

Modeling Ideas and techniques, by Bob Rohwer
What is the right DCC Decoder for my Locomotive?

I hear this question a lot. Fortunately there are a lot of resources to answer the question. The best I have found is Tony's Trains. Web Site: <http://www.tonystrains.com/>. Tony provides an online catalog that lists almost every decoder that is available. It shows all of manufacturer specific decoders. Digitrax also has a lot of information. We site: <http://www.digitrax.com/>. One of the best sources is the individual instruction sheets for each decoder. We have PDF files for most of the instruction sheets on the Society's PC and Laptop. We also have an instruction manual binder with most of the information on decoders. There is a sheet in this book that has a picture of most of the decoders. You can also tell what you will need by looking at the drive in your locomotive. Below I will explain the decoder options. Other than specialty decoders like sound decoder there are only three types of locomotive decoders. - wired, NMRA plug and board replacement.

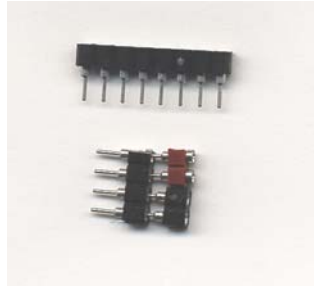
When you open up your locomotive does it have a circuit board? If it does not, you will have to use a decoder with individual wires. These decoders come with a wiring harness with 6 to 9 wires. Most steam engines require a decoder with wires. If your locomotive has an open frame motor, you will have to replace the motor with a low draw can motor. The decoder instruction sheet will explain how to wire it.

If your locomotive has a circuit board, what type is it? Does it have an 8 pin plug on the board. (NMRA plug). If the board has the 8 pin NMRA plug, you will need a plug in decoder. They come either with the plug in the decoder or soldered to a wiring harness. Usually all you have to do is plug the decoder in. Frequently the Digitrax DH163IP will be your choice. On some small locomotives you may need to use a thin profile plug in decoder. An example would be the Atlas RS1's and S-2's. Many times the circuit board that the decoder is plugged into will reduce the voltage for the lights. Be sure to test the output since you may need to install resistors for 1.5v bulbs. Most Atlas locomotive use NMRA plug decoders and are plug and play.

If the locomotive has a circuit board but no NMRA plug you will most likely need a board replacement decoder. You simply remove the board in the locomotive and replace it with the decoder board. The wiring is identical for the decoder board. These boards are specific to the manufacturer. As an example in the Digitrax line Kato uses a DH163KO, Proto 2000 uses a DH163LO, and Athearn Genesis uses a DH163AO. Since you are replacing the circuit board you will have to install resistors to use 1.5v light bulbs.

The examples I have provided above will handle about 90% of the locomotive you will install decoders in. Also feel free to call Tony's or Digitrax if you need help.

Sipp Pins:



Sipp Pins

Many of us have been installing DCC decoders in our locomotives. One of the issues with decoders is the number of wires. If you are using a decoder with wires and you want a headlight and a backup light you will have a minimum of seven (7) wires. At least 3 wires will have connected between the shell/boiler and the frame. Even with the NMRA plug decoders you will still have the three wires. The problem is that you have lots of wires to get caught in motors, flywheels and drives. They will always wind up being visible through the windows or where you don't want them.

The solution – Sipp pins

Sipp pins were first used for memory chips in early computers. We still see them today as plugs. The NMRA 8 pin plug and receptacle used in DCC decoders is an example of Sipp pins. The main advantage is that they plug into each other. Sipp pins are used as plugs between the shell/boiler and the frame. If the receptacle Sipp pins are glued on the top of the motor, you can use short wires between the Shell/boiler and the frame. This will keep the wires high in the shell/boiler and away from the flywheels and drives. An example of an installation is as follows: Steam locomotive (no rear headlight) with the decoder in the boiler

1. A 4 pin Sipp is cut from a strip of 25 (they come in many lengths).
2. The 4 pin Sipp is glued to the top of the motor.
3. The 2 track leads (red and black) are soldered to two of the Sipp pin tails
4. The 2 motor leads (orange and gray) are soldered to the other two tails.
5. Two 2 pin Sipp are cut from the strip.
6. Solder the red, black, orange and gray wires to the two 2 pin Sipp to line up the same color on the 4 pin Sipp glued on the motor. 4 pin Sipp are hard to plug-in. It is easier to use two 2 pin Sipp. Cut the wires in the boiler so that the boiler will clear the frame enough so you can to pull the plugs with tweezers.
7. The rest of the wires (white and blue) are used for lights in the boiler.

The same process will be used with the shell of a diesel except the wire would be a different color. Sipp pins can be purchased at HSC Electronic Supply, 4837 Amber Lane, Sacramento 916-338-2545 or any of the mail order electronic houses such as DigiKey. At HSC they are surplus and come in a number of lengths. For further information or to see what they look like please contact me.

Modeling Ideas and techniques, by Bob Rohwer
Installing Bulbs in a Dual Pyle Light:

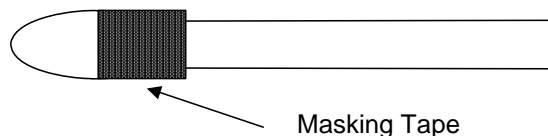
In the last Newsletter the use of SIPP pins was discussed. SIPP pins allow the use of shorter wires between the shell and the power unit and to unplug the shell from the power unit. This article will discuss the installation of light bulbs in a Dual Pyle light on a diesel shell.

There are a number of ways to install lights in a shell. This is the way that I do it and it seems to work for me. I have standardized on Miniaturics 1.5 volt 30ma 1.2mm light bulbs (18-C03-10). These bulbs put out more light than the standard 15ma bulbs. You can use lower voltage that will make them last much longer. The only difficulty is that the current draw is higher so you must wire multiple light bulbs in series if you are going to use DCC. This will be discussed later. So lets get started.

1. The first task is to get two light bulbs that have the same brightness. Take two bulbs from the package. Twist the ends of one of the two wire leads from each bulb together (series connection). Connect the one remaining wire leads from each bulb to a DC power source that will supply 2.5 to 3.0 volts. Two 1.5v batteries will do or an old throttle. Be sure that the throttle supplies no more than 3.0 volts or you will burn out the bulbs. I recommend that you check the voltage with a voltmeter. With the voltage applied hold the light bulbs together and look at the ends. If they are the same brightness they are ready to use. If the brightness is different exchange one bulb for a new one and repeat the process until you have two bulbs that match.
2. Inspect the Pyle light on the shell. It will either have holes already drilled through the shell for clear plastic lens or recesses for jewels.

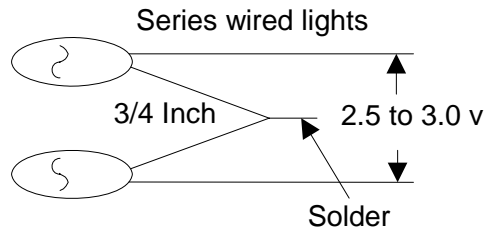
Lets begin with the Pyle light with the recesses. Drill a hole in each light recess using a number 55 drill. The number 55 drill is the correct size for the 1.2mm light bulb. You can buy number drills at Emigh Hardware.

The Pyle lights with predrilled holes will require that you shim the light bulbs since the holes are too big. Cut a strip of masking tap about an eighth of an inch wide. Wrap one thickness of tape around half the bulb toward the wires as shown below.



This will center the bulb in the Pyle light housing.

- From each of the two matched light bulbs cut one wire to $\frac{3}{4}$ inch from the bulb. Strip about $\frac{1}{4}$ inch of insulation from the $\frac{3}{4}$ inch wires. Twist the ends of the two short wires together. This will wire the bulbs in series. Be sure that the ends of the two light bulbs line up. If they do not pull the short wires apart, realign the ends of the bulb and twist the ends of the wires together again. Once you are satisfied, apply flux to the twisted wires and solder them together.

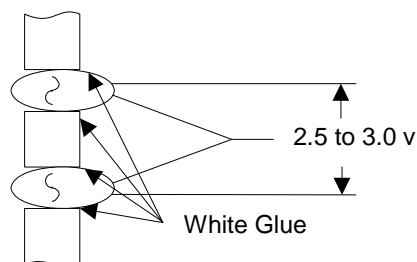


Connect the two remaining wire leads to a DC power source that will supply 2.5 to 3.0 volts to be sure the bulbs light. I like to continually test light bulbs just to be sure they light. You can apply heat shrink tubing to the solder joint or just leave it bare.

- We are now ready to install the bulbs in the shell. Using tweezers or needle nose pliers hold the wires so that the distance between the light bulbs and the two holes in the Dual Pyle light are the same. Push the bulbs through the holes from the inside of the shell until they poke out of the holes. This can be a little frustrating and take a number of tries.

Carefully push the bulbs back into the holes until the lens barely protrude from the holes. Connect the two remaining wire leads to your 2.5 to 3.0 volt DC power source on inspect the lighted bulbs. Adjust the bulbs until you are satisfied with their looks. This adjustment is strictly a matter of what you like. Some modelers like them to protrude so the lights can be seen from the side. Others want them visible only from the front. I personally like them to barely protrude and be barely visible from the side.

- Once you are satisfied, glue them in place with white glue. I use a toothpick, apply white glue to it and then apply it around the two bulbs where they go into the shell. If the bulbs move just reposition them. Allow the glue to dry. I use white glue because it seems to hold well enough and you can easily remove the bulbs if one burns out.



If you are impatient you can also use ACC. Be sure to use Poly Zap since it will not attack the clear plastic windows. Poly Zap can be purchase at either Bruce's or Railroad Hobbies. If you burn out a light bulb it is more difficult to remove the bad bulb with ACC.

Once the glue dries, retest the light bulbs with your 2.5 to 3.0 DC power supply to be sure they still work. Once this is completed we are ready to wire them to the DCC decoder. This will be the topic of the next article.

The process for wiring a single light is the same. The only difference is that a single bulb uses 1.2 and 1.5 volts to test. Also Single light generally needs a reflector since they are usually much larger in diameter. Building the reflector and lens is another subject. If you are interested in how to do it, please contact me. If there is enough interest I will do an article on it. If you have any questions please feel free to contact me. I would also like any comments you have on these "Modeling Ideas and Techniques" articles. Are they easy to understand? Are they helpful?

Modeling Ideas and techniques, by Bob Rohwer
Finding the Resistor for DCC Lighting:

In the second article on DCC installation we discussed installing light bulbs in a diesel shell with a dual light housing. The two light bulbs in the shell are connected in series. This article will discuss how to connect the light bulbs to the decoder. We are making the assumption that the decoder is installed and ready for lights. There are a number of ways to install lights in DCC. This is a discussion on how I do it. Don Butler and Dave Megeath would probably do it a little differently.

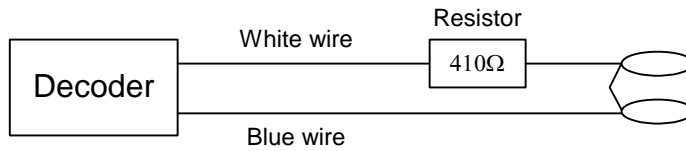
My philosophy of lighting is to use as few wires as possible and keep them short. As was discussed in our Electronics Clinic the decoder puts out about 12v DC and the two light bulbs connected in series need about 2.8v. We must choose a method to reduce the voltage at the light bulbs. There are two methods that I use – voltage regulators and resistors. I prefer to use a voltage regulator since it allows one to adjust the brightness of the bulbs and provides precise voltage control to the light bulbs. If you want to know more about voltage regulators just ask me. For this article we are going to use resistors. In the Electronics Clinic we discussed how to calculate the value of the resistor. Another way to find the resistor value is to use a cheat sheet. Many are available. Below is one example.

Recommend dropping resistors if using 1.5 volt bulbs

Track Voltage (14 volts is typical for HO scale)

Bulb Current	12.5	13	13.5	14	14.5	15	15.5	16	Wattage
15ma	680	680	720	750	820	820	910	910	¼ watt
30ma	330	360	360	390	390	430	430	470	½ watt
40ma	240	270	270	300	300	300	330	330	1 watt
50ma	200	200	220	220	240	240	270	270	1 watt
60ma	160	180	180	200	200	200	220	220	1 watt
80ma	120	130	130	150	150	160	160	160	2 watt

We need to determine the resistor value. Since the light bulbs are 30ma we will use a ½ watt resistor. Digitrax has a track voltage of about 14v. According to the chart we will need a resistor value of 390Ω. Put the locomotive on the programming track, apply track power and logon the decoder to the DCC system. Be sure the locomotive operates and the functions are turned off. Turn the power off on the programming track. In this example we are connecting up the front headlight. Connect a test wire to the blue wire (+) and the other test wire to the white wire (F0F). If the decoder is a plug-in type find the + and F0F solder tabs and connect test wires. Create test light bulbs by taking two 30ma 1.5v Minitronics light bulbs and connecting them in series. Refer to the last article. Do not use the light bulbs you glued in the shell. Connect one wire of the light bulbs to the test wire connected + on the decoder (blue wire) and the other light bulb wire to the resistor. In this example start with a little higher value ½ watt resistor – say around 410Ω. Connect the other end of the resistor to the test wire connected to F0F (white wire) on the decoder. Below is a diagram. Very carefully inspect the test connection to be sure there are no shorts.



Turn the track power on. Re-inspect the test connections again to insure there are no shorts. Turn on F0. The light bulbs should have turned on. If they did not turn on, turn F0 off and re-check your wiring. The bulbs are probably not bright enough. Substitute a ½ watt resistor of a lower value say 390Ω and re-test. A good rule of thumb is to lower the resistor value by 20Ω. Keep substituting lower value resistors until the light bulbs are at a brightness that you like. You will need to purchase resistors of different values about 20Ω apart. DigiKey and Mouser are good sources for resistors. You can borrow a resistor test device from either Don or me. I always check the actual voltage with a voltmeter across the two light bulb leads. For the two 1.5v light bulbs in series a 2.8v is about right. The bulbs will be fairly bright and will last a long time.

We have found the resistor value and tested the lights. Use the same process to test the rear light (FOR – yellow wire) and the other functions. If the function is a flashing light such as a mars or gyalight, use a lower resistor value. This will give a brighter flash, which looks better. You can apply a higher voltage since the lights are flashing. Flashing lights require the adjusting of the resistor value and CV's to get the right look. In the next article we will install the SIPP pins and resistor in the locomotive.

Modeling Ideas and techniques, by Bob Rohwer
Connecting the Lights to the DCC Decoder:

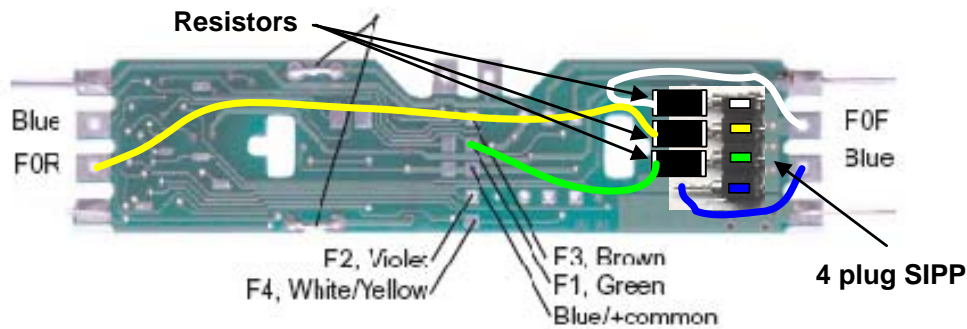
In the first article we discussed installing lights in a diesel locomotive shell. The second article discussed how to test the lights and find the resistor value to reduce the 14v output from the decoder to the 3 volts needed by the two light bulbs in a dual headlight. This is the third article and will deal with connecting the lights in the shell to the decoder on the locomotive frame. If you do not have the previous articles, please feel free to contact me and I will provide you with copies. There are three previous articles – the two mentioned above and one on how to use SIPP pins.

In my opinion the key to lighting DCC locomotives is to use as few wires as possible between the shell and frame, have short wires, and use plugs so the shell can be separated from the frame. The plugs we will use are SIPP pins (see the first article). Our example will be a more complex installation such as a Kato SP SD45 with an operating dual front headlight, a dual rear light, and a dual front Gyalight. We will install a Digitrax DH163K0 decoder for Kato. To install the decoder you simply remove the Kato board and replace it with Digitrax board and plug the wires back in. I would suggest you solder the wires. Based on the instructions, you would think the installation is plug and play. It is not. It uses 1.5 volts light bulbs and a light bar, which doesn't look very good. We will replace them with new 1.5v 30 ma light bulbs. Install and test six light bulbs for the three dual lights needed on the SD45 as discussed in the first two articles. The two light bulbs in each dual light will be connected in series per the article.

Let's start with the frame and decoder. To light the shell we will need to connect 4 wires to the shell as follows. You do not need to use colored wire, but referring to the colors makes installation easier to follow.

Blue wire – Common (+) wire for all three dual lights
White wire – Front headlight (Function 0 Forward)
Yellow wire – Rear headlight (Function 0 Reverse)
Green wire - Gyalight (Function 1)

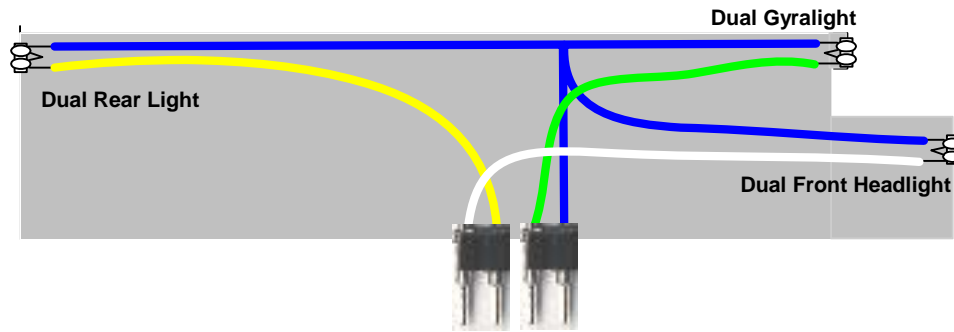
We will need to wire a strip of 4 SIPP pins to the decoder. The strip will need to be glued to the frame or the decoder. With a DH163K0 we can glue the strip right on the decoder as follows:



I use epoxy to glue the SIPP pin strip. Glue a square of paper as shown in the drawing to insulate the strip from the decoder board. The resistors should be soldered as shown. Resistor values were determined in article two. Wires should be soldered as show in the drawing. The instructions sheet for each decoder will show you where the wire should be soldered on the decoder. One of the benefits of DCC is that the wires and connections are color-coded and are the same for all decoders. Be sure to note what color goes to each SIPP pin. I have added colored blocks to the drawing to show the color of each SIPP pin. After you finish, carefully inspect the board to be sure there are no shorts.

We need to test the frame installation. Make a test light by soldering two light bulbs in series (2nd article) and solder single SIPP pins on the ends of each wire so they will plug into the 4 plug SIPP on the decoder. Program the decoder being sure that Function 1 (green wire) is set to a gyalight. Plug one lead of the test light into the SIPP pin marked Blue. Plug the other lead into each colored SIPP pin one at a time. When you have plugged the other lead into the colored SIPP pin turn on the function for the color. In the case of Functions F0F and F0R the forward/reverse button will turn them on and off after F0 is turned on. The light bulbs should turn on for each function. You may want to test them further with a voltmeter. A good voltage for two 1.5v light bulbs in series is about 2.8v. When you get to Function 1 (green wire) you should see the gyalight flashing. You may have to change a resistor to a different value if the lights intensity is not correct. If everything tests properly, we are ready to wire the shell.

We need to use 4 SIPP pins so we can plug them into the SIPP pins on the decoder. Cut the SIPP pins into two strips of two pins. It is much easier to plug two pins into the SIPP strip on the decoder than four pins. Wire and solder the wires as shown below. Note that one wire from each dual light is connected to form a bus (blue wire). This reduces the number of wires between the shell and frame.



Be very careful to insure that the same color wire lines up with the same color on the SIPP pin strip on the decoder. Most of us do not use colored wires when we install decoders so you will have to trace the wires to their source to determine the color. I actually paint the SIPP pins the proper color so I don't get them mixed up. If you mix them up you can burn out a light bulb.

Use a pair of tweezers to plug in the SIPP pins and connect the shell. We have completed the DCC light installation.

Few additional Comments: The installation of the DH163A0 (proto 2000, etc) is the same as the DH163K0. For decoders with wires like DH163D or DZ143, I glue the SIPP pin strip to the top of the motor. You can glue the SIPP pin strip anywhere on the frame. For Genesis F units I glue 3 SIPP pins the in the hole in the front of the plastic cab interior. Resistors can also be put anywhere. If I don't have room on the frame I sometimes put them in the shell. Just be sure there is space between the resistor and the plastic shell since they can get very hot. I hope these articles have helped you. Once you have done a couple of DCC installation you find they are not that hard. The approach used in these three articles is the same for almost all locomotives. Just remember, almost all of us have created a "B" unit decoder. (A "B" unit decoder is one where you burned out a light transistor on a decoder) If you need help on your DCC installations, just ask.