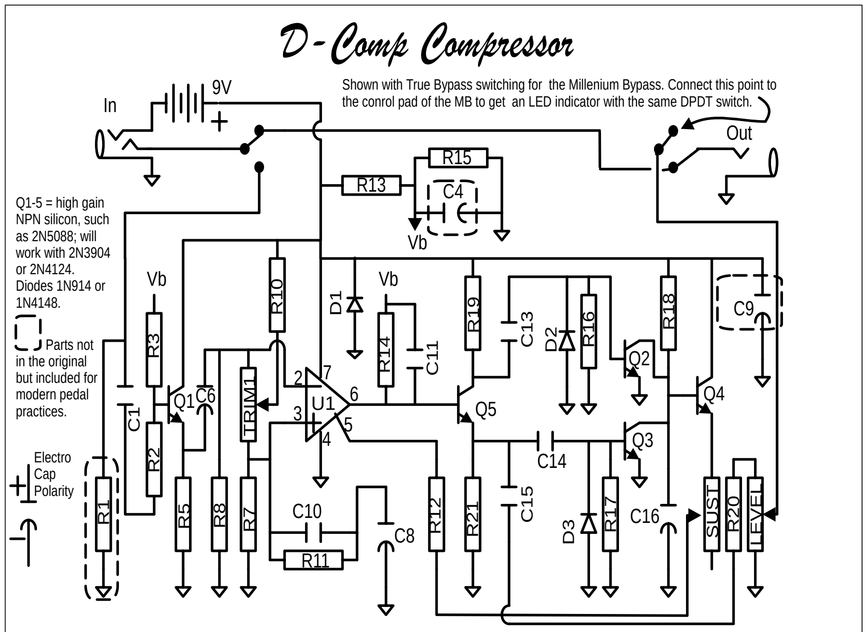
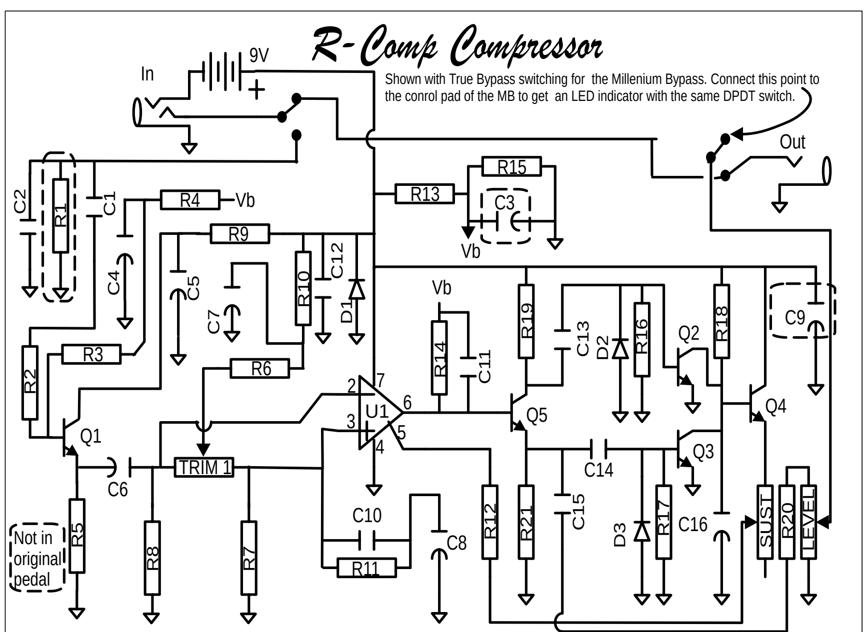
D&R Comp - A Workalike for either DynaComp or Ross Compressors

The lazy, sustain-for-days sound of a lot of rock guitar sounds was only partially the result of the guitar construction and/or amp settings. In many cases, the guitarist was using a compressor, a kind of volume controller that varied its internal gain to keep the sound through it at about the same level no matter what the actual signal level was. The original Dynacomp compressor, built by MXR, was a very popular means of achieving this sound. The D-comp uses the same technology as the original Dynacomp to get the same tone. A later variant of the same circuitry was the Ross Compressor. This effect varied from the Dynacomp by using a bit of additional bypassing and filtering. Otherwise, they are identical. It's possible to make a single board to do both - this is the D&R Comp.

The heart of the D&Rcomp is a variable gain amplifier built around a Operational Transconductance Amplifier or OTA. The CA3080 OTA IC (U1 on the schematic) has a differential input, and a gain that is dependent on the amount of bias current supplied to its pin 5, which sets the bias current of the device, and its gain. The rest of the circuit is housekeeping, to make the OTA happy in its role of providing variable gain, or the level detecting circuit to supply that proper bias current.



How it works: Input capacitor C1 isolates the effect's internal DC bias level from the 0Vdc level of the guitar. In the D-Comp, Q1 is biased to a reference DC level by resistor R3 to the Vb bias voltage source created by the R13/R15 divider. In the R-comp, R4 is added in series with R3 and the junction bypassed to ground by capacitor C4. Q1 supplies a low-impedance buffered signal at its emitter. This buffered signal is routed to the inverting input (pin2) of the OTA. The non-inverting input (pin 3) of the OTA is held at the same DC level as pin 2. The OTA is biased by R10 to the +9V supply and R7/R8 to ground at the two ends of the 2K bias-balance trimmer . The trimmer serves to balance the



input currents of the differential inputs and balance out any control voltage noises as the gain of the OTA changes. In the R-Comp, R6 is added in series with R10, and the junction of the two are bypassed to ground by C5.

The maximum gain of the OTA is set by the R14 load resistor attached from pin 6 to the bias voltage, and the high frequency rolloff is set by the parallel combination of R14 and C11. From pin 6, the signal goes to the base of Q2. Q2 performs two tasks - it acts as an output buffer to drive the output signal, and also as a phase inverter to help derive the DC level signal which controls the gain of the whole circuit. The output signal is tapped from the emitter of Q2, while both the emitter and collector of Q2 provide out-of-phase signals to a rectifier-filter arrangement built from Q3 and Q4.

The most negative peak of the both phases of the signal from Q2 is clamped to ground by the diodes at the bases of Q3 and Q4, providing a "rectified" signal that is as large as the peak-to-peak Q2 signal. Since there are two of these working on the two out-of-phase signals from Q2, the signal is effectively full wave rectified. Q3 and Q4 invert; that is, higher signals cause them to pull their collectors to a lower voltage. The collectors pull this current from R18 to +9V, pulling down on the voltage of C16. In the absence of a signal, C16's voltage rises to nearly the supply voltage. When large signals are passed through, Q3 and Q4 pull the voltage on capacitor C16 lower. The voltage on this capacitor is buffered by Q5, and in turn drives the bias current of the OTA through the 500K sensitivity control and the 27K resistor.

So as a result, if there is a very small or no signal at the input, Q3 and Q4 do not pull down on C16, and the voltage at the emitter of Q5 is high; this supplies a current to the bias pin which is determined by the voltage at Q5's emitter and the Sustain control in series with R12. With a high voltage at Q5's emitter, the bias voltage into Pin 5 of the OTA is high, and the gain of the OTA is high. As the signal level rises, Q3 and Q4 pull the voltage on the 10uF capacitor down, so the voltage across Sustain and R12 are lower, and current is reduced to the bias pin so the OTA gain goes down. Note that the sustain control can vary the current over a wide range as it varies from 0 to 500K.

This setup effectively forms a negative feedback loop which attempts to adjust the signal level at the output of Q2 so it is almost constant. When a note is first hit, it is loud and the level feedback adjusts the OTA to a low gain. As the note trails off, the feedback circuit lets the gain come up to hold the output signal almost constant until the maximum gain of the circuit is reached and the OTA can no longer keep the tiny signal up to the desired level.

The stomp switch on the vintage units is a DPDT switch, but not wired for true bypass. The guitar always connected to the input of the effect unit. Because the input signal must go through a 10K resistor at the input to the effect, the loading may be bad enough to cause "tone sucking". I have drawn the circuit with true bypass switching to get around this. I have also shown how to wire the units for true bypass with an LED status indictor; see the "Millenium Bypass" at GEO, http://www.geofex.com for how to build the circuit to do that.

Building it: While neither circuit is complicated, and the use of a printed circuit board (PCB) does make things much easier, you will need to pay attention to the differences between the D-comp and R-comp versions. In the Parts List that follows, I have shaded the entries where the D-comp and R-comp versions are different. The R-comp version uses more parts, but the D-comp version needs jumpers strategically placed. It's probably a good idea to study the differences in the two population diagrams before beginning building, or in fact before ordering your parts, just to be sure that you get the right set of parts.

I like to build things in a specific order:

- clean the copper side of the board to ensure easy soldering. Acetone, kitchen scrubbing powder or just 0000 steel wool all do a good job
- insert and solder in any jumpers; the jumpers on this board all replace resistors, so they are on the same 0.4" spacing as the resistors.
- insert resistors; all the resistor holes are on 0.4" centers, so you could make a piece of wood or plastic that's the right width to bend many of them to the right spacing at the same time; I also use a lead bender gadget that I got at Mouser. Very, very handy.
- Bend the resistor leads slightly to hold them in the board as you insert them, and clip them off, leaving about 1/16" of lead protruding above the copper.
- Solder in the resistors.
- Place the capacitors next, clenching the leads slightly and then clipping and soldering.

- Once all the passive parts are in place, double check the values and correct any placement mistakes. I often mistake 4.7K for 47K, as I confuse the red with the orange bands.
- Double check the pinouts of the transistors, then insert them and solder them into position
- Finally, solder the IC in. I like to tack-solder pins 4 and 8 to get the IC placed and flat on the PCB, and once it's all in position, solder the rest of the pins.

You're probably wondering if there is any difference in the sound of the D-comp and R-comp versions.

There is. It's not big, but there is a slight advantage in smoothness of compression in favor of the R-comp.

Notes on the parts list:
[1.] The original transistor type number is not know. 2N5088's worked well in the prototype. You can probably get away with 2N3904 and 2N4124 as well.
[2.] The D &R Comp PCB is designed to fit into the Hammond 1590BB die cast aluminum box. This is a sturdy unit, and with care in fitting parts into it, you can make a pedal which will stand up to the rigors of road gigs.
[3.] Parts different between the two versions are shown shaded gray in the parts list. Be sure to check and buy the right parts for the version you want.

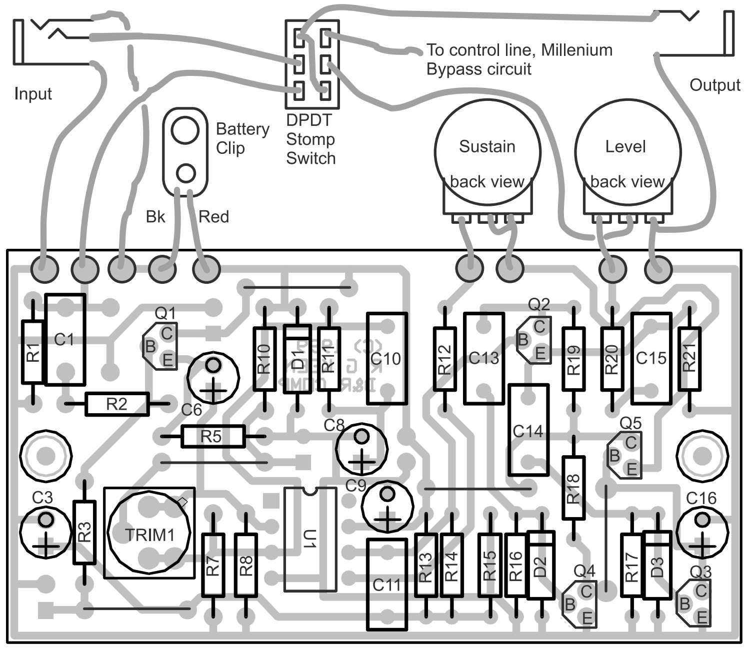
[4] Part numbers and prices listed were current when this was written. Since part numbers and prices change all the time, do not be surprised if some of them have changes. Just ask the sales rep to help you find a replacement part that they do have.

Parts List

Part	D-Comp	R-Comp	Description	Mouser Stock No.	Est. $$$
U1	CA3080	CA3080	Operational Transconductance Amplifer	570-CA3080E	0.68
Q1-Q5	2N5088	2N5088	High gain, low noise NPN transistor	610-2N5088	0.26
D1-D3	1N914/4148	1N914/4148	Signal diode	625-1N914	0.06
R1	4.7M	4.7M	¼ W carbon film resistor	29SJ250-4.7M	0.07
R2	10K	10K	¼ W carbon film resistor	29SJ250-10K	0.07
R3	1M	470K	¼ W carbon film resistor	29SJ250-1M or 470K	0.07
R4	jumper	470K	¼ W carbon film resistor	29SJ250-470K	0.07
R5	10K	10K	¼ W carbon film resistor	29SJ250-10K	0.07
R6	jumper	220K	¼ W carbon film resistor	29SJ250-22K	0.07
R7	1M	1M	¼ W carbon film resistor	29SJ250-1M	0.07
R8	1M	1M	¼ W carbon film resistor	29SJ250-1M	0.07
R9	jumper	10K	¼ W carbon film resistor	29SJ250-10K	0.07
R10	470K	220K	¼ W carbon film resistor	29SJ250-470K or 220K	0.07
R11	15K	15K	¼ W carbon film resistor	29SJ250-15K	0.07
R12	27K	27K	¼ W carbon film resistor	29SJ250-27K	0.07
R13	56K	56K	¼ W carbon film resistor	29SJ250-56K	0.07
R14	150K	150K	¼ W carbon film resistor	29SJ250-150K	0.07
R15	27K	27K	¼ W carbon film resistor	29SJ250-27K	0.07
R16	1M	1M	¼ W carbon film resistor	29SJ250-1M	0.07
R17	1M	1M	¼ W carbon film resistor	29SJ250-1M	0.07
R18	150K	150K	¼ W carbon film resistor	29SJ250-150K	0.07
R19	10K	10K	¼ W carbon film resistor	29SJ250-10K	0.07
R20	10K	10K	¼ W carbon film resistor	29SJ250-10K	0.07
R21	10K	10K	¼ W carbon film resistor	29SJ250-10K	0.07
C1	0.01uF	0.01uF	Film capacitor	140-PF1H103K	0.11
C2	not used	0.0022uF	Film capacitor	140-PF2A222K	0.10
C3	1uF electro	1uF electro	Radial package aluminum electrolytic cap	140-XRL25V1.0	0.05
C4	not used	1uF electro	Radial package aluminum electrolytic cap	140-XRL25V1.0	0.05
C5	not used	1uF electro	Radial package aluminum electrolytic cap	140-XRL25V1.0	0.05
C6	1uF electro	1uF electro	Radial package aluminum electrolytic cap	140-XRL25V1.0	0.05
C7	not used	1uF electro	Radial package aluminum electrolytic cap	140-XRL25V1.0	0.05
C8	1uF electro	1uF electro	Radial package aluminum electrolytic cap	140-XRL25V1.0	0.05
C9	10uF electro	10uF electro	Radial package aluminum electrolytic cap	140-XRL25V10	0.05
C10	0.01uF	0.01uF	Film capacitor	140-PF1H103K	0.11
C11	0.01uF	0.01uF	Film capacitor	140-PF1H103K	0.11
C12	optional	0.1uF cer.	Ceramic capacitor	21RZ310	0.08
C13	0.01uF film	0.01uF film	Film capacitor	140-PF1H103K	0.11
C14	0.01uF film	0.01uF film	Film capacitor	140-PF1H103K	0.11
C15	0.047uF film	0.047uF film	Film capacitor	140-PF1H473K	0.17
C16	10uF electro	10uF electro	Radial package aluminum electrolytic cap	140-XRL25V10	0.05
Sust	500K lin pot	500K lin pot	Potentiometer	313-1000-500K	1.21
Level	50K log pot	50K log pot	Potentiometer	313-4000-50K	1.74

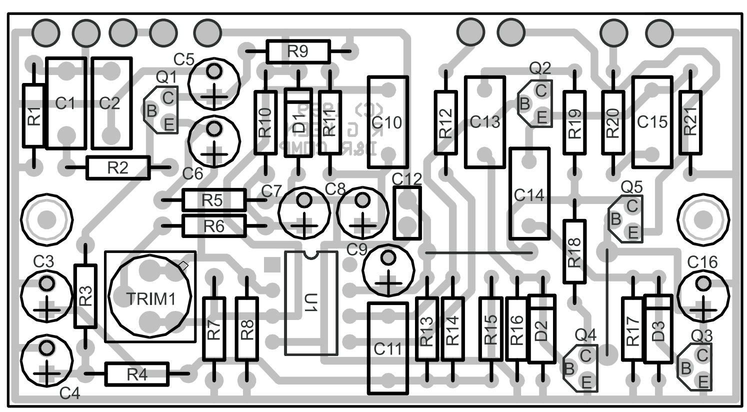
Part	Description	Mouser Stock No.	Est. $$$
enclosure	Hammond 1590BB or eq.		
stomp switch	DPDT stomp switch. Preferably Carling 317PP	Not stocked by Mouser	
knobs	to your own taste.		
batt clip	PP3 / 9V battery clip		

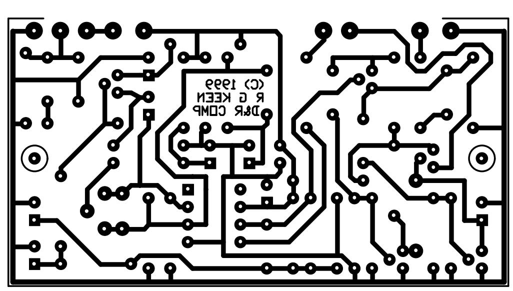
D&R Comp - Parts Placement and wiring for Dyna-Comp (tm) clone



Not used: C2,C4, C5, C7, C12. Replaced by jumpers: R4, R6, R9

D&R Comp - Parts Placement for Ross Compressor (tm) clone - wiring is identical!





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