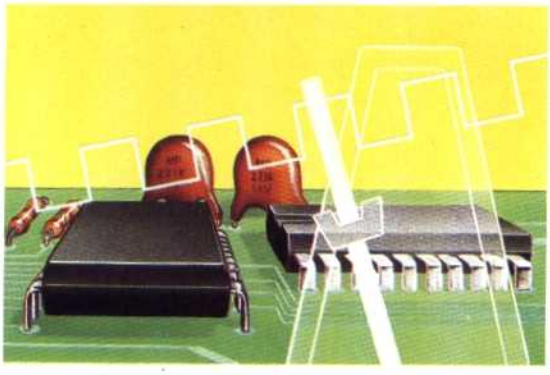
CLOCK

The purpose of the *clock* in your home micro, surprisingly, is to slow down the operation of the computer! All the functions of the CPU can be broken down into simple operations performed by logic gates and individual transistors. Though it may seem instantaneous in operation, a transistor takes a finite time to switch its output current in response to an input — although at this level the delay is measured in billionths of a second.

However, these response times will vary from one logic gate to another — even on the same chip — and as the number of logic stages that the data has to pass through increases, so does the possibility of data getting out of synchronisation. A microprocessor, for example, handles eight bits of data in parallel, right through the system. If one of the bits was to arrive at the input to the adder circuitry later than the others, the result produced would be meaningless.

That is why all the digital circuits in a computer, including the memory chips, are synchronised by a central clock. Data cannot progress to the next stage before a clock pulse has been received, and this pulse must therefore be designed to be slower than the response time of the slowest circuit.



The clock itself is simply a quartz crystal, pulsing at a known frequency, with some logic circuitry to divide that frequency down to the one required. Computer clocks give out a few million pulses each second and so are said to have clock speeds of a few *megahertz* (MHz for short). Thus most computers will have clock speeds of 1MHz, 2MHz, 4MHz or even 8MHz.

Companies sometimes try to show how fast their computers are by quoting their clock speeds. This is only useful when comparing computers with the same microprocessor. A computer with a 1MHz 6502 microprocessor is slower than one with a 2MHz 6502, but it can't really be compared with a 2MHz Z80 microprocessor. Even when computers have the same microprocessor, many other things affect their performance, so the clock speed is only a rough guide.

If your machine has a 1MHz clock, that doesn't mean that all operations take one millionth of a second. The clock may well have three *phases*: it produces three independent 1MHz signals, each a third of a cycle apart. On many systems, a memory read is completed in the first phase, and memory write in the second or third phase.

CMOS

A semiconductor material can be impregnated or doped with impurities to make it either *n-type* or *p-type*, according to whether the mobile carriers of electric charge are negative electrons or positive 'holes' (regions where there is a deficit of electrons). The physical arrangement of p-type and n-type areas on a chip determines the circuit or logic gate implemented: a diode is simply an area of one type next to the other, whilst a transistor is a sandwich of one type between two areas of the other type.

Most integrated circuits are based on either PMOS or NMOS technology — the MOS stands for metal oxide semiconductor, and the P or N is indicative of the way in which the types of doping have been arranged to form the circuits.

CMOS means *complementary metal oxide semiconductor*, and is a hybrid of the two other technologies — in simple terms each circuit has two mirror halves that complement each other. CMOS chips consume less electricity than PMOS or NMOS, and are therefore used widely in portable and pocket microcomputers. With a permanent battery connection they can provide non-volatile memory (the contents of which will not be lost when the machine is switched off). For example, the Tandy Model 100 uses CMOS chips; these allow battery operation of the computer itself, and enable data to be stored for many weeks. The main disadvantage of CMOS chips is that they are relatively expensive, although, with increasing popularity, prices are falling fast.

COAXIAL CABLE

Ordinary wire and ribbon cables are fine for transmitting low-frequency digital signals over short distances, but for high-frequency signals they are useless. There are two main reasons for this: the signal is vulnerable to electrical noise from the surrounding environment, and it is prone to start 'seeping' out of the cable. *Coaxial cable*, which consists of a central wire surrounded by an insulation tube and an earthed metal screen, is designed for high-frequency use, and is invariably used for the UHF connection between your micro and television set. Its other main use in computing is to form the link on certain types of local area network (in particular, the Ethernet), in which all the individual stations simply couple onto a common piece of coaxial cable.

COBOL

The COmmon Business Oriented Language was the first programming language written for commercial applications. Languages developed before this were designed for scientific and mathematical programming. Though much commercial software was written in COBOL for mainframes and minicomputers, little use has been made of it for micros. Nevertheless, COBOL is available for machines running CP/M — the most widely acclaimed version being CIS COBOL produced by Microfocus.