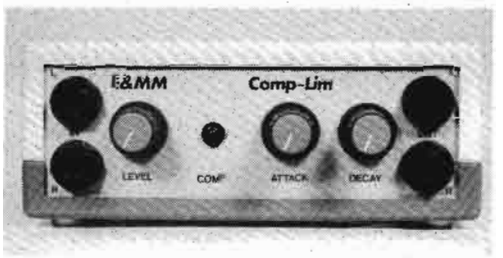
Comp-Lim

PARTS COST GUIDE £30
Complete kit



Paul Williams

- ★ **For amplifier & recorder protection, mix thickening or effects.**
- ★ **Two signal channels for stereo use.**
- ★ **Adjustable attack & decay characteristics.**
- ★ **LED indication of compression.**
- ★ **Precision full-wave control rectifier.**
- ★ **Control input for special effects.**
- ★ **Easy to use.**
- ★ **Studio quality.**
- ★ **Uses two low cost IC's.**

Have you ever wondered why your tracks or instruments always seem to sound so deliberate and separate, where as professional recordings and performances sound so full, thick and rich? The answer is by judicious use of a good compressor. A compressor reduces the upper dynamic range of a signal, such that above a certain threshold level, an increase in input level of, say 3dB might result in an output level increase of say 1dB, indicating a compression ratio of 3:1. The compressor can be used effectively on complete mixes, or on single instruments for special effects.

The limiter is an equally valuable device for both the home electro-musician and the gigging band. It is used for curtailing high signal levels applied to, for instance a tape recorder to prevent over modulation of the tape, or to a PA amplifier to prevent output saturation, either of which would otherwise lead to harmonic distortion. Vocals are a very good example of a signal source with a rather unpredictable level, ideally suited to the application of a limiter. Using a limiter, the system gain can be set to a higher level than normal, where the occasional high level peak will be taken care of by the limiter. This allows an improvement in signal to noise ratio to be achieved in the case of the tape recorder, or a higher average output power in the case of the PA amplifier. Limiters typically exhibit a compression ratio of 10:1 or more; that is a 10dB increase in the input level results in a 1dB increase in output level. There is also, of course, a threshold level, below which no compression takes place. The E&MM Comp-Lim was designed to fulfill both of these functions by using a compromised compression ratio of 6:1. Figure 1a shows how the output voltage changes with input voltage. Figure 1b shows the transfer characteristics in decibels. Notice the well defined 'knee', and the dramatic change of slope above the threshold level. Adequate control over the attack and decay characteristics is provided to further widen the range of applications. The input gain, and hence the input threshold can be varied, providing a convenient method of adjusting the amount of compression, indicated by an LED.

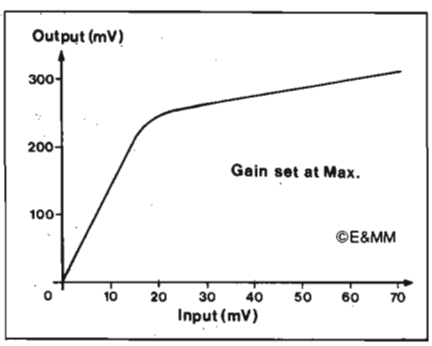


Figure 1a. Output voltage vs input voltage.

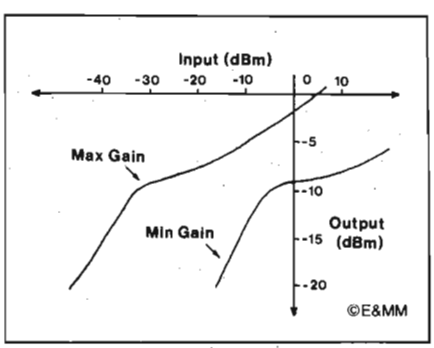


Figure 1b. Transfer characteristics in dB's.

Circuit

Referring to the circuit diagram, Figure 2; the left channel gain is determined by the amplifier IC2a, whose initial gain is set by RV1a, the input level control. IC2a forms an identical right channel. The outputs from the two channels are summed up by R19 and R20, the composite signal being passed via C4 to the full-wave control rectifier formed by IC2b&c. The resulting DC voltage at IC2b pin 14 is buffered by TR1 and subsequently passed through R2 and RV3, the attack control to charge C1, ultimately to the same voltage. In the absence of any signal, C1 is discharged through R2, RV3 and RV2, the decay control.

If a signal is sufficient in level to produce a DC voltage capable of overcoming the Vbe's of TR1 and TR3, then current will be sourced by TR3 and injected via R6 into pins 1 and 16 of IC2, the dual transconductance amplifier. IC1 a & b will then increase the current feedback around IC2 a & d, reducing their gain until the output signal level and hence the DC control voltage reaches the threshold level, where a state of equilibrium is attained. The control current and hence the amount of compression is tracked by TR2, driving the LED, D1, in sympathy with the control current.

The control signal path can be interrupted, and an external control signal applied at JK4 for special effects. When a mono signal is applied to just one input, the input socket switching arrangement allows the signal to be fed to both channel amplifiers, keeping the threshold level the same for either single or twin inputs.

Construction

All the components, including the potentiometers are contained on a single PCB, as shown in Figure 3. The assembly of which should proceed as follows: insert and solder the veropins first, then the wire link and all the resistors, bending the leads out at 45° to hold them in place. Now crop the leads and solder. Follow this procedure similarly for the capacitors, IC sockets, diodes and transistors. Position the potentiometers in the PCB, but before soldering, secure them to the front panel so that strain is not put on the joints.

SPECIFICATIONS

Minimum input threshold	-33dBm
Maximum input threshold	-5dBm
Output threshold	-10dBm
Maximum input level	20dBm (maximum gain)
Compression ratio	6:1 Approx.
Attack time	30uS to 30mS
Decay time	15mS to 1S
Frequency response	3Hz to 30kHz (-3dB)
Output noise	-67dBm (A) (maximum gain)
Output noise	-86dBm (A) (minimum gain)
Positive supply current	7mA
Negative supply current	25mA

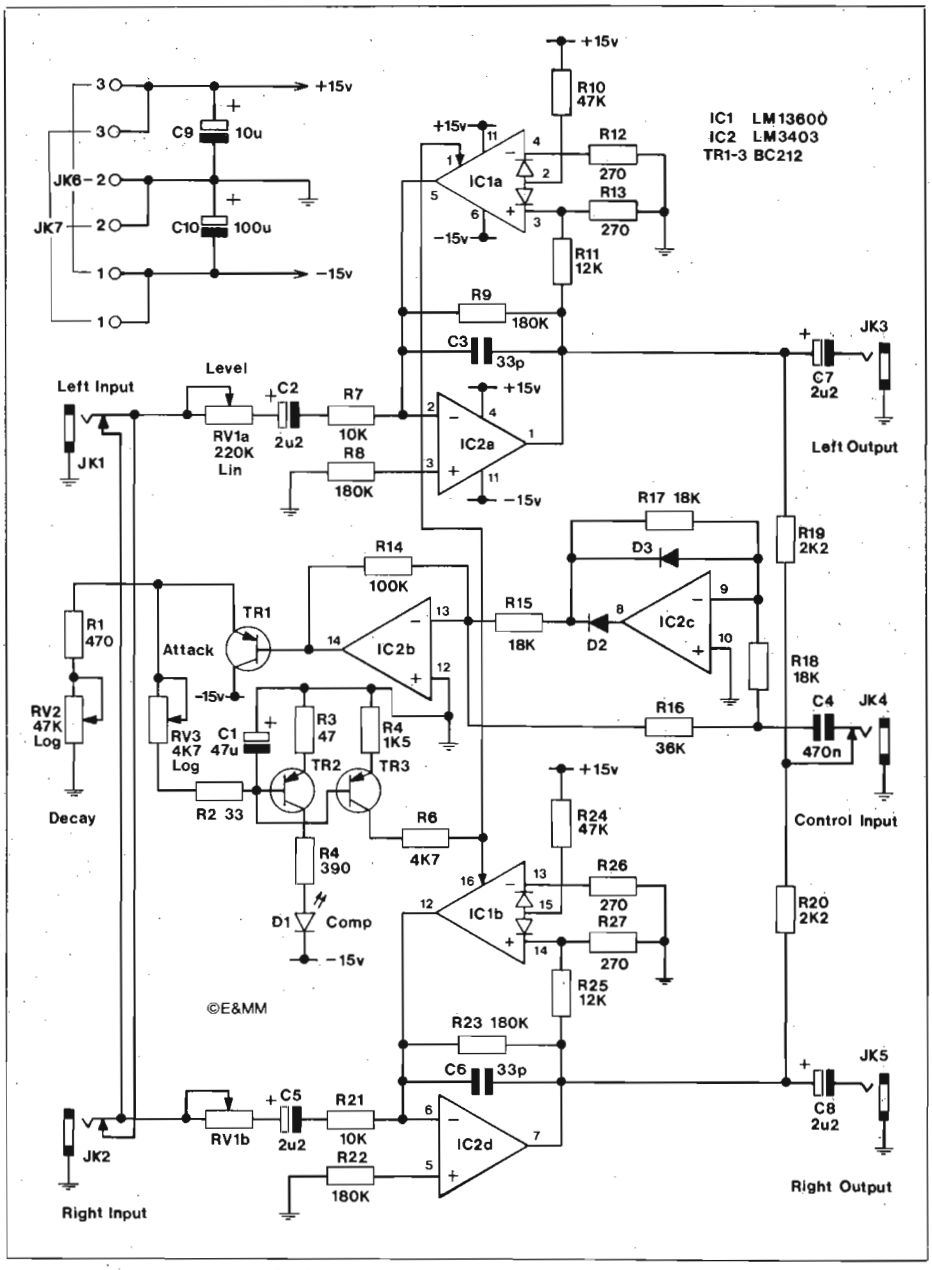


Figure 2. Circuit diagram of the Comp-Lim.

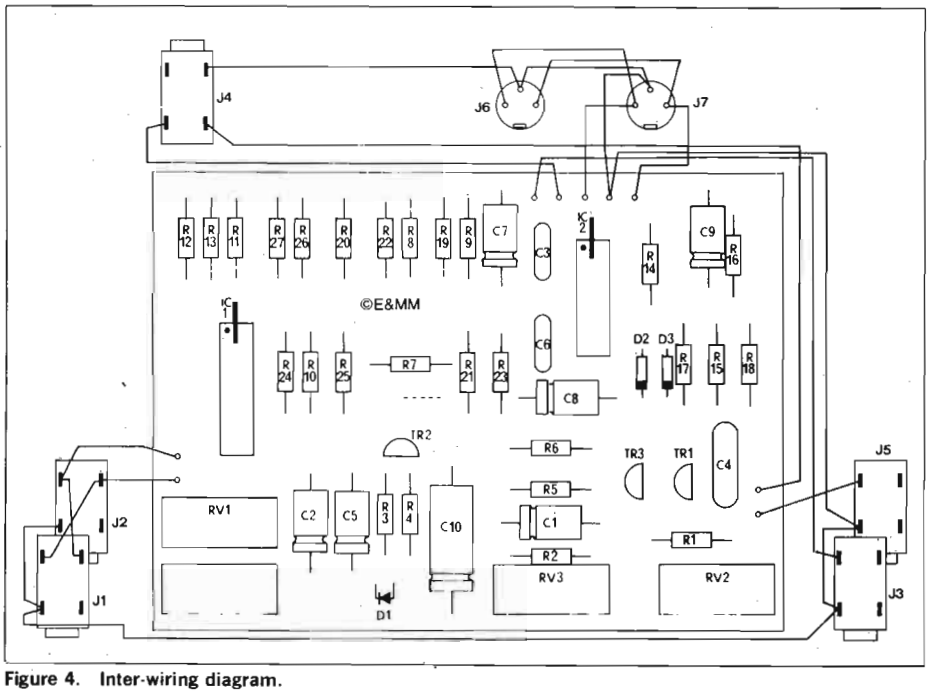


Figure 4. Inter-wiring diagram.

To fit the LED, bend its leads down at 90°, about 7mm from the body and pass the leads through the PCB, checking polarity. Now push the LED clip bezel into the front of the panel and slip the ring over the LED. Offer the LED into the clip and push the ring over to secure. The LED can now be soldered in place.

Check very carefully the orientation of diodes, electrolytic capacitors and transistors. When you are sure that the assembly is correct, and that all the soldered joints look healthy the IC's can be loaded into their sockets, checking orientation carefully.

Now prepare the case and install the panels with all the sockets fitted. The PCB is held in position by means of the potentiometers, and requires no further retention. Finally, complete the small amount of interwiring shown in Figure 4.

Testing

There are no presets to adjust, so your Comp-Lim should be ready to use. The DC power can be obtained from almost any regulated ±15v supply. The E&MM Twinpak power supply makes an ideal companion for the Comp-Lim. The supply is connected to one of the DIN sockets, the other socket being intended to extend the DC supply to another audio signal processing unit in a "daisy-chain" fashion.

Limiter

For use as a protection limiter, set the attack control to minimum, and the decay control to the 9 o'clock position. The input level control should then be adjusted so that the loudest passages cause the LED to glow. The input sensitivity control of your amplifier or tape recorder can then be adjusted to give the desired maximum level when limiting takes place.

Mix thickening

For mix thickening, use fairly low settings for the attack and decay controls, although beware of very low settings of both controls simultaneously since this can lead to modulation of the signal by the low frequency notes. The input level control will then determine the amount of thickening. Remember though that 20dB of compression will take 20dB off your signal-to-noise ratio, so if you want a lot of compression, you should have a low noise source, preferably not from tape unless you have a very good noise reduction system. By increasing the attack control position to halfway or so, the effect will be that of accenting the percussiveness of the sound, resulting in a very 'punchy' sound. Single instruments too will have much stronger attack characteristics, an effect particularly noticeable on bass guitars.

Control input

The control input can be used to reduce the level of the main program, dependent on the level of the control signal, such as for voice-over ducking, where an amplified microphone signal would be applied to the control input. Also using the control input, a particular instrument can be 'lifted' out of a mix by allowing the signal from the track of that instrument to control to level of the remainder of the mix. This result in a very powerful, dynamic effect when used on a lead guitar.

After some experimentation, the Comp-Lim will soon become one of your most used studio or stage audio processing units.

PARTS LIST FOR COMP-LIM

Resistors — all ¼W 5% carbon

R1	470	
R2	33	
R3	47	
R4	390	
R5	1k5	
R6	4k7	
R7,21	10k	2 off
R8,9,22,23	180k	4 off
R10,24	47k	2 off
R11,25	12k	2 off
R12,13,26,27	270	4 off
R14	100k	
R15,17,18	18k	3 off
R16	36k	
R19,20	2k2	2 off
RV1	220k lin stereo pot	
RV2	47k log pot	
RV3	4k7 log pot	

Capacitors

C1	47uF 10v electrolytic	
C2,5,7,8	2u2F 63v electrolytic	4 off
C3,6	33pF ceramic	2 off
C4	470nF ceramic	
C9	10uF 25v electrolytic	
C10	100uF 25v electrolytic	

Semiconductors

IC1	LM13600	
IC2	3403	
TR1,2,3	BC212	3 off
D1	LED red	
D2,3	1N4148	2 off

Miscellaneous

JK1-5	Jack socket	5 off
SK6,7	3 Way DIN socket	2 off
	Case, Vero 212	
	Knob	3 off
	Knob cap	3 off
	14 Way DIL socket	
	16 Way DIL socket	
	LED clip	
	3 Way DIN plug	2 off
	3 Core cable	
	Wire	
	Veropins	
	PCB	

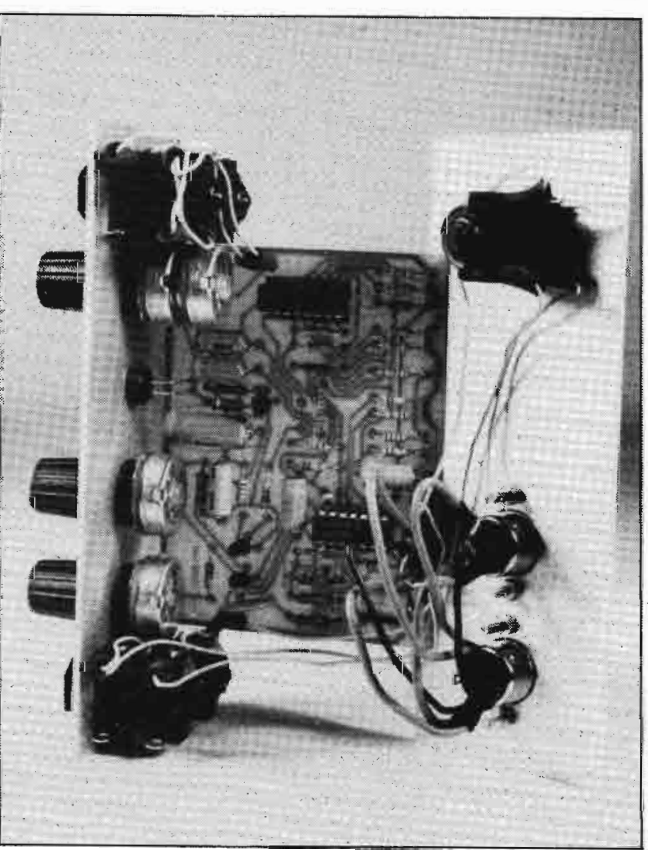


Figure 4. Internal view of the Comp-Lim.

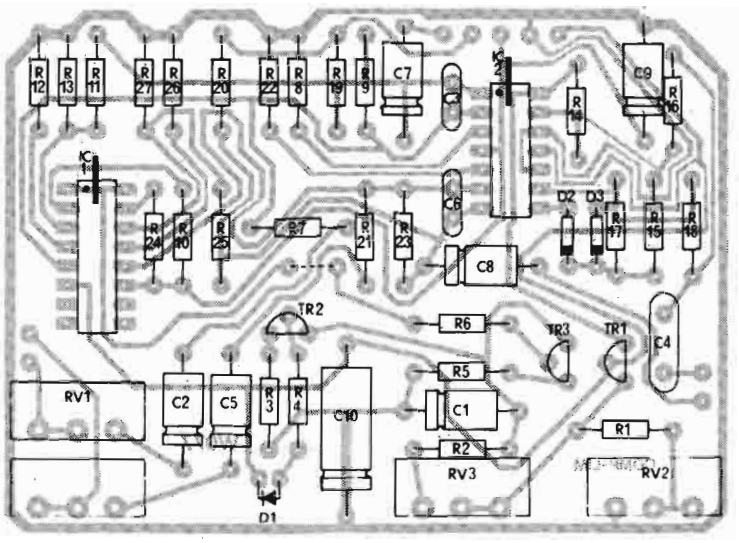


Figure 3. PCB component overlay (not to scale).

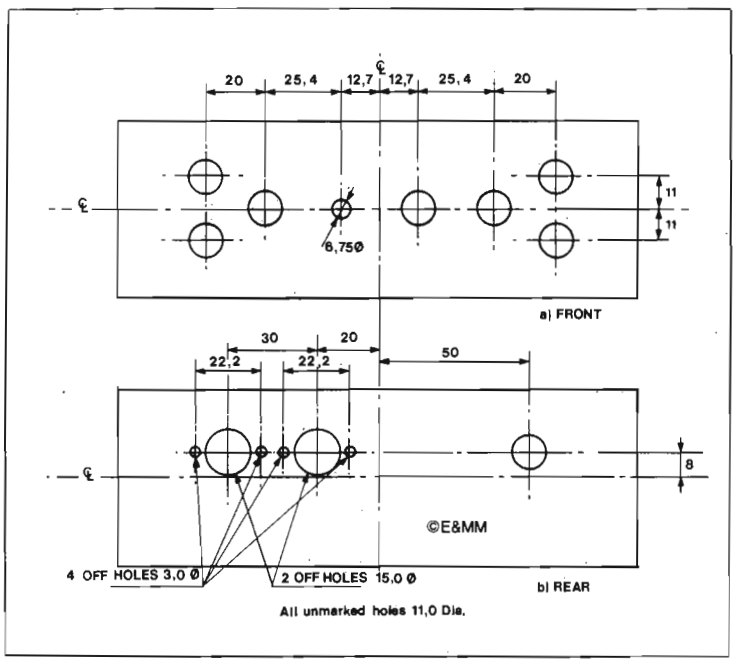


Figure 5. Inter-wiring diagram.

A complete set of parts for the Comp-Lim including all components, hardware, PCB and case is available from E&MM, 282 London Road, Westcliff-on-Sea, Essex SS0 7JG, at a cost of £29.95, including postage, packing and VAT. Please order as: Comp-Lim Kit.

The PCB is also available separately at a cost of £2.99, including postage, packing and VAT. Please order as: Comp-Lim PCB.

E&MM