

How To Make A Basic DC Controller For Model Trains.

By John Rumming.

Welcome to another of my PDF how to documents. This one will cover a topic of a basic DC controller. There are a minimal amount of parts, so they can be easily fixed if anything goes wrong. They are also very easy to make, and once you have done one, you can knock up another in less than 30 minutes. Incorporated in this is a Bridge Rectifier so 12-16v AC or DC as the power in is not a problem.

The only part that I have ever had to replace is the 25 cent 2N2222 transistor. The centre off switch is not just for direction, but also just in case of an emergency. Also, make sure that the cable used below the controller is flexible, not rigid. I have done this project in a clear jiffy box for this PDF, but you can do them in any colour. The original and cheapest is the black one. I will also put a parts list and catalogue number on the last page. Also, any colour of LED will do, and I decided on a green one for this project. One word of warning: Do Not Use High Intensity LED'S!!!!!!



The parts list is as follows:

- **Diodes:**
 1. Small Bridge Rectifier
 2. Any 5mm LED
- **Transistors:**
 1. 2N2222 Transistor
 2. 2N3055 Transistor
- **Resistors:**
 1. 10k Ohm Resistor
 2. 470 Ohm Resistor
- **Miscellaneous:**
 1. Potentiometer Linear 1K (B1K Markings)
 2. Jiffy Box (54mm x 83mm x 30mm)
 3. DPDT Toggle Switch Center Off
 4. Knob
 5. Cable for power in/out (4 Core)
 6. Small spare bits of wire for linking up
 7. 2x nuts and bolts for mounting the TO3 Transistor
 8. 2 Small PCB sections for +ve and -ve (optional)
 9. LED Holder (optional)
 10. Heatsink for T03 (optional)

Tools Required:

- Drill and Drill bits
- Soldering Iron and Solder



Firstly you will need most of the parts. You will notice that some are optional, such as the 2 PCB pieces and the LED holder.



Drill the holes for the following items:

- Potentiometer
- Direction Switch
- LED &/or Holder
- 2N3055 Transistor
- Cable at bottom

Next, superglue the small PCB boards to the sides of the box. These will act as positive and negative pads. This will make it easy to solder them so they do not cross wires anytime.

In the next picture, you will see that I have added in a couple more copper PCB boards – these are for the power out to the tracks. These are optional as you can solder the wires directly to the direction switch. Also, there is the addition of the bridge rectifier with the positive leg touching the pad.



Place the cable through the hole you made at the bottom. I tie the cable in a knot to stop it from pulling out of the controller.

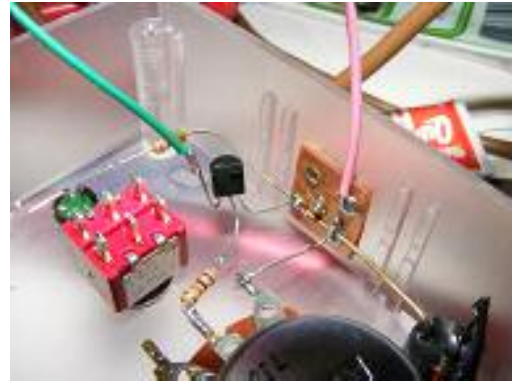
The colour codes I use for all my cables like this are:
 Red & Black – AC or DC power in.
 Blue & White – Power for tracks.



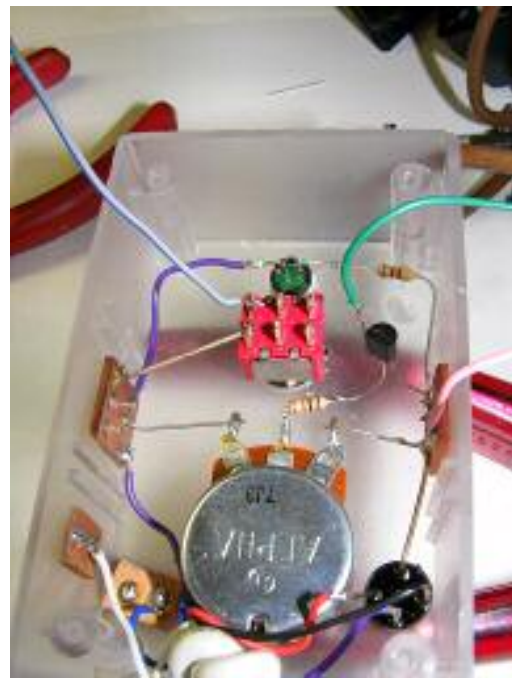
Next, connect the two resistors. The 470 Ohm goes to the LED positive lead and also to the positive pad. The 10K Ohm has its leads cut short for a reason and soldered to the middle line of the potentiometer. The leads are short because you have to turn it as soon as possible from the potentiometer towards the positive pad.



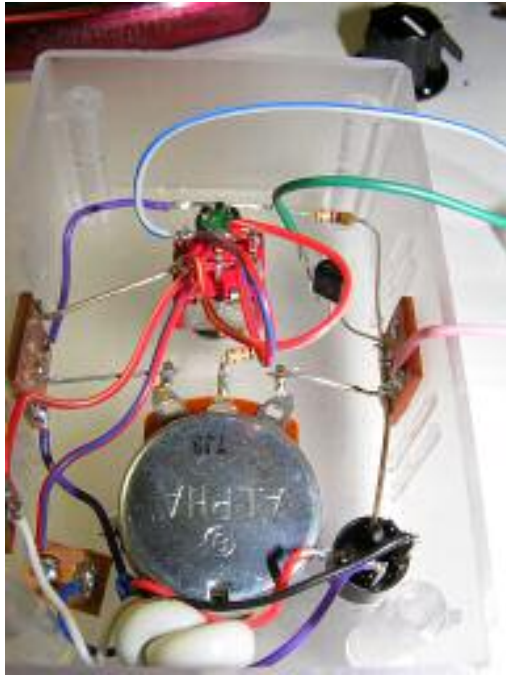
The 2N2222 resistor is next. The flat side is facing us at the moment, and the right leg goes straight for the positive pad. The middle leg goes to the 10k Ohm resistor from the potentiometer. The left leg is risen up so it can go to the 2N3055 Transistor on the back panel.



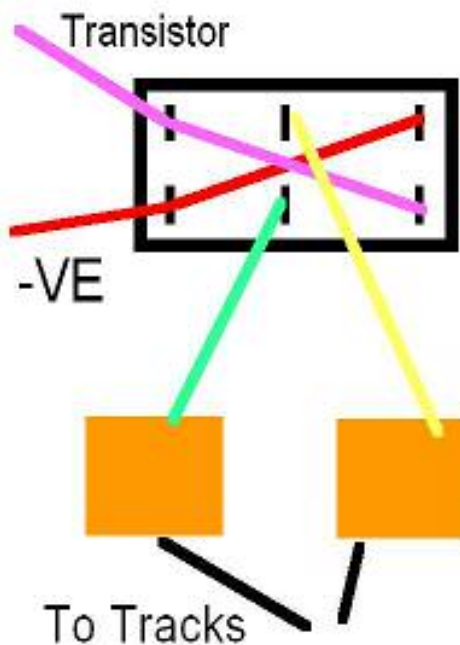
Here are the 2 of the flying leads need for the transistor on the back panel. One comes from the 2N2222 transistor and the other is straight from the positive lead. Also notice the connection between the right pin of the potentiometer and the positive pad.



Next is the negative pad on the other side. There are three connections to do here. One is from the negative pad to the left pin of the potentiometer. Another is from the negative pad to one side of the switch. The third one is to the other side of the LED up the top. The final one is another flying lead from the switch. This is the white lead with the blue stripe in the picture.

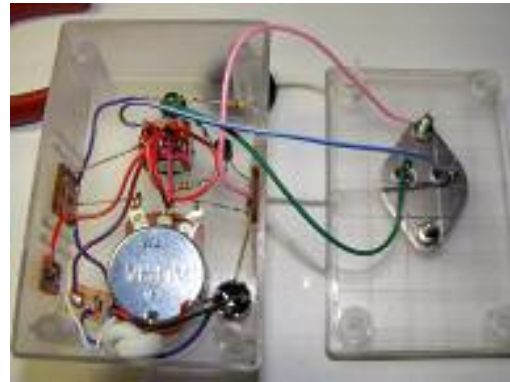


Now you will need to connect the two middle connectors of the switch to the solder pads you soldered earlier with the blue and white wires to.



You will also have to wire the opposite poles of the switch together as in the diagram above. I have used extra leads to do this, as if you cross over the bare wires as above, you will short it out.

It is a bit hard to see it in the picture above.



With the flying leads, connect them to the 2N3055 transistor on the back of the controller. The pink is from the positive pad and is connected using the bolts that hold the transistor to the panel. The green is going to the left leg of the small transistor. The blue is going to the switch.



Wire the controller to AC or DC 12v – 16v using the red and black wires. Get the white and blue wires and connect them to your track. Test it and off you go. You can make the cable as long as you like, or even mount the controller as a permanent fixture on your layout.

This controller works well for single loco's. If double heading or a bigger current draw is required, it may be advisable to mount a heat sink to the T03 at the back of the controller.

Troubleshooting:

- LED light not on
 1. LED put in the wrong way
 2. No power to unit – check connections
 3. Short

- Train runs slowly when controller in the off position
 1. Transistor on back wired wrong

- Train ‘runs away’ even when the controller is in the off or any position
 1. 2N2222 diode shorted out. Replace.

<u>Part</u>	<u>Dick Smith</u>	<u>Altronics</u>	<u>Jaycar</u>	<u>Radioshack*</u>
W04 Bridge Rectifier	Z3304	Z0073	ZR1304	276-1152
2N2222 Transistor	Z2069	Z1166	ZT2298	276-1617
2N3055 Transistor T03	Z1804	Z1174	ZT2300	276-2041
10k Ohm Resistor 1/4w	R0598	R7058	RR0596	271-1126
470 Ohm Resistor 1/4w	R0566	R7042	RR0564	271-1317
DPDT Centre Off Switch	P7682	S1365	ST0356	275-325
Potentiometer Linear 1K	R6915	R2202	RP3504	?
Cable 4 Core Flexible	?	W2341	WB1590	?
Jiffy Box	H5005	H0205	HB6016	270-1801
Knob	User Preference	User Preference	User Preference	User Preference
LED Holder 5mm	H1934	?	?	?

* Radioshack is for the American Market. The other 3 are Australian companies.

