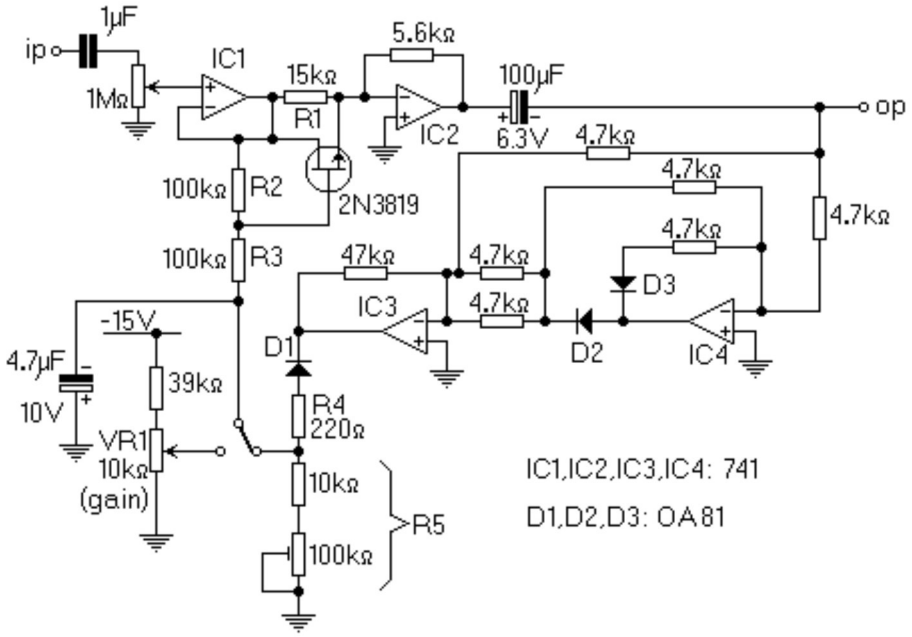
# Audio compressor

The gain of the single stage virtual earth amplifier IC1 is determined by the drain-source resistance of the f.e.t. Resistors R1, R2 and R3 linearise the f.e.t.'s V-I characteristic. A control voltage is derived from the output signal by using a precision rectifier and peak detector. Attack and decay times are adjustable by resistors R4 and R5, and with the values shown give time constants of 1 and 517ms respectively.

The two way switch allows the compressor to act as a conventional fixed-gain amplifier by applying a fixed control voltage (which may be varied with the potentiometer which could be used as a gain or volume control).

In the compress mode, a 29dB change in the input signal level produces a 9dB change in the output.

L. Mayes,
Ipswich,
Suffolk.




## Notes

1. This article was published in: WIRELESS WORLD, **84**, No 1511; JULY 1978 p 74.
2. The original publishers made an error in the circuit diagram and although this was pointed out to them at the time (but only after it was published - I wasn't sent any proofs and even had to buy my own copy of Wireless World to see my work) I do not know if a correction was subsequently published.
3. This is now a very old design (the diodes are germanium point contact types and the amplifiers are good old 741s); I would not go about this sort of circuit design

in the same way today. Incidentally, this article is the first thing I had published (and I found when looking up the manuscript that I was paid the fee of £10 for my efforts - which seemed a lot of money at the time).

4. The key component is the 2N3819 JFET which is used as a voltage controlled resistor - the output of the circuit provides the control voltage which is derived by full-wave rectification followed by a peak detector. The full-wave rectifier (more properly called a precision absolute value circuit can be found in Tobey, Graeme and Huelsman's: "Operational Amplifiers" (1971) - page 249). The circuit requires several matched resistors for correct operation and alternative versions of this sub-circuit, which require fewer matched resistors and overall fewer components, could be advantageously substituted. The full-wave rectifier shown will work with silicon diodes but it may be that substituting a silicon diode for D1 in the peak detector may alter the characteristics of the compressor; this could occur because of the greater forward voltage drop (0.7V rather than 0.2V) of silicon diodes. However, because the circuit operates in a closed-loop mode (which means that the gain is adjusted automatically to hold the voltage on the 4.7 µF capacitor approximately constant) the overall effect of the extra voltage drop will be reduced and so the effect of the substitution may be negligible. More modern op-amps such as LF353 (which are 8-pin duals) could be used instead of the 741s.

5. The f.e.t. is operated in its so-called 'triode region' but without R1 and especially R2 and R3 its drain-source resistance would be non-linear (i.e. it would not obey Ohm's Law - or to put it another way: the value of $r_{ds}$ would be dependent on $v_{ds}$). Explanation of the linearisation process.

6. The attack time constant is determined by the product of R4 and the 4.7 µF capacitor. When the input signal drops D1 becomes reverse biased and the decay time constant is determined by R5. (Since the original publication date I have discovered that the term *'release'* is used rather than *'decay'* in the case of compressors.) Both time constants are something of a compromise - the attack must be fast if the start of high amplitude signals are not to be overloaded until the gain reduces and the decay must be fast enough to allow low amplitude signals shortly following high amplitude ones to be given sufficient gain. A problem arises after long periods of silence or low amplitude inputs - the next high amplitude signal will get the 'full gain treatment' and so will initially overload the circuit and some distortion will be result. The best that could be done under these circumstances would be to reduce R4 to zero resulting in minimal attack time (determined by the maximum output current of IC3). The circuit is by no means 'hi-fi' but will be useful for agc in tape-recording, radio and signal processing where a signal's large dynamic range needs to be reduced.

7. Andrew Holme has modified this circuit to work with a single power rail (5V). He uses it to process the input of a spread spectrum system. I haven't tried his version but it looks like an improvement. (see: www.holmea.demon.co.uk/Spread/Spread.htm)

8. For a selection of other compressor designs see the compressor section of the ePanorama site.

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