

GO MICRO

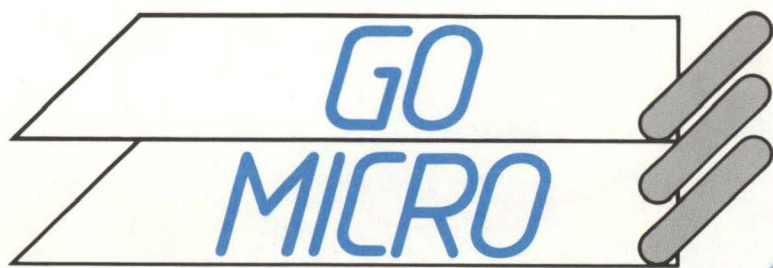


COMMODORE 64

FAMILY COMPUTER PACK

VIFI
INTERNATIONAL

LONGMAN SOFTWARE 

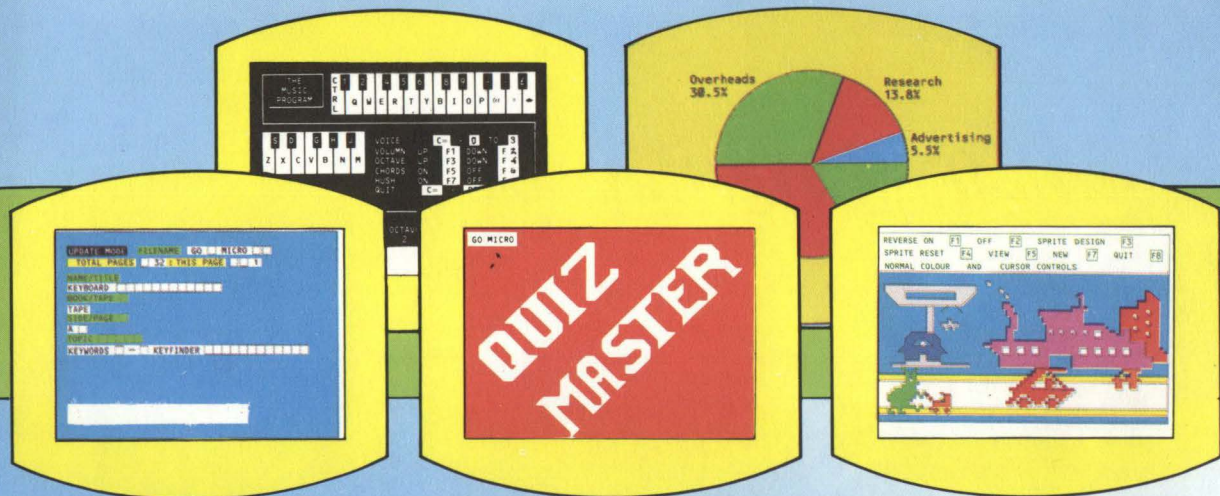


Commodore 64 Family Computer Pack

P. K. McBride

GO MICRO





This pack aims to show that the Commodore 64 isn't just for space invader addicts! Computer games are great fun, but there are lots more things that the Commodore can do. This book, and the set of programs that go with it, explore some of these activities. Find your way around the keys, and discover the graphics, with the **KEYBOARD** program. Play the 64 with **MUSIC**. Use **FILES** to keep the family's records or to organize a collection, or your correspondence, or even to help you run a club or society. **QUIZMASTER** lets you write your own quizzes for your family and friends, and **SCREENS** will produce colourful and intricate pictures to your own design.

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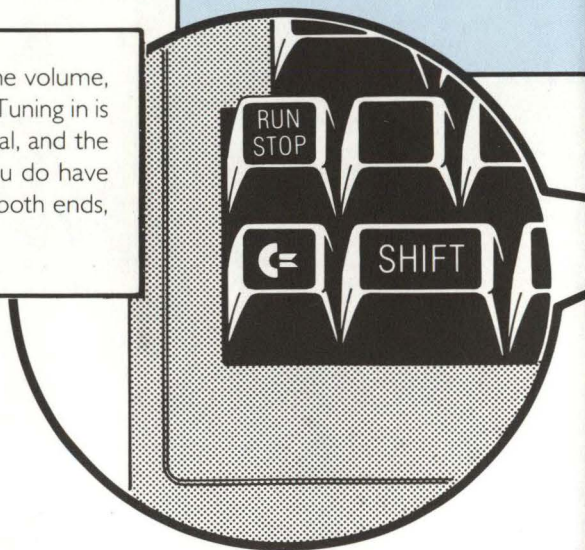
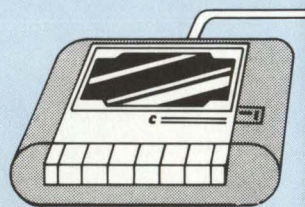
G etting started

Plug in your C2N cassette unit before you do anything else. If you plug it in – or disconnect it – while the computer is on, there is a chance that you will damage your micro. The plug fits onto the second edge connector, and make sure that it is a good tight fit. You will save time and trouble – and wear on the connections – if you leave the cassette unit connected when the machine is switched off.

The woven wire lead on the cassette plug is an Earth lead, required by American law, but serving no purpose in the UK. Wrap it round the plug and stick it down with Sellotape to get it out of the way.

Plug in the leads from the transformer and switch on, at the mains and on the side of the 64. The red tell-tale light should now be glowing. When the machine is not in use, remember to turn the mains power off, otherwise the transformer will carry on working (and getting hot).

Connect the TV lead, turn on the set and turn up the volume, as the 64's sound comes through the TV speakers. Tuning in is not difficult, as the Commodore gives a good strong signal, and the dark blue 'READY' screen is instantly recognizable. If you do have problems, check that the TV lead is plugged in firmly at both ends, and that the 64's red power light is on.



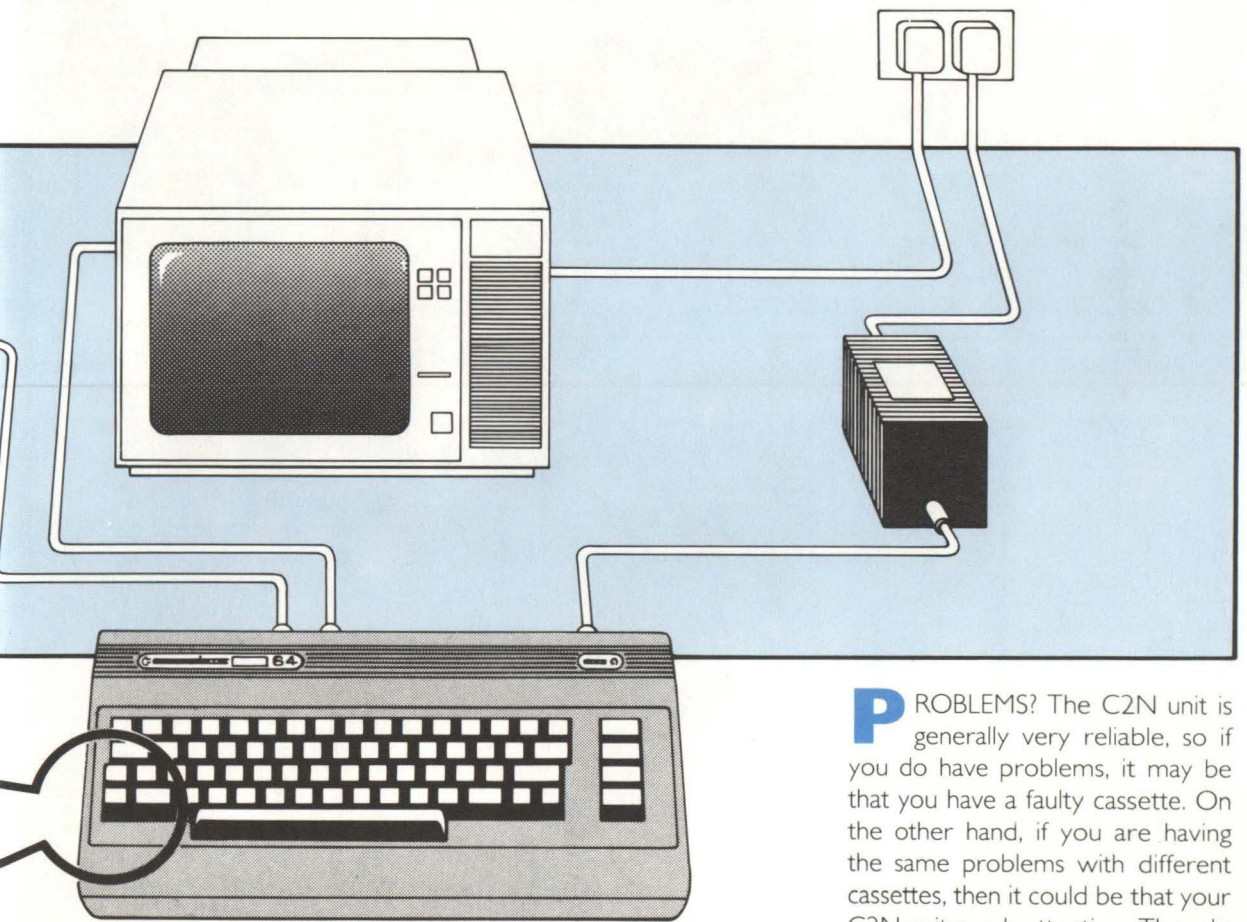
L OADING A PROGRAM. Put your tape in the unit, and rewind to the beginning. Where there are several programs on a tape, you can use the tape counter to help you find the right place for the start of the one that you want. You can get the program to load in two ways. The simplest is to press SHIFT and RUN STOP together, and then press PLAY on the unit. A program loaded this way will run automatically once it has been transferred to the computer.

The other way to load is to type in 'LOAD' and press RETURN, and then start the cassette. Programs loaded this way will not run themselves.

While the program is actually loading, the whole screen turns the same colour as the border (usually pale blue). When the 64 finds a program, the name will appear briefly on the screen. If this is the program that you want, do nothing, and the 64 will automatically load it in. If it's not the one that you want,

then press the space bar, and it will search on until it finds the next program.

The time taken for loading depends entirely on the length of the program, but it can be several minutes. At the end of the operation, the cassette will stop itself, and the TV screen will leap into life (if the program was auto-run). If you had started by typing 'LOAD', then you will now need to type 'RUN' (and press RETURN).



PROBLEMS? The C2N unit is generally very reliable, so if you do have problems, it may be that you have a faulty cassette. On the other hand, if you are having the same problems with different cassettes, then it could be that your C2N unit needs attention. They do get dirty, and the magnetic heads can slip out of alignment.

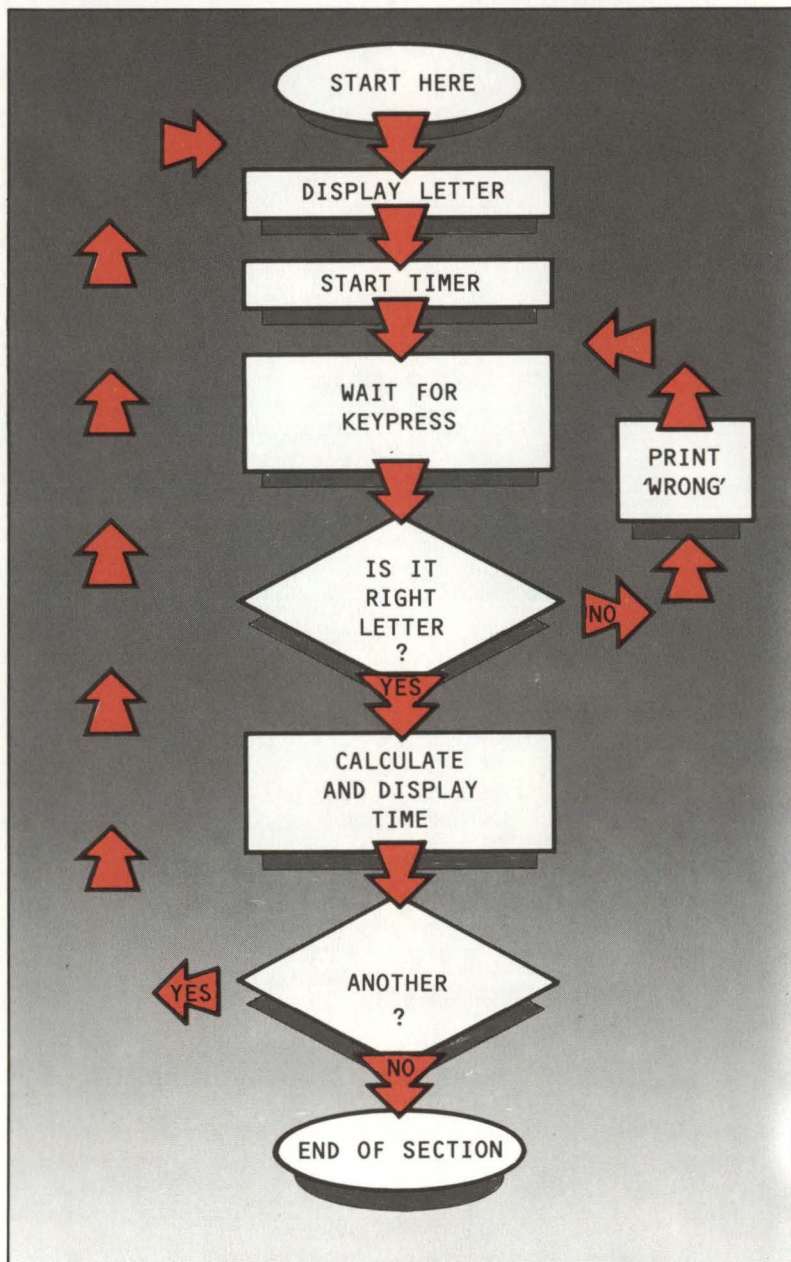
What is a program?

A program is a series of instructions that tells the computer how to do a job. It may be a simple task, like printing a message on the screen, or it may be a complex one such as managing the bank accounts of thousands of customers. Without a program, a computer is useless.

When a programmer sets to work, he begins by analyzing the job that the computer is to perform, and breaking it down into a series of linked operations. He can then draw up a flowchart, which shows how the various routines fit together. The one given here is a section of the **KEYBOARD** program. It's the part where you have to find and press a letter as fast as possible.

Follow the arrows, starting from the top. When you meet a question, trace the 'YES' and 'NO' paths that lead from the diamond-shaped boxes. These are the ways that the computer can run through the program.

The next stage in creating a program is to write out the instructions in a way that the computer can understand. Commodore programs are normally written in a language called BASIC.



Typing in

Type in this program (2) if you would like to see how it works. Make sure that the Basic words – PRINT, INPUT, POKE and GOTO – are spelt correctly, and press RETURN at the end of each line. If you make a mistake, press INST/DEL to rub it out. Start the program by typing 'RUN' (and press RETURN).

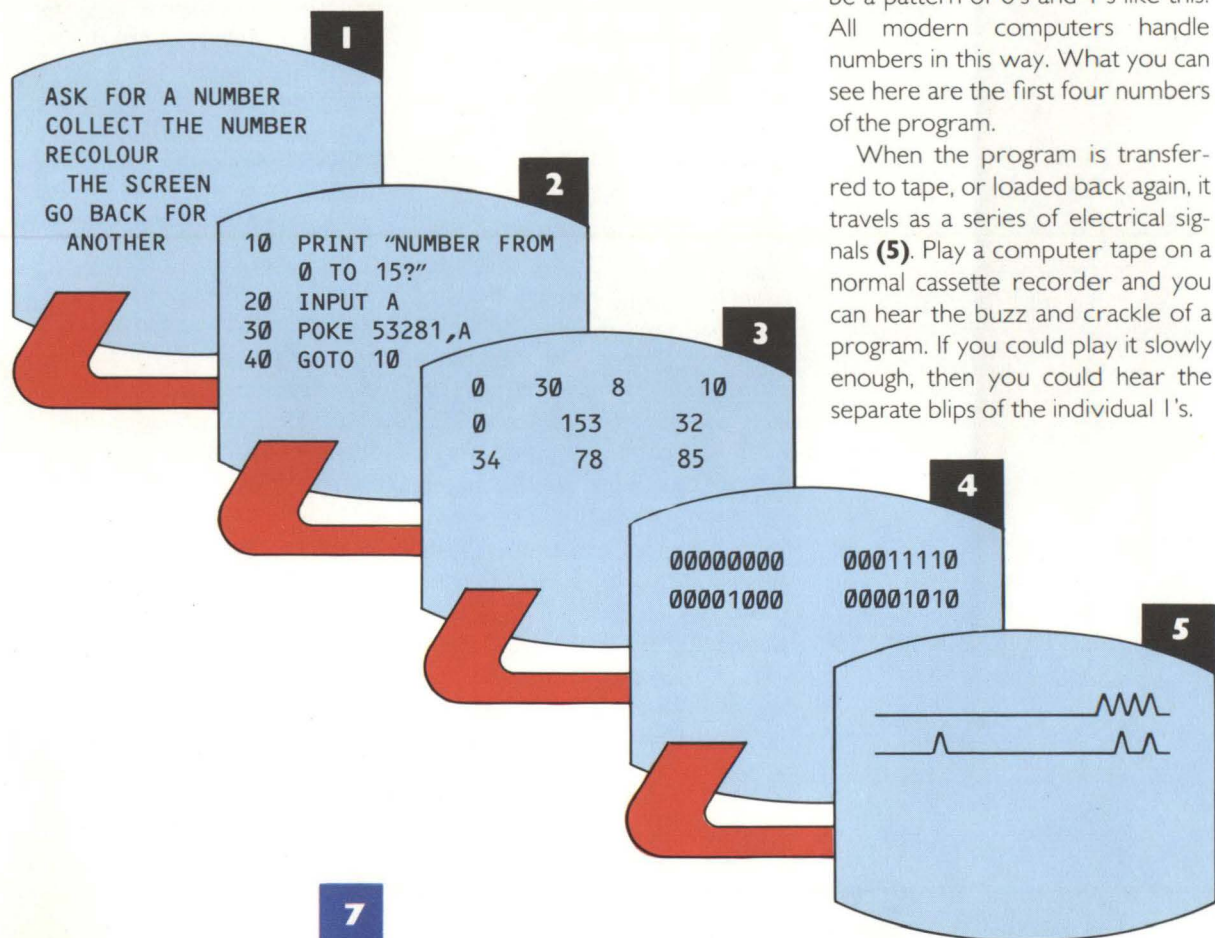
This (1) is a simple looped program that shows you the different screen colours. There are 16 colours, with code numbers from 0 to 15. You type in the number, and the program recolours the screen.

Written in Basic it would look like this (2). The line numbers are there to keep the instructions in the right order.

The CBM 64 computer stores the program as a series of numbers (3). Every character and every Basic word has a reference number, and other numbers are needed to keep the lines in order. Fifty-four numbers were needed to store these four lines. The first few are shown here.

The numbers used by the computer are BINARY rather than normal decimal ones (4). What you would actually find if you were able to look inside the memory, would be a pattern of 0's and 1's like this. All modern computers handle numbers in this way. What you can see here are the first four numbers of the program.

When the program is transferred to tape, or loaded back again, it travels as a series of electrical signals (5). Play a computer tape on a normal cassette recorder and you can hear the buzz and crackle of a program. If you could play it slowly enough, then you could hear the separate blips of the individual 1's.



The home tutor

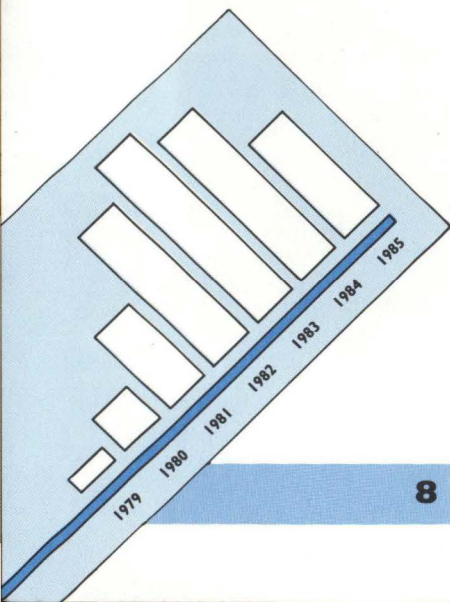
There is a wealth of educational software around at the moment covering a wide range of ages and topics. Many of these are of the 'drill' type – giving repetitive practice in solving a particular type of problem. Computers are a good way of tackling this kind of learning. They can be designed to produce a different range of problems each time the program is run, and can have a variety of 'rewards' built into them to keep up the student's interest – although using the computer is often reward enough in itself.

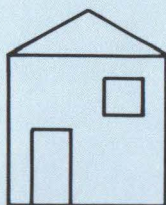
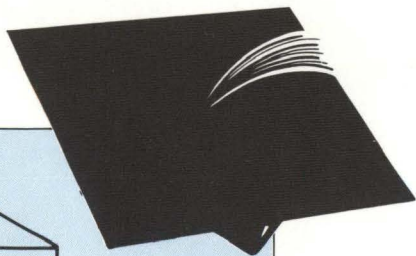
The 64, like almost all computers is able to generate RANDOM NUMBERS. These are numbers selected from a very long and very complex series. A good program will always start at a different point in the series, so that the person using the program cannot predict what will come up next. These random numbers can be pulled into the range that the programmer wants by the use of fairly simple techniques, so that writing an arithmetic program to handle numbers between 10 and 20 is a straightforward job. It is also possible to write the program so that the level changes to suit the student. It is this flexibility that gives 'drill' learning on a computer the edge over the same sort of practice done with a book.

There is a second aspect to computerized learning that makes

it so much more effective than book-based exercises, and that is the way that the student can get instant feedback. If you are told immediately that you have answered the question correctly, then it boosts your confidence for the next question. On the other hand, if you have made a mistake, being told that it is wrong will make you think why, and if you cannot see the problem, you will go and seek help, rather than feel demoralized.

These two facilities – random number generation and instant answer checking – can be put to use in other subjects besides arithmetic. QUIZMASTER, on the tape, is really intended to produce quizzes for fun, but it could equally well be used for revision in any word-based subject. The program stores matched sets of questions and answers and selects at random from them. The questions could be on History, Geography, Science subjects, or even foreign words. As a way of learning, computer quizzes have their limitations. They are useful where you need to learn a small set of short answers, but not so good at testing real understanding. It is possible to write the programs so that they accept alternative answers, or so that the computer looks for key words in longer answers, but this is more complex.



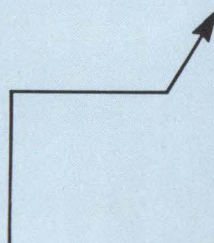


SQUARE
PEN UP
FORWARD 20
TRIANGLE

DATABASES offer a different, and more interactive, approach to educational software. Here, the program stores a large mass of information (data) on a topic, and the student is able to examine this in a variety of ways. For example, a Chemistry database might hold information on chemical elements – their atomic number, molecular weight, melting point, boiling point, and so on. On the simplest level, the student can use this to look at the data one element at a time, much as you could in a book, but you can also organize SEARCHES. The computer can be asked to display those elements that have particular characteristics – boiling point over 250°C, atomic number between 20 and 50, or whatever. The student is in control of the program. He defines the terms of the searches. This sort of program does not simply test knowledge. It builds understanding, because those searches allow data to be compared and examined in such a wide variety of ways.

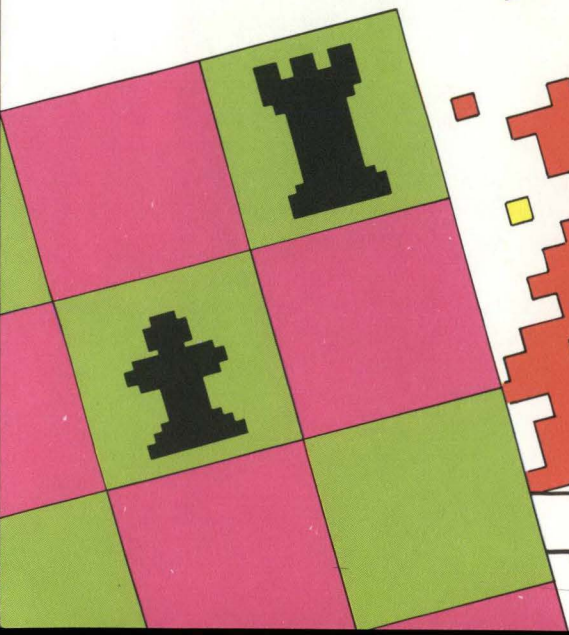
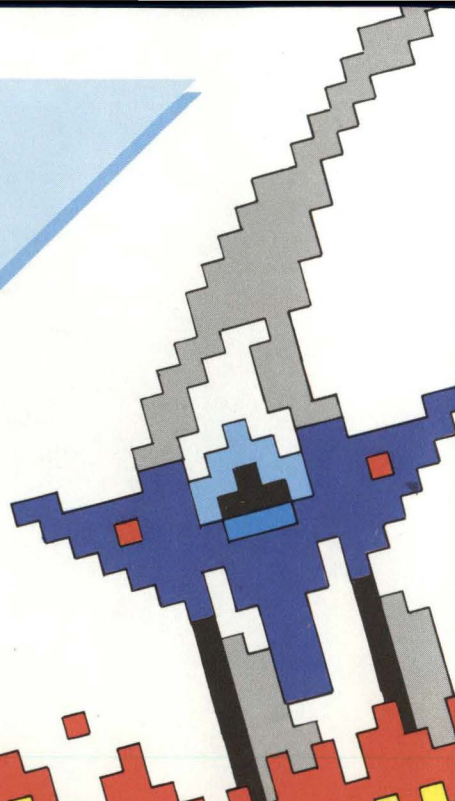
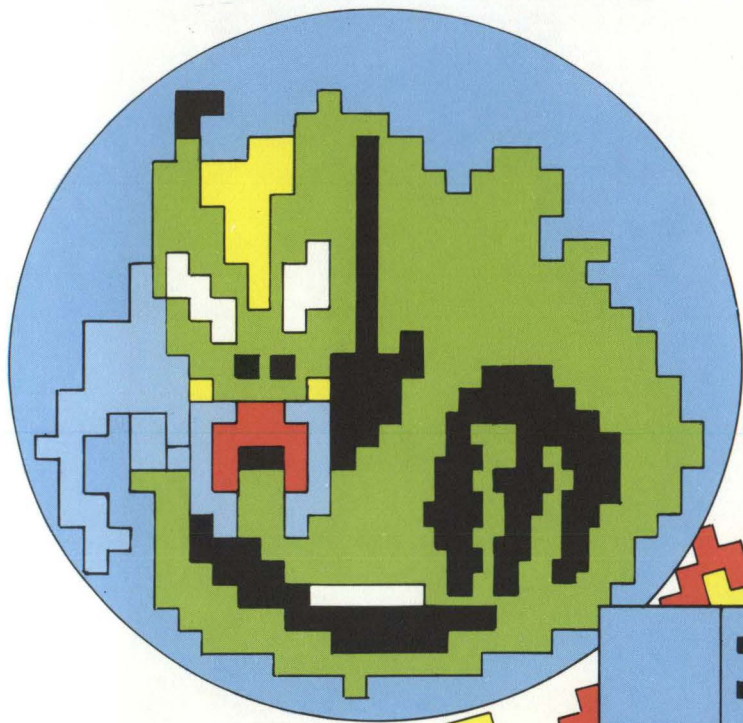
LOGO is a language that has been taken up by many computer-using schools, simply because of its educational value. The part of the languages that is most used is the set of commands and routines that make up 'Turtle Logo'. A cursor, sometimes shaped like a turtle, is moved about the screen, drawing lines, at the student's command. The instructions are given in mathematical terms, 'FORWARD 20' moves it 20 steps in the way that it faces. 'RIGHT 90' makes it turn 90 degrees to the right. This is all useful geometry, but what makes Logo even more interesting is the way that the student can teach the computer new commands. He could define a new

word 'SQUARE' to mean 'FORWARD 20' and 'RIGHT 90' 4 times: In the same way he could define words to draw different sizes and shapes of triangles and rectangles. The student can go beyond this to define words in terms of new words of his own, so that, for example, the command 'HOUSE' might make the computer draw a pattern of different squares, triangles and other shapes to produce a picture of a house. Logo trains the student in logic and structured thought, as well as in geometry.



FORWARD 20
RIGHT 90
FORWARD 20
LEFT 60
FORWARD 10

The entertainer



S	T	A	R
		G	
S	A	G	A
		I	

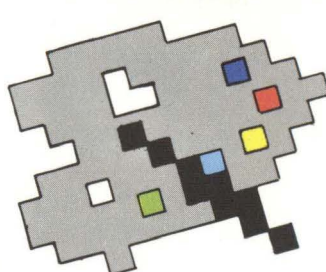
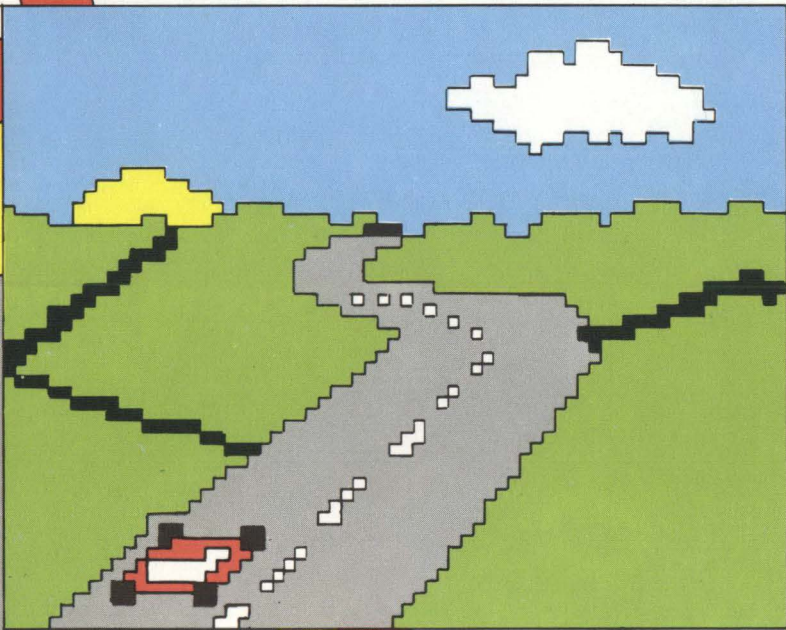
Not all computer games are about shooting up aliens. A lot are, but many others use Commodore's capabilities to provide games of quite different types.

Arcade games include the alien attack type, but also include all of those games where fast reactions and good coordination are needed to play the game well – car races, TV sports and a growing variety of games where the object is to steer around an obstacle course, dodging assorted nasties and picking up point-scoring objects.

Games for the more thoughtful player range from computerized board games such as Scrabble, Chess, Othello and many others, through to adventure games. Playing a board game against a computer is always an interesting experience, and it is also a good way to practice the tactics and strategies of the game. In an adventure game, the player has to explore a world created by the program, trying to find solutions to a variety of intriguing problems. Usually, these games take the form of a quest, or a hunt for hidden treasure, and the worlds are often peopled with goblins, dragons, evil dwarves, wolves and other monsters. Playing the game is rather like reading an adventure story, except that you are part of the story. The main difference is that a book adventure is always the same, while an adventure game will vary each time you make a new move.

Games are not the only form of entertainment that can be enjoyed on a computer. Paintbox programs, such as SCREENS in this pack, are a good way to explore the artistic possibilities of computer graphics. The Commodore's sound chip is as good as any that you would find in most synthesizers, so that its musical potential is enormous. The MUSIC program will show you some of the sounds that the 64 can produce.

Last, but by no means least, writing programs is a fascinating pastime, and it can be very rewarding.

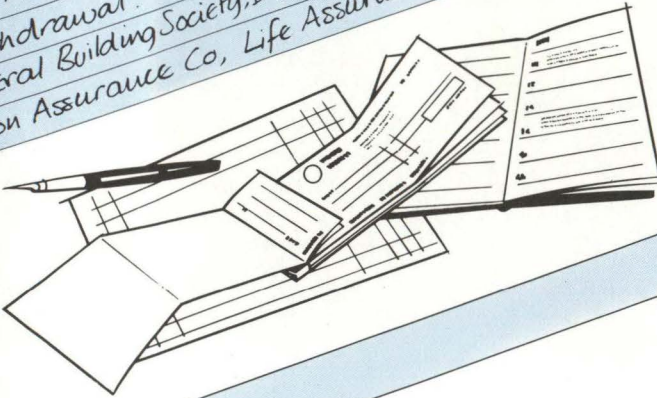


The

home office

Keeping the accounts

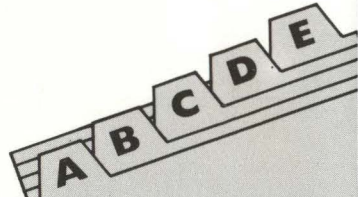
Board, Water Rates.	£32.00
Food and household goods.	£38.50
Owner for 2.	£15.75
Building Society, Mortgage	£128.48
Spencer, New shirt.	£12.99
Postage fees for the half year.	£75.00
New spark plug for car.	£5.00
Withdrawal.	£40.00
General Building Society, Deposit in Account	£50.00
London Assurance Co, Life Assurance	£27.00



12

All computers are good at handling numbers – it is, after all, the purpose for which they were originally designed. When you add a substantial memory to this number-crunching ability, then you have an ideal way of keeping accounts. The Commodore 64 has enough memory to hold about 4000 numbers, and a program to cope with them. A bank-balance-type program that recorded the reference number, date, amount and type of each entry, along with a running total, could hold information on 800 entries – more than enough for the average family's annual accounts.

What is the point of computerizing your accounts? Ask any person in business who has done so, and he will soon tell you. The most important advantage is that you have a fast and flexible way of handling information. You can track down an individual item almost instantly, or find the total that you have spent in any given period, or on any particular type of thing. The better accounts programs also have routines to display information in the form of graphs or pie charts. Being able to see the pattern of your expenditure allows you to plan for the future more wisely.



Filing system

If you run a club or small business, you will appreciate the advantage of a good filing system. Which club members still haven't paid their dues? Who has got skills that could be used when you want scenery made for the Christmas show? Are there any car-owning members down North Street whom you could ask to pick up the equipment that the club is borrowing? Any home business needs to keep a note of its customers and their requirements, so that information about new products or reminders of regular services can be sent out.

An efficient card index system will hold all this sort of information, and enable you to find what you want fairly quickly. A computerized system will do the same, and more, much more swiftly. It could whip through your membership list and pull out the names of all those owing their dues in a matter of moments. Using a card index, you would either have to write down each name as you worked through, or take the cards out of the pack, and then sort them back in again later. The computer's files are not affected by this kind of search. If a printer is attached to your computer, you can even get the program to write out reminders as it works through.



Family files

It's an interesting exercise – and actually quite useful – to build up a file for your family. It could cope with all those reference numbers that the modern world requires – Medical cards, National Insurance, bank and building society accounts, passports, driving licences and all the rest – together with shoe and clothes sizes, birthdays, weights and any special medical information. Create your own file, using the FILES program, and save it on tape ready for instant fact-finding when you need it. You will find out how to use the program on pages 42–43 of the book.

S *oftware at work*



You won't find many Commodore 64's in offices, but you will find a great many other types of larger computers. Installing a new computer can produce teething problems, as the program has to be adjusted to suit the office, and the staff have to adjust to using the computer, but at the end of it, most office managers are delighted with the improved speed and efficiency of their operations.

Very often, the first part of the business to be computerized is the accounts system. A good accounting program will link together invoicing, sales, stock control and credit control. When a sale is made and recorded on the computer, it is automatically registered in the main accounts and the customer's account; the stock change is noted, and an invoice is created and printed out.

These accounts programs usually take the form of a spreadsheet, with the information laid out in lines and columns as it would be on an accountant's paper. Simple commands allow the user to add or change information, or to get the computer to total up sets of figures or to pick out specific items for use elsewhere.

Word processing

Word processors are gradually replacing typewriters for a number of very good reasons. When a letter has been produced on a typewriter it can't be changed, apart from the minor corrections that are made with correction ribbons. If you want to take a sentence out, or add a few words in the main part of the letter, you really have to start again on a fresh piece of paper. With a word processor, your letter is written on the screen, and can be easily altered at any time, right up to the point where it is sent to the printer. A word, sentence or whole paragraph can be deleted, inserted or moved from one part of the text to another. Good word processing packages have other functions as well, to make life even easier. A common one is the 'Search and Replace' function, which makes the computer scan through the whole text, replacing a specific word, wherever it appears, with another given word.

This flexibility is the reason why word processing has been taken up so rapidly by mail order houses. One standard letter can be sent out to a thousand homes, in a personalized form. People do think that they are dealing with a better, friendlier company if the letter begins 'Dear Mrs Brown' rather than 'Dear Madam'.

A word processing package, such as the one that the Sales Manager of FissionChips is trying to sell to his clients, would normally consist of a specialized computer, one or two disk drives, a printer and a monitor. The computer might be intended for word-processing only, in which case the program would be permanently written into one of its chips. This means that the machine would be ready for use the instant it was turned on, rather than the operator having to load in the program from disk or cassette.

It is essential to have at least one disk drive, so that words can be stored and recalled quickly and efficiently. Having two drives doesn't just double the amount of memory; it also allows the operator to hold the original versions of the letters, reports, articles or books on one drive, and the edited versions on the other. A typical 5" diameter disk will hold around 80 to 100,000 characters – about 12 to 14,000 words on each side. One such disk would cope with the entire text of this book!

Printers come in several varieties, of which the most common are the Daisywheel, and the Dot-Matrix. A Daisywheel printer has keys, like a normal typewriter, but here they are arranged in a flat disk like the petals of a daisy. This

can be spun round, at considerable speeds, to bring letters into line with a single hammer at the top. This taps a petal onto the paper to type the character. Daisywheels produce very good quality printing, but are rather slow – only 60 characters a second at best – and too expensive for the average home user.

Dot-Matrix printers are cheaper, and faster – 160 characters a second is possible on a cheap machine – but the print quality is not so good. Each letter is composed of a set of dots made by fine wires prodding the ink ribbon against the paper. These wires are usually arranged in a vertical line of 7 or 9, and for each letter they will be brought to bear 8 times. The best quality printers have twice as many wires and produce characters that are almost as crisp as those of the Daisywheels.

A monitor is a video set designed for use with a computer. Its screen allows the display of 80 clear characters on a line – compared with the 40 that the Commodore produces on your TV. Eighty characters is the width of a standard sheet of letter paper, so the monitor allows the operator to see on the screen exactly what will be printed on the paper.

Dear customer *replace with customer's name in form.*

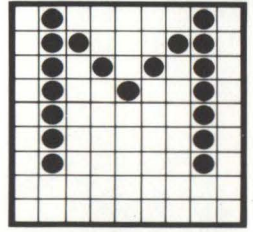
Here at 'FissionChips' we felt sure that you would like to know about our knew wrod *insert "i"* processing package. *replace 'wrod' with 'word'*

The 'High Flyer' wrod *insert 'has its own built-in disk drive and'* processor comes complete with a near *delete word.* letter quality printer, and a green tube 80 character minotaur *re-type monitor.*.

The first 100 buyers will also receive a free 'Soft-Touch' fur-covered typists' cushion. *delete paragraph we found a buyer for them.*

Yours Sincerely,

insert "The 'High Flyer' pack has been designed with the small business in mind. It is amazingly simple to use and a snip at only £1 749."



DOT-MATRIX CHARACTER



Dear Mr. Smith,

Here at 'FissionChips' we felt sure that you would like to know about our new word processing package.

The 'High Flyer' pack has been designed with the small business in mind. It is amazingly simple to use and a snip at only £1749. The 'High Flyer' word processor has its own built-in disk drive, and comes complete with a letter quality printer, and a green tube 80 character monitor.

Yours Sincerely,

Sales Manager

N *etworks and terminals*

If you go to a travel agent to book a flight, the chances are that the agent will handle the booking through a computer network. It's another example of the way in which computers are used to get fast access to up-to-date information.

A VIEWDATA terminal in the agency will be linked through the 'phone line to a central computer. This carries full details of flight bookings, and can tell the agent of any empty seats. This link with the central computer is a two-way one, so that the agent can make a booking there and then.



The software behind this is a sophisticated filing program. Details of the airline's schedules, seating plans and ticket prices are fed into the computer, and constantly updated. When the agent requests a booking, the program searches for any suitable flights and vacancies. When the booking is made, the program reserves the seat. This is confirmed later when the ticket is issued.

Similar networks are being installed in some of the larger chain stores, linking tills directly with a computer at the main office. It gives the central management a tighter control of the branches, and should, in theory at least, ensure a more regular flow of stock to replenish the shelves.

The Visual Display Unit (VDU) and keyboard in the travel agent's office and the till in the chain store are both examples of terminals, small units that feed into a central computer. Some networks have intelligent terminals. These are small micros that can be used as independent computers, but which can also be linked through to a central one for particular purposes. These are very useful in those businesses where Accounts, Sales, Market Research, Production and Management all need their own machines, and Management needs to know what everyone else is doing.

Many people have expressed their fears that a real threat to privacy and civil liberties is presented by the increasing amount of personal information held in government and business computers, and the ease with which data can be transferred. These fears are justified, for knowledge is power, and can be misused if it falls into the wrong hands. However, knowledge can also serve us, and the argument is not that databanks should be banned, but that access to information should be strictly controlled, and that the individual concerned should have a right to know who is keeping what records on him.



Computer languages

Commodore programs are normally written in a language called BASIC. This consists of a set of simplified words and symbols that are easy for the computer to handle, yet are close enough to English for us to understand.

```
10 PRINT "HOW MUCH  
IN THE ACCOUNT?"  
20 INPUT BALANCE  
30 PRINT BALANCE  
40 PRINT "AMOUNT  
SPENT?"  
50 INPUT CHEQUE  
60 IF CHEQUE=0 THEN  
GOTO 110  
70 PRINT CHEQUE  
80 LET BALANCE=  
BALANCE-CHEQUE  
90 PRINT "AMOUNT  
LEFT =";BALANCE  
100 GOTO 40  
110 STOP
```

This is a chequebook program. It tells the computer how much you had to start with, and then the amount of each cheque. It calculates the dwindling balance for you. When you want to stop the program, enter '0' for the 'AMOUNT SPENT'. (Line 60).

All popular home computers use Basic – or rather different dialects of Basic, for each manufacturer seems to have his own version of the language. As computer languages go, Basic is easy to learn; programs written in it are rather slow. To get the speed needed for fast-action computer games, or for many other business and scientific purposes, programmers have to turn to other languages.

Basic programs run slowly because the computer has to work out what the instructions mean, and where they are. Every Basic statement has to be interpreted into the sort of code that Commodore understands, and every time it is told to find another line ('GOTO 40') it has to go right back to the first line of the program and count its way down. Fortunately, computers count very fast.

BASIC

BEGINNERS
ALL-PURPOSE
SYMBOLIC
INSTRUCTION
CODE

If you can give your computer instructions in a code that it can use directly, then it will run much faster. Machine code programmers do this, though most work by means of a special program known as an assembler. This is a half-way house, where the instructions bear a passing resemblance to English. A routine written in Assembly language might look like this:

```
LDX # $02
STX $ AOFF
LDA # $02
ADC $ AOFF
STA $ 0600
```

This puts the number '2' into 2 places in memory and gets the computer to add them together, and transfer the answer to another place which will make it appear on the screen. In other words 'PRINT 2 + 2'.

The assembler converts these instructions into machine code (which consists entirely of numbers) and it is this which is saved on tape as the program. Typically, a machine code routine will run 50 times as fast as its Basic equivalent – but it could take the programmer 50 times as long to work it out!

There are several other 'high-level' languages. Like Basic these use normal English words, and their meanings are more or less obvious. The ones most commonly used today include COBOL (COMmon Business Oriented Language), FORTRAN (FORMula TRANslator) and PASCAL (named after the 'father of Mathematics'). They are much faster than BASIC mainly because they are 'compiled' languages. This means that the program is converted into a block of machine code before it is run.

LOGO (See 'The home tutor') is a language increasingly used in schools. It is excellent for mathematical exercises, but to write a complete program is more complex in Logo than in Basic.

COBOL
COMMON BUSINESS ORIENTED LANGUAGE
FORTRAN
FORMULA TRANSLATOR
PASCAL
NAMED AFTER THE FATHER OF MATHEMATICS
LOGO

Storing programs

The cassette provides a cheap and reliable means of storing programs. A C15 (15 minute) cassette can easily store two very long programs on each side, and it will cost you very little. As long as you don't store the tape near strong magnetic fields, or stretch the tape by misuse, then the program will be safely stored indefinitely.

When you are going to save your own programs, for example, your own versions of the QUIZ-MASTER and FILES programs, then use a reasonable quality tape. The computer cassettes sold in your High Street stores are ideal, but any good audio tape will do. It's best to use short tapes, simply because there is nothing more irritating than trying to find a program that you know is somewhere in the middle of C90! Whatever the length of tape, always keep a close eye on the tape counter numbers. It's much easier to find a program if you know where it is.



**THE
FLOPPY DISK**

**PROTECTIVE
COVER**

**READING
WINDOW**

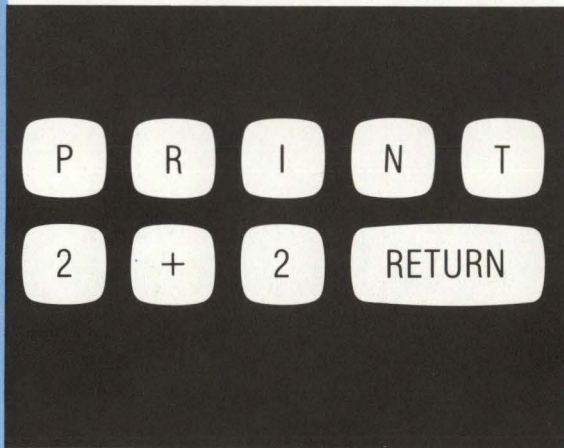
**MAGNETIC
'FLOPPY DISK'**

Commodore 1541 disk drives are ideal for use with the 64. These use 'floppy disks' rather than tape for storing programs and data. A disk consists of a circle of magnetic material enclosed in a stiff cover that protects it from dust and sticky fingers. When in use, the disk spins round inside its cover, constantly bringing new areas to the 'window' where the disk drive's reading heads can draw off information for the computer. Finding and loading a program from disk is almost instantaneous. Disk drives are essential for any business that intends to have its files handled by computer. They are finding their place in schools too, where many different programs may be needed in the space of one lesson. They will find their place in the home in the near future, though at the time of writing only a limited number of programs is available on disk for the Commodore.

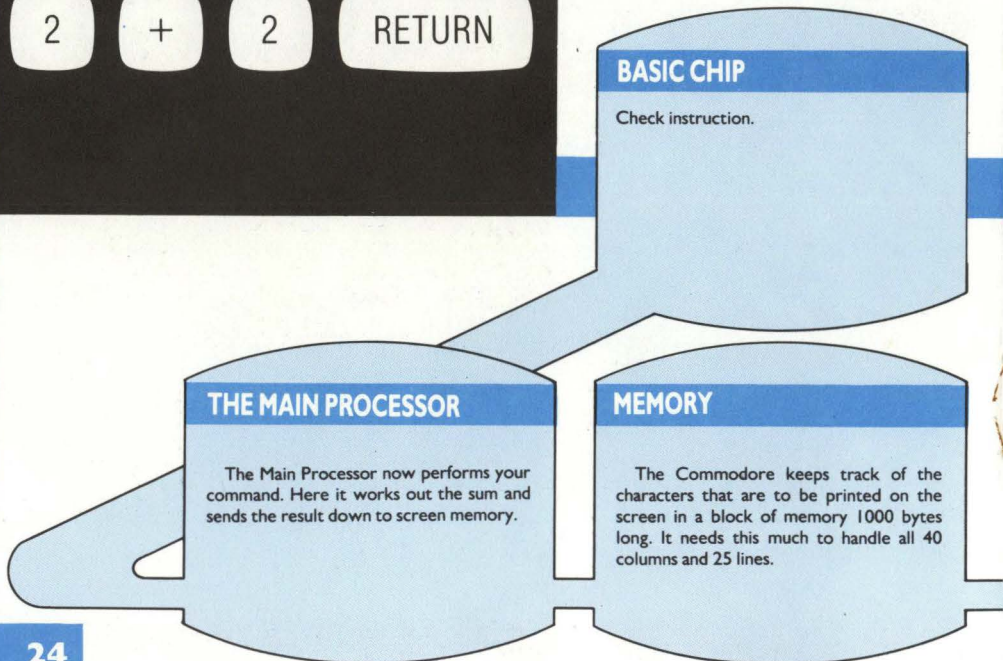
The Commodore 64 is fairly slow in transferring information from memory to tape, or back. This is largely because it actually saves (or loads) everything twice – the second run being a check on the first. All this goes to make the tape recorder a very reliable storage medium, but there are times when you need something quicker. Disk drives give you speed and reliability.

From keyboard to screen

If you typed 'PRINT 2+2' and pressed RETURN, you would see the answer appear almost instantaneously, but a lot has happened in that tiny fraction of a second between the touch of the RETURN key and '4' being printed on the screen.



The BASIC chip first checks that your instruction is a valid one, and converts it to code for the next stage of the process. If you have made a mistake, this is when it will be spotted.



Commodore calculations

The 64 can be used in the same way as an ordinary calculator. You don't have to write a program to work out a sum. Just type 'PRINT' and enter the calculation.

Use these symbols:

ADDITION	+
SUBTRACTION	-
MULTIPLICATION	*
DIVISION	/

VIC

The VIC chip copies the Screen Memory – and any Sprite information – onto the screen 50 times a second.

TV SIGNAL

The 'picture' that comes from VIC has to be converted to a proper TV signal before it can be sent out. This is the job of the Modulator.

4

This is a very much simplified version of what goes on inside the Commodore. You will get a better idea of the complexity of the machine by looking at the next page.

Inside the Commodore 64

F **TV MODULATOR.** This converts the computer's video output into a standard TV signal. The lead fits directly into the back of this.

A **AUDIO/VIDEO OUTPUT.** Connect the 64 to a HiFi system and listen to the quality of the sound!

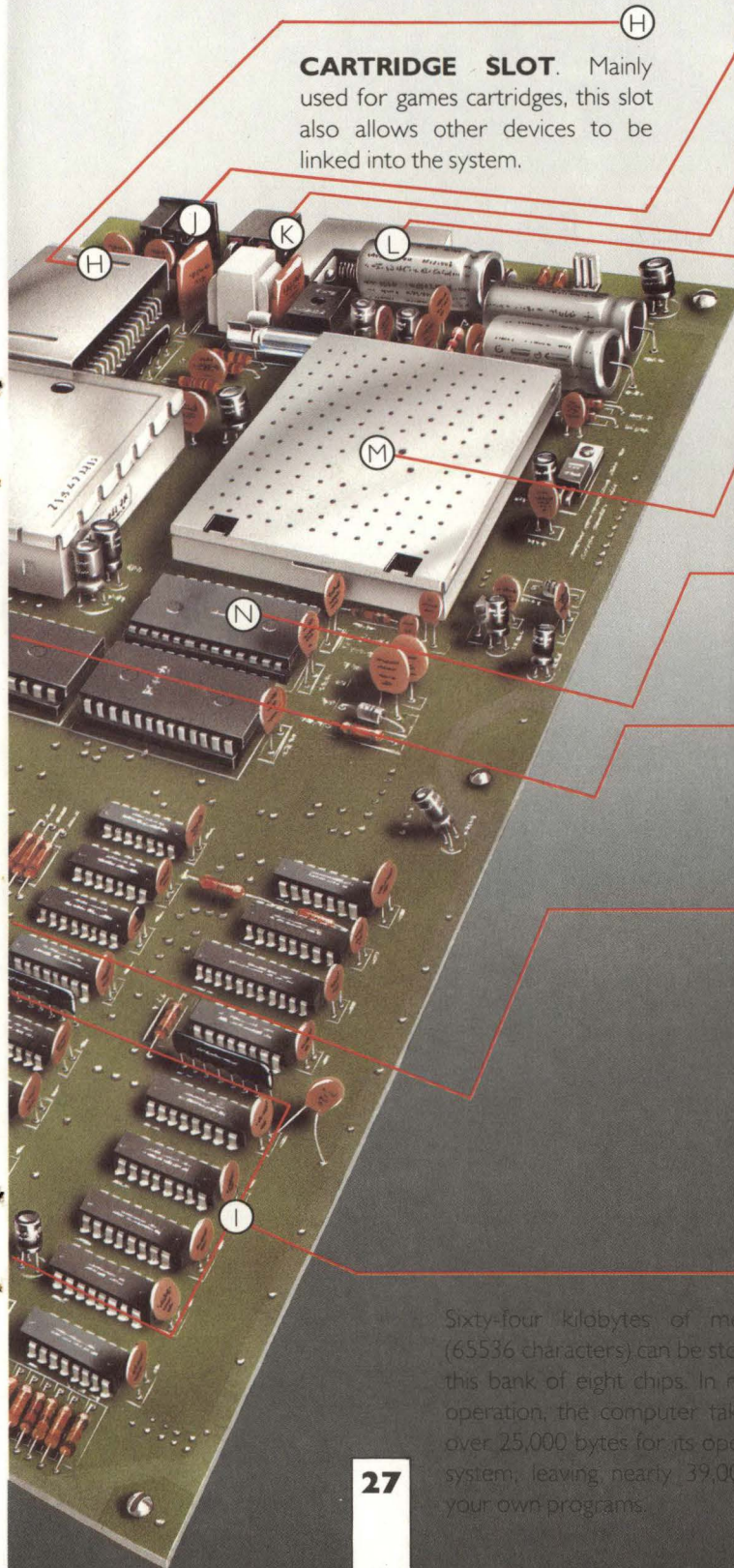
B **THE RS232 PORT.** Use this for connecting up to the Commodore printer or the 1541 disk drive.

C **THE CASSETTE PORT.** The cassette lead fits onto this edge connector.

D **THE USER PORT.** This edge connector can be used to plug a range of peripheral devices into the Commodore 64.

E This is where the keyboard feeds into the system.

G The two chips here are CIA's – Complex Interface Adaptors. They are the links between the computer and the outside world, interpreting and controlling the flow of information.



CARTRIDGE SLOT. Mainly used for games cartridges, this slot also allows other devices to be linked into the system.

POWER SOCKET. The transformer plugs in here.

ON/OFF SWITCH

JOYSTICK PORTS. Port 2 is the one most commonly used for games.

VIC – the Video Interface Chip – is tucked in here, under a special heat shield. This chip handles the graphics, and the screen output.

SID – the Sound Interface Device – the chip that gives the 64 such superb sound facilities.

This is the brain of the machine, the Main Processor. It is this chip which coordinates the activities of all the others.

These three chips handle the Basic programs, checking for syntax errors and converting instructions into code for the machine to use.

Sixty-four kilobytes of memory (65536 characters) can be stored in this bank of eight chips. In normal operation, the computer takes up over 25,000 bytes for its operating system, leaving nearly 39,000 for your own programs.

The 64 contains nearly 200 smaller components, as well as those picked out here. They are all arranged on a printed circuit board where lines of metal drawn on the surface take the place of wires. As you can imagine, mending a Commodore is a job for a well-qualified specialist.

Synthesizing sound



The Commodore 64 has excellent sound capabilities – far better than those of most other popular home computers. Unfortunately, getting even the simplest beep out of the machine is hard work. There are no Basic commands to control the sounds; instead, you have to put code numbers, one by one, into a special part of the memory.

The 64's sounds come from the Sound Interface Device chip – known to all its friends as SID. SID can play three notes at the same time, and each note can have a different tone and texture as well as a different pitch. Just as a good electronic organ can be made to sound like a wide variety of instruments, so can the 64, thanks to SID. You can also go beyond this and produce sounds that could never be made by any wind or string instrument.

To get the best out of SID you must either get to know all of his 29 parts thoroughly, or buy some good music-making software. You can have some fun, however, without getting too deep into it. The program given here will make each of the keys produce a different note. It uses the fewest possible parts of the SID chip, to turn up the volume, give the notes a basic shape, and to set the pitch. The code numbers that do these things are put into place by the lines that start 'POKE SID+...' Lines 40 and 50 pick up the separate keystrokes.

```
10 SID = 54272
20 POKE SID+24,15
30 POKE SID+6,80
40 A = PEEK(197)
50 IF A = 64 THEN
   GOTO 40
60 POKE SID+1,A
70 POKE SID+4,33
80 GOTO 40
```

Press RETURN at the end of each line and 'RUN' and RETURN to run program.

POKE means 'put something into a place in the memory'.

PEEK means 'find out what's happening at a place'.

Line 70 can be changed to 'POKE SID+4,17' to give a quieter, rounder note, or to 'POKE SID+4,129' to give the crackles and hisses of 'white noise'.

To stop the music, press INST/DEL, if the program is still running, or RUN STOP and RESTORE, at the same time, if you have already stopped the program by breaking in with the RUN STOP key.

If you have an ear for music, you will soon realize that your Commodore is hopelessly out of tune! This is because you are only giving it part of the information it needs to create the notes properly. The pitch of a note depends upon its frequency – the number of vibrations per second. At the bottom end of the piano this is just a few hundred, while at the other end of the keyboard a note would have a frequency of over 6000. Home computers like the Commodore simply cannot handle numbers bigger than 255 in one byte, but they can in two. One byte is multiplied by 256 to give a big number, and the second byte is added to it to give the fine tuning.

Each note, then, requires two numbers, and to tune your keyboard you have to attach a pair of numbers to each key. If you want a well-organized keyboard, it will take some careful programming – although you can always use the MUSIC program – but if you don't mind hunting for your notes, try adding these lines to the last program. They use a mathematical formula to generate the frequency numbers – after all, music is a branch of mathematics.

```
1 DIM N(63,2)
2 BASE =1072
3 FOR T=0 TO 63
4 N(T,1)=INT
  (BASE/256)
5 N(T,2)=BASE -
  N(T,1)*256
6 BASE =BASE+
  BASE*.0595
7 NEXT T
```

replace line 60.

```
60 POKE SID+1,N(A,1)
65 POKE SID+0,N(A,2)
```

Editing a program

If you want to correct a typing mistake, or you want to see what happens if you change the code numbers that you are POKEing into SID, then it is easily done. Start by typing 'LIST' (and press RETURN) to get the lines displayed on the screen.

The simplest way to change a line is to rewrite it altogether. Type in a new line with the same line number, and press RETURN. Your new line replaces the old one in the computer's memory. 'LIST' the program again to see.

If you just want to make a minor change to a line, then take the cursor, the flashing block, up to the line you want to alter by pressing SHIFT and the CRSR up/down key. Move it across the line using the CRSR left/right key, and type the new characters over the old ones. You can wipe characters out by printing spaces over them. Press RETURN when you have made your changes, and 'LIST' to check the program.

E

Exploring colour

The Commodore 64 has sixteen colours available, and these can be put to use in a variety of ways. The short program given here runs through the colour range in the border area. Type it in and 'RUN' it. The border will turn black (Colour 0) and a question mark will appear. This is the INPUT line. It's used here to hold the program until you are ready for the next colour. Press RETURN to move on. When the program has reached the end, type 'LIST' (and RETURN) and change line 20 to this '20 POKE 53281,COLOUR'. 'RUN' it again, and you will see the colours in the screen area. When you reach colour 14 – pale blue, the writing, which is also in pale blue, becomes invisible.

```
10 FOR COLOUR
   = 0 TO 15
20 POKE 53280, COLOUR
30 PRINT COLOUR
40 INPUT AS$
50 NEXT COLOUR
```

BORDER

The colour of the edges of the screen. This can be altered by the command 'POKE 53280,' followed by a number between 0 and 15:

BACKGROUND

The main part of the screen, where text and graphics can be displayed. This is changed by the command 'POKE 53281,' (and a number 0 to 15)

FOREGROUND

The colour of the 'ink' in which characters are printed. This is controlled by commands inside the PRINT lines. Press CTRL or C = and a number key from 1 to 8.

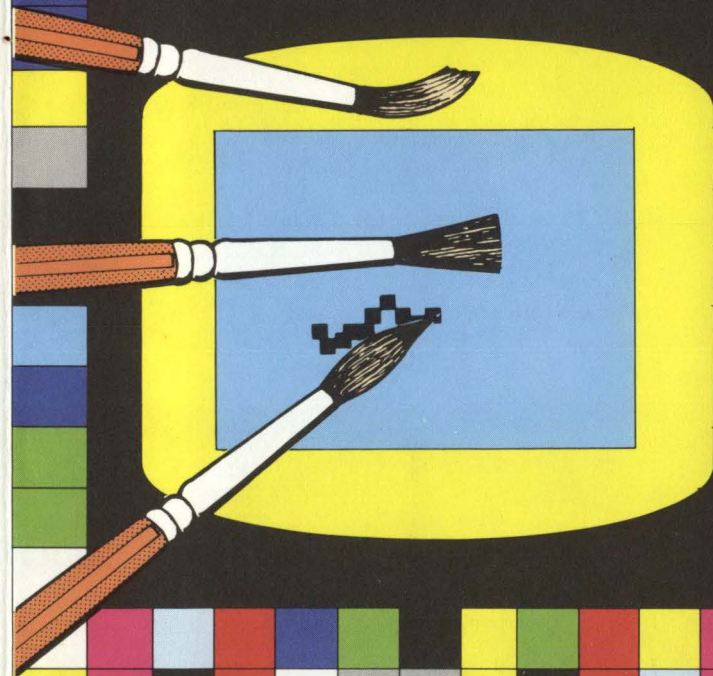
Doodles

You don't have to write a program to create pictures on the screen. You can doodle, just as you can on paper, but, no matter how good your doodle is, there is no way of saving a permanent record of it.

Clear the screen by pressing SHIFT and CLR/HOME. You will see a flashing cursor in the top left corner. This can be moved to any part of the screen by using the CURSR keys, with or without the SHIFT.

Press CTRL and 9/RVS ON. Nothing visible happens, but you have actually turned the REVERSE on. This means that space now appears as a block of colour, and all of the other characters are printed in reversed colours, like photographic negatives. Press the space bar and see what happens. It should leave a block of pale blue.

To get a different ink colour, press CTRL and one of the keys from 1 to 8, or the Commodore key C=, and those numbers. The cursor will change to your chosen colour. Sketch your doodle using the space bar and the graphics characters. To rub out, press INST/DEL, or turn off REVERSE by pressing CTRL and 0/RVS OFF, and then going over the errors with proper spaces.



Random patterns

Random patterns! If numbers are random, then they can hardly form a pattern, but the numbers produced by the Commodore only appear to be random. You can see the pattern they produce in the PATTERN program listed here. This should put blocks of colour (160 is the code for REVERSEd space), at random places on the screen, by POKEing into the part of the memory which controls the screen. At first it does look random, but a pattern soon begins to emerge.

```
10 PRINT "♥"  
20 SCREEN = 1024  
30 COLOUR = 55296  
40 PLACE = RND(0)*  
    1000  
50 POKE COLOUR +  
    PLACE,3  
60 POKE SCREEN+  
    PLACE,160  
70 GOTO 30
```

SHIFT

CLR
HOME



PATTERN



The second program given here is a little longer and more complex, but well worth typing in as it produces an ever-changing screen pattern. It is still using random numbers, but now each position on the screen is the product of 2 numbers. The effect is to make the pattern disappear.

```

10 PRINT " "
20 LINE = RND(0)*24
30 COLUMN = RND(0)*39
40 INK = RND(0)*15
50 SCREEN = 1024+
  40*LINE+COLUMN
60 POKE SCREEN,160
70 POKE SCREEN+54272,
  INK
80 GOTO 20

```

The screen has 25 lines, and 40 columns on which characters can be printed. These are actually numbers 0 to 24, and 0 to 39. (See program lines 20 and 30.) Line 70 puts a random colour in the part of the memory that controls the screen colours.

Try this for a more organized pattern. Here the random element is in the colours only. The design itself is mathematical, using sines and cosines to produce a spiral. That symbol in line 110 is Pi. You will find it on the arrow key next to RESTORE.

Perhaps there will come a day when, instead of hanging pictures on our walls, we hang flat-screen TV's with built-in pattern generators. They are certainly fascinating to watch.

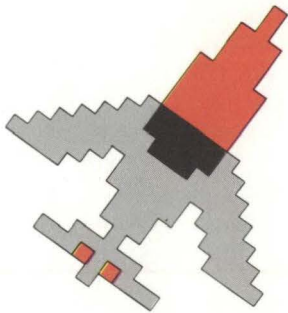
```

10 PRINT "♥"
20 POKE 53280,0:POKE
  53281,0
30 PRINT" "
40 A=0:X=1
50 L=SIN(A)*X:
  C=COS(A)*X
60 INK=RND(0)*15
70 S=1523+40*INT
  (L)+C
80 IF S>2023 OR
  X<1024 THEN GO TO
  90
90 POKE S,160: POKE
  S+54272,INK
100 IF X>20 THEN GOTO
  30
110 A=A+π/10:
  X=X+.05
120 GOTO 40

```

S

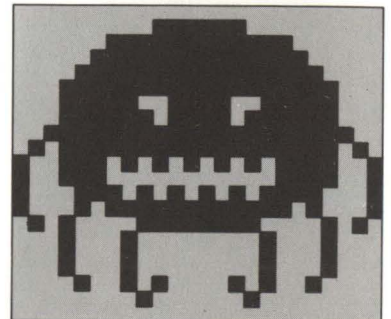
prites - the stars of the screen

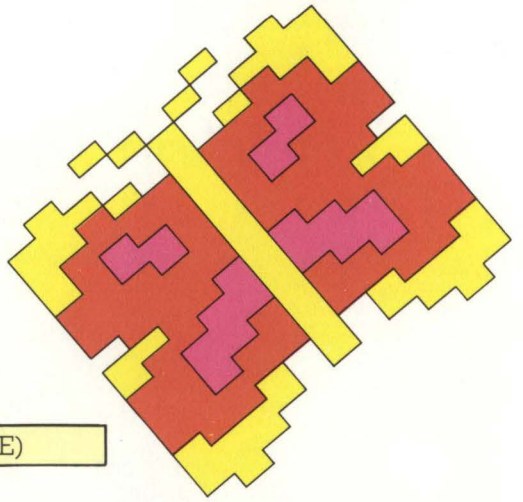


The presence of SPRITES is what makes the Commodore such a first rate machine for arcade type games and children's software. Sprites – also known as MOBs (Movable Object Blocks) – are images which can be slid smoothly about, or off, the screen. The standard sprite is 9 times the size of a printed character, but they can also be doubled in width and height. A sprite can be any of the available colours, or a combination of 3 colours.

Sprites allow a smooth animation that is simply not possible with normal printed characters. For this reason, learning how to handle them is almost the first thing that any budding games programmer must do. Unfortunately this is not particularly easy. This is partly because there are so many ways in which you can control your sprites, but it's also because Commodore has no special Basic words to handle them. The SCREENS program has a section on sprites which gives you much simpler ways to design and animate these images.

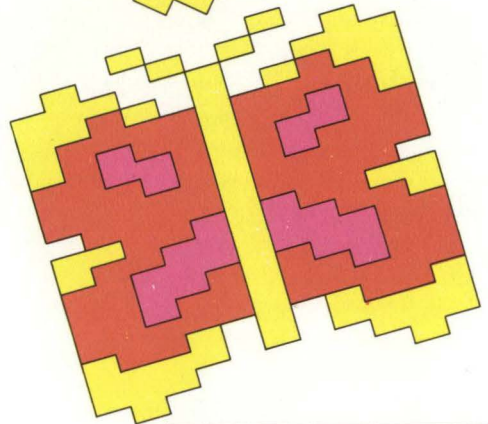
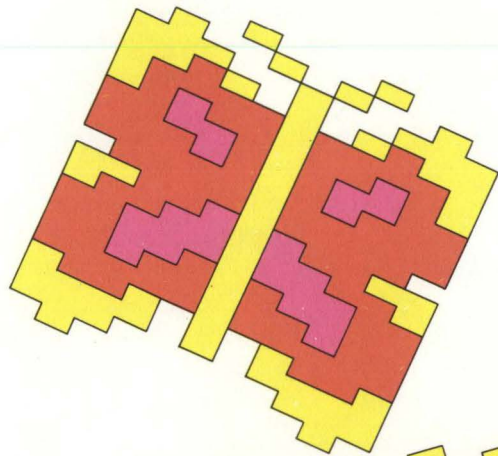
A sample program is given here, to show you what is involved. You met the SID chip in the section on sound. Here the important chip is VIC – the Video Interface Chip. This is the one that handles all the sprites, and some other aspects of the screen display. The program starts by POKEing the set of numbers that define the sprite pattern into an area of memory. The next set of lines (60 to 110) give essential information to VIC. Lines 120 to 150 allow you to control the position of the sprite on the screen. When you run the program you can move the image around by pressing the 'f' keys on the right of the keyboard. You may well find that when you are moving the image, you go beyond the acceptable limits, and the program will crash to a halt. If this happens, type 'RUN' to start it again.





(SHIFT and CLR/HOME)

```
10 PRINT "♥"  
20 FOR MEM=12800 TO  
12862  
30 READ NUM  
40 POKE MEM,NUM  
50 NEXT MEM  
60 POKE 2040,200  
70 VIC=53248  
80 POKE VIC+21,1  
90 X=100:Y=100  
100 POKE VIC,X  
110 POKE VIC+1,Y  
120 A=PEEK(197)  
130 X=X+(A=3)-(A=4)  
140 Y=Y+(A=5)-(A=6)  
150 GOTO 100  
160 DATA 0,130,0,0,  
68,0,0,40,0,0,56,  
0,112,56,28,140,  
56,98  
170 DATA 131,17,130,  
128,254,2,128,56,  
2,64,56,4,63,255,  
248  
180 DATA 64,56,4,128,  
84,2,128,186,2,  
67,57,132,60,56,120  
190 DATA  
0,56,0,0,16,  
0,0,0,0,0,0,0,  
0,0,0
```



E xtending the system

The Commodore 64, like its predecessor the VIC 20, is one of the world's most successful home computers. It's no surprise then, to find that there is a wide range of peripherals, software and books to go with it. Commodore owners need never be short of ways to spend their spare cash!

Hardware

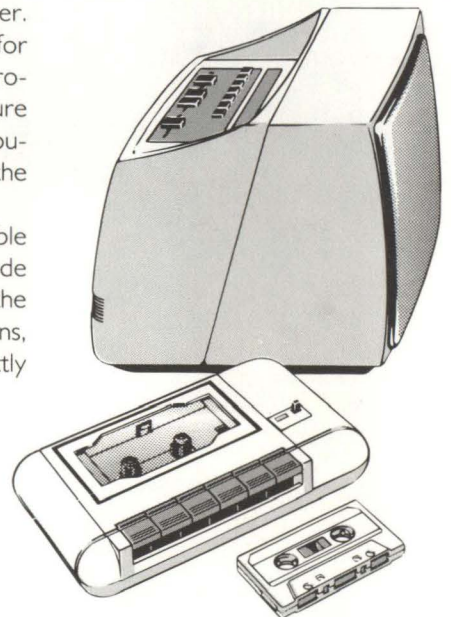
If you are a keen games player, or if there is one in the family, then a joystick is essential. Not only does it improve the games, it also saves wear and tear on the keyboard. There are a variety of suitable joysticks readily available in the shops. Choose one that feels right to your games player, but make sure that it is robust enough to take vigorous handling.

A printer will make life much easier for a budding programmer. You really need to be able to see the whole of a program listed out on paper if you are going to sort out its bugs (faults). Commodore produce the 1525 Printer, and the 1520 Printer/Plotter – which will also draw out figures and graphs in four different colours – but many other manufacturers' printers can be used instead if you prefer.

You will also need a printer if you intend to use your computer to help you to organize a business or a club. In this case, you should also think about adding a disk drive to the system. Cassette storage is really too slow for file-handling.

Modems allow computers to talk to each other on the telephone. More seriously, they give the home user access to large computerized information services, like PRESTEL and VIEWDATA. There are modem clubs that offer software-by-phone services, and electronic mailboxes, where users can leave messages for each other. There is even a pilot scheme for shopping by modem, and it is proving quite popular. In the future you can expect your home computer to become more of a link to the outside world.

Other peripherals now available for your Commodore include speech synthesizers – to make the machine talk to you; and light-pens, which allow you to draw directly on the screen.



Software is produced for the 64 in three forms – cassette, disk and cartridge. Cassette software is by far the cheapest and most plentiful, but you need to buy wisely. The quality of the programs sold in the shops and by mail order is very variable. Read any reviews that you can find – there are whole magazines devoted to software – and try to get to see the program running before you buy.

If you intend to make programming your hobby, or even a career, then you should think seriously about buying some utilities. These are programs, almost always written in machine code, that will make your life easier. The first utility you should get is an improved Basic. There are several on the market, all with additional commands that allow you to write programs with a better structure. Most include commands to handle sounds and sprites as well. Simon's Basic, from Commodore dealers, is very comprehensive, and BC Basic, if you can find it, is no less thorough.

Toolkits are machine code programs designed to make programming simpler. At the very least, a toolkit should be able to renumber lines, allow the insertion or deletions of blocks of lines, and 'trace' your program. A trace facility displays the line numbers that the program is working through, as it runs, and this is very useful when debugging complex programs.

Finally, if it's games programs that you want to write, you will need an assembler to allow you to work efficiently in machine code. Commodore supply one, and you can sometimes find listings for assembler programs in books on machine code programming.



K eyboard



There are two parts to the KEYBOARD program. Section A is a straightforward speed test designed to encourage you to find your way round the letter keys quickly. If you are used to working with a typewriter, this will be no problem, as the Commodore uses a standard QWERTY keyboard (one where the top row of letters reads Q-W-E-R-T-Y.). If you are not used to keyboards, then the layout may seem strange at first, but you should soon find that the keys you want most often have been placed in the most convenient places. Aim to be able to find any key within a second – a really proficient typist would take only a fraction of that time.

Speed does not matter at all in the second part of this program. Finding the right graphic character can be a hard enough job anyway without having to race against the clock. You will see a picture, or a pattern made up out of graphics. The object of the exercise is to find the keys needed to copy over the design. The graphics characters are shown on the front of the letter keys. To get those on the left-hand sides, you need to hold down the Commodore key (C=) while you

press the letter. Holding down either of the SHIFT keys when you press a letter will give you the graphics on the right.

Because there is such a range of characters available, it may not be easy to spot the one you want – the thinner lines are particularly hard to find. Don't worry, help is at hand. When the design appears, the program will ask you if you want some help. Tap Y, for Yes and you will be shown the combination of keys needed for each character as you work through the design. Even if you choose not to take this option, the program will point out any mistakes you make, and direct you to the right keys.

The Commodore does have lower-case (small) letters, although they are not used in this program. Have a look at them next time you turn the machine on. Press the Commodore key (C=), and SHIFT at the same time, and you will see that any writing on the screen changes down to lower case. When in Lower Case Mode you can still get capital letters, simply by using the SHIFT key, but you can no longer get the right-side graphics. (The Commodore graphics on the left sides are still there.) To get back to Upper Case Mode, press C= and SHIFT again.

QUIZMASTER is a type of file-handling program, but here the file is a set of questions and answers, and the program simply picks the questions, checks the answers and keeps track of the scores.

When you load and run QUIZMASTER, the first thing you will see is the question whether or not you want to load in a quiz from tape. Answer 'Yes', the first time, and the GO MICRO quiz will be loaded in. This will show you how the program runs, and also test your understanding of the book!

When you are ready to create your own quiz, have a tape, and your set of questions and answers at hand. Decide whether to give the same marks for all questions, or whether to score each individually. Make sure that there is only one acceptable answer for each question. The program can cope with finding words in a sentence – if the answer was 'LONDON' and the player typed in 'THE CAPITAL OF ENGLAND IS LONDON' he would still get full marks. However, if you asked 'NAME A BRITISH CAPITAL CITY' and the program

had been given 'LONDON OR EDINBURGH OR CARDIFF OR BELFAST', the 'LONDON' would score only partial marks, as the answer was only part of what was wanted!

Type in carefully, and check each question and answer as the computer displays them on the screen. You can change them later, but it is simpler to get it right first time. When you have finished, or when you want to stop for the day, save the quiz data on your tape, and label the cassette. You can always add more questions in a later session.

Use QUIZMASTER to create as many quizzes as you like for the entertainment of your family and friends – or even as a way of revising for exams. You will learn as you type in the quiz, and again later when you play. It is simplest to use a separate tape for each quiz – or at least a separate side, but if you are short of tapes, then do keep a note of the tape counter number where each quiz starts, and space them out well on the tape. The program will always load in the first quiz that it finds.

GO MICRO

QUIZMASTER

B
e your own QUIZMASTER

The MUSIC program

MUSIC is for playing. It converts your Commodore 64 home computer into a Commodore 97 home organ. Yes, there is a full range of 97 notes available, from very, very low to piercingly high. The organ also has 10 different voices, and the keys can produce single notes, or chords at your choosing. All in all, a total of 2910 different musical sounds.

The Keyboard

At any one time, the keyboard covers three octaves – a range of 37 notes. These are laid out with the lower octave on the bottom row from Z to M, and the sharps and flats on the row above. The top two octaves fit between the CTRL key (middle C) and the ↑ key, with sharps and flats above. The keyboard image on the screen will show you where to find your notes. Notice that some keys do not produce any sound at all, and pressing these has no effect whatsoever.

THE MUSIC PROGRAM

C 1 2 4 5 6 8 9 + - £
 T R L Q W E R T Y U I O P @ * ↵

S D G H J
 Z X C V B N M

VOICE
 VOLUME UP F1 DOWN F2
 OCTAVE UP F3 DOWN F4
 CHORDS ON F5 OFF F6
 HUSH ON F7 OFF F8
 QUIT C= + 0 TO 9
 C= + RETURN

VOICE 1 VOLUME 10 OCTAVE 2 CHORDS ON HUSH! OFF

The Voices

When the program is first run, the notes are typically mellow organ tones. This is voice 1. Other voices produce different quality sounds. To change voice, hold down the C= key and press one of the numbers between 0 and 9. You may recognize the sounds of other instruments in some of the voices, but others are pure electronic sounds that could never be produced without a synthesizer chip. Some voices are fairly similar to others, when playing single notes, but produce a different effect when playing chords.

Chords

When turned on, by pressing f5, the keys automatically produce major chords. In some voices the notes of the chord all sound at once, in others the notes are staggered like the strumming of a guitar. Turn the chords off with SHIFT and f6.

Volume Control

Turn the volume up by adjusting your TV volume, or by pressing f1. To reduce the volume, hold down SHIFT and press f1 – this gives you f2, the second function of that key. You may find you need to adjust the volume as you change voice – some are louder than others.

Octave Control

Check the window at the bottom of the screen to see the Octave number. It is set to 2 when the program starts to give you middle range notes. Press f3 to move up to higher octaves, and SHIFT and f4 to get lower pitches. Whatever octave you are in, the names of the notes remain the same. CTRL always produces a 'C'. Think of the octave control as a way of shuffling your seat along in front of the piano keyboard. Notice that some voices work best in certain octaves.

Hush!

This is for when the telephone rings, or you want a moment of peace. It is not necessary in some voices where the notes die away quickly, but in others they will sound for a very long time unless you play a different note – and that will likewise keep on sounding. HUSH! cuts the note off instantly. (Press f7) You can turn it back on again with SHIFT and f8, or by playing another note.

Have fun exploring the different voices at different pitches, with and without chords. See what instruments you can recognize within the Commodore 97!

club's membership records, then you might use this option to search for those members who had not paid their annual subscriptions. A search for the 'Unpaid' under the 'SUBS' heading, would quickly bring the names of the slow payers to light. You could also use this routine to track down half-remembered information. What was that person's name? Robson, Robertson, Robinson, Robards? Type in 'Rob' under your 'Name' heading, and the program will find any names beginning with those 3 letters.

When you have got to grips with the GO MICRO file, and have felt your way around Options 2, 3 and 4, you might like to try this exercise in file-creation. It will set up a file for your family, with a page for each member, and room on each page for essential information about each. Select the Create a File Option.

You will be asked for a Filename – type in your own family's name (or a shortened version of it if yours is a long name, as 10 characters is the maximum length.) The next question is 'How many pages do you want?' You could have up to 250, though your family is unlikely to be that big. How many people will you want to hold information on? Allow a page for each, then add a few more in case

you want to expand the file at a later date.

The next stage is to work out the layout of your pages. What do you want to write about each person? You may decide you need a line for each heading, such as Name, Birthday, Medical number, Work/School phone number, Bank Account or Building Society number, Shoe size and Shirt/Dress size. This is a total of 7 sub-headings. Give this information to the program, and you will then be asked to type in each heading. Keep these short – remember your limit of 10 characters. The headings are typed on to the green bars, and are the same for every page in the file.

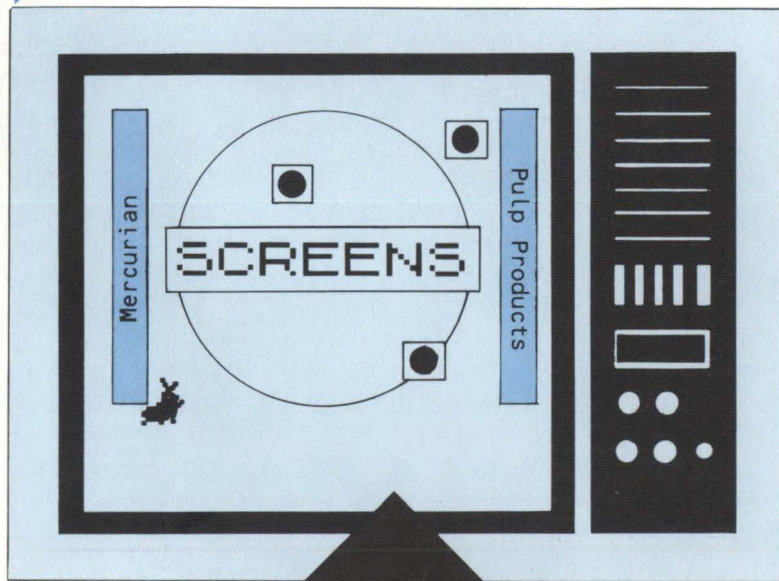
When all of the headings have been entered, the file is ready for use. Select the Data Entry Mode to begin writing in your information. Write on the screen as if you were filling out a set of cards. You can write a full line, 39 characters, under each heading. Move up and down the lines by using CRSR ↑ ↓. Type letters and numbers direct from the keyboard. If you make a mistake, or want to add something to a line, then move the cursor left or right using CRSR ← →. Correct mistakes by typing over them, and wipe out characters by typing spaces over. Press f5 to wipe the whole page clear. You do not have to fill in all the information on a

page before moving on to the next. You can always return to any page and add or correct the entries at any time. The f2 key moves you onto the next page, and f1 takes you back a page.

When you want to stop, press f7 to get back to the Main Options. If your file is not in alphabetical order, and you would like it to be, then now is the time to use the Re-order Mode to sort this out.

Before you turn off, SAVE the file onto tape. Remove the GO MICRO tape, and put in a clean cassette. Select Option 5 (Save) and follow the instructions there. While the file is being saved, label the cassette insert with the name of the file and the date. You will need this information later when you want to update your file. When that happens, the latest version of your file should be saved on to a separate tape, or the reverse of your original, so that you have two copies of the file, one of which will be up-to-date, and the other which serves as a back-up in case the latest version is lost or damaged.

Designing SCREENS

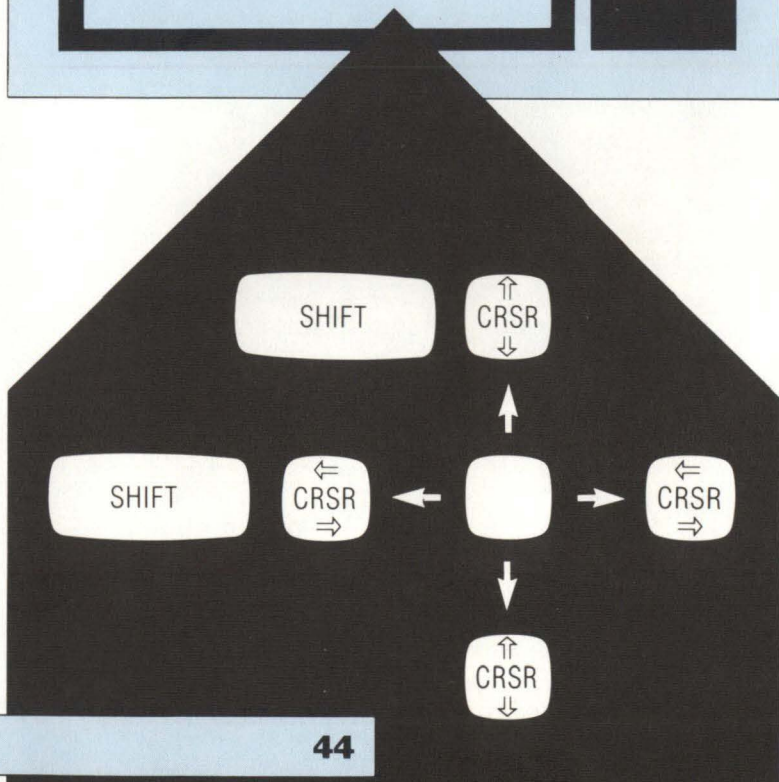


Creating an attractive picture, whether on paper, canvas or a TV screen, is always fun even though it can be hard work at times. SCREENS takes much of the slog out of computer graphics, so that you give free rein to your artistic talents.

There are two major aspects to the program. In the Standard Mode you can create patterns and pictures using the low-resolution graphics – the characters that are shown on the front of the keys. Pictures created in this mode can also serve as backgrounds on which you can fit more complex and detailed graphics that you have produced using the Sprite Mode. You can even make your own cartoons, as the sprites can be made to move across the back-drop.

Standard Mode

This is a development of the 'doodle' idea mentioned earlier. Move your cursor around the screen using the CRSR keys on the bottom right of the keyboard. The Up/Down key will normally move the cursor downwards, but hold down SHIFT at the same time to make it move upwards. The Left/Right key takes it right, and left when SHIFTed. You can travel over parts of the screen that you



have already printed on without wiping out the existing graphics, as long as REVERSE is off. Turn REVERSE on when you want to use the cursor to print blocks of colour as it moves.

COLOURS. Change the 'ink' colour any time you like either by pressing CTRL and one of the number keys from 1 to 8, or by pressing C= and a number key. Some combinations of colours that work well on paper can go very badly on the TV screen. For example, letters or thin lines of red on a green background look awful because a blurr forms where the lines meet. Other combinations look splendid. Black makes a good background colour, but for a pale background, yellow or pale grey work better than white.

THE FUNCTION KEYS. These are the grey 'f' keys on the far right of the keyboard. Get f1, f3, f5 and f7 by simply pressing the keys. Hold down SHIFT at the same time to get the even numbers.

REVERSE. The f1 key turns REVERSE on. Use this to print words or graphics in the screen colour on an ink-coloured background, or when you want the cursor to leave a trail of blocks as it moves around the screen. Press f2 to get back to normal.



SPRITES. f3 is the first one to use here. This will take you into Sprite Mode so that you can define your sprites and fit them into your design. If you want to move, remove or recolour them later, then press f4 to get into the Sprite Reset Mode.

VIEW. If you have created a purely graphics picture, or have used only stationary sprites, the VIEW (f5) serves no useful function for you. It comes into its own when you are making an animated picture. Select VIEW to get the full picture, with all your carefully created sprites in motion.

NEW is for times of despair when everything has gone wrong, or for times of great creativity, when having finished one masterpiece you want to start another straight away. If it's a good screen, call all the family to have a look, and capture its beauty with your Polaroid before you hit the key. If it's not that hot, just press f8 and the screen, and all memories of it, will be wiped away.

D^esigning SCREENS



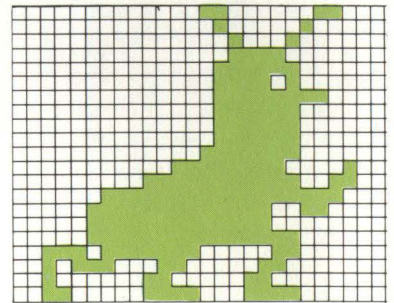
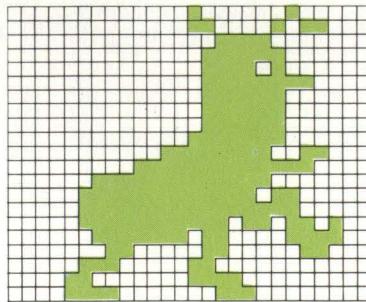
Sprite Mode

When you go into Sprite Mode, your beautiful screen is lost! Don't worry, there is a copy of it elsewhere in the 64, and it can be brought back when you need it.

You can use up to 7 different sprites numbered from 1 to 7. Pick any one you like to work on, and redefine old ones if you don't like them. In standard size they are three characters wide and about two and a half characters high, but they can be doubled in height, width or both. Select a colour for your sprites from the range of 16, and try to pick one that will go well with your background colours.

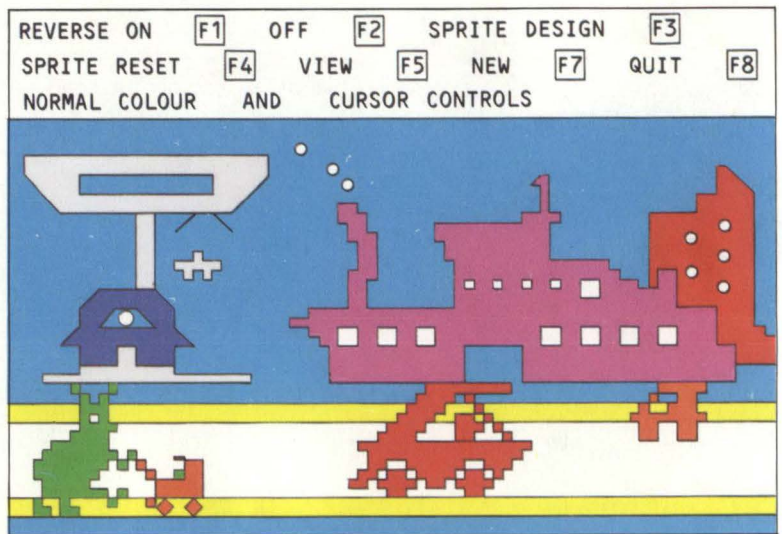
Design your sprite on the big grid. Use the cursor controls to move around, and press f1 wherever you want a dot of colour to be on the sprite – you can see it forming on the right of the screen. If a dot is in the wrong place, go over it and press f3 to remove it. When you are satisfied with the design, press f8.

If you want an animated graphic – like the Mercurian bug that runs across the screen at the start, then you need an alternate pattern. Usually this will be almost the same as the original, but with the legs in a different position. When the sprite is set moving later, it will be shown with first one, then the other pattern as it goes across the screen. The two patterns for the bug are shown here. Your original design will still be present on the grid. Adapt that to get your second pattern.



With the designs complete, you are now ready to fit the sprite onto your screen. Your background graphics will reappear – you see, they weren't lost forever! – and the sprite will start up in the top left corner. Move it to where you want it to sit, or to the place from which it will start to 'walk', by using the cursor keys. If this is to be an animated sprite, the 64 will need to know which way, and how fast to move it. A horizontal movement figure of between 4 and 12 will give reasonably smooth left to right movement. Go up to 32 for fast, but jerkier, motion. Give a minus figure if the sprite is to move right to left. If the movement is to be purely horizontal, then give 0 for the vertical movement, otherwise minus values will give the sprite lift, and plus figures will drop it down the screen.

Some of the ideas in the program will take a while to master, so explore it thoroughly before you sit down to produce your first masterpiece. Even then, don't worry if things don't go right first time, the backgrounds are simple to change, and sprites can be redesigned, recoloured and reset any time you like.



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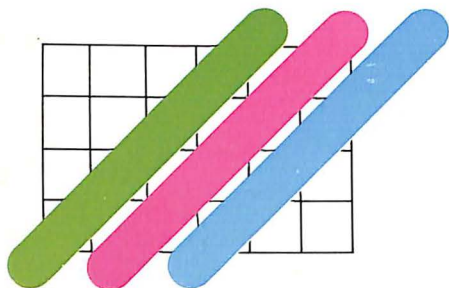
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