SMOOTH FUZZ

OF all the effects units for electric guitars, fuzz is undoubtedly the most popular and numerous designs have appeared in *Practical Electronics* and other magazines over the years. So why yet another fuzz unit?

In principle fuzz is easy to produce; all one has to do is distort the signal. But in practice it is very difficult to obtain just the right amount and the right character of distortion, and most designs end up producing a sound which is unpleasantly harsh and rasping. We know because we have tried many of them. Some designs use a Schmitt trigger circuit to 'square up' the input waveform and these tend to give very poor results as the output remains absolutely constant up to a certain point and then suddenly stops. Also a guitar produces a large transient at the start of a note and in some designs this causes momentary blocking due to coupling capacitors charging up. This produces a disconcerting 'hiccup' in the output.

What the professional musician usually wants is a more refined sound—a fuzz unit which gives the guitar tone which is 'different' rather than obviously distorted and gives a limited sustain without completely destroying the dynamics of the input signal. The unit described here will do just this and that is why we have called it 'smooth fuzz'.

CIRCUIT

The circuit uses a dual low noise f.e.t. operational amplifier as these devices now offer excellent performance for a very reasonable price.

The first part of the circuit, around IC1a performs two functions—it provides a voltage gain of about 60 to raise the input signal to a suitable level to operate IC1b, and it acts as a low pass filter with a cut-off at about 1kHz and a slope of 18dB per octave. This removes the higher harmonics of the strings and so reduces the number of intermodulation products produced by the following stage.

IC1b is the distortion generator. Very small signals are passed without distortion, but as the output voltage rises above about ±0·5 volts diodes D1 and D2 conduct, providing gradual limiting of the signal. The output waveform produced by this stage varies as shown in Fig. 3 as the input signal is increased.

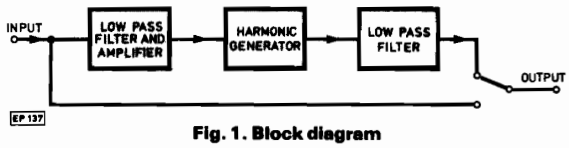


Fig. 1. Block diagram

Although the waveform distortion produced by this stage is not excessive the direct output would still be a little too harsh for most peoples tastes, so two stages of additional filtering are provided by R9 and C8 and VR1 and C9. VR1 is the tone control and as it is varied from the C9 end to the C8 end the tone becomes progressively sharper.

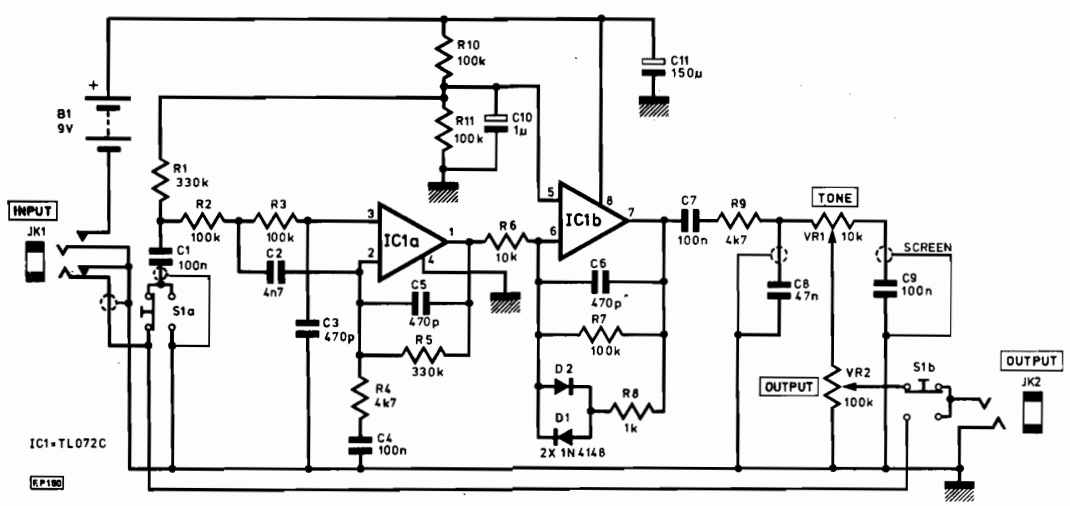


Fig. 2 Circuit diagram

COMPONENTS . . .

Resistors:

R1	330k	R5	330k	R9	4k7
R2	100k	R6	10k	R10	100k
R3	100k	R7	100k	R11	100k
R4	4k7	R8	1k		

All resistors are 0·25W or 0·33W miniature carbon film, 5%

Potentiometers

VR1 10k single gang linear law
VR2 100k single gang log law

Capacitors

C1 100n 250V polyester film
C2 4n7 100V 10% plate ceramic
C3 470p 100V 10% plate ceramic
C4 100n 250W polyester film
C5 470p 100V 10% plate ceramic
C6 470p 100V 10% plate ceramic
C7 100n 250W polyester film
C8 47n 250V polyester film
C9 100n 250V polyester film
C10 1µ 35V tantalum bead
C11 150µ 16V electrolytic

Semiconductors

IC1 TL072CP Texas instruments
D1 1N4148 or 1N914
D2 1N4148 or 1N914

Miscellaneous

S1 d.p.d.t. footswitch (latching type)
JK1 Switched jack socket with front contact normally open and rear contact normally closed (Davian Electronics)
JK2 Normal, non-switched jack socket
Box I.T.T. diecast box type 46R CSOO 043 AOO
PP3 type battery and battery clip
Two control knobs
Two rubber self adhesive feet
Screened lead and connecting wire

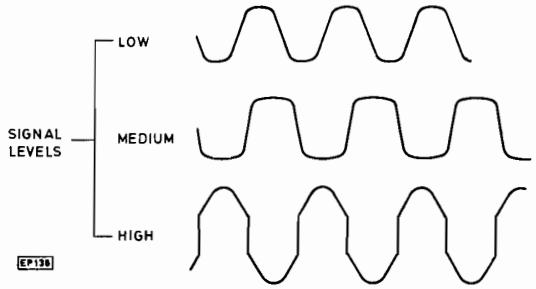


Fig. 3. Waveforms

CONSTRUCTION

Most of the components are mounted on a small printed circuit board which fits into the slots in the side of the box. This is a convenient method of assembly as no screws are required. The component layout and copper pattern for the printed circuit board are shown in Fig. 4.

A low profile type of 8 lead d.i.l. socket can be used for the i.c. if desired.

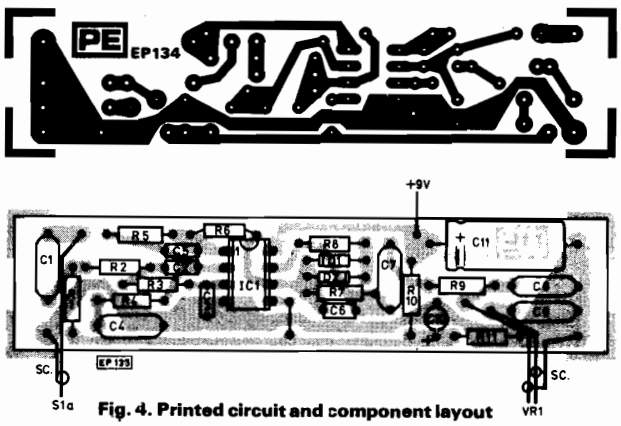


Fig. 4. Printed circuit and component layout

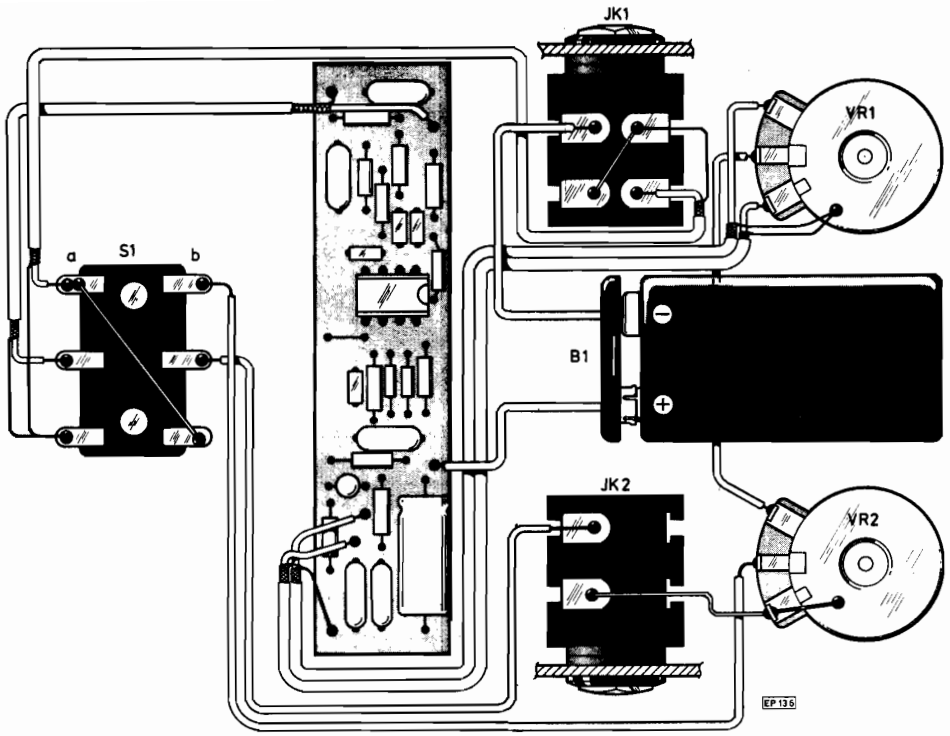
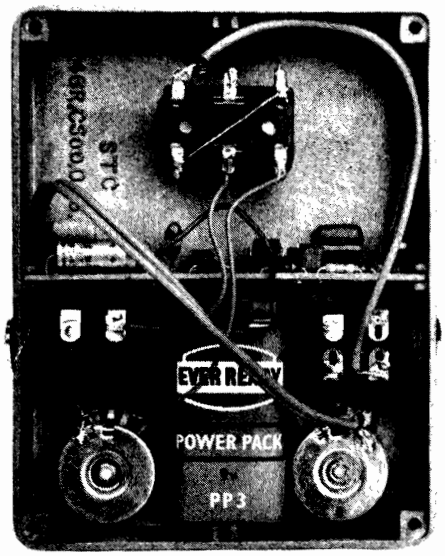


Fig. 5. External assembly to board



Box assembled

The battery should be held in place with a piece of foam rubber glued inside the lid, and the unit is finished off with two self adhesive rubber feet fixed to the rear end of the lid. These stop the box from sliding around and tilt it forward at a convenient angle for foot operation.

A wiring diagram for the unit is given in Fig. 5. Note that miniature screened lead should be used between the input jack and the footswitch, the printed circuit input and the footswitch, and between the printed circuit and the tone control. Note that earth connections are made to the box by soldering to the case of the potentiometers, although a screw and solder tag can be used if preferred.

The input jack socket is a special type which has a front contact (nearest the nut) which is normally open and a rear contact which is normally closed. The battery negative is connected to the normally open contact so that when the input jack plug is inserted this contact 'makes' and automatically switches the unit on. At the same time the rear contact opens and allows the input signal to reach the circuit.

USING IT

Connect the battery, screw on the lid of the box and insert the input and output jack plugs. Then play a note through the unit, adjusting VR1 for a pleasing tone and VR2 for an output signal of similar loudness to the input. The output level from the guitar should be set high to give the best sustain.

If for some reason the unit does not work, check the output voltages at pins 1 and 7 and IC1. Pin 1 should be at exactly half the battery voltage and pin 7 should be within ±0·7 volts of this.

The current taken by the unit is only about 4 milliamps giving a long life from the PP3 battery used, but don't forget to remove the input jack plug when you have finished playing. ★