# 5 RANGE CURRENT LIMITER

By F. G. Rayer

THIS type of "electronic fuse" protects d.c. power supplies against short circuits or excess loads, as well as limiting the current which can flow in equipment operated from the supply. There are five ranges, selected by a switch. These allow limiting at 50mA, 100mA, 250mA, 500mA and 1 ampere.

## CIRCUIT DESCRIPTION

The complete circuit diagram of the current limiter is shown in Fig. 1. Transistor TR1 is a d.c. amplifier, TR2 the series control transistor, and TR3 the limiting circuit transistor. Switch S1 selects the wanted range, and the limiting action depends on the values of the resistors R2 to R9. By employing resistors in parallel, standard values of $\frac{1}{4}$W resistors can be used throughout, which is an advantage when obtaining the components.

Actual values for the five ranges are 12 ohm (R2) for 50mA, 6 ohm (R2 and R3 in parallel) for 100mA, 2·2 ohm (R2 and R4 in parallel) for 250mA, 1·32 ohm (R2, R5 and R6 in parallel) for 500mA, and 0·69 ohm (R2, R7, R8 and R9 in parallel) for 1A.

## CURRENT LIMITING

With current under the set limiting value, TR1 base is supplied by R1 and TR2 base from TR1 emitter. Transistor TR3 is not operating since the emitter-base potential depends on the particular resistance value present between these two points, for example 12 ohm for 50mA. Current is thus available through TR2 for the equipment.

Should current increase due to a heavy load or short circuit, the voltage drop across R2 rises to 0·6V for 50mA, so TR3 switches on. The excess load or short circuit across the output terminals means that TR3 emitter is

**COMPONENTS approximate cost £3·50**

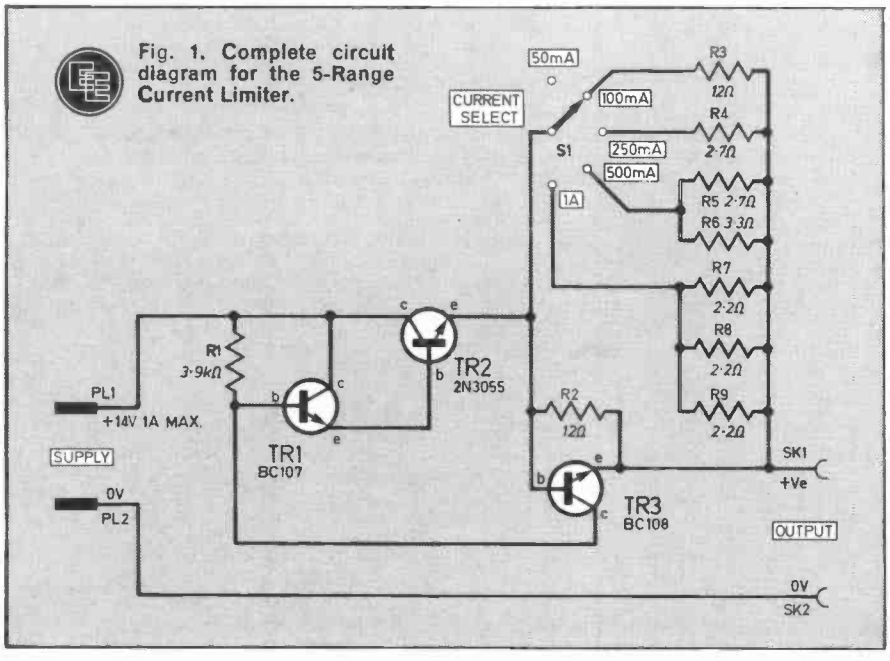


Fig. 1. Complete circuit diagram for the 5-Range Current Limiter.

## COMPONENTS

**Resistors**

R1 3·9kΩ
R2 12Ω
R3 12Ω
R4 2·7Ω
R5 2·7Ω
R6 3·3Ω
R7 2·2Ω
R8 2·2Ω
R9 2·2Ω

All $\frac{1}{4}$ watt carbon ± 5%

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**Semiconductors**

TR1 BC107 *npn* silicon
TR2 2N3055 *npn* silicon
TR3 BC108 *npn* silicon

**Miscellaneous**

S1 2-pole, 6-way switch (see fig.2.)
SK1, SK2 4mm sockets (one red, one black)
PL1, PL2 4mm plugs (one red, one black)
Metal box 165 × 65 × 40mm; five-way tag strip; mica washer, insulating bushes and mounting nuts and bolts for TR2; control knob; solder tag; two lengths of p.v.c. covered 16/0·2mm connecting wire (one red, one black).

negative, so conduction in TR3 moves TR1 base negative, and TR1 emitter follows this, shutting off TR2.

For heavier currents, R3 or other resistors will be in parallel with R2, as described. The current level at which TR3 operates is thus increased.

## CONSTRUCTION starts here

### ASSEMBLY

A metal box 165 x 65 x 40mm is used to house the unit. Transistor TR2 is mounted on the side of the box itself using insulating bushes and mica washers and the remainder of the components are wired between a five-way tag strip and S1 as shown in Fig. 2.

The input to the unit from an external power supply is taken via red and black flexible leads terminated by plugs PL1 and PL2, the output is taken from sockets SK1 and SK2.

Resistor R2 is in circuit for all ranges, so no connection is made to the 50mA position tag on S1. The unit could simply be placed in the positive supply line, but it was found more convenient generally to have negative run to the second socket.

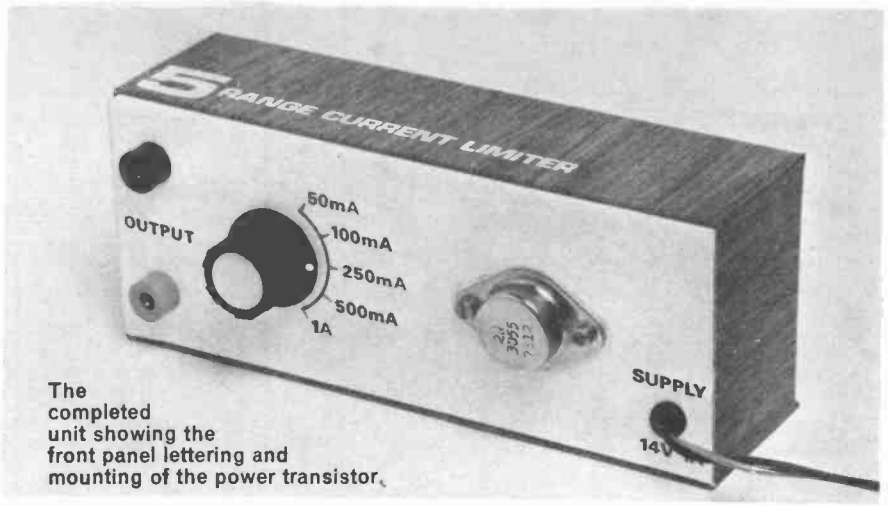
### TESTING THE LIMITER

After assembly, the unit can be checked by placing a meter in series with the supply. Set the instrument to the 1A or larger current range, or to an appropriate lower current range for the lower current positions of S1. With a deliberate overload or short circuit at the sockets of the unit, current will be limited to about the values shown for the various switch positions.

### USING THE LIMITER

The unit is intended for power supplies of up to 24V. In the worst operating conditions, that is a complete short circuit of output on the 1A range with 24 volts, dissipation in TR2 is about 24 watts. This is not immediately too important because the panel and box are a heat sink for TR2, but the short or overload should of course be removed.

At lower currents and voltages, the heating of TR2 will be proportionally less. Switch S1 is set to that current range which comes most nearly above the normal current demand of the equipment, model, or other apparatus being powered. ⌑




The completed unit showing the front panel lettering and mounting of the power transistor.

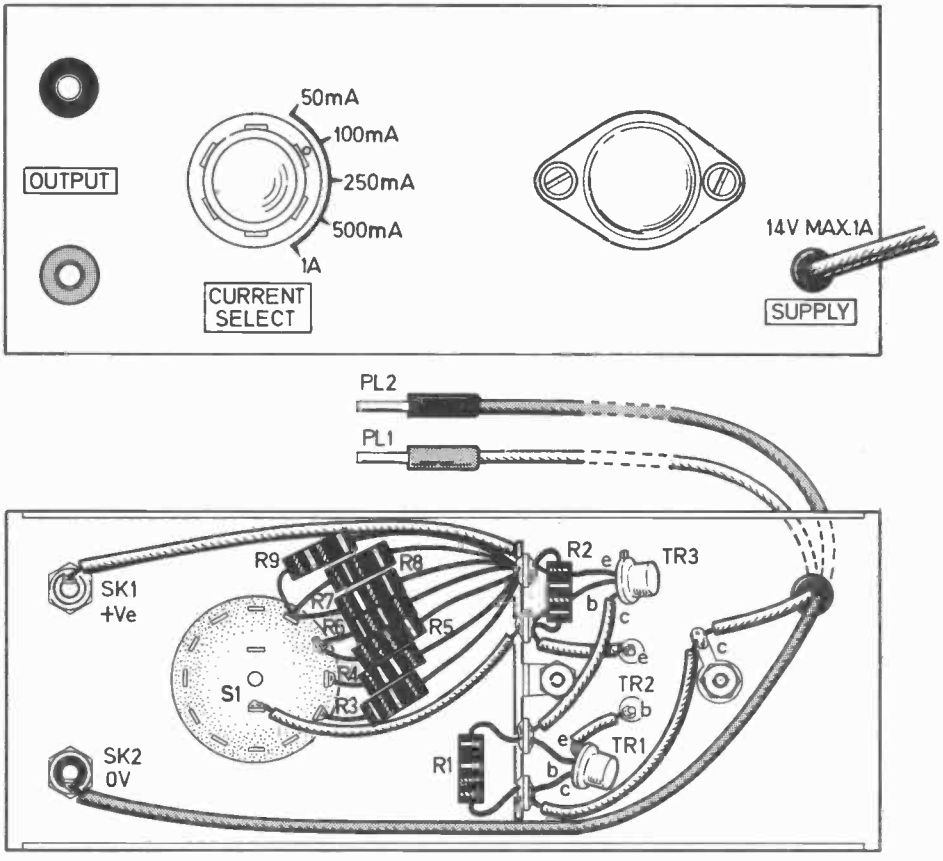



Fig. 2. Layout of components, interwiring and front panel details. Note that S1 consists of one section of a 2 pole-6 way rotary switch with two positions unused.

All components are mounted on the rear of the front panel. The range resistors are wired directly between the range switch (S1) and the small tag strip.