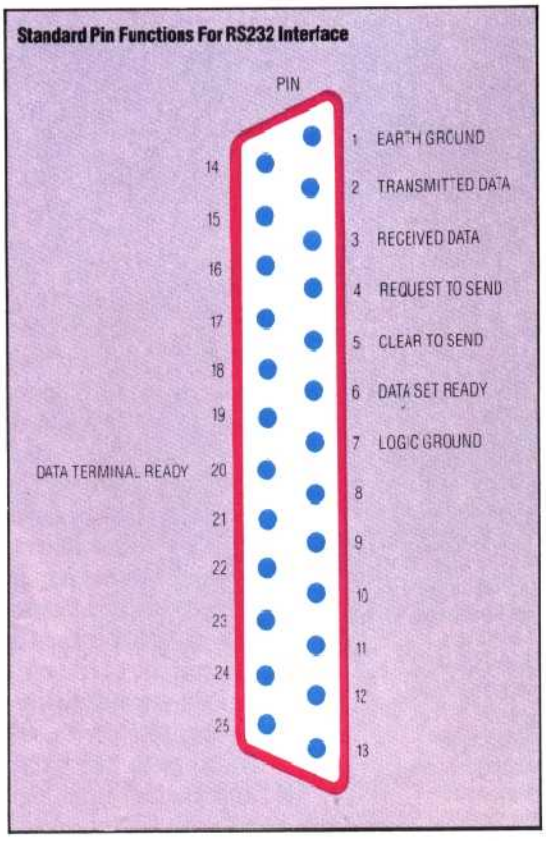
Many peripheral devices are also designed to transmit or receive data in parallel. The interfaces provided for peripherals of this type are called 'parallel interfaces' and most computers provide at least one socket or connector specifically for 'parallel' devices.

Not all peripheral devices are able to receive or transmit data in parallel. Some use a single wire to communicate with the computer a bit at a time. Internally they still use the data as eight or 16-bit bytes, but the bits in each byte will be transmitted or received one at a time, starting from the 'least significant' bit in the byte and ending with the 'most significant' bit. Each byte is split up into a stream of bits, sent off one after the other, and re-assembled into a byte at the other end, using special parallel-to-serial and serial-to-parallel converter circuits.

Both serial and parallel interfaces can be made to convey information either out of the computer or into it. Computers usually include other interfaces, which either always send information out (for example, the television output circuit) or always accept incoming information (for example, joystick ports).



Serial Interface

There is a standard serial interface, known as the RS232 interface, for which every detail of the signal levels and pin assignments is defined. Even the type of connector is specified. Unfortunately, the standard is seldom fully adhered to and making serial connections work can be difficult. RS232 is a 'bi-directional' serial interface, with one pin (terminal) for transmitting data from the computer and one for receiving data.

The data is sent one bit at a time via the 'transmitted data' terminal and received via the 'received data' terminal. The stream of bits may take a number of standard formats but it doesn't matter which is used as long as both transmitting and receiving devices use the same one.

Since each byte of information is sent out as a serial stream of bits, the software controlling the interface must have a way of indicating when the first bit of the data starts and when the last bit has ended. The convention most commonly used has a single 'start bit' (0 in Boolean logic), followed by eight bits of data, followed by a single 'stop bit' (a logical 1).

The rate at which the data is transmitted needs to be specified in advance, otherwise the pattern of pulses representing the eight bits of data in 0s and 1s could be misinterpreted. This data transmission rate is known as the 'baud rate', named after the 19th-century French inventor Baudot, and pronounced 'bored'. Baud rates range between 75 baud and 9,600 baud. These figures correspond to 75 and 9,600 bits transmitted per second, and as there are usually 10 bits (including the start and stop bits) for each character, the character transmission rate is one tenth of the baud rate.

Parallel Interfaces

The parallel interface transmits or receives information one byte at a time, but in addition to eight 'data lines' it will also need to provide other signals so that the computer and the peripheral know when it is possible for data to be transmitted and when it is not. The commonest type of parallel interface is the 'Centronics' interface (named after an American printer manufacturer, Centronics Corporation), but this so-called standard is not rigidly adhered to. The type of connector used and the assignment of signals to particular pins differ widely from one manufacturer to another. Most Centronics interfaces provide at least the following signals:

DATA 0 to DATA 7	Eight wires to carry the eight bits of the byte being transmitted.
ADK	An input signal to the computer to indicate that the receiving device is ready to accept data.
GND	The 'ground' or earth lead that gives a common reference of 0 volts for both the computer and the peripheral device.
BUSY	A signal from the peripheral device to the computer indicating that the peripheral cannot accept data.
STROBE	An output signal from the computer that indicates to the peripheral that data is ready and should be read in.

Many other devices apart from printers adopt the quasi-standard Centronics parallel interface, and connection with the computer may involve no more than buying a special connecting lead or wiring up one of your own. As a general rule, no changes in the software needed to 'drive' the peripheral will be necessary.

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