Fitting a Hornby 4 Function Decoder and a PCB Lighting Board to a Hornby Inter City 125 (HST)

The lighting board is made by Black Cat Technology

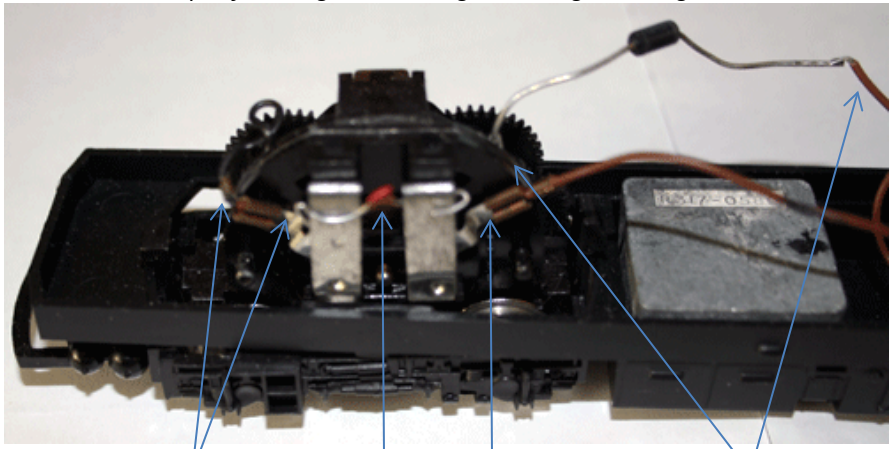
After searching the web for instructions to fit a Hornby decoder to my locos from the eighties I became rather disgruntled at the lack of any decent instructions and associated pictures to help me learn how to do this for myself. The intention at the outset was merely to fit a decoder to my Inter City 125 HST motor unit and dummy car. I didn't even think about changing the bulb in either unit until I found, on eBay, a PCB made by Black Cat Technology where the two bulbs would be replaced by two PCB's thus giving bi-directional lighting by adding the two 4 function decoders (R8249) and removing the original bulbs. However, it still took a trip to a very good model shop to ask a guy how to go about the rewiring for the pickups and motor etc. Once I understood the schematics I finally took the plunge and bought a new 12W soldering iron (from Weller) with a fine tip (included) as others would give up too much solder when tinning the wires etc. and of course would be too hot. Wire strippers are also a good tool for stripping back the sleeve on the wires you will cut. Also have a multimeter to hand (although not essential). Now we have the general background and the tools that are required for the job.

OK… here goes. I'll try to give as precise instructions as possible and will include pictures so you can actually see what's going on at each step. The loco's motor is a three pole Ringfield type that has no screws feeding through from the brushes to the motor so no isolation was required. I will cover isolation later. The service sheet required (if you prefer) is linked to here: http://www.hornbyguide.com/item_details.asp?itemid=73
This is an excellent site for all Hornby catalogued items, and some uncatalogued, over many years and still growing! Great resource.

Step 1

Picture 1: First of all you must remove the body of the loco from the chassis and once done you will be presented with the following:

Picture 2: Close-ups of the bogies show original wiring: rear bogie – motor unit



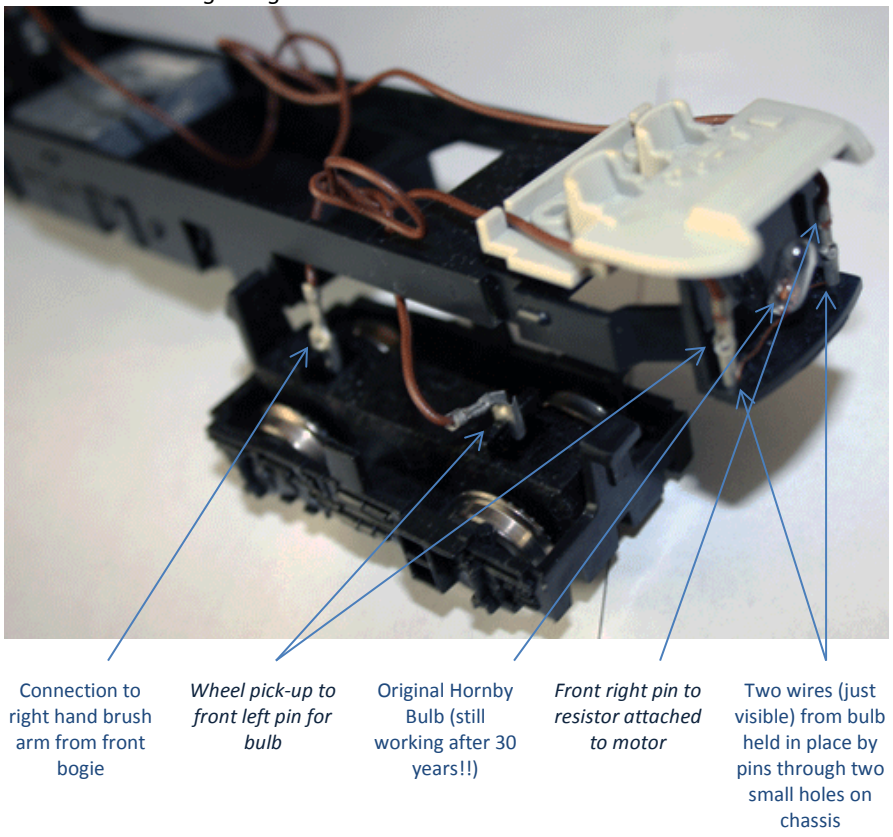
Short cable from motor to left hand brush arm

Capacitor to be removed

Connection to right hand brush arm from front bogie

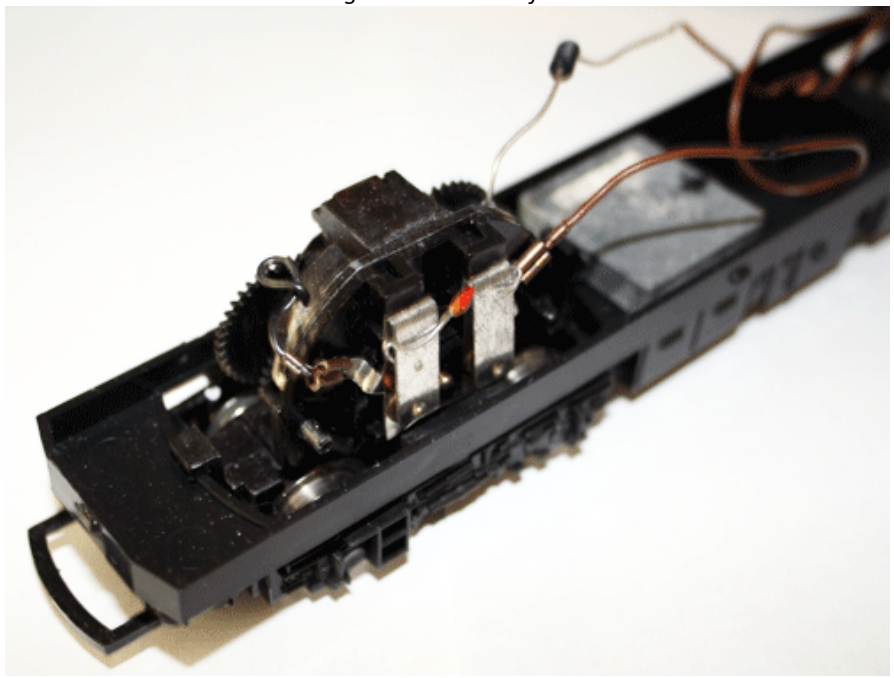
Resistor connection to motor from front bogie for bulb

Picture 3: Front bogie - light bulb



Although I have shown this original wiring none of it is important when connecting the decoder and PCB except to say you will disconnect all this and need to cut the wires to length for later use. You may refer back to these images to convert back to DC if you wish later on.

Picture 4: A clearer shot showing the short cable from motor to brush arm



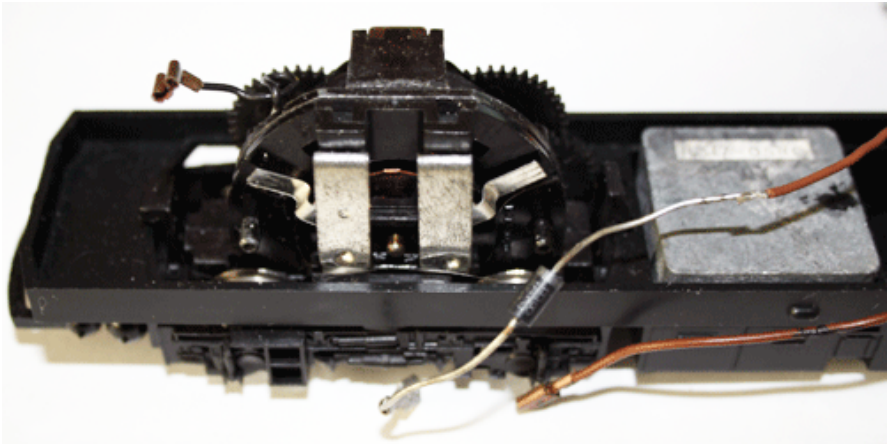
Step 2

At this stage it is important to know that your engine is running smoothly. Carry out a test run if you are not sure. Once you are happy that the motor is running smoothly you can confidently begin to take on the rest of the necessary steps for conversion. If the loco is not running smoothly at this stage then you need to sort it out as fitting a decoder will NOT fix any running issues.

Step 3

Disconnect all the cables from the motor and carefully remove the capacitor. You will not need this for reconnection later so store it away if you wish. Now will be a good time to give everything a very good clean out (unless you did that under step 2…) and it will be well worth just adding a little oil to the motor at the usual points. *Debate:* Some folk say never use this, that or the other type of oil because of damage to the plastics or motor. I have used small dabs of 3-in-1 oil for years and had no problems whatsoever. You choose your own as per your preferences. Be very sparing when using any oil of course as too much is no good at all – the oil should not 'run' after applying.

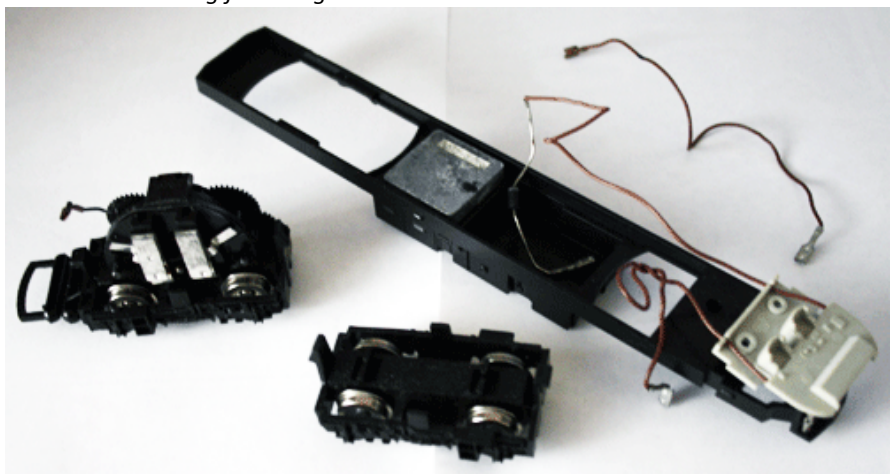
Picture 5: All cables removed bar the small one attached to the motor. A connection to the end of this cable may be made by soldering another cable later on but I removed it



Step 4

Remove the cables and bulb from the front bogie. The picture shows them attached so you need to lift the cables from the top of the cab/seating area where they are slotted into two cut slits in the rear of this piece. Lift away the part altogether to reveal the cables slotted into two small holes which hold the wires for the bulb. Gently pull up each pin to free the wires and the bulb which should be easily removed now. The bulb is no longer used so store it away.

Picture 6: Removing front bogie cables etc



You should now have both bogies removed from the chassis and no wires attached (except maybe from personal choice (see Picture 5)) and no bulb still in place. Now we get to test the motor to check for connections from the brushes to the motor.

Step 5

If you have the same motor as shown in my example you will have no need to test for this if you remove all wires successfully. But it's better to check anyway. You will need a multimeter to do this effectively. Have the motor checked by a person in the know if you don't own one of these or don't know what you're doing. The picture shows my digital multimeter at the required settings to check this out.

Picture 7: Multimeter settings to check motor readings

As you can see the cables are plugged into the relevant sockets on the unit (common = black, marked COM and OHMS = red, marked Ω) – although I inadvertently blocked these symbols off in the picture!

The dial should be turned to the right of the Ω marker and set to 200K. When switched on the unit will show '1' in the display. While switched on hold the plastic on each pin and then allow both needles to touch each other. The reading should drop to '0.00' and this is not what you want to see when you eventually test the motor. Effectively what you have done here is create a short circuit. You should always have the figure on the readout stay as '1' (when testing the motor) so you know there is no short.

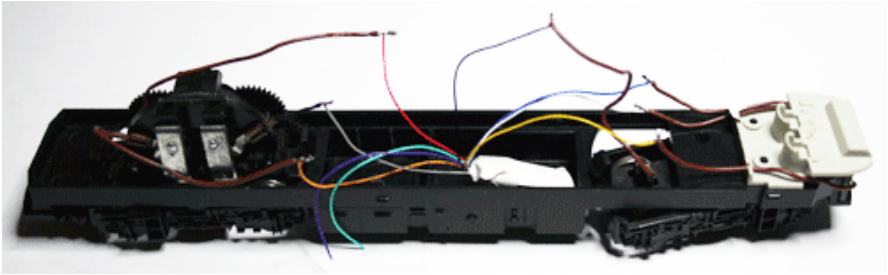
Test the motor by touching one of the needles to the left brush arm and the other to the motor housing (metal area – connecting to plastic obviously will not work). Check the reading. Move the needle from the brush arm to the wheels on the brush side leaving the other needle on the motor. Check reading. Repeat for other wheel on same side! Now check the other brush arm and motor. If all readings remain unchanged you can go ahead with the rest of this procedure. If you get a reading of '0.00' at any point then STOP and remove the problem causing the short. It may be a pin going from the brush side through to the motor (it won't be the brushes themselves). DO NOT proceed if this situation exists unless you want to blow a decoder and spend more money replacing it so seek advice if unsure. It would be a little foolish to try and source all problems here but an expert near you will help out if you aren't sure. I will add that if the motor has two screws attaching the brushes to the motor then removing the left hand one and

replacing it with a nylon screw will help somewhat – even a shorter metal screw will do as long as it does not go through and retouch the motor side. There are other ways to sort out the problem here so check some forums maybe for advice on that one. Recheck connections again with the multimeter. I cannot stress this enough.

Once you are sure you have no issues with the motor and no shorts then continue to step 6.

Step 6

Picture 8: Decoder attached



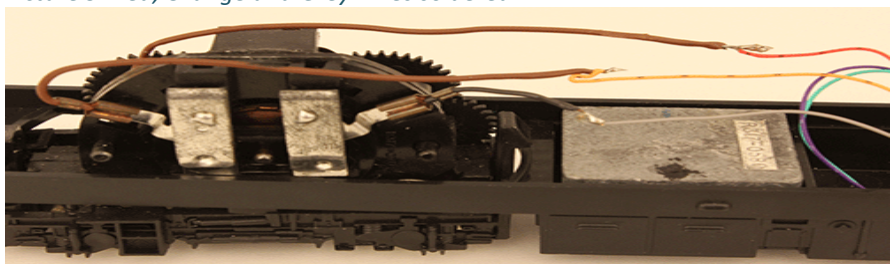
As you can see from the picture above the decoder is attached already - as is the PCB. The decoder has been enclosed in good electrician's tape with the black sleeve inside (a temporary measure - the sticky side does not touch the chip at all as I reversed the tape and then wrapped it up as you would normally afterward). Again the choice is yours here. You can leave it unwrapped if no metal or soldered joins touch it (although not recommended) or, better still, wrap it in the black sleeve supplied with a DCC ready engine and then heat shrink the tubing. There are videos on YT to show you how. You choose which way to do this to suit your own preferences. All soldered joints MUST be insulated though of course as this will cause severe problems if any of them touch when running the loco. Goodbye decoder! While testing, I used electrician's tape but removed it all when the loco worked as it should.

Step 6a

The wiring of the motorised car isn't too hard to achieve and overall there are 10 solder points on this example. Depending upon the wire lengths you use it may be less. I actually reused the wiring from the original and cut it to length to suit the job. One word of caution here... do not overcut the lengths as you will need to leave some slack for the bogies to move side to side during operations and also so the soldered joins do not pull apart.

From Picture 8 you should be able to gauge the lengths of brown wire quite easily from both bogies. The original clamps that were attached to the motor are used again here to save soldering. The contacts are excellent so there was no need to alter anything. The pins that were originally fitted to the front of the chassis near the cab area to hold the wiring for the lights have been removed altogether. When the PCB is fitted all wires to it are soldered.

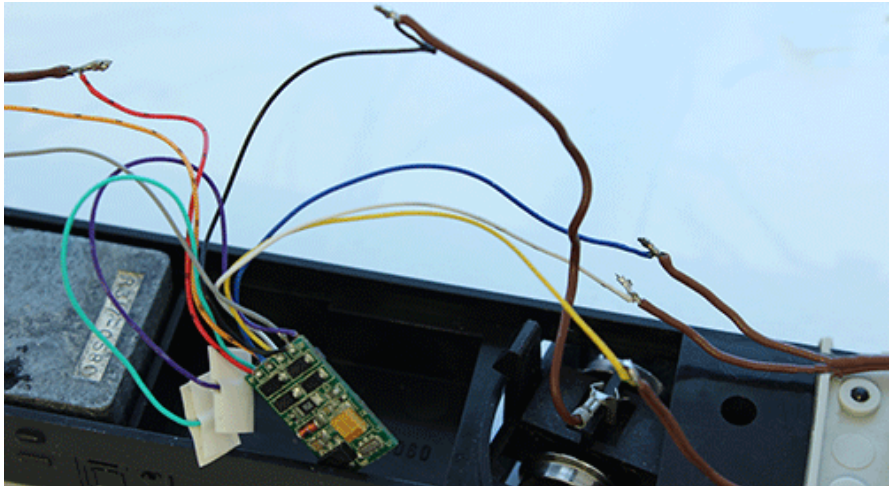
Picture 9: Red, Orange and Grey wires soldered



As in Picture 9, the red wire from the decoder goes to the rear centre motor connector nearest the rearmost cog; the orange wire is attached to the left brush arm of the motor unit and the grey to the rightmost brush arm of the motor unit. Once again I have done a temporary job, with the soldering this time, just to make sure it all works before making it all tidy so do forgive the rather bad looking soldering.

The left and right brush connections can be soldered directly to the arms or plates if you wish to. You can see where solder has been added to the plates to emphasise where I mean.

Picture 10: Yellow, White, Blue and Black wires soldered

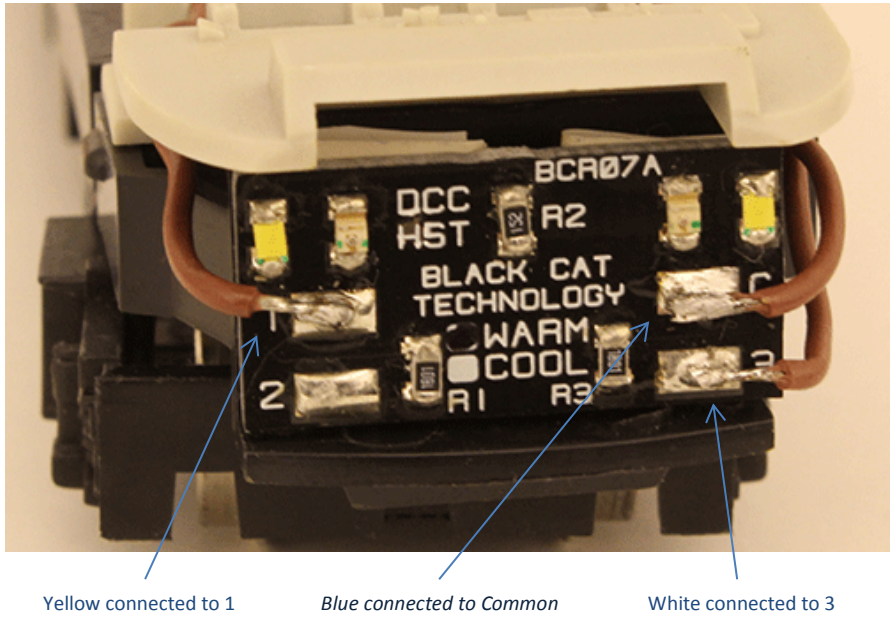


I removed the tape etc from the decoder to show this, Picture 10, and subsequent pictures more clearly. You will note the green and purple wires are not used and are temporarily taped off ready for testing.

The black wire is connected to the front bogie pickup (soldered to the brown extension of course), the yellow wire is soldered to the wire connected to the PCB position number 1. The white wire is connected to position number 3 and the blue wire to position C which is the Common connection.

Step 6b

Picture 11: Yellow to 1, White to 3, Blue to C



OK... this is the first time you have seen the main PCB that does this wonderful work for your loco. How is it fitted and what's what?

The PCB is fitted with a double sided sticky pad, simple as that. Oh and NO modifications are required to the loco at all! Great news.

So, there are four connections on the board numbered 1, 2 and 3 plus one lettered C. The easy one first: C, this is the Common which should always be wired up to the BLUE decoder wire which is the positive connection from said decoder.

Connection 2 gives you the left headlight and connection 3 gives the right headlight (forward direction). The WHITE wire from the decoder is connected to one of these terminals. A little research will tell you which was lit during day and night running. If BOTH headlights are required to be lit then extend and connect the WHITE wire to both terminals.

Connection 1 gives the rear tail lights and is connected to the YELLOW wire from the decoder.

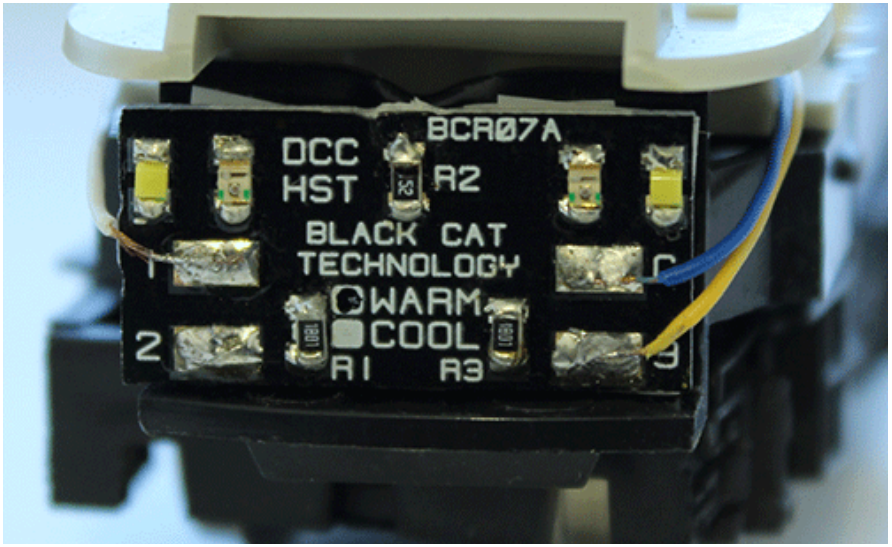
IF you decide to use only one decoder in the main car and not use a second in the dummy car (and I cannot see why you should then think about how you would wire it up) and you only wanted forward lighting you would leave off the connection to number 1.

If you use a second decoder and place that into the dummy car you will no doubt use directional lighting. I will come to that further on.

Back to the PCB... there are three resistors which are marked R1, R2 and R3 which control the output to the LED's. The other four parts to the PCB are the LED's and are on the upper line of the board and paired to the outer edges of it. The outer two give a warm white light and the inner two give the red lights. So that's nice and simple.

Step 6c

Picture 12: Yellow to 3, White to 1, Blue to C

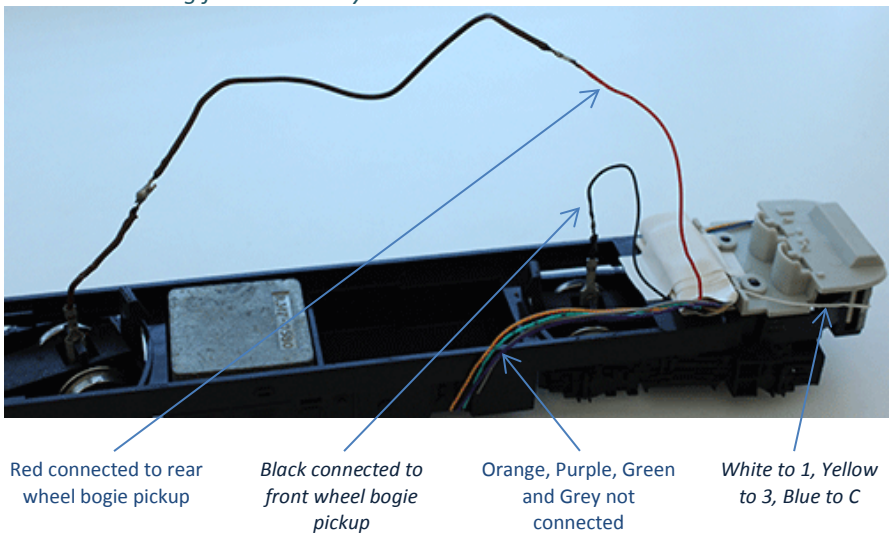


Note that Picture 12 is of the dummy car and that no extensions to the decoder wires were required and subsequently you can make out the colours of the cables to the correct connections on the PCB. REMEMBER, that on the motorised car the YELLOW and WHITE wires are reversed in order to obtain directional lighting.

Important: BOTH decoders should be numbered exactly the same when programming them if directional lighting is to work correctly with the Elite or other control unit.

Step 7

Picture 13: Wiring for the dummy car



Scavenged wiring from the original in the dummy car in Picture 13 again shows how you can use the original connectors instead of soldering wires to the bogies. The choice is entirely yours as to the best way to achieve connections. I later used better wire with less soldering but this gives you the idea.

I have wrapped the decoder in electricians tape for testing and because I had no more heat shrink tubing left. That has now been removed! The decoder is taped to the chassis near the cab area so the shorter decoder wires can reach around to the solder points on the PCB although you can use extensions to fit the decoder in the well space of the chassis.

The RED wire is connected to the rear wheel bogie pickup and the BLACK to the front wheel bogie pickup. The BLUE is soldered to C (common) on the PCB while YELLOW is soldered to 3 and WHITE to 1. Remember this is the opposite of the YELLOW and WHITE for the motorised car so you will get directional lighting.

The ORANGE, GREY, PURPLE and GREEN wires are not used in the dummy car.

As in the motorised car if BOTH headlights are required to be lit then extend and connect the YELLOW wire this time to both terminals (2 and 3) for the dummy car. (I have not attempted to wire both lights up in this way so if it doesn't work out there will be a way to do it. However, I am confident it will.)

Step 8

Picture 14: White LED left light

Picture 15: Red LED rear lights

When you look at these pictures, 14 and 15, you might think the LED's are not giving out what they should. Well, having done photography courses with professionals I can tell you it is very difficult to get LED's to show correct light and colour without

making a lot of adjustments and testing lighting conditions so I just give a basic shot here to show them working.

The front white LED's appear to show both lights through the lens of the motorised car. The left light is on though the right side light is off. The camera sensors are picking up the extra light through the lens but when the eye looks at this same arrangement the light only appears from the left light.

The same goes for the rear red LED's. The camera picks up the actual LED red and the sensors show it as almost white. The red blurring around the red LED is not visible with the human eye but the actual red LED when seen is very nice.

When I thought about buying these boards the seller says light will emit from the whole plastic lens in both the front and rear cars although I do not experience this at all. If you do however, it is a simple process of removing the lens and putting something in place to block the extra light. I don't think many of you will have to do this though.

My overall opinion? Well, for a cost of £5 for each board (price correct at time of writing (June 2013)) I find that overall the experience of modifying my 80's 125 was a very good one and that the boards work extremely well. I would recommend this to anyone but as is always the case I cannot be held responsible for anything going wrong during your own fitting of these boards, decoders or wiring.

Now, if only the boards were available for the Class 91 GNER loco and dummy vehicle...