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**CREATE-A-BASE** is a data base file management system that enables the user to choose the number of fields needed in a file, and add or delete fields without disturbing any of the existing data. Once a file is created you can perform any of 30 functions. Such as:

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## 1-303-221-1955



User Manual) must be corrected. The easiest way to do this is to type any line number *not* in the program and return. Two, record the length of the program by PEEKing at locations 124 and 125 after an *ordinary* tape load. In my example program 1 showed 4 and 74 respectively. Since I intended to relocate the program to a partition beginning at hex 800, it was necessary to use the values 8 and 74 in line 210 in the master program.

The partition idea described above should be applicable, with only minor changes, to any micro-computer using Microsoft BASIC. In fact I used a partition for the first time on my SYM to store an initialization program which was used infrequently. In this case the partitions were of unequal length, 4K and 8K. Readers might be interested in storing their short BASIC utility programs in an out of the way partition and activate the programs when necessary as I did with the SYM initialization program. Maybe others could share their ideas on the subject with me care of this magazine. We could publish the best ones in a future article. (Anyone for time sharing?)

### Important PET Pointers (Low/High Bytes)

	1107 Old ROM	Upgrade ROM
Start of Text	122/123	40/41
End of Text	124/125	42/43
Top of Memory	134/135	52/53

```

10 REM MEMORY PARTITION-MASTER PROGRAM
20 REM EXAMPLE:
30 REM THREE PROGRAM WORKSPACES
35 REM CREATED AT:
40 REM HEX 0800-0FFF PROGRAM 1
50 REM HEX 1000-17FF PROGRAM 2
60 REM HEX 1800-1FFF PROGRAM 3
65 POKE 123,04:POKE 122,01
66 POKE 125,06:POKE 124,57:CLR
67 POKE 2048,0:POKE 4096,0:POKE 6144,0
70 :
80 REM HARVEY B. HERMAN
90 :
95 PRINT "WHICH PROGRAM DO YOU WANT";
100 INPUT "(1-3)";N
110 ON N GOTO 200,300,400
200 POKE 123,08:POKE 122,01
205 POKE 135,24:POKE 134,0
210 POKE 125,08:POKE 124,74:CLR:END
300 POKE 123,16:POKE 122,01
305 POKE 135,24:POKE 134,0
310 POKE 125,16:POKE 124,74:CLR:END
400 POKE 123,24:POKE 122,01
405 POKE 135,32:POKE 134,0
410 POKE 125,24:POKE 124,74:CLR:END

```

```

10 REM PROGRAM 1
20 A=1
30 PRINT A
40 POKE 123,4
45 POKE 124,57
50 POKE 125,06
55 POKE 135,8
60 CLR:END

10 REM PROGRAM 2
20 B=2
30 PRINT B
40 POKE 123,4
45 POKE 124,57
50 POKE 125,06
55 POKE 135,8
60 CLR:END

10 REM PROGRAM 3
20 C=3
30 PRINT C
40 POKE 123,4
45 POKE 124,57
50 POKE 125,06
55 POKE 135,8
60 CLR:END

```

©

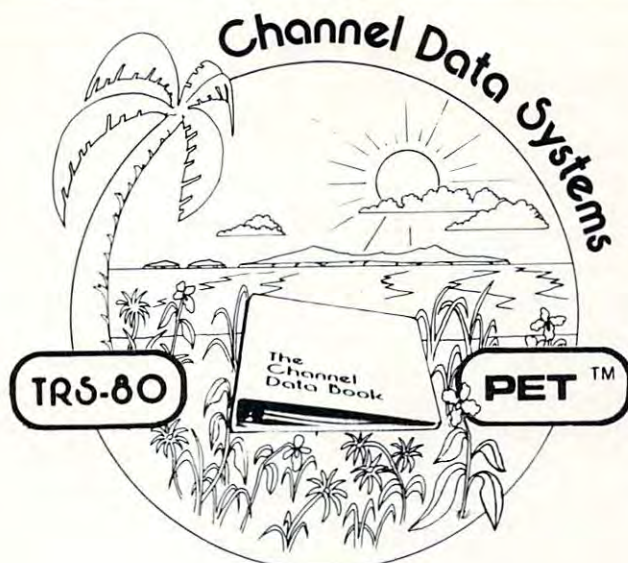
# Machine Language Code For Appending Disk Files

Robert H. Wollenberg  
Department of Chemistry  
Stanford University

The attached machine language routine provides a very useful tool for those who have been frustrated (as I have) at the inability of the current disk operating system (DOS) of the Commodore 2040 Dual Drive Disk to append programs. Although firmware recently introduced by Palo Alto IC's (The Programmer's Toolkit) provides some relief to those who require a convenient appending procedure, it suffers a serious drawback. The system operates only by appending a tape file to a program already in memory. Thus, it becomes necessary to first save program pieces to tape and then reload these in proper sequence using the append command. Since I was reluctant to use this slow tape file procedure, I searched for alternatives involving disk files.

A little investigation of the DOS command, Copy, reveals that this instruction goes a long way toward solving the problem. Basic is stored in memory starting at location \$0401. The first two bytes are forward



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**Omnifile** is a versatile, in-memory database program with sorting, formatting, and computational features. Records can be entered, edited, and processed with a single letter command. **Omnifile** applications include inventory records, mailing lists, sales journals and collection lists. Records can be stored on the Commodore floppy disks or on the tape cassette. **Omnifile** uses approximately 6k of RAM memory. Up to 500 records can be contained in memory in a 32k CBM at any time. Multiple files are easily accessed from disk or tape. Items can be sorted, moved, inserted and reformatted. Calculations can be made and totals can be printed. The **Omnifile** package includes the program with sample data, listing and manual, and will operate on the large keyboard Commodore PET or CBM computers with at least 16k memory. Also available on diskette for \$36. An abbreviated version, **Data Logger**, requiring only 1k of RAM is available on cassette for \$15.

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Inspired by the computerized fantasy simulation "Adventure," **Explore** is a conversational program which operates on the Commodore PET with only 8k bytes of memory. **Explore** contains four adventures in which you operate a computerized tank, hunt treasure in a magic cave, explore the mall in Washington D.C., and survive in a haunted castle. **Explore** package includes introduction, five data files, and complete manual. Available from Channel Data Systems on cassette for \$15. Indication of old or new ROMs is requested.

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CBM

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pointers to the next line of code (stored by the usual 6502 convention of low byte/high byte). Locations \$0403 and \$0404 store the line number for this first line of basic. The ASCII Code for this line is stored beginning at location \$0405 and ends with the delimiter zero. The next byte begins the second line of basic and is stored at the location pointed to by the forward pointers at locations \$0401 - \$0402 described above. By following the forward pointers from line to line, one eventually reaches the end of the basic code. This event is signaled when the forward pointers are zero.

When the DOS Copy command concatenates two disk files, the zero page values indicate that both programs were combined; however, listing the concatenated program reveals only the first program. The second program for all purposes remains invisible to the basic interpreter. This is because the forward pointers of the first program eventually point to the two delimiters, zero, and at this point the end of basic is signaled. The next two bytes are pointers to the start of basic text for the second program as originally saved to disk. If the first line of the second program is moved forward in memory by four bytes, then the last line of the first program will point to the first line of the second program and the linking process will be nearly complete. In order to finish the linking procedure, the forward pointers of the second program must be

disk Copy command to concatenate up to four program pieces. For example, to append parts A, B and C to form program D, the following command is executed (after loading the DOS support):

►C0:D = 1:A,1:B,1:C

Next load the machine code and the concatenated program D into memory and type:

**SYS826**

The programs are linked and the message: "READY." appears.

For comparison, I have written a basic program to link concatenated programs. In this case the linking program must be the first program concatenated. Once concatenated, the new program is loaded into memory and then linked by typing:

**RUN**

The linking program is then deleted, leaving only the desired appended program. Comparison of these two procedures revealed that the machine language code ran nearly a thousand times faster than the basic code. ©

## Multitasking On Your PET?

# QUADRA-PET

Charles Brannon  
Greensboro, NC

QUADRA-PET is a machine language program that lets you partition the memory of an upgrade ROM PET or CBM into four 8K blocks. Each block is an independent program workspace. Programs existing in each 8K partition can be selected and then used and modified without affecting any of the other programs. You can jump to any other of the programs at any time.

After initialization with SYS 926, PET displays the question:

**WHICH PET? [1-4]**

Perhaps Mary, an avid computer-games buff, types in "1" and loads STARTREK. She plays it for a while and then leaves to eat lunch. Meanwhile, Bob goes to the PET, sees that someone is using PET #1, and switches to PET #2 to write a business program. After nearly "perfecting" it, he leaves to see what Mary is up to. Now the kids come in, and after arguing for a half-hour agree to share the PET, one using PET #3 and the other PET #4. Fortunately for Bob and Mary, nothing the kids do can harm their programs.

**How To Use QUADRA-PET**

1. Load or type in one of the versions of QUADRA-

```
0015 0000          * = $033A
0017 033A A9 FF      START LDA #FF          ;SETUP TO FIND PROGRAM DELIMITER
0018 033C 85 11      STA #11
0019 033E 85 12      STA #12
0020 0340 20 20 C5    JSR #C52C          ;FROM FIND LINE # ROUTINE
0021 0343 20 6C 03    JSR ENDBAS        ;CHECK FOR END OF BASIC
0022 0346 F0 21      BEQ DONE          ;YES, EXIT AND PRINT READY
0023 0348 A5 5C      LDA #5C          ;CURRENT LINE
0024 034A D0 02      BNE SKIP
0025 034C 06 5D      DEC #5D          ;MOVE BACK ONE BYTE
0026 034E 06 5C      SKIP
0027 0350 A9 00      LDA #00
0028 0352 00 04      LDY #04          ;SETUP FOR 4 LOOPS
0029 0354 91 5C      STA (#5C),Y      ;STORE NEW PROGRAM DELIMITER
0030 0356 A9 20      LDA #20          ;LOAD ASCII BLANK
0031 0358 88          DEY
0032 0359 91 5C      STA (#5C),Y      ;STORE BLANKS
0033 035B 88          DEY
0034 035C 10 FB      BPL AGAIN
0035 035E 20 72 C5    JSR #C572          ;FROM CLR# ROUTINE
0036 0361 20 42 C4    JSR #C442          ;FROM FIX CHAINING ROUTINE
0037 0364 20 6C 03    JSR ENDBAS        ;CHECK FOR END OF BASIC
0038 0367 D0 D1      BNE START        ;DO NEXT PROGRAM IF MORE
0039 0369 4C 58 C3    JNE #C38B        ;EXIT TO BASIC
0040 036C 38          ENDBAS          ;CHECK FOR END OF BASIC ROUTINE
0041 036D A5 2A      LDA #2A          ;TOP OF VARIABLES
0042 036F E5 5C      SEC #5C          ;CURRENT LOCATION
0043 0371 C9 02      CMP #02          ;DIFFERENCE = 2 IF END
0044 0373 D0 04      BNE NOTEND        ;RETURN IF NOT DONE
0045 0375 A5 28      LDA #28          ;CHECK HIGH ADDRESS
0046 0377 C5 5D      CMP #5D
0047 0379 60          NOTEND RTS
```

```
0 REM ROBERT H WOLLENBERG
10 REM PROGRAM TO APPEND USING DISK CONCATENATE COMMAND
15 DEF FNA(X)=PEEK(X)+256*PEEK(X+1):DEF FNB(X)=FNA(X)-X
20 I=FNA(40):E=FNA(42):X=FNB(1)
25 IF I=X-2 THEN PRINT"END OF MEMORY-NO LINK":END
30 I=I+X:IF FNA(I)<0 THEN X=FNB(I):GOTO 25
35 FOR J=1 TO I+3:POKEJ,PEEK(J+4):NEXT
40 FORJ=I+4 TO I+7:POKEJ,32:NEXT:Y=I-1025+4:REM OFFSET
45 X=FNB(I)+Y:POKEI+1,INT((I+X)/256):POKEI,I+X-256*INT((I+X)/256)
50 I=I+X:IF FNA(I)<0 AND ICE-2 THEN 45
55 IF FNA(I)=0 AND ICE-2 THEN 35
60 PRINT"LINK-COMplete":END
READY.
```

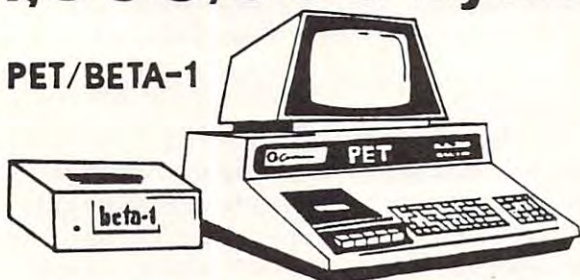
recalculated to compensate for the relocation of code. This is done conveniently using the ROM chaining routine at \$C442.

To use the attached machine code, first use the



# 1,000,000 Bytes

## PET/BETA-1



If your data and program handling requirements are minimal, a mini-disk may be for you. If you want to access large amounts of data, program libraries, flexible user-defined data formatting, and easy to understand documentation, CONSIDER the PET/BETA-1.

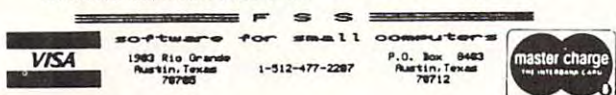
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PET. (Basic or hex)

2. Enter **NEW**

3. **SYS 926** to initialize.

4. PET will respond with **WHICH PET? (1-4)**

5. Select the one you wish to use.

6. Before loading or typing in a program for the first time, type in **NEW**.

7. To select another PET, **SYS 826** and follow instructions 4-7.

Now comes the fun part -- how does it work? Many memory locations in zero-page (0-256) are *pointers* QUADRA-PET works with three of those pointers.

On power-up, PET determines the end of memory by writing a character to every memory location and then reading it back. PET then increments a memory location until a failure in reading that character occurs. This indicates that the end of available memory has been reached. Physically, this pointer is at location 52 decimal. (\$34). The second pointer is at the start of memory, stored in location 41. Originally, this points to the actual start of user memory, 1024. The last pointer is the end of text pointer. As you write your program it changes.

QUADRA-PET partitions the memory by changing these pointers to point to successively higher memory locations, depending on which PET is in use. Since the end of text pointer changes, it must be saved before we move to a new PET and restored on return. QUADRA-PET, as it is in machine language, does all these things seemingly instantaneously.

#### HOW TO SAVE A PROGRAM PRODUCED WITH QUADRA-PET:

1. **SYS 1024** to go to the Monitor.
2. Enter: **.M 0028 002B** and type **RETURN**.
3. You will get a display something like:  
.: 0028 01 04 3E 04 .. .. .
4. We will use only the first four bytes. Write down the first pair in reverse order on paper, for example: 0401  
Do the same with the second pair. (e.g. 043E)
5. Enter: **.S "PROG NAME",01,XXXX,YYYY**  
where "PROG NAME" is the name of your program, XXXX is the first number you wrote down, and YYYY is the second. For example, to save the example program which we will call "PET #1, you would enter: **.S "PET #1", 01,0401,043E**
6. Press **RETURN** and press play and record to save your program.
7. To load *this* saved program into a space prepared by QUADRA-PET, just **SYS 1024** and enter **.L "PROG NAME"** where "PROG NAME" is the name of your program.

#### HOW TO LOAD A PRE-EXISTING PROGRAM INTO A SPACE PREPARED BY QUADRA-PET:

I could tell you how to do this on the old ROM PET but quite frankly, I can't find the memory locations for this procedure in the new PET. All you PET experts -- **HELP!**

If you can figure it out, please send in the procedure to **COMPUTE**.

exist simultaneously in PET's memory, ready to use. For the small penalty of loading the programs into the program workspaces at the start of the day, all four are within reach of a carriage return -- faster than any disk drive.

Machine language programmers can fill partitions with useful routines, leaving one or more partitions for BASIC. QUADRA-PET itself is short and easily relocatable.

I would be interested to find out what novel and useful applications for QUADRA-PET *you* can think up!

Happy QUADRA-PETing!

#### References

CBM User Manual 2001-32, First Edition. Commodore Business Machines, Inc., Palo Alto, CA (1979)

Havery B. Herman, "Memory Partition of BASIC Workspace", **COMPUTE**, pp. 18-20 (Jan., Feb. 1980)

Jim Butterfield, "PET in Transition (memory map) **COMPUTE**, pp. 68-70 (Fall, 1979)

```

0 REM*****
1 REM          QUADRA PET
2 REM*****
3 REM:BY CHARLES BRANNON 06/07/80
10 FOR I = 826 TO 941
20 READ A
30 POKE I, A
40 NEXT
50 SYS926
60 END
1000 DATA174,126,3,165,42,157,131,3,165
1010 DATA43,157,135,3,169,143,160,3,32
1020 DATA28,202,32,228,255,41,15,240,249
1030 DATA201,5,176,245,170,202,142,126,3
1040 DATA169,1,133,40,189,127,3,133,41
1050 DATA189,131,3,133,42,189,135,3,133
1060 DATA43,169,0,133,52,189,139,3,133
1070 DATA53,32,119,197,96,0,4,32,64
1080 DATA96,3,3,3,4,2,64,96
1090 DATA32,64,96,128,87,72,73,67,72
1100 DATA32,80,69,84,63,32,40,49,45
1110 DATA52,41,0,169,0,141,0,32,141
1120 DATA0,64,141,0,96,76,58,3
READY.
  
```

©

A little imagination will create many uses for QUADRA-PET.

For education, it is the perfect way to keep four students' programs in the PET at the same time. Each program can be worked on and modified in any way without affecting any other of the programs.

In business, four different business programs can



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# PET/CBM Disk Formats

Robert W. Baker  
Atco, NJ

Commodore is now including a new manual with all 5 1/4" floppy disk systems that are currently being shipped. If you have an older disk, whether or not you've upgraded the disk ROMs, you might be interested in trying to get a copy of the new manual listed as Commodore part number 320899. The manual covers the 2040, 3040, 4040, and 8050 drives in great detail. It includes general information on each, along with instructions for using the various programs included on the TEST/DEMO diskette supplied with the drive. The manual also discusses DOS support and the various DOS commands (both new and old). For more advanced programmers, there are sections on using random access files and the special disk utility commands. There's also a chart showing the corresponding disk commands for BASIC 3.0, the DOS Wedge, and for BASIC 4.0. This also provides a handy, quick reference that you might want to make a copy of and keep close by.

Of particular interest, are several tables and charts near the back of the book that describe the format of the disk header, BAM, directory, and disk files. They're provided for all three known formats of the Commodore disks. I thought it might be helpful to present some of the information here in a somewhat condensed form.

Remember that you can read the BAM, header, and directory blocks as a single sequential data file opened with a filename of \$0 or \$1. To read the data contained in these blocks you must use the GET# command since there are no carriage return delimiters. Also, you will only see 254 bytes per block, since the first two bytes used for the track/sector links are not sent to the PET/CBM when reading a data file.

If you look at the header formats, you'll see that the first byte received will always be an unique value for each disk format type. It identifies the disk format that the disk was originally created with, not the current DOS revision being used. This can be used as a program flag telling how the remainder of the header and directory should be read.

If you open a program file as a data file, the first two bytes read will indicate the load address for the program in standard 6502 address format (low byte, high byte). The remainder of the file will then be the tokenized BASIC program just as normally stored in memory.

## 2040/3040 BAM & HEADER

Track 18, Sector 0

Byte	Contents	Definition
0-1	18,1	Track & sector of first directory block.
2	1	Indicates DOS 1 format
3	0	Null flag for future use
4-143	...	BAM - bit map of available blocks for tracks 1-35
144-161	...	Disk name padded with shifted spaces
162-163	...	Disk ID
164-170	160	Shifted spaces
171-255	0	Nulls, not used

## 4040 BAM & Header

Track 18, Sector 0

Byte	Contents	Definition
0-1	18,1	Track & sector of first directory block
2	65	ASCII "A" for 4040 format
3	0	Null flag for future use
4-143	...	BAM - bit map of available blocks for tracks 1-35
144-161	...	Disk name padded with shifted spaces
162-163	...	Disk ID
164	160	Shifted space
165-166	50,65	ASCII "2A" for DOS version & format type
166-170	160	Shifted spaces
171-255	0	Nulls, not used

Note: Some 2040, 3040, 4040 disks may have ASCII characters in locations 180-191.

## 8050 Directory Header

Track 39, Sector 0

Byte	Contents	Definition
0-1	38,0	Track & sector of first BAM block
2	67	ASCII "C" for 8050 format
3	0	null flag for future use
4-5	0	unused
6-21	...	Disk name padded with shifted spaces
22-23	160	Shifted spaces
24-25	...	Disk ID
26	160	Shifted space
27-28	50,67	ASCII "2C" for DOS version and format type
29-32	160	Shifted spaces
33-255	0	Nulls, not used

## 8050 BAM Format

First BAM Block = Track 38, Sector 0

Byte	Contents	Definition
0,1	38,3	Track & sector of second BAM block
2	67	ASCII "C" for 8050 format
3	0	Null flag for future use
4	1	Lowest track# in this BAM block
5	51	Highest track# + 1 in this BAM block
6	...	Number of unused blocks on track 1
7-10	...	Bit map of available blocks on track 1
11-255	...	BAM for tracks 2-50, 5 bytes each



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**Second BAM Block = Track 38, Sector 3**

Byte	Contents	Definition
0,1	39,1	Track & sector of first directory block
2	67	ASCII "C" for 8050 format
3	0	Null flag for future use
4	51	Lowest track# in this BAM block
5	78	Highest track# + 1 in this BAM block
6	...	Number of unused blocks on track 51
7-10	...	Bit map of available blocks on track 51
11-140	...	BAM for tracks 52-77, 5 bytes each
141-255	...	Unused

**Common Directory Format**

First block on 2040/3040/4040 = Track 18, Sector 1

First directory block on 8050 = Track 39, Sector 1

Byte	Definition
0-1	Track & sector of next directory block (last block has a track of 0)
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 Single Directory Entries**

Byte	Definition
0	File type flag OR'ed with \$80 Types: 0 = Deleted 1 = Sequential 2 = Program 3 = Relative
1-2	Track & sector of 1st data block
3-18	File name padded with shifted spaces
19-20	Track & sector of first side sector block for relative files only
21	Record size for relative files
22-25	Unused
26-27	Track & sector of replacement file when OPEN@ is in effect
28-29	Number of blocks in file (low byte, high byte)

**Standard File Formats**

Byte	Definition
0-1	Track & sector of next sequential block. The last block is indicated by a 0 followed by a value that indicates the length of the last partial block.
2-255	Sequential data files— 254 bytes of data with carriage returns as record separators. Program files— 254 bytes of program information stored in PET/CBM memory format. (key words stored as BASIC tokens) End of file is marked by three zero bytes just as in memory. The first two bytes of the first block indicate the load address of the program. Relative files— 254 bytes of data. Empty records contain \$FF (all binary ones) in the first byte followed by \$00 (binary zeroes) to the end of the record. Partially filled records are padded with nulls (\$00).

**Structure Of BAM Entries For Any Track**

Byte	Definition
0	number of available sectors for track
1	bit map sectors 0-7
2	bit map sectors 8-15
3	bit map sectors 16-23
4	bit map sectors 24-31 (only on 8050)
For the bit maps, 1 = available 0 = not available	

**Relative File Side Sector Blocks**

Byte	Definition
0-1	Track & sector of next side sector block
2	Side sector number (0-5)
3	Record length
4-5	Track & sector of 1st side sector (number 0)
6-7	Track & sector of 2nd side sector (number 1)
8-9	Track & sector of 3rd side sector (number 2)
10-11	Track & sector of 4th side sector (number 3)
12-13	Track & sector of 5th side sector (number 4)
14-15	Track & sector of 6th side sector (number 5)
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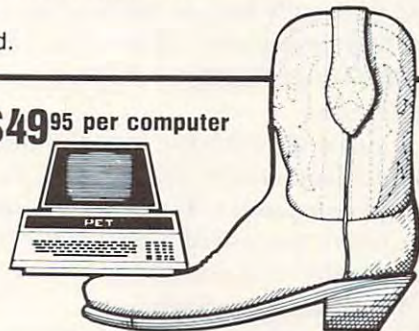
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# Interfacing With The User Of Your Pet Programs

Don Cassel

As programmers of microcomputers we seldom write programs that are intended solely for our own use. Rather the programs we develop are directed to a student audience, to business users or even for publication or sale to the general micro-computer public. It is therefore crucial that we develop the program in such a way that it interacts with the user at a suitable intellectual level and with an effectiveness that permits ease and simplicity of operation.

The intellectual level considers both the language and technical ability of the program's user and employs prompting and dialogue that is consistent with this level. Effectiveness of operation complements the intellectual by considering the methods which are used to communicate with the user. These methods may include queries, prompting, codes, menus, form filling and so on. Suitable choices by the program designer often determines a person's success in using the program and a willingness to use it again.

## User Level

When we develop a program it is usually intended for a specific audience. In general, we should assess the age, education, training, intelligence and motivation of the user. After a general evaluation of our audience it is useful to place the user in one of the following three categories.

### 1. Casual

This is a user who uses a micro infrequently and generally has no training in computers. All first time users fall into this category. So do many students and educators.

### 2. Trained

A trained user is a person who has been given formal (sometimes informal) training on the use of computers. This training might be limited to the use of a particular program or be as broad as a computer literacy course.

### 3. Programming Skills

This is the most sophisticated user. He or she will have done some programming and be familiar with programming terminology and language syntax.

In addition to these three categories a user may operate the program on two different levels. These are defined as an active or passive operator. An active operator is one who initiates program action by entering commands. This level is typical of games where the user enters values that control the direction and speed of a ball on the screen.

A passive operator is one who takes action based on the program's initiative. For instance, when a program asks for the user's name. Many programs will use both active and passive interaction.

## User Dialogues

### Prompting

In a sense any information that requires a user response represents prompting. However, our interest here is when the program displays a statement or question and then waits for the user to type a response. Prompting is appropriate for all levels of users but the language of the prompt should be directed to the specific user level. In any case courtesy should be used. A prompt such as

**PLEASE ENTER YOUR NAME?**

is infinitely better than a curt

**NAME?**

This kind of prompt is usually implemented as follows:

```
100 PRINT "PLEASE ENTER YOUR NAME";
110 INPUT N$
```

or more directly and efficiently as

```
100 INPUT "PLEASE ENTER YOUR NAME";N$
```

With this type of prompt you may get a variety of responses, such as:

```
JOHN
JOHN SMITH
SMITH
```

In some programs this doesn't matter but if it does make a difference the prompt should be more specific.

**PLEASE ENTER YOUR SURNAME?**

Some prompts may have simple alternatives such as YES or NO, TRUE or FALSE, ADD or SUBTRACT. In these situations the prompt should indicate which responses are expected.

```
100 INPUT "DO YOU WANT MULTIPLE CHOICE
(YES/NO)";A$
110 IF A$="YES" THEN 200
```

This prompt indicates clearly that a YES or NO answer is expected. Some programs also permit the user to respond with just the first letter of the response. This is done by extracting the first letter of A\$ using the LEFT\$ function and then testing for a "Y" or "N". Using this method single letter responses as well as the complete word are acceptable.

```
100 INPUT "WOULD YOU LIKE MULTIPLE
CHOICE
(YES/NO)";A$
110 IF LEFT$(A$,1)="Y" THEN 200
```



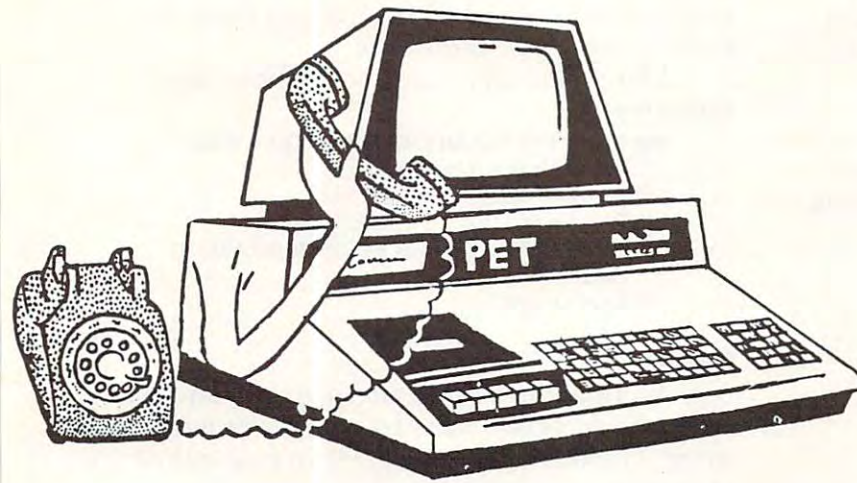
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Some prompts use data from previous operations in the program. An example of this is a program that generates drill and practice questions for addition. Prior to the prompt the program generates two values (A and B) which the student then adds mentally or on paper before entering the answer. This prompt might then use both the print and input statements.

```
100 PRINT "[clr dn dn dn dn dn]";
110 PRINT "WHAT IS THE SUM OF";A;"+"B;
120 INPUT S
```

Note the use of line 100 which clears the screen and moves the cursor down 5 lines before printing the prompt. This action avoids any distraction from previous questions that would otherwise remain on the screen.

A more creative solution to this problem might be to print the prompt in the form of a traditional addition question as follows:

```
100 PRINT "[clr dn dn dn dn dn]";
110 PRINT "[rt rt rt rt]";A
120 PRINT "[rt rt rt] + ";B
130 PRINT "[rt rt rt]_____" ( _ is a shift@)
140 INPUT "[rt rt rt]";S
```

If A is the value 10 and B is 15 this code displays the following:

```
10
15
_____
?
```

Although this solution is a lot more work the results are far superior to previous methods and uses the capability of the PET in implementing an effective solution.

### Default Responses

In many applications a choice is given to the user but the response can often be anticipated. A program which normally reads a file but has an option to create a file is an example of when a default would be useful. The prompt might be:

(READ) OR (CREATE) A FILE?

Here the user must type in either READ or CREATE as a response. Since we expect that READ is the most frequent response it may become the default. This is done by printing the default value with the prompt and then moving the cursor to the left past the default value.

```
100 INPUT "(READ) OR (CREATE) A FILE
      READ[lt lt lt lt lt lt]";A$
```

↑                      ↑  
2 blanks          6 cursor lefts

This is what the display shows:

(READ) OR (CREATE) A FILE? READ

Question mark created as a result of A\$ in the INPUT statement.

↑  
cursor position

The six cursor lefts are needed to move past the four letters of READ and the two spaces. The question mark appears in the first space and then the cursor automatically moves one position to the right leaving the second space for readability. Now if the user wants to use the READ default only the return key is pressed. If not CREATE may be typed to select the alternative.

A complete input module might be the following:

```
100 INPUT "(READ) OR (CREATE) A FILE
      READ[lt lt lt lt lt lt]";A$
110 IF A$="READ" THEN 200
120 IF A$="CREATE" THEN 400
130 PRINT "[clr]ENTER EITHER READ OR
      CREATE"
140 GOTO 100
```

### Menus

A menu provides a list of alternatives from which the user selects one entry by typing a number or letter. The following code gives an example of this approach:

```
100 PRINT "[clr]SELECT ONE OF THESE
      SEARCHES"
110 PRINT "1 - BY AUTHOR"
120 PRINT "2 - BY SUBJECT"
130 PRINT "3 - BY KEYWORD"
140 PRINT "4 - BY TITLE"
150 INPUT A
160 ON A GOTO 1000,2000,3000,4000
170 GOTO 100
```

The codes 1,2,3,4 translate nicely for use in either an ON — GOTO or ON — GOSUB which greatly simplifies program analysis of the user's response.

A similar approach uses the first letter of each menu item as the response key. The letter may be highlighted by turning the reverse on before the character and off after it.

```
100 PRINT "[clr]SELECT ONE OF THESE
      SEARCHES"
110 PRINT "[rvs]A[rvs off]UTHOR"
120 PRINT "[rvs]S[rvs off]UBJECT"
130 PRINT "[rvs]K[rvs off]EYWORD"
140 PRINT "[rvs]T[rvs off]ITLE"
150 INPUT A$
160 FOR I=1 TO 4
170 IF A$=MID$("ASKT",I,1) THEN ON I GOSUB
      1000,2000,3000,4000: I=4
180 NEXT I
190 GOTO 100
```

This approach tends to cause the reversed characters to run together on the screen. A simple solution is to separate each line by placing a PRINT at lines 105,125,135 and 145 as follows:

```
105 PRINT
```

Lines 160 to 180 examine the input character against the string "ASKT" in line 170. The response character will be equal to position I of the string. In other words letter S will be found when I is 2 and the GOSUB will transfer to subroutine 2000. The I=4 at the end of line 170 forces the end of



the FOR loop without the need for additional looping.

Most menus require only a single letter or number response as seen in the previous examples. When the INPUT statement is used two keystrokes are required: one for the character and one for the Return key. One advantage this has is the user may change the character anytime before return is pressed by moving the cursor to the left and retyping the character.

In other cases a quick response is preferred with a minimum of keying. Here the GET statement comes to our rescue. If the previous example replaces line 150 with

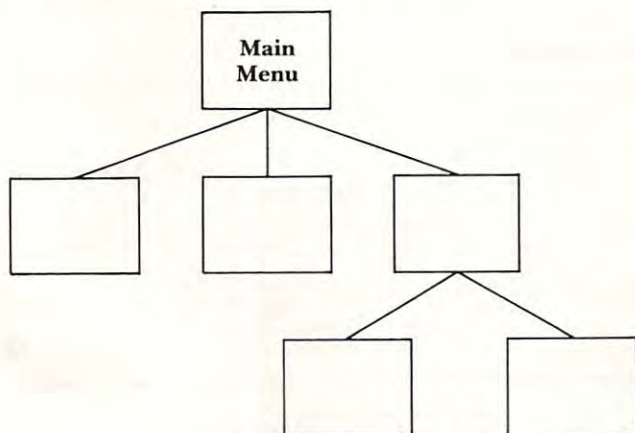
```
150 GET A$:IF A$="" THEN 150
```

the typing of a single letter will be sufficient. This method works only for a single character response but is unequalled for speed.

### Multi-Level Menus

When we are using a screen as the program's medium for communication with the user there is a limit to the number of items a menu can contain. Usually it is preferable to limit menu items to less than ten if numeric responses are required. With a blank line between each item this requires at least 19 lines on the screen. However, many applications may require well in excess of ten items. The procedure for handling many entries is to create a multi-level menu.

The multi-level menu begins with a main menu that branches to several lower level menus. Lower level menus may themselves point to even lower levels in a complex application.



These lower level menus should provide a means of escape in the form of a menu item that points back to the main menu.

An example of this application is a budgeting program with a main menu that asks for annual, monthly or daily budget items. The program then branches to a lower level menu to itemize particular entries in one of these three categories.

```
100 PRINT "[clr]ENTER A BUDGET CATEGORY"
110 PRINT "[dn rvs]A[rvs off]NNUAL"
120 PRINT "[dn rvs]M[rvs off]ONTHLY"
```

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```
130 PRINT "[dn rvs]D[rvs off]AILY"
140 GET A$:IF A$="" THEN 140
150 FOR I=1 TO 3
160 IF A$=MID$("AMD",I,1) THEN ON I GOSUB
    200,400,600
170 GOTO 100
200 REM ANNUAL BUDGET ITEMS
210 PRINT "[clr]SELECT AN ANNUAL ITEM"
220 PRINT "[dn]1 - HOUSE INSURANCE"
230 PRINT "[dn]2 - CAR INSURANCE"
240 PRINT "[dn]3 - INCOME TAX"
250 PRINT "[dn]4 - PROPERTY TAX"
260 PRINT "[dn]5 - RETURN TO MAIN MENU"
270 GET A$:IF A$="" THEN 270
280 N=VAL(A$)
290 IF N=5 THEN RETURN
300 ON N GOSUB 1000,2000,3000,4000
310 GOTO 200
400 REM MONTHLY BUDGET ITEMS
:
etc.
```

### Form Filling

Some application areas such as accounting, CAI and testing can benefit from a technique called form filling. This method permits the program's user to input data in a predefined location on the line. Typically this location is inside a box, as in an accounting ledger, or in a blank area such as a fill in the blank type of test question. The following code shows the use of form filling to enter an account number and date in a precise location within a box.



In the following code the lower case "b" represents a blank character.

```
10 PRINT "[clr rvs]bbACCountbbbbbbDATEbbbbbb
[rvs off]"
20 PRINT "[rvs]b[rvs off]bbbbbbbbb[rvs]b[rvs off]bbb
bbbbbbbbb[rvs]b[rvs off]"
30 PRINT "[rvs]24 space[rvs off]"
40 INPUT "[home dn rt]";A$
50 INPUT "[home dn 11 rt's]";D$
60 A$ = LEFT$(A$,6)
70 D$ = LEFT$(D$,9) sk 2
```

The above code displays a form on the screen something like this:

ACCOUNT ?	DATE
--------------	------

When the program asks for input the question mark appears in the box under the appropriate heading and is followed by the flashing cursor. This type of program presents a unique problem since the INPUT statement accepts all of the characters on the line following the question mark. This also includes graphic characters.

One solution is to use the GET statement in a loop but a far simpler method is to use the LEFT\$ function which selects the number of characters desired from the input string. This of course means you need to know how many characters will be entered.

### Command Language

Command languages are useful for applications such as word processing where simple prompting or the use of a menu is either impractical or too unwieldy to enter complex commands. For instance, a typical command is to change a string from one value to another to correct a spelling error or to change a word. To change the word "error" in the previous sentence to "mistake" a command like

C/error/mistake

is entered.

Using a command language requires considerably more experience than simply responding to a menu, but it is much faster than using a dialogue. Programming for a command language also tends to be more complex since the program needs to recognize the type of command, often identified by the first character in the command, and the operands which can legitimately accompany that command. Often there is no prompt since this type of application requires an active operator who initiates all action.

The following code shows how the preceding command might be analyzed in BASIC.

```
100 INPUT C$
110 IF LEFT$(C$,1) = "C" THEN 500
:
500 REM DECODE CHANGE COMMAND
```

```
510 IF MID$(C$,2,1) = "/" THEN PRINT "COMMAND
ERROR": GOTO 100
520 L = LEN(C$)
530 FOR I = 3 TO L
540 IF MID$(C$,I,1) = "/" THEN 570
550 S1$ = S1$ + MID$(C$,I,1)
560 GOTO 580
570 S2$ = RIGHT$(C$,L-I):I = L
580 NEXT I
590 IF LEN(S2$) = 0 THEN PRINT "COMMAND
ERROR": GOTO 100
```

Statements 510 and 590 ensure the command format is followed by checking for a slash separating the command (C) from the first string and that there is a second string. Statements 530 to 560 extract the first string by concatenating each character to S1\$. When the end of the string is found by 540 the second string is extracted in 570 and stored in S2\$.

The discussion has certainly not been an exhaustive study of user interaction but hopefully some insights have been given into ways of communicating effectively with the users of your programs.

### Conventions

For ease of reading and interpreting the BASIC language examples in this report the following conventions have been used:

Code	Interpretation
b	blank or space
clr	clear screen
home	home cursor
dn	cursor down
lt	cursor left
rt	cursor right
up	cursor up
rvs	reverse
rvs off	reverse off

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- Poynor, Hugh. *Improving Your Console Input*. Interface Age, October 1980, Page 100.

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# Keeping TABs On The Printer

Jim Butterfield  
Toronto, Canada

It seems to work, but it doesn't. This vexes a lot of people: after all, TAB seems ready made for the printer, and quick tests appear to show that it works. But it won't work when you get down to cases — with one exception we'll mention later.

## It Can't Work

To understand the difficulty, we must first understand that a Basic TAB does not send a special "tab" signal out to the printer. Instead, it sends out what it thinks is the proper number of space characters. If you code PRINT#4, TAB(15) the computer will probably transmit 14 spaces to the printer.

The mechanisms to make TAB work properly to the printer are not in place. Consider this: that if TAB were built to work with the printer, it must also be able to work properly with two printers at the same time. A user can hook up two printers as devices 4 and 5, for example, and print invoices on number four and summaries on number five. If printer TAB were in there, the computer would need to keep separate records of where each printer was positioned on its own line. In principle, we could run ten printers at the same time, since we can have up to ten logical files; the computer would need to keep ten independent records of each printer's line position.

No such information is available in the PET/CBM. Thus, there's no way to calculate how many space characters would bring it to the desired column.

## It Seems To Work

PET/CBM Basic included TAB strictly as a screen function. You can TAB quite effectively on a screen display. The mechanism is this: the computer subtracts the cursor position from the desired print position, and sends the appropriate number of spaces (or cursor-rights in the case of the screen). For example, if the cursor is at position 7 and the program gives TAB(16), nine spaces will be delivered. If we're printing to the screen, that produces exactly the right result; we'll end up at column 16 where we can print the next item.

However, if we're sending this information to the printer, we may produce a wrong result. Suppose, for example, we code PRINT#4, "THERE";TAB(10);"IT";TAB(20);"IS". The five characters of THERE go to the printer, leaving the printer positioned at column six. At this point we would hope that the computer would subtract six

from the TAB value of ten and send four spaces; instead, it subtracts one (the screen cursor position) from ten and sends nine spaces. It prints in column 15 rather than the desired column 10. It gets worse, since we hoped that the computer would send 8 spaces to carry us to TAB(20); instead, it will send 19, and IS ends up starting in column 36.

The misleading part of all this is that tabbing seems to be taking place; spaces are certainly inserted in the print line. The columns don't seem to line up quite right, and the programmer/victim goes looking through his coding trying to find his mistake. It's not a coding mistake: the system can't work. The only mistake is trying to use TAB with the printer at all.

## Finding Another Way

The healthiest way around the problem is to calculate your own print line spacings. Keep track of where the printer is working by counting characters with the LEN function, or making sure every printed item is always the same length. Here's a quick program using LEN:

```
100 OPEN 4,4
110 DATA FIVE,SIX,SEVEN,EIGHT,NINE,TEN,
    ELEVEN
120 FOR J=5 TO 11
130 READ A$
140 B$=STR$(J)
150 PRINT#4,A$;LEFT$(" ",10-LEN(A$));
160 PRINT#4,B$;LEFT$(" ",5-LEN(B$));
170 PRINT#4,"X"
180 NEXT J
190 CLOSE 4
```

Note how we change the numeric into a string (B\$) so that we can measure its length. Here's another approach which forces all strings to the same length:

```
100 OPEN 4,4
110 DATA FIVE,SIX,SEVEN,EIGHT,NINE,TEN,
    ELEVEN
120 FOR J=5 TO 11
130 READ A$
140 B$=STR$(J)
150 PRINT#4,LEFT$(A$+" ",10);
160 PRINT#4,LEFT$(B$+" ",5);
170 PRINT#4,"X"
180 NEXT J
190 CLOSE 4
```

Can you see how to change lines 150 and 160 to right-justify the columns if desired? For example, line 160 becomes PRINT#4,RIGHT\$(B\$+" ",5); and the numbers slide over to the right.

Since we're arranging our own columns, this type of program works equally well to printer or screen. Try changing line 100 to OPEN 4,3 in either program and the output will go neatly to the screen display.

## Making It Work

You can force TAB to work with the printer by using a trick. It's probably too cute for serious



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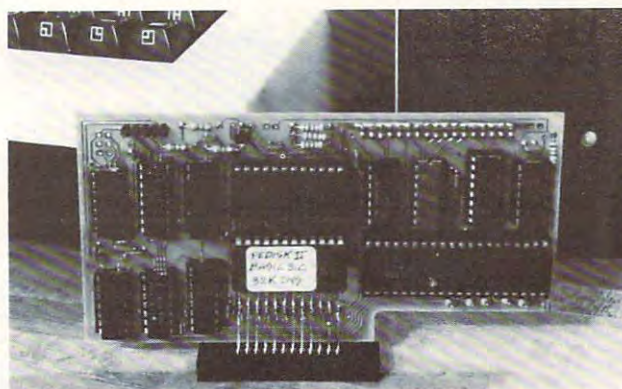
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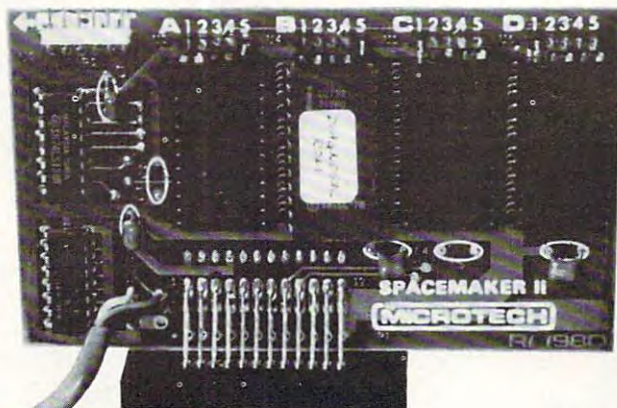
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coding, but it will perform correctly.

Here's the method: force the screen cursor to match the printer column exactly. Then a TAB, which references the cursor, will generate the proper number of spaces since the cursor and the printer are at the same column. The coding needs to be carefully worked out; the screen must print exactly the same as the printer, and output must always go to the printer first. Additionally, TAB references must be arranged so that they always begin a PRINT statement.

An example will show how it's done:

```
100 OPEN 4,4
110 DATA FIVE,SIX,SEVEN,EIGHT,NINE,TEN,
    ELEVEN
120 FOR J=5 TO 11
130 READ A$
140 REM
150 PRINT#4,A$;
155 PRINT A$;
160 PRINT#4,TAB(10);J;
165 PRINT TAB(10);J;
170 PRINT#4,TAB(15),"X"
175 PRINT TAB(15),"X"
180 NEXT J
190 CLOSE 4
```

It's not recommended as a general programming approach. But seeing this program work will give you an insight into how TAB functions — and malfunctions. ©

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# Assembler in BASIC for the PET

Eric Brandon

The most important tool the machine language programmer has is his assembler. If he has 32K, a disk, new ROMs, and \$170, he can buy MAE or the Commodore assembler. Otherwise, his choice is limited. If the thing he lacks the most is the \$170, or if he just wants to dabble in machine language, he will often end up with Newmon, Supermon, or a similar extended monitor that has a simple assembler. This is fine, but these assemblers are not symbolic, and he must calculate branches, jumps, and the like every time he modifies or relocates it.

Since I have an 8K PET with old ROMs, the only option open to me was to write my own symbolic assembler. I had to decide whether to write it in machine language or BASIC. Since I could not face the bleak prospect of writing a parser in machine language, I wrote it in BASIC. An added bonus is that it works on all ROMs (I have tested it on 2.0 and 3.0), and can easily be used by readers of **COMPUTE!** with other machines, since they all use the 6502.

The first thing you must do after typing it in, is to change line 1 to suit your memory size. MEM is the number of lines of machine code it can hold. When MEM is large, not only does it eat up memory, but it slows down the assembly process as well. M2 is the number of symbols it can keep track of. For an 8K PET, I suggest MEM=40 and M2=20; larger values are likely to run out of memory. For 16K or 32K PETs, MEM=200 and M2=100, unless you know you are going to use more lines or symbols.

When you RUN it, you will see the number 1, and a white cursor beside it. This means you are in line 1, and that it is waiting for input into the label field. If you type to the end of the field, hit SPACE, or hit RETURN, you will jump to the next field. The length of the label field is 6 characters, the operation field is 3, and the operand field is 10 characters long. A SPACE or RETURN in the operand field will put you at the beginning of the next line. When in the label field, there are two special commands you can type in. You type "FIX" when you have made a mistake. FIX returns you to the previous line so that if you type FIX on line 20, a 19 with a cursor beside it will appear underneath.

Typing "EXIT" will bring you to a menu.

Type "I" to input some more code. You will be asked at what line you wish to begin inputting. Type "D" to delete. You will be asked for a starting and an ending line number. The starting line and everything up to, but not including, the ending line will be deleted. To delete just one line, type its number as both starting and ending lines. Type "N" to insert. You will be asked what line to begin inserting at and how many lines to insert. All lines including and below the one you specified will be moved down the number of lines you said, leaving a gap of blank lines behind. Type "L" for list; you supply the beginning and ending line numbers. Type "A" to assemble your program. You must specify whether you want the output to go to the screen printer. Note that if you choose the screen, there will often be lines of more than 40 characters since the output was designed for the printer. If you plan to use the screen exclusively, I suggest you modify lines 1180-1210 to make the output less than 40 characters long. Note that your program has been POKEd into memory and may be executed with an SYS after assembly. Type "Q" to quit the program. If you hit Q accidentally, a GOTO 300 will return you to the program with your work intact.

I have included a sample printout which you should consult as I explain the operation of the assembler. As you can see, a symbol table is generated before the actual code. An "=" as the operation will set the symbol on the left equal to the value of the expression on the right. The first line should be an asterisk equal to a value. This sets the origin of the program in memory. The origin may be set only once, and only in the first line; any other attempt will give unpredictable results. Immediate addressing must be indicated with a pound sign as in lines 8 and 16 of my sample program. Hexadecimal numbers must be preceded by a dollar sign, and must be 1 to 4 characters in length. Binary numbers must be preceded by a percentage sign, and may be of any length. Decimal is assumed by default. A symbol must begin with a letter, and contain only letters and numbers. In accumulator addressing, the operand must be the letter "A", therefore "A" is an illegal symbol, although symbols may contain and begin with the letter "A". Addition within the operand field is non-standard. Only



```

CHAR = $03E0
SCRN = $0020
AGAIN = $0342
LOOP = $0349
1
2      *      = $33A
3      CHAR   = $3E0
4      SCRIN  = $20
5      LDA    #0
6      TAY
7      STA    CHAR
8      STA    SCRIN
9      LDA    #$80
10     STA    SCRIN+
11     LDA    CHAR
12     STA    (SCRIN),Y
13     INY
14     BNE    LOOP
15     INC    SCRIN+
16     LDX    SCRIN+
17     CPX    #$84
18     BNE    LOOP
19     INC    CHAR
20     BNE    AGAIN
    RTS

```

symbols can be added to and addition is done by following the symbol with plus signs as in lines 9, 14, and 15 of the sample program. The number of plus signs is equal to the number to be added. If `BUFFER = 30`, `LDA (BUFFER++ ,X)` means `LDA (32,X)`. I suggest that when writing self-modifying code, you put the code to be modified physically before the code that modifies it. Otherwise, you are almost sure to get an error message. By the way, my sample program fills the screen with every possible character, and is an excellent demonstration of the speed of machine language. It is written for the old ROM PET, but will work on the new ROMs if line 3 is changed to `SCRN = B5`.

Here is a quick summary of the part of my program for those who may wish to modify it:

- Lines 100-200** : control the input, and use the input routine at line 4000.
- Lines 300-600** : execute the command options other than ASSEMBLE.
- Lines 660-770** : create the symbol table.
- Lines 790-1220** : assemble the code.
- Lines 4000-4160** : input routine
- Lines 5000-5510** : are the op-code tables
- Lines 6000-6100** : find the numerical value of the operand.
- Lines 7000-7040** : Convert hexadecimal numbers to decimal.
- Lines 8000-8020** : Convert binary numbers to decimal.
- Lines 9000-9020** : Convert decimal numbers to hexadecimal.
- Lines 1000-10100** : Separate the labels, operations, and operands from the packed array A\$.

The program is quite compact because it had to be compressed to fit in an 8K PET. As it is, 8K can only hold about 40 lines of machine code along with the program before running out of memory.

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Improvements that could be made are: compacting the code even more, putting in READ/WRITE to cassette or disk routines, putting a BYT pseudo-op, and much more. In the meantime, it is a better assembler than the non-symbolic ones, and hopefully will be of use to PET owners; especially those with old ROMs who have woefully few assemblers available for them. If you find any bugs, make any improvements or have any questions about my

program, please write me at:

Eric Brandon  
36 Hartfield Road  
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Canada  
M9A 3C9

If you don't want to type it in, send me a blank cassette and \$5, and I'll make you a copy.

## ASSEMBLER/EDITOR 1.5 - ERIC BRANDON

```

1 MEM=50:M2=20
5 PRINT"J"
10 DIMA$(MEM),S$(M2),V(M2),LI(3)
15 H$="0123456789ABCDEF"
100 LN=1
110 PRINTLN:TB=5:LT=6:GOSUB4000:IFIN$="EXIT"THEN300
120 IFIN$="FIX"THENLN=LN-1:PRINTCHR$(-13*(ASC(GT$)<>13));GOTO110
125 IF GT$=CHR$(13)THENPRINT"J";
130 A$(LN)=IN$+" ":TB=13:LT=3:GOSUB4000:A$(LN)=A$(LN)+IN$+" "
160 IF GT$=CHR$(13)THEN200
170 TB=18:LT=10:GOSUB4000:A$(LN)=A$(LN)+IN$
190 IF GT$<>CHR$(13)THENPRINT
200 LN=LN+1:GOTO110
300 PRINT"DELETE INSERT LIST ASSEMBLE QUIT"
310 PRINT"COMMAND ?";
320 GETCM$:IFCM$=""THEN320
325 PRINTCM$:IFCM$<>"I"THEN410
340 INPUT"LINE ":LN:IFLN=0THEN300
350 GOTO110
410 IF CM$<>"D"THEN460
420 INPUT"X LINES - FROM,TO ":FL,LL:IFFL<LLTHEN430
422 FORT=FLTOMEM-1:A$(T)=A$(T+1):NEXTT:GOTO300
430 FORT=LL TO MEM:A$(T-LL+FL)=A$(T):A$(T)="" :NEXTT:GOTO300
460 IFCM$<>"N"THEN500
470 INPUT"FIRST LINE,NUMBER":FL,LL:FORT=MEM-LLTOFLSTEP-1:A$(T+LL)=A$(T):NEXTT
490 FORT=FLTOFL+LL-1:A$(T)="" :NEXTT:GOTO300
500 IF CM$<>"L"THEN580
510 INPUT"X LINES FIRST, LAST":FL,LL:FORT=FLTOLL
521 IF LEN(A$(T))=0THENPRINTT:GOTO565
525 LI(1)=0:LI(2)=0:LI(3)=0:LI=0:FORQ=1TOLEN(A$(T))
540 IF MID$(A$(T),Q,1)="" THENLI=LI+1:LI(LI)=Q
545 NEXTQ:IFLI(3)=0THENLI(3)=Q-1
550 PRINTTAB(5)LEFT$(A$(T),LI(1))TAB(13)MID$(A$(T),LI(1)+1,LI(2)-LI(1));
560 PRINTTAB(18)RIGHT$(A$(T),LI(3)-LI(2)+1)
565 NEXTT:GOTO300
580 IFCM$<>"Q"THEN600
590 PRINT"GET BACK IN WITH GOTO 300":END
600 IFCM$<>"A"THEN300
605 PRINT"SCREEN OR PRINTER ?";
610 GETDV$:IFDV$=""THEN610
620 PRINTDV$:IFDV$="S"THENDV=3:GOTO650
640 DV=4
650 CLOSE1:OPEN1,DV:SB=1
660 FORT=1TOMEM:GOSUB1000:IFLB$=""THEN710
670 IF OC$<>"*"THEN700
680 GOSUB600:IFLB$="*"THENPC=NU:OG=NU:GOTO770
690 S$(SB)=LB$:V(SB)=NU:SB=SB+1
692 N=V(SB-1):GOSUB9000
695 PRINT#1,S$(SB-1)" =LEFT$( " ",8-LEN(S$(SB-1)))"$R$:GOTO770
700 S$(SB)=LB$:V(SB)=PC:SB=SB+1
702 N=V(SB-1):GOSUB9000
705 PRINT#1,S$(SB-1)" =LEFT$( " ",8-LEN(S$(SB-1)))"$R$

```





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```

710 IFOC$="" THEN 770
715 IFOP$="" THEN PC=PC+1:GOTO 770
717 IFOP$="A" THEN PC=PC+1:GOTO 770
720 IF LEFT$(OC$,1) <> "B" THEN OROC$="BIT" OR OROC$="BRK" THEN 740
730 PC=PC+2:GOTO 770
740 IF LEFT$(OC$,1) = "J" THEN PC=PC+3:GOTO 770
750 GOSUB 6000: IF NU < 256 THEN PC=PC+2:GOTO 770
760 PC=PC+3
770 NEXT T
790 PC=0:ER=0
800 FORT=1:OMEM:GOSUB 10000: IFOC$="" THEN 1220
805 IFOC$="" THEN O1$=OP$:MV$="" : PC$="" : IL=0:GOTO 1160
810 IFOP$="" THEN AM$="G":IL=1:GOTO 1060
820 IFOP$="A" THEN AM$="H":IL=1:GOTO 1060
825 X=0:Y=0:I=0:M=0:Z=0
830 FOR Q=1 TO LEN(OP$):Q$=MID$(OP$,Q,1):IFQ$="" THEN I=1:GOTO 865
840 IFQ$="#" THEN M=1:GOTO 865
865 NEXT Q
866 FOR Q=1 TO LEN(OP$)-1:Q$=MID$(OP$,Q,2)
867 IFQ$=",Y" THEN Y=1:GOTO 870
868 IFQ$=",X" THEN X=1
870 NEXT Q
875 O1$=OP$:GOSUB 6000
876 IF NU < 256 THEN Z=1
880 IF LEFT$(OC$,1) = "B" AND OROC$ <> "BRK" AND OROC$ <> "BIT" THEN 1000
890 IF Z THEN 940
900 IF X THEN AM$="K":GOTO 1030
910 IF Y THEN AM$="L":GOTO 1030
920 IF I THEN AM$="M":GOTO 1030
930 AM$="N":GOTO 1030
940 IF M THEN AM$="I":GOTO 1030
950 IF I AND Y THEN AM$="Q":GOTO 1030
960 IF I AND X THEN AM$="P":GOTO 1030
970 IF X THEN AM$="Q":GOTO 1030
980 IF Y THEN AM$="R":GOTO 1030
990 AM$="S":GOTO 1030
1000 AM$="J": IF NU > PC+1 THEN OS=NU-PC-2: IF OS > 127 THEN ER=1
1010 IF NUMBER(PC+1) THEN OS=254+NU-PC: IF OS < 128 THEN ER=1
1020 IF ER=1 THEN PRINT "TOO LONG CONDITIONAL BRANCH":GOTO 300
1025 FO=OS:IL=2:GOTO 1060
1030 IF Z=0 THEN 1050
1040 FO=NU:IL=2:GOTO 1060
1050 SO=INT(NU/256):FO=(NU/256-SO)*256:IL=3
1060 RESTORE:FOR W9=1 TO 56:READ I$:IF LEFT$(I$,3)=OC$ THEN CD$=I$:W9=100
1070 NEXT W9:IF W9=57 THEN PRINT "ILLEGAL MNEMONIC":GOTO 300
1080 FOR W9=4 TO LEN(CD$) STEP 3:IF MID$(CD$,W9,1)=AM$ THEN LW=W9:W9=100
1090 NEXT W9:IF W9 < 100 THEN PRINT "ILLEGAL ADDRESSING MODE":GOTO 300
1100 MV$=MID$(CD$,LW+1,2):N$=MV$:GOSUB 7000
1110 POKE PC,V:IF IL=1 THEN 1140
1120 POKE PC+1,FO:IF IL=2 THEN 1140
1130 POKE PC+2,SO
1140 N=PC:GOSUB 9000:PC$=R$:PC=PC+IL
1150 N=FO:GOSUB 9000:FO$=R$:N=SO:GOSUB 9000:SO$=R$
1160 IF IL < 3 THEN SO$=""
1170 IF IL < 2 THEN FO$=""
1175 IF AM$="H" THEN O1$="A"
1180 PRINT#1,LEFT$(" ",4-LEN(STR$(T)))PC$ " ";
1190 PRINT#1,MV$ " "RIGHT$(FO$,2) " "RIGHT$(SO$,2) " ";
1200 PRINT#1,LEFT$( " ",8-LEN(LB$))OC$LEFT$( " ",5-LEN(OC$));
1210 PRINT#1,O1$:O1$=""
1220 NEXT T:GOTO 300
3999 END
4000 IN$="" : NL=0:PRINT TAB(TB);
4020 PRINT "  ";
4030 GETGT$:IFGT$="" THEN 4030

```



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```

4031 IF GT#>"Z"ORGT#<" "ANDGT#<>CHR$(13)
      ANDGT#<>CHR$(20)THEN4030
4035 NL=NL+1
4040 IF GT#=CHR$(20)ORGT#=CHR$(13)THEN4100
4045 IFGT#=" "THENPRINT" ";:RETURN
4050 PRINTGT#;:IN#=IN#+GT#
4060 IF NL=LTTHEN4100
4070 GOTO4020
4100 IF GT#<>CHR$(20)THEN4150
4105 IF LEN(IN#)<2THEN4120
4110 PRINT" ████";:NL=NL-2:IN#=LEFT$(IN#,
      LEN(IN#)-1):GOTO4020
4120 IFLEN(IN#)=0THENNL=NL-1:GOTO4020
4130 PRINT" ████";:NL=NL-2:IN#="":GOTO4020
4150 IFGT#=CHR$(13)THENPRINT" "
4160 RETURN
5000 DATAADCN6DS65I69K7DL79P61071075
5010 DATAANDN2DS25I29K3DL39P21031035
5020 DATAASLH0AN0ES06K1EQ16
5030 DATABCCJ90,BCSJB0,BEQJF0
5060 DATABITN2CS24
5070 DATABMIJ30,BNEJD0,BPLJ10,BRKG00
5110 DATABVCJ50,BVSJ70,CLCG18,CLDGD8
5150 DATACLIG50,CLVGB8
5170 DATACMPNCDSC5IC9KDDL9PC10D10D5
5180 DATACFXNECSE4IE0
5190 DATACPYNCCSC4IC0
5200 DATADECNCESC6KDEQD6
5210 DATADEXGCA,DEYGB8
5230 DATAORN4DS45I49K5DL59P41051055
5240 DATAINCNEESE6KFEQF6
5250 DATAINXGE8,INYGC8
5270 DATAJMPN4CM6C
5280 DATAJSRN20
5290 DATALDANADSA5IA9KBDLB9PA10B10B5
5300 DATALIXNAESA6IA2LBERB6
5310 DATALDYNACSA4IA0KBCQB4
5320 DATALSRH4AN4ES46K5EQ56
5330 DATANOPGEA
5340 DATAORAN0DS05I09K1DL19P01011015
5350 DATAPHAG48,PHPG08,PLAG68,PLPG28
5390 DATAROLH2AN2ES26K3EQ36
5400 DATARORH6AN6ES66K7EQ76
5410 DATARTIG40,RTSG60
5430 DATASBCNEIDSE5IE9KFILF9PE10F10F5
5440 DATASECG38,SEDFG8,SEIG78
5470 DATASTAN8DS85K9DL99P81091095
5480 DATASTXN8ES86R96
5490 DATASTYN8CS84Q94
5500 DATATAXGAA,TAYGA8,TSXGBA,TXAG8A
5510 DATATXSG9A,TYAG98
6000 AD=0
6005 Q#=LEFT$(OP#,1):IFQ#="$"ORQ#="% "OR
      (ASC(Q#)>64ANDASC(Q#)<91)THEN6030
6010 IFASC(Q#)>47ANDASC(Q#)<58THEN6030
6020 OP#=RIGHT$(OP#,LEN(OP#)-1):GOTO6000
6030 Q#=RIGHT$(OP#,1):Q1=ASC(Q#):IF(Q1
      >47ANDQ1<58)OR(Q1>64ANDQ1<91)THEN6050
6035 IFQ#="+"THEN6050
6040 OP#=LEFT$(OP#,LEN(OP#)-1):GOTO6030
6050 IFRIGHT$(OP#,2)=","X"THENOP#=
      LEFT$(OP#,LEN(OP#)-2)
6052 IFRIGHT$(OP#,2)=","Y"THENOP#=
      LEFT$(OP#,LEN(OP#)-2)

```

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```

6053 IFRIGHT$(OP$,1)=")" THEN OP$=LEFT$(OP$,LEN(OP$)-1)
6055 IFLEFT$(OP$,1)="$" THEN N$=OP$:GOSUB7000:NUMBER=V:GOTO6100
6060 IFLEFT$(OP$,1)="$" THEN N$=OP$:GOSUB8000:NUMBER=V:GOTO6100
6070 IFASC(LEFT$(OP$,1))<58 THEN NUMBER=VAL(OP$):GOTO6100
6075 IFRIGHT$(OP$,1)="$" THEN AD=AD+1:OP$=LEFT$(OP$,LEN(OP$)-1):GOTO6075
6080 FORW1=1 TO M2:IFS$(W1)=OP$ THEN NUMBER=V(W1):W1=999
6090 NEXTW1:IFW1=M2+1 THEN PRINT "UNDEFINED SYMBOL ERROR":GOTO300
6100 NU=NU+AD:RETURN
7000 IFLEFT$(N$,1)="$" THEN N$=RIGHT$(N$,LEN(N$)-1)
7010 V=0:IFLEN(N$)=4 THEN 7030
7020 N$=LEFT$(N$,4-LEN(N$))+N$
7030 FORR2=1 TO 4:D$=MID$(N$,R2,1):TV=ASC(D$)-48:IFTV>9 THEN TV=TV-7
7040 V=TV*16+(4-R2)+V:NEXTR2:RETURN
8000 IFLEFT$(N$,1)="$" THEN N$=RIGHT$(N$,LEN(N$)-1)
8010 V=0:FORZ=LEN(N$) TO 1 STEP -1:V=V+VAL(MID$(N$,Z,1))*2^(LEN(N$)-Z):NEXTZ
8020 RETURN
9000 FD=INT(N/4096):N=(N/4096-FD)*4096:SD=INT(N/256):N=(N/256-SD)*256
9010 TD=INT(N/16):N=INT((N/16-TD)*16):R$=MID$(H$,FD+1,1)+MID$(H$,SD+1,1)
9020 R$=R$+MID$(H$,TD+1,1)+MID$(H$,N+1,1):RETURN
10000 IFA$(T)="" THEN OC$="" :LB$="" :GOTO10100
10005 LI(1)=0:LI(2)=0:LI(3)=0:LI=0
10010 FORR2=1 TO LEN(A$(T)):IFMID$(A$(T),R2,1)=" " THEN LI=LI+1:LI(LI)=R2
10020 NEXTR2:IFLI(3)=0 THEN LI(3)=R2-1
10030 LB$=LEFT$(A$(T),LI(1)):OC$=MID$(A$(T),LI(1)+1,LI(2)-LI(1))
10040 OP$=RIGHT$(A$(T),LI(3)-LI(2)+1)
10050 IFLB$="" THEN LB$="" :GOTO10070
10060 LB$=LEFT$(LB$,LEN(LB$)-1)
10070 OC$=LEFT$(OC$,LEN(OC$)-1)
10080 IFOP$="" THEN OP$="" :GOTO10100
10090 OP$=RIGHT$(OP$,LEN(OP$)-1)
10100 RETURN

```

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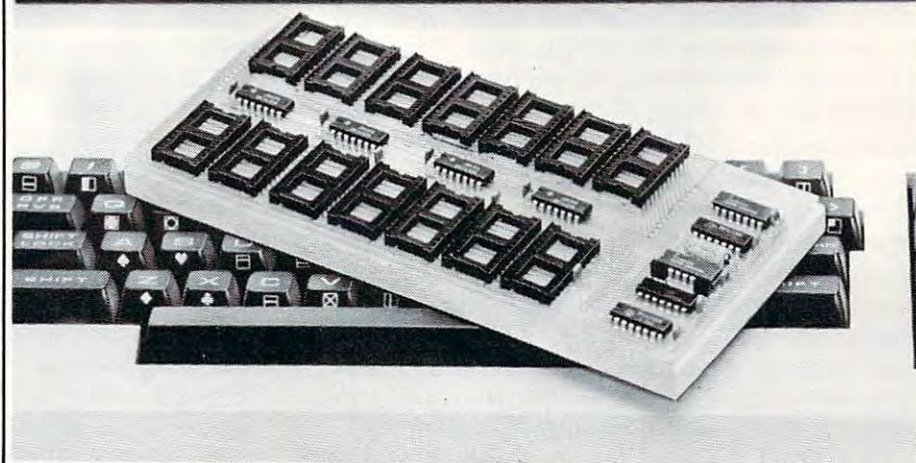


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# Machine Language: Uncrashing

Jim Butterfield  
Toronto, Canada

Techniques for uncrashing a PET/CBM system were outlined in **COMPUTE!** issue 1. It's worth while going over it again.

The term "crash" sounds noisy; but in fact, a computer system that crashes goes utterly silent. It no longer responds to the keyboard, and can't be controlled. A crash can be corrected by turning the power off and on, but in doing so you will lose the contents of RAM memory. Not only will you lose your program, but it will be much harder to investigate why the crash happened.

## Three Types Of Uncrash

There are three ways of getting your machine out of a crash: soft reset, NMI and Reset line. I recommend the Reset line method for reasons that will become visible later.

A soft reset system involves planting a program in the interrupt system which will check the RUN/STOP key, or a selected combination of keys, at periodic intervals. If it finds the RUN/STOP key is pressed, the interrupt routine automatically sets the main program to a fixed restart point.

An NMI reset has a hardware configuration that causes a signal received on the NMI (Non Maskable Interrupt) line to send the processor to a fixed restart point. It requires no program, just a setting of the NMI vector address to point at the desired restart location.

Both of the above methods depend upon the interrupt system being able to function properly. There's a class of crash that leaves the interrupts completely out of action; in this case neither the soft reset nor the NMI reset will work. Additionally, Original ROM PETs don't support NMI reset.

The Reset line method involves sending a signal on the processor's Reset line, of course. With many processors you are given a button or key to press to cause this; the processor will then ask you what you want to do: Machine language or Basic? In some cases the Reset key is too accessible, and users must learn how to get back to their program after they have pressed the button accidentally.

On the PET, you are supplied with no button for Reset; and even after you arrange to connect it yourself, you have a second problem to solve: how to stop Basic from going into cold start and wiping memory. This problem cannot be completely

solved for Original ROM PETs, but can be done on more recent systems. We'll give details on this later.

## Types of crash

If you lead a charmed life, your programs will run without fault and you'll never need uncrashing methods. If you're very lucky, your programs will give wrong answers but will run without crashing. Most mortal programmers, however, write machine language programs that crash once in a while. The crashes can be broadly divided into four categories: Break, Tight Loop, X2, and Battered Basic.

Break is not a true crash, since you don't lose control of the system. When your machine language program goes wild, it eventually stumbles into a location that contains zero — which is read as a Break instruction. The processor flips into the monitor, and you're saved. On early PET systems that have no built-in monitor, you're likely to see an ?INVALID QUANTITY error. Either way, you have miraculously escaped disaster.

Tight Loop crashes are situations where the machine language program gets into a loop from which there is no exit. This may be a coding error on your part; or the program might have branched to entirely the wrong place and have gotten itself locked up there. You can usually get out of this type of crash with a soft reset system or an NMI reset.

X2 crashes are the tough ones. The processor has encountered an Op Code which ends in binary 0010, or 2 in hexadecimal, and it's not A2 which is a legitimate LDX command. The microprocessor goes into an internal "race" condition: it will cease to execute code and will ignore all interrupts. Neither soft reset nor NMI will help here, since both are based on interrupts. The only thing that works is Reset; and in the PET, Reset causes Basic cold start; and Basic cold start causes memory to be wiped; and wiped memory causes programmers to gnash their teeth and tear their hair out. For all PETs except those fitted with Original ROMs, there is a better way; it's called the Reset line method.

Battered Basic may be a side issue, but can be annoying if you don't understand it. Basic cannot work unless a number of locations, mostly in zero page, contain the right values. Your program may have changed some of these locations — indeed, you may have deliberately swapped out parts of zero page to give yourself working space. If so, you can get back to the Machine Language Monitor but it would be unreasonable to expect Basic to work. That's often all right, since you'll be doing your debugging work largely in the Machine Language Monitor and won't need Basic. Just be sure you know about this potential problem, so that you won't be disturbed by Basic's inability to function.



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34-35	Limit of Basic memory pointer
50	Garbage yardstick
51	Jump op code (4C)
65	Floating accumulator overflow
70-87	CHRGET subroutine
0400	Basic start (00)

On other machines, the equivalent locations can be found. You may wish to note their contents in case you ever need to fix up a sick Basic.

### The Reset Line Method

This is good for Upgrade and subsequent ROM systems on PET/CBM. The basic method is: set the Diagnostic Sense line to ground, then place a momentary ground on the Reset line. The system will awake in the Machine Language Monitor, but the Stack Pointer is set at 01, which means trouble unless you use a special procedure. Type a semicolon and press the RETURN key. This seems to do nothing but give you an empty line, but it's important. Now go back and change the Stack Pointer (the value under SP) from 01 to FA and press RETURN. Your machine is now cleanly in the Machine Language Monitor. You may also return to Basic if Basic is still in working order.

There are two hardware connections you need to make for Reset Line uncrashing. If you're not technically oriented, you might ask your dealer to hook up the buttons for you. On the original PET hardware (edge connector on the right hand edge of the board), the Reset line is pin 27 of the memory expansion connector and the diagnostic sense pin is pin 5 of the parallel user port. On newer PET hardware (memory expansion pin connector at the right of the board), the Reset line is available on pin J4-22 of the front pin connector, and the Diagnostic line at both pin J9-20 of the rear pin connector as well as on pin 5 of the parallel user port.

Whether you hook it up yourself, have a friend or dealer do it for you, or buy a commercial product, you'll find a Reset line uncrasher to be well worth-while. If you never make mistakes, you won't need one, of course.

### Summary

It's good to be able to re-awaken a dead machine. It gives you the chance to pick through memory to find where the fatal error might have occurred; or even to restart your program, implanting Break instructions at crucial points to pin down the problem.

Original ROM PETs can't be revived in many cases; if you do much machine language work you'll be wise to upgrade your ROM set. Newer PETs need only a little hardware and a procedure

which you can learn, and you'll be able to uncrash in almost all cases.

Whatever machine you use, remember that Basic may not survive a serious crash. Be prepared to use your Machine Language Monitor for most of your testing and debugging.

Beginning programmers often feel a sense of dread when their machine goes dead. There's no need. Crashes are part of the game. Learning how to come cleanly out of them — and pin them down — can be part of the fun of programming. ©

## Notes On The Pet SAVE Command

Louis F. Sander  
Pittsburgh, PA

You can SAVE several copies of a program by using a FOR ... NEXT loop. Giving the direct mode command:

```
FOR I=1 TO 3 : SAVE "SPACEWARS" : NEXT
```

will SAVE three consecutive copies of SPACEWARS without further action from you. The same method also works in program mode. If you're developing a program and want to make periodic backup copies, put these two lines into the program:

```
63998 END
63999 FOR I=1 TO 3 : SAVE "PROGRAM NAME" :
NEXT
```

When you're ready to make backup copies, just get into direct mode and enter GOTO 63999, and you'll get three copies. Line 63999 has the highest line number allowed by BASIC, insuring that the automatic save routine keeps away from the rest of your program. Line 63998 keeps your program from inadvertently SAVEing itself.

You have great flexibility in naming a program you are about to SAVE. You can give it the name it had when it was LOADED, or you can give it a completely new name. Or you can SAVE it with no name at all. The name of a program to be SAVED can appear within quotes, or as a string variable:

```
FOR I=1 TO 3 : A$ = "PROGRAM #" + STR$(I):
SAVE A$ : NEXT
```

will SAVE your program three times, under the names PROGRAM #1, PROGRAM #2, and PROGRAM #3.

You can also use a FOR ... NEXT loop to VERIFY multiple copies of the same program, SAVED as described above:

```
FOR I=1 TO 3 : VERIFY : NEXT
```



will make PET do the job without further instructions from you. If a VERIFY ERROR occurs, however, the loop will abort and PET will return to the READY state.

Be extremely careful about your RECORD button when you are SAVEing and VERIFYing, especially when these are done under program control. Trying to SAVE *without* the RECORD button will leave your tape exactly as it was before the SAVE, and trying to VERIFY *with* the RECORD button depressed will erase the tape. Remember — PET can't tell the difference between its cassette recorder buttons. It only knows whether one or more of them are down, and it can't tell which ones or how many you've pushed.

Like most other BASIC commands and statements, SAVE can be abbreviated. The proper abbreviation is 'Sa', which prints on the screen as 'S(spade)' if your PET is in graphics mode. Similarly, VERIFY can be abbreviated as 'Ve', and LOAD as 'Lo'. The abbreviated forms work exactly like the fully-spelled ones, but they are easier to type. ©

## Product Review:

# The Optimized Data Systems PH-001 2114 RAM Adapter

David C. Swaim  
Marietta, GA

I turned on my PET 2001-8 one day, loaded a program and typed RUN. The computer went into never-never land leaving me with no option but turning it off and back on. When I did this I got the "\*\*\* COMMODORE BASIC \*\*\*" but only 2612 bytes free. I had a bad RAM chip. If you own an "original" PET 2001-8 and recently had a RAM chip go bad you already know the next part of the story. The 2001-8 PET uses the 6550 RAM chips. These chips are out of production and if you can locate one you will pay a premium price for it. Eventually you will not be able to get one at any price. Just when I was feeling like my computing days were over I discovered Optimized Data Systems (P.O. Box 595, Placentia California 92607). These fellows make a handy adapter which allows you to replace your 6550 RAMs with the more available (and cheaper) 2114 RAMs. Their PH-001 2114 RAM Adapter allows you to replace up to 4K of memory one chip at a time so you can keep

using your good 6550 RAMs. This was obviously just what I needed.

Being impatient and knowing only that they made an adapter I decided to call them (area code 714 996-3201, don't call collect). The person I talked to was very helpful and explained what they made. You can get the RAM adapter in various stages of readiness. The PHB-001 is a bare double-sided printed circuit board and sells for \$8.95 (add \$1.50 postage and handling to all prices, California residents add sales tax). You supply all the other parts. The other parts needed are two 22 pin wire-wrap sockets, a 74LS139 dual decoder, two 0.1 uf capacitors and 2114s and sockets. If you think you might have trouble finding these parts the PHK-001 at \$13.95 contains all the parts to make the adapter with two 2114 sockets. The PHK-001S at \$16.95 is the complete kit including eight sockets for your 2114s. If you are not adept at soldering miniature PC boards (the lands on the adapter board are pretty close together) I recommend the assembled and tested PH-001S adapter at \$22.95. The 2114 RAMs are extra on all of the above. I only needed one so that's all I got. I ordered the assembled version plus one 2114 RAM over the phone Monday afternoon (phone charge card orders only). On Thursday I received the adapter in the mail. I can only say that shipment was prompt. The adapter itself was in a sealed plastic bag. The 2114, which I almost threw away with the packing, was pressed onto a small piece of conductive foam and was loose in the packing material. They included a self addressed stamped post card requesting an honest response to the product on which I suggested they at least put the 2114s in a plastic bag in the future.

Installation of the adapter is simple. First you remove the last two 6550 RAMs from the main PC board on the PET. These are inserted into the 22 pin sockets on the adapter board. These two sockets are wire-wrap sockets and they plug directly into the now empty sockets on the PET. Then when any 6550 RAM in the top 4K goes bad simply unplug it and plug a 2114 into the corresponding socket on the adapter board (a diagram is provided). With two of these adapter boards the entire 8K of memory can be replaced with 2114s.

The user instructions that come with the PH-001 are pretty thorough with adequate warnings on avoiding static electricity while handling the RAMs. The only problem I had was figuring out which way the 2114 went onto the circuit board. After studying the parts layout diagram I was able to figure it out. The last page of the directions gives a very detailed description of how the adapter works and suggests the possibility of using the PH-001 as a 4K memory expansion (Hmm.....).

The materials and workmanship on the PH-001 are excellent and the peace of mind is well worth the small price. ©



# Discovering Tape File Names

David R. Heise  
Chapel Hill, NC

A PET BASIC program can open a data file on tape without knowing the file name. The statement:

**OPEN 1,1**

causes the PET to search the tape and open the first file it encounters.

The PET gets the file's name, but the information is not provided to the program. The file name is read from tape and stored in the tape buffer when the open statement is executed. It stays there until an INPUT or GET statement is executed for the file.

The program below demonstrates a procedure for retrieving the unknown file name and storing it in a BASIC string that can be used as desired.

The program itself also is of interest. It automatically transfers data files on a tape over to a disk, retaining the original file names. (Names are truncated to 16 characters if necessary since 16 is the maximum for disk file names.) The program continues transferring files until you press the STOP key.

```
100 REM MAKE A STRING THE FIRST VARIABLE IN THE PROGRAM
110 AA$=""
120 REM FIND OUT WHERE IT IS DEFINED
130 X=PEEK(42)+256*PEEK(43)
140 REM REDEFINE IT SO IT REFERS
    TO CELLS IN FIRST TAPE BUFFER
150 POKE X+3,127:POKE X+4,2:POKE X+2,16
160 :
170 REM PAUSE FOR USER
180 PRINT
    "PRESS A KEY WHEN READY TO TRANSFER TAPE FILES TO DISK"
190 GET A$:IF A$="" THEN 190
200 :
210 REM GET THE NEXT TAPE FILE
220 OPEN 1,1
230 REM AA$ HAS ITS NAME PLUS
    BLANKS SPACING OUT TO 16 CHARACTERS
240 PRINT AA$
250 REM REMOVE THE BLANKS
260 FOR I=16 TO 1 STEP -1
270 IF MID$(AA$,I,1)="" THEN NEXT I
280 C$=LEFT$(AA$,I)
290 I=1:NEXT I
300 REM OPEN THE DISK ERROR CHANNEL
310 CLOSE 15:OPEN 15,8,15
320 REM OPEN THE DISK DATA FILE
330 OPEN 2,8,5,"0:"C$+",S,W"
340 REM CHECK FOR PROBLEMS
350 INPUT#15,A$,B$,C$,D$:IF A$<>"00" THEN PRINT B$:STOP
360 REM GET A DATUM FROM THE TAPE FILE
370 GET#1,A$
380 REM IF THE TAPE FILE IS DONE,
    CLOSE THE READ AND WRITE FILES AND REPEAT
390 IF (ST)=64 THEN CLOSE 1:CLOSE 2:GOTO 220
400 REM OTHERWISE BUILD THE DISK FILE
410 PRINT#2,A$;
420 GOTO 370
```

©

# Petbug

John Blackburn  
London, UK

There is a bug in the machine language tape SAVE routine which only applies to 32K machines. I first discovered this when saving a self-relocating program which automatically packs itself into the top of memory. When loaded, it didn't run. It turns out that the byte at \$7FFF gets corrupted.

I spent a lot of time trying to find out what I was doing wrong. Finally, I decided that there's only one thing to do at a time like this. So I did it.

Jim replies, "The problem is at \$FC08 to \$FC0B in 4.0 systems; the high bit of the tape write address (in C7 and C8) is used as a flag to signal end-of-write ... with the result that LDA \$C8, BPL WRITEBYTE drops through one byte early and the byte at \$7FFF gets confused with the checksum byte."

So, if you're writing this sort of program, put in a dummy byte at the end, so avoiding \$7FFF.

If you've got one and it gives trouble, set top-of-memory to \$7FFF before you load it (instead of leaving it at \$8000 as at power-up). Then save it again the easy way. All your SYS commands will be one byte lower, but doubtless the screen will inform you of the changes.

©

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## Review:

# Machine Language Utility-Pac (PET ROM)

Competitive Software  
21650 Maple Glen Drive  
Edwardsburg, Mi 49112  
\$79.95

Harvey B. Herman  
Greensboro, NC

PETs with version 2.0 (upgrade) and version 4.0 ROMs have a built-in machine language monitor. It, however, is fairly primitive and many people have felt the need for enhancement. User's groups have distributed a program by Jim Butterfield (among others) called Supermon. The program adds about seven more commands (e.g. disassemble and hunt) to the original monitor. It must be loaded from tape, a time consuming procedure, if one is sans disk. Furthermore, it takes up valuable RAM space. Plugging in the 4K ROM from Competitive Software (specify 2.0 or 4.0 ROM and \$9000 or \$A000 as a starting location) gives an additional 34 commands and no waiting for tape to load. I was impressed with all they were able to fit into a 4K ROM.

There was no trouble installing the ROM (\$A000 in my version) as the instructions are quite explicit. A simple SYS call enables and jumps to the monitor. I tried a representative sample of the commands listed below and they all worked. A few act exactly like Supermon, but I said the ROM includes many additional commands. It really is convenient to have the routines always at the ready, especially if you don't have a disk. Even if you do there are extra disk support commands (like the wedge) which the company has fitted into the remaining free space on the ROM, after the monitor. I think the Utility-Pac ROM should be seriously considered by PET machine language hackers who have the need for a comprehensive monitor.

### COMMODORE MONITOR COMMANDS

.G GO RUN  
.L LOAD FROM TAPE  
.M MEMORY DISPLAY  
.R REGISTER DISPLAY  
.S SAVE TO TAPE OR DISK  
.X EXIT TO BASIC

### MACHINE LANGUAGE UTILITY-PAC 1.2R COMMANDS

.A SIMPLE ASSEMBLER  
.B BREAK SET  
.C COMPARE MEMORY  
.D DISASSEMBLER  
.F FAST TYPE  
.H HUNT MEMORY  
.I INTEGRATE MEMORY  
.N NEW LOCATER  
.Q QUICK TRACE  
.T TRANSFER MEMORY  
.W WALK CODE  
.P PRINTER MODE ON  
.O PRINTER MODE OFF  
.V VIDEO SCREEN DUMP TO PRINTER  
.Z RELOCATE  
.\$ HEX TO DECIMAL (4 DIGIT HEX)  
.# DECIMAL TO HEX (4 DIGIT HEX)  
> DECIMAL TO HEX & ASCII (2 DIGIT HEX)  
< HEX TO DECIMAL & ASCII (2 DIGIT HEX)  
↑ ASCII TO DECIMAL & HEX (2 DIGIT HEX)  
.\* AUTO REPEAT ON OR OFF  
+ PLUS  
- MINUS  
@ JUMPS TO USER PROGRAM LOCATION 1  
<BACKSLASH> JUMPS TO USER PROGRAM LOCATION 2

### USE SHIFTED CHARACTERS FOR THE FOLLOWING COMMANDS

.F FILL MEMORY  
.A AND  
.O OR  
.E EXCLUSIVE OR  
.C 1'S COMPLIMENT  
.I INVERSE +/-  
.N NO COMPARE TO HEX  
.V ENHANCED VIDEO SCREEN DUMP TO PRINTER  
.M MEMORY TEST

### Additional Commands from BASIC

REV PRINT: Lists programs to printer in UPPER AND LOWER CASE

DOS: Allows easy WEDGE commands to operate disk system

SCREEN DUMP: Dumps screen to printer automatically

ENHANCED SCREEN DUMP: Dumps enhanced Video Image to printer!

RE-NEW: Restores program if you accidentally wipe it out

AUTO-CURSOR: Allows automatic repeating of all keys

DISK APPEND: Allows merging of disk files

REV SCREEN: Reverses display on screen

DISPLAY: Displays memory locations in operation

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N.B. all programs come on diskettes

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# THE SBC GAZETTE



## The Single Board 6502

Eric Rehnke

### KIM Is Dead!!! Long Live KIM!!!

A few minutes ago, I confirmed the rumor that Commodore is no longer producing the KIM-1. The person I spoke with at Commodore didn't offer any reason for the decision so one must assume that other high priority projects like VIC and PET needed the production capacity and resources that were being allocated to support KIM.

While I can fully understand this move, that doesn't make it easier to accept. I cut my computer eye teeth on KIM and still use this remarkable system for all of my work (my Apple and PET are gone now). Of all the 6502 single board computers, KIM still is the favorite CPU in my disk based system.

If you feel about KIM as I do, please bow your head and observe a moment or two of silence.

### New Chips From MOS Technology

In my last column I mentioned some of the recent developments in the 6500 family coming from Rockwell. Since they were of the single chip computer variety, they were probably of limited interest to most of you hobbyists and designers of small quantity custom systems.

Well, if you're done crying in your soymilk, I have some good news for you. It seems that the folks at MOS Technology have also been busy with some developments of their own to enhance the 6500 family. Three new members of the family, a new CPU, and two I/O ports, are being introduced (or will be introduced shortly). The new CPU is designated the 6508 and features a built-in 8 bit I/O port, 256 bytes of RAM as well as the 16 address and 8 data lines necessary for full 64K expansion. The 6508 has been designed for multiprocessing as evidenced by the tri-state address bus and the need for an external two-phase clock.

One of the new I/O ports is the 6523, which contains three 8-bit I/O ports. These ports operate in a similar fashion to those on the earlier 6530's. That is, they have no automatic handshaking capability and are used as simple I/O ports. Of

course, each of the 24 I/O lines on the 6523 is individually programmable.

The 6525 is the other new I/O port. It is similar to the 6523 except that the 6525 has an additional operating mode available giving it a rather powerful capability. Depending on the mode selected, the 6525 can provide 24 individually programmable I/O lines or 16 I/O lines, 2 handshake lines and 5 *priority interrupt inputs!!!* How's that for capability? And the priority interrupt operation is fully automatic.

The only thing that disappointed me about these new chips was the lack of a hardware interval timer. I would be willing to give up some of the addressing space (who uses 65K of memory in a small controller anyway?) or even 50 or so bytes of RAM to have an interval timer in the CPU chip. (Maybe I'd better quit crying in my soymilk.)

Anyway, here are the pinouts for the new devices:

6508			
RES	1	40	$\emptyset_2$ IN
$\emptyset_1$ IN	2	39	R/W
IRQ	3	38	DB <sub>0</sub>
AEC	4	37	DB <sub>1</sub>
VDD	5	36	DB <sub>2</sub>
A <sub>0</sub>	6	35	DB <sub>3</sub>
A <sub>1</sub>	7	34	DB <sub>4</sub>
A <sub>2</sub>	8	33	DB <sub>5</sub>
A <sub>3</sub>	9	32	DB <sub>6</sub>
A <sub>4</sub>	10	31	DB <sub>7</sub>
A <sub>5</sub>	11	30	P <sub>0</sub>
A <sub>6</sub>	12	29	P <sub>1</sub>
A <sub>7</sub>	13	28	P <sub>2</sub>
A <sub>8</sub>	14	27	P <sub>3</sub>
A <sub>9</sub>	15	26	P <sub>4</sub>
A <sub>10</sub>	16	25	P <sub>5</sub>
A <sub>11</sub>	17	24	P <sub>6</sub>
A <sub>12</sub>	18	23	P <sub>7</sub>
A <sub>13</sub>	19	22	A <sub>13</sub>
VSS	20	21	A <sub>14</sub>

If I get a chance to play with some of these devices in the near future, perhaps I'll present some simple circuits.

Another significant bit of information I'm sure you'll be interested in is the fact that MOS Technology is working on a CMOS version of the 6502 and is planning to introduce a complete family of CMOS microprocessor devices. The factory is fairly tight-lipped about just what sort of devices will be included in their CMOS line, but said it would be a *complete* family. (To me, that means CPU, I/O, RAM and ROM/EPROM.) Oh well ... time will tell.

Get more information on the 6508, 6523, and



# — AIM 65 —

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## From Optimal Technology

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## From The Computerist

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VSS	1	40	DB7
PA0	2	39	DB6
PA1	3	38	DB5
PA2	4	37	DB4
PA3	5	36	DB3
PA4	6	35	DB2
PA5	7	34	DB1
PA6	8	33	DB0
PA7	9	32	PC7
PB0	10	31	PC6
PB1	11	30	PC5
PB2	12	29	PC4
PB3	13	29	PC3
PB4	14	28	PC2
PB5	15	26	PC1
PB6	16	25	PC0
PB7	17	24	RS0
CS	18	23	RS1
WRITE	19	22	RS2
VDD	20	21	RST

6525 from MOS Technology, 950 Rittenhouse Rd., Norristown, PA 19403 (215) 666-7950.

Here's a list of some application notes that are available from MOS Technology:

#### Applications

Brief #	Title
1	Octal Bus Transceiver, Our Equivalent Asynchronous Two-Way Communicator, TTL-CMOS Compatible
2	MPS 6525 Versus MC6821/8255
3	Handling The 'RDY' Line In 6500 CPU's
4	MPS6520 Versus MC6820/MC6821
5	Dual Processor Configuration With The MPS6508
6	6551 Versus 6850
7	Memory Expansion With The 6508
9	MPS 6508-An Active CPU During Block DMA
11	MPS6508-Handling Vectored Interrupts
12	MPS6525-A Two In One Deal

They can be obtained from MOS Technology (950 Rittenhouse Rd., Norristown, PA 19403)

#### Modem Update

Almost there ... but not quite. If you read my column in the June/July 1980 issue of **Compute II**, you are aware of my interest in modems. Quite frankly, I have been searching for the "perfect" modem. Here are my requirements.

1. Under \$300.
2. Direct connection to phone line w/FCC approved interface.
3. Has capability for autodial/autoanswer under computer control.
4. Originate/Answer mode can be set by computer.
5. Communicates at 300 baud.
6. Interfaces easily with my computer (probably through an RS232 port).

While at the 6th West Coast Computer Faire, I did find one that met all the requirements except for number 4. This modem is called the Microconnection and is made by The Microperipheral Corp. (2643 151st Place N.E., Redmond, WA 98052 206-881-7544). The fact that the Originate/Answer mode is only manually settable from a switch on the front panel and not by the computer, takes it off my list. (*Editor's Note ... picky, picky. RCL*) But this doesn't mean you have to take it off your list. The reason I want this feature is for a possible automated store and forward system where another computer calls my computer for a message for yet another computer somewhere else. Without the ability of my computer to set the mode under software control, someone would have to manually set the switch to Answer while the system is waiting for a call, or to Originate when the system is ready to make a call to the other computer. If you don't need this feature, then the Microconnection could be considered for your application. (*Editor's Note ... Now I understand. RCL*)

Strangely enough, as I was writing this article, the latest issue of Electronic Design (April 16, 1981) reached my desk. In it was an article on how to build a 300 baud modem (with ALL my requirements) from scratch using some preassembled filter modules from Cermetek (1308 Borregas Ave., Sunnyvale, CA 94086). These modules are used in the D.C. Hayes Micromodem which is available for the Apple II or the S-100 bus.

If it turns out that I can't find a commercially available modem that meets all my requirements, I may have to build it from scratch. My rule of thumb on building things from scratch is — IF IT'S AVAILABLE DON'T BUILD IT. If I figure all the time involved in chasing around for parts and the time it takes to actually build and debug the project, I come out WAY ahead if I just spend the extra bucks and let someone else do all the hard work.

Come to think of it, I may be able to MODIFY the Microconnection to suit my needs. Hmmmm....

#### Real Time Clock Subroutine

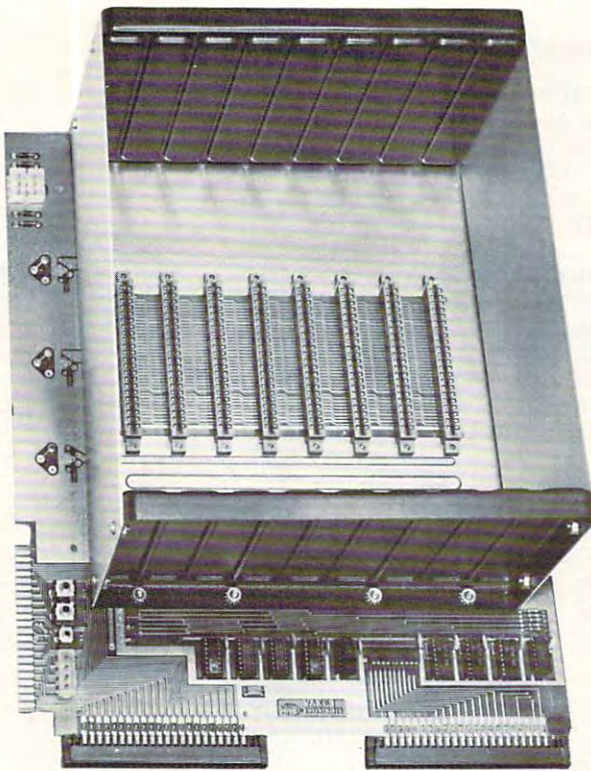
I wrote this subroutine a few years ago just as an exercise and thought you might like to see it.

As opposed to the more conventional straight line coding of real time clocks, this one uses a loop to increment each value and check it against the limit. Five zero page locations are required to hold the time and they must be properly initialized prior to use. Keep in mind that this is just a SUBROUTINE. The complete real time operating system must be written which uses RTCLK as the clock update routine.

Can you write one that is shorter?? If so, send it in and it may be published. How about one that's shorter AND faster?



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\*KIM-4 is a product of MOS Technology/C.B.M.



## HDE ASSEMBLER REV 2.2

```

LINE#  ADDR  OBJECT  LABEL  SOURCE  PAGE 0001
01-0005  2000          $6502 REALTIME CLOCK SUBROUTINE
01-0010  2000          $WRITTEN BY E REHNKE 12,31,77
01-0015  2000          $THE IDEA COMES FROM BYTE MAG
01-0020  2000          $NOV. 77 P. 50. IT WAS CONVERTED
01-0025  2000          $FROM A 6800 PROGRAM JUST TO SEE
01-0030  2000          $HOW EASY IT BE TO DO.
01-0035  2000          $
01-0040  2000          $THIS ROUTINE IS SETUP TO USE
01-0045  2000          $THE HARDWARE FROM BYTE, NOV.77
01-0050  2000          $P. 72 AND CONSISTS OF THE 60 HZ.
01-0055  2000          $LINE FREQ, DIVIDED DOWN AND
01-0060  2000          $PROPERLY CONDITIONED TO FORM A
01-0065  2000          $TTL COMPATIBLE 15 HZ. CLOCK WHICH
01-0070  2000          $IS APPLIED TO THE INTERRUPT INPUT
01-0075  2000          $ON KIM.
01-0080  2000          $
01-0085  2000          $THE FOLLOWING ZPAGE CLOCK REGS
01-0090  2000          $MUST BE INITIALIZED TO THE
01-0095  2000          $CORRECT TIME PRIOR TO STARTING
01-0100  2000          $THE REAL TIME CLOCK.
01-0105  2000          $THEY ARE AS FOLLOWS:
01-0110  2000          $      $00E0= DAYS COUNTER
01-0115  2000          $      $00E1= HOURS COUNTER
01-0120  2000          $      $00E2= MINUTES COUNTER
01-0125  2000          $      $00E3= SECONDS COUNTER
01-0130  2000          $      $00E4= FRACTIONAL COUNTER
01-0135  2000          $
01-0140  2000          $      *=$E0
01-0145  00E0          CLKREG *=$+5
01-0150  00E5          $
01-0155  00E5          $      *=$2000
01-0160  2000  F8          CLOCK  SED          $WORK IN THE DECIMAL MODE
01-0165  2001  A2 04          LDX  #$4          $INITIAL OFFSET
01-0170  2003          $
01-0175  2003  18          CKLOOP  CLC
01-0180  2004  B5 E0          LDA  CLKREG,X          $GET THE TIME...
01-0185  2006  69 01          ADC  #$1          $DO A DECIMAL INCREMENT...
01-0190  2008  95 E0          STA  CLKREG,X          $AND PUT IT BACK.
01-0195  200A  DD 17 20        CMP  TABLE,X          $CHECK IT AGAINST THE LIMIT.
01-0200  200D  D0 07          BNE  RETURN          $NOT YET? THEN LEAVE.
01-0205  200F  A9 00          LDA  #$0          $IF SO, CLEAR THAT REGISTER.
01-0210  2011  95 E0          STA  CLKREG,X
01-0215  2013  CA          DEX          $IS IT TIME TO LEAVE?
01-0220  2014  10 ED          BPL  CKLOOP          $NOT DONE, DO SOME MORE.
01-0225  2016  60          RETURN  RTS          $BACK TO MAIN LINE.
01-0230  2017          $
01-0235  2017  99          TABLE  .BYTE $99,$24,$60,$60,$15
01-0235  2018  24
01-0235  2019  60
01-0235  201A  60
01-0235  201B  15
01-0240  201C          FINISH .END

```

ERRORS = 0000

END OF ASSEMBLY = 201B  
:ASM

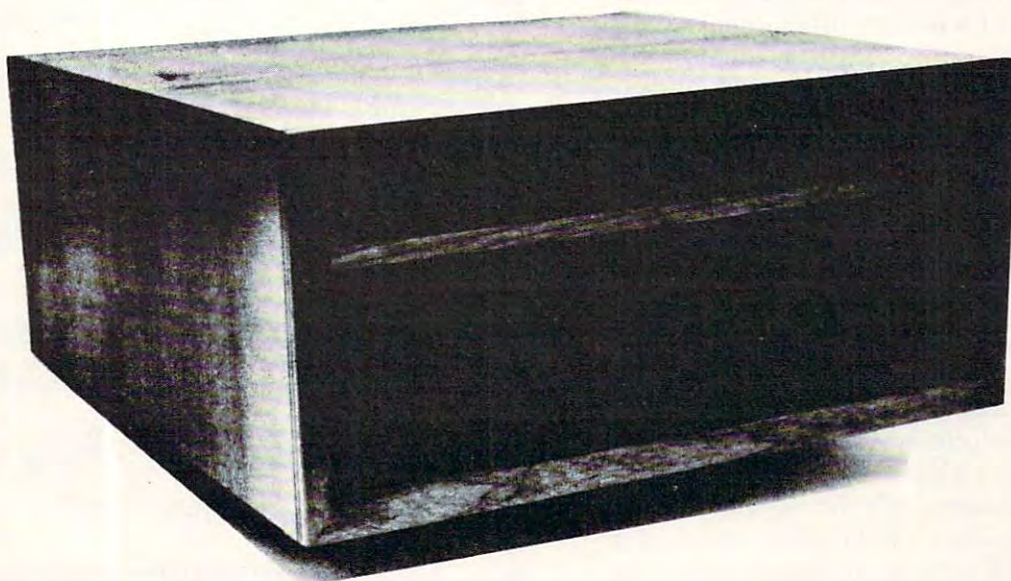




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restoring them without affecting the A register. These are PHXY and PLXY. I found need to investigate these two interesting subroutines when I tried to enter PLXY via a JMP (Jump) instruction instead of a JSR (Jump to Sub-Routine) instruction. Whenever a subroutine call is the last instruction of another subroutine I usually enter it with a JMP instruction instead of a JSR followed by a RTS. This saves one byte and normally works the same. This does not work for PHXY or PLXY because of the way they manipulate the stack. When a subroutine is entered via JSR, the return address is the last two bytes on the stack. Anything that the subroutine pushes on the stack must be pulled off before it can return properly. To get around this problem PHXY and PLXY use a third subroutine called SWSTAK (SWap the STAcK). SWSTAK swaps the 2 bytes that are 2 locations back on the stack with the 2 bytes that are 4 locations back on the stack. So, PHXY pushes the X and Y registers onto the stack and calls SWSTAK. SWSTAK swaps the X and Y bytes with the return address for PHXY and then returns to PHXY. PHXY then returns to its caller with the X and Y register values next on the stack. PLXY works just the opposite. It first calls SWSTAK to swap the saved X and Y registers with its return address. It then pulls X and Y off the stack and returns. If PLXY is entered via a JMP instead of a JSR the stack is not in the expected condition and PLXY ends up returning to the address contained in the saved X and Y registers giving unpredictable results. As long as they are used properly, PHXY and PLXY can be used by the user I/O routines to save and restore the X and Y registers.

A problem I had with the output routine is detecting the end of the output stream. Some devices such as tape and disk need to have a termination or 'close' routine that is executed after all output is complete. This routine must write the last buffer or, as in the case of disk, update the directory. The AIM output routine gives the user routine no indication of when output is complete. There is no consistent way to determine this from the data itself. I solved this problem by using one of the

```

0000      ; PL65 .DFILE INTERFACE
0000      ;
0000      ;   PL65 DATA AREAS
0000      ;
0000      PLDRIV  = $0158      ; PL65 SAVEA DRIVE NUMBER HERE
0000      PLBUFF  = $014B      ; PL65 SAVES FILE NAME HERE
0000      ;
0000      ;   AIM ADDRESSES
0000      DIBUFF  = $A438      ; DISPLAY BUFFER
0000      PHXY    = $EB9E      ; SAVE X AND Y REGS
0000      ;
0000      ;   ZAPDOS ADDRESSES
0000      POINTI  = $9B8E      ; POINT TO INPUT FCB
0000      PL65IN  = $93EB      ; ENTRY FOR DFILE INTERFACE
0000      FCBPTR  = $F8        ; POINTER TO FCB
0000      DRIVE   = 6          ; OFFSET TO DRIVE # IN FCB
0000      ;
0000      * = $112
0112      ; F3 VECTOR
0112 4CD00F      JMP DFILE      ;
0115      * = $0FD0
0FD0      ;
0FD0 209EEB      DFILE JSR PHXY      ; SAVE REGS
0FD3 A206        LDX #6
0FD5 BD4B01      DLUP  LDA PLBUFF,X  ; COPY FILE NAME TO DIBUFF
0FD8 9D38A4      STA DIBUFF,X
0FDB CA          DEX
0FDC 10F7        BPL DLUP
0FDE A920        LDA #$20
0FE0 8D3EA4      STA DIBUFF+6      ; MARK END OF NAME
0FE3 208E9B      JSR POINTI        ; POINT TO INPUT FCB
0FE6 AD5801      LDA PLDRIV        ; GET PL65 DRIVE
0FE9 C9FE        CMP #$FE          ; ANY SPECIFIED?
0FEB F007        BEQ NODRV         ; NO, SKIP
0FED 6A          ROR A
0FEE 6A          ROR A              ; SHIFT TO 2 HI BITS
0FEF 6A          ROR A
0FF0 A006        LDY #DRIVE
0FF2 91F8        STA (FCBPTR),Y    ; AND SAVE IN FCB
0FF4 4CEB93      NODRV JMP PL65IN   ; ENTER ZAPDOS
0FF7      .END
0FF7      ERRORS= 0000

0000      ;   TIMER BUG VERIFICATION PROGRAM
0000      DI1024  = $A497      ; TIME X 1024
0000      RINT    = $A485      ; TIME OUT
0000      COMIN   = $E1A1      ; RETURN TO MONITOR
0000      CUREAD  = $FE83      ; INPUT A CHARACTER
0000      RED2    = $E976      ; ECHO A CHAR
0000      * = $200
0200 2083FE      READ JSR CUREAD    ; READ A CHAR
0203 48          PHA              ; SAVE IT
0204 A9FF        SET  LDA #$FF      ; 255 X 1024
0206 8D97A4      STA DI1024        ; START TIMER
0209 2C85A4      BIT RINT          ; TIME UP ALREADY?
020C 1003        BPL LUP           ; NO, TRY AGAIN
020E 4CA1E1      JMP COMIN        ; EXIT ON TIMER ERROR
0211 2C85A4      LUP   BIT RINT     ; TIME UP?
0214 10FB        BPL LUP          ; NO, WAIT
0216 68          PLA
0217 2076E9      JSR RED2          ; ECHO CHAR
021A 4C0002      JMP READ         ; REPEAT
021D      .END
021D      ERRORS= 0000

```

AIM user function keys to execute the routine to close the output file. This means that I must remember to push that key after each use of user output. This is inconvenient but the only feasible way to solve the problem.



An even greater problem is how to handle end of file on input. My disk routines detect end of file and return a condition code, but there is no way to tell the AIM routine that there is no more data. Each different AIM program detects the end from the data in its own way. The 'L' command uses a zero length record; the editor uses two successive CRs (carriage returns); the assembler uses a .END statement followed by two CRs; BASIC uses a CTL-Z. Another inconsistency in the 'L' command causes it to try to read 5 or 6 more characters from the final zero length record than the 'D' command wrote. The user input routine must compensate for this and provide pad characters or the 'L' command will not terminate properly. When the KBD/TTY switch is in the TTY position, and OUTFLG is set to 'U', the AIM CRLF routine inserts an LF (Line Feed) and a null (AIM uses hex FF for a null) after each CR. On input AIM does not expect these characters to be included. The 'L' command will ignore the LFs and nulls when inputting a line of data. The editor will ignore the LFs but not the nulls. The null between the two successive CRs that end the file cause the editor to fail to recognize the end and continue to request data. To solve this problem, the nulls must be deleted from either the input stream or the output stream. I chose to delete nulls from the output stream because this saves disk storage space.

The assembler requires that the source file be read twice, once for each pass. It is designed to read the source file from tape. Before starting pass 1 it saves the name of the tape file at location \$A7. Before starting pass 2 it moves the name of the tape file back to the name buffer (\$A42E) and to the display buffer (\$A438). It then calls the tape open routine. If the source is coming from the 'U' device it moves the file name and then makes an extra call to the user input routine. However it does not indicate to the user input routine that the call is to open a file and not to read another character. The only way I could find to detect the extra call is to test the stack to see what page the call was from. The assembler also makes an extra call to the user input routine when it encounters a .FILE statement. The .FILE statement is used to link source files together so that programs too long for the editor buffer may be assembled. When the assembler encounters a .FILE statement it moves the file name to the name buffer and display buffer and makes a call to the user input routine. Again the only way to distinguish this call from a normal input call is by checking the stack. While investigating the .FILE statement I found an undocumented feature of the assembler. The .END statement may also contain a file name. If it does, then that file is used to start pass 2 instead of the one saved at location \$A7. This allows pass 2 to start with a different file than pass 1. Of what use is

# 6502 FORTH

- 6502 FORTH is a complete programming system which contains an interpreter/compiler as well as an assembler and editor.
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this feature? Sometimes it may be useful to have the first file of a program contain only label definitions (= directives). Since these statements only make entries in the symbol table and generate no code it is not necessary to read them again for pass 2. This feature can be used to save time and printer paper. You may have a file containing definitions for all the AIM subroutine addresses that you use for every program you write, but they still consume no extra space in the source file or the program listing. You can use the .END feature to omit the definition file from pass 2, but remember to set the program counter in the first file to be read in pass 2, instead of in the definitions file or assembly errors may result.

So, the user input must detect the special open calls by the assembler .FILE and .END statements, and the start of pass 2. This can only be done by checking the page of the calling routine. These calls are made from pages \$D4 and \$D6. It must also provide pad characters for the 'L' command. The user output routine must delete all null characters so that the editor can properly recognize the end of the file on input. As an example I have included listing 1 which is the user I/O interface for my disk system. The disk routines are not included. These routines work with all AIM commands that use the AID or AOD including 'L', 'D', the editor, the assembler, BASIC, and PL/65.

PL/65 also has a linked file feature. It uses the .TFILE statement to link tape files and the .DFILE statement to link disk files. The .TFILE statement causes the tape open routine to be executed. The .DFILE statement executes the disk open routine through the user F3 key vector. This makes the disk open interface much more straightforward than the way the assembler does it. PL/65 stores the file name at location \$14B and the drive number at location \$158 before calling the F3 key routine. Listing 2 is the routine needed to implement the .DFILE statement.

Another consideration is console communications. It may be necessary to request information from the user during user I/O. For example, my disk initialization routines prompt the user for the name of the file to be used. Care must be taken which AIM monitor subroutines are used at this time. Some communicate with the keyboard and display only, while others use the AID or AOD. Normally the keyboard and display are the AID and AOD so calling OUTPUT and OUTALL, for example, give the same results. After the WHERE subroutine is executed the AID or AOD has changed. If the user output initialization calls OUTALL instead of OUTPUT to display a character, it will end up calling itself. The results are unpredictable. There are two ways to solve this problem. Either be sure to call only keyboard/display routines or change the AID or AOD to the

keyboard/display before attempting to communicate with the user, and restore the AID or AOD after communications is complete.

You can make your programs device independent also. To make a program device independent, you must call the WHERE subroutines before doing any I/O that is to be device independent. The data must be read or written with subroutines that use the AID or AOD. Here again care must be taken to use only AID and AOD subroutines and not the keyboard/display subroutines. Calling a wrong subroutine could cause part of the data to end up on the display or the program could hang up waiting for input from the keyboard. Subroutine LL can be used to return the keyboard and display to the AID and AOD. Even BASIC programs can change the AID and AOD by calling the WHERE subroutines with the USR function. This will cause BASIC input or output to be redirected. Of course when using some devices such as tape or disk there are close routines that must be executed to terminate output. Routine DU12 (\$E511) does this for AIM tape output.

Another discovery that I made is that AIM's 6532 timer has the same bug as KIM's 6530 timer. KIM's 6530 has a bug that causes it to ignore a start command on the average of once every 256 starts. I chose to use the 6532 because it has a maximum interval of more than a quarter of a second, while the 67522 timer can only time up to 65 milliseconds. I was immediately suspicious of the 6532 when I saw that it works exactly like the 6530 and that the two chips have other similar features. So I wrote a small program to prove the presence of this bug. Listing 3 is the result.

The 6530/32 timer, when not in use, is continuously counting down from \$FF to 0 at the rate of the CPU clock signal. The bug occurs when the CPU tries to store a starting value in the counter register just as the count is passing zero. When this occurs the timer ignores the CPU. The result is an immediate time out the first time the program checks the timer. The routine in listing 3 proves that the 6532 is guilty. It first reads a character from the keyboard to get a random starting time for the timer. It then starts the timer for about a quarter second and checks to see if there is an immediate time out. If there is, it returns to the monitor. If there is not an immediate time out it enters a loop and waits for the timer to time out. Then it echos the character and repeats the sequence. If the timer is working correctly the program can never end, unless the escape key is used. It may take several hundred tries sometimes, but this program will always eventually catch the timer bug and return to the monitor.

This bug will cause occasional errors in my disk system if not circumvented. The way to circumvent this bug is to always use 2 successive stores



to start the timer. If the first try fails, the second will work since the timer will not have counted back to zero by the time the second store is executed. If the first try is successful then the second will also be successful since the timer will not have counted back to zero yet. Does this bug cause any problems in the AIM? I am not sure. I looked at the AIM program listing manual and found that the AIM uses this timer in the printer routines and the tape routines. The best guess I could make is that it may

cause an occasional 'PRINTER DOWN' when the printer is really up, or maybe a lost bit on tape. I would like to know if anyone has experienced any problems like these.

AIM 65 provides you with a flexible I/O system. The user I/O function gives an expandability not usually found in an SBC. If you follow the guidelines given here you should be able to implement any device via the AIM user I/O function. ©

# Dungeons And Dragons Dice Simulator For The KIM-1

Myron A. Calhoun  
Manhattan, KS

Last Christmas my older son received a "Dungeons and Dragons" game, but when the package was opened there were no dice included. (There were small numbered squares of cardboard for shaking and drawing out of a cup, but this seemed to slow the game considerably.) Even worse, the local

hobby shop was completely sold out, so a state of near emergency existed.

(Trumpets!) Enter a KIM-1 to the rescue. The enclosed little program was quickly derived, my son was taught how to load it into the KIM-1, and the crisis was over. (Even though he has since located dice in another store, their relatively high cost and his small allowance have caused him to continue using this program!)

## Summary Of Operation

Pressing the KIM-1's "0", "1", "2", "3", "4", or "5" key simulates rolling a 4-, 6-, 8-, 10-, 20-, or 100-sided die. The result is displayed as a random number in the range 1-4, 1-6, 1-8, 1-10, 1-20, or 1-100, respectively. Pressing any other key clears the display to zeroes. Holding any one of the operational keys down displays successive random numbers but too fast to read. "Random" numbers are derived from the free-running built-in timer in the KIM-1.

ASM6502: 6502 CROSS-ASSEMBLER USING PROPOSED I.E.E.E. STANDARD (DRAFT 11)

; DUNGEONS AND DRAGONS DICE SIMULATOR FOR THE KIM-1

; PRESSING THE KIM-1'S "0", "1", "2", "3", "4", OR "5" KEY  
; SIMULATES ROLLING A 4-, 6-, 8-, 10-, 20-, OR 100-SIDED  
; DIE. THE RESULT IS DISPLAYED AS A RANDOM NUMBER IN THE  
; RANGE 1-4, 1-6, 1-8, 1-10, 1-20, OR 1-100, RESPECTIVELY.  
; HOLDING ONE OF THE ABOVE-NAMED KEYS DOWN WILL DISPLAY  
; SUCCESSIVE RANDOM NUMBERS BUT TOO FAST TO READ. PRESSING  
; ANY OTHER KEY WILL CLEAR THE DISPLAY TO ZEROES. "RANDOM"  
; NUMBERS ARE DERIVED FROM THE FREE-RUNNING BUILT-IN TIMER  
; IN THE KIM-1.

1704	RANDOM	EQU	H'1704	; DEFINE MISCELLANEOUS ADDRESSES
00FB	LEFT	EQU	H'FB	; OF THIS-N-THAT IN THE KIM-1
00FA	MIDDLE	EQU	LEFT-1	; "OPERATING SYSTEM" RESERVED
00F9	RIGHT	EQU	MIDDLE-1	; MEMORY AREA
1F1F	SCANDS	EQU	H'1F1F	
1F6A	GETKEY	EQU	H'1F6A	

0000	A9	00	START	LD	.A,#0	; CLEAR THE INITIAL DISPLAY
0002	85	F9		ST	.A,RIGHT	; TO ALL ZEROES
0004	85	FA		ST	.A,MIDDLE	
0006	85	FB	NEWVALU	ST	.A,LEFT	; SET NEW VALUE (FOUND BELOW)
0008	20	1F 1F	DISPLAY	CALL	SCANDS	; "PUMP" THE DISPLAY AND ALSO
000B	F0	FB		BZ	DISPLAY	; SEE IF ANY KEYS ARE PRESSED



```

000D D8          CLRD          ; FETCH THE BINARY
000E 20 6A 1F    CALL GETKEY   ; KEY VALUE FROM THE KEYBOARD.
0011 C9 15       CMP .A,#21    ; IF NO KEY IS BEING PRESSED
0013 F0 F3       BEQ DISPLAY   ; RIGHT NOW, CONTINUE DISPLAY. IF
0015 C9 06       CMP .A,#6     ; A KEY LARGER THAN "5" IS PRESSED,
0017 B0 E7       BC START      ; THEN CLEAR THE DISPLAY AGAIN.
0019 AA          MOV .A,.X      ; SAVE VALID KEY (0,1,2,3,4,5)

001A AD 04 17    LD .A,RANDOM;  FETCH "RANDOM" NUMBER FROM TIMER
001D 29 7F       AND .A,#H'7F ; AND CONVERT TO VALUE BETWEEN 0
001F D5 3B       TRYAGIN CMP .A,TABLE(X); AND 3, 5, 7, 9, 19, OR 99
0021 90 06       BNC CONVERT   ; (DEPENDING ON VALUE IN X REGISTER)
0023 38          SETC          ; BY REPEATEDLY SUBTRACTING 4, 6,
0024 F5 3B       SUBC .A,TABLE(X); 8, 10, 20, OR 100 (FROM THE TABLE)
0026 4C 1F 00    BR TRYAGIN    ; AND CHECK AGAIN.

0029 AA          CONVERT MOV .A,.X ; NUMBER IS STILL IN BINARY FORM, SO
002A A9 00       LD .A,#0      ; CONVERT TO DECIMAL BY COUNTING
002C F8          NOTYET SETD    ; THE BINARY DOWN WHILE COUNTING
002D 18          CLRC          ; THE DECIMAL UP.
002E 69 01       ADDC .A,#1    ; (THIS IS A "CHEAP AND DIRTY"
0030 CA          DEC .X        ; CONVERSION METHOD!)
0031 10 FA       BP NOTYET

0033 85 FA       ST .A,MIDDLE ; THEN PUT POSSIBLE 2-BYTE ANSWER
0035 A9 00       LD .A,#0      ; INTO ADDRESS PART OF DISPLAY
0037 2A          ROLC .A       ; (LEFTMOST BYTE CAN ONLY CONTAIN
0038 4C 06 00    BR NEWVALU   ; THE "1" AS IN "100")

003B 04 06 08    TABLE DATB 4,6,8,10,20,100 ; MAX VALUES FOR 6 DICE
003E 0A 14 64
0000            END START      ; MYRON A. CALHOUN, 29XII80

```

The program is written using the proposed IEEE (Institute of Electrical and Electronic Engineers) Microprocessor Assembly Language Standard (Draft 11) as it applies to the 6502 microprocessor. Although it differs slightly from the assembly language seen in other **COMPUTE!** articles, it should be easily understandable. According to Wayne P. Fischer, Chairman of the IEEE Computer Society's Microprocessor Assembly Language Standard Subcommittee, "The impetus for the development of this standard was the helter skelter proliferation of microprocessor mnemonic codes, the inconsistent and conflicting use of operands, the varying definition of address modes, and other annoying anomalies of the various assembly languages. The standard will transform this mishmash of languages into one that is consistent, easily understood, and easily used"(1).

The program itself is rather simple and the comments should explain it sufficiently. About the only "trick" is the method used to convert a binary

number in the accumulator into a BCD number in the display. Beginning at the label CONVERT (at address H'0029), the program performs a "brute force" conversion by counting the binary value downward (after moving it to the index register) while simultaneously counting the BCD value upward in the accumulator *in decimal mode*. The value 100 (decimal) causes the CARRY bit to be set, and care must be taken to move the "1" to the display.

The TABLE values (at location H'003B) may be changed if other maximum die values are desired. The maximum length of the table is the immediate operand of the instruction at location H'0015.

The program is short enough that loading before a game takes but a few minutes. It has even gotten my boy a little interested in computers!

(1) Fisher, Wayne P., "Microprocessor Assembly Language Draft Standard", IEEE Computer Magazine, December 1979, pp. 96-109.

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# New Products



## New Business Software Packages

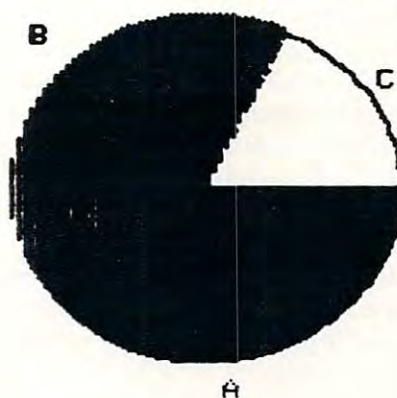
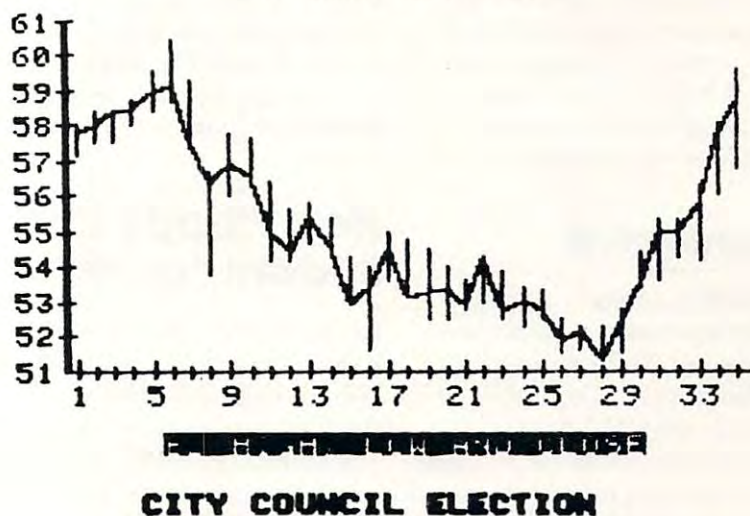
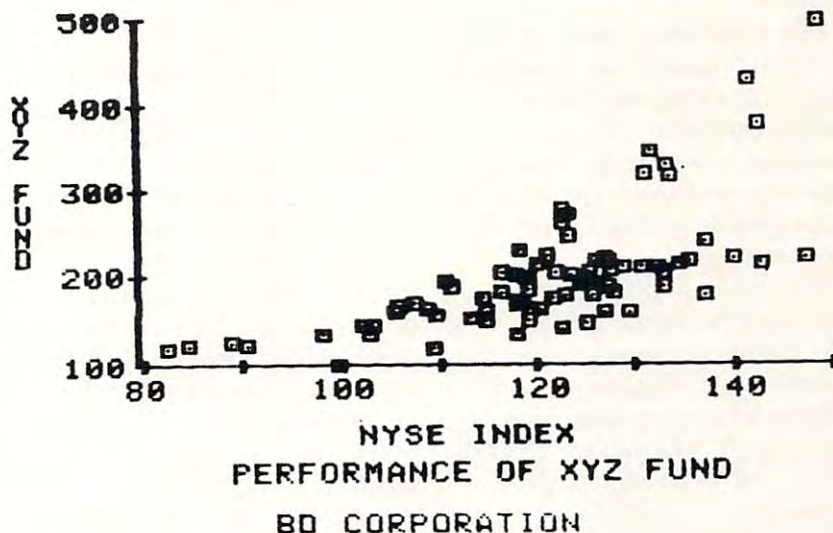
SUNNYVALE, CA — May 1, 1981 — Four new software packages for business use have been introduced by Personal Software Inc. The new software more than doubles the firm's line of generic software applications packages for major brand personal computers.

The new software products include the VisiPlot™ program, a high-resolution plotting and graphics package; the VisiDex™ program, a highly flexible and personal information system; the VisiTrend/VisiPlot™ program, a combination of VisiPlot graphics and a program for time-series manipulation, trend forecasting and descriptive statistics; and the VisiTerm™ program, which allows a personal computer to communicate with a variety of computers ranging from mainframes to micros.

Also being introduced is an enhanced version of the VisiCalc™ program, which is available for the Apple II and Apple II Plus computers. Compatible with Apple's 16-sector disk storage format, the updated VisiCalc features 17 new commands and operations which make computerized numerical model-building much easier and more powerful.

A major feature of many of the Personal Software™ programs is the ability to pass information between programs. VisiPlot and VisiTrend, for example, can share data directly with the recently updated VisiCalc program.

With VisiTerm program files from VisiCalc, VisiPlot and VisiTrend/VisiPlot, or files created with VisiDex, can be sent



A BROWN	44%
B GREEN	38%
C UNDECIDED	18%
% OF VOTE	

PERSONAL SOFTWARE INC., 1981

Sample printout from the VisiPlot and the VisiTrend/VisiPlot programs illustrate inverse type and shading. Producible graphs include bar, area, scatter, pie, line and high-low. VisiPlot and VisiTrend/VisiPlot will graph on the Apple Silentype, Trendcom 200, Integral Data Systems' Paper Tyger and NEC Spinwriter Printers.



between computers over phone lines or through other connections. VisiTerm acts as a terminal for accessing large computer systems from a personal computer, or for allowing one personal computer to transfer information to another.

The four new products bring to seven the number of packages in Personal Software's line of "generic" business software. Generic software can be used for a wide variety of tasks and applications by people without programming expertise.

All four new programs operate on the Apple II and Apple II Plus personal computers with 48K bytes of memory and are 16-sector compatible, with or without Apple's Language System. VisiDex and VisiTerm require one disk drive. VisiPlot and VisiTrend/VisiPlot require two disk drives and Applesoft Basic.

Suggested retail prices are: VisiDex, \$199.95; Visi-Plot, \$179.95; VisiTrend/VisiPlot \$259.95; VisiTerm \$149.95.

## CompuServe

COLUMBUS, Ohio — CompuServe Incorporated (Corporate Headquarters, 5000 Arlington Centre Boulevard, Columbus, OH 43220 614/457-8600) announced today that more than 10,000 customers now comprise the active list of subscribers to the CompuServe Information Service.

The 10,000 figure reflects the actual number of paying customers and does not include demonstration accounts, media accounts or employees.

The geographic distribution of the 10,000 customers shows high concentrations in and around New York City and the eastern seaboard, the "Silicon Valley" area of California and the areas around Los Angeles, populous areas of the South and industrial cities of the Midwest.

The CompuServe Information Service provides information

and services to owners of personal computers and computer terminals in the main subject areas of news, finance, entertainment, home information, electronic mail and personal computing. Customers access CompuServe by a local telephone call in more than 260 U.S. cities.

Specific offerings include the latest news from a national news wire and major newspapers; family information including food recipes, nutrition, meal planning, home improvement and self development; financial information such as current and historical data on securities, commodities pricing and financial analysis; entertainment including multi-player games and simulations; electronic mail for message sending and retrieving; and personal computing services which include programming languages, software purchases and technical documentation.

CompuServe is an H&R Block Company.

## New Floppy Disk System For PET™

CGRS Microtech, Inc. has introduced a new low cost, high performance floppy disk system for the Commodore Pet series of computers. PEDISK II is now available and can be purchased with 5¼" or 8" disk drives. A small 2½ x 5 inch disk controller board mounts inside the machine and contains the PDOS software ROM and all the disk control circuitry. An external disk drive(s) and cable complete the system.

One, two, or three drives connect to the PEDISK II controller board providing the fastest mass storage system available for the 2000, 4000, or 8000 series Commodore Pet. The single drive 5¼" system retails for \$595.00 and offers 143 Kbytes of storage. The dual drive 5¼" quad density system provides 572 Kbytes of high speed storage and retails for \$1195.00

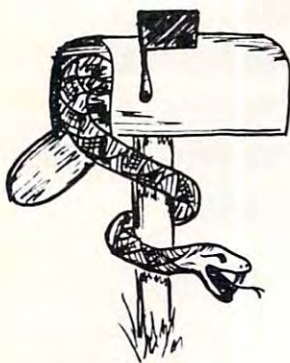
PEDISK II is compatible with all Commodore disk systems and both can be simultaneously used in the same machine. With appropriate software, files can be transferred from one disk system to the other.

One of the unusual features of the 8" PEDISK II System is its ability to exchange diskettes with large computers. Data files can be entered and edited on a small Pet/PEDISK system and the diskettes can be transferred to a larger 3740 format computer for more extensive processing or storage. Data files, mailing lists, etc. that are available on large business computers can also be read and processed by remote distributed PEDISK II Systems.

The PDOS II software package links the resident BASIC language to the disk system by adding a new repertoire of disk commands. !OPEN, !CLOSE, !INPUT, and !PRINT provide the basis of a powerful file handling package. Sequential, Random, Indexed, or Relative file types are accommodated in the standard PDOS software package. !LOAD, !SAVE, !LIST, and !RUN commands provide complete program control from BASIC. PDOS II software also offers a full DOS-mode of operation for all disk diagnostic and utility functions. Diskette formatting, backup copying, diagnostics,

*New Product releases are selected from submissions for reasons of timeliness, available space, and general interest to our readers. We regret that we are unable to select all new product submissions for publication. Readers should be aware that we present here some edited version of material submitted by vendors and are unable to vouch for its accuracy at time of publication.*





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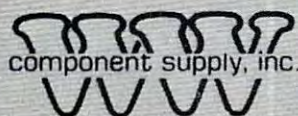
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and file reorganization capabilities are all available.

The PEDISK II floppy disk system is available in several versions. Either 5¼" or 8" disk drives are available. The system can accommodate 40 or 80 track drives in the 5¼" version. Standard versions are available with either a single or dual drives. For more information, contact your local dealer or CGRS MICRO-TECH, Inc. P.O. Box 102, Langhorne, PA 10947 215-757-0284.

## INSTANT ROM!

Greenwich Instruments Limited announce INSTANT ROM, a new programming aid for microcomputers and microcontrollers.

INSTANT ROM is 2k bytes or 4k bytes of CMOS memory with battery back-up which plugs into any standard ROM/EPROM socket, or into the ROM expansion sockets of the PET and similar microcomputers. It can be treated as RAM, and machine language programs can be easily written into it.

The difference is that the program stays when the power is switched off. Therefore, it behaves exactly like ROM.

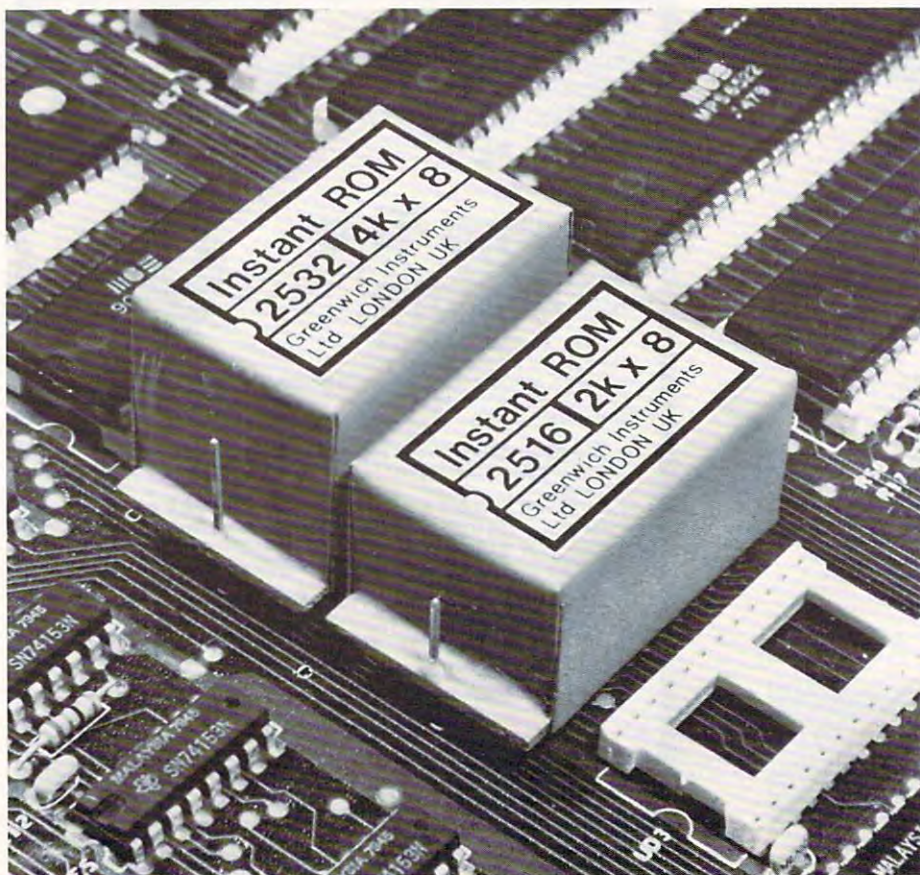
Programs can be edited or altered immediately, without any erasure problems, yet the program is permanent.

When used with personal computers (particularly the PET), it is now possible to write security and utility programs quickly, run and debug them, and finally consign the program to EPROM. But since battery life is typically 6 years, it is possible to ship a system with INSTANT ROM and supply the ROM later.

"Custom font" character generators for microcomputers and printers can also be quickly produced with INSTANT ROM; the results can be observed and put into service immediately.

### Prices

2k devices: 2516 (for use with PET) and 2716: £39 inc. postage  
4k devices: 2532 (for use with PET) and 2732: £56 inc. postage  
VAT extra 15%



## Commodore International Introduces "Micro-Mainframe" Computer

NORRISTOWN, PA — Commodore International Ltd. (NYSE: CBU) has announced the introduction of the "Micro-Mainframe", a new generation computer that combines the power and languages available on mainframe systems with the low cost of microcomputers.

Applications developed on the Micro-Mainframe can be up-loaded to a mainframe system, and executed without modification.

The computer is based on the standard Commodore Business Machines Model 8032 microcomputer, featuring an integrated green phosphor 12 inch (80 x 25) display, 73-key typewriter style keyboard with standard upper/lower case, numeric keypad, and full cursor control.

The Micro-Mainframe is a pseudo 16 bit 6809 based system with 36K ROM, 96K user RAM and 2K screen RAM (134K total) that supports all current CBM peripherals except the C2N cassette recorder.

The communication facility supports the standard RS232 C interface with speeds up to 9600 baud.

Files are stored in true ASCII format for communication and compatibility with mainframe systems.

The Micro-Mainframe allows the generation, testing, editing, and debugging of program source files in the interpretive mode.

These files can then be executed on the Micro-Mainframe or transmitted and executed on the mainframe system utilizing the same language interpreters.

An extensive software package for the Micro-Mainframe has been developed by Waterloo



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\*NOTE: Old DOS doesn't recognize three of the commands.

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The Disk-O-Pro is completely compatible with the BASIC programmer's Toolkit. The chip resides in the socket at hexadecimal address \$9000, the rightmost empty socket in most PETS. And for the owners of "classic" (or old) PETS, we do have interface boards.

(For those owning a BASIC 4.0 or 8032, even though the Disk-O-Pro may not be suitable, the Command-O is. Just write to Skyles for additional information. Remember, we have never abandoned a PET owner.)

Complete with 84-page manual written by Greg Yob...who was having so much fun that he got carried away. We had expected 32 pages.

Skyles guarantees your satisfaction: if you are not absolutely happy with your new Disk-O-Pro ROM chip, return it to us within ten days for an immediate full refund.

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# CBM/PET? SEE SKYLES ... CBM/PET?

## "Look how fast I create these great graphic displays on my PET with the new PicChip... it's like home movies."

**PicChip, the new ROM that took Europe by storm, available only from Skyles Electric Works in the U.S. and Canada.**

PicChip, a ROM extension of the BASIC version III, BASIC 4.0 or BASIC 8032 interpreter that offers over 40 commands that allow you to create programs with dynamic graphics displays: plots, bar graphs, pictures; and rolling, scrolling, shifting and inverting. All instantly and easily added to your BASIC program.

The address for the 2000/3000 (which would require PicChip module PC2), for the 4000 (PC4), and for the 8000(PC8) is \$A000... unless you have a Mikro, WordPro III or IV, or Jinsam, which occupy that same address. In those cases, you will need the PicChip on an interface board that would reside in address B800... for the 2000/3000 series (PCB2), above the Toolkit. For the 4000 (PCA4) and 8000 (PCA8), the Mikro or WordPro would be switchable manually using the Skyles Socket-2-ME.

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Computing Systems Limited to meet the requirements of the University of Waterloo, Waterloo, Ontario. This portable software is particularly suited to microcomputers, but identical versions are available on medium and large scale systems. Thus a user is not limited by the capacity of the micro; the identical program will run without modification on many of the largest and fastest systems available.

The package consists of interpreters for various languages, an editor, an operating system (supervisor) and an assembly language development system.

The four language interpreters include Waterloo microBASIC, Waterloo microPascal, Waterloo microFORTRAN and Waterloo microAPL. COBOL is under development by Waterloo Computing Systems Limited. These language interpreters have been designed specifically for teaching computer programming. Their design emphasizes good error diagnosis and debugging capabilities which are useful in educational and other program development environments.

Waterloo microBASIC includes ANS Minimal BASIC, with certain minor exceptions, and several extensions such as structured programming control, long names for variables and other program entities, character-string manipulation, callable procedures and multi-line functions, sequential and relative file capabilities, integer arithmetic, debugging facilities, and convenient program entry and editing facilities.

Waterloo microPascal is an extensive implementation of Pascal, corresponding very closely to draft proposals being produced by the international standards Organization (ISO) Pascal Committee. The ISO draft language is a refinement of the language originally defined by Wirth, varying only in minor aspects.

This implementation includes



sophisticated features such as text file support, pointer variables, and multi-dimensioned arrays. A significant feature of Waterloo microPascal is its powerful interactive debugging facility.

Waterloo microFORTRAN is a special dialect designed for teaching purposes. It has many of the characteristics and much of the flavor of normal FORTRAN, but varies significantly from established standards for that language.

This language processor has many of the important characteristics of the WATFIV-S compiler, which is widely used on IBM computers, plus some features from the new FORTRAN-77 definition.

Examples of language features supported are FORMAT, subroutines and functions, multi-dimensioned arrays, extended character-string manipulation, structured programming control and file input/output. In addition, the interpreter provides a powerful interactive debugging facility.

Waterloo microAPL is intended to be a complete and faithful implementation of the IBM/ACM standard for APL with respect to the syntax and semantics of APL statements, operators and primitive functions, input/output forms, and defined functions.

System commands, system variables and system functions are those consistent with a single-user environment. There are no significant design limitations on the rank or shape of arrays or name length. The shared variable processor is omitted. Extensions include system functions supporting files of APL arrays. APL equivalents of BASIC features PEEK, POKE and SYS are included.

A text editor, known as Waterloo microEDITOR, is included which is suitable for creating and maintaining both program and source data files. It is a traditional line-oriented text editor with powerful text search-

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ing and substitution commands including global change. Full-screen support and special function keys allow text to be altered, inserted and deleted on the screen without entering commands. Facilities for repeating and editing previously issued commands further enhance the useability of this editor.

Disk-oriented Assembler and Linker programs, the Waterloo 6809 Assembler and Linker, are included which support development of general purpose Motorola 6809 machine-language programs.

The Assembler supports syntax and directives for Motorola 6809 assembly language and includes powerful macro capabilities. In addition, the Assembler supports pseudo opcodes for structured programming control, long names (labels) for meaningful identification of program segments and data, and the ability to include definitions from separate files. The Assembler produces both a listing and relocatable object file.

The Linker allows the combination of an arbitrary number of relocatable object files to produce an absolute loadable and executable program file. Since it is disk-oriented, the Linker is capable of building programs which are larger than the RAM work space available. The Linker supports building of programs in segments or banks for operation in bank-switched RAM memory, as well as supporting building of programs for operation in normal RAM memory.

The Waterloo microSUPERVISOR is an operating system designed for single-user micro-computer environments. It includes a Monitor, Library and Serial Line Communication support.

The Monitor program supports loading of Linker-produced program files into bank-switched RAM memory or normal RAM memory. The Monitor also provides facilities

which are useful for debugging machine-language programs. These include commands to display and alter RAM memory and 6809 microprocessor registers, utilizing full screen features for ease of use. In addition, a Monitor command permits disassembly of Motorola 6809 microprocessor instructions into assembly-language mnemonics.

A library of functions and procedures is supplied for general use by other programs included in the Package. The Library includes support functions for input/output operations to the keyboard, screen and peripheral devices. Other elements of the Library provide floating-point arithmetic, fundamental trigonometric functions, and several general purpose utility functions.

A Serial Line Setup program is included which provides for the selection of programmable characteristics, such as baud rate. The program includes support for establishing communication with a host computer, through a serial line, for accessing the host's files and peripheral devices.

Reference manuals, textbooks and instructors' guides are available for each software component of the system.

The Micro-Mainframe can operate as a stand-alone system, with the wide variety of software available, as a mainframe system development tool with the available languages and up-load/off-load capabilities, and in the educational environment for training in languages and system design.

Deliveries are scheduled for late 1981.

## PET To Mainframe Interface

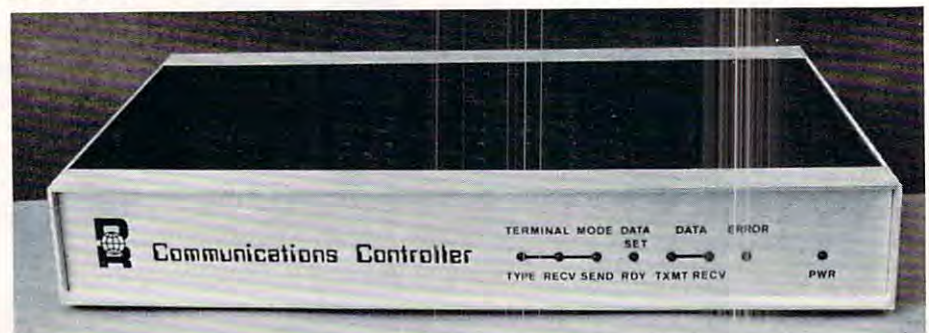
A combined hardware/software package that enables PET Micro-computers to be connected to Mainframes and act as full facility interactive terminals is available from Davidson-Richards Limited.

The system comprises a communications control box and software that controls both it and the PET when running in the communications mode. The box, which connects directly to the PET user port, is microprocessor controlled. Memory is provided to house the protocol handling routines, which are both resident in ROM and downloaded from the PET, and also act as a receive and transmit buffer.

Output from the control box is via a RS232C interface, enabling communication with the host Mainframe by direct line or telephone modem. Efficient handling techniques allow several terminals (whether PET based or not) to share a single line depending upon its capacity and quality.

In use, the PET emulates a full facility video terminal with addressable cursor, format control and protected fields. Facilities for screen hard copy print and mainframe controlled loading and running of PET Basic application programs are provided. The status protocol enables the PET to be switched from the mainframe for local program working, and returned via a 'break-in' message. Disk drive and printer operation is unaffected.

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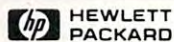
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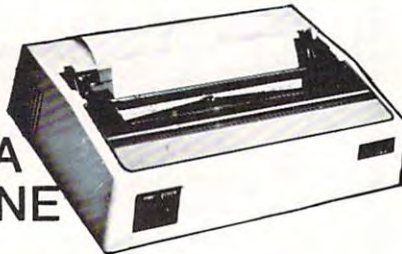
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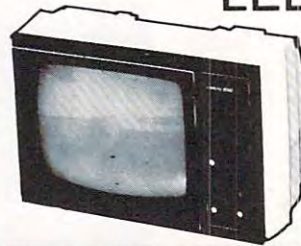
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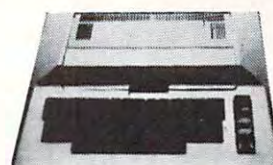
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## Price Reductions, New Software Announced For ATARI Computers

SUNNYVALE, CA — May 4, 1981 — Significant price reductions on selected computer, memory and peripheral products, new consumer and technical software, and pricing for products introduced earlier were announced today by the Computer Division of Atari, Incorporated, headquartered here.

Timed for announcement at the National Computer Conference in Chicago, these moves are "aimed at giving our customers an even better price/performance package, while adding program-

ming aids that will appeal to those who develop software for the markets we want to address," Roger H. Badertscher, president of the division, said. Atari also announced special software and accessory packages and pricing for particular market segments, designed for sale through mass merchandisers and dealers.

The changes in suggested retail prices:

— The ATARI 400™ Personal Computer System with 16K of random access memory (RAM) has been reduced in price 37 percent, from \$630.00 to \$399.00, making it the most powerful personal computer in its price range. The ATARI 400 computer system with 8K RAM has been discontinued.

— Prices of the company's 8K and 16K RAM Memory Modules™ for the ATARI 800™ are now \$49.95 and \$99.95, respectively, reductions of 60 and 50 percent.

— The ATARI 820™ 40-column impact printer has been reduced 33 percent to \$299.95, from \$449.95.

— New software includes: Personal Financial Management System™, a database-oriented system designed to help the user plan and analyze a home budget. For the ATARI 800™ computer, \$74.95.

Dow Jones Investment Evaluator™ connects an ATARI 800 computer to the Dow Jones Information Service to keep track of portfolio value and current financial news, \$99.95.

Microsoft BASIC, a programming language, which, with the Atari computer player missile graphics system, gives serious programmers the ability to create faster, more powerful and more precise programs. For the ATARI 800 computer, \$89.95.

ATARI SORCIM Macro Assembler and Program-Text Editor, both for the ATARI 800 computer, are for use by advanced programmers. Price and availability have not been determined.

### Pricing

The previously introduced ATARI Accountant™ software package for small business or professional use has been priced at \$1,499.85. Each of its three components, which are available separately, is priced at \$499.95. They include systems for accounts receivable, general accounting and inventory control. The ATARI Word Processor has been priced at \$149.95. Both of these products are for the ATARI 800 computer. Pilot, a programming language for use in creating interactive educational programs, has been priced at \$89.95.

Prices of the following Atari entertainment cartridges have been reduced from \$39.95 to \$29.95: Basketball, 3-D Tic-Tac-Toe and Video Easel™; Star Raiders™ has been reduced to \$39.95 from \$59.95. Asteroids™ and Missile Command™ games have been priced at \$39.95.

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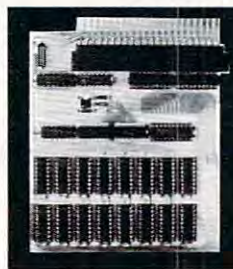
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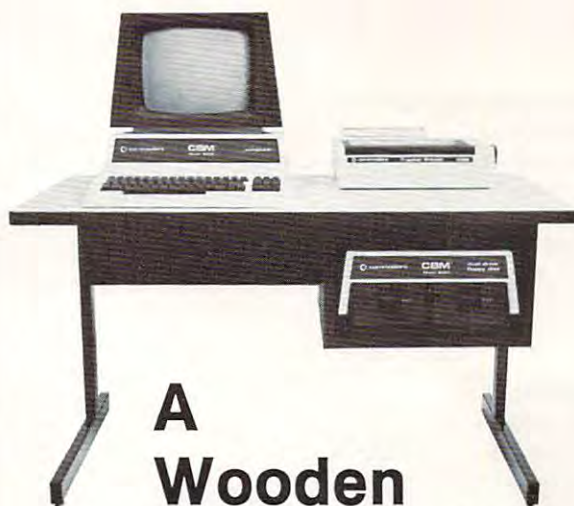
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