**Direct memory access (DMA)**

DMA is the name given to a method by which blocks of data can be sent from memory to a device and vice versa without detailed attention by the CPU. This relieves the CPU of the burden of handling numerous interrupts during the transfer of a block of data from disk to memory or vice versa.

DMA requires another bus control device called a DMA controller, shown in the following illustration, which is able to work autonomously after it has been initialised by the CPU.

CPU DMA controller Memory Device 1 Device 2

Start address

Count

Device identifier

Direction flag

Bus

Typically, the CPU loads the following for registers in the DMA controller: a memory start address, a count of the number of words to be transferred, a device identifier and a direction flag to indicate input or output. The DMA controller can then be left to get on with the job until it interrupts the CPU to tell it that the transfer has been completed. Meanwhile, the CPU can perform other tasks, provided that they do not conflict with this transfer.

There is, however, the possibility of a conflict when both the CPU and the DMA controller wish to access memory at precisely the same time. Because the transfer of data from very fast peripheral devices attached to the DMA cannot be held up, priority is usually given to the DMA in preference to the CPU. In most cases the CPU will originate the majority of memory access cycles, and hence in the case of contention the DMA can be thought of as ‘stealing’ a cycle from the CPU. Hence this is often known as cycle stealing.

The DMA controller is used to transfer data from:

• memory to memory

• I/O to memory

• memory to I/O.

Typically a machine has more than one DMA channel.

The advantages of DMA are:

• A computer that has DMA channels can transfer data to and from devices faster

than a computer without them.

• They are useful for making backups since the data being sent does not require

any CPU processing.

• The CPU can be carrying out other tasks while the backups are taking place. DMA fell from favour for a while when CPU speeds increased and DMA bus technology did not. But it has made a comeback with the development of I/O bus technologies (the peripheral component interconnect bus (PCI), universal serial bus (USB), and the card bus) that are much faster and comparable with those on the main memory bus.