



# DCC Install Primer

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# Elements of DCC







## ■ Basic components

- Command station – “Brains”
- Booster – “Energy boost”
- Circuit breakers - Overload protection
- Auto Reversers
- Mobile Decoders – For locos and Rolling stock
- Stationary Decoders – For turnouts, turntables, and many other things

# Brands of DCC Systems - 1

-  Digitrax – #1 market share for DCC Systems, Decoders, and Accessories in the US
-  Lenz – Originator of DCC technology, and Marklin's first OEM vendor, market leader worldwide
-  NCE – Strong alternative for DCC systems, Decoders, and Accessories
-  ESU – Graphical Command station, Marklin's new OEM vendor, very strong competitor to Lenz worldwide. Started sound boards for model boats in 1995, locos in 1996

# Brands of DCC Systems II




-  Bachmann – EZ Command
-  MRC – Prodigy
-  Atlas – Commander
- Easy DCC –
-  Roco – LokMaus
-  Zimo
-  Train Control Systems? Coming






# Brands of Control Decoders

- Digitrax
- Train Control Systems
- NCE
- Lenz – OEM for Atlas and Bachmann, Old OEM for Marklin
- MRC
- ESU – New OEM for Marklin

# Brands of Sound decoders

-  Soundtraxx – DSX – only DCC  
Discontinued but still being sold
-  Dalee – DC or DCC
-  Digitrax – Sound Bug and Sound FX  
module – DC or DCC
- These are Sound Only Decoders

# Brands of Sound Control decoders 1

-  QSI – Quantum #1 OEM in US, #2 OEM Worldwide, growing after market product OEM for Broadway Limited HO scale, Proto2000, Lionel, many others
-  Soundtraxx – DSD, Tsunami, #1 after market, #3 OEM for Bachmann, Stewart, just recently Athearn
-  ESU – LokSound #2 in US, #1 Worldwide – first N Scale sound decoder, OEM -Precision Craft, Stewart, Hornby, Marklin, Fleischmann, Roco, Broadway Limited N scale



## Brands of Sound Control Decoders II

- MRC – OEM for Athearn, has extensive after market line of decoders
- Digitrax – OEM for KATO and Overland has after market line of sound decoders
- MTH DCS – Installed in MTH products, work with DCC (for the most part) only installed in their own branded products



# Which brand is better

- Typical Engineer answer
  - “It depends”
  - People have “religious” views on the subject
  - There is nothing wrong with “religious” views on the subject as long as **YOU** are happy
- Every brand has strengths and weaknesses.





# Ins and outs according to Vic

## Control decoders

- NCE – Low failure rate, and does not have the cost of some of their competitors, high number of product options, good warranty.
- ESU – US Assembled, German company, very low failure rate, lots of customized features such as lighting effects, good price options, good for matching up with LokSound Sound decoders, basic decoder type options  
Company has kept up with current features
- TCS – goof proof warranty from the beginning, very high functionality, extensive choice of product options for different installations, reasonable price. Company is an innovator in the mobile decoder space, very low failure rate.



# Ins and outs according to Vic Control decoders

- Digitrax –Improved stronger warranty, prefer 6 series products (eg DH165). Company innovates in the space. Number one market share for control decoders in the US. Feature rich decoders with high number of decoder product options
- Lenz – Very high market share Worldwide, have some unique offerings such as a 4 Amp HO decoder, and their Railcom system allows for a well rounded signaling system such as automagically stopping the locomotive at a red signal. Most current decoders have lighting effects, Number one market share worldwide for control decoders. Innovators for mobile decoders. Respectable number of decoders



# Ins and outs according to Vic Control decoders

- MRC – Improving product line, long time player
- Bachmann & Hornby – economy version of Lenz decoder
- Atlas – Good decoder, not available as a standalone anymore. Quality Lenz product, Extremely low failure rate but you have to set DC or DCC mode with a physical switch, where the competition is doing this automagically

# Ins and outs of Sound Control

## Decoders according to V

- QSI / QSI Revolution – Good control decoder, more difficult to program without a programming aid which is highly recommended, good overall sound with good volume control, lighting effects, decoders can be reprogrammed for different sound schedules with some slight limitations, easy ability to upgrade software, 8 and 16 ohm system means speakers are very easy to get. Support from the factory is good. Innovator in the space



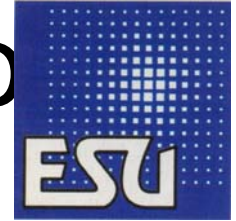
# Ins and outs of Sound Control decoders according to Vi



- Soundtraxx – Good sound, very straight-forward programming, loud with granular control of volume, lighting effects, no sound schedule re-programming options currently, 8 ohm system means speakers are very easy to get. Tsunami Micro has all of the features of the larger brethren however there is a slight uplift in cost. Support from the factory is superior in the industry.



# Ins and outs of Sound Control decoders according to Vic



- LokSound (ESU) – Excellent control decoder with full features, straight forward programming made easier with a programming aid that allows complete reprogramming of the decoder down to an individual sound in a sound schedule with virtually no limitations. Many companies offer after-market sound schedules not offered by ESU. Speakers are 100 ohm which means only options are from ESU. Very low failure rate, #1 OEM outside Worldwide. N scale sound decoders (LokSound Micros) have all of the features/functionality of their larger brethren at same price as regular LokSound. Best support of the product is from an experienced Dealer due to the number of features the products have.



# Ins and outs of Sound Control decoders according to Vic

- MRC –OEM for Athearn, Steam MRC sound schedules are slightly better than the Diesel sound schedules. Loudness is not a problem, but sound volume control is limited to four steps, Very Loud, Really loud, Loud, and somewhat quiet.





# Ins and outs of Sound Control decoders according to Vic

- Digitrax – Fully programmable sound decoder, Good control decoder, best results if you have a solid installation process, Good volume and low cost, easy to program via PR2 programmer. Excellent value and support from the factory is good





# Ins and outs of Sound Control decoders according to Vic

- Typically the Factory installed sound is the best result if you don't already own the locomotive
- Decoder pro works with just about all of them for graphical programming
- If you already own the locomotive it is typically cheaper to add an aftermarket decoder than to buy a whole new locomotive.
- Make sure there is plenty of room for the speakers for after market installations



# Installing a decoder

- The same basic principles apply to installing a decoder whether it is sound or not
- Electrical 101 – from four to twelve+ wires to hook up depending on the install
- Tackle one pre planned task at a time is the formula for best success
- If the equipment runs like garbage in DC, it will surely run like garbage in DCC
- Have the right tools
- Make sure you test your equipment to make sure it meets specs for DCC



# Recommended tools you need to install an after-market decoder

- Same tools for disassembling a locomotive – screwdriver, large mallet, etc.
- Soldering iron and Solder recommended for most internal connections
- If you feel you are going to have to go back and change something later or for joining Steam loco to tender or power unit to dummy you can use clips or connectors
- Heat shrink tube
- Wire
- A DC test system
- A way to measure the Motor draw on a DC test system
- A DCC system
- A decoder tester



# Equipment design considerations

## ■ Electrical issues

- Split or both side pickups – Split side means interruptions at turnouts likely
- Electrically Isolated motor from the rest of the locomotive is a must
- The more straight forward the electrical pickup, the better the operations, however picking up one side from the frame can be ok



# Equipment design considerations

- What is the draw of the current motor? Is it too high?
  - Measured at worst case – Stall current or what does the motor draw when its motion is seized at full voltage
  - Open frame and Hamo motors should likely be replaced with more efficient can motors
  - Is there a lot of metal in the electrical pickup design? IE picking up from the frame This will reduce the effective current to the system
  - Don't use a non-Hamo decoder with a Hamo type motor – the locomotive does funny tricks for a short period of time if you do this
- Know the capabilities of the decoder you are installing for best results



# Equipment design considerations

- Make sure there is plenty of space, if not you will have to make space and this might require courage (but don't use liquid courage)
- Sound installs – plan where the speaker is going to be ahead of time (Did I say that once already), the better it can “breathe” the better you will hear the sounds. Make space for a proper baffle. A big speaker in a tender can sometime have good results without baffling the speaker
- Plan the install ahead (Did I say that twice already)
- Lighting – LEDs last longer, so if possible use them to avoid replacing lights but make sure the color is right for the period of the locomotive  
Incandescent era lights are off white (but not yellow), modern diesel lights are bright white (except for the new number boards). Make sure you have the proper resistors for the lights/LEDs that you are using



# Choose your decoder

- How many functions do you need?
  - Lights
  - Mars lights
  - Firebox flicker
  - Gyrolights
  - SP GP-40X as an example – lights, lights and more lights.

Also look at size, motor control capability, Sound options, other features to support your model's prototype

Some companies offer specific decoders for specific brands or even specific models ie TCS, Digitrax, NCE, QSI, Soundtraxx





# Choose your lights

- LED – longer lasting, newer white LEDs have prototypical whiteness, versus the early “Blues”
  - Newer white LEDs are 3 volt – I use 450-600 Ohm resistor
  - Colored LEDs are 1.5 volt usually – I use 550 – 1000 ohm resistor
- Grain of rice (GOR) bulbs – used due to size of simulating individual lamps on Diesel locos, my best results have been with 820 Ohm resistors, some use 1000 ohm
- Bulbs included with the loco – make sure you know what voltage they are so you can buy the appropriate resistor
  - Some P2K kits come with the resistor for the standards lights – Soundtraxx
  - Replace bulbs that generate excessive heat with lower voltage bulbs

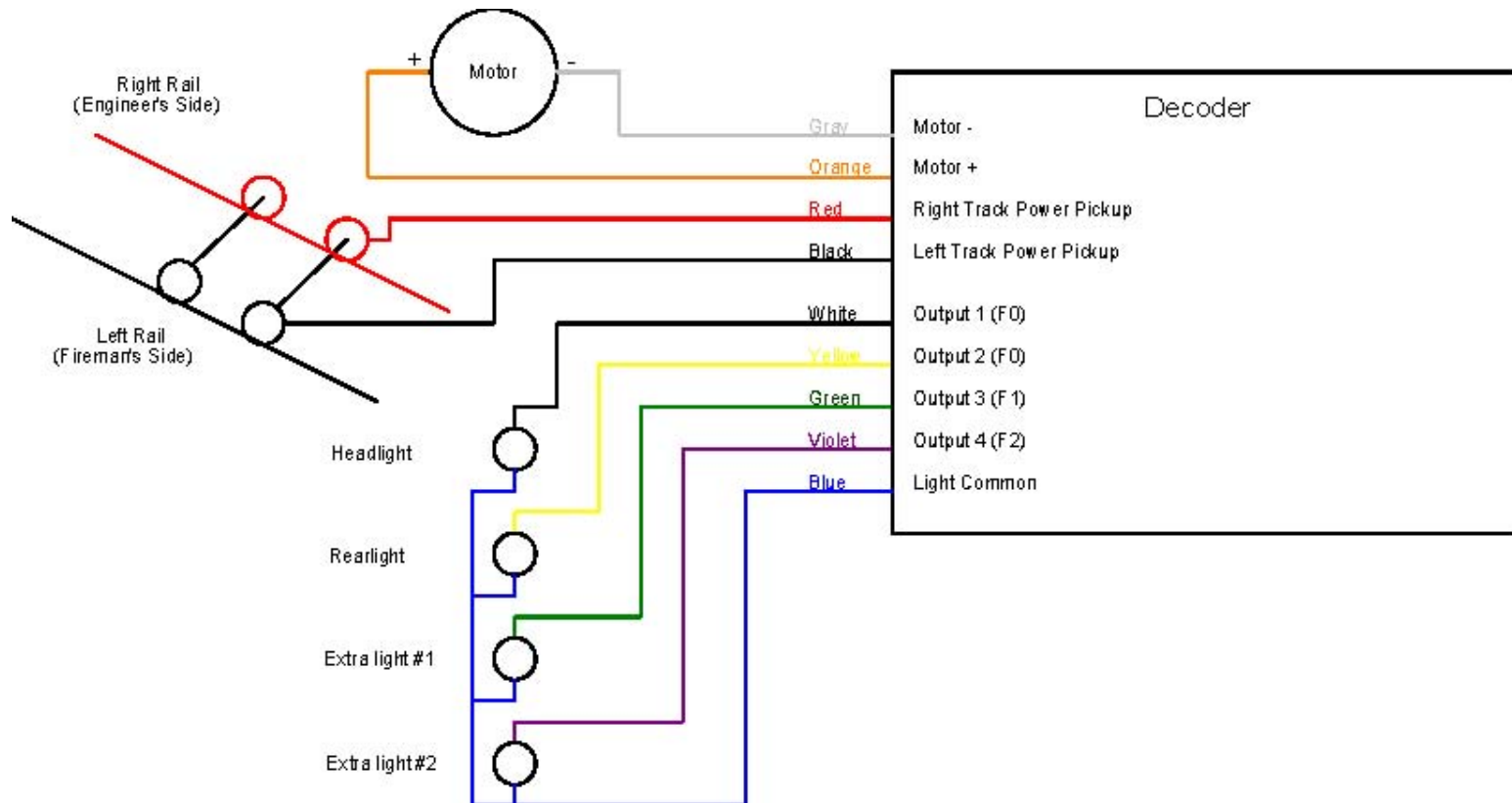


# Commencing the install

- Wire Color codes – newer locomotives sometimes follow the color standard, older ones likely don't
  - Red – Right track pickup
  - Black – Left track pickup
  - Orange – Motor +
  - Gray – Motor –
  - Blue Light/Function +
  - White – Headlight or F0 -
  - Yellow – Headlight or FR –
  - Green – Function 1 –
  - Purple – Function 2 –
  - Brown – Function 3 –
  - Pink – Function 4-

Read the decoder instructions to see if there are variations – ie Soundtraxx speaker leads are typically also purple, LokSound uses brown

# Wiring diagram





# Commencing the install

- One wire at a time and double check what you are wiring up to what
- Make sure your connections are solid
- Make sure your wires and decoder don't touch an arcing source such as the metal frame
- Use connectors where it makes sense – Steam Locomotives
- Leave plenty of wire if you have to disassemble so wires don't get pulled out or break
- However don't use so much wire that it gets stuck in Gears, Drive shafts, etc.



# Commencing the install

- Heat shrink is your friend
  - Can be used inline or as a edge wrap around.
  - Wrap around means easier to go back and redo something if necessary
  - Use inline for any needed wire extension splices or anything that is meant to be permanent



# Solder – basic procedures

- Using a lower heat iron can avoid “smoking” the wire
- Make sure that you apply enough heat to the surface to be soldered to make sure the solder binds.



# Commencing the sound install

## ■ Speakers and baffles

- Right size speaker for the project
- Requires planning for room of the speaker and the baffle
- The bigger the speaker the bigger the baffle needs to be
- Large speakers can sometimes use the tender as the baffle to avoid building one
- Bigger speakers tend to have a better range of sound and tend to have a fuller sound to them - but you have to have the room
- Newer locomotives many times already have the speaker logistic mapped out for you – Which is nice
- Sometimes you can do a two speaker installation, ie PCM, Broadway, Atlas and Athearn projects



# The Lab portion of this course

- At erailhobbies – call ahead for a Saturday afternoon training session 918-382-0382
- Bring your locomotive – if the loco needs extensive work it may require multiple visits ie remotor, adding electrical pickups





Questions?