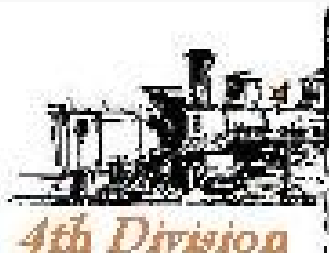


DCC Decoder Installation



© Max Maginness MMR, 2006
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:

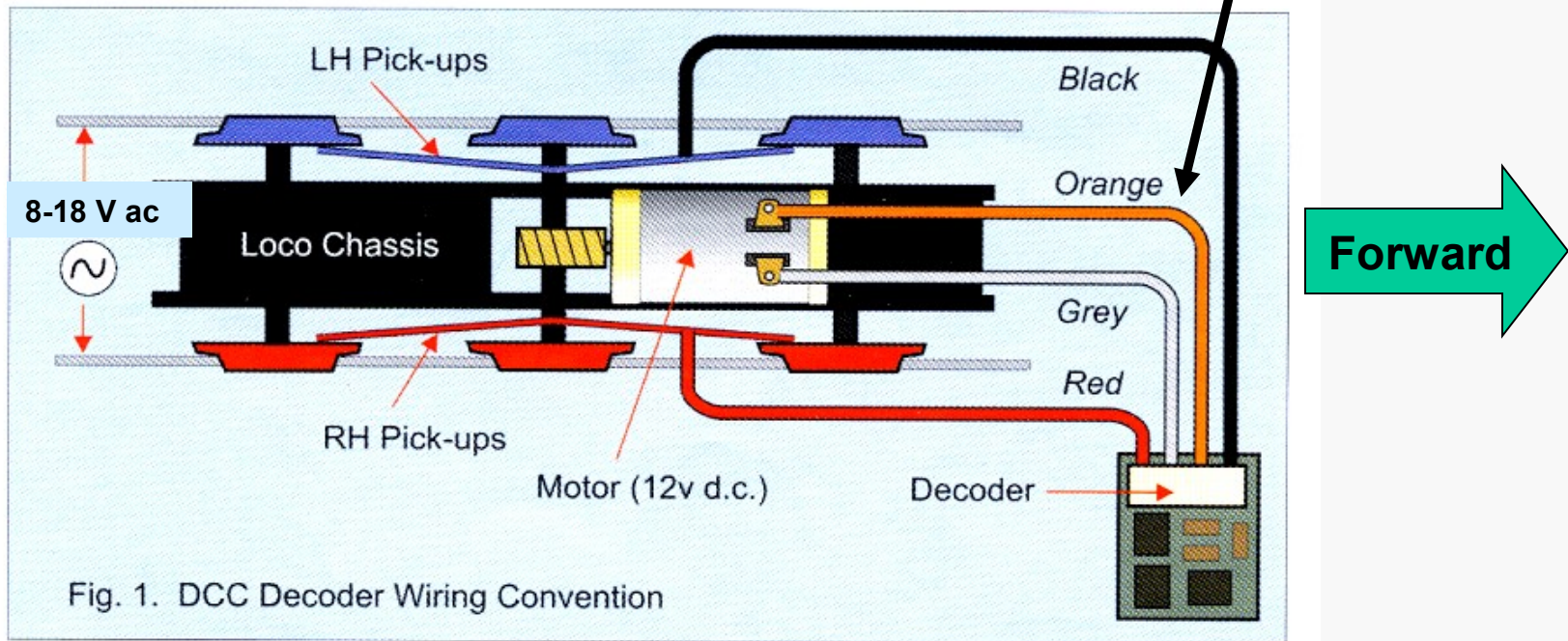
- DCC Theory (except if you ask or I can't resist)
- Full programming of decoders
- Competitive Equipment Comparisons
- Detailed use of decoder function outputs
 - lighting
 - sound
- Details of old brass steam outline conversions

DCC Decoder Installation Basics

DCC DECODER INSTALLATION

Red and Black = original connections
to motor.
may include: wired, clips, frame etc.
connections

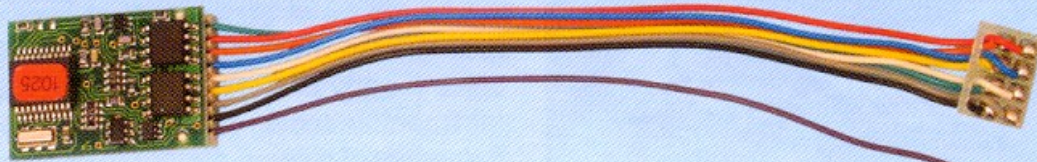
Orange and Gray May be
reversed to set desired
“forward” direction



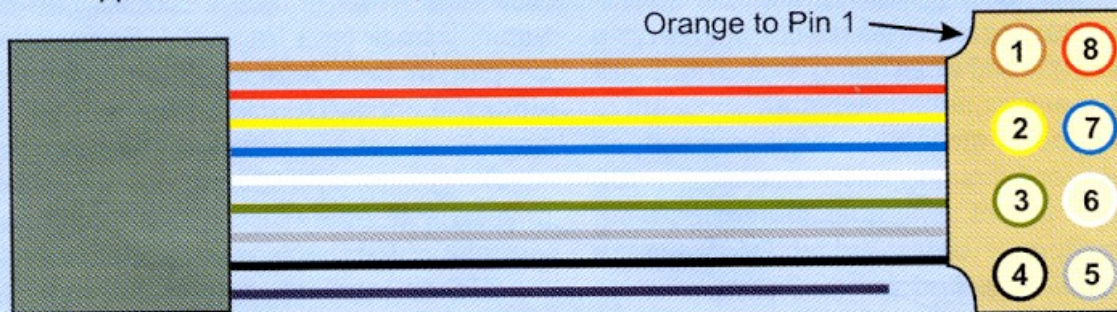
Decoder Installation Basics

DCC DECODER INSTALLATION

Fig. 2. Standard Decoder Wiring



Example shows a Lenz LE1025E Decoder fitted with NEM 652 8 pin plug
The wires are colour coded as follows, this is an international standard
and applies to all NMRA compatible locomotive decoders - with or without plugs

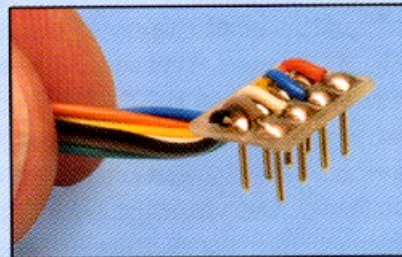


WIRE

Orange to motor terminal (brush) 1
Yellow to output function B
Green to output function C
Black to left rail pick-ups
Grey to motor terminal (brush) 2
White to output function A
Blue - function common
Red to right rail pick-up
Purple to function output D

PIN (if plug fitted)

Pin 1
Pin 2
Pin 3
Pin 4
Pin 5
Pin 6
Pin 7
Pin 8



(Refer to your decoder documentation for detailed information on the output functions)

plug is optional

When used for lights
(F0)

White = Forward
Yellow = Reverse
Blue = Common

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

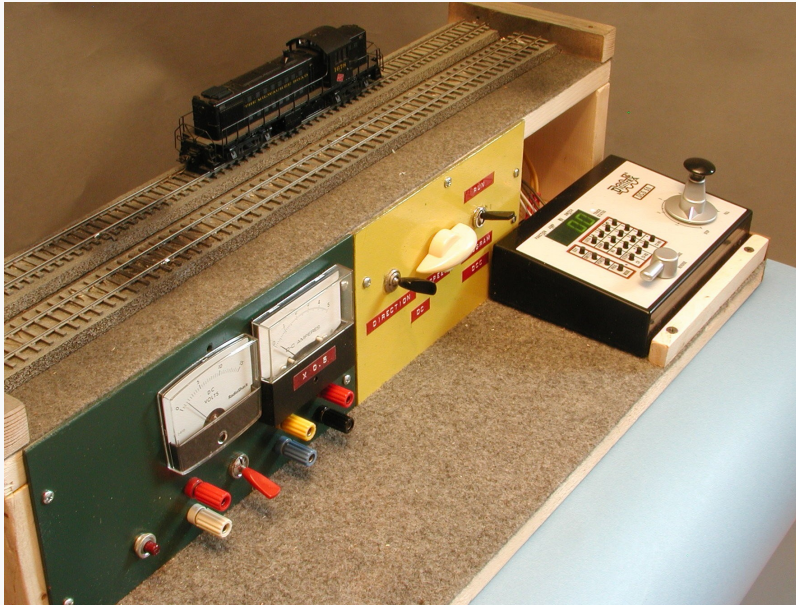
Locomotive Test Bench

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



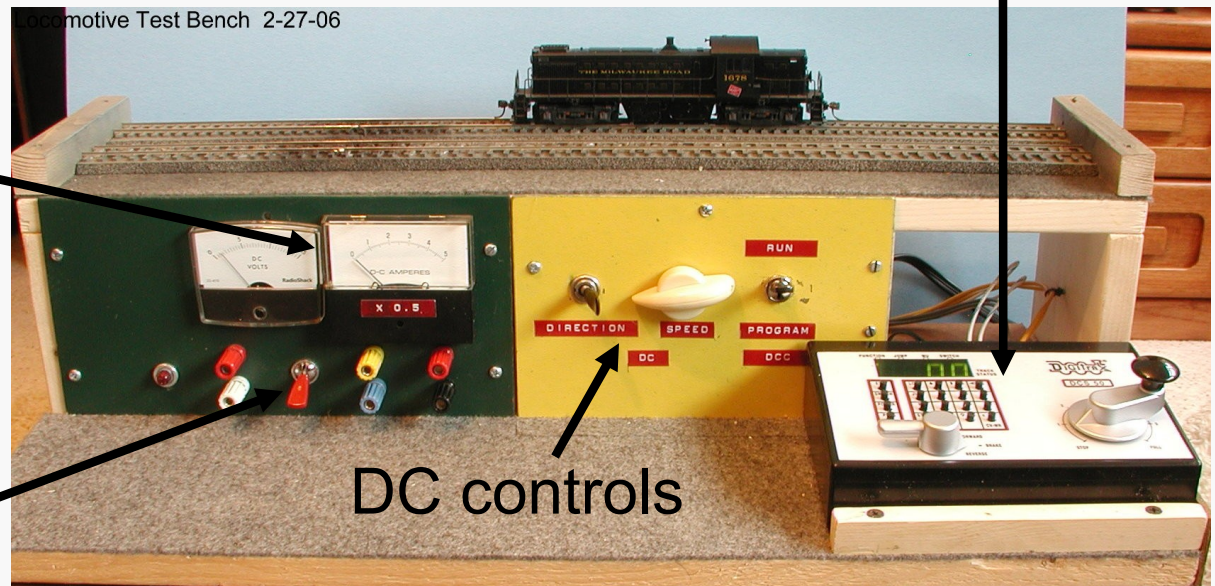
Locomotive test and
programming bench

DCC control and
programming

Meters: voltage and
current, DC or DCC

DC or DCC select

DC controls



DCC DECODER INSTALLATION



From: Yahoo Digitrax Group 2/17/05

More elaborate test bench, with wheel rollers

DCC Conversion Atlas/Kato RS-1

DCC DECODER INSTALLATION

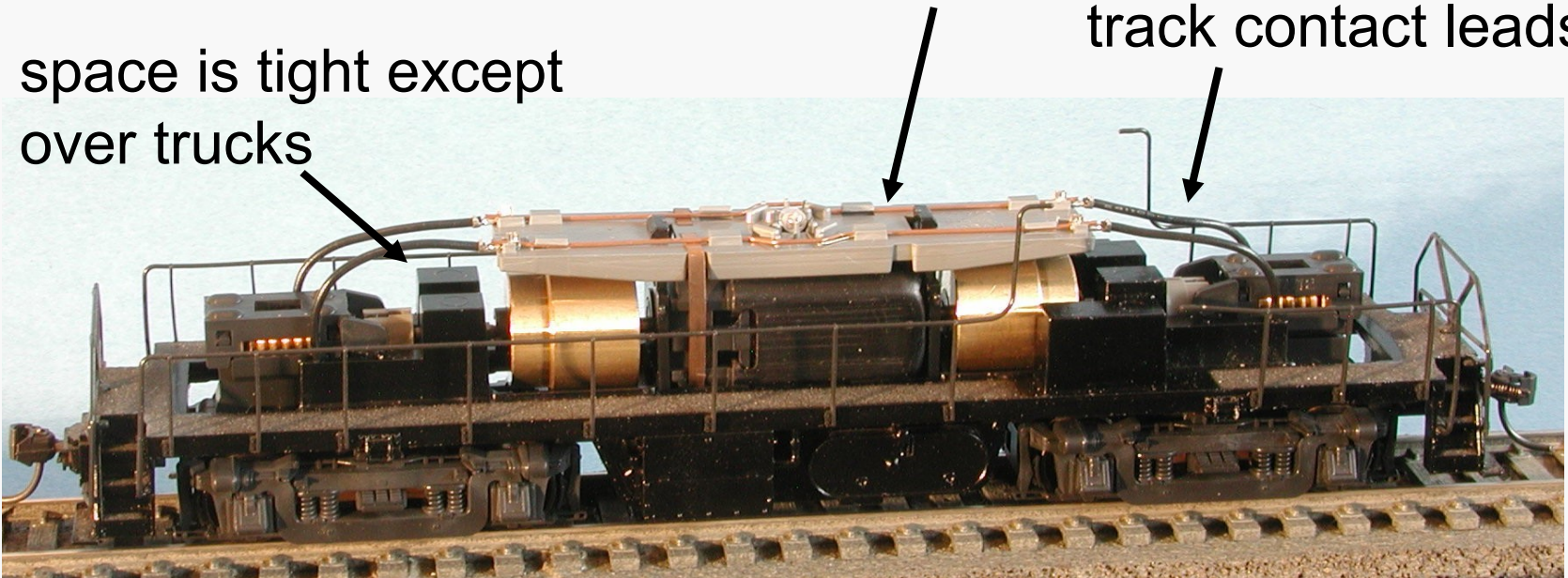


Atlas RS-1
factory condition

interconnect board

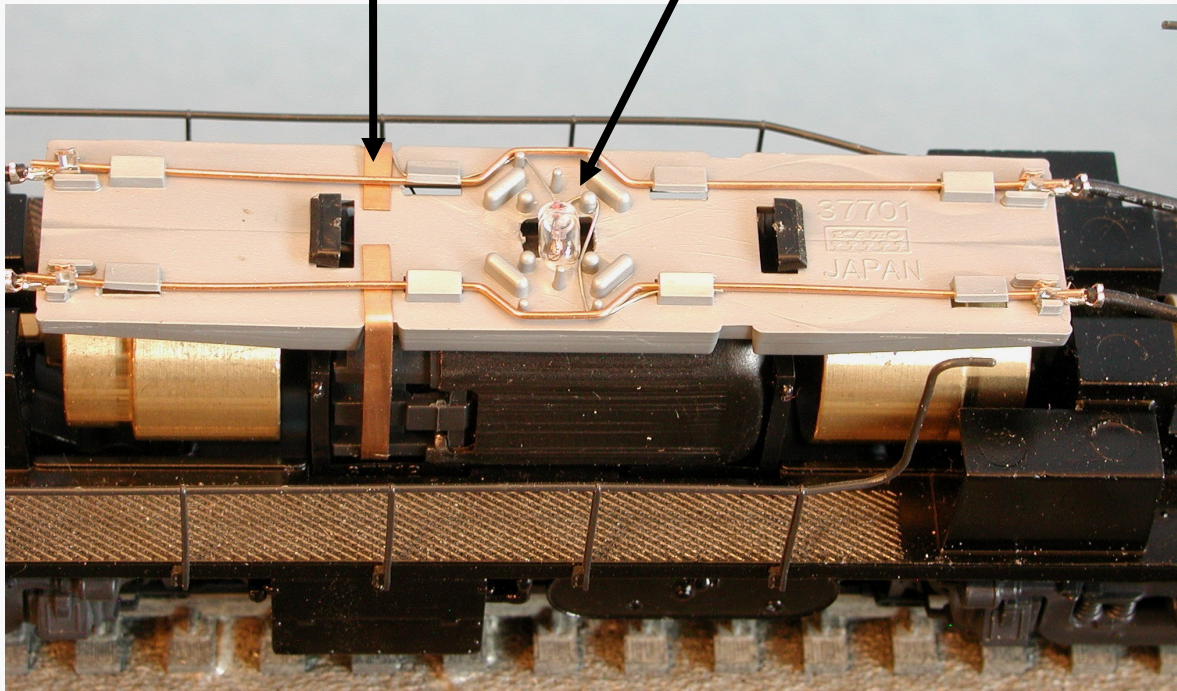
space is tight except
over trucks

track contact leads

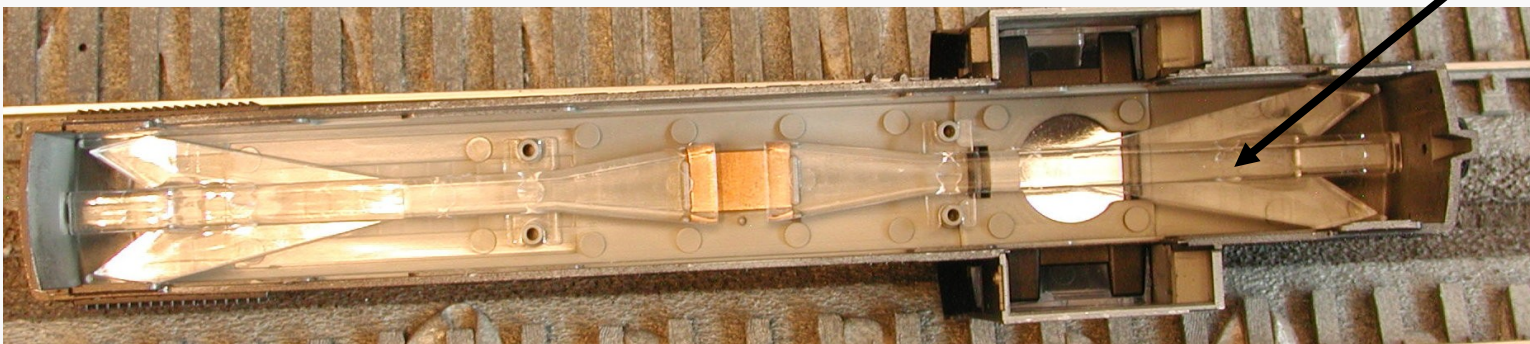


DCC DECODER INSTALLATION

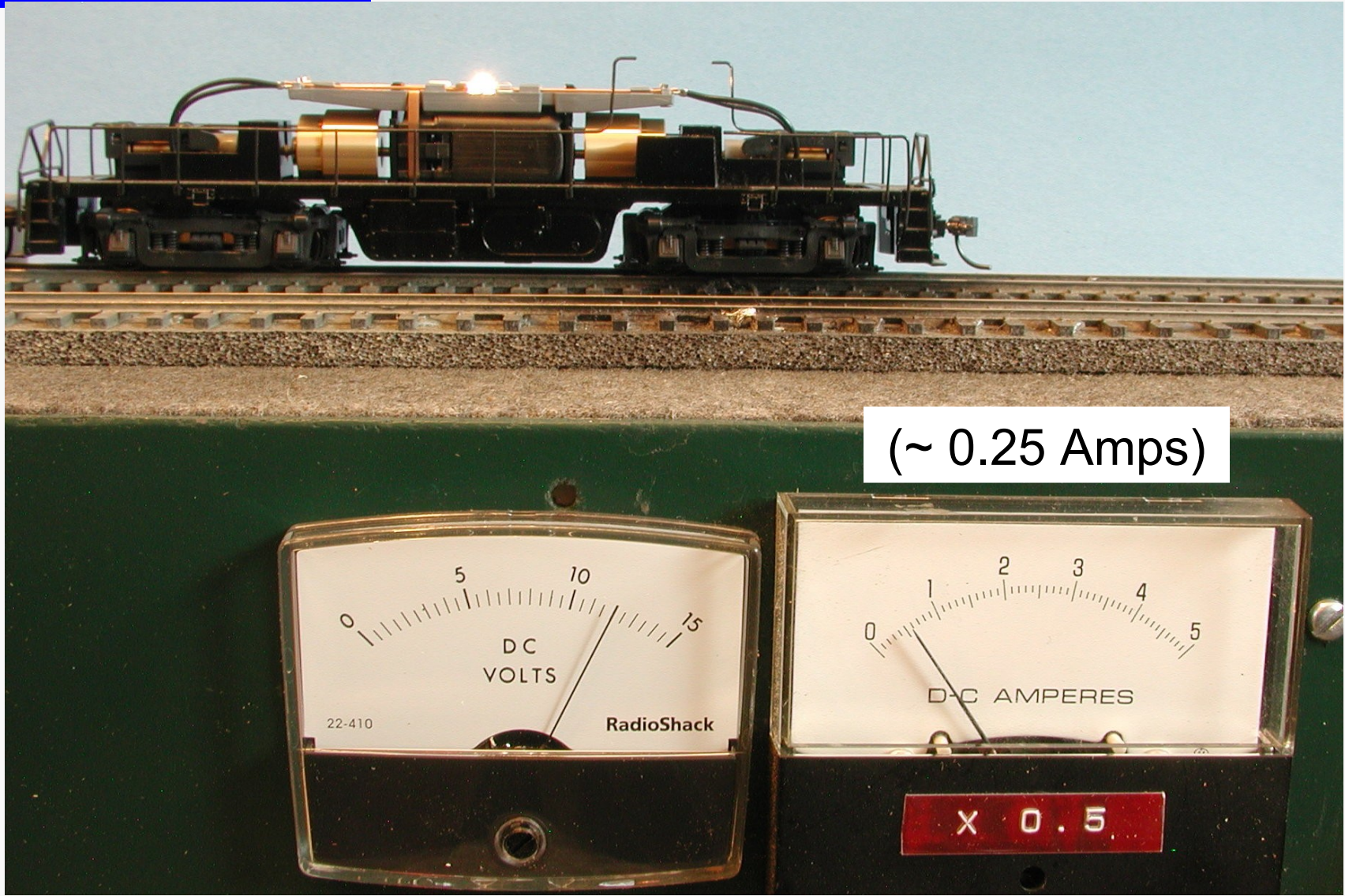
motor leads light



light
pipe

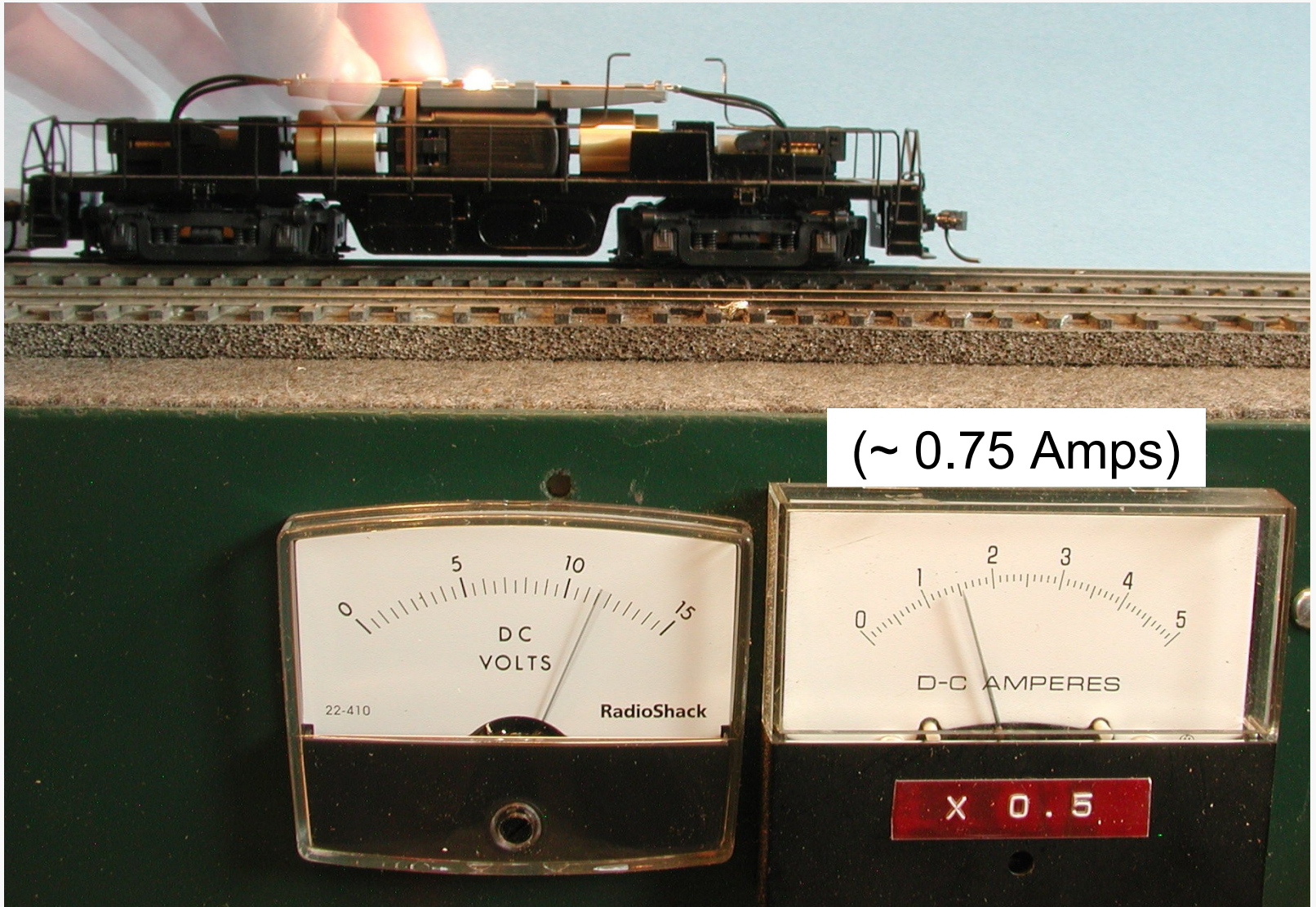


DCC DECODER INSTALLATION



Slipping Current Measurement

DCC DECODER INSTALLATION



Locked Rotor Current Measurement

DCC DECODER INSTALLATION

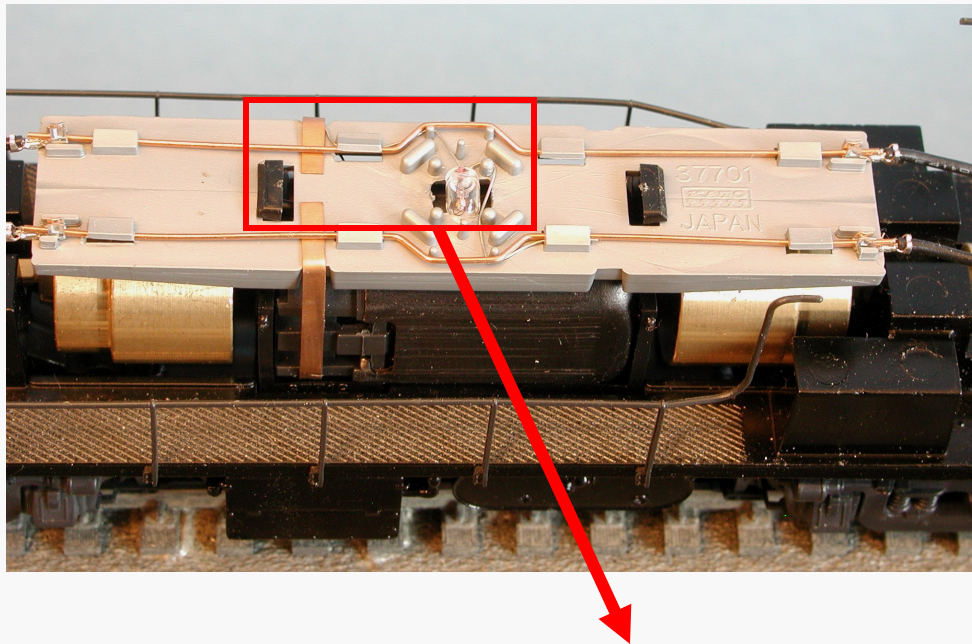
Decoder selection

Decoder selection								Current Amps.				Size										
HO	TTE	AtlasSW					X	1.3	2	2	X	X						X	A	\$29.95	\$23.75	
HO	TTE	AtlasSW					X	1.3	2	2	X	X						X	X	A	\$29.95	\$23.75
HO	TTE	TTE GP7 (LL GP9, GP30)		X	X		X	1.3	2	4	X		X		1.9"	.63"	.12"	X	X	A	\$29.95	\$23.75
HO	TTE	TTE RS2		X	X		X	1.3	2	4	X		X		1.9"	.65"	.12"	X	X	A	\$29.95	\$23.75
HO	TTE	SW9/12					X	1.3	2	3	X		X					X	X	A	\$29.95	\$23.75
Z	Digitrax	DZ123	X					1	2	2	X		X		0.57	0.38	0.13			A	\$15.95	\$15.50
Z	Digitrax	DZ123PS				X		1	2	2	X		X	X	0.57	0.38	0.13			A	\$19.50	\$18.50
Z	Digitrax	DZ143	X					1	1.5	4	X		X	X	.36"	.55"	.13"		X	A	\$34.95	\$27.95
Z	Digitrax	DZ143PS	X		X			1	1.5	4	X		X	X	.36"	.55"	.13"		X	A		
								run/peak				W L T										

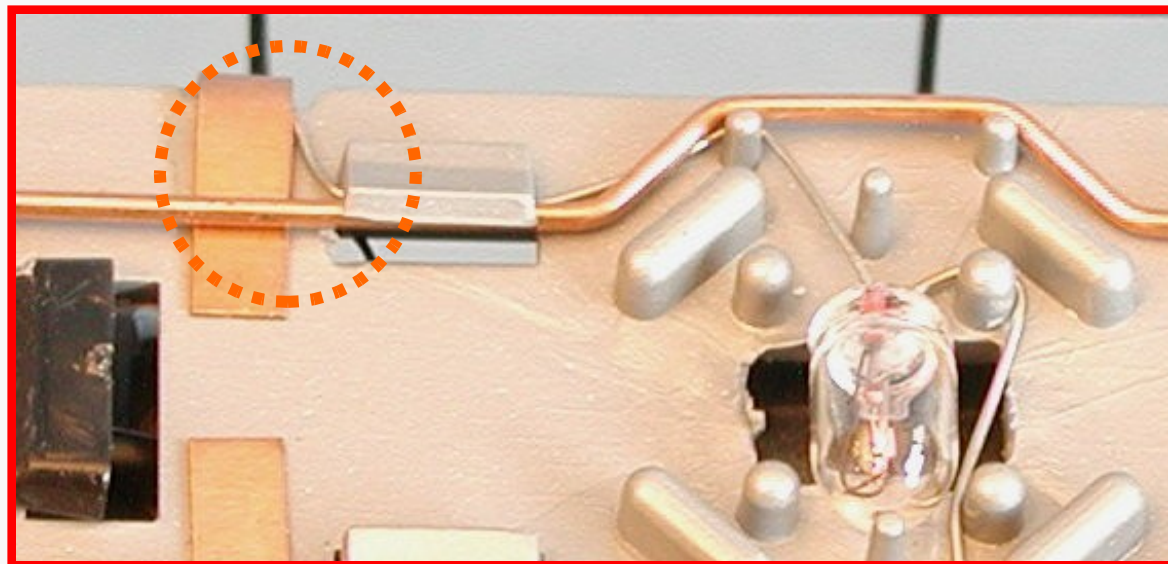
(Section of Tonys Train Exchange Matrix)

- Decoder current rating must exceed locked rotor current.
- After that it's a matter of size, features and cost.

DCC DECODER INSTALLATION

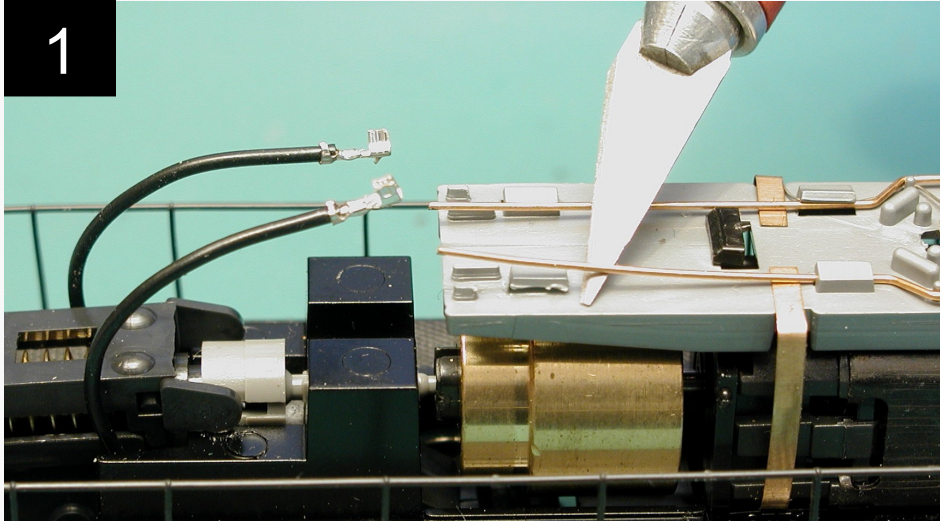


Look carefully
for “gotcha’s”



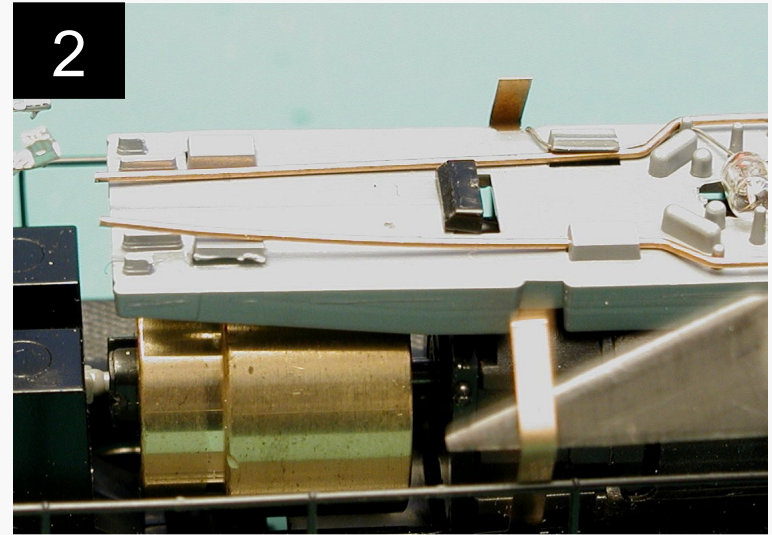
DCC DECODER INSTALLATION

1



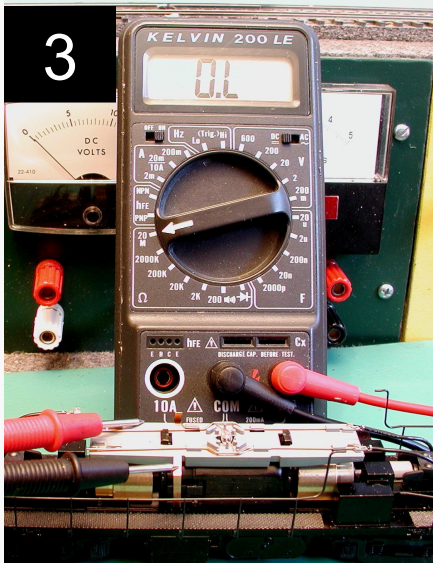
lifting truck connections and wire from board

2

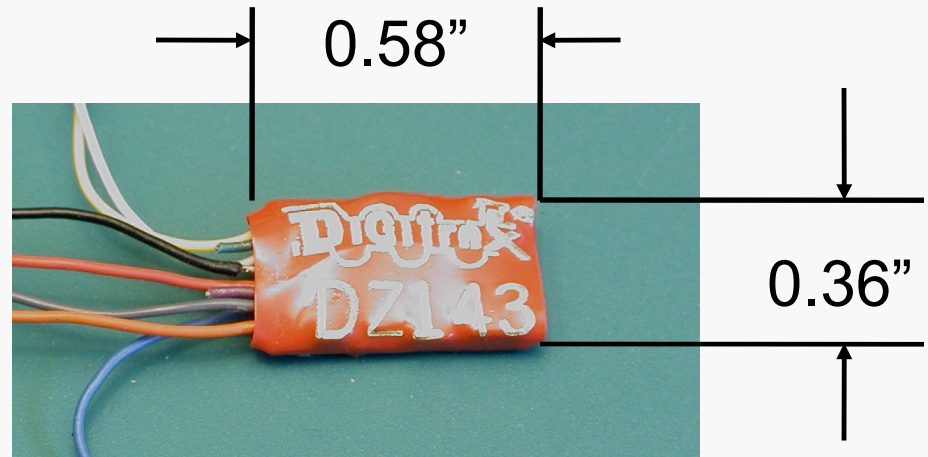


disconnect motor leads

3



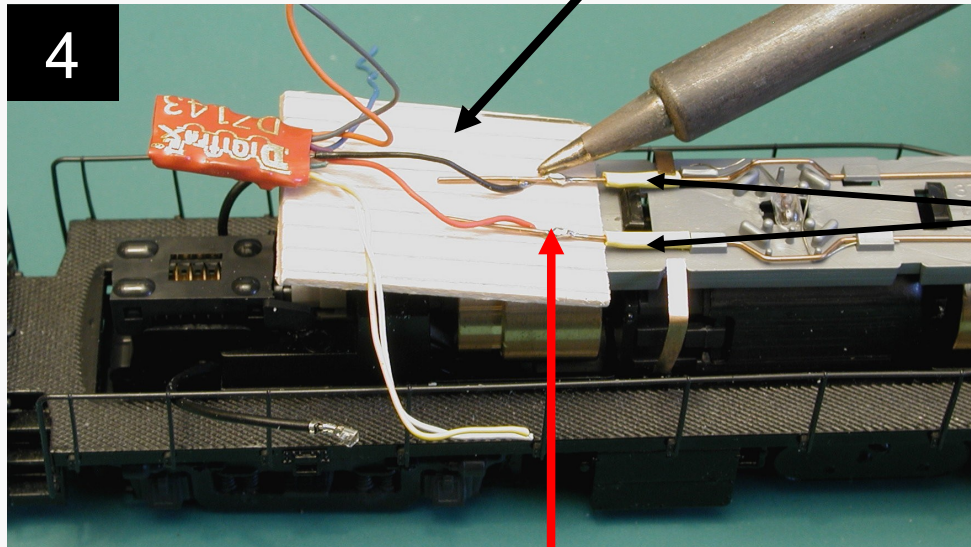
no contact to track leads!



Selected Decoder

DCC DECODER INSTALLATION

4



wood to protect plastic board from heat

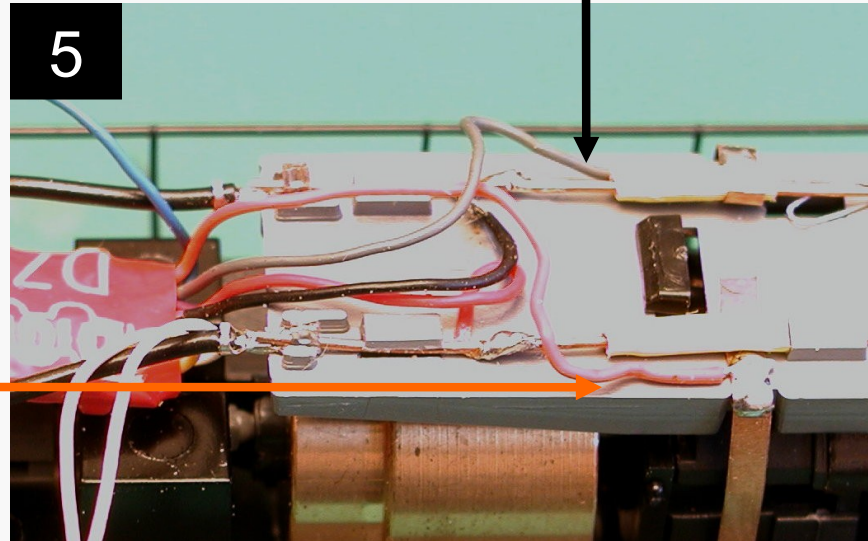
Heat shrink tubing
where motor leads fit

gray wire to other
motor lead

right hand = red

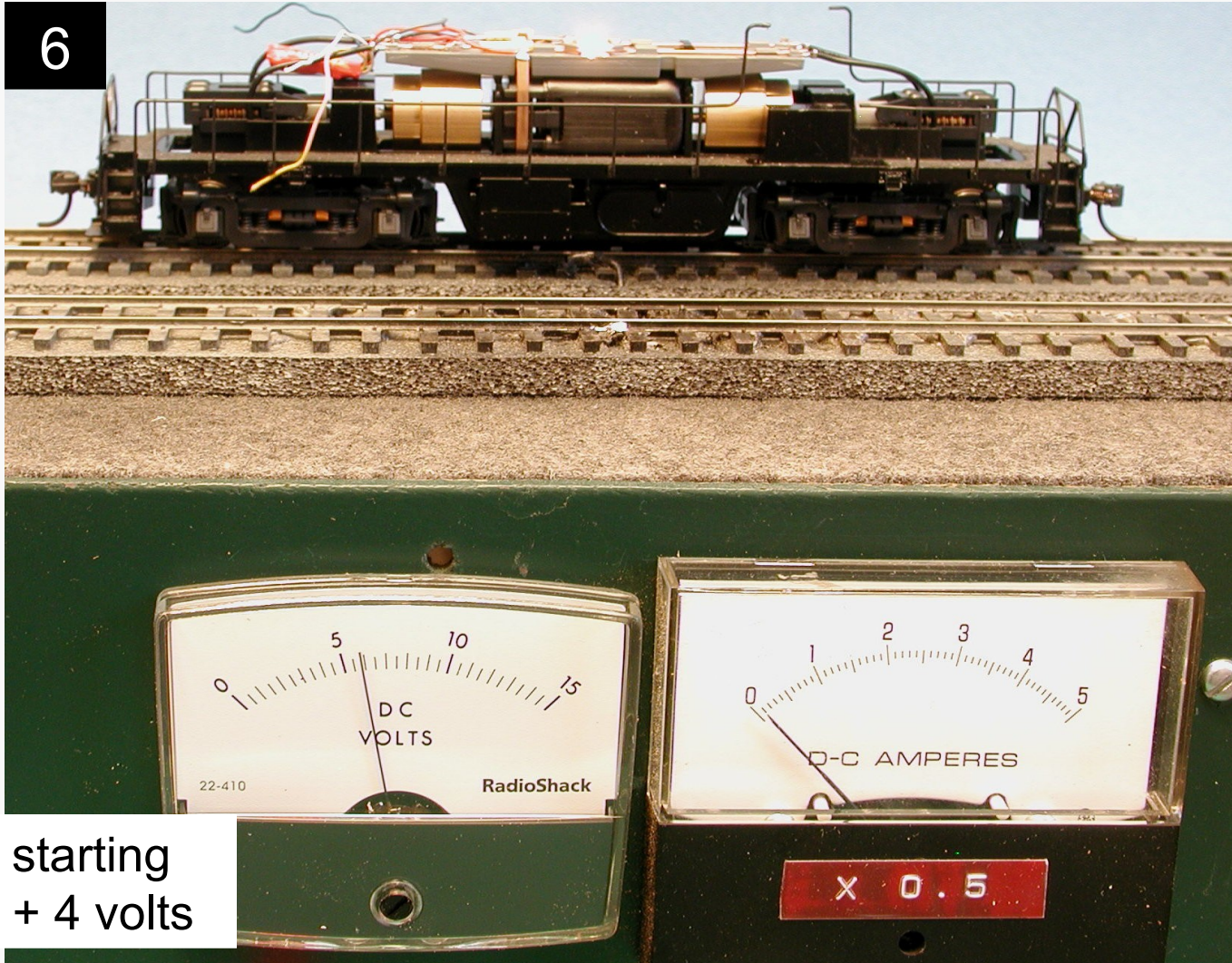
orange = motor lead
originally connected to
right hand wheels

5



DCC DECODER INSTALLATION

6

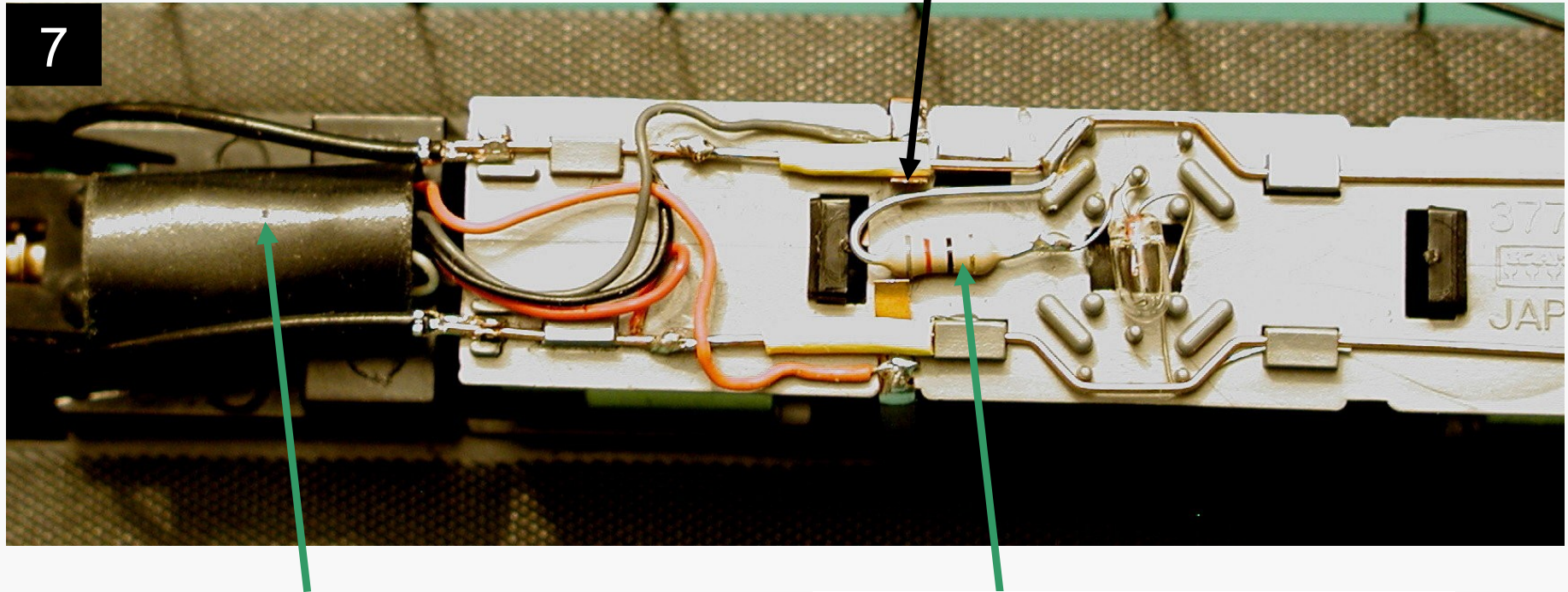


~ Original starting
voltage + 4 volts

DC Operation Test - Starting Voltage

careful - no stray contacts here!

7



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

DCC DECODER INSTALLATION

The Alternative for many popular Locomotives



Digitrax DH150K

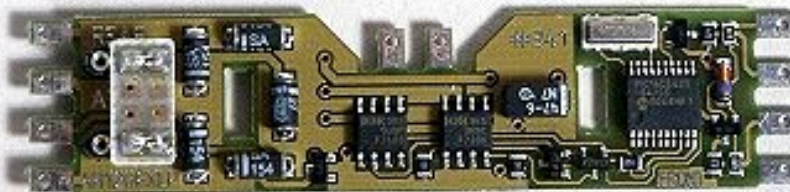


Digitrax DH150A

Atlas 340.



NCE DA-SR



Atlas 340.

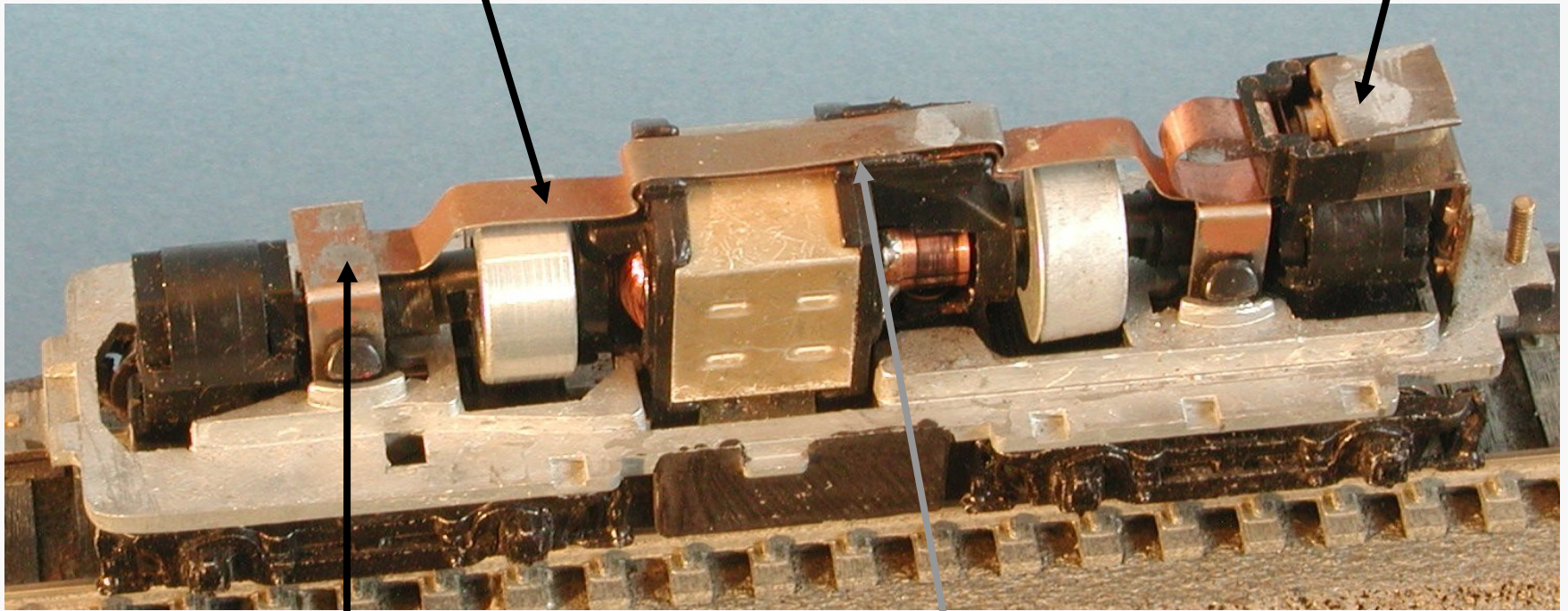
Drop in Replacements for Atlas/Kato RS-1 boards

Vintage Athearn Conversions

DCC DECODER INSTALLATION

top connection clip

light

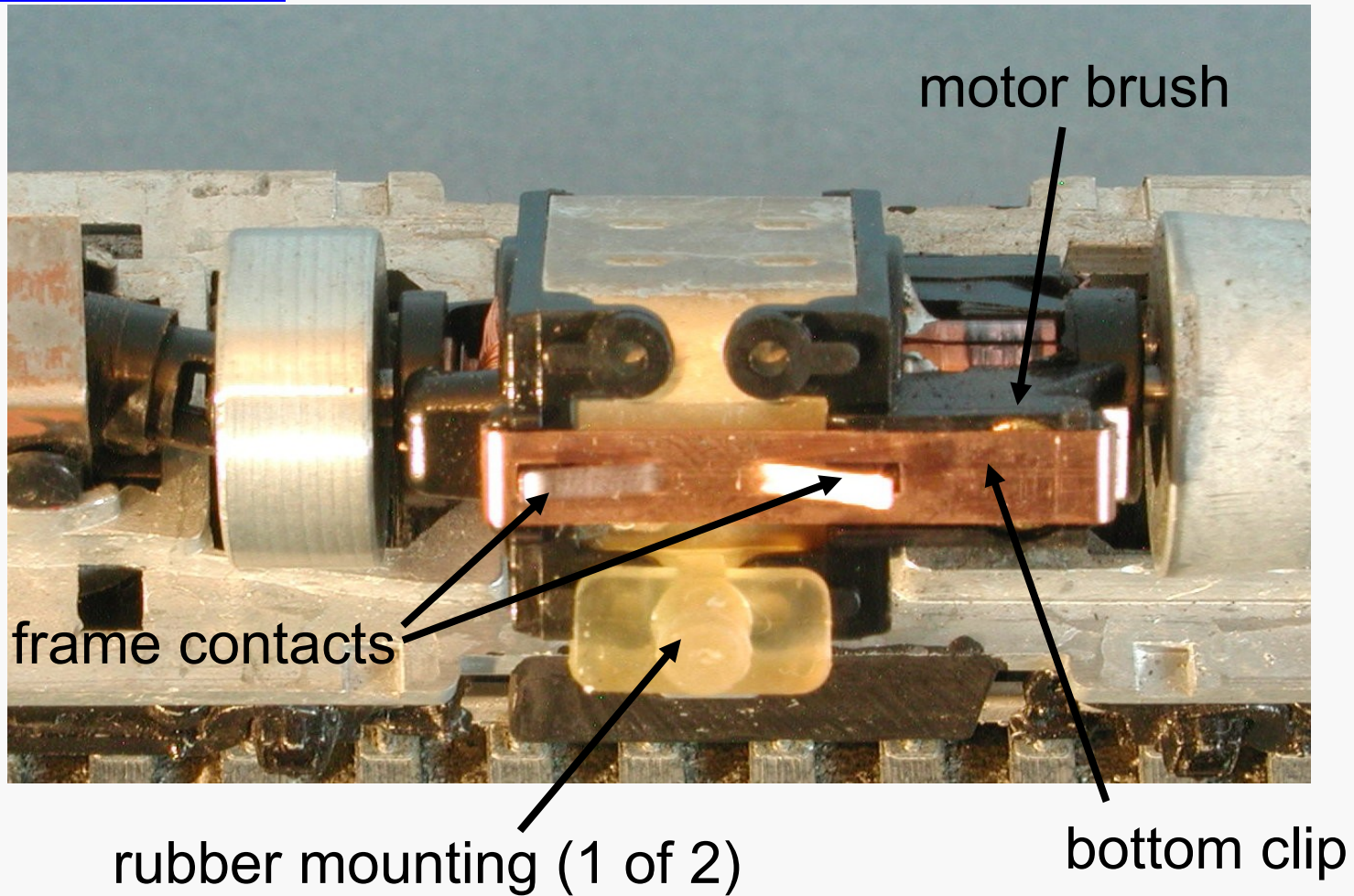


rubbing contacts

brush retention clip (underneath)

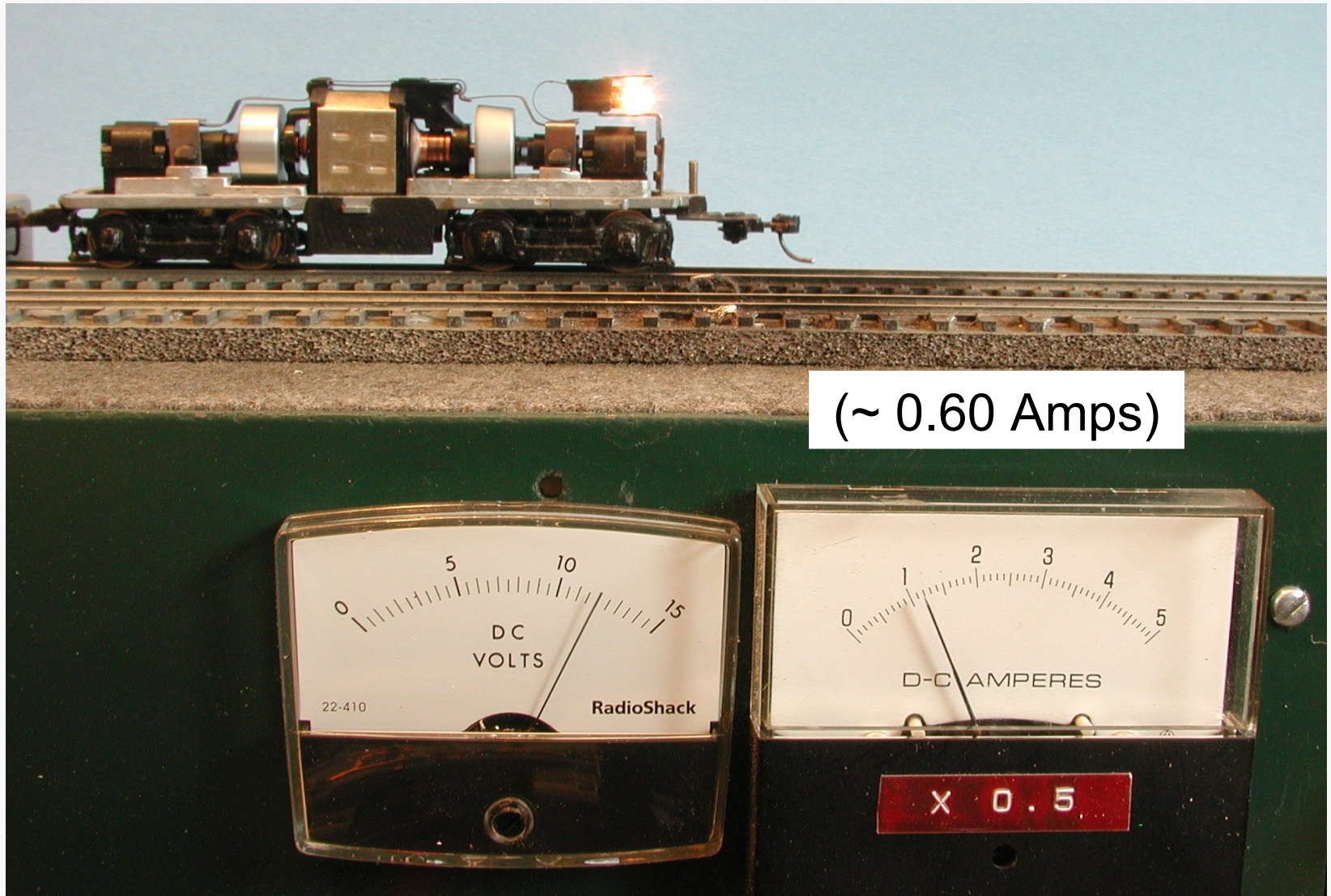
Vintage Athearn Construction

DCC DECODER INSTALLATION



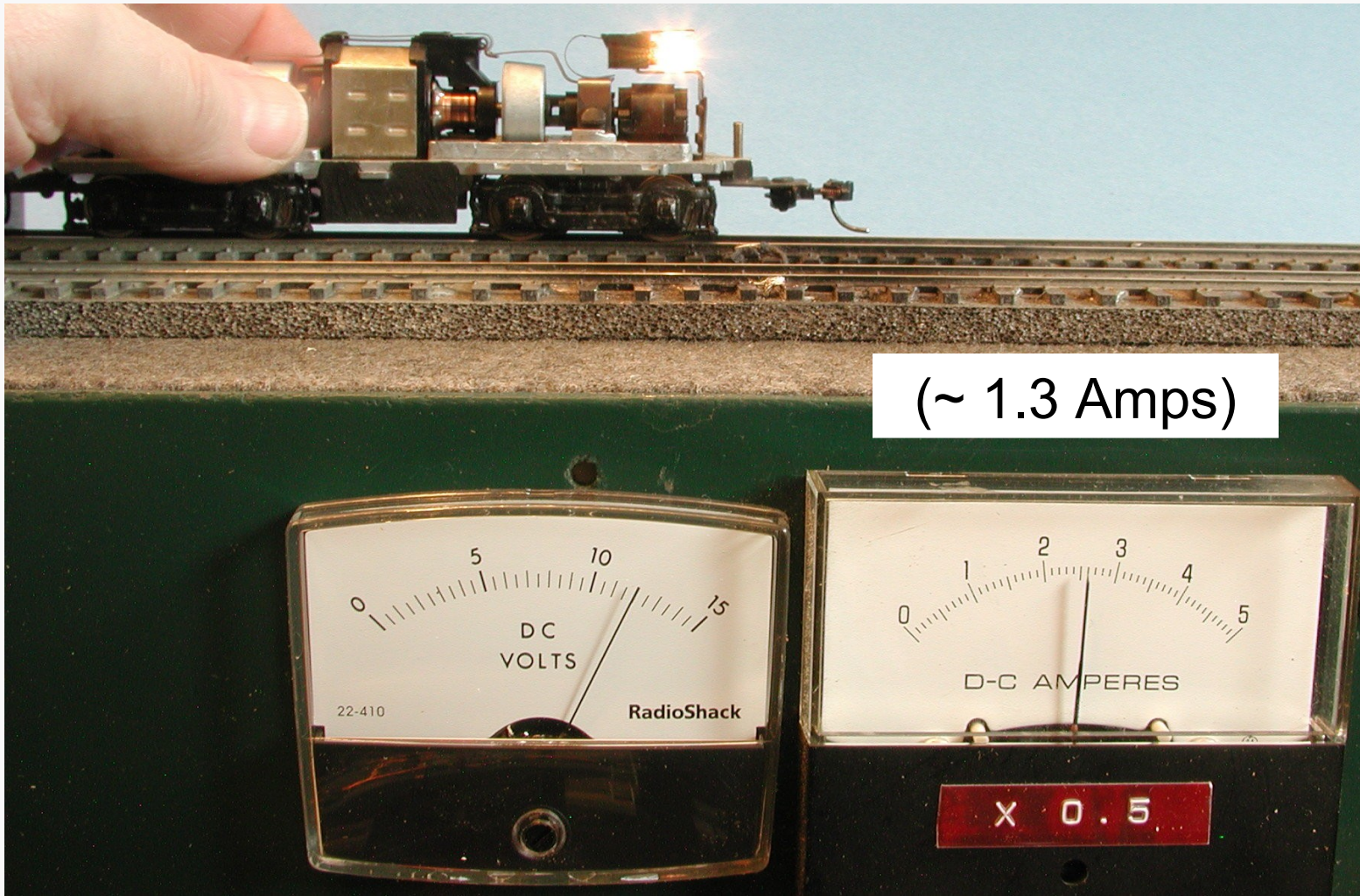
Vintage Athearn – lower motor contact to frame

DCC DECODER INSTALLATION



Slipping Current Measurement “Vintage” Athearn

DCC DECODER INSTALLATION



Locked Rotor Current – “Vintage” Athearn

DCC DECODER INSTALLATION

to decoder

from decoder

remove top clip

remove lamp

solder jumper

frame screw

from decoder

- 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

DCC DECODER INSTALLATION

DCC Corner

Mike Polsgrove



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 photos

The Lenz Gold JST-WH decoder includes a JST connector (a 9-pin in-line 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 flywheel, helping 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.

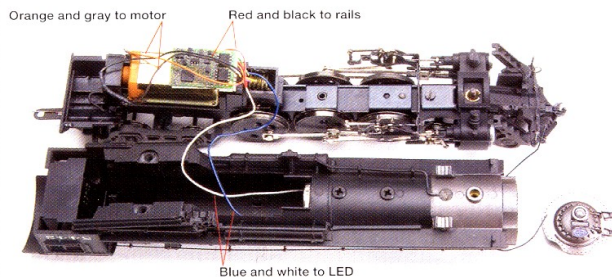


Fig. 1 Wiring. Mike wired the Hudson with a JST harness, allowing him to plug any JST-connector-equipped decoder into the locomotive.

Other Conversions:

Much information exists for many specific cases examples:

MR DCC corner

http://www.tcsdcc.com/decoderpics/Atlas%20RS1/Atlas_RS1.htm

<http://www.wiringfordcc.com/atlasrs1.htm>

<http://www.loystoys.com/Info/decoders-install.html>

http://www.tonystrains.com/technews/dn142_for_atlas.htm

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.

References

- “DCC Made Easy”; Lionel Strang; Kalmbach 2003
- “The Digitrax Big Book of DCC”; Zana Ireland ed; Digitrax, 1999
- “Digital Command Control”; Stan Ames, Rutger Friberg, Ed Loizeaux; Allt om Hobby, 1998
- Allan Gartner <http://www.wiringfordcc.com/>
- Decoders and Installations | Tony's Train Exchange
- NMRA Recommended Practice RP-9 Electrical
- Athearn Tune Up
http://www.mcor-nmra.org/Publications/Athearn_TuneUp.html

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.

