

## Tip: 2670 Set Locomotive with 60903 Conversion and LED Lighting

Date: 20-10-2013, 15-10-2017, New 16-01-2024

Hi All,

15-10-2017 [Coach LED Light Upgrade](#) for this 2670 Set

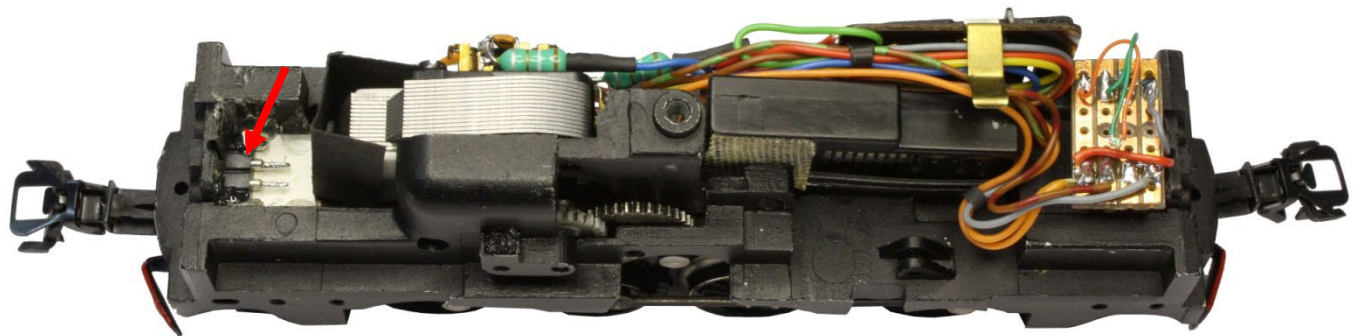
At long last I've had some time to update my records on the 60903 conversion of the 2670 Electric locomotive from the Swedish State Wooden Set using a 60902 decoder. I wanted to maintain the original look of the locomotive on the outside but improve the lighting effects by using LED lighting to complete the project. The results proved worthwhile after much trial and error with the lighting effects.



The photo above shows cabin lights on at both ends of the locomotive.

**Warning:** - You undertake the following modifications at your own risk.

The motor conversion was straight forward. I cleaned the motor block and ensured that the new motor would turn freely when assembled. After lubricating the engine with oil I was ready for the next stage.



At each end of the locomotive I removed the light bulb electrical connection by drilling out the mounting rivets. The plastic detail stairs etc were carefully removed at four locations to avoid breaking the items while I was working on the locomotive.

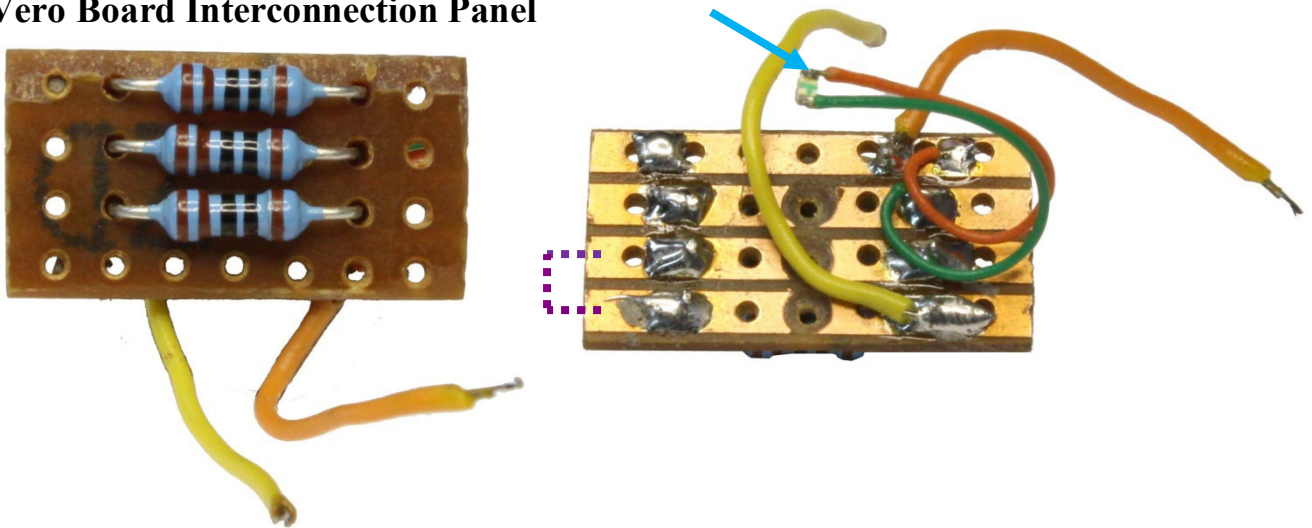
The red arrow shows two turned IC pins to be used as sockets for the main LED light. The white material in the same area is plastic insulating material which I used to pack under the sockets to make them central in the original light bulb hole. This was done for both ends of the locomotive. All items were glued in place with hot melt glue.

The right hand end shows a small Vero board interconnection panel for all the LED connections and the mounting of the current limiting resistors. This is required for both ends of the locomotive.

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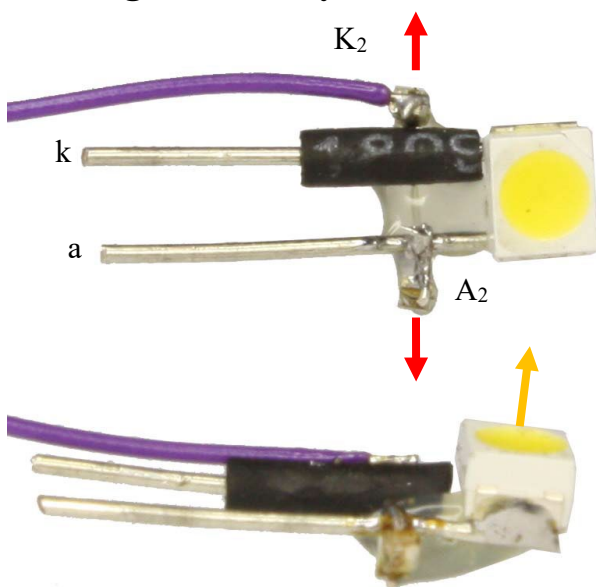
### Vero Board Interconnection Panel



Two interconnection Vero boards (4 foils x 7 holes each) as above are required. All resistor values are 1k. The first resistor is for the warm white LED main lights. The second resistor is for the red LEDs (two in series) at the other end of the locomotive and the last resistor is for the cabin light shown by the blue arrow. Note that the foils under the resistors have been cut using a 3mm drill.

The violet dotted line shows where a wire link is required for the front and red tail lights common connection (grey or yellow) to the decoder for the F0 function. (See wiring diagram)

### LED Light Assembly



First, I soldered cut off resistor leads to the warm white PLCC type LED as shown.

Next, I soldered a thin solid wire across two ends of the 0603 red LEDs (k to a) and another solid wire at the other ends of the LEDs (a to k) this formed a small rectangle shape which I threaded on the (a) and (k) of the warm white LED making sure that the (A<sub>2</sub>) anode of the 0603 LED connected to the (a) anode. The position of the red LEDs is about 2mm behind the white LED and point in the direction of the red arrows.

The A<sub>2</sub> connection was soldered onto the (a) lead and the remaining lead across to K<sub>2</sub> was removed.

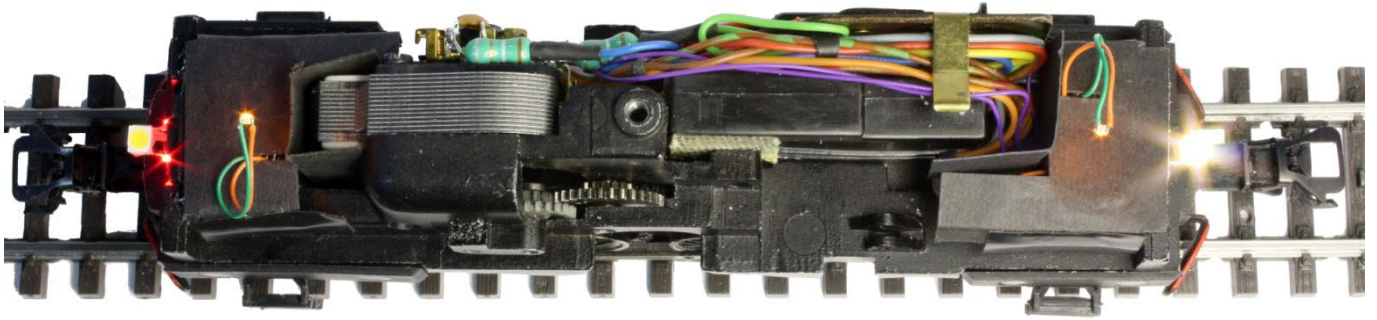
The violet wire is soldered to the K<sub>2</sub> cathode of the red LED and should be longer than the locomotive.

I pre-shrunk some heat-shrink and slid it onto the (k) lead as shown. This is to stop the bottom wire across the red LEDs from shorting. The last step is to add some hot melt glue as shown to provide strength and further insulation.

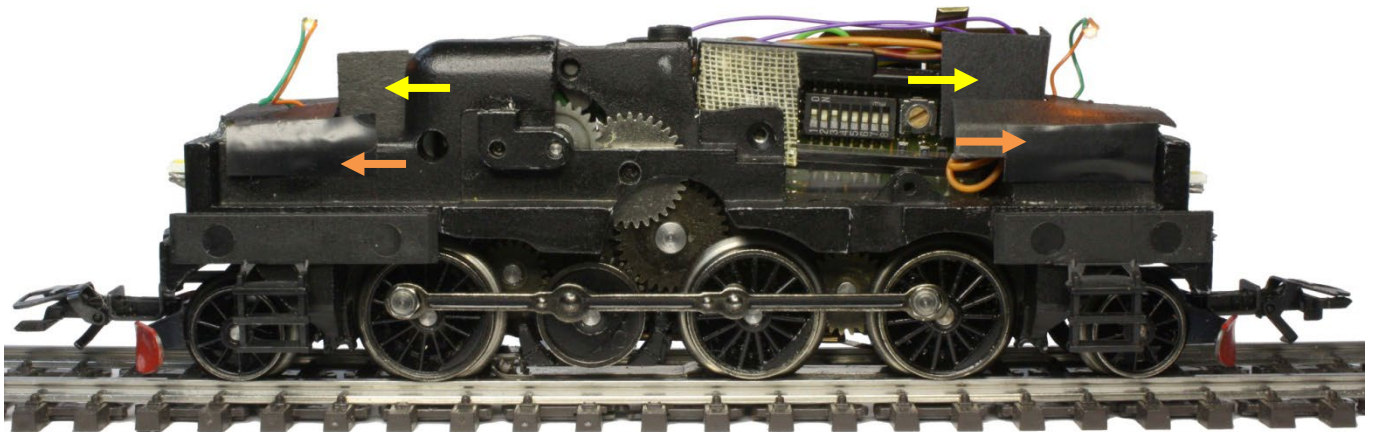
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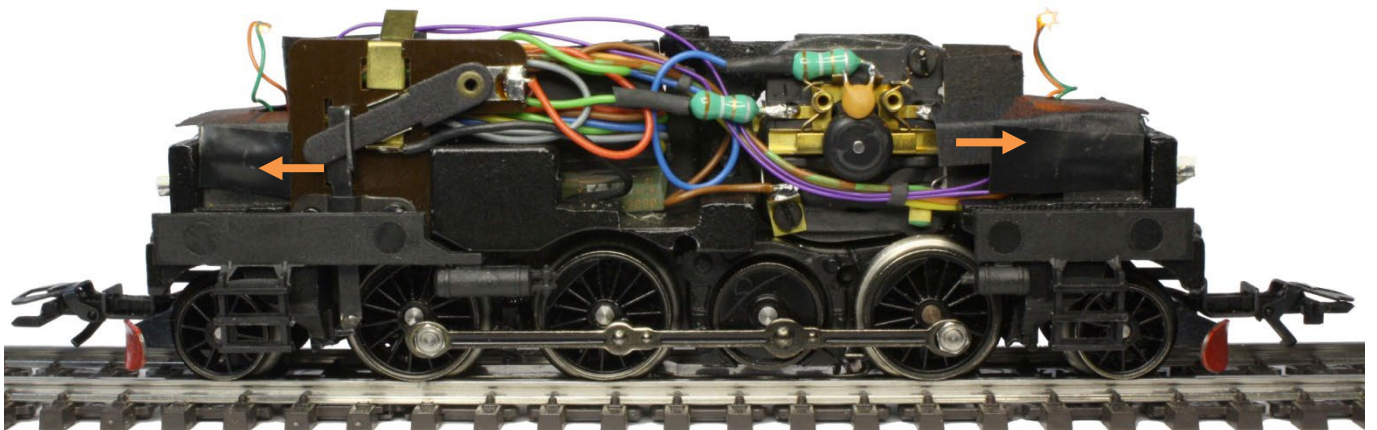
### General Views



The top view shows the red LEDs on the left and the main warm white LED on the right for the forward direction. The cabin lights are on and you will notice I have covered the Vero board with thin black card at both ends.



The side views show the height of the cabin LEDs and there is also thin black card at the positions with the yellow arrows.

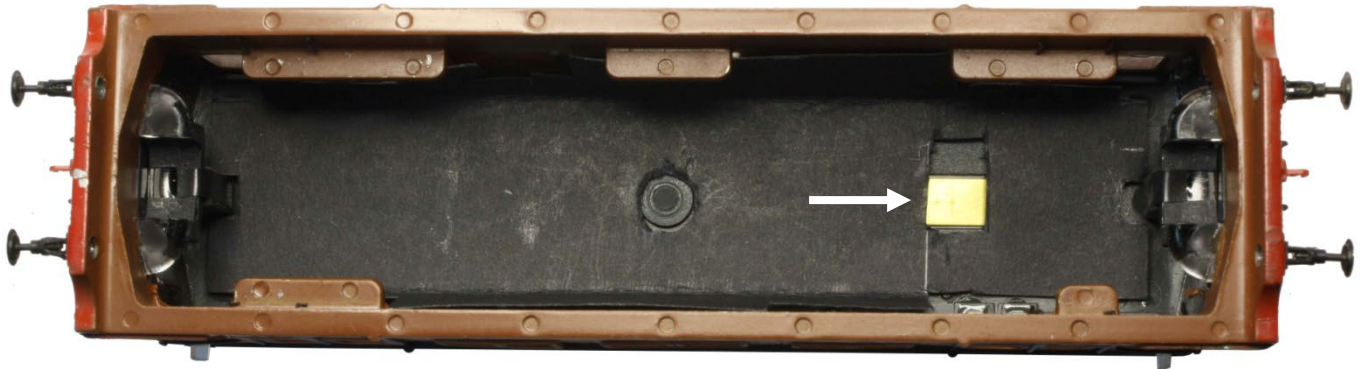


In the two side views above, the masking card is held in position by black tape (See orange arrows).

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### Locomotive Body Shell



In the body shell I used thin black card for further masking of the middle windows on both sides and insulation of the pantograph electrical connections and the cabin light LEDs. I provided a small square cut out (white arrow) for the pantograph power connection.

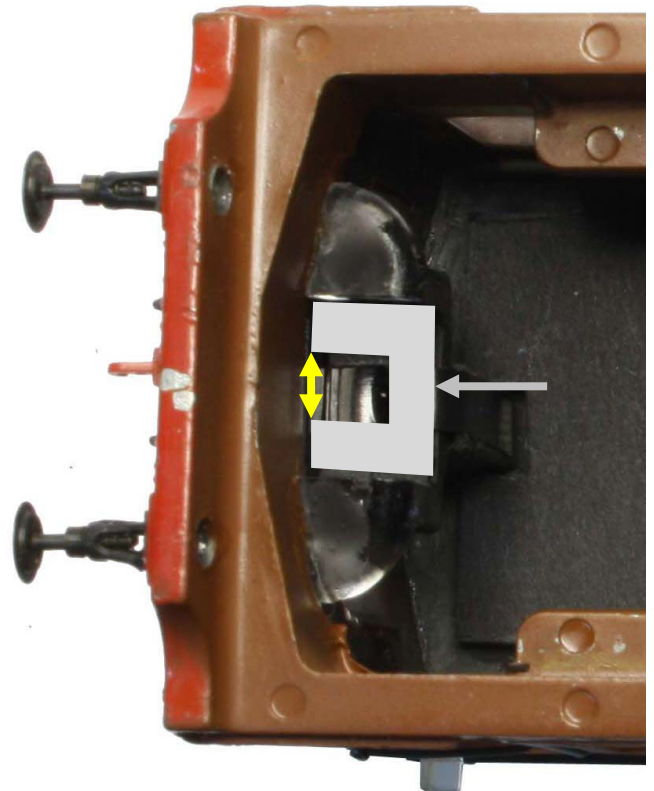
### Light Mask

On each light pipe I cut a thin black card mask (shown in grey) that covers the bottom of the light pipe only. It is held in position with tape that can be removed.

This mask is the most important mask as it stops the red-light bleeding into the top central light.

The width of the mask at the grey arrow side is approx. 2mm wide and requires adjustment if the red light bleeds into the central top light. This required a few goes to get it just right.

If you have a close look at the light pipe you will see a clear rectangle which goes up to the central light. The yellow arrow shows that the mask should match this portion of the light pipe rectangle size. The clear bit is where the warm white LED shines through.



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### Results



Left photo shows main lights with cabin light

Right photo shows rear lights with cabin light

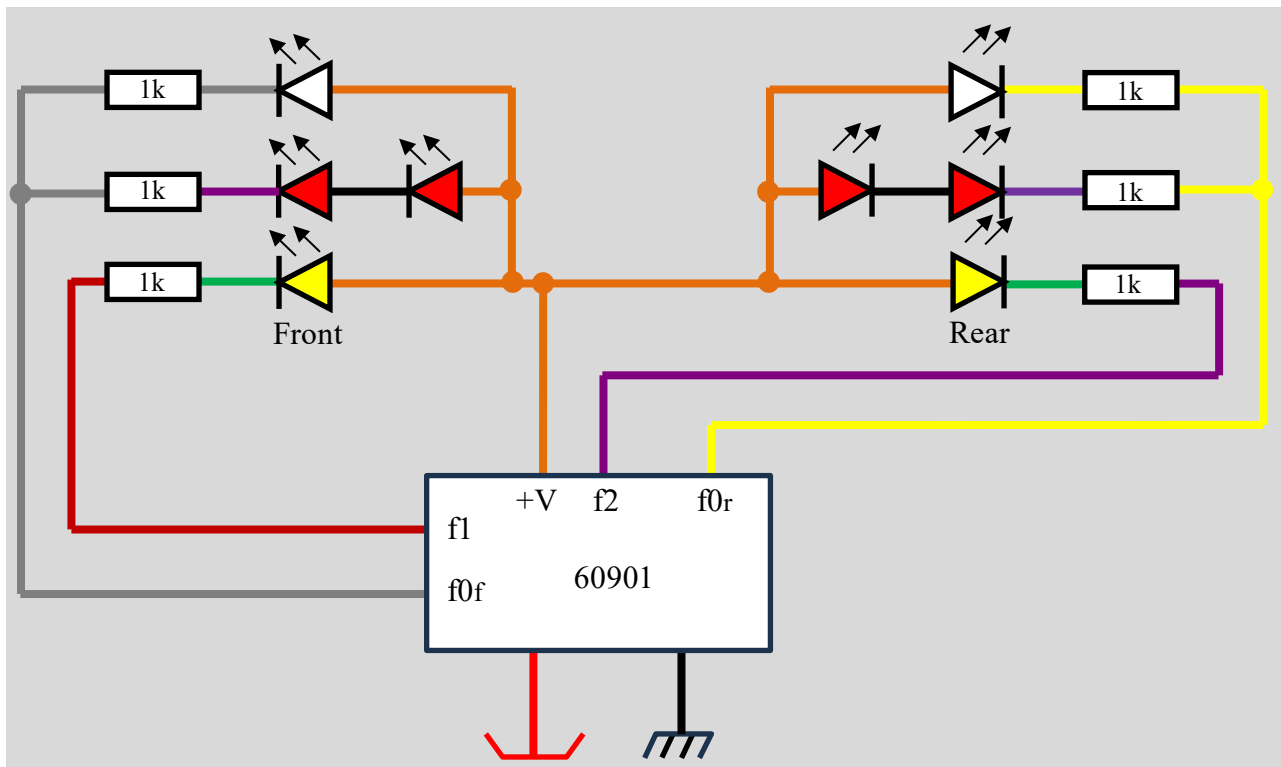


Side view with both cabin lights on

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## Schematic Diagram



Please note that the red LEDs are at the opposite end of the locomotive to the white LEDs

I used the mechanical parts of a Märklin 60903 conversion kit.

| Part Number | Description      | Quantity |
|-------------|------------------|----------|
| 224615      | Magnet           | 1        |
| 224613      | Motor Shield     | 1        |
| 210888      | Armature 8 Teeth | 1        |
| 784820      | M2.5x12 screw    | 2        |
| 516520      | Choke 3.9uH      | 2        |
| 601460      | Brushes          | 2        |
| 60902       | Märklin Decoder  | 1        |

All original parts have been kept to allow someone to return the locomotive to its original state.

As always enjoy your model trains.