



American Hobby Helpful Hints



Installing Dual Decoders

by Don Fiehmman

Why Two Decoders

Today decoders have included many impressive new features along with improved performance. Some decoders are better at Back-EMF and others have sound only with no motor control, like the SoundTraxx DSX series. We want to get the best for our locomotives and this leaves us with a problem of which decoder to install. One way to get the best performance is to combine the best features of two decoders into one engine. If the engine is too small to install sound, you may put the sound decoder into a car that follows behind the engine. Another reason for dual decoders is to have one decoder for motor control and the other for added lighting functions. One place where two decoders can be used is with an A and B unit that both have their own decoders and are permanently consisted.

The NMRA DCC standards state that if a decoder CV addresses and the decoder does not use that specific CV, the decoder should not respond. This lets you modify a CV that is used by one decoder and not the other decoder. This may work most of the time, but there is always the chance that both decoders do use the same CV number and you end up changing both decoders. One you want to change one and the other you may **not** want to change. You can make changes to both decoders at the same time on things like CV-3 and CV-4 for acceleration and deceleration. These can be changed with OPS mode programming.

Installing two decoders is not a hard project. You can have the two decoders use separate addresses. This allows you to separately control and modify either of the decoders. This also means to operate the features you need to switch addresses. You also have to remember the dual addresses. A better way is to control both decoders by setting them to the same address. Then the locomotive uses a single address to activate the functions of either decoder. But there is a problem when setting CVs in one of the decoders and not affecting the other decoders.

Setting Up Two Decoders

There are some problems when setting up two decoders at the same time with the same address. If you use the program track for two decoders, they can overload the command station's limited power to the program track. This will cause either a "CAN'T READ CV" or can even detect the two decoders as a short circuit. Another problem comes up when you are setting values in the CVs. There are ways to do setups or make changes to the CVs in a decoder "A" without affecting decoder "B" or "B" with affecting "A." There is more than one way to control which decoder's CVs you wish to modify.

Lock Feature

There is a proposal by Digitrax to the NMRA DCC Working Group to be able to control which decoder to modify while the other decoder is locked. The lock uses a pair of CVs in each decoder. This is only a proposal and the only decoders I know of that have this feature is the Digitrax DH163 series and the new SoundTraxx Tsunami. This feature requires both decoders have the Lock feature to work.

Lock Substitute Scheme

There was a hint on the internet on setting up two decoders that was very clever. This scheme works a little like the lock feature, but without the special lock feature. It used a combination of 2 digit and 4 digit addressing. Two digit addresses are setup separately before the decoders are installed. When CV-29 is set for 4 digit addressing, both decoders respond. When CV-29 is set for 2 digit addressing, each decoder can be addressed separately using the 2 digit address with OPS mode programming. Here is how the decoders are setup. I tested this using an NCE decoder and a SoundTraxx DSX decoder. **One advantage of this scheme is you don't have to remove the body shell to make changes to CVs.**



Goose with a Zemo decoder in the cab and a SoundTraxx DSX in the trailer.

Address	Decoder A(Motor)	Decoder B(Sound)
2 Digit	CV-1 = 1	CV-1 = 2
4 Digit	CV-17/18 =1234	CV-17/18 = 1234

(The address's used are just samples.)

Setting up CV 29.

Bit 5 (Value 32) in CV29 controls the 2/4 digit addressing, *on* for 4 digit and *off* for 2 digit. Most also use the 28 speed step option, bit 1 (Value 2) if you add the two together the total is **34** for 4 digit, and **2** for 2 digit addressing. (Other bits can be added to CV-29 for other features. See the chart below.)

Setting up the Dual Decoders

These steps work best using a decoder tester like the NCE decoder tester.

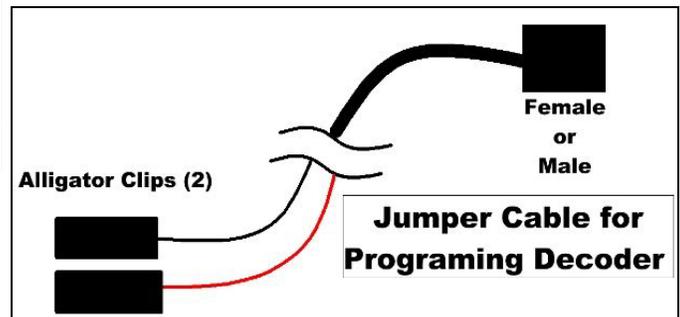
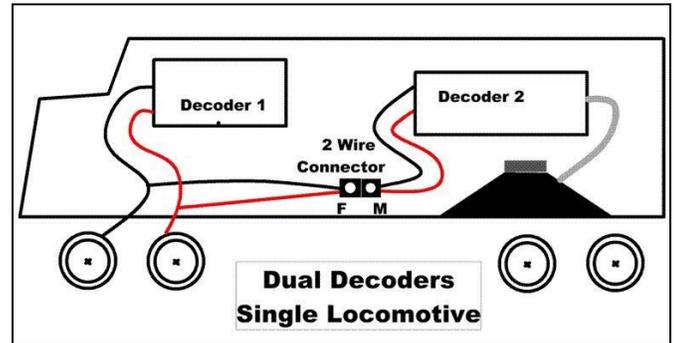
- (1) Setup the two decoders separately on the program track. Use address "1" for the motor control decoder and "2" for the second decoder. Avoid using "3" as this is the default value.
- (2) Setup the same 4 digit address for both decoders.
- (3) Customize other CVs as needed.
- (4) Install the decoders.

Changing CVs

To change one of the decoders, with OPS mode use the 4 digit address to program the value in CV-29 to "2". Use the 2 digit address of 1 or 2, to program the CVs in each of the separate decoders. To return to 4 digit addressing you need to return the value in CV-29 of **both** decoders using OPS mode and the separate two digit addresses (1 and 2).

CV-29 Bit functions Chart (Not all decoders have all of these features.)

Bit	Value	Function the bit control's
0	1	Normal Direction of Travel (NDOT) ON for reverse
1	2	OFF for 14 speed steps, ON for 28 Speed Steps
2	4	OFF will not run on dc power, ON to run on dc power,
3	8	ON for advance acknowledgment
4	16	OFF for standard speed table, ON for alternate table
5	32	OFF for 2 digit address, ON for 4 digit address.



Separate Wiring Method

Two decoders can be separately programmed before installation and then wired together. The problem with this method is once they are wired and installed changes may be needed. How do you make a change in one without the possibility of also making changes to the other decoder? Connectors can be installed to make it easy to electrically separate the two decoders for safe programming.

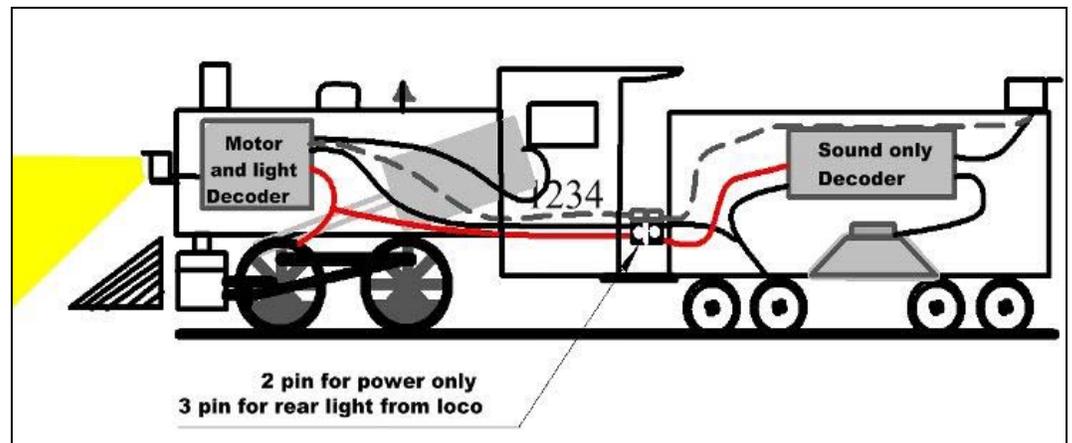
Diesels

The easiest way is to use small connectors like the two wire Miniaturics connectors. The two decoders can be separated by disconnecting the connectors. With the connectors disconnected decoder 1 can be programmed by putting the engine on the program track or using OPS mode programming. To program decoder 2 make a jumper from a matching half of the 2 pin connector. Connect a pair of alligator clips to the wires. When the decoders are disconnected, the jumper can be used to connect decoder 2 to the program track rails via the jumper cable.

Once installed you can unplug the connector to safely program decoder 1. To program decoder 2 make a jumper cable that can be plugged into the male connector of decoder 2. Connect the jumper to the rails. Remember to remove the locomotive from the rails to disconnect decoder 1. Now decoder 2 can be programmed safely.

Dual Units

For more reliable operation with an A and B unit connector a two pin connector can be run between the two units. The



Miniatronics connectors are small and almost hidden when installed. I have a pair of F7s where the two wire connector fits in the widows of the doors between the two diesels. It is hardly visible and easily disconnected.

Steam

Steam engines normally use the engine to pick up power from the engineer's side and the tender from the fireman's side. To power a decoder in either the engine and/or tender, an extra wire is needed between the two. Some steam engines have the "wireless" draw-bar that is not always a reliable connection. With least one additional wire needed, a connector for both wires should be used for more reliable operation. If dual decoders are installed and more connections needed Miniatronics has 2,3, and 4 wire connectors.

It is normally easy to find room in the tender for a decoder, but the engine is another story. With the newer smaller decoders, they can fit under the cab roof or in the boiler. Some weight may have to be removed to make room for the decoder. Be sure to insulate the decoder to prevent shorts.

Test Installation

I have an Akane brass cab-forward that has been re-motored with a can motor. A Lenz decoder was installed because of its small size and excellent Back-EMF characteristic. To add sound a SoundTraxx DSX decoder was selected. There was plenty of room in the tender for the speaker and decoder.

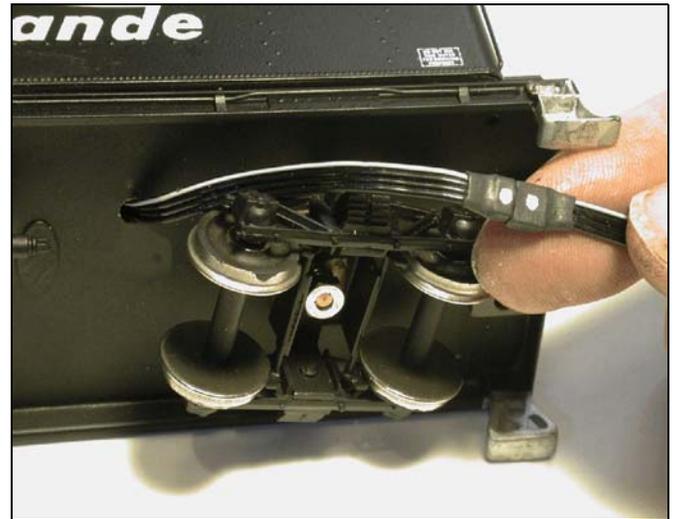
One of the rail power feeds is normally transferred from the tender to the engine via the "wireless" draw-bar. To power the DSX decoder in the tender a wire is needed for the other rail connection from the locomotive. For a more reliable connection a two wire Miniatronics connector was run between the engine and tender so both the locomotive and the tender had connections to both rails.

Cab-forward's are oil fired so there is no coal load to hid the speaker. The best place for the speaker was the floor of the tender. A weight in the center of the tender had to be removed to make room for an oval speaker. The weight was cut in two and each part mounted on the ends of the tender floor. A series of holes was drilled in the area below the speaker location. The DSX decoder was attached on top the speaker using form tape.

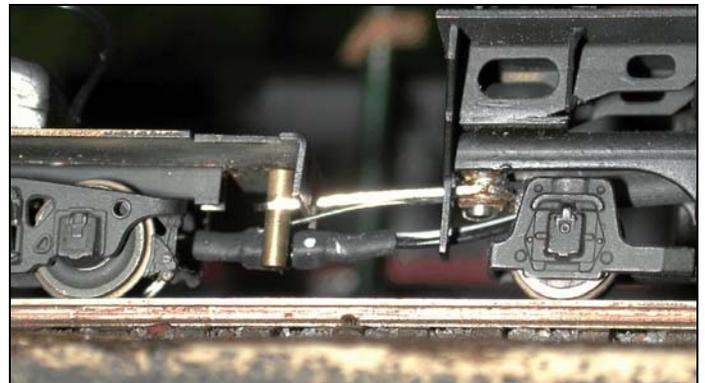
Before connecting the two decoders together I programmed the decoders with a short address of "1" for the Lenz and "2" for the DSX. The decoders were then programmed for a long address of 4177 to match the engine number.

In the first test I left the tender shell off. The volume was low and so I programed the DSX for maximum volume. I also was able change the chuff rated to match the engine wheel revolutions. I could run the engine using address 1 and change the CV in the DSX using address 2 until I got a close match. Speed steps have to be the same in both decoders when matching the chuffs to wheel revolutions. Then I changed the addresses back to the four digit address (4177) for normal operation.

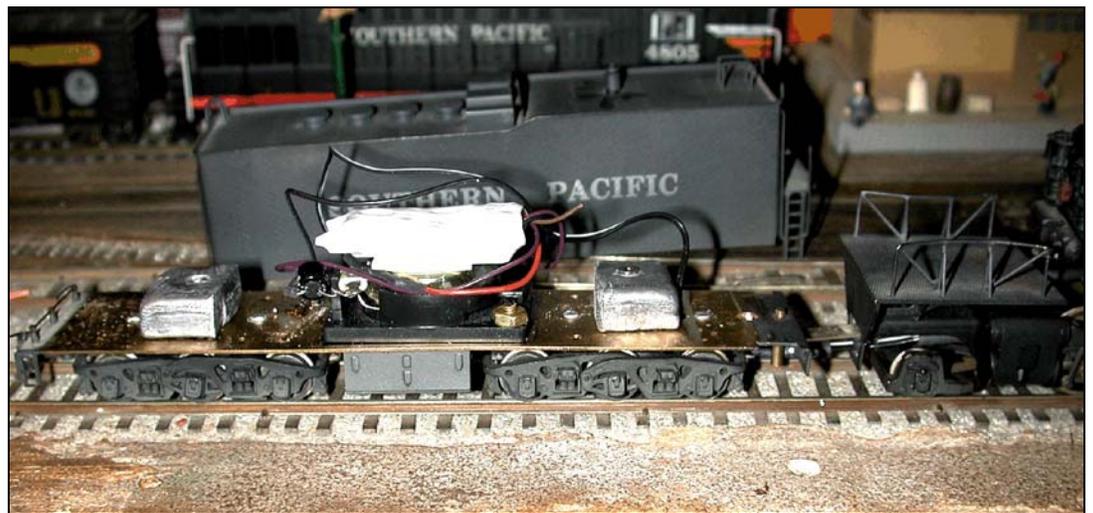
The big surprise was when the tender shell was installed over the tender floor. The sound level increased substantially, so much that I



Up to 4 wires are available with Miniatronics connectors. White dot helps when plugging together.



The 2 wire connector is below the wireless connector.



Decoder mounted on top of the speaker with foam tape. Sound was much louder with the shell on.

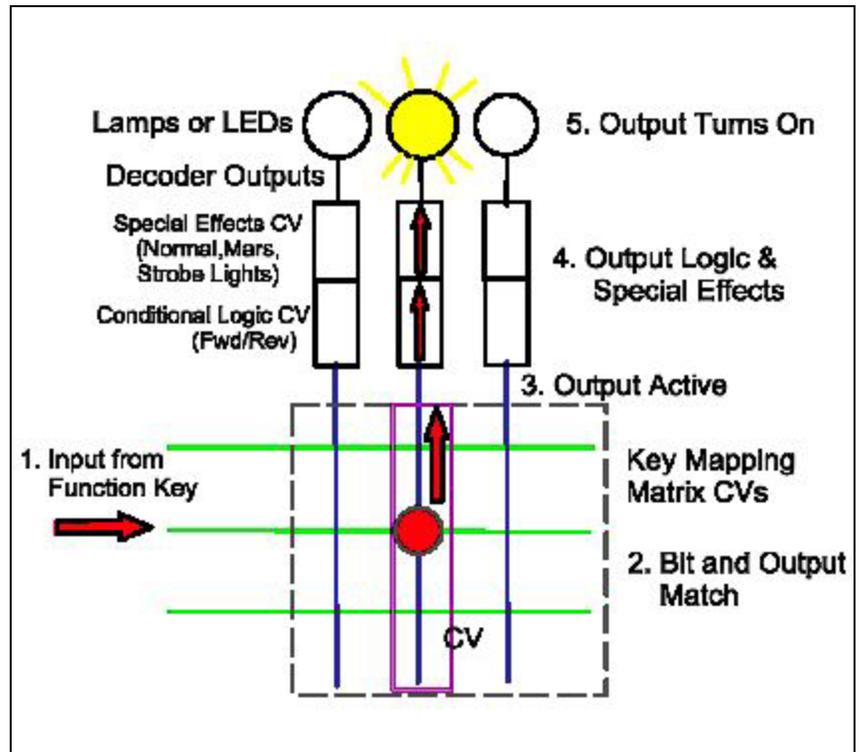
had to reduce the volume!

The 4177 is now in service pulling a string of PFE refers in a train known as the Fruit Block.

Key Mapping

With dual decoders you may need more functions operate with a single function key. One application would be the horn/whistle operates in one decoder while the other decoder runs two outputs as ditch lights. I did this as a test using a pair of F7s with the light control in the A unit and the sound in the B unit. For this test I connected to two number board lights in the A unit as "ditch lights". The A unit key mapping was changed so the whistle key would also activate the two outputs connected to the number board lamps. These outputs CVs also needed to be setup to act as ditch lights. (Are ditch lights prototype on an F7? Yes , I have seen ditch lights on an F7.) When the whistle key was operated, the horn would sound and the lights would start flashing for a period of time set by a CV. When finish the lights would go back on.

Key mapping works by using CVs 33 to 46 as a matrix. Each CV in this group controls one output line. The bits that are turned on in the CVs control which function key(s) will turn on the output line.



Here is the sequence of operation. The decoder is given a function key instruction (1.) The signal is sent to the matrix in the decoder. (2., 3.) When it matches a bit set in the CV in the matrix, the signal is sent to activate the output logic. (4.) The output logic determines if the conditions are met to turn the light on and then how it is to be operated. Like a ditch light or whatever has been programmed in the control CV. (5.) If all conditions are met, the light will turn on.

Key mapping is something that you should experiment with to become familiar with how it operates.. If you have more than one light, like headlight, strobe and Mars light, they can all be turned on with one function key. More than one output can be controlled by a single function key. That way you can turn on all the lights with a single key. Handy if you are like me and forget which keys on which locomotive operate the different lights.

Conclusion

There are a number of reasons why two decoders will do a job that cannot be done with a single decoder. Newer, smaller decoders make it easier to fit in more than one decoder in a locomotive. Using more than one decoder lets you choose the best performance decoders for your locomotives. If you have a locomotive with good motor control, why not add a sound only decoder to complete the locomotive.

Connecting two or more locomotives together that are kept together as one unit makes consisting easier. The units can also be connected together with two pin connectors for more reliable electrical pick up.

Don Fiehmann 07Dec05