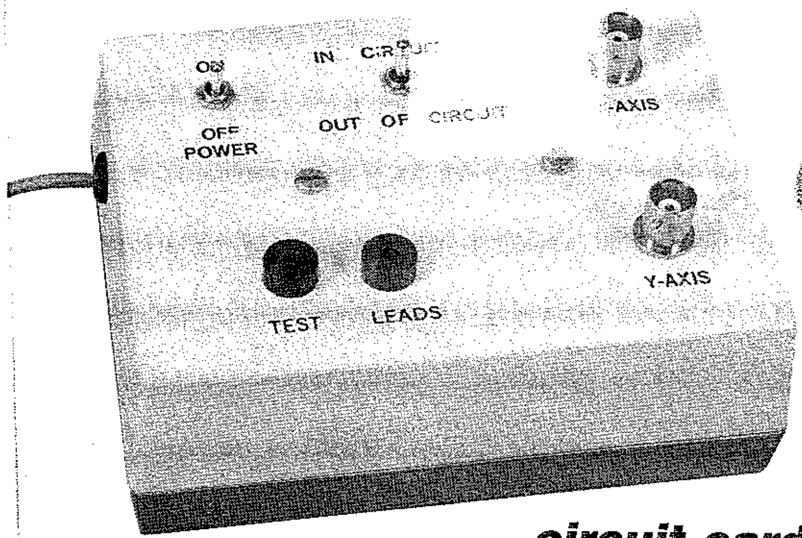

QUICK-TEST COMPONENT TESTER

Find bad components in-circuit on a crowded circuit card. Build this inexpensive, yet very useful tester in a single evening.

JAMES MELTON

IN TODAY'S WORLD OF ELECTRONICS, technicians sometimes forget or have never learned the older methods used to troubleshoot components. The result is that they spend way too much time working on a problem that a more experienced technician would quickly locate. Today, as always, time is money, and if you spend too much time on simple problems, you are not making as much money or profit as you could. By saving time you might also be able to reduce the charges to your customer. There are several old-time methods for finding trouble in electronic circuits that still apply to the most modern of electronic marvels

One such troubleshooting method calls for injecting an AC signal into a component, and then reading the voltage produced across the component and the current flowing through it on an oscilloscope. Many test instruments have been sold that perform this task. The advent of more and more digital, CMOS, mega-transistor logic modules that must be replaced as a unit has made these testers harder and harder to find, and people who know how to use them are becoming scarce.

With a *Quick-Tester* and an oscilloscope, you can determine the status of capacitors, resistors, diodes, transistors, SCR's, Zener diodes—in fact just about any bipolar junction device—either in-circuit or out-of-circuit. Therefore you can pinpoint the defective component on a board, eliminating unnecessary and often damaging desoldering of good, but suspect components from densely packed circuit boards. Best of all, the tester can be built from readily available components found in the barest of scrap boxes

Experienced troubleshooters will tell you that 90 percent of the problems in electronic gear arise in two major areas: the power supply, and then any circuit sections that interface the circuit board to the outside world, such as the power transistors, sensors, driver or interface IC's. Many circuits will continue to operate to some degree with a bad power supply. But when supply voltage dips or rises or if there is too much AC ripple on the supply, the circuit can act up at unpredictable times. The problem may appear to be a bad component, yet you will find it extremely difficult to trace this kind of power supply problem to a specific bad component on the board. Many electronic assemblies can be repaired by simply testing the power supply first, to be sure it is doing its job

All the interface components of a printed-circuit board are subject to a variety of unusual stresses: stray static charges, connectors wired wrong, and lightning or other surges that can also damage components. The *Quick-Tester* shown here

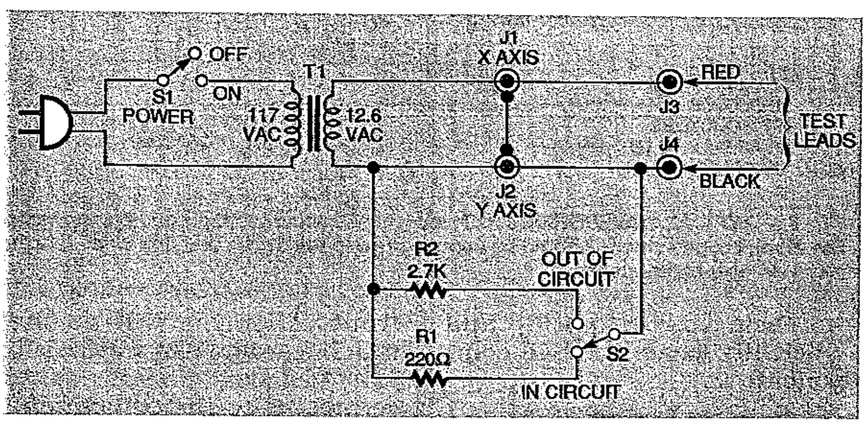

FIG. 1 — FULL SCHEMATIC OF THE instrument. When you use it to check components it creates a specific signature waveform on your scope.

will help you to quickly and efficiently locate the bad component.

Inside the tester

The circuit is shown in Figure 1. There are two BNC connectors for the oscilloscope inputs, two banana jacks for the test leads to the component under test, two resistors, two switches, one line cord and one transformer. Once you have assembled your tester you will need an oscilloscope to view the waveforms. No special construction techniques are required to assemble this device. There are not enough components to justify a printed circuit board. All the wiring inside is point to point, and all the components are mounted to the top (lid) of the box. Since all the components come out of the box with the lid, there are fewer connecting wires to break, and troubleshooting will be that much easier. Anyway, build your test box as shown, then connect it to the components you wish to test as shown in Fig. 2. The polarity of the leads will affect the diagram shown on the oscilloscope (reverse the leads and the trace turns upside down), but the actual polarity of the device or the leads is not important as far as troubleshooting is concerned.

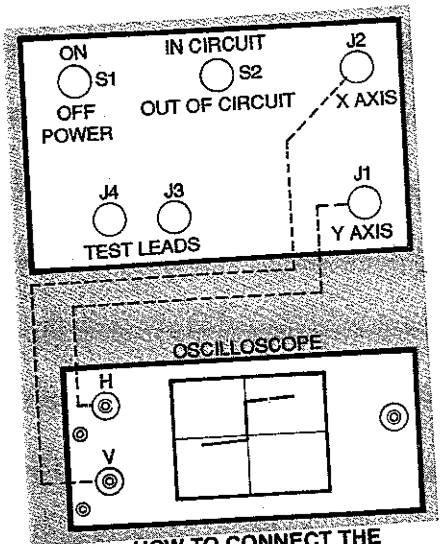

FIG. 2 — HOW TO CONNECT THE TESTER to your scope.

PARTS LIST

R1—220 ohms, 1/4 watt, carbon film resistor
R2—2,700 ohms, 1/4 watt, carbon film resistor
J1, J2—BNC jacks
J3, J4—Banana jacks
S1—SPST toggle switch
S2—DPST toggle switch
T1—Transformer: primary 120 volts, secondary 12.6 volts, 10 mA or greater
Miscellaneous: Case, line cord
Note: The following are offered by SolarWorks, 2747 Wentworth Drive, Grand Prairie, TX 75052.
- Kit of all parts mentioned in the parts list is available for $45.00 plus $3.00 S&H.
- Fully assembled and tested *Quick-Tester* is available for $55.00 plus $3.50 S&H.

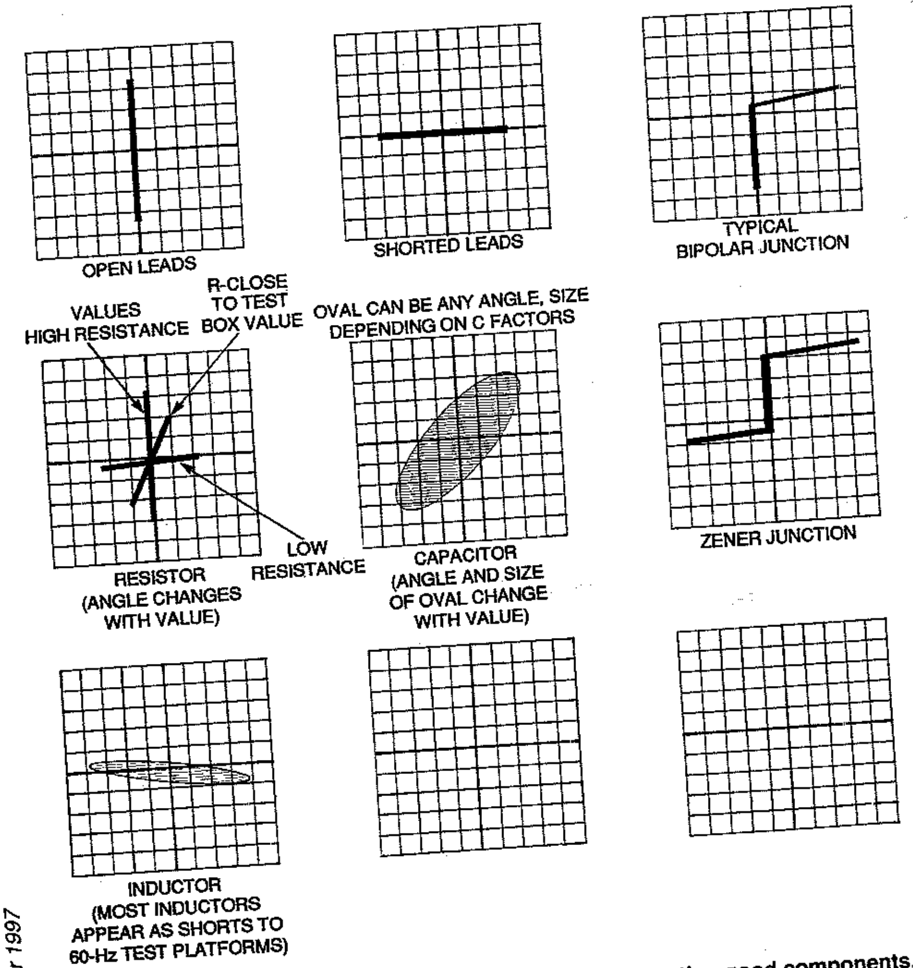

FIG. 3 — TYPICAL WAVEFORMS THAT you will see when testing good components. The blank scope screens should be used to draw in the traces you find when use the tester on new components.

How to put it to work

This test box allows you to place an AC voltage across the DUT (Device Under Test) and measure the voltage across it and the current through it simultaneously. As you can see from the circuit diagram in Fig. 1, the black test lead can be considered to be the ground lead, and the red can be considered to be the positive or active test lead. Connect your oscilloscope as shown in Figure 2. For this explanation, let's assume that the DUT is a Zener diode with a reverse voltage rating of 6.3 volts. If this diode is hooked up as shown in Fig. 2, you can see that as the voltage becomes more positive on the red lead, the diode will allow the voltage to rise and there will be no current flow. This will cause the scope vertical input (Y) to rise, and it will go straight up, because there is no current flow.

At some point near the Zener voltage, current will start to flow through one of the resistors (in circuit or out) and the voltage will slow or stop rising as the current goes up. This will have the effect of putting a small voltage on the X axis (horizontal) input of the oscilloscope, and the trace will then move in a positive direction (to the right) for the rest of the half cycle of AC. On the reverse cycle, the opposite occurs. You will be able to see the Zener knee voltage quite clearly (as shown in Fig. 3) and you will also see a knee in the opposite direction as the voltage passes through the normal or diode junction of the Zener in the forward biased mode.

When testing any junction devices, the procedure is the same, but the waveforms will be slightly different in values according to the breakdown vootages of the DUTs. The point of this procedure is to become familiar with the expected waveforms. With practice you will be able to identify components without looking at the waveform chart simply because there are not that many waveforms to remember.

Other discrete devices that you will encounter and will want to test include capacitors, resistors and inductors. See Fig. 3 to see the waveforms for each of these devices.

You've got to think

One important note about using the *Quick-Tester*. When you use it to test components in a circuit, you must analyze the circuit to figure out why you have a particular waveform on your scope. In most cases, the really odd waveforms are the result of mixing two or more components in parallel (or perhaps in series inside a component) when using the unit. It is perfectly normal to see a capacitor across the base-emitter junction in a transistor circuit, and when you check that junction you will see a combination of the two discrete waveforms on the screen. Do not let that pattern throw you; just learn what it looks like and go on to the next piece to be tested. Ω

ELECTRONICS TECHNICIANS

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and not in education. Do we need to develop a cooperative work program for educators? A cooperative salary schedule would make the field of education more attractive. How many of our teacher-education facilities are even providing the training for electronics instruction? That too has shown a distinct drop in enrollment and the elimination of vocationally oriented teacher-education programs across our nation.

I suggest developing a cooperative program between industry and education where the educational institutions can provide the expertise in curriculum development, how people learn and the use of instructional technology. The community college or technical college can provide the required electronics-specific education to the potential educator, and industry can provide the necessary hands-on experience with state-of-the-art equipment for both future educators and those presently employed in electronics education. The three groups, working hand in hand, can provide a qualified and well-trained individual to teach the future generations of electronics technicians.

Getting it Done. None of the suggestions presented here will occur without the total involvement of all facets of our industry and our educators. We need a national movement to support such endeavors. Without it, we will never provide the people required to service the rapidly growing number of electronics products owned and used by consumers. I call upon the entire electronics-service industry and its manufacturers to work together with educators and our educational system to develop and deliver the materials necessary to meet this demand. The present need as well as the future need for qualified electronics-service personnel is not going to diminish—it can only increase. Only through a joint effort will this critical need be met and the future of this very important industry be continued. Ω