CONTINUITY TESTER

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THE obvious method of determining the value of an unknown resistance is to employ an ohmeter set to the appropriate scale. However, quite often all that one may require is a simple indication of whether the circuit or component under test is an open or short circuit.

This particularly applies when testing suspect audio leads, fuses and printed circuit boards. A further disadvantage is that whilst trying to position multimeter test probes on the circuit, one must also observe the meter to read off the resistance.

This Continuity Test Unit is a device which generates an audio tone when it detects a short circuit or resistance up to 6·8kΩ or so. It is, therefore, considerably easier to apply the probes of the continuity test unit and listen for the tell-tale audio signal rather than use a less convenient multimeter which always seems to demand your constant attention!

FUSE CHECK

A special facility has been incorporated into the design which permits the unit to quickly and conveniently test the condition of all types of cartridge fuse, without the need to use test probes. This has proved most valuable.

Further details are given to enable you to perform simple tests on diodes and the majority of electrolytic capacitors, to enable you to obtain a quick go/no-go reading.

CIRCUIT DESCRIPTION

The circuit diagram appears in Fig. 1. There are two distinctive sections, each one being centred around an operational amplifier (op-amp).

IC1a and associated components form a simple comparator and it is this part of the device which detects for the presence of short circuits. R3 and R4, being of equal value, set the non-inverting input (pin 3) to half the supply voltage. Since R1 and R2 clamp the inverting input at three-quarters of the supply rail, the op-amp output is held low at roughly 0V, due to comparator action.

Current is able to sink through D1, which illuminates, and its associated current limiting resistor R5 into IC1a output, pin 1.

SK1 and SK2 are the two input sockets to the continuity test unit. Note that they are polarised, SK1 being positive and SK2 negative: this is relevant when testing diodes and capacitors but is otherwise not important.

The component under test is connected up through SK1 and SK2 and thus R2 will be shunted to 0V if a short circuit is present. This will mean that the voltage at the non-inverting input of IC1a will exceed that at the inverting terminal, and then the potential at pin 1 will rise to approximately the supply rail voltage.

The second op-amp, IC1b, is arranged as an astable oscillator which generates a square wave of roughly 4·7kHz. This drives a piezo-ceramic transducer, AWD 1, to produce a distinctive tone without undue battery consumption.

The oscillator is disabled when the output of IC1a is low. Conversely, the audible tone will be generated when a short circuit is present across SK1 and SK2.

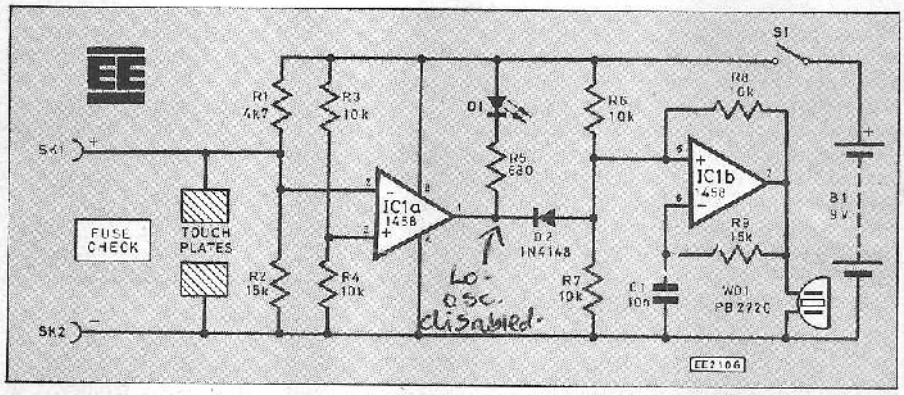
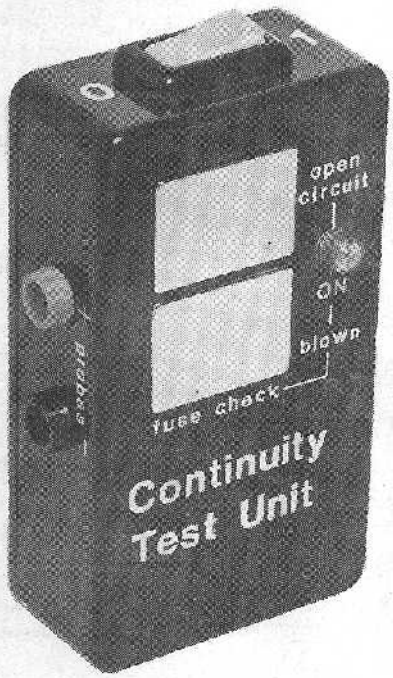


Fig. 1. Circuit diagram of the Continuity Tester.

In actual fact, any resistance up to about 6·8kΩ placed across R2 will cause the op-amp output to go high.



The l.e.d., D1, can be deemed to perform two functions. When power is applied by closing S1, the l.e.d. will light up, assuming that no short circuit is present across R2. In this mode, then, the l.e.d. acts as a power-on indicator.

If, however, this l.e.d. does not illuminate after switching on, then you should immediately check the condition of the battery B1. Thus the l.e.d. will also double as a simple battery condition indicator.

In fact, it was found that if the battery voltage dropped to 5V or less, the oscillator just started to operate. This gives an advanced warning that the battery is on its last legs!

The operational amplifiers used are similar to the universal 741 types. However, it is possible to obtain twin op-amp chips which incorporate two op-amps in an 8-pin d.i.l. package, this device being designated the 1458C, and this chip is used for IC1. A common rail supplies both op amps at pins 8 (positive), and 4 (negative).

CONSTRUCTION

Assembly is a straightforward matter and the components are arranged on 0·1"

matrix stripboard measuring 8 strips by 23 holes, see Fig. 2.

There are four breaks in the copper strips underneath the i.c., and these should be made using preferably a spot face cutter or hand-held twist drill of appropriate diameter.

To protect the integrated circuit from possible thermal damage during soldering, it is best to use an 8-pin d.i.l. socket. Then solder in the components in accordance with the diagram. In particular, observe correct polarity of the diode D2 and do not heat it for too long when soldering.

The prototype was constructed in an ABS box which measures 113 × 63 × 31mm. It is then possible to slot the component panel into the internal p.c.b. guides moulded inside the box, and so no mounting hardware is required for the stripboard.

The special fuse-checking facility incorporated into the prototype. This consisted of two rectangular touch pads bolted to the front panel with approximately 2mm between them. The touch pads, it will be seen, are effectively extensions of SK1 and SK2 and thus it becomes an easy matter to place suspect fuses across the pads to determine their condition. Of course, the audio tone will sound if the fuse is intact.

The case must be drilled to take the touch pads (if used), the l.e.d. and rocker switch. The l.e.d. can be affixed to the front using a transparent lens clip. The two 4mm sockets are mounted on the side of the box, having once made certain that they will not interfere with the touch pad mounting studs which protrude into the case.

At this stage you may wish to letter the case; this can be accomplished with rub-down lettering, followed by several light coats of protective lacquer.

AWD1, the piezo transducer, can simply be stuck to the inside of the removable panel with double sided foam strip. This will be found to be perfectly adequate in holding the transducer firmly in place.

With construction complete, snap on a suitable battery (PP3), and then switch on at S1. The l.e.d. should illuminate. Shorting the touch pads or sockets should cause the l.e.d. to extinguish and the audio tone should be clearly heard. The unit is then complete and ready for use.

USING THE TESTER

The continuity test unit can immediately be used to check out the confusing terminals of rotary switches, breaks in copper tracks of printed circuit boards (not to mention heated rear window elements in cars) and also helps unravel connections in DIN audio leads.

It is also possible to perform simple tests on electrolytic capacitors. Connect the positive terminal to SK1 and the negative to SK2. The oscillator should sound for a period determined by the capacitance of the unit under test. A continued tone indicates a shorted capacitor

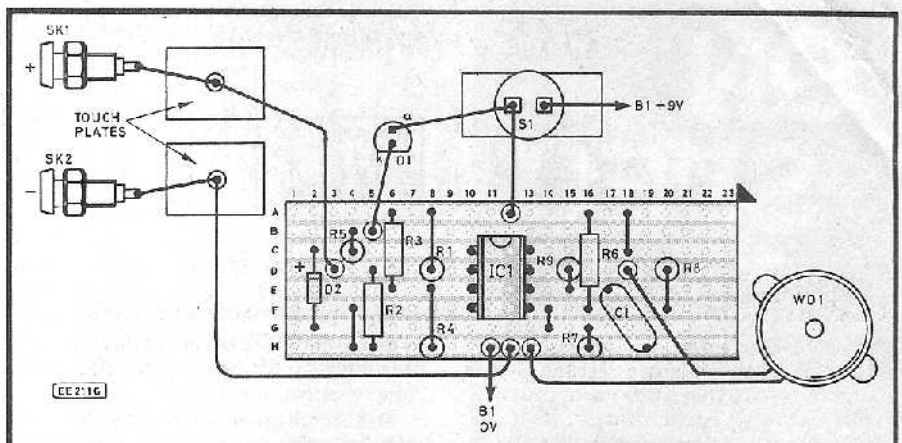
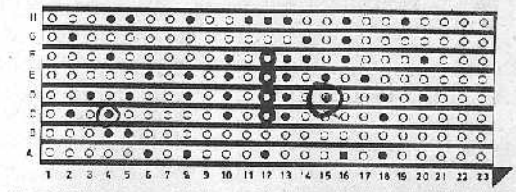


Fig. 2. Stripboard cutting details and component layout of the Continuity Tester.



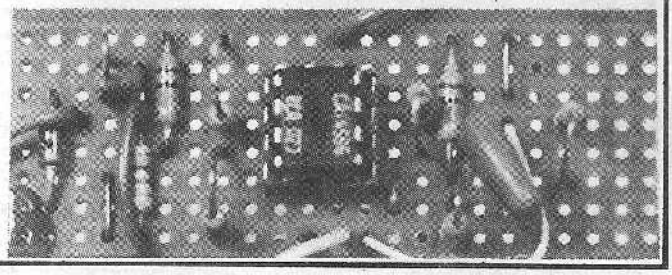


Photo illustrating the stripboard layout of the Continuity Tester.

or possibly excessive leakage current. No tone at all hints at an open circuit capacitor. Ensure that the capacitor is discharged to begin with. As a guide, a 1,500µF capacitor caused the tone to be heard for about nine seconds.

To check the polarisation of diodes, clip the diode to the test leads inserted into SK1 and SK2, note any results and then reverse the connections.

A tone heard both ways indicates a short circuited diode and again no tone at all would imply an open circuit: in both cases, of course, the diode can be considered unserviceable. If a tone is heard one way round but not the other, then, with the oscillator sounding, the anode of the diode is connected to SK1; also, the diode can be considered to be functioning normally.

The above information will hold true for both silicon and germanium diodes, as well as l.e.d.s. The forward current through the diode will be no more than 2mA and so there is no risk of damage in this respect. ☐

COMPONENTS

Resistors

R1	4k7
R2	15k
R3,R4, R6–R8	10k (five off)
R5	680
R9	15k

All resistors ¼W 5% carbon

Capacitor

C1	10n polyester

Semiconductors

D1	TIL220 0·2" red l.e.d.
D2	1N4148 silicon diode
IC1	1458C twin op-amp

Miscellaneous

S1 s.p.s.t. rocker switch; B1 9V PP3 battery and clip; AWD1 TOKO PB2720 piezo-ceramic transducer; SK1 red 4mm socket; SK2 black 4mm socket; 0·1" matrix stripboard, 8 strips × 23 holes; ABS case, 113 × 63 × 31mm; rectangular touch pads, two off; 8-pin d.i.l. i.c. socket; transparent l.e.d. lens-clip; general-purpose hook-up wire; solder, etc.

See Shop Talk page 377

Approx. cost Guidance only **£7.00**