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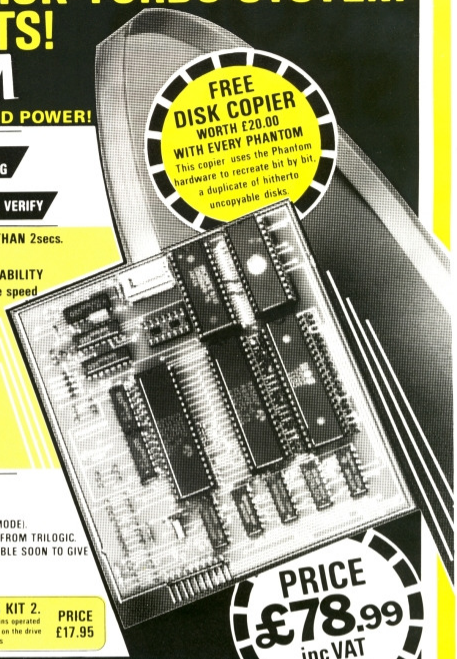

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CONTENTS

The Your Commodore Serious User Guide is packed full of vital information and programmes for all types of Commodore owners.

If you use your computer for 'home office' purposes then the 80 column C64 wordprocessor will no doubt come in extremely handy (tape and disk supported). If you need to keep lists of information, the database Multifile will be very useful. Multifile is customized to suit your specific needs and it can be used for anything from running a stock control to keeping a list of names and addresses.

Many utility programmes are also included. MPS801/3 owners can now use descenders and user-defined character sets on their printers. Plus/4 owners can add a wealth of new commands with our extended Basic. Disk owners will find the fast formatter and file describer invaluable utilities.

If you write your own programmes then there's plenty in the Guide for you too. Program Lock will protect your programmes and keep prying eyes from reading your code. A character scroller for the C64 will help to improve the visual effect of your programs.

Beginners and hardened programmers alike will find the wealth of technical information provided in our Technical Appendix, an invaluable reference. Here you will find memory maps for all of the popular Commodore computers. ROM calls are also listed so that you can find out, at a glance, information that you need when programming. Aids such as the hex-decimal convertor and the list of useful POKE commands will also prove extremely useful.

The Your Commodore Serious Users Guide is something that no Commodore owner should be without.

Listings

Get it right first time with our deluxe program system for the C64.

You may have noticed that our listings are free of those horrible little black blobs which send you searching around the keyboard for a suitable graphic symbol. You may also have noticed the funny numbers by the side of each line of the listing. Fret no more, it's all part of our easy entry aid.

Instead of those nasty graphics and rows of countless spaces in PRINT statements and strings we use a special coding system. The code, or mnemonic, is always contained in square brackets and you'll soon learn to decipher their meanings.

For example, [SA] would mean type in a Shifted A, or an ace of spades in layman's terms, and [SA10] would mean a row of ten of these symbols.

[S+2] means hold down the shift key and press the plus key twice. It doesn't take a great leap of logic to realise that [C+2] means exactly the same thing except that the Commodore key (bottom left of the keyboard) is held down instead of the shift key.

If more than two spaces appear in a statement then this will be printed as [SPC4] or, exceptionally, [SSPC4]. Translated into English this means press the spacebar four times or in the latter case hold the shift key down while you do it.

A string of special characters could appear as:

[CTRL N, DOWN2,LEFT5,BLUE, F3,C3]

This would be achieved by holding down the CTRL key as you press N, press the cursor key down twice, the cursor left key five times, press the key marked BLUE while holding down the CTRL key, press the F3 key and, finally hold the Commodore key down while pressing the number two key (C2 would of course make the computer print in brown).

Always remember that you should only have a row of graphics characters on your screen with no square brackets and no commas, unless something like this appears:

[SS],[C*]

In this case the two characters should have a comma between them.

On rare occasions [REV T] will appear in a listing. This is a delete symbol and is created by entering the line up to this mnemonic. Then type a closing quotation mark (SHIFT & 2) and delete it. This gets the computer out of quotes mode. Hold down CTRL and press the number nine key (RVSON), type the relevant number of reversed T's and then hold down CTRL and press zero (RVSOFF). Next type another quotation mark and delete it again. Now finish the line and press RETURN.

A list of these special cases is given in the table but remember that only one of these mnemonics will appear outside of a PRINT string: the symbol for pi. This may appear when its value is needed in a calculation so this may look something like:

:CC=2*[PI]*R:

Ignore the square brackets and just type in a shifted upward pointing arrow (ie. the pi symbol).

PROGRAM: SYNTAX CHECKER

```
5 REM SYTAX CHECKER - ERIC DOYLE

10 BL=10   :LN=70   :SA=49152
20 FOR L=0 TO BL:CX=0:FOR D=0 TO
 15
30 READ A:IF A>255THENPRINT"NUMB
ER TO LARGE";LN+(L*10):STOP
40 CX=CX+A:POKE SA+L*16+D,A:NEXT
 D
50 READ A:IF A><CX THENPRINT"ERR
OR IN LINE";LN+(L*10):STOP
60 NEXT L:SYS 49152:NEW
70 DATA 173,5,3,201,165,208,31,1
20,169,9,141,32,208,141,33,208,1
847
80 DATA 169,7,141,134,2,169,13,3
2,210,255,169,64,141,4,3,169,168
2
90 DATA 192,141,5,3,88,96,120,16
9,124,141,4,3,169,165,141,5,1566

100 DATA 3,169,14,141,134,2,141,
32,208,169,6,141,33,208,88,96,15
85
110 DATA 32,124,165,72,138,72,15
2,72,162,0,165,20,133,254,165,21
,1747
120 DATA 24,101,254,133,254,189,
0,2,240,18,69,254,133,254,232,18
9,2346
130 DATA 0,2,240,8,24,101,254,13
3,254,232,208,233,169,1,141,134,
2134
140 DATA 2,165,254,74,74,74,74,3
2,156,192,32,210,255,165,254,41,
2054
150 DATA 15,32,156,192,32,210,25
5,169,13,32,210,255,169,13,32,21
0,1995
160 DATA 255,169,7,141,134,2,104
,168,104,170,104,96,24,105,48,20
1,1832
170 DATA 58,16,1,96,24,105,7,96,
0,0,0,0,0,0,0,0,403
```

by Eric Doyle

Mnemonic	Symbol	Keypress
[RIGHT]		CRSR left/right
[LEFT]		SHIFT & CRSR left/right
[DOWN]		CRSR up/down
[UP]		SHIFT & CRSR up/down
[F1]		f1 key
[F2]		SHIFT & f1 key
[F3]		f3 key
[F4]		SHIFT & f3 key
[F5]		f5 key
[F6]		SHIFT & f5 key
[F7]		f7 key
[F8]		SHIFT & f7 key
[HOME]		CLR/HOME
[CLR]		SHIFT & CLR/HOME
[RVSON]		CTRL & 9
[RVSOFF]		CTRL & 0

Mnemonic	Symbol	Keypress
[BLACK]		CTRL & 1
[WHITE]		CTRL & 2
[RED]		CTRL & 3
[CYAN]		CTRL & 4
[PURPLE]		CTRL & 5
[GREEN]		CTRL & 6
[BLUE]		CTRL & 7
[YELLOW]		CTRL & 8
[POUND]		£
[LARROW]		←
[UPARROW]		↑
[PI]		SHIFT & ↑
[INST]		SHIFT & INST/DEL
[REV T]		see text
[Cletter]		CBM + letter
[Sletter]		SHIFT + letter

Checksum Program

The hexadecimal numbers appearing in a column to the left of the listing should not be typed in with the program. These are merely checksum values and are there to help you get each line right. Don't worry if you don't understand the hexadecimal system, as long as you can compare two characters on the screen with the corresponding two characters in the magazine you can use our line checking program.

Type in the Checksum Program, make sure that you've not made any mistakes and save it to tape or disk immediately because it will be used with most of the present and future listings appearing in Your Commodore.

At the start of each programming session, load Checksum and run it. The screen will turn brown with yellow characters and each time you type in a line and press the RETURN key a number will appear on the screen in white. This should be the same as the corresponding value in the magazine.

If the two values don't relate to one another, you have not copied the line exactly as printed so go back and check each character carefully. When you find the error simply correct it and press RETURN again.

If you want to turn off the checker simply type SYS49152 and the screen will return to the familiar blue colours. You can then do whatever it was you wanted to do and if this doesn't use the area where Checksum lies you can go back to it with the same SYS command.

No system is foolproof but the chances of two errors cancelling one another out are so remote that we believe our listings are more reliable than any other magazine in the world. So get typing!

Hashing it with Commodore

We would all like to make more use of data files but lack of clear advice as to how to index/retrieve the data often deters programmers from using relative files to their full advantage

By Owen C English

A problem often encountered with databases employing relative files is that of not being able to rapidly read records without specifying the DOS record number. Clearly, searching and comparing in record number sequence through an entire data file in order to find one record defeats the purpose of random access files. Imagine being able to access a record by defining the data of one or a combination of more than one field.

For example if you have a relative data file containing six fields:

SURNAME
FIRSTNAME
BIRTHDATE
STREET
TOWN
COUNTY

You may need to find a record by specifying the SURNAME and FIRSTNAME without even knowing by what record number the data had been filed. The purpose of a good database would preclude you keeping a list of record numbers and records so it would be most unlikely that you would know the DOS record number anyway.

The solution to this problem of how to find records by specifying the data lies in the maintenance of one or more *HASH FILES*. Yes, you may say "why HASH a program that's probably already a HASH?" well hashing doesn't quite mean to make a mess of it!

One creates a number called a *hash number* by performing a mathematical calculation upon the data in defined data fields. That *hash number* (referred to hereafter as *HASH(No.)*) is ideally unique to any set of data. Let us take for example, the following record and perform a calculation upon it.

The record could be as shown in Figure 1

A short Basic program, normally a subroutine, such as that in Figure 2 could be used to work out the *HASH(No.)*

NOTE although I have used variable names of more than two characters length, Commodore Basic will only recognise the first two letters.
The variable MF (multiplication factor) is calculated to give the appropriate range of *HASH(No.)* numbers and the SF (subtraction factor) lowers the range minimum to zero. The range must generally be twice the total number of possible records to be written – this reduces the chance of a double up of the unique *HASH(No.)* numbers.

Lets us take another working example. If we apply the formula in the program in Figure 2 we will find that the name HENRY BLOGGS produces a *HASH(No.)* of 791. The name JULIA FORSE produces a *HASH(No.)* of 1359.

Writing data

Right, how do we use this *HASH(No.)*? We find the next available record number (from a sequential file named LASTUSED.DAT) and write the six fields of data into that record number in the main datafile, MAINDATA.DAT. We then calculate *HASH(No.)* and write the used record number as DATA into record no *HASH(No.)* in the index file INDEX.DAT.

Well, that may seem complicated but by the careful use of files a very retrievable database can be structured.

Getting it back

Reading records is a reverse of the above although a little simpler. the user is asked for the SURNAM$ and FIRNAM$ of the record that is required to be retrieved. The *HASH(No.)* is then calculated with exactly the same formula, it will be the same as it was when the record was written as nothing has changed in the calculations. The data is then read from record number *HASH(No.)* in INDEX.DAT. That data will be the record number that the six fields of DATA were written to in MAINDATA.DAT so it only remains to read that data from MAINDATA.DAT.

If you can forsee that you may need to search for data by other fields or combinations of fields, more index files

Figure 1

FIELDNO	FIELDNAME	FIELDTYPE	DATA
1	SURNAM$	ALPHA	BLOGGS
2	FIRNAM$	ALPHA	HENRY
3	BIRDAT$	ALPHA	200953
4	STREET$	ALPHA	56 THE CLOSE
5	TOWN$	ALPHA	HORNCHURCH
6	COUNTY$	ALPHA	ESSEX

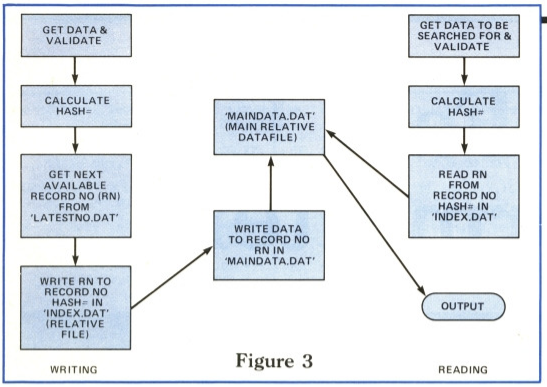

Figure 3

could be maintained – these could even be created at a later date by reading the MAINDATA.DAT file sequentially and creating additional index hash files.

Duplicates

Now, one obvious problem is that of a *HASH(No.)* occurring more than once. To safeguard against this possibility, before writing to record number *HASH(No.)* in INDEX.DAT, read that record to ensure that no data exists. If it does , go down and read the next record and when you find a blank one, use that. Accordingly this means that after looking up a record in INDEX.DAT and reading the pointed record from MAINDATA.DAT, you must compare it with the specified data to ensure that it is the correct one.If it is not, go back to INDEX.DAT and read the next *HASH(No.)* down and read the record pointed to in MAINDATA.DAT. Keep doing this until you find the match.

Mathematics will show you that the chances of a double up of a *HASH(No.)* are unlikely as long as you have a maximum *HASH(No.)* of two times the maximum number of records to be written into MAINDATA.DAT.

Getting MF and SF

To calculate MF and SF, one must define the characters that we are going to hash and index against. Take the example given. The maximum *HASH(No.)* will occur if the name is ZZZZZZ ZZZZZZ (SURNAM$ and FIRNAM$ respectively). The minimum *HASH(No.)* will occur if the name is AAAAAA AAAAAA (SURNAM$ and FIRNAM$ respectively).

To calculate the range of possible *HASH(No.)*, one must decide the maximum number of records to be written to MAINDATA.DAT. Lets take the maximum here as 1200 records. We therefore require a *HASH(No.)* range of 0000–2400 and as each record in INDEX.DAT will occupy four bytes (2400 has four characters), the total space to be occupied by INDEX.DAT will be 2400*4=9600 bytes.

The variable SF is chosen to move the range of minimum *HASH(No.)* – maximum *HASH(No.)* to 0000–2400.

O.K. this may all seem rather complex and time consuming but if you have any doubts to the speed of this system try the following:

Figure 2

```
10  SURNAM$="BLOGGS": FIRNAM$="HENRY"
20  HASHSTRING$=LEFT$(SURNAM$,3)+LEFT$(FIRNAM$,3)
30  PRINT HASHSTRING$: REM IT SHOULD BE "BLOHEN"
40  FORI=1TO6:H(I)=ASC(MID$(HASHSTRING$,I,I+1)):NEXTI
50  MF=6.641E-11: SF=724: REM SEE TEXT
60  HASH(No.)=(INT((H(1)*H(2)*H(3))+(H(4)*H(5)*H(6))*MF))-SF:
    REM DO THE CALCULATION
70  PRINT HASH(No.): REM IT SHOULD BE 791
```

Set up a dummy data file with six fields of random dummy data in each record(have 1000 records). Hide a record of known data near the end of it at say, record number 941. Now, OPEN and READ the file in sequential order from record number one and at each record compare the read data with that known to be 'hideing'.

Go away and have lunch and if you're lucky the experiment may have found the 'hidden' record by the time you return.

Try setting up a small system as described above with an indexed HASH file and RUN it. You will now appreciate what relative data files and good indexing is all about!

Multiple hash files

A word of caution. Before deciding to index every field or every combination of fields consider what the most likely unique fields will be. Index files occupy a significant amount of disk space and I found it unnecessary in the example database to index more than two combinations. I have indexed SURNAM$/FIRNAM$ together and SURNAM$/BIRDAT$ together as it is very unlikely to find two BLOGG's with the same BIRDAT$. In fact on a base of 27000 records, no two have ever matched in that way. So, despite Commodore's deploringly slow DOS, quite a workable database has been created.

The simple flowchart in Figure 3 summarises the use of hash files, both writing or creating and reading.

VARIABLES:

H(1) Is the left most character form the string SURNAM$
H(2) Is the second character from the string SURNAM$
H(3) Is the third character from the string SURNAM$
H(4) Is the left most character from the sting FIRNAM$
H(5) Is the second character from the string FIRNAM$
H(6) Is the third character from the string FIRNAM$

Fast Formatter

Fed up with waiting for your disks to be formatted? Speed things up with this handy program.

By Ben Wellbay

Fast Formatter is a utility that, quite simply, fully formats a disk with ID in a fraction under 10 seconds.

The routine will no doubt gain most benefit when included within a database/filing program that calls upon a disk routine before saving file data. Provision for listing the directory of a disk without destroying a program in memory is also made.

Getting it in

The program is presented here in the form of a Basic loader. This should be typed in using the *SYNTAX CHECKER* program that can be found on the *LISTINGS* page of this magazine. Once you RUN the program it will POKE the necessary machine code into memory. Should you want to SAVE the machine code for later retrieval by another program etc. then you can do so with the following instructions:

POKE43,0:POKE44,202:POKE45,168:POKE46,207:SAVE"ML",8

Using the program

The routine is screen–option driven and should cause no problems. To activate the routine a SYS call is required. To start the program simply type:

SYS 51712

Now you can format a blank disk without the normal 80–second wait!!

PROGRAM: FAST FORMATTER

```
30  4 REM  * 10 SECOND FORMATTER
    *
25  8 REM  * RESIDENT IN HIGH MEM *
8F  12 REM * TO ACTIVATE ROUTINE
    *
F2  16 REM *      'SYS 51712'
    *
EE  20 REM *  WILL RESET TO WARM
    *
C3  24 REM * START WHEN FINISHED
    *
0E  28 REM *  THUS KEEPING BASIC
    *
93  32 REM *     MEMORY INTACT.
    *
C9  36 REM * BY BEN WELLBAY 1986
    *
DA  40 REM * FOR 'YOUR COMMODORE
    ' *
01  44 FORI=51712TO53160:READA:POKEI,A:C=C+A:NEXT
F1  48 IFC<>176818THENPRINT"ERROR IN DATA!":END
18  50 DATA 76,126,205,165,186,201,8,176,4,169,8,133,186,169,5,162
73  51 DATA 207,160,202,32,134,202,169,6,162,183,160,203,32,134,202,169
E2  52 DATA 7,162,169,160,204,32,134,202,169,1,162,192,160,0,141,202
79  53 DATA 202,142,200,202,140,201,202,169,87,141,199,202,32,123,202,160
93  54 DATA 0,185,197,202,32,168,255,200,192,6,208,245,160,0,173,167
7B  55 DATA 2,32,168,255,32,174,255,162,0,160,5,142,192,202,140,193
60  56 DATA 202,32,123,202,160,0,185,189,202,32,168,255,200,192,5,208
98  57 DATA 245,32,174,255,234,32,123,202,76,174,255,165,186,32,177,255
93  58 DATA 169,111,32,147,255,96,141,185,202,134,251,132,252,160,0,140
D4  59 DATA 184,202,32,123,202,162,0,189,181,202,32,168,255,232,224,6
```

```
AF  60 DATA 208,245,162,32,177,2
    51,32,168,255,200,202,208,24
    7,32,174,255
E3  61 DATA 192,0,208,219,96,77,
    45,87,224,7,32,234,234,77,45
    ,69
F3  62 DATA 0,5,234,234,234,77,4
    5,87,192,0,1,234,234,234,234
    ,173
BB  63 DATA 121,5,133,18,173,122
    ,5,133,19,169,1,133,34,169,1
    0,133
A5  64 DATA 186,120,173,0,28,9,4
    ,141,0,28,169,45,133,74,32,1
    47
00  65 DATA 5,198,74,208,249,162
    ,0,32,160,5,32,189,5,169,238
    ,141
E2  66 DATA 12,28,32,0,6,133,192
    ,173,0,28,41,251,141,0,28,16
    9
92  67 DATA 236,141,12,28,88,144
    ,1,96,32,148,7,169,18,133,6,
    169
0B  68 DATA 0,133,7,32,200,7,32,
    190,7,169,255,141,1,3,230,7
F2  69 DATA 32,200,7,76,5,208,66
    ,76,65,78,75,160,160,160,160
    ,160
6B  70 DATA 160,160,160,160,160,
    160,160,160,66,87,160,50,65,
    160,160,160
69  71 DATA 160,160,2,174,0,28,2
    32,32,160,5,136,208,246,230,
    34,76
15  72 DATA 189,5,160,2,174,0,28
    ,202,32,160,5,136,208,246,96
    ,138
A7  73 DATA 41,3,133,187,173,0,2
    8,41,252,5,187,141,0,28,169,
    4
27  74 DATA 133,187,162,0,202,20
    8,253,198,187,208,249,96,165
    ,34,32,75
66  75 DATA 242,138,10,10,10,10,
    10,133,68,173,0,28,41,159,5,
    68
45  76 DATA 141,0,28,96,173,12,2
    8,41,31,9,192,141,12,28,169,
    255
50  77 DATA 141,3,28,141,1,28,96
    ,165,34,32,75,242,133,67,32,
    213
81  78 DATA 5,169,255,141,1,28,1
    69,0,133,188,170,168,165,57,
    153,0
6A  79 DATA 3,165,188,153,2,3,16
    5,34,153,3,3,165,19,153,4,3
03  80 DATA 165,18,153,5,3,169,1
    5,153,6,3,153,7,3,169,0,89
4B  81 DATA 2,3,89,3,3,89,4,3,89
    ,5,3,153,1,3,24,152
7A  82 DATA 105,8,168,230,188,16
    5,188,197,67,144,193,152,72,
    232,138,157
26  83 DATA 0,4,232,208,250,169,
    75,141,0,4,169,3,133,49,32,4
    8
7F  84 DATA 254,104,168,136,32,2
    29,253,32,245,253,169,4,133,
    49,32,233
4F  85 DATA 245,133,58,32,143,24
    7,169,0,133,50,169,255,141,1
    ,28,162
41  86 DATA 5,80,254,184,202,208
    ,250,162,10,164,50,80,254,18
    4,185,0
0F  87 DATA 3,141,1,28,200,202,2
    08,243,132,50,162,8,80,254,1
    84,169
2F  88 DATA 85,141,1,28,202,208,
    245,169,255,162,5,80,254,184
    ,141,1
43  89 DATA 28,202,208,247,162,1
    87,80,254,184,189,0,1,141,1,
    28,232
D7  90 DATA 208,244,160,0,80,254
    ,184,177,48,141,1,28,200,208
    ,245,169
97  91 DATA 85,162,8,80,254,184,
    141,1,28,202,208,247,198,188
    ,208,154
C2  92 DATA 80,254,184,80,254,18
    4,76,0,7,32,0,254,165,192,20
    8,3
89  93 DATA 76,103,7,169,200,133
    ,189,165,67,133,188,169,0,13
    3,50,32
68  94 DATA 119,7,162,10,164,50,
    80,254,184,173,1,28,217,0,3,
    208
9D  95 DATA 48,200,230,50,202,20
    8,239,32,119,7,160,187,80,25
    4,184,173
02  96 DATA 1,28,217,0,1,208,26,
    200,208,242,162,252,80,254,1
    84,173
43  97 DATA 1,28,209,48,208,11,2
    00,202,208,242,198,188,208,1
    93,76,103
E8  98 DATA 7,198,189,208,178,19
    8,186,240,3,76,0,6,169,3,56,
    96
11  99 DATA 165,34,201,35,240,6,
    32,130,5,76,0,6,169,1,24,96
A2 100 DATA 169,208,141,5,24,16
    9,3,44,5,24,16,12,44,0,28,48

79 101 DATA 246,173,1,28,184,16
    0,0,96,104,104,76,88,7,32,19
    0,7
3F 102 DATA 169,3,133,110,32,18
    3,238,160,27,185,103,5,153,1
    44,3,136
6D 103 DATA 16,247,169,65,141,2
    ,3,169,42,141,3,3,169,17,141
    ,72
F7 104 DATA 3,169,252,141,73,3,
    96,160,0,152,153,0,3,200,208
    ,250
4A 105 DATA 96,169,144,133,0,16
    5,0,48,252,96,234,234,234,23
    4,160,0
57 106 DATA 185,32,207,240,6,32
    ,22,231,200,208,245,188,185,
    59,207,240
7B 107 DATA 6,32,22,231,200,208
    ,245,32,19,206,160,0,185,74,
    207,240
9A 108 DATA 6,32,22,231,200,208
    ,245,32,70,206,32,9,207,160,
    1,132
3D 109 DATA 212,185,88,207,240,
    6,153,240,4,200,208,245,32,3
    ,202,160
CB 110 DATA 0,185,120,207,240,6
    ,153,240,4,200,208,245,32,24
    3,206,208
FF 111 DATA 3,32,123,206,160,0,
    185,103,207,240,6,153,240,4,
    200,208
CA 112 DATA 245,32,243,206,208,
    19,32,9,207,234,234,234,160,
    0,132,212

3A 113 DATA 76,126,205,136,16,2
    48,76,126,205,169,147,32,22,
    231,96,234
75 114 DATA 234,234,234,234,234
    ,234,234,234,234,234,234,234
    ,234,234,234
0A 115 DATA 234,234,234,169,1,1
    33,212,160,0,32,207,255,153,
    144,207,200
02 116 DATA 201,13,208,245,192,
    18,144,5,32,114,206,240,230,
    136,152,240
C5 117 DATA 232,200,169,160,153
    ,143,207,192,18,144,246,136,
    185,144,207,153
2B 118 DATA 54,203,136,16,247,9
    6,169,1,133,212,160,0,32,207
    ,255,153
84 119 DATA 144,207,200,201,13,
    208,245,192,3,240,6,32,110,2
    06,76,70
3F 120 DATA 206,173,144,207,141
    ,72,203,173,145,207,141,73,2
    03,96,192,1
90 121 DATA 240,251,169,20,32,2
    2,231,136,208,248,96,169,0,1
    33,212,169
74 122 DATA 147,32,210,255,234,
    234,234,234,169,1,133,183,16
    9,207,133,188
54 123 DATA 169,134,133,187,169
    ,96,133,185,32,213,243,165,1
    86,32,180,255
BB 124 DATA 165,185,32,150,255,
    169,0,133,144,160,3,132,183,
    32,165,255
B1 125 DATA 133,195,32,165,255,
    133,196,164,144,208,53,164,1
    83,136,208,235
C5 126 DATA 160,6,169,32,32,22,
    231,136,208,250,166,195,165,
    196,32,205
6C 127 DATA 189,169,32,32,22,23
    1,32,165,255,166,144,208,19,
    201,0,240
F2 128 DATA 6,32,22,231,76,214,
    206,169,13,32,22,231,160,2,2
    08,187
47 129 DATA 76,66,246,32,228,25
    5,208,251,32,228,255,240,251
    ,201,89,208
3A 130 DATA 1,96,201,78,208,237
    ,169,1,96,234,234,234,234,23
    4,234,234
3C 131 DATA 234,234,234,234,234
    ,234,234,234,234,234,234,234
    ,234,234,96,234
13 132 DATA 147,13,32,70,79,82,
    77,65,84,84,69,82,32,79,80,6
    9
84 133 DATA 82,65,84,73,79,78,6
    5,76,32,68,0,13,32,68,73,83
17 134 DATA 75,32,78,65,77,69,3
    2,42,32,0,13,32,68,73,83,75
D3 135 DATA 32,73,46,68,46,42,3
    2,0,32,6,15,18,13,1,20,20
F9 136 DATA 9,14,7,46,46,32,0,3
    2,1,14,15,20,8,5,18,32
BC 137 DATA 4,9,19,11,32,63,32,
    0,32,3,1,20,1,12,15,7
3B 138 DATA 21,5,32,63,32,0,36,
    14,254,246,83,0,0,0,0,0
90 139 DATA 66,87,13,160,160,16
    0,160,160,160,160,160,160,16
    0,160,160,160
E2 140 DATA 160,160,0,255,0,2,0
    ,16,255
```

MULTIFILE 64

A database that can easily be tailored to your own needs.
For C64 plus disk drive.

Multifile is a disk–based data filing program. It has been constructed to offer the routines necessary for such a program, such as input and retrieval of data, as well as printing out neatly in columns. However it has been designed to allow it to be easily tailored to suit your own requirements. It could easily be converted to handle names and addresses (for personal use or club records), a collection catalogue, a stock control index, in fact the possibilities are endless.

Storing large amounts of array data in Basic introduces large time delays in array handling, so the main data storage routines of this program have been written in machine code. However, the main program is in Basic for ease of customisation for your own use.

Multifile comprises of two programs; the first is a Basic loader program for the machine code section,this loads the machine code (in a series of DATA statements) into memory at 49152. When the data is correct, the machine code section (just under 1k) is SAVEd as a machine code file to disk. The main program can then load this file directly, and the loader with the machine code data need only be used once, hence saving time when the program is in use.

The second program is the Basic section of the filing system itself, and provides easy access to the machine code routines used.

Data storage

The data is stored by the program in a series of records, each record comprising of a series of data items about one particular item. Each of these data items is called a field. The data is stored as in Figure 1.

Multifile will handle up to 10 fields, and up to 255 records in a file. Field length is not fixed, but the total length of all fields must not exceed 255 characters (this should not be a problem if a printout of the file on a standard 80–column printer is desired). The number of records in the file is updated as the program is used, but the number of fields required and their lengths must be set up as part of the program before any data files are created. Several versions of the program would required to be kept if the program was used for a variety of filing applications.

Setting up for use

The only lines needing to be changed in the Basic program are lines 500–560 (though the program title in lines 210 and 1000 could be altered also), and these should be changed to your requirements as you enter the listing. Line 500 defines variable F, the number of fields in the files handled. Lines 510–520 define the length (ie. number of characters) of each of the fields (if F is less than 10, the unused field lengths should be set to zero), and lines 530–560 define the titles of each of the fields. These titles are used within the program to refer to the columns, and are also printed as a header on any printout of the file. Note that the length of the title must be the same as the corresponding field size, otherwise an error will occur on running the program. If necessary, the field titles should be filled out with spaces eg. if FL(2)= 10, then FT$(2)="SURNAME...". With these variables defined correctly, the program is ready to run.

The memory used by the program is as follows: 6 bytes + F bytes (F=number of fields) + record storage. Each record uses memory as follows: 2 bytes + F bytes + 1 byte for each character in each field. All records are stored as string (ie.character) data, including any numbers stored. Memory is hence used more efficiently (and more quickly) than from Basic.

Data is stored upward from location 20000 ($4E20), giving a maximum storage capacity of just over 20k per file. Note that records are not necessarily stored in memory in numerical order, though this is transparent to the user ie. they always appear to be in order when listed. Data is saved as a block of program memory from 20000 to the end of the file.

Using the program

Upon RUNning the program, the machine code section is loaded in from disk if it is not already in memory. A menu of functions is then presented, and offers the following options (note that if entry to options is made in error, pressing RETURN from most prompts causes a return to the previous menu) :

View Data in File

After choosing the output device (screen or printer (device 4)), or exit back to the menu, all of the data file currently in memory is listed out. The field titles are printed at the top, with the fields neatly printed out in vertical columns beneath their headings with one space between each column. The number of each record is printed down the left side. Listing can be slowed by pressing the CTRL key, and can be paused completely by holding SHIFT or clicking SHIFT LOCK. Pause is indicated by a red border, and the listing will continue when SHIFT is released.

IAIN MURRAY

HOW IT WORKS.

10–410	Titles and load machine code.
500–590	Set up data lengths and check.
600–620	Set up file memory area.
700–790	Set up addresses of machine code routines.
1000–1120	Print main menu and get selection.
1500–1570	Print out data to screen or printer.
2000–2140	Add record to file.
2500–2590	Change record in file.
3000–3080	Delete record from file.
3500–3990	Disk file handling procedures.
4000–4390	Data processing routines.
4500–4540	Exit program.

Subroutines

6000–6080	Input new or modified record.
7000–7070	Get disk filename and store in memory.
8000–8030	Read record from machine code buffer.
8500–8620	Check for empty file memory.
9000–9050	Place record into machine code buffer.
9500–9700	Wait for SPACE to be pressed.
9800–9850	Check disk drive error channel and report.

Add a Record to File.
If more than one record is in the file already, the program asks for the number of the record after which the current one is to be added. Each of the field titles is then given, and an input is requested for this field. The whole record is then stored in memory by the machine code routine.
Change Record in File.
The program prompts for the number of the record to be changed, and withdraws this record from memory. Each field title is then given, along with the current entry in this field, and a new entry is prompted for. If no change is required to this entry, then pressing RETURN on it's own will indicate this. When all fields have been done, the old record is deleted from memory, and the new one added.
Delete Record from File.
The program prompts for the number of the record to be deleted, and it is deleted from memory and printed on the screen.
Disk File Handling.
Selecting this option presents another menu, offering file handling options as follows:

Load Data File
A file name is requested (the .FILE extension should not be given), then the required file is loaded from disk. If a file transfer error occurs, this is indicated, otherwise a successful LOAD is indicated. After LOADing, a check is made to see if the file is compatible with the field lengths set up within the program, and if non–compatibility is found, a warning is given on the screen.
Save Data File
A file name is requested, then the data file currently in memory is SAVEd to disk. If a file transfer occurs, this is indicated, otherwise a successful SAVE is indicated. Note that the extension .FILE is added to the given file name to indicate in the disk directory that this is a data file.
Disk Directory
A directory of the current disk is displayed on the screen. Pressing CTRL will slow the listing, and pressing SHIFT will pause the listing.
Rename a File
The file's current name is requested, followed by it's new one, the file is then renamed on the disk.
Delete a File
The file's name is requested, and the file deleted from the disk.
Return to Main Menu
The program returns immediately to the main menu screen.
Process Data.
Selecting this option presents another menu, offering data processing options as follows:
Search for Data
A search string of between 2 and 40 characters is asked for, the memory is scanned for all occurrences of this string. All records containing the search string are printed out in full along with their numbers, and a total number of finds is printed.
Sum column
A menu of field titles is printed, and a prompt for one of these is given. All elements in the requested column are then added up, and a total and average for the column are printed. This process may take some time for a long data file.
Return to Main Menu
The program returns immediately to the main menu screen.
Exit Program.
After asking for confirmation of exit, the program exits back to Basic.

Figure 1

	FIELDS (No.)	NAME	ADDRESS	PHONE	MEMBER
R	001	J.Adams	3,Main St, Anytown.	123456	654
E					
C	002	F.Jones	10,High St, Uptown.	987654	321
O					
R	003	G.Smith	54,New St, Downtown.	888666	432
D					
S	004	P.Young	17,Low Rd, Anytown.	765765	223

MULTIFILE MC GEN

```
41  10 REM *** MULTIFILE MACHINE
    CODE GENERATOR ***
AB  20 REM *** BY IAIN MURRAY (C
    ) 1986 ***
08  30 REM *** FOR YOUR COMMODOR
    E ***
34  50 POKE 53280,6:POKE 53281,1

1C  60 PRINT "{CLR,BLACK,DOWN3,R
    IGHT3,RVSON} MULTIFILE MACHI
    NE CODE GENERATOR {RVSOFF}"
1B  70 PRINT "{DOWN3,RIGHT3}THIS
     WILL SAVE 'FILECODE' TO DIS
    K"
7F  80 PRINT"{DOWN5,RIGHT7}LOADI
    NG DATA - PLEASE WAIT"
E3  100 AD=49152:C=0
11  110 READ A:POKE AD,A:C=C+A:A
    D=AD+1
B4  120 IF AD<50135 THEN 110
BE  130 IF A=195 AND C=130189 TH
    EN 150
9A  140 PRINT "{DOWN3,RIGHT7}ERR
    OR IN DATA!!";END
41  150 PRINT "{DOWN3,RIGHT5}DAT
    A OK - PRESS {RVSON} SPACE {
    RVSOFF} TO SAVE"
8A  160 GET A$:IF A$<>" " THEN 1
    60
E9  170 POKE 43,0:POKE 44,192:PO
    KE 45,220:POKE 46,195
DB  180 SAVE "FILECODE",8
3E  190 END
64  1000 DATA 165,251,56,233,1,1
    33,251,165,252,233
7B  1010 DATA 0,133,252,96,165,2
    51,24,105,1,133
BE  1020 DATA 251,165,252,105,0,
    133,252,96,169,44
EC  1030 DATA 133,251,169,78,133
    ,252,96,160,0,177
51  1040 DATA 251,201,255,208,7,
    200,177,251,201,255
33  1050 DATA 240,6,32,14,192,76
    ,37,192,200,177
61  1060 DATA 251,96,173,2,206,2
    08,12,160,255,169
83  1070 DATA 1,141,3,206,169,3,
    76,83,192,160
B3  1080 DATA 7,169,4,170,32,186
    ,255,169,0,32
D9  1090 DATA 189,255,32,192,255
    ,169,3,24,109,2
38  1100 DATA 206,170,32,201,255
    ,76,101,193,32,231
74  1110 DATA 255,169,0,141,3,20
    6,96,169,3,141
1A  1120 DATA 5,206,24,109,32,78
    ,141,4,206,169
41  1130 DATA 0,141,6,206,172,4,
    206,177,251,32
CB  1140 DATA 210,255,238,4,206,
    238,6,206,172,5
7B  1150 DATA 206,177,251,205,6,
    206,208,232,172,5
CF  1160 DATA 206,185,31,78,56,2
    33,1,205,6,206
51  1170 DATA 48,20,152,56,233,2
    ,205,32,78,240
6A  1180 DATA 11,169,32,32,210,2
    55,238,6,206,76
92  1190 DATA 158,192,169,32,32,
    210,255,238,5,206
82  1200 DATA 173,5,206,56,233,3
    ,205,32,78,208
BA  1210 DATA 174,169,13,32,210,
    255,32,210,255,96
57  1220 DATA 255,255,32,62,192,
    240,1,96,169,1
CD  1230 DATA 141,7,206,32,94,19
    5,32,28,192,32
40  1240 DATA 37,192,201,255,240
    ,46,205,7,206,240
A3  1250 DATA 6,32,14,192,76,239
    ,192,32,41,195
B6  1260 DATA 32,60,195,32,117,1
    92,238,7,206,173
5D  1270 DATA 142,2,201,1,208,8,
    169,2,141,32
BE  1280 DATA 208,76,13,193,169,
    6,141,32,208,76
EB  1290 DATA 236,192,76,108,192
    ,255,0,169,8,170
93  1300 DATA 160,255,32,186,255
    ,173,0,207,162,1
51  1310 DATA 160,207,32,189,255
    ,32,28,192,32,37
92  1320 DATA 192,201,255,240,6,
    32,14,192,76,62
8F  1330 DATA 193,32,14,192,32,1
    4,192,32,14,192
53  1340 DATA 166,251,164,252,16
    9,31,133,251,169,78
F7  1350 DATA 133,252,169,251,32
    ,216,255,32,183,255
25  1360 DATA 41,128,141,8,206,9
    6,255,255,169,8
E4  1370 DATA 170,160,255,32,186
    ,255,173,0,207,162
A9  1380 DATA 1,160,207,32,189,2
    55,169,0,32,213
DA  1390 DATA 255,76,101,193,255
    ,255,32,28,192,32
8F  1400 DATA 37,192,201,255,240
    ,24,205,1,206,240
47  1410 DATA 2,16,6,32,14,192,7
    6,143,193,24
A7  1420 DATA 105,1,145,251,32,1
    4,192,76,143,193
FF  1430 DATA 160,0,32,14,192,32
    ,14,192,173,1
87  1440 DATA 206,24,105,1,145,2
    51,32,14,192,185
0A  1450 DATA 0,205,145,251,200,
    204,0,206,208,245
E8  1460 DATA 169,255,145,251,20
    0,145,251,200,145,251
ED  1470 DATA 238,33,78,96,255,2
    55,32,28,192,32
D0  1480 DATA 37,192,205,9,206,2
    40,6,32,14,192
2C  1490 DATA 76,223,193,169,0,1
    41,2,206,32,62
5A  1500 DATA 192,32,117,192,32,
    108,192,174,32,78
27  1510 DATA 169,3,168,24,109,3
    2,78,24,113,251
6B  1520 DATA 200,202,208,249,14
    1,11,206,169,0,141
B9  1530 DATA 10,206,172,11,206,
    177,251,160,0,145
E5  1540 DATA 251,201,255,240,9,
    140,10,206,32,14
06  1550 DATA 192,76,20,194,238,
    10,206,173,10,206
C2  1560 DATA 201,3,240,6,32,14,
    192,76,20,194
AF  1570 DATA 32,28,192,32,37,19
    2,201,255,240,27
8E  1580 DATA 56,237,9,206,176,6
    ,32,14,192,76
90  1590 DATA 61,194,160,2,177,2
    51,56,233,1,145
44  1600 DATA 251,32,14,192,76,6
    1,194,206,33,78
EF  1610 DATA 96,0,255,169,48,13
    3,252,169,2,133
79  1620 DATA 253,169,0,133,144,
    169,36,133,251,169
BD  1630 DATA 251,133,187,169,0,
    133,188,165,253,133
8E  1640 DATA 183,169,8,133,186,
    169,96,133,185,32
4A  1650 DATA 213,243,165,186,32
    ,180,255,165,185,32
3F  1660 DATA 150,255,164,144,20
    8,70,160,6,132,251
D0  1670 DATA 32,165,255,166,252
    ,133,252,164,144,208
F3  1680 DATA 55,164,251,136,208
    ,238,164,252,32,205
E6  1690 DATA 189,169,32,32,210,
    255,32,165,255,72
17  1700 DATA 173,142,2,201,1,24
    0,249,104,166,144
63  1710 DATA 208,24,170,240,6,3
    2,210,255,76,184
98  1720 DATA 194,169,13,32,210,
    255,165,197,201,63
DF  1730 DATA 240,4,160,4,208,18
    8,32,66,246,96
92  1740 DATA 255,255,32,28,192,
    173,2,207,24,105
F2  1750 DATA 2,141,2,207,32,37,
    192,205,15,206
A4  1760 DATA 240,6,32,14,192,76
    ,242,194,173,32
C8  1770 DATA 78,170,160,3,204,2
    ,207,208,3,141
BF  1780 DATA 3,207,24,113,251,2
    00,202,208,241,24
44  1790 DATA 105,3,141,0,206,16
    0,3,177,251,153
BF  1800 DATA 253,204,200,204,0,
    206,208,245,96,160
5E  1810 DATA 0,185,12,206,32,21
    0,255,200,192,3
C3  1820 DATA 208,245,169,32,32,
    210,255,96,238,14
47  1830 DATA 206,173,14,206,201
    ,58,208,23,169,48
02  1840 DATA 141,14,206,238,13,
    206,173,13,206,201
AD  1850 DATA 58,208,8,169,48,14
    1,13,206,238,12
20  1860 DATA 206,96,169,48,141,
    12,206,141,13,206
31  1870 DATA 141,14,206,238,14,
    206,96,0,255,32
88  1880 DATA 94,195,162,0,142,4
    ,207,232,142,7
CF  1890 DATA 206,32,28,192,32,3
    7,192,201,255,208
AA  1900 DATA 1,96,205,7,206,240
    ,6,32,14,192
4E  1910 DATA 76,126,195,32,14,1
```

```
    92,160,0,32,14
D4  1920 DATA 192,177,251,217,61
    ,3,240,13,201,255
84  1930 DATA 208,240,32,60,195,
    238,7,206,76,126
64  1940 DATA 195,200,204,60,3,2
    08,230,32,0,192
FD  1950 DATA 160,0,177,251,201,
    255,208,245,200,177
59  1960 DATA 251,201,255,208,23
    8,32,41,195,32,117
6A  1970 DATA 192,32,60,195,238,
    7,206,238,4,207
7E  1980 DATA 76,123,195
```

PROGRAM: MULTIFILE

```
68  10 REM *** MULTIFILE-CONVERT
    IBLE FILE PROCESSOR ***
AB  20 REM *** BY IAIN MURRAY (C
    ) 1986 ***
08  30 REM *** FOR YOUR COMMODOR
    E ***
17  40 REM *** DISK-BASED FILE S
    TORAGE ***
93  80 UP$=CHR$(147)+CHR$(142):D
    N$=CHR$(147)+CHR$(14)+CHR$(8
    ):REM * CASES
21  100 PRINT "{BLACK}"+DN$:REM
    * BLACK/LOWER CASE
1E  110 POKE 53280,6:POKE 53281,
    1:REM * SCREEN COLOURS
AF  200 IF PEEK(49152)=165 THEN
    300
89  210 PRINT DN$+"{DOWN2,RIGHT1
    0,RVSON}  {SM,SU,SL,ST,SI,SF
    ,SI,SL,SE}  "
6A  220 PRINT "{DOWN4,RIGHT6,SL,
    SO,SA,SD,SI,SN,SG,SSPC,SM,SA
    ,SC,SH,SI,SN,SE,SSPC,SC,SO,S
    D,SE,SSPC,SS,SE,SC,ST,SI,SO,
    SN}"
D6  230 PRINT"{DOWN3,RIGHT13,RVS
    ON}  {SP,SL,SE,SA,SS,SE}  {SW,
    SA,SI,ST}  {RVSOFF}"
6F  240 LOAD "FILECODE",8,1
1C  250 POKE 56,78:REM * MEMORY
    TOP
A0  300 DIM FL(10),FT$(10),FS$(1
    0)
18  400 MM = 20000:REM * START O
    F DATA AREA
9F  410 BF=52480:REM * M/C INTER
    FACE BUFFER
D7  500 F=***:REM * NUMBER OF FI
    ELDS
DE  510 FL(1)=***:FL(2)=***:FL(3
    )=***:FL(4)=***:FL(5)=***:RE
    M * LENGTH OF FIELDS
CB  520 FL(6)=***:FL(7)=***:FL(8
    )=***:FL(9)=***:FL(10)=***:R
    EM * LENGTH OF FIELDS
67  530 FT$(1)="{ST,SI,ST,SL,SE}
     1":FT$(2)="{ST,SI,ST,SL,SE}
    2":FT$(3)="{ST,SI,ST,SL,SE,
    SSPC}3":REM * FIELD TITLES
1F  540 FT$(4)="{ST,SI,ST,SL,SE}
     4":FT$(5)="{ST,SI,ST,SL,SE}
     5":FT$(6)="{ST,SI,ST,SL,SE}
     6":REM * FIELD TITLES
93  550 FT$(7)="{ST,SI,ST,SL,SE,
    SSPC}7":FT$(8)="{ST,SI,ST,SL
    ,SE,SSPC}8":FT$(9)="{ST,SI,S
    T,SL,SE,SSPC}9":REM * FIELD
    TITLES
B1  560 FT$(10)="{ST,SI,ST,SL,SE
    ,SSPC}10":REM * FIELD TITLES

EE  565 IF F<2 OR F>10 OR F<>INT
    (F) THEN PRINT "{SF}IELD NUM
    BER ERROR":END
9C  570 FOR I=1 TO F:IF LEN(FT$(
    I))<>FL(I) THEN PRINT "{SS}T
    RING";I;"LENGTH ERROR":END
86  580 FS$(I)=FT$(I):IF LEN(FS$
    (I))>12 THEN FS$(I)=LEFT$(FS
    $(I),12)
D2  590 NEXT
07  600 POKE MM,F:POKE MM+1,0:RE
    M * SET UP MEMORY AREA
F8  610 FOR I=1 TO F:POKE MM+1+I
    ,FL(I):NEXT
3C  620 FOR I=MM+12 TO MM+14:POK
    E I,255:NEXT
E3  700 PT=49374:REM *** PRINTOU
    T ***
F5  710 SV=49449:REM *** SAVE FI
    LE ***
BF  720 LD=49520:REM *** LOAD FI
    LE ***
0A  730 AR=49548:REM *** ADD REC
    ORD ***
80  740 DR=49628:REM *** DELETE
    RECORD ***
07  750 DY=49765:REM *** DISK DI
    RECTORY ***
C7  760 SR=49894:REM *** RECORD
    SEARCH ***
08  770 SH=50031:REM *** DATA SE
    ARCH ***
40  775 REM *** END OF CODE AT 5
    0138 ***
CB  780 FT$="{DOWN,RIGHT7,RVSON}
     FILE TRANSFER COMPLETED {RV
    SOFF}"
49  790 FE$="{DOWN,RIGHT9}FILE T
    RANSFER ERROR!"
8D  999 REM *** MAIN MENU ***
F4  1000 PRINT DN$+"{DOWN2,RIGHT
    13,RVSON}  {SM,SU,SL,ST,SI,S
    F,SI,SL,SE}  "
4E  1010 PRINT "{DOWN,RIGHT13,RV
    SON}  {SM,SA,SI,SN}  {SM,SE,S
    N,SU}  "
32  1020 PRINT "{DOWN2,RIGHT8}1)
    {SSPC,SV}IEW {SD}ATA IN {SF}
    ILE"
9C  1030 PRINT "{DOWN,RIGHT8}2){
    SSPC,SA}DD {SR}ECORD TO {SF}
    ILE"
BA  1040 PRINT "{DOWN,RIGHT8}3){
    SSPC,SC}HANGE {SR}ECORD IN {
    SF}ILE"
59  1050 PRINT "{DOWN,RIGHT8}4)
    {SD}ELETE {SR}ECORD FROM {SF
    }ILE"
0C  1060 PRINT "{DOWN,RIGHT8}5)
    {SD}ISK {SF}ILE {SH}ANDLING"

9E  1070 PRINT "{DOWN,RIGHT8}6)
    {SP}ROCESS {SD}ATA"
DE  1080 PRINT "{DOWN,RIGHT8}7)
    {SE}XIT {SP}ROGRAM"
54  1100 PRINT "{DOWN2,RIGHT4,SW
    }HICH DO YOU REQUIRE (1-7) ?
    "
F2  1110 GET A$:A=VAL(A$):IF A<1
     OR A>8 THEN 1110
A4  1120 ON A GOTO 1500,2000,250
    0,3000,3500,4000,4500
6A  1499 REM *** VIEW FILE DATA
    ***
54  1500 PRINT "{CLR,DOWN2,RIGHT
    11,RVSON,SV}IEW {SD}ATA IN {
    SF}ILE"
F2  1505 GOSUB 8500:IF MX=0 THEN
     1000
CE  1510 PRINT "{DOWN2,RIGHT4,SO
    }UTPUT TO {SS}CREEN OR {SP}R
    INTER, OR"
7B  1520 PRINT "{RIGHT4}RETURN T
    O {SM}AIN {SM}ENU ({SS}/{SP}
    /{SM}){SSPC}?"
BA  1530 GET A$:IF A$="M" THEN 1
    000
53  1534 DV=0:IF A$="P" THEN DV=
    1:GOTO 1538
31  1536 IF A$<>"S" THEN 1530
4C  1538 POKE 52738,DV
37  1540 PRINT "{DOWN2,RIGHT6,SP
    }RESS {RVSON,SS,SH,SI,SF,ST,
    RVSOFF} TO PAUSE LISTING{DOW
    N2}"
0D  1550 IF DV=1 THEN PRINT "{RI
    GHT15,RVSON}  {SP,SR,SI,SN,ST
    ,SI,SN,SG}  {RVSOFF,DOWN}";:OP
    EN 1,4,7:GOTO 1555
F6  1553 OPEN 1,3
47  1555 PRINT#1,"#  ";:FOR I=1
    TO F:PRINT#1," ";FT$(I);:NEX
    T:PRINT#1:PRINT#1:CLOSE1
1A  1560 SYS PT:IF PEEK(52744)<>
    0 THEN PRINT "{UP2,RIGHT9,SP
    ,SR,SI,SN,ST,SE,SR,SSPC,SN,S
    O,ST,SSPC,SA,SV,SA,SI,SL,SA,
    SB,SL,SE}!"
32  1570 GOSUB 9600:GOTO 1000
0D  1999 REM *** ADD DATA TO FIL
    E ***
63  2000 PRINT "{CLR,DOWN2,RIGHT
    12,RVSON,SA}DD {SD}ATA TO {S
    F}ILE{DOWN2}"
31  2010 PRINT "{DOWN2,RIGHT4,SD
    }O YOU WISH TO ADD A RECORD
    ({SY}/{SN})  ?"
27  2020 GET A$:IF A$="N" THEN 1
    000
19  2030 IF A$<>"Y" THEN 2020
8F  2040 MX=PEEK(MM+1):IF MX=0 T
    HEN MX=1
91  2045 IF MX=1 THEN A=1:GOTO 2
    080
72  2050 PRINT "{DOWN2,RIGHT4,SW
    }HICH RECORD DO YOU WISH TO
    ADD"
B8  2060 PRINT "{RIGHT4}AFTER (
    1 -";MX;")  :{SSPC}";
C5  2070 INPUT A$:A=VAL(A$):IF A
    <1 OR A>MX THEN 2050
BF  2080 POKE 52737,A:IF PEEK(MM
    +1)=0 THEN POKE 52737,0
1D  2120 RP=0:GOSUB 6000
F7  2130 SYS AR
13  2140 PRINT "{DOWN2,RIGHT13,S
    R}ECORD {SA}DDED":GOSUB 9600
    :GOTO 1000
CD  2499 REM *** CHANGE A RECORD
     ***
EB  2500 PRINT "{CLR,DOWN2,RIGHT
    13,RVSON,SC}HANGE {SR}ECORD"
```

```
59 2510 GOSUB 8500:IF MX=0 THEN
    1000
AE 2520 PRINT "{DOWN2,RIGHT4,SW
   }HICH RECORD DO YOU WISH TO
   CHANGE"
E3 2530 PRINT "{RIGHT4}( 1 -";M
   X;") ";
04 2540 A$="":INPUT A$:IF LEN(A
   $)=0 THEN 1000
26 2550 A=VAL(A$):IF A<1 OR A>M
   X THEN 2520
CA 2560 POKE 52751,A:SYS SR:GOS
   UB 8000:RP=1:GOSUB 6000
AC 2565 PRINT "{WHITE}";:REM *
   WHITE FOR INVISIBILITY
3E 2570 POKE 52745,A:SYS DR:REM
    * REMOVE OLD RECORD
26 2580 POKE 52737,A-1:SYS AR:R
   EM * ADD NEW RECORD
30 2590 PRINT "{BLACK,UP,RIGHT1
   0,SR}ECORD {SC}HANGED":GOSUB
    9600:GOTO 1000
04 2999 REM *** DELETE A RECORD
    ***
74 3000 PRINT "{CLR,DOWN2,RIGHT
   13,RVSON,SD}ELETE {SR}ECORD"

1F 3010 GOSUB 8500:IF MX=0 THEN
    1000
31 3020 PRINT "{DOWN2,RIGHT4,SW
   }HICH RECORD DO YOU WISH TO
   DELETE"
59 3030 PRINT "{RIGHT4}( 1 -";M
   X;") ";
AA 3040 A$="":INPUT A$:IF LEN(A
   $)=0 THEN 1000
06 3050 A=VAL(A$):IF A<1 OR A>M
   X THEN 3020
1D 3060 PRINT "{DOWN2}":POKE 52
   745,A:SYS DR
B5 3070 PRINT "{DOWN,RIGHT12,SR
   }ECORD {SD}ELETED"
B6 3080 GOSUB 9600:GOTO 1000
65 3499 REM *** DISK FILE HANDL
   ING ***
5F 3500 PRINT DN$+"{DOWN2,RIGHT
   11,RVSON,SD}ISK {SF}ILE {SH}
   ANDLING{DOWN2}"
18 3510 PRINT "{RIGHT8}1) {SL}O
   AD {SD}ATA {SF}ILE"
55 3520 PRINT "{DOWN,RIGHT8}2)
   {SS}AVE {SD}ATA {SF}ILE"
F3 3530 PRINT "{DOWN,RIGHT8}3)
   {SD}ISK {SD}IRECTORY"
6F 3540 PRINT "{DOWN,RIGHT8}4)
   {SR}ENAME A {SF}ILE"
DF 3550 PRINT "{DOWN,RIGHT8}5)
   {SD}ELETE A {SF}ILE"
F3 3560 PRINT "{DOWN,RIGHT8}6)
   {SR}ETURN TO {SM}AIN {SM}ENU
   "
E2 3570 PRINT "{DOWN2,RIGHT4,SW
   }HICH DO YOU REQUIRE (1-6) ?
   "
3E 3580 GET A$:IF A$<"1" OR A$>
   "6" THEN 3580
8B 3590 A=VAL(A$):ON A GOTO 370
   0,3800,3600,3900,3950,1000
5B 3600 PRINT UP$+"{DOWN2,RIGHT
   4}PRESS {RVSON}SHIFT{RVSOFF}
    TO PAUSE DIRECTORY{DOWN2}"
DB 3610 SYS DY:GOSUB 9500:GOTO
   3500
AB 3700 PRINT UP$+"{DOWN2,RIGHT
   15,RVSON}LOAD DATA"
AB 3710 GOSUB 7000:IF FM=0 THEN
    3500
56 3740 GOSUB 9700:PRINT "{DOWN
   ,RIGHT15,RVSON} LOADING {RVS
   OFF}"
4A 3750 SYS LD
40 3760 IF PEEK(52744)<>0 THEN
   PRINT FE$:GOTO 3780
DB 3770 GOSUB 9800:IF ER<20 THE
   N PRINT FT$
41 3775 IF ER>=20 THEN 3780
F9 3776 F=PEEK(MM):FOR I=1 TO F
   :FL(I)=PEEK(MM+I+1)
62 3777 IF FL(I)<>LEN(FT$(I)) T
   HEN PRINT "{DOWN,RIGHT10}INC
   OMPATIBLE FILE!":GOTO 3780
52 3778 NEXT
68 3780 GOSUB 9500:GOTO 3500
3E 3800 PRINT UP$+"{DOWN2,RIGHT
   15,RVSON}SAVE DATA"
2C 3810 GOSUB 8600:IF MX=0 THEN
    3500
C1 3820 GOSUB 7000:IF FM=0 THEN
    3500
27 3840 GOSUB 9700:PRINT "{DOWN
   ,RIGHT15,RVSON} SAVING {RVSO
   FF}"
4A 3850 SYS SV
36 3860 GOTO 3760
BF 3900 PRINT UP$+"{DOWN2,RIGHT
   14,RVSON}RENAME FILE"
A7 3910 PRINT "{DOWN2,RIGHT4}GI
   VE PRESENT FILENAME :"
B1 3920 PRINT "{DOWN,SPC6}12345
   67890123456"
FE 3925 INPUT "{SPC4}";CN$:FM$=
   CN$:IF LEN(CN$)=0 THEN 3500
88 3927 IF LEN(CN$)>16 THEN 391
   0
E2 3930 PRINT "{DOWN2,RIGHT4}GI
   VE NEW FILENAME :"
22 3935 PRINT "{DOWN,SPC6}12345
   67890123456"
A7 3940 INPUT "{SPC4}";NN$:IF L
   EN(NN$)=0 THEN 3500
00 3942 IF LEN(NN$)>16 THEN 393
   0
C6 3945 PRINT "{DOWN,RIGHT15,RV
   SON} RENAMING {RVSOFF}"
A3 3949 OPEN 1,8,15,"R:"+NN$+"=
   "+CN$:CLOSE 1:GOSUB 9800:GOS
   UB 9500:GOTO 3500
FA 3950 PRINT UP$+"{DOWN2,RIGHT
   14,RVSON}DELETE FILE"
02 3960 PRINT "{DOWN2,RIGHT4}GI
   VE FILENAME :"
4F 3970 PRINT "{DOWN,SPC6}12345
   67890123456"
4D 3980 INPUT "{SPC4}";CN$:FM$=
   CN$:IF LEN(CN$)=0 THEN 3500
2A 3982 IF LEN(CN$)>16 THEN 396
   0
30 3985 PRINT "{DOWN,RIGHT14,RV
   SON} DELETING {RVSOFF}"
4A 3990 OPEN 1,8,15,"S:"+CN$:CL
   OSE 1:GOSUB 9800:GOSUB 9500:
   GOTO 3500
84 3999 REM *** PROCESS DATA **
   *
B6 4000 PRINT "{CLR,DOWN2,RIGHT
   14,RVSON,SP}ROCESS {SD}ATA"
65 4004 GOSUB 8500:IF MX=0 THEN
    1000
CB 4010 PRINT "{DOWN2,RIGHT4}1)
   {SS}EARCH FOR {SD}ATA"
A5 4020 PRINT "{DOWN,RIGHT4}2)
   {SS}UM {SD}ATA {SC}OLUMN"
9A 4030 PRINT "{DOWN,RIGHT4}3)
   {SR}ETURN TO {SM}AIN {SM}ENU
   "
8A 4040 PRINT "{DOWN2,RIGHT4,SW
   }HICH DO YOU REQUIRE (1-3) ?
   ";
46 4050 GET A$:A=VAL(A$):IF A<1
    OR A>3 THEN 4050
19 4060 PRINT A$;"{DOWN}" :ON A
   GOTO 4100,4300,1000
89 4100 PRINT "{DOWN,RIGHT4,SG}
   IVE SEARCH STRING : ";
C1 4110 INPUT S$:S=LEN(S$):IF S
   <2 OR S>40 THEN 4100
61 4120 PRINT "{DOWN}":POKE 828
   ,S:FOR I=1 TO S:POKE 828+I,A
   SC(MID$(S$,I,1)):NEXT
E7 4130 SYS SH
77 4140 PRINT "{DOWN,RIGHT4,ST}
   OTAL OF";PEEK(52996);"OCCURR
   ENCES FOUND"
7C 4150 GOSUB 9600:GOTO 1000
C8 4300 FOR I=1 TO F STEP 2:PRI
   NT "{RIGHT3}";I;"{LEFT}) ";F
   $(I);
C4 4305 IF I+1>F THEN PRINT:GOT
   O 4310
B5 4307 PRINT TAB(20);I+1;"{LEF
   T}) ";FS$(I+1)
06 4310 NEXT:PRINT "{DOWN,RIGHT
   4,SW}HICH COLUMN DO YOU WISH
    TO SUM"
AA 4315 PRINT "{RIGHT4}( 1 -";F
   ;") ";
6F 4320 INPUT A$:A=VAL(A$):IF A
   <1 OR A>F THEN PRINT "{DOWN}
   ":GOTO 4300
3C 4330 N=0:PRINT "{DOWN2,RIGHT
   15,RVSON} {SS,SU,SM2,SI,SN,S
   G} {RVSOFF}"
90 4340 FOR W=1 TO MX:POKE 5275
   1,W:POKE 52994,A:SYS SR
47 4350 RL=PEEK(BF+A-1):RX=PEEK
   (52995)+BF:N$=""
39 4360 FOR J=0 TO RL-1:N$=N$+C
   HR$(PEEK(RX+J)):NEXT
1D 4370 N=N+VAL(N$):NEXT
2B 4380 PRINT "{DOWN2,RIGHT4,SC
   }OLUMN";A;"(";FS$(A);") TOTA
   L =";N
7B 4385 PRINT "{DOWN,RIGHT4}({S
   T}OTAL OF";MX;"ITEMS)"
5C 4390 PRINT "{DOWN,RIGHT4,SC}
   OLUMN AVERAGE =";N/MX:GOSUB
   9600:GOTO 1000
19 4499 REM *** EXIT PROGRAM **
   *
27 4500 PRINT "{CLR,DOWN2,RIGHT
   14,RVSON,SE}XIT {SP}ROGRAM{D
   OWN2}"
64 4510 PRINT "{DOWN2,RIGHT4,SD
   }O YOU WISH TO EXIT ({SY}/{S
   N}) ?"
DD 4520 GET A$:IF A$="N" THEN 1
   000
EE 4530 IF A$<>"Y" THEN 4520
56 4540 PRINT UP$+CHR$(9)+"{DOW
   N20}":END
DE 5999 REM *** GET NEW DATA RE
   CORD ***
F2 6000 FOR I=1 TO F
38 6020 IF RP=1 THEN PRINT "{DO
   WN,RIGHT4,SE}XISTING ";FS$(I
   );" IS :":PRINT "{RIGHT4}";D
   $(I)
72 6025 IF RP=0 THEN D$(I)=""
```

```
B2  6030 A$="":PRINT "{DOWN,RIGH
    T4,SN}EW ";FS$(I);" {SI}TEM
    :"
15  6035 INPUT "{RIGHT4}";A$
7E  6040 IF LEN(A$)=0 THEN 6055
06  6044 IF LEN(A$)<=FL(I) THEN
    6050
4B  6046 PRINT "{DOWN,RIGHT4,SD}
    ATA {SI}NPUT {ST}OO {SL}ONG!
    !{SSPC}({SM}UST BE"
A8  6047 PRINT "{RIGHT3}";FL(I);
    "CHARACTERS LONG OR LESS)":G
    OTO 6020
57  6050 D$(I)=A$:DL(I)=LEN(A$)
E0  6055 IF LEN(D$(I))=0 THEN PR
    INT "{DOWN,RIGHT4,SN}O {SD}A
    TA {SI}NPUT!!":GOTO 6020
28  6060 NEXT I
E9  6070 GOSUB 9000
59  6080 RETURN
74  6999 REM *** GET FILENAME AN
    D STORE ***
00  7000 PRINT "{DOWN2,RIGHT22}1
    2345678901"
AF  7010 PRINT "{RIGHT4}GIVE FIL
    ENAME :{SSPC}";
88  7020 FM$="":INPUT FM$:FM=LEN
    (FM$)
A1  7025 IF FM=0 THEN 7070
70  7030 IF FM<2 OR FM>11 THEN 7
    000
73  7040 FM$=FM$+".FILE"
69  7050 POKE 52992,FM+5
7C  7060 FOR I=1 TO FM+5:POKE 52
    992+I,ASC(MID$(FM$,I,1)):NEX
    T
37  7070 RETURN
75  7999 REM *** GET RECORD FROM
    M/C BUFFER ***
9D  8000 PRINT "{DOWN,RIGHT13,RV
    SON} {SP,SL,SE,SA,SS,SE,SSPC
    ,SW,SA,SI,ST} {RVSOFF}"
F7  8005 FOR I=1 TO F:DL(I)=PEEK
    (BF+I-1):D$(I)="":NEXT
FC  8010 TT=0:FOR I=1 TO F
58  8020 FOR J=1 TO DL(I):D$(I)=
    D$(I)+CHR$(PEEK(BF+F+TT+J-1)
    ):NEXT:TT=TT+DL(I):NEXT
F3  8030 RETURN
98  8500 MX=PEEK(MM+1)
2E  8510 IF MX=0 THEN PRINT "{DO
    WN4,RIGHT10,SN,SO} {SR,SE,SC
    ,SO,SR,SD,SS} {SI,SN} {SF,SI
    ,SL,SE}!":GOSUB 9600
E7  8520 RETURN
3C  8600 MX=PEEK(MM+1)
91  8610 IF MX=0 THEN PRINT "{DO
    WN4,RIGHT10}NO RECORDS IN FI
    LE!":GOSUB 9500
43  8620 RETURN
B4  8999 REM *** PUT RECORD INTO
    M/C BUFFER ***
59  9000 PRINT "{DOWN,RIGHT13,RV
    SON} {SP,SL,SE,SA,SS,SE,SSPC
    ,SW,SA,SI,ST} {RVSOFF}"
7A  9005 FOR I=1 TO F:POKE (BF+I
    -1),DL(I):NEXT:TT=0:BL=F
BC  9010 FOR I=1 TO F
B6  9020 FOR J=1 TO DL(I):POKE (
    BF+F+TT+J-1),ASC(MID$(D$(I),
    J,1))
37  9030 NEXT:TT=TT+DL(I):BL=BL+
    DL(I):NEXT
EE  9040 POKE 52736,BL:REM * BUF
    FER LENGTH
F3  9050 RETURN
F6  9499 REM *** WAIT FOR SPACE
    PRESS ***
61  9500 PRINT "{DOWN,RIGHT7}PRE
    SS {RVSON} SPACE {RVSOFF} TO
     CONTINUE"
39  9510 GET A$:IF A$<>" " THEN
    9510
DB  9520 RETURN
2D  9600 PRINT "{DOWN,RIGHT7,SP}
    RESS {RVSON} {SS,SP,SA,SC,SE
    } {RVSOFF} TO {SC}ONTINUE"
B5  9610 GOTO 9510
2C  9700 PRINT "{DOWN,RIGHT11}PR
    EPARE DISK AND":GOTO 9500
CF  9799 REM *** GET DISK STATUS
     ***
D3  9800 OPEN 15,8,15:INPUT#15,E
    R,ER$:CLOSE 15
DE  9810 IF ER<20 THEN 9850
20  9815 PRINT "{UP2}";FE$
6E  9820 PRINT "{DOWN,RIGHT9}ERR
    OR #";ER
11  9830 PRINT "{DOWN,RIGHT9}(";
    ER$;")"
50  9840 PRINT "{DOWN,RIGHT9}FIL
    ENAME : ";FM$
2E  9850 RETURN
```

Disk File Describer

Keep track of which files do what with this handy disk utility.

Picture this scenario, you have just spent hours on your epic program, and have yet to tie the loose ends, but it's getting late, and you'll finish it off the next day. You SAVE your routine with all others, any old file name will do, and pack up for the night.

Unfortunately, the next day you're busy, and the day after you've just bought a cracker of a game and then spend four months getting an unbeatable score on it. You flick through your old disks 'cos you're running short on space, and you find that disk you worked on all that time ago. "I wonder what these files are, names like TRY1 and ML4, even a TZXE27!".

Your epic has gone, hasn't it! Has it? Not now! This little program will help you to remember even the most odd-named files you happened to SAVE with a description of up to 55 characters in length! A SYS for an old game perhaps? No need to remember it now, write it in the file describer and it will never get lost.

The Commodore DOS on the 64 is unfortunately limited in several ways, not least in the fact that file names may only have 16 characters. For most applications, it isn't enough, this program allows you to add a definitive description of 55 characters to any file on the disk. Merely create the descriptive titles and SAVE them onto the particular disk to which it refers. Then, simply LOAD and RUN Disk File Describer and, if you desire, additions and editions can be made at any time.

Getting it in

Disk File Describer is a Basic program, and thus fairly simple to follow and type in. Use the *SYNTAX CHECKER* program that is found on the *LISTINGS* page to help you with your typing.

After RUNning, the program loads the description file, if one exists, then LOADs the directory. On screen, you are presented with a menu offering five choices.

Option 1 views the directory together with the descriptions and a further menu at the bottom of the screen gives options to add or alter the current text. The file names are shown in blocks of six. If there are more files on disk keys f5 and f7 allow you to page back and forth as required. Pressing the f3 key puts you into edit mode.

Once into the edit mode you enter the file number (the number next to the files on the screen). The cursor then moves to the start of the light field in which you can make the necessary text edition. If you have made an incorrect choice of file then just press RETURN and the directory screen will return with no alterations made. All characters can be entered within the description area except inverted commas (quote marks) and although the cursor travels automatically to the next text line it cannot distinguish ends of words unlike a word processor. If you are a tidy sort of person, you will no doubt space your description so that it is easily readable at a later date. The INST/DEL key erases as per it's normal function, and RETURN after completion of entering your desired text brings the directory screen back for you to continue entering descriptive text or, by pressing f1 and option 3, SAVE the description file onto disk. Make sure that enough room exists on the disk for this file.

far as the other options are concerned, option 2 gives you normal DOS commands such as scratch, validate and rename. It also formats disks.

As stated, option 3 SAVEs the directory descriptions to disk as a sequential file. If a file is already present on disk, the program will overwrite it with the current data in memory. Choosing option 4 simply allows you to work with other disks and reRUNs the program as this option is chosen.

To exit the program, choose option 5.

I am sure you will find many uses for this program, and it would be interesting to hear how it could be adapted to individual needs.

```
PROGRAM: DISK DESCRIBER


84  1 REM **********************
    *
27  2 REM * DISK FILE DESCRIBER
    *
3B  3 REM *      BEN WELLBAY
    *
3B  4 REM * YOUR COMMODORE 1986
    *
80  5 REM **********************
    *
CA  6 POKE53280,11:POKE53281,11:
    PRINT"{CLR,DOWN6,RIGHT4,C8}D
    ISK FILE DESCRIBER"
2C  7 PRINT"{DOWN2,RIGHT4}PLEASE
     WAIT - READING DATA"
39  8 FORI=830TO902:READA:POKEI,
    A:NEXT
90  9 A1$="{HOME,DOWN21}":FL=1
61  10 A2$="{RVSON,SPC19,RVSOFF,
    SPC4,RVSON,SPC36}"
71  11 FA=144:DIMDT$(FA),J$(FA),
    K$(FA),J1$(FA)
CE  12 FORI=0TOFA:DT$(I)=CHR$(32
    )+"{SPC18}":NEXT
FE  13 PRINT"{UP,SPC11}READING D
    IRECTORY  ":OPEN1,8,0,"$":SY
    S830:CLOSE1
83  14 GOSUB88
6F  15 POKE198,0:PRINT"{CLR,DOWN
    }"SPC(6)"{RVSON}{1}{RVSOFF}"
    SPC(3)"GET DISK DIRECTORY"
AB  16 PRINT"{DOWN2}"SPC(6)"{RVS
    ON}{2}{RVSOFF}"SPC(3)"DISK D
    RIVE COMMANDS"
D8  17 PRINT"{DOWN2}"SPC(6)"{RVS
    ON}{3}{RVSOFF}"SPC(3)"SAVE D
    ESCRIPTIONS FILE"
45  18 PRINT"{DOWN2}"SPC(6)"{RVS
    ON}{4}{RVSOFF}"SPC(3)"CHANGE
     TO ANOTHER DISK"
4B  19 PRINT"{DOWN2}"SPC(6)"{RVS
```

Ben Wellbay.

```
   ON)[5)[RVSOFF]"SPC(3)"QUIT P
   ROGRAM"
4B 20 PRINT"[DOWN2]"SPC(21)"[RV
   SON] * [RVSOFF]":PRINT"[UP]"
   SPC(6)"OPTION NUMBER  [RVSON
   ] [RVSOFF]";
27 21 POKE204,0:GETNK$:IFNK$<"1
   "ORNK$>"5"THEN21
14 22 POKE204,1:POKE207,0:PRINT
   "[RVSON]"NK$:NK=VAL(NK$)
18 23 ONNKGOTO24,101,46,116,125

76 24 Q3=PEEK(0)-1:Q1=1
A6 25 IFQ1=>Q3THEN28
B3 26 IFQ1<0ANDQ3/6=INT(Q3/6)TH
   ENQ1=Q3-5:GOTO28
EC 27 IFQ1<0THENDN=INT(Q3/6):Q1
   =DN*6+1
B9 28 PRINT"[CLR,DOWN,RVSOFF,SP
   C4]DISK NAME: [RVSON]"DT$(0)
   " ":PRINT"[DOWN]":DR=5
29 29 FORI=Q1TOQ1+DR
C3 30 IFDT$(I)=CHR$(32)+"[SPC18
   ]"ORDT$(I)=""THENDT$(I)="":D
   R=DR-1
9D 31 NEXT
2A 32 FORI=Q1TOQ1+DR
71 33 IFI>9THENW$="[LEFT,RVSON]
   ":GOTO35
00 34 W$="  [LEFT,RVSON]"
BD 35 PRINT"[LEFT]"I;W$;LEFT$(D
   T$(I),16)":"A2$:PRINT"[UP2]"
   SPC(20);
23 36 PRINT"[RVSON]"J$(I)"[DOWN
   2]":NEXT
B3 37 PRINTA1$"[DOWN3]F1-MENU F
   3-ADD F5-FWD F7-BACK £-ERASE
   [HOME]":POKE198,0:WAIT198,1
01 38 IFPEEK(197)=48THEN119
55 39 IFPEEK(197)=4THEN15
0A 40 IFPEEK(197)=5THEN54
65 41 IFPEEK(197)=6ANDQ1=Q3THEN
   Q1=1:GOTO25
91 42 IFPEEK(197)=6ANDQ1+6>Q3TH
   ENQ1=1:GOTO25
91 43 IFPEEK(197)=6ANDQ1<Q3THEN
   Q1=Q1+6:GOTO25
F2 44 IFPEEK(197)=3THENQ1=Q1-6:
   GOTO25
EF 45 GOTO38
D0 46 PRINT"[UP2]"SPC(28)"[LEFT
   ,DOWN2]":PRINT"[UP2]"SPC(9)"
     SAVING "CHR$(34)"FILE DES"
   ;
10 47 PRINTCHR$(34)"...";FORQ=1
   TOQ3:IFJ$(Q)=""THENJ$(Q)="[R
   VSON]"
03 48 NEXTQ
82 49 CLOSE1:CLOSE15:OPEN1,8,15
   ,"S0:FILE DES":CLOSE1:OPEN15
   ,8,15,"I"
7A 50 OPEN1,8,8,"0:FILE DES,S,W
   ":GOSUB98
72 51 PRINT#1,Q3
30 52 FORI=1TOQ3:PRINT#1,LEFT$(
   DT$(I),16):PRINT#1,J$(I):NEX
   T:CLOSE1
7A 53 PRINT"[UP,SPC31]":GOTO15
BB 54 PRINTA1$"[DOWN3]"SPC(8)"[
   RVSON]F3-ADD[HOME]"
81 55 PRINTA1$"[DOWN]  WHICH F
   ILE ";:POKE198,0:INPUTDF$:DF
   =VAL(DF$)
9B 56 IFDF$="0"THENPRINTA1$"[DO
   WN,SPC18]":GOTO37
B4 57 IFDF<Q1ORDF>Q1+DRTHENPRIN
   TA1$SPC(17)"[DOWN,SPC18]":GO
   TO54
59 58 PRINTA1$"[DOWN,SPC26]":IF
   DF<7THENQ6=DF:GOTO61
46 59 Q6=INT(DF/6)+1:Q7=Q6*6-DF
   :Q6=6-Q7
14 60 IFQ6=0THENQ6=6
E8 61 PRINT"[HOME,DOWN]":FORI=1
   TOQ6:PRINT"[DOWN]":NEXT
46 62 DT$(DF)=LEFT$(DT$(DF),16)

84 63 F1$=""
5B 64 PRINT"[UP]"SPC(19)"[RVSON
   ]>"SPC(LEN(F1$));:CR$="<":QB
   =LEN(CR$):NM=1
BC 65 PRINT"[RVSON]"MID$(CR$,NM
   ,2);"[LEFT]";:NM=-NM*(NM<QB)
   +1
0E 66 GETOP$:IFOP$=""OROP$=CR$
   (34)OROP$=CHR$(44)OROP$=CHR$
   (58)THEN66
76 67 IFOP$=CHR$(59)THEN66
90 68 IFOP$=CHR$(13)ANDLEN(F1$)
   =18THEN84
64 69 IFLEN(F1$)=18ANDOP$<>CHR$
   (20)THENF1$=F1$+OP$:PRINTOP$
   "[RVSOFF,SPC4,RVSON]<[LEFT]"
   ;:GOTO65
50 70 IFLEN(F1$)=55THENQ5=1
E6 71 IFLEN(F1$)=55ANDOP$<>CHR$
   (20)ANDOP$<>CHR$(13)THEN66
4F 72 IFOP$=CHR$(13)ANDLEN(F1$)
   =0THEN28
A6 73 IFOP$=CHR$(13)THEN84
66 74 IFOP$=CHR$(20)ANDLEN(F1$)
   =19THEN81
A6 75 IFOP$=CHR$(20)ANDLEN(F1$)
   >0THEN78
AE 76 IFASC(OP$)<32ORASC(OP$)>9
   5THEN65
69 77 F1$=F1$+OP$:PRINTOP$;:GOT
   O65
46 78 F1$=LEFT$(F1$,LEN(F1$)-1)

B1 79 IFLEN(F1$)=54THENPRINT"[R
   VSOFF] [RVSON,LEFT2]";:GOTO6
   5
F0 80 PRINT"[RVSON] [LEFT2]";:G
   OTO65
E8 81 F1$=LEFT$(F1$,LEN(F1$)-1)
   :PRINT"[RVSON] ";D=19
40 82 IFQ5=1THENPRINT"[UP3]"SPC
   (38)"";:GOTO65
61 83 PRINT"[UP2]"SPC(38)"";:GO
   TO65
FC 84 J$(DF)=F1$
BB 85 IFLEN(J$(DF))<19THEN28
42 86 J$(DF)=MID$(J$(DF),1,19)+
   "[RVSOFF,SPC4,RVSON]"+MID$(J
   $(DF),20,37)
33 87 J$(DF)=J$(DF)+"[UP]":GOTO
   28
38 88 OPEN15,8,15,"I"
71 89 OPEN1,8,8,"0:FILE DES,S,R
   ":GOSUB98:IFER=62THENCLOSE15
   :RETURN
83 90 PRINT"[UP]"SPC(19)"FILE D
   ES[SPC5]"
BE 91 INPUT#1,Q3
8B 92 FORI=1TOQ3:INPUT#1,K$(I):
   INPUT#1,J$(I):J1$(I)=J$(I):N
   EXT
C3 93 CLOSE1:CLOSE15:NF=PEEK(0)
   -1
27 94 FORQ1=1TONF:IFLEFT$(DT$(Q
   1),16)=K$(Q1)THENJ$(Q1)=J1$(
   Q1):GOTO97
8D 95 FORQ2=1TOQ3:IFLEFT$(DT$(Q
   1),16)=K$(Q2)THENJ$(Q1)=J1$(
   Q2):Q2=Q3+2
3C 96 NEXTQ2:IFQ2=Q3+1THENJ$(Q1
   )=""
B1 97 NEXTQ1:RETURN
1D 98 INPUT#15,ER,ER$:IFER=0THE
   NRETURN
FE 99 IFER=62ANDFL=1THENFL=0:RE
   TURN
2F 100 PRINT"[CLR,DOWN4]DISK ER
   ROR:[RVSON]"ER,ER$:PRINT"[HO
   ME,DOWN4]"SPC(14)"[RVSON] [R
   VSOFF]":END
57 101 PRINT"[CLR,DOWN2,RVSON]D
   ISK COMMANDS[RVSOFF]":PRINT"
   [DOWN2]SUMMARY-":PRINT
C2 102 PRINT"[DOWN]VO"SPC(20)"V
   ALIDATE A DISK":PRINT"[DOWN]
   IO"SPC(20)"INITIALISE"
3D 103 PRINT"[DOWN]SO:FILENAME"
   SPC(11)"SCRATCH A FILE"
1B 104 PRINT"[DOWN]RO:NEWNAME=O
   LDNAME[SPC4]RENAME A FILE"
DB 105 PRINT"[DOWN2,RVSON]OPTIO
   N REQUIRED[RVSOFF] (RETURN F
   OR MENU)":Q6$="":PRINT"[DOWN
   ]>";
66 106 GETP1$:IFP1$=""THEN113
81 107 IFLEN(Q6$)=37ANDP1$<>CHR
   $(13)ANDP1$<>CHR$(20)THEN106

5E 108 P1=ASC(P1$):IFP1=13THEN1
   14
84 109 IFP1<>20THEN112
FD 110 IFLEN(Q6$)<>0THENQ6$=MID
   $(Q6$,1,LEN(Q6$)-1):PRINTP1$
   ;
5D 111 GOTO106
B3 112 IFP1<32ORP1>90THEN106
53 113 PRINT" [LEFT]";P1$;:Q6$=
   Q6$+P1$:GOTO106
C1 114 IFQ6$=""THEN15
5B 115 CLOSE1:OPEN1,8,15,Q6$:CL
   OSE1:CLOSE15:OPEN15,8,15,"I"
   :GOSUB98:GOTO15
49 116 PRINT"[CLR,DOWN8,SPC7]IN
   SERT NEW DISK IN DRIVE"
C8 117 PRINT"[DOWN2,SPC7]PRESS
   ANY KEY TO CONTINUE":POKE198
   ,0:WAIT198,1:GETE$
69 118 PRINT"[UP,SPC13]PLEASE W
   AIT[SPC8]":CLR:GOTO9
C7 119 PRINTA1$"[DOWN3]"SPC(30)
   "[RVSON]£-ERASE[HOME]"
C6 120 PRINTA1$"[DOWN]"SPC(10)"
   [SPC29]"
C5 121 POKE198,0:DF$="":PRINTA1
   $"[DOWN] WHICH FILE";:INPUTD
   F$:DF=VAL(DF$)
DD 122 IFDF$="0"THENPRINTA1$"[D
   OWN,SPC14]":GOTO37
8C 123 IFDF<Q1ORDF>Q1+DRTHEN119

E8 124 J$(DF)="[RVSON] ":GOTO28

36 125 POKE198,0:SYS198:END
FD 126 DATA169,255,133,0,165,55
   ,133,71,165,56,133
5C 127 DATA72,162,1,32,198,255,
   166,0,232,134,0
B2 128 DATA216,56,165,71,233,20
   ,133,71,176,5,166
76 129 DATA72,202,134,72,32,207
   ,255,164,144,208
54 130 DATA22,201,34,208,245,16
   0,0,32,207,255,201
54 131 DATA34,240,249,145,71,20
   0,192,19,208,242
D6 132 DATA240,207,32,204,255,9
   6,0,0,0
```

Character Scroller

Do you long to have text scrolling smoothly wherever you like? The dream can become a little closer to reality.

By John Fletcher

Have you ever played *Strangeloop* from Virgin? If you have, you will have seen the way that the instructions are displayed (they scroll up to three-quarters of the way across the screen and then stop) and you might have also wondered how they did it.

Well, look no further. The routines here will do the same for your own programs. They allow you to scroll a message between specified characters, either scrolling upwards or from the left.

The routines work by getting a character from the text and putting the graphic of that character into the end of the characters you chose, and then it moves the graphic one pixel upwards or to the left, depending on the option chosen.This means that wherever the characters you chose for the scroll are put on the screen, the text will be scrolled through them. As the demo program shows, you can use this to create tunnel effects.

The Routines

The first routine, Listing 1, is a left scroll and is called as follows:

SYS49152,A,B,C,D

where:
A is the start of text;
B is the start of the character set;
C is the start of the characters;
D is the number of characters to scroll;

Listing 2 is an up scroll with the same parameters as above, but is called by:

SYS4950

Listing 3 is a routine to set up a raster interrupt to run the above two routines; we will delve into this more deeply in the 'Tips' section.

Listing 4 is a routine to copy the ROM characters into $3000, and also allows you to re-design them by copying a character into spare memory, then moving the top four pixels to the right, so creating double-thickness with a slant.

Listing 5 is a Basic demo program.

When your text is in the memory, remember to put the character 255 ($FF) at the end; the scroller checks to see if any of the characters are 255, and if it is, this causes the text to be reset.

Some Tips

The raster interrupt that I have set up is rather make-shift, and you may wish to improve on it yourself. The addresses of the scroll routines are $C069 (48257 dec) for the left scroll, and $C1C5 (49695 dec) for the up scroll.

You may think the routines are rather bulky for their functions, but most of the code is used to extract the specified parameters. If you wish to make them more effective, you could just get rid of all the parameter routines.

If you're a would-be demo producer, then you'll know the basis of the left-scroll could be amended to scroll the text within sprites.

If you're thinking of using this routine for a landscape, then you will have to duplicate the scroll routine and also change the part of the routine that extracts the data and converts it to text, so that it changes the data to your landscape graphic.

Getting it all in

All of the routines are presented here as Basic programs. You should enter all of these using the SYNTAX CHECKER program that can be found on the LISTINGS page. Each program should be typed in and SAVEd one at a time.

Before you RUN the DEMO program you should have LOADed and RUN each of the other programs.

LISTING 1: CHAR LEFT

```
E4  10 REM <<<<<<<<<-----------
    ->>>>>>>>>
B4  11 REM <<<<
           >>>>
A6  12 REM <<<< CHARACTER SCROLL
     LEFT >>>>
B2  13 REM <<<<
           >>>>
B8  14 REM <<<< SYS 49152, TEXT
    SA    >>>>
FA  15 REM <<<<             , CHAR
    SA    >>>>
6B  16 REM <<<<             , START
     CHAR >>>>
B2  17 REM <<<<             , NO. C
    HARS  >>>>
1D  18 REM <<<<
           >>>>
93  19 REM <<<<<<<<<-----------
    ->>>>>>>>>
5F  20 REM <<
             >>
9C  21 REM << INVENTED BY JOHN F
    LETCHER >>
A1  22 REM <<       IN 1986 FOR '
    YC'     >>
60  23 REM <<
             >>
FA  24 REM <<<<<<<<<-----------
    ->>>>>>>>>
23  25 :
20  26 :
```

```
63  27 PRINT"[CLR]":FORL=0TO17:C
    X=0:FORD=0TO15:READA:CX=CX+A
    :POKE49152+L*16+D,A:NEXTD
B7  28 READA:IFA<>CXTHENPRINT"[W
    HITE,RVSON]ERROR IN LINE[WHI
    TE]";31+L:END
4C  29 PRINT"[HOME,C7]READING LI
    NE[YELLOW]";31+L
52  30 NEXTL:END
C9  31 DATA32,89,192,165,20,141,
    153,192,165,21,141,154,192,3
    2,253,174,2116
DB  32 DATA32,235,183,165,20,133
    ,158,165,21,133,159,142,151,
    192,169,0,2058
77  33 DATA141,152,192,138,133,1
    48,169,8,133,149,169,0,141,1
    51,192,162,2178
11  34 DATA8,70,148,144,3,24,101
    ,149,106,110,151,192,202,208
    ,242,141,1999
F6  35 DATA152,192,173,152,192,2
    4,101,159,141,152,192,32,253
    ,174,32,158,2279
5F  36 DATA183,138,201,32,48,13,
    76,72,178,32,253,174,32,138,
    173,32,1775
48  37 DATA247,183,96,141,149,19
    2,76,241,192,160,7,32,167,19
    2,174,155,2404
2A  38 DATA192,24,8,40,177,166,4
    2,145,166,8,165,166,56,233,8
    ,133,1729
EC  39 DATA166,176,2,198,167,202
    ,16,235,40,136,16,223,206,15
    0,192,173,2298
3E  40 DATA150,192,240,41,96,30,
    8,240,34,0,80,30,173,153,192
    ,133,1792
3F  41 DATA254,173,154,192,133,2
    55,86,173,151,192,133,166,17
    3,152,192,133,2722
9D  42 DATA167,96,173,151,192,13
    3,248,173,152,192,133,249,96
    ,169,8,141,2473
36  43 DATA150,192,160,0,132,167
    ,177,254,201,255,240,208,41,
    63,10,10,2260
A2  44 DATA10,133,166,144,2,230,
    167,165,167,24,101,159,133,1
    67,32,178,1978
D7  45 DATA192,160,7,177,166,145
    ,248,136,16,249,230,254,208,
    2,230,255,2675
E7  46 DATA96,174,151,192,172,15
    2,192,134,187,132,188,173,14
    9,192,141,155,2580
A7  47 DATA192,10,10,10,141,151,
    192,24,105,8,141,232,3,169,0
    ,160,1548
F4  48 DATA0,145,187,200,204,232
    ,3,208,248,32,156,192,96,3,0
    ,255,2161
```

LISTING 2:CHAR UP

```
E4  10 REM <<<<<<<<<------------
    ->>>>>>>>>
84  11 REM <<<<
           >>>>
E6  12 REM <<<< CHARACTER SCROLL
     UP   >>>>
82  13 REM <<<<
           >>>>
6F  14 REM <<<< SYS 49500, TEXT
    SA    >>>>
FA  15 REM <<<<           , CHAR
    SA    >>>>
6B  16 REM <<<<           , START
     CHAR >>>>
B2  17 REM <<<<           , NO. C
    HARS  >>>>
1D  18 REM <<<<
           >>>>
93  19 REM <<<<<<<<<------------
    ->>>>>>>>>
5F  20 REM <<
             >>
9C  21 REM << INVENTED BY JOHN F
    LETCHER >>
A1  22 REM <<       IN 1986 FOR '
    YC'     >>
60  23 REM <<
             >>
FA  24 REM <<<<<<<<<------------
    ->>>>>>>>>
23  25 :
20  26 :
6C  27 PRINT"[CLR]":FORL=0TO15:C
    X=0:FORD=0TO15:READA:CX=CX+A
    :POKE49500+L*16+D,A:NEXTD
87  28 READA:IFA<>CXTHENPRINT"[W
    HITE,RVSON]ERROR IN LINE[WHI
    TE]";31+L:END
4C  29 PRINT"[HOME,C7]READING LI
    NE[YELLOW]";31+L
52  30 NEXTL:END
97  31 DATA32,181,193,165,20,141
    ,221,193,165,21,141,222,193,
    32,253,174,2347
C9  32 DATA32,235,183,165,20,133
    ,164,165,21,133,165,142,219,
    193,169,0,2139
96  33 DATA141,220,193,138,133,1
    66,169,8,133,167,169,0,141,2
    19,193,162,2352
E4  34 DATA8,70,166,144,3,24,101
    ,167,106,110,219,193,202,208
    ,242,141,2104
FF  35 DATA220,193,173,220,193,2
    4,101,165,141,220,193,32,253
    ,174,32,158,2492
6F  36 DATA183,138,201,26,48,13,
    76,72,178,32,253,174,32,138,
    173,32,1769
D6  37 DATA247,183,96,141,217,19
    3,76,42,194,160,0,200,177,17
    6,136,145,2383
8D  38 DATA176,200,204,223,193,1
    44,244,206,218,193,240,30,96
    ,20,8,0,2395
5C  39 DATA52,0,64,168,173,221,1
    93,133,252,173,222,193,133,2
    53,96,173,2499
D8  40 DATA219,193,133,248,173,2
    20,193,133,249,96,169,8,141,
    218,193,160,2746
B0  41 DATA0,132,251,177,252,201
    ,255,240,219,41,63,10,10,10,
    133,250,2244
33  42 DATA144,2,230,251,165,251
    ,24,101,165,133,251,32,235,1
    93,160,7,2344
E1  43 DATA177,250,145,248,136,1
    6,249,230,252,208,2,230,253,
    96,174,219,2885
91  44 DATA193,172,220,193,134,1
    76,132,177,173,217,193,10,10
    ,10,141,219,2370
B2  45 DATA193,24,105,8,141,223,
    193,141,232,3,169,0,160,0,14
    5,176,1913
52  46 DATA200,204,232,3,208,248
    ,169,8,141,218,193,32,224,19
    3,96,155,2524
```

LISTING 3: RASTER

```
E4  10 REM <<<<<<<<<------------
    ->>>>>>>>>
84  11 REM <<<<
           >>>>
79  12 REM <<<< THIS ROUTINE WIL
    L SET >>>>
82  13 REM <<<<
           >>>>
21  14 REM <<<< UP A RASTER INTE
    RRUPT >>>>
00  15 REM <<<<
           >>>>
43  16 REM <<<< TO RUN THE TWO S
    CROLL >>>>
1E  17 REM <<<<
           >>>>
79  18 REM <<<< ROUTINES .(SYS 4
    9800) >>>>
1C  19 REM <<<<
           >>>>
BE  20 REM <<<<<<<<<------------
    ->>>>>>>>>
5E  21 REM <<
             >>
09  22 REM << INVENTED BY JOHN F
    LETCHER >>
64  23 REM <<       IN 1986 FOR '
    YC'     >>
5B  24 REM <<
             >>
E9  25 REM <<<<<<<<<------------
    ->>>>>>>>>
20  26 :
21  27 :
81  28 PRINT"[CLR]":FORL=0TO5:CX
    =0:FORD=0TO15:READA:CX=CX+A:
    POKE49800+L*16+D,A:NEXTD
CD  29 READA:IFA<>CXTHENPRINT"[W
    HITE,RVSON]ERROR IN LINE[WHI
    TE]";32+L:END
B4  30 PRINT"[HOME,C7]READING LI
    NE[YELLOW]";32+L
53  31 NEXTL:END
D4  32 DATA120,169,127,141,13,22
    0,169,1,141,25,208,141,26,20
    8,169,27,1905
B7  33 DATA141,17,208,169,1,141,
    132,3,162,172,160,194,142,20
    ,3,140,1805
A7  34 DATA21,3,88,96,173,25,208
    ,141,25,208,41,1,240,28,206,
    132,1636
DF  35 DATA3,16,5,169,1,141,132,
    3,174,132,3,189,224,194,141,
    32,1559
46  36 DATA208,189,222,194,141,1
    8,208,138,240,6,32,105,192,7
    6,126,234,2329
EF  37 DATA32,197,193,76,49,234,
    49,251,6,0,0,0,0,0,0,0,1087
```


By John Fletcher

LISTING 4: COPY

```
E4  10 REM <<<<<<<<<<----------
    ->>>>>>>>>>
B4  11 REM <<<<
           >>>>
80  12 REM <<<<    THE FIRST ROUT
    INE    >>>>
87  13 REM <<<< COPIES THE ROM C
    HARS. >>>>
66  14 REM <<<< INTO $3000 (1228
    8)     >>>>
00  15 REM <<<<
           >>>>
2A  16 REM <<<<    THE SECOND ROU
    TINE  >>>>
73  17 REM <<<< RE-DESIGNS THE C
    HARS. >>>>
47  18 REM <<<< BY SHIFTING THE
    FIRST >>>>
13  19 REM <<<< FOUR PIXELS OF T
    HE    >>>>
F1  20 REM <<<< CHAR RIGHT ONE.
    WITH  >>>>
5D  21 REM <<<< DOUBLE WIDTH ...
    ....  >>>>
99  22 REM <<<<
           >>>>
E6  23 REM <<<< 1... SYS 49900
           >>>>
E9  24 REM <<<< 2... SYS 49952
           >>>>
96  25 REM <<<<
           >>>>
B4  26 REM <<<<<<<<<<----------
    ->>>>>>>>>>
5C  27 REM <<
              >>
7F  28 REM << INVENTED BY JOHN F
    LETCHER >>
96  29 REM <<       IN 1986 FOR '
    YC'     >>
59  30 REM <<
              >>
E7  31 REM <<<<<<<<<<----------
    ->>>>>>>>>>
1A  32 :
1B  33 :
B4  34 PRINT"[CLR]":FORL=0TO7:CX
    =0:FORD=0TO15:READA:CX=CX+A:
    POKE49900+L*16+D,A:NEXTD
A1  35 READA:IFA<>CXTHENPRINT"[W
    HITE,RVSON]ERROR IN LINE[WHI
    TE]";38+L:END
60  36 PRINT"[HOME,C7]READING LI
    NE[YELLOW]";38+L
49  37 NEXTL:END
96  38 DATA169,0,141,14,220,169,
    51,133,1,162,0,160,48,169,20
    8,134,1779
BB  39 DATA250,134,252,132,251,1
    33,253,160,0,177,252,145,250
    ,200,208,249,3046
0E  40 DATA230,251,230,253,165,2
    53,201,216,208,239,169,55,13
    3,1,169,1,2774
C4  41 DATA141,14,220,96,169,0,1
    33,250,169,48,133,251,160,7,
    177,250,2218
16  42 DATA74,153,94,195,136,16,
    247,160,7,177,250,25,94,195,
    145,250,2218
78  43 DATA136,16,246,160,3,177,
    250,74,145,250,136,16,248,16
    5,250,24,2296
62  44 DATA105,8,133,250,144,8,2
    30,251,165,251,201,50,240,3,
    76,40,2155
E7  45 DATA195,96,204,223,193,14
    4,244,206,218,193,240,30,96,
    20,8,0,2310
```

LISTING 5: CHAR DEMO

```
89  100 POKE53280,3:POKE53281,3:
    PRINT"[BLACK,CLR,DOWN10,RIGH
    T8]PLEASE WAIT..READING TEXT
    "
4A  110 IFPEEK(16384)=45THEN200
42  120 :
A0  130 A$="--.. HELLO THERE FEL
    LOW YC READERS ..--  THIS RO
    UTINE WILL ALLOW YOU"
E0  140 A$=A$+" TO SCROLL TEXT W
    ITHIN A CHARACTER .. AS YOU
    CAN SEE SOME STUNNING"
25  150 A$=A$+" EFFECTS CAN BE A
    CHIEVED WITH EASE !!..YOU CA
    N SCROLL UP OR LEFT..."
9A  160 :
08  170 L=LEN(A$):FORI=1TOL:POKE
    16383+I,ASC(MID$(A$,I,1)):NE
    XT:POKE16384+L,255
96  180 FORI=0TO7:POKE12288+I+25
    5*8,0:NEXT
B4  190 :
6F  200 PRINT"[CS,CLR]":POKE5328
    1,0:POKE53280,0:POKE16383,0:
    POKE53265,0
24  210 PRINT"[SPC8,CP25]"
39  220 PRINT"[SPC8,RVSON,C*,RVS
    OFF,CP23,SN,CHJ"
B6  230 PRINT"[SPC8,RVSON] [RVSO
    FF,SPC4,CH] [CYAN]INVENTED B
    Y[CS] [CN,SPC4,CH2]"
83  240 PRINT"[SPC8,S£,CY4,CH,RV
    SON,SPC13,RVSOFF,CN,CY4,SM,C
    HJ"
E7  250 PRINT"[SPC8,CY,SP,CY,SO,
    CY,CH,RVSON,SPC5,RVSOFF,SM,C
    P,SN,RVSON,SPC5,RVSOFF,CN,CY
    ,SP,CY,SO,CYJ "
13  260 PRINT"[SPC9,CN,RVSON,WHI
    TE]AC[RVSOFF,CS,CH] [CH,RVSON
    ,SPC5,RVSOFF,CN,RVSON,WHITE]
    PCRVSOFF,CS,CH,RVSON,SPC5,RV
    SOFF,CN] [CN,RVSON,WHITE]ACR
    VSOFF,CS,CHJ"
02  270 PRINT"[SPC9,CN,RVSON,WHI
    TE]BC[RVSOFF,CS,CH] [CH,RVSON
    ,SPC5,RVSOFF,CN,RVSON,WHITE]
    QC[RVSOFF,CS,CH,RVSON,SPC5,RV
    SOFF,CN] [CN,RVSON,WHITE]BCR
    VSOFF,CS,CHJ"
3E  280 PRINT"[SPC8,CP,S@,CP,SL,
    CP,CH,RVSON,SPC5,RVSOFF,SN,C
    Y,SM,RVSON,SPC5,RVSOFF,CN,CP
    ,S@,CP,SL,CP]"
05  290 PRINT"[SPC8,RVSON,C*,RVS
    OFF,CP4,CH,RVSON,SPC13,RVSOF
    F,CN,CP4,SN,CHJ"
FA  300 PRINT"[SPC8,RVSON] [WHIT
    E,SA,SB,SC,SD,RVSOFF,CS,CH,Y
    ELLOW]JOHN FLETCHER[CS,CN,RV
    SON,WHITE,ST,SU,SV,SW,RVSOFF
    ,CS,CH2J"
75  310 PRINT"[SPC8,S£,CY23,SM,C
    HJ"
FF  320 PRINT"[SPC8,CY,SP,CY,SO,
    CY6,SP,SM,CP,SN,SO,CY6,SP,CY
    ,SO,CYJ"
F4  330 PRINT"[SPC9,CN,RVSON,WHI
    TE]HC[RVSOFF,CS,CH,SPC6,CN2,R
    VSON,WHITE]JWC[RVSOFF,CS,CH2,S
    PC6,CN,RVSON,WHITE]HC[RVSOFF,
    CS,CHJ"
C7  340 PRINT"[SPC9,CN,RVSON,WHI
    TE]IC[RVSOFF,CS,CH,SPC6,CN2,R
    VSON,WHITE]XC[RVSOFF,CS,CH2,S
    PC6,CN,RVSON,WHITE]IC[RVSOFF,
    CS,CHJ"
26  350 PRINT"[SPC9,CN,RVSON,WHI
    TE]JC[RVSOFF,CS,CH,SPC6,CN,SN
    ,CY,SM,CH,SPC6,CN,RVSON,WHIT
    E]JC[RVSOFF,CS,CHJ"
9A  360 PRINT"[SPC9,CN,RVSON,WHI
    TE]KC[RVSOFF,CS,CH,SPC4,RVSON
    ,S£,RVSOFF,SO,CY5,SP,SM,SPC4
    ,CN,RVSON,WHITE]KC[RVSOFF,CS,
    CHJ"
BB  370 PRINT"[SPC9,CN,RVSON,WHI
    TE]LC[RVSOFF,CS,CH,SPC4,RVSON
    ] [RVSOFF,CG,RVSON,SPC5,RVSON
    FF,CN] [CH,SPC3,CN,RVSON,WHI
    TE]LC[RVSOFF,CS,CH]"
8A  380 PRINT"[SPC9,CN,RVSON,WHI
    TE]MC[RVSOFF,CS,CH,SPC4,S£,CH
    ,RVSON,SPC5,RVSOFF,CN,SM,CH,
    SPC3,CN,RVSON,WHITE]MC[RVSOFF
    ,CS,CHJ"
52  390 PRINT"[SPC7,RVSON,S£,RVS
    OFF,SO,CY7] [CH,RVSON,SPC5,R
    VSOFF,CN] [CY6,SP,SM]"
6D  400 PRINT"[SPC7,RVSON] [RVSO
    FF,CG,RVSON,WHITE,SB,SC,SD,S
    E,SF,SG,SH,SI,RVSOFF,CS,CH,R
    VSON,SPC5,RVSOFF,CN,RVSON,WH
    ITE,SQ,SR,SS,ST,SU,SV,SW,RVS
    OFF,CS,CN] [CH]"
20  410 PRINT"[SPC7,RVSON] [RVSO
    FF,CG,SPC7,RVSON,S£,RVSOFF,C
    G,RVSON,SPC5,RVSOFF,CN,SM,SP
    C6,CN] [CH]"
61  420 PRINT"[SPC7,S£,CY7,SP,RV
    SON] [RVSOFF,SL,CP5,S@] [SO,
    CY6,SM,CHJ"
66  430 PRINT"[SPC7,CY8,SP,S£,SP
    C7,SM,SO,CY7J"
CC  440 PRINT"[SPC16,CY9J";
F9  450 :
F4  460 REM **** COPY CHARS. FRO
    M ROM ****
ED  470 :
3D  480 SYS 49900
D1  490 :
16  500 REM **** RE-DESIGN CHAR.
      SET  ****
C5  510 :
87  520 SYS 49952
2E  530 :
92  540 REM **** SET PARMS FOR S
    CROLL ****
12  550 :
2D  560 SYS 49152,16384,12288,19
    2,25
3B  570 SYS 49500,16384,12288,12
    8,25
7C  580 :
8F  590 REM **** INIT. INTERRUPT
    S ... ****
60  600 :
DF  610 POKE53272,28:SYS 49800
2C  620 PRINT"[HOME]"
```

TRANS-SCRIPT

Many Plus/4 owners have upgraded to the SCRIPT-PLUS wordprocessor. Unfortunately you can't use 3+1 files with this wordprocessor. TRANS-SCRIPT changes all this.

Having recently obtained the SCRIPT/PLUS cartridge I was left with the problem of converting several disks of 3+1 wordprocessor files into a format suitable for SCRIPT/PLUS.

This program *TRANS-SCRIPT* will enable 3+1 format files to be converted using either single or twin disk units. The program is menu driven and will prompt for single/twin disk units, filename, directory or exit. Exit from the directory is by pressing return.

In single disk mode the program reads the file, converts it and then writes it back to the disk using the same filename but with the first character of the filename overwritten with an exclamation mark.

When using twin disk units the file is written to the second unit using the same filename.

The conversion is done on a character by character basis but by use of machine code the process is fairly swift, especially if 1551 disk drives are used. The layout of the original 3+1 file is preserved, but the 3+1 embedded commands are removed.

Getting it in

To enter the program use the MONITOR and the M command to type in the hex dump listing.

Then SAVE "TRANS-SCRIPT",08, 1001,14C9

The program can then be loaded and run like a normal BASIC program.

N.B. The program must be located at the normal start of basic area. E.g. Hex 1001. GRAPHIC CLR can be used to ensure this.

File format

The 3+1 wordprocessor file is held on disk in the following format. Byte 01 and 02 point to the end address of the document in memory. Byte 03 is the number of lines in the document. The next 99 bytes are the text pointers. This is followed by a further 77 bytes for the Tab settings. Finally there is a further gap until the start of the document text. This gives a total of 303 bytes before the document text which can be discarded during the conversion process.

The document text is stored in memory and on disk in CBM screen code. The text is stored in 77 character lines. The carriage return "Hex 0D" is replaced by "Hex 9F". The line after the carriage return is padded to the full 77 characters with spaces. These spaces will be discarded during the conversion, reducing the size of the converted document.

```
PROGRAM: TRANS-SCRIPT

1001 0D 10 0A 00 9E 28 34 31:
1009 31 31 29 00 00 00 A0 09:
1011 A9 00 99 D7 00 88 D0 FA:
1019 A9 32 85 E2 A9 03 85 E3:
1021 A0 FF A9 93 20 D2 FF C8:
1029 B9 36 13 D0 F7 20 5A 12:
1031 A2 0B A0 02 18 20 F0 FF:
1039 A0 FF A9 53 20 D2 FF C8:
1041 B9 3B 13 D0 F7 20 83 11:
1049 AD 32 03 C9 53 D0 03 4C:
1051 6E 10 C9 54 D0 03 4C FB:
1059 10 C9 58 D0 E8 A9 1B 20:
1061 D2 FF A9 4C 20 D2 FF A9:
1069 09 20 D2 FF 60 AD 32 03:
1071 85 E0 20 5A 12 A2 06 A0:
1079 02 18 20 F0 FF A0 FF A9:
1081 53 20 D2 FF C8 B9 BC 13:
1089 D0 F7 20 83 11 A5 DE C9:
1091 01 D0 14 AD 32 03 C9 24:
1099 D0 06 20 9F 11 4C 73 10:

10A1 C9 58 D0 E6 4C 2E 10 A9:
10A9 02 A2 08 A0 02 86 E1 20:
10B1 BA FF 20 68 12 A5 DE A2:
10B9 32 A0 03 20 BD FF 20 C0:
10C1 FF 90 03 4C B9 11 20 FC:
10C9 11 B0 A7 A9 21 8D 32 03:
10D1 A9 03 A2 08 A0 03 86 E1:
10D9 20 BA FF 20 7F 12 A5 DE:
10E1 A2 32 A0 03 20 BD FF 20:
10E9 C0 FF 90 03 4C B9 11 20:
10F1 FC 11 B0 03 20 93 12 4C:
10F9 73 10 AD 32 03 85 E0 20:
1101 5A 12 A2 06 A0 02 18 20:
1109 F0 FF A0 FF A9 54 20 D2:
1111 FF C8 B9 EE 13 D0 F7 20:
1119 83 11 A5 DE C9 01 D0 14:
1121 AD 32 03 C9 24 D0 06 20:
1129 9F 11 4C 00 11 C9 58 D0:
1131 E6 4C 2E 10 A9 02 A2 08:
1139 A0 02 86 E1 20 BA FF 20:
1141 68 12 A5 DE A2 32 A0 03:
1149 20 BD FF 20 C0 FF 90 03:
1151 4C B9 11 20 FC 11 B0 A7:
1159 A9 03 A2 09 A0 03 86 E1:
1161 20 BA FF 20 7F 12 A5 DE:
```

```
1169 A2 32 A0 03 20 BD FF 20:
1171 C0 FF 90 03 4C B9 11 20:
1179 FC 11 B0 B3 20 93 12 4C:
1181 00 11 A2 14 A0 12 18 20:
1189 F0 FF A0 00 20 CF FF C9:
1191 0D F0 08 99 32 03 C8 C0:
1199 10 D0 F1 B4 DE 60 A9 93:
11A1 20 D2 FF A9 1B 20 D2 FF:
11A9 A9 4C 20 D2 FF 20 BC C8:
11B1 20 E4 FF C9 0D D0 F9 60:
11B9 B5 DF A0 0C B9 B4 14 99:
11C1 D9 0F 88 D0 F7 A5 DF 69:
11C9 2F 8D E6 0F 20 48 12 A5:
11D1 E0 C9 53 D0 03 4C 73 10:
11D9 4C 00 11 20 CC FF A2 14:
11E1 A0 02 18 20 F0 FF A0 FF:
11E9 A9 50 20 D2 FF C8 B9 92:
11F1 14 D0 F7 20 E4 FF C9 0D:
11F9 D0 F9 60 A9 0F A8 A6 E1:
1201 20 BA 00 20 2C 2E 24 FF:
1209 FF FF FF FF 0F 20 C6 C9:
1211 14 CF FF C9 30 D0 11 20:
1219 CF FF C9 30 D0 0D A9 0F:
1221 20 C3 FF 20 CC FF 18 60:
1229 20 CF FF 20 CF FF A2 18:
1231 A0 00 18 20 F0 FF 20 CF:
1239 FF C9 0D F0 05 20 D2 FF:
1241 D0 F4 A9 0F 20 C3 FF A9:
1249 03 20 C3 FF A9 02 20 C3:
1251 FF 20 CC FF 20 DC 11 38:
1259 60 A0 FF A9 93 20 D2 FF:
1261 C8 B9 75 14 D0 F7 60 A2:
1269 00 A4 DE 80 C1 14 91 E2:
1271 C8 E8 E0 04 D0 F5 18 A5:
1279 DE 69 04 85 DE 60 38 A5:
1281 DE E9 04 A8 A2 00 BD C5:

1289 14 91 E2 C8 E8 E0 04 D0:
1291 F5 60 A2 02 20 C6 FF A2:
1299 FF A0 30 20 E4 FF CA D0:
12A1 FA 20 E4 FF 88 D0 FA 20:
12A9 CC FF A2 00 B6 DA B6 DB:
12B1 E8 B6 D9 A2 02 20 C6 FF:
12B9 20 E4 FF B5 DC 20 B7 FF:
12C1 4B 20 CC FF E6 DB A5 DB:
12C9 C9 4D D0 08 A2 00 B6 DB:
12D1 A2 01 B6 DA A5 DC C9 9F:
12D9 D0 14 A2 03 20 C9 FF A9:
12E1 0D 20 D2 FF 20 CC FF A2:
12E9 00 B6 D9 4C 18 13 29 80:
12F1 30 25 A5 DC B5 DB 29 3F:
12F9 06 DB 24 DB 10 02 09 80:
1301 70 02 09 40 85 DC A5 D9:
1309 F0 0D A2 03 20 C9 FF A5:
1311 DC 20 D2 FF 20 CC FF A5:
1319 DA F0 07 A2 00 86 DA E8:
1321 86 D9 60 29 40 F0 BC A9:
1329 03 20 C3 FF A9 02 20 C3:
1331 FF 20 E7 FF 60 93 0B 1B:
1339 4D 00 20 3D 20 53 49 4E:
1341 47 4C 45 20 44 49 53 4B:
1349 20 44 52 49 56 45 0D 0D:
1351 20 20 54 20 3D 20 54 57:
1359 49 4E 20 44 49 53 4B 20:
1361 44 52 49 56 45 53 0D 0D:
1369 20 20 58 20 3D 20 45 58:
1371 49 54 0D 0D 0D 0D 0D 20:
1379 20 20 20 45 4E 54 45 52:
1381 20 4F 50 54 49 4F 4E 3F:
1389 20 53 00 49 4E 47 4C 45:
1391 20 44 49 53 4B 20 4F 50:
1399 45 52 41 54 49 4F 4E 0D:
13A1 20 20 20 20 20 20 20 20:

13A9 28 4F 4E 20 55 4E 49 54:
13B1 20 3B 29 0D 0D 0D 20 20:
13B9 24 20 3D 20 44 49 52 45:
13C1 43 54 4F 52 59 0D 0D 20:
13C9 20 58 20 3D 20 45 58 49:
13D1 54 0D 0D 0D 0D 0D 0D 0D:
13D9 0D 20 20 45 4E 54 45 52:
13E1 20 46 49 4C 45 4E 41 4D:
13E9 45 3F 20 2A 00 57 49 4E:
13F1 20 44 49 53 4B 20 4F 50:
13F9 45 52 41 54 49 4F 4E 0D:
1401 0D 20 20 50 4C 41 43 45:
1409 20 53 4F 55 52 43 45 20:
1411 44 49 53 4B 20 49 4E 20:
1419 55 4E 49 54 20 38 0D 20:
1421 20 26 20 54 4B 45 20 54:
1429 41 52 47 45 54 20 44 49:
1431 53 4B 20 49 4E 20 55 4E:
1439 49 54 20 39 0D 0D 20 20:
1441 24 20 3D 20 44 49 52 45:
1449 43 54 4F 52 59 0D 0D 20:
1451 20 58 20 3D 20 45 58 49:
1459 54 0D 0D 0D 0D 0D 0D 0D:
1461 20 20 45 4E 54 45 52 20:
1469 46 49 4C 45 4E 41 4D 45:
1471 3F 20 2A 00 93 1B 4D 20:
1479 20 20 20 20 20 20 20 20:
1481 20 20 20 20 54 52 41 4E:
1489 53 2D 53 43 52 49 50 54:
1491 00 52 45 53 53 20 52 45:
1499 54 55 52 4E 20 54 4F 20:
14A1 43 4F 4E 54 49 4E 55 45:
14A9 20 20 20 20 20 20 20 20:
14B1 20 20 20 00 09 2F 0F 20:
14B9 05 12 12 0F 12 20 23 20:
14C1 2C 53 2C 52 2C 53 2C 57:
```

LIFESAVERS	C64	MACHINE CODE SAVE	1/1

For those of you that do not posses a monitor or assembler, saving areas of memory is somewhat difficult and time consuming. This small programme will enable you to SAVE any area of memory you like, except for RAM hidden under the ROMs.

The syntax for using the routine is as follows:

SYS50000,"name",8,1,SA,EA+1

Where EA and SA are the end and start address respectively.

P.A.Eves

```
1 X=50000
2 READZ:IFZ=256THENEND
3 POKEX,Z:X=X+1:GOTO2
4 DATA32,253,174,32,212,225,32,2
53,174,32,138,173,32,247,183,165
,20,72,165,21
5 DATA72,32,253,174,32,138,173,3
2,247,183,166,20,164,21,104,133,
252,104,133
6 DATA251,169,251,76,95,225,256
```

Extended Basic For The Commodore Plus/4

Although printers and disk drives are optional, they are necessary if full use is to be made of the existing Basic.

By Robert Jaycocks

This program adds an extra 39 commands to the existing Basic. Some commands are intended for disk users only and some are intended for printer users only (primarily MPS803 users but these commands may be compatible with other printers i.e. MPS801). The other commands are intended to aid basic programming, i.e. an old command which when executed will regain a 'newed' program.

The program sits from $1000 to $2100 with Basic starting at $2101. The graphic screen can still be used, as the program will automatically relocate itself to $4000 when you turn on the graphic screen for the first time. The program, once relocated to $4000 by the initialisation of the hi-res screen, will automatically relocate itself back to $1000 once graphiccIr has been activated.

The program uses $0600 to $068D for the relocating routine and the zero page is used by some of the commands.

Typing It In

Type in listing one and save it to disk or tape, run the program and if any data errors are detected the program will automatically list the line in which the error occured. Therefore editing can be carried out to correct the line.

The program can then be re-saved and re-executed. Once the data has been read into memory the computer will prompt you with the device (tape or disk). If you are using fast loader from February's issue or a different device number for the disk drive, you will need to change the device number to the corresponding device in line 90.

When the device has been entered the computer will then save the machine-code program produced to the chosen device under the name "extended Basic". If you are using the fast loader program, delete line 10 in listing one before saving it and type in the following basic line:—
POKE 44, 64: POKE 43,1: POKEDEC ("4000), 0: NEW

Load in the 'fast loader' program, adding the lines for relocating it from August's issue. Run the program and relocate fast loader to $3D00 (remember delete line 1165 in the fast loader relocate program first); type new and load in listing one and add the following line:—
95 IFA$="T"THENSYSDECK("3D00")

Execute The Program

Listings two to six are demo programs and therefore need not be entered unless you want a demonstration of the comands at work (N.B. the extended Basic must be executed before the demo programs are entered. The demo programs must be entered in order, and saved before the next one is entered. If you haven't a disk drive you need not type in listing six.) When the demo programs have been entered and saved listing two can then be loaded by using the chain command.

Commands Summary and Format

COMMAND: **APPEND**
FORMAT: APPEND["FILENAME"[,DEVICE]]
Abbreviated to A(SHIFT)P
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct and Program
RECOMMENDED MODE: Direct
PURPOSE: To append a program from tape or disk to the end of the current program in memory.

COMMAND: **BSAVE**
FORMAT: BSAVE["FILENAME"[,DEVICE[,EOT FLAG[,START[,FINISH]]]]]
Abbreviated to B(SHIFT)S
AFFECTED BASIC ABBRECIATIONS: None
MODES: Direct and program
RECOMMENDED MODE: Either
PURPOSE: To save a block of memory to tape or disk. The start address defaults to the start of the basic and the end address defaults to the end of the current

basic program. The EOT flag is the same as for the basic SAVE command.

COMMAND: **CGOSUB**
FORMAT: CGOSUB Variable Expression.
Abbreviated to CGO(SHIFT)S
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct and Program
RECOMMENDED MODE: Either
PURPOSE: To GOSUB a line number evaluated from the variable expression.

COMMAND: **CGOTO**
FORMAT: CGOTO Variable Expression.
Abbreviated to C(SHIFT)G
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct and Program
RECOMMENDED MODE: Either
PURPOSE: To GOTO a line number evaluated from the variable expression.

COMMAND: **CHAIN**
FORMAT: CHAIN["FILENAME"[, DEVICE[, RELOCATE FLAG]]]
Abbreviated to C(SHIFT)H
AFFECTED BASIC ABBREVIATIONS: CHR$ —> CH(SHIFT)R
MODES: Direct and Program
RECOMMENDED MODE: Direct
PURPOSE: To load in a program whilst keeping the current variables intact.

COMMAND: **DISK**
FORMAT: DISK STRING[, DEVICE(8-11)]
Abbreviated to D(SHIFT)I
AFFECTED BASIC ABBREVIATIONS: DIM
MODES: Direct and Program
RECOMMENDED MODE: Either
PURPOSE: To send a command to the disk drive.

COMMAND: **DOKE**
FORMAT: DOKE ADDRESS, VALUE(0-65535)
Abbreviated to D(SHIFT)O
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct and Program
RECOMMENDED MODE: Either
PURPOSE: To POKE a 16 bit number in (LO/HI) format in locations address AND address+1.

COMMAND: **OMERGE**
FORMAT: DMERGE"FILENAME"C, DEVICE(8-11)[
Abbreviated to D(SHIFT)M
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct and Program
RECOMMENDED MODE: Direct
PURPOSE: To merge a program from disk to the one currently in memory.

COMMAND: **DPROC**
FORMAT: DPROC NAME[(VARIABLES)]
Abbreviated to D(SHIFT)P
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct and Program
RECOMMENDED MODE: Program
PURPOSE: To define a procedure under the name-NAME.

COMMAND: **DUMP**
FORMAT: DUMP FLAG (0 OR 1)
Abbreviated to D(SHIFT)U
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct and Program
RECOMMENDED MODE: Either
PURPOSE: To dump the Hi-res or Lo-res screen to printer. If flag equals nought then the Lo-res screen will be dumped else the Hi-res screen will be dumped to printer.
COMMAND: **ENTER**
FORMAT: ENTER(X CO-ORDINATE, Y CO-ORDINATE)[STRING]
ABBREVIATED TO E(SHIFT)N
AFFECTED BASIC ABBREVIATIONS: END
MODES: Program
PURPOSE: To input variables at a specific location on the screen.

COMMAND: **EPROC**
FORMAT: EPROC
ABBREVIATED TO E(SHIFT)P
AFFECTED BASIC ABBREVIATIONS: None
MODES: DIRECT AND PROGRAM
RECOMMENDED MODE: Program
PURPOSE: To return from a proceudre. If this is not executed in a proc routine then a RETURN WITHOUT GOSUB ERROR will occur.

COMMAND: **FAST**
FORMAT: FAST
ABBREVIATED TO F(SHIFT)A
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct and Program
RECOMMENDED MODE: Either
PURPOSE: To switch out the screen and therefore speed up basic by approximately 30%

COMMAND: **FIND**
FORMAT: FIND[TEXT]
ABBREVIATED TO F(SHIFT)I
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct
PURPOSE: To list the lines where the text occurs

COMMAND: **HIMEM**
FORMAT: HIMEM ADDRESS
ABBREVIATED TO H(SHIFT)I
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct or Program
RECOMMENDED MODE: Either
PURPOSE: To set the bottom of memory to the address specified.

COMMAND: **LOMEM**
FORMAT: LOMEM ADDRESS
ABBREVIATED TO L(SHIFT)O
AFFECTED BASIC ABBREVIATIONS: LOAD —> LO(SHIFT)A
MODES: Direct or Program
RECOMMENDED MODE: Direct
PURPOSE: To set the bottom of memory to the address specified. This will perform a NEW at the new location when executed.

COMMAND: **MERGE**
FORMAT: MERGE["FILENAME"[, DEVICE]]
ABBREVIATED TO M(SHIFT)E
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct or Program
RECOMMENDED MODE: Direct
PURPOSE: To merge a program from disk or tape to the one currently in memory.

COMMAND: **OLD**
FORMAT: OLD
ABBREVIATED TO O(SHIFT)L
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct or Program
RECOMMENDED MODE: DIRECT
PURPOSE: To regain back a NEW ed program.

COMMAND: **PLIST**
FORMAT: PLIST[FIRST LINE]—[LAST LINE]]
ABBREVIATED TO PL(SHIFT)I
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct or Program
RECOMMENDED MODE: Either
PURPOSE: To list a program from memory to printer.

COMMAND: **PLOT**
FORMAT: PLOT(X CO-ORDINATE, Y CO-ORDINATE)
ABBREVIATED TO P(SHIFT)L
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct or Program
RECOMMENDED MODE: Either
PURPOSE: To position the cursor in the Lo-res screen at the specified co-ordinates.

COMMAND: **POP**
FORMAT: POP
ABBREVIATED TO P(SHIFT)O
AFFECTED BASIC ABBREVIATIONS: POKE —> PO(SHIFT)K
MODES: Program
PURPOSE: To enable you to RETURN from a GOSUB, CGOSUB or PROC routine as it takes the GOSUB parameters off the stack, i.e. it performs a RETURN without returning to the original location. If this is not used in a CGOSUB, GOSUB or PROC routine then a RETURN WITHOUT GOSUB ERROR will occur.

COMMAND: **PROC**
FORMAT: PROC NAME[(PARAMETERS)]
ABBREVIATED TO P(SHIFT)R
AFFECTED BASIC ABBREVIATIONS: PRINT —> PR(SHIFT)I
MODES: Direct or Program
RECOMMENDED MODE: Program
PURPOSE: To GOSUB a defined procedure under the name-NAME.
The parameters will past into the variable names in the OPROC command.

COMMAND: **QUIT**
FORMAT: QUIT
ABBREVIATED TO Q(SHIFT)U
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct or Program
RECOMMENDED MODE: Direct
PURPOSE: To return to Basic.

COMMAND: **RECORD**
FORMAT: RECORD FILE , RECORD , [OFFSET]
ABBREVIATED TO R(SHIFT)E
AFFECTED BASIC ABBREVIATIONS: RED —> RE(SHIFT)A
MODES: Direct or Program
RECOMMENDED MODE: Program
PURPOSE: To position the record pointer to the record number of the file number with offset—OFFSET for a relative file. The equivalent disk command is:—
PRINT#15,"P"+CHR$(FILE +96)+CHR$(RECORD LO—BYTE)+CHR$(RECORD HI-BYTE)+CHR$(OFFSET): where 15 is the file opened for the command channel.
NOTE. The command channel must be opened beforehand.

COMMAND: **SLOW**
FORMAT: SLOW
ABBREVIATED TO S(SHIFT)L
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct or Program
RECOMMENDED MODE: Either
PURPOSE: To restore the screen back to normal and hence the speed of basic after a FAST command has been executed.

COMMAND: **VARLIST**
FORMAT: VARLIST
ABBREVIATED TO V(SHIFT)A
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct
PURPOSE: To print all variables (except arrays and functions) from memory to the current output device.

COMMAND: **WINDOW**
FORMAT: WINDOW TOP, LEFT, RIGHT, BOTTOM
ABBREVIATED TO W(SHIFT)I
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct or Program
RECOMMENDED MODE: Either
PURPOSE: To set the window size.

COMMAND: **WRITE**
FORMAT: WRITE(X CO-ORDINATE, Y CO-ORDINATE) PRINTLIST
ABBREVIATED TO W(SHIFT)R
AFFECTED BASIC ABBREVIATIONS: None
MODES: Direct or Program
RECOMMENDED MODE: Either
PURPOSE: To print at the specified co-ordinates on the screen.

Functions

FUNCTION: ACS
FORMAT: ACS(X)
ABBREVIATED TO A(SHIFT)C
AFFECTED BASIC ABBREVIATIONS: None
PURPOSE: To return the ARCCOS of X, where $-1<=X<=1$

FUNCTION: ASN
FORMAT: ASN(X)
ABBREVIATED TO A(SHIFT)S
AFFECTED BASIC ABBREVIATIONS: ASC
PURPOSE: To return the ARCSIN of X, where $-1<=X<=1$

FUNCTION: BIN$
FORMAT: BIN$(X)
ABBREVIATED TO B(SHIFT)I
AFFECTED BASIC ABBREVIATIONS: None
PURPOSE: To return as a string the binary equivalent of X, where X is an integer such that $0<=X<=65535$.

FUNCTION: BTOH$
FORMAT: BTOH$(X$)
ABBREVIATED TO B(SHIFT)T
AFFECTED BASIC ABBREVIATIONS: None
PURPOSE: To return as a string the hexadecimal value of the binary expression given by X$

FUNCTION: DEEK
FORMAT: DEEK(X)
ABBREVIATED TO D(SHIFT)E
AFFECTED BASIC ABBREVIATIONS: DEF FN —> DE(SHIFT)F
PURPOSE: To return a sixteen bit number stored as Lo-hi format in the addresses X and X+1.

FUNCTION: DEG
FORMAT: DEG(X)
PURPOSE: To convert radians to degrees where X is the number to be converted.

FUNCTION: EVAL
FORMAT: EVAL(X$)
ABBREVIATED TO E(SHIFT)V
AFFECTED BASIC ABBREVIATIONS: None

PURPOSE: To evaluate to a floating point number the expression in X$. X$ must contain functions only.

FUNCTION: HTOB$
FORMAT: HTOB$(X$)
ABBREVIATED TO H(SHIFT)T
AFFECTED BASIC ABBREVIATIONS: None
PURPOSE: To return as a string in a binary form the hexadecimal value in X$.

FUNCTION: RAD
FORMAT: RAD(X)
ABBREVIATED TO R(SHIFT)A
AFFECTED BASIC ABBREVIATIONS: None
PURPOSE: To convert degrees to radians where X is the number to be converted.

FUNCTION: TWO
FORMAT: TWO(X$)
ABBREVIATED TO T(SHIFT)W
AFFECTED BASIC ABBREVIATIONS: None
PURPOSE: To convert a binary string (X$) to a floating point number.

```
PROGRAM: +4 EX BASIC 1
```

```
10 GRAPHIC1,1:GRAPHIC0
20 L=120:AD=4096:PRINT"{CLEAR}{D
OWN}{DOWN}WORKING:.";
30 CK=0:FORX=0TO21:READM$:M=DEC(
M$):POKEAD+X,M:CK=CK+M
40 NEXTX:READCH$:IFDEC(CH$)<>CKT
HENPRINT"ERROR IN";L:GOTO70
50 AD=AD+22:IFAD>8602THENPRINT:
PRINT"{DOWN}OK...";:GOTO80
60 PRINT".";:L=L+10:GOTO30
70 PRINT"L{s IJ"L:POKE239,4:POKE
1319,145:POKE1320,145:POKE1321,1
45:POKE1322,13:END
80 PRINT"{DOWN}{DOWN}DEVICE ({RV
SON}I{RVSOFF}APE OR {RVSON}D{RVS
OFF}ISK) ? ";:DO:GETD$:LOOPUNTILL
D$="D"ORD$="I":PRINTD$
85 POKEDEC("1369"),85:POKEDEC("1
368"),16:POKEDEC("1372"),76:POKE
DEC("2109"),144
90 DE=1:IFD$="D"THENDE=8
100 SYS8020"EXTENDED BASIC",DE,1
,4097,8602
110 END
120 DATA00,0D,10,00,00,9E,34,31,
31,32,3A,A2,00,00,00,00,4C,E8,10
,20,73,04,9A3A
130 DATAF0,07,C9,DE,D0,03,4C,22,
10,4C,D9,BB,20,73,04,C9,9C,F0,18
,A5,75,F0,0AAD
140 DATA03,4C,3B,10,A9,10,20,00,
06,20,3C,C6,20,79,04,20,D1,C5,4C
,DC,BB,A5,0746
150 DATA75,F0,03,20,4B,10,4C,DC,
BB,A9,40,20,00,06,A9,9C,4C,C3,C5
,A2,FF,86,09E5
160 DATA3A,20,5A,BB,86,3B,84,3C,
20,73,04,AA,F0,EF,90,0D,20,53,B9
,20,79,04,0813
170 DATAC9,DE,F0,06,4C,D9,BB,4C,
2E,B7,4C,22,10,A9,AF,A0,11,84,23
,85,22,A0,09C3
180 DATA00,84,0B,BB,CB,20,A5,04,
38,F1,22,F0,F7,C9,B0,F0,22,B1,22
,30,03,CB,0A03
190 DATAD0,F9,CB,E6,0B,18,98,65,
22,85,22,90,02,E6,23,18,A0,00,B1
,22,D0,D9,0A2F
200 DATA3B,20,79,04,4C,6A,B9,05,
0B,CB,4C,D4,B9,AA,A0,11,84,23,A0
,AF,84,22,08BC
210 DATA4C,9E,BB,C9,B0,90,18,C9,
9C,90,04,C9,A6,B0,10,3B,E9,B0,0A
,AB,B9,5C,0AF6
220 DATA12,48,B9,5D,12,48,4C,73,
04,4C,A1,94,A0,10,A9,7B,8C,0D,03
,8D,0C,03,071A
230 DATAA0,10,A9,BD,8C,0F,03,8D,
0E,03,A0,10,A9,C9,8C,11,03,8D,10
,03,A9,39,0796
240 DATA00,11,8C,0B,03,8D,0A,03,
A9,13,A0,10,8D,0B,03,8C,09,03,A0
,10,A9,55,062F
250 DATA8D,02,03,8C,03,03,A9,6A,
A0,11,20,FC,20,A9,01,A0,21,84,2C
,85,2B,A9,0798
260 DATA00,8D,00,21,60,A9,00,85,
0D,20,73,04,C9,FE,F0,06,20,79,04
,4C,1E,94,0738
270 DATA20,73,04,C9,9C,90,5B,C9,
A6,B0,57,3B,E9,B0,0A,AB,B9,5C,12
,85,56,B9,0A6B
280 DATA5D,12,85,55,20,54,00,4C,
17,93,93,45,5B,54,45,4E,44,45,44
,20,42,41,063A
290 DATA53,49,43,20,46,4F,52,20,
54,4B,45,20,43,4F,4D,4D,4F,44,4F
,52,45,20,05CC
300 DATA50,4C,55,53,2F,34,0D,42,
59,20,52,4F,42,45,52,54,20,4A,41
,59,43,4F,05D3
310 DATA43,4B,53,20,20,31,39,38,
36,00,4C,A1,94,4F,4C,C4,46,41,53
,D4,53,4C,0726
320 DATA4F,D7,57,49,4E,44,4F,D7,
4C,4F,4D,45,CD,48,49,4D,45,CD,4D
,45,52,47,0893
330 DATAC5,41,50,50,45,4E,C4,50,
4C,4F,D4,57,52,49,54,C5,45,4E,54
,45,D2,44,0909
340 DATA4F,4B,C5,51,55,49,D4,50,
52,4F,C3,44,50,52,4F,C3,45,50,52
,4F,C3,43,090A
350 DATA47,4F,54,CF,43,47,4F,53,
55,C2,50,4F,D0,43,48,41,49,CE,50
,4C,49,53,0886
360 DATAD4,56,41,52,4C,49,53,D4,
44,55,4D,D0,44,4D,45,52,47,C5,46
,49,4E,C4,0904
370 DATA52,45,43,4F,52,44,A3,42,
53,41,56,C5,44,49,53,CB,44,45,45
,CB,54,57,0B42
380 DATACF,42,49,4E,A4,42,54,4F,
48,A4,48,54,4F,42,A4,45,56,41,CC
,41,53,CE,0BFB
390 DATA41,43,D3,44,45,C7,52,41,
C4,00,12,84,12,A8,12,B1,18,73,12
,CD,12,EA,08A7
400 DATA12,FC,13,E5,14,28,14,4B,
14,51,14,01,14,57,14,5D,8E,0A,8D
,82,15,0D,05C0
410 DATA15,16,15,3D,15,58,1A,53,
16,6B,1A,85,1B,D3,1E,07,1E,F7,1F
,53,1F,9E,05CE
420 DATA17,7F,1B,BB,19,03,19,3C,
19,4B,19,66,19,D5,1A,05,1A,3D,1A
,1C,00,AD,04FE
430 DATA06,FF,29,EF,8D,06,FF,60,
4C,7B,E3,A9,FF,A0,01,91,2B,20,18
,BB,A5,22,0A42
440 DATA18,69,02,85,2D,A5,23,69,
00,85,2E,4C,9A,BA,20,14,93,20,E4
,9D,A4,15,07AA
450 DATAA5,14,84,2C,85,2B,A9,00,
A0,00,91,2B,E6,2B,D0,02,E6,2C,4C
,7B,BA,20,0BB4
460 DATA14,93,20,E4,9D,A4,15,A5,
14,84,38,85,37,60,4C,21,99,20,D5
,13,86,2B,0851
470 DATAB4,2C,A0,00,98,91,2B,20,
75,13,86,2D,86,2E,20,18,BB,20,B2
,13,A9,5E,075F
480 DATAA2,13,BD,02,03,8E,03,03,
A9,01,85,3C,A9,FF,85,3B,A0,00,A9
,D0,20,94,087B
490 DATA04,85,D2,CB,A9,D0,20,94,
04,85,D3,F0,2D,CB,A9,D0,20,94,04
,85,14,CB,08E3
500 DATAA9,D0,20,94,04,85,15,A2,
00,E8,CB,A9,D0,20,94,04,9D,FE,01
,D0,F4,BA,0B3B
510 DATAAB,20,34,B7,A5,D2,A6,D3,
85,D0,86,D1,D0,BB,A9,12,A2,87,BD
,02,03,8E,0BAB
520 DATA03,03,20,03,87,20,C3,13,
A9,00,85,AD,A6,2B,A4,2C,20,D5,FF
,B0,10,20,07F6
530 DATAB7,FF,29,BF,F0,0B,20,9D,
13,A2,1D,4C,83,B6,60,4B,20,9D,13
,68,4C,7D,0923
540 DATAA7,A5,D0,3B,E9,02,85,14,
A5,D1,E9,00,85,D1,A9,00,A8,91,14
,CB,91,14,0AF0
550 DATAA5,D2,A6,D3,85,2B,86,2C,
A5,D0,A6,D1,85,2D,86,2E,60,A9,00
,20,BD,FF,0B89
560 DATAA2,01,A0,00,20,BA,FF,20,
9D,AB,4C,7A,AB,A5,2B,85,D2,A5,2C
,85,D3,A6,0AE5
570 DATA2D,A4,2E,86,D0,84,D1,60,
20,D5,13,BA,3B,E9,02,85,2B,9B,E9
,00,85,2C,09A1
580 DATA20,75,13,86,D0,84,D1,20,
82,13,20,18,BB,60,20,14,93,20,E4
,9D,A5,14,0B79
590 DATA85,52,A5,15,85,F2,20,91,
94,20,14,93,20,E4,9D,A6,15,A5,14
,A0,00,91,09F9
600 DATAF1,C8,BA,91,F1,60,4C,21,
99,20,BE,94,20,84,9D,E0,28,90,03
,4C,1C,99,0A4A
610 DATABA,48,20,A5,AB,20,84,9D,
E0,19,B0,F1,68,A8,18,20,F0,F1,20
,BB,94,60,0AF0
620 DATA20,29,14,4C,00,90,20,29,
14,4C,08,91,20,17,81,4C,6B,C5,A2
,00,C6,3B,0652
630 DATAB0,02,C6,3C,20,73,04,F0,
10,C9,28,D0,06,20,A1,17,4C,7B,14
,9D,00,02,0764
640 DATAE8,D0,EB,A9,00,9D,00,02,
A0,05,20,05,89,88,A5,3C,91,7C,88
,A5,3B,91,09AD
650 DATA7C,88,A5,3A,91,7C,88,A5,
39,91,7C,88,A9,8D,91,7C,A5,2B,85
,D0,A5,2C,0824
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660 DATA85,D1,A0,00,A9,D0,20,94,
04,85,D2,C8,A9,D0,20,94,04,85,D3
,D0,05,A2,0B46
670 DATA11,4C,83,86,A0,04,A9,D0,
20,94,04,C9,FE,D0,0A,C8,A9,D0,20
,94,04,C9,0A9E
680 DATA8E,F0,0A,A5,D2,85,D0,A5,
D3,85,D1,D0,C9,A2,FF,E8,C8,A9,D0
,20,94,04,0E3D
690 DATAF0,11,C9,28,D0,06,20,C0,
17,4C,FE,14,D0,00,02,F0,E8,D0,DA
,D0,00,02,0A5D
700 DATAD0,D5,38,A5,D0,E9,01,85,
3B,A5,D1,E9,00,85,3C,4C,DC,88,20
,14,93,20,0A86
710 DATAE4,9D,4C,50,8D,A0,05,20,
05,89,88,A5,3C,91,7C,88,A5,3B,91
,7C,88,A5,0A15
720 DATA3A,91,7C,88,A5,39,91,7C,
88,A9,8D,91,7C,20,79,04,20,0E,15
,4C,DC,88,0918
730 DATAA9,FF,85,4A,A9,8D,85,02,
20,71,88,F0,05,A2,0C,4C,83,86,20
,69,A7,A0,0A15
740 DATA05,20,72,A7,60,A5,32,C5,
2E,D0,09,A5,31,C5,2D,D0,03,A9,80
,2C,A9,00,09DA
750 DATA85,0C,20,79,04,4C,80,15,
A5,0C,10,04,C6,30,C6,32,20,20,8D
,4C,DC,88,0742
760 DATA20,6B,AB,EA,EA,EA,EA,20,
54,A9,A5,2D,85,5F,A5,2E,85,60,38
,A5,31,85,0AF9
770 DATA5A,E5,2F,85,D2,A5,32,85,
5B,E5,30,85,D3,A5,33,38,E9,01,85
,58,A5,34,0A99
780 DATAE9,00,85,59,20,C7,88,A5,
37,85,41,A5,38,85,42,A5,58,85,D0
,85,37,E6,0A70
790 DATA59,A5,59,85,D1,85,3B,A6,
2B,A4,2C,A9,00,20,D5,FF,90,03,4C
,7D,A7,20,09CB
800 DATA87,FF,29,8F,F0,05,A2,1D,
4C,83,86,86,2D,84,2E,86,5F,84,60
,A5,D0,85,0ACF
810 DATA5A,A5,D1,85,5B,38,A5,33,
E9,01,A8,A5,34,E9,00,AA,98,38,E5
,5A,85,58,0AAA
820 DATAA8,8A,E5,5B,AA,E8,98,F0,
1F,A5,5A,18,65,58,85,5A,90,03,E6
,58,18,A5,0AEC
830 DATA5F,65,58,85,5F,90,02,E6,
60,98,49,FF,A8,CB,C6,5B,C6,60,A9
,5A,20,94,0B26
840 DATA94,91,5F,C8,D0,F6,E6,5B,
E6,60,CA,D0,EF,38,A5,5F,85,31,E5
,D2,85,2F,0CEF
850 DATAA5,60,85,32,E5,D3,85,30,
A5,41,85,37,A5,42,85,38,68,68,20
,18,88,A9,09AB
860 DATA00,20,90,FF,20,E7,FF,20,
D5,8A,20,EE,8A,4C,72,15,A5,9A,C9
,80,F0,01,0B18
870 DATA60,A5,2D,85,AF,A5,2E,85,
B0,A5,B0,C5,30,D0,07,A5,AF,C5,2F
,D0,01,60,0B08
880 DATAA0,00,A9,AF,20,94,04,C9,
80,B0,6F,20,D2,FF,CB,A9,AF,20,94
,04,C9,7F,0B2C
890 DATAB0,1A,20,D2,FF,20,6E,17,
A5,AF,A4,B0,20,22,A2,20,6F,A4,20
,BB,90,A9,0A00
900 DATAFF,F0,03,4C,4C,17,29,7F,
20,D2,FF,A9,24,20,D2,FF,20,6E,17
,A9,22,20,0988
910 DATAD2,FF,A0,00,A9,AF,20,94,
04,AA,F0,1E,CB,A9,AF,20,94,04,85
,22,C8,A9,0B29
920 DATAAF,20,94,04,85,23,A0,00,
A9,22,20,94,04,20,D2,FF,CB,CA,D0
,F4,A9,22,0A44
930 DATA20,D2,FF,F0,51,D0,4F,90,
03,4C,B3,16,29,7F,20,D2,FF,C8,A9
,AF,20,94,0B2E
940 DATA04,C9,7F,B0,12,20,D2,FF,
20,6E,17,A9,46,20,D2,FF,A9,4E,20
,D2,FF,D0,0B3C
950 DATA29,29,7F,20,D2,FF,A9,25,
20,D2,FF,20,6E,17,A0,00,A9,AF,20
,94,04,85,095B
960 DATA62,CB,A9,AF,20,94,04,85,
63,A2,90,20,C9,A2,20,6F,A4,20,BB
,90,A9,0D,0A00
970 DATA20,D2,FF,1B,A5,AF,69,05,
85,AF,90,02,E6,B0,20,E4,FF,20,E1
,FF,D0,01,0BFB
980 DATA60,A5,C6,C9,40,D0,F1,3B,
B0,8F,A9,3D,20,D2,FF,1B,A5,AF,69
,02,85,AF,0BEE
990 DATA90,02,E6,B0,60,20,73,04,
20,85,94,A5,15,48,A5,14,48,20,E4
,9D,A0,01,089D
1000 DATAB1,14,AA,BB,B1,14,AB,68
,85,14,68,85,15,8A,4C,76,9A,A5,3
B,B0,4B,1B,091A
1010 DATAA5,3C,BD,49,1B,20,73,04
,C9,29,F0,03,4C,AB,17,20,73,04,D
0,01,60,A2,07C3
1020 DATA0E,4C,83,86,1B,98,65,D0
,85,3B,A5,D1,69,00,85,3C,20,D2,1
7,4C,33,1B,0B4B
1030 DATA20,73,04,20,4B,1B,BD,42
,1B,8C,43,1B,A5,0E,BD,44,1B,A5,0
D,BD,45,1B,0620
1040 DATAA5,3B,A4,3C,BD,46,1B,8C
,47,1B,AD,4B,1B,AC,49,1B,85,3B,8
4,3C,AD,42,081F
1050 DATA1B,85,49,AD,43,1B,85,4A
,20,73,04,20,2C,93,A5,3B,BD,4B,1
B,A5,3C,BD,076E
1060 DATA49,1B,AD,44,1B,85,0E,4B
,AD,45,1B,85,0D,4B,A9,8E,4B,A9,9
0,4B,AD,46,081C
1070 DATA1B,85,3B,AD,47,1B,85,3C
,60,20,79,04,C9,2C,F0,34,C9,29,F
0,03,4C,BB,08A7
1080 DATA17,60,00,00,00,00,00,00
,00,00,00,A6,3B,D0,02,C6,3C,C6,3
B,A2,00,24,04F3
1090 DATA4B,8A,BA,E0,28,90,0E,20
,61,1B,60,A9,00,85,0D,20,73,04,4
C,A5,96,4C,07D0
1100 DATA27,93,20,D2,17,4C,33,1B
,20,84,9D,E0,19,B0,3A,86,D0,20,D
8,9D,E0,28,0971
1110 DATAB0,31,86,D1,20,D8,9D,E0
,28,B0,28,86,D2,20,D8,9D,E0,19,B
0,1F,86,D3,08BB
1120 DATAA6,D0,C5,D3,B0,17,A5,D1
,C5,D2,B0,11,A5,D3,A6,D2,20,67,D
E,A5,D0,A6,0E12
1130 DATAD1,20,7A,DE,4C,91,D8,4C
,1C,99,A5,14,48,A5,15,48,20,73,0
4,20,85,94,08D2
1140 DATA20,67,9D,85,52,C9,10,F0
,07,C9,08,F0,03,4C,A1,94,A9,00,8
5,14,85,15,08EC
1150 DATAA0,00,20,B0,04,C8,C9,32
,B0,1C,C9,30,90,18,6A,26,14,26,1
5,C4,52,D0,0869
1160 DATAE8,A5,14,A6,15,A8,68,85
,14,68,85,15,8A,4C,76,9A,4C,A1,9
4,A5,14,48,0972
1170 DATAA5,15,48,20,73,04,20,8E
,94,20,14,93,20,E4,9D,20,8B,94,2
0,24,19,68,0747
1180 DATAB5,15,68,85,14,4C,CA,9C
,A9,10,20,5C,9B,A0,00,A9,00,06,1
4,26,15,2A,06E5
1190 DATA69,30,91,62,C8,C0,10,D0
,F0,60,20,8B,1B,A5,14,48,A5,15,4
8,4C,10,85,094B
1200 DATA20,73,04,20,85,94,20,1B
,9E,A5,14,48,A5,15,48,20,E4,9D,2
0,24,19,68,0712
1210 DATAB5,15,68,85,14,4C,CA,9C
,20,73,04,20,48,9C,C9,58,90,03,4
C,4C,CC,85,0885
1220 DATAD0,A5,3B,48,A5,3C,48,A0
,00,20,B0,04,99,00,02,C8,C4,D0,D
0,F5,A9,00,09FA
1230 DATA99,00,02,85,3B,A9,02,85
,3C,20,53,89,20,14,93,68,85,3C,6
8,85,3B,60,073B
1240 DATA24,61,1B,10,23,A5,61,29
,7F,C9,02,B0,1C,C9,01,1B,D0,16,A
2,00,85,63,0797
1250 DATAC9,00,D0,0F,E8,E0,03,D0
,F5,A5,62,29,7F,C9,00,D0,02,38,6
0,4C,1C,99,0A1B
1260 DATA20,73,04,20,85,94,4C,17
,93,20,CC,19,20,A0,19,90,03,4C,0
F,1A,A0,1A,0666
1270 DATAA2,3B,20,59,A2,20,27,A6
,A0,1A,A9,3B,20,5C,A0,A0,9F,A9,F
0,20,66,A0,0997
1280 DATA20,E4,A5,A0,1A,A9,3B,20
,72,A0,4C,1A,AB,20,D5,19,A0,AA,A
9,EC,4C,6C,0A2C
1290 DATAA0,A5,66,10,06,20,7F,1A
,4C,27,A6,4C,7F,1A,20,CC,19,A9,3
9,A0,94,20,07B2
1300 DATA5C,A0,20,94,A2,A0,1A,A9
,33,20,21,A2,4C,97,A1,88,34,00,0
0,00,00,00,070B
1310 DATA00,00,00,20,CC,19,A0,1A
,A9,33,20,5C,A0,20,94,A2,A9,39,A
0,94,20,21,0764
1320 DATAA2,4C,97,A1,20,E7,FF,A9
,00,20,BD,FF,A9,04,AA,A0,FF,20,B
A,FF,20,85,0C25
1330 DATAA7,A2,04,20,97,A7,A9,0D
,20,D2,FF,20,79,04,20,FF,BA,A2,0
4,20,C3,FF,0A20
1340 DATA4C,E7,FF,A9,EC,A0,AA,4C
,21,A2,20,B4,9D,E0,02,90,03,4C,1
C,99,86,E0,083D
1350 DATAA9,04,AA,A0,FF,20,BA,FF
,A9,00,20,BD,FF,20,C0,FF,A2,04,2
0,C9,FF,A6,0C67
1360 DATAE0,F0,03,4C,BB,1C,AD,13
,FF,C9,D1,F0,0B,A9,11,8D,FE,07,2
0,D2,FF,4C,0B03
1370 DATAC8,1A,A9,91,8D,FE,07,20
,D2,FF,A9,00,85,22,A9,0C,85,23,A
2,00,A0,00,09BE
1380 DATA98,85,4B,38,B1,22,85,5E
,85,5D,38,98,49,4A,45,4B,A8,A5,5E,2
9,80,F0,05,098D
1390 DATA20,89,1B,A5,5E,29,7F,85
,5E,A5,5E,E9,20,1B,10,08,69,60,9
9,AC,1B,4C,0B03
1400 DATA2F,1B,69,20,3B,E9,40,18
,10,08,69,40,99,AC,1B,4C,2F,1B,6
9,40,3B,E9,06CD
1410 DATA60,1B,10,08,69,80,99,AC
,1B,4C,2F,1B,69,60,3B,E9,80,1B,1
0,05,69,C0,072F
1420 DATA99,AC,1B,68,A8,CB,E6,4B
,A5,5D,29,80,F0,03,20,9B,1B,C0,1
4,D0,96,A0,0AB7
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1430 DATA00,B9,AC,1B,20,D2,FF,C8
,C4,4B,D0,F5,E8,E0,32,D0,12,A9,9
1,20,D2,FF,0D14
1440 DATA49,0D,20,D2,FF,A9,04,20
,C3,FF,4C,CC,FF,1B,A5,22,69,14,8
5,22,A5,23,0A1B
1450 DATA65,00,85,23,A5,22,29,04
,F0,03,4C,D2,1A,A9,0D,20,D2,FF,A
D,FE,07,20,08A9
1460 DATAD2,FF,4C,D2,1A,8A,85,4C
,A5,4B,AA,A9,12,9D,AC,1B,E6,4B,A
5,4C,AA,C8,08B1
1470 DATA60,8A,85,4C,A5,4B,AA,A9
,92,9D,AC,1B,E6,4B,A5,4C,AA,60,0
0,00,00,00,0920
1480 DATA00,00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00,00,0
0,00,00,00,0000
1490 DATA00,00,00,00,00,00,00,00
,00,00,00,00,00,00,20,92,1C,A9,8
6,A0,1C,20,08D9
1500 DATA88,90,20,7E,F1,AD,02,03
,8D,90,1C,AD,03,03,8D,91,1C,A9,0
E,20,A6,1C,080C
1510 DATA85,AC,8D,85,1C,A9,00,85
,AD,20,C0,FF,AE,85,1C,20,C6,FF,A
9,84,8D,2A,0B31
1520 DATA03,A9,1C,8D,28,03,A9,1E
,8D,02,03,A9,1C,8D,03,03,20,CF,F
F,20,CF,FF,0B10
1530 DATA20,CF,FF,85,14,20,CF,FF
,85,15,05,14,F0,36,A5,90,D0,32,2
0,CF,FF,85,0AF8
1540 DATA14,20,CF,FF,85,15,A0,00
,20,CF,FF,99,00,02,AE,F6,07,E0,3
F,F0,19,C8,0A60
1550 DATAC9,00,D0,EE,98,85,0B,A5
,90,D0,0D,A9,02,A0,00,85,3C,84,3
B,A4,08,4C,0987
1560 DATA36,87,AD,90,1C,8D,02,03
,AD,91,1C,8D,03,03,A9,08,8D,2A,0
3,A9,EF,8D,0825
1570 DATA28,03,AD,85,1C,20,C3,FF
,20,CC,FF,4C,03,87,60,00,4D,45,5
2,47,49,4E,0841
1580 DATA47,20,00,00,00,00,A9,E6
,20,21,C8,20,85,CC,A9,00,8D,78,0
2,85,0A,A0,0782
1590 DATA05,4C,3F,CA,A6,97,E0,00
,F0,0E,DD,08,05,D0,06,38,E9,01,4
C,A6,1C,CA,092F
1600 DATAD0,F2,60,20,BF,C7,A9,08
,20,D2,FF,A9,0D,20,D2,FF,A9,00,8
D,AF,1B,A9,08BA
1610 DATA06,8D,B0,1B,A9,00,8D,AC
,1B,8D,AD,1B,A9,80,8D,B1,1B,AD,A
F,1B,8D,AE,09E4
1620 DATA1B,AD,AC,1B,8D,B2,1B,AD
,AD,1B,29,F8,8D,B3,1B,A9,00,8D,B
4,1B,8D,B5,0A21
1630 DATA1B,AD,AE,1B,4A,4A,4A,AA
,F0,17,A9,00,A8,48,1B,98,69,40,A
8,68,69,01,08BC
1640 DATA48,CA,D0,F4,8C,B5,1B,68
,8D,B4,1B,AD,AE,1B,29,07,8D,B6,1
B,AD,AD,1B,0A6F
1650 DATA29,07,8D,B7,1B,A9,07,38
,ED,B7,1B,8D,B7,1B,1B,A9,00,6D,B
5,1B,A8,A9,08E4
1660 DATA20,6D,B4,1B,AA,98,6D,B3
,1B,A8,8A,6D,B2,1B,AA,98,6D,B6,1
B,8D,B9,1B,0A26
1670 DATA8A,69,00,8D,B8,1B,AC,B9
,1B,AD,B8,1B,85,D1,A9,00,85,D0,A
9,D0,20,94,0AD4
1680 DATA04,8D,BA,1B,A9,01,AE,B7
,1B,F0,04,0A,CA,D0,FC,2D,BA,1B,F
0,15,AD,AE,0A86
1690 DATA1B,3B,ED,AF,1B,8D,BB,1B
,A9,01,AE,BB,1B,F0,04,0A,CA,D0,F
C,1B,6D,B1,0A65
1700 DATA1B,8D,B1,1B,AD,AF,1B,1B
,6D,B0,1B,EE,AE,1B,CD,AE,1B,30,0
3,4C,EB,1C,090E
1710 DATAAD,B1,1B,20,D2,FF,1B,AD
,AD,1B,69,01,8D,AD,1B,AD,AC,1B,6
9,00,8D,AC,09CC
1720 DATA1B,A9,01,CD,AC,1B,D0,07
,A9,40,CD,AD,1B,F0,03,4C,DA,1C,A
9,0D,20,D2,098B
1730 DATAFF,AD,AF,1B,1B,69,07,8D
,AF,1B,C9,C4,B0,03,4C,D2,1C,C9,C
B,F0,08,A5,0804
1740 DATA03,8D,B0,1B,4C,D2,1C,A9
,0F,20,D2,FF,A9,0D,20,D2,FF,20,D
2,FF,A9,04,0AB3
1750 DATA20,C3,FF,4C,CC,FF,20,DE
,86,A5,3B,8D,33,1E,8D,4E,1E,A5,2
B,85,5F,A5,0ABD
1760 DATA2C,85,60,A0,01,84,0F,20
,6D,81,F0,43,20,E4,FF,C9,03,F0,3
C,A0,03,A2,09C6
1770 DATAFF,84,03,E8,BD,02,02,F0
,33,C9,20,F0,F6,C9,22,F0,F2,C8,2
0,6D,81,F0,0CB4
1780 DATA12,C9,20,F0,F6,C9,22,F0
,F2,5D,02,02,F0,DF,A4,03,C8,D0,D
6,F0,00,20,0BB3
1790 DATA6D,B1,AA,C8,20,6D,B1,86
,5F,85,60,D0,B4,4C,CB,1E,A0,01,8
4,0F,20,3E,0983
1800 DATA90,C8,20,6D,B1,AA,C8,20
,6D,B1,84,49,20,5F,A4,A9,20,A4,4
9,29,7F,20,0954
1810 DATAB2,90,C9,22,D0,06,A5,0F
,49,FF,85,0F,C8,F0,D2,20,6D,B1,F
0,BD,10,E9,0BD1
1820 DATAC9,FF,F0,E5,C9,FE,F0,3A
,D0,47,24,0F,30,DB,AA,B4,49,A0,0
0,0A,F0,10,0C04
1830 DATACA,10,0C,E6,22,D0,02,E6
,23,B1,22,10,F6,30,F1,CB,B1,22,3
0,BB,20,B2,0A1B
1840 DATA90,D0,F6,20,3E,90,A0,01
,A9,00,91,3B,BB,A9,3F,91,3B,A2,8
0,4C,83,B6,0A0D
1850 DATAAE,11,B6,23,A2,AF,B6,22
,CB,20,6D,B1,4C,A6,1E,A2,B1,B6,2
3,A2,BE,B6,09BD
1860 DATA22,4C,A6,1E,20,B4,9D,E0
,9F,90,03,4C,1C,99,B6,D0,20,91,9
4,20,14,93,08E8
1870 DATA20,E4,9D,B4,D1,B5,D2,20
,42,1F,A2,2F,B6,13,20,97,A7,1B,A
9,50,69,50,09CC
1880 DATA8D,50,1F,A5,D1,8D,51,1F
,A5,D2,8D,52,1F,A5,D3,8D,53,1F,A
0,00,B9,4F,0A03
1890 DATA1F,20,B2,90,CB,C0,05,D0
,F5,4C,FE,90,A9,00,85,D3,20,9D,A
8,20,D8,9D,0BA8
1900 DATA86,D3,60,50,00,00,00,00
,20,6B,A8,A5,2B,A4,2C,85,D0,84,D
1,A5,2D,A4,0BFC
1910 DATA2E,85,D2,84,D3,20,7E,1F
,20,D8,FF,A5,D0,A4,D1,85,2B,84,2
C,A5,D2,A4,0BF5
1920 DATAD3,85,2D,84,2E,60,20,90
,1F,85,2C,84,2B,20,90,1F,48,98,A
A,68,A8,A9,08DB
1930 DATA2B,60,20,9D,A8,20,91,94
,20,14,93,4C,E4,9D,EA,EA,EA,20,4
8,9C,85,D0,0AE0
1940 DATA86,D1,84,D2,20,F7,1F,A0
,00,C4,97,F0,0B,B9,1D,05,C9,6F,F
0,1F,C8,4C,0B0F
1950 DATAAD,1F,A9,0F,20,A6,1C,85
,D4,A0,0F,A6,D3,20,BA,FF,A9,00,2
0,BD,FF,20,0A65
1960 DATA85,A7,A6,D4,4C,E1,1F,B9
,13,05,C5,D3,D0,DA,BE,09,05,20,9
7,A7,A5,D0,08A4
1970 DATAA6,D1,B6,22,A4,D2,B4,23
,20,BE,90,20,3E,90,4C,FE,90,20,7
9,04,D0,05,09B4
1980 DATAA2,08,B6,D3,60,20,D8,9D
,E0,08,B0,F6,4C,1C,99,0C,06,25,0
9,06,0E,04,07D3
1990 DATA12,0B,09,0B,12,15,2C,06
,0B,12,1E,2F,47,7A,7E,BF,DC,E0,E
9,F3,FD,09,0790
2000 DATA13,1B,34,5C,61,5C,5E,60
,62,64,66,68,6A,6C,6E,70,72,74,7
6,7C,7E,B0,0857
2010 DATAB2,B4,B6,B8,BA,BC,BE,90
,92,94,96,98,9A,9C,9E,A0,A2,A4,A
6,FF,0B,15,0C1B
2020 DATA19,77,BE,98,E8,F6,FD,4E
,54,71,74,EE,F1,3A,71,6B,A5,B9,C
6,01,16,2F,0B77
2030 DATAA5,AA,B4,CE,D1,D7,DA,DD
,E2,E7,EE,F1,F4,F7,FE,03,10,15,1
8,1E,2A,2F,0D7B
2040 DATA40,5F,70,73,1A,3E,5C,D7
,DA,DF,E1,E8,FC,07,15,1B,1E,2A,3
F,41,AD,BF,09F9
2050 DATAEC,FE,01,0E,11,1E,21,2E
,3C,45,7A,8B,93,A5,D6,DA,E6,EC,F
1,F6,00,0A,0AA5
2060 DATA14,64,6A,7A,B6,CC,D1,D6
,D9,DE,E1,E4,E7,EA,ED,F2,F7,FA,F
D,16,1A,1D,0EEC
2070 DATA22,25,2A,30,33,39,3F,44
,49,4E,51,57,5A,5D,6B,70,79,7E,8
2,85,8A,9A,077D
2080 DATA97,9A,9E,A1,A4,A9,AC,B3
,BB,BB,C0,C5,CC,D1,D9,DF,E6,EF,F
2,0F,12,69,0EBA
2090 DATADF,EC,F7,13,22,27,2C,31
,36,69,AA,BB,C0,D6,20,8B,90,A0,0
0,B9,0D,21,09D4
2100 DATA99,00,06,CB,C0,8D,D0,F5
,60,78,8D,3F,FF,B5,D2,C9,10,D0,1
5,A9,1B,8D,0B7F
2110 DATA46,06,A9,69,8D,47,06,A9
,20,8D,35,06,8D,3C,06,4C,31,06,A
9,38,8D,46,06CF
2120 DATA06,A9,E9,8D,47,06,A9,50
,8D,35,06,8D,3C,06,A2,00,BD,0B,2
0,85,D0,A0,08B1
2130 DATA00,B9,1B,20,85,D1,C8,84
,D3,A0,00,B1,D1,18,69,30,91,D1,A
4,D3,C4,D0,0BA9
2140 DATAD0,E9,18,98,6D,3B,06,8D
,3B,06,90,03,EE,3C,06,E8,E6,D2,E
0,10,D0,CE,0AD6
2150 DATAA5,D2,C9,40,B0,03,A2,40
,2C,A2,10,8E,0D,03,8E,0F,03,8E,1
1,03,8E,09,076A
2160 DATA03,8E,03,03,8E,6B,13,E8
,8E,0B,03,A9,1B,8D,3B,06,8D,3E,F
F,58,60,00,073B
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```
PROGRAM: +4 EX BASIC 2

10 REM LISTING2
20 SCNCLR
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```
30 WRITE(2,1)"DO YOU OWN A PRINT
ER ";:DO:GETP$:LOOPUNTILP$="Y"OR
P$="N":PRINTP$
40 WRITE(2,3)"DO YOU OWN A DISKD
RIVE ";:DO:GETD$:LOOPUNTILD$="Y"
ORD$="N":PRINTD$
60 PRINT"{CLEAR}CHAIN"+CHR$(34)+
"LISTING3"+CHR$(34)+",";:IFD$="Y
"THENPRINT"8":ELSEPRINT"1"
70 POKE1319,19:POKE1320,13:POKE2
39,2:END
```

PROGRAM: +4 EX BASIC 3

```
10 GRAPHIC1,1
20 REM LISTING3
30 DEFFNH(X)=DEC("2000")+INT(Y/8
)*320+Y-INT(Y/8)*8+INT(X/8)*8
40 CHAR1,5,0,"GRAPHIC DEMO"
50 CIRCLE1,160,100,10
60 FORI=20TO70STEP2:CIRCLE1,160,
100,I:NEXT
70 PAINT1,171,100
80 X=0:Y=0
90 FORI=1TO48
100 READA$
110 A$=RIGHT$(HIDB$(A$),8)
120 FORT=1TOLEN(A$)
130 Q=VAL(MID$(A$,T,1))
140 POKEFNH(X),PEEK(FNH(X))OR2^(
8-T)*Q
150 X=X+1
160 NEXT
170 IFX=24THENX=0:Y=Y+1
180 NEXT
190 IFP$="Y"THENDUMP1
200 GETKEYY$:GRAPHIC0
210 DATAFF,FF,FF,FF,FF,FF,C0,00,
03,C0,3B,03,C0,6C,03,C0,44,03,C0
,6C,03,C0,3B,03
220 DATAC0,00,03,DF,FF,FF,C0,00,
03,DF,FF,FF,C0,00,03,DF,FF,FF,C0
,00,03,DF,FF,FF
230 DATAC0,00,03,DF,FF,FF,C0,00,
03,DF,FF,FF,C0,00,03,C0,00,03,FF
,FF,FF,FF,FF,FF
240 PRINT"{CLEAR}";:IFD$="Y"THEN
PRINT"DMERGE"+CHR$(34)+"LISTING4
"+CHR$(34)
250 IFD$="N"THENPRINT"MERGE"+CHR
$(34)+"LISTING4"+CHR$(34)
260 POKE1534,ASC(P$):POKE1535,AS
C(D$)
265 POKE1319,19:POKE1320,13:POKE
1321,82:POKE1322,213:POKE1323,13
270 POKE239,5:END
```

PROGRAM: +4 EX BASIC 4

```
10 REM LISTING4
20 GOTO30*10
300 GRAPHIC0,1
310 WRITE(14,0)"LO-RES DEMO"
320 WRITE(14,1)"{c OJCc UJCc UJC
c UJCc UJCc UJCc UJCc UJCc UJCc
UJCc UJ"
330 PRINT"{c AJCc RJCc RJCc RJCc
 RJCc RJCc RJCc RJCc RJCc RJCc R
JCc RJCc RJCc RJCc RJCc RJCc RJC
c RJCc RJCc RJCc RJCc RJCc RJCc
RJCc RJCc RJCc RJCc RJCc RJCc RJ
{c RJCc RJCc RJCc RJCc RJCc RJCc
 RJCc RJCc RJCc SJ"
340 PRINT"{s BJCs BJCs BJCs BJCs
 BJCs BJCs BJCs BJCs BJCs BJCs B
JCs BJCs BJCs BJCs BJCs BJCs BJC
s BJCs BJCs BJCs BJCs BJCs BJCs
BJCs BJCs BJCs BJCs BJCs BJCs BJ
{s BJCs BJCs BJCs BJCs BJCs BJCs
 BJCs BJCs BJCs BJ"
350 PRINT"{c QJCs +JCs +JCs +JCs
 +JCs +JCs +JCs +JCs +JCs +JCs +
JCs +JCs +JCs +JCs +JCs +JCs +JC
s +JCs +JCs +JCs +JCs +JCs +JCs
+JCs +JCs +JCs +JCs +JCs +JCs +J
{s +JCs +JCs +JCs +JCs +JCs +JCs
 +JCs +JCs +JCs WJ"
360 PRINT"{c ZJCc EJCc EJCc EJCc
 EJCc EJCc EJCc EJCc EJCc EJCc E
JCc EJCc EJCc EJCc EJCc EJCc EJC
c EJCc EJCc EJCc EJCc EJCc EJCc
EJCc EJCc EJCc EJCc EJCc EJCc EJ
{c EJCc EJCc EJCc EJCc EJCc EJCc
 EJCc EJCc EJCc XJ"
370 PRINT:PRINT"QWERTYUIOPASDGFG
HJKLZXCVBNMCs QJCs WJCs EJCs RJC
s TJCs YJCs UJCs IJCs OJCs PJCs
AJCs SJCs DJCs FJCs GJCs HJCs JJ
{s KJCs LJCs ZJCs XJCs CJCs VJCs
 BJCs NJCs MJCc QJCc WJCc EJCc R
JCc TJCc YJCc UJCc IJCc OJCc PJC
c AJCc SJCc DJCc FJCc GJCc HJCc
JJCc KJCc LJCc ZJCc XJCc CJCc VJ
{c BJCc NJCc MJ"
380 IFPEEK(1534)=89THENDUMP0
390 PRINTCHR$(14)
400 IFTY=1THEN415:ELSETY=TY+1
410 CGOTO3*100
415 CGOSUB91*5
420 PRINTCHR$(142):SCNCLR
430 PRINT"APPEND"CHR$(34)"LISTIN
GS"CHR$(34)",";:IFPEEK(1535)=89T
HENPRINT"8":ELSEPRINT"1"
440 POKE1319,19:POKE1320,13:POKE
1321,13:POKE1322,71:POKE1323,207
:POKE1324,53
445 POKE1325,48:POKE1326,48:POKE
1327,13:POKE239,9
450 END
455 VOL8:FORI=0TO1023STEP10:SOUN
D1,I,5:SOUND2,I,5:SOUND1,1023-I,
5:SOUND2,1023-I,5:NEXT
460 RETURN
```

PROGRAM: +4 EX BASIC 5

```
500 REM LISTING5
510 CLR:SCNCLR
520 PROCINPUT
530 PROCPRINT(X,A$)
540 END
550 DPROCINPUT
560 INPUT"VALUE : -1<=VALUE<=1";
X
570 INPUT"STRING TO BE EVALUATED
";A$
580 EPROC
590 DPROCPRINT(X,A$)
600 PRINT"ACS"X"="ACS(X)
610 PRINT"ASN"X"="ASN(X)
620 PRINT"DEG"X"="DEG(X)
630 PRINT"RAD"X"="RAD(X)
640 PRINT"EVAL"A$"="EVALA$
650 POP
660 PRINT"DEEK(20B)="DEEK(20B)
670 PRINT"BIN$(B)="BIN$(B)
680 IFPEEK(1534)=89THENPLIST-80
690 IFPEEK(1535)=89THENDE=B:ELSE
STOP
700 LOAD"LISTING6",DE
```

PROGRAM: +4 EX BASIC 6

```
10 REM LISTING6
15 TRAP1000
20 OPEN15,8,15
30 OPEN3,8,3,"MYRELFILE,L,"+CHR$
(88)
40 CR$=CHR$(13)
50 PRINT"{CLEAR}{RVSON}RECRVSOFF}
EAD OR {RVSON}WCRVSOFF}RITE";:DO
:GETA$:LOOPUNTILA$="R"ORA$="W":P
RINTA$
60 IFA$="W"THEN160
70 CGOSUB36*10
80 RECORD#3,RE,1
90 CGOSUB40*10
100 INPUT#3,NA$,SA$,CS$,ZP$
110 GOSUB400
120 RECORD#3,RE,1
130 GOSUB400
140 PRINTNA$:PRINTSA$:PRINTCS$:P
RINTZP$:GETKEYY$
150 GOTO50
160 GOSUB360
170 INPUT"NAME";NA$
180 IFLEN(NA$)>30THEN170
190 INPUT"STREET";SA$
200 IFLEN(SA$)>30THEN190
210 INPUT"CITY & STATE";CS$
220 IFLEN(CS$)>25THEN210
230 INPUT"ZIP CODE";ZP$
240 IFLEN(ZP$)>10THEN230
250 DA$=NA$+CR$+SA$+CR$+CS$+CR$+
ZP$
260 IFLEN(DA$)<88THEN280
270 PRINT"RECORD TO LONG":GOTO50
280 RECORD#3,RE,1
290 IFDS=50THENPRINT#3,CHR$(255)
:GOSUB400:GOTO280
300 GOSUB400
310 PRINT#3,DA$
320 GOSUB400
330 RECORD#3,RE,1
340 GOSUB400
350 GOTO50
360 INPUT"ENTER RECORD NUMBER";R
E
390 RETURN
400 IFDS<20THENRETURN
410 PRINT"ERROR"D$:CLOSE3:CLOSE
15:END
1000 CLOSE3:CLOSE15:PRINT:PRINTE
RR$(ER),EL
1010 END
```

Word Processor Roundup

As a word processor is defined as a simple means of entering, editing, printing, and storing text on a computer why are there so many of them? This article covers no less than twelve different word processors, each offering a variety of functions and options to cater for the incredible variety of uses these essential programmes are used for.

By Tony Hetherington

If you have ever written a letter, memo, note or magazine article then you need a word processor and so you will no longer be buried in 'early drafts' and pools of correcting fluid. With a word processor you can type on the keyboard anything you would on a typewriter and then correct it, alter it, save it for later use and print it out.

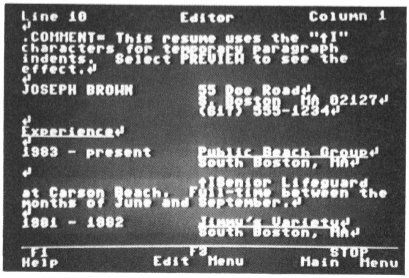
In this article (which I wrote using PaperClip) I have looked at twelve word processors and assembled their strengths and weaknesses and included certain factors and features that may help you find the word processor that is best suited for your needs. (Table 2).

EASY SCRIPT/Commodore

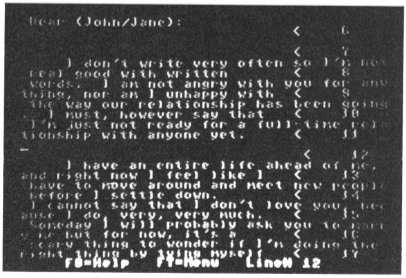
Easy Script is probably one of the best known C64 word processors as it was given away free with the 1541 disk drive.

Although Easy Script contains facilities to create and edit documents, it uses a system of control commands that means that text on the screen isn't the same as it will appear on the paper. In fact the program includes a special function to show the document as it will actually appear. Since then the word processors have become friendlier which means you can get started without wading through a huge manual.

• *Ski Writer*



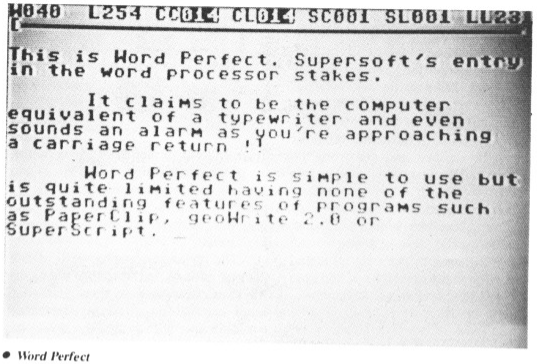
• *Master Word*



SKI WRITER/Mastertronic

Mastertronic's imported Ski Writer includes only the briefest of manuals (three pages of a minute leaflet) and consists of four main functions that are assessed through a main menu.

The Edit option allows you to type and edit your document and format it, using Easy Script style commands to set margins, page numbers, headers and text justification. The Preview mode interprets these commands and displays the text as it would appear on paper. Your document can then be saved, loaded or merged from disks with the file option that can also format blank disks before printing on any defined printer and paper type.



• *Word Perfect*

If you don't expect too much from Master Word you won't be disappointed.

MASTER WORD/Argus Press Software

As part of the Load 'N Go series of cheap and cheerful disk programs Master Word has the distinction of being the only word processor that is supplied with no instructions at all!

If this complete lack of documentation hasn't put you off you'll find pages and pages of help screens to get you going as well as files of sample letters which include nine different business letters, nine letters home, five true love notes, two, 'the romance is' over and one, 'it never really began' letter for the one you hate!

WORD PERFECT/Supersoft

Word Perfect is an easy to use program but has its limitations including a 254 line limit to documents. This is just over four A4 pages and so limits its applications to short notes, letters and memos. Longer articles such as this one just wouldn't be possible.

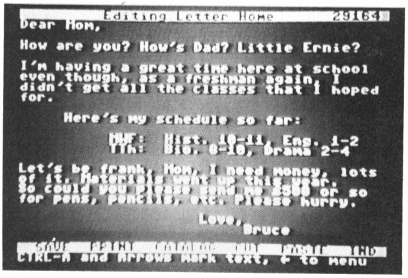
If you stay within this limitation you'll be able to enter and edit text using simple commands that try to mimic a typewriter. You even hear a bell when you're hearing a carriage return although you can let the program automatically wordwrap to a new line.

CUT & PASTE/Ariolasoft (Electronic Arts)

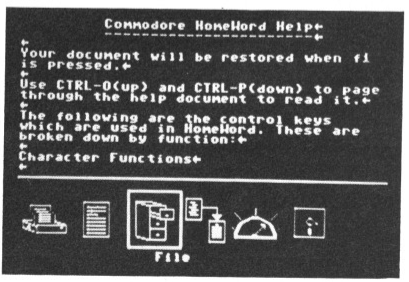
Many word processors claim to be easy to use but this one actually is so much so, that you can load in a sample document, edit it, add in your own words of wisdom and save it without looking at the slim introduction manual!

Some word processors include a command bar; Cut & Paste has two! At

• *Cut & Paste*



• *Homeword*



the top of the screen you get a menu of files on disk and at the bottom a duck-shoot command bar to load and save these files and format blank disks.

Once your're actually editing text, whether it's one of the supplied formatted letters (to Mom asking for money!), resume or memos or all your own work, then cut and paste is the name of the game. Any word, sentence or block of text can be defined and cut from the document and then pasted in another part of it.

This means you can move and copy text as well as restore deleted words that you really wanted (as long as you haven't cut anything else, or even cut a general introduction that can then be pasted onto a whole series of different documents.

HOMEWORD/Green valley

Homeword (also sold as Master Writer) is the only icon controlled word processor in this collection. It has a picture of a filing cabinet for its load, merge and save options as well as a printer, a page of text for move, copy, erase and find and replace edit options, a layout icon to set text justification and a disk to catalog and create files.

Selecting any icon leads to another set of icons and so on until you find the option you need. As with Cut and Paste, the manual is almost redundant as it's always clear through icons and screen prompts, what you're doing, how you got there and how to get out of it without losing all your work.

To help you further a display, at the bottom of the text entry screen shows the current page, a bar illustrates the remaining memory and a bit pattern representation of your page is shown.

TEAM-MATE/Tri Micro

Team-Mate is in fact the C64 version of the programmes supplied with Plus/4 and features an integrated package of a word processor, spreadsheet, database and graphics package (that produces bar and pie charts).

The word processing part of the package is undoubtedly limited with each file restricted to only 99 lines. However, more than one file can be linked together to form longer documents that can use the output from graphics and spreadsheet packages in its documents. It doesn't compare with the full word processors but is a useful addition to a package.

TRI WORD/

Tri Word is part of the Triangle (word processor/spreadsheet and file handler package) and is less limited than its Team-Mate competitor with up to 400 lines in a file. However data cannot be mixed between the programmes, and files can't be linked together. However you shouldn't need to as the files should be big enough. One thing that remains a mystery is why F1 moves the page down and F7 moves it up?

MINI OFFICE II/Database

The Mini Office II word processor is probably the best word processor supplied in an integrated package.

From a single menu you can edit and create your text, preview it, search and replace consistent spelling errors and load and save your work. Meanwhile a bar at the top of the screen keeps track of the various modes you are in, the time it has taken you to create the document and an extremely useful word count. In fact everything you'd expect from an ordinary word processor which you get with a spreadsheet, database, graphics package, label printer and communications package!

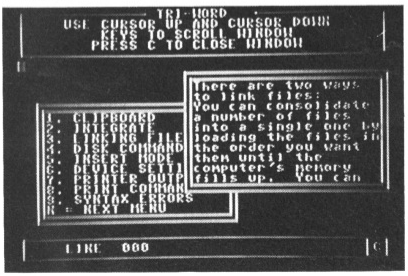
GEOWRITE 2.0/First Analytical

GeoWrite 2.0 is just part of the Writer's Workshop package that runs with the pull-down menus and pointers of the Mac like GEOS operating system.

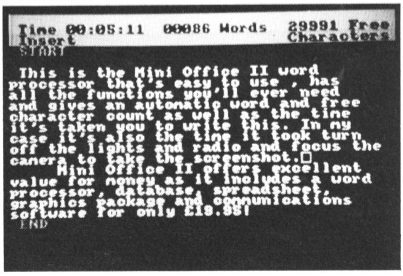
A version of geoWrite was included with the GEOS master disk but this was little more than a text handler and has been replaced by a full word processor featuring headers and footers, left, right and centre justification, plain, bold, italic, outline, subscript and superscript text as well as a choice of fonts in a variety of point sizes and the incredibly powerful text grabber.

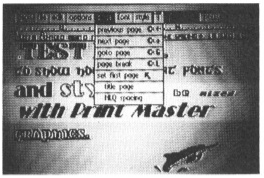
The text grabber can convert any C64 word processor document into

• *Tri Word*

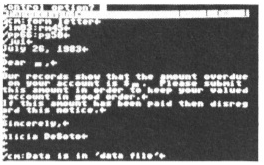


• *Mini Office II*

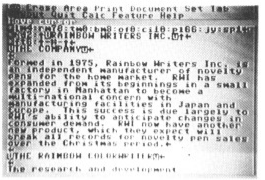




• *Geowrite*



• *Paperclip*



• *Superscript*

geoWrite format which can then be edited by geoWrite and improved by adding different fonts and geoPaint graphics.

PAPERCLIP/Ariolasoft (Batteries Included)

I used Paperclip to write this article because I found it the easiest machine to use. I needed a word processor that didn't have any complicated control codes, that you could accept, type directly onto the screen and could easily correct mistakes as you go. Also which had a spell checker to remove any spelling mistakes before being saved to disk, for direct entry into a typesetting machine.

I didn't want to be restricted to a small number of lines but I needed to know how many words I had used. (The Spellchecker is only available in the special Paperclip with Spell Checker pack which is definitely worth the extra fiver.)

The spell checker is the secret of Paperclip's success as it compares these words with its 15,000 word dictionary and prompts you to alter any it can't find or understand. Therefore it can spot typing errors, spelling mistakes and words run together through missed spaces, while giving you a report of the total number of words used and their average length.

This time I didn't need any of its other features such as transferring text between different documents, sorting capabilities, editing data from databases and spreadsheets or the ability to create form letters. But I did use the special commands to construct the comparison table. (Table 2).

Paperclip with the added spell checker is more expensive than the others but you do get more for your money. Great value and a must for journalists with deadlines!

SUPERSCRIPT/Precision

I may prefer Paperclip but there are others such as Your Commodore's illustrious Editor who prefers Superscript to create his words of wisdom.

Superscript is undoubtedly an incredibly powerful word processor that's equal to Paperclip in the feature it offers including a spell-checker and mail-merge facility.

If there's any difference then it's how the commands are accessed. In Paperclip these are through conversational two key commands, whereas Superscript employs a series of nested duckshoot menus. For example, selecting Document from the main menu leads to a sub-menu that includes options to load, save, directory and spell. Select spell and you're led to another menu and options to check spelling, view or print the user dictionary and display a word count.

Comparing Superscript and Paperclip is like the comparison between a Ferrari and a Porsche. They are both equally impressive but different to drive.

The following table compares the tested word processors with eight factors that are important to a buyer. The final two factors are an opinion of the programmes themselves and their manuals, and take into account, friendliness and general ease of use.

	Easy Script	Ski Writer	Master Word	Word Perfect	Cut & Paste	Home-Word
Headers	Yes	Yes	No	No	Yes	Yes
Footers	Yes	No	Yes	No	No	Yes
Line Spacing	Yes	Yes	Yes	No	Yes	Yes
Search/Replace	Yes	No	No	No	No	Yes
Help Function	No	No	Yes	No	No	No
Spell Checker	No	No	No	No	No	No
Word Count	No	No	No	No	No	No
Price		£4.99		£19.94		
Program	Fair	Fair	Good	Fair	Good	Good
Manual	Poor	Poor	None	Fair	Good	Good

	Team Mate	Tri Word	Mini Office	Geo-Write 2	Paper Clip	Super Script
Headers	No	Yes	Yes	Yes	Yes	Yes
Footers	No	No	Yes	Yes	Yes	Yes
Line Spacing	Yes	No	Yes	Yes	Yes	Yes
Search/Replace	Yes	Yes	No	Yes	Yes	Yes
Help Function	No	Yes	No	Yes	No	Yes
Spell Checker	No	No	No	No	No	Yes
Word Count	No	No	Yes	No	Yes	Yes
Price			£19.95	£37.50	£44.95	£39.95
Program	Fair	Fair	Good	Good	Great	Great
Manual	Fair	Fair	Good	Good	Good	Good

Everyman's Guide to Graphics

Graphics are a fascinating application for the C64. In this comprehensive guide, we point the way to better understanding and use of this facility.

By Allen Webb

In my view, the crucial part of any piece of software is the graphics. There are very few items which need no attention to graphics, with even a text only package being improved by a redesigned font.

In this article, I want to give a detailed run down of the C64's graphics capability and how you can use it. Where it simplifies life, I will give listings of helpful routines

Vic Chip

First, let us consider the driving force behind graphics, the VIC-II chip. This chip controls the graphics system which can in turn be altered via a number of registers. These registers are memory mapped allowing you to change them easily. Table 1 lists the most useful registers.

That's a pretty meaty lump of information and it's only provided as reference material. The rest of this piece will show you how the more important registers are used.

If you want to use your 64 efficiently, an appreciation of how it handles its memory is necessary. Figure 1 gives a simple memory map. The memory map can be considered to consist of two layers. The bottom layer is a block of 64K of RAM. On top of this are superimposed two areas of ROM and other chips. Since different devices occupy the same addresses, a register at address one is used to decide

Table 1

Register	Bit	Function
		Sprite positions
$D000-$D010 (53248-53264)		
$D011 (53265)	Bit	
	7	Raster Compare
	6	Extended colour mode
	5	Bit map mode
	4	Blank screen
	3	24/25 row text
	2-0	smooth scroll Y direction
$D012 (53266)		Raster Read/write
$D013-$D014 (53267-53268)		Light Pen registers
$D016 (53270)	4	Multicolour mode
	3	38/40 column text
	2-0	Smooth scroll X direction
$D017 (53271)		Y expand register
$D018 (53272)		Memory Control Register
	7-4	screen matrix
	3-1	Character table
$D019 (53273)		Interrupt register
$D01A (53274)		IRQ mask register
$D01B (53275)		Sprite priority register
$D01C (53276)		Sprite colour mode register
$D 01D (53277)		X expand register
$D01E (53278)		Sprite to sprite collision register
$D01F (53279)		Sprite to background collision register
$D020 (53280)		Screen border colour
$D021.$D024 (53281-53284)		Background colour registers
$D025-$D026 (53285-53286)		Sprite multicolour registers
$D027-$D02E (53287-53294)		Sprite colour registers

which are switched in. In normal use, the RAM under the ROMs is unavailable to Basic but it can be used for graphics.

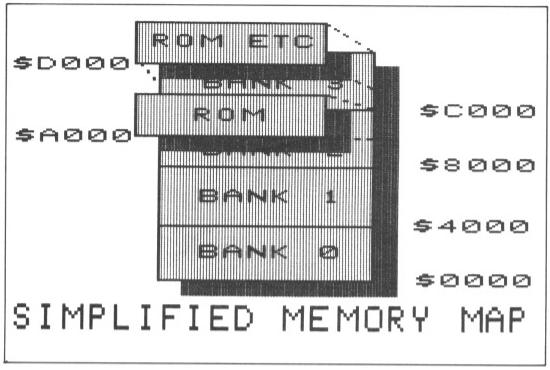
The 64 treats the block of RAM as four banks of 16k:
Bank0–$0000–$3FFF(0 to 16383).
Bank1–$4000–$7FFF(16384 to 32767)
Bank2–$8000–$BFFF(32768 to49151)
Bank3–$C000–$FFFF(49152 to 65535

Bank 0 is the default bank. The bank in use is specified in bits 0 and 1 of location $DD00.

The VIC can only address one bank at a time and it expects to find an area of screen memory and a character set within the bank. This approach offers almost unlimited flexibility but also makes the use of graphics in the default bank restricted.

Since the CPU and the VIC chip operate independently, the CPU doesn't care which bank is used for graphics. We can therefore reconfigure the machine from Basic very easily.

Let us consider how to reconfigure the memory map.



Changing the BANK

This is achieved easily by changing the register at $DD00:

```
10 POKE 56578, PEEK(56578) OR 3
20 POKE 56576, (PEEK(56576) AND
252) OR(3-BN)
```

Line 10 prepares the ground and line 20 switches in BANK number BN.

The VIC chip ignores the absolute address of the bank and uses only the relative addresses within the bank, i.e. each bank ranges from $0000 to $3FFF.

Moving the Character Set

The register at 53272 tells the VIC chip where to get its character data. In fact, bits one to three hold this information.

This information is changed by:

```
POKE 53272, (PEEK(53272)
AND240) OR X
```

X is equal to the start adress of the character data divided by 1024. With only three bits used, only eight character sets are possible i.e. x = 0,2,4,6,8,10,12,14.

Since the machine powers up with a character set, there must be default information somewhere. In fact, the default character set is held in ROM. This data is imaged to banks 0 and 2 and is found at the following addresses:

$1000-$17FF (Lower case set X=*4*)
$1800-$1FFF (Upper case set X=6)

Clearly, it is possible to have a number of different sets of characters in a bank and simply switch between them as needed.

Moving the Screen

The screen comprises of 1000 bytes of contiguous memory which usually resides between locations 1024 and 2024. This position is specified in bytes 4 to 7 in location 53272. These bytes actually specify the position of the screen in any bank of memory, and can be changed by:

```
POKE 53272, (PEEK(53272) AND15)
OR Y
```

Y is equal to the start address of the screen divided by 64. This time we have four bits in the register allowing 16 possible screen positions with Y ranging from 0 to 240 in increments of 16. Unfortunately, you cannot use all RAM areas for the screen. If you use the areas imaged by the character ROM, you will get garbage on the screen.

In addition to changing the VIC register, you must also tell the operating system where the screen is. This is done with:

```
POKE 648,SCREEN/256
```

where SCREEN is the start address of the screen area.

The screen colour matrix cannot be moved and, in fact, presents no difficulties.

Listing 1 allows you to reconfigure your 64. The first part asks you to specify where the screen and character set are to go. These values are checked to ensure that they are in the same bank and are not at the same address. It doesn't check any further so beware. Line 60 to 80 calculate the register values. Line 90 checks to see if you need to copy down the character set and lines 100 to 150 do this job if required. Lines 160 to 190 reconfigure the machine.

Listing 1: Reconfigure

```
26  10 PRINTCHR$(147): INPUT "SC
    REEN POSITION";SCREEN
44  20 INPUT "CHARACTER SET ADDR
    ESS";CHARS
```

Table 2

Pixel one	Pixel two	Colour Register
clear	clear	53281
clear	set	53282
set	clear	53283
set	set	colour matrix

```
F0  30 IF SCREEN = CHARS THEN E$
    ="ERROR..CHARS AND SCREEN AT
     SAME ADDRESS":GOTO60000
A1  40 IF INT(SCREEN/16384)=INT(
    CHARS/16384)THENGO
34  50 E$="ERROR..CHARS AND SCRE
    EN NOT IN SAME BANK":GOTO600
    00
1B  60 X=INT(SCREEN/16384)
5B  70 Y=(SCREEN-X*16384)/64
95  80 Z=(CHARS-X*16384)/1024
E1  90 IF Z<>4 AND Z<>6 THEN
8E  100 PRINTCHR$(147)"COPYING R
    OM CHARACTER SET...THIS WILL
    [SPC3]TAKE A WHILE"
F4  110 POKE56334,PEEK(56334)AND
    254
4F  120 POKE 1,PEEK(1) AND 251
A2  130 FORI=0TO2047:POKECHARS+I
    ,PEEK(53248+I):NEXT
F6  140 POKE1,PEEK(1)OR4
03  150 POKE56334,PEEK(56334)OR1

17  160 POKE56578,PEEK(56578)OR3

12  170 POKE56576,(PEEK(56576)AN
    D252)OR(3-X)
3B  180 POKE53272,Y+X
B3  190 POKE648,SCREEN/256
C3  200 PRINTCHR$(147)"DONE"
52  210 END
FD  60000 PRINT:PRINTE$
9C  60010 GET I$:IFI$=""THEN6001
    0
3B  60020 GOTO10
```

In my view, the crucial part of any piece.

Run Listing 1 putting the screen at 50176 and the character table at 51200 and then enter the line:

POKE 44,4: POKE 1024, 0: NEW

You will have a machine offering 39933 bytes for Basic and 144 sprites. That's a lot more than you get on switch on! This extra capacity is achieved by:

1) Using BANK 3 and moving the screen and character set to a handy block of RAM between the ROMs.

2) Moving the start of Basic program storge down to 1025. Since we've moved the screen we can use the normal screen area for Basic.

3) You can use the memory behind the Kernal ROM ($E000 to $FFFF) and the remaining memory between the ROMs ($C000 to $C3FF) for sprites.

Machine code users don't have such a tough time since they aren't constrained by where they have to put their programs. It is, nevertheless, useful to reconfigure the machine.

Graphics Modes

Before we launch forth into graphics handling, we must consider the graphics modes available to us. The screen occupies 1000 bytes and is divided into 64000 addressable points or pixels. There are two graphics modes allowing manipulation of the screen.

1. Character Mode

In this default mode, the screen uses 1000 characters, each occupying an 8×8 pixel cell.

2. Bit mapped Mode

In this mode, the screen uses a 320 by 200 array of pixels. Using this mode it is possible to create pictures and other images.

The fundamental difference between these modes is that character mode is supported by the operating system whereas bit map mode has no software to drive it. Both modes use 8×8 cells to control the colours used.

In addition to the graphics modes, there are three colour modes.

1. High resolution Mode

This is the default graphics mode. In this mode, any given cell may contain only two colours; the background or paper colour and the foreground or ink colour. Any set pixel will have the ink colour and any unset pixel will have the paper colour.

In character mode, the paper colour is held in VIC register 53281 and the ink colour is held in the colour matrix.

This mode allows the greatest detail, albeit at the most limited colour range.

2. Multi-colour Mode

In this mode, pairs of pixels are used to define dots of colour. Since there are four possible arrangements for two pixels, four colours are allowed in any given character cell (Table 2).

This mode is a lot coarser but allows greater colour flexibility.

Extended Background

This mode uses high resolution but offers four different paper colours in addition to the usual ink colours. The paper colour is determined by the POKE value of the character used and limits you to 64 different characters (Table 3).

Redefined characters

OK, we've done the spade work, let's now look at the use of user defined characters.

You will have realised that the shape of characters is held in a table of data. Exactly how is of essence. Consider Figure 2. This shows a character design. The design comprises of eight lines of dots. Imagine that each set pixel is a 1 and each clear pixel is 0. That being so, the top line becomes 00111100. The decimal equivalent of this binary number is 60. Similarly, each line can be converted to a data value. The character table comprises of a sequence of data values for each character. The first eight data values in

Listing 2

```
10 DATA 60, 34, 34, 60, 34, 34, 60, 0
20 ch=4: FOR I=0T07: READ X
30 POKE 51200+8*CH+I,X
40 NEXT
```

POKE CODE	COLOUR REGISTER
0-63	53281
64-127	53282
128-191	53283
192-255	53284

the table is used by the character normally used by @. The second block of eight is used by the character A. And so on. For any given character CH, its data values start at:

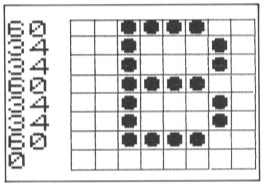
TABLE ADDRESS + CH*8

As an experiment, run Listing 1 as before putting the character table at 51200. Then type in and run Listing 2.

Note what happens to the letter D.

Using this approach is rather slow, Listing 3 gives a machine code alternative.

This code lives at $SC000 allowing you to use a relocated screen and character set as earlier. The code has



two routines. The first copies the ROM characters to a specified address, rather like lines 110 to 150 but faster. You call the routine with the command:

SYS 49152, ADDRESS

Listing 3

```
77  2000 FORL=0TO15:CX=0:FORD=0T
    O15:READA:CX=CX+A:POKE49152+
    L*16+D,A:NEXTD
B2  2010 READA:IFA<>CXTHENPRINT"
    ERROR IN LINE";2040+(L*10):S
    TOP
0F  2020 NEXTL:END
0D  2040 DATA76,6,192,76,153,192
    ,32,196,192,169,216,141,131,
    3,169,208,2152
C4  2050 DATA141,130,3,169,0,133
    ,253,173,130,3,133,254,165,2
    0,133,251,2091
67  2060 DATA165,21,133,252,141,
    238,3,141,233,3,173,14,220,4
    1,254,141,2167
2C  2070 DATA14,220,165,1,41,251
    ,133,1,160,0,177,253,145,251
    ,165,251,2228
A0  2080 DATA24,105,1,133,251,16
    5,252,105,0,133,252,24,165,2
    53,105,1,1969
B5  2090 DATA133,253,165,254,105
    ,0,133,254,165,253,208,222,1
    65,254,205,131,2900
4B  2100 DATA3,208,215,165,1,9,4
    ,133,1,102,21,173,14,220,9,1
    ,1279
DB  2110 DATA141,14,220,173,0,22
    1,41,3,168,173,232,3,56,249,
    149,192,2035
1C  2120 DATA141,232,3,78,232,3,
    78,232,3,173,24,208,41,240,1
    3,232,1933
C7  2130 DATA3,141,24,208,96,192
    ,128,64,0,32,227,192,32,206,
    192,169,1906
D0  2140 DATA0,141,237,3,32,253,
    174,32,138,173,32,247,183,17
    2,237,3,2057
1F  2150 DATA165,20,145,251,200,
    238,237,3,192,8,208,232,96,1
    73,238,3,2409
BE  2160 DATA141,239,3,96,32,253
    ,174,32,138,173,32,247,183,9
    6,6,251,2096
4F  2170 DATA38,252,6,251,38,252
    ,6,251,38,252,24,165,252,109
    ,233,3,2170
E4  2180 DATA133,252,96,32,196,1
    92,165,20,133,251,169,0,133,
    252,96,32,2152
34  2190 DATA144,97,32,134,97,16
    5,20,133,251,173,136,2,24,10
    5,4,133,1650
```

Where ADDRESS is the start of the character table. The routine also remembers where the character table is so always call it first in your program before trying to use the second routine.

The second routine redesigns a specified character and has the form:

SYS 49155,CH,B1,B2,B3,B4,B5,B6, B7,B8

Where CH is the character number and B1 to B8 are the bytes defining the character. To redefine D as B as done earlier, the command is:

SYS 49155,4,60,34,34,60,34,34,60,0

For a bit of a laugh try this one:

```
10SYS 49152,51200
20 FOR I=0TO999: POKE
50176+I,0:NEXT
30 FOR I=0TO7: A(I)=RND(1)*
256: NEXT
40 SYS 49155, 0,A(0),A(1),A(2),A(3),
A(4),A(5),A(6),A(7)
50 GOTO 20
```

Listing 3 works equally well in multicolour and extended background modes. To turn on multicolour character mode you must use:

POKE 53270, PEEK(53270)OR16

To turn it off, use:

POKE 53270, PEEK(53270)AND239

To turn on extended background mode, you must use:

POKE 53265, PEEK(53265)OR64

To turn it off, use:

POKE 53265, PEEK(53265)AND191

Bit Mapped Mode

This mode is a bit of a paradox. Whilst on one hand it offers the greatest scope for artistic creativity, it is also memory hungry. In essence, it uses two or three blocks of memory.

1. The bit map

This is an area of 64000 pixels arranged in 200 lines of 320. This occupies 8K of RAM.

2. The colour array

This holds the colour information and comprises of 1000 character cells.

3. The color matrix

Multicolour mode uses this area to hold one of the colours.-

The concepts discussed earlier with respect to telling the VIC chip where the bit map lies also apply here. Register 53272 holds the details of the bit map area (bits 1 to 3) and the colour array (bits 4 to 7). In other words the bit map occupies the character set area and the colour array occupies the screen memory.

To turn on the bit map, you must turn on bit 5 of register 53265:

POKE 53265, PEEK(53265)OR32

Register 53270 decides whether multicolour or high resolution modes is used:

Multicolour on:POKE 53270, PEEK(53270)OR16
Multicolour off: POKE 53270, PEEK(53270)AND239

So how do we select the colours? In high resolution mode, the colour array

holds this information. Each character cell value holds the paper colour in bits 0 to 3 and the ink colour in bits 4 to 7.

In multicolour, colours 1 and 2 are held in the colour array with colour 1 in bits 4 to 7 and colour 2 in bits 0 to 3. Colour 0 is held in register 53281 and colour 3 is held in the colour matrix. The colours are displayed by the bit combinations:

Colour 0. . .0 0
Colour 1. . .0 1
Colour 2. . .1 0
Colour 3. . .1 1

Since two pixels form a dot in multicolour mode, the horizontal resolution is limited to 160 points.

Any given pixel in the bit map is turned on with the following equations: Assuming that the pixel coordinates are X and Y and the bit map starts at the address BASE.

ROW = INT(Y/8)
CHAR = INT(X/8)
LINE = Y AND 7)
BIT = 7-(X AND 7)
BYTE = BASE + ROW *320 +
CHAR*8 + LINE
POKE BYTE, PEEK(BYTE) OR
2 ^ BIT

Using bit mapped mode from Basic is slow and over complex. Listing 4 gives a machine code package for handling bit mapped mode.

```
LISTING 4

EE  2000 FORL=0TO45:CX=0:FORD=0T
    O15:READA:CX=CX+A:POKE49152+
    L*16+D,A:NEXTD
82  2010 READA:IFA<>CXTHENPRINT"
    ERROR IN LINE";2040+(L*10):S
    TOP
0F  2020 NEXTL:END
7E  2040 DATA76,26,192,76,178,19
    2,76,16,193,76,178,194,32,25
    3,174,32,1964
7A  2050 DATA138,173,32,247,183,
    165,20,164,21,96,32,12,192,1
    41,136,3,1755
FC  2060 DATA32,12,192,141,132,3
    ,32,12,192,141,133,3,173,136
    ,3,240,1577
37  2070 DATA20,32,12,192,141,13
    4,3,32,12,192,141,135,3,173,
    136,3,1361
9C  2080 DATA240,3,76,187,194,17
    3,132,3,10,10,10,10,13,133,3
    ,141,1338
E0  2090 DATA137,3,32,133,192,32
    ,218,192,173,2,221,9,3,141,2
    ,221,1711
CE  2100 DATA173,0,221,41,252,9,
    0,141,0,221,173,17,208,9,32,
    141,1638
3E  2110 DATA17,208,169,121,141,
    24,208,173,136,3,240,8,173,2
    2,208,9,1860
68  2120 DATA16,141,22,208,96,16
    9,220,133,169,169,0,133,168,
    32,0,193,1869
D0  2130 DATA173,137,3,162,8,160
    ,127,145,168,136,16,251,72,2
    4,165,168,1915
E1  2140 DATA105,128,133,168,169
    ,0,101,169,133,169,104,202,2
    08,231,32,8,2060
C1  2150 DATA193,96,173,2,221,9,
    3,141,2,221,173,0,221,41,252
    ,9,1757
29  2160 DATA3,141,0,221,173,17,
    208,41,223,141,17,208,169,21
    ,141,24,1748
3F  2170 DATA208,173,22,208,41,2
    39,141,22,208,96,169,224,133
    ,169,169,0,2222
70  2180 DATA133,168,169,0,162,6
    4,160,127,145,168,136,16,251
    ,72,24,165,1960
D2  2190 DATA168,105,128,133,168
    ,169,0,101,169,133,169,104,2
    02,208,231,96,2284
5A  2200 DATA120,165,1,41,249,13
    3,1,96,165,1,9,6,133,1,88,96
    ,1305
A3  2210 DATA32,12,192,141,138,3
    ,140,139,3,32,12,192,141,147
    ,3,32,1359
FD  2220 DATA12,192,141,140,3,17
    3,136,3,240,3,76,235,193,32,
    77,193,1849
20  2230 DATA32,133,194,32,0,193
    ,173,147,3,160,0,174,140,3,2
    40,6,1630
55  2240 DATA32,166,194,76,73,19
    3,32,171,194,32,8,193,96,173
    ,147,3,1783
03  2250 DATA74,74,74,141,141,3,
    173,139,3,74,173,138,3,106,7
    4,74,1454
BB  2260 DATA141,142,3,173,147,3
    ,41,7,141,145,3,173,141,3,14
    1,143,1547
01  2270 DATA3,169,0,141,144,3,1
    62,6,32,220,193,202,208,250,
    173,144,2050
27  2280 DATA3,133,171,173,143,3
    ,133,170,32,220,193,32,220,1
    93,24,173,2016
2B  2290 DATA143,3,101,170,133,1
    70,173,144,3,101,171,133,171
    ,169,0,141,1926
82  2300 DATA144,3,173,142,3,141
    ,143,3,32,220,193,32,220,193
    ,32,220,1894
90  2310 DATA193,24,173,143,3,10
    1,170,133,170,173,144,3,101,
    171,133,171,2006
4B  2320 DATA24,173,145,3,101,17
    0,133,170,169,0,101,171,133,
    171,24,169,1857
E9  2330 DATA0,101,170,133,170,1
    69,224,101,171,133,171,96,16
    9,0,14,144,1966
BC  2340 DATA3,14,143,3,109,144,
    3,141,144,3,96,14,138,3,46,1
    39,1143
B5  2350 DATA3,173,138,3,141,148
    ,3,173,139,3,141,149,3,173,1
    47,3,1540
54  2360 DATA141,150,3,173,140,3
    ,240,19,201,1,240,26,201,2,2
    40,33,1813
72  2370 DATA169,1,32,60,194,169
    ,1,32,60,194,96,169,0,32,60,
    194,1463
FE  2380 DATA169,0,32,60,194,96,
    169,0,32,60,194,169,1,32,60,
    194,1462
A0  2390 DATA96,169,1,32,60,194,
    169,0,32,60,194,96,141,151,3
    ,173,1571
C6  2400 DATA148,3,141,138,3,173
    ,149,3,141,139,3,173,150,3,1
    41,147,1655
F0  2410 DATA3,32,77,193,32,133,
    194,32,0,193,173,147,3,160,0
    ,174,1546
95  2420 DATA151,3,240,6,32,166,
    194,76,109,194,32,171,194,32
    ,0,193,1793
B9  2430 DATA24,173,148,3,105,1,
    141,148,3,173,149,3,105,0,14
    1,149,1466
B6  2440 DATA3,32,8,193,96,173,1
    38,3,41,7,141,146,3,56,169,7
    ,1216
BC  2450 DATA237,146,3,141,146,3
    ,24,169,1,174,146,3,240,4,10
    ,202,1649
0E  2460 DATA208,252,141,147,3,9
    6,17,170,145,170,96,73,255,4
    9,170,145,2137
D6  2470 DATA170,96,32,12,192,14
    1,136,3,76,88,192,173,132,3,
    141,33,1620
F1  2480 DATA208,173,135,3,141,1
    34,2,169,147,32,210,255,173,
    133,3,10,1928
10  2490 DATA10,10,10,13,134,3,7
    6,79,192,191,0,191,0,191,0,1
    91,1291
```

This code starts at 49152 and has three routines.

1. Activate bit map

This clears the bit map, set up the colours and turns on bit map mode. It has two forms:

High resolution mode: SYS 49152,0,C1,C2.

C1 = paper colour, C2 = ink colour.

Multicolour mode: SYS 49152,1,C0, C1,C2,C3.

C0 = paper colour

2.Return to text mode.

This returns you to the normal text screen at its normal position, SYS 49155.

3. Draw point

This draws the points at X,Y with the specified pen: SYS 49158,X,Y,PEN where:

PEN = 0 draws the point in paper

colour, i.e. it erases the point.
PEN = 1 draws the point in ink 1.
PEN = 2 draws the point in ink 2.
PEN = 3 draws the point in ink 3.

In high resolution mode, X must be in the range 0 to 319. In multicolour mode, X must be in the range 0 to 159. In either mode, Y must be in the range 0 to 199.

In order to keep the routine as short as possible. I have omitted any range checking of the co-ordinates. If you use values outside the allowed range, a crash may occur.

4.Turn on bit map.
Without clearing it: SYS 49161, MODE. MODE = 0, high resolution. MODE = 1, multicolour.

So that you don't loose any memory for Basic, the bit map is placed behind the Kernal ROM and interface chip.
Listing 5 is a simple demonstration.

LISTING 5

```
10 SA=12*4096
20 SYS SA,1,15,11,12,0
30 X1=5:Y1=5:X2=30:Y2=30:PA=
   1:GOSUB1000
40 X1=10:Y1=10:X2=20:Y2=20:P
   A=2:GOSUB1000
50 X1=27:Y1=1:X2=35:Y2=50:PA
   =3:GOSUB1000
60 FOR X = 0 TO 50
70 SYS SA+6,X+0,X,RND(1)*4:N
   EXT X
80 O=O+1:IFO<10THENGO
90 END
1000 FOR Y=Y1TOY2
1010 FOR X=X1TOX2
1020 SYS SA+6,X,Y,PA
1030 NEXT X,Y
1040 RETURN
```

Sprites

Sprites are probably the thing which makes games writer's lives simplest. To those of you who don't know, a spriate is a moveable block of 504 pixels arranged in a block of 21 rows of 24. The design is stored in a similar way to characters in that each row can be represented by 3 bytes with the whole design occupying 63 bytes. These designs are stored as a sequence of blocks in any given bank. The address of any given sprite block is given by:

ADDRESS = (BANK*16384) + (BLOCK NO*64)

Specifying a sprite design

The next step is to tell the VIC which pattern block is to be used. A maximum of eight sprites are possible and each has a pointer. These pointers are located above the screen memory and can be found by:

POINTER ADDRESS = SCREEN ADDRESS + 1014 + SPRITE NO

where SPRITE NO is from 0 to 7

A power up, the screen sits at 1024 so the pointer for sprite 3 is at 1024+1014+3 or 2043. To tell the VIC which pattern to use, you simply POKE the block number into the pointer, eg to set sprite 1 to pattern 43:

POKE 2041, 43

Turning on a Sprite
Whether or not a sprite is visible is determined by VIC register 53269. Each bit of this register controls a sprite. To activate sprite SP use:

POKE 53269, PEEK(53269) OR (2 ^SP)

To turn off sprite SN use:

POKE 53269, PEEK(53269) AND 255-2 ^SP)

Expanded Sprites
Sprites can be expanded in both directions to give four possible sizes. These are controlled by two registers. To expand sprite SP in the X direction use:

POKE 53277,PEEK(53277) OR (2 ^SP)

To reduce it again use:

POKE 53277,PEEK(53277) AND (255-2 ^SP)

To expand sprite SP in the Y direction use:
POKE 53271, PEEK(53271) OR (2 ^SP)

To reduce it again use:

POKE 53271,PEEK(53271) AND (255-2 ^SP)

Colours
Each sprite has a colour register. This is given by:
REGISTER = 53287 + SPRITE NO

This is used to specify the colour of high resolution sprites

In multicolour sprites the colours are selected by the usual bit pairs, see Table 3.

The eight bits in register 53276 control the colour mode.

To set a sprite SP to multicolour mode use:

POKE 53276, PEEK(53276) OR (2 ^SP)

To set sprite SP to high resolution mode use:

POKE 53276, PEEK(53276) AND (255-2 ^SP)

Positioning a Sprite
The positioning of any given sprite on the screen is defined by its X,Y co-ordinates. The X co-ordinate can range from 0 to 512 and Y co-ordinate from 0 to 256. Each sprite has a dedicated pair of registers. The first holds part of the X position and the other holds the Y co-ordinates. They can be found from:

X Register = 53248 + SN*2

and the Y register is found from:

Y Register = 53249 + SN*2

The X position is defined in two parts:

Most significant byte (msb) = INT(XPOS/256)

Least significant byte (lsb) = XPOS-msb*256

Register 53264 holds the msb details, one bit per sprite

So to position a sprite you use:

POKE XREG,LSB
POKE YREG,Y

If msb=1 then POKE 53264, PEEK(53264) OR 2 ^SP).
If msb=0 then POKE 53264, PEEK(53264) AND (255-2 ^SP).

Table 4.

BIT PAIR	COLOUR SOURCE
0 0	Screen colour
0-1	Register 53285
1 0	Colour register
1 1	Register 53286

Selecting Colour Mode

Priorities

Each sprite has a priority which decides whether it appears in front of or behind the characters on the screen. Register 53275 decides this, one bit per sprite

To put sprite SP behind the characters use:

POKE 53275, PEEK(53275) OR (2 ^SP)

To put sprite SP in front of the characters use:

POKE 53275, PEEK(53275) AND (255-2 ^SP)

That's quite a mouthful and hardly conducive to simple programming. Listing 6 gives the ubiquitous machine code package.

This code has four routines.

Setup Sprite

SYS 49408,SP,TYPE,COLOUR, XEXP,PRIORITY,(COLOUR1, COLOUR2)

where: SP sprite number (0 t0 7).
TYPE-0=High resolution, 1=Multi-colour.
COLOUR - High resolution colour.
XEXP - 1= X direction, o=don't expand X direction.
YEXP - 1=expand Y direction, 0=don't expand y direction.
PRIORITY-1=behind background, 0=in front of background.
COLOUR1 - Multicolour 1, only needed if TYPE =1.
COLOUR2 - Multicolour 2, only needed if TYPE=1.

Switch on

SYS 49411,SP,FLAG where:

FLAG=1 - turn on sprite SP.
FLAG=0 - turn off sprite SP.

Sprite position

SYS 49414,SP,X,Y where:
SP - sprite number.
X - X position.
Y - Y position.

Pattern

SYS 49417,SP,DESIGN, BLOCK

The routine is quite smart in that it sorts out which bank you are using and where the sprite pointers are. I therefore recommend that you use the configuration used earlier (screen at 50176 and characters at 51200. This allows you a block of 128 sprites from design block 128 to 255.

In Summary

In all, this has been a hefty slab of information and I must apologise for not giving more detail. If you want to really get into graphics you must invest in the Programmers Reference Guide or something similar. Having said that, I believe that the routines I've given will be useful tools.

```
62  2000 FORL=0TO30:CX=0:FORD=0T
    015:READA:CX=CX+A:POKE49408+
    L*16+D,A:NEXTD
B2  2010 READA:IFA<>CXTHENPRINT"
    ERROR IN LINE";2040+(L*10):S
    TOP
0F  2020 NEXTL:END
F1  2040 DATA76,194,194,76,12,19
    3,76,66,193,76,241,193,32,14
    4,194,32,1932
C3  2050 DATA134,194,165,20,41,1
    ,240,13,172,133,3,185,50,193
    ,13,21,1578
F0  2060 DATA208,141,21,208,96,1
    72,133,3,185,58,193,45,21,20
    8,141,21,1854
AD  2070 DATA208,96,1,2,4,8,16,3
    2,64,128,254,253,251,247,239
    ,223,2026
C3  2080 DATA191,127,32,144,194,
    32,134,194,165,20,164,21,141
    ,134,3,140,1836
3E  2090 DATA135,3,32,134,194,16
    5,20,141,136,3,173,133,3,24,
    10,168,1474
B3  2100 DATA173,134,3,153,0,208
    ,173,136,3,200,153,0,208,173
    ,135,3,1855
D1  2110 DATA240,13,172,133,3,18
    5,50,193,13,16,208,141,16,20
    8,96,172,1859
3B  2120 DATA133,3,185,58,193,45
    ,16,208,141,16,208,96,41,1,2
    40,13,1597
F4  2130 DATA172,133,3,185,50,19
    3,13,28,208,141,28,208,96,17
    2,133,3,1766
6B  2140 DATA185,58,193,45,28,20
    8,141,28,208,96,32,134,194,1
    65,20,41,1776
0B  2150 DATA1,240,15,172,133,3,
    185,50,193,13,29,208,141,29,
    208,76,1696
57  2160 DATA206,193,172,133,3,1
    85,58,193,45,29,208,141,29,2
    08,32,134,1969
BB  2170 DATA194,165,20,41,1,240
    ,13,172,133,3,185,50,193,13,
    23,208,1654
1F  2180 DATA141,23,208,96,172,1
    33,3,185,58,193,45,23,208,14
    1,23,208,1860
CA  2190 DATA96,32,144,194,32,13
    4,194,165,20,133,251,173,136
    ,2,24,105,1835
D3  2200 DATA4,133,254,169,0,133
    ,253,56,165,253,233,8,133,25
    3,165,254,2466
F1  2210 DATA233,0,133,254,172,1
    33,3,165,251,145,253,96,192,
    128,64,0,2222
85  2220 DATA32,134,194,165,20,4
    1,1,240,13,172,133,3,185,50,
    193,13,1589
54  2230 DATA27,208,141,27,208,9
    6,172,133,3,185,58,193,45,27
    ,208,141,1872
60  2240 DATA27,208,96,32,159,19
    4,169,0,141,142,3,32,95,194,
    172,142,1806
6C  2250 DATA3,145,253,200,192,6
    4,240,6,140,142,3,76,75,194,
    96,169,1998
15  2260 DATA255,141,14,212,141,
    15,212,169,128,141,18,212,16
    9,128,141,24,2120
A6  2270 DATA212,173,27,212,96,3
    2,134,194,165,20,141,37,208,
    32,134,194,2011
2D  2280 DATA165,20,141,38,208,9
    6,32,253,174,32,138,173,32,2
    47,183,96,2028
9B  2290 DATA32,134,194,165,20,2
    01,8,144,2,169,7,141,133,3,9
    6,32,1481
8D  2300 DATA134,194,165,20,133,
    253,169,0,133,254,162,6,6,25
    3,38,254,2174
5D  2310 DATA202,208,249,173,0,2
    21,41,3,168,185,28,194,24,10
    1,254,133,2184
09  2320 DATA254,96,32,144,194,3
    2,134,194,165,20,141,141,3,3
    2,140,193,1915
7F  2330 DATA32,134,194,165,20,1
    72,133,3,153,39,208,32,170,1
    93,32,32,1712
52  2340 DATA194,173,141,3,240,3
    ,32,117,194,96,133,3,96,32,2
    28,255,1940
```

Swapper 64

Use part of your C64's memory as a RAM disk for storing Basic programs.

Swapper 64 is a utility which allows a Basic program resident in memory to be stored in RAM for recall later, rather like a RAM−disk. Commands are available for storing and recalling a program. Swapping the program in Basic memory for that in storage, and storing part of a program (linenumber to linenumber).

The program can be used either in direct mode or in program mode, the latter being especially useful for utilising two programs held concurrently in memory − one in basic memory and one in storage. These can be rapidly interchanged when desired via the swap command.

Using the program

Upon initialising the program, the top of Basic memory is lowered to prevent a program overwriting the storage area. This leaves the user with 19K of Basic RAM which should be enough for most programs.
Swapper 64 has five commands which are activated by the syntax:

SYS 49152,command number (1−5),condition 1, condition 2

The commands are as follows:

1 − **Initialise**

SYS 49152,1

This lowers the top of Basic memory to $5400 to prevent overwriting the storage area. This should always be the first command executed when Swapper 64 is to be used.

2 − **Store**

SYS 49152,2

This command stores the resident Basic program into memory. this can be recalled using command three or swapped with another program using command four.

3 − **Recall**

SYS 49152,3 − recall program
SYS 49152,3,1 − recall program and auto−run

This function recalls a program in storage, overwriting any program currently in basic memory. If a one is added to the SYS statement, the recalled program will auto−RUN. Make sure that there is a program in storage before you call this command.

Once recalled the storage area is NOT cleared. This means that a program can be recalled more than once if accidently NEWed.

4 − **Swap**

SYS 49152,4 − swap Basic program with stored program
SYS 49152,4,1 swap Basic program with stored program and auto−run.

Using this command swaps the program in basic memory with a program stored in RAM. As in command three, if a one is added to the SYS instruction, the recalled program will auto−run. Again, ensure that there is a program in stored memory before calling this instruction.

5 − **Store part of a program**

SYS 49152, beginning line, end line.

This stores only the part of the program specified by the beginning line and end line numbers stated in the SYS statement. This commands main use is for when two programs are to be set up in memory to utilise the swap command. The programer can skip the initial lines of the first program stored (these are the lines that LOAD in the next part) so that they are not re−run every time this program is re−called from memory.
For example the first program LOAded would have initial lines something like those in Figure 1. The lines have the following function:

By Chris Horton

10 If swapper has been LOADed then skip lines 20 and 30

20 Set A to show that *SWAPPER* will have been LOADed

30 LOAD *SWAPPER* into memory

40 Initialise memory

50 SAVE the part of *PROG1* that is wanted

60 LOAD next program

Figure 1

```
10 IF A=1 THEN 40

20 A=1

30 LOAD "SWAPPER64",1 (or ',8' for disk) ,1

40 SYS 49152,1

50 SYS 49152,5,70,end line of program

60 LOAD "PROG2",1 (or ',8' for disk)

70 REM *START OF PROGRAM 1*
```

PROGRAM: SWAPPER LDR

```
19   10 BL=50:LN=70:SA=49152
F9   20 FOR L=0 TO BL:CX=0:FOR D=
     0 TO 15
9F   30 READ A:IF A>255THENPRINT"
     NUMBER TO LARGE";LN+(L*10):S
     TOP
28   40 CX=CX+A:POKE SA+L*16+D,A:
     NEXT D
A9   50 READ A:IF A><CX THENPRINT
     "ERROR IN LINE";LN+(L*10):ST
     OP
4C   60 NEXT L:END
F1   70 DATA 32,253,174,32,138,17
     3,32,247,183,165,21,208,44,1
     65,20,240,2127
64   80 DATA 40,201,6,176,36,201,
     1,240,23,201,2,240,13,201,3,
     240,1824
64   90 DATA 12,201,4,240,14,201,
     5,240,13,0,76,62,192,76,87,1
     92,1615
C4   100 DATA 76,71,193,76,80,193
     ,76,228,193,162,11,76,55,164
     ,32,118,1804
C0   110 DATA 192,160,0,177,251,1
     45,253,76,145,192,162,0,181,
     43,157,59,2193
A4   120 DATA 195,232,224,14,208,
     246,96,32,20,193,32,105,192,
     32,118,192,2131
A6   130 DATA 160,0,177,253,145,2
     51,76,180,192,162,0,189,59,1
     95,149,43,2231
52   140 DATA 232,224,14,208,246,
     96,169,0,133,251,169,8,133,2
     52,165,45,2345
A1   150 DATA 141,39,195,165,46,1
     41,40,195,169,0,133,253,169,
     84,133,254,2157
AB   160 DATA 96,230,251,208,2,23
     0,252,230,253,208,2,230,254,
     165,252,205,3068
B3   170 DATA 40,195,240,3,76,67,
     192,165,251,205,39,195,240,3
     ,76,67,2054
5B   180 DATA 192,76,74,192,230,2
     51,208,2,230,252,230,253,208
     ,2,230,254,2884
37   190 DATA 165,252,205,40,195,
     240,3,76,98,192,165,251,205,
     39,195,240,2561
2F   200 DATA 3,76,98,192,165,43,
     133,251,165,44,133,252,32,22
     ,195,160,1964
0B   210 DATA 0,169,0,145,251,76,
     59,193,230,251,208,2,230,252
     ,230,253,2549
BC   220 DATA 208,2,230,254,165,2
     52,201,84,240,3,76,137,193,3
     2,102,193,2372
E1   230 DATA 165,43,133,251,165,
     44,133,252,32,22,195,160,0,1
     69,0,145,1909
22   240 DATA 251,76,59,193,169,4
     4,160,0,209,122,240,6,169,0,
     141,37,1876
FA   250 DATA 195,96,32,253,174,3
     2,138,173,32,247,183,165,21,
     208,237,165,2351
D1   260 DATA 20,201,1,208,231,16
     9,1,141,37,195,96,173,37,195
     ,208,1,1914
23   270 DATA 96,32,89,166,76,174
     ,167,169,255,133,55,169,83,1
     33,56,96,1949
FA   280 DATA 32,20,193,169,0,133
     ,251,169,8,133,252,169,0,133
     ,253,169,2084
8F   290 DATA 84,133,254,76,126,1
     93,162,0,181,43,141,41,195,1
     89,59,195,2072
B6   300 DATA 149,43,173,41,195,1
     57,59,195,232,224,14,208,235
     ,96,160,0,2181
88   310 DATA 140,35,195,140,34,1
     95,140,36,195,177,251,141,41
     ,195,177,253,2345
B1   320 DATA 145,251,201,0,208,1
     1,173,34,195,208,6,238,35,19
     5,76,164,2140
04   330 DATA 193,140,35,195,173,
     41,195,145,253,173,35,195,20
     1,0,240,21,2238
48   340 DATA 165,252,197,46,208,
     12,165,251,197,45,208,6,76,2
     15,193,76,2312
0D   350 DATA 253,192,76,232,192,
     169,1,141,34,195,238,36,195,
     173,36,195,2358
96   360 DATA 201,2,240,235,76,17
     6,193,238,36,195,173,36,195,
     201,2,240,2439
53   370 DATA 222,76,194,193,32,2
     53,174,32,138,173,32,247,183
     ,165,20,141,2275
31   380 DATA 42,195,165,21,141,4
     3,195,32,253,174,32,138,173,
     32,247,183,2066
98   390 DATA 165,20,141,44,195,1
     65,21,141,45,195,173,43,195,
     205,45,195,1988
DD   400 DATA 240,25,176,34,165,4
     3,133,251,165,44,133,252,162
     ,0,181,43,2047
E5   410 DATA 157,50,195,232,224,
     5,208,246,76,57,194,173,42,1
     95,205,44,2303
17   420 DATA 195,176,3,76,20,194
     ,76,57,192,173,42,195,141,48
     ,195,173,1956
04   430 DATA 43,195,141,49,195,3
     2,217,194,32,22,195,32,22,19
     5,32,22,1618
1F   440 DATA 195,165,251,141,38,
     195,165,252,141,39,195,173,4
     6,195,133,251,2575
59   450 DATA 173,47,195,133,252,
     173,44,195,141,48,195,173,45
     ,195,141,49,2199
E3   460 DATA 195,32,217,194,173,
     46,195,133,251,173,47,195,13
     3,252,165,251,2652
BD   470 DATA 141,55,195,165,252,
     141,56,195,177,251,141,57,19
     5,169,0,145,2335
9A   480 DATA 251,32,15,195,177,2
     51,141,58,195,169,0,145,251,
     32,15,195,2122
28   490 DATA 173,38,195,133,43,1
     73,39,195,133,44,165,251,133
     ,45,165,252,2177
8A   500 DATA 133,46,32,62,192,16
     2,0,189,50,195,149,43,232,22
     4,5,208,1922
C4   510 DATA 246,173,55,195,133,
     251,173,56,195,133,252,160,0
     ,173,57,195,2447
6E   520 DATA 145,251,200,173,58,
     195,145,251,96,160,0,177,251
     ,141,46,195,2484
74   530 DATA 32,15,195,177,251,2
     40,24,141,47,195,32,15,195,1
     77,251,205,2192
E1   540 DATA 48,195,208,14,32,15
     ,195,177,251,205,49,195,208,
     4,96,76,1968
BE   550 DATA 57,192,173,46,195,1
     33,251,173,47,195,133,252,76
     ,219,194,230,2566
B5   560 DATA 251,208,2,230,252,9
     6,166,251,202,134,251,224,25
     5,208,2,198,2930
56   570 DATA 252,96,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0,348
```


Continued on page 88

128 Disk Utility

Create auto boot disks and much more with this powerful utility.

How many times have you wanted to load a program from the directory and been frustrated to see the SYNTAX ERROR message appear when you press RETURN? The reason for this is that the letters PRG still existed on the command line when you pressed the RETURN key. It is very annoying and is the main reason that I decided to write the C128 Disk Utility.

If you wish to LOAD a program directly from the directory listing you must either remove the three characters (usually PRG) representing the filetype, from the line or you could place a colon before them before pressing return. In effect your command line would look like this.

DLOAD "program name" : PRG

This is a valid command.This program will modify any file you wish, to enable you to simply type DLOAD before the file name in the directory listing. It does this by modifying the disk directory and placing a colon outside the quotes but before the filetype flag so that each directory entry will look like the above.

C128 Disk Utility has many other functions as well but the *put colon after filename* feature is probably the most useful. It is well worth the trouble of obtaining a copy of *C128 Disk Utility* simply to have it available.

Other Options

128 Disk Utility also offers the user the following functions:

RENAME FILES
INITIALIZE THE DISK DRIVE
DISPLAY DIRECTORY OF DISK
MAKE A BOOT DISK
PRINT DIRECTORY IN DETAIL
DELETE FILES ON DISK
1541/1571 FORMAT A DISK
CLEAN UP A DISK
LOCK A FILE AGAINST SCRATCH
UNLOCK THE FILE AGAIN
PERFORM A QUICK SCAN AND DELETE
RECOVER A SCRATCHED FILE
QUIT THE PROGRAM
CHANGE SCREEN COLOURS

As you can see, *C128 Disk Utility* is a very valuable addition to your program library.

Each function of the program is described below.

RUNNING THE PROGRAM.

C128 Disk Utility is written completely in Basic V7.0, so it is simply LOADed, SAVEed and RUN as any other Basic program. There will be a short delay while the program initialises variables and strings.

RENAMING FILES.

This is selected from the main menu as are the rest of the functions available.

To select from the menu, move the pointer at the right of the menu block up and down using the cursor up/down keys, until it points to the function that you want.

After you make your selection press RETURN to indicate to the computer that you want to accept the function the arrow is pointing to.

Selecting RENAME FILES will gain entry to a sub−menu. This menu works in exactly the same way as the main menu. You may select from PLACE COLON AFTER FILENAME, RENAME FILES, or GO TO MAIN MENU. Couldn't be simpler right?. Should you select the PLACE COLON AFTER FILENAME option you will be asked if you want to perform the operation on all the files on the disk or by selection from the directory. Select the former and the machine will carry out its operation on all the files providing there is sufficient room after the filename for the necessary change to the directory.

Any errors will be reported and the program always defaults back to the main menu after an error occurs.

If you elect to choose files to be altered there will be a short delay while the program memorizes the directory and you will then be offered the files on the disk one after another and asked if you wish to alter them. You will be able to select one of three possible replies to the prompt, these are "Y" for yes, "N" for no, or "C" for cancel everything and go back to the menu. This holds true for virtually all modes in C128 Disk Utility.

INITIALIZE DRIVE

This will clear the error channel on the drive and perform a dclear.

DISPLAY DIRECTORY

Selecting this mode will print the directory on the screen. You may slow the display down by pressing the COMMODORE key, or pause the display by pressing the NO scroll key. Follow the prompt on the screen to return to the main menu.

MAKE A BOOT DISK

As the name suggests, this allows you to make a disk which is BOOTable on the C128 computer. A BOOTable disk is one which will load a nominated program, either by pressing the reset button, entering the command BOOT (RETURN), or switching the computer on with the disk in the drive. Your C128 manual will explain this further. To create a BOOT disk with C128 Disk Utility you should follow the procedure below.

Select the disk you wish to BOOT. It may have been used before or not.If not it will have to be formatted first. This is therefore the first question you will be asked, FORMAT DISK? (Y/N). Select

By K.R.Sharkey

the appropriate answer. See the part of this article pertaining to formatting disks for information about this.

You now should have formatted in the drive either with or without any programs on it. *C128 Disk Utility* will now perform a check of track one to ensure that there is no chance of writing over any data on the disk. The program will report if it is safe to proceed, at the same time asking for your assurance that you want to continue. If you reply NO there will be no harm done to the disk and you will be returned to the main menu, however, if you wish to continue you will be asked for the name of the program to be BOOTed. Upon answering this question you are asked if the program is a Basic program if you reply NO then the boot will be a non−relocatable boot, otherwise the boot will be for a Basic program.

The BOOT sector will now be written to the disk and you may SAVE the program you wish to boot,if it is not already there.

When you wish to LOAD and RUN the program simply BOOT the disk (see your Commodore manual for more details) and it will come up RUNning.

PRINT DIRECTORY

This function prints out a detailed directory onto the printer or the screen. To nominate the screen, switch the printer off and the program will default to the screen.

Only one question needs to be answered in this mode and that is whether or not to show files in the directory which have been scratched. This can be handy if you are looking for a deleted file on a disk which you may be able to recover using *C128 Disk Utility*

The printout of the directory will show the following information:

DISK NAME
DISK ID
DISK FORMAT (usually 2A)
FILETYPE OF PROGRAM
TRACK WHERE IT LIVES
SECTOR ON THAT TRACK
FILENAME OF PROGRAM
NUMBER OF BLOCKS USED
START LOCATION IN C128
BLOCKS FREE ON DISK

DELETE FILES

This mode works exactly the same as **RENAME** except it deletes the file rather than renaming it. You are still given the option of which programs to scratch from the disk. If you make a mistake don't panic *C128 Disk Utility* can recover the program, so read on.

FORMAT A DISK

Any disk to be used on a Commodore C128 must first be formatted. Most of you will have learned this already, but if not please refer to the manual which came with your computer for details.

This section of the program allows you to format a disk without the need to know the necessary syntax. All you have to know is whether you want the disk in 1571 double sided format or 1541 single sided format, and what name you would like to give the disk.

C128 Disk Utility takes care of things from now on. If you wish you can even forget about the disk name and ID as the program will give the disk one for you. Any errors occurring during the preparation of the new disk will be reported, and eventually you will be passed back to the main menu.

If you elect not to give a name and ID for the disk and the disk has been used before, the program will do a fast directory clear out on the disk, which only takes a few seconds. Please note that you cannot recover any programs from the disk with *C128 Disk Utility* once a format has been carried out, so be careful.

COLLECT

Collect is the same as the COLLECT command in Basic V7.0. Disks in use should be COLLECTed periodically to ensure that they have a valid BAM (Block Allocation Map) and that they are using up disk space efficiently. A COLLECT should always be done after you recover any scratched file using this program.

LOCK/UNLOCK A FILE

It is not commonly known that it is possible to put a security lock flag on a file to prevent that file from inadvertantly being scratched. This function does just that. When you select this part of the program, you will be passed to the FILETYPE EDITOR part of *C128 Disk Utility*. Simply follow the prompts on the screen and you won't go wrong.

If you elect to place a lock on a program, it will appear in the directory as a'(' symbol beside the filetype.

By selecting unlock (simply press U when you are offered the program you wish to unlock) you can remove the lock.

QUICK DELETE/RECOVER FILES

Once a program or file has been scratched from the disk it is still possible to recover it providing the area on the disk which the program occupies has not been over written by a subsequent write to the disk. If it is at all possible to recover the file this feature of *C128 Disk Utility* will do it. Select R when the program you wish to recover appears on the screen.

You will now be asked which type of file to recover, and your options are:

0=DELETED (not normally used)
1=SEQUENTIAL (usually text)
2=PROGRAM (normally this one)
3=USER (special user design)
4=RELATIVE (usually a database)

Select the number corresponding to the filetype you require and the program will be recovered as that type of file. It is always wise to carry out a COLLECT of the disk after this is done.

Quick Delete is a much faster way to delete a selected file than the previous Delete function. This is because it doesn't have to read the whole directory before it commences, it also does not clean up the BAM after it is finished.

Should you press the return key at the prompt in the Filetype Editor then no change will occur on the disk and you will be offered the next file in the directory.

QUIT

Quit does just that. It restores the default Commodore colours and returns control to BASIC.

CHANGE COLOURS

This has been added to the program just in case you don't like my colour selection. Enter a number between one and sixteen and you will be asked if it is correct. Answer YES or NO and press RETURN. If you selected yes the colour will be transfered to the screen and you will then be asked to select a new border and then a new character colour.

If you answer NO when asked if your selection is correct you will be asked again to enter a new colour.

I hope you find the *C128 Disk Utility* useful in maintaining your disk files.

```
PROGRAM: 128 DISK UTIL



1 REM  ************************
*************************************
**************
2 REM  *                          DI
SK UTILITY PROGRAM
       *
3 REM  *--------------------------
--------------------------------------
-------------*
4 REM  *
       BY
       *
5 REM  *
  K. R. SHARKEY
       *
6 REM  *--------------------------
--------------------------------------
-------------*
7 REM  *   TO USE SIMPLY RUN THI
S PROGRAM - IT WILL GIVE THE OPT
ION OF     *
8 REM  *   EITHER CONVERTING ALL
 FILES ON DISK OR SELECTING CERT
AIN FILES  *
9 REM  *   THE FILES WILL THEN BE
 RENAMED TO ALLOW DLOAD TO BE US
ED IN      *
10 REM *   FRONT OF THEIR NAME O
N THE DIRECTORY LISTING WITHOUT
THE        *
11 REM *   ANNOYANCE OF HAVING T
O INSERT A COLON AFTER THE FILE
NAME OR    *
12 REM *   CLEARING OUT THE REST
 OF THE LINE ON THE SCREEN.
       *
13 REM *

       *
14 REM *  A BOOT DISK CAN BE CRE
ATED BY SIMPLY SELECTING 'MAKE B
OOT DISK'  *
15 REM *  ON THE MENU AND THEN A
NSWERING THE PROMPTED QUESTIONS.
       *
16 REM *

       *
17 REM *  PROGRAMS CAN BE RENAME
D OR DELETED ON THE DISK IN THE
DRIVE BY   *
18 REM *  SELECTING THE CORRECT
COMMAND FROM THE MENU & ANSWERIN
G THE PROMPTS.*
19 REM *

       *
20 REM *  LOCK/UNLOCK WILL ALLOW
 YOU TO LOCK A FILE SO THAT IT C
ANNOT BE   *
21 REM *  SCRATCHED OR UNLOCK IT
 AGAIN AT WILL. RESTORE RECOVERS
 SCRATCHED *
22 REM *  FILES. NOTE: IT IS WIS
E TO VALIDATE THE BAM AFTER UNSC
RATCHING.  *
23 REM *

       *
24 REM *  SELECT 'PRINT DIRECTOR
Y' AND A DETAILED DIRECTORY WILL
 BE LISTED ON *
25 REM *  THE PRINTER. 'COLLECT'
 WILL CLEAN UP THE BAM ON THE DI
SK.        *
26 REM **************************
**************************************
**************
27 COLOR RGR(0),1:COLOR4,1:COLOR
5,15:IFRGR(0)=5THENPRINTCHR$(27)
;"R"
28 CLR:DIM5$(15),NA$(120),NE$(12
0):BE$=CHR$(7)+CHR$(15)
29 TY$(0)="DELETED   ":TY$(1)="S
EQUENTIAL":TY$(2)="PROGRAM   ":T
Y$(3)="USER      ":TY$(4)="RELAT
IVE  "
30 TRAP292:REM ROUTINE TO HANDLE
 ERRORS
31 :
32 REM  **** DISPLAY MENU ****
33 :
34 SCNCLR:FAST:GS=1:YU=15:RESTOR
E366:IF MID$(S$(4),10,1 )="R"THE
N35:ELSEGOSUB298
35 IFRGR(0)=5THENWINDOW0,0,79,24
:ELSEWINDOW0,0,39,24
36 SLOW:SCNCLR:CHAR1,5,0,"     M
AIN MENU     ",1:GOSUB37:GOTO41
37 FORXT=4TOYU:CHAR1,0,XT,S$(XT)
,1:NEXT
38 CHAR1,1,17,"USE CRSR U/D TO S
ELECT"
39 CHAR1,1,19,"PRESS RETURN TO A
CCEPT SELECTION"
40 X=30:Y=6:CHAR1,X,Y,"[RVSON]_C
RVSOFF]":RETURN
41 GOSUB54
42 :
43 IF GSTHEN ON Y GOSUB,,,48,80,
85,91,132,137,142,171,309,309,17
9,372
44 IFGS=0THEN ON Y GOSUB,,,61,75
,78:RETURN
45 RETURN
46 :
47 REM  **** RENAME FILES ****
48 :
49 GOSUB 187:SCNCLR
50 FAST:GS=0:YU=6:RESTORE 368:GO
SUB298:SLOW
51 CHAR1,5,0,"     RENAME MENU
   ",1
52 GOTO36
53 REM  ****  MAIN LOOP  ****
54 DO:GET A$:LOOP UNTIL A$="[DOWN
]"OR A$="[UP]"ORA$=CHR$(13)
55 IFA$=CHR$(13)THENGOSUB43:GOTO
29
56 IFA$="[DOWN]"THENP$=" ":GOSUB
59:Y=Y+1:P$="[RVSON]_[RVSOFF]" :
GOSUB59
57 IFA$="[UP]"THENP$=" ":GOSUB59
:Y=Y-1:P$="[RVSON]_[RVSOFF]":GOS
UB59
58 GOTO54:  STOP
59 IFY>YUTHEN Y=4:ELSE IF Y<4THE
N Y=YU
60 CHAR 1,X,Y,P$ :CHAR0,0,Y,S$(Y
):CHAR1,0,Y,S$(Y),1: RETURN
61 PRINT"[CLEAR]RENAME USING COL
ON":PRINT"[DOWN][DOWN]APPLY COLO
N TO ALL NAMES [RVSON](Y/N/C)[RV
SOFF]"
62 DO:GET A$:LOOP UNTIL A$="N" OR
 A$="Y" ORA$="C"
63 IF A$="Y"THEN 70
64 IF A$="C"THENPRINT"OK:-CANCEL
LED":SLEEP3:GOTO46
65 :
66 REM  **** SELECTED NAMES ****
*
67 :
68 GOSUB 183
69 GOSUB219:SC=0:SC$="WRITE COLO
N AFTER":GOSUB 246:CLOSE1:RETURN
70 :
71 REM **** RENAME ALL ****
72 :
73 GOSUB219:GOSUB 258:CLOSE1:RET
URN
74 :
75 REM **** RENAME FILES ****
76 :
77 GOSUB219:SC=0:SC$="CHANGE":GO
SUB271
78 CLOSE1:RETURN
79 :
80 REM  ****  INITIALIZE ****
81 :
82 UI$="":PRINT"[CLEAR]";S$(5):C
LOSE15:OPEN15,8,15,"I0:":CLOSE15
 :IFDSTHENGOSUB187:SLEEP4 :PRINT
83 RETURN
84 :
85 REM  **** DISPLAY DIR ****
86 :
87 PRINT"[CLEAR]";S$(6):CHAR1,1,
1,"[RVSON]NO SCROLL[RVSOFF] KEY
TO PAUSE[HOME][DOWN][DOWN][DOWN]
"
88 GOSUB183:DIRECTORY:IFDSTHENPR
INTCHR$(7);CHR$(15);DS$:SLEEP4:E
LSEPRINTCHR$(15);CHR$(7);"[DOWN]
PRESS A KEY":GETKEY A$
89 RETURN
90 :
91 REM  **** SETUP BOOT ****
92 :
93 PRINT"[CLEAR]";S$(7):N$=CHR$(
0):GOSUB183
94 CHAR1,0,3,"FORMAT DISK [RVSON
](Y/N)[RVSOFF]"
95 DO:GET A$:LOOP UNTILA$="Y"ORA$
="N"
96 IFA$="Y"THENFL$="":GOSUB141:R
```

```
EM GO DO FORMAT
97 OPEN15,8,15:OPEN8,8,8,"#":PRI
NT#15,"B-A:";0;1;0
98 IF DS=0 THEN PRINT:PRINT"BOOT
 SECTOR IS FREE":FR=1:GOTO105
99 FR=0:PRINT#15,"U1";8;0;1;0
100 PRINT#15,"B-P";8;0:GET#8,C$,
B$,M$:IFCS="C"ANDB$="B"ANDM$="M"
THENBEGIN:PRINT#15,"B-P";8;7 :PR
INT:RUS=""
101 DO:GET#8,A$:RU$=RU$+A$:LOOP
UNTIL A$=""
102 IFRU$>""THENRU$="BOOT FOR "+
RU$+" EXISTS"
103 PRINTRU$:BEND
104 PRINT"BOOT SECTOR IS IN USE"
105 PRINT:PRINTCHR$(15),CHR$(7);
"CONTINUE OPERATION (RVSON)(Y/N)
(RVSOFF)"
106 DO:GET A$:LOOP UNTILA$="Y"ORA
$="N"
107 IFA$="N"ANDFR=1THENPRINT#15,
"B-F:";0;1;0
108 IFA$="N"THENCLOSE8:CLOSE15:R
ETURN
109 DO
110 SCNCLR:CHAR1,0,24,"ENTER QUI
T TO RETURN TO MENU".1
111 INPUT"(HOME)(DOWN)(DOWN)(DOW
N)(DOWN)(DOWN)NAME OF BOOT PROGR
AM";NN$
112 IFLEN(NN$)>16THENPRINTERR$(2
3):NN$="":SLEEP3:GOTO115
113 IFNN$="THENPRINTERR$(8):SLE
EP3
114 IFNN$="QUIT"THENPRINT"ABORTI
NG":SLEEP3:CLOSE8:CLOSE15:RETURN
115 LOOPWHILE LEN(NN$)>16ORNN$="
"
116 PRINT"IS "NN$:PRINT"A BASIC
PROGRAM (RVSON)(Y/N)(RVSOFF)"
117 DO:GET A$:LOOP UNTILA$="Y"ORA
$="N"
118 IFA$="N"THENBEGIN
119 PRINT"BOOT IS FOR NON RELOCA
TABLE PROGRAM"
120 MO$="BOOT":BEND :ELSEMO$="RU
N"
121 V0=LEN(NN$)+2831:VL=(V0ANDZ5
5):VH=INT(V0/256)
122 PRINT#15,"U1:8 0 1 0"
123 PRINT#15,"B-P 8 0"
124 PRINT#8,"CBM";N$;N$;N$;N$;NN
$;N$;N$;
125 PRINT#8,CHR$(162);CHR$(VL);C
HR$(160);CHR$(VH);CHR$(76);CHR$(
165);CHR$(175);
126 PRINT#8,MO$;CHR$(34);NN$;N$
127 PRINT#15,"U2:8 0 1 0"
128 CLOSE8:CLOSE15
129 PRINT"FINISHED.....";:PRINT"
SAVE ";NN$," TO THIS DISK ":PRIN
T"AND IT WILL AUTOBOOT"
130 SLEEP5:RETURN
131 :
132 REM  **** PRINT DIRECTORY **
**
133 :
134 PRINT"(CLEAR)";S$(8):PRINT"W
ILL I PRINT (RVSON)(DELETED(RVSOF
F) FILES?":DO:GETQA$:LOOP UNTILL
QA$="Y"ORQA$="N"
135 GOSUB183:CLOSE2:DV=4:GOSUB18
9:CLOSE1:CLOSE2:RETURN
136 :
137 REM  **** DELETE FILES ****
138 :
139 GOSUB219:SC=1:SC$="DELETE":G
OSUB 271
140 CLOSE1:RETURN
141 :
142 REM  **** FORMAT DISK ****
143 :
144 PRINT"(CLEAR)";S$(10):ID$=HE
X$(INT(RND(0)*65535)):ID$=MID$(I
D$,2,2):DCLEAR:DI$="":SE$=" ,":I
FDS =0THENBEGIN
145 PRINT"(HOME)(DOWN)";CHR$(27)
;"@THIS DISK HAS BEEN FORMATTED
BEFORE"
146 PRINT"(HOME)(DOWN)(DOWN)";CH
R$(27)"@CONTINUE (RVSON)Y/N(RVS
OFF))";ID$=""
147 DO:GET A$:LOOP UNTILA$="Y"ORA
$="N"
148 IFA$="Y"THENSE$=" (RVSON)OLD
 ID(RVSOFF)": GOTO150
149 PRINTBE$;"(HOME)(DOWN)";CHR$
(27);"@FORMAT CANCELLED":SLEEP3:
GOTO29
150 BEND
151 INPUT"FORMAT IN 1541 OR 1571
 MODE  1571(CLEFT)(CLEFT)(CLEFT)(CLE
FT)(CLEFT)(CLEFT)";DM
152 IFDM=1541THENM$="U0>M0"
153 IFDM=1571THENM$="U0>M1"
154 PRINT"(UP)"CHR$(27)"@":INPUT
"INPUT NEW DISK NAME  DISK#(CLEFT
)(CLEFT)(CLEFT)(CLEFT)(CLEFT)(CLE
FT)";NM$
155 PRINT"(HOME)(DOWN)";CHR$(27)
;"@PRESS RETURN FOR QUICK DIRECT
ORY":PRINT"CLEAROUT OR ENTER NEW
 ID FOR"
156 DO:INPUT"FULL FORMAT ON DISK
";DI$
157 LOOP UNTIL LEN(DI$)<=20R ASC
(DI$)=0
158 IFDI$=CHR$(13)THEN160
159 IFDI$<>""THENID$=DI$:SE$=" ,
"
160 PRINT"(HOME)(DOWN)";CHR$(27)
;"@FORMATTING :-"NM$;SE$;ID$
161 OPEN15,8,15:PRINT#15,M$:PRIN
T#15,"N0:"+NM$+","+ID$
162 PRINT#15,"U0>M1":CLOSE15
163 PRINT"(HOME)(DOWN)";CHR$(27)
;"@DISK IS READY FOR USE"
164 IFDS<>0THENBEGIN:PRINT"(HOME
)(DOWN)";CHR$(27)"@DISK ERROR OC
CURRED          "
165 PRINTCHR$(15);CHR$(7);DS$
166 PRINT"TRY AGAIN ((RVSON)Y/N(
RVSOFF))"
167 DO:GET A$:LOOP UNTILA$="Y"ORA
$="N":IFA$="N"THENPRINT"ABORTING
 OPERATION"
168 IFA$="Y"THENPRINT"OK":BEND:G
OTO160
169 SLEEP3: RETURN
170 :
171 REM  **** VALIDATE DISK ****
172 PRINTCHR$(7);:SCNCLR :PRINT
S$(11)
173 PRINTCHR$(15);"(DOWN)COLLECT
ING A DISK CAN DESTROY"
174 PRINTCHR$(15);"DIRECT ACCESS
 FILES:- ":PRINT" CONTINUE (RVSO
N)(Y/N)(RVSOFF)"
175 DO:GET A$:LOOP UNTILA$="Y"OR
 A$="N"
176 IF A$="Y"THENPRINT"(UP)(UP)(
UP)";CHR$(27)"@OK : VALIDATING D
ISK":COLLECT:FL$="":GOSUB187:SLE
EP3:DCLEAR:RETURN
177 PRINT"(UP)(UP)(UP)(UP)";CHR$
(27);"@OK:- CANCELLED":SLEEP3:RE
TURN
178 :
179 REM **** END PROGRAM ****
180 :
181 SCNCLR:PRINT"END PROGRAM :-
ARE YOU SURE?":DO:GET A$:LOOP UNT
IL A$="Y"ORA$="N"
182 IFA$="Y"THENCOLOR0,12 :COLOR
4,14 :COLORS,14:CLR:GRAPHIC RGR(
0),1:GRAPHICCLR:NEW:SYS16384:ELS
E RETURN
183 :
184 REM **** DCLEAR & CHECK ERRO
RS
185 :
186 DCLEAR
187 PE$=BE$+"DISK ERROR :-"+DS$:
IF DS THENCHAR1,0,24,PE$,1:SLEEP
3:PRINT"(CLEAR)":GOTO29
188 RETURN
189 :
190 REM **** GET DIRECTORY ****
191 :
192 PR$="":OPEN2,DV :PRINT#2,"DI
SK NAME:-    ";:IF -128 AND ST TH
EN PE$=BE$+ERR$(5):CHAR1,0,24,PE
$,1:SLEEP2:SCNCLR:DV=3:CLOSE2:GO
TO192
193 OPEN15,8,15:OPEN5,8,5,"#":IF
DSTHENPRINTCHR$(7);CHR$(15);DS$:
SLEEP4:RETURN
194 PRINT#15,"U1";5;0;18;0:PRINT
#15,"B-P";5;144
195 DO:GET#5,A$:PRINT#2,A$;:LOOP
 UNTIL A$=CHR$(160):DO:GET#5,A$:
LOOP UNTILA$<>CHR$(160)
196 PRINT#2," ID:-";A$;:DO:GET#5
,A$:PRINT#2,A$;:LOOP UNTIL A$=CH
R$(160)
197 PRINT#2,"FORMAT:-";:DO:GET#5
,A$:PRINT#2,A$;:LOOP UNTIL A$=CH
R$(160):PRINT#2:FORI=1TO80:PRINT
#2,"(s #)";:NEXT
198 PRINT#2,"FILETYPE TRACK SECT
OR"," NAME       BLOCKS
 LOCATION"  :FORI=1TO80:PRINT#2,
"(s #)";:NEXT
199 TR=18:SE=1:PI=TR:PS=SE
200 PRINT#15,"U1";5;0;TR;SE
201 PRINT#15,"B-P",5,0:GET#5,TR$
,SE$:TR=ASC(TR$):SE=ASC(SE$)
202 B=2:FORN=1TO8:PRINT#15,"B-P"
;5;B
203 GET#5,A$:Z=ASC(A$):IFZ<>0AND
Z-192>0THENZ=Z-192:ELSEIFZ<>0THE
NZ=Z-128
204 IFQA$="N"ANDZ=0THENGOTO212:E
LSE PR$=PR$+TY$(Z)+" "
205 GET#5,A$:TK=ASC(A$):IFTK=0TH
EN214:ELSEIFTK>9THENPR$=PR$+STR$
(TK):ELSEPR$=PR$+" "+STR$(TK)
206 GET#5,A$:SK=ASC(A$):IFSK>9TH
ENPR$=PR$+STR$(SK):ELSEPR$=PR$+"
 "+STR$(SK)
207 PR$=PR$+"                ":FORI=
3TO18:GET#5,A$:PR$=PR$+A$:NEXTI:
208 FORI=19TO28:GET#5,A$:NEXT:LO
=ASC(A$):GET#5,A$:HI=ASC(A$):I=L
0+256*HI
209 IFI<=9THENPR$=PR$+"  "+STR$(
I):ELSEIFI<=99THENPR$=PR$+" "+ST
R$(I):ELSEPR$=PR$+STR$(I)
210 IFZ<>0THENPRINT#15,"U1";5;0;
TK;SK:PRINT#15,"B-P";5;2:GET#5,A
```

```
$:LO=ASC(A$):GET#5,A$:HI=ASC(A$)
:Q=LO+256*HI:PRS=PRS+"
"+STR$(Q)
211 PRINT#2,PRS
212 PRINT#15,"U1";5;0;PT;PS:B=B+
32:PRS="":NEXTN
213 IFASC(TRS)<>0THENPT=TR:PS=SE
:GOTO200
214 FORJ=1TO80:PRINT#2,"{s *}";:
NEXTJ:PRINT#2:CLOSE5
215 NU$=CHR$(0):OPEN1,8,0,"$0:$%
&'":GET#1,A$,A$,A$,A$,A$,A$,A$
216 GET#1,A$:IFA$<>""THEN216
217 GET#1,A$,A$,A$,B$:BC=ASC(A$+
NU$)+ASC(B$+NU$)*256
218 PRINT#2,CHR$(27)"-"CHR$(1)"*
**":BC; "*** BLOCKS AVAILABLE "C
HR$(27)"-"CHR$(0):CLOSE1:CLOSE15
:SLOW:IFDV=3THENPRINT"PRESS A KE
Y":DO:GETA$:LOOPWHILEA$="":RETUR
N
219 :
220 REM **** GET NAMES ****
221 :
222 OPEN15,8,15,"I0":PRINT#15,"M
-R"CHR$(18)CHR$(0)CHR$(2):UT$=""
223 FORI=1TO2:GET#15,A$:UT$=UT$+
A$:NEXT
224 IFUT$=FL$THENCLOSE15:RETURN
225 FL$=UT$:CLOSE15
226 FAST:FORXT=0TO120:NA$(XT)=""
:NEXT
227 OPEN1,8,0,"$0":IFDSTHENSLOW:
GOSUB187:SLEEP4:RETURN
228 CO=0
229 SCNCLR:GET#1,A$,A$
230 GET#1,A$,A$:IFA$=""THEN SLOW
:RETURN
231 GET#1,A$,B$
232 GET#1,A$:IFA$=""THENGOTO230
233 IFA$=CHR$(34)THENBEGIN:CO=CO
+1
234 A$="":DO UNTIL A$=CHR$(34):G
ET#1,A$:IFA$<>CHR$(34)THEN NA$(C
O)=NA$(CO)+A$
235 LOOP:BEND
236 GOTO232
237 SLOW:RETURN
238 :
239 REM **** GET BYTES FROM DISK
 ****
240 :
241 SCNCLR:GET#1,A$,A$
242 GET#1,A$,A$:IFA$=""THENGOTO3
4
243 GET#1,A$,B$
244 GET#1,A$:IFA$=""THENGOTO242
245 RETURN
246 :
247 REM **** SELECT NAMES ****
248 :
249 GOSUB 302
250 FORXT=2TOCO:PRINT"{HOME}{DOW
N}{DOWN}{DOWN}{DOWN}{DOWN}
                    "
251 PRINT"{HOME}{DOWN}{DOWN}{DOW
N}{DOWN}";CHR$(27);"@RENAME :-";
NA$(XT);" {RVSON}(Y/N/C){RVSOFF}
"
252 DO:GET A$:LOOP UNTILA$="Y"OR
A$="N"ORA$="C":IFA$="C"THENPRINT
"OK:- CANCELLED":SLEEP3:GOTO257
253 IFA$="Y"THENBEGIN:NE$(XT)=LE
FT$(NA$(XT),14)+CHR$(160)+":":FL
$=""
254 RENAME D0,(NA$(XT)) TO (NE$(
XT)),U8  :BEND
255 IFDSTHENPRINTCHR$(7);CHR$(15
):CHAR1,0,24,DS$,1:SLEEP2:GOSUB1
83:PRINT"{UP}"CHR$(27)"@"
256 NEXT
257 RETURN
258 :
259 REM **** CHANGE ALL NAMES **
**
260 :
261 SCNCLR:IF CO=1THEN:PRINTCHR$
(7);CHR$(15)"NO FILES ON THIS DI
SK":SLEEP3:RETURN
262 PRINT"CURRENT DISK :-{RVSON}
";NA$(1);"{RVSOFF} ID :-{RVSON}"
;UT$:PRINT
263 PRINT"THIS PROCEDURE WILL RE
NAME ALL FILES"
264 PRINT"CONTINUE {RVSON}(Y/N){
RVSOFF}":DO:GETA$:LOOPUNTILA$="Y
"ORA$="N"
265 IFA$="N"THENRETURN
266 FL$="":FORXT=2TOCO:PRINT"{HO
ME}{DOWN}{DOWN}{DOWN}{DOWN}CHANG
ING :-";NA$(XT)+"
                "
267 NE$(XT)=LEFT$(NA$(XT),14)+CH
R$(160)+":"
268 RENAME D0,(NA$(XT)) TO (NE$(
XT)),U8
269 IFDSTHENPRINTCHR$(7);CHR$(15
):CHAR1,0,24,DS$,1:SLEEP1:PRINT"
{UP}"CHR$(27)"@":NEXT:ELSE NEXT
270 RETURN
271 :
272 REM  ****  RENAME   ****
273 :
274 GOSUB302
275 PRINT:PRINT:FORXT=2TOCO
276 PRINT"{HOME}{DOWN}{DOWN}{DOW
N}{DOWN}{DOWN}";SC$;" :-";CHR$(2
7)"Q";NA$(XT);" {RVSON}(Y/N/C){R
VSOFF}"
277 DO:GET A$:LOOP UNTILA$="Y"OR
A$="N"OR A$="C"
278 IFA$="Y"ANDSC=1THENSCRATCH (
NA$(XT)):FL$="":GOTO284
279 IF A$="C"THENPRINTCHR$(15);C
HR$(7);"OK:- CANCELLED":GOTO288
280 IFA$="Y"ANDSC=0 THENBEGIN:QU
$="":PRINT"{HOME}{DOWN}{DOWN}{DO
WN}{DOWN}{DOWN}";CHR$(27);"@ENTE
R NEW NAME FOR ";NA$(XT):INPUT Q
U$
281 IFQU$=""THEN287
282 NE$(XT)=QU$
283 RENAME D0,(NA$(XT)) TO (NE$(
XT)),U8  :FL$="":BEND
284 IFDSTHENBEGIN:PRINTCHR$(7);C
HR$(15):CHAR1,0,24,DS$,1
285 IFSC=0THEN CHAR1,0,23,"BLANK
 NAME TO MOVE ON OR RE-ENTER NAM
E":SLEEP2
286 SLEEP2:DCLEAR:PRINT"{UP}{UP}
{UP}"CHR$(27)"@":BEND:GOTO280
287 NEXT:PRINTDS$:DCLEAR:RETURN
288 SLEEP3:RETURN
289 :
290 REM  **** ERROR TRAP ****
291 :
292 FAST:IFREGR(0)=5THENWINDOW0,
0,79,24:ELSEWINDOW0,0,39,24
293 IFER=5ANDDV=4THENDV=3:SLOW:E
LSEIFER=5THENSLOW:PES=BE$+ERR$(E
R):CHAR1,0,24,PE$,1:SLEEP3
294 FL$="":GOTO29
295 :
296 REM **** READ DATA FOR MENU
 ****
297 :
298 FORXT=4TOYU:READ S$(XT)
299 DO:S$(XT)=" "+S$(XT)+" "
300 LOOP UNTIL LEN(S$(XT))=>30
301 S$(XT)=LEFT$(S$(XT),30):NEXT
:RETURN
302 :
303 REM ** PRINT DETAILS ON SCRE
EN **
304 :
305 SCNCLR:PRINT"CURRENT DISK :-
{RVSON}";NA$(1);"{RVSOFF} ID :-{
RVSON}";UT$:PRINT
306 IF CO=1THEN:PRINTCHR$(7);CHR
$(15)"NO FILES ON THIS DISK":SLE
EP3:RETURN
307 PRINT "{HOME}{DOWN}{DOWN}SEL
ECT FILENAMES TO ";SC$
308 RETURN
309 :
310 REM ****       LOCK/UNLOCK
  ****
311 REM **** DELETE/RESTORE FILE
S ****
312 :
313 GOSUB 317:RETURN
314 :
315 REM ****    FILETYPE EDITOR
  ****
316 :
317 SCNCLR
318 OPEN15,8,15,"I":IFDSTHENSCNC
LR:GOTO186
319 OPEN5,8,5,"#":PRINT"{CLEAR}{
RIGHT}{RIGHT}{RIGHT}{RIGHT}{RIGH
T}{RIGHT}{RIGHT}{RIGHT}{RIGHT}{R
IGHT}{RIGHT}{RIGHT}FILETYPE EDIT
OR":TR=18:SE=1
320 PRINT#15,"U1";5;0;TR;SE:PT=T
R:PS=SE
321 PRINT#15,"B-P",5,0:GET#5,TR$
,SE$:TR=ASC(TR$):SE=ASC(SE$)
322 B=2:FORN=1TO8:PRINT#15,"B-P"
;5;B
323 GET#5,T$,DI$,DB$
324 T=ASC(T$):DB=ASC(DB$):DI=ASC
(DI$):IFDI=0THEN335 :REM LAST NA
ME NO TRACK
325 IFT>0ANDT-128<6THENT=T-128:L
$="            ":GOTO327
326 IFT>0ANDT-192<6THENT=T-192:L
$="LOCKED "
327 PRINT"{HOME}{DOWN}{DOWN}{DOW
N}{DOWN}{DOWN}"CHR$(27)"@FOUND :
-":PRINT
328 FORI=1TO16
329 GET#5,A$:IFA$=""THENA$=CHR$(
0)
330 PRINTA$;
331 NEXTI:PRINT"_{s *}{RVSON}";L
$;TY$(T);:GOSUB338:B=B+32
332 IFKE$="Q"THEN337
333 NEXT N
334 IFASC(TR$)<>0THEN320:REM NOT
 LAST DIRECTORY SECTOR YET
335 CLOSE5 : REM    CLOSE
336 CLOSE15: REM    EVERYTHING
337 RETURN
338 :
339 REM ****  GET ELECTION  ****
340 :
341 KE$="":PRINT"{HOME}{DOWN}{DO
WN}{DOWN}{DOWN}{DOWN}{DOWN}{DOWN
}{DOWN}{DOWN}{RVSON}LC{RVSOFF}=LO
CK {RVSON}UC{RVSOFF}=UNLOCK {RVSO
N}DC{RVSOFF}=DELETE {RVSON}RC{RVSO
```

```
FF]-RESTORE"
342 PRINT"[RVSON][CRVSOFF]-QUIT"
;:INPUT" [RVSON]RETURN[RVSOFF] -
 NO CHANGE";KE$
343 IFKE$=""ORASC(KE$)=0  THENRE
TURN
344 IFKE$<>"L"ANDKE$<>"U"ANDKE$<
>"R"ANDKE$<>"D"ANDKE$<>"Q"THEN34
1
345 IFKE$="Q"THENCLOSE5:CLOSE15:
RETURN
346 IFKE$="L"THENT=ASC(T$)OR64
347 IFKE$="U"THENT=ASC(T$)AND191
348 IFKE$="D"THENT=0
349 IFKE$="R"THENGOSUB359
350 :
351 REM ***WRITE MODFCTION TO DI
SK***
352 :
353 PRINT#15,"B-P";5;B
354 PRINT#5,CHR$(T);
355 PRINT#15,"U2";5;0;PT;PS
356 IFKE$="R"THENBEGIN:PRINT"IT
 IS ADVISABLE TO COLLECT"
357 PRINT"THE DISK TO ENSURE A V
ALID BAM":BEND
358 FORXT=0TO500:NEXT:RETURN
359 :
360 REM SELECT TYPE OF FILE
361 :
362 PRINT"[HOME][DOWN][DOWN][DOW
N][DOWN][DOWN]"CHR$(27)"@";:FORX
T=0TO4:PRINTXT;":-";TY$(XT):NEXT
XT
363 PRINT"SELECT FILETYPE TO RES
TORE":INPUTX
364 IFX>4ORX<0THENPRINT"[UP]":GO
TO363
365 T=X+128:RETURN
366 DATARENAME FILES,INITIALIZE
DRIVE,DISPLAY DIRECTORY,MAKE A B
OOT DISK,PRINT DIRECTORY
367 DATADELETE FILES,FORMAT A DI
SK,COLLECT,LOCK/UNLOCK FILE,DELE
TE/RECOVER FILES,QUIT,SELECT COL
ORS
368 DATAPUT COLON AFTER F/NAME,R
ENAME FILES,GO TO MAIN MENU
369 REM
370 REM SELECT SCREEN COLORS
371 REM
372 SCNCLR:L1$=" [s U]{s *]{s *]
[s *]{s *]{s *]{s *]{s *]{s *]{s
 *]{s *]{s *]{s *]{s *]{s *]{s *
]{s *]{s *]{s *]{s *]{s *]{s *]{
s *]{s *]{s *]{s *]{s *]{s *]{s
 *]{s *]{s *]{s *]{s *]{s *]{s *]
[s *]{s I]"
373 L2$=" [s J]{s *]{s *]{s *]{s
 *]{s *]{s *]{s *]{s *]{s *]{s *
]{s *]{s *]{s *]{s *]{s *]{s *]{
s *]{s *]{s *]{s *]{s *]{s *]{s
 *]{s *]{s *]{s *]{s *]{s *]{s *]
[s *]{s *]{s *]{s *]{s *]{s *]{s
 K]"
374 SCNCLR:PRINTL1$:PRINT " [s -
]       COLOR SELECTION MENU
    [s -]":PRINTL2$
375 WINDOW0,12,39,23
376 SCNCLR:PRINTL1$:PRINT " [s -
]       SELECT SCREEN COLOUR
    [s -]":PRINTL2$:INPUTS:IFS<1
ORS>16THENPRINTERR$(14):GOTO376:
ELSECOLOR4,S
377 GOSUB390
378 IFA$<>"Y"THEN376
379 REM       FRGR(0)=STHENCOLOR
6,S:ELSECOLOR0,S
380 SCNCLR:PRINTL1$:PRINT " [s -
]       SELECT BORDER COLOUR
    [s -]":PRINTL2$:INPUTB:IFB<1
ORB>16THENPRINTERR$(14):GOTO380:
ELSECOLOR4,B
381 GOSUB390
382 IFA$<>"Y"THEN380
383 REM  COLOR4,B
384 SCNCLR:PRINTL1$:PRINT " [s -
]       SELECT PRINT COLOUR.
    [s -]":PRINTL2$:INPUTPP:IFPP
<10RPP>16THENPRINTERR$(14):GOTO3
84:ELSECOLOR4,PP
385 GOSUB390
386 IFA$<>"Y"THEN384
387 REM   COLOR5,S
388 COLOR4,B:COLOR5,PP:COLOR (RG
R(0)),S:IFRGR(0)=STHENWINDOW0,0,
79,24:RETURN:ELSEWINDOW0,0,39,24
:RETURN
389 A$="":INPUTA$:IFA$=""THEN389
:ELSE RETURN
390 SCNCLR:PRINTL1$:PRINT " [s -
]       IS YOUR SELECTION OK?
    [s -]":PRINTL2$
391 GOSUB389
392 RETURN
```

LIFESAVERS	C64	BASIC PROTECTOR	1/1

These short Basic and machine code routines will enable a Basic program to be protected against prying eyes trying to LIST it.

They work by changing the LIST vector to point to a place in memory where a message is stored. The routine is situated at 53210 ($CFDA) and is called by SYS 53210.

To use the program to its full effectiveness, the routine should be incorporated in to a short auto-run loader program.

P.A.Eves

```
1 DATA 169,229,160,207,141,5,3,1
40,7,3,96,169,239,160,207,32,30,
171,76,116
2 DATA 164,147,73,76,69,71,65,76
,32,69,78,84,82,89,46,46,46,00'
3 FORA=53210TO53247:READB:POKEA,
B:NEXT
4 SYS53210
10 ; program start address
20          *=$CFDA
30 ; lo byte of new pointer
40          LDA #<NEWPNT
50 ; hi byte of new pointer
60          LDY #>NEWPNT
70 ; put into lo byte of LIST
vector
80          STA $0306
90 ; put into hi byte of LIST
vector
100         STY $0307
110         RTS
120 ; lo byte of start of
message
130 NEWPNT  LDA #<TEXT
140 ; hi byte of start of message
150         LDY #>TEXT
160 ; print the message
170         JSR $AB1E
180 ; back to Basic
190         JMP $A474
200 TEXT    .BYT $93,$48,$4C,$4C
,$45,$47,$41,$4C,$20,$45,$4E,$54
,$52,$59,$2E
210         .BYT $2E,$2E,$00
220         .END
```

New Characters on the MPS 801/3

Fed up with your MPS 801/3 character set? Now you can design your own characters.

By Mathew Bittleston

When I bought my MPS 803 printer, I was very disappointed with the print quality; no true descenders and no chance of having Near Letter Quality (NLQ).

To overcome the most annoying problem of the two, no true descenders, I could think of two ways:

One, to print each line of text with two passes of the print head, the first to print the top part of the letters, the second to print the descenders.

Two, to re-define the character set so it's a little more squashed but has true descenders.

I chose the latter, partly because it would be quicker to print the text, and partly because I could design lots of different character sets more easily and they would take up less memory.

Presented here is that program, with a few extra frills. It is not very difficult to use, is as fast as it can be, because the printer is operating in bit image mode, and also uses up very little memory.

The character sets take up $0300 (768) bytes and can be stored anywhere in memory (except from $0000-$0800 (2048), obviously!), including under the ROMs.

Getting it in

The program is presented here as a Basic listing called *PRINTER DRIVER*. Type this in using our *SYNTAX CHECKER* program that can be found with the *LISTINGS* article. Make sure that you SAVE the program to tape or disk before you RUN it.

If the program finds any errors when you RUN it it will indicate the line where the error has occurred. When you've got everything going O.K., type:

```
SYS 52603
```

to initialise it, or

```
SYS 52600
```

to switch it off, which I doubt will be necessary. If you use RUN STOP/RESTORE, you'll have to re-initialise it. Nothing should appear to have happened after initialisation. You can now use the printer as normal, but everything will be printed through the driver.

There are a few more things that you may need to know:

OPEN X,Y,7 - will print in UPPER CASE/lower case, as normal.
OPEN X,Y - will print in UPPER CASE only (shifted letters will be printed in lower case.)
CHR$(27)CHR$(SET) - selects the character set, where set is the most significant byte of the start address of the set i.e. If the start address of the character set is $FC00 (64512), the most significant byte is 64512/256=252.
CHR$(18) - will print in inverse characters until you de-select it with CHR$(146)
CHR$(8) - will print in Bit Image mode until you de-select it with CHR$(15)
CHR$(14) - will print in enhanced characters until you de-select it with CHR$(15)

All of the above CHR$ codes must be printed after a PRINT(No.)X instruction, where X is the logical file number (see printer manual), and Y is the device number (normally 4).

Printing Rubbish

If you have typed in the Driver and initialised it, don't be surprised when you get a whole load of garbage printed out. This is because you have to do more work; you have to type in a character set. There are five sets that I have designed included here, choose which you think will be the most useful, and type it in, or better still, type them all in. Again use the *SYNTAX CHECKER* to check your typing. The default character set that the driver software will print starts at 64512. If you wish to print from another set use:

```
PRINT(No.)X,CHR$(27)CHR$(start address/256)
```

The character sets can be relocated to any position in memory, (I have positioned them under the KERNAL ROM) provided that the start address divided by 256 gives a whole number.

On your own

If you plan to design your own character sets, you'll find the following information useful:

When designing the characters, each number in the list of data stands for one

row which is printed. The format in which the information is stored is shown in Figure 1.

The important thing about the above is that it is different from when you define normal U.D.G.s (for games etc.). For the printer, the rows are VERTICAL instead of horizontal.

The MPS 803 can only print 7 dots vertically, so in each byte there is one bit not used. I've used this bit to tell the driver whether to print that row or not; if bit 7 is SET, then that row will be printed, if it's NOT, then it won't be. This makes it possible to define character sets of different widths, or even a proportional set. The maximum width of a character is 8 rows, the normal MPS803 character width is just 6 rows.

Now let me try to clarify what I've just said: Look at Figure 1, from that you can see that because bit 7 is SET, row 0 will be printed. In fact, if you look carefully at it, you can see that nothing will be printed, but the print head will move one row to the right, so that all the letters aren't joined together. Now look at row 7, bit 7 is NOT set, so that line will not be sent to the printer.

The line of data for the letter 'M' I have designed would be:

DATA 128,191,130,140,191,0,0

Figure 1

```
Bit     Value       Row: 0 1 2 3 4 5 6 7
0.....  1     ..........  O * O O O * O O  This
1.....  2     ..........  O * * O * * O O  example
2.....  4     ..........  O * O * O * O O  shows
3.....  8     ..........  O * O * O * O O  'M'
4.....  16    ..........  O * O O O * O O  from
5.....  32    ..........  O * O O O * O O  the
6.....  64    ..........  O O O O O O O O  Descender
7.....  128   ..........  * * * * * * O O  set.
                          128 130 130  0
                            191 140 191  0
```

NLQ?

I have thought of one way of producing a form of NLQ (???) on this printer:

First, print out your text, remembering **exactly** how far up and across the paper was.

Now, put the paper back into the same position as last time, and print the text again. If you do this just slightly wrong, you'll get double images of every letter, extremely annoying, but, do it right, and you have a kind of NLQ on the MPS 803.

Important Note

This program should work with most *Commodore* printers that will print in Bit Image Mode, e.g. the MPS 801 but we haven't been able to test it with them all. The program is not designed to work together with commercial software. If you want to try it go ahead, but, we can't guarantee what the results will be.

PROGRAM: DESCENDER LDR

```
AE  100 REM * DRIVER CANNOT BE R
    ELOCATED *
88  110 SA=52500
A8  120 B=0:FORX=0TO11:READA:B=B
    +A:POKESA+X,A:NEXT:SA=SA+X:R
    EADA:IFA=BTHEN120
06  130 IFA>0THENPRINT"DATA ERRO
    R IN LINE"PEEK(63)+PEEK(64)*
    256
52  1000 DATA 76,51,205,169,0,14
    1,150,206,141,151,206,141,16
    37
43  1002 DATA 152,206,141,153,20
    6,141,155,206,160,205,169,64
    ,1958
7D  1004 DATA 140,39,3,141,38,3,
    96,172,157,206,173,156,1324
65  1006 DATA 206,140,39,3,141,3
    8,3,96,234,141,148,206,1395
5F  1008 DATA 165,154,201,3,208,
    6,173,148,206,76,22,231,1593

17  1010 DATA 176,3,76,219,241,1
    73,148,206,72,32,95,205,1646

15  1012 DATA 76,243,205,173,152
    ,206,208,33,173,155,206,208,
    2038
FB  1014 DATA 46,173,148,206,201
    ,27,240,13,173,151,206,240,1
    824
72  1016 DATA 55,173,148,206,141
    ,154,206,169,0,141,151,206,1
    750
CE  1018 DATA 104,104,104,24,96,
    173,148,206,201,15,208,5,138
    8
C4  1020 DATA 169,0,141,152,206,
    104,104,104,76,168,255,173,1
    652
91  1022 DATA 148,206,141,155,20
    6,240,225,169,32,32,243,205,
    2002
DA  1024 DATA 206,155,206,208,24
    6,76,128,205,173,148,206,201
    ,2158
4E  1026 DATA 8,208,6,141,152,20
    6,76,145,205,201,14,208,1570

84  1028 DATA 6,141,153,206,76,1
    28,205,201,15,208,11,169,151
    9

0F  1030 DATA 0,141,153,206,141,
    152,206,76,128,205,201,18,16
    27
E8  1032 DATA 208,6,141,150,206,
    76,128,205,201,146,208,8,168
    3
46  1034 DATA 169,0,141,150,206,
    76,128,205,201,16,208,6,1506

02  1036 DATA 141,155,206,76,128
    ,205,96,201,32,144,24,201,16
    09
12  1038 DATA 96,176,6,56,233,32
    ,76,24,206,201,192,144,1442
C7  1040 DATA 10,201,224,176,6,5
    6,233,128,76,24,206,169,1509

C1  1042 DATA 15,32,168,255,104,
    76,168,255,133,251,165,185,1
    807
B8  1044 DATA 201,255,208,10,165
    ,251,201,32,144,4,73,96,1640

BC  1046 DATA 133,251,169,0,133,
    252,6,251,38,252,6,251,1742
B4  1048 DATA 38,252,6,251,38,25
    2,173,154,206,24,101,252,174
    7
18  1050 DATA 133,252,140,149,20
    6,142,148,206,169,8,32,168,1
    753
99  1052 DATA 255,160,7,120,32,1
    38,206,177,251,153,159,206,1
    864
A5  1054 DATA 136,16,248,32,138,
    206,88,200,185,159,206,16,16
    30
32  1056 DATA 18,174,150,206,240
    ,2,73,127,174,153,206,240,17
    63
B3  1058 DATA 3,32,168,255,32,16
    8,255,200,192,8,208,228,1749

AA  1060 DATA 172,149,206,174,14
    8,206,173,155,206,208,2,104,
    1903
83  1062 DATA 24,96,165,1,73,7,1
    33,1,96,0,0,0,596
DF  1064 DATA 0,0,0,0,0,0,252,0,
    202,241,0,0,695
E1  1066 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,-1
```

PROGRAM: DESCENDER SET

```
70 100 REM * DESCENDER *
8C 110 SA=64512
42 120 PRINT"ESC CODE FOR SET =
    CHR$(27)CHR$("SA/256")"
23 130 B=0:FORX=0TO11:READA:B=B
   +A:POKESA+X,A:NEXT:SA=SA+X:R
   EADA:IFA=BTHEN130
04 140 IFA>0THENPRINT"DATA ERRO
   R IN LINE"PEEK(63)+PEEK(64)*
   256
58 1000 DATA 128,128,128,128,12
   8,128,0,0,128,128,128,222,13
   74
90 1002 DATA 128,128,0,0,128,13
   2,131,128,132,131,0,0,1038
40 1004 DATA 128,148,190,148,19
   0,148,0,0,128,132,170,255,16
   37
CD 1006 DATA 170,144,0,0,128,17
   7,137,164,163,128,0,0,1211
D3 1008 DATA 128,148,170,255,17
   0,162,0,0,128,128,128,132,15
   49
DC 1010 DATA 131,128,0,0,128,15
   6,162,193,128,128,0,0,1154
54 1012 DATA 128,128,193,162,15
   6,128,0,0,128,170,156,190,15
   39
E1 1014 DATA 156,170,0,0,128,13
   6,136,190,136,136,0,0,1188
77 1016 DATA 128,128,128,192,17
   6,128,0,0,128,136,136,136,14
   16
E1 1018 DATA 136,136,0,0,128,12
   8,128,176,176,128,0,0,1136
99 1020 DATA 128,160,144,136,13
   2,130,0,0,128,158,177,173,14
   66
32 1022 DATA 163,158,0,0,128,12
   8,162,191,160,128,0,0,1218
19 1024 DATA 128,178,169,169,16
   9,166,0,0,128,145,161,161,15
   74
40 1026 DATA 165,155,0,0,128,13
   6,140,138,191,136,0,0,1189
7C 1028 DATA 128,151,165,165,16
   5,153,0,0,128,156,166,165,15
   42
C3 1030 DATA 165,152,0,0,128,12
   9,129,185,133,131,0,0,1152
B9 1032 DATA 128,154,165,165,16
   5,154,0,0,128,134,169,169,15
   31
FF 1034 DATA 153,142,0,0,128,12
   8,128,164,164,128,0,0,1135
3B 1036 DATA 128,128,128,196,18
   0,128,0,0,128,136,148,162,14
   62
C8 1038 DATA 162,128,0,0,128,14
   8,148,148,148,148,0,0,1158
10 1040 DATA 128,162,162,148,13
   6,128,0,0,128,130,129,169,14
   20
96 1042 DATA 133,130,0,0,128,15
   8,161,173,169,134,0,0,1186
2D 1044 DATA 128,144,170,170,17
   0,188,0,0,128,191,164,162,16
   15
13 1046 DATA 162,156,0,0,128,15
   6,162,162,162,162,0,0,1250
AE 1048 DATA 128,156,162,162,16
   4,191,0,0,128,156,170,170,15
   87
E6 1050 DATA 170,140,0,0,128,12
   8,132,190,133,129,0,0,1150
D2 1052 DATA 128,140,210,210,21
   0,150,0,0,128,191,132,130,16
   69
00 1054 DATA 130,188,0,0,128,12
   8,164,189,160,128,0,0,1215
26 1056 DATA 128,128,192,197,18
   9,128,0,0,128,191,136,140,15
   57
1B 1058 DATA 146,160,0,0,128,12
   8,161,191,160,128,0,0,1202
46 1060 DATA 128,190,130,188,13
   0,188,0,0,128,190,132,130,15
   34
3D 1062 DATA 130,188,0,0,128,15
   5,162,162,162,156,0,0,1244
45 1064 DATA 128,254,146,162,16
   2,156,0,0,128,156,162,162,16
   16
B1 1066 DATA 146,254,0,0,128,19
   0,132,130,130,132,0,0,1242
80 1068 DATA 128,164,170,170,17
   0,144,0,0,128,130,159,162,15
   25
A0 1070 DATA 162,144,0,0,128,15
   8,160,160,160,190,0,0,1262
A7 1072 DATA 128,142,144,160,14
   4,142,0,0,128,158,160,152,14
   58
07 1074 DATA 160,158,0,0,128,16
   2,182,136,182,162,0,0,1270
E9 1076 DATA 128,142,208,208,20
   8,190,0,0,128,162,178,170,17
   22
68 1078 DATA 166,162,0,0,128,12
   8,255,193,193,128,0,0,1353
75 1080 DATA 128,168,190,169,16
   9,162,0,0,128,128,193,193,16
   28
42 1082 DATA 255,128,0,0,128,12
   8,130,191,130,128,0,0,1218
A5 1084 DATA 128,136,156,136,13
   6,136,0,0,136,136,136,136,13
   72
BE 1086 DATA 136,136,0,0,128,18
   8,138,137,138,188,0,0,1189
FB 1088 DATA 128,161,191,165,16
   5,154,0,0,128,158,161,161,15
   72
2C 1090 DATA 161,146,0,0,128,16
   1,191,161,146,140,0,0,1234
9F 1092 DATA 128,161,191,165,16
   5,161,0,0,128,161,191,165,16
   16
3E 1094 DATA 133,129,0,0,128,15
   8,161,161,169,185,0,0,1224
B2 1096 DATA 128,191,132,132,13
   2,191,0,0,128,128,161,191,15
   14
9D 1098 DATA 161,128,0,0,128,14
   4,160,161,159,129,0,0,1170
6E 1100 DATA 128,128,191,140,14
   6,161,0,0,128,161,191,161,15
   35
59 1102 DATA 160,176,0,0,128,19
   1,130,140,130,191,0,0,1246
2C 1104 DATA 128,191,130,132,13
   6,191,0,0,128,158,161,161,15
   16
03 1106 DATA 161,158,0,0,128,16
   1,191,169,137,134,0,0,1239
4A 1108 DATA 128,158,161,169,14
   5,174,0,0,128,161,191,137,15
   52
30 1110 DATA 153,166,0,0,128,14
   6,165,165,165,152,0,0,1240
9C 1112 DATA 128,131,161,191,16
   1,131,0,0,128,159,160,160,15
   10
24 1114 DATA 160,159,0,0,128,13
   5,152,160,152,135,0,0,1181
D2 1116 DATA 128,159,160,156,16
   0,159,0,0,128,161,179,140,15
   30
4B 1118 DATA 179,161,0,0,128,13
   1,164,188,164,131,0,0,1246
92 1120 DATA 128,163,177,173,16
   3,177,0,0,136,136,136,255,16
   44
29 1122 DATA 136,136,0,0,0,85,4
   2,85,0,0,0,0,484
84 1124 DATA 0,0,0,0,0,127,0,0,0,
   0,4,60,4,195
B8 1126 DATA 28,2,0,0,0,62,65,9
   3,85,65,62,0,-1
```

PROGRAM: MODERN SET

```
CE 100 REM * MODERN *
90 110 SA=63744
42 120 PRINT"ESC CODE FOR SET =
    CHR$(27)CHR$("SA/256")"
23 130 B=0:FORX=0TO11:READA:B=B
   +A:POKESA+X,A:NEXT:SA=SA+X:R
   EADA:IFA=BTHEN130
04 140 IFA>0THENPRINT"DATA ERRO
   R IN LINE"PEEK(63)+PEEK(64)*
   256
B1 1000 DATA 128,128,128,128,12
   8,128,128,0,128,128,172,175,
   1499
44 1002 DATA 128,128,128,0,128,
   134,135,128,134,135,128,0,13
   06
06 1004 DATA 128,138,186,191,13
   8,191,138,0,128,174,170,255,
   1837
55 1006 DATA 170,186,186,0,128,
   179,187,152,132,180,179,0,16
   79
86 1008 DATA 128,188,191,165,17
   3,144,168,0,128,128,128,133,
   1674
66 1010 DATA 131,128,128,0,128,
   188,250,225,193,128,128,0,16
   27
C5 1012 DATA 128,128,193,225,25
   0,188,128,0,128,170,156,190,
   1884
D3 1014 DATA 156,170,128,0,128,
   136,136,184,190,136,136,0,15
   00
60 1016 DATA 128,128,128,208,17
   6,128,128,0,128,136,136,136,
   1560
19 1018 DATA 136,136,128,0,128,
   128,128,176,176,128,128,0,13
   92
3C 1020 DATA 128,160,176,152,14
   0,130,129,0,128,184,191,169,
   1687
27 1022 DATA 165,163,191,0,128,
   128,184,191,128,128,128,0,15
   34
81 1024 DATA 128,184,185,169,16
   9,173,175,0,128,160,169,169,
```

```
    1809
72  1026 DATA 169,191,184,0,128,
    143,140,136,184,190,136,0,16
    01
35  1028 DATA 128,175,173,169,16
    9,185,184,0,128,184,191,169,
    1855
AF  1030 DATA 168,168,184,0,128,
    129,129,185,185,133,131,0,15
    40
D2  1032 DATA 128,184,191,169,16
    9,173,191,0,128,143,139,137,
    1752
15  1034 DATA 185,191,128,0,128,
    128,128,148,148,128,128,0,14
    40
90  1036 DATA 128,128,128,212,18
    0,128,128,0,128,128,152,180,
    1620
1F  1038 DATA 226,193,128,0,128,
    148,148,148,148,148,128,0,15
    43
D4  1040 DATA 128,128,193,226,18
    0,152,128,0,128,131,129,217,
    1740
8C  1042 DATA 217,139,143,0,129,
    158,161,173,173,169,142,0,16
    04
62  1044 DATA 128,184,191,137,13
    7,139,191,0,128,191,185,169,
    1780
05  1046 DATA 171,175,184,0,128,
    184,191,161,161,163,179,0,16
    97
72  1048 DATA 128,184,191,161,16
    2,164,184,0,128,184,191,171,
    1848
6F  1050 DATA 169,169,160,0,128,
    184,191,139,137,137,128,0,15
    42
F9  1052 DATA 128,184,188,162,16
    1,161,185,0,128,184,191,136,
    1808
9C  1054 DATA 136,140,191,0,128,
    128,184,191,131,128,128,0,14
    85
A0  1056 DATA 128,184,184,160,19
    1,131,128,0,128,184,191,136,
    1745
C9  1058 DATA 140,154,185,0,128,
    184,191,160,160,176,176,0,16
    54
99  1060 DATA 128,184,191,129,14
    3,129,191,0,128,184,191,129,
    1727
D7  1062 DATA 129,131,191,0,128,
    184,191,161,161,163,191,0,16
    30
FD  1064 DATA 128,184,191,137,13
    7,139,143,0,128,184,191,161,
    1723
E5  1066 DATA 169,147,175,0,128,
    184,191,137,153,171,143,0,15
    98
BB  1068 DATA 128,144,166,169,16
    9,187,187,0,128,129,185,191,
    1783
B7  1070 DATA 129,131,131,0,128,
    184,191,160,160,163,191,0,15
    68
A1  1072 DATA 128,152,191,160,16
    0,147,143,0,128,184,191,160,
    1744
FC  1074 DATA 184,163,191,0,128,
    176,187,140,140,139,176,0,16
    24
B5  1076 DATA 128,143,139,184,18
    4,140,143,0,128,160,177,185,
    1711
FD  1078 DATA 169,165,163,0,128,
    128,248,255,193,128,128,0,17
    05
B3  1080 DATA 128,160,184,191,16
    9,171,163,0,128,128,192,249,
    1863
41  1082 DATA 255,128,128,0,128,
    132,242,255,130,132,128,0,16
    58
80  1084 DATA 136,136,136,168,18
    6,156,136,0,0,0,0,255,1309
D9  1086 DATA 255,0,0,255,128,18
    4,191,137,137,139,191,0,1617

9D  1088 DATA 128,191,185,169,17
    1,175,184,0,128,184,191,161,
    1867
1B  1090 DATA 161,163,179,0,128,
    184,191,161,162,164,184,0,16
    77
18  1092 DATA 128,184,191,171,16
    9,169,160,0,128,184,191,139,
    1814
4C  1094 DATA 137,137,128,0,128,
    184,188,162,161,161,185,0,15
    71
0A  1096 DATA 128,184,191,136,13
    6,140,191,0,128,128,184,191,
    1737
B0  1098 DATA 131,128,128,0,128,
    184,184,160,191,131,128,0,14
    93
F6  1100 DATA 128,184,191,136,14
    0,154,185,0,128,184,191,160,
    1781
B6  1102 DATA 160,176,176,0,128,
    184,191,129,143,129,191,0,16
    07
E4  1104 DATA 128,184,191,129,12
    9,131,191,0,128,184,191,161,
    1747
79  1106 DATA 161,163,191,0,128,
    184,191,137,137,139,143,0,15
    74
AD  1108 DATA 128,184,191,161,16
    9,147,175,0,128,184,191,137,
    1795
A7  1110 DATA 153,171,143,0,128,
    144,166,169,169,187,187,0,16
    17
A9  1112 DATA 128,129,185,191,12
    9,131,131,0,128,184,191,160,
    1687
01  1114 DATA 160,163,191,0,128,
    152,191,160,160,147,143,0,15
    95
EB  1116 DATA 128,184,191,160,18
    4,163,191,0,128,176,187,140,
    1832
87  1118 DATA 140,139,176,0,128,
    143,139,184,184,140,143,0,15
    16
C6  1120 DATA 128,160,177,185,16
    9,165,163,0,128,128,248,255,
    1906
1C  1122 DATA 193,128,128,0,128,
    160,184,191,169,171,163,0,16
    15
7E  1124 DATA 128,128,192,249,25
    5,128,128,0,128,132,242,255,
    1965
E6  1126 DATA 130,132,128,0,136,
    136,136,168,186,156,136,0,-1
```

PROGRAM: ITALIC SET

```
6D  100 REM * ITALIC *
94  110 SA=62976
42  120 PRINT"ESC CODE FOR SET =
    CHR$(27)CHR$("SA/256")"
23  130 B=0:FORX=0TO11:READA:B=B
    +A:POKESA+X,A:NEXT:SA=SA+X:R
    EADA:IFA=BTHEN130
04  140 IFA>0THENPRINT"DATA ERRO
    R IN LINE"PEEK(63)+PEEK(64)*
    256
5D  1000 DATA 128,128,128,128,12
    8,128,0,0,128,128,192,144,13
    60
E1  1002 DATA 140,131,0,0,128,13
    3,131,128,133,131,0,0,1055
CC  1004 DATA 144,244,156,247,15
    6,151,0,0,128,128,164,234,17
    52
04  1006 DATA 171,146,0,0,128,17
    6,137,173,164,131,0,0,1226
6A  1008 DATA 128,144,172,234,17
    1,130,0,0,128,128,128,133,14
    96
3C  1010 DATA 131,128,0,0,128,12
    8,152,164,194,129,0,0,1154
A5  1012 DATA 128,128,192,161,14
    6,140,0,0,128,170,156,190,15
    39
E1  1014 DATA 156,170,0,0,128,13
    6,136,190,136,136,0,0,1188
85  1016 DATA 128,128,128,208,17
    6,128,0,0,128,136,136,136,14
    32
E1  1018 DATA 136,136,0,0,128,12
    8,128,176,176,128,0,0,1136
88  1020 DATA 128,160,144,136,13
    2,130,0,0,128,156,170,161,14
    45
B0  1022 DATA 149,142,0,0,128,12
    8,160,186,167,128,0,0,1188
52  1024 DATA 128,176,170,169,16
    9,134,0,0,128,144,161,165,15
    44
05  1026 DATA 155,129,0,0,128,13
    6,140,170,157,139,0,0,1154
1C  1028 DATA 128,144,166,165,16
    5,153,0,0,128,156,166,165,15
    36
0C  1030 DATA 165,153,0,0,128,16
    0,145,137,133,131,0,0,1152
D8  1032 DATA 128,144,170,165,16
    5,154,0,0,128,166,169,169,15
    58
A3  1034 DATA 153,142,0,0,128,12
    8,144,148,132,128,0,0,1103
5E  1036 DATA 128,128,208,180,13
    2,128,0,0,128,136,148,162,14
    78
51  1038 DATA 161,129,0,0,128,14
    4,148,148,148,132,0,0,1138
86  1040 DATA 128,160,161,145,13
    8,132,0,0,128,128,194,153,14
    67
A2  1042 DATA 137,134,0,0,128,15
    8,161,173,173,169,142,0,1375

F5  1044 DATA 128,184,164,162,14
    6,174,0,0,128,176,174,165,16
    01
A3  1046 DATA 164,152,0,0,128,15
    2,164,162,162,148,0,0,1232
```

```
9C  1048 DATA 128,156,162,162,15
    6,163,0,0,128,152,172,170,15
    49
55  1050 DATA 170,132,0,0,128,19
    2,200,190,137,129,0,0,1278
9A  1052 DATA 128,204,210,210,17
    0,158,0,0,128,160,158,133,16
    59
15  1054 DATA 164,152,0,0,128,12
    8,180,172,165,129,0,0,1218
05  1056 DATA 128,176,192,180,14
    1,129,0,0,128,160,158,137,15
    29
D7  1058 DATA 180,162,0,0,128,12
    8,184,166,165,131,0,0,1244
1C  1060 DATA 128,188,130,140,16
    2,156,0,0,128,176,142,132,14
    82
4D  1062 DATA 178,140,0,0,128,18
    4,164,162,146,140,0,0,1242
C8  1064 DATA 128,248,150,162,16
    2,156,0,0,0,136,148,210,1500

A6  1066 DATA 178,158,128,0,128,
    162,158,132,130,132,0,0,1306

58  1068 DATA 128,160,164,170,17
    0,146,0,0,128,128,180,174,15
    48
4F  1070 DATA 165,144,0,0,128,18
    4,166,160,152,166,0,0,1265
4D  1072 DATA 128,152,166,160,14
    4,142,0,0,128,188,146,184,15
    38
53  1074 DATA 144,142,0,0,128,16
    0,150,136,180,130,0,0,1170
9A  1076 DATA 128,204,210,200,18
    8,130,0,0,128,160,178,170,16
    96
65  1078 DATA 166,146,0,0,128,22
    4,220,195,129,129,0,0,1337
78  1080 DATA 128,200,248,206,20
    1,192,0,0,128,192,192,225,19
    12
64  1082 DATA 157,131,0,0,128,12
    8,228,154,135,130,4,0,1195
47  1084 DATA 136,136,136,168,15
    4,140,0,0,136,136,136,136,14
    14
1A  1086 DATA 136,136,0,0,128,15
    6,162,161,157,163,0,0,1199
3E  1088 DATA 128,184,167,165,16
    5,154,0,0,128,156,162,161,15
    70
47  1090 DATA 161,146,0,0,128,18
    4,167,161,145,142,0,0,1234
78  1092 DATA 128,184,167,165,16
    5,129,0,0,128,184,135,133,15
    18
5D  1094 DATA 133,129,0,0,128,15
    6,162,225,169,154,0,0,1256
80  1096 DATA 128,184,135,132,18
    8,135,0,0,128,128,160,185,15
    03
2C  1098 DATA 167,129,0,0,128,15
    2,160,161,153,135,0,0,1185
9C  1100 DATA 128,184,143,148,16
    2,129,0,0,128,184,166,161,15
    33
11  1102 DATA 160,144,0,0,128,19
    0,129,142,161,158,0,0,1212
7A  1104 DATA 128,184,135,129,18
    5,134,0,0,128,156,162,161,15
    02
57  1106 DATA 145,142,0,0,128,18
    4,143,137,137,134,0,0,1150

B2  1108 DATA 128,156,162,169,14
    5,174,0,0,128,184,143,153,15
    42
CE  1110 DATA 169,134,0,0,128,14
    4,162,165,165,153,0,0,1220
40  1112 DATA 128,129,185,135,12
    9,129,0,0,128,152,167,160,14
    42
9F  1114 DATA 184,135,0,0,128,15
    2,167,160,144,143,0,0,1213
C0  1116 DATA 128,158,161,152,16
    0,159,0,0,128,160,147,140,14
    93
D6  1118 DATA 140,179,128,0,128,
    182,201,200,190,129,0,0,1477

66  1120 DATA 128,162,177,173,16
    3,145,0,0,136,136,136,255,16
    11
84  1122 DATA 136,136,0,0,0,0,0,
    0,0,0,0,0,272
8B  1124 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0
C5  1126 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,-1
4F  1128 DATA 128,128
```

PROGRAM: GOTHIC SET

```
8D  100 REM * GOTHIC *
83  110 SA=61440
42  120 PRINT"ESC CODE FOR SET =
    CHR$(27)CHR$("SA/256")"
23  130 B=0:FORX=0TO11:READA:B=B
    +A:POKESA+X,A:NEXT:SA=SA+X:R
    EADA:IFA=BTHEN130
04  140 IFA>0THENPRINT"DATA ERRO
    R IN LINE"PEEK(63)+PEEK(64)*
    256
39  1000 DATA 128,128,128,128,12
    8,128,128,128,128,128,128,22
    2,1630
37  1002 DATA 239,128,128,128,12
    8,138,135,130,128,138,135,13
    0,1685
D1  1004 DATA 148,254,190,148,21
    2,190,190,148,128,164,174,23
    5,2181
A1  1006 DATA 235,186,146,128,12
    8,227,179,152,140,230,227,12
    8,2106
2C  1008 DATA 128,146,183,237,15
    7,178,168,236,128,128,128,12
    8,1945
1E  1010 DATA 138,135,130,128,12
    8,128,156,190,227,193,128,12
    8,1809
C5  1012 DATA 128,128,193,227,19
    0,156,128,128,136,170,190,15
    6,1930
AE  1014 DATA 156,190,170,136,12
    8,136,136,190,190,136,136,12
    8,1832
67  1016 DATA 128,128,240,224,19
    2,128,128,128,128,144,136,14
    0,1844
A3  1018 DATA 136,136,136,136,12
    8,128,128,176,176,192,128,12
    8,1728
54  1020 DATA 128,160,176,152,14
    0,134,131,129,128,190,255,20
    1,1924
54  1022 DATA 197,255,190,128,12
    8,136,196,254,191,160,128,12
    8,2091
D9  1024 DATA 128,194,227,245,23
    3,239,198,128,128,162,227,20
    1,2310
7A  1026 DATA 201,237,182,128,14
    4,152,148,146,255,255,176,12
    8,2152
2C  1028 DATA 128,167,213,197,20
    5,221,184,128,128,190,255,20
    9,2225
EB  1030 DATA 201,251,176,128,12
    8,130,131,243,251,167,131,12
    8,2065
06  1032 DATA 128,182,237,201,20
    1,219,182,128,128,150,175,20
    1,2132
AA  1034 DATA 229,191,158,128,12
    8,128,160,180,150,130,128,12
    8,1838
54  1036 DATA 128,128,192,180,18
    2,130,128,128,128,136,156,18
    2,1798
0F  1038 DATA 227,193,193,128,12
    8,148,148,148,148,148,148,12
    8,1885
C4  1040 DATA 128,193,193,227,18
    2,156,136,128,128,136,134,16
    3,1904
D1  1042 DATA 235,143,134,128,12
    8,190,193,221,221,209,174,12
    8,2104
45  1044 DATA 128,148,186,170,17
    0,190,188,144,128,130,191,19
    1,1964
53  1046 DATA 164,162,158,156,12
    8,160,156,190,162,166,162,14
    4,1908
8F  1048 DATA 128,160,156,190,16
    2,165,191,191,128,156,190,17
    8,1995
85  1050 DATA 170,238,180,128,12
    8,136,196,190,191,149,133,12
    9,1968
82  1052 DATA 128,172,222,210,20
    2,254,188,132,128,130,191,15
    9,2116

AA  1054 DATA 132,196,252,184,12
    8,144,168,189,187,160,144,13
    6,2020
67  1056 DATA 128,160,192,200,25
    3,185,144,128,128,130,191,19
    1,2030
2E  1058 DATA 168,156,180,144,12
    8,192,162,190,191,144,128,12
    8,1911
68  1060 DATA 128,190,158,132,14
    0,166,190,156,128,190,158,13
    2,1868
8D  1062 DATA 194,190,188,144,12
    8,220,190,178,171,190,158,12
    9,2080
D2  1064 DATA 128,132,254,254,14
    6,162,158,140,128,156,158,16
    2,1978
22  1066 DATA 146,254,254,160,12
    8,132,190,190,148,130,134,13
    2,1998
92  1068 DATA 128,196,174,186,17
    4,186,145,128,128,140,132,15
    8,1875
F8  1070 DATA 191,164,150,128,12
    8,156,190,160,144,190,190,14
    4,1935
```

```
78 1072 DATA 128,132,142,158,17
   6,180,158,142,128,156,158,17
   6,1834
E0 1074 DATA 156,176,158,156,14
   4,162,182,156,156,182,162,13
   2,1922
44 1076 DATA 128,132,174,222,20
   8,244,190,158,128,129,202,20
   2,2117
C3 1078 DATA 190,186,144,128,12
   8,128,255,255,193,193,128,12
   8,2056
17 1080 DATA 128,208,232,254,22
   1,201,202,160,128,128,193,19
   3,2248
75 1082 DATA 255,255,128,128,12
   8,132,134,255,255,134,132,12
   8,2064
69 1084 DATA 128,140,158,191,14
   0,140,140,140,152,152,152,15
   2,1785
1C 1086 DATA 152,152,152,152,12
   8,192,188,158,145,255,190,16
   0,2024
FC 1088 DATA 128,226,191,173,16
   5,159,138,128,128,156,190,17
   7,1959
36 1090 DATA 255,161,146,128,12
   8,192,161,191,163,163,191,15
   8,2037
08 1092 DATA 128,156,190,229,25
   5,229,161,128,128,192,209,19
   0,2195
7A 1094 DATA 191,137,137,130,12
   8,188,250,195,211,250,178,12
   8,2123
E6 1096 DATA 128,194,190,191,13
   3,194,190,156,128,192,160,19
   0,2046
36 1098 DATA 191,146,128,128,12
   8,160,208,193,255,190,130,12
   8,1985
E4 1100 DATA 128,194,255,216,18
   2,226,224,128,128,192,252,19
   0,2315
1C 1102 DATA 227,224,192,128,25
   2,190,131,190,156,195,190,15
   6,2231
D1 1104 DATA 194,191,191,130,19
   5,191,190,128,128,192,190,19
   1,2111
B5 1106 DATA 201,197,190,159,12
   8,196,191,191,145,143,142,12
   8,2011
88 1108 DATA 128,158,191,169,16
   5,255,222,192,192,188,190,16
   9,2219
4F 1110 DATA 157,183,226,128,19
   2,182,190,205,205,190,153,12
   8,2139
FC 1112 DATA 128,178,139,207,19
   1,191,147,129,128,188,254,19
   3,2073
50 1114 DATA 196,254,191,128,12
   8,132,158,191,224,226,190,15
   9,2177
8A 1116 DATA 128,158,191,196,19
   0,225,252,191,128,192,227,21
   5,2293
03 1118 DATA 141,220,243,227,12
   8,129,191,254,208,217,206,16
   6,2330
BF 1120 DATA 128,160,210,202,23
   7,191,187,144,140,140,140,25
   5,2134
34 1122 DATA 255,140,140,140,14
   9,149,170,170,128,128,128,12
   8,1825
A0 1124 DATA 128,128,128,255,25
   5,128,128,128,149,149,170,17
   0,1916
3B 1126 DATA 149,149,170,170,23
   0,204,153,179,230,204,153,17
   9,-1
```

PROGRAM: CONDENSED SET

```
62 100 REM * CONDENSED *
8A 110 SA=62208
42 120 PRINT"ESC CODE FOR SET =
   CHR$(27)CHR$("SA/256")"
23 130 B=0:FORX=0TO11:READA:B=B
   +A:POKESA+X,A:NEXT:SA=SA+X:R
   EADA:IFA=BTHEN130
04 140 IFA>0THENPRINT"DATA ERRO
   R IN LINE"PEEK(63)+PEEK(64)*
   256
40 1000 DATA 128,128,128,128,0,
   0,0,0,128,128,223,128,1119
37 1002 DATA 0,0,0,0,135,128,13
   5,128,0,0,0,0,526
2F 1004 DATA 255,148,255,128,0,
   0,0,0,174,235,186,128,1509
D0 1006 DATA 0,0,0,0,243,136,23
   1,128,0,0,0,0,738
DC 1008 DATA 255,217,166,208,0,
   0,0,0,128,139,135,128,1376
41 1010 DATA 0,0,0,0,156,162,19
   3,128,0,0,0,0,639
7E 1012 DATA 193,162,156,128,0,
   0,0,0,170,156,170,128,1263
77 1014 DATA 0,0,0,0,136,190,13
   6,128,0,0,0,0,590
82 1016 DATA 192,240,176,128,0,
   0,0,0,136,136,136,128,1272
54 1018 DATA 0,0,0,0,128,176,17
   6,128,0,0,0,0,608
99 1020 DATA 176,140,131,128,0,
   0,0,0,191,161,191,128,1246
25 1022 DATA 0,0,0,0,164,191,16
   0,128,0,0,0,0,643
26 1024 DATA 177,169,166,128,0,
   0,0,0,161,165,155,128,1249
AD 1026 DATA 0,0,0,0,143,136,19
   0,128,0,0,0,0,597
F0 1028 DATA 167,165,153,128,0,
   0,0,0,156,166,153,128,1216
79 1030 DATA 0,0,0,0,129,177,14
   1,131,0,0,0,0,578
BB 1032 DATA 191,165,191,128,0,
   0,0,0,166,153,142,128,1264
E3 1034 DATA 0,0,0,0,128,148,14
   8,128,0,0,0,0,552
D7 1036 DATA 128,212,180,128,0,
   0,0,0,136,148,162,128,1222
63 1038 DATA 0,0,0,0,148,148,14
   8,128,0,0,0,0,572
73 1040 DATA 162,148,136,128,0,
   0,0,0,195,217,135,128,1249
3D 1042 DATA 0,0,0,0,190,217,21
   7,222,0,0,0,0,846
1B 1044 DATA 186,170,190,128,0,
   0,0,0,191,162,190,128,1345
4A 1046 DATA 0,0,0,0,190,162,16
   2,128,0,0,0,0,642
D9 1048 DATA 190,162,191,128,0,
   0,0,0,190,170,174,128,1333
41 1050 DATA 0,0,0,0,200,190,13
   7,128,0,0,0,0,655
D1 1052 DATA 222,210,254,128,0,
   0,0,0,191,130,190,128,1453
FB 1054 DATA 0,0,0,0,165,189,16
   0,128,0,0,0,0,642
F3 1056 DATA 160,197,253,128,0,
   0,0,0,191,136,182,128,1375
78 1058 DATA 0,0,0,0,161,191,16
   0,128,0,0,0,0,640
9C 1060 DATA 190,140,190,128,0,
   0,0,0,190,130,188,128,1284
D6 1062 DATA 0,0,0,0,190,162,19
   0,128,0,0,0,0,670
2E 1064 DATA 254,162,190,128,0,
   0,0,0,190,162,254,128,1468
C9 1066 DATA 0,0,0,0,190,130,13
   4,128,0,0,0,0,582
A0 1068 DATA 174,170,186,128,0,
   0,0,0,130,191,162,128,1269
12 1070 DATA 0,0,0,0,158,160,19
   0,128,0,0,0,0,636
C9 1072 DATA 158,160,158,128,0,
   0,0,0,190,152,190,128,1264
20 1074 DATA 0,0,0,0,182,136,18
   2,128,0,0,0,0,628
2F 1076 DATA 222,208,254,128,0,
   0,0,0,178,170,166,128,1454
21 1078 DATA 0,0,0,0,255,193,12
   8,128,0,0,0,0,704
70 1080 DATA 164,190,165,128,0,
   0,0,0,128,193,255,128,1351
3B 1082 DATA 0,0,0,0,132,191,13
   2,128,0,0,0,0,583
16 1084 DATA 136,156,170,136,0,
   0,0,0,128,128,128,128,1110
D8 1086 DATA 0,0,0,0,191,133,19
   1,128,0,0,0,0,643
42 1088 DATA 191,165,187,128,0,
   0,0,0,191,161,161,128,1312
18 1090 DATA 0,0,0,0,191,161,15
   8,128,0,0,0,0,638
39 1092 DATA 191,165,165,128,0,
   0,0,0,191,133,133,128,1234
4C 1094 DATA 0,0,0,0,191,161,18
   5,128,0,0,0,0,665
7A 1096 DATA 191,132,191,128,0,
   0,0,0,161,191,161,128,1283
E6 1098 DATA 0,0,0,0,176,161,19
   1,128,0,0,0,0,656
52 1100 DATA 191,132,187,128,0,
   0,0,0,191,160,160,128,1277
92 1102 DATA 0,0,0,0,191,134,19
   1,128,0,0,0,0,644
26 1104 DATA 191,129,190,128,0,
   0,0,0,158,161,158,128,1243
31 1106 DATA 0,0,0,0,191,137,14
   3,128,0,0,0,0,599
62 1108 DATA 158,161,254,192,0,
   0,0,0,191,137,183,128,1404
A7 1110 DATA 0,0,0,0,167,165,18
   9,128,0,0,0,0,649
00 1112 DATA 129,191,129,128,0,
   0,0,0,159,160,191,128,1215
75 1114 DATA 0,0,0,0,159,160,15
   9,128,0,0,0,0,606
6B 1116 DATA 191,152,191,128,0,
   0,0,0,187,132,187,128,1296
3C 1118 DATA 0,0,0,0,135,188,13
   5,128,0,0,0,0,586
61 1120 DATA 185,165,163,128,0,
   0,0,0,0,0,0,0,641
E5 1122 DATA 0,0,0,0,0,0,0,0,0,
   0,0,0,0
8B 1124 DATA 0,0,0,0,0,0,0,0,0,
   0,0,0,0
C5 1126 DATA 0,0,0,0,0,0,0,0,0,
   0,0,0,-1
```

00	ø 16	@ 32	p 48	— 64	P 80
! 01	1 17	a 33	q 49	A 65	Q 81
" 02	2 18	b 34	r 50	B 66	R 82
# 03	3 19	c 35	s 51	C 67	S 83
$ 04	4 20	d 36	t 52	D 68	T 84
% 05	5 21	e 37	u 53	E 69	U 85
& 06	6 22	f 38	v 54	F 70	V 86
' 07	7 23	g 39	w 55	G 71	W 87

(08	8 24	h 40	x 56	H 72	X 88
) 09	9 25	i 41	y 57	I 73	Y 89
* 10	: 26	j 42	z 58	J 74	Z 90
+ 11	; 27	k 43	[59	K 74	+ 91
, 12	< 28	l 44	£ 60	L 75	▩ 92
- 13	= 29	m 45	] 61	M 76	▮ 93
. 14	> 30	n 46	↑ 62	N 78	▩ 94
/ 15	? 31	o 47	← 63	O 79	▧ 95

The above shows the order in which the information defining the characters is stored. This order has been chosen because it makes the easiest (therefore quickest) conversion for the driving software.
NOTE: The characters from 96 to 127 cannot be re-defined. The driving software prints the normal MPS 803 characters. The characters no.96 to 127 are those printed with CHR$(224) to CHR$(255).

C64 PLUS DISK	C64	NO LOAD DIRECTORY	1/1

When you have produced a program it is wise to prevent other people from reading your disks to see what is on them. The routine presented here will allow you to stop the disk directory from being loaded into the computers memory.
The routine forces the disk drive to keep on reading the directory, without actually loading it.

P.A.Eves

```
10 PRINT "INSERT DISK - ANY KEY
TO CONTINUE"
20 POKE198,0:WAIT198,1
30 OPEN1,8,15,"IO:":OPEN5,8,5,"#
":T=18:S=1:Q$=CHR$(0)
40 PRINT#1,"U1 5 0 "T;S
50 FORI=0TO1:PRINT#1,"M-R"CHR$(I
)CHR$(5):GET#1,B$:B4=B$+Q$:B(I)=
ASC(B$):NEXT
60 IFB(0)=18THENS=B(1):GOTO40
70 PRINT#1,"B-P:5 0":PRINT#5,CHR
$(T);CHR$(1);
80 PRINT#1,"U2 5 0 "T;S:INPUT#1,
A,A$:PRINTA$:CLOSE1:CLOSE5
```

YC WRITER

Sell your typewriter and get into serious wordprocessing with with 'YC Writer', an 80 column wordprocessor.

By Burghard–Henry Lehmann

People who know nothing of the joys and tribulations of programming a computer and who are not interested in arcade games often ask, rather cynically, "What good are computers anyhow?"

Of course, they do not question the use of the kind of computer the gas board, for example, employs. The usefulness of this becomes clear every quarter when they get their gas bill. But what good is a home computer?

Well, I believe there is one good, solid reason why nearly everyone should invest in a home computer: wordprocessing. Everybody who has to do any writing at all, be it for work or for pleasure can benefit tremendously from using a wordprocessor. Even if all you want to do is write some letters, you will not know how easy and carefree it can be until you have done it on a wordprocessor.

A wordprocessor is more than just a souped–up typewriter or even an electronic typewriter. It should really be called a 'text processor', because a good wordprocessing program goes far beyond letting you enter mere 'words'. It allows you to build up a piece of text and then restructure it in any way you like. And all this without wasting a single sheet of paper.

No more second, third and fourth drafts! You start by writing from the top of your head and correct the text as you go along. A wordprocessor allows you to develop a letter, an article or even a novel from its inception to its final form all in one go without wasting time on rewriting manuscript pages which have come to look like battlefields. The savings in time and material are tremendous!

Getting Started

There is no better way to find out about wordprocessing than doing it. This is what I have written *YC Writer* for, to give you a very real taste of it.

The first thing you will notice when the program has started is that the letters are much smaller than the ordinary C 64 letters. This is because *YC Writer* uses a sort of microprint which is printed on the high–resolution screen and gives you 80 characters per screen row.

This is of course the number of characters you get on any of the Commodore printers. So the main advantage of *YC Writer* is that you'll get on paper exactly what you see on screen.

This kind of microprint may take a while to get used to, depending on the kind of TV set you've got. If you are unhappy with the way things are and find it an excessive strain on your eyes, do a bit of experimenting with different colours and also with different brightness and contrast settings on your TV.

To experiment with different

background and foreground colours hold down the CTRL–key and press "M". Now you will be prompted to enter the border, paper and ink colours you prefer. Type the number of the colour you want (e.g. 6 for blue – see your Commodore manual) and the colour will be changed immediately. Finally, if you are satisfied with your settings, press "Y" to return to the text, if not, press "N" and the process will be repeated.

Entering Commands

Most commands to the program are given with the CTRL key held down and a single letter being entered, e.g. CTRL+L for "LOAD textfile", CTRL+S for "SAVE textfile" and so on.

Help

If you press function key 1 you will be presented with the first of the two help pages which the program incorporates. The RETURN key gets you the second help page and lets you toggle between the two pages. Function key 1 returns you to the text.

Remember, all of the letters given with functions are to be entered with CTRL held down!

Information On Screen

The first three lines at the top are reserved for information. First you get the number of the line and the number of the column the cursor is on at any moment. Enter a few words and you'll see what I mean.

Next to it you get the number of words you have written so far. This wordcount is updated as you write. Later on when you start editing text it soon gets out of date. So, to get the exact wordcount press CTRL+U. This will update the number of words contained in the whole of the textfile.

Next to the number of words in the top line you see a "W", a "J" and a space in between four stars. These letters tell you which text entry mode is switched on. "W" stands for "word wrap" and "J" stands for "right hand justification". More about this and the space next to it in a minute.

The line below gives you the name of the document you are writing. When you enter the program this has the default name "no name". You can change this to a 16–letter name of your own choice by pressing CTRL+N. Now the cursor will move into the right position, ready for you to enter the document name.

There is a practical reason for this: This name will also be the filename used later on when you want to SAVE your document onto disk or tape.

The Tabulator

The third line at the top of the screen also has a practical reason beyond mere cosmetics: It shows you the tab position on each line.

To start with there is a tab point every 5 characters. Press function key 5 and the cursor will jump forward to the next tab position. Press function key 6 and the cursor will jump backwards to the former tab position.

You can install your own tab-position anywhere on the line by pressing CTRL+T. A "/" appears on the tab-line at the top of the screen where the new tab is. Press CTRL+T again, and the "/" vanishes.

If you want a completely different set-up of tab-positions than the one given press CTRL+F. Now all the tab-points are erased and, with CTRL+T you can make up your own tab-spacings. Press CTRL+F again and the default tab-positions are restored.

Entry Modes

There are really two sides to wordprocessing: you want to enter text and you want to edit it in the most convenient manner possible.

For this *YC Writer* has three entry modes: word wrap, right hand justification and insert.

Word wrap means that you can write your text as if you had one long continuous line. That is, you can ignore the end of a line and the computer does the rest. If you start a word at the end of the line it will automatically be moved onto the new line while you are writing.

For this to work there is an extra keystroke at the beginning of each line: If you enter a letter at the beginning of a new line the computer will know that this is part of a word started on the previous line and will move the whole word onto the new line. If you enter a space, the cursor won't move on, because the computer knows that the characters on the end of the line above form a complete word and are not to be moved (or "word wrapped") onto the new line. All this works of course only if you have the word wrap mode switched on. When the program starts, you will find it is on, but you can switch it on or off by pressing CTRL+W.

Right Justification

The next important entry feature is right hand justification. This always works in combination with word wrap and means that the line is spaced out in such a way that it is flush with the right hand side. Like word wrap it works automatically as you write.

Again, you can turn right hand justification on or off by pressing CTRL+J. But note: You can have word wrap without justification to get the 'typewriter look', but you can't have justification without word wrap.

Insert Mode

The third entry mode is most useful when you want to edit the text you have written and add additional words or whole sentences.

For this move the cursor onto the paragraph into which you want to insert something. Then press CTRL+I.

Now the paragraph is reformatted by the computer, that is, it is 'un–justified' so that there is at least one space at the end of each line. This is necessary for insert to work properly. Don't worry about this restructuring of the paragraph! After you have done your insert and switched insert off again (as you should every time !) the whole paragraph will automatically be word wrapped and justified again!

Once in the insert mode you can enter text, but it will not overwrite other text. Instead the text to the right will be pushed along by the cursor. If there isn't enough space at the end of the paragraph it will automatically insert an empty line. So you can insert as much as you like.

Do remember to switch insert off after you have finished! Otherwise it will go on wherever you put the cursor.

If you want an empty line anywhere, you can insert one by pressing CTRL+A.

This will move the rest of the textfile down by one line.

Erasing

Conversely, you can erase the line the cursor is on by pressing CTRL+B. This moves the rest of the textfile into the line you want to be erased.

If you want simply to erase one or two characters use the delete key as normal.

If you want to erase a whole block of text quickly and efficiently there is a powerful block erase facility. For this you first have to tell the computer the first line of the block you want to be erased and then the last line.

This is called marking out a block, and I mention it especially because the same procedure will also be used for marking out a block which you want to be moved or copied. It works like this:

Block-set

Move the cursor onto the first line of the block you want to mark out. Press CTRL+G. You will notice that in the information header at the top of the screen a remark has appeared, for example: "Blk-start: 4". This is to remind you that you have marked out the beginning of a block starting at line 4.

Next move the cursor to the last line of the block you want to mark out and press again CTRL+G. Now the message "Blk-end: 10" will appear at the top of the screen.

You have now set a block starting at line 4 and ending at line 10, inclusive. This is now the "current block". Thus a block always goes from the beginning of one line to the end of another.

If for any reason you are not happy with the parameters you have given press CTRL+G again and the info at the top of the screen will be erased so that you can start again.

To erase the block you have marked out, simply press CTRL+K.

If you want to get rid of the whole textfile and start afresh press CTRL+E. Since this is a pretty final command there is a safety-catch built into it: You will be asked if you are sure about erasing everything. If you are not, press "N" and no harm will be done. If you are certain, press "Y" and not only will the whole of the textfile be erased but the program will reset as if you just have started it off.

Moving and Copying

If you want to move the current block to somewhere else in the textfile, move the cursor to the line above the one you want the block moved to and press CTRL+O.

Similarly, if you want to copy the block: bring the cursor to the line you want and press CTRL+H.

You will notice that after block erasure and block move the messages at the top of the screen will vanish. Not so after block-copy! This is so that you can copy the block you have chosen as many times as you wish. But this only works of course, as long as you don't do any more editing. If you do, the position of the block may have changed so that you will get something different copied out!

Formating Text

At any given time you can reformat a paragraph to have it right hand justified or not. CTRL+C un-justifies the paragraph the cursor is on, while CTRL+D justifies it.

For all this,and the insert mode, to work properly the computer has to know where a paragraph starts and ends. So there is an important rule: A paragraph has to be started with an indent of at least two spaces!

Other wordprocessors use formating characters to mark out the beginning or the end of a paragraph. With *YC Writer* I wanted to have no distracting formating characters on screen. For this to work, you have to obey the above rule. A small price to pay, don't you agree?

Margins

Impressive as 80-columns on screen and on paper are, with most Commodore printers it looks rather cramped because it fills nearly the whole width of an A4 sheet. This doesn't look very good if you are writing a letter you want to create a good impression.

For this reason I was determined to include a margin setting facility in *YC Writer*. It only works on fresh textfile before you have entered any text. You have to stick with the margins you have chosen throughout the textfile and can't change them afterwards.

Let's say you want a left hand margin of 10 characters. Put the cursor into the right position (2 tab-positions with F5) and press CTRL+X.

The margin is demonstrated graphically by the space on the left being filled and by the cursor position becoming column 0.

If you now want to set a margin of 10 characters to the right, again place the cursor at the appropriate position and press CTRL+Y. A similar thing will happen.

For technical reasons there is a rule (more rules!) to all this: The left margin has to be set on an even numbered column, while the right margin has to be set on an odd numbered column!

Saving and Loading

Once you have written your document the first thing you want to do it is SAVE it on disk or tape.

It is a good idea to do this at regular intervals. Powercuts, however brief, are not an unknown thing and it takes only a few cycles of no electricty and hours of your work may be down the drain!

Saving a document is very straight forward. After you have given it the name you want as I have already described: Press CTRL+S.

In order to make the program work for tape as well as disk, so you don't always have to answer the annoying question: "Tape or Disk?", you can switch the program into the tape or disk mode by POKEing location 8010 from Basic and then saving that version.

As a matter of fact, you only have to do this POKE if you are using tape. Simply POKE 8010,1. If, for any reason, you want to revert to disk, POKE 8010,8.

The disk version of the program includes a replace facility. You can use this if you have already saved a certain document and want merely to replace it with a changed version.

Since there is a lot of discussion going on in the C 64 community about the safety of the replace facility and I seem to belong to the 2 percent of disk-drive owners where it isn't safe to use, I have circumnavigated this sordid area by doing the replace in *YC Writer* with a combination of scratch and SAVE. Better safe than sorry!

Printout

Finally, you will naturally want your document printed out.

This is very easy with *YC Writer*: Simply get your printer switched on and ready and then press CTRL+P. The whole of your document will be sent to the printer as it appears on screen.

Many wordprocessors have additional print options, like page–numbers, footers, headers and so on. I didn't have enough time in developing this program to give you anything but a straight forward printout. I also thought that this is a nice little programming job you could easily do yourself in Basic.

Incidentally, you can quit the program at any given moment by pressing function key 7. And you can re–enter it by entering SYS 8050.

The is some 8k of memory empty for your own programs. The textfile starts in memory at location 16020.

There textfile is limited to 300 lines. Not quite enough for 'War and Peace', but remember Tolstoy's textfile was limited to one sheet of foolscap and just think of all his corrections!

Getting it all in

Entering the programs.

1) Type in each of the programs presented here seperately using the SYNTAX CHECKER found on the LISTINGS page.

2) If using cassette SAVE WRITER BOOT on a seperate cassette to the other programs.

3) LOAD and RUN YC WRITER A & B. When B has finished it will SAVE a new program out. If using tape this should be SAVEd after WRITER BOOT.

4) LOAD and RUN YC WRITER C to YC WRITER O. When finished a second program will be SAVEd. If using tape this should be SAVEd after the program from 3.

5) To RUN the program simply LOAD and RUN WRITER BOOT. This will LOAD the other two parts and start the program.

PROGRAM: YC WRITER A

```
2F   10 BL=34   :LN=50   :SA=49152
5B   20 FOR L=0 TO BL:CX=0:FOR D=0 TO 15:READ A:CX=CX+A:POKE SA+L*16+D,A:NEXT D
A5   30 READ A:IF A><CX THENPRINT "ERROR IN LINE";LN+(L*10):STOP
40   40 NEXT L:END
77   50 DATA 173,237,3,201,2,240,3,76,120,31,56,173,233,3,237,235,2023
4C   60 DATA 3,133,181,173,234,3,237,236,3,133,182,230,181,208,2,230,2369
1B   70 DATA 182,165,167,133,88,133,169,133,179,56,165,166,229,172,133,87,2357
9C   80 DATA 133,168,133,178,176,6,198,88,198,169,198,179,24,165,178,109,2300
60   90 DATA 58,31,133,178,144,2,230,179,56,173,64,31,229,178,133,73,1892
35   100 DATA 173,65,31,229,179,5,73,144,14,24,165,178,109,57,31,133,1610
43   110 DATA 178,144,229,230,179,176,225,56,165,178,229,87,133,92,165,179,2645
F8   120 DATA 229,88,133,93,24,165,168,101,181,133,89,165,169,101,182,133,2154
31   130 DATA 90,32,0,35,32,37,193,144,18,24,173,235,3,101,181,133,1431
57   140 DATA 87,173,236,3,101,182,133,88,76,165,192,173,235,3,133,87,2067
AD   150 DATA 173,236,3,133,88,165,168,133,89,165,169,133,90,165,181,133,2224
F5   160 DATA 92,165,182,133,93,32,0,35,56,173,64,31,229,168,133,73,1659
26   170 DATA 173,65,31,229,169,5,73,176,18,24,165,168,101,181,141,64,1783
70   180 DATA 31,165,169,101,182,141,65,31,76,236,192,24,173,64,31,101,1782
68   190 DATA 181,141,64,31,173,65,31,101,182,141,65,31,32,37,193,144,1612
E1   200 DATA 34,24,173,235,3,101,181,141,235,3,173,236,3,101,182,141,1966
D6   210 DATA 236,3,24,173,233,3,101,181,141,233,3,173,234,3,101,182,2024
50   220 DATA 141,234,3,173,232,3,240,3,76,79,37,165,171,133,91,32,1813
15   230 DATA 180,45,76,120,31,56,173,235,3,229,168,133,73,173,236,3,1934
40   240 DATA 229,169,5,73,96,32,145,178,200,192,16,208,249,32,90,193,2107
52   250 DATA 169,13,32,210,255,32,210,255,96,69,78,84,69,82,32,70,1756
ED   260 DATA 73,76,69,78,65,77,69,58,32,0,169,0,76,98,193,76,1209
86   270 DATA 164,193,32,68,229,24,162,12,160,0,32,240,255,169,147,160,2047
53   280 DATA 193,32,30,171,169,97,133,178,169,31,133,179,160,0,169,32,1876
B0   290 DATA 145,178,200,192,16,208,249,32,164,193,169,13,32,210,255,32,2288
53   300 DATA 210,255,96,69,78,84,69,82,32,70,73,76,69,78,65,77,1483
A7   310 DATA 69,58,32,0,169,0,133,204,70,207,32,228,255,240,245,201,2143
64   320 DATA 17,240,241,201,145,240,237,72,56,165,211,233,168,104,166,2512
EE   330 DATA 211,224,16,240,50,144,48,192,16,176,25,201,13,240,61,32,1889
C0   340 DATA 210,255,201,20,240,47,201,32,144,202,201,129,144,2,73,128,2229
C5   350 DATA 145,178,208,192,32,228,255,240,251,201,13,240,31,201,20,240,2675
DE   360 DATA 222,201,157,240,218,208,237,201,13,240,17,201,20,240,165,201,2781
8D   370 DATA 157,240,161,208,202,136,169,32,145,178,208,152,162,1,134,204,2489
3E   380 DATA 202,134,207,96,0,0,0,0,0,0,0,0,0,0,0,0,639
D4   390 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
```

PROGRAM: YC WRITER B

```
C0   10 BL=152   :LN=50   :SA=49769
5B   20 FOR L=0 TO BL:CX=0:FOR D=0 TO 15:READ A:CX=CX+A:POKE SA+L*16+D,A:NEXT D
A5   30 READ A:IF A><CX THENPRINT "ERROR IN LINE";LN+(L*10):STOP
AC   40 NEXT L:PRINT"{DOWN2}GET READY TO SAVE AND PRESS A KEY":POKE198,0:WAIT198,1
A2   45 POKE43,0:POKE44,192:POKE45,27:POKE46,204:X=PEEK(186):SAVE"WRITER1",X
69   50 DATA 120,32,62,196,32,230,195,32,10,196,169,0,141,192,2,169,1778
51   60 DATA 165,141,20,3,169,194,141,21,3,169,235,141,38,3,169,197,1603
61   70 DATA 141,39,3,32,152,195,88,96,173,192,2,240,3,76,41,195,1668
B6   80 DATA 206,184,2,240,79,169,50,205,184,2,240,3,76,41,195,169,2045
1F   90 DATA 1,141,186,2,165,251,141,188,2,165,252,141,189,2,173,167,2166
```

```
8A  100 DATA 2,141,190,2,133,251
    ,173,168,2,141,191,2,133,252
    ,32,214,2027
96  110 DATA 195,160,7,177,251,1
    53,193,2,174,171,2,208,5,9,2
    40,76,2023
68  120 DATA 241,194,9,15,145,25
    1,136,16,234,32,222,195,169,
    20,141,184,2204
CC  130 DATA 2,76,31,195,169,0,1
    41,186,2,173,190,2,133,251,1
    73,191,1915
A6  140 DATA 2,133,252,160,7,185
    ,193,2,145,251,136,16,248,16
    9,70,141,2110
25  150 DATA 184,2,173,188,2,133
    ,251,173,189,2,133,252,32,23
    4,255,165,2368
E9  160 DATA 204,208,41,198,205,
    208,37,169,20,133,205,164,21
    1,70,207,174,2454
01  170 DATA 135,2,177,209,176,1
    7,230,207,133,206,32,36,234,
    177,243,141,2355
BF  180 DATA 135,2,174,134,2,165
    ,206,73,128,32,28,234,165,1,
    41,16,1536
9C  190 DATA 240,10,160,0,132,19
    2,165,1,9,32,208,8,165,192,2
    08,6,1728
89  200 DATA 165,1,41,31,133,1,3
    2,135,234,202,189,119,2,201,
    140,208,1834
24  210 DATA 23,198,198,173,17,2
    08,41,32,208,6,32,152,195,76
    ,149,195,1903
CC  220 DATA 32,182,195,169,14,3
    2,202,241,76,126,234,173,2,2
    21,9,3,1911
C5  230 DATA 141,2,221,173,17,20
    8,9,32,141,17,208,173,0,221,
    41,252,1856
6A  240 DATA 141,0,221,169,56,14
    1,24,208,96,173,2,221,9,3,14
    1,2,1607
33  250 DATA 221,173,17,208,41,2
    23,141,17,208,173,0,221,41,2
    52,9,3,1948
1E  260 DATA 141,0,221,169,21,14
    1,24,208,96,120,165,1,41,253
    ,133,1,1735
94  270 DATA 96,165,1,9,2,133,1,
    88,96,169,0,133,251,169,224,
    133,1670
52  280 DATA 252,160,0,169,0,145
    ,251,165,251,201,63,208,7,16
    5,252,201,2490
39  290 DATA 255,208,1,96,230,25
    1,208,2,230,252,76,240,195,1
    69,0,133,2546
99  300 DATA 251,169,204,133,252
    ,160,0,173,33,208,41,15,133,
    253,173,134,2332
6B  310 DATA 2,10,10,10,10,41,24
    0,5,253,145,251,166,251,224,
    232,208,2058
F1  320 DATA 7,166,252,224,207,2
    08,1,96,230,251,208,2,230,25
    2,76,38,2448
F2  330 DATA 196,169,0,141,167,2
    ,169,224,141,168,2,169,0,141
    ,169,2,1860
D4  340 DATA 169,204,141,170,2,1
    69,0,141,171,2,96,169,0,141,
    173,2,1750
0B  350 DATA 32,214,195,169,123,
    133,251,169,202,133,252,24,1
    4,172,2,46,2131
06  360 DATA 173,2,24,14,172,2,4
    6,173,2,24,173,172,2,101,251
    ,133,1464
77  370 DATA 251,173,173,2,101,2
    52,133,252,173,167,2,133,253
    ,173,168,2,2408
AE  380 DATA 133,254,173,171,2,2
    08,68,160,0,162,4,177,253,41
    ,15,141,1962
21  390 DATA 172,2,177,251,41,24
    0,13,172,2,145,253,230,253,2
    08,2,230,2391
FC  400 DATA 254,177,253,41,15,1
    41,172,2,177,251,10,10,10,10
    ,13,172,1708
16  410 DATA 2,145,253,230,253,2
    08,2,230,254,230,251,208,2,2
    30,252,202,2952
6A  420 DATA 208,201,238,171,2,3
    2,222,195,76,35,197,160,0,16
    2,4,177,2080
D5  430 DATA 253,41,240,141,172,
    2,177,251,74,74,74,74,13,172
    ,2,145,1905
22  440 DATA 253,230,253,208,2,2
    30,254,177,253,41,240,141,17
    2,2,177,251,2884
B3  450 DATA 41,15,13,172,2,145,
    253,230,253,208,2,230,254,23
    0,251,208,2507
FE  460 DATA 2,230,252,202,208,2
    01,165,253,141,167,2,165,254
    ,141,168,2,2553
16  470 DATA 206,171,2,32,222,19
    5,173,169,2,133,251,173,170,
    2,133,252,2286
AE  480 DATA 160,0,173,134,2,10,
    10,10,10,141,172,2,177,251,4
    1,15,1308
CE  490 DATA 13,172,2,145,251,17
    3,171,2,208,8,238,169,2,208,
    3,238,2003
6F  500 DATA 170,2,96,169,0,133,
    251,24,105,64,133,253,169,22
    4,133,252,2178
C6  510 DATA 105,1,133,254,32,21
    4,195,160,0,177,253,145,251,
    165,253,201,2539
45  520 DATA 63,208,6,165,254,20
    1,255,240,15,230,251,208,2,2
    30,252,230,2810
36  530 DATA 253,208,2,230,254,7
    6,102,197,32,222,195,169,0,2
    30,251,208,2629
94  540 DATA 2,230,252,145,251,1
    66,251,224,63,208,6,166,252,
    224,255,240,2935
EB  550 DATA 3,76,138,197,169,0,
    133,251,24,105,40,133,253,16
    9,204,133,2028
C5  560 DATA 252,105,0,133,254,1
    77,253,145,251,165,253,201,2
    32,208,6,165,2800
22  570 DATA 254,201,207,240,15,
    230,251,208,2,230,252,230,25
    3,208,2,230,3013
3E  580 DATA 254,76,178,197,169,
    0,141,167,2,169,254,141,168,
    2,169,192,2279
CF  590 DATA 141,169,2,169,207,1
    41,170,2,169,0,141,171,2,96,
    141,172,1893
CF  600 DATA 2,72,138,72,152,72,
    165,154,201,3,240,8,104,168,
    104,170,1825
4E  610 DATA 104,76,202,241,169,
    1,141,192,2,173,186,2,240,30
    ,169,0,1928
46  620 DATA 141,186,2,173,190,2
    ,133,251,173,191,2,133,252,1
    60,7,185,2181
2C  630 DATA 193,2,145,251,136,1
    6,248,169,51,141,184,2,173,1
    72,2,201,2086
69  640 DATA 255,208,8,169,126,1
    41,172,2,76,79,198,201,224,1
    44,9,56,2068
11  650 DATA 233,64,141,172,2,76
    ,79,198,201,192,144,6,56,233
    ,96,141,2034
28  660 DATA 172,2,201,13,208,6,
    32,246,201,76,238,201,201,17
    ,208,117,2139
DB  670 DATA 173,168,2,201,254,1
    44,73,173,167,2,201,0,144,66
    ,173,171,2112
03  680 DATA 2,141,178,2,173,167
    ,2,141,174,2,173,168,2,141,1
    75,2,1643
6B  690 DATA 173,169,2,141,176,2
    ,173,170,2,141,177,2,32,80,1
    97,173,1810
4A  700 DATA 178,2,141,171,2,173
    ,174,2,141,167,2,173,175,2,1
    41,168,1812
77  710 DATA 2,173,176,2,141,169
    ,2,173,177,2,141,170,2,76,20
    7,198,1811
A6  720 DATA 24,173,167,2,105,64
    ,141,167,2,173,168,2,105,1,1
    41,168,1603
69  730 DATA 2,24,173,169,2,105,
    40,141,169,2,173,170,2,105,0
    ,141,1418
BC  740 DATA 170,2,76,238,201,20
    1,19,208,6,32,62,196,76,238,
    201,201,2127
05  750 DATA 20,240,3,76,248,199
    ,173,167,2,141,176,2,173,168
    ,2,141,1931
93  760 DATA 177,2,173,169,2,141
    ,178,2,173,170,2,141,179,2,3
    2,246,1789
72  770 DATA 201,173,176,2,141,1
    67,2,173,177,2,141,168,2,173
    ,178,2,1878
AE  780 DATA 141,169,2,173,179,2
    ,141,170,2,162,8,160,0,32,21
    4,195,1750
F3  790 DATA 173,171,2,208,77,17
    3,167,2,201,0,208,13,173,168
    ,2,201,1935
4D  800 DATA 224,208,6,32,222,19
    5,76,238,201,56,173,169,2,23
    3,1,141,2177
66  810 DATA 169,2,173,170,2,233
    ,0,141,170,2,56,173,176,2,23
    3,8,1710
9A  820 DATA 141,176,2,141,167,2
    ,173,177,2,233,0,141,177,2,1
    41,168,1843
E4  830 DATA 2,173,176,2,133,253
    ,173,177,2,133,254,177,253,4
    1,240,141,2330
FB  840 DATA 182,2,173,174,2,133
    ,251,173,175,2,133,252,140,1
    72,2,56,2022
C9  850 DATA 165,251,233,8,133,2
    51,165,252,233,0,133,252,177
    ,251,24,46,2574
A1  860 DATA 172,2,42,46,172,2,4
    2,46,172,2,42,46,172,2,42,46
    ,1048
C8  870 DATA 172,2,145,251,46,17
    2,2,46,172,2,46,172,2,46,172
    ,2,1450
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6C  880 DATA 165,251,205,176,2,2
    08,200,165,252,205,177,2,208
    ,193,173,171,2753
D7  890 DATA 2,208,9,177,253,41,
    15,13,182,2,145,253,238,174,
    2,208,1922
9A  900 DATA 3,238,175,2,238,176
    ,2,208,3,238,177,2,202,240,1
    1,173,2088
8F  910 DATA 171,2,240,3,76,111,
    199,76,94,199,32,222,195,206
    ,171,2,1899
7C  920 DATA 240,6,238,171,2,238
    ,171,2,76,238,201,201,29,208
    ,59,173,2253
B7  930 DATA 171,2,208,6,238,171
    ,2,76,238,201,206,171,2,24,1
    73,167,2056
A2  940 DATA 2,105,8,141,167,2,1
    73,168,2,105,0,141,168,2,238
    ,169,1591
F9  950 DATA 2,208,3,238,170,2,1
    73,167,2,201,64,208,10,173,1
    68,2,1791
4D  960 DATA 201,255,208,3,32,80
    ,197,76,238,201,201,141,208,
    6,32,246,2325
AB  970 DATA 201,76,238,201,201,
    145,208,53,162,225,236,168,2
    ,144,9,208,2477
5E  980 DATA 41,174,167,2,224,64
    ,144,34,56,173,167,2,233,64,
    141,167,1853
4C  990 DATA 2,173,168,2,233,1,1
    41,168,2,56,173,169,2,233,40
    ,141,1704
AB 1000 DATA 169,2,173,170,2,23
    3,0,141,170,2,76,238,201,201
    ,147,208,2133
36 1010 DATA 12,32,230,195,32,1
    0,196,32,62,196,76,238,201,2
    01,148,240,2101
B8 1020 DATA 3,76,114,201,173,1
    67,2,141,176,2,173,168,2,141
    ,177,2,1718
5B 1030 DATA 173,169,2,141,178,
    2,173,170,2,141,179,2,32,246
    ,201,173,1984
EF 1040 DATA 176,2,141,167,2,17
    3,177,2,141,168,2,173,178,2,
    141,169,1814
23 1050 DATA 2,173,179,2,141,17
    0,2,173,167,2,133,251,173,16
    8,2,133,1871
3A 1060 DATA 252,160,0,140,172,
    2,162,8,32,214,195,173,171,2
    ,240,9,1932
7D 1070 DATA 177,251,141,182,2,
    41,15,145,251,177,251,24,110
    ,172,2,106,2047
08 1080 DATA 110,172,2,106,110,
    172,2,106,110,172,2,106,110,
    172,2,145,1599
5F 1090 DATA 251,110,172,2,110,
    172,2,110,172,2,110,172,2,24
    ,165,251,1827
7D 1100 DATA 105,8,133,251,165,
    252,105,0,133,252,165,251,20
    5,174,2,208,2409
F4 1110 DATA 200,165,252,205,17
    5,2,208,193,173,171,2,240,17
    ,173,176,2,2354
24 1120 DATA 133,251,173,177,2,
    133,252,173,182,2,41,240,145
    ,251,238,176,2569
C7 1130 DATA 2,208,3,238,177,2,
    173,176,2,133,251,173,177,2,
    133,252,2102
2C 1140 DATA 238,174,2,208,3,23
    8,175,2,140,172,2,173,171,2,
    240,9,1949
09 1150 DATA 177,251,141,182,2,
    41,15,145,251,202,240,3,76,2
    30,200,32,2188
DD 1160 DATA 222,195,76,238,201
    ,201,157,208,68,173,171,2,24
    0,6,206,171,2535
4E 1170 DATA 2,76,238,201,173,1
    67,2,201,0,208,10,173,168,2,
    201,224,2046
0B 1180 DATA 208,3,76,238,201,2
    38,171,2,56,173,167,2,233,8,
    141,167,2004
BA 1190 DATA 2,173,168,2,233,0,
    141,168,2,56,173,169,2,233,1
    ,141,1664
36 1200 DATA 169,2,173,170,2,23
    3,0,141,170,2,76,238,201,201
    ,160,208,2146
C6 1210 DATA 5,169,32,141,172,2
    ,201,161,144,5,169,128,141,1
    72,2,201,1845
4A 1220 DATA 32,144,30,201,129,
    176,26,56,233,32,141,172,2,3
    2,88,196,1690
2A 1230 DATA 173,167,2,201,64,2
    08,10,173,168,2,201,255,208,
    3,32,80,1947
42 1240 DATA 197,169,0,141,192,
    2,76,249,197,169,0,141,174,2
    ,169,224,2102
E2 1250 DATA 141,175,2,162,0,17
    3,175,2,205,168,2,144,12,208
    ,31,173,1773
26 1260 DATA 174,2,205,167,2,24
    0,2,176,21,24,173,174,2,105,
    64,141,1672
54 1270 DATA 174,2,173,175,2,10
    5,1,141,175,2,232,76,2,202,1
    73,172,1807
A6 1280 DATA 2,201,148,240,72,2
    01,20,240,68,173,174,2,141,1
    67,2,173,2024
77 1290 DATA 175,2,141,168,2,16
    9,0,141,171,2,169,0,141,169,
    2,169,1621
D9 1300 DATA 204,141,170,2,232,
    202,240,20,24,173,169,2,105,
    40,141,169,2034
15 1310 DATA 2,173,170,2,105,0,
    141,170,2,76,82,202,173,167,
    2,201,1668
E6 1320 DATA 64,144,10,173,168,
    2,201,255,208,3,32,80,197,96
    ,0,0,1633
26 1330 DATA 0,0,102,102,6,96,8
    5,0,0,85,245,95,85,39,170,
    1110
EB 1340 DATA 115,226,234,242,79
    ,87,4,164,169,112,36,0,0,0,1
    8,68,1554
20 1350 DATA 68,33,66,17,17,36,
    0,150,246,144,2,39,34,0,0,0,
    852
2B 1360 DATA 3,52,0,7,0,0,0,0,6
    ,96,17,34,68,136,105,189,713
7B 1370 DATA 153,96,38,34,34,11
    2,105,18,72,240,113,39,18,64
    ,19,121,1276
5B 1380 DATA 241,16,116,71,17,9
    6,18,78,153,96,241,34,68,64,
    105,150,1564
DE 1390 DATA 153,96,105,151,18,
    64,6,96,6,96,6,96,6,100,18,7
    2,1089
49 1400 DATA 66,16,0,112,112,0,
    132,33,36,128,37,18,32,32,10
    5,187,1046
F0 1410 DATA 136,112,0,113,117,
    112,68,117,85,112,0,116,68,1
    12,17,117,1402
91 1420 DATA 85,112,0,117,116,1
    12,3,68,100,64,0,117,87,23,6
    8,117,1189
E8 1430 DATA 85,80,32,34,34,32,
    32,34,34,36,69,86,101,80,68,
    68,905
E1 1440 DATA 68,96,0,159,153,14
    4,0,117,85,80,0,117,85,112,0
    ,117,1333
C7 1450 DATA 87,68,0,117,87,17,
    0,116,68,64,0,116,113,112,68
    ,116,1149
A9 1460 DATA 68,112,0,85,85,112
    ,0,85,85,32,0,153,159,144,0,
    85,1205
90 1470 DATA 37,80,0,85,87,23,0
    ,113,36,112,118,102,102,112,
    37,79,1123
4B 1480 DATA 68,240,115,51,51,1
    12,2,114,34,34,0,79,64,0,0,1
    5,979
0C 1490 DATA 240,0,37,87,85,80,
    101,87,85,96,117,68,69,112,1
    01,85,1450
D5 1500 DATA 85,96,116,71,68,11
    2,116,71,68,64,117,71,85,112
    ,85,87,1424
BA 1510 DATA 85,80,114,34,34,11
    2,114,34,42,224,85,86,101,80
    ,68,68,1361
86 1520 DATA 68,112,159,153,153
    ,144,157,223,187,144,117,85,
    85,112,117,87,2103
0F 1530 DATA 68,64,117,85,85,35
    ,117,87,101,80,116,71,17,112
    ,114,34,1303
4B 1540 DATA 34,32,85,85,85,112
    ,85,85,85,32,153,153,159,144
    ,85,82,1496
5A 1550 DATA 37,80,85,85,34,32,
    113,18,68,112,102,111,246,10
    2,165,165,1555
7D 1560 DATA 165,165,102,102,10
    2,102,0,250,170,160,255,119,
    51,17,255,255,2270
47 1570 DATA 255,255,0,0,0,0,0,
    0,0,0,0,0,0,0,0,0,510
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PROGRAM: YC WRITER C
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14  10 BL=49    :LN=50    :SA=5731
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
3F  50 DATA 76,105,22,76,206,23,
    32,206,23,160,0,140,232,3,13
    2,181,1617
5E  60 DATA 132,180,200,140,238,
    3,160,0,177,168,201,32,208,8
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    ,200,204,2253
B0  70 DATA 58,31,208,244,240,93
    ,132,183,132,184,177,168,201
    ,32,208,38,2329
29  80 DATA 204,58,31,176,48,133
    ,73,200,177,168,201,32,208,2
    2,132,183,2046
4F  90 DATA 164,184,145,168,164,
    183,177,168,201,32,208,18,20
    0,204,57,31,2304
7B  100 DATA 208,244,240,17,165,
    73,164,184,145,168,230,183,2
    30,184,164,183,2782
F2  110 DATA 204,57,31,208,197,1
    73,232,3,208,103,164,184,204
    ,57,31,176,2232
B5  120 DATA 51,169,32,145,168,2
    00,204,57,31,208,248,173,238
    ,3,240,3,2170
BD  130 DATA 32,186,45,24,165,16
    8,109,57,31,133,168,144,2,23
    0,169,230,1893
A7  140 DATA 91,160,0,177,168,20
    1,32,208,7,200,177,168,201,3
    2,240,3,2065
2B  150 DATA 76,121,22,96,173,68
    ,31,240,210,177,168,201,32,2
    40,3,136,1994
3D  160 DATA 208,242,162,0,200,1
    77,168,157,65,3,169,32,145,1
    68,232,200,2328
F8  170 DATA 204,57,31,208,240,1
    57,65,3,232,134,181,238,232,
    3,76,222,2283
CC  180 DATA 22,164,184,204,58,3
    1,176,10,169,32,145,168,200,
    204,57,31,1855
46  190 DATA 208,248,165,184,133
    ,183,24,101,181,205,57,31,14
    4,66,56,173,2159
60  200 DATA 58,31,229,181,168,1
    77,168,201,32,240,3,136,208,
    247,132,183,2394
CB  210 DATA 200,162,0,177,168,1
    57,234,159,201,32,208,8,200,
    177,168,201,2452
27  220 DATA 32,240,12,136,169,3
    2,145,168,232,200,204,57,31,
    208,228,169,2263
82  230 DATA 32,157,234,159,232,
    134,182,24,165,183,101,181,1
    33,184,208,2,2311
CF  240 DATA 133,184,164,183,177
    ,168,164,184,145,168,198,184
    ,198,183,16,242,2691
1C  250 DATA 166,181,164,184,202
    ,189,65,3,145,168,202,136,16
    ,247,166,182,2416
15  260 DATA 240,19,189,234,159,
    157,65,3,202,16,247,165,182,
    133,181,169,2361
95  270 DATA 0,133,182,240,3,206
    ,232,3,76,222,22,165,166,133
    ,168,165,2116
0E  280 DATA 167,133,169,56,165,
    168,229,172,133,168,176,2,19
    8,169,165,171,2441
B1  290 DATA 133,91,165,168,205,
    69,31,208,7,165,169,205,70,3
    1,240,32,1989
DB  300 DATA 160,0,177,168,201,3
    2,208,7,200,177,168,201,32,2
    40,17,56,2044
C0  310 DATA 165,168,237,57,31,1
    33,168,176,2,198,169,198,91,
    76,229,23,2121
F8  320 DATA 96,127,127,127,127,
    127,127,127,127,127,127,127,
    127,127,127,127,2001
6B  330 DATA 127,127,127,127,127
    ,127,127,127,127,127,127,127
    ,127,127,127,2032
3A  340 DATA 127,127,127,127,127
    ,32,102,22,169,0,133,181,133
    ,182,141,232,1962
09  350 DATA 3,165,168,133,73,16
    5,169,133,74,24,165,73,109,5
    7,31,133,1675
D1  360 DATA 73,144,2,230,74,160
    ,0,177,73,201,32,208,10,200,
    177,73,1834
A4  370 DATA 201,32,208,3,238,23
    2,3,172,57,31,177,168,201,32
    ,240,44,2039
6D  380 DATA 136,177,168,201,32,
    240,37,173,68,31,240,32,162,
    0,177,168,2042
04  390 DATA 201,32,240,4,232,13
    6,208,246,134,181,162,0,200,
    177,168,157,2478
6B  400 DATA 65,3,169,32,145,168
    ,200,232,228,181,208,241,173
    ,232,3,208,2488
89  410 DATA 3,32,20,30,32,186,4
    5,24,165,168,109,57,31,133,1
    68,144,1347
31  420 DATA 2,230,169,230,91,16
    0,0,177,168,201,32,208,63,20
    0,177,168,2276
C6  430 DATA 201,32,208,10,165,1
    81,240,3,76,146,25,76,97,25,
    160,0,1645
BF  440 DATA 177,168,201,32,208,
    38,173,68,31,208,3,76,68,24,
    132,184,1791
D7  450 DATA 200,132,183,174,57,
    31,164,183,177,168,164,184,1
    45,168,230,183,2543
09  460 DATA 230,184,202,208,241
    ,172,58,31,169,32,145,168,17
    3,68,31,240,2352
5D  470 DATA 90,165,181,240,86,1
    72,58,31,166,181,177,168,201
    ,32,208,79,2235
67  480 DATA 136,202,208,246,177
    ,168,201,32,208,3,136,208,24
    7,132,183,24,2511
19  490 DATA 165,183,101,181,133
    ,184,164,183,177,168,164,184
    ,145,168,198,184,2682
B7  500 DATA 198,183,16,242,166,
    181,164,184,202,189,65,3,145
    ,168,202,136,2444
F4  510 DATA 16,247,169,0,133,18
    1,166,182,240,17,189,234,159
    ,157,65,3,2180
63  520 DATA 202,16,247,165,182,
    133,181,169,0,133,182,76,68,
    24,96,56,1930
EC  530 DATA 173,58,31,229,181,1
    68,177,168,201,32,240,3,136,
    208,247,200,2452
3F  540 DATA 162,0,177,168,157,2
    34,0,0,0,0,0,0,0,0,0,0,898
```

```
PROGRAM: YC WRITER D
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```
14  10 BL=49    :LN=50    :SA=6521
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
7E  50 DATA 159,169,32,145,168,2
    32,200,204,57,31,208,240,134
    ,182,56,173,2390
9C  60 DATA 58,31,229,181,133,18
    3,76,34,25,165,168,72,165,16
    9,72,165,1926
ED  70 DATA 91,72,32,224,46,104,
    133,91,104,133,169,104,133,1
    68,56,165,1825
DB  80 DATA 168,237,57,31,133,16
    8,176,2,198,169,32,20,30,198
    ,91,32,1742
DA  90 DATA 186,45,24,165,168,10
    9,57,31,133,168,144,2,230,16
    9,230,91,1952
4C  100 DATA 162,0,160,0,189,65,
    3,145,168,200,232,228,181,20
    8,245,32,2218
41  110 DATA 186,45,96,165,166,1
    33,168,165,167,133,169,56,16
    5,168,229,172,2383
2B  120 DATA 133,168,176,2,198,1
    69,172,58,31,177,168,201,32,
    208,32,132,2057
10  130 DATA 184,136,132,183,164
    ,183,177,168,164,184,145,168
    ,198,184,198,183,2751
FD  140 DATA 164,184,186,172,208
    ,238,169,32,145,168,169,148,
    32,210,255,76,2566
91  150 DATA 120,31,127,127,127,
    127,127,127,127,127,127,127,
    127,127,127,127,1929
C4  160 DATA 127,127,127,127,127
    ,127,127,127,127,127,127,127
    ,127,127,127,2032
CA  170 DATA 127,127,127,127,127
    ,127,127,127,127,127,127,127
    ,127,127,127,2032
1C  180 DATA 127,127,127,127,127
    ,127,127,127,127,127,127,201
    ,1,200,6,32,1845
7B  190 DATA 227,46,76,120,31,20
    1,2,208,3,76,106,49,201,3,20
    8,11,1568
D9  200 DATA 173,68,31,208,3,32,
    99,22,76,120,31,201,4,208,11
    ,173,1460
4F  210 DATA 68,31,208,244,32,56
    ,24,76,120,31,201,5,208,3,76
    ,196,1579
2C  220 DATA 47,201,6,208,3,76,8
    2,50,201,7,208,3,76,90,35,20
    1,1494
AC  230 DATA 8,208,3,76,93,35,20
    1,9,208,3,76,246,27,201,10,2
    08,1612
A3  240 DATA 3,76,121,27,201,11,
    208,3,76,79,37,201,12,208,3,
    76,1342
2B  250 DATA 71,52,201,13,208,3,
    76,4,61,201,14,208,3,76,89,2
    8,1308
B9  260 DATA 201,15,208,3,76,99,
    35,201,16,208,3,76,184,36,20
    1,18,1580
AB  270 DATA 208,4,169,1,208,6,2
    01,19,208,7,169,0,133,255,7E
    ,74,1738
CE  280 DATA 52,201,20,208,3,76,
    97,47,201,21,208,6,32,94,51,
    76,1393
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03  290 DATA 120,31,201,23,240,2
    4,201,24,208,3,76,182,28,201
    ,25,208,1795
67  300 DATA 3,76,185,28,201,26,
    208,3,76,0,35,76,120,31,173,
    66,1307
6B  310 DATA 31,240,47,169,0,141
    ,66,31,141,67,31,32,60,40,16
    9,0,1265
33  320 DATA 141,171,2,169,184,1
    41,167,2,169,224,141,168,2,1
    69,23,141,2014
6F  330 DATA 169,2,169,204,141,1
    70,2,169,32,32,72,40,32,63,4
    0,76,1413
8A  340 DATA 126,27,169,1,141,66
    ,31,133,177,32,60,40,169,0,1
    41,171,1484
4C  350 DATA 2,169,184,141,167,2
    ,169,224,141,168,2,169,23,14
    1,169,2,1873
99  360 DATA 169,204,141,170,2,1
    69,215,32,72,40,32,63,40,76,
    120,31,1576
D0  370 DATA 173,67,31,240,44,16
    9,0,141,67,31,32,60,40,169,0
    ,141,1405
9B  380 DATA 171,2,169,200,141,1
    67,2,169,224,141,168,2,169,2
    5,141,169,2060
AD  390 DATA 2,169,204,141,170,2
    ,169,32,32,72,40,32,63,40,76
    ,120,1364
A0  400 DATA 31,169,1,141,67,31,
    141,66,31,133,177,169,0,141,
    171,2,1471
4B  410 DATA 169,184,141,167,2,1
    69,224,141,168,2,169,23,141,
    169,2,169,2040
9B  420 DATA 204,141,170,2,169,2
    15,32,72,40,169,200,141,167,
    2,169,224,2117
35  430 DATA 141,168,2,169,25,14
    1,169,2,169,204,141,170,2,16
    9,0,141,1813
32  440 DATA 171,2,169,202,32,72
    ,40,32,63,40,76,120,31,173,6
    8,31,1322
EE  450 DATA 240,47,32,56,24,169
    ,0,141,68,31,32,60,40,169,0,
    141,1250
4F  460 DATA 171,2,169,216,141,1
    67,2,169,224,141,168,2,169,2
    7,141,169,2078
7D  470 DATA 2,169,204,141,170,2
    ,169,32,32,72,40,32,63,40,76
    ,120,1364
9E  480 DATA 31,169,1,141,68,31,
    32,60,40,169,0,141,171,2,169
    ,216,1441
DB  490 DATA 141,167,2,169,224,1
    41,168,2,169,27,141,169,2,16
    9,204,141,2036
26  500 DATA 170,2,169,201,32,72,
    40,32,63,40,32,99,22,76,120,
    31,1201
BB  510 DATA 32,60,40,169,104,14
    1,167,2,169,225,141,168,2,16
    9,45,141,1775
97  520 DATA 169,2,169,204,141,1
    70,2,169,0,141,171,2,169,80,
    133,178,1900
9F  530 DATA 169,31,133,179,169,
    16,133,211,169,165,141,20,3,
    169,194,141,2043
96  540 DATA 21,3,88,32,95,193,1
    20,32,63,40,76,120,31,0,0,0,
    914
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PROGRAM: YC WRITER E
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```
01  10 BL=50   :LN=50   :SA=7350
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
45  50 DATA 76,194,28,76,35,29,7
    6,90,29,76,177,29,32,67,29,2
    40,1283
52  60 DATA 3,76,120,31,165,172,
    240,249,74,176,246,24,173,63
    ,31,208,2051
0F  70 DATA 240,101,172,133,172,
    56,173,57,31,229,172,141,57,
    31,168,136,2069
FE  80 DATA 140,58,31,165,172,14
    1,63,31,74,133,73,170,24,173
    ,59,31,1538
54  90 DATA 105,8,141,59,31,144,
    3,238,60,31,238,61,31,208,3,
    238,1599
93  100 DATA 62,31,202,208,231,5
    6,165,166,229,172,133,166,17
    6,2,198,167,2364
7A  110 DATA 169,0,133,172,32,23
    9,44,32,90,29,76,120,31,32,6
    7,29,1295
09  120 DATA 240,3,76,120,31,165
    ,172,201,79,240,247,74,144,2
    44,164,172,2372
5E  130 DATA 140,58,31,200,140,5
    7,31,32,177,29,76,120,31,56,
    173,64,1415
94  140 DATA 31,237,69,31,133,73
    ,173,65,31,237,70,31,5,73,24
    0,1,1500
BB  150 DATA 96,165,171,96,173,1
    67,2,133,168,133,87,173,168,
    2,133,169,2036
C0  160 DATA 133,88,166,73,56,16
    5,168,233,8,133,168,133,87,1
    76,4,198,1989
0B  170 DATA 169,198,88,202,208,
    238,169,22,133,74,166,73,169
    ,170,160,0,2239
EB  180 DATA 145,87,200,192,8,20
    8,245,24,165,87,105,8,133,87
    ,144,2,1844
90  190 DATA 230,88,202,208,231,
    24,165,168,105,64,133,168,13
    3,87,165,169,2340
9E  200 DATA 105,1,133,169,133,8
    8,198,74,208,208,96,173,167,
    2,133,168,2056
2B  210 DATA 133,87,173,168,2,13
    3,169,133,88,24,165,168,105,
    8,133,168,1857
3C  220 DATA 133,87,144,4,230,16
    9,230,88,169,22,133,73,56,16
    9,80,229,2016
B1  230 DATA 172,237,63,31,74,17
    0,169,85,160,0,145,87,200,19
    2,8,208,2001
60  240 DATA 249,24,165,87,105,8
    ,133,87,144,2,230,88,202,208
    ,231,24,1987
29  250 DATA 165,168,105,64,133,
    168,133,87,165,169,105,1,133
    ,169,133,88,1986
2B  260 DATA 198,73,208,200,96,1
    27,127,127,127,127,127,127,1
    27,127,172,58,2148
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76  270 DATA 31,177,168,201,32,2
    40,1,96,162,0,134,185,134,18
    7,232,134,2114
49  280 DATA 186,160,0,177,168,2
    01,32,208,13,177,168,201,32,
    208,7,200,2138
C3  290 DATA 204,57,31,208,244,9
    6,177,168,201,32,208,2,230,1
    85,200,204,2447
BE  300 DATA 57,31,208,242,165,1
    85,240,207,172,58,31,132,184
    ,136,177,168,2393
4B  310 DATA 201,32,208,5,230,18
    6,136,208,245,132,183,56,165
    ,185,229,186,2587
BE  320 DATA 133,185,197,186,176
    ,22,162,1,56,165,186,229,185
    ,133,186,197,2399
A2  330 DATA 185,144,3,232,208,2
    42,134,187,166,185,208,2,166
    ,186,164,183,2595
B6  340 DATA 177,168,164,184,145
    ,168,201,32,240,7,198,184,19
    8,183,76,132,2457
02  350 DATA 30,198,184,164,184,
    169,32,145,168,198,184,198,1
    83,165,187,240,2629
0B  360 DATA 29,134,73,166,187,1
    65,186,240,5,198,186,76,183,
    30,202,240,2300
F2  370 DATA 11,164,184,169,32,1
    45,168,198,184,202,208,245,1
    66,73,202,208,2559
CC  380 DATA 189,96,255,255,255,
    255,255,255,255,255,255,255,
    255,255,255,255,3855
A8  390 DATA 255,255,255,255,255
    ,255,255,255,255,255,255,255
    ,255,255,255,255,4080
3E  400 DATA 255,255,255,255,255
    ,255,255,255,255,255,255,255
    ,255,255,255,255,4080
41  410 DATA 255,255,255,255,255
    ,255,255,255,255,255,127,127
    ,127,127,127,127,3312
C9  420 DATA 127,127,127,127,127
    ,127,127,127,127,127,127,127
    ,127,127,127,127,2032
4F  430 DATA 127,127,127,127,127
    ,127,127,127,127,127,127,127
    ,127,127,127,127,2032
9B  440 DATA 127,127,127,127,127
    ,127,127,127,127,127,127,12,
    0,0,0,41,1450
3B  450 DATA 0,122,8,80,79,192,2
    27,120,204,0,160,8,1,1,0,188
    ,1390
F2  460 DATA 62,155,159,127,8,12
    7,127,64,83,58,78,79,32,78,6
    5,77,1379
5B  470 DATA 69,32,32,32,32,32,3
    2,32,32,32,127,127,127,127,1
    27,127,1119
1B  480 DATA 127,127,127,127,127
    ,127,127,127,127,127,127,127
    ,76,129,31,76,1836
2E  490 DATA 226,31,76,14,32,76,
    61,32,76,70,32,169,254,141,3
    3,208,1531
7B  500 DATA 169,6,141,134,2,141
    ,32,208,169,128,141,138,2,16
    0,7,169,1747
E4  510 DATA 0,153,193,2,136,16,
    250,32,125,194,32,125,38,173
    ,69,31,1569
BA  520 DATA 133,166,133,73,141,
    64,31,173,70,31,133,167,133,
    74,141,65,1728
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5C  530 DATA 31,32,78,40,32,81,4
    0,160,80,140,57,31,136,140,5
    8,31,1167
0B  540 DATA 169,192,141,59,31,1
    69,227,141,60,31,169,120,141
    ,61,31,169,1911
3B  550 DATA 204,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0,204
```

PROGRAM: YC WRITER F

```
A7  10 BL=50    :LN=50    :SA=8151

5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
ED  50 DATA 141,62,31,169,0,141,
    63,31,76,14,32,173,55,31,133
    ,166,1318
3C  60 DATA 173,56,31,133,167,17
    3,54,31,133,171,173,53,31,13
    3,172,173,1857
F8  70 DATA 51,31,133,175,173,52
    ,31,133,176,173,49,31,133,17
    3,173,50,1737
3A  80 DATA 31,133,174,120,32,13
    2,194,32,228,255,240,251,201
    ,133,208,3,2367
45  90 DATA 76,246,54,201,135,20
    8,3,76,86,44,201,136,240,24,
    201,139,2070
DC  100 DATA 208,3,76,89,44,172,
    141,2,192,4,208,3,76,84,26,2
    01,1529
BD  110 DATA 134,240,212,76,138,
    32,32,68,229,32,152,195,32,1
    82,195,169,2118
D1  120 DATA 49,141,20,3,169,234
    ,141,21,3,169,202,141,38,3,1
    69,241,1744
6B  130 DATA 141,39,3,165,166,14
    1,55,31,165,167,141,56,31,16
    5,171,141,1778
7E  140 DATA 54,31,165,172,141,5
    3,31,165,175,141,51,31,165,1
    76,141,52,1744
5A  150 DATA 31,165,173,141,49,3
    1,165,174,141,50,31,96,255,2
    55,255,255,2267
AB  160 DATA 255,253,255,76,144,
    32,76,61,33,201,13,208,3,76,
    94,34,1814
51  170 DATA 201,17,208,3,76,211
    ,33,201,19,240,45,201,20,208
    ,3,76,1762
9C  180 DATA 119,46,201,32,208,3
    ,76,200,50,201,145,208,3,76.
    37,34,1639
99  190 DATA 201,148,208,3,76,22
    0,25,201,157,208,3,76,38,33,
    201,134,1932
69  200 DATA 208,3,76,123,31,76,
    254,41,120,173,59,31,141,167
    ,2,173,1678
B4  210 DATA 60,31,141,168,2,173
    ,61,31,141,169,2,173,62,31,1
    41,170,1556
CF  220 DATA 2,169,0,141,171,2,8
    8,56,165,166,229,172,133,166
    ,176,2,1838
C2  230 DATA 198,167,166,171,240
    ,15,56,165,166,237,57,31,133
    ,166,176,2,2146
49  240 DATA 198,167,202,208,241
    ,56,165,175,229,171,133,175,
    176,2,198,176,2672
FD  250 DATA 169,0,133,171,133,1
    72,32,236,44,32,239,44,76,12
    0,31,164,1796
BD  260 DATA 175,208,11,164,176,
    208,7,164,172,208,3,76,120,3
    1,164,166,2053
6B  270 DATA 208,2,198,167,198,1
    66,198,172,164,172,192,255,2
    40,3,76,202,2613
77  280 DATA 33,165,171,208,37,3
    2,66,40,32,216,39,169,0,133,
    91,165,1597
4F  290 DATA 166,133,168,165,167
    ,133,169,56,165,168,237,58,3
    1,133,168,176,2293
9C  300 DATA 2,198,169,32,186,45
    ,120,76,147,33,198,171,120,5
    6,173,167,1893
8B  310 DATA 2,233,64,141,167,2,
    173,168,2,233,1,141,168,2,56
    ,173,1726
76  320 DATA 169,2,233,40,141,16
    9,2,176,3,206,170,2,173,57,3
    1,74,1648
3F  330 DATA 170,24,173,167,2,10
    5,8,141,167,2,144,3,238,168,
    2,238,1752
7C  340 DATA 169,2,208,3,238,170
    ,2,202,208,231,88,169,157,32
    ,210,255,2344
27  350 DATA 173,58,31,133,172,1
    65,175,208,2,198,176,198,175
    ,32,236,44,2176
8B  360 DATA 76,205,33,32,210,25
    5,32,239,44,76,120,31,133,17
    3,133,1762
AB  370 DATA 74,56,173,71,31,237
    ,57,31,133,73,176,2,198,74,5
    6,165,1607
06  380 DATA 73,229,166,133,75,1
    65,74,229,167,5,75,144,46,16
    0,0,177,1918

A3  390 DATA 166,133,73,24,165,1
    66,109,57,31,133,166,144,2,2
    30,167,165,1931
D9  400 DATA 171,201,21,208,6,32
    ,199,34,76,25,34,230,171,169
    ,17,32,1626
8B  410 DATA 210,255,230,175,208
    ,2,230,176,32,236,44,76,120,
    31,165,175,2365
4B  420 DATA 208,7,165,176,208,3
    ,76,120,31,160,0,177,166,133
    ,73,56,1759
75  430 DATA 165,166,237,57,31,1
    33,166,176,2,198,167,165,171
    ,208,6,32,2080
5C  440 DATA 217,34,76,83,34,198
    ,171,169,145,32,210,255,165,
    175,208,2,2174
6D  450 DATA 198,176,198,175,76,
    31,34,173,72,31,133,74,56,17
    3,71,31,1702
3E  460 DATA 237,57,31,133,73,17
    6,2,198,74,56,165,73,229,166
    ,133,75,1878
CB  470 DATA 165,74,229,167,5,75
    ,144,69,56,173,57,31,229,172
    ,24,101,1771
7B  480 DATA 166,133,166,144,2,2
    30,167,165,171,201,21,208,27
    ,165,172,72,2210
9B  490 DATA 169,0,133,172,32,19
    9,34,104,170,240,18,120,169,
    157,32,210,1959
6F  500 DATA 255,202,208,250,88,
    76,180,34,230,171,32,1,42,23
    0,175,208,2302
A0  510 DATA 2,230,176,169,0,133
    ,172,32,239,44,32,236,44,76,
    120,31,1736
4D  520 DATA 32,60,40,32,66,40,3
    2,116,39,32,63,40,169,21,133
    ,91,1006
50  530 DATA 208,16,32,60,40,32,
    66,40,32,216,39,32,63,40,169
    ,0,1085
BA  540 DATA 133,91,165,167,133,
    169,165,166,133,168,56,165,1
    68,229,172,133,2413
C7  550 DATA 168,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0,168
```

PROGRAM: YC WRITER G

```
6E  10 BL=52    :LN=50    :SA=8952

5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
75  50 DATA 176,2,198,169,32,186
    ,45,96,8,72,138,72,152,72,21
    6,166,1800
57  60 DATA 93,56,165,87,229,89,
    165,88,229,90,144,24,160,0,2
    32,196,2047
6F  70 DATA 92,208,3,202,240,46,
    177,87,145,89,200,208,242,23
    0,88,230,2487
36  80 DATA 90,76,23,35,164,92,1
    38,101,88,133,88,138,24,101,
    90,133,1514
B5  90 DATA 90,232,152,240,8,136
    ,177,87,145,89,76,58,35,198,
    88,198,2009
21  100 DATA 90,202,208,241,104,
    168,104,170,104,40,96,127,12
    7,127,127,127,2162
FD  110 DATA 127,127,76,102,35,7
    6,5,36,76,230,35,76,32,36,17
    3,237,1479
FB  120 DATA 3,208,52,169,1,141,
    237,3,165,167,141,236,3,56,1
    65,166,1913
92  130 DATA 229,172,141,235,3,1
    76,3,206,236,3,32,60,40,32,1
    21,36,1725
6E  140 DATA 32,147,36,169,92,16
    0,36,32,30,171,166,175,165,1
    76,32,205,1824
2D  150 DATA 189,32,63,40,76,120
    ,31,201,2,240,67,169,2,141,2
    37,3,1613
61  160 DATA 165,167,141,234,3,5
    6,173,58,31,229,172,24,101,1
    66,141,233,2094
1A  170 DATA 3,144,3,238,234,3,3
```

```
    2,60,40,32,121,36,24,173,167
   ,2,1312
D3  180 DATA 105,208,141,167,2,1
   44,3,238,168,2,173,169,2,105
   ,26,141,1794
DF  190 DATA 169,2,144,3,238,170
   ,2,169,104,160,36,76,143,35,
   169,0,1620
8B  200 DATA 141,237,3,32,60,40,
   32,121,36,32,147,36,162,35,1
   69,32,1315
B4  210 DATA 134,178,32,72,40,16
   6,178,202,208,244,76,153,35,
   169,0,141,2028
B0  220 DATA 232,3,56,173,235,3,
   237,233,3,133,73,173,236,3,2
   37,234,2264
C6  230 DATA 3,5,73,176,7,76,0,1
   92,169,1,208,227,32,60,40,32
   ,1301
B6  240 DATA 121,36,32,147,36,16
   2,30,169,32,32,210,255,202,2
   08,250,24,1946
14  250 DATA 173,167,2,105,208,1
   41,167,2,144,3,238,168,2,173
   ,169,2,1864
0E  260 DATA 105,26,141,169,2,14
   4,3,238,170,2,169,114,160,36
   ,32,30,1541
07  270 DATA 171,76,153,35,194,7
   6,75,45,83,84,65,82,84,58,32
   ,0,1313
7F  280 DATA 194,76,75,45,69,78,
   68,58,32,0,197,82,82,79,82,3
   3,1250
35  290 DATA 0,169,64,141,167,2,
   169,225,141,168,2,169,40,141
   ,169,2,1769
C2  300 DATA 169,204,141,170,2,1
   69,0,141,171,2,96,24,173,167
   ,2,105,1736
43  310 DATA 136,141,167,2,144,3
   ,238,168,2,173,169,2,105,15,
   141,169,1775
A9  320 DATA 2,144,3,238,170,2,9
   6,253,255,255,255,255,255,25
   5,255,255,2948
D3  330 DATA 173,64,31,205,69,31
   ,208,11,173,65,31,205,70,31,
   208,3,1578
F8  340 DATA 76,120,31,169,0,32,
   189,255,169,4,170,160,255,32
   ,186,255,2103
9F  350 DATA 32,192,255,162,4,32
   ,201,255,169,13,32,210,255,1
   73,69,31,2085
0A  360 DATA 133,168,173,70,31,1
   33,169,160,0,165,145,201,127
   ,240,72,174,2161
E4  370 DATA 63,31,240,8,169,32,
   32,210,255,202,208,250,169,1
   7,32,210,2128
20  380 DATA 255,177,168,32,210,
   255,200,204,57,31,208,240,17
   3,57,31,201,2499
FF  390 DATA 80,240,5,169,13,32,
   210,255,24,165,168,109,57,31
   ,133,168,1859
E2  400 DATA 144,2,230,169,160,0
   ,56,173,64,31,229,168,133,73
   ,173,65,1870
4A  410 DATA 31,229,169,5,73,176
   ,178,169,13,32,210,255,169,4
   ,32,195,1940
67  420 DATA 255,32,204,255,76,1
   20,31,173,237,3,201,2,240,3,
   76,120,2028
AF  430 DATA 31,173,233,3,133,87
   ,173,234,3,133,88,230,87,208
   ,2,230,2048
F3  440 DATA 88,173,235,3,133,89
   ,173,236,3,133,90,56,165,87,
   237,235,2136
7B  450 DATA 3,133,181,165,88,23
   7,236,3,133,182,56,173,64,31
   ,229,87,2001
B8  460 DATA 133,73,173,65,31,22
   9,88,5,73,144,30,56,173,64,3
   1,229,1597
39  470 DATA 87,133,92,173,65,31
   ,229,88,133,93,56,165,92,229
   ,181,133,1980
6F  480 DATA 73,165,93,229,182,5
   ,73,176,8,165,181,133,92,165
   ,182,133,2055
CD  490 DATA 93,32,0,35,56,173,6
   4,31,237,233,3,133,73,173,65
   ,31,1432
99  500 DATA 237,234,3,5,73,176,
   15,173,235,3,141,64,31,173,2
   36,3,1802
D3  510 DATA 141,65,31,76,17,38,
   56,173,64,31,229,181,133,73,
   141,64,1513
E4  520 DATA 31,173,65,31,229,18
   2,133,74,141,65,31,160,0,166
   ,182,240,1903
22  530 DATA 12,169,32,145,73,20
   0,208,251,230,74,202,208,246
   ,166,181,240,2637
EF  540 DATA 8,169,32,145,73,200
   ,202,208,250,165,167,133,169
   ,56,165,166,2308
6A  550 DATA 229,172,133,168,176
   ,2,198,169,165,171,133,91,24
   0,16,56,165,2284
1A  560 DATA 168,237,57,31,133,1
   68,176,2,198,169,198,91,208,
   240,32,180,2288
51  570 DATA 45,76,96,35,0,0,0,0
   ,0,0,0,0,0,0,0,252
```

```
PROGRAM: YC WRITER H
```

```
AD  10 BL=50   :LN=50   :SA=9853
5B  20 FOR L=0 TO BL:CX=0:FOR D=
   0 TO 15:READ A:CX=CX+A:POKE
   SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
   "ERROR IN LINE";LN+(L*10):ST
   OP
40  40 NEXT L:END
DF  50 DATA 169,176,160,38,32,30
   ,171,169,1,160,39,32,30,171,
   169,13,1560
C6  60 DATA 32,210,255,162,80,18
   9,19,39,157,0,50,202,16,247,
   169,0,1827
FB  70 DATA 160,50,32,30,171,162
   ,0,189,100,39,157,80,31,232,
   224,16,1673
0E  80 DATA 208,245,96,204,73,78
   ,69,58,32,49,32,32,32,195,79
   ,76,1558
BE  90 DATA 85,77,78,58,32,49,32
   ,32,32,215,79,82,68,83,58,32
   ,1092
39  100 DATA 48,32,32,32,32,32,3
   2,32,32,32,32,32,32,32,32,42
   ,538
00  110 DATA 32,215,32,42,32,202
   ,32,42,32,32,32,42,32,32,32,
   32,895
70  120 DATA 32,32,32,32,32,32,3
   2,32,42,32,198,49,61,200,197
   ,204,1239
AA  130 DATA 208,32,42,0,196,79,
   67,85,77,69,78,84,58,32,78,7
   9,1264
16  140 DATA 32,78,65,77,69,0,22
   1,46,46,46,46,58,46,46,46,46
   ,968
62  150 DATA 221,46,46,46,46,58,
   46,46,46,46,221,46,46,46,46,
   58,1110
B6  160 DATA 46,46,46,46,46,221,46,
   46,46,46,58,46,46,46,46,221,
   46,1098
3B  170 DATA 46,46,46,58,46,46,4
   6,46,221,46,46,46,46,58,46,4
   6,935
A2  180 DATA 46,46,221,46,46,46,
   46,58,46,46,46,46,221,46,46,
   46,1038
EA  190 DATA 46,58,46,46,46,46,0
   ,78,79,32,78,65,77,69,32,32,
   830
56  200 DATA 32,32,32,32,32,32,3
   2,32,214,195,169,0,133,87,16
   9,229,1452
73  210 DATA 133,88,169,192,133,
   89,169,227,133,90,162,21,160
   ,0,177,87,2030
52  220 DATA 145,89,200,208,249,
   230,88,230,90,177,87,145,89,
   200,192,64,2483
83  230 DATA 208,247,24,165,87,1
   05,64,133,87,144,2,230,88,24
   ,165,89,1862
CB  240 DATA 105,64,133,89,144,2
   ,230,90,202,208,209,32,222,1
   95,96,255,2276
95  250 DATA 255,255,255,255,255
   ,255,255,255,255,255,255,255
   ,255,255,255,255,4080
4B  260 DATA 255,255,255,255,255
   ,255,255,255,255,255,255,32,
   214,195,169,192,3607
F5  270 DATA 133,87,169,252,133,
   88,169,0,133,89,169,254,133,
   90,162,21,2082
43  280 DATA 160,0,177,87,145,89
   ,200,208,249,230,88,230,90,1
   77,87,145,2362
FE  290 DATA 89,200,192,64,208,2
   47,198,88,198,90,56,165,87,2
   33,64,133,2312
25  300 DATA 87,165,88,233,1,133
   ,88,56,165,89,233,64,133,89,
   165,90,1879
3F  310 DATA 233,1,133,90,202,20
   8,201,32,222,195,96,127,127,
   127,127,127,2248
C4  320 DATA 127,127,127,127,127
   ,127,127,127,127,127,127,127
   ,127,127,127,76,1981
E4  330 DATA 32,40,76,132,40,76,
   238,40,76,24,41,76,127,41,76
   ,150,1343
62  340 DATA 41,76,179,41,76,221
   ,41,76,175,40,76,81,41,120,1
   69,49,1502
8D  350 DATA 141,20,3,169,234,14
   1,21,3,173,167,2,141,60,3,17
   3,168,1619
0A  360 DATA 2,141,61,3,173,169,
```

```
    2,141,62,3,173,170,2,141,63,
    3,1309
C7  370 DATA 173,171,2,141,64,3,
    96,120,169,165,141,20,3,169,
    194,141,1772
1B  380 DATA 21,3,173,60,3,141,1
    67,2,173,61,3,141,168,2,173,
    62,1353
31  390 DATA 3,141,169,2,173,63,
    3,141,170,2,173,64,3,141,171
    ,2,1421
BD  400 DATA 88,96,120,169,165,1
    41,20,3,169,194,141,21,3,173
    ,60,3,1566
4D  410 DATA 141,167,2,133,251,1
    73,61,3,141,168,2,133,252,17
    3,62,3,1865
43  420 DATA 141,169,2,173,63,3,
    141,170,2,173,64,3,141,171,2
    ,32,1450
CB  430 DATA 214,195,160,7,177,2
    51,153,193,2,136,16,248,32,2
    22,195,88,2289
2D  440 DATA 96,169,1,141,192,2,
    173,167,2,141,190,2,133,251,
    173,168,2001
B7  450 DATA 2,141,191,2,133,252
    ,160,7,185,193,2,145,251,136
    ,16,248,2064
C9  460 DATA 169,33,141,184,2,16
    9,0,141,192,2,96,165,251,141
    ,188,2,1876
2E  470 DATA 165,252,141,189,2,1
    73,167,2,141,190,2,133,251,1
    73,168,2,2151
45  480 DATA 141,191,2,133,252,3
    2,214,195,160,7,177,251,153,
    193,2,174,2277
73  490 DATA 171,2,208,5,9,240,7
    6,72,41,9,15,145,251,136,16,
    234,1630
5F  500 DATA 32,222,195,96,169,1
    ,141,192,2,173,186,2,240,30,
    169,0,1850
17  510 DATA 141,186,2,173,190,2
    ,133,251,173,191,2,133,252,1
    60,7,185,2181
80  520 DATA 193,2,145,251,136,1
    6,248,169,33,141,184,2,169,0
    ,141,192,2022
5F  530 DATA 2,96,201,128,144,5,
    56,233,128,208,3,56,233,32,1
    41,172,1838
04  540 DATA 2,152,72,32,88,196,
    104,168,96,169,192,133,251,1
    69,227,32,2083
3D  550 DATA 236,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0,236
```

PROGRAM: YC WRITER I

```
2E  10 BL=50   :LN=50   :SA=1065
    4
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
12  50 DATA 195,169,120,133,251,
    169,204,32,16,196,160,7,169,
    0,153,193,2167
33  60 DATA 2,136,16,250,96,56,1
    73,71,31,237,69,31,72,173,72
    ,31,1516
09  70 DATA 237,70,31,170,160,0,
    169,32,145,73,200,208,251,23
    0,74,202,2252
CF  80 DATA 208,246,104,240,9,17
    0,169,32,145,73,200,202,208,
    250,96,160,2512
39  90 DATA 0,132,171,132,91,132
    ,175,132,176,132,172,132,173
    ,132,174,140,2196
34  100 DATA 68,31,140,237,3,200
    ,140,66,31,140,67,31,132,177
    ,96,255,1814
E1  110 DATA 76,4,42,76,232,43,1
    33,75,165,166,205,71,31,208,
    10,165,1702
CC  120 DATA 167,205,72,31,208,3
    ,76,120,31,165,75,201,29,240
    ,26,172,1821
1B  130 DATA 68,31,240,3,32,62,4
    8,164,172,208,8,172,66,31,24
    0,3,1548
E0  140 DATA 76,189,42,160,0,165
    ,75,145,166,230,166,208,2,23
    0,167,56,2077
D1  150 DATA 165,166,237,64,31,1
    33,77,165,167,237,65,31,5,77
    ,144,16,1780
36  160 DATA 165,75,201,29,240,1
    0,165,166,141,64,31,165,167,
    141,65,31,1856
6E  170 DATA 230,172,165,172,205
    ,57,31,208,75,169,0,133,177,
    165,171,201,2331
6E  180 DATA 21,208,36,165,75,20
    1,29,240,6,32,72,40,76,128,4
    2,32,1403
8B  190 DATA 66,40,32,116,39,165
    ,166,133,168,165,167,133,169
    ,169,21,133,1882
0E  200 DATA 91,32,186,45,76,156
    ,42,230,171,165,75,32,210,25
    5,32,232,2030
F7  210 DATA 43,169,0,133,172,32
    ,239,44,230,175,208,2,230,17
    6,32,236,2121
E6  220 DATA 44,76,120,31,165,75
    ,32,210,255,32,239,44,76,120
    ,31,172,1722
02  230 DATA 68,31,240,7,160,1,1
    32,177,76,49,42,164,175,208,
    4,164,1698
13  240 DATA 176,240,15,201,32,2
    08,14,164,177,208,7,160,1,13
    2,177,76,1988
6D  250 DATA 120,31,76,49,42,133
    ,179,164,177,240,3,76,49,42,
    32,236,1649
B2  260 DATA 44,165,167,133,169,
    56,165,166,229,172,133,168,1
    76,2,198,169,2312
F2  270 DATA 56,165,168,237,57,3
    1,133,168,176,2,198,169,160,
    0,177,168,2065
59  280 DATA 201,32,208,3,200,20
    8,247,177,168,201,32,240,9,2
    00,204,57,2387
15  290 DATA 31,208,244,76,49,42
    ,165,166,133,89,165,167,133,
    90,165,89,2012
6D  300 DATA 208,2,198,90,198,89
    ,162,0,160,0,177,89,201,32,2
    40,11,1857
E8  310 DATA 165,89,208,2,198,90
    ,198,89,232,208,239,134,178,
    32,232,43,2337
E2  320 DATA 165,167,133,181,56,
    165,166,229,178,133,180,176,
    2,198,181,160,2470
F1  330 DATA 0,166,178,240,17,17
    7,180,145,166,169,32,145,180
    ,169,29,32,2025
67  340 DATA 210,255,200,202,208
    ,239,230,178,165,179,145,166
    ,169,29,32,210,2817
FC  350 DATA 255,24,165,166,101,
    178,133,166,144,2,230,167,24
    ,165,172,101,2193
BF  360 DATA 178,133,172,32,239,
    44,56,165,166,237,64,31,133,
    77,165,167,2059
CC  370 DATA 237,65,31,5,77,144,
    10,165,166,141,64,31,165,167
    ,141,65,1674
34  380 DATA 31,169,1,133,177,16
    5,167,133,169,56,165,166,229
    ,172,133,168,2234
A7  390 DATA 176,2,198,169,166,1
    71,134,91,32,186,45,56,165,1
    68,237,57,2053
6B  400 DATA 31,133,168,176,2,19
    8,169,173,67,31,240,3,32,20,
    30,166,1639
A3  410 DATA 171,202,134,91,32,1
    86,45,76,120,31,120,169,0,14
    1,171,2,1691
68  420 DATA 173,59,31,141,167,2
    ,173,60,31,141,168,2,173,61,
    31,141,1554
81  430 DATA 169,2,173,62,31,141
    ,170,2,166,171,240,149,24,17
    3,167,2,1842
9F  440 DATA 105,64,141,167,2,17
    3,168,2,105,1,141,168,2,24,1
    73,169,1605
08  450 DATA 2,105,40,141,169,2,
    144,3,238,170,2,202,208,222,
    88,96,1832
F1  460 DATA 127,127,127,127,127
    ,127,127,127,127,127,127,127
    ,127,127,127,2032
F7  470 DATA 127,127,127,127,127
    ,127,127,127,127,127,127,127
    ,127,127,127,2032
E3  480 DATA 127,127,127,127,127
    ,127,127,127,76,92,44,76,150
    ,44,24,173,1695
C2  490 DATA 58,31,109,63,31,133
    ,73,24,165,172,109,63,31,170
    ,189,0,1421
98  500 DATA 50,201,46,240,2,208
    ,11,228,73,240,23,189,0,50,2
    01,46,1808
73  510 DATA 208,16,169,29,32,21
    0,255,230,166,208,2,230,167,
    230,172,232,2556
DC  520 DATA 208,229,32,239,44,7
    6,120,31,24,165,172,109,63,3
    1,170,236,1949
3C  530 DATA 63,31,240,238,189,0
    ,50,201,46,240,2,208,12,236,
    63,31,1850
C5  540 DATA 240,224,189,0,50,20
    1,46,208,217,169,157,32,210,
    255,165,166,2529
7C  550 DATA 208,2,198,167,198,1
    66,198,172,202,208,226,240,1
    97,0,0,0,2382
```

PROGRAM: YC WRITER J

```
12  10 BL=51    :LN=50    :SA=1150
    0
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
79  50 DATA 76,242,44,76,61,45,3
    2,60,40,169,24,141,167,2,169
    ,224,1572
97  60 DATA 141,168,2,169,3,141,
    169,2,169,204,141,170,2,169,
    0,141,1791
8A  70 DATA 171,2,166,175,232,20
    8,7,24,165,176,105,1,208,2,1
    65,176,1983
81  80 DATA 32,205,189,165,176,2
    08,22,165,175,201,10,176,7,1
    69,32,32,1964
DB  90 DATA 210,255,208,6,201,10
    0,176,5,169,32,32,210,255,32
    ,63,40,1994
FE  100 DATA 96,32,60,40,169,72,
    141,167,2,169,224,141,168,2,
    169,9,1661
52  110 DATA 141,169,2,169,204,1
    41,170,2,169,0,141,171,2,166
    ,172,232,2051
8B  120 DATA 169,0,32,205,189,16
    5,172,201,10,176,5,169,32,32
    ,210,255,2022
FA  130 DATA 32,63,40,96,127,127
    ,127,127,127,127,127,127,127
    ,127,127,1755
7B  140 DATA 127,127,127,127,253
    ,255,255,255,255,255,255,255
    ,255,255,253,255,3564
3C  150 DATA 255,255,253,255,255
    ,255,255,255,255,255,255,255
    ,255,255,253,255,4076
86  160 DATA 255,255,255,255,255
    ,255,255,253,255,255,255,255
    ,253,255,255,253,4074
46  170 DATA 253,255,253,255,255
    ,255,255,255,76,189,45,76,21
    3,45,76,21,2777
28  180 DATA 46,32,186,45,24,165
    ,168,109,57,31,133,168,144,2
    ,230,169,1709
F1  190 DATA 230,91,165,91,201,2
    2,208,233,96,169,192,141,167
    ,2,169,227,2404
B4  200 DATA 141,168,2,169,120,1
    41,169,2,169,204,141,170,2,1
    66,91,240,2095
48  210 DATA 34,24,173,167,2,105
    ,64,141,167,2,173,168,2,105,
    1,141,1469
63  220 DATA 168,2,24,173,169,2,
    105,40,141,169,2,144,3,238,1
    70,2,1552
FC  230 DATA 202,208,222,169,0,1
    41,171,2,96,165,91,201,0,144
    ,74,201,2087
3C  240 DATA 22,176,70,32,60,40,
    32,183,45,173,63,31,240,39,1
    73,57,1436
69  250 DATA 31,201,80,240,32,12
    0,173,63,31,74,170,24,173,16
    7,2,105,1686
E6  260 DATA 8,141,167,2,144,3,2
    38,168,2,238,169,2,208,3,238
    ,170,1901
B5  270 DATA 2,202,208,231,88,16
    0,0,177,168,132,73,32,72,40,
    164,73,1822
D3  280 DATA 200,204,57,31,208,2
    41,32,84,40,96,127,127,127,1
    27,127,127,1955
8B  290 DATA 127,127,127,127,127
    ,127,127,127,127,127,127,164
    ,175,208,11,164,2119
02  300 DATA 176,208,7,164,172,2
    08,3,76,120,31,56,173,57,31,
    229,172,1883
37  310 DATA 133,178,165,166,133
    ,87,133,89,133,168,165,167,1
    33,88,133,90,2161
91  320 DATA 133,169,165,89,208,
    2,198,90,198,89,160,0,177,16
    6,145,89,2078
43  330 DATA 200,196,178,208,247
    ,169,32,145,89,56,165,168,22
    9,172,133,168,2555
12  340 DATA 176,2,198,169,165,1
    71,133,91,32,186,45,165,166,
    208,2,198,2107
C8  350 DATA 167,198,166,169,157
    ,76,141,32,255,255,255,255,2
    55,255,255,255,3146
80  360 DATA 255,255,255,255,76,
    230,46,76,56,47,173,65,31,13
    3,90,133,2176
56  370 DATA 88,24,173,64,31,133
    ,87,109,57,31,133,89,144,2,2
    30,90,1485
82  380 DATA 165,89,141,64,31,16
    5,90,141,65,31,160,0,177,87,
    145,89,1640
68  390 DATA 165,87,208,2,198,88
    ,198,87,165,89,208,2,198,90,
    198,89,2072
20  400 DATA 165,90,197,169,208,
    230,165,89,197,168,208,224,1
    60,0,169,32,2471
80  410 DATA 145,168,200,204,57,
    31,208,248,32,180,45,96,165,
    167,133,169,2248
A4  420 DATA 56,165,166,229,172,
    133,168,176,2,198,169,56,165
    ,168,237,64,2324
47  430 DATA 31,133,251,165,169,
    237,65,31,5,251,144,1,96,166
    ,171,134,2050
8C  440 DATA 91,32,230,46,96,32,
    60,40,169,128,141,167,2,169,
    226,141,1770
4F  450 DATA 168,2,169,80,141,16
    9,2,169,204,141,170,2,24,165
    ,172,109,1887
21  460 DATA 63,31,133,73,106,17
    6,4,160,0,240,2,160,1,140,17
    1,2,1462
1C  470 DATA 170,240,27,24,173,1
    67,2,105,8,141,167,2,144,3,2
    38,168,1779
CA  480 DATA 2,238,169,2,208,3,2
    38,170,2,202,208,231,166,73,
    189,0,2101
D8  490 DATA 50,201,46,240,5,169
    ,46,76,184,47,169,47,157,0,5
    0,32,1519
81  500 DATA 210,255,32,63,40,76
    ,120,31,32,123,31,32,68,229,
    24,162,1528
E7  510 DATA 12,160,4,32,240,255
    ,169,247,160,47,32,30,171,16
    9,9,133,1870
B4  520 DATA 211,169,24,160,48,3
    2,30,171,32,228,255,240,251,
    201,78,240,2370
01  530 DATA 7,201,89,208,243,76
    ,114,31,76,117,31,82,69,65,6
    8,89,1566
24  540 DATA 32,84,79,32,69,82,6
    5,83,69,32,87,72,79,76,69,32
    ,1042
DD  550 DATA 84,69,88,84,70,73,7
    6,69,33,13,13,0,18,32,65,82,
    869
43  560 DATA 69,32,89,79,85,32,8
    3,85,82,69,0,0,0,0,0,0,705
```

PROGRAM: YC WRITER K

```
31  10 BL=48    :LN=50    :SA=1232
    6
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
7C  50 DATA 63,32,40,89,47,78,41
    ,32,146,0,127,127,127,127,12
    7,127,1330
73  60 DATA 127,127,127,127,127,
    127,127,127,165,166,133,93,1
    33,168,165,167,2206
05  70 DATA 133,94,133,169,165,9
    4,133,98,56,165,93,229,172,1
    33,97,133,2097
7C  80 DATA 168,176,4,198,98,198
    ,169,165,171,133,91,133,80,1
    33,86,76,2079
AD  90 DATA 115,48,24,165,97,105
    ,2,133,97,144,2,230,98,206,5
    8,31,1555
8E  100 DATA 24,165,97,109,58,31
    ,133,97,144,2,230,98,238,58,
    31,230,1745
0B  110 DATA 91,230,86,160,0,177
    ,97,201,32,208,9,200,177,97,
    201,32,1998
23  120 DATA 208,208,240,71,160,
    2,177,97,201,32,208,198,200,
    177,97,201,2477
0E  130 DATA 32,208,191,177,97,2
    01,32,208,14,200,204,57,31,2
    08,244,230,2334
4B  140 DATA 97,208,40,230,98,20
    8,36,165,91,72,165,168,72,16
    5,169,72,2056
C0  150 DATA 165,98,133,169,24,1
    65,97,105,2,133,168,144,2,23
    0,169,32,1836
DE  160 DATA 224,46,104,133,169,
    104,133,168,104,133,91,230,9
    7,208,2,230,2176
1B  170 DATA 98,56,165,97,229,16
    6,133,99,165,98,229,167,133,
    100,56,165,2156
D8  180 DATA 97,237,64,31,133,73
    ,165,98,237,65,31,5,73,144,1
    0,165,1628
2C  190 DATA 97,141,64,31,165,98
    ,141,65,31,165,97,133,95,165
    ,98,133,1719
A0  200 DATA 96,165,95,208,2,198
    ,96,198,95,165,93,197,97,208
    ,6,165,2084
2C  210 DATA 94,197,98,240,25,16
    0,0,177,95,145,97,165,95,208
    ,2,198,1996
```

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94  220 DATA 96,198,95,165,97,20
    8,2,198,98,198,97,76,31,49,1
    65,80,1853
A1  230 DATA 133,91,32,186,45,24
    ,165,168,109,57,31,133,168,1
    44,2,230,1718
2E  240 DATA 169,230,80,165,80,1
    97,86,208,229,96,127,127,127
    ,127,127,127,2302
2C  250 DATA 127,127,127,127,165
    ,167,133,169,133,88,133,90,5
    6,165,166,229,2202
74  260 DATA 172,133,168,133,89,
    176,4,198,169,198,90,24,165,
    168,109,57,2053
07  270 DATA 31,133,87,144,2,230
    ,88,56,165,87,237,64,31,133,
    91,165,1744
DE  280 DATA 88,237,65,31,5,91,1
    44,3,76,120,31,160,0,177,87,
    145,1460
EB  290 DATA 89,230,89,208,2,230
    ,90,230,87,208,2,230,88,173,
    64,31,2051
7A  300 DATA 197,87,208,231,173,
    65,31,197,88,208,224,160,0,1
    65,87,197,2318
3E  310 DATA 89,208,6,165,88,197
    ,90,240,14,165,87,208,2,198,
    88,198,2043
63  320 DATA 87,169,32,145,87,20
    8,230,165,171,133,91,32,180,
    45,165,89,2029
04  330 DATA 141,64,31,165,90,14
    1,65,31,76,120,31,253,255,25
    5,255,255,2228
E5  340 DATA 255,255,255,255,255
    ,255,255,255,255,255,221,46,
    46,46,46,58,3013
2F  350 DATA 46,46,46,46,221,46,
    46,46,46,58,46,46,46,46,221,
    46,1098
EE  360 DATA 46,46,46,58,46,46,4
    6,46,221,46,46,46,46,58,46,4
    6,935
57  370 DATA 46,46,221,46,46,46,
    46,58,46,46,46,46,221,46,46,
    46,1098
32  380 DATA 46,58,46,46,46,46,2
    21,46,46,46,46,58,46,46,46,4
    6,935
9E  390 DATA 221,46,46,46,46,58,
    46,46,46,46,0,127,32,60,40,1
    69,1075
2F  400 DATA 128,141,167,2,169,2
    26,141,168,2,169,80,141,169,
    2,169,204,2078
99  410 DATA 141,170,2,169,0,141
    ,171,2,162,0,189,0,50,201,46
    ,240,1684
78  420 DATA 27,201,47,240,23,16
    9,46,157,0,50,134,74,32,72,4
    0,166,1478
28  430 DATA 74,232,224,80,208,2
    39,32,63,40,76,120,31,162,79
    ,189,19,1868
84  440 DATA 39,157,0,50,202,16,
    247,162,0,189,0,50,134,73,32
    ,72,1423
B7  450 DATA 40,166,73,232,224,8
    0,208,241,76,140,50,255,255,
    255,255,255,2805
BC  460 DATA 255,255,255,255,255
    ,255,255,255,255,255,255,253
    ,255,255,8,40,3616
D0  470 DATA 8,40,76,206,50,76,5
    ,51,56,165,166,237,64,31,133
    ,73,1437
5B  480 DATA 165,167,237,65,31,5
    ,73,176,2,144,31,165,166,208
    ,2,198,1835
F9  490 DATA 167,198,166,160,0,1
    77,166,201,32,240,9,230,173,
    208,2,230,2359
44  500 DATA 174,32,5,51,230,166
    ,208,2,230,167,169,32,76,254
    ,41,32,1869
1F  510 DATA 60,40,169,112,141,1
    67,2,169,224,141,168,2,169,1
    3,141,169,1887
7B  520 DATA 2,169,204,141,170,2
    ,169,1,141,171,2,166,173,165
    ,174,32,1882
B6  530 DATA 205,189,165,174,208
    ,22,165,0,0,0,0,0,0,0,0,0,11
    28
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PROGRAM: YC WRITER L

```
2C  10 BL=50    :LN=50    :SA=1310
    1
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
00  50 DATA 173,201,10,176,7,169
    ,32,32,210,255,208,6,201,100
    ,176,5,1961
26  60 DATA 169,32,32,210,255,32
    ,63,40,96,77,79,86,69,32,84,
    65,1421
EE  70 DATA 66,80,79,83,73,84,73
    ,79,78,32,70,79,82,87,65,82,
    1192
3B  80 DATA 68,169,0,133,173,133
    ,174,165,166,133,87,165,167,
    133,88,230,2184
8F  90 DATA 87,208,2,230,88,165,
    87,205,64,31,208,8,165,88,20
    5,65,1906
F4  100 DATA 31,208,1,96,120,173
    ,69,31,133,87,133,92,173,70,
    31,133,1581
EA  110 DATA 88,133,93,24,165,92
    ,109,58,31,133,92,144,2,230,
    93,169,1656
C6  120 DATA 0,133,89,133,90,133
    ,91,160,0,177,87,201,32,240,
    6,169,1741
63  130 DATA 0,133,89,240,14,165
    ,89,208,10,169,1,133,89,230,
    173,208,1951
47  140 DATA 2,230,174,230,87,20
    8,2,230,88,165,87,205,64,31,
    208,215,2226
3C  150 DATA 165,88,205,65,31,20
    8,208,56,173,64,31,229,92,13
    3,94,173,2015
68  160 DATA 65,31,229,93,5,94,1
    44,35,160,0,177,92,201,32,24
    0,13,1611
B1  170 DATA 200,177,92,201,32,2
    40,6,230,90,208,2,230,91,24,
    165,92,2080
00  180 DATA 109,57,31,133,92,14
    4,208,230,93,176,204,24,165,
    173,101,90,2030
5B  190 DATA 133,173,165,174,101
    ,91,133,174,88,32,29,52,32,2
    03,50,96,1726
7C  200 DATA 32,60,40,169,112,14
    1,167,2,169,224,141,168,2,16
    9,13,141,1750
85  210 DATA 169,2,169,204,141,1
    70,2,169,1,141,171,2,162,5,1
    69,32,1709
E2  220 DATA 32,210,255,202,208,
    250,32,63,40,96,76,77,52,76,
    132,53,1854
BB  230 DATA 32,123,31,32,92,193
    ,169,60,133,178,169,3,133,17
    9,162,15,1704
EB  240 DATA 189,97,31,201,32,20
    8,3,202,208,246,232,138,162,
    97,160,31,2237
00  250 DATA 32,189,255,169,1,17
    4,74,31,168,32,186,255,169,0
    ,32,213,1980
49  260 DATA 255,144,13,173,74,3
    1,201,1,240,3,32,170,54,76,1
    17,31,1615
06  270 DATA 142,64,31,140,65,31
    ,169,0,133,198,173,69,31,133
    ,168,133,1680
29  280 DATA 166,173,70,31,133,1
    69,133,167,133,252,56,165,16
    6,233,7,133,2187
27  290 DATA 251,176,2,198,252,1
    60,0,177,251,141,57,31,200,1
    77,251,141,2465
12  300 DATA 58,31,200,177,251,1
    41,59,31,200,177,251,141,60,
    31,200,177,2185
47  310 DATA 251,141,61,31,200,1
    77,251,141,62,31,200,177,251
    ,141,63,31,2209
20  320 DATA 32,81,40,173,59,31,
    141,167,2,173,60,31,141,168,
    2,173,1474
DA  330 DATA 61,31,141,169,2,173
    ,62,31,141,170,2,169,0,141,1
    71,2,1466
CE  340 DATA 32,180,45,173,63,31
    ,208,13,173,57,31,201,80,240
    ,68,32,1627
98  350 DATA 60,40,76,41,53,32,6
    0,40,173,63,31,74,133,73,32,
    188,1169
C9  360 DATA 28,24,173,63,31,109
    ,57,31,201,80,240,36,173,58,
    31,74,1409
6E  370 DATA 170,24,173,167,2,10
    5,8,141,167,2,144,3,238,168,
    2,202,1716
F5  380 DATA 208,239,165,172,72,
    173,58,31,133,172,32,191,28,
    104,133,172,2083
97  390 DATA 32,63,40,120,32,135
    ,194,32,236,44,32,239,44,32,
    94,51,1420
0C  400 DATA 76,120,31,18,32,80,
    82,69,83,83,32,65,78,89,32,7
    5,1045
C1  410 DATA 69,89,32,84,79,32,8
    2,69,84,85,82,78,32,84,79,32
    ,1092
16  420 DATA 84,69,88,84,32,146,
    0,32,123,31,32,68,229,24,162
    ,12,1216
1F  430 DATA 160,8,32,240,255,17
    3,74,31,201,1,240,10,165,255
    ,240,6,2091
0C  440 DATA 32,8,62,76,170,53,1
    69,80,160,54,32,30,171,169,9
    ,133,1408
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E5  450 DATA 211,169,106,160,54,
    32,30,171,32,228,255,240,251
    ,201,78,208,2426
07  460 DATA 3,76,77,54,201,89,2
    08,240,173,74,31,201,1,240,7
    ,165,1840
84  470 DATA 255,240,3,32,11,62,
    173,70,31,133,252,56,173,69,
    31,233,1824
59  480 DATA 7,133,251,176,2,198
    ,252,160,0,173,57,31,145,251
    ,200,173,2209
AF  490 DATA 58,31,145,251,200,1
    73,59,31,145,251,200,173,60,
    31,145,251,2204
91  500 DATA 200,173,61,31,145,2
    51,200,173,62,31,145,251,200
    ,173,63,31,2190
11  510 DATA 145,251,169,60,133,
    178,169,3,133,179,162,16,202
    ,189,80,31,2100
0F  520 DATA 201,32,240,248,232,
    138,162,80,160,31,32,189,255
    ,169,3,174,2346
60  530 DATA 74,31,160,255,32,18
    6,255,169,251,174,64,31,172,
    65,31,232,2182
7B  540 DATA 208,1,200,32,221,24
    5,173,74,31,201,1,240,3,32,1
    70,54,1886
BB  550 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
```

PROGRAM: YC WRITER M

```
14  10 BL=50    :LN=50    :SA=1390
    1
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
D4  50 DATA 76,117,31,82,69,65,6
    8,89,32,84,79,32,83,65,86,69
    ,1127
5D  60 DATA 32,84,69,88,84,70,73
    ,76,69,33,13,13,0,18,32,65,8
    19
3D  70 DATA 82,69,32,89,79,85,32
    ,83,85,82,69,63,32,40,89,47,
    1058
99  80 DATA 78,41,32,146,13,13,0
    ,169,0,32,189,255,169,15,162
    ,8,1322
1E  90 DATA 168,32,186,255,32,19
    2,255,162,15,32,198,255,166,
    144,208,9,2309
D3  100 DATA 32,207,255,32,210,2
    55,76,153,54,32,204,255,96,1
    69,13,32,2075
F3  110 DATA 210,255,32,210,255,
    169,7,133,211,169,1,133,204,
    32,132,54,2207
49  120 DATA 169,13,32,210,255,3
    2,210,255,169,4,133,211,169,
    96,160,53,2171
DB  130 DATA 32,30,171,32,228,25
    5,240,251,96,169,13,32,210,2
    55,32,210,2256
FB  140 DATA 255,169,4,133,211,1
    69,110,160,53,32,30,171,32,2
    28,255,240,2252
FB  150 DATA 251,96,81,173,33,20
    8,133,82,173,32,68,229,32,15
    2,195,32,1970
4B  160 DATA 182,195,173,32,208,
    133,81,173,33,208,133,82,173
    ,134,2,133,2075
CD  170 DATA 83,169,0,141,32,208
    ,141,33,208,169,1,133,80,32,
    170,55,1655
B5  180 DATA 32,228,255,240,251,
    201,13,208,24,165,80,208,10,
    169,1,133,2218
67  190 DATA 80,32,170,55,76,29,
    55,169,0,133,80,32,147,58,76
    ,29,1221
6F  200 DATA 55,201,133,208,219,
    165,81,141,32,208,165,82,141
    ,33,208,165,2237
EF  210 DATA 83,141,134,2,120,32
    ,132,194,76,120,31,32,68,229
    ,76,126,1596
41  220 DATA 31,7,171,60,67,79,7
    6,79,85,82,0,108,7,154,83,75
    ,1164
F3  230 DATA 73,80,53,0,118,7,17
    9,62,67,79,76,79,85,82,0,128
    ,1168
F7  240 DATA 7,59,0,138,7,83,75,
    73,80,53,168,35,60,84,69,88,
    1079
DF  250 DATA 84,50,0,148,7,177,3
    5,62,84,69,88,84,50,0,158,7,
    1103
EF  260 DATA 153,36,65,66,49,69,
    0,168,7,59,0,178,7,76,179,55
    ,1167
E1  270 DATA 76,61,56,76,86,56,1
    69,0,133,87,169,4,133,88,169
    ,0,1363
93  280 DATA 133,89,169,216,133,
    90,32,68,229,160,0,169,85,14
    5,87,169,1574
A1  290 DATA 6,145,89,200,169,67
    ,145,87,169,6,145,89,192,38,
    208,243,1998
9B  300 DATA 200,169,73,145,87,1
    69,6,145,89,32,61,56,185,150
    ,56,240,1863
30  310 DATA 9,145,87,169,6,145,
    89,200,208,242,32,61,56,185,
    191,56,1881
76  320 DATA 240,9,145,87,169,6,
    145,89,200,208,242,32,61,56,
    169,74,1932
1E  330 DATA 145,87,169,6,145,89
    ,200,169,67,145,87,169,6,145
    ,89,192,1910
F2  340 DATA 38,208,243,200,169,
    75,145,87,169,6,145,89,32,61
    ,56,32,1755
13  350 DATA 61,56,169,232,133,8
    4,169,56,133,85,162,16,32,86
    ,56,96,1626
DE  360 DATA 24,165,87,105,40,13
    3,87,144,2,230,88,24,165,89,
    105,40,1528
30  370 DATA 133,89,144,2,230,90
    ,160,0,96,169,0,133,73,160,0
    ,177,1656
23  380 DATA 84,240,36,201,254,2
    40,15,201,255,208,17,32,61,5
    6,230,84,2214
5D  390 DATA 208,235,230,85,208,
    231,169,128,133,73,208,242,6
    9,73,145,87,2524
26  400 DATA 169,6,145,89,200,20
    8,216,24,200,152,101,84,133,
    84,144,2,1957
95  410 DATA 230,85,32,61,56,202
    ,208,197,96,93,32,32,32,32,3
    2,32,1452
69  420 DATA 32,32,32,42,42,42,3
    2,39,25,3,32,23,18,9,20,5,42
    8
C5  430 DATA 18,39,32,42,42,42,3
    2,32,32,32,32,32,32,32,32,32
    ,535
B3  440 DATA 93,0,93,40,3,41,32,
    49,57,56,55,32,2,45,8,32,638
B0  450 DATA 12,5,8,13,1,14,14,3
    2,32,32,32,32,22,5,18,19,291
C0  460 DATA 9,15,14,32,1,47,53,
    47,49,93,0,20,5,24,20,45,474
C4  470 DATA 5,14,20,18,25,32,13
    ,15,4,5,19,58,0,45,45,45,363
57  480 DATA 45,45,45,45,45,45,45,4
    5,45,45,45,45,45,45,0,23,
    653
A9  490 DATA 32,45,32,23,15,18,4
    ,32,23,18,1,16,32,15,14,47,3
    67
BC  500 DATA 15,6,6,0,10,32,45,3
    2,18,9,7,8,20,32,10,21,271
C5  510 DATA 19,20,9,6,9,3,1,20,
    9,15,14,32,15,14,47,15,248
94  520 DATA 6,6,0,9,32,45,32,9,
    14,19,5,18,20,32,13,15,275
A6  530 DATA 4,5,32,15,14,47,15,
    6,6,0,255,6,15,18,13,1,452
63  540 DATA 20,9,14,7,32,6,1,3,
    9,12,9,20,9,5,19,58,233
BB  550 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
```

PROGRAM: YC WRITER N

```
15  10 BL=50    :LN=50    :SA=1470
    1
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
E6  50 DATA 0,45,45,45,45,45,45,
    45,45,45,45,45,45,45,45,45,6
    75
28  60 DATA 45,45,45,45,45,45,0,
    3,32,45,32,21,14,45,10,21,49
    3
8C  70 DATA 19,20,9,6,25,32,16,1
    ,18,1,7,18,1,16,8,32,229
C7  80 DATA 21,14,4,5,18,32,3,21
    ,18,19,15,18,0,4,32,45,269
8E  90 DATA 32,18,9,7,8,20,32,10
    ,21,19,20,9,6,25,32,16,284
9A  100 DATA 1,18,1,7,18,1,16,8,
    32,21,14,4,5,18,32,3,199
EC  110 DATA 21,18,19,15,18,0,1,
    32,45,32,9,14,19,5,18,20,286
```

```
3B  120 DATA 32,5,13,16,20,25,32
    ,12,9,14,5,32,1,20,32,3,271
8C  130 DATA 21,18,19,15,18,0,25
    5,5,18,1,19,5,32,6,1,3,436
2D  140 DATA 9,12,9,20,9,5,19,58
    ,0,45,45,45,45,45,45,45,456
FE  150 DATA 45,45,45,45,45,45,4
    5,45,45,45,0,2,32,45,32,5,56
    6
DC  160 DATA 18,1,19,5,32,12,9,1
    4,5,32,21,14,4,5,18,32,241
D0  170 DATA 3,21,18,19,15,18,0,
    11,32,45,32,5,18,1,19,5,262
EC  180 DATA 32,3,21,18,18,5,14,
    20,32,2,12,15,3,11,0,5,211
0C  190 DATA 32,45,32,5,18,1,19,
    5,32,23,8,15,12,5,32,20,304
64  200 DATA 5,24,20,6,9,12,5,0,
    255,255,254,32,32,6,49,32,99
    6
09  210 DATA 45,32,2,1,3,11,32,2
    0,15,32,20,5,24,20,32,32,326
DE  220 DATA 32,18,5,20,32,45,32
    ,13,15,18,5,32,8,5,12,16,308
2A  230 DATA 32,32,32,0,89,0,169
    ,0,133,87,169,4,133,88,169,0
    ,1137
BF  240 DATA 133,89,169,216,133,
    90,32,68,229,169,180,133,84,
    169,58,133,2085
F7  250 DATA 85,162,21,32,176,55
    ,96,2,12,15,3,11,45,13,15,22
    ,765
D9  260 DATA 5,32,6,1,3,9,12,9,2
    0,9,5,19,58,0,45,45,278
FD  270 DATA 45,45,45,45,45,45,4
    5,45,45,45,45,45,45,45,45,45
    ,720
FC  280 DATA 45,45,45,45,0,7,32,
    45,32,19,5,20,32,19,20,1,412
0F  290 DATA 18,20,47,5,14,4,32,
    15,6,32,2,12,15,3,11,0,236
67  300 DATA 8,32,45,32,3,15,16,
    25,32,3,21,18,18,5,14,20,307
91  310 DATA 32,2,12,15,3,11,32,
    20,15,32,3,21,18,19,15,18,26
    8
CC  320 DATA 0,15,32,45,32,13,15
    ,22,5,32,3,21,18,18,5,14,290
2D  330 DATA 20,32,2,12,15,3,11,
    32,20,15,32,3,21,18,19,15,27
    0
CB  340 DATA 18,0,255,13,1,18,7,
    9,14,32,6,1,3,9,12,9,407
99  350 DATA 20,9,5,19,58,0,45,4
    5,45,45,45,45,45,45,45,45,56
    1
FD  360 DATA 45,45,45,45,45,45,4
    5,45,0,24,32,45,32,19,5,20,5
    37
E4  370 DATA 32,12,5,6,20,32,13,
    1,18,7,9,14,0,25,32,45,271
FE  380 DATA 32,19,5,20,32,18,9,
    7,8,20,32,13,1,18,7,9,250
C2  390 DATA 14,0,255,20,1,2,32,
    6,1,3,9,12,9,20,9,5,398
3C  400 DATA 19,58,0,45,45,45,45
    ,45,45,45,45,45,45,45,45,45,
    662
D2  410 DATA 45,45,0,6,53,32,45,
    32,10,21,13,16,32,20,15,32,4
    17
B4  420 DATA 14,5,24,20,32,20,1,
    2,45,16,15,19,9,20,9,15,266
C3  430 DATA 14,0,6,54,32,45,32,
    10,21,13,16,32,20,15,32,6,34
    8
F1  440 DATA 15,18,13,5,18,32,20
    ,1,2,45,16,15,19,9,20,9,257
4D  450 DATA 15,14,0,6,32,45,32,
    3,12,5,1,18,47,18,5,19,272
4B  460 DATA 20,15,18,5,32,1,12,
    12,32,20,1,2,45,16,15,19,265
EA  470 DATA 9,20,9,15,14,19,0,2
    0,32,45,32,3,12,5,1,18,254
F4  480 DATA 47,18,5,19,20,15,18
    ,5,32,19,9,14,7,12,5,32,277
12  490 DATA 20,1,2,45,16,15,19,
    9,20,9,15,14,0,255,15,20,475
A4  500 DATA 8,5,18,19,58,0,45,4
    5,45,45,45,45,45,32,32,32,51
    9
9A  510 DATA 32,32,32,32,32,32,3
    2,32,32,93,32,21,32,45,32,23
    ,566
4F  520 DATA 15,18,4,3,15,21,14,
    20,0,12,32,45,32,12,15,1,259
04  530 DATA 4,32,6,9,12,5,32,32
    ,32,32,32,93,32,14,32,431
F7  540 DATA 45,32,3,8,1,14,7,5,
    32,6,9,12,5,14,1,13,207
BB  550 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0,0
```

PROGRAM: YC WRITER D

```
7B  10 BL=30    :LN=50    :SA=1550
    1
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
AC  40 NEXT L:PRINT"{DOWN2}GET R
    EADY TO SAVE AND PRESS A KEY
    ":POKE198,0:WAIT198,1
ED  45 POKE43,99:POKE44,22:POKE4
    5,142:POKE46,62:X=PEEK(186):
    SAVE"WRITER2".X
2F  50 DATA 5,0,19,32,45,32,19,1
    ,22,5,32,6,9,12,5,32,276
EE  60 DATA 32,32,32,32,32,93,32
    ,13,32,45,32,3,8,1,14,7,440
7C  70 DATA 5,32,3,15,12,15,21,1
    9,19,0,18,32,45,32,18,5,290
1F  80 DATA 16,12,1,3,5,32,6,9,1
    2,5,32,32,32,93,32,16,338
9B  90 DATA 32,45,32,16,18,9,14,
    20,15,21,20,0,255,254,32,32,
    815
B2  100 DATA 6,49,32,45,32,2,1,3
    ,11,32,20,15,32,20,5,24,329
5B  110 DATA 20,32,32,32,18,5,20
    ,32,45,32,13,15,18,5,32,8,35
    9
8A  120 DATA 5,12,16,32,32,32,0,
    32,123,31,32,68,229,24,162,1
    0,840
4E  130 DATA 160,10,32,240,255,5
    6,173,32,208,233,240,133,77,
    169,104,160,2282
C7  140 DATA 61,32,169,61,144,3,
    141,32,208,56,173,33,208,233
    ,240,133,1927
51  150 DATA 77,169,120,160,61,3
    2,169,61,144,3,141,33,208,17
    3,134,2,1687
A3  160 DATA 133,77,169,135,160,
    61,32,169,61,144,3,141,134,2
    ,198,211,1830
16  170 DATA 169,148,160,61,32,3
    0,171,32,228,255,240,251,201
    ,78,240,170,2466
7D  180 DATA 201,89,208,243,120,
    32,132,194,76,120,31,66,79,8
    2,68,69,1810
AC  190 DATA 82,32,67,79,76,79,8
    5,82,58,32,0,80,65,80,69,82,
    1048
54  200 DATA 32,67,79,76,79,85,8
    2,58,32,0,73,78,75,32,67,79,
    994
04  210 DATA 76,79,85,82,58,32,0
    ,18,32,83,65,84,73,83,70,73,
    993
5A  220 DATA 69,68,63,32,40,89,4
    7,78,41,32,146,0,32,30,171,1
    65,1103
C3  230 DATA 211,72,169,0,166,77
    ,32,205,189,104,133,211,162,
    0,134,73,1938
AD  240 DATA 134,74,134,75,32,22
    8,255,240,251,201,13,240,26,
    201,48,144,2296
35  250 DATA 243,201,58,176,239,
    32,210,255,73,48,166,75,149,
    73,232,224,2454
3E  260 DATA 2,134,75,240,2,208,
    221,169,13,32,210,255,32,210
    ,255,169,2227
B5  270 DATA 10,133,211,166,75,2
    08,2,24,96,24,162,10,169,0,1
    01,73,1464
5E  280 DATA 202,208,251,101,74,
    56,96,59,42,42,42,76,14,62,7
    6,22,1423
22  290 DATA 62,169,88,160,62,32
    ,30,171,96,162,0,189,78,31,1
    57,85,1552
3D  300 DATA 3,201,32,208,11,232
    ,189,78,31,201,32,208,238,20
    2,208,5,2079
24  310 DATA 232,224,18,208,230,
    169,0,157,65,3,169,0,32,189,
    255,169,2120
BE  320 DATA 15,174,74,31,168,32
    ,186,255,32,192,255,162,15,3
    2,201,255,2079
1A  330 DATA 169,65,160,3,32,30,
    171,32,181,171,96,82,69,65,6
    8,89,1483
BB  340 DATA 32,84,79,32,82,69,8
    0,76,65,67,69,32,84,69,88,84
    ,1092
27  350 DATA 70,73,76,69,33,13,1
    3,0,0,0,0,0,0,0,0,0,347
```

PROGRAM: WRITER BOOT

```
C9  5 A=A+1:Y=PEEK(186)
13  10 IFA=1THENLOAD"WRITER1",Y,
    1
B9  20 IFA=2THENLOAD"WRITER2",Y,
    1
43  30 IFA=3THENSYS8050
```

Technical Information

All you ever wanted to know about your Commodore but were afraid to ask.

Most programmers spend a lot of their time sifting through piles of technical books looking for the address of a certain routine or trying to find the POKE to perform a certain function.

Now you can throw away your books, as on the following pages you will find a wealth of information about all of the popular Commodore computers.

Advanced programmers will find the memory maps invaluable while both beginners and old hands alike will find the Hex converter, the hints and tips and much more, to their liking.

Most of the information provided here is useful by itself. Some information, such as the addresses of routines within the ROMs, will be of more use when used together with a ROM disassembly.

C16 OP-SYSTEM AND MEMORY MAP

HEX ADDRESS	BIT	DESCRIPTION OF ROUTINE
$0001		Cassette control
	4	Cassette read
	3	Cassette motor (0=on)
	1	Cassette write
$000A		0=LOAD; 1=VERIFY
$000D		Type: FF=string, 00=numeric
$000E		Type: 80=integer, 00=floating
$000F		DATA scan/LIST quote/memory flag
$0014-0015		Integer value
$0016		Pointer temporary string stack
$0017-0018		Last temp string vector
$0019-0021		Temporary string stack
$0022-0025		Utility pointer area
$0026-002A		Product area for multiplication
$002B-002C		Pointer: start of basic
$002D-002E		Pointer: start of basic variables
$002F-0030		Pointer: start of arrays
$0031-0032		Pointer: end of arrays
$0033-0034		Pointer: bottom of strings
$0035-0036		Pointer: current string
$0037-0038		Pointer: top of basic memory
$0039-003A		Current basic line number
$003B-003C		CHARGET pointer
$003D-003E		Pointer: CONT basic line number
$003F-0040		Current DATA line number
$0041-0042		Current DATA address
$0043-0044		Input vector
$0045-0046		Current variable name
$0047-0048		Current variable address
$0049-004A		Variable pointer for FOR/NEXT
$004B-004C		Y save/op save/basic pointer save
$004D		Comparison symbol accumulator
$004E-0053		Misc numeric work area
$0054-0056		Jump vector for functions
$0057-0060		Misc work area
$0061		FAC#1 exponent
$0062-0065		FAC#1 mantissa
$0066		FAC#1 sign
$0067		Series evaluation constant pointer
$0068		FAC#1 overflow
$0069-006E		FAC#2
$006F		FAC sign comparison
$0070		FAC#1 rounding
$0075		Room for graphics screen (0=not available)
$007C-007D		Pointer: GOSUB stack
$0093		Flag for window ($40=window on,$80=multicolor,$C0=both)
$0090		Status word ST
$0091		Keyswitch CIA: STOP and RVS flags
$0093		0=load; 1=verify
$0094		Serial output: deferred char flag
$0095		Serial deferred character
$0097		number of open files
$0098		Input device
$0099		Output CMD device
$009A		Direct=$80:run=0 output control
$009D-009E		Tape end address/end of program
$00A3-00A5		Jiffy clock
$00A6		Serial bit count/EOI flag
$00A9		Countdown tape write/bit count
$00AB		number characters in filename
$00AC		Current logical file
$00AD		Current secondary address
$00AE		Current device
$00AF-00B0		Pointer to filename
$00B2-00B3		I/O start address
$00B4-00B5		Alt start address (load/verify)
$00B6-00B7		Pointer: cassette buffer
$00C4-00C5		Input cursor log (row,column)
$00C6		Which key ($4=no key)
$00C7		Input from screen/keyboard
$00C8-00C9		Pointer to screen line
$00CA		Pointer: cursor column
$00CB		Output quotes flag
$00CD		Pointer: cursor row
$00CE		Output character (to screen)
$00CF		Number of inserts outstanding
$00E4-00EB		Screen color pointer
$00EC-00ED		Keyboard pointer
$00EF		Number of characters in keyboard buffer
$00F8		Type of tape file
$00FF-010A		Floating to ASCII work area
$0100-013E		Tape error log
$0100-01FF		Processor stack area
$0200-0258		Basic input buffer
$0259-025A		Pointer: line number for CONT
$025B-025C		Pointer: basic statement for CONT
$02F2-02F3		Float-fixed vector
$02F4-02F5		Fixed-float vector
$0300-0311		Basic vectors
$0312-0313		IRQ vector for keyscan/clock
$0314-0315		Main IRQ vector for sound duration/graphics split
$0316-0317		BRK interrupt vector
$0318-0319		OPEN vector
$031A-031B		CLOSE vector
$031C-031D		Set input vector
$031E-031F		Set output vector
$0320-0321		Restore I/O vector
$0322-0323		INPUT vector
$0324-0325		OUTPUT vector
$0326-0327		Test STOP vector
$0328-0329		GET vector
$032A-032B		Abort I/O vector
$032C-032D		User vector
$032E-032F		LOAD vector
$0330-0331		SAVE vector
$0333-03FF		Cassette buffer
$0473		CHARGET subroutine
$04FC/04FE		Duration for voice 1
$04FD/04FF		Duration for voice 2/noise
$0503		RND seed value
$0503-0512		Logical file table
$0513-051C		Device number table
$051D-0526		Secondary address table
$0527-0530		Keyboard buffer
$0531-0532		Start of usable memory
$0533-0534		End of usable memory
$0535		Serial bus timeout flag

```
$053B          Current color code
          7    1=Flash
        6-4    Luminance (0-7)
        3-0    Color (0-15)
$053F          Max size of keyboard buffer
$0541          Repeat speed counter
$0542          Repeat delay counter
$0543          Keyboard shift/control flag
$0544          Case switch count
$0545-0546     Keyboard table setup pointer
$0547          Case switch disable
$0700-07B0     Gosub stack
$07F2          SYS A reg save
$07F3          SYS X reg save
$07F4          SYS Y reg save
$07F5          SYS status reg save
$07F6          Last key
$07FD          Countdown for double TI bump
$0800-08FF     Color memory
$0C00-0FFF     Screen memory
$1000-3FF5     Basic program memory
$1000-3FF5     Graphics screen/color memory
$3FF6-3FFD     Reset entry (When ROM is out)

MEMORY MAP

$8000          Basic ROM cold start routine
$8019          Initialize basic
$80CC          Power-up message
$8105          Vectors for $0300
$8117          Initialize vectors
$8123          CHRGET for $0*79
$818E          Keywords
$8383          Command vectors
$8415          Function vectors
$8553          Arithmetic operator vectors
$8571          Error messages
$8681          'SYNTAX ERROR'
$8683          Error routine
$8703          'READY'
$870F          Basic warm start
$8A3D          Find basic line
$8A79          Perform NEW
$8A98          Perform CLR
$8AF1          Set text pointer
$8AFF          Perform LIST
$8BBC          Perform RUN
$8C9A          Perform RESTORE
$8CD8          Perform STOP
$8CDA          Perform END
$8D03          Perform CONT
$82C          Perform GOSUB
$8D40          Perform GOTO
$8D83          Perform RETURN
$8D80          Perform DATA
$8DE1          Perform IF
$8E08          Perform REM and ELSE
$8E1B          Perform ON
$8E3E          Get line number (0-63999)
$8E7C          Perform LET
$8FE0          Perform PRINT#
$8FE6          Perform CMD
$9000          Perform PRINT
$9088          Print string from (y,a)
$9088          Perform GET
$90EE          Perform INPUT#
$9108          Perform INPUT
$914F          Perform READ
$9208          '?REDO FROM START' message
$9294          Perform NEXT
$933C          Evaluate expression
$9439          Constant PI
$9465          Perform NOT
$9488          Scan past )
$948E          Scan past (
$9491          Scan past ,
$95F8          Perform OR
$95FB          Perform AND
$9628          Perform comparisons (<=>)
$963B          Perform DIM
$96A5          Locate variable
$986C          Constant - 32768
$9886          Float-fixed
$9A62          Perform FRE
$9A7D          Perform POS
$9A9D          Perform DEF
$9ADE          Perform FN
$9B66          Perform STR$
$9C40          Get temporary string
$9C8B          Perform CHR$
$9CCF          Perform LEFT$
$9D03          Perform RIGHT$
$9D15          Perform MID$
$9D61          Perform LEN
$9D70          Perform ASC
$9D8A          Get 1 byte parameter
$9D93          Perform VAL
$9DD2          Get parameters for POKE/WAIT
$9DFA          Perform PEEK
$9E12          Perform POKE
$9E6A          Perform WAIT
$9E87          Perform SUBTRACT
$9E9E          Perform ADD
$9A1E          Perform LOG
$9A78          Perform MULTIPLY
$A197          Perform DIVIDE
$A221          Memory to FAC#1
$A2B1          FAC#2 to FAC#1
$A2A0          Round FAC#1
$A2BE          Perform SGN
$A2DD          Perform ABS
$A35B          Perform INT
$A5E4          Perform SQR
$A5EE          Perform POWER
$A6A7          Perform NEGATE
$A6E0          Perform EXP
$A707          Perform RND

$A77D          Basic I/O error handler
$A78B          Basic-kernal patch for OPEN
$A78B          Basic-kernal patch for PRINT
$A791          Basic-kernal patch for INPUT
$A797          Basic-kernal patch for set output device
$A7A6          Basic-kernal patch for set input device
$A7AF          Basic-kernal patch for GET
$A7B5          Perform SYS
$A7DE          Perform SAVE
$A7F0          Perform VERIFY
$A7F3          Perform LOAD
$A84D          Perform OPEN
$A85A          Perform CLOSE
$A86B          Get parameters for LOAD/SAVE
$A8B8          Get parameters for OPEN/CLOSE
$A8B4          Garbage collect
$AA70          Perform COS
$AA77          Perform SIN
$AAC0          Perform TAN
$AB1A          Perform ATN
$AB8D          Perform RENUMBER
$ADCA          Perform FOR
$AE5A          Perform DELETE
$AE2A          Get range for LIST/DELETE
$B42B          Perform TRAP
$B440          Perform RESUME
$B5A4          Perform PUDEF
$B557          Perform DO
$B5AC          Perform EXIT
$B603          Perform LOOP
$B652          Perform TRON
$B655          Perform TROFF
$B6CD          Perform AUTO
$B6EB          Perform HELP
$B729          Perform KEY
$B849          Perform SOUND
$B88D          Perform VOL
$B8D1          Perform PAINT
$B9D4          Perform CHAR
$BAE2          Perform BOX
$BD35          Perform GSHAPE
$BE29          Perform SSHAPE
$C01E          Perform CIRCLE
$C409          Perform DRAW
$C58D          Perform LOCATE
$C51A          Perform COLOR
$C567          Perform SCNCLR
$C5BB          Perform SCALE
$C5C3          Perform GRAPHIC
$C88C          Perform DIRECTORY
$C9A1          Perform DSAVE
$C951          Perform DLOAD
$C96B          Perform HEADER
$C99C          Perform SCRATCH
$C9CC          Perform COLLECT
$C9DA          Perform COPY
$C9F4          Perform RENAME
$CA00          Perform BACKUP
$CB21          Get parameters for disk commands
$CCCF          Read disk error
$CD3D          'ARE YOU SURE' message
$CE00          IRQ/BRK Entry
$CE0E          IRQ routine($0314)->handles graphics split,sound duration
$CE42          IRQ routine($0312)->handles clock,keyboard
$CECD          Handle sound durations
$CEF0          Bump clock
$CF26          Get time
$CF2D          Set time
$D000          Character defination (2K)
$D800          Screen address (LOW)
$D818          Screen address (HIGH)
$D824          Get screen size
$D839          Put/Get Row/Col
$D8A0          Set screen pointers
$D8C1          Remove char from keyboard
$D965          Input until carriage return
$D811          Read keyboard
$DC49          Output to screen
$E01E          Keyboard select vectors
$E026          Unshifted table
$E067          Shifted table
$E0A8          CBM key table
$E0E9          Control table
$E12A          Shift/run equivalent
$E2EA          Delay for 0.5 sec
$E9CC          Find any tape header
$EA21          Find a specific header
$EBD9          Get ($0308)
$EBEB          Input ($0322)
$EC4B          Output ($0324)
$EC8B          Receive from serial
$ECDF          Send serial deferred
$ED1B          Set input device ($031C)
$ED60          Set output device ($031E)
$EDFA          Send TALK
$EE1A          Send TALK SA
$EE2C          Send LISTEN
$EE4D          Send LISTEN SA
$EE5D          Close file ($031A)
$EEEB          Find file entry
$EEFB          Get file details
$EF0B          Abort all files ($032A)
$EF4C          Restore default I/O ($0320)
$EF23          Send UNLISTEN
$EF3B          Send UNTALK
$EF53          Open file ($0318)
$F09A          Load program ($032E)
$F1A4          Save program ($0330)
$F265          Test STOP key ($0328)
$F2A4          Power reset entry
$F2CE          Set kernal vectors
$F2D3          Store kernal vectors
$F30B          Initialize I/O
$F352          Initialize system constants
$F48C          Set filename details
$F413          Set file details
$F41A          Flag status
$F41C          Get status
$F423          Set timeout
$F427          Read/set top of memory
$F429          Read top of memory
$F42F          Set top of memory
$F436          Read/set bottom of memory
$F439          Read bottom of memory
$F43E          Set bottom of memory
```

$F445	Monitor call entry
$F44C	Monitor BRK entry ($0316) user vector ($032C)
$FC19	Get I/O address
$FC83	IRQ entry
$FC8E	IRQ exit
$FD00	TED memory
$FF52	Perform MONITOR

+4 MEMORY MAP

DEC ADDRESS	DESCRIPTION
0	7501 Data direction register
1	7501 8 bit I/O port (asC64)
3-4	New start address (RENUMBER)
5-6	Step width (RENUMBER)
7	Search character
8	Flag: searching for quote
9	Screen column from last TAB
10	Flag: 0=LOAD, 1=VERIFY
11	Input buffer counter, number of elements
13	Flag: $FF=string, $00=numeric
14	Flag: $FF=integer, $00=floating
15	Flag: Data scan/LIST quote/memory flag
16	Flag: user function call
17	Flag: $00=INPUT, $40=GET, $98=READ
20-21	Integer value
22	Pointer: Temporary string stack
23-24	Vector: Last temporary string
25-33	Temporary string stack
34-37	Utility pointer area
38-42	Product area for multiplication
43-44	Pointer: start of basic
45-46	Pointer: start of basic variables
47-48	Pointer: start of basic arrays
49-50	Pointer: end of arrays
51-52	Pointer: start of strings
53-54	Pointer: current string
55-56	Pointer: top of basic memory
57-58	Current basic line number
59-60	Previous basic line number
61-62	**Pointer: CONT basic line number**
63-64	Current DATA line number
65-66	Pointer: current DATA address
67-68	Vector: input routine
69-70	Current variable name
71-72	Variable address
73-74	Variable pointer for FOR/NEXT
75-76	Y save, op save, basic pointer save
77	Comparison: 1=larger, 2=equal, 4=smaller
78-83	Misc work area
84-86	Vector: functions
87-96	Misc work area
97	Accumulator #1 exponent
98-101	Accumulator #1 mantissa
102	Accumulator #1 sign
103	Series evaluation constant pointer
104	Accumulator #1 hi-order overflow
105-110	Accumulator #2 as for #1
111	Accumulator sign comparison
113	Accumulator #1 rounding
113-114	Pointer: cassette buffer
115-116	Flag: AUTO command $00=OFF
117	Flag: $01= 10K reserved for graphics
124-125	Pointer: GOSUB stack
131	Current graphics mode: $00=text, $20=hires, $60=split hires
	$40=multicolor, $E0=multicolor split
132	Current color
133	Multi-color 1
134	Foreground color
135	Max number of columns
136	Max number of rows
144	Status word ST
145	Flag: STOP and RVS keys
147	Flag: $00=LOAD, $01=VERIFY
148	Flag: character in serial buffer $00=NO, $80=YES
149	Character in buffer for serial address
151	Number of files open
152	Default input device
153	Device output device
154	Flag: $80=direct mode, $C0=monitor, $00=program
157-158	Pointer: tape end/program end
163-165	Jiffy clock
171	Length of filename
172	Logical file number
173	Secondary address
174	Device number
175-176	Pointer: filename
178-179	I/O start address
180-181	Basic loading address
182-183	Pointer: load end address for tape
194	Flag: RVS $12=Yes, $00=No
196-197	Cursor position (x,y)
198	Flag: key pressed: $40=none
199	Input from screen/keyboard
200-201	Pointer: screen line
202	Pointer: screen column
203	Flag: $00=not in quote mode
204	Length of current screen line
205	Pointer: cursor row
206	Output character to screen
207	Flag: insert mode, >$00=number of inserts
214-235	Pointer: current screen color
236-238	Vector to keyboard decode
239	Number of characters in keyboard buffer
248	Type of tape file
249	Bit 7=1:WRITE, Bit 6=1:READ
275-289	Color luminance table in RAM
291-511	Processor stack
512-600	Basic input buffer
601-602	Previous basic line number
603-604	Pointer: Basic statement for CONT
754-755	Pointer: float to fixed routine
756-757	Pointer: fixed to integer
768-769	Vector:basic error messages
770-771	Vector:basic warm start
772-773	Vector:basic token generator
774-775	Vector:basic LISt
776-777	Vector:basic command execute
778-779	Vector:basic token evaluate
780-781	Vector:basic user token evalulate
782-783	Vector:create keyword
784-785	Vector:prepare user token
786-787	Vector:interrupt
788-789	Vector:hardware interrupt
790-791	Vector:BRK interrupt
792-793	Vector:kernal OPEN
794-795	Vector:CLOSE
796-797	Vector:CHKIN
798-799	Vector:CHKOUT
800-801	Vector:CLRCHN
802-803	Vector:CHRIN
804-805	Vector:CHROUT
806-807	Vector:STOP
808-809	Vector:GETIN
810-811	Vector:CLALL
812-813	Vector:monitor break
814-815	Vector:LOAD
816-817	Vector:SAVE
818-1010	Tape buffer
1138-1144	CHARSET subroutine
1145-1156	CHRSET subroutine
1263	Last error number
1264-1265	Row number of last error
1266-1267	Reference for ON ERROR GOTO
1280	USR jump command
1281-1282	USR address (lo/hi)
1283	RND seed value
1288-1298	Table of logical file numbers
1299-1308	Table of device numbers
1309-1318	Table of secondary addresses
1319-1328	Keyboard buffer
1329-1330	Start address of RAM for OS
1331-1332	Pointer: end of RAM OS
1339	Current color code: BIT 7:1=flash BIT 6-4:luminance (0-7) BIT 3-0:color (0-15)
1343	Size of keyboard buffer
1344	Flag:Key repeat: $80=All,$40=None,$00=DEL,SPACE,CURSORS
1345	Repeat speed
1346	Repeat delay counter
1347	Flag: shift,ctrl,cbm key
1348	Last pattern of shift
1349-1350	Pointer: keyboard table setup
1351	Flag: SHIFT: $80=NO, $00=YES
1362	Program counter hi
1363	Program counter lo
1364	Processor flags
1365	Processor A reg
1366	Processor X reg
1367	Processor Y reg
1368	Processor stack pointer
2030	Current key pressed

LOW MEMORY MAP OF C64

LABEL	HEX	DECIMAL	DESCRIPTION
D6510	$0000	0	6510 Direction register
R6510	$0001	1	6510 I/O, Memory and tape
ADRAY1	$0003-0004	3-4	Float to fixed vector
ADRAY2	$0005-0006	5-6	Fixed to float vector
CHARAC	$0007	7	Search character
ENDCHR	$0008	8	End of quote flag
TRMPOS	$0009	9	Save screen last TAB
VERCK	$000A	10	Flag: LOAD=0 VERIFY=1
COUNT	$000B	11	Pointer input buffer/#subscripts
DIMFLG	$000C	12	Default DIM to 10 flag
VALTYP	$000D	13	Data type: String=255 Numberic=0
INTFLG	$000E	14	Integer=128 Float=0
GARBFL	$000F	15	DATA scan/LIST quote/Garbage collect flag
SUBFLG	$0010	16	Subscript/User fn call
INPFLG	$0011	17	Input flag: $00=Input $40=Get $80=Read
TANFLG	$0012	18	TAN sign/comparison
	$0013	19	Current I/O prompt
LINNUM	$0014-0015	20-21	Integer value
TEMPPT	$0016	22	Pointer temp string stack
LASTPT	$0017-0018	23-24	Last temp string address
TEMPST	$0019-0021	25-33	Stack for temp strings
INDEX	$0022-0025	34-37	Utility pointer area
RESHO	$0026-002A	38-42	Product area for multiply
TXTTAB	$0028-002C	43-44	Pointer start of BASIC
VARTAB	$002D-002E	45-46	Pointer start of variables
ARYTAB	$002F-0030	47-48	Pointer start of arrays
STREND	$0031-0032	49-50	Pointer end of arrays
FRETOP	$0033-0034	51-52	Pointer bottom of strings
FRESPC	$0035-0036	53-54	Utility string pointer
MEMSIZ	$0037-0038	55-56	Pointer highest address used by BASIC
CURLIN	$0039-003A	57-58	Current BASIC line number
OLDLIN	$003B-003C	59-60	Previous BASIC line number
OLDTXT	$003D-003E	61-62	BASIC statement for CONT
DATLIN	$003F-0040	63-64	Current DATA line
DATPTR	$0041-0042	65-66	Current DATA address
INPPTR	$0043-0044	67-68	INPUT vector
VARNAM	$0045-0046	69-70	Pointer current variable name
VARPNT	$0047-0048	71-72	Pointer current variable data
FORPNT	$0049-004A	73-74	Pointer variable for FOR/NEXT
	$004B-004C	75-76	Y-save/op-save/BASIC pointer save
	$004D	77	Comparison symbol accumulator
	$004E-0053	78-83	Misc work area
	$0054-0056	84-86	Jump vector for functions
	$0057-0060	87-96	Misc numeric work area
FACEXP	$0061	97	FPACC#1 - exponent
FACHO	$0062-0065	98-101	FPACC#1 - mantissa
FACSGN	$0066	102	FPACC#1 - sign
SGNFLG	$0067	103	Pointer series evaluation constant
BITS	$0068	104	FPACC#1 - overflow digit
ARGEXP	$0069	105	FPACC#2 - exponent
ARGHO	$006A-006D	106-109	FPACC#2 - mantissa
ARGSGN	$006E	110	FPACC#2 - sign

ARISGN	$006F	111	Sign comparison result
FACOV	$0070	112	FPACC#1 - low order rounding
FBUFPT	$0071-007E	113-114	Pointer: cassette buffer
CHRGET	$0073-008A	115-138	Subroutine: get next byte of BASIC
CHRGOT	$0079	121	Entry point to get same byte
TXTPTR	$007A-007B	122-123	Pointer current byte of basic
RNDX	$008B-008F	139-143	RND seed value
STATUS	$0090	144	Kernal I/O status ST
STKEY	$0091	145	STOP key and RVS keys switch
SVXT	$0092	146	Timing constant for tape
VERCK	$0093	147	$00= Load $01= Verify
C3PO	$0094	148	Serial output: deferred char flag
BSOUR	$0095	149	serial output deferred char
SYNO	$0096	150	Tape EOT received
	$0097	151	Register save
LDTND	$0098	152	Number of files open
DFLTN	$0099	153	Input device (default=0)
DFLTO	$009A	154	Output device (default=3)
PRTY	$009B	155	Tape char parity
DPSW	$009C	156	Tape byte received flag
MSGFLG	$009D	157	BASIC mode flag: $00=Program $80=Direct
PTR1	$009E	158	Tape pass 1 error log
PTR2	$009F	159	pass 2 error log
TIME	$00A0-00A2	160-162	Real time jiffy clock
	$00A3	163	Serial bit count/EOI flag
	$00A4	164	Cycle count
CNTDN	$00A5	165	Tape sync countdown/bit count
BUFPNT	$00A6	166	Pointer: tape I/O buffer
INBIT	$00A7	167	RS232 input bits - tape wrt ldr/rd count
BITCI	$00A8	168	RS232 input bit count tape wrt ldr/rd count
RINONE	$00A9	169	RS232 start bit flag
RIDATA	$00AA	170	RS232 input byte buffer tape scan/counter/ldr
RIPRTY	$00AB	171	RS232 input parity tape wrt ldr length'rd checksum
SAL	$00AC-00AD	172-173	Pointer tape buffer/scrn scroll
EAL	$00AE-00AF	174-175	Tape end address/end program
CMPO	$00B0-00B1	176-177	Tape timing constants
TAPE1	$00B2-00B3	178-179	Pointer start of tape buffer
BITTS	$00B4	180	RS232 out bit count/tape enabled = 1
NXTBIT	$00B5	181	RS232 next bit to send/tape EOT
RODATA	$00B6	182	RS232 out byte buffer/rd char error
FNLEN	$00B7	183	Length current filename
LA	$00B8	184	Current logical file number
SA	$00B9	185	Current secondary address
FA	$00BA	186	Current device number
FNADR	$00BB-00BC	187-188	Pointer current file name address
ROPRTY	$00BD	189	RS232 out parity/tape rd input char
FSBLK	$00BE	190	Tape number of blocks left to wrt/rd
MYCH	$00BF	191	Serial word buffer
CAS1	$00C0	192	Tape motor control
STAL	$00C1-00C2	193-194	I/O start address
MEMUSS	$00C3-00C4	195-196	Kernal setup ptr/tape temp address
LSTX	$00C5	197	Last key pressed
NDX	$00C6	198	Number characters in keyboard queue
RVS	$00C7	199	RVS char print flag $01=yes $00=no
INDX	$00C8	200	Pointer: end of line for INPUT
LXSP	$00C9-00CA	201-202	Cursor row,col at start of INPUT
SFDX	$00CB	203	Current key pressed 64= no key
BLNSW	$00CC	204	0 = blink cursor
BLNCT	$00CD	205	Cursor countdown timer
GDBLN	$00CE	206	Character at cursor position
BLNON	$00CF	207	Cursor blink flag on/off
CRSW	$00D0	208	Flag: INPUT from screen or GET from keyboard
PNT	$00D1-00D2	209-210	Pointer current start of screen line address
PNTR	$00D3	211	Cursor col on above line
QTSW	$00D4	212	Flag: 0=cursor in edit mode else quote mode
LNMX	$00D5	213	Physical screen line length
TBLX	$00D6	214	Current row where cursor lives
	$00D7	215	Last inkey/checksum/buffer temp data
INSRT	$00D8	216	number of inserts outstanding
LDTB1	$00D9-00F2	217-242	Screen line link table
USER	$00F3-00F4	243-244	Pointer screen colour
KEYTAB	$00F5-00F6	245-246	Keyboard decode table vector
RIBUF	$00F7-00FB	247-248	RS232 input buffer pointer
ROBUF	$00F9-00FA	249-250	RS232 output buffer pointer
FREKZP	$00FB-00FE	251-254	Free zero page area
BASZPT	$00FF	255	BASIC temp data area
	$0100-010A	256-266	Float to ASCII work area
	$0100-013E	256-318	Tape error log
	$0100-01FF	256-511	Processor stack
BUF	$0200-025B	512-600	System input buffer
LAT	$0259-026E	601-618	Logical file table
FAT	$026З-026C	611-620	Device number table
SAT	$026D-0276	621-630	Secondary address table
KEYD	$0277-0280	631-640	Keyboard buffer
MEMSTR	$0281-0282	641-642	Start of BASIC memory
MEMSIZ	$0283-0284	643-644	Top of BASIC memory
TIMOUT	$0285	645	Serial bus time out flag
COLOR	$0286	646	Current character colour
GDCOL	$0287	647	Background colour under cursor
HIBASE	$0288	648	Start of screen memory: page number
XMAX	$0289	649	Size of keyboard buffer
RPTFLG	$028A	650	Repeat key flag: $80=Repeat all keys
KOUNT	$028B	651	Repeat speed counter
DELAY	$028C	653	Flag: shift/ctrl/logo key
LSTHF	$028E	654	Last shift pattern flag
KEYLOG	$028F-0290	655-656	Keyboard setup table pointers
MODE	$0291	657	Flag: 0=disable shift keys 128=enable shifts
AUTODN	$0292	658	0=scroll down enable
M51CTR	$0293	659	RS232 control register
M51CDR	$0294	660	RS232 command register
M51AJB	$0295-0296	661-662	RS232 non-standard baud rate
RSSTAT	$0297	663	RS232 status register
BITNUM	$0298	664	RS232 bits left to send
BAUDOF	$0299-029A	665-666	RS232 baud rate
RIDBE	$029B	667	RS232 index to end of input buffer
RIDBS	$029C	668	RS232 page number of start of input buffer
RODBS	$029D	669	RS232 page number of start of output buffer
RODBE	$029E	670	RS232 index to end of output buffer
IRQTMP	$029F-02A0	671-672	IRQ save during tape I/O
ENABL	$02A1	673	RS232 enable/CIA(NMI) interupt control
	$02A2	674	CIA 1 timer A control log during tape I/O
	$02A3	675	CIA 1 interrupt log tape read
	$02A4	676	CIA 1 timer A enable log tape read
	$02A5	677	Screen line marker
	$02A6	678	PAL/NTSC flag: 0=NTSC 1=PAL
	$02A7-02FF	679-767	Unused
	$02C0-02FE	704-766	Block 11 for sprites
IERROR	$0300-0301	768-769	Vector: BASIC error msgs ($E38B)
IMAIN	$0302-0303	770-771	Vector: BASIC warm start ($A483)
ICRNCH	$0304-0305	772-773	Vector: BASIC crunch tokens ($A57C)
IQPLOP	$0306-0307	774-775	Vector: BASIC print tokens ($A71A)
IGONE	$0308-0309	776-777	Vector: BASIC start new line($A7E4)
IEVAL	$030A-030B	778-779	Vector: BASIC token evaluate($AE86)
SAREG	$030C	780	Save A register
SXREG	$030D	781	Save X register
SYREG	$030E	782	Save Y register
SPREG	$030F	783	Save status register
USRPOK	$0310	784	USR function jump instruction ($4C)
USRADD	$0311-0312	785-786	USR address low/high form ($B248)
	$0313	787	Unused
CINV	$0314-0315	788-789	Vector: Hardware IRQ ($EA31)
CBINV	$0316-0317	790-791	Vector: BRK interrupt ($FE66)
NMINV	$0318-0319	792-793	Vector: NMI ($FE47)
IOPEN	$031A-031B	794-795	Vector: KERNAL OPEN ($F34A)
ICLOSE	$031C-031D	796-797	Vector: KERNAL CLOSE ($F291)
ICHKIN	$031E-031F	798-799	Vector: KERNAL CHKIN ($F20E)
ICKOUT	$0320-0321	800-801	Vector: KERNAL CHKOUT ($F250)
ICLRCH	$0322-0323	802-803	Vector: KERNAL CLRCHN ($F333)
IBASIN	$0324-0325	804-805	Vector: KERNAL CHRIN ($F157)
IBSOUT	$0326-0327	806-807	Vector: KERNAL CHROUT ($F1CA)
ISTOP	$0328-0329	808-809	Vector: KERNAL STOP ($F6ED)
IGETIN	$032A-032B	810-811	Vector: KERNAL GETIN ($F13E)
ICLALL	$032C-032D	812-813	Vector: KERNAL CLALL ($F32F)
USRCMD	$032E-032F	814-815	Vector: User WARM start ($FE66)
ILOAD	$0330-0331	816-817	Vector: KERNAL LOAD ($F4A5)
ISAVE	$0332-0333	818-819	Vector: KERNAL SAVE ($F5ED)
	$0334-033B	820-827	Unused
TBUFFER	$033C-03FB	828-1019	Tape I/O buffer
	$03FC-03FF	1020-1023	Unused
	$0340-037F	832-895	Block 13 sprite data
	$0380-03BF	896-959	Block 14 sprite data
	$03C0-03FE	960-1022	Block 15 sprite data
VICSCN	$0400-07FF	1024-2047	Screen memory
	$0400-07E7	1024-2023	Visible memory
	$07F8-07FF	2040-2047	Sprite block data pointers (0-7)
	$0800-9FFF	2048-40959	Start of BASIC (TXTTAB-1)
	$8000-9FFF	32768-40959	Alternate: ROM plug-in area
	$A000-BFFF	40960-49151	Basic ROM
	$A000-BFFF	40960-49151	Alternate RAM
	$C000-CFFF	49152-53247	RAM memory, including alternate
	$D000-D02E	53248-53294	Video Chip (6566)
	$D400-D41C	54272-54300	Sound chip (6581)
	$D800-DBFF	55296-56319	Colour nybble memory
	$DC00-DC0F	56320-56335	Interface chip1 IRQ (6526 CIA)
	$DD00-DD0F	56576-56591	Interface chip2 NMI (6526 CIA)
	$D000-DFFF	53248-57294	Alternate: character set
	$E000-FFFF	57344-65535	ROM: operating system
	$E000-FFFF	57344-65535	Alternate RAM
	$FF81-FFF5	65409-65525	Kernal JUMP table

C128 OP-SYSTEM AND MEMORY MAP

ADDRESS HEX	DEC	DESCRIPTION
$0000	0	6510 data direction - processor port
$0001	1	6510 data register - processor port
$0002	2	Storage for bank byte
$0003	3	Storage for program counter high
$0004	4	Storage for program counter low
$0005	5	Storage for CPU status register
$0006	6	Storage for accumulator
$0007	7	Storage for X-register
$0008	8	Storage for Y-register
$0009	9	Storage for stack pointer
$000A	10	Look for quotation mark at end of string
$000B	11	Screen column at last TAB
$000C	12	Disk flag:0=LOAD,1=VERIFY
$000D	13	Number of elements, input buffer pointer
$000E	14	Default for array subscripts (DIM)
$000F	15	Data-type flag 1:$00=numeric,$FF=string
$0010	16	Data-type flag 2:$00=float,$80=fixed pnt
$0011	17	Flag:LIST,read from program or coll.
$0012	18	Pntr for FN funct, var type for FOR/NEXT
$0013	19	Input-flag:$00=INPUT,$40=GET,$98=READ
$0014	20	Sign of INT answer flag for comparison
$0015	21	Active I/O device, flag:INPUT comment
$0016-0017	22-23	Line number, integer value Lo/High
$0018	24	Pointer to temporary string stack
$0019-001A	25-26	Last string address
$001B-001D	27-29	3-byte stack for temporary strings
$001E-0020	30-32	3-byte stack for temporary strings
$0021-0023	33-35	3-byte stack for temporary strings
$0024-0025	36-37	2-byte help pointer index I
$0026-0027	38-39	2-byte help pointer index 2
$0028-002C	40-44	Floating-point result of multiplication
$002D-002E	45-46	Pointer:Start of BASIC vars Lo/Hi
$002F-0030	47-48	Pointer:Start of BASIC variables Lo/Hi
$0031-0032	49-50	Pointer:Start of BASIC arrays Lo/Hi
$0033-0034	51-52	Pointer:End of BASIC arrays Lo/Hi
$0035-0036	53-54	Pointer:Start of string memory Lo/Hi
$0037-0038	55-56	Help pointer for string storage Lo/Hi
$0039-003A	57-58	Pntr:End string memory,var.Bank 1 Lo/Hi
$003B-003C	59-60	Current BASIC line number Lo/Hi
$003D-003E	61-62	Pntr BASIC text for CHRGET,CHRGOT Lo/Hi
$003F-0040	63-64	PRINT USING pntr,char search pntr Lo/Hi
$0041-0042	65-66	Current DATA line number Lo/Hi
$0043-0044	67-68	Pointer to current DATA address Lo/Hi
$0045-0046	69-70	Vector pointer for INPUT routine Lo/Hi
$0047-0048	71-72	Current BASIC variable name Lo/Hi
$0049-004A	73-74	Pointer to address of current var.Lo/Hi
$004B-004C	75-76	Mask for AND,LIST pntr, FOR NEXT pntr
$004D-004E	77-78	Temporary storage for program pointer
$004F	79	Mask for compare operation>:2,=:1,<:0

$0050-0051 80-81	Var pntr for FN defin.,+ For garb coll.
$0052-0054 82-84	Pntr:descriptor var list-string compares
$0055 85	Help flag:$xx=HELP,$xx=LIST
$0056-0057 86-87	Jump vector for function evaluations
$0058 88	Oldov
$0059 89	Area for INSTRING oper./temp pointer 1
$005A-005B 90-91	Pointer:block transfer,DIM init
$005C-005D 92-93	Pointer:block transfer
$005E 94	Temp pntr 2, occasionally floating-pt acc
$005F-0060 95-96	# places before/after dec. for conver.
$0061 97	Pntr:Dec. pt when reading digit strings
$0062 98	Exponent sign of the # read (neg.=$80)
$0063 99	Floating-pt. accumulator 1:Exponent
$0064-0067 100-103	Floating-pt. accumulator 1:Mantissa
$0068 104	Floating-pt. accumulator 1:sign
$0069 105	pointer: Polynomal evaluation
$006A 106	Floating-pt. accumulator 2:Exponent
$006B-006E 107-110	Floating-pt. accumulator 2:Mantissa
$006F 111	Floating-pt. acc. 2:sign
$0070 112	Result flag:sign compare Acc 1 to Acc 2
$0071 113	Floating-pt. accumulator 1:Round off
$0072-0073 114-115	Pointer:Cassette buffer
$0074-0075 116-117	Offset value for AUTO command,$00=off
$0076 118	Hires flag:1=BASIC-start set 10k higher
$0077 119	Sprite number-counter for leading zeros
$0078 120	Help counter
$0079 121	Temp storage for indirect loading
$007A-007C 122-124	Description of error-variable D$$
$007D-007E 125-126	End-of-stack during program run
$007F 127	Mode Flag:$xx=RUN mode,$xx=direct mode
$0080 128	USING pntr for dec pnt.,Stat.DOS parser
$0081 129	Peretx
$0082 130	Oldstx
$0083 131	Current colour for graphic mode
$0084 132	Multi-col Mode:colour 1
$0085 133	Multi-colour Mode:colour 2
$0086 134	Foreground colour
$0087-0088 135-136	X-direction scale factor
$0089-008A 137-138	Y-direction scale factor
$008B 139	Flag:=0 if not background colour
$008C-008D 140-141	Address pointer for graphic routines
$008E 142	Temp storage 1 for graphic routines
$008F 143	Temp storage 2 for graphic routines
$0090 144	Status word for kernal input/output
$0091 145	Stop Flag:STOP key,RVS key
$0092 146	Time constants for cassette operations
$0093 147	Load Flag:$00=LOAD,$01=VERIFY
$0094 148	Serial bus flag:character in buffer
$0095 149	Char. in buffer for serial bus
$0096 150	Sync # for cass,EOT received from tape
$0097 151	Temporary data address
$0098 152	Index for file tables, no. of open files
$0099 153	Standard input device (0 for keyboard)
$009A 154	Standard output device (3 for screen)
$009B 155	Parity byte from cassette
$009C 156	Tape flag:byte received
$009D 157	Status flag for kernal
$009E 158	Cassette error pass 1:char error
$009F 159	Cassette error pass 2:corrected
$00A0-00A2 160-162	24-hr real-time clock: 1/60th count
$00A3-00A4 163-164	Temporary storage for serial bus
$00A5 165	Countdown - SAVE on tape,ser.help ptr.
$00A6 166	Pointer for cassette buffer
$00A7 167	Tape short counter,RS-232 input bits
$00A8 168	Tape read err,RS-232 counter input bits
$00A9 169	Tape @ read flag, RS-232 start bit flag
$00AA 170	Tape READ mode, RS-232 buffer input byte
$00AB 171	Tape short counter,RS-232 input parity
$00AC-00AD 172-173	Pointer:screen scroll,cass buffer Lo/Hi
$00AE-00AF 174-175	pointer:program end,cassette end Lo/Hi
$00B0-00B1 176-177	Cassette constant for time
$00B2-00B3 178-179	Pointer:Start of cassette buffer Lo/Hi
$00B4 180	Tape help pntr,RS232 next bit for scroll
$00B5 181	EOT chart,RS-232 next bit for transfer
$00B6 182	Tape help pointer,RS-232 byte buffer
$00B7 183	Length of current filename
$00B8 184	Logical file number(LFN)
$00B9 185	Current secondary address (SA)
$00BA 186	Current device number (GA)
$00BB-00BC 187-188	Pntr:Address of current filename Lo/Hi
$00BD 189	Tape pntr, RS-232 rotate parity buffer
$00BE 190	No. of remaining read/write blocks
$00BF 191	Serial buffer
$00C0 192	Flag:cassette motor
$00C1 193	Start address in/output (Lo),track no.
$00C2 194	Start address in/output (Hi),sector no.
$00C3-00C4 195-196	Tape LOAD temp.pntr kernel vector address
$00C5 197	Tape read/write data range
$00C6 198	Bank no current LOAD,SAVE,VERIFY calls
$00C7 199	Bank no. of current filename $BB,$BC
$00C8-00C9 200-201	Pointer:RS-232 input buffer
$00CA-00CB 202-203	Pointer:RS-232 output buffer
$00CC-00CD 204-205	Pointer:keyboard decoder table
$00CE-00CF 206-207	Pntr to screen line, kernal PRINT routine
$00D0 208	Index to keyboard buffer queue
$00D1 209	Function key call flag
$00D2 210	Function key string call index
$00D3 211	Shift flag:Shift=$01,C=$02,Ctrl=$04,old=$08
$00D4 212	Flag for keypress
$00D5 213	Flag current pressed key (CHR$(0)=none)
$00D6 214	Flag for INPUT or GET -- keyboard input
$00D7 215	Flag for 40/80 column mode
$00D8 216	Flag for text/graphic screen mode
$00D9 217	Pointer for char set,RAM/ROM (only bit 2)
$00DA 218	Pointer for MOVLIN (Lo), <keysiz,bitmask>
$00DB 219	Pointer for MOVLIN (Hi), <keylen,save?>
$00DC 220	Number of the function key
$00DD 221	F-key string length up to current F-key
$00DE 222	Bank for function key call(<edl>)
$00DF 223	F-key string length up to current (F-key-1)
$00E0-00E1 224-225	Pointer to running screen line:text RAM
$00E2-00E3 226-227	pointer running screen line:attribute RAM
$00E4 228	Lower border of window
$00E5 229	Upper border of window
$00E6 230	Left border of window
$00E7 231	Right border of window
$00E8 232	Start of running input column
$00E9 233	Start of running input line
$00EA 234	End of running input line
$00EB 235	Current cursor position:line
$00EC 236	Current cursor position:column
$00ED 237	Maximum number of screen lines
$00EE 238	Maximum number of screen columns
$00EF 239	Temp storage of characters to be put out
$00F0 240	Memory:previous char (for ESC test)
$00F1 241	Colour code under cursor for char output
$00F2 242	Colour code protection for INSERT/DELETE
$00F3 243	Flag:RVS mode active
$00F4 244	Flag:Quote mode active
$00F5 245	Flag:Insert mode active
$00F6 246	Flag:Auto insert active
$00F7 247	Cutoff switching of C-Shift ($80) and Ctrl S ($40)
$00F8 248	Cutoff of screen scrolling
$00F9 249	Cutoff of beep tones made by Ctrl G
$00FA-00FE 250-254	Free area for user applications
$00FF 255	Lofbuf

NOTE:- When using the C128 in C64 mode the Zero page mem map is the same as for the C64

+4 KERNAL JUMP TABLE

LABEL	HEX ADD	DEC ADD	CODE	DESCRIPTION	
	$FF49	65353	JMP $B7C2	Define function key no. after $76, addr. after $22-23, length in acc.	
	$FF4C	65356	JMP $DC49	Print	
	$FF4F	65359	JMP $FBDB	Print message	
	$FF52	65362	JMP $FF45	Call M/C Monitor	
	$FF55	65365	---	Not used	
	$FF7E	65406	---	Not used	
	$FF7F	65407	$0A	Not used	
	$FF80	65408	$04	Not used	
CINT	$FF81	65409	JMP $DB9E	Initialise editor	
IOINIT	$FF84	65412	JMP $F3B8	Initialise I/O	
RAMTAS	$FF87	65415	JMP $F352	Run RAM,open cass buffer,scn to $C000	
RESTOR	$FF8A	65418	JMP $FF3F	Restore vectors	
VECTOR	$FF8D	65421	JMP $FF33	Vector RAM	
SETMSG	$FF90	65424	JMP $F41A	Control KERNAL messages	
SECOND	$FF93	65427	JMP $EE4D	Send sec addr to listen	
TKSA	$FF96	65430	JMP $EE1A	Send sec addr to talk	
MEMTOP	$FF99	65433	JMP $F427	set/read top RAM pointer	
MEMBOT	$FF9C	65436	JMP $F43E	set/read bottom RAM pointer	
SCNKEY	$FF9F	65439	JMP $DB11	Scan keyboard	
SETTMO	$FFA2	65442	JMP $F423	Set timeout for (optional) IEC-Bus	
ACPTR	$FFA5	65445	JMP $EE0B	Input byte from serial port	
CIOUT	$FFA8	65448	JMP $EEDF	Output byte via serial port	
UNTLK	$FFAB	65451	JMP $EF3B	Command serial bus to UNTALK	
UNLSN	$FFAE	65454	JMP $EF2D	Command serial bus to UNLISTED	
LISTEN	$FFB1	65457	JMP $EE2C	Command ALL devices on bus to listen	
TALK	$FFB4	65460	JMP $EDFA	Command device on serial bus to talk	
READST	$FFB7	65463	JMP $F41C	Read I/O status word	
SETLFS	$FFBA	65466	JMP $F413	Set logical primary and secondary addr	
SETNAM	$FFBD	65469	JMP $F40C	Determine file names	
OPEN	$FFC0	65472	JMP (@0310)	Open a logical file	$EF53
CLOSE	$FFC3	65475	JMP (@031A)	Close a logical file	$EE5D
CHKIN	$FFC6	65478	JMP (@031C)	Open channel for input	$ED18
CHKOUT	$FFC9	65481	JMP (@031E)	Open channel for output	$ED60
CLRCHN	$FFCC	65484	JMP (@0320)	Close I/O channels	$EF0C
CHRIN	$FFCF	65487	JMP (@0322)	Input character	$EE0B
CHROUT	$FFD2	65490	JMP (@0324)	Output character	$EC4B
LOAD	$FFD5	65493	JMP $F043	Load from peripheral device	
SAVE	$FFD8	65496	JMP $F139	Store on peripheral device	
SETTIM	$FFDB	65499	JMP $CF2D	Set time	
RDTIM	$FFDE	65502	JMP $CF26	Read time	
STOP	$FFE1	65505	JMP (@0328)	Scan STOP key	$F265
GETIN	$FFE4	65508	JMP (@032B)	Read char from kb buffer	$EBD9
CLALL	$FFE7	65511	JMP (@032A)	Close all channels and logical files	
UDTIM	$FFEA	65514	JMP $CEF0	Increment time	
SCREEN	$FFED	65517	JMP $DB34	Identify X,Y screen set-up	
PLOT	$FFF0	65520	JMP $DB39	Read/set X,Y cursor positioning	
IOBASE	$FFF3	65523	JMP $FC19	Base addr-reports back on I/O devices	
	$FFF6	65526	JMP $FF3E	Switch on ROM	
	$FFF9	65529	JMP $F2A4	Jump to reset routine	
	$FFFC	65532	JMP $FFF6	Processor reset	
	$FFFE	65534	JMP $FCB3	Processor interrupt	

C64 KERNAL ROUTINES

HEX ADDRESS	DESCRIPTION
$E45F	Messages of the operating system
$E4E8	Waits for Commodore key
$E4EC	Constants for RS-232 timing
$E500	Gets BASIC-address of the CIA or the VIA
$E505	Gets screen format line/column
$E50A	Set cursor or get cursor position
$E518	Screen reset
$E544	Clear screen
$E566	Cursor home
$E5A0	Initialize video controller
$E5B4	Get character from keyboard buffer
$E5CA	Waiting loop for keyboard input
$E632	Get a character from the screen
$E684	Checks for quote
$E6B6	Calculate MSB for line starts
$E00A	Table of colour codes
$E8EA	Scroll screen
$E9C8	Shift line up
$E9FF	Clear screen line
$EA1C	Set character and colour on screen
$EA24	Calculate pointer on colour RAM
$EA31	Interrupt routine
$EA87	Keyboard prompt
$EB48	Checks on shift,ctrl and commodore keys
$EB79	Pointer on keyboard decoding tables
$EB81	Decoding tables
$EC44	Checks on control character
$EC78	Decoding tables
$ECB9	Constants for video controller
$ECE7	'Load (cr) Run (cr)'
$ECF0	LSB tables of screen starts
$ED09	Send TALK
$ED0C	Send LISTEN
$ED40	Output of byte on IEC-bus

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$EDB9       Send secondary address for LISTEN
$EDC7       Send secondary address for TALK
$EDEF       Send UNTALK
$EDFE       Send UNLISTEN
$EE13       Get a byte from the IEC-bus
$EE3B       One millisecond delay
$EE8B       Output RS232
$EF4A       Calculate number of RS232 data-bits
$F014       Output in RS232 buffer
$F086       GET of RS232
$F0A4       Set timer for IEC time-out
$F0BD       Error messages of the operating system
$F12B       Put out messages
$F157       BASIN get a character
$F1CA       BSOUT output a character
$F20E       CHKIN fixing of the input-device
$F250       CKOUT fixing of the output-device
$F291       CLOSE
$F30F       Look for logical file number
$F31F       Set file parameter
$F32F       CLALL closes all I/O channels
$F34A       OPEN
$F49E       LOAD
$F5AF       Output 'Searching for file name'
$F5D2       Output 'Loading/verifying'
$F5ED       SAVE
$F68F       Output 'Saveing filename'
$F69B       UDTIM increase running time
$F6DD       Get time
$F6E4       Set time
$F6ED       Ask stop-key
$F6FB       Put out error messages of the operating system
$F72C       Read program header of tape
$F76A       Write header on tape
$F7D0       Get start address of tape buffer
$F7D7       Set start and end address of the tape buffer
$F7EA       Look for name on tape-header
$F80D       Increase tape buffer pointer
$F817       Waits for tape key for reading
$F82E       Asks for tape key
$F838       Waits for tape key for writing
$F841       Read block of tape
$F89A       Load program of tape
$F864       Write tape buffer on tape
$F868       Write block or program on tape
$F8BE       Wait for I/O end
$F8E1       Checks on stop key
$F92C       Read interrupt routine for tape
$F997       Set bit counter for serial output
$F9A6       Write on bit on tape
$F9CD       Write interrupt routine for tape
$FCB8       Set IRQ vector
$FCCA       Switch off tape drive
$FCD1       Checks on reaching of end address
$FCDB       Increase address pointer
$FCE2       RESET
$FD00       Checks on ROm in $8000 or $A000
$FD10       ROM module identification
$FD15       Set or get hardware and I/O vectors
$FD30       Table of hardware and I/O vectors
$FD50       Initialize work memory
$FD9B       Table of IRQ vectors
$FDF9       Set parameter for file names
$FE00       Set parameter for active file
$FE07       Get status
$FE18       Set flag for messages of the operating system
$FE1C       Set status
$FE21       Set timeout flag for IEC-bus
$FE25       Set or get RAM-upper limit
$FE34       Set or get RAM-lower limit
$FE43       NMI routine
$FEC2       Constants for RS232 baud rate
$FF48       Interrupt handler
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JMP TABLE ADDRESSES

Jmp ADDRESS	DESCRIPTION OF ROUTINE
$FF81	JMP $FDA3 Initialize CIA's
$FF87	JMP $FD50 Clear or check RAM
$FF8A	JMP $FD15 Initialize I/O
$FF8D	JMP $FD1A Initialize I/O vectors
$FF90	JMP $FE18 Set status
$FF93	JMP $EDB9 Send LISTEN secondary address
$FF96	JMP $EDC7 Send TALK Secondary address
$FF99	JMP $FE25 Set/get RAM end
$FF9C	JMP $FE34 Set/get RAM start
$FF9F	JMP $E5B7 Scan keyboard
$FFA2	JMP $FE21 Set IEC-bus time out flag
$FFA5	JMP $EE13 Input for IEC-bus
$FFA8	JMP $EDDD Output to IEC-bus
$FFAB	JMP $EDEF Send UNTALK
$FFAE	JMP $EDFE Send UNLISTEN
$FFB1	JMP $EDBC Send LISTEN
$FFB4	JMP $ED09 Send TALK
$FFB7	JMP $FE07 Get status
$FFBA	JMP $FE00 Set file parameter
$FFBD	JMP $FDF9 Set filename parameter
$FFC0	JMP ($031A) $F34A OPEN
$FFC3	JMP ($031C) $F291 CLOSE
$FFC6	JMP ($031E) $F20E CHKIN set input device
$FFC9	JMP ($0320) $F250 CKOUT set output device
$FFCC	JMP ($0322) $F333 CLRCH
$FFCF	JMP ($0324) $F157 BASIN input character
$FFD2	JMP ($0326) $F1CA BSOUT output character
$FFD5	JMP $F49E LOAD
$FFD8	JMP $F5ED SAVE
$FFDB	JMP $F6E4 Set time
$FFDE	JMP $F6DD Get time
$FFE1	JMP ($0328) $F6ED Scan stop-key
$FFE4	JMP ($032A) $F13E GET
$FFE7	JMP ($032C) $F32F CLALL
$FFEA	JMP $F69B Increase time
$FFED	JMP $E505 SCREEN get number lines and coloumns
$FFF0	JMP $E50A Set/get cursor position
$FFF3	JMP $E500 Get start of I/O element
$FFFA	JMP $FE43 NMI vector
$FFFC	JMP $FCE2 RESET vector
$FFFE	JMP $FF48 IRQ vector

128 KERNAL ROUTINES

HEX ADDRESS	DESCRIPTION OF ROUTINE
$C17C	Adapt attribute RAM address
$D8FC	Addresses of the individual monitor cmds (table)
$B8BA	Base table for four number systems
$C3BE	Bell:create tone
$EF84	BSOUT output not to screen
$E224	C128 mode routine
$FB1C	CMPARE routine for FAR operations RAM
$FB1C	CMPARE routine for FAR operations ROM
$FE9B	Change IRQ vector for tape operation
$C3F4	Check Commodore key for time delay
$F3A1	Check filename for burst mode
$CA9F	Clear from cursor position to screen end
$CA76	Clear from cursor position to line end
$CA8B	Clear from line start to line end
$CBB1	Clear line overflow bit
$C6A4	Commodore/Shift character set switch
$CB9B	Commodore/Shift switch to 40-column mode
$CB9F	Commodore/Shift switch to 80-column mode
$E8CD	Copy NMI and IRQ routines to all banks
$E723	CKOUT routine for RS-232 output
$F16C	CKOUT evaluation on serial bus
$F127	CHKIN evaluation on RS-232
$E795	CHKIN routine for RS-232 input
$F1A9	CLOSE routine for tape operation
$EED0	Check cassette recorder-keyboard
$E980	Check tape header address for validity
$E9A2	Check EXROM input form cartridge test
$E618	Check RS-232 send parity
$CAEA	Clear or set auto-insert pointer
$C142	Clear screen window
$CA65	Clear screen line in 40-column mode
$C4C0	Clear screen line in 80-column mode
$B8D2	Convert acc contents into two ASCII characters (X/A)
$B8CE	Convert acc to two ASCII characters and output
$F755	Coordinate system status word
$E2A8	Configure system as Commodore 64
$E4D0	Copy a window line (routine:MOVLIN)
$C430	Copy a window line in 80-Column mode
$FD51	Copy start address for input/output operations
$F533	Control message: output LOADING
$F50F	Control message: output SEARCHING FOR filename
$F533	Control message: output VERIFYING
$CE0C	Copy character set into VDC RAM
$C320	Conversion from ASCII characters to POKE codes
$C93D	Delete character under cursor
$CA52	Delete current input line
$CA24	Define screen as window
$F1E4	Delete file entry from table
$F1C1	Delete a file entry
$C91B	Delete character to the left of the cursor
$C3DC	Delete line on screen (with move)
$B050	Display monitor register contents
$B8C5	Determine address of a monitor command
$B841	Determine address of BRANCH commands
$C36C	Determine tab position
$C0A6	Disable or enable Commodore/Shift
$03F0	DMA call routine of common area in RAM
$CAF2	Enable block cursor
$C19A	Editor IRQ routine
$C62F	Evaluate decoder table according to shift pattern
$C6AD	Evaluate and store keypress
$C7B6	Execute control code
$C9BE	Execute escape sequences
$C0E3	Execute insert
$02A2	Fetch routine for FAR operations RAM
$FB00	Fetch routine for FAR operations ROM
$FFC9	Fetch routine for LSV operations
$F7AE	Fetch routine for character from filename
$C6E7	Flash VIC cursor
$E268	Function ROM test for C-128 mode
$E569	Get bit from serial bus into carry flag
$CC6A	Get cursor position and set
$C2A4	Get character from keyboard queue
$CB50	Get character and colour at cursor position
$C29B	Get character from screen
$EF5C	Get character from serial bus
$EF40	Get character from cassette
$EF67	Get character from RS-232
$E7CE	GET routine for RS-232
$EEF3	GETIN evaluation not over keyboard
$E5D6	Give fast-mode pulse on serial bus
$E9BE	Increment tape buffer pointer
$C07B	Initialize screen and editor
$C079	Initialize editor and screen
$B046	Initialization of monitor commands
$B021	Initialize monitor for regular entry
$B014	Initialize monitor after BREAK
$E1DC	Initialize VDC registers
$C37C	Insert line on screen
$EAE8	Interrupt routine for tape read
$ED30	Interrupt routine for tape write
$CCF6	Insert function key string
$02E3	JMPFAR routine RAM
$FB41	JMPFAR routine ROM
$02CD	JSRFAR routine RAM
$FB2B	JSRFAR routine ROM
$C94F	Jump to tab stop
$E43E	Kernel Acptr routine
$EF06	Kernel BASIN routine
$F934	Kernel boot routine
$EF79	Kernel BSOUT routine
$F106	Kernel CHKIN routine
$EF06	Kernel CHRIN routine
$EF79	Kernel CHROUT routine
$E503	Kernel CIOUT routine
$F14C	Kernel CKOUT routine
$F222	Kernel CLALL routine
$F188	Kernel CLOSE routine
$F226	Kernel CLRCH routine
$F7A5	Kernel DMA call routine
$E5FB	Kernel FSTMODE routine
$F7EC	Kernel GETCFG routine
$EEEB	Kernel GETIN routine
$E24B	Kernel GO64 routine
$F781	Kernel IOBASE routine
$E109	Kernel IOINIT routine

$FF17	Kernel IRQ routine
$C550	Kernel KEY routine ($FCB7 in International versions)
$E3A3	Kernel LISTN routine
$F79D	Kernel LKUPLA routine
$F786	Kernel LKUPSA routine
$F265	Kernel LOAD routine
$F772	Kernel MEMBOT routine
$F763	Kernel MEMTOP routine
$FF05	Kernel NMI routine
$EFBD	Kernel OPEN routine
$FB67	Kernel PHOENIX routine
$FA17	Kernel PRTMN routine
$E093	Kernel RAMTAS routine
$F65E	Kernel RDTIM routine
$F744	Kernel READST routine
$FF3D	Kernel RESET routine
$E4D2	Kernel SECND routine
$F73F	Kernel SETBNK routine
$F738	Kernel SETFLS routine
$F75C	Kernel SETMSG routine
$F731	Kernel SETNAM routine
$F665	Kernel SETTIM routine
$F75F	Kernel SETTMO routine
$E3B8	Kernel TALK routine
$E4E0	Kernel TKDA routine
$F5FB	Kernel UDTIM routine
$E526	Kernel UNLSN routine
$E515	Kernel UNTLK routine
$E056	Kernel VECTOR routine
$F53E	Kernel SAVE routine
$F66E	Kernel STOP routine
$E05B	Kernel VECTOR routine
$C67E	Key repeat evaluation
$C55D	Keyboard matrix read
$F63D	Keyboard row selection: RUN/STOP-SHIFT
$C5E1	Keyboard read evaluate
$C6CA	Keyboard buffer prepare for function key
$B976	Load bank pointer and program counter from zero page
$E9FB	Load program from cassette
$F3EA	LOAD routine in burst mode
$F87B	LOAD routine from serial bus
$B486	Monitor command:, (assemble a line)
$B1B4	Monitor command:> (change register)
$B1A8	Monitor command:> (change memory contents)
$BA90	Monitor command:@ (disk command)
$B486	Monitor command:A (assemble a line)
$B831	Monitor command:C (compare memory areas)
$B599	Monitor command:D (disassemble memory)
$B3DB	Monitor command:F (fill memory area)
$B1D6	Monitor command:G (Jump to XXXX without return)
$B2CE	Monitor command:H (Search for memory contents)
$B1DF	Monitor command:J (Jump to XXXX with RTS)
$B337	Monitor command:L (Load a program)
$B152	Monitor command:M (display memory contents)
$B050	Monitor command:R (display register contents)
$B337	Monitor command:S (store a program)
$B2B4	Monitor command:T (move memory areas)
$B337	Monitor command:V (compare program with memory)
$B0E3	monitor command:X (exit)
$B981	Monitor command:Convert number to different system
$E005	NMI routine for RS-232
$E0A9	NMI routine for RS-232 output
$E0B7A	NMI routine for RS-232 input
$F915	Output boot sector message
$F0CB	Open file on serial bus
$EFF0	OPEN routine for tape operation
$F0A0	OPEN routine for RS-232
$E75C	Output in RS-232 buffer
$CC2F	Output acc at cursor position
$FD15	Output combined accent
$CC27	Output space at cursor position
$E3E2	Output byte on serial bus
$C76F	Output carriage return to screen
$C88C	Output character at cursor position
$C72D	Output character on screen
$F521	Output found filename on screen
$F71E	Output system and control messages
$CE8C	Prepare byte output on serial bus
$F9F8	Prepare acc contents in two ASCII characters (-99)
$EA41	Prepare cassette synchronization
$C363	Preform linefeed
$E69D	Process received bit from RS-232
$CCA2	Program function key
$F4C5	Read data block in burst mode
$E9F2	Read data block from tape
$F4BA	Read data byte in burst mode
$C250	Read an input line terminated by RETURN
$E0D0	Read program header from cassette
$E987	Recalculate tape-end address
$EE57	Recorder operation end
$EE38	Recorder motor off
$E000	Reset routine
$C651	Repeat keyboard logic
$C77D	Reset quote mode
$F080	Reset CIAs to RS-232
$FCAA	Reset decoder table set vectors
$F9B3	Recreate DOS output buffer
$C980	Reset tab stops
$E5FF	RS-232 output
$E6BE	RS-232 data-bit number calculate
$E672	RS-232 NMI status set
$E6D4	RS-232 start bittest
$EFB7	RS-232 character output
$C3A6	Scroll screen up
$F5C8	SAVE routine for tape operation
$E99A	Search tape header for name
$CBC3	Search for end of input line
$F202	Search in logical file number table
$CACA	Scroll down
$CABC	Scroll up
$CAE2	Scrolling permit or prohibit
$F23D	Set standard I/O devices
$CA14	Set window borders
$ED5A	Set bit counter for serial output
$C837	Set or clear bell pointer
$CDF9	Set attribute address for attribute RAM
$C7E5	Set character colour in 40-column mode
$C7EC	Set character colour in 80-column mode
$C893	Set line overflow bit
$CB05	Set cursor flash mode
$CD57	Set cursor at current column
$C33E	Set cursor to end of line
$C150	Set cursor in screen window at HOME position
$CB75	Set cursor to left in window to left
$CB67	Set cursor up in window
$CB54	Set cursor right in window
$CB5A	Set cursor down in window
$CC00	Set cursor one position left in window
$CBED	Set cursor one position right in window
$C932	Set cursor address again
$CD6F	Set cursor colour at cursor position
$F0D5	Set filename to serial bus
$CB61	Set or clear tab stop
$E573	Set clock frequency to 1MHz
$CB8F	Set or clear reverse mode
$C207	Set IRQ register
$F39B	Set program end address after LOAD
$B2AF	Stash routine for FAR operations RAM
$F80D	Stash routine for FAR operations ROM
$F7BC	Stash routine for LSV operations
$C02C	Switch 40/80 column modes
$FA65	System IRQ routine
$FA40	System NMI routine
$F7F8	Table of configuration values
$CEB2	Table of function key assignments
$C6DD	Table of function key codes
$E4A8	Table of IRQ vectors for tape operations
$CE74	Table of initialization values for 40-column
$CE8E	Table of initialization values for 80-column
$C78C	Table of control codes
$E04B	Table of MMU initialization values
$B0E6	Table of monitor keywords
$E050	Table of timer constants for RS-232 baud rate
$E2F8	Table for VDC initialization
$E2C7	Table for VIC initialization
$FCE3	Test accent keys and combine accents
$CB74	Test line overflow bit
$C2FF	Test quote character and set pointer
$B7A5	Test separator between command operands
$EA8F	Test for STOP key
$E9DF	Test for tape button
$C8DC	Turn off cursor flash mode
$CB1A	Turn cursor flash off for 40 column mode
$CBEE	Turn cursor flash on for 40 column mode
$C80B	Turn cursor flash off for 80 column mode
$C821	Turn cursor flash on for 80 column mode
$CB48	Turn off 80 column reverse
$CB3F	Turn on 80 column reverse
$C8CE	Turn underline mode off
$C8C7	Turn underline mode on
$CAFE	Turn underline cursor on
$C06F	Vector table to ASCII decoder tables
$FE34	Vector table to DIN decoder tables(International versions only)
$C000	Vector table for editor routines
$C9DE	Vector table for escape routines
$C7B6	Vector table for control code routines
$F3EA	Verify routine in burst mode
$EA7D	Wait for tape I/O termination
$E7EC	Wait for end of RS-232 transfer
$E9BC	Wait for fast mode response from bus
$E9E9	Wait for RECORD & PLAY on datasette
$E9CA	Wait for button on datasette
$EA15	Write tape buffer to tape
$ED69	Write bit to tape
$E919	Write data block to tape
$E919	Write header to tape
$EA1C	Write data block to tape
$EE2E	Write the header

USEFUL BASIC INTERPRETER ADDRESSES

HEX ADDRESS	DESCRIPTION OF ROUTINE
$A000	Start vector
$A002	NMI vector
$A004	'CBMBASIC'
$A00C	Addresses of the BASIC commands minus 1
$A052	Addresses of the BASIC functions
$A08B	Hierarchy-codes and addresses of the BASIC operators
$A09E	List of BASIC command words
$A19E	BASIC error messages
$A36A	Messages of the BASIC interpreter
$A3BA	Stack-search-routine for FOR-NEXT and GOSUB
$A3BB	Block-shifting routine
$A3FB	Checks on space in stack
$A408	Makes space in memory
$A435	Output of 'Out of memory'
$A437	Output of error messages
$A469	Break vector
$A474	Ready vector
$A480	Input waiting-loop
$A49C	Clear and inserting program lines
$A533	Tie BASIC program lines anew
$A560	Gets a line into input buffer
$A571	Output of 'String too long'
$A579	Change of a line into interpreter-code
$A613	Look for start address of a BASIC line
$A642	BASIC-command NEW
$A65E	BASIC-command CLR
$A68E	Set program pointer to BASIC start
$A68C	BASIC-command LIST
$A717	Change interpreter code to command word
$A742	BASIC-command FOR
$A7AE	Interpreter loop, carries out BASIC commands
$A7ED	Carries out BASIC command
$A81D	BASIC-command RESTORE
$A82C	Interrupts program at pressed stop-key
$A82F	BASIC-command STOP
$A831	BAISC-command END
$A857	BASIC-command CONT
$A871	BASIC-command RUN
$A883	BASIC-command GOSUB
$A8A0	BASIC-command GOTO
$A8F8	BASIC-command RETURN
$A8D2	BASIC-command DATA
$A906	Looks for next statement
$A909	Looks for next line

```
$A928   BASIC-command IF
$A93B   BASIC-command REM
$A94B   BASIC-command ON
$A96B   Looks for address of a BASIC line
$A9A5   BASIC-command LET
$A9B0   BASIC-command PRINT#
$A9B6   BASIC-command CMD
$A9C0   BASIC-command PRINT
$ABIE   Output string
$AB3E   Output empty character (Or cursor right)
$AB4D   Error handling for INPUT
$AB7B   BASIC-command GET
$AB85   BASIC-command INPUT#
$AB8F   BASIC-command INPUT
$AC06   BASIC-command READ
$ACFC   Output '?extra ignored' and '?redo from start'
$AD1D   BASIC-command NEXT
$AD8A   FRMNUM gets term and checks on numeric
$AD8D   Checks on numeric
$AD8F   Checks on string
$AD99   Output of 'Type mismatch'
$AD9E   FRMEVL gets and evaluates term
$AE83   Get arithmetic term
$AEA8   Floating point constant for PI
$AED4   BASIC-command NOT
$AEF1   Gets term in parenthesis
$AEF7   Checks on Parenthesis closed
$AEFA   Checks on Parenthesis open
$AEFD   Checks on Comma
$AEFF   Checks on characters in accumulator
$AF00   Output of 'Syntax error'
$AF28   Gets variable
$AFE6   BASIC-command OR
$AFE9   BASIC-command AND
$B016   Comparison operations
$B081   BASIC-command DIM
$B113   Checks for letter
$B19A   Calculates pointer to first array-element
$B1A5   Floating point constant -32768
$B1AA   Change FAC to INTEGER
$B245   Output of 'Bad subscript'
$B248   Output of 'Illegal-quantity'
$B34C   Calculates array size
$B37D   BASIC-function FRE
$B39E   BASIC-function POS
$B3A6   Checks on direct-mode
$B3A8   Output of 'Illegal direct'
$B3AE   Output of 'Undefi'd function'
$B3B3   BASIC-command DEF
$B3E1   Checks on FN syntax
$B3F4   BASIC-function FN
$B465   BASIC-function STR$
$B475   String administration, calculate pointer on string
$B487   Establish string
$B526   Garbage collection, remove unwanted strings
$B63D   String connection '+'
$B6A3   String administration FRESTR
$B6EC   BASIC-function CHR$
$B700   BASIC-function LEFT$
$B72C   BASIC-function RIGHT$
$B737   BASIC-function MID$
$B77C   BASIC-function LEN
$B78E   Get string parameter
$B78B   BASIC-function ASC
$B79B   Gets byte term (0-255)
$B7A0   BASIC-function VAL
$B7E8   Gets address (0-65535) and byte value (0-255)
$B7F7   Change FAC to address-format (Range 0-65535)
$B800   BASIC-function PEEK
$B824   BASIC-command POKE
$B82D   BASIC-command WAIT
$B849   FAC = FAC + 0.5
$B850   Minus FAC = constant (A/Y) - FAC
$B853   Minus FAC = ARG - FAC
$B867   Plus FAC = constant (A/Y) - FAC
$B86A   Plus FAC = ARG + FAC
$B97E   Output of 'Overflow'
$B98C   Floating point constant for LOG
$B9EA   BASIC-function LOG
$BA28   Multiplication FAC = constant (A/Y) * FAC
$BA2B   Multiplication FAC = ARG * FAC
$BA8C   ARG = constant (A/Y)
$BAE2   FAC = FAC * 10
$BAF9   Floating point constant 10
$BAFE   FAC = FAC/10
$BB0F   FAC = constant (A/Y) / FAC
$BB12   FAC = ARG/FAC
$BB0A   Output of 'Division by zero'
$BBA2   FAC = constant (A/Y)
$BBC4   Accu#4 = FAC
$BBC8   Accu#3 = FAC
$BBD0   Variable = FAC
$BBFC   FAC = ARG
$BC0C   ARG = FAC
$BC1B   Round FAC
$BC2B   Get signs of FAC
$BC39   BASIC-function SGN
$BC58   BASIC-function ABS
$BC5B   Compare constant (A/Y) with FAC
$BC9B   Change from FAC to integer
$BCCC   BASIC-function INT
$BCF3   Change ASCII to floating point
$BDB3   Floating point constants for floating point to ASCII
$BDC2   Output of line number at error message
$BDCD   Output of positive integer number (0-65535)
$BDDD   Change FAC to ASCII format
$BF11   Floating point constant 0.5
$BF16   Binary numbers for change of FAC to ASCII
$BF71   BASIC-function SQR
$BF78   FAC = constant (A/Y) to the power of FAC
$BF7B   FAC = ARG to the power of FAC
$BFBF   Floating point constant for EXP
$BFED   BASIC-function EXP
$E043   Series 1 polynomial calculation
$E059   Series 2 polynomial calculation
$E080   Floating point constant for RND
$E097   BASIC-function RND
$E107   Output of 'Break'
$E10C   BSOUT output of character
$E112   BASIN receive a character
$E118   CKOUT establish output-device
$E11E   CKKIN establish input-device
$E124   GETIN get a character
$E12A   BASIC-command SYS
$E156   BASIC-command SAVE
$E165   BASIC-command VERIFY
$E168   BASIC-command LOAD
$E18E   BASIC-command OPEN
$E1C7   BASIC-command CLOSE
$E1D4   Get parameters for LOAD and SAVE
$E219   Get parameter for OPEN
$E264   BASIC-function COS
$E268   BASIC-function SIN
$E2B4   BASIC-function TAN
$E2E0   Floating point constants for SIN and COS
$E30E   BASIC-function ATN
$E33E   Floating point constants for ATN
$E378   BASIC NMI jump-in
$E394   BASIC cold start
$E3A2   Copy of the CHRGET routine
$E3BA   Start value for the RND function
$E3BF   Initialize RAM for BASIC
$E447   Table of BASIC vectors
$E453   Load BASIC vectors
```

DISKETTE FORMATS & LAYOUTS

BLOCK DISTRIBUTION BY TRACK

Track Numbers		Range of Sectors		Total sectors		S.Sided	D.Sided
HEX	DEC	HEX	DEC	HEX	DEC		
$01-$11	01-17	$00-$14	00-20	$15	21	YES	YES
$12-$18	18-24	$00-$12	00-18	$13	19	YES	YES
$19-$1E	25-30	$00-$11	00-17	$12	18	YES	YES
$1F-$23	31-35	$00-$10	00-16	$11	17	YES	YES
$24-$34	36-52	$00-$14	00-20	$15	21	NO	YES
$35-$3B	53-59	$00-$12	00-18	$13	19	NO	YES
$3C-$41	60-65	$00-$11	00-17	$12	18	NO	YES
$42-$46	66-70	$00-$10	00-16	$11	17	NO	YES

BAM FORMAT 1541 - TRACK 18 SECTOR 0

BYTE NUMBER	CONTENTS	DEFINITION
0	18	Track of next directory block. Always 18
1	1	Sector of next directory block. Always 1
2	65	ASCII characacter A indicating 1541/51/71/4040 format
3		Double sided flag. Ignored on 1541
4		Number of sector available on track 1
5		Track 1, sector 0-7 availability map
6		Track 1, sector 8-16 availability map
7		Track 1, sector 17-23 availability map
8		Number of sector available on track 2
9		Track 2, sector 0-7 availability map
10		Track 2, sector 8-16 availability map
11		Track 2, sector 17-23 availability map
....ETC DOWN TO...		
140		Number of sector available on track 35
141		Track 35, sector 0-7 availability map
142		Track 35, sector 8-16 availability map
143		Track 35, sector 17-23 availability map
144-159		Disk name padded with shifted spaces (CHR$(160))
160-161	160	Shifted space (CHR$(160))
162-163		Disk ID
164	160	Shifted space (CHR$(160))
165-166		ASCII representation of 2A which are respectively the DOS version (2) format type 1540/41/51/71/4040/2040
167-170		Shifted spaces (CHR$(160))
171-255		Nulls (CHR$(0)), not used

1571 Drive as above except:-

3		Double sided flag:$80=Double Sided, $00=Single Sided
171-220		Nulls (CHR$(0)), not used
221-237		Number of sector available track 36-52 (each sector by each byte)
238	0	Number of sector available track 53 (always 0, all sectors allocated
239-244		Number sector available tk 54-59(each tk by each byte)
245-250		Number sector available tk 60-65(each tk by each byte)
251-255		Number sector available tk 66-70(each tk by each byte)

PROGRAM FILE FORMAT

BYTE	DEFINITION
FIRST SECTOR	
0,1	Track and sector of next block in program file 1
2,3	Load address of program
4-255	Next 252 bytes of prg info stored as in comp mem.(keywords tokenized)
REMAINING FULL SECTORS	
0,1	Track and sector of next block in program file1
2-255	Next 254 bytes of prg info stored as in comp mem.(keywords tokenized)
FINAL SECTOR	
0,1	Null ($00), followed by number of valid data bytes in sector
2-???	Last bytes of prg info stored as in comp mem.(keywords tokenized).The end of a BASIC file is marked by three zero bytes in a row. Any remaining bytes in the sector are garbage and may be ignored.

SEQUENTIAL FILE FORMAT

BYTE	DEFINITION
ALL BUT FINAL SECTOR	
0,1	Track and sector of next sequential data block
2-255	254 bytes of data

FINAL SECTOR	
0,1	Null ($00), followed by number of valid data bytes in sector
2-???	Last bytes of data. Any remaining bytes are garbage & can be ignored

RELATIVE FILE FORMAT

BYTE	DEFINITION
DATA BLOCK	
0,1	Track and sector of next data block
2-255	254 bytes of data. Empty records contain $FF (all binary ones) in the first byte followed by $00 (all binary zeroes) to the end of the record. Partially filled records are padded with nulls ($00)
SIDE SECTOR BLOCK	
0-1	Track and sector of next side sector block
2	Side sector number (0-5)
3	Record length
4-5	Track and sector of first side sector (number 0)
6-7	Track and sector of second side sector (number 1)
8-9	Track and sector of third side sector (number 2)
10-11	Track and sector of fourth side sector (number 3)
12-13	Track and sector of fifth side sector (number 4)
14-15	Track and sector of sixth side sector (number 5)
16-255	Track and sector pointers to 120 data blocks

DIR FILE FORMAT,TRACK 18 SECTORS 1-19

BYTE	DEFINITION
0,1	Track and sector of next directory block
2-31	File entry 1
34-63	File entry 2
66-95	File entry 3
98-127	File entry 4
130-159	File entry 5
162-191	File entry 6
194-223	File entry 7
226-255	File entry 8

STRUCTURE OF EACH INDIVIDUAL DIRECTORY ENTRY

BYTE	CONTENTS	DEFINITION
0	128+type	File type OR'ed with $80 to indicate properly closed file. (if OR'ed with $C0 instead, file is locked) TYPES: 0 = DELeted 1 = SEQuential 2 = PRODrar 3 = USER 4 = RELative
1-2		Track and sector of first data block
3-18		File name padded with shifted spaces
19-20		Rel file only. Track and sector of first side sector
21		Rel file only. Record length
22-25		UNUSED
26-27		Track and sector of replacement file during an @SAVE or @OPEN
28-29		Number of blocks in file, stored as a two-byte integer in normal lo-byte hi-byte format

1541 MEMORY MAP

DRIVE ADDRESS

HEX	DECIMAL	DESCRIPTION
$0000	0	Command code for buffer 0
$0001	1	Command code for buffer 1
$0002	2	Command code for buffer 2
$0003	3	Command code for buffer 3
$0004	4	Command code for buffer 4
$0005-0007	5-7	Track and sector for buffer 0
$0008-0009	8-9	Track and sector for buffer 1
$000A-000B	10-11	Track and sector for buffer 2
$000C-000D	12-13	Track and sector for buffer 3
$000E-000F	14-15	Track and sector for buffer 4
$0012-0013	18-19	ID for drive 0
$0014-0015	20-21	ID for drive 1
$0016-0017	22-23	ID
$0020-0021	32-33	Flag for head transport
$0030-0031	48-49	Buffer pointer for disk controller
$0039	57	Constant 8, mark for begining of data block header
$003A	58	Parity for data buffer
$003D	61	Drive number for disk controller
$003F	63	Buffer number for disk controller
$0043	67	Number of sectors per track for formating
$0047	71	Constant 7, mark for begining of data block header
$0049	73	Stack pointer
$004A	74	Step counter for head transport
$0051	81	Actual track number for formatting
$0069	105	Step size for sector division (10)
$006A	106	Number of read attempts (5)
$006F-0070	111-112	Pointer to address for M and B commands
$0077	119	Device number + $20 (32 dec) for Listen
$0078	120	Device number + $40 (64 dec) for Talk
$0079	121	Flag for listen (I/O)
$007A	122	Flag for talk (I/O)
$007C	124	Flag for ATN from serial bus receiving
$007D	125	Flag for EOI from serial bus
$0077	127	Drive number
$0080	128	Track number
$0081	129	Sector number
$0082	130	Channel number
$0083	131	Secondary address
$0084	132	Secondary address
$0085	133	Data byte
$0088-008D	139-141	Work storage for division
$0094-0095	148-149	Actual buffer pointer
$0093-0094	153-154	Address of buffer 0 $0300
$0098-009C	155-156	Address of buffer 1 $0400
$009D-009E	157-158	Address of buffer 2 $0500
$009F-00A0	159-160	Address of buffer 3 $0600
$00A1-00A2	161-162	Address of buffer 4 $0700
$00A3-00A4	163-164	Pointer to input buffer $0200
$00A5-00A6	165-166	Pointer to buffer error message $0205
$00B5-00BA	181-186	Record number LO, block number LO
$00BB-00C0	187-192	Record number HI, block number HI
$00C1-00C6	193-198	Write pointer for REL file
$00C7-00CC	199-204	Record length for REL file
$00D4	212	Pointer in record for REL file
$00D5	213	Side sector number
$00D6	214	Pointer to data block in side sector
$00D7	215	Pointer to record in REL file
$00E7	231	File type
$00F8	248	Buffer number
$0100-0145	256-325	Stack
$0200-0228	512-552	Buffer for command string
$024A	586	File type
$0258	600	Record length
$0259	601	Track side-sector
$025A	602	Sector side-sector
$0274	628	Length of input line
$0278	632	Number of file names
$0297	663	File control method
$0280-028A	640-644	Track of a file
$0285-028B	645-649	Sector of a file
$0205-02F9	725-761	Buffer for error messages
$02FA-02FC	762-764	Number of free blocks
$0300-03FF	768-1023	Buffer 0
$0400-04FF	1024-1279	Buffer 1
$0500-05FF	1280-1535	Buffer 2
$0600-06FF	1536-1791	Buffer 3
$0700-07FF	1792-2047	Buffer 4

1541 DISK ERROR MESSAGES AND THEIR CAUSES

The following list are the error messages that the DOS can recognise. Note that TT and SS denote Track and Sector respectively.

ERROR NUMBER	DESCRIPTION
00,OK,00,00	This message occurs when the last disk operation was error free or if no command or data was sent after the last error message.
20,READ ERROR,TT,SS	This error means that the 'header' of a block was not found. It is usually the result of a defective disk. TT and SS designate the track and sector in which the error occured. Remedy: change the disk.
21,READ ERROR,TT,SS	The SYNC marker of a block was not found. The cause may be an unformatted disk, or no disk in the drive. This error can also be caused by misaligned read/write head. Remedy: Either insert a diskette and format the disk, or have the heads aligned.
22,READ ERROR,TT,SS	This error means that a checksum error has occured in the header of a data block, which can be caused by the incorrect writing of a block.
23,READ ERROR,TT,SS	This error implies that a data block was read into the DOS buffer, but a checksum error occured. One or more data bytes are incorrect. Remedy: Save as many files as possible onto another diskette.
24,READ ERROR,TT,SS	This error also results from a checksum error in the data block or in the preceding data header. Incorrect bytes have been read. Remedy: Same as 23
25,WRITE ERROR,TT,SS	This is actually a VERIFY error. After writing every block the data is read again, checked against the data in the buffer. This error is produced if the data are not identical. Remedy: Repeat the command that caused the error. If this does not work, the corresponding block must be locked out from further use by the Block-allocate command.
26,WRITE PROTECT ON,TT,SS	An attempt was made to write to a disk with the write protect tab on. Remedy: Remove the tab.
27,READ ERROR,TT,SS	A checksum error occurred in the header of a data block. Remedy: Repeat command or rescue block.
28,WRITE ERROR,TT,SS	After writing a data block, the SYNC characters of the next data block were not found. Remedy: Format the disk again, or exchange it.
29,DISK ID MISMATCH,TT,SS	The ID in the DOS memory does not agree with the ID on the diskette. The diskette was either not initialized or there is an error in the header of a data block. Remedy: Initialize diskette.
30,SYNTAX ERROR,00,00	A command was sent over the command channel that the DOS could not understand. Remedy: Correct cmd.
31,SYNTAX ERROR,00,00	A command was not recognized by the DOS. Remedy: Do not use the command.
32,SYNTAX ERROR,00,00	The command sent over the command channel was over 40 characters. Remedy: Shorten the command.
33,SYNTAX ERROR,00,00	A wildcard, ("*" or "?") was used in an OPEN or SAVE command. Remedy: Remove wildcard.
34,SYNTAX ERROR,00,00	The DOS cannot find the filename in a command. The cause maybe a colon was forgotten after the cmd. word. Remedy: Check command.
39,FILE NOT FOUND,00,00	User program of type 'USR' was not found for automatic execution. Remedy: Check filename.
50,RECORD NOT PRESENT,00,00	A record was addressed in a relative data file that has not yet been written. When writing a record this is not really an error. You can avoid this error message if you write the highest record number of the file with CHR$(255) when initializing it. This error will no longer occur upon later access.
51,OVERFLOW IN RECORD,00,00	The number of characters sent when writing a record in a relative file was greater than the record length. The excess characters are ignored.
52,FILE TOO LARGE,00,00	The record number of a relative file is too big; the diskette does not have enough capacity. Remedy: Use another diskette or reduce the record number.

60,WRITE FILE OPEN,00,00 — An attempt was made to OPEN a file that had not been previously been CLOSEd after writing. Remedy: Use mode 'M' in the OPEN command to read file.

61,FILE NOT OPEN,00,00 — A file was accessed that had not been OPENed. Remedy: OPEN the file or check the filename.

62,FILE NOT FOUND,00,00 — An attempt was made to load a program or open a file that does not exist on the disk. Remedy: Check the filename.

63,FILE EXISTS,00,00 — An attempt was made to establish a new file with the name of an existing file on the disk. Remedy: Use different name or use @0:

64,FILE TYPE MISMATCH,00,00 — The file type used in the OPEN command does not agree with the file type in the directory. Remedy: Correct filetype.

65,NO BLOCK,TT,SS — This message is given in association with the Block-allocate command when the specified block is no longer free. In this case,the DOS automatically searches for a free block with a higher sector and /or track number and gives these values as the track and sector number in the error message. If no block with a greater number is free, two zeroes will be given.

66,ILLEGAL TT or SS,TT,SS — If you attempt to use a block with the block commands that does not exist, this error is then returned.

67,ILLEGAL TT or SS,TT,SS — The track-sector combination of a file produces a non-existent track or sector.

70,NO CHANNEL,00,00 — An attempt was made to open more files than channels available or a direct access channel is already reserved.

71,DIR ERROR,TT,SS — The number of free blocks in the DOS storage does not agree with the BAM. Usually this means the disk has not been initialized.

72,DISK FULL,00,00 — Fewer than three blocks are free on the disk or the maximum number of directory entries have been used. (144 on the 1541).

73,CBM DOS v.26 1541,00,00 — The message is the power-up message of the 1541. As an error message, it appears when an attempt is made to write to a disk that was not formatted with the same DOS version.

74,DRIVE NOT READY,00,00 — The drive does not have a diskette inserted.

75,FORMAT SPEED ERROR,00,00 — This error only occurs on the CBM 8050. It indicates a deviation from the normal revolution speed whilst formatting.

STANDARD CBM KEYWORD TOKENS

HEX	DEC		HEX	DEC		HEX	DEC		HEX	DEC	
$20	32	SPACE	$43	67	C	$86	134	DIM	$A9	169	STEP
$21	33	!	$44	68	D	$87	135	READ	$AA	170	+ ADD
$22	34	"	$45	69	E	$88	136	LET	$AB	171	- MINUS
$23	35	#	$46	70	F	$89	137	GOTO	$AC	172	* MULTIPLY
$24	36	$	$47	71	G	$8A	138	RUN	$AD	173	/ DIV
$25	37	%	$48	72	H	$8B	139	IF	$AE	174	^ POWER
$26	38	&	$49	73	I	$8C	140	RESTORE	$AF	175	AND
$27	39	'	$4A	74	J	$8D	141	GOSUB	$B0	176	OR
$28	40	(	$4B	75	K	$8E	142	RETURN	$B1	177	> GTR THAN
$29	41	)	$4C	76	L	$8F	143	REM	$B2	178	= EQUAL
$2A	42	*	$4D	77	M	$90	144	STOP	$B3	179	< LESS THAN
$2B	43	+	$4E	78	N	$91	145	ON	$B4	180	SGN
$2C	44	,	$4F	79	O	$92	146	WAIT	$B5	181	INT
$2D	45	-	$50	80	P	$93	147	LOAD	$B6	182	ABS
$2E	46	.	$51	81	Q	$94	148	SAVE	$B7	183	USR
$2F	47	/	$52	82	R	$95	149	VERIFY	$B8	184	FRE
$30	48	0	$53	83	S	$96	150	DEF	$B9	185	POS
$31	49	1	$54	84	T	$97	151	POKE	$BA	186	SGR
$32	50	2	$55	85	U	$98	152	PRINT#	$BB	187	RND
$33	51	3	$56	86	V	$99	153	PRINT	$BC	188	LOG
$34	52	4	$57	87	W	$9A	154	CONT	$BD	189	EXP
$35	53	5	$58	88	X	$9B	155	LIST	$BE	190	COS
$36	54	6	$59	89	Y	$9C	156	CLR	$BF	191	SIN
$37	55	7	$5A	90	Z	$9D	157	CMD	$C0	192	TAN
$38	56	8	$5B	91	[	$9E	158	SYS	$C1	193	ATN
$39	57	9	$5C	92	£	$9F	159	OPEN	$C2	194	PEEK
$3A	58	:	$5D	93	]	$A0	160	CLOSE	$C3	195	LEN
$3B	59	;	$5E	94	↑	$A1	161	GET	$C4	196	STR$
$3C	60	<	$5F	95	L.ARROW	$A2	162	NEW	$C5	197	VAL
$3D	61	=	$00	128	END	$A3	163	TAB(	$C6	198	ASC
$3E	62	>	$01	129	FOR	$A4	164	TO	$C7	199	CHR$
$3F	63	?	$02	130	NEXT	$A5	165	FN	$C8	200	LEFT$
$40	64	@	$03	131	DATA	$A6	166	SPC(	$C9	201	RIGHT$
$41	65	A	$04	132	INPUT#	$A7	167	THEN	$CA	202	MID$
$42	66	B	$05	133	INPUT	$A8	168	NOT	$CB	203	GO

STANDARD CBM128 TOKENS

HEX	DEC	HEX	DEC	HEX	DEC
$80	128 END	$AA 170 +		$D5 213 ELSE	
$81	129 FOR	$AB 171 -		$D6 214 RESUME	
$82	130 NEXT	$AC 172 *		$D7 215 TRAP	
$83	131 DATA	$AD 173 /		$D8 216 TRON	
$84	132 INPUT#	$AE 174 (POWER)		$D9 217 TROFF	
$85	133 INPUT	$AF 175 AND		$DA 218 SOUND	
$86	134 DIM	$B0 176 OR		$DB 219 VOL	
$87	135 READ	$B1 177 >		$DC 220 AUTO	
$88	136 LET	$B2 178 =		$DD 221 PUDEF	
$89	137 GOTO	$B3 179 <		$DE 222 GRAPHIC	
$8A	138 RUN	$B4 180 SGN		$DF 223 PAINT	
$8B	139 IF	$B5 181 INT		$E0 224 CHAR	
$8C	140 RESTORE	$B6 182 ABS		$E1 225 BOX	
$8D	141 GOSUB	$B7 183 USR		$E2 226 CIRCLE	
$8E	142 RETURN	$B8 184 FRE		$E3 227 GSHAPE	
$8F	143 REM	$B9 185 POS		$E4 228 SSHAPE	
$90	144 STOP	$BA 186 SGR		$E5 229 DRAW	
$91	145 ON	$BB 187 RND		$E6 230 LOCATE	
$92	146 WAIT	$BC 188 LOG		$E7 231 COLOR	
$93	147 LOAD	$BD 189 EXP		$E8 232 SCNCLR	
$94	148 SAVE	$BE 190 COS		$E9 233 SCALE	
$95	149 VERIFY	$BF 191 SIN		$EA 234 HELP	
$96	150 DEF	$C0 192 TAN		$EB 235 DO	
$97	151 POKE	$C1 193 ATN		$EC 236 LOOP	
$98	152 PRINT#	$C2 194 PEEK		$ED 237 EXIT	
$99	153 PRINT	$C3 195 LEN		$EE 238 DIRECTORY	
$9A	154 CONT	$C4 196 STR$		$EF 239 DSAVE	
$9B	155 LIST	$C5 197 VAL		$F0 240 DLOAD	
$9C	156 CMD	$C6 198 ASC		$F1 241 HEADER	
$9D	157 CLR	$C7 199 CHR$		$F2 242 SCRATCH	
$9E	158 SYS	$C8 200 LEFT$		$F3 243 COLLECT	
$9F	159 OPEN	$C9 201 RIGHT$		$F4 244 COPY	
$A0	160 CLOSE	$CA 202 MID$		$F5 245 RENAME	
$A1	161 GET	$CB 203 GO		$F6 246 BACKUP	
$A2	162 NEW	$CC 204 RGR		$F7 247 DELETE	
$A3	163 TAB(	$CD 205 RCLR		$F8 248 RENUMBER	
$A4	164 TO	$CE 206 JOY		$F9 249 KEY	
$A5	165 FN	$D0 208 RDOT		$FA 250 MONITOR	
$A6	166 SPC(	$D1 209 DEC		$FB 251 USING	
$A7	167 THEN	$D2 210 HEX$		$FC 252 UNTIL	
$A8	168 NOT	$D3 211 ERR$		$FD 253 WHILE	
$A9	169 STEP	$D4 212 INSTR			

128 DOUBLE-BYTE TOKENS

HEX	DEC	HEX	DEC
$CE $02	206 2 POT	$FE $11	254 17 BLOAD
$CE $03	206 3 BUMP	$FE $12	254 18 RECORD
$CE $04	206 4 PEN	$FE $13	254 19 CONCAT
$CE $05	206 5 RSPPOS	$FE $14	254 20 DVERIFY
$CE $06	206 6 RSPRITE	$FE $15	254 21 DCLEAR
$CE $07	206 7 RSPCOLOR	$FE $16	254 22 SPRSAV
$CE $08	206 8 XOR	$FE $17	254 23 COLLISION
$CE $09	206 9 RWINDOW	$FE $18	254 24 BEGIN
$CE $0A	206 10 POINTER	$FE $19	254 25 BEND
$FE $02	254 2 BANK	$FE $1A	254 26 WINDOW
$FE $03	254 3 FILTER	$FE $1B	254 27 BOOT
$FE $04	254 4 PLAY	$FE $1C	254 28 WIDTH
$FE $05	254 5 TEMPO	$FE $1D	254 29 SPROEF
$FE $06	254 6 MOUSPR	$FE $1E	254 30 QUIT
$FE $07	254 7 SPRITE	$FE $1F	254 31 STASH
$FE $08	254 8 SPRCOLOR	$FE $21	254 33 FETCH
$FE $09	254 9 RREG	$FE $23	254 35 SWAP
$FE $0A	254 10 ENVELOPE	$FE $24	254 36 OFF
$FE $0B	254 11 SLEEP	$FE $25	254 37 FAST
$FE $0C	254 12 CATALOG	$FE $26	254 38 SLOW
$FE $0D	254 13 DOPEN		
$FE $0E	254 14 APPEND		
$FE $0F	254 15 DCLOSE		
$FE $10	254 16 BSAVE		

PLUS4 ABBREVIATED KEYWORDS

KEYWORD	ABBREVIATION	KEYWORD	ABBREVIATION	KEYWORD	ABBREVIATION
ABS	AshiftB	GOSUB	GOshiftS	READ	RshiftE
ASC	AshiftS	GOTO	GshiftO	RENAME	REshiftN
ATN	AshiftT	GRAPHIC	GshiftR	RENUMBER	RENshiftU
AUTO	AshiftU	GSHAPE	GshiftS	RENUMBER	RENshiftU
BACKUP	BshiftA	HEADER	HEshiftA	RESTORE	REshiftO
BOX	BshiftO	HEX$	HshiftE	RESUME	RESshiftE
CHAR	ChshiftA	INPUT#	IshiftN	RETURN	REshiftT
CHR$	CshiftA	INSTR	INshiftS	RGR	RshiftG
CIRCLE	CshiftI	JOY	JshiftO	RIGHT$	RshiftI
CLOSE	CLshiftO	KEY	KshiftE	RLUM	RshiftL
CLR	CshiftL	LEFT$	LEshiftF	RND	RshiftN
CMD	CshiftM	LET	LshiftE	RUN	RshiftU
COLLECT	COLshiftL	LIST	LshiftI	SAVE	SshiftA
COLOR	COshiftL	LOAD	LshiftO	SCALE	SCshiftA
CONT	CshiftO	LOCATE	LOshiftC	SCNCLR	SCshiftC
COPY	COshiftP	LOOP	LOshiftO	SCRATCH	SCshiftA
DATA	DshiftA	MID$	MshiftD	SGN	SshiftG
DEF FN	DshiftE	MONITOR	MshiftO	SIN	SshiftI
DELETE	DEshiftL	NEXT	NshiftE	SOUND	SshiftO
DIM	DshiftI	ON..GOSUB	ON..GOshiftS	SPC(	SPshiftC
DIRECTORY	DIshiftR	ON..GOTO	ON..GshiftO	SQR	SshiftQ
DLOAD	DshiftL	OPEN	OshiftP	SSHAPE	SshiftS
DRAW	DshiftR	PAINT	PshiftA	STOP	SshiftT
DSAVE	DshiftS	PEEK	PshiftE	STR$	StShiftR
END	EshiftN	POKE	PshiftO	SYS	SshiftY
ERR$	EshiftR	PRINT	PshiftR	TAB(	TshiftA
EXP	EshiftX	PRINT#	PshiftR	TRAP	TshiftR
FOR	FshiftO	PRINT USING	?USshiftI	TROFF	TRShiftF
FRE	FshiftR	PUDEF	PshiftU	TRON	TRshiftO
GET	GshiftE	RCLR	RshiftC	UNTIL	UshiftN
GETKEY	GETKshiftE	RDOT	RshiftO	USR	UshiftS

NOTE:- Any keywords not listed indicates that there is not abbreviation for that particular keyword.

128 ABBREVIATED KEYWORDS

KEYWORD	ABBREVIATION	KEYWORD	ABBREVIATION	KEYWORD	ABBREVIATION
ABS	AshiftB	FRE	FshiftR	RENUMBER	RENshiftU
APPEND	AshiftP	GET	GshiftE	RESTORE	REshiftS
ASC	AshiftS	GETKEY	GETKshiftE	RESUME	RESshiftE
ATN	AshiftT	GOSUB	GOshiftS	RETURN	REshiftT
AUTO	AshiftU	GOTO	GshiftO	RGR	RshiftG
BACKUP	BAshiftC	GRAPHIC	GshiftR	RIGHT$	RshiftI
BANK	BshiftA	GSHAPE	GshiftS	RND	RshiftN
BEGIN	BshiftE	HEADER	HEshiftA	RREG	RshiftG
BEND	BEshiftN	HELP	HEshiftL	RSPCOLOR	RSPshiftC
BLOAD	BshiftL	HEX$	HshiftE	RSPPOS	RshiftS
BOOT	BshiftO	INPUT#	IshiftN	RSPRITE	RSPshiftR

BSAVE	BshiftS	INSTR	InshiftS	RUN	RshiftU
BUMP	BshiftU	JOY	JshiftO	RWINDOW	RshiftW
CATALOG	CshiftA	KEY	KshiftE	SAVE	SshiftA
CHAR	CHshiftA	LEFT$	LEshiftF	SCALE	SCshiftA
CHR$	CshiftN	LET	LshiftE	SCNCLR	SshiftC
CIRCLE	CshiftI	LIST	LshiftI	SCRATCH	SCshiftK
CLOSE	CLshiftO	LOAD	LshiftO	SGN	SshiftG
CLR	CshiftL	LOCATE	LOshiftC	SIN	SshiftI
CMD	CshiftM	LOOP	LOshiftO	SLEEP	SshiftL
COLLECT	COLLshiftE	MID$	MshiftI	SOUND	SshiftO
COLLISION	COLshiftL	MONITOR	MOshiftN	SPRCOLOR	SPRshiftC
COLOR	COLshiftO	MOVSPR	MshiftO	SPRDEF	SPRshiftD
CONCAT	CshiftO	NEXT	NshiftE	SPRITE	SshiftP
COPY	COshiftP	ON..GOSUB	ON..GOshiftS	SPRSAV	SPRshiftS
DATA	DshiftA	ON..GOTO	ON..GOshiftO	SQR	SshiftQ
DCLEAR	DCLshiftE	OPEN	OshiftP	SSHAPE	SshiftS
DCLOSE	DshiftC	PAINT	PshiftA	STASH	SshiftT
DELETE	DEshiftL	PEEK	PEshiftE	STEP	STshiftE
DIM	DshiftI	PEN	PshiftE	STOP	STshiftO
DIRECTORY	DIshiftR	PLAY	PlshiftA	STR$	STshiftR
DLOAD	DshiftL	POKE	POshiftO	SWAP	SshiftW
DOPEN	DshiftO	POT	PshiftO	TAB(	TshiftA
DRAW	DshiftR	PRINT	?	TEMPO	TshiftE
DSAVE	DshiftS	PRINT#	PshiftR	TRAP	TshiftR
DVERIFY	DshiftV	PRINT USING	?USshiftI	TROFF	TROshiftF
ENVELOPE	EshiftN	PUDEF	PshiftU	TRON	TRshiftO
ERR$	EshiftR	RBUMP	RBshiftU	UNTIL	UshiftN
EXIT	EXshiftI	RCLR	RshiftC	USR	UshiftS
EXP	EshiftX	RDOT	RshiftD	VERIFY	VshiftE
FETCH	FshiftE	READ	REshiftA	VOL	VshiftO
FILTER	FshiftI	RECORD	RshiftE	WAIT	WshiftA
FOR	FshiftO	RENAME	REshiftN	WHILE	WshiftH
				WIDTH	WIshiftD
				WINDOW	WshiftI
				XOR	XshiftO

NOTE:- Any keywords not listed indicates that there is not abbreviation for that particular keyword.

PLUS4 COLOUR CODES

Value to POKE for each colour:

COLOUR	VALUE
Black	1
White	2
Red	3
Cyan	4
Purple	5
Green	6
Blue	7
Yellow	8
Orange	9
Brown	10
Yellow-green	11
Pink	12
Blue-green	13
Light blue	14
Dark blue	15
Light green	16

C64 SCN/COLOUR CODES & MODES

Value to POKE for each colour:

COLOUR	LOW NYBBLE COLOUR VALUE	HIGH NYBBLE COLOUR VALUE	MULTICOLOUR COLOUR VALUE
Black	0	0	0
White	1	16	9
Red	2	32	10
Cyan	3	48	11
Purple	4	64	12
Green	5	80	13
Blue	6	96	14
Yellow	7	112	15
Orange	8	128	--
Brown	9	144	--
Lt Red	10	160	--
Dark Gray	11	176	--
Med Gray	12	192	--
Lt Green	13	208	--
Lt Blue	14	224	--
Lt Gray	15	240	--

Where to POKE colour values for each mode:

MODE [@]	BIT OR BIT-PAIR	LOCATION	COLOUR VALUE
Regular text	0	53281	Low nybble
	1	Colour memory	Low nybble
Multicolour	00	53281	Low nybble
text	01	53282	Low nybble
	10	53283	Low nybble
	11	Colour memory	Select multicolour
Extended	00	53281	Low nybble
colour text	01	53282	Low nybble
[1]	10	53283	Low nybble
	11	53284	Low nybble
Bitmapped	0	Screen memory	Low nybble [2]
	1	Screen memory	High nybble [2]
Multicolour	00	53281	Low nybble [2]
bitmapped	01	Screen memory	High nybble [2]
	10	Screen memory	Low nybble [2]
	11	Colour memory	Low nybble

[@] For all modes, the screen border colour is controlled by POKE'g 53280 with the low nybble colour value.
[1] In extended colour mode, bits 6 & 7 of each byte of screen memory serve as the bit-pair controlling background colour. Because only bits 0-5 are available for character selection, only characters with screen codes 0-63 can be used in this mode.
[2] In the bitmapped modes, the high and low nybble colour values are ORed together and POKed into the SAME LOCATION in screen memory to control the colours of the corresponding CELL in the bitmap. For example, to control the colours of cell 0 of the bitmap, OR the high and low nybble values and POKE the result into location 0 of screen memory.

C128 COLOUR CODES

COLOUR SOURCE

NUMBER	SOURCE
0	40 column background colour (VIC)
1	Foreground for graphics screen (VIC)
2	Foreground colour 1 for multicolour screen (VIC)
3	Foreground colour 2 for multicolour screen (VIC)
4	40 column border (VIC - whether in text or graphics mode)
5	Character colour for 40 or 80 column text screen
6	80 column background colour (8563)

Value to POKE for each colour: 40 column mode:

COLOUR	VALUE
Black	1
White	2
Red	3
Cyan	4
Purple	5
Green	6
Blue	7
Yellow	8
Orange	9
Brown	10
Light red	11
Dark gray	12
Medium gray	13
Light green	14
Light blue	15
Light gray	16

Value to POKE for each colour: 80 column mode:

COLOUR	VALUE
Black	1
White	2
Dark red	3
Light cyan	4
Light purple	5
Dark green	6
Dark blue	7
Light yellow	8
Dark purple	9
Brown	10
Light red	11
Dark cyan	12
Medium gray	13
Light green	14
Light blue	15
Light gray	16

CBM CONTROL & CHR$ CODES

CHR$	KEYS	FUNCTION	C64	C128
CHR$(2)	CTRL B	Underline (80 col)	N	Y
CHR$(5)	CTRL 2/CTRL E	Set char color to white (80 and 40 col)	Y	Y
CHR$(7)	CTRL G	Produce bell tone	N	Y
CHR$(8)	CTRL H	Disable char set change key	Y	N
CHR$(9)	CTRL I	Enable char set change key	Y	N
		Move cursor to next tab position	N	Y
CHR$(10)	CTRL J	Send carriage return with line feed	Y	Y
		Send a line feed	N	Y
CHR$(11)	CTRL K	Disable char set change key	N	Y
CHR$(12)	CTRL L	Enable char set change key	N	Y
CHR$(13)	CTRL M	Send carr ret,line feed & enter BASIC line	Y	Y
CHR$(14)	CTRL N	Set char set to lower/upper case set	Y	Y
CHR$(15)	CTRL O	Turn flash on (80 col)	N	Y
CHR$(17)	CTRL Q/CRSR$	Move cursor down one row	Y	Y
CHR$(18)	CTRL 9	Chars to be printed in reverse field	Y	Y
CHR$(19)	CTRL S/HOME	Move cursor to home position	Y	Y
CHR$(20)	CTRL T/DEL	Delete last char typed	Y	Y
CHR$(27)	CTRL [/ESC	Send an ESC character	N	Y
CHR$(28)	CTRL 3/CTRL /	Make char color RED (40 and 80 column)	Y	Y
CHR$(29)	CTRL]/CRSR	Move cursor one column to right	Y	Y
CHR$(30)	CTRL 6	Set char color to GREEN (40 and 80 column)	Y	Y
CHR$(34)	"	Print double quote on scn & set quote mode	Y	Y
CHR$(129)	CBM 1	Set char color ORANGE (40 col),DARK PURPLE (80 col)	Y	Y
CHR$(130)		Underline off (80 column)	N	Y
CHR$(131)		Run a programme. (Only works from kb buffer)	Y	Y
CHR$(133)	F1	Reserved CHR$ code for F1 key	Y	Y
CHR$(134)	F3	Reserved CHR$ code for F3 key	Y	Y
CHR$(135)	F5	Reserved CHR$ code for F5 key	Y	Y
CHR$(136)	F7	Reserved CHR$ code for F7 key	Y	Y
CHR$(137)	F2	Reserved CHR$ code for F2 key	Y	Y
CHR$(138)	F4	Reserved CHR$ code for F4 key	Y	Y
CHR$(139)	F6	Reserved CHR$ code for F6 key	Y	Y
CHR$(140)	F8	Reserved CHR$ code for F8 key	Y	Y

CHR$(141) SHIFT RETURN	Send carriage return and line feed without entering a line of basic	Y	Y
CHR$(142)	Set char set to upper case set	Y	Y
CHR$(143)	Turn flash off (80 column)	N	Y
CHR$(144) CTRL 1	Set char color to BLACK (40 and 80 col)	Y	Y
CHR$(145) CRSR UP	Move cursor or printing up one row	Y	Y
CHR$(146) CTRL 9	Terminate reverse field mode	Y	Y
CHR$(147) HOME	Clear window screen & position csr topleft	Y	Y
CHR$(148) INST	Move char from cursor position right 1 col	Y	Y
CHR$(149) CBM 2	Set char color BROWN (40) DARK YELLOW (80)	Y	Y
CHR$(150) CBM 3	Set char color LIGHT RED (40 and 80 column)	Y	Y
CHR$(151) CBM 4	Set char color DARK GRAY (40) DARKCYAN (80)	Y	Y
CHR$(152) CBM 5	Set char color MEDIUM GRAY (40 and 80)	Y	Y
CHR$(153) CBM 6	Set char color LIGHT GREEN (40 and 80)	Y	Y
CHR$(154) CBM 7	Set char color LIGHT BLUE (40 and 80)	Y	Y
CHR$(155) CBM 8	Set char color LIGHT GRAY (40 and 80)	Y	Y
CHR$(156) CTRL 5	Set char color PURPLE (40 and 80)	Y	Y
CHR$(157) CRSR LEFT	Move cursor left one column	Y	Y
CHR$(158) CTRL 4	Set char color CYAN (40 and 80)	Y	Y

128/PLUS4 ESCAPE CODES

ESCAPE KEYS	ESCAPE FUNCTION	PLUS4	128
ESC A	Enable Auto insert mode	Y	Y
ESC B	Set bottom of scrn window at cursor postition	Y	Y
ESC C	Disable auto insert mode	Y	Y
ESC D	Delete current line	Y	Y
ESC E	Set cursor to non flashing mode	N	Y
ESC F	Set cursor to flashing mode	N	Y
ESC G	Enable bell (by control-G)	N	Y
ESC H	Disable bell	N	Y
ESC I	Insert a line	Y	Y
ESC J	Move to start of current line	Y	Y
ESC K	Move to end of current line	Y	Y
ESC L	Turn on scrolling	Y	Y
ESC M	Turn off scrolling	Y	Y
ESC N	Return to normal screen display size (128 in 80 col)	Y	Y
ESC O	Cancel insert,quote,reverse and flash modes	Y	Y
ESC P	Erase all up to start of current line	Y	Y
ESC Q	Erase all to end of current line	Y	Y
ESC R	Reduce screen display	Y	N
ESC S	Set screen to reverse video (128 80 col only)	N	Y
ESC T	Change to block cursor (128 80 col)	N	Y
ESC U	Set top of screen window to top left corner	Y	Y
ESC V	Change to underline cursor (128 80 col only)	N	Y
ESC W	Scroll screen up	Y	Y
ESC X	Scroll screen down	Y	Y
ESC Y	Cancel esc function (plus 4 only)	Y	N
ESC X	Swap 40/80 column display output device	N	Y
ESC Y	Set default tab stop (8 spaces)	N	Y
ESC Z	Clear all tab stops	N	Y
ESC @	Clear to end of screen	N	Y

C64 KEYCODES STORED AT LOCACTION 197

KEY	KEYCODE	KEY	KEYCODE
A	10	6	19
B	28	7	24
C	20	8	27
D	18	9	30
E	14	Ø	35
F	21	+	40
G	26	-	43
H	29	£	48
I	33	CLR/HOME	51
J	34	INST/DEL	Ø
K	37	Lt.ARROW	57
L	42	@	46
M	36	*	49
N	39	'	54
O	38	:	45
P	41	;	50
Q	62	=	53
R	17	RET	1
S	13	.	47
T	22	.	44
U	30	/	55
V	31	CSR UP/DOWN	7
W	9	CSR LT/RT	2
X	23	F1	4
Y	25	F3	5
Z	12	F5	6
1	56	F7	3
2	59	SPACE	60
3	8	RUNSTOP	63
4	11	NOKEY PRESSED	64
5	16		

Vaules to be found at location 653

CODE	KEY(s)PRESSED
Ø	No key pressed
1	SHIFT
2	Commodore
3	SHIFT and Commodore
4	CTRL
5	Shift and CTRL
6	Commodore and CTRL
7	SHIFT, CTRL and Commodore

+4 TED CHIP - MEMORY MAP

REG	HEX ADD	DEC ADD	BITS	DESCRIPTION
Ø	$FF00	65280		Timer 1, Reload low
1	$FF01	65281		Timer 1, Reload high
2	$FF02	65282		Timer 2, low
3	$FF03	65283		Timer 2, high
4	$FF04	65284		Timer 3, low
5	$FF05	65285		Timer 3, high
6	$FF06	65286	Ø-2	Vertical scroll position (Y)
			3	Select 24/25 rows (1=25)
			4	Switch screen off
			5	Switch bitmap mode (1=ON)
			6	Switch extended color mode (1=ON)
			7	Testbit (always Ø)
7	$FF07	65287	Ø-2	Horizontal scroll position (X)
			3	select 38/40 columns (1=40)
			4	Switch multicolor mode (1=ON)
			5	Switch freeze mode on (1=ON)
			6	PAL/NTSC mode (Ø=PAL;1=NTSC)
			7	RVS video (Ø=hardware;1=software)
Ø	$FF08	65288		Keyboard matrix
9	$FF09	65289		Interrupt sources
			Ø	Not used
			1	Raster interrupt
			2	Light pen (Not possible with C-16)
			3	Timer 1 interrupt
			4	Timer 2 interrupt
			5	Not used
			6	Timer 3 interrupt
			7	Interrupt bit
10	$FF0A	65290		Interrupt masking
			Ø	Bit Ø of Raster compare (Register 11)
			1	Raster interrupt
			2	Light pen (Not possible with C-16)
			3	Timer 1 interrupt
			4	Timer 2 interrupt
			5	Not used
			6	Timer 3 interrupt
			7	Not used
11	$FF0B	65291		Raster comparison (bit0-7)
12	$FF0C	65292	Ø-1	Bit Ø-9 of cursor position (Register 13)
			2-7	Not used
13	$FF0D	65293		Hardware cursor position (bit0-7)
14	$FF0E	65294		Frmquency voice 1 (bit0-7)
15	$FF0F	65295		Frmquency voice 2 (bit0-7)
16	$FF10	65296	Ø-1	Frmquency voice 2 (bit8-9)
			2-7	Not used
17	$FF11	65297	Ø-3	Volume (Ø=OFF;15=LOUDEST)
			4	Switch voice 1 (1=ON)
			5	Switch voice 2 rectangular (1=ON)
			6	Switch voice 2 noise (1=ON)
			7	Sound reload bit
18	$FF12	65298	Ø-1	Bit Ø-9 frmquency voice 1 (register 14)
			2	RAM/ROM bank (Ø=RAM;1=ROM)
			3-5	Address of bitmap RAM (bit 13-15)
			6-7	Not used
19	$FF13	65299	Ø	ROM bank status bit (read only)
			1	Force singleclock bit;1=prohibit double time freq
			2-7	Address of character set (bit10-15)
20	$FF14	65300	Ø-2	Not used
			3-7	Address of video RAM (bit11-15)
21	$FF15	65301	Ø-3	Background Ø color
			4-6	Background Ø luminiscence
			7	Not used
22	$FF16	65302	Ø-3	Background 1 color
			4-6	Background 1 luminiscence
			7	Not used
23	$FF17	65303	Ø-3	Background 2 color
			4-6	Background 2 luminiscence
			7	Not used
24	$FF18	65304	Ø-3	Background 3 color
			4-6	Backgrnd 3 luminiscence
			7	Not used
25	$FF19	65305	Ø-3	Frame color
			4-6	Frame luminiscence
			7	Not used
26	$FF1A	65306	Ø-1	Bit Ø-9 of bit map reload (register 27)
			2-7	Not used
27	$FF1B	65307		Bit map reload of character position (bit Ø-7)
28	$FF1C	65308	Ø	Bit Ø of raster-row (register 29)
			1-7	Not used
29	$FF1D	65309		Current raster row (bit Ø-7)
30	$FF1E	65310		Current raster colum (bit1-8)
31	$FF1F	65311	Ø-2	Vertical sub address
			3-6	Flash rate
			7	Not used
62	$FF3E	65342		ROM-select (write only)
63	$FF3F	65343		RAM-select (write only)

VIC AND SID CHIPS

VIC-CHIP ADDRESS $D000-$D02E (53248-53294)

ADDRESS HEX	DECIMAL	BIT	DESCRIPTION
$D000	53248		Sprite Ø - X position (bits Ø-8)
$D001	53249		Sprite Ø - Y position (bits Ø-8)
$D002	53250		Sprite 1 - X position
$D003	53251		Sprite 1 - Y position
$D004	53252		Sprite 2 - X position
$D005	53253		Sprite 2 - Y position
$D006	53254		Sprite 3 - X position
$D007	53255		Sprite 3 - Y position
$D008	53256		Sprite 4 - X position
$D009	53257		Sprite 4 - Y position
$D00A	53258		Sprite 5 - X position
$D00B	53259		Sprite 5 - Y position
$D00C	53260		Sprite 6 - X position
$D00D	53261		Sprite 6 - Y position
$D00E	53262		Sprite 7 - X position
$D00F	53263		Sprite 7 - Y position

$D010	53264		9th bit of sprite X co-ordinate
		0	Sprite 0
		1	Sprite 1
		2	Sprite 2 etc through sprite 7
$D011	53265		VIC Control Register
		7	Raster compare register. Bit 9
		6	1=Enable extended colour text mode
		5	1=Enable bit map mode
		4	1=Blank screen to border
		3	1=25 row text display. 0=24 row text display
		2-0	Smooth scroll to Y dot position
$D012	53266		Raster compare register. Position of raster on screen
$D013	53267		Light pen X position
$D014	53268		Light pen Y position
$D015	53269		Enable or disable sprite
		0	1=Enable sprite 0
		1	1=Enable sprite 1
		2	1=Enable sprite 2 etc through sprite 7
$D016	53270		VIC Control Register
		4	1=Multicolour mode on
		3	1=40 Column text:0=39 coloumn text
		2-0	Smooth scroll to X position
$D017	53271		Sprite Vertical Expansion
		0	Expand sprite 0 Vertically
		1	Expand sprite 1 Vertically
		2	Expand sprite 2 Vertically etc through to sprite 7
$D018	53272		VIC Memory Control
		7-4	Video matrix base address
		3-0	Character set base address
$D019	53273		VIC Interrupt Flags
		7	Set to any VIC IRQ condition
		3	Light pen triggered (bit 7)
		2	Sprite vs sprite triggered (bit 7)
		1	Sprite vs background triggered (bit 7)
		0	Raster compare triggered (bit 7)
$D01A	53274		VIC Interrupt Switches
		3	1=Enable light pen interrupt
		2	1=Sprite vs sprite enabled
		1	1=Sprite vs background enabled
		0	1=Raster compare enabled
$D01B	53275		Sprite Priority Registers
		0	1=Sprite 0 passes in front of graphics
		1	1=Sprite 1 passed in front of graphics etc through sp 7
$D01C	53276		Sprite multi-colour select
		0	1=Sprite 0 is multicolour
		1	1=Sprite 1 is multicolour etc through sprite 7
$D01D	53277		Sprite Horizontal Expansion
		0	1=Sprite 0 expanded horizontally
		1	1=Sprite 1 expanded horizontally etc through sprite 7
$D01E	53278		Sprite vs sprite collision detection. If a sprite is touching a sprite, the bit for that sprite is turned on.
$D01F	53279		Sprite vs background. If sprite has hit text or background, relevant bit is set.
$D020	53280		Border colour
$D021	53281		Background colour
$D022	53282		Multi-colour 1
$D023	53283		Multi-colour 2
$D024	53284		Multi-colour 3
$D025	53285		Sprite multi-colour
$D026	53286		Sprite multi-colour
$D027	53287		Sprite 0 colour
$D028	53288		Sprite 1 colour
$D029	53289		Sprite 2 colour
$D02A	53290		Sprite 3 colour
$D02B	53291		Sprite 4 colour
$D02C	53292		Sprite 5 colour
$D02D	53293		Sprite 6 colour
$D02E	53294		Sprite 7 colour
$D030	53296		C128 ONLY 2MHZ
		0	Determines if the C128 operates at 2Mhz or 1Mhz. If the bit is set then there is no access to the VIC chip and the C128 operates in the 2 Mhz mode.

SID CHIP ADDRESS $D400-$D41C (54272-54300)

ADDRESS HEX	DECIMAL	BIT	DESCRIPTION
$D400	54272		Voice 1: low byte of frequency
$D401	54273		Voice 1: High byte of frequency
$D402	54274		Voice 1: Low byte of pulse width
$D403	54275	3-0	Voice 1: High byte of pulse width
$D404	54276		Voice 1 Control Register
		7	1=Random noise
		6	1=Pulse waveform on
		5	1=Sawtooth waveform on
		4	1=Triangle waveform on
		3	1=Disable voice 1
		2	1=Ring modulate voice 1 with voice 3
		1	1=Synchronize voice 1 with freq of voice 3
		0	1=Start attack,decay,sustain: 0=Start release
$D405	54277		Voice 1 Attack/decay
		7-4	Attck cycle duration
		3-0	Decay cycle duration
$D406	54278		Voice 1 Sustain/release
		7-4	Sustain cycle duration
		3-0	Release cycle duration
$D407	54279		Voice 2: low byte of frequency
$D408	54280		Voice 2: high byte of frequency
$D409	54281		Voice 2: low byte of pulse width
$D40A	54282	3-0	Voice 2: high byte of pulse width
$D40B	54283		Voice 2 Control Register
		7	1=Random noise on
		6	1=Pulse waveform on
		5	1=Sawtooth waveform on
		4	1=Triangle waveform on
		3	1=Disable oscillator 1
		2	1=Ring modulate oscillator 2 with oscillator 1
		1	1=Synchronize oscillator 2 with oscillator 1 frequency
		0	1=Start attack,decay,sustain: 0=Start release
$D40C	54284		Voice 2 Attack/decay
		7-4	Attack cycle duration
		3-0	Decay cycle duration
$D40D	54285		Voice 2 Sustain/release
		7-4	Sustain cycle duration
		3-0	Release cycle duration
$D40E	54286		Voice 3: low byte of frequency
$D40F	54287		Voice 3: high byte of frequency
$D410	54288		Voice 3: low byte of pulse width
$D411	54289	3-0	Voice 3: high byte of pulse width
$D412	54290		Voice 3 Control Register
		7	1=Random noise on
		6	1=Pulse waveform on
		5	1=Sawtooth waveform on
		4	1=Triangle waveform on
		3	1=Disable voice
		2	1=Ring modulate oscillator 3 with oscillator 2 output
		1	1=Synchronize oscillator 3 with freq of oscillator 2
		0	1=Start attack,decay,sustain: 0=start release
$D413	54291		Voice 3 Attack/decay
		7-4	Attack cycle duration
		3-0	Decay cycle duration
$D414	54292		Voice 3 Sustain/release
		7-4	Sustain cycle duration
		3-0	Release cycle duration
$D415	54293	2-0	Filter cut-off low nybble
$D416	54294		Filter cut-off high byte
$D417	54295		Filter Control
		7-4	Filter resonance
		3	1=External input to filter
		2	1=Voice 3 to filter
		1	1=Voice 2 to filter
		0	1=Voice 1 to filter
$D418	54296		Filter Volume And Mode
		7	1=Turn off voice 3 output
		6	1=High pass filter on
		5	1=Band pass filter on
		4	1=Low pass filter on
		3-0	Output volume
$D419	54297		A/D convertor for paddle 1
$D41A	54298		A/D convertor for paddle 2
$D41B	54299		Produces random number when voice 3 set to noise
$D41C	54300		Output of voice 3 envelope generator

6510 ADDRESSING MODES & OPCODES

The following table gives the HEX values for the various opcodes in their individual addressing modes. The following key to be used for the Address Mode

```
A    = Accumulator
#    = Immediate
ZP   = Zero page
AB   = Absolute
ABX  = Absolute X
ABY  = Absolute Y
ZPX  = Zero page X
ZPY  = Zero page Y
,X)  = Indexed X
),Y  = Indexed Y
```

MNEMONIC	ADDRESSING MODE									
--	A	#	ZP	AB	ABX	ABY	ZPX	ZPY	,X)	),Y
ADC	-	69	65	6D	7D	79	75	-	61	71
AND	-	29	25	2D	3D	39	35	-	21	31
ASL	0A	-	06	0E	1E	-	16	-	-	-
BIT	-	-	24	2C	-	-	-	-	-	-
CMP	-	C9	C5	CD	DD	D9	D5	-	C1	D1
CPX	-	E0	E4	EC	-	-	-	-	-	-
CPY	-	C0	C4	CC	-	-	-	-	-	-
DEC	-	-	C6	CE	DD	-	D6	-	-	-
EOR	-	49	45	4D	50	59	55	-	41	51
INC	-	-	E6	EE	FD	-	F6	-	-	-
LDA	-	A9	A5	AD	BD	B9	B5	-	A1	B1
LDX	-	A2	A6	AE	-	BE	-	B6	-	-
LDY	-	A0	A4	AC	BC	-	B4	-	-	-
LSR	4A	-	46	4E	5E	-	56	-	-	-
ORA	-	09	05	0D	1D	19	15	-	01	11
ROL	2A	-	26	2E	3E	-	36	-	-	-
ROR	6A	-	66	6E	7E	-	76	-	-	-
SBC	-	E9	E5	ED	FD	F9	F5	-	E1	F1
STA	-	-	85	8D	9D	99	95	-	81	91
STX	-	-	86	8E	-	-	-	96	-	-
STY	-	-	84	8C	-	-	94	-	-	-

GROUPED INSTRUCTIONS

BRANCH INSTRUCTIONS

BPL	BMI	BVC	BVS	BCC	BCS	BNE	BEQ
10	30	50	70	90	B0	D0	F0

TRANSFER INSTRUCTIONS

TXA	TAX	TYA	TAY	TSX	TXS
8A	AA	98	A8	BA	9A

STACK INSTRUCTIONS

PHP	PLP	PHA	PLA
08	28	48	68

JUMP INSTRUCTIONS

BRK	JSR	RTI	RTS	JMP	JMP	NOP
00	20	40	60	4C	6C	EA

FLAG INSTRUCTIONS

CLC	SEC	CLI	SEI	CLV	CLD	SED
18	38	58	78	B8	D8	F8

INC/DEC INSTRUCTIONS

DEY	INY	DEX	INX
88	C8	CA	E8

ASCII and SCREEN CODES

SCREEN CODE		ASCII CODE		CHARACTER		SCREEN CODE		ASCII CODE		CHARACTER	
HEX	DECIMAL	HEX	DECIMAL	SET1	SET2	HEX	DECIMAL	HEX	DECIMAL	SET1	SET2
$00	0	$40	64	@	@	$40	64	$60	96		
$01	1	$41	65	A	a	$41	65	$61	97	A	A
$02	2	$42	66	B	b	$42	66	$62	98	B	B
$03	3	$43	67	C	c	$43	67	$63	99	C	C
$04	4	$44	68	D	d	$44	68	$64	100	D	D
$05	5	$45	69	E	e	$45	69	$65	101	E	E
$06	6	$46	70	F	f	$46	70	$66	102	F	F
$07	7	$47	71	G	g	$47	71	$67	103	G	G
$08	8	$48	72	H	h	$48	72	$68	104	H	H
$09	9	$49	73	I	i	$49	73	$69	105	I	I
$0A	10	$4A	74	J	j	$4A	74	$6A	106	J	J
$0B	11	$4B	75	K	k	$4B	75	$6B	107	K	K
$0C	12	$4C	76	L	l	$4C	76	$6C	108	L	L
$0D	13	$4D	77	M	m	$4D	77	$6D	109	M	M
$0E	14	$4E	78	N	n	$4E	78	$6E	110	N	N
$0F	15	$4F	79	O	o	$4F	79	$6F	111	O	O
$10	16	$50	80	P	p	$50	80	$70	112	P	P
$11	17	$51	81	Q	q	$51	81	$71	113	Q	Q
$12	18	$52	82	R	r	$52	82	$72	114	R	R
$13	19	$53	83	S	s	$53	83	$73	115	S	S
$14	20	$54	84	T	t	$54	84	$74	116	T	T
$15	21	$55	85	U	u	$55	85	$75	117	U	U
$16	22	$56	86	V	v	$56	86	$76	118	U	U
$17	23	$57	87	W	w	$57	87	$77	119	W	W
$18	24	$58	88	X	x	$58	88	$78	120	X	X
$19	25	$59	89	Y	y	$59	89	$79	121	Y	Y
$1A	26	$5A	90	Z	z	$5A	90	$7A	122	Z	Z
$1B	27	$5B	91	[	[	$5B	91	$7B	123	+	+
$1C	28	$5C	92	£	£	$5C	92	$7C	124		
$1D	29	$5D	93	]	]	$5D	93	$7D	125	+	+
$1E	30	$5E	94	↑	↑	$5E	94	$7E	126	π	π
$1F	31	$5F	95	L.Ar	L.Ar	$5F	95	$7F	127	◥	◥
$20	32	$20	SPC	SPC	SPC	$60	96	$A0	160	SSPC	SSPC
$21	33	$21	33	!	!	$61	97	$A1	161	▌	▌
$22	34	$22	34	"	"	$62	98	$A2	162		
$23	35	$23	35	#	#	$63	99	$A3	163		
$24	36	$24	36	$	$	$64	100	$A4	164		
$25	37	$25	37	%	%	$65	101	$A5	165		
$26	38	$26	38	&	&	$66	102	$A6	166		
$27	39	$27	39	'	'	$67	103	$A7	167		
$28	40	$28	40	(	(	$68	104	$A8	168		
$29	41	$29	41	)	)	$69	105	$A9	169	◤	
$2A	42	$2A	42	*	*	$6A	106	$AA	170		
$2B	43	$2B	43	+	+	$6B	107	$AB	171		
$2C	44	$2C	44	,	,	$6C	108	$AC	172	+	+
$2D	45	$2D	45	-	-	$6D	109	$AD	173		
$2E	46	$2E	46	.	.	$6E	110	$AE	174		
$2F	47	$2F	47	/	/	$6F	111	$AF	175		
$30	48	$30	48	0	0	$70	112	$B0	176		
$31	49	$31	49	1	1	$71	113	$B1	177		
$32	50	$32	50	2	2	$72	114	$B2	178		
$33	51	$33	51	3	3	$73	115	$B3	179		
$34	52	$34	52	4	4	$74	116	$B4	180		
$35	53	$35	53	5	5	$75	117	$B5	181	▌	▌
$36	54	$36	54	6	6	$76	118	$B6	182	▌	▌
$37	55	$37	55	7	7	$77	119	$B7	183		
$38	56	$38	56	8	8	$78	120	$B8	184	—	—
$39	57	$39	57	9	9	$79	121	$B9	185	—	—
$3A	58	$3A	58	:	:	$7A	122	$BA	186		
$3B	59	$3B	59	;	;	$7B	123	$BB	187	▝	▝
$3C	60	$3C	60	<	<	$7C	124	$BC	188	▘	▘
$3D	61	$3D	61	=	=	$7D	125	$BD	189	▀	▀
$3E	62	$3E	62	>	>	$7E	126	$BE	190	▖	▖
$3F	63	$3F	63	?	?	$7F	127	$BF	191	▚	▚

C64 POKES/PEEKS/TIPS

The following table gives some useful POKES, PEEKS, and other programming TIPS. The table is not laid out in any specific manner. These are just some of the bits and pieces that I have picked up over the last two years. The list is meant for BASIC programmers, but obviously, MACHINE CODE users can work out the M/C equivalents.

NOTE:- In all cases, LOW,MI and AD = Low byte of an address, High byte of an address and the address itself.

POKE and/or PEEK	Effect of instruction
poke56334,peek(56334)and254	Switch off interrupts
poke56334,peek(56334)or1	Interrupts back on
poke1,peek(1)and252	Basic ROM switched out
poke1,peek(1)or3	Basic ROM switched back in
poke43,low:poke44,hi:pokead,0:clr	Raise start of BASIC
poke55,low:poke56,hi:clr	Lower end of BASIC
poke53265,peek(53265)or64	Enables extended background mode
poke53265,peek(53265)and191	Disables extended background mode
poke53270,peek(53270)or16	Enables multicolour mode
poke53270,peek(53270)and239	Disables multicolour mode
poke53272,(peek(53272)and240)or x	Activate character set designated by 'X'
poke53272,(peek(53272)and240)or4	Switch off character set (upper case)
poke53272,(peek(53272)and240)or6	Switch off character set (lower case)
poke53272,(peek(53272)and15)or x	Relocate video ram to add denoted by 'X'
poke648,x	Tell vid controller of new scn page no.
poke646,x	Change character color to that of 'X
poke211,column:poke214,row:sys58372	Place cursor at designated position
poke204,0	Turn on cursor
poke207,0:poke204,1	Turn off cursor
poke199,1	Reverse video on
poke199,0	Reverse video off
poke216,x	Insert mode on.'X denotes no of inserts
poke53265,peek(53265)and239	Switch screen off
poke53265,peek(53265)or16	Switch screen on
poke53265,59	Switch on Hi-res mode
poke788,52	Disable run/stop key
poke788,49	Re-enable run/stop key
poke792,193	Disable restore key
poke792,71	Re-enable restore key
poke808,237	Disable BREAK and LIST
poke650,128	All keys repeat
poke650,64	Disable repeat key function
poke650,0	Normal key repeat condition
poke651,x	x-signifies delay.of repeat(64'ths sec)
poke198,0:wait198,1	Clear keyboard buff & wait for keypress
poke775,1	Disable list
poke775,167	Restore list
poke774,131:poke775,164	Disable list (alt method)
poke808,0:poke802,0:poke818,165	Disable save command
poke818,131:poke819,164	Disable save command (alt method)
poke816,157	Disable load command
poke818,165	Re-enable load command
poke22,35	Remove line numbers from basic prg
poke22,25	Replace line numbers
printpeek(144)	Returns value of ST
printpeek(147)	Returns LOAD/VERIFY flag value
printpeek(150)	Cassette motor flag status
printpeek(152)	Number of files open
printpeek(153)	Actual input device
printpeek(154)	Actual output device
printpeek(184)	Actual file
printpeek(185)	Actual secondary address
printpeek(186)	Actual device
sys64738	Activate system re-set
sys65255	Close all open files
sys65494	Re-set TI to 000000
sys4808	Gives invisible 'Syntax Error'
sys42115	Ends program without the READY prompt

HEX TO DECIMAL CONVERTER

HEX	DECIMAL LOW	DECIMAL HIGH	HEX	DECIMAL LOW	DECIMAL HIGH	HEX	DECIMAL LOW	DECIMAL HIGH	HEX	DECIMAL LOW	DECIMAL HIGH
$00	0	0	$40	64	16384	$80	128	32768	$C0	192	49152
$01	1	256	$41	65	16640	$81	129	33024	$C1	193	49408
$02	2	512	$42	66	16896	$82	130	33280	$C2	194	49664
$03	3	768	$43	67	17152	$83	131	33536	$C3	195	49920
$04	4	1024	$44	68	17408	$84	132	33792	$C4	196	50176
$05	5	1280	$45	69	17664	$85	133	34048	$C5	197	50432
$06	6	1536	$46	70	17920	$86	134	34304	$C6	198	50688
$07	7	1792	$47	71	18176	$87	135	34560	$C7	199	50944
$08	8	2048	$48	72	18432	$88	136	34816	$C8	200	51200
$09	9	2304	$49	73	18688	$89	137	35072	$C9	201	51456
$0A	10	2560	$4A	74	18944	$8A	138	35328	$CA	202	51712
$0B	11	2816	$4B	75	19200	$8B	139	35584	$CB	203	51968
$0C	12	3072	$4C	76	19456	$8C	140	35840	$CC	204	52224
$0D	13	3328	$4D	77	19712	$8D	141	36096	$CD	205	52480
$0E	14	3584	$4E	78	19968	$8E	142	36352	$CE	206	52736
$0F	15	3840	$4F	79	20224	$8F	143	36608	$CF	207	52992
$10	16	4096	$50	80	20480	$90	144	36864	$D0	208	53248
$11	17	4352	$51	81	20736	$91	145	37120	$D1	209	53504
$12	18	4608	$52	82	20992	$92	146	37376	$D2	210	53760
$13	19	4864	$53	83	21248	$93	147	37632	$D3	211	54016
$14	20	5120	$54	84	21504	$94	148	37888	$D4	212	54272
$15	21	5376	$55	85	21760	$95	149	38144	$D5	213	54528
$16	22	5632	$56	86	22016	$96	150	38400	$D6	214	54784
$17	23	5888	$57	87	22272	$97	151	38656	$D7	215	55040
$18	24	6144	$58	88	22528	$98	152	38912	$D8	216	55296
$19	25	6400	$59	89	22784	$99	153	39168	$D9	217	55552
$1A	26	6656	$5A	90	23040	$9A	154	39424	$DA	218	55808
$1B	27	6912	$5B	91	23296	$9B	155	39680	$DB	219	56064
$1C	28	7168	$5C	92	23552	$9C	156	39936	$DC	220	56320
$1D	29	7424	$5D	93	23808	$9D	157	40192	$DD	221	56576
$1E	30	7680	$5E	94	24064	$9E	158	40448	$DE	222	56832
$1F	31	7936	$5F	95	24320	$9F	159	40704	$DF	223	57088
$20	32	8192	$60	96	24576	$A0	160	40960	$E0	224	57344
$21	33	8448	$61	97	24832	$A1	161	41216	$E1	225	57600
$22	34	8704	$62	98	25088	$A2	162	41472	$E2	226	57856
$23	35	8960	$63	99	25344	$A3	163	41728	$E3	227	58112
$24	36	9216	$64	100	25600	$A4	164	41984	$E4	228	58368
$25	37	9472	$65	101	25856	$A5	165	42240	$E5	229	58624
$26	38	9728	$66	102	26112	$A6	166	42496	$E6	230	58880
$27	39	9984	$67	103	26368	$A7	167	42752	$E7	231	59136
$28	40	10240	$68	104	26624	$A8	168	43008	$E8	232	59392
$29	41	10496	$69	105	26880	$A9	169	43264	$E9	233	59648
$2A	42	10752	$6A	106	27136	$AA	170	43520	$EA	234	59904
$2B	43	11008	$6B	107	27392	$AB	171	43776	$EB	235	60160
$2C	44	11264	$6C	108	27648	$AC	172	44032	$EC	236	60416
$2D	45	11520	$6D	109	27904	$AD	173	44288	$ED	237	60672
$2E	46	11776	$6E	110	28160	$AE	174	44544	$EE	238	60928
$2F	47	12032	$6F	111	28416	$AF	175	44800	$EF	239	61184
$30	48	12288	$70	112	28672	$B0	176	45056	$F0	240	61440
$31	49	12544	$71	113	28928	$B1	177	45312	$F1	241	61696
$32	50	12800	$72	114	29184	$B2	178	45568	$F2	242	61952
$33	51	13056	$73	115	29440	$B3	179	45824	$F3	243	62208
$34	52	13312	$74	116	29696	$B4	180	46080	$F4	244	62464
$35	53	13568	$75	117	29952	$B5	181	46336	$F5	245	62720
$36	54	13824	$76	118	30208	$B6	182	46592	$F6	246	62976
$37	55	14080	$77	119	30464	$B7	183	46848	$F7	247	63232
$38	56	14336	$78	120	30720	$B8	184	47104	$F8	248	63488
$39	57	14592	$79	121	30976	$B9	185	47360	$F9	249	63744
$3A	58	14848	$7A	122	31232	$BA	186	47616	$FA	250	64000
$3B	59	15104	$7B	123	31488	$BB	187	47872	$FB	251	64256
$3C	60	15360	$7C	124	31744	$BC	188	48128	$FC	252	64512
$3D	61	15616	$7D	125	32000	$BD	189	48384	$FD	253	64768
$3E	62	15872	$7E	126	32256	$BE	190	48640	$FE	254	65024
$3F	63	16128	$7F	127	32512	$BF	191	48896	$FF	255	65280

Foreign Formats

In theory, the C128 has the valuable ability to read a wide range of CP/M disk formats. In practice, it isn't so easy. Your Commodore shows you how to do it.

One of the most interesting features of the C-128's CP/M mode is its ability to read a wide number of MFM disk formats created on other CP/M systems. The feature was only provided so that the 128 owner would have ready access to the full range of CP/M applications without having to rely on companies to copy programs on to the non-standard Commodore format diskette. By contrast owners of, for example, Amstrad machines are in the main limited to a selection of the most popular CP/M packages.

While this in itself is a major benefit, provision of the facility also provides some less well-publicised advantages. Of course it means that you can now create your own programs and datafiles for use on other CP/M machines. What, however will be of interest to a greater number of 128 owners is that the disk drives work faster with MFM disks than with the standard GCR format. The main reason for this is almost certainly, because the physical track/sector layout of Comodore disks does not fit very well with CP/M's internal logical representation of a disk. Additionally, the new disk ROM routines for handling MFM disks are the only tide sections within the disk ROMs.

Horror movie

At the point it would be very easy to digress into a discussion of CP/M internals and the horror movie lurking within your disk drive. For readers interested in these topics I have suggested books on both topics at the end of this article and we will just consider the more immediate problem of creating an MFM format disk.

Further investigations have revealed that while Commodore originally intended at one time to provide an MFM formatting facility from within CP/M, it is now extremely difficult to do so. Fortunately, however, it is relatively simple to do this using BASIC 7.0.

In order to implement CP/M, the new disk drives support a set of instructions called Burst Commands. These account for the slight improvement in disk performance that is always obtained in CP/M mode by using faster data transfers. The main functions in this group are for fast read and write of 128 byte CP/M logical records and a special fast program LOAD command. Also included within the set is a general purpose MFM formating command. The information on this is found on page 84 of the 1571 Disk Drive Users Guide. It isn't too hard to use Burst Commands — I successfully formatted a disk to KAYPRO II format at the second attempt.

Straightforward

Everything seemed quite straightforward, so I was somewhat surprised when every other format I attempted to create was greeted by CP/M with the response MISSING. This is shorthand for: "I have searched through my internal tables, oh master, and cannot find an entry that matches this format". Clearly another gem from the Commodore School of Technical Authorship. The disk manual seems to be accurate, but gives no details on the actual formats supported. They are given in the CP/M sections of the main manual, but this does not tell you how the sectors are numbered, which you need to identify.

There is one place where you can find this information and you will only have it if you have bought the CP/M utilities and documentation pack. This package also contains a disk of CP/M sources and at the end of the BIOS file CXDISK. ASM you will find Disk Parameter Block (DPB) Table. The DPB Table holds preset information for a range of different file formats, but is modifiable by the user.

After the DPB entries for the Commodore formats and the MFM formats there are a number of blank entries and two unimplemented ones used on Morrow machines. This means it is possible to insert new entries without having to discard any of the existing ones. The easiest way to modify this file is to use a word-processor, otherwise you will have to struggle with the infamous ED editor.

The DPB table is unique to Commodore, a most CP/M machines have only a single DPB. This is required by the operating system in order to convert from the logical structure of the disk used in the BDOS section and the physical structure of tracks and sectors on the disk. Logically, CP/M considers a disk to contain a number of 128 byte records, which are organised into blocks of between 1k and l6k bytes in length. For the C128 the block size is 1k for single-sided disks and 2k for double-sided disks.

By Paul Schofield

This is an important parameter as it defines the minimum size of a CP/M disk file, regardless of how little data it may contain.

The parameters in the DPB are used to calculate the numbers of the sectors on a particular track that correspond to a logical block. For formatting purposes the only parameters of interest are the sector size, the number of sectors per track and the number allocated to the first sector on a track. The other parameters concern the order in which the disk drive writes sectors on the disk. These parameters can be specified in the format command, but they should not be required.

The demonstration program show in Listing 1 will create two of the most useful formats. The KAYPRO II format packs more data than normal on a disk and the IBM-8 formats are very widely used. Using the table of parameters for other formats provided in Table 1, it would of course be possible to extend the program to allow the creation of all the supported formats. However, unless you are planning to provide a CP/M disk copying service, it is probably better to limit the formats you are using.

Further reading

As mentioned earlier, here are a couple of book recommendations for readers who would like to pursue these subjects further. A very good introduction to this subject is provided by *CP/M The Software Bus*. This is a programmer's companion written by Andrew Clarke, Mike Eaton and David Powys-Lybbe and published by Sigma Technical Press. This book scores high on readability and follows a sensible progression from the very basics through editors, assemblers and compilers to the operating system internals.

I have only two reservations in recommending this to C-128 users. The first is that the book concentrates on CP/M rather than CP/M Plus which is used on the 128. While the differences are fully covered but not in great detail. Secondly in my copy at least (several years old) the chapter on CP/M programming languages badly needs updating and does not even mention some of the best compilers available. In all other respects this book should suit all but the most dedicated hackers and is quite reasonably priced.

By contrast the 1570/71 disk drives are still too new to have had many books written about them yet. I know of only 3, which are in fact editions of the same book in German, American and English. The English version is entitled *The Anatomy of the 1571 Disk Drive* and is published by First Publishing. If this book had appeared a little later (the German original has been available almost as long as the drives) it would probably have been excellent. As it is it is simply very good. The main weakness is that in places they have had to anticipate what information users would require and so have not included everything that Commodore forgot. All the disk housekeeping commands, file types, and special user commands are fully covered, although the inexperienced programmer would probably have appreciated more example programs.

This is not, however, a book aimed at the novice and over half of it is ROM listings. In this case the authors have done a really first class job of adding comments to these and they are genuinely useful. Despite this it is still difficult to follow some commands from reception to completion, which is hardly the fault of the authors, but is inherent in the byzantine structure of the ROMs. There is great potential for getting these C128 disk drives to perform better than intended and this is the type of book you need if you want to try.

MFM Formatting Parameters Table

No.	Format	Sides	Sct size (B5)	Sct/Trk (B7)	1st Sct (B3)
1	Epson QX10	2	1	16	129
2	Epson QX	2	2	10	129
3	IBM-8 SS	1	2	8	129
4	IBM-8 DS	2	2	8	129
5	KAYPRO IV	2	2	10	128
6	KAYPRO II	1	2	10	128
7	Osborne DD	2	3	5	129
8	Osborne SD	1	3	5	129
9	Epson Euro	2	1	16	129

Formats 10-16 are available for user definition.

PROGRAM: MFM FORMATTER

```
10 REM 1570 MFM DISK FORMATTER -
 BY PAUL SCHOFIELD
20 SCNCLR:CHAR 1,30,3,"MFM DISK
FORMATTER"
30 CHAR 1,30,4,"=== ==== =======
=="
40 CHAR 1,10,7,"1. KAYPRO II"
50 CHAR 1,10,9,"2. IBM-8 SS"
60 CHAR 1,10,11,"PLEASE ENTER RE
QUIRED FORMAT :    "
70 CHAR 1,41,11,"":INPUT F:IF F>
2 OR F<1 THEN 60
80 CHAR 1,10,14,"INSERT DISK AND
 ENTER DEVICE NUMBER (8-11) :
    "
90 CHAR 1,56,14,"":INPUTD:IFD<8
OR D>11 THEN 80
100 IF F=1 THEN B5=2:B7=10:B3=12
8
110 IF F=2 THEN B5=2:B7=8:B3=129
120 C$="UO"+CHR$(6)+CHR$(B3)+CHR
$(0)+CHR$(B5)+CHR$(39)+CHR$(B7)
130 CHAR 1,10,16,"":OPEN 1,D,15,
C$:PRINT#1,"UO"+CHR$(4):GET#1,A$
:CLOSE1
140 SB=ASC(A$)-48:IF DS>1 OR SB<
>0 THEN PRINT "FORMAT ERROR - ";
DS$;"     STATUS = ";SB;:END
150 PRINT "ANOTHER DISK (Y/N) :
";
160 INPUT Y$:IF Y$="Y" OR Y$="(s
 Y)" THEN CHAR 1,10,16,"
                    ":GOTO 130:EL
SE SCNCLR
170 REM FOR 1571 DOUBLE SIDED FO
RMATS CHANGE CHR$(6) TO CHR$(38)
 IN LINE 110
```

Print Master

Having problems designing sprites, characters and screens? Use this program to print grids to help you.

If you are designing a game, a business program or a utility you will no doubt at some time be required to design a screen, sprites and even user defined characters. Print Master will help you with your designs by printing out on an MPS 801 or compatible printer a range of four grids. The grids are as follows:

1) A Character Designer Grid (row of three);
2) Sprite Designer Grid;
3) Small Screen Grid and
4) Large Screen Matrix.

Getting it in

The program is presented as a Basic listing. You should use the *SYNTAX CHECKER* program found on the *LISTINGS* page of this magazine to check each of your lines as you enter the program. Read the *LISTINGS* page for more information on how to do this.

When RUN the program will prompt you for the type of grid that you require and the number of copies of the GRID that you require.

After you have been using the grids for a while they will no doubt become an invaluble aid to your programming. Why not photocopy a number of grids to save wear on your printer ribbon.

PROGRAM: PRINTMASTER

```
97  50 M$=CHR$(147):N$=CHR$(19)
07  55 O$="{DOWN15}":P$="{RIGHT1
    0}"
D6  60 AA$=CHR$(15):ZZ$=CHR$(8)
A3  100 PRINTM$;"{C7}":POKE53280
    ,11:POKE53281,0:POKE650,128:
49  130 PRINTTAB(13)"{CA,S*12,CS
    }"
C4  135 PRINTTAB(13)"{S-,RVSON}
    {SP}RINT {SM}ENU {RVSOFF,S-}
    "
F5  140 PRINTTAB(13)"{CZ,S*12,CX
    }"
2C  145 PRINTCHR$(14)N$;LEFT$(O$
    ,5);LEFT$(P$,2);
16  150 PRINT"{C6}1) {SC}HARACTE
    R {SM}ATRIX"
62  155 PRINT"{DOWN,RIGHT2}2) {S
    S}PRITE {SM}ATRIX"
42  160 PRINT"{DOWN,RIGHT2}3) {S
    S}MALL {SS}CREEN {SM}ATRIX"
58  165 PRINT"{DOWN,RIGHT2}4) {S
    L}ARGE {SS}CREEN {SM}ATRIX"
8B  167 PRINT"{DOWN,RIGHT2}5) {S
    E}XIT"
8A  170 PRINTN$;LEFT$(O$,15);LEF
    T$(P$,5);
53  175 INPUT"{SW}HICH";W
65  180 IFW=5THENPRINTM$CHR$(142
    ):END
75  185 IFW<1ORW>4THEN50
F3  190 FORT=1TO500:NEXT
2A  195 ONWGOSUB1000,2000,3000,4
    000
46  200 GOTO50
27  997 REM**********************
    **********
15  998 REM CHARACTER MATRIX DES
    IGNER      *
65  999 REM**********************
    **********
46  1000 PRINTM$;LEFT$(O$,5)LEFT
    $(P$,3);
18  1010 PRINT"{ST}HIS ROUTINE W
    ILL PRINT OUT COPIES"
FE  1015 PRINT"{RIGHT3}OF A CHAR
    ACTER MATRIX IN ROWS OF 3"
4B  1030 PRINT"{DOWN2,RIGHT3,SY}
    OU SELECT HOW MANY ROWS TO P
    RINT"
BD  1035 PRINT"{RIGHT3}BUT WHATE
    VER YOU CHOOSE WILL BE"
63  1040 PRINT"{RIGHT3}MULTIPLIE
    D BY 3"
66  1050 PRINT"{DOWN2,RIGHT3}";:
    INPUT"{SN}UMBER OF ROWS";NR
8C  1055 IFNR<1THEN1000
66  1060 PRINT"{DOWN2,RIGHT3,ST}
    HIS WILL GIVE YOU"NR*3"MATRI
    XES"
40  1070 PRINT"{DOWN2,RIGHT3}";:
    INPUT"{SD}O YOU WISH TO CHAN
    GE THIS  Y{LEFT3}";Y$
57  1080 IFY$="Y"ORY$<>"Y"ANDY$<
    >"N"THEN1000
9D  1150 FORC=1TONR
9F  1160 OPEN4,4
68  1169 REM**(SHIFT + O SHIFT +
    P)*8
C9  1170 A$="{SO,SP,SO,SP,SO,SP,
    SO,SP,SO,SP,SO,SP,SO,SP,SO,S
    P}"
AD  1171 :
49  1174 REM**(SHIFT + L SHIFT +
    @)*8 (LOGO + @)*4
03  1175 B$="{SL,S@,SL,S@,SL,S@,
    SL,S@,SL,S@,SL,S@,SL,S@,SL,S
    @} {C@4}"
E4  1180 C$="1{SPC23}"
FD  1185 D$="2 6 3 1{SPC17}"
7E  1190 E$="8 4 2 6 8 4 2 1  DA
    TA{SPC3}"
F0  1200 PRINT#4,AA$
66  1205 PRINT#4,C$C$C$
2E  1210 PRINT#4,D$D$D$
5E  1215 PRINT#4,E$E$E$
34  1220 FORL=1TO8
E2  1225 PRINT#4,AA$A$"{SPC8}"A$
    "{SPC8}"A$ZZ$
FC  1230 PRINT#4,AA$B$"{SPC3}"B$
    "{SPC3}"B$ZZ$
A1  1235 NEXTL
FD  1240 PRINT#4,AA$:CLOSE4:NEXT
    C:RETURN
31  1997 REM**********************
    **********
49  1998 REM SPRITE MATRIX DESIG
    NER        *
73  1999 REM**********************
    **********
55  2000 PRINTM$;LEFT$(O$,5)LEFT
    $(P$,2);"{ST}HIS ROUTINE WIL
    L PRINT OUT A COPY OR"
EF  2005 PRINT"{RIGHT2}COPIES OF
     A SPRITE MATRIX DESIGNER"
AB  2010 PRINTN$;LEFT$(O$,15)LEF
    T$(P$,2);
3C  2015 INPUT"{SH}OW MANY COPIE
    S ";NR
C7  2020 IFNR=0THEN2000
B2  2030 FORC=1TONR
```

By G Thorpe

```
19  2050 OPEN4,4
FC  2060 C$="1[SPC14]"
EA  2070 D$="2 6 3 1[SPC8]"
44  2080 E$="8 4 2 6 8 4 2 1"
94  2089 REM**(SHIFT + O SHIFT + P)*8
E5  2090 A$="[SO,SP,SO,SP,SO,SP,SO,SP,SO,SP,SO,SP,SO,SP,SO,S P]"
4F  2099 REM**(SHIFT + L SHIFT + @)*8
20  2100 B$="[SL,S@,SL,S@,SL,S@,SL,S@,SL,S@,SL,S@,SL,S@,SL,S @]"
7B  2110 G$="[C@4] [C@4] [C@4]"
3B  2120 PRINT#4,C$" "C$" "C$
86  2130 PRINT#4,D$"[SSPC]"D$" "D$
CF  2140 PRINT#4,E$"[SSPC]"E$"[S SPC]"E$" DATA"
61  2150 FORL=1TO21
09  2160 PRINT#4,AA$A$A$A$ZZ$
BB  2170 PRINT#4,AA$B$B$B$" "G$Z Z$
1B  2180 NEXTL:PRINT#4,AA$:CLOSE 4:NEXTC
18  2190 RETURN
94  2300 STOP
25  2997 REM********************** **********
64  2998 REM SMALL SCREEN MATRIX *
67  2999 REM********************** **********
61  3000 PRINTM$;LEFT$(O$,5)LEFT $(P$,2);"[ST]HIS ROUTINE WIL L PRINT OUT A COPY OR"
3A  3005 PRINT"[RIGHT2]COPIES OF A SMALL SCREEN MATIX"
7F  3010 PRINTN$;LEFT$(O$,15)LEF T$(P$,2);
A8  3015 INPUT"[SH]OW MANY COPIE S ";NR
C2  3020 IFNR=0THEN3000
66  3030 FORC=1TONR
E6  3050 OPEN4,4
2A  3069 REM**(LOGO + A)*1 (LOGO + R)*21
C0  3070 A$="[CA,CR21]"
30  3071 :
6A  3074 REM**(LOGO + R)*18 (LOG O + S)*1
A9  3075 B$="[CR18,CS]"
2A  3076 :
B9  3079 REM**(LOGO + Q)*1 (SHIF T AND +)*21
39  3080 C$="[CQ,S+21]"
2F  3081 :
B8  3084 REM**(SHIFT AND +)*18 ( LOGO + W)*1
1C  3085 D$="[S+18,CW]"
20  3086 :
DD  3089 REM**(LOGO + Z)*1 (LOGO + E)*21
D1  3090 E$="[CZ,CE21]"
25  3091 :
D0  3094 REM**(LOGO + E)*18 (LOG O + X)*1
42  3095 F$="[CE18,CX]"
1E  3096 :
DC  3100 PRINT#4,AA$A$;B$ZZ$
FE  3110 FORL=1TO24:PRINT#4,AA$C $;D$ZZ$:NEXTL
C8  3120 PRINT#4,AA$E$:F$ZZ$
95  3130 CLOSE4:NEXTC:RETURN
C9  3997 REM********************** **********
B6  3998 REM LARGE SCREEN MATRIX *
0B  3999 REM********************** **********
8D  4000 PRINTM$;LEFT$(O$,5)LEFT $(P$,2);"[ST]HIS ROUTINE WIL L PRINT OUT A COPY OR"
DC  4005 PRINT"[RIGHT2]COPIES OF A LARGE SCREEN MATIX"
73  4010 PRINTN$;LEFT$(O$,15)LEF T$(P$,2);
F4  4015 INPUT"[SH]OW MANY COPIE S ";NR
69  4020 IFNR=0THEN4000
4A  4030 FORC=1TONR
D2  4050 OPEN4,4
CB  4069 REM**(SHIFT + O SHIFT + P)*8
2E  4070 A$="[SO,SP,SO,SP,SO,SP, SO,SP,SO,SP,SO,SP,SO,SP,SO,S P]"
60  4079 REM**(SHIFT + L SHIFT + @)*8
67  4080 B$="[SL,S@,SL,S@,SL,S@, SL,S@,SL,S@,SL,S@,SL,S@,SL,S @]"
50  4090 FORL=1TO25
1D  4100 PRINT#4,AA$A$A$A$A$ZZ $
74  4110 PRINT#4,AA$B$B$B$B$B$ZZ $
C3  4120 NEXTL:PRINT#4,AA$:PRINT #4:PRINT#4:CLOSE4:NEXTC:RETU RN
```

Continued from page 42

70 First line of program when recalled later.

On cassette the files would have to be in the order:

1: PROG 1
2: SWAPPER 64 (machine code not Basic loader.)
3: PROG2

On disk the order does not matter.

When the store part instruction is used, the bottom of Basic is raised to the address of the beginning line number, This will cause no problems if used in program mode, but in direct mode it may be noticed. In such cases it is advisable to SAVE the program, reset the computer, and re–LOAD the program.This procedure is not required if the beginning line number was the first line of the program. It is advised that you only use this command in program mode.

Extremely fast

Here is a short Basic program which will demonstrate the speed of *SWAPPER 64*.Type:

```
NEW
10 PRINT "HELLO"
20 SYS 49152,4,1
SYS 49152,2
RUN
```

The program scrolls 'HELLO' up the screen. What is happening is that line 10 is executed thus printing 'HELLO'. Then the program is swapped for that in storage which auto–RUNs. Since this is the same program, the above process is repeated.

Getting it all in

The program is presented here in the form of a Basic loader. Type the program in using the *SYNTAX CHECKER* program that can be found on the *LISTINGS* page.

SAVE the program before you RUN it. On RUNning you will be informed of any errors that you may have missed. When the program has been RUN successfully, type:

```
POKE43,0:POKE44,192:POKE45,35:
POKE46,195
SAVE "SWAPPER",1 (or ,8 for disk).
```

This SAVEs a working copy of the machine code.
When the program is to be used, simply type the following command:

```
LOAD "SWAPPER",1,1 for tape or,
LOAD "SWAPPER",8,1 for disk.
```

If loaded directly (ie. as above) rather than from within a program then you must type NEW or CLR to reset the pointers after LOADing *SWAPPER*.

For those interested the machine code for *SWAPPER* is located between memory locations 49152 ($C000) and 49991 ($C347).

Program Lock

Are you keen to keep prying eyes off your beautiful Basic coding? This utility will help you to keep a few secrets.

By David Derrick

Here is a program to make it very difficult for prying eyes to look at your Basic programs without your permission. PROG–LOCK is a 'skeleton' program which sits below your own program, so that when the program is loaded and listed, the result will be the message '10 SYS2076' which is far from informative.

To see the Basic program, you must RUN the program, which will then ask you for a password, which if entered correctly will allow you to run or list the Basic program. If you don't give the correct password, the machine resets itself!

Getting Going

Type in the program and SAVE it as LOCK LOAD **before** RUNning it. If all the data is correct, PROG–LOCK is SAVEd to tape or disk, as you require.

Now to keep out the nosey–parkers.

Turn the computer on and off, then LOAD PROG–LOCK back in. Type:

```
POKE43,124
```

followed by RETURN.

Now LOAD in the BASIC program you want to protect, and type:

```
POKE43,1
```

followed by RETURN.

The default password is set as ELEPHANT, but you change it by typing:

```
SYS2150
```

followed by RETURN, and you can then type is a new password of up to 20 characters (counting RETURN at the end as one character).

That's it! The program is now protected, and just needs to be SAVEd.

Note that PROG–LOCK doesn't copy–protect your program, and would be rapidly defeated by an experienced hacker, but it will make the casual program thief think twice, not to mention the *cachet* it will give to your programs!

```
PROGRAM: PROG LOCK

8B   10 X=16385:T=0:N=0
39   20 READA:IFA=-1THEN40
88   30 POKEX,A:T=T+A:N=N+1:X=X+1
     :GOTO20
ED   40 IFT<>10932THENPRINT"DATA
     VALUE ERROR":END
0F   50 IFN<>125THENPRINT"DATA AM
     OUNT ERROR":END
52   60 PRINT"(T)APE OF (D)ISK ?"
C7   70 GETD$:IFD$<>"T"ANDD$<>"D"
     THEN70
39   80 POKE251,1:IFD$="D"THENPOK
     E251,8
5C   90 POKE43,1:POKE44,64:POKE45
     ,127:POKE46,64:SAVE"PROG-LOC
     K",PEEK(251)
1D   1000 DATA 11,8,10,0,158,50,4
     8,55,54,0
FB   1010 DATA 0,0,147,8,14,32,20
     8,65,83,83
A6   1020 DATA 87,79,82,68,32,63,
     0,169,13,160
12   1030 DATA 8,32,30,171,160,0,
     32,207,255,153
3F   1040 DATA 64,3,200,201,13,20
     8,245,169,0,153
A7   1050 DATA 64,3,160,0,185,64,
     3,240,12,217
A6   1060 DATA 81,8,240,3,76,226,
     252,200,76,55
90   1070 DATA 8,169,124,133,43,1
     69,8,133,44,96
81   1080 DATA 69,76,69,80,72,65,
     78,84,13,0
3D   1090 DATA 153,34,72,69,76,76
     ,79,34,0,108
BE   1100 DATA 0,169,13,160,8,32,
     30,171,160,0
72   1110 DATA 32,207,255,153,81,
     8,200,201,13,208
95   1120 DATA 245,96,0,0,0,-1
```

Want to use the programmes in this publication?

Typing in long programs can be a pretty daunting task. Once you've entered the program there will no doubt be typing errors that need to be corrected. Why not save yourself time and trouble by buying a disk or cassette of the programme from this publication. All of the programmes that are presented here are on the cassette or disk at a bargain price of £6.00 for disk or £4.00 for cassette.

The disk and cassette are only available mail order from the address on the order form. A cheque payable to ASP Ltd for the correct amount should be included with the order. Overseas customers should add £1.00 for postage.

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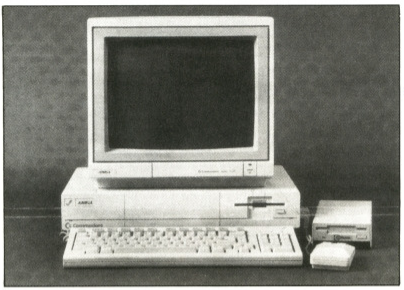

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FREEZE FRAME (LAZER)	25 SECS	TWO	YES
EXPERT SYSTEM	30 SECS	THREE	NO

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