A

A-D CONVERTOR

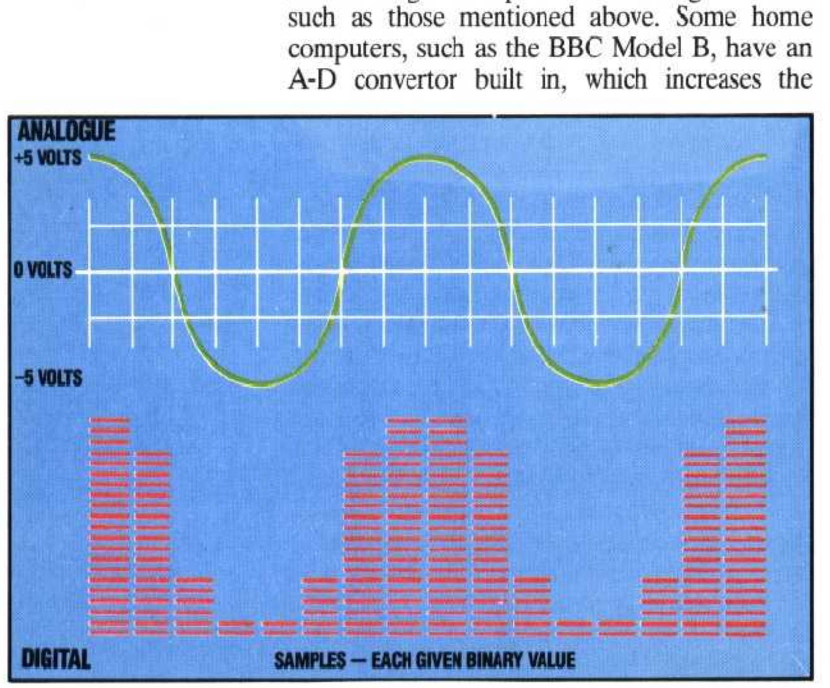
An analogue-to-digital (usually abbreviated to A-D) convertor is a hardware device that converts electrical signals in analogue form into their digital equivalent. Digital-to-analogue (D-A) convertors perform the opposite process, but the circuitry involved is quite different.

To understand the purpose of such devices, we need to appreciate the precise difference between the terms 'analogue' and 'digital'. A digital signal (by signal we mean a varying voltage) has two properties: first, it is 'discrete', which means that it can take on only one of a number of predefined values. Inside a home computer, for example, the digital signals can assume only two values — 0 volts or 5 volts — corresponding to logical zero or one. Secondly, a digital signal is almost always 'encoded': any value is represented as a collection or series of discrete values. You should already be familiar with the idea of the binary system, where a collection of eight bits can represent a value in the range 0 to 255.

An analogue signal, by contrast, is 'continuous' rather than discrete. Within a range defined by the maximum and minimum limits, the signal can take on any one of an infinite number of possible values. Secondly, as the name suggests, an analogue signal is always an analogy of a measurable quantity. For example, a thermocouple will output a voltage in proportion to the temperature it measures, and a microphone produces a fluctuating voltage in proportion to the level of sound.

There are computers that process analogue signals directly (called analogue computers) but these are expensive and are limited mostly to engineering applications. It is far easier to perform mathematical and logical processes on digital signals, which is why almost all computers are now digital.

A-D and D-A convertors are therefore used to interface digital computers with analogue devices such as those mentioned above. Some home computers, such as the BBC Model B, have an A-D convertor built in, which increases the machine's appeal to school science departments. It is possible to buy A-D (and, less commonly, D-A) convertors for many home computers.



ADDER

An adder is a logic circuit constructed from elementary logic gates (AND, OR and NOT) that will add two binary values together and produce an output.

The simplest adder is called a half-adder, which features two single-bit inputs (called A and B, say) and two outputs: sum and carry. The latter is needed because if both A and B take the binary value 1, then their sum will be 10 (i.e. the sum will be set to 0 and carry to 1).

A full adder is one that can accept a carry bit as an input in addition to A and B. This means that it is possible to chain any number of full adders together (connecting the carry output of one to the carry input of the one on the left) and thereby create a circuit that can add, for example, one eight-bit binary number to another, to create an eight-bit result (with the possibility of a ninth bit or final carry).

ADDRESS

When programming in BASIC a memory address is seldom needed, but in machine code it is vital. Every microprocessor (CPU) can talk to a finite number of memory locations (each location is a byte) and this is referred to as the addressing range — 65,536 on a standard eight-bit home computer. Each byte will have a unique number, label or address by which the CPU can refer to it and thereby read or alter the contents or the data that it contains. To read the contents of, for example, byte number 47,339 the CPU must put the binary equivalent of this address onto the group of 16 wires called its *address bus*. The selected byte puts a copy of its eight bits onto a separate collection of lines called the data bus, from which the CPU can read them into one of its internal registers.

ADSR

Even the earliest computers designed specifically for home use had some form of sound output, and the better models allowed you to alter the volume of the noise or music produced, under software control. ADSR is a facility introduced on the more sophisticated home computers that allows the programmer to control not only the tone or frequency of the note (or notes, if it has more than one voice) produced, but also the timbre or type of sound.

It is properly called Attack Decay Sustain Release envelope control, meaning that you have control over the way the volume of a note changes as it is played. The envelope is the curve or shape of the graph of volume against time. Values are given to each of the four phases of a note: attack (as it rises in volume), decay (as it falls off), sustain (the volume at which the note is sustained), and its release at a specified rate.