3–5 Troubleshooting

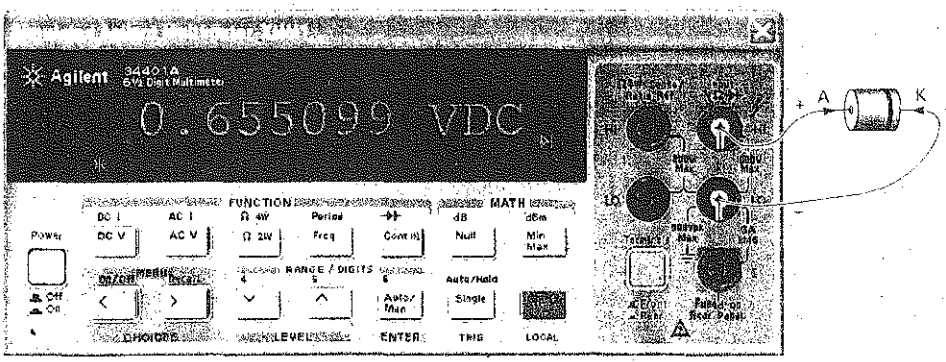
You can quickly check the condition of a diode with an ohmmeter on a medium-to-high resistance range. Measure the dc resistance of the diode in either direction, and then reverse the leads and measure the dc resistance again. The forward current will depend on which ohmmeter range is used, which means that you get different readings on different ranges.

The main thing to look for, however, is a high ratio of reverse to forward resistance. For typical silicon diodes used in electronics work, the ratio should be higher than 1000:1. Remember to use a high enough resistance range to avoid the possibility of diode damage. Normally, the R × 100 or R × 1K ranges will provide proper safe measurements.

Using an ohmmeter to check diodes is an example of go/no-go testing. You're really not interested in the exact dc resistance of the diode; all you want to know is whether the diode has a low resistance in the forward direction and a high resistance in the reverse direction. Diode troubles are indicated for any of the following: extremely low resistance in both directions (diode shorted); high resistance in both directions (diode open); somewhat low resistance in the reverse direction (called a *leaky diode*).

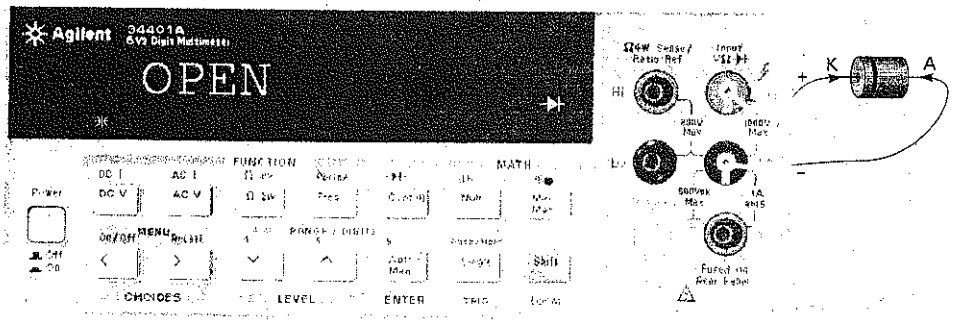
When set to the ohms or resistance function, most digital multimeters (DMMs) do not have the required voltage and current output capability to properly test *pn*-junction diodes. Most DMMs do, however, have a special diode test range. When the meter is set to this range, it supplies a constant current of approximately 1 mA to whatever device is connected to its leads. When forward biased, the DMM will display the *pn*-junction's forward voltage V_F shown in Fig. 3-13*a*. This forward voltage will generally be between 0.5 V and 0.7 V for normal silicon *pn*-junction diodes. When the diode is reverse biased by the test leads, the meter will give an overrange indication such as "OL" or "1" on the display as shown in Fig. 3-13*b*. A shorted diode would display a voltage of less than 0.5 V in both directions. An open diode would be indicated by an overrange display in both directions. A leaky diode would display a voltage less than 2.0 V in both directions.

Figure 3-13 (*a*) DMM diode forward test.



(*a*)

Figure 3-13 (*b*) DMM diode reverse test.



(*b*)

Example 3-9

Figure 3-14 Troubleshooting a circuit.

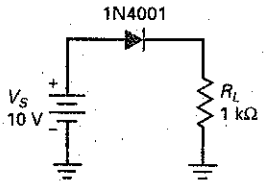


Figure 3-14 shows the diode circuit analyzed earlier. Suppose something causes the diode to burn out. What kind of symptoms will you get?

SOLUTION When a diode burns out, it becomes an open circuit. In this case, the current drops to zero. Therefore, if you measure the load voltage, the voltmeter will indicate zero.

Example 3-10

Suppose the circuit of Fig. 3-14 is not working. If the load is not shorted, what is the trouble?

SOLUTION Many troubles are possible. First, the diode could be open. Second, the supply voltage could be zero. Third, one of the connecting wires could be open.

How do you find the trouble? Measure the voltages to isolate the defective component. Then disconnect any suspected component and test its resistance. For instance, you could measure the source voltage first and the load voltage second. If there is source voltage but no load voltage, the diode may be open. An ohmmeter or DMM test will tell. If the diode passes the ohmmeter or DMM test, check the connections because there's nothing else to account for having source voltage but no load voltage.

If there is no source voltage, the power supply is defective or a connection between the supply and the diode is open. Power-supply troubles are common. Often, when electronics equipment is not working, the trouble is in the power supply. This is why most troubleshooters start by measuring the voltages out of the power supply.