Tips & Tech #09

- WIRING & DCC –

- Installing DCC control on an existing layout -

Changing the layout over to digital command control is not hard to do. Replacing the mainline power pak or walk-around control is where to start. Changing the main line control will allow you to power up the most track with the least amount of work. Begin by removing the main track wires to the old power unit. You will need a transformer that puts out about 19 to 20 volts AC. The amp rating should be at least the same as the DCC command station (mixer) which is about 5 amps. Hook up the wires from the transformer to the two terminals on front of the command station. Then hook up the track wires. The system is now ready to operate. This is as simple as it gets. As you get more familiar with the system you may want to break the layout into several areas and power each one with an additional booster. These additional boosters would make more amperage for the layout as well as keep a short circuit from shutting down the whole layout.

Installing the new RJ-12 telephone jacks, for the walk-around keypads, will be the most time consuming part of the project. These jacks can be the regular wall plate type that are used in houses and can be purchased locally. Just remember that the wire is six conductor and should be solid not stranded. The stranded wire will work but the ends would need to be soldered so that they will hold better under the screws.

The plug panels that the DCC manufacturers produce are built so that there will be two places to plug into and will usually have a track status light. The two different jacks can also be mixed together. The use of either type works it just depends on what the layout owner likes.

At the Clarion Club we had the layout changed over in about 10 minutes as we already had the layout set up with a plug system that allowed us to change over from conventional DC or Onboard. All it took was adding the plugs to the DCC system and plug it in and away we went. We added several 6 conductor phone cables around the layout and added some RJ12 jacks. The Radio/IR receiver was connected to one of these cables and mounted as high in the room as we could. This would allow the IR a better chance to clear the backdrops and peninsulas. With the Infra-red being line of sight at least two more receivers at various other places in the room.

Other than that the system worked right out of the box. We are now adding the plug panels around the layout and mounting them in the fascia. There are several different types as we are experimenting with different types and brands of RJ12 jacks. We hope that we can soon find a phone jack that will work well and have the right price so that we can standardize the system.

- Buss Wires - Size -

The recommendation of using #12 stranded wire for DCC is not because of the maximum current that the base unit can put out, but because of the resistance of the wire and the subsequent loss of signal because of the resistance. It is recommended that the booster be placed in the electrical center of the layout. This means that the system should try and have the wire runs about equal length to the extremes of the layout. The shorter runs will not cause any problems, only when the wiring runs approach 50 to 75 feet in length. Now remember that there are two wires going to the track and they have to be added together, so now we are only talking about a 25 to 35 foot run.

With runs getting close to the 100 foot mark they should be running #10 stranded wire. Again this is to reduce the resistance in the wire, which will affect the signal reaching the engines. Most of the time it will work but then there are the cases where there is an unexplained loss of control to the engine. Something to look at!

When running the track wires under the layout, keep the two wires together not separated. Separating the wires using the old DC would work but now that we have high frequency square wave signals on the track an AC problem sneaks in called Inductive Reactance. This reactance is the AC version of DC resistance. When the wires are spaced apart they tend to act like transformer windings but only to the point of creating resistance. To eliminate this is just keep the wires together and having a twist in them every once in a while.

- Buss Wires - Length -

As stated many times before that the recommended use of #12 stranded wire for DCC is not because of the maximum current that the base unit can put out, but because of the resistance of the wire and the subsequent loss of signal because of the resistance. The recommendation is to have the booster be placed in the electrical center of the layout. This means that the system should try and have the wire runs about equal length to the extremes of the layout. The shorter runs will not cause any problems, only when the wiring runs approach 50 to 75 feet in length. Now remember that there are two wires going to the track and they have to be added together, so now we are only talking about a 25 to 35 foot run.

With runs getting close to the 100 foot mark t#10 stranded wire should be considered. Again this is to reduce the resistance in the wire, which will affect the signal reaching the engines. Most of the time it will work but then there are the cases where there is an unexplained loss of control to the engine, which has finally happened!

I have run into, what I think is a problem connected with the long Buss wire runs. I kept having unexplainable engine run a ways. These would be completely random and even with the Keypads plugged into the Loconet (not using Radio) the engine would respond strangely (slow movement, not being able to stop the engine, etc.).

I finally tried putting a Snubber on the end of the Buss lines. This Snubber is really a RC (Resistor/Capacitor) filter. It is used to filter out the high frequency noise that is present on the Buss wires.

What I think is happening to my layout is the really long track Buss Wire runs are finally picking up enough noise and it is making the decoders miss the DCC signals. Therefore the engine continues on doing the last command it was given.

As it is the Power Buss has noise on it at all times. And as the length of the Buss increases the noise will increase also. This is a fact of life.

This noise will affect certain engines faster than others as the decoders must vary in their ability to reject this noise. As I can run some engines through the areas that are having problems while others will act up and not want to run at all.

So be aware of this little fix to your track power buss lines.

- Buss Wires - Twisting -

To twist or not Twist – Is that really the question!

From time to time the question comes up on the forums that I visit about DCC and the Buss wire.

Usually it has to do with the size of the wire to use but eventually someone then throws in the remark about twisting the buss wires.

Then everyone begins taking sides!

What really gets me is the fact that some state that twisting the buss wires is a waste of time and then they even go to the extent of using the analogy that you can't twist the rails so therefore the Buss wires do not need twisted.

For those that are not up to speed on the Buss wire twist or not to twist thing I will try and explain it one more time!

In DC wiring we have only the wire resistance to worry about but with DCC and the AC type of signal we impose on the track we have the physical resistance of the wire itself plus the AC resistance in the form of INDUCTAVE and CAPACITIVE Reactance.

While these are big electrical words they can cause problems if not dealt with.

Inductance is where parallel wires can induce voltages from one wire to another. This is the way transformers work. The primary windings of a transformer are insulated from the transformer secondarys, yet there is a voltage generated in the output side of the transformer.

This can happen with a layout and having the buss wires running under the layout side by side. The DCC signal can induce a voltage into the parallel wire and cause the DCC signals to be missed.

Capacitive reactance begins to show up when wires are twisted, as we do with the buss lines to eliminate the Inductive Reactance. But this is at higher frequencies (DCC signal) than the 60 cycle we use in the standard house wiring.

If we want to control the Capacitive reactance we are supposed to keep the buss wires running parallel to each other.

If we want to control the Inductive reactance we need to twist the buss wires.

It gets complicated doesn't it?

This is where the twisted wire and the parallel rails thing comes in to play. If we twist the Buss wires under the layout and the rails run parallel to each other on the top of the layout would we actually be able to control both the Inductance and Capacitance?

Maybe, maybe not but since we can't twist the rails and then running the buss lines parallel under the layout we are for sure going to generate more Inductive reactance than if we twisted the buss lines.

But does all of this really matter?

Probably not!

For most modelers they just pull the old power paks and connect up the Command station and run. Usually they do not have any trouble IF they had good wiring under their old DC layout.

Where the problems show up is in the marginal wiring that a lot of modelers did with their DC layouts:

Just twisting the wire ends together
Relying on the track jointers to carry all of the track voltage
Not enough track drop wires from the track to the buss lines if they even had a Buss line!

Although with a small layout the resistance thing never shows up! But we all know that a model railroader never quits adding to the layout or at the very least makes continual changes.

This is where I believe that the problems begin to compound themselves. I know one layout that was in a constant state of change and the wiring finally caught up with the owner. He had a nightmare until he spent the time to solder a lot of twisted ends. The problems went away. The same thing happened to a club south of us. Their wiring was so bad that the trains would just stop and there was no way they could get them to run.

When I went down to help them fix the problem and saw the wiring problems I stated that that was their problem. They reluctantly made the changes and the problems mysteriously went away. And this was with no changes to the DCC system they had installed. Everything just began working as it should have.

Something to think about isn't it?

BOB H

- Buss Wire Terminators -

Well a while back I had an afternoon OPs session for the modelers from the Erie and Jamestown, NY areas. Along with my regular group and those that came down we had 27, which worked out to be just about the right amount.

The layout had the new staging yard (Valley Yard) up and running. This new staging would allow me to keep the South Driftwood/Emporium staging open and also made for a long run using most of the modeled Lowgrade line.

It provided a way to store the trains (Stack – Roadrailers – Steel Train) off the visible portion of the layout but they were still easily accessible. The total trackage in this new area was about 80 feet, so it is quite a large staging area. It is single ended and requires the trains to be backed out and turned around. I added a Wye to this area to aid in the rearranging of the trains after the session was over.

It worked just as I had expected and is now using the East Brady tunnel, which up to this point, was not used all that much. Some track at Phillipston yard was revised due to this new yard and the overall increase in traffic it generated. The new changes to Phillipston yard would allow pre-staged trains to be held out of the main yard area and still allow easy access to the crews both working the yard as well as the crews taking the trains out on the road. This really helped speed up the train movement in and out of the yard.

The sound engines are still causing problems when the layout encounters a short caused by running a turnout. I had subsequently added 2 – 8 amp boosters in addition to the 8 amp command station and the problems with the sound engines were less frequent. But as the sound engines congregated in Phillipston yard and a short happened then the booster for that area would not reset without lifting 2 or 3 sound engines off the layout.

I knew that I would have to add additional Circuit Breakers to the yard booster because as soon as I added the new staging area there were real problems trying to reset the booster in that area.

With the new staging we added 5 more engines to an already engine congested area. So I added four Circuit Breakers to the layout and put the yard on one - the new staging area on another and the Lawsonham track on section three. The last section was a short track area just south of the yard (Brady Siding) and this breaker could stand to have a little more track added to it.

The sound problems seemed to go away (for the time being) but now a new problem began to show up, unexplained engine runaways. And this was with the keypads plugged into the layout. So this eliminated the Radios as a problem.

I have since begun to add Buss wire Terminators. These are AC filters which help remove some noise on the buss wires. The new staging tracks were having this runaway problem but only with certain engines. The Terminator on this track has stopped the engine runaways, at least for now!

- Wiring Using IDC Connectors -

There is much controversy about using Insulation Displacement Connectors (suitcase/3M/no solder connectors) of the various forums.

If one wants to stir up a hornets nest this one topic that will do it.

While they will work the real problem is installing them **CORRECTLY**! Notice the word correctly. This is where the problem lies and very few modelers are going to go out and purchase the proper tool for the job. I know as the Club members did not do so

Using IDC (suitcase) connectors will work for a while but in an environment where moisture and humidity is high (basements – garages) they begin to cause problems.

We used them on our club Lionel display (located in an old basement) and had the trackwork up for almost 10 years. We had used #12 stranded buss wires and #12 drop wires. The track we used was Gargraves and most of the #12 drop wires were soldered to the rails. The IDC connectors were used to connect the drops to the buss wires. We had the proper Scotckloc connector for #12 wire and they worked well for 5 years.

We then began to notice that the trains would slow down on certain sections of track and were not sure why. An inspection of the wiring showed nothing wrong and in the process of checking the wiring the problems seemed to go away. While this was OK it did not really explain why the problems even showed up.

Then a different section of track began giving problems. We had the layout set up blocks using industrial toggle switches and it was designed to be able to have 2 different transformers available to run any given section of track. So the transformers were not the problem as either one would not make the track run any better. It got so bad at the last we had to have the bad sections set on the other transformer set to a higher voltage just to keep the trains moving at the same speed section to section.

Then on the forums someone stated that the potential problems existed where the metal blades came in contact with the wire and very minute amounts of corrosion would form on the IDCs. This then explained why when we did our wiring inspections we seemed to correct the power loss but had not actually done anything except moving the wires around. By moving the wires we must have made good contact again by somehow breaking through the corrosion. I really could not see any of this in any of the connectors but then it probably was that very small amount.

We subsequently rebuilt the Lionel display at our club and we are NOT using the IDC connectors PERIOD ! We are soldering all connections.

Also IDC (suit-case connectors) as well as any other connector (posi locks) need to be installed correctly per manufacturers instructions. And what male ever reads the instructions?

When you want to be absolutely sure you have a good connection, SOLDER it!

BOB H

- Lightening and the Model Railroad -

Lightening (and I am not talking about weight here) is a problem with any house and its contents. I have several first had experiences with the effects on my layout. The latest was about 2 weeks ago and it happened early in the morning just after 6:00am. I had left for work and one hit very close to the house. Needless to say it woke everyone up in the house.

Later in the day I got a call at work informing me that my DCS 200 Command station was junk as well as a PM42, my modem in my computer and one in a laptop as well as several phones. That night with a borrowed command station the layout was checked out. The radios seemed to work fine but we did not check out all of the engines. In goes a call to the insurance company to open a claim!

With that out of the way, the next thing was to see if there was some way to stop the problem! Once I put a new modem in my computer and had it working again I was on one of the many forums and they just happened to be talking about lightening. So I read everything that was wrote.

And as I had figured there is really little one can do to keep this problem from happening! They stated that pulling the plug was about the only thing that was sure to work. A few other things to try were grounding everything. This was high on the list and then laying something metal across the tracks was the other.

Now the grounding thing was my first project. I added 2 more new grounding rods at the opposite end of the house and ran a new #8 wire over to the Command Station. This would be where I would then ground all of my DCC equipment from now on. I am also going to ground the house frame (Yes I have a steel frame above the ceiling), again hoping this will eliminate any

static buildup. Besides the DCC manual stated that it needs a GOOD earth ground, so now we have one!

The next thing was to replace the on/off switch with a 2 line service disconnect. This is a snap action switch with about 3 times that distance from conductor to the contacts. This is hoping that any static charge will not be able to jump the gap and discharge into the electronics. I have both the Power and Neutral wires disconnected. This I hoped would eliminate the static charge from moving back up the neutral wire.

But the last thing is to put something metal across the tracks to short the tracks together. As they explained that during the storm a static charge is building up and the rails are acting as an antenna (as unlikely as it may seem) and will begin building up a static charge of their own. Then when a close enough strike happens the charge in the rails will do likewise (discharge) and end up going through the engines and power supplies.

I may have had this happen (the static charge build up) to me many years ago when I was doing alternator work at one of the C&K coal company mines. Although at the time I was not sure what it was. I was working on a drilling rig on a bench above the cut. The boom was in the air and there were dark storm clouds in the west but it was still clear sky where I was working on the rig. I had been changing the alternator and had it about finished but had to get down on the ground and had to step in behind the one set of duals. Needless to say it was a tight squeeze but I made it. So here I am standing on the ground and had elbowed my way back to reach the wires. I finished up the connection and was trying to elbow my way back out when I got this shock. Now the only thing I was touching was the frame and my feet were on the ground. You tell me what it was? Anyway I soon left the area and the unit was charging when I left, the batteries that is!