DCC Passive 3ms Reverser Instructions

Description

The DCC Passive 3 millisecond Reverser is designed to automatic reversal of the DCC signal in a reverse loop or other application where reversing may be needed, such as on a turntable. Its small size makes it easier to hide under the track.

- The latching relay used provides a 3 ms switching time. DCC packets are on the average 5ms long, so only one or two packets are lost. (27 to 36 bits with average length of 174 microseconds).
- No noticeable interruption in power when switching (3ms).
- No external power required. Relay switching voltage comes from the momentary (3ms) short circuit.
- Inexpensive. The most expensive part is the relay which costs around $5.
- Negligible effect if used in a block with an induction-based occupancy detector.
- Immune to motor noise if primaries are properly phased.
- Small form factor, .75” x 2.9”

Assembly

Surface Mount Parts

The surface mount parts need to be soldered onto the board before the through-hole parts since the bottom surface needs to be laid flat on the “cookie sheet”. My cookie sheet is a piece of 1/16” thick aluminum big enough to cover the hot plate, with a wooden handle attached. My hot plate is actually a heater section from a semiconductor wafer oven with a digital controller.

Set the hot plate to 250^{o}C. Having the hot plate too hot will cause some of the parts to dance around when the flux boils. Check the profile included with the solder paste for details.

There is only one surface mount part used for this project, the latching relay. I’m using a surface mount relay because that’s what I have on hand from a previous design. It is large enough to allow for manual solder paste application and part placement, even if you’re not an expert.

Apply solder paste to all the pads, then place the relay on the pads.

Place the board(s) on the cookie sheet then place the cookie sheet on the hot plate. Watch the boards carefully so you can nudge the relay back into place if it moves. Carefully remove and let cool when everything flows nicely.

After the board(s) cool, use a magnifying glass to check for bridging between the pins and if any is found, remove it with solder wick or a fine point soldering iron. Also check for pins that may be missing solder.

Through-Hole Parts

Install the through-hole parts. Make sure to observe the polarity of C1 and C2, and the orientation of B1 and B2.

T1 and T2 are comprised of a secondary or 30 turns of wire-wrap wire and 2 turns each of hook up wire for the primaries. The primaries must be wound in the same direction. In other words the wire from P1 should go into the center of the core around once, through the core again, and to P2. The primary from P3 to P4 **must** be wound in the same direction. If the primaries are not "phased" in this manner, the reverse will be very unacceptable to motor noise instead of being immune to it.

The noise immunity comes from the current in one primary canceling out the current in the other primary. When a reverse condition is detected, only one primary sees current flow, since a wheel is shorting out the other.

If both wheels cross the gap in the rails at exactly the same time, the reverser will not work. Since track is not perfect, this shouldn't happen but in rare occasions, but if by chance it should happen, it can be remedied by moving the gap in the rails slightly.

Table 1: Parts Needed

Qty	Part	Value	DigiKey #	Device
2	B1,B2	Bridge rectifier	DF04M-ND	DBL201G
2	C1,C2	10uF	1189-2227-ND	CPOL-USE2-5
1	K1	Latching DPDT Relay	255-2348-5-ND	TXS2SA-L2-4.5V
2	T1,T2	Ferrite Core	Amazon UPC 675234790876	MA03-1
2	X1,X2	2 pos term block	277-12547-ND	W237-102

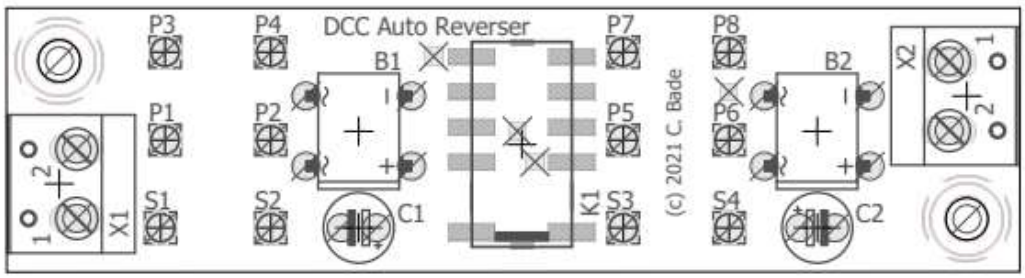

Figure 1: Parts Placement

Testing

1. Connect the main track to on side and the reverse loop to the other. It doesn’t matter which goes where.
2. Run a locomotive through the loop. There should be no noticeable interruption in power to the locomotive.