DCC Decoder Installation

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Updated March 2006
What This Clinic Will Cover

• Decoder Installation Basics
• Locomotive requirements for conversion
• Locomotive Test Bench
• “Easy” Example (Atlas/Kato HO)
  – opening and inspection
  – measurements
  – decoder selection
  – wiring changes
  – decoder installation
  – test
• “Hard” Example (Vintage Athearn)
• Comments and Conclusions
What This Clinic Will NOT Cover:

- DCC Theory (except if you ask or I can’t resist)
- Full programming of decoders
- Competitive Equipment Comparisons
- Detailed use of decoder function outputs
  - lighting
  - sound
- Details of old brass steam outline conversions
DCC Decoder Installation Basics
Red and Black = original connections to motor. may include: wired, clips, frame etc. connections

Orange and Gray May be reversed to set desired “forward” direction

Fig. 1. DCC Decoder Wiring Convention

Decoder Installation Basics
Decoder wiring color convention applies to all makes and models.

NMRA RP 9.1.1.
Locomotive Requirements
Requirements for DCC Conversion

Good DC Operation:

2. Locomotive starts to move with track voltage:
   - Less than 2 volts – preferred, 2-3 volts OK
   - More than 3 volts – marginal
   - More than 4 volts – reject, needs tuning and/or re-motoring

   - After starting must run smoothly, no binding

   - Stops smoothly with less than 0.5 volt reduction

   - Measure current with wheels slipping (12 volts applied)
     - Good HO < 0.5 Amps

   - Measure current with motor stalled (“locked rotor”)
     - Good HO < 1.0 Amps
     - 1.0 to 1.5 Amps – marginal
     - > 1.5 Amps – reject
Locomotive Test Bench
Locomotive Test Bench

Provides:

- Test track(s)
- DC and DCC sources
- Current and voltage metering
- Computer interface for more elaborate decoder programming

Not an essential but very handy for multiple conversions and locomotive tuning.
DCC DECODER INSTALLATION

Locomotive test and programming bench

DCC control and programming

Meters: voltage and current, DC or DCC

DC or DCC select

DC controls
More elaborate test bench, with wheel rollers
DCC Conversion Atlas/Kato RS-1
DCC DECODER INSTALLATION

Atlas RS-1 factory condition

interconnect board

space is tight except over trucks

track contact leads
DCC DECODER INSTALLATION

motor leads

light

light pipe
Slipping Current Measurement

(~ 0.25 Amps)
Locked Rotor Current Measurement

(~ 0.75 Amps)
## Decoder selection

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- Decoder current rating must exceed locked rotor current.
- After that it’s a matter of size, features and cost.
Look carefully for "gotcha's"
lifting truck connections and wire from board

disconnect motor leads

no contact to track leads!
right hand = red

orange = motor lead originally connected to right hand wheels

Heat shrink tubing where motor leads fit

gray wire to other motor lead

wood to protect plastic board from heat
DC Operation Test - Starting Voltage

~ Original starting voltage + 4 volts
secure extra decoder leads (loose tape or “blue tack”)

resistor for lamp*

*lamp is rated for ~ 8 volts – OK on usual DC short life on constant 12 to 14 volts with DCC

• Full lighting conversion is another clinic!

Atlas RS–1: Final
DCC test and programming

1. Use isolated programming track or test bench
2. Default for new decoders is Address 03
3. Change to preferred address (CV01) is all that’s needed to get into operation
4. If running direction is opposite that expected, reverse orange and gray leads – or can be changed in decoder set up
The Alternative for many popular Locomotives

Digitrax DH150K
Digitrax DH150A
Atlas 340.
NCE DA-SR
Atlas 340.

Drop in Replacements for Atlas/Kato RS-1 boards
Vintage Athearn Conversions
DCC DECODER INSTALLATION

- Top connection clip
- Light
- Rubbing contacts
- Brush retention clip (underneath)

Vintage Athearn Construction
Vintage Athearn – lower motor contact to frame
Slipping Current Measurement “Vintage” Athearn

(~ 0.60 Amps)
Locked Rotor Current – “Vintage” Athearn

(~ 1.3 Amps)
**DCC DECODER INSTALLATION**

- Remove top clip from decoder.
- Remove lamp.
- Cut off/bend down contact tabs.
- Solder wire from decoder output.
- Smooth surface.
- Electrical tape over clip.
- Reinstall.

*Vintage Athearn DCC Conversion*
Comments, Notes and Conclusions
Installing a decoder in a Rivarossi locomotive

I've received a number of questions recently from readers wanting to install Digital Command Control (DCC) decoders in older locomotive models. So, with that in mind, this month we'll look at installing a decoder in a Rivarossi 4-6-4 Hudson locomotive.

Steam engines usually have a lot of room available in the tender for installing a decoder. I had planned on wiring the decoder in this engine in a manner similar to the brass locomotive installation I did in the February 2006 issue of Model Railroader. However, when I opened the locomotive, I found there was plenty of room inside the Hudson's boiler for a decoder, greatly simplifying the project.

I used a Lenz Gold series decoder for the engine because it has some nice features and was small enough to mount directly on top of the motor. One of Rivarossi's later models, this particular Hudson comes with a flat-topped can motor. Earlier Rivarossi models have a larger motor and may not have space for a decoder in this location. Adding Digital Command Control to non-DCC locomotive models is often a lot easier than you may think. Jim Forbes photo

The Lenz Gold JST-FH decoder includes a JST connector (a 9-pin inline connector) soldered to the decoder. This arrangement allows you to install the wiring harness separately, after which you simply plug the decoder into the JST connector. The connector makes the decoder easy to replace, essentially turning your locomotive into a plug-and-play model.

An optional feature of Lenz Gold decoders is that you can add a Lenz Power-1 Module. [See a review of this product in the January 2006 Model Railroader. – Ed.] This component acts like an electronic ByPass, allowing a locomotive run over sections of dirty track and insulated turnout frogs. I didn't install a Power-1 Module on the Hudson because there wasn't room for both it and the decoder in the boiler; however, if you want that feature, you could place the module in the cab.

Steam outline locomotives, especially older brass may need extensive electrical and mechanical tune up to make a conversion worthwhile.

Locked rotor current is more critical – probability of jamming is higher.

While you can still run a DC loco on DCC its likely to be noisy and have reduced speed.

Other Conversions:

Much information exists for many specific cases examples:

MR DCC corner
http://www.wiringfordcc.com/atlasrs1.htm
http://www.loystoys.com/Info/decoders-install.html
http://www.tonystrains.com/technews/dn142_for_atlas.htm
References

- “DCC Made Easy”; Lionel Strang; Kalmbach 2003
- “The Digitrax Big Book of DCC”; Zana Ireland ed; Digitrax, 1999
- Decoders and Installations | Tony's Train Exchange
- NMRA Recommended Practice RP-9 Electrical
Conclusions

1. Locomotive MUST be in good condition.
   • DCC will not fix bad motors or mechanics
2. Basic decoder installation is just 4 wires!
3. Many popular locomotives have drop in decoder assemblies available.
4. Older locomotives can be converted but often marginal without re-motoring and tune up.
5. There is overflowing advice and specifics of many conversions available on web sites.

Basic conversions are quite easy - Go for it!
If This Was Not Enough for You

- DCC Decoder Installation Camp
- What: Five days of Decoder Installation information and shop time.
  Where: Loy's Toys facility in Northwest Arkansas, 21 miles east of Fayetteville
  When: Monday, June 5 through Friday, June 9, 2006.
  Price: $172 includes five days of clinics and shop supplies, including an electronic project we'll assemble.
  Other: Food and lodging are extra. Refer back to the main page for links to that information.

Topics will include:
- Electronics 101: What's a diode, resistor, relay, etc., and how to use them.
- Soldering 101: Learn valuable soldering techniques for all your soldering. We'll even assemble a resistor selection box to hone your soldering skills.
- Decoder Selection: Select your own to get exactly what you want and save money.
- Testing the Decoder: Two very good reasons - confidence and eliminate frustration.
- Testing the Loco: Important for all installations, including plug-n-play.
- Motor Isolation: It may not be what you think.
- Decoder Wiring: Which is pin #1 and what color is the wire?
- Bulb Resistors: Finding the correct resistor for the bulb.
- Programming: 50% of decoder failure is due to incorrect programming!
- Test Running: Lets have some fun while fine tuning it.
- Troubleshooting: There is a methodology.