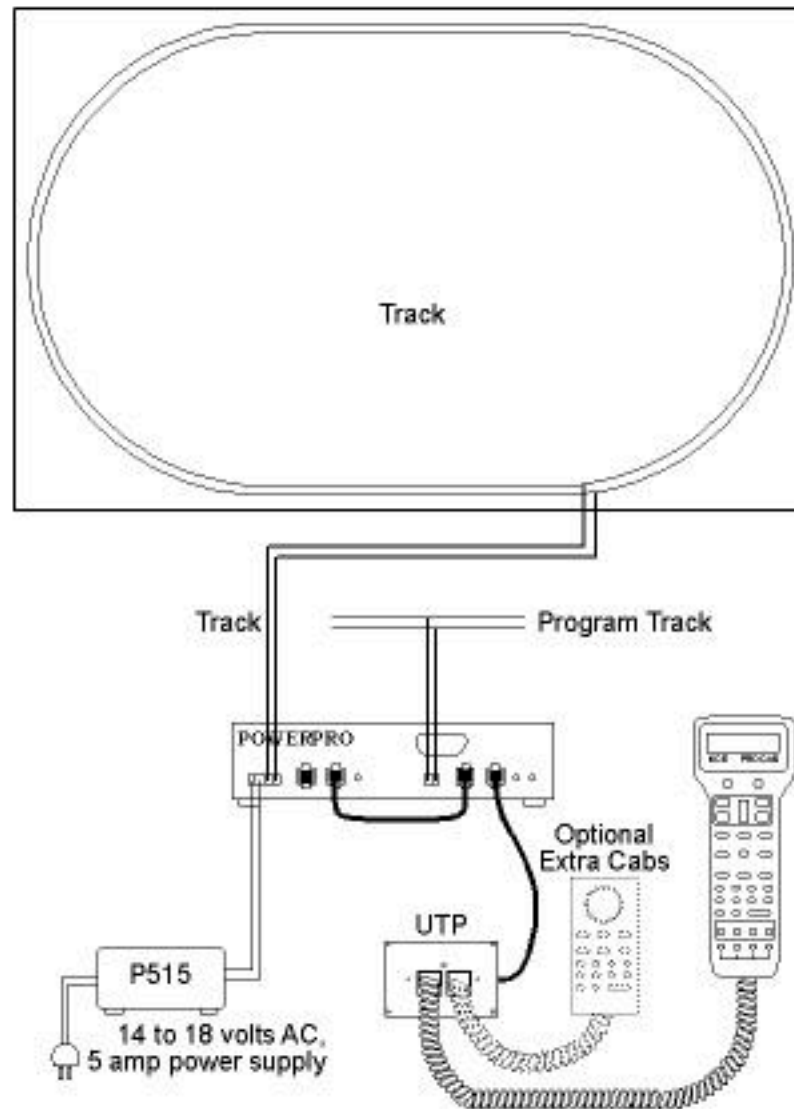
POWERING THE COMMAND STATION

- Transformer output should be 18 volts AC with sufficient amperage to match your Base station.
- on/off switch to power depower the transformer
- A circuit breaker - between the transformer and the Command Station.

A Systematic Approach

- Establish wire colors and size standards for:
 - **Primary** bus

Typical DCC system setup



A Systematic Approach

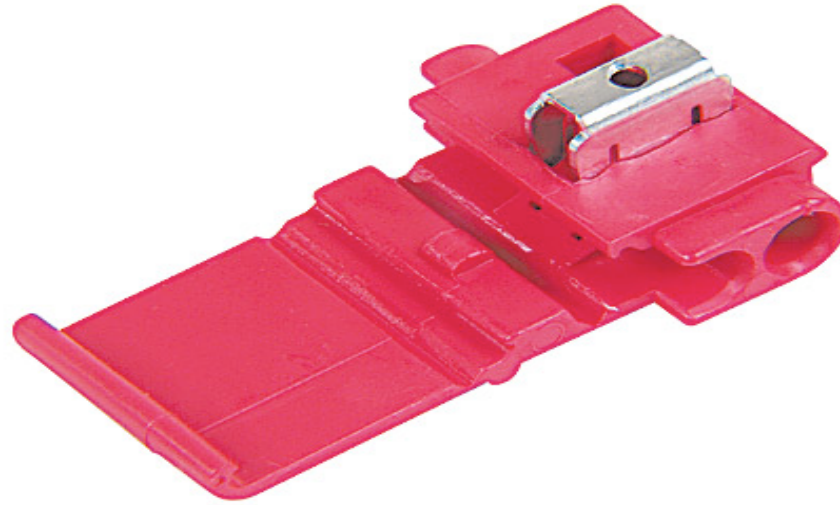
- Establish wire colors and size standards for:
 - Primary bus
 - power shields between primary and Track buses
 - Track Drops
 - Powering frogs
 - The 12 volt DC circuit for powering accessories
- Color Insulated wire
 - Available from the hardware stores, white, red, black, green, yellow, blue, brown, etc.
 - Record your choices

Destroying Your Systematic Approach

- Using short segments of a different color because you (fill in this blank)

Wire for DCC

Stranded or Solid?



Suitcase - Insulation Displacement Connector

- § **Red (IDC #905)** is for bus sizes **#14-18** with feeder sizes **#18-22**.
- § **Pink (IDC #558)** is for bus and feeder sizes **#16-22**.
- § **Brown (IDC #567)** is for bus sizes **#10-12** with feeder sizes **#14-18**.

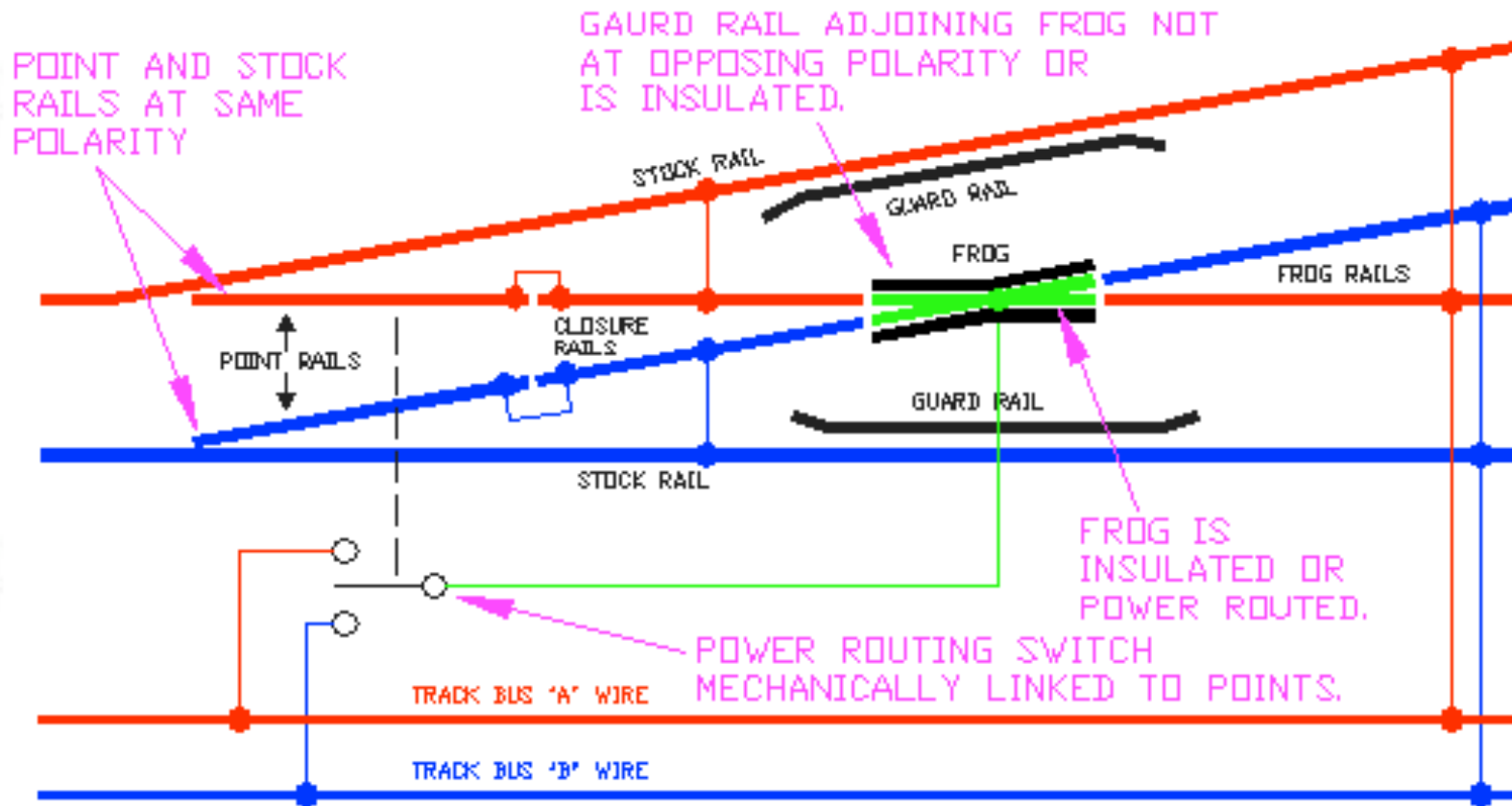
Wire for DCC

- Stranded or Solid?
- Primary track bus –Base Station to Power Shields
 - White and Black or Red and Black - 14 gauge stranded (14awg)
- Power Shield to track drops
 - White and Black or Red and Black 14awg stranded. (color tab or marker to differentiate from the Primary Bus)

Wire for Track Drops

- **Red** and black - but 22 gauge (22awg) stranded, normally under six feet in length.
- Which rail is Black?
 - I use **red** and black push pins along the rails while wiring drops

THE TURNOUT – FROG ISOLATED

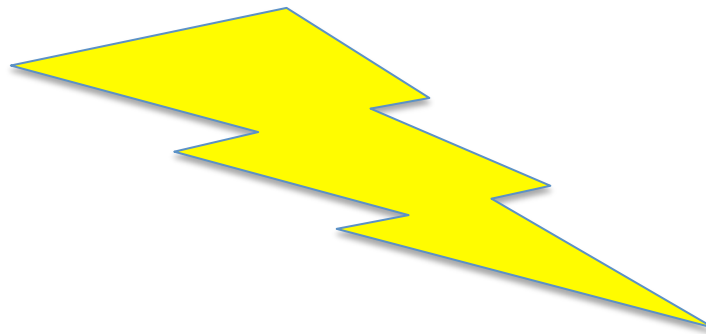


Powering Frogs

- Same gauge as track drops
- I use green 22awg
- I use green push pins

Safety Point

If you run 120 volts under your layout do so in conduit.



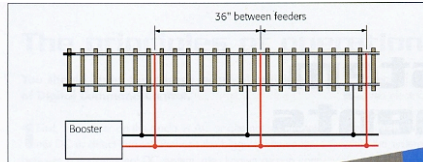
Track Wiring

- Bus length
- Voltage drops per 100 feet of wire (round trip)
 - #18 1.91 V
 - #16 1.20 V
 - #14 0.76V
 - #12 0.48V

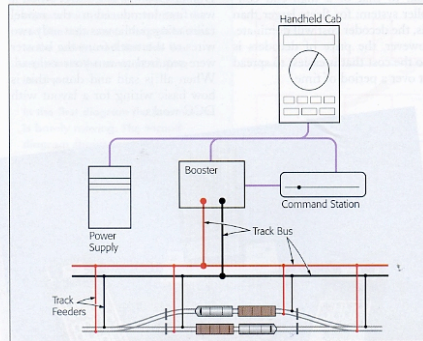
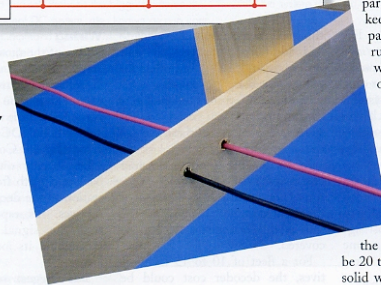
Track Wiring

- Bus length
- Frequency of drops
 - Rail joiners
 - Power routing via turnout points to branch line
 - Powering the frog

Connecting Track Wiring



Be sure to keep the wires underneath your layout parallel to each other, even as they route through benchwork.



The track in the diagram is divided into four blocks, but every block receives its power from the same two wires that make up the power bus.

My own railroad, the Allegheny & Lackawanna Southern, is approximately 20 x 30 feet and is wired

with just two wires to the track. The track on the railroad is divided into many sections or blocks. Circuit

breakers are cut into the wire to limit the effect of short circuits, but the same two wires always come from the booster/power station to provide power to the track. The two wires are more commonly known as the track bus. The track bus wires should for the most part be parallel to each other. I keep the wires on my railroad parallel at all times, even when running wires through benchwork or around different obstacles.

Typically, I use two sizes of wire around the layout. The main track bus is 14 gauge wire, which is heavy enough to carry as much power as 5-amp boosters are capable of producing. From the main track bus I have track feeders, wire from the bus to the track. These can be 20 to 22 gauge wire. Stranded solid wire will do, but it should be copper.

So, you're asking yourself, why do we need only 20 to 22 gauge wire to carry power from the main track bus to the track, when we need 14 gauge wire to carry the power from the booster?

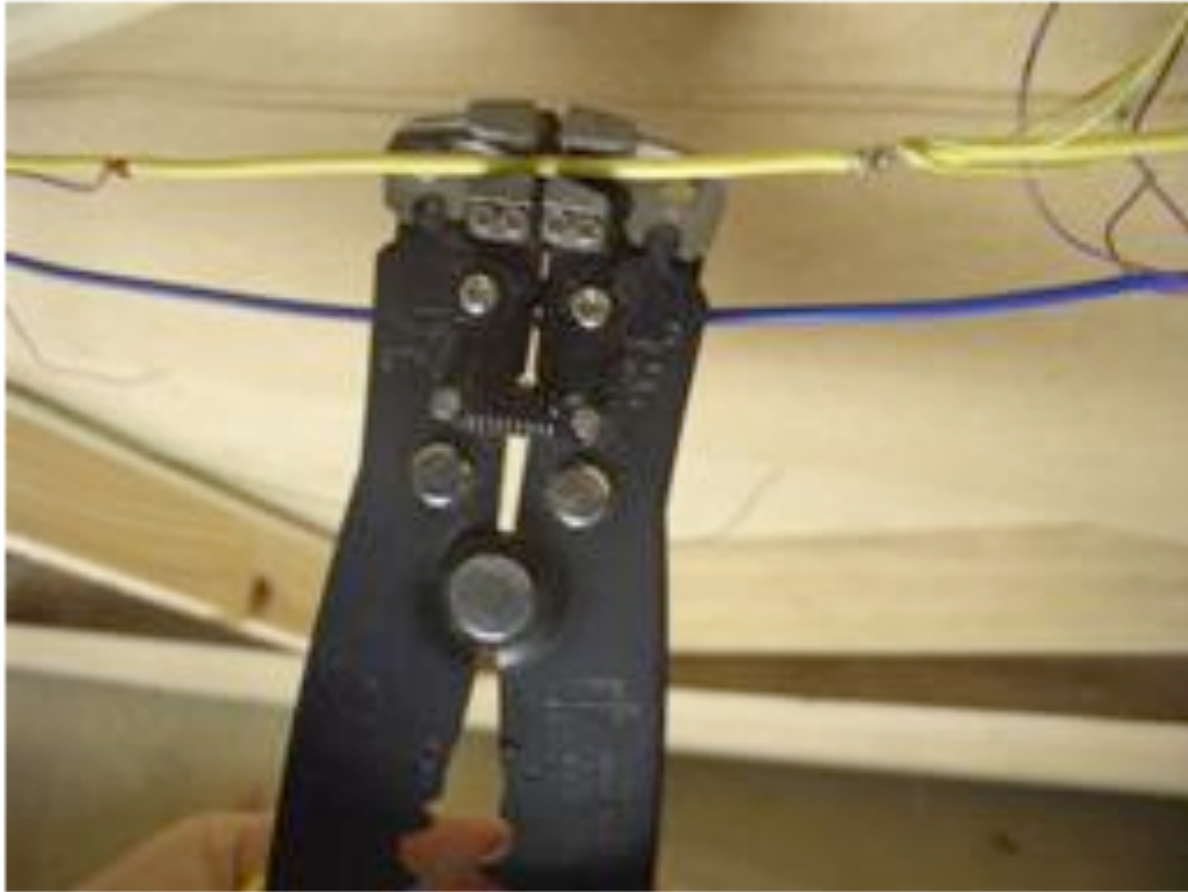
The answer relates to resistance. In electrical terms, the smaller the wire, the more resistance is created for the voltage coming from the booster.

Think of electricity as water flowing through a pipe. Larger-diameter wires can handle more current, just as larger pipes can handle more water flow.

To avoid creating a lot of resistance, 14 gauge wire is needed to carry the power from the booster around the layout because of long runs that might be required. However, track feeders should not be more than 3 feet long; for that short distance you can use thin wire because the resistance created over 3 feet is minimal.

Many of the companies sell Digital Command Control h

INSULATION STRIPPER

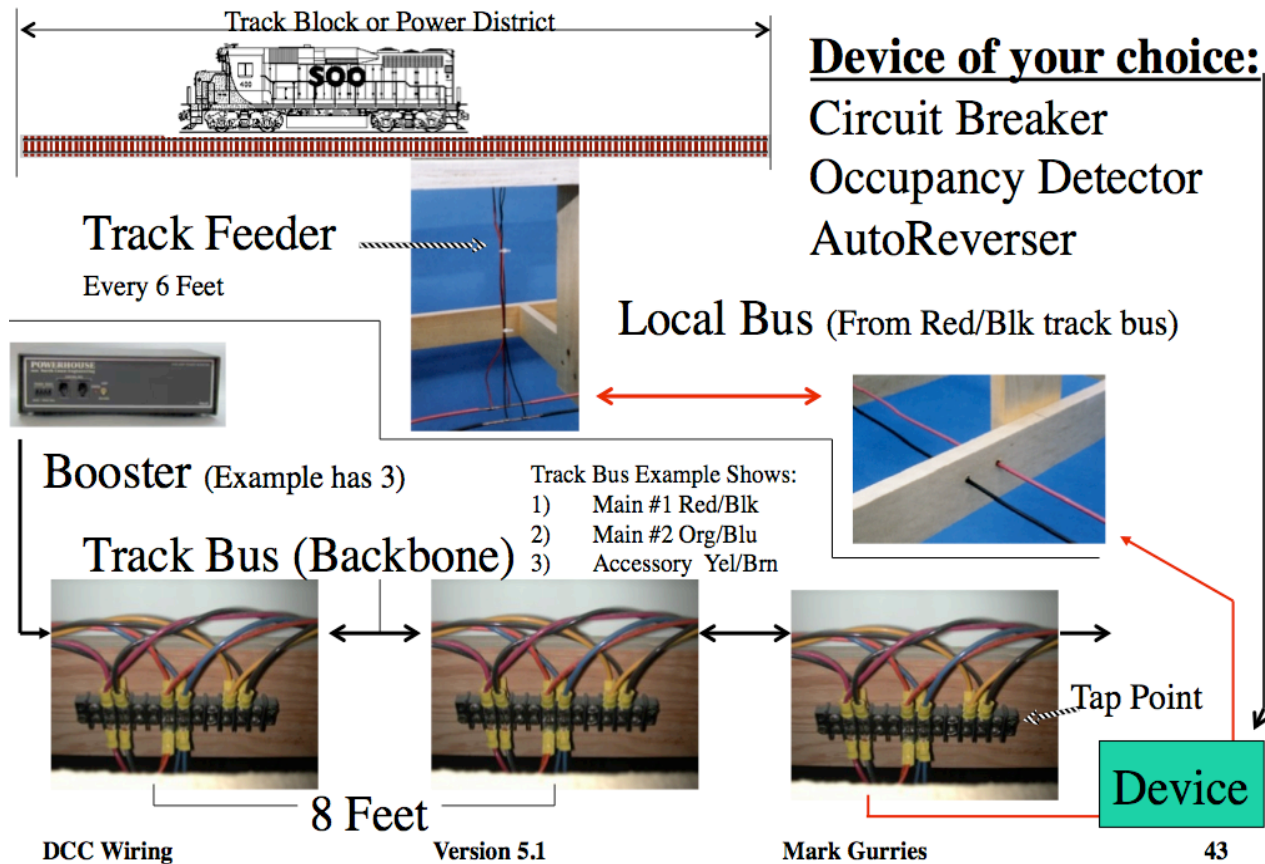


Powerpole Connectors



Another view from Mark Gurries

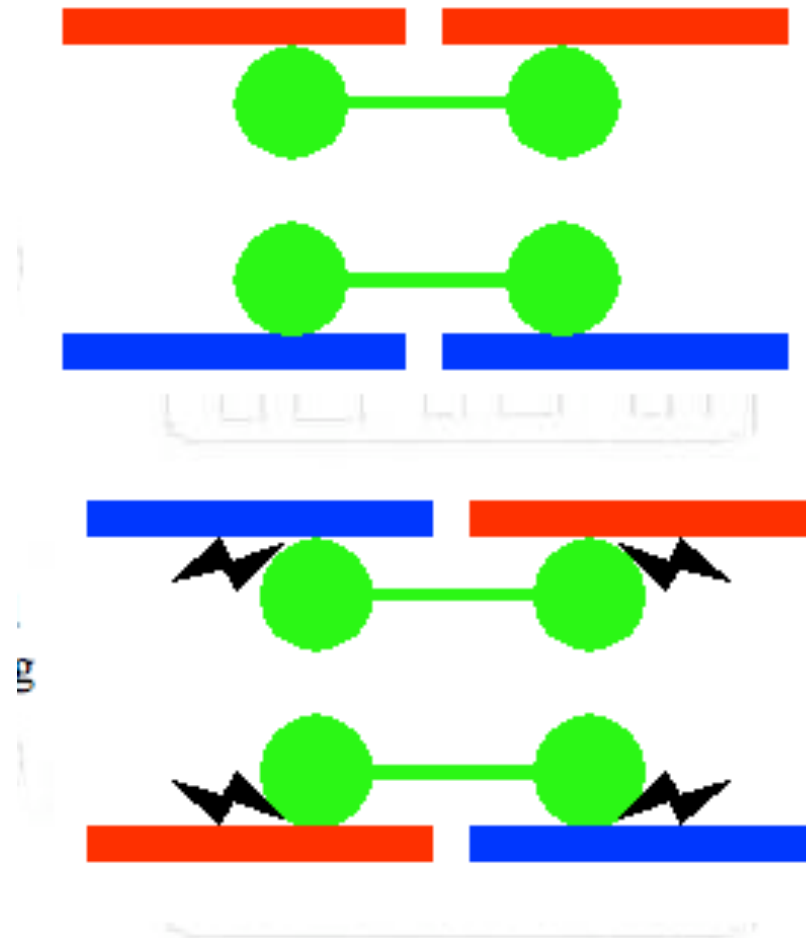
New Wiring: Modular Track Bus Example(2)



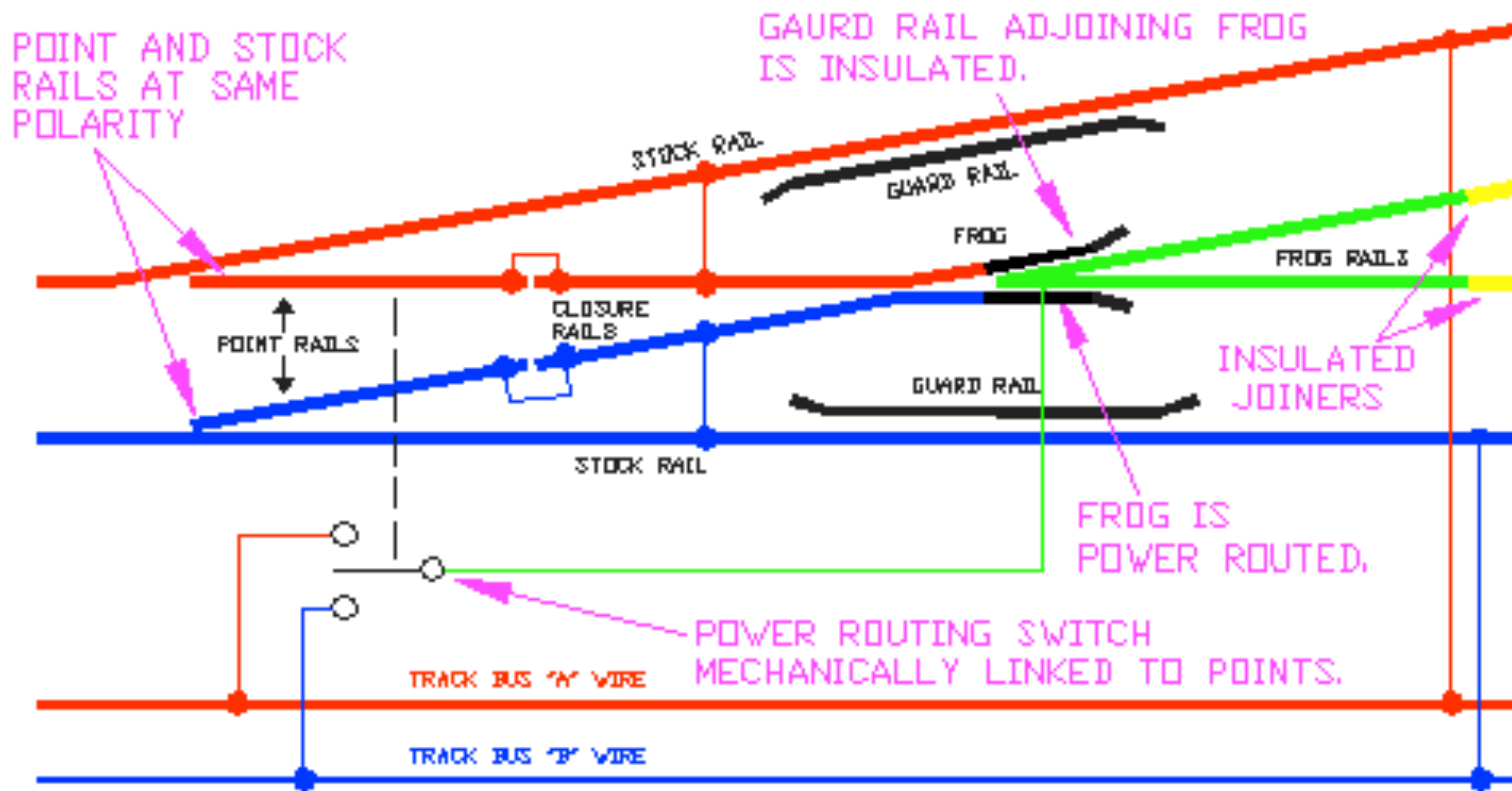
SHORTS

- **Why worry?**
- **The Full power of the DCC booster can be applied to a Decoder if a short occurs!**
- **Decoders are in the range of one amp – booster can put out 5 amps**
- **Hence - *fried* decoder in the absence of a power interrupter.**

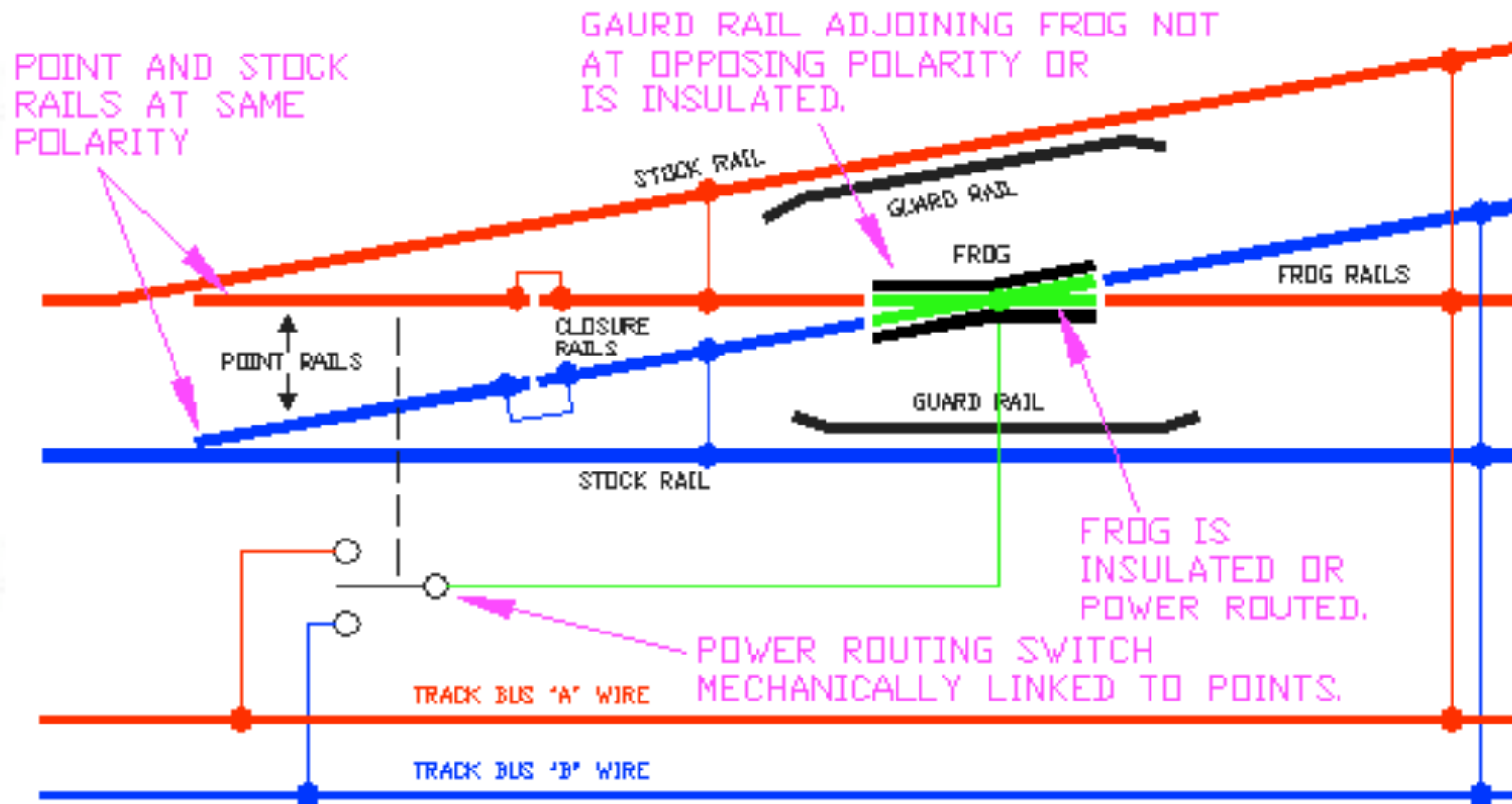
Color coding of rails helps to display a short



SHORTS – The Turnout – FROG POWERED by POINTS



SHORTS - THE TURNOUT – FROG ISOLATED



Shorts Partial Solution - PowerShield



Confirming presence of power with a Ramp Meter



As you wire each section ---- TEST

- **Confirm the section is powered**
- **Confirm there is no short**
- **Confirm the section is connected to the correct Power Shield/circuit breaker**

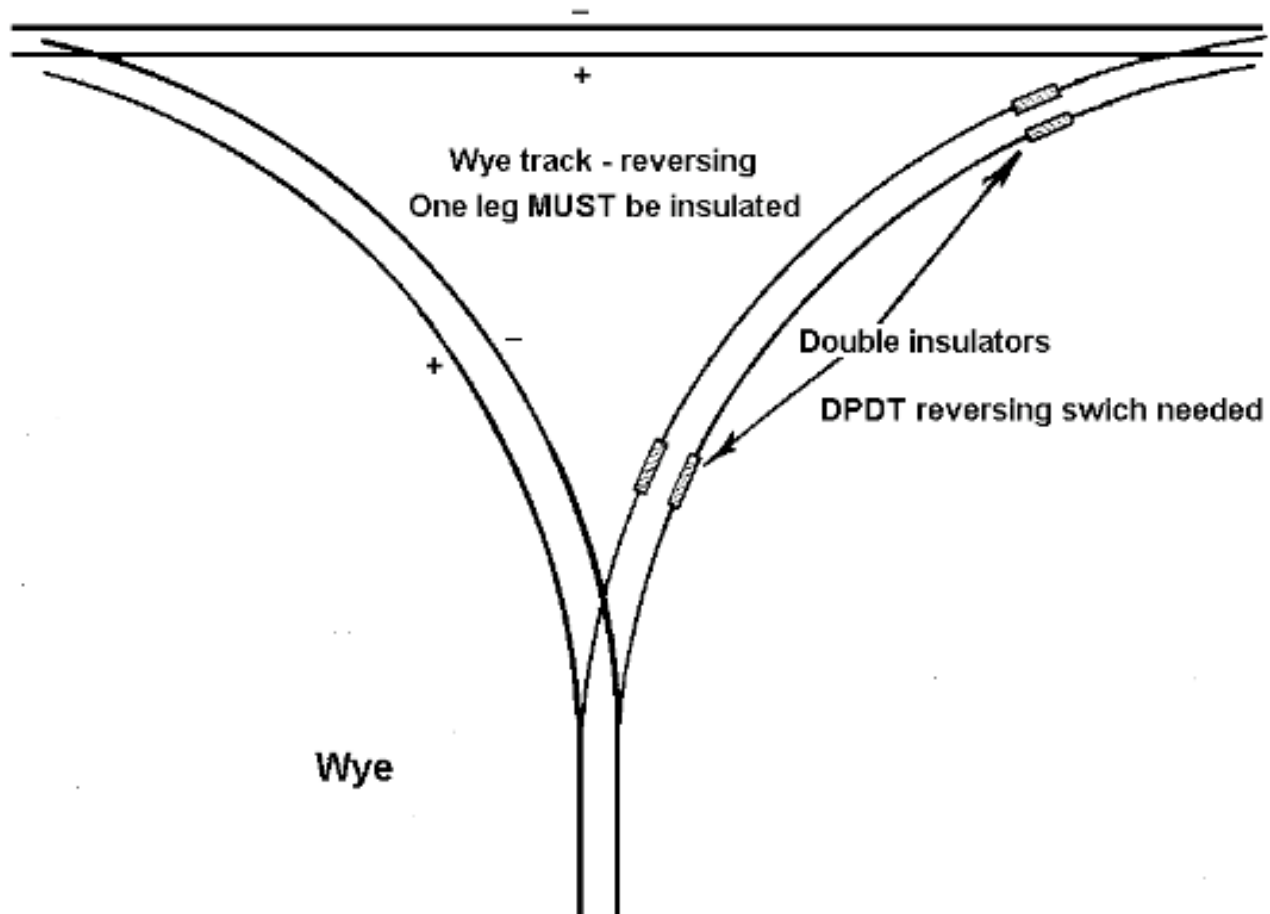
Wiring For

- Wyes
- Reverse loops
- The Programming Track

Wye requiring a Reverser



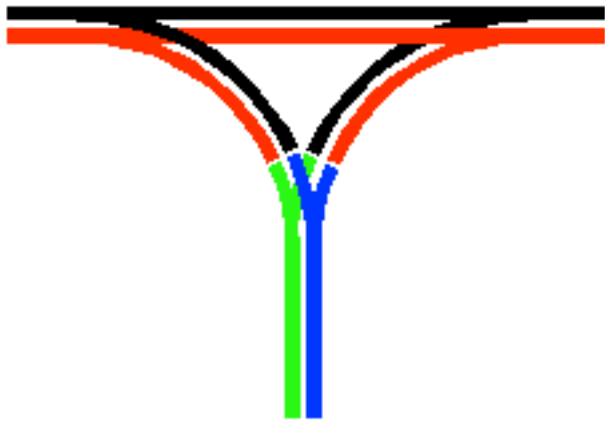
The WYE



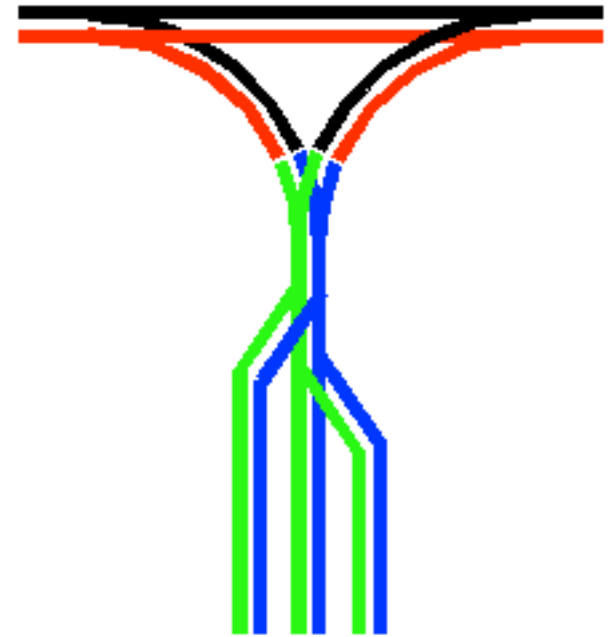
The Wye

- Solutions
 - Permit change of polarity of one leg of wye
 - Permit Changing of polarity of branch leg of wye

The Wye



"A"

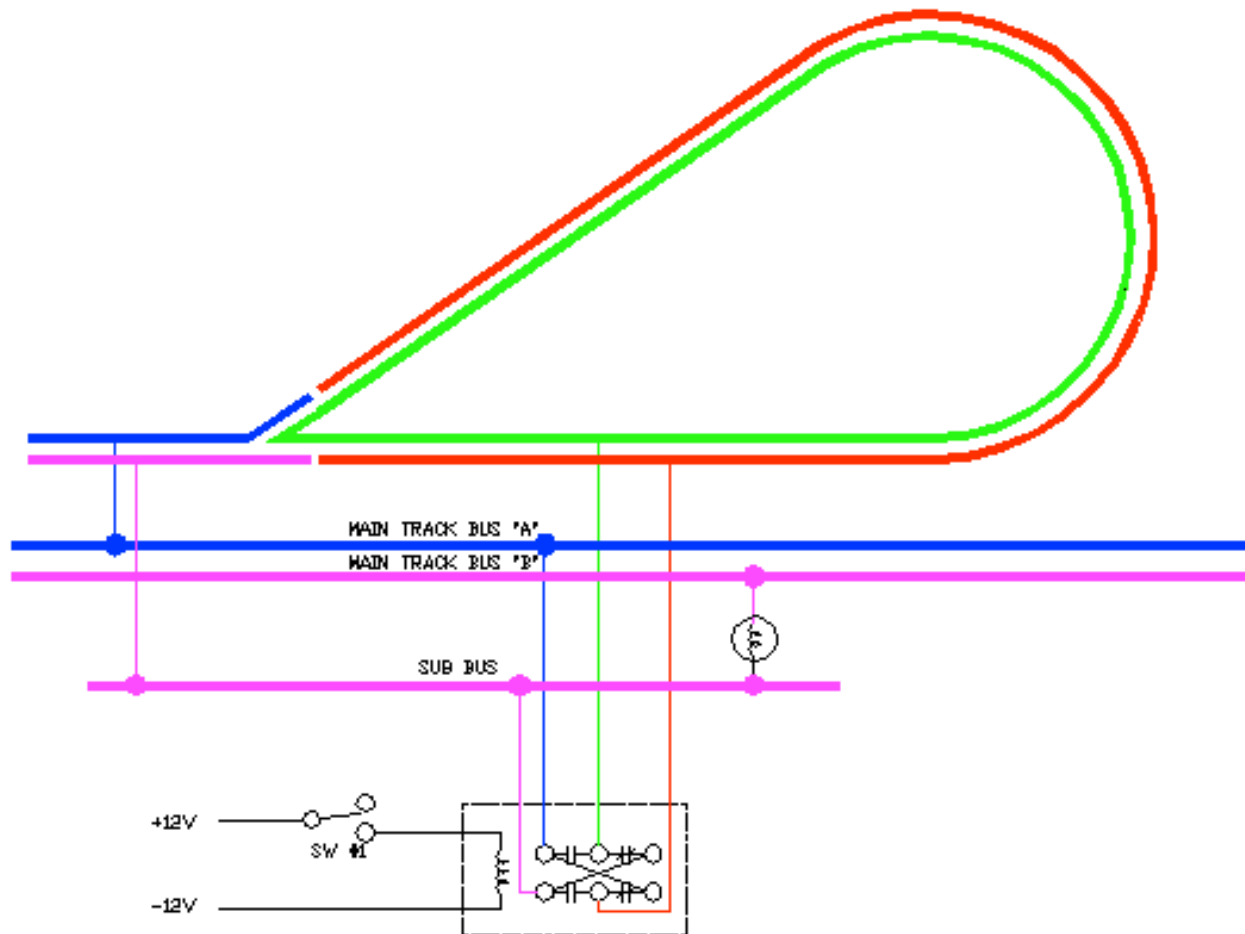


"B"

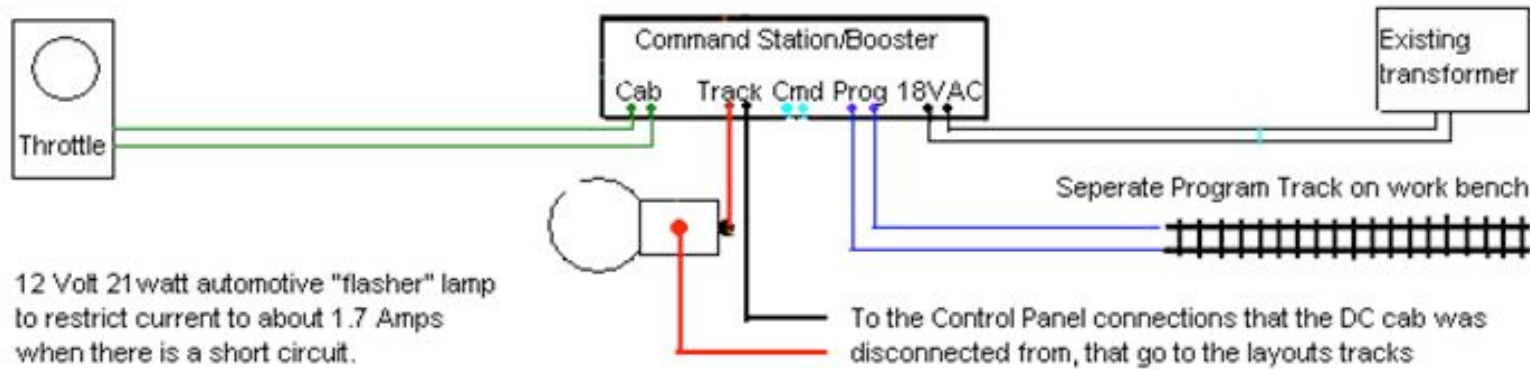
Power Shield / Reverser



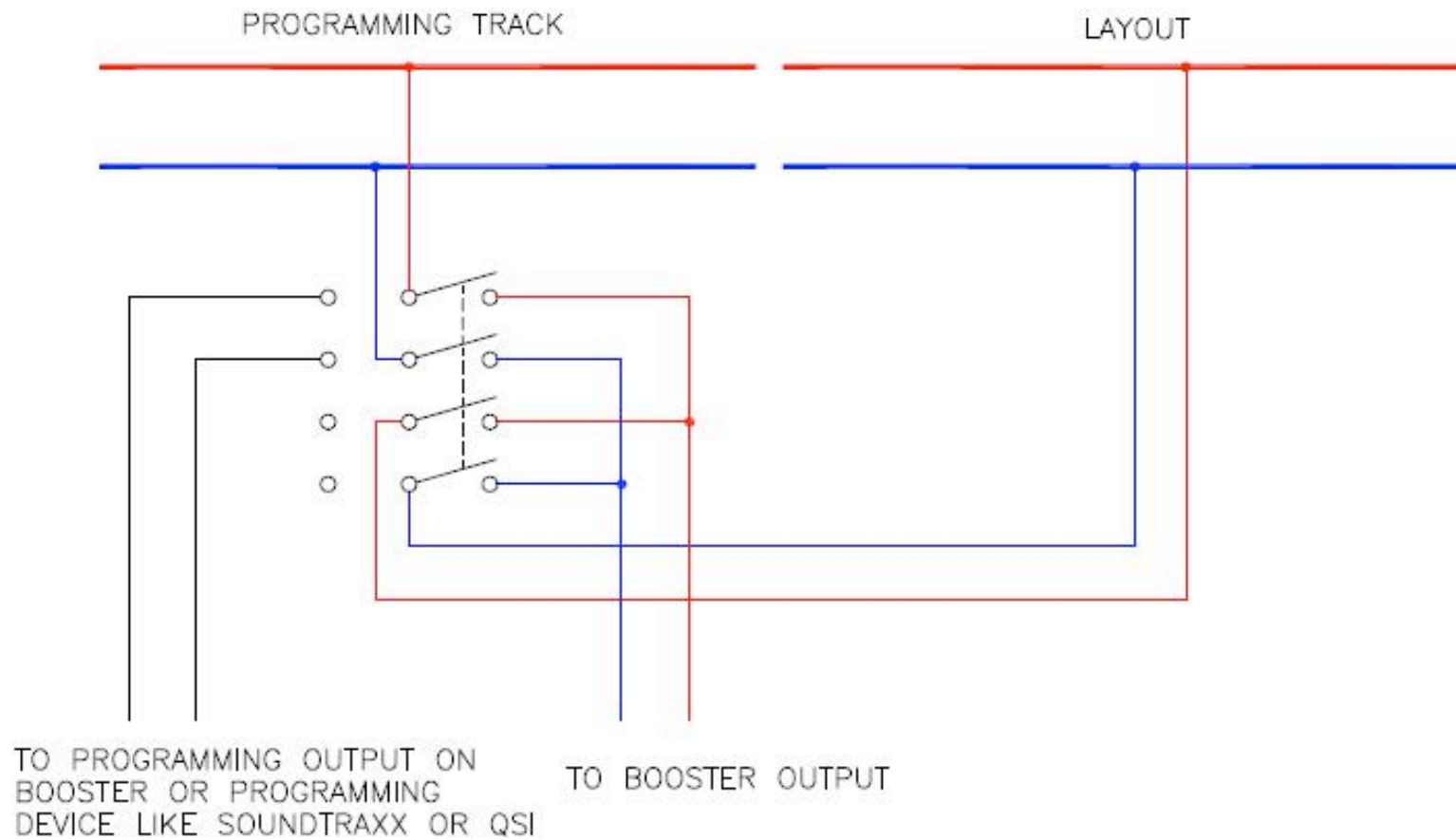
The Reverse Loop



WIRING THE PROGRAMING TRACK

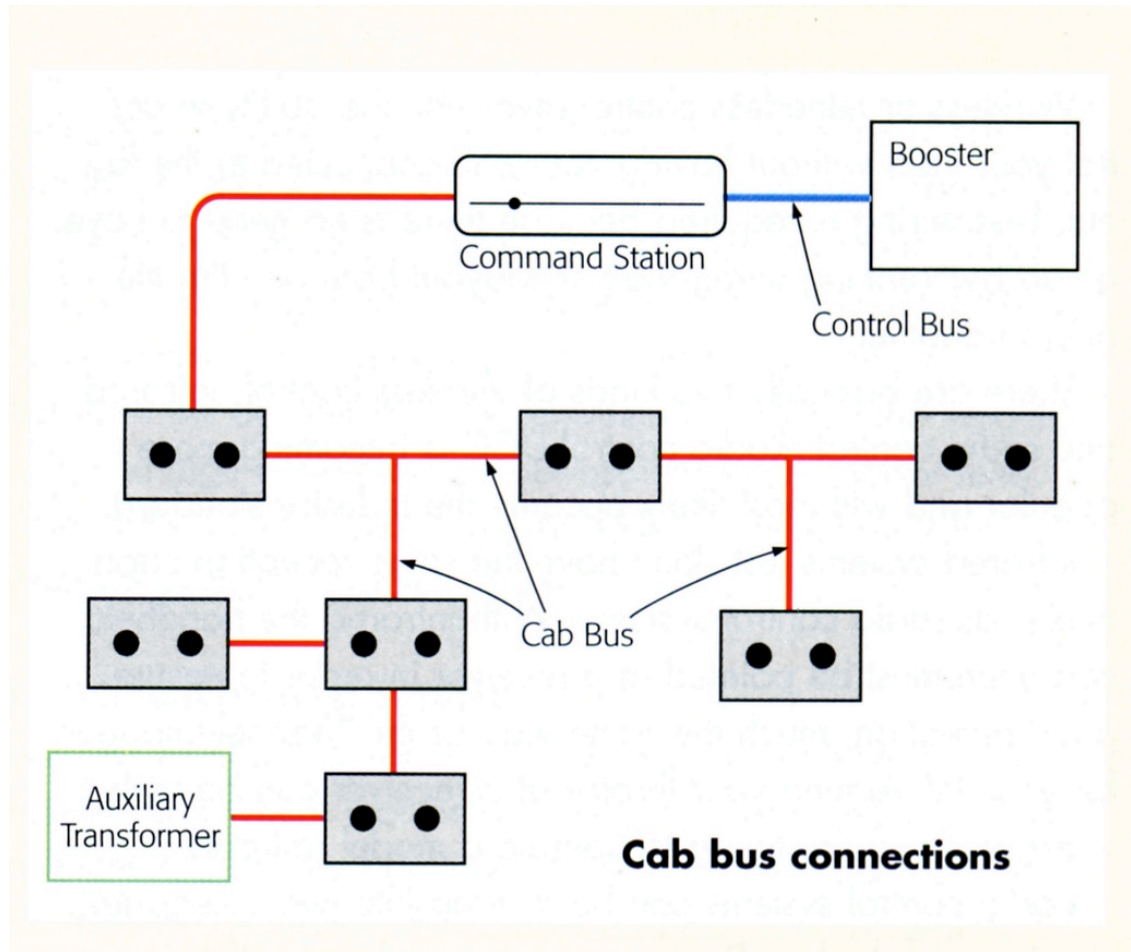


Programming Track

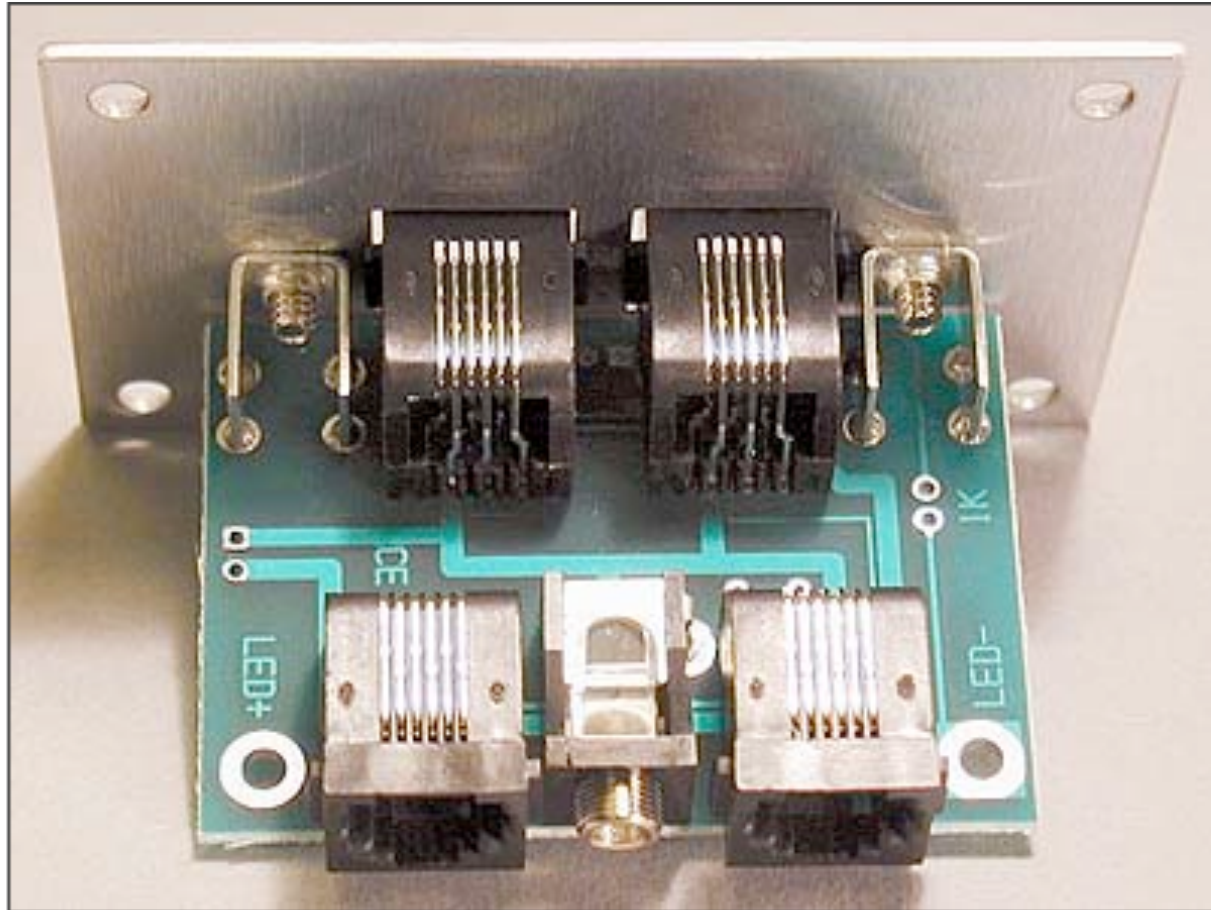


THE CAB BUS

Normally the Cab Bus is a Daisy Chain



Back of a UTP



The Cab Bus – NCE Digitrax

All plugs are wired the same - Straight Through



The DC 12 Volt Accessory Supply

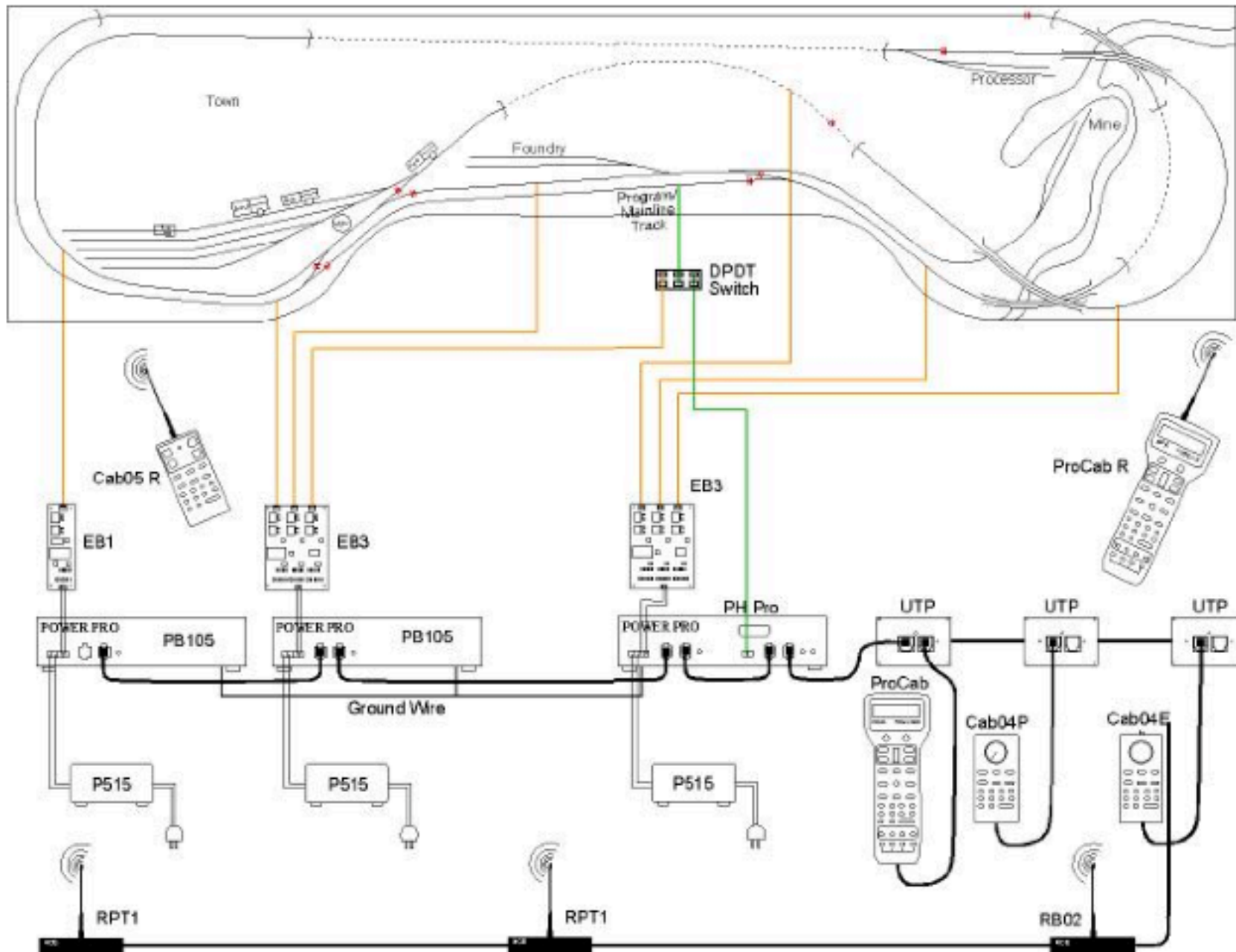
- 16 gauge speaker wire
- I string this separately
- I keep it as a paired cord

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Advanced DCC system setup



THANK YOU

References

- DCC for Dummies see: www.members.optusnet.com.au/nswmn2/DCC.htm
- How to wire: www.wiringfordcc.com/ Track wiring Parts 1 and 2
- Books on DCC.
 - DCC Made Easy by Lionel Strang. Kalmbach
 - DCC Projects & Applications; DCC Projects & Applications, volume 2; both by Mike Polsgrove. Kalmbach
 - The DCC Guide by Don Fiehmman. Kalmbach
 - Digital Command Control A comprehensive guide to DCC by Stan Ames, Rutger Friberg and Ed Loizeaux. Allt om Hobby Publishing Company
 - Basic Wiring For Model Railroaders by Rick Selby, Kalmbach 2007
 - A Practical Introduction to Digital Command Control For Railway Modelers, by Nigel Burkin, The Crowood Press
- Presentation by Jim Scorse, of NCE: NER Convention in Stamford, CT Fall 2005 “What is DCC anyway”
- Mark Gurries’ DCC presentations: www.siliconvalleylines.com/dcc/presentations.html

REFERENCES

- For Anderson Power Poles try:
 - www.andersonpower.com then search PP30
 - To purchase single connectors: C.W. Distribution Inc.,
5779 N. Tischer RD, Duluth, MN 55804 (218) 525-2205
- NMRA DCC recommended Practices

Rail polarity and the NMRA DCC Standards

- **Is Left & Right Rail applicable to DCC during decoder installation?**
- **If you never plan to operate with Direct Current on this layout, it does not matter how you connect the red and black wires to the rails in terms of which goes to which rail. Direction of the locomotive is controlled solely by the decoder and not the rail polarity.**
- **The NMRA DC polarity convention covering rail polarity is: The red wire goes to the positive rail.**

When Many amps are Needed Add Boosters

