

# CONSTANT VOLUME AMPLIFIER

The uses of a Constant Volume Amplifier may at first seem somewhat limited, but any audio enthusiasts will immediately recognise it as a compressor, invaluable in high quality tape recording etc.

ANY ENTHUSIASTIC USER of a tape recorder, cassette or reel to reel, will appreciate that the recording of rapidly fluctuating sound levels such as the human voice or an orchestra for example, can often pose certain difficulties. If the level control is set on the recorder during a loud passage then when a quiet passage comes along, it can be almost inaudible. Likewise if the level is set on a quiet passage then the louder ones will be distorted.

What is needed is a piece of equipment which can strengthen the weak signals and lower the louder. Such a device is the HE Constant Volume Amplifier which attempts to give a relatively unchanging output level for a multitude of inputs.

The key word here, of course, is 'relatively' — we don't really want a *constant* volume level because we might not be able to tell if the orchestra was playing a

crecendo or a quiet passage. The ideal device would simply reduce the volume range. In other words it compresses the volume, in fact equipment of this sort is

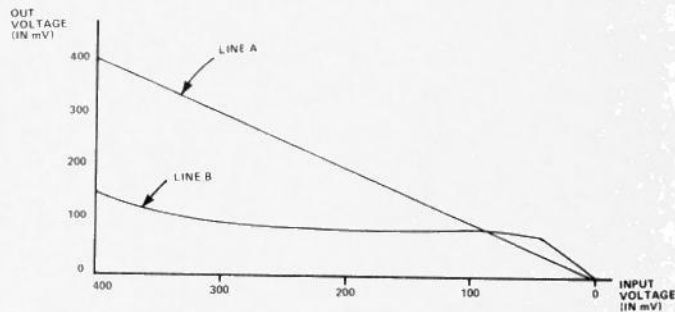
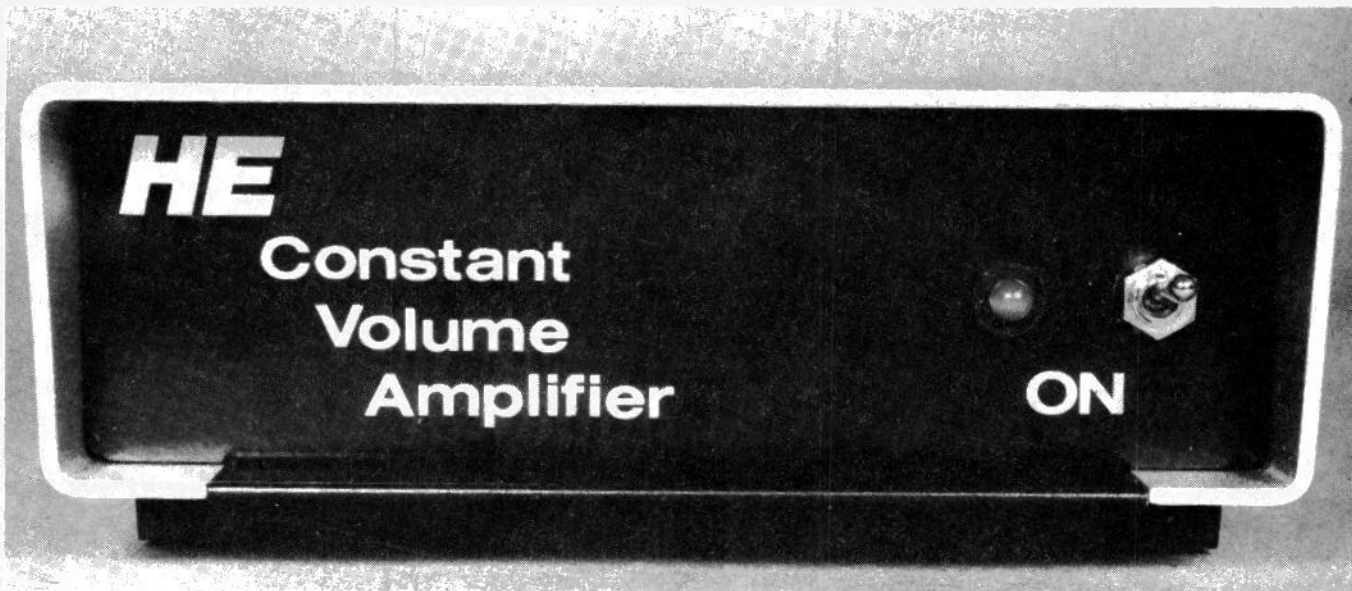


Fig.1. Graph of output vs. input voltage.



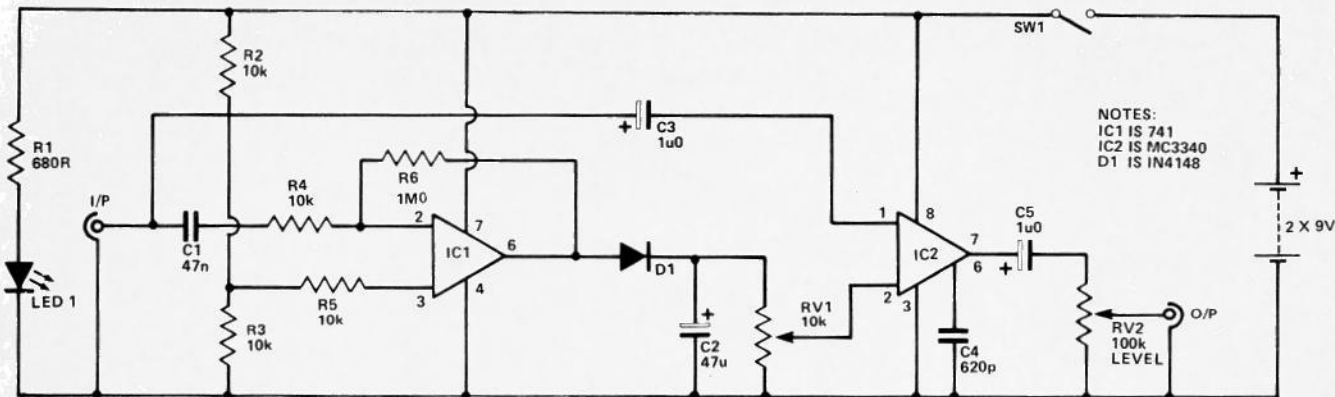


Fig.2. Circuit diagram of the Constant Volume Amplifier.

## HOW IT WORKS

IC 2 is a voltage controlled amplifier. That is, an amplifier whose gain is directly proportional to a DC control voltage present at pin 2. Following the circuit diagram, the signal can be seen to pass through coupling capacitor C3, to pin 1 of IC2, the input. The output from pin 7 is coupled via C5 to the preset RV2 which is set to give the required output amplitude. As the voltage on pin 2 alters, so does the gain of the amplifier. At 3.5 V the gain is at maximum, but at 6 V the output of the amp is virtually zero. At control voltages in between these two limits the o/p amplitude is between maximum and zero. (See figure 5)

The circuit around IC 1 derives the control voltage. IC 1 is used as an inverting amplifier whose gain is given by the formula

$$\frac{R \text{ feedback}}{R \text{ input}}$$

according to figure 6. These two resistors correspond to R6 and R4 in the final circuit, giving a gain of  $1M/10K = 100$ .

D1 half wave rectifies this amplified AC waveform which is then stored as a DC voltage on C2. The voltage should vary between about 8-14 volts, depending on the amplitude of the input signal. RV1 is used as a variable potential divider to drop this voltage to 3.5 to 6 V DC – used now for the necessary control voltage to pin 2 of IC2.

A compressor should ideally have a fast attack time, in the order of just a few milliseconds, so that any sharp loud note is acted upon quickly, but a relatively slow decay time of say 100 milliseconds – otherwise the effect described previously of a *constant* CVA would occur. These two times are inherent in the circuit as capacitor C2 charges quickly through D1, when a loud sound is present at the input, but it discharges at a much slower rate through RV1.

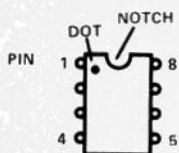


Fig.3. Showing an integrated circuit viewed from above (with pins pointing away).

locating notch or dot is on the top of the chip (see figure 3).

Some ICs have a dot used as a locator, some a notch and some have both. The printed circuit board has a dot

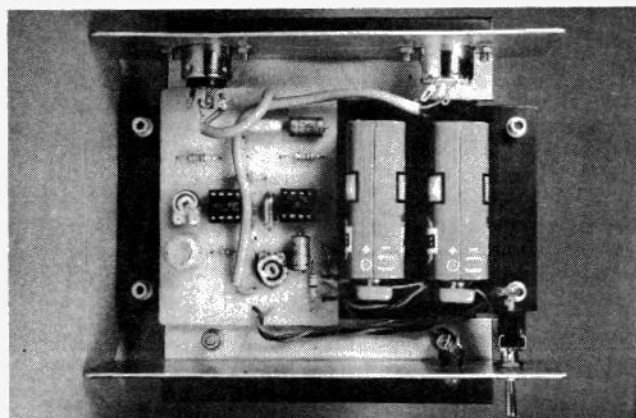
quite often referred to by people in the know as a compressor.

The graph in figure 1 displays the characteristics of the HE Constant Volume Amplifier showing output voltage vs input voltage. Line A is the graph obtained if the CVA is not used i.e. the output voltage is the same as that of the input (because there is nothing there to alter the input). However, with the CVA in use (line B) the output varies a greatly reduced amount as the input changes.

These results were obtained using the prototype constant volume amplifier and show how effectively it functions as an audio compressor.

### Construction

Make sure that IC1 and 2 are inserted correctly – note that pin 1 of both ICs is the top left hand pin when the



Note the position of the two nine volt batteries, make sure the metal cases of the batteries don't short against the switch or socket connections.

etched on it which corresponds to the correct placing of pin 1 for both ICs (see PCB pattern).

Looking at the inside photograph of the case shows the layout of wiring up, which is quite easy. Remember to use screened cable for input and output leads. The case ideally should be metal and grounded, to screen the circuit against lines hum. The grounding can take place at either input or output socket by connecting a short lead from tag 2 of the socket to the tag which is connected to the metal shield. The signal should come from tag 1 of the input socket and go to tag 3 of the output socket. (See figure 4).

The rest of the components should present no difficulties, the circuit being fairly straightforward.

### Setting Up

The procedure for setting up requires the use of the CVA in situ. Feed an input to the device and the output to an amplifier with the amplifier volume turned down. Set RV2 to mid-position and RV1 fully anti-clockwise then switch everything on. Turn the amplifier volume up till you hear the signal. Now turn RV1 clockwise until distinct distortion of the signal occurs, then turn it back until the distortion just disappears. Finally, adjust RV2 to give the required volume level.

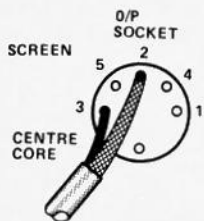


Fig.4. Phone sockets can be used or alternatively, DIN sockets could be incorporated, we have shown standard connections.

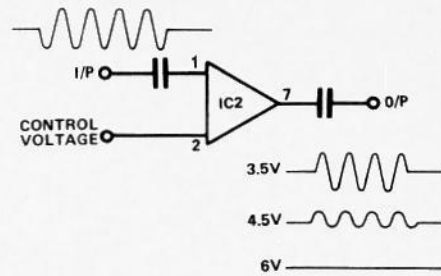


Fig.5. Showing the outputs obtained with control voltages.

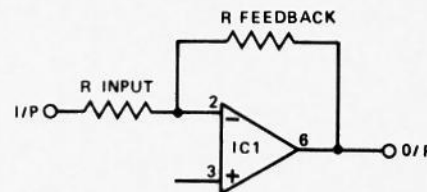
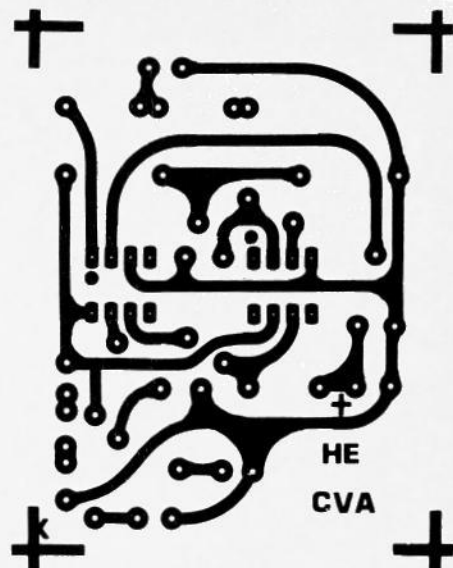
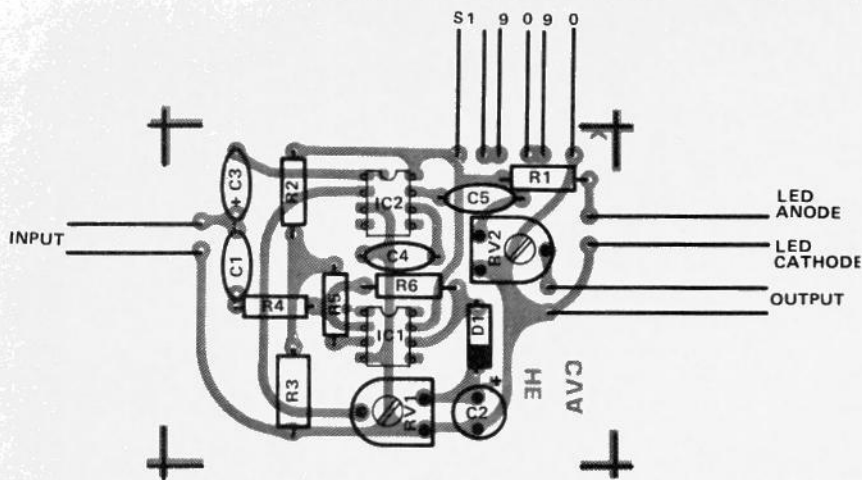


Fig.6. A straightforward operational amplifier circuit.



The on-off switch and LED keep the front panel neat and uncluttered.





### PARTS LIST

#### RESISTORS (All 1/4W, 5%)

R1 680R  
R2,3,4,5 10K  
R6 1M

#### POTENTIOMETERS

RV1 10K Preset  
RV2 100K Preset

#### CAPACITORS

C1 47nF Polyester  
C2 47uF Elect.

C3,5 1uF Elect  
C4 620pF Polystyrene

#### SEMICONDUCTORS

IC1 741  
IC2 MC3340  
D1 1N4148  
LED 1 TIL 220 0.1" LED

#### MISCELLANEOUS

Switch  
2x9 Volt batteries & clips  
Case to suit  
2 x 3-pin Din Sockets

Above Left: the overlay for the Constant Volume Amplifier.

Above: The PCB.

Below Left: The complete Amp Unit.

Below: The overhead view of the completed PCB.

The PCB foil pattern for the main board.

