



# Cracking The Code

Type your computer language onto the keyboard and a single program working within the micro will speedily convert it into the machine's own code

Although microcomputers appear to perform similar functions, each model is unique. Some are supplied with programs already built in, while others require such programs to be 'read' in from an external disk or cassette tape.

Some machines contain a single, all-embracing program that allows both the entry of programs, and the use of direct instructions such as SAVE or LOAD. Other models need separate programs to carry out these functions.

There are, however, similar principles upon which most popular microcomputers operate. The movement of information to and from external storage devices (disks and tapes) to the screen is, in each case, controlled by the keyboard. Also, every machine can communicate with other external devices such as printers, plotters, and scientific instruments. And most micros allow their users to write programs in languages similar to English, such as BASIC for example.

When you type a BASIC program at the keyboard of your computer, a program called the 'operating system' passes what you have typed both to the screen, and to a BASIC interpreter program. This means that three programs are being held inside the computer at the same time; namely the operating system, the BASIC interpreter and your own program.

When you run your program, all three programs would appear to be active at the same time. Each BASIC instruction in your program is translated by the interpreter and, one by one, the resulting machine code instructions are passed to the microprocessor for action. At the same time, the operating system is checking the keyboard for

data entry and possibly displaying this on the screen.

If one of your program instructions asks for something to be printed or written on disk, for example, then the interpreter would request the operating system to carry out this task.

The illusion that several things are happening at once is due to the microprocessor's incredible speed. It can process instructions from the operating system and the interpreter so quickly that they can both be served at the same time.

Some machines can run even more quickly by allowing the arrival of data to 'interrupt' normal processing. In this way, there is no need for the operating system to check the various external sources of data, such as the keyboard or disk drives.

A less sophisticated type of word processor is called an 'editor'. These tend to vary considerably in quality, and you will probably find the editor built into the BASIC interpreter equally as good.

Instead of using an interpreter to run your BASIC programs, you could use a compiler. Whereas the interpreter has to translate each instruction every time it is encountered, the compiler translates your entire program into computer machine code for once and for all. Programs which have been 'compiled' run much more quickly than their 'interpreted' counterparts.

BASIC is a very popular language for writing programs. It has the advantage of being very close to plain English, and is ideal for beginners. But the more adventurous programmer can make his programs run much faster by using an assembly language. This is not like English at all, therefore the programmer must have a fairly detailed knowledge of how the microprocessor performs its functions.

Each instruction that you give the computer has a direct equivalent in machine code. An assembly language is a collection of abbreviated instructions such as MVI (Move Immediate) or JZ (Jump on Zero). These are used to help the programmer remember their functions.

If you master an assembly language, then the next thing to tackle would be machine code, but there would be very little point unless you really needed to shave tiny fractions of a second off a program's execution time.

Machine code on microcomputers is generally written in a form called Hexadecimal. This is a form of numbering to a base of 16. You count from 0 to 9 normally, then go on to use the letters

### Disk Operating System

When programs are stored on a floppy disk the information is distributed at random around the surface of the disk. The disk operating system is a program that automatically keeps track of the location of each byte of information.

The illustration shows the information stored on one small section of a disk. This is represented in 'hexadecimal' form in the left-hand block and the equivalent character is shown on the right. Codes that do not correspond to characters that are to be printed are shown as dots.

