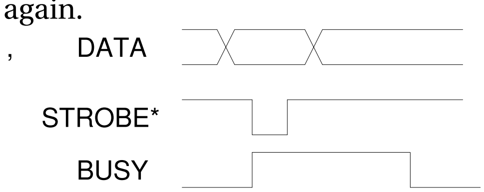
Parallel Interfaces

Parallel interfaces are used to connect computers and peripherals such as printers and disk drives.
They differ from serial interfaces in that they transfer multiple bits, usually one byte, at a time. This increases the overall data rate for a given cable bandwidth.
Parallel interfaces are restricted to short distances since the cost of the multiple-conductor cables would be too expensive for long distances.
Parallel interfaces closely resemble the processor bus since they read and write a word at a time and the handshaking requires separate control signals such as strobes.
The object of this lecture is to enable you to design simple parallel input and output ports for different devices using latches and bus buffers. You should also understand the handshaking signals on a "Centronics" printer interface.

"Centronics" Parallel Printer Port

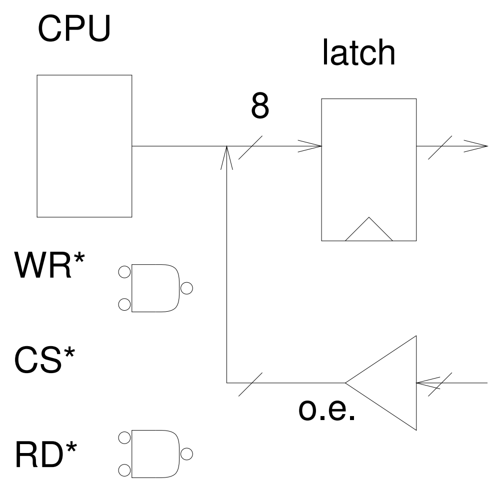
This simple unidirectional interface is used to drive printers. There are 8 data lines and two data transfer control lines, STROBE* and BUSY. BUSY is an output from the printer that is high when the printer cannot accept data. STROBE* is a an output from the PC which is strobed (brought low and then high again) to transfer the data on the data lines to the printer. This interface uses TTL signal levels.

To write a character to the printer the computer waits until busy is low, puts the character on data lines and brings STROBE* low and then high again.



There are additional handshaking lines to control various printer features (e.g. auto line feed) and to indicate various printer status conditions (e.g. out of paper).

Parallel ports are easy to implement. Although specialized parallel interface chips such as the 68030 described in the text and the Intel 8255 are available, a parallel output port can be implemented simply as a latch attached to the data bus. The latch's clock input is driven by an address decoder and a write strobe. A parallel input (e.g. to read the status line) can be implemented by using a tri-state buffer with the output enable driven by a decoder.



There original IBM PCs parallel port was an output-only Centronics-compatible interface but in recent designs the port can also be configured as an input. The maximum speed usually depends on the software use but is typically 50 to 100 kB/s.

Small System Computer Interface (SCSI)

This is a type of parallel interface that allows for bidirectional data transfer and for up to 8 hosts ("initiators") and peripherals ("targets") to be connected together on the same bus. The SCSI interface is well defined and and is available on many different computers. It is widely used to connect computers to disk and tape drives, CD-ROMs, scanners, high-speed printers, etc.

The SCSI interface includes a protocol for arbitrating access to the bus by initiators and for selecting a specific target. The actual data transfers over the SCSI bus use a similar request/acknowledge protocol with each byte transfer being acknowledged by the target before another byte is transferred.

Depending on the speed of the peripheral and the host interface the bus can transfer data at up to several megabytes per second. The SCSI devices attached to the bus are electrically connected up in parallel with each device configured to respond to a particular bus ID number (ID).

The physical interface uses a 50-pin connectors with two connectors on each device so that they can be daisy-chained. Because of the high bus speed care has to be taken to properly terminate the bus in it's characteristic impedance to minimize reflections. Like the Centronics interface the SCSI bus also uses TTL-level signals but it needs open-collector or tri-state drivers.

Another advantage of the SCSI interface is that it defines a set of common commands for devices with similar characteristics. This allows the same software to drive different devices. For example, the same generic commands (rewind, skip forward, etc) can be used to control tape drives from different manufacturers.

Although a SCSI interface can be built using a simple parallel interface and programmed i/o, this type of interface is too slow for most applications. SCSI interface chips are available that implement the interface between the CPU and the SCSI bus and transfer data using either DMA or on-board FIFOs.

HPIB/GPIB/IEEE-488

The General Purpose Interface Bus (GPIB) is another bidirectional interface. Like the SCSI bus it allows multiple bus masters ("talkers") and slaves ("listeners"). It was developed by HP who named it HPIB (HP Interface Bus). The standard is called IEEE-488. This bus is used mostly for control of laboratory instruments.