record separator (RS) and file separator (FS). The communication control characters are useful during the transmission of text between remote terminals. Examples of communication control characters are STX (start of text) and ETX (end of text), which are used to frame a text message when transmitted through a communication medium.

byte

ASCII is a 7-bit code, but most computers manipulate an 8-bit quantity as a single unit called a *byte*. Therefore, ASCII characters most often are stored one per byte. The extra bit is sometimes used for other purposes, depending on the application. For example, some printers recognize 8-bit ASCII characters with the most significant bit set to 0. Additional 128 8-bit characters with the most significant bit set to 1 are used for other symbols, such as the Greek alphabet or italic type font. When used in data communication, the eighth bit may be employed to indicate the parity of the binary-coded character.

11-2 Input–Output Interface

Input–output interface provides a method for transferring information between internal storage and external I/O devices. Peripherals connected to a computer need special communication links for interfacing them with the central processing unit. The purpose of the communication link is to resolve the differences that exist between the central computer and each peripheral. The major differences are:

1. Peripherals are electromechanical and electromagnetic devices and their manner of operation is different from the operation of the CPU and memory, which are electronic devices. Therefore, a conversion of signal values may be required.
2. The data transfer rate of peripherals is usually slower than the transfer rate of the CPU, and consequently, a synchronization mechanism may be needed.
3. Data codes and formats in peripherals differ from the word format in the CPU and memory.
4. The operating modes of peripherals are different from each other and each must be controlled so as not to disturb the operation of other peripherals connected to the CPU.

interface

To resolve these differences, computer systems include special hardware components between the CPU and peripherals to supervise and synchronize all input and output transfers. These components are called *interface* units because they interface between the processor bus and the peripheral device. The word “Interface” is a general term for the point of contact between two parts of a system. In digital computer system the interface is refered as a complementary set of signal connection points between two parts of a system. Therefore, “to interface” means to attach two or more components or systems,

via their respective interface points for data exchanges between them. Two main types of interface are CPU interface that corresponds to the system bus and input–output interface that depends on the nature of input–output device. To attach an input–output device to CPU and input–output interface, circuit is placed between the device and the system bus. This circuit is meant for matching the signal formats and timing characteristics of the CPU interface to those of the input–output device interface. The main function of input–output interface circuit are data conversion, synchronization and device selection. Data conversion refers to conversion between digital and analog signals, and conversion between serial and parallel data formats. Synchronation refers to matching of operating speeds of CPU and other peripherals. Device selection refers to the selection of I/O device by CPU in a queue manner. In addition, each device may have its own controller that supervises the operations of the particular mechanism in the peripheral.

I/O Bus and Interface Modules

A typical communication link between the processor and several peripherals is shown in Fig. 11-1. The I/O bus consists of data lines, address lines, and control lines. The magnetic disk, printer, and terminal are employed in practically any general-purpose computer. The magnetic tape is used in some computers for backup storage. Each peripheral device has associated with it an interface unit. Each interface decodes the address and control received from the I/O bus, interprets them for the peripheral, and provides signals for the peripheral controller. It also synchronizes the data flow and supervises the transfer between peripheral and processor. Each peripheral has its own controller that operates the particular electromechanical device. For example, the printer controller controls the paper motion, the print timing, and the selection of printing characters. A controller may be housed separately or may be physically integrated with the peripheral.

Figure 11-1 Connection of I/O bus to input–output devices.