

## Low Side versus High Side Switch

The arrangement of the line voltage, the thyristor switch, and the load has a major impact on the safety of the equipment you design and build. A mistake or a misunderstanding at these voltages can be fatal. In the simple world of low voltage electronics, the position of the voltage source, the switch, and the load makes little difference. After all, it is a series circuit. Elements in a series circuit can be rearranged without changing the circuit's operation. Current is still the same, regardless of which part it passes through first.

Look at Figure 8-10. One end of the line source is **neutral**. Somewhere in the wiring of the power distribution system this side is tied to **earth**, perhaps at a cold water pipe or other metal rod that actually runs deep into the soil. This end is safe. There is little difference in potential between this end and the chassis of the equipment you operate, or the concrete or metal floor on which you stand.

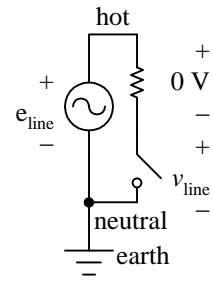
The other end of the source is **hot**. It is lethal. It is over 100 V above earth, with massive current carrying ability. Touching this point while standing on earth may result in a serious shock, sending enough current through you to kill.

The switch in Figure 8-10 is tied to the **low side**, neutral and earth. When it is closed, neutral is applied to one side of the load and hot to the other. The lamp lights, the heater warms, the motor spins. All is well.

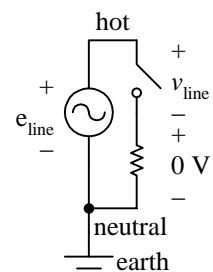
But opening the switch creates a hazard. True, with the switch open, no current flows, and the load is deactivated. With no current flowing through the load, it drops no voltage. So both ends of the load are at the same potential. They are *both* hot. The line voltage now appears across the open switch. Anyone seeing that the load is deactivated could reasonably assume that power had been removed, and that the load is safe to work on. But both ends are hot. Touching either end of the deactivated load, when it is controlled by a low side switch, connects you to the line!

The proper arrangement is shown in Figure 8-11. The switch has been moved to the **high side**, and the load is now tied to neutral. With the switch closed, hot powers the load. But when the switch is opened, with no current through the load, the load drops no voltage. Both ends are at the same potential, neutral. With the load obviously deactivated, it is now safe to touch.

Using the thyristor as a high side switch is the preferred configuration. However, it does present two difficulties. Should it be necessary



**Figure 8-10** Low side switch



**Figure 8-11** High side switch