DCC Wiring – A Practical Guide.
Most people just hear the word DCC and cringe—if they would only give it a chance they would probably be pleasantly suprised.
DCC Really Is Less Complicated!!


Much more information on much less wire!
What This Clinic Will Cover

- Requirements and Installation of DCC Wiring
- Materials and tools.
- Basic power and track wiring
- Handling common track features – turnouts, reversing loops.
- Tricks
- Demonstration Module.
What This Clinic Will NOT Cover:

- DCC Theory (except if you ask or I can’t resist.)
- Installing decoders in Locomotives.
- Programming Decoders.
- Competitive Equipment Comparisons
- Requests to wire your layout not accompanied by generous rewards.
- Fixing Problems if you already wired it or messed with it. (for any rewards no matter how generous).
Comparison: DC Block Wiring vs. DCC Wiring

Figure 1. DC Cab System

- Locomotive Controlled by Block Voltage and Polarity.
- One train per cab and block

Figure 2. DCC System

- Locomotive decodes and responds only to its own address regardless of position on track. Any number of trains per booster.
DCC Wiring

- **Needed wiring:**

  - **Track Power Bus**
    - Same regardless of Manufacturer
    - Power Blocking or Districts on larger layouts
    - Automatic Reversing Switch for Loops
    - Programming Track

  - **Cab Bus**
    - Links multiple outlets for plug in cabs
    - Varies depending on Manufacturer. Telephone wire commonly used.
    - Not needed for very simple set ups (no walk-around)

- **Accessory Power (optional but recommended)**
  - +/- 9 to 12 volts DC for turnouts, lights, signal power ......
DCC Wiring Basics I

- With DC cab control the maximum current in a block ~1-2 Amps. Each wiring run needs to handle just one block current. 18 AWG is ample.

  - limited capacity of DC cab prevents high currents in a short circuit. Usually recovers fast from transient problems. Often not noticed.
  - Short in one block will shut down just that one block and train. Rest of layout is unaffected.

- With DCC all the current for all the trains comes from one source through one wiring “bus” run. Minimum capacity provided is normally 5 Amps. Wiring needs to handle this current level. 14 AWG is minimum for track bus wire (except very small layouts.)

  - An uncontrolled short has as much power as a 60 watt light bulb!
  - For protection the booster trips out and shuts down very fast – stopping the whole layout.
  - The fast reaction gives zero tolerance for transient short circuits that you might not notice with DC. (Some causes can be controlled e.g. in turnouts)
  - The overall electrical resistance must be low. A short must draw the trip current momentarily to make the protection work. (“25 cent test”)
  - For an existing DC cab control layout with no electrical problems at all you may be able to convert by using a DCC supply in place of one cab.
DCC Wiring Basics II

- With just one large block, wiring mistakes and failures can be very hard to locate – one defect anywhere and its no go everywhere.

  - Be very careful in wiring methods and workmanship. Leave no bare wire.
  - Check for short circuits as you go, before the booster is connected. Simple multi-meter is fine.
  - Select and stick with a simple color code. (here its mostly blue and red for the rails and green for switching frog connections)

- Track electrical gaps are still needed but simpler to figure than with DC. 99% of all cases are covered by one set of rules.
  - Gap any rail coming from a turnout frog.
  - If in doubt gap both rails at this location.
  - Fill the gaps with solid insulating material.
  - Try the fancier track work (three way turnouts etc.) as they come before modifying.
DCC Wiring Basics III

- Learn to solder well.

- You can make many under baseboard connections with solder-less splices, but still need to solder to the rails at least.

- The five basics for electrical soldering:
  - Clean all surfaces (fresh wire surfaces, no oxide on track, no track weathering...)
  - Clean again
  - If any doubt clean again!
  - Apply heat and a little rosin cored solder wire.
  - When the initial solder runs, apply some more and stop.

- Keep the soldering tip clean and “tinned”
- Solder guns are not recommended, too hard to control the heat.
- Result must be smooth and shiny.
Basic Plain Track Wiring for DCC

Track Feeders
- Less than 3 feet long
- 20 – 24 gauge stranded

Track Bus Wires:
- 10 gauge – 14 gauge, solid conduit wire
  (14 gauge more than sufficient for 100 feet run in HO.)

3 feet+ OK between feeds, closer on smaller code track. Solder rail joints between feeders and/or at least one feeder each rail length.
Tape the Joints! Secure the Tape! Finding stray connections later is very exasperating!
Wiring Arrangements – Solderless Splices

Use the Correct Size splices. They are color coded:

- Blue = 14-16 AWG
- Red = 18-22 AWG
- Double over undersized wire

All materials: Lowes etc.
A Very Handy Tool

 Automatically Adjusting Wire Stripper.

 About $19 at the home improvement store of your choice.

 Avoids wire nicks and stray strands.
There are 4 track sections (blocks) but all are fed from the same Track Power Bus.
Turnout Wiring

The ideal turnout for model railroad use

All rails after frog electrically powered

Frog electrically isolated and powered by switch contacts

Points electrically connected to stock rails


How Well do Available Turnouts meet this?

What is the meaning of “DCC friendly”? 
Turnout Wiring Example, Isolated Frog. (Atlas “Super Track”)

- Insulated Tie-bar
- Stock and Point rails electrically bonded
- Rail Gaps
- Track Feeds
- Isolated Frog
- For Live Frog, Add wire to switch on turnout motor or linkage
Turnout Wiring Example (Peco code 75 – optional wiring)

- **Insulated Tie-bar**
- **Rail Gaps**
- **Jumpers cut**
- **All Frog Rails Bonded**
- **Frog and adjacent rails isolated by cutting jumpers**
- **To switch motor contacts**
- **These rails must be gapped**

**ex factory: wiring is equivalent to older Shinohara type.**

**As Supplied**

**Modified/Add**

**Track Feeds added to both rails exposed in base gap.**

**To switch on turnout motor or linkage**
Turnout Wiring Example: Power Routing. (Older Shinohara type)

- Metal Tie-bars
- All Frog Rails Bonded
- Track Feeds
- Contact Tabs

Careful Observance of Standards Gauge Clearances is Essential!

With electrical contacts on switch motor for better frog powering, any mistiming of point blade and contact movement causes a momentary short – but enough to trip DCC X

Current Limiter, 1156 Auto Bulb

contacts on switch machine
Tricks with Auto Lamps I

Momentary Shorts that would just stall one train with DC can shut down the entire layout with DCC.

- Switch
- Current Limiter
- Gaps

1156 Light bulb has less than 1 ohm resistance at low current, drops full 12 volts with 2.1 amps.

No current limiting, booster will shut down whole layout.

Goof Proof Isolated Frog Turnout.
This protection is suited to a smaller layout with just one booster supply. Separate boosters can be used for each section or “power district” on larger layout with more than 5-6 locos running at once.
Reversing Loops (+ Wyes and Turntables) I

**Wiring** - Connect the two yellow wires to the reverse loop section and the two red wires to the main line section as shown:

Module flips polarity of reverse loop section to match that of main line as train starts across insulated gaps.

Reacts so fast that main power station does not trip out.
Reversing Loops (+ Wyes and Turntables) II

Alternative Method:
• More $$$
• Good for multiple train storage loops.

> Complete Train Length between gaps

The diagram shows how to use an extra power booster to provide auto reversing for a reverse loop.

From: DCC Made Easy; Lionel Strang, Kalmbach, 2003; p27

A slight mistake in the book!
Programming Track - Example

Exact arrangement can differ depending on command/booster configuration and manufacturer. Configuration variables (CV’s) can often be set “on the main” but not the initial address setting.
Summary

- DCC wiring is different from DC blocks and cab control in consideration of wiring methods, but many of the same basic rules for electrical gaps etc. still apply.

- Higher currents = heavier power wiring, and overload protection must work.

- DCC wiring is simpler, but intolerant of sloppy workmanship and “make do” practices. Electrical joints must be soldered or properly crimped – gas tight

- Turnouts need certain attention for trouble free operation.

- Special devices drastically simplify reverse loops, wyes etc.
References

- “DCC Made Easy”; Lionel Strang; Kalmbach 2003
- “The Digitrax Big Book of DCC”; Zana Ireland ed; Digitrax, 1999
- “Easy Model Railroad Wiring”; Andy Sperandeo; Kalmbach, 1990
- http://www.wiringfordcc.com/ Allan Gartner