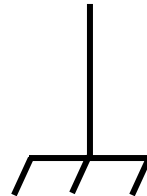
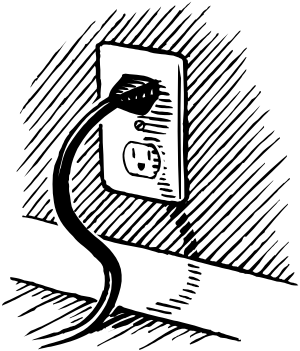


Grounding and Commons for DCC Systems



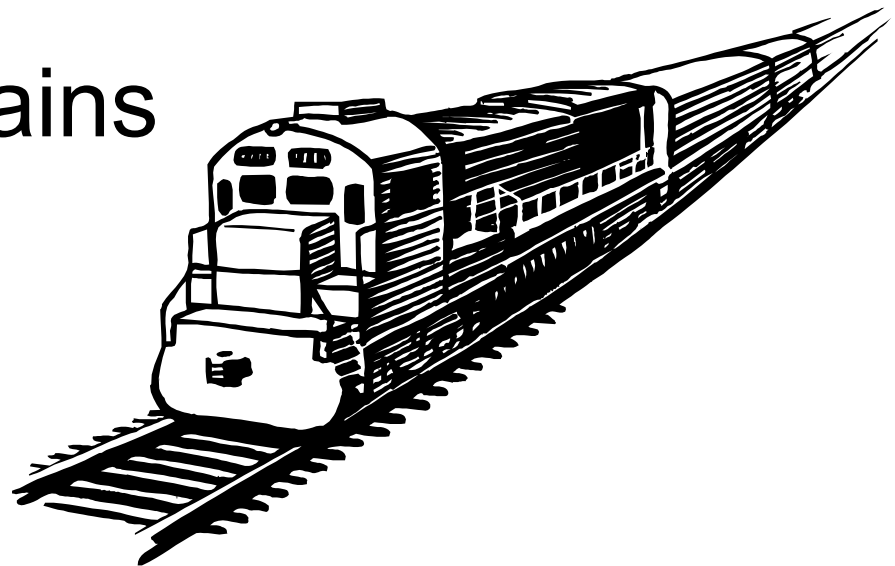
Doug Stuard
NVNTRAK

Two Objectives

- To keep you from electrocuting yourself...



- To keep the trains running!!!



High Voltage / Low Voltage

- DCC transformers or power supplies connected to AC mains (120-240 VAC) must provide protection against contact or exposure to high voltages
 - Grounding
 - Insulation
 - Disconnect
- The transformer/power supply output and all voltages on the DCC side are “Safety Extra Low Voltage” (SELV)
 - SELV defined as < 42.4 VAC (Peak) or < 60 VDC
 - No danger if exposed (you can touch it!)
 - Safety “ground” not required
- Isolation between high voltage and low voltage sides is ensured by double insulation (“SELV Class 2”)
 - No possibility of exposure to high voltages on the low voltage side under normal or single fault conditions

Personal Safety

- AC Safety Ground (Center Prong/Green Wire)
 - Provides return path for 120 VAC current in the event of a short from hot or neutral to a metal case
 - Carries no current except under fault conditions
- Insulated case
 - Exposed surfaces are insulated from internal AC wiring
 - Any faults on the AC side are contained within the case and/or cable
 - Three prong plug not required (think hair dryers, soldering irons, etc.)
- Ground Fault Circuit Interrupter (GFCI)
 - An in-line circuit breaker that senses AC current on the hot (black) and neutral (white) wires of the AC mains circuit
 - If not equal, then there is leakage somewhere (i.e., a “ground fault”), and the GFCI trips
 - Provides protection even if there is no center prong (green wire) connection.

DCC Commons and Grounding

- DCC Booster Common
 - Provides a common voltage reference and return path between boosters, power managers and other DCC components
 - Required when locos cross power district boundaries
 - Loconet “ground” wires (26AWG) are too small to be effective
- “Grounding” of Booster Common
 - Can be used to prevent static buildup
 - If done, do so at ONLY ONE point (typically the command station case to command station transformer AC safety ground)
 - Multiple connection points run the risk of creating "ground loops" which can couple AC ground voltage differentials into the DCC low voltage system.
 - Not a DCC “safety” ground (none required for SELV)
 - RF ground performance is questionable due to lead length (many wavelengths at 900 MHz)

Implementation Guidelines

- High Voltage Side -

- Connect the AC safety ground of each booster transformer/power supply to house ground
 - Use center prong of AC line cord (where provided) or direct connection to center screw of wall outlet
 - Not required for insulated cases with two prong plugs (PS 315, PS 515)
- A GFCI may be used if desired to trip the AC supply in the event of AC leakage to undesired return paths.

Implementation Guidelines

- Low Voltage Side -

- Provide a “Booster Common” between the “ground” (case) of the command station and all boosters, PM42s, BDL168s and other DCC components.
 - Loconet “ground” wires are insufficient - Use #14 or better.
- The low voltage side of the power supplies (including the entire DCC system) contains no hazardous voltages and thus needs no safety ground.
 - Booster Common MAY be connected to AC Safety or house ground for static discharge purposes
 - If connected, do so at ONLY ONE point to avoid ground loops

DCC Grounding and Commons

