

Installing DCC into the Proto 1000 HO RDC

Introduction

Lifelike Products Inc make a number of HO-scale (1:87) models of the Budd RDC (Rail Diesel Car). These models are released as part of their Proto 1000 range and cover three of the five types of RDC - the all-passenger RDC-1, the baggage/passenger combination RDC-2, and the baggage/Travelling Post Office/passenger RDC-3. These are released directly by Likelife Products in a wide variety of US roadnames, and manufactured by Likelife Products for Hobbycraft Canada in a variety of Canadian roadnames. The models illustrated here are all from the Hobbycraft range so you are unlikely to find them in US stores. The RDCs modified in this way were purchased from Hockley Valley Railroad (Orangeville, near Toronto ON, Canada) Rio Hobby (Chapleau ON, Canada - mid-way point on Canada's last mainland RDC service, VIArail's *The Lake Superior*) and Mac's Models (Helensburgh, Scotland, UK). All three stores provided excellent service and I would recommend them - consult their respective web sites or email them for latest prices and availability. The electrical parts were purchased here in the UK and hence those are what I have specs for.

This web document is designed to explain how to install DCC into these locomotives (aka self-powered vehicles). Two potential modifications are described here, one just straight DCC with LED headlamps, the other adds interior lighting controlled by F1 as well (*RDC3 only - instructions specific to this modification are in italics like this*). While they have certainly been designed with DCC in mind, one can hardly call it an easy modification. It will take between 2 and 3 hours and requires the use of:

- a smallish Philips screwdriver with a long handle
- a pair of thin-nosed pliers
- a pair of wire cutters
- a very sharp knife
- a soldering iron with a fine tip
- a multimeter.

In addition you will need the following supplies for each RDC locomotive to be modified:

- Suitable "With Wires" DCC mobile decoder for use on HO models - the one used in the illustrations is the Digitrax DH163D decoder. Those by other makes such as Lenz should also work just fine.
- Fine-grade electrical solder
- Plastic insulating tape
- 2 (or 4) 3mm white LEDs (5V) - Maplin part no GV65 or equivalent
- 2 (or 4) 1000 Ohm 0.6 watt resistors - Maplin part no M1K or equivalent

This document is based upon instructions given in a web page provided by Tony's Train Exchange, with additional work by a friend of mine, DAve.

DISCLAIMER: This modification is hard. You can damage your new model VERY EASILY with the tools needed to perform the modification. These instructions are designed to make the process easier, and are based upon the successful modification of no less than five Proto 1000 RDC models. However we can accept no liability for what happens to your model, nor do we guarantee that this modification will work. If you undertake the modification detailed here, you do so entirely at your own risk.

Procedure

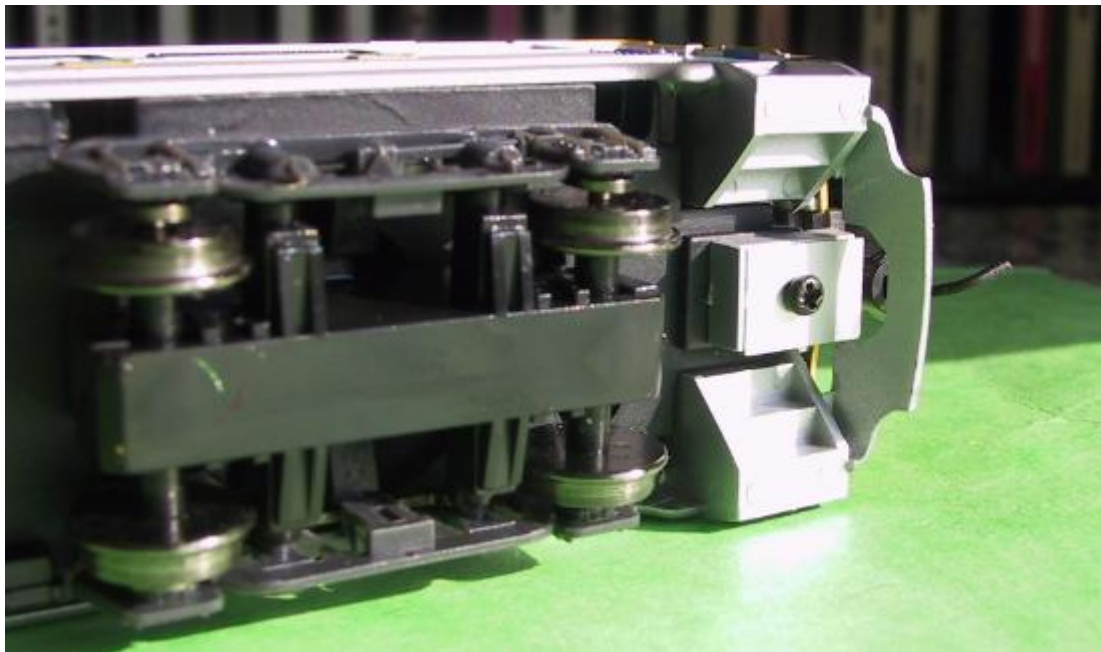
Step 0: Unpack the loco and check it runs OK on analogue (DC) power.

There's no point in modifying a faulty loco!

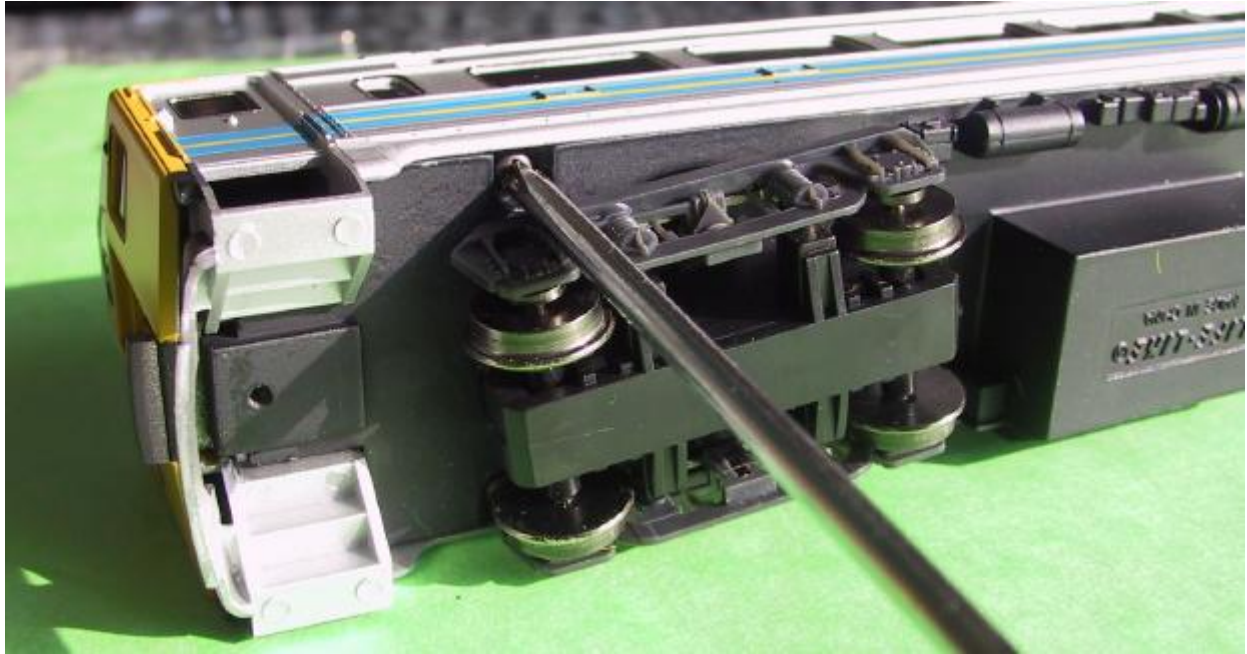


Step 1: Remove the couplers and body shell.

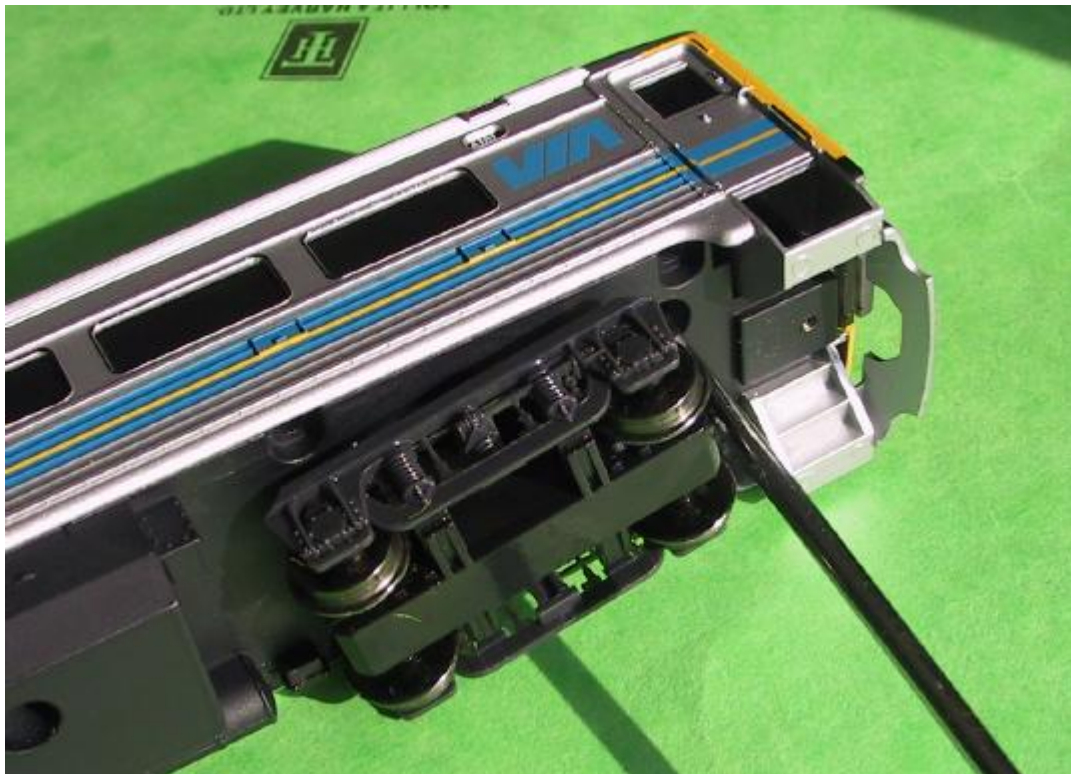
The couplers have to come off first - each is held in place with a single Philips screw. There are five parts - the screw (black, bolt-style thread), the coupler itself, the brass centering spring plate, the plastic back plate and the flat cover piece.



At one end of the RDC (non-motor end in the model), the body shell is held in place by two small black (self-threaded) screws whose heads are immediately visible. By turning the truck, you can easily get the screw driver to these and remove them.



At the other end (motor end in the model), the body shell is secured by two screws buried in a fairly deep recess. Again two black screws (with plastic style threads, but not the self-tapping sharp tip) are to be found securing the shell. Once again the truck can be turned to afford access to these screws shafts, one at a time. This is where the long shaft on the screwdriver is vital - short shafted ones were fouling with the truck. On the models I tried, one of these screws came out, the other didn't. Not sure why.

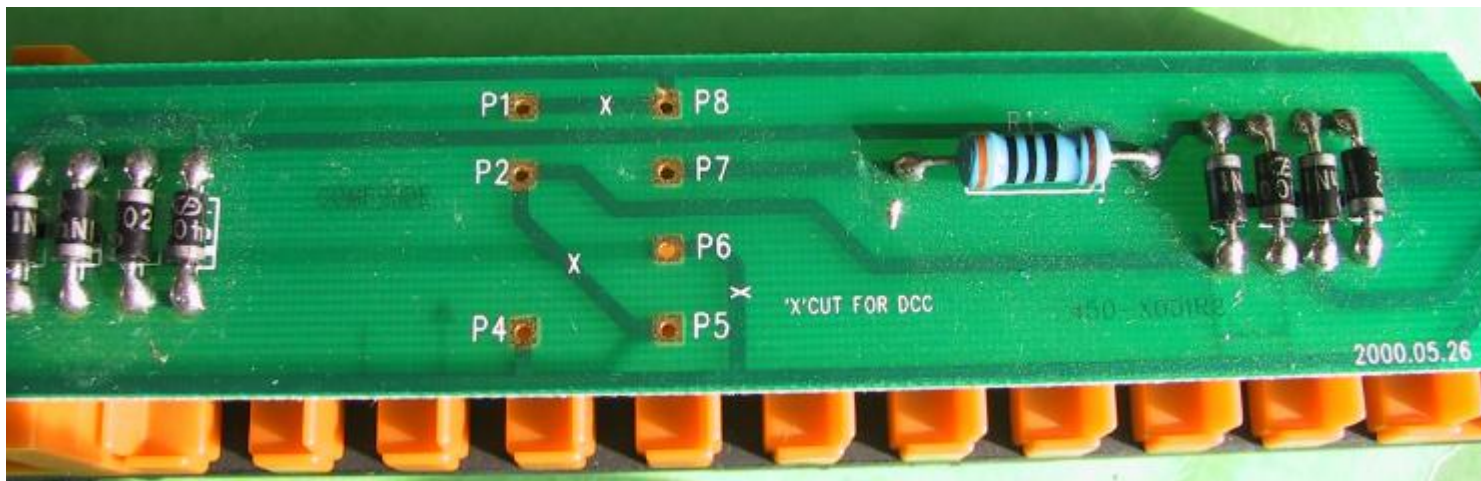


Finally with both couplers removed, and all four body screws undone, gently ease the body shell away from the loco chassis. Parts of the chassis moldings appear to be metal and strong enough to take moderate pressure. Once free, move the shell vertically upwards away from the chassis.



Step 2: Remove the unwanted components from the circuit board (PCB).

The RDC model comes with a set of components designed to try to make the headlights function with a constant intensity during most speeds of normal DC operation. With DCC, the track voltage is higher and constant, so these circuits are superfluous. In addition, the supplied bulbs did not last long with the higher DCC voltage, so the decision was made to replace them with white LEDs instead. This also actually served to improve the look of the loco when running as these were much more like the headlights of the real RDC itself. Here are the components prior to removal: we are going to be removing all eight of the diodes (black components), and the resistor (striped component). Notice the connection points for DCC and the three tracks within the circuit board marked with an 'X' and 'X - Cut for DCC'.



First we remove the left hand set of Diodes (marked D1 thru D4).



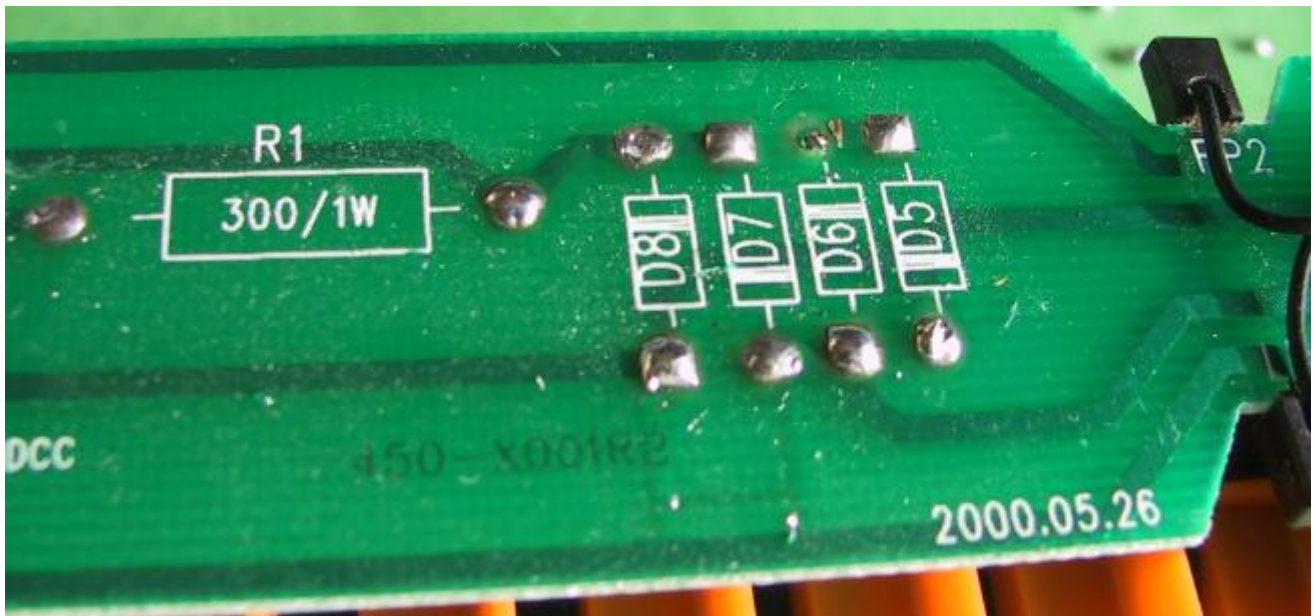
This is done by gripping the component body with the thin-nosed pliers, and then heating the existing solder at either end of the component. Do not keep the soldering iron pressed to the solder or the component - touch for maybe a few seconds and then release. Do each end in turn, in quick succession, and after about the third touch to each end with the iron, start lifting the component with the pliers while continuing to alternately touch the solder on each end with the soldering iron. As the weight of the chassis is bearing on the component, it will come away. Be careful of course that you've not lifted it too high off the workbench - the chassis will drop when the component comes free. A quarter of a inch should be ideal. Repeat for all four diodes in the block and it should look like this.



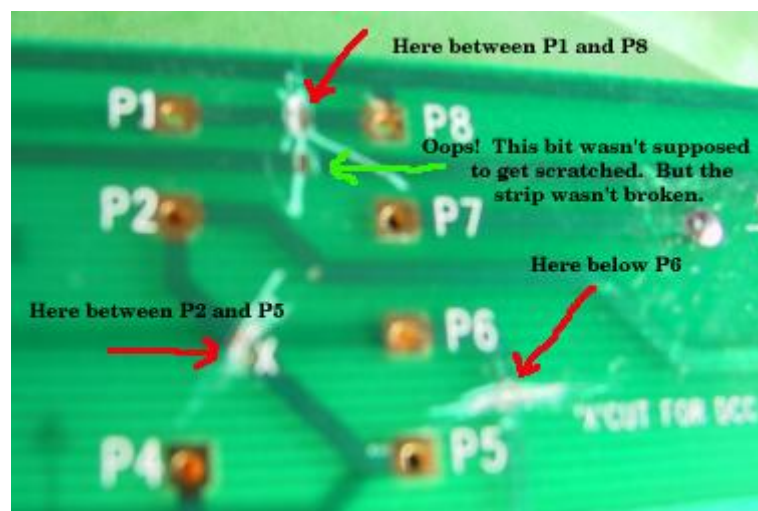
Now we remove the other set of four diodes and the resistor in the same way as before.



OK, and here's how the board looks when they've been removed. *If you're going to do the with-lights modification for the RDC3, note the locations of the two circuit board tracks which go nowhere. These are between D2 and D3, and between D6 and D5. With the motor to your left, the useful D2/D3 is on the back side (further from you) and the useful D6/D5 connection is on the back side.*



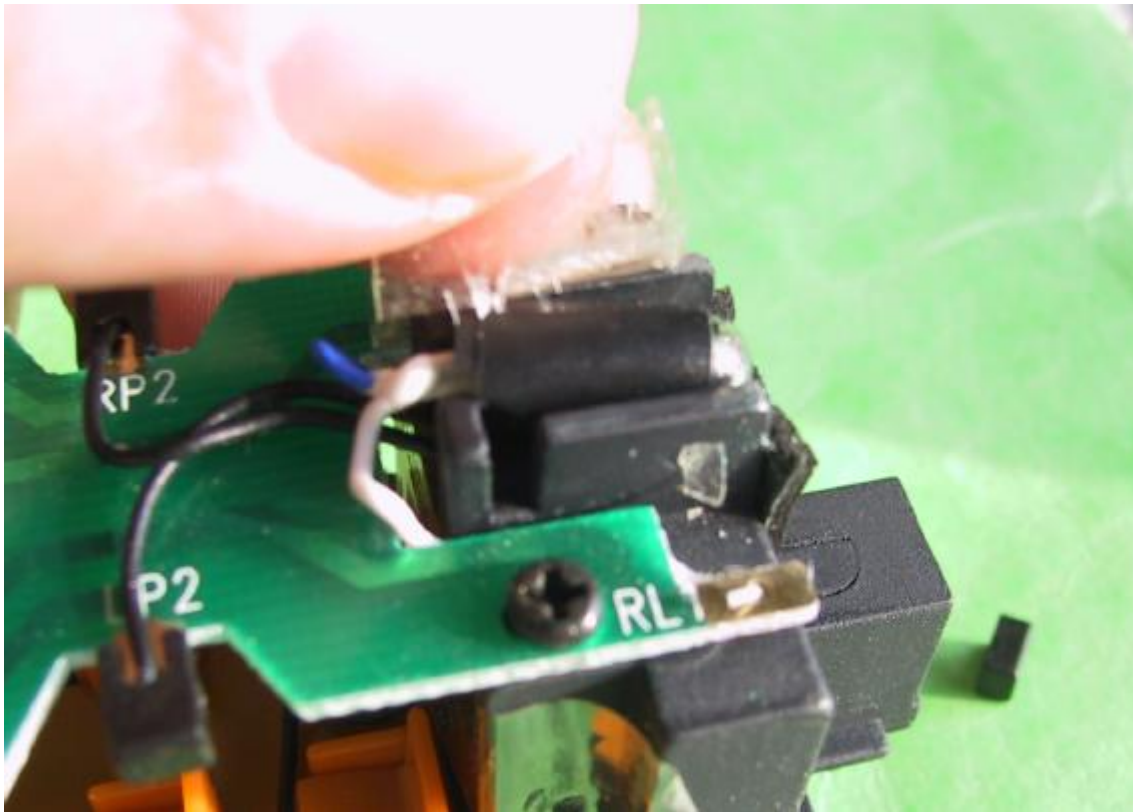
Next we need to get the sharp knife and cut those tracks in the circuit board that have been helpfully marked for us. There is a thin brass strip placed on top of the circuit board which we need to cut through, but without breaking the circuit board itself. I found it possible to support the circuit board itself from the underside to stop it bending too much with one hand, while repeatedly running the sharp knife across the brass strip (circuit board track) we need to cut. I found that with maybe twenty or thirty low-pressure cutting motions, I managed to dig a reasonable groove into the PCB across where the track (brass strip) had been. A scratching motion with the side of the knife blade tip cleared the debris and showed the circuit board cleared of the brass strip. It is important to make sure there is a clear area visibly free of the brass track - this connection must not short out or bad things will happen. All three tracks need to be cut at the points marked.



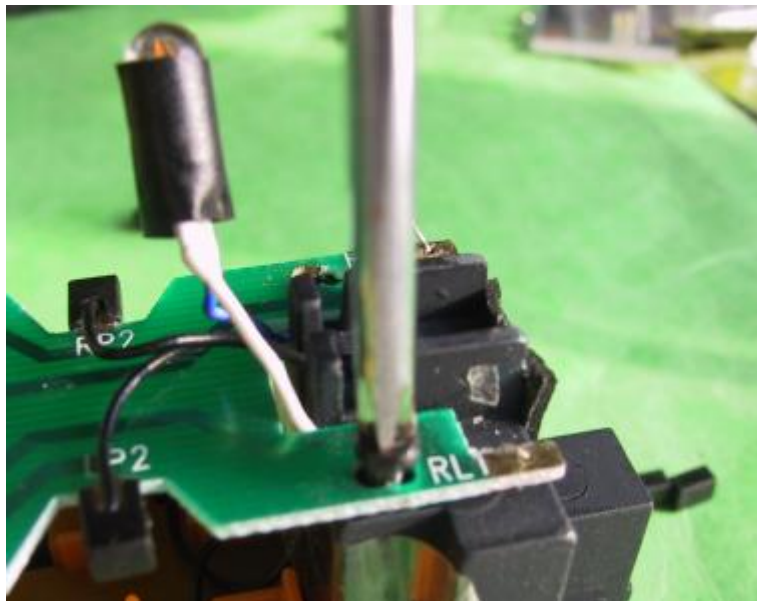
And as you can see from the picture, the knife slipped and I almost cut a track I wasn't supposed to. Fortunately it only scratched the surface and the brass strip remained intact. I could have probably fixed this even if I had cut it by scrapping off the green lacquer and placing a blob of solder to re-join the brass strip on each side of the cut.

Once the cuts have been made, check carefully using a multimeter that the connection is indeed gone between P1 and P8, between P2 and P5 and between P6 and the brass strip it's connected to. I found the track pick up contact point further down the same circuit board track as P6 was connected to was a good place to touch the multimeter probe.

We now have only two more components to remove - the original headlight bulbs. The wires from the one near the motor can be easily removed by pulling off the plastic sleeve (plug) holding them in place and pulling on the cable. The one at the non-motor end is far more tricky since the cables appear to be trapped by the circuit board itself. First remove the clear sticky tape holding the bulb in.

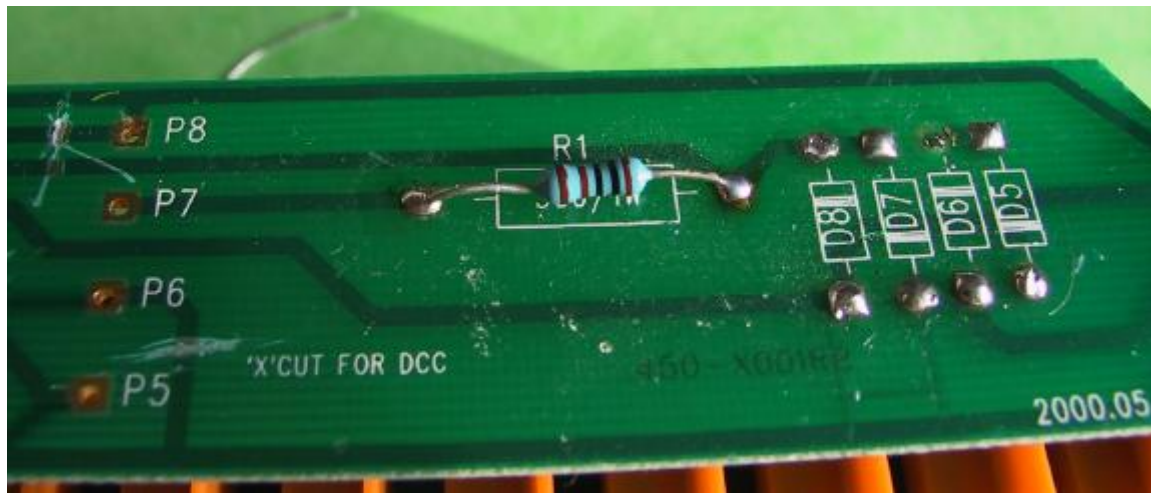


Now remove the two screws securing this end of the circuit board, and you should then be able to get the bulb out.

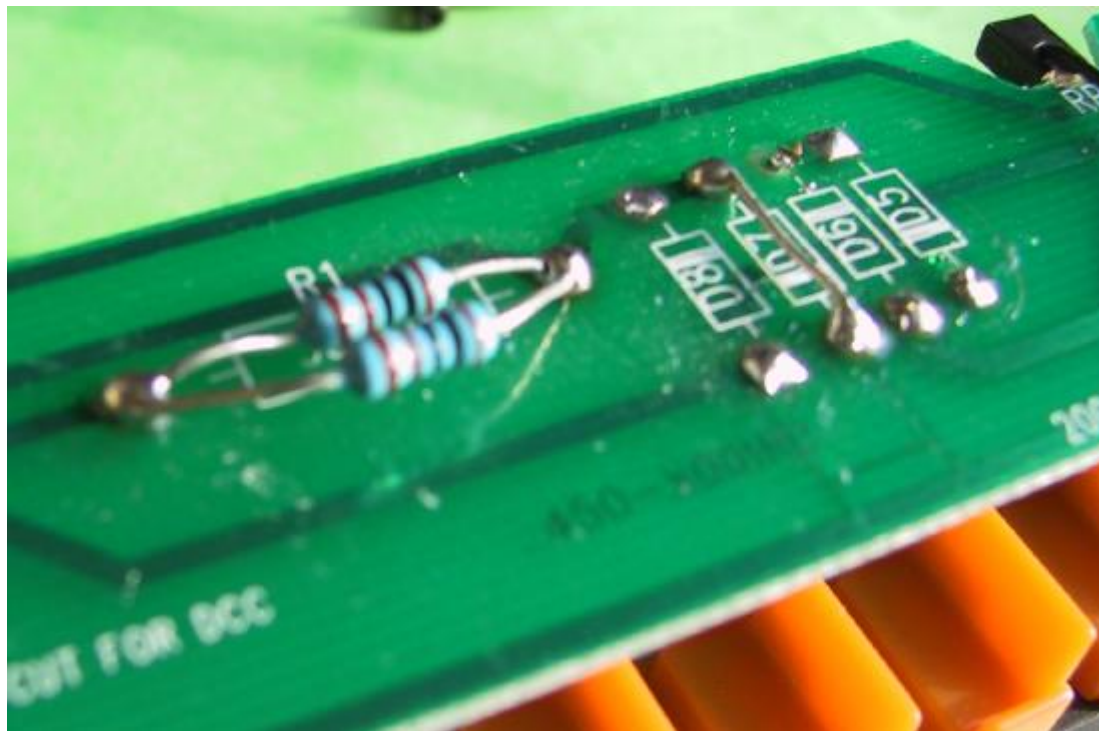


Step 3: Install new components into the circuit board (PCB).

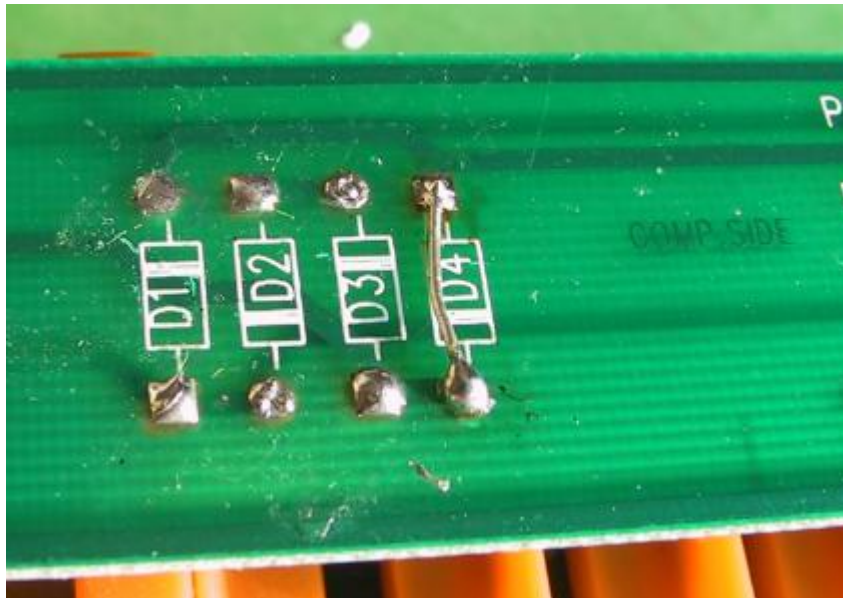
Next we install the new components into the circuit board. These are two 1000 ohm resistors wired in parallel, and two link wires replacing diodes D4 and D7. First step is to install one of the resistors into the holes in the circuit board.



Then we add a second resistor in parallel over the first one, basically adding it's wire into the solder blob holding the first one in place. Next we need to add a link wire into the circuit board in place of the Diode marked D7. I found the excess cut off the end of the resistor was perfect for making this link. *If you're going to add lighting to an RDC3, you'll need to connect a second resistor package onto the left hand end (nearer the decoder connector) to provide a current-protected -ve (negative) power supply for the two interior LEDs. Note that that two LEDs is about the limit for this; more will need either a third set of resistors or different values, hence my saying RDC3 only for the lights.*



And finally we need to add the other required link, that in place of Diode D4 in the other component group. Again, I found the excess cut off the resistor was ideal for this purpose.



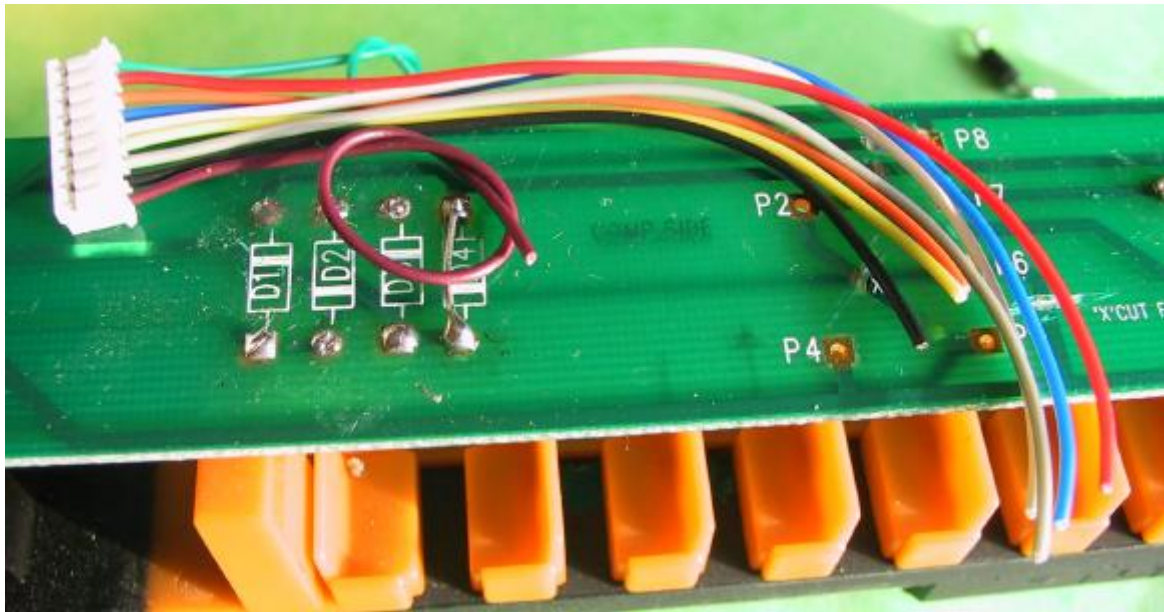
Step 4: Installing the DCC decoder itself

We've now prepared the circuit board, so the next step is to actually install the DCC decoder itself. I'm using a Digitrax DH163D which has a detachable wire harness. In these pictures, I basically install the harness completely first and only then attach the decoder. A hardwired decoder probably does not present a significantly bigger problem, except one must be a little more sensitive to not overheating the wires with the soldering iron.

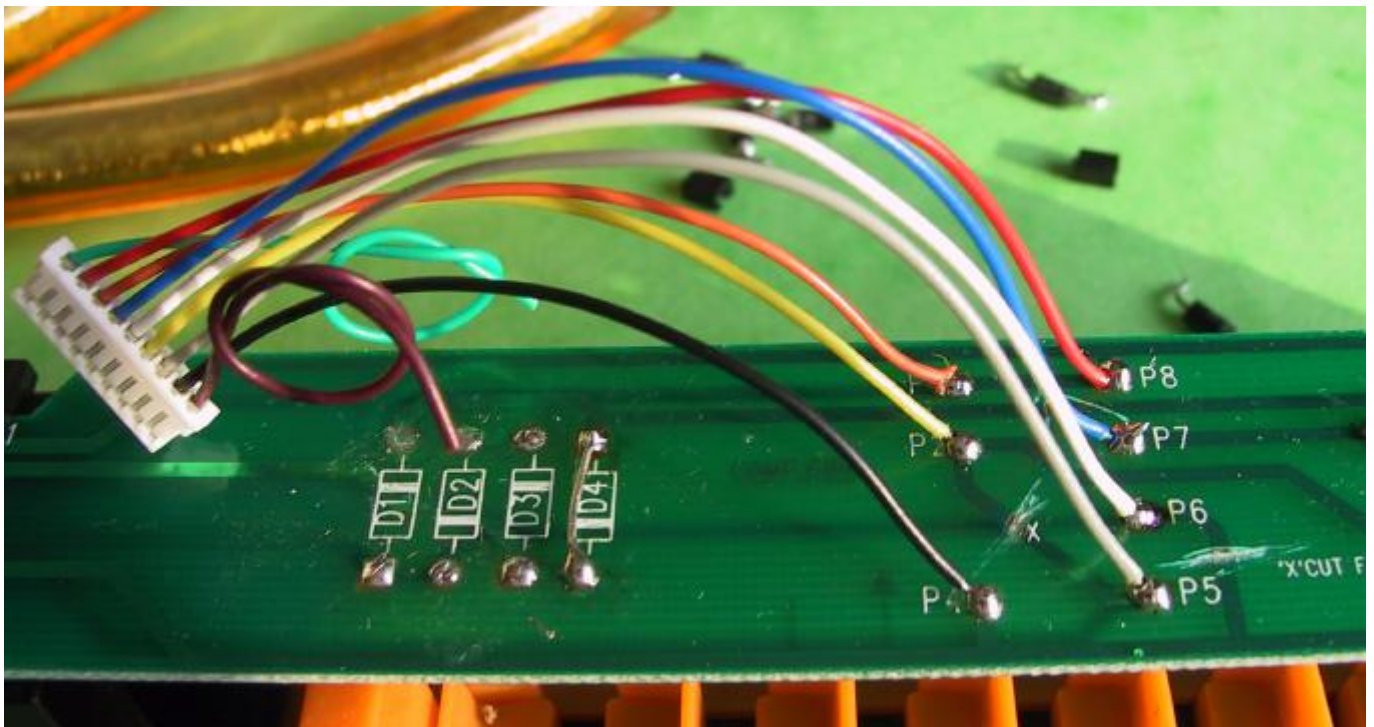
The first step is to trim the harness wires to an appropriate length, so first they need to be measured up against the solder points on the circuit board. I cut those going to the nearby contacts (P1, P2 and P4) about half an inch (1.2cm) shorter than those going to the further ones (see table for colours/connections below). Just where the D1-D4 diodes were is a good place for the decoder to be since it's just under the radiator bubble on the RDC body shell. This gives the decoder a little more ventilation. If your decoder is not sleeved (as the digitrax one is), you will need to ensure that all the contacts and the link strip at D-4 are covered with an appropriate piece of insulating tape. I believe the colours stated in the table below are to an NMRA standard, but it is important to check them with your decoder specification sheet before proceeding. Note that two of the wires are not actually used, but I left a reasonable tail on the cables and just tied it back as they may be useful in future. One in particular is the F1 function cable which would be ideal for activating interior lighting in the car should you wish to add that.

Cable Colours and Assignments		
Colour	Purpose	Destination
Orange	Motor +ve	P1
Yellow	Rear Headlight	P2
Black	Left Rail Power Pickup	P4
Grey	Motor -ve	P5
White	Front Headlight	P6
Blue	Lighting (Common)	P7
Red	Right Rail Power Pickup	P8
Green	Function F1	<i>Interior lights: RDC3 with lighting or Not Used</i>
Violet	Function F2	Not Used

Having sorted out which cable should go to each place, I then proceeded to trim the wiring loom to the appropriate lengths.



The next step is to trim the plastic sleeving back at the end of each wire by approximately .2 of an inch (5mm), twist it tight and then tin the wires we're going to use with a little bit of solder. Be careful not to use too much solder as it has to go through the holes in the circuit board. Once they're all tinned, solder each one in turn into the appropriate place on the circuit board. *For an RDC3 with interior lights, twist together a length of loose wire and the green wire (F1), and solder them into the back terminal for Diode 2. One of the two LEDs for interior lights will have (BUT not yet, we need to determine the polarity first and that can only be done later) a pin poked through from below the PCB and soldered to the back terminal for Diode 3. This uses the two joined terminals to carry the +ve from the F1 output of the decoder through the PCB to the LED, and provides a mounting for the LED itself on the under side.*

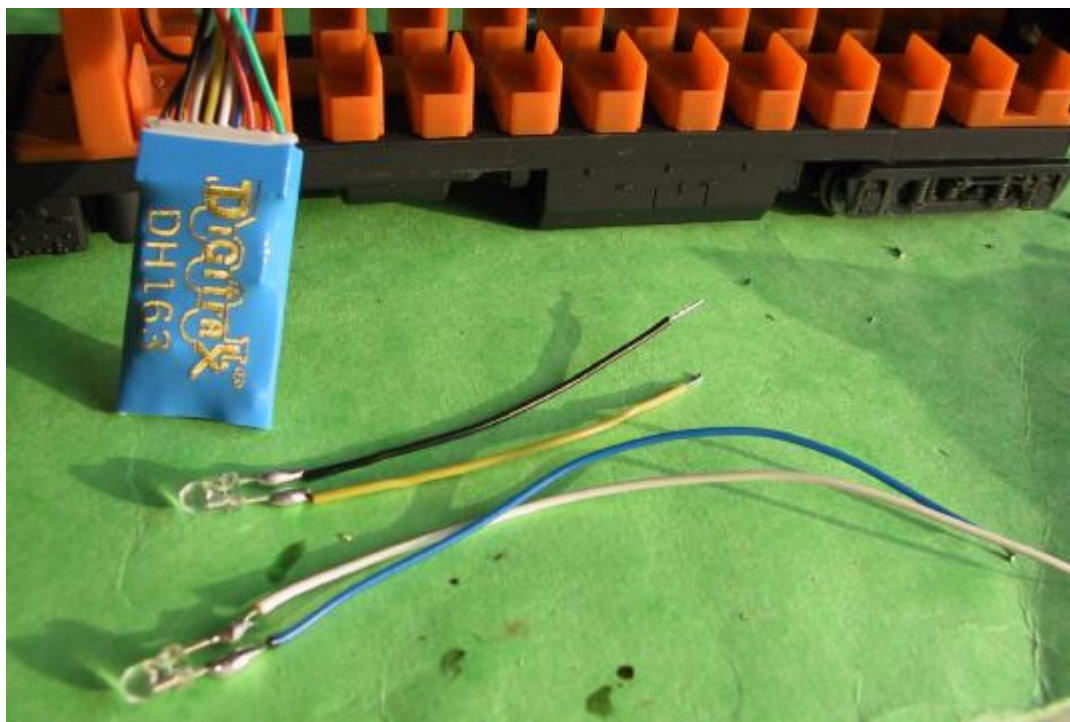


Next up, we need to prepare the white LEDs for installation. To do this we need to first shorten the pins of the LED itself, and then to attach flexible wires to them. I cut the LED's pins off just beyond the broader tabs approximately .5 inch (1.25 cm) out from the LED itself. I found that the tails trimmed from the DCC decoder harness were suitable for the flexible cables - they were reasonably small diameter and multi-strand. I cut these to length (two longer ones for the motor end, and two shorter ones for the other end), removed the plastic sleeving and tinned the ends with solder as before. Again this has to be able to pass through the drilled holes in the circuit board, so use a minimum of solder. I then soldered the wires against the broader tabs on the LED - when connecting to the LED, be very careful not to overheat it with the soldering iron. Just a very quick touch to the solder above the contact

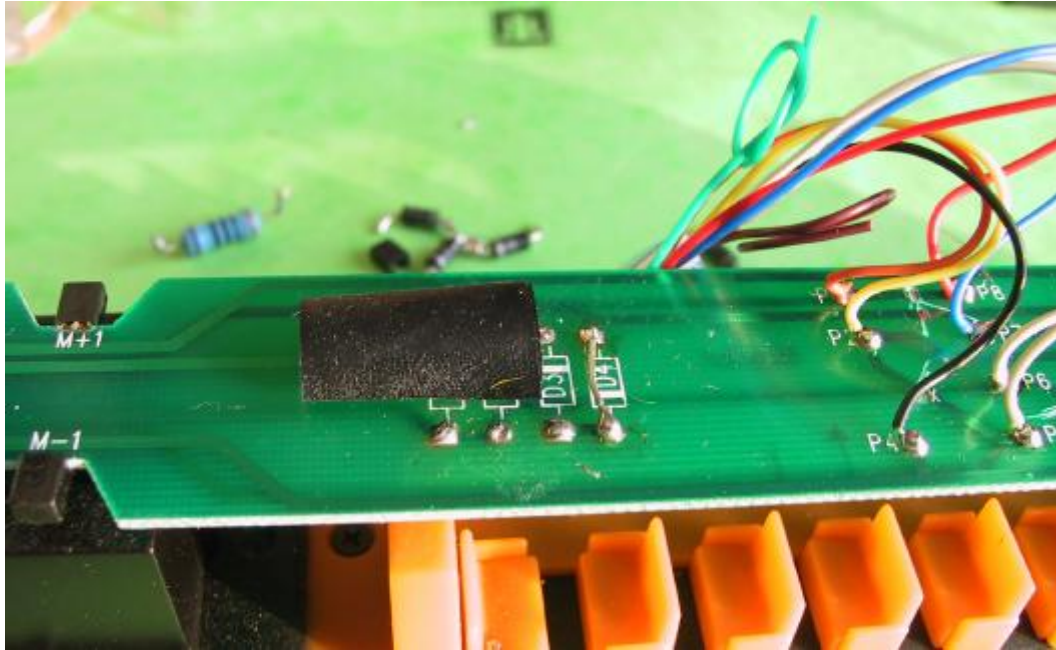
should drop a suitable blob onto the contact to make it permanent. I used the thin nosed pliers lying on the worktop with their jaws loosely gripping the LED to stop it from rolling while soldering the wires on.



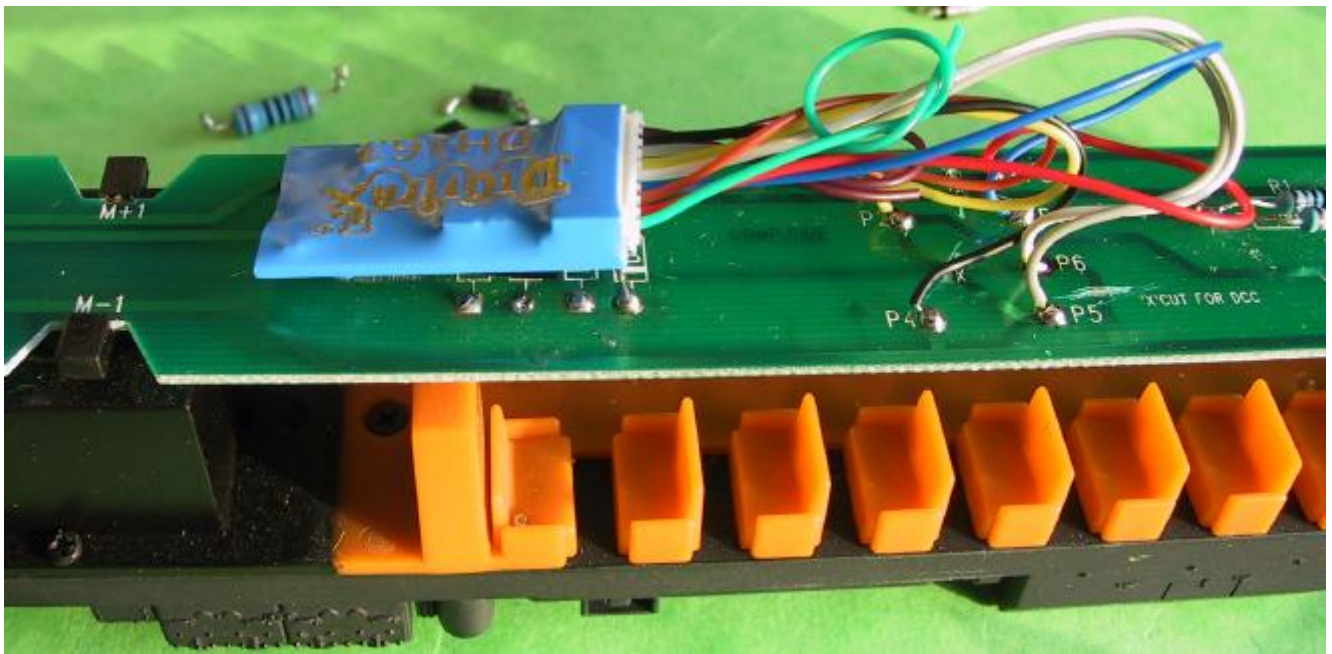
The RDC3 lighting instructions will be completed shortly - sorry I repeated the procedure for the other end LED, but with significantly shorter cables. I did not actually connect the LEDs at this point, but I did hold them up to their position to check the leads were the right length. Once done, I connected the DCC decoder to the wiring harness as shown below.



Finally I made a roll of insulating tape to attach the DCC decoder onto the printed circuit board, although you could use a short bit of double sided tape if you have some. I installed it over the D1-D4 diode area on the printed circuit board.

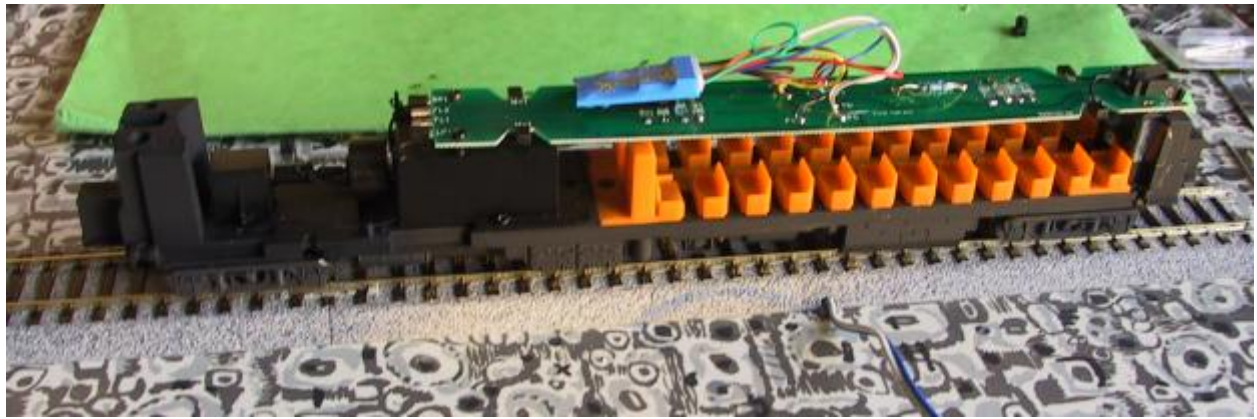


Press down firmly on the decoder to make the tape stick, and you have the conversion almost complete.



Step 5: Testing the Decoder and Installation.

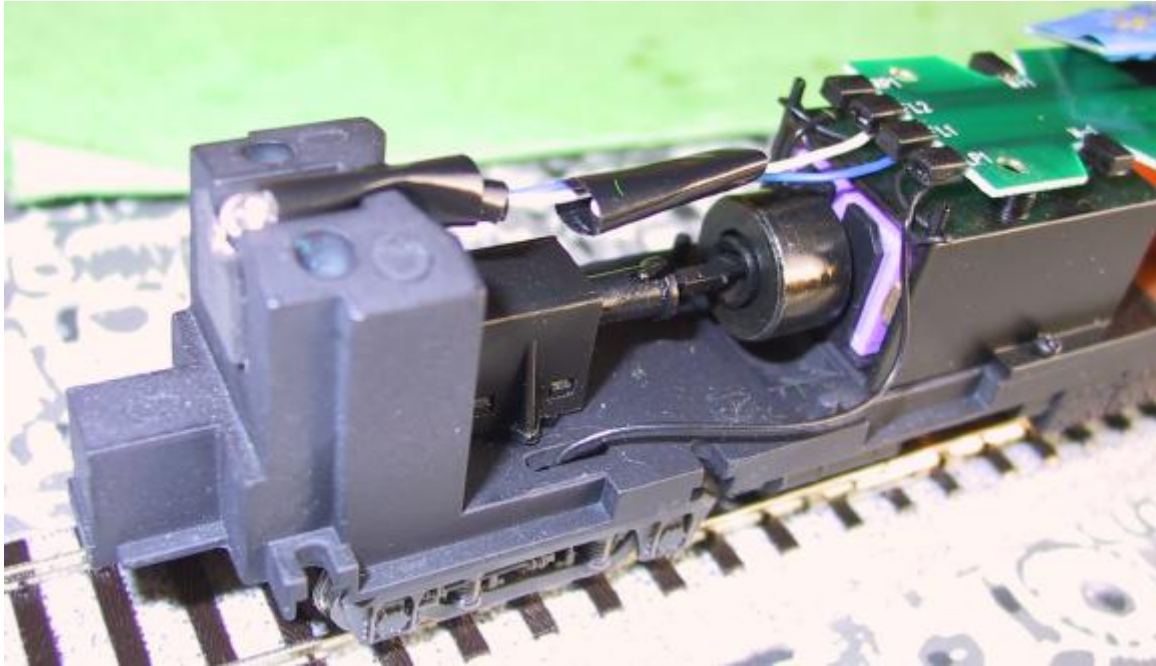
To make sure that nothing has gone wrong, we now need to test the locomotive. For safety's sake, it's best to use the DCC programming track for the first tests since this is much lower voltage than the running track and is less likely to cause damage if something is not wired correctly or is short circuiting. So place the loco onto the programming track and set the DCC controller into programming mode.



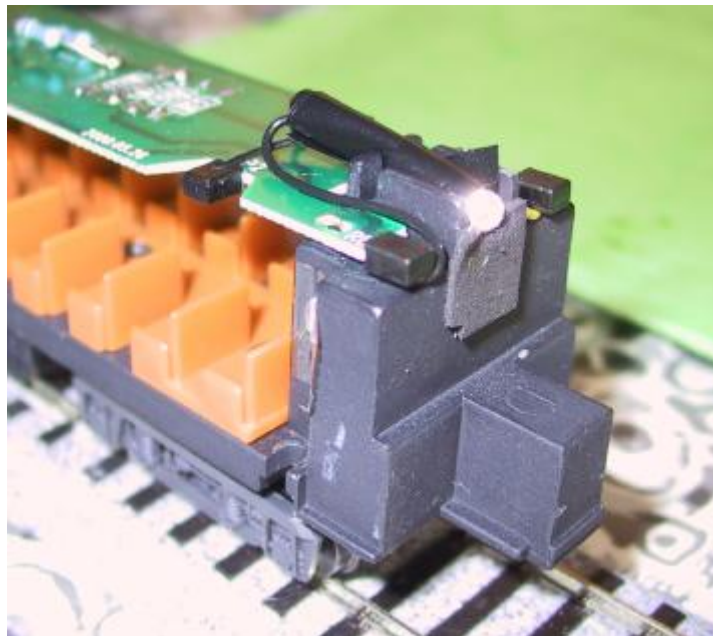
First step - read back the value in Register 1 (locomotive address) - this should show up as either 03 (normal default) or 01 (seen this as a default too) depending on the decoder. If this times out or produces any other error, do not proceed further. Check the locomotive is properly on the track, check the connections to the DCC decoder, check the cuts to the circuit board, check all the connections between the circuit boards and other components (motor, track pickups, etc). You must be able to read that register 1 before proceeding any further. If you can't, you may have faulty decoder, or there may be something wrong with the locomotive or modification. At this point seek professional help; moving it to a running track "just to try it" is a really bad move if it isn't working on the programming track and may cause serious damage.

Once you can read register 1, try reading registers 3 and 4 as well - their values may well be zero. If all three check out fine, then you can proceed to the next step. I normally then program the loco address (R1) and a basic acceleration (R3) and deceleration (R4) value. For this loco, since it's road number is 6101 I'd decided to set it's (short) address to 01, so I programmed register 1 with value 1. I then read back register 1 and it had value 1 instead of the original value 3 (default). I then set register 3 (acceleration) to 2, and register 4 (deceleration) also to 2. I then read back all three values to check that the changes had stuck.

Once you are completely happy that you can read and set the values on the programming track, it should be ok to move the loco to a running track. Once on the running track, check it moves when commanded to do so at the address you just assigned it on the programming track. Once you've determined which way it is currently moving, enable the headlights (function F0). Then touch the wires from the LED to the contacts to determine which way round lights the LED. Once you've found that out, remove the chassis from the track and install the LED. To do so wrap a piece of insulating tape around first only one pin of the LED and then on the second time round, round both pins. This will serve both insulate the two pins from each other, and to protect both of them and their connections. Connect the LED up to the two terminals, using the plastic sleeve (plugs) to make the connection. Slide the LED into the housing for it, masking it to direct the light in the right direction with a little more insulating tape if desired. Once installed, return the locomotive chassis to the track and check it lights.



Now reverse the direction of the locomotive and repeat the steps for the other headlight. Once you're happy with this, remember to secure the circuit board once again with the screws you removed earlier.



Step 6: Reassembly and final testing.

The conversion is now almost complete - gently re-attach the body shell to the chassis and check that everything still works. In particular, make sure that none of the wires foul the body.



Once you've checked it all works, re-install the four screws that hold the body shell in place; self tappers with sharp tips in the two where the heads remain visible; the two with blunt ends deep in the recessed holes. Then reattach the couplers; onto the chassis the assembly order is: U-shaped holder first with it's flat side to the chassis; brass spring plate next, then the coupler itself, then the cover plate. Then the black bolt-like screw goes through the lot. I found the easiest way was to pre-assemble the first four components and slip them in from the end and then push the screw through the assembled sandwich and screw into place. Do not screw so tight as to foul the free motion of the coupler itself.

Once re-assembled, run the locomotive again to test it. Enjoy your DCC equipped Budd car!



Your comments and feedback on these instructions would be appreciated.

Please send feedback to: [Bevis King](#)

[Back to DCC Index Page](#)