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STUDENT HANDOUT

SEMICONDUCTOR TEST DEVICE

Terminal Learning Objective: Provided a schematic, a faulty generator set electrical system, and applicable tools and test equipment, with the aid of references, repair the generator set electrical system so that it functions properly in accordance with the appropriate equipment technical manual. (1142.1.03)

Enabling Learning Objective: Given a list of circuit characteristics, identify the characteristics that apply to a semiconductor test device, in accordance with the semiconductor test device's Operators Manual. (1142.01.03ba)

BODY:

1. Uses of the Semiconductor Test Device:

a. The semiconductor test device represents new generation test instruments designed specifically for troubleshooting and testing solid state components and circuitry. The semiconductor test device's unique capabilities apply to a wide range of electronics hardware, including telephone, radio, audio, computers and peripherals, CB's, ham radios, automotive electronics, electro-medical equipment and many more. Now you are thinking, that covers a lot of ground. Right! So what do all of these have in common?

b. The semiconductor test device will check integrated chips, bipolar transistors, Darlingtons, F.E.T.'s, diodes, Light Emitting Diodes, Zener Diodes, U.J.T.'s, bridge rectifiers, electrolytic capacitors, selenium’s, gate control switches, and diodes "back to back".

2. Operation of the Semiconductor Test Device:

a. The semiconductor test device injects a signal into a circuit or component giving graphic displays circuit or component's response. The unique circuitry of semiconductor test device makes it possible to test components with shunt resistances as low as 10 ohms and the

semiconductor test device has the ability to test solid state components "in-circuits".

b. Semiconductor test device's integral scopes display and visualize both forward and reverse response of the device being tested. Only two, non-polar, leads are required since polarity is not significant to testing, and reversing leads merely changes the scope response from one side to the other, resulting in a display reversal.

c. Operating controls for the semiconductor test device are simple and concise. There are three front panel controls to adjust the scope display for vertical, horizontal, centering, and brightness. It also has a rear panel focus control and a power on/off switch. It has three impedance range switches.

(1) Low - to test junctions accurately down to a shunt resistance to 10 ohms.

(2) Medium - will test down to 4,000 ohms resistance while presenting higher voltage to the device being tested.

(3) High - will test down to 5,000 ohms also presenting higher voltage, which is extremely useful for testing high-powered devices.

d. Some special features are the high impedance circuit, which allows a transistor to be tested between emitter and collector with no damage to the transistor. You can also test direct-coupled circuits because it isolates and locates defective components without removing them from the circuit. Semiconductor test device have a built in oscilloscope, the visual response displays the reaction of a circuit to the test signal and ground or any other common point.

3. **Safety Rules**: Since the semiconductor test device does inject an AC signal into the component there are a couple of safety rules to follow when using the test device.

a. Start on the low setting and work up to higher settings, this prevents you from injecting a signal that will damage the component.

b. Never Use On Energized Circuit: Using the test device on an energized circuit can damage both the component being tested and the test device itself.

4. **Procedures and Observation**:

a. As soon as your test device is warmed up, you should see a green line across the screen. Using the vertical and horizontal hold knobs, center the line on the screen. Once

you have this done, turn the focus to where your line is sharp and clear.

(1) On the Huntron Tracker the line will be diagonal across the screen.

(2) On the Vu-Data the line will be horizontal across the screen.

(3) On both types of test devices this is an indication of an “open”. Some places that you would expect to see opens are:

(a) Transistors, across the emitter to collector.

(b) SCR’s across the anode to cathode and across the anode to gate.

(c) UJT’s across base 1 to base 2.

b. On both types of test devices a “short” is indicated by a vertical line. The only time you should see a “short” is when you are checking for continuity. If you get this indication at any other time, check to ensure that the test device is on the “low” setting.

c. Resistance. The semiconductor test device is not typically used to test resistance, but it will indicate resistance by showing a straight line on the screen that is in between the indicators for a open or a short.

(1) On the Huntron the line will fall in one of the shaded areas of the diagram.

(2) On the Vu-Data the line will fall in one of the shaded areas of the diagram.

(3) The test device will not give an actual value of resistance, but the closer the line is to being an open the higher the resistance, and the closer the line is to being a short the lower the resistance.

c. PN Junction: There are two significant characteristics of a satisfactory PN junction: (1) sharp angles and (2) straight legs. Any curved angles or curved legs displayed on the scope indicate a leaking junction, which is a defect. If there is no change in the display then there is an "open" in the component. A "short" in a component will be represented by the display running vertically, top to bottom.

(1) On the Huntron the display will be check mark as shown. The diagram shows a forward biased PN junction. If the display was inverted it would designate a reversed bias junction.

(2) On the Vu-Data the diagram will a right angle. Again the diagram shows a forward bias junction, and an inverted signal would indicate a reverse bias junction.

(3) Some of the places that you can expect to see the PN junction displays we have shown are:

(a) On transistors across both the base-emitter junction, and the base-collector junction.

(b) Across PN junction diodes and light emitting diodes.

(c) Across the gate to cathode junction of a silicon controlled rectifier.

(d) Across the base 1 and emitter junction of an unijunction transistor.

(4) There are some PN junctions that give us slightly different displays than what we have stated previously. These displays do not mean the component is bad, but are normal variances.

(a) On the Huntron a zener diode may display with a second angle. The same rules apply as it should be a sharp angle and have straight lines. The diagram does show a forward bias junction.

(b) On the Vu-Data a zener diode may also display a second angle as with the Huntron.

(c) Testing with the Huntron across base 2 and emitter of an unijunction transistor will normally display a curve as shown in the diagram. This curve is due to the increased resistance that is also being measured.

(d) On the Vu-Data testing across base 2 to emitter of the unijunction transistor will give you a curve instead of a sharp angle.

e. Capacitors: In testing capacitors, there is a rule-of-thumb to remember: the lower the value of the capacitor rating, the higher the impedance. The higher the capacitor rating, the lower the impedance. In using the Semiconductor test device to test capacitors, set the impedance ranging buttons properly to achieve a valid test.

2 ufd to 5000 ufd - - - - - Low
.01 ufd to 4 ufd - - - - - Medium
.0025 ufd to .4 ufd - - - - High

When we test capacitors, we no longer look for straight legs and sharp angles. A good capacitor displays an oval or egg shaped circle on the screen.

REFERENCE: Semiconductor Test Device Operator Manual.

Equipment Record Procedures.