TRANSISTOR TESTER

WITH a view to holding costs at a reasonable level and using ex-equipment devices where possible the circuit of Fig. 1 was developed to test transistors.

Used as a plug-in extension to an existing multimeter, the tester will measure I_{cbe} from 0 to 30μA and 0 to 300μA and β from 0 to 120 and 0 to 300 at 5mA. The values of the components given are for a multimeter with a 30μA, 1kΩ movement, but calculations for other instruments are quite straightforward.

Heart of the unit is the constant current source, R3, R4, R5, D1, D2, which feeds a known I_b to the transistor under test. The choice of voltage for D1 and D2 is fairly restricted as it has to be high enough to overcome V_{be} variations but sufficiently low to allow a reasonable use of the battery supply. In the event, 6V seems a good compromise.

Neglecting a small I_{coe}, β is given by I_c/I_b which gives

$$R_{base} = \frac{V_{effective}}{I_b} \text{ or } \frac{V_{eff} \times \beta}{I_c}$$

The voltage across the base resistance R_b is only the effective voltage V_{eff} of one diode as the forward voltage of the other is approximately equal to V_{be}. R3 is chosen such that it allows I_b to flow even at a low battery voltage but does not consume excessive power.

As constant alteration of meter setting is not attractive in such an application the flexibility is accommodated in the circuit of Fig. 1 and the meter is used on its most sensitive range. R9 protects overcurrent from flowing in the event of a shorted device. R10 shunts the still protected meter up to 300μA.

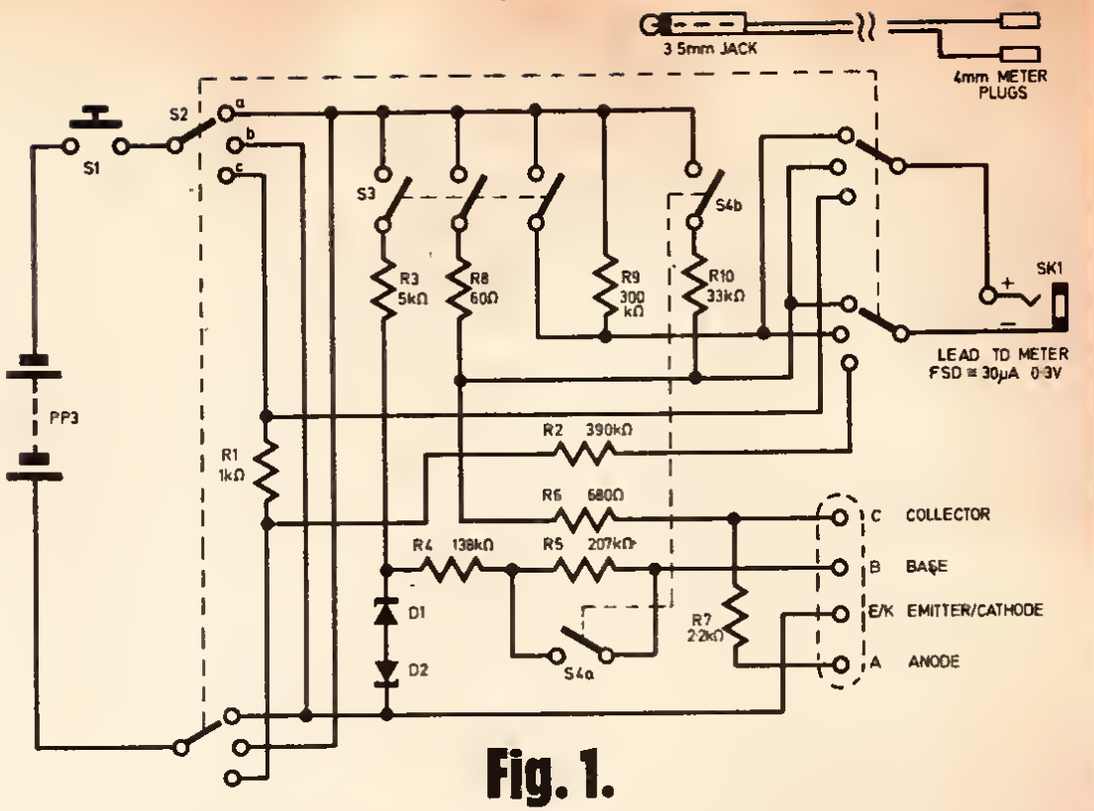

Fig. 1.

For leakage measurements S3 is open circuit and even though the base is connected to ground via D1 and D2 it is effectively open circuit.

R9 must be shorted for β measurements and R8 is used to shunt the meter to 5mA. In this position R6 gives some protection, limiting the current to about 15mA on short circuit. For a diode test R7 limits the current to 3mA.

For reliable operation the battery voltage should be greater than 7V and the battery should be capable of supplying 6mA.

For a transistor holder I used half an 8-pin d.i.l. socket soldered on a piece of Veroboard which in turn was Araldited to the top of a box containing the circuitry and switches.

S4 is connected so that with S4a open and S4b closed both h_{fe} and leakage measurements are at their least sensitive. The meter is less likely to be overloaded if S4 is kept in this state and switched if needed.

S2 gives *npn* in position a, *pnp* in position b and battery test in position c. For diode testing the device to be tested is inserted in the anode and cathode sockets. If it conducts on *npn* then the anode and cathode terminals indicate actual terminations, if the reverse then the opposite connections apply.

The unit is not intended to be accurate beyond about 10 per cent but devices can be matched to about 2 per cent.

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POINTS ARISING

R.F. ORION *(January and*