Separable connection

The power connection consists of two sections the wall receptacle and the wall plug. This connection is a **separable connection**, the wall plug is separable from the wall receptacle to enable the lamp to be moved to different locations. The wall plug has two metal pins that are inserted into the wall receptacle and the wall receptacle contains two metal spring systems that are deflected as the pins are inserted. Two pins/receptacle springs are necessary to provide both input and output power connections. The force created by the deflection of the receptacle spring when a pin and the receptacle spring come in contact creates and maintains the metal-to-metal interface that enables the power, voltage and current, from the power source to be transmitted to the lamp. The properties of this interface will be discussed in detail later in this chapter, but it is worth noting at this point **that creating and maintaining a metal-to-metal interface is the prime goal of connector design**.

Permanent connection

Connector

In addition to this separable connection, there are two **permanent connections**. The wall receptacle is connected to the house wiring, usually by a mechanical connection. Similarly, the wall plug is connected to the lamp cord wiring, also through a mechanical connection. **These two types of connections, separable and permanent, are characteristics of connectors**.

1.1 Connector Function

With this basic introduction to connectors in hand, consider now a more detailed introduction to connectors and the components of a connector. A functional definition of a connector is:

A connector is an **electromechanical** system which provides a **separable connection** between two subsystems of an electronic system without an **unacceptable effect** on the performance of the device.

The bolded terms in this definition are the most significant characteristics of a connector.

A connector is an **electromechanical** system in that it creates an electrical connection by mechanical means. As previously mentioned, deflection of mechanical springs creates a force between the two halves of the connector on mating which creates areas of metal-to-metal contact at the mating interface. The metal-to-metal interface provides the connection where the current flow takes place.

A separable connection, separability, is the primary reason for using a connector. Separability may be required or desirable for a variety of reasons. Manufacturability considerations include allowing for independent manufacturing of subassemblies or subsystems with final assembly taking place at a central location. As the complexity and functionality of electronic systems continues to increase this manufacturing flexibility is increasingly important. One example is the ability to “custom build” a personal computer to your own specifications. A second example is to allow for maintenance or upgrading of components or subsystems as increased functionality becomes necessary. Finally, portability and the ability to support an increasing range

of peripherals in a laptop computer require separable connections for multiple use of an input port or usage at multiple locations. The number of **mating cycles**, mate and unmate, needed depends on the reason separability is required. Manufacturability reasons generally require only a few mating cycles while portability and multiple port usage may require several hundred mating cycles in a laptop computer.

Mating cycle

While these separability capabilities are virtues, separability, by definition, introduces an additional interface into the system. This interface must not introduce any **unacceptable effects**, in particular any unacceptable electrical effects, on the system performance. The most significant potentially unacceptable electrical effect relates to the resistance across the mating interface: both the magnitude and stability of the resistance. Resistance increases are of particular importance in power transmission for two reasons. First, the Joule, or I^2R, heating as current, I, flows increases as the electrical resistance, R, increases. Joule heating increases the temperature of the contacts which, in turn increases the degradation rate of the interface, up to and including, melting or open circuiting of the interface. Second, large increases in resistance can impact the signal transmission characteristics in digital applications. Thus, the magnitude and stability of the resistance across a mating interface is a major consideration in connector performance and reliability. Interface resistance will be discussed in detail later in this chapter.

1.2 Connector Structure

Consider now a structural definition of a connector. There are four basic components in a connector. They are:

A. the connector housing
B. the contact springs
C. the contact finish
D. the contact interface

This chapter will provide a basic introduction to connector housings, contact springs and contact finishes with details to be provided in following chapters. The contact interface will be discussed in detail in this chapter.

A few general comments are appropriate at this point. All connectors consist of two mating halves, a plug half which is inserted into the receptacle half. This plug/receptacle structure exists in both the housings and the contact springs. With respect to the contact springs, as mentioned earlier, in most connectors the plug contact deflects a spring system in the receptacle contact. This spring deflection produces the contact force which creates and maintains the desired metal-to-metal contact interface.

Plug
Receptacle

Consider these components as realized in a wall plug/receptacle connector as shown in Figure 1.2. The housing of the plug connector is overmolded onto the straight copper alloy plug contacts which are crimped onto the lamp cord wire. The housing of the

Contact

receptacle connector is assembled around the copper alloy receptacle contacts which are pressure connected to the house wiring. When the connector halves are mated, the receptacle contact spring is deflected by the plug contact creating the contact interface. In this example, there is no contact finish, no plating or coating, on the contacts. The functions of a contact finish will be discussed in a following section.

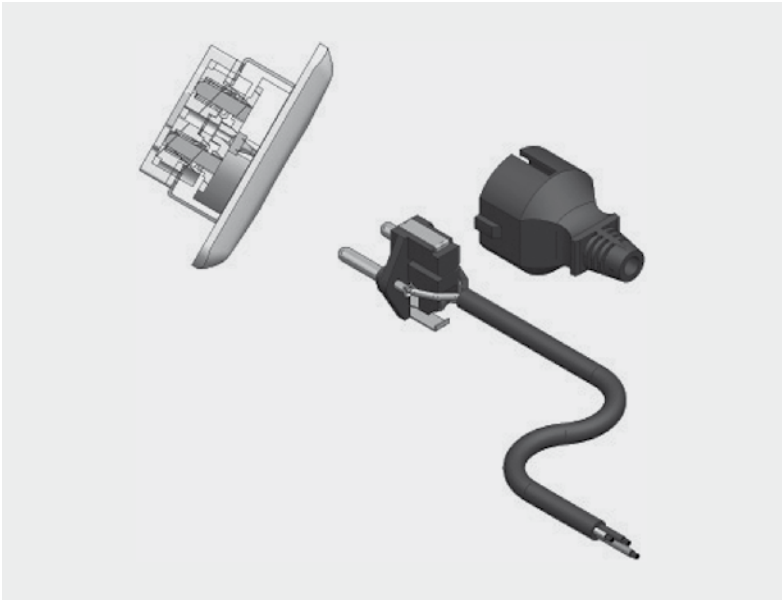

Fig. 1.2: Components of a wall plug/receptacle connector

A cross section of a more typical connector is shown in Figure 1.2 with all components illustrated. Each of the connector components will be discussed briefly in this chapter and in detail in the following chapters.