

Building a DCC Layout

Considerations Before Building

Jim Lemmond

2/16/2008

DCC Model Railroad Layout Construction

Planning Considerations:

The following are many of the considerations that should be made prior to the actual construction of a DCC controlled Layout.

1. What Scale or gauge? G, S, HO, N or Z
2. What DCC system do I use? Digitrax, NCE, Easy DCC, Lenz, Atlas, Bachmann or MRC
3. How large of area do I have for a layout? Garage, room, or dedicated building
4. What bench work construction methods to use? L – girder, Cookie cutter or open grid
5. What type of track and turnouts to use? Atlas, Kato, Micro Engineering, Peco, Walthers or hand laid track
6. Will the turnouts be powered or hand thrown? Snap motors or slow motion motors
7. Is the layout to be used for Display or Operations?
8. Will the layout have signaling? DCC or independent from the DCC System
9. What type of railroad equipment will be used? Steam or diesel or both
10. What is your track plan like? Your design, friend's design or professional design

A few Suggestions:

1. Choosing DCC Systems:

Once you have decided to build a layout, no matter the size, make the decision of the brand of your DCC system. There are many good systems available. Some systems have unique characteristics that are not found in all systems. Some systems are easier to setup for beginners or people with little or no electronics or computer knowledge. Some systems have great equipment, but difficult to understand documentation. Before buying, make the effort to find other layouts in your area that use the various available DCC systems. An area layout tour is an excellent way to observe and possibly try out a system before buying.

Once you have decided upon your DCC system, it is suggested not to mix DCC components from other brands. The NMRA standards are not completely followed by the manufacturers and mixed components may interact poorly. This does not apply to decoders.

2. Layout Location:

If building in a garage, think **air conditioning**. This area is too hot and humid to play with your layout in the summer without air conditioning. If the layout is inside your home, take the type of flooring in the room into consideration. Tile floors or vinyl floors are good for layout construction. Carpeting must be protected to prevent a divorce. Consider static electricity when working on a carpet flooring, this can kill electronic equipment.

A dedicated building or a room over a garage may be the best solution for a DCC layout. If building in a dedicated building the electrical supply to the building is very important. A 60 amp circuit or more to the building is adequate with its' own breaker box. There can never be too many electrical outlets. Some outlets may need to be built into the ceiling. Place wall outlets 6 to 8 feet apart for good electrical coverage.

How much electrical power is needed? Look at it from a Power outlook rather than current or voltage alone. Assume that you have **five boosters** rated at 5 amps each was under full load capacity (which is highly unlikely). **Power is voltage times current.** At 15 volt track voltage and 5 amp current for 5 boosters would be a power load of 375 watts. A 15 amp circuit at 110 volts has a power load capacity of 1650 watts. You could have 22 boosters, if they were the only items on the circuit.

Lighting in your layout room is very important both in the building phase and the operations phase. You may want to install variable (dimmers) lighting for special lighting effects. Consider lighting that minimizes shadows upon the layout.

How will you provide air conditioning to your building? Window units or through the wall units work well. A motel type air conditioning is worth considering because of the lower wall mounting and the availability of heat.

Windows! Do you cover them over or leave them? A suggestion would be to sheetrock over the installed windows to maximize your wall space and continuity for scenery. The sheetrock can always be removed at a later time.

You will need a water source nearby, hopefully inside your building or garage. Hot water can be optional, but is wonderful to have in your train room or building. A nearby restroom is wonderful to have.

3. Track Plan

What is the square footage available? What shape is the room? What is your minimum curve radius? What is the maximum acceptable grade (branch line and mainline)? Will the layout include a helix (one or more)? What size turnouts (#4, #6, #8, etc), crossovers, or double slips?

How to produce your track plan? The old way is to draw it out by hand on graph paper. The newer method is by using a Cad program on a computer. Atlas has a free track planning program for simple track plans. There are commercial track planning programs available that are fairly easy to use and will produce full size templates of the track plan. Full size templates will save many hours when building a large, complex layout. A great way to produce a track plan is to find a person that is a Cad artist, model railroader and builder/designer.

4. Track

What code track to use? HO track is made in code 40, 50, 70, 75, 83 and 100. N scale track is commonly code 55 and 80. The code number is the height of the rail above the ties. The larger the code number, the taller and heavier the rail. Code 83 is becoming a common standard height for HO track. Most track manufacturers sell this type of rail with matching turnouts. The ultimate track is hand laid. Many N gaugers are using the finer scale code 55 instead of Code 80 of previous years.

5. DCC “Friendly” turnouts

Much has been said that only some turnouts can be used for DCC layouts, the “so called DCC friendly” turnouts. The truth is that any turnout can be used with some knowledge of the electronics being used. Knowing where track insulators must be placed will make most any turnout DCC friendly. The simplest solution is “gaps” or insulators at the two “Frog” rails. Modification of other parts of the turnout may be made but are not necessary for DCC friendly. The mods may help the electrical reliability of the turnout, but do not increase its’ “friendliness”.

6. DCC Buss

My suggestion for the power (DCC) buss is to use 12 awg (gauge) stranded copper wire for HO or larger; 14 awg (gauge) stranded copper wire for N or smaller. Solid core wire is usable but more difficult to handle. For your wire drops from the track to the DCC buss, use 24 awg to 20 awg. The small gauge wire (larger number) is okay if you have yours drops every 2 to 4 feet apart. In most cases the more drops from track to buss is better. The heavier (18 awg and 20 awg) wire is really not necessary and is hard to conceal. Drops can be solid or stranded (I like stranded) wire.

“To solder or not to solder, that is the question.” You cannot lose if you solder all your buss wire connections, but it takes more time than other methods. Soldering does take some skill, but it is easily learned. An alternate to soldering is to use one of several types of crimp connectors available at electronic stores (locally and mail order). My favorite crimp connection is made by 3M and is called Scotchlok #953X (terminals – 12 gauge – yellow) and Scotchlok #952X (terminals – 18 – 14 gauge – blue). These are very easy to apply with a large pair of pliers or with the specific crimping tool for these connectors. Their reliability is very close to a solder connection. The matching “male” terminals come for various wire sizes (gauges) and make replacement or trouble shooting very easy. (See the Electrical Supplies List for description and parts numbers). Crimping is easier than soldering and takes very little time.

7. Turnout Control

Manual throw turnouts are easy and reliable to operate and inexpensive. Make sure the throw mechanism is within a person's reach (24 inches or less). Turnout motors are found in two types: snap and slow motion motors. The most commonly known snap motors are the Atlas snap switch motors and the switch motors by Peco. The slow motion motors are built by Circuitron and are called “Tortoise Switch Machines”. Consideration must be given as to how you will control the switch motors, either with a separate electrical circuit (12 to 14 volts) or integrate their control into the DCC circuit and DCC control. Another important consideration should be the vertical placement/clearance of the switch machine when track is placed below a turnout. The vertical clearance could affect the type of switch motor used.

Basic DCC Setup and Wiring

Equipment Requirements:

1. Command Station
2. Booster(s)
3. Throttles
4. Power Supply(ies) for DCC Command Station, Booster(s), Throttles and other accessories
5. Wire for power buss and track drops
6. Network cable for Throttle and Command Station to Booster connection (Loconet, etc)
7. Power management accessories for larger layouts and Reverse Loops

DCC Manufacturers (USA):

1. NCE - <http://www.ncedcc.com/>
2. Digitrax - <http://www.digitrax.com/>
3. EasyDCC - <http://www.cvpusa.com/>
4. Lenz - <http://www.lenz.com/>
5. MRC - <http://www.modelrectifier.com/train-controls/dcc.asp>
6. Bachmann - <http://www.bachmanntrains.com/home-usa/dwg/index.php?opt=1>

All of the above manufacturers build basic starter kits suitable for a small layout. They also build other equipment for large, complex layouts (Bachmann only sells starter DCC equipment). Please visit their web sites for a listing of all of their products.

Most of the DCC manufacturers utilize some form of a computer style network (LAN). Because of this you will need network cables made. The cables usually require 6 conductor flat cable and RJ12 modular connectors. These cables may be purchased or built by the user with the correct crimping tool.

Several manufacturers offer radio throttles along with wire tether throttles. Which to use? It depends on the size of the layout and your preferences and operating style. If you are building a new layout, radio is worth considering especially in a dedicated train house or room. Each company will have special features that are unique to that particular manufacturer.

Dividing your new layout into several Power Districts is recommended. This prevents a complete system shut down in case of a derailment or short in some area of the layout. It helps with trouble shooting by isolating the offending area, rather than trouble shooting the entire layout. Having Power Districts will help increase the capacity of the layout, especially if you run a large number of sound equipped locomotives (example: A **one** Power District layout will have a 5 amp current capacity, a layout with **several** Power Districts will each have a 5 amp capacity. Sound locomotives consume more amps than other DCC locomotives.) The more amps available, the better.

Which is the “Best” DCC system? They are all the “Best”. The “Best” system is the one that suits your needs and operating style. Cost of the system may be a factor or not. Each manufacturer has

a system for your pocketbook. They do vary in ease to setup and operate. Look at and read the manuals of several systems. Find something that you can understand and use. Some systems will suit a person that likes to tinker with electronics and computers better than others that operate very simply. Usually the simpler a system is, the less flexibility for add-ons and expansion it may have. It's your choice.

DCC Accessories Available for a DCC Layout

Electronic Devices:

1. Auto Reverse Loop Modules

Digitrax - AR1
MRC - AD520
Tony's Train Exchange - PSX-AR (basic unit)
Lenz - LK100 Reverse Loop Module

2. Block Detectors

Digitrax – BD-4 (4 blocks) and BDL-168 (16 blocks)
NCE – BD20 (1 block)
Dallee - TRAK-DT (several models available)
Lenz – LB 101, BM-1, BM-2 and BM-3
Team Digital – DB-2 and DBD22 - DCC Block Detector
Tony's Train Exchange - Block Watcher

3. Signaling Modules

Digitrax – SE8C (requires computer and software)
Team Digital – SIC24 (stand alone unit, computer not required)
Logic Rail Technologies - LR-1000 BlockMaster (combines detection and signal logic)

4. Turnout Control Decoders

Digitrax – DS44 (controls 4 slow motion motors) and DS64 (controls 4 snap or slo-mo motors)
Team Digital – SMD88 (controls 8 snap or slow motion motors)
NCE – Snap It (controls 1 snap motor); Switch-8 (controls 8 slow motion motors) and Switch It (controls 2 slow motion motors)
Tony's Train Exchange – Wabbit (controls 2 slow motion motors) and the Hare (controls 1 Tortoise motor)
Lenz - LS150 Turnout Decoder (controls 6 snap or slow motion motors)

Suggested Tools Needed for a DCC Layout

Tools Hand:

1. Hammer
2. Assorted sizes of screw drivers (slotted and Philips)
3. Surform scrappers
4. Putty knives (narrow and wide blade)
5. Box knives (Stanley or Craftsman replaceable blade types)
6. large scissors
7. caulking gun
8. an assortment of household tools
9. Builder's Squares (large and small)
10. Straight Edges (1 to 6 feet long)
11. Levels (large and small)
12. Laser Level (very handy, but not required)
13. Electrical Extension Cords - 25 to 50 feet (Heavy duty with multiple outlets)
14. Small hand saw (keyhole or sheetrock saw)
15. As many small to large clamps as possible (you can never have enough)

Power Tools: recommended

1. Saber saw
2. Table saw (wide a wide table)
3. Band Saw
4. Heavy duty battery powered Drill (18 to 24 volts)
5. Wet/Dry vacuum cleaner (3 to 5 hp.)
6. Rotozip tool
7. Laser Level (Tripod mounted if possible)
8. Hot Knife (for cutting foam)

Tools: Electronics

1. Soldering Iron (15 to 25 watts – for small gauge wire)
2. Soldering Iron (100 to 400 watts – for large gauge wire)
3. Wire stripper (small)
4. Wire stripper (large)
5. Large Pliers
6. Various small pliers (needle nose, etc.)
7. Small screw drivers
8. Heat Gun (Heavy duty hairdryer might work)
9. Crimper (for building Loconet – expensive is better)
10. Crimper (for crimping small gauge wire for power drops – cheap is okay)
11. Large Wire Cutters
12. Small Wire Cutters (rail nippers are okay)

Construction Supplies: (This varies with construction methods used)

1. Blue or Pink foam – 4 X 8 sheets (1 to 2 inches in thickness)
2. White Styrofoam – 4 X 8 sheets (2 inch thickness – really on 1 & ¾ inches)
3. Various sizes and types of lumber and plywood as needed
4. Sheetrock screws (1 inch to 3 inches – by the box)
5. Glue (Yellow carpenter's glue and white glue)
6. Foam board Adhesive (if using foam or Styrofoam in your construction)
7. Contact Cement (Acrylic is safer and does not harm foam)

Electrical Supplies:

1. Buss Wire (14 to 12 gauge stranded)
2. Drop Wire (24 to 20 gauge stranded – recommended)
3. Terminal blocks (I like the Euro Telco Blocks)
4. Scotchlok #953X (terminals – 12 gauge - yellow)
5. Scotchlok #952X (terminals – 18 – 14 gauge - blue)
6. 3M Highland Terminals FDI18-250L (22 – 18 gauge – Red)
7. 3M Highland Terminals FDI14-250L (16 – 14 gauge – Green)
8. 3M Highland Terminals FDI10-250Q (12 – 10 gauge – Yellow)
9. Commercial Electric Plastic Mounting Bases #295-956 (White or Black)
10. Various sizes of Tie Wraps (many colors available)

Track Laying Supplies:

1. Track (either flex track or sectional track)
2. Metal rail joiners (by the thousands)
3. Insulator rail joiners
4. Road bed (cork or homasote – foam road bed not recommended)
5. Glue for gluing the road bed and/or track (Liquid nails, water based contact cement or Woodland Scenic's Cement)
6. Weights or tacks to secure the road bed and track while waiting for the glue to set
7. Spikes or track nails (Use the appropriate size for you gauge of track)
8. Something to layout curve radii if not using full size templates
9. Straight edges of various lengths (1 to 6 feet long)

Sources of Scenery Materials

1. Foam Board

- a. **Ryder Insulation** – has blue foam in 1”, 2”, 4” and 8” thicknesses. The 1” and 2” comes in 4’ X 8’ panels. The other sizes come in 2’ X 8’ panels. Address is: **Ryder Insulation, 5810 North Houston-Rosslyn Road, Houston. Telephone: 713-686-4336**
- b. **Lowes and Home Depot** – have blue and pink foam board in ½” and ¾” thick 4’ X 8’ sheets. Note: This type of foam has a vapor shield that must be peeled off before using.
- c. **Olshan Lumber Company** – has Styrofoam sheets 2” thick and in 4’ X 8’ sheets. Address is: **Olshan Lumber Company, 2600 Canal, Houston. Telephone: 713-225-5551. Web page is: <http://www.olshanlumber.com/>**

2. Molding Plaster

- a. **Circle Supply** – has 100 lbs. sacks of Molding Plaster. Address is: **Circle Supply Company, 6401 Longpoint, Bldg. #506, Houston. Telephone: 713-688-9803.**

3. Plaster Cloth

- a. **Woodland Scenics** – See your favorite hobby shop or mail order
- b. **Medco-Athletics** – has plaster cloth in case lot orders (12 rolls). Telephone: (800) 556-3326. On the web at: <http://www.medco-athletics.com/> (click the casting & mobility aids menu). Note: **Buy only the Plaster Casting Cloth, not the Fiberglas casting tape.**
- c. **Orthotape.Com** – has plaster cloth in case lot orders (12 rolls). **May only be contacted through e-mail (k10medical@yahoo.com) or their web site at: <http://www.orthotape.com>.** This company has the lowest prices for casting cloth that I have found. It is of good quality and works as good as any other casting cloth.