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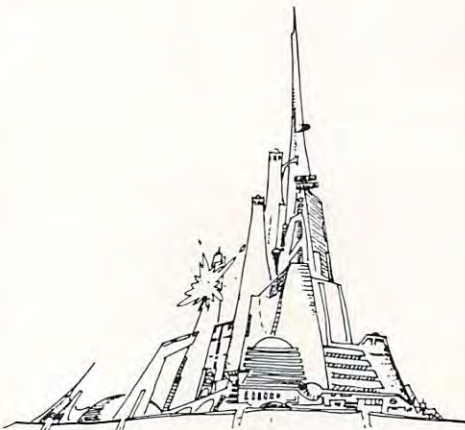
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page). The C1P video memory has 4 pages (D000-D3FF) and the C2P has 8 (D000-D7FF).

The cursor stays on the "home" line; its address varies by only 24 or 64 (dec.). Because we know it will always be on the same page, the cursor's location can be specified by only one byte (loc. 0200). I call this byte the cursor offset. The location of the cursor is found by adding the cursor offset to D300 (C1P) or D700 (C2P).

For those not familiar with machine language, I suggest you think of the A, X, and Y registers as variables. When a value is loaded into the X register, think $x = \text{value}$.

On Our Way At Last!

We start with the character to be displayed in the A register. This character may come from any one of several routines such as LOAD, LIST, or FTB. At BF2D, the A register is loaded into location 0202. The A, X, and Y registers are saved on the stack. At BF35, the contents of 0202 are put back into the A register. This seemingly meaningless back-and-forth shift is done because the X and Y registers must be transferred to the A register so that they can be pushed onto the stack. At BF38, the character is checked to see if it is a null (00). If so, the routine branches to BF6D where the Y, X, and A registers are pulled from the stack and restored. Then, at BF72, the VR returns to the routine that called it.

If the character is not a null, location 0206 is examined to see if it is greater than zero. If it is greater than zero, the contents of 0206 are used as a counter for the TV delay loop. This timing loop slows the VR to keep it from printing too fast for slower peripherals. If 0206 contains zero, the timing loop is bypassed.

At BF47, the character is checked to see if it is an LF(0A). If the character is other than an LF, it falls through to BF48. If the character is an LF, we go to BF76. For the time being, let's bypass BF76 and see what happens if the character is not an LF.

At BF48, the character is tested to see if it's a CR(0D). If the character is a CR, the routine falls through to BF4F. Again, let's defer exploration of this route and branch to BF55. This is the route all non-control characters travel.

Stalking The Non-Control Character

At BF55, the character is stored in location 0201. We JSR (jump to subroutine) to BFC2, where the contents of 0201 are printed D300 (C1P) or D700 (C2P) plus the cursor offset. The cursor offset is stored in 0200, which was initialized with the contents of FFE0 when the BREAK key was pressed at system start-up. The contents of FFE0 are 65 (C1P) or 40 (C2P). This means "home" position in the C1P is D365 and D740 in the C2P. After the character is printed, we RTS to BF5B and increment the cursor offset (loc. 0200).

At BF65, the current cursor offset is compared to the maximum cursor offset. If the end of the

video line has been reached, an automatic CR/LF is done (JMP BF73). Otherwise, the routine JSRs to BFDE. At BFDE the character at D300 (C1P) or D700 (C2P), plus the cursor offset, is stored in 0201. Remember that location 0200 was incremented at BF5B, so the character stored is the one in front of the current character. As far as I can tell, this character is never reused, except when a CR is done. At BFEF, the cursor character (5F) is printed and an RTS to BF6D is done.

At BF6D, the A, X, and Y registers are pulled from the stack and restored. Then BF72 does an RTS back to the routine that called the VR.

Let's go back and see the path a CR character follows. The CR starts at BF4F with a JSR to BFD5. BFD5 does a JSR to BFC2, which prints the character in 0201, the character "underneath" the cursor. This character is invariably a "space" (20). At BFD4 we RTS to BFD8, where the character in the "home" position is stored in 0201. At BFEF, the cursor character (5F) is printed at the "home" position. Now we RTS to BF52, which JMPs to BF6D. The A, X, and Y registers are restored and we RTS to the VR calling routine.

Spoor Of The Wily LF

Let's review the status of the TV display at the end of the CR. The cursor character has moved from its former position at the end of the home line to the home position. The character that formerly occupied this position is now stored in 0201.

With this in mind, we track the line feed character through the VR. The LF is usually done immediately after a CR. We left the LF at BF76, which JSRs to BFC2 and prints the contents of 0201 at the home position. This restores the first character of the line and erases the cursor. At BFD4, we RTS to BF79, where the cursor offset is ANDed with the hex number E0. This has the effect of rounding the offset to the start of the video line.

The rounded-off number is stored in 0202. Next, a scroll-one-byte routine is copied from BASIC ROM to RAM at 0207-020E. At BF8C, the X register is loaded with D3(C1P) or D7(C2P). The X register will be used later to determine whether or not the routine is scrolling the last page of video memory. Hex 20 is stored in the A register and the line width is put into the Y register. If the line width is greater than 20, which indicates a 2K memory, the A register is doubled (40). At BF99, the A register is used to set the 0207-E subroutine for a 20 (32 dec.) or a 40 (64 dec.) character line length. The Y register is zeroed in preparation for use as an offset counter for the 0207 subroutine.

At BF9E, the actual scroll is started with a JSR to 0207, which gets one byte from video memory and stores it in the next line above. The Y register is incremented and we RTS to BFA1 and check to see if the current page has been completely scrolled.

If the page is not done, we branch to BF9E to scroll another byte. When the page is done, the 0207 subroutine is set to scroll the next page. A check is made to see if the 0207 subroutine is set to the last page of video memory. If the sub is not set to the last page, we go back to BF9E to scroll another page. If we are on the last page, we scroll down to the home line, using the Y register and location 0202 to tell when to stop scrolling. At BFB6, the home line is cleared by storing "space" characters in its memory locations. We JSR to BFDE, which prints the cursor in the home position. Finally, we RTS to BF6D, pull the A, X, and Y registers from the stack and, at BF72, the VR returns to the routine that called it. Our journey is finally over, and I hope it has been an informative one.

Video Routine (BF2D)

JSR - GOSUB
RTS - RETURN
BRANCH, JUMP - GOTO
INCREMENT - Add one
/0200/ - Contents of loc. 0200
AND - Logical function

Figure 1.

All numbers are in hexadecimal.

BF2D Put /A reg./ (char.) in 0202
BF30 Save A,X,Y registers on stack
BF35 Put /0202/ (char.) in A reg.
BF38 If char. is null, branch to BF6D.
BF3A Load Y reg. with /0206/ (TV delay)
BF3D If Y is zero, branch to BF47.
BF3F TV delay loop
BF47 If char. is a LF, branch to BF76.
BF4B If char is not CR, branch to BF55.
BF4F JSR to BFD5.

BFD5 JSR BFC2

BFC2 Load X with /0200/
(cursor offset)

BFC5 Load A with /0201/
(char to print)

BFC8 Load Y with /FFE2/
(video mem size)

BFCB If Y is not zero, go to BFD1.

BFGD Store A is D300+/X/ (C1P)

BFD0 RTS

BFD1 Store a in D700+/X/ (C2P)

BFD4 RTS

BFD8 Load A with /FFED/
(cursor "home" offset)

BFD8 Put /A/in 0200 (cursor offset)

BFDE Put /0200/ is X.

BFE1 Put char at D300-/X/ in A.

BFE4 Put /FFE2/ (video mem size) in Y.

BFE7 If Y is equal to zero, (1K video mem.) goto BFEC.

BFE9 Load A with char. at D700+/X/.

BFEC Put A in 0201
(temporary char. storage)

BFEF Put cursor char. (5F) in A.

BFF1 Branch always to BFC8.

BFC8 Load Y with /FFE2/
(video mem size)

BFCB If Y is not zero, go to BFD1.

BFGD Store A is D300+/X/ (C1P)

BFD0 RTS

BFD1 Store a in D700+/X/ (C2P)

BFD4 RTS

BF52 JMP BF6D

BF55 Put char. in 0201
(temporary char. storage)

BF58 JSR BFC2

BFC2 (See BFC2 subroutine above)

BFD4 RTS

BF5B Increment /0200/ (cursor offset).

BF5E Put /FFE1/ (chars/line-1) in A.

BF62 Add /FFE0/ (cursor "home" offset)
to A.

BF65 If A is greater than /0200/
(cursor offset) JMP BF73.

BF73 JSR BFD8

BFD8 (See BFD8 subroutine above)

Put char. in "home" position into
0201 and print cursor in
its place.

BFD4 RTS

BF76 JSR BFC2

BFC2 (See BFC2 above)/

Print char. from 0201 at home
position.

BFD4 RTS

BF79 Put /FFE0/ (cursor "home" offset)
in A.

BF7C AND A with number E0 and put
result in 0202.

BF81 Transfer scroll subroutine from
BFF3-A to RAM. (0207-B)

BF8C Load X with /BFFE/ (D3) or
/BFFC/ (D7).

BF8F Put 20 (line length) in A.

BF91 Put /FFE1/ (chars.line-1) in Y.

BF94 If Y greater than 20, then /A/.

BF99 Use A to set line length in
scroll subroutine (0207-E).

BF9C Zero Y register (byte counter).

BF9E JSR 0207

0207 Load one byte from video memory

020A Store byte one line above
previous location

020D Increment Y.

020E RTS

BFA1 If page is not done, loop to BF9E.

BFA3 Increment high byte of video
addresses in scroll subroutine.

BFA9 If high byte not equal to D3 (C1P)
or D7 (C2P) then branch to BF9E.

BFB1 Scroll last page down to
cursor line.

BFB6 Put "spaces" in home line
(erase line).

BFC0 Branch always to BF6A.

BF6A JSR BFDE (See BFDE sub above.)
print cursor at home position,
store char. in 0201.

BF6D Pull A,X,Y from stack.

BF72 RTS (Return from calling routine.) ©

Odds And Ends

String Array Bug

J. Horemans

If you use string arrays for example A\$(N), then be aware of OSI's program bug that can wipe out your program if the FRE function is called by the machine when leftover strings fill your RAM. Avoiding the problem is simple. Merely choose the DIMensions of the string array with the formula $N = 3 * 3$. For example DIM A\$(44) is O.K., but DIM A\$(45) can cause a program to crash. Also call the FRE function after doing a string array manipulation. Write yourself a program to find (and then make a permanent list of) the values that circumvent this problem. Here is a suitable example.

```
10 for I=1 to 20 (or any other values e.g. 21 to 40)
20 N=3*I+2
30?N
40 next I
```

You should get a list like:

2, 5, 8, 11, 14, ... 44, 47, 50, ...

The values of N printed on the screen are the ones to use. Choose the one closest to the size array you need. It is also necessary to put a line like this after string array manipulations:

```
100 X= FRE(0)
```

For Those Inclined To Experiment

Here is a program to demonstrate the string array bug in OSI.

```
5 A$="B"
10 FOR I=1 TO 100
20 B$(1)=B$(1)+A$
30 next
40 B$(1)=" "
50 X= FRE(0)
60 A=A+1:?"DONE" A;X
70 GOTO 10
```

Run the program as is. Nothing happens for a few moments, then the screen starts to flicker. This is the external symptom of the string bug. Recover by pressing the break key and doing a warm start by pressing W. Now add line one:

```
1 DIMB$(2) (or use any number generated by 3*N+2)
```

The computer should now hum through this little program, telling you it is happily doing its job and, in the process, cleaning up the leftover string in line 50. Remember, it is necessary to have a line like line 50 to call this function. Try running the program without line 50. If the DIM statement is o.k. the screen won't flicker, but my 8K machine never gets past DONE 1.

If you are making a graphic display, and the o.k. message keeps coming up to mess it up, here are two ways to defeat it.

1. In immediate mode (no line number):

```
POKE 3,96
```

This will turn off the message altogether, but you have to press RETURN to get the cursor back to the left of the screen.

2. Just before your subroutines, put this line:

```
3990 FOR I=1 to 10000: NEXT:END
```

Your program will now wait for the time specified by counting from 1 to 10000 (or whatever number you put in) before flashing the o.k. message and ruining your display. If your subroutines aren't at the end or you haven't any yet, just use any convenient high number for the line.

Those fast screen clears are great, but those pokes to locations 11 and 12 can be hard to keep in order if several ML calls are needed. Here is a fast full screen clear that does NOT use the ML call via USR(X). The method is described in *The First Book of OSI* by Williams and Dorner. I have adapted it to the CIP/Superboard screen. It does take more memory than some machine screen clears, but many of them need DATA lines to POKE in too, and that can cause confusion with your DATA statements.

```
5000 A= PEEK(129): B= PEEK(130):POKE129,0:
POKE130,212
5010 S$=" " rem 31 BLANK SPACES
5020 FOR I=1 to 32:S$=S$+" ":NEXT:POKE 129,A:
POKE 130,B:RETURN
```

To call this screen clear insert a line like this:

```
100 GOSUB 5000
```

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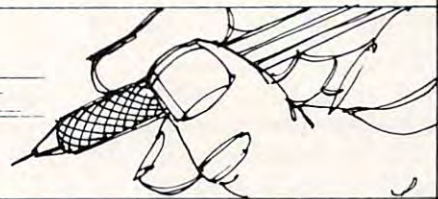
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THE PET GAZETTE



The Unwedge – Tape Append And Renumber

David A. Hook
Ontario, Canada

Lately in **COMPUTE!** there has been a great emphasis on the subject of appending. Both Harvey Herman (#8 pg. 96, #10 pg. 164) and Roy Busdiecker (#10 pg. 132) have presented their techniques.

These examples all require the use of a Basic program, which must be deleted later. Reference is made to the need to correctly arrange the line numbers. However, the programmer is required to find his own solution to this particular obstacle.

Wouldn't a utility combining Append with Renumber be helpful? The UNWEDGE attempts to satisfy these needs:

1. Written in machine language for speed of operation.
2. Self-relocating. The Basic program loads the code into high memory and protects itself from intrusion by Basic.
3. Works with Basic 2.0 (upgrade ROM) or Basic 4.0. The Basic loader automatically takes the proper code for the machine in use.
4. Reads and allows Appending of programs recorded on original (1.0) upgrade, and 4.0 machines.
5. The UNWEDGE attaches itself to the operating system (CHRGOT routine). Its commands may be used in the direct mode, with a minimum of user effort.
6. Compatible with the popular DOS support programs. While the Append function only works for tape append, the UNWEDGE doesn't interfere with the Wedge's function.
7. The same 'SYS' command is used to activate and to cancel the routines.
8. Consumes only 771 bytes of user memory.

Bill Seiler deserves the credit for nearly all the coding. 'PET Renumber 3.0' for original ROM (1.0) appeared in Pet User Notes (Vol I, #7 Nov./Dec. 1978). I have upgraded this for 2.0 and 4.0 ROM and provided for user input of line numbers.

Seiler was also responsible for the 'Append Wedge' for original ROM, which was printed in Commodore Canada's Transactor (Vol. 2, #3 July 1979).

The above PET User Notes issue included "M7171" by Jim Russo and Henry Chow. This is a high-monitor with merge capability for original ROM.

Features of both of these were cannibalized and converted for use with the recent ROM releases. Additions were made to provide messages and to allow loading of tape recorded on older machines.

To Use The Program (First Time):

1. Copy the Basic program listing. Watch for the "L", "H" and "-" in the DATA statements.
2. Save the Basic Program. If you try to run it first, an error may require a reset of the PET. You know what that means!
3. RUN the program. In about 20 seconds the screen will clear and give you the important information. Copy down the SYS number shown — you'll need it to activate/cancel UNWEDGE.
4. (OPTIONAL)

(If you're not familiar with the machine language monitor, the next set of "funny numbers" might confuse you. Don't let it, they are there to ease the next step.)

Prepare a tape to save the machine language code by itself. Move the cursor up to the line that begins:

.S "AP/REN...(etc.)

Hit the return key, and follow instructions (PRESS PLAY...). When the cursor returns, type

X RETURN

which gets you back to Basic.

You will note that the file name contains both the version (2 or 4) saved as well as the correct SYS number to use. This will be helpful when you come to use the machine code again.

This copy will load faster than the Basic program and doesn't require RUN after loading. SYS number will activate/cancel. The restriction is that it always sits in the same spot, and could overwrite something already in that spot in high-memory. Use the relocating Basic version if you're not sure.

For Tape #2 or Disk:

Change the "01" to "02" if you're saving to Tape #2. Insert "0:" or "1:" (Drive #) after the quote and ahead of the "AP/REN", and change

"01" to "08" if you're saving the object code on disk.

5. Activate the routine with the given SYS number. Since this is reversible, you may cancel UNWEDGE using the same number. (Don't try to save the machine language as in step 4 above, when the UNWEDGE is active).

To Use The Program (Subsequently):

Either: Load the Basic program, then Steps 3 and 5.

Or: Load the machine code, then Step 5.

To Renumber A Basic Program In Memory

The Append routine requires each segment (on tape) to have higher line numbers than the previous one (in memory). Thus, Renumber will often be called upon to prepare the various segments — the benefit of combining these utilities.

1. Clear the screen and move the cursor about 3/4 of the way down the screen.
2. Type the '<' (less-than key) in the first column of a line.

Examples of options available:

·R	'RETURN'
·R 1000	'RETURN'
·R 250,5	'RETURN'

The first example will renumber with starting line of 100 and step size of 10, which are the default settings.

The second one selects a starting line of 1000, and increment 10.

The final selection results in a starting line of 250, with a step size of 5.

The maximum step size allowed is 255. Be sure that the last line number (after Renumbering) will not exceed 63999.

3. When 'RETURN' is pressed, the upper part of the screen will show a variety of characters. (It is being used to store the line numbers). The message 'RENUMBERING' will be displayed.

4. When the cursor returns (1-10 seconds) the process is complete. All 'GOTO', 'THEN', 'GOSUB' and 'RUN' destinations have been updated. Any references to non-existent lines will be numbered '65535' (illegal line number) to flag the error. You'll have to correct these before proceeding.

5. Renumber will handle up to 500 lines, which should cover most programs.

To Append One Basic Program To Another

1. Place the program to be appended in Tape #1. Its first line number must be higher than the last line of the program in memory. Use the Renumber feature to prepare this segment beforehand.
2. Type the '<' (less-than key) in the first column of a screen line.

Examples:

·APPEND	'RETURN'
·A	'RETURN'
·A "PROG"	'RETURN'

The first two examples will Append the next program found on tape to the program in memory. Note that only the first letter "A" is necessary, though the whole word may be entered.

By specifying a file name (in quotes), the program 'PROG' will be Appended. Others found on the tape will be bypassed.

3. Only Basic programs may be Appended and Appended-to. If the in-memory program is not all Basic, the routine aborts giving 'NOT ALL BASIC PROGRAM' message.

4. If the specified program is not all Basic, a simple LOAD, not Append is executed. The same message is printed, but without the error condition. Be careful here, since the memory pointers may have been changed.

5. If the combined program will not fit into memory, an 'OUT OF MEMORY ERROR' will be shown. The Append will not take place.

6. The routine handles one of the differences in SAVE locations between Basic 1.0 and 2.0/4.0.

The other difference may be handles in one of two ways: Since Renumber (with subsequent SAVE) will often precede Append of a routine, the other discrepancy will be covered. As an extra precaution, simply reSAVE any segment before attempting to append it.

7. The message 'APPENDING' will be displayed as the proper file is found and loaded. When the cursor returns, the job is complete.

8. Repeat step 2 for further Appends, using Renumber as necessary.

I hope that this utility will find a home in your machine. Loading UNWEDGE into memory after power-up will keep it available for use.

As with most of my work, little would be possible without the published references by Jim Butterfield. Additionally, my thanks to Jim for the advice and suggestions on many subjects.

```

0 REM APPEND & RENUMBER BASIC PROGRAMS
1 REM      SELF-RELOCATING
2 REM FOR BASIC 2.0 AND BASIC 4.0
3 REM
4 REM DAVID A. HOOK, 58 STEEL STREET
5 REM      BARRIE, ONTARIO, CANADA
6 REM      L4M 2E9      (705) 726-8126

```

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```

8 REM      ALL RIGHTS RESERVED
9 REM PERMISSION TO COPY FOR NON-COMMERCIAL PURPOSES
10 QV=PEEK(50003):IF QV=1 OR QV=160 THEN12
11 PRINT"ITWON'T WORK WITH YOUR ROM":END
12 EA=PEEK(52)+256*PEEK(53)-1:B=770:SA=EA-B:J%=SA/256:J=SA-256*J%
13 POKE EA-1,J%:POKE 53,J%:POKE 49,J%
14 POKE EA-2,J:POKE 52,J:POKE 48,J
15 J%=(SA+31)/256:J=SA+31-256*J%
16 POKE EA-3,J%:POKE EA-4,J
17 PRINT"ITWORKING...(20 SECONDS)
18 FOR I=SA TO EA-5:READ A$:A=VAL(A$)
19 IFASC(A$)=72 THEN J=I+VAL(MID$(A$,2)):A=J/256:GOTO21
20 IFASC(A$)=76 THEN J=I+VAL(MID$(A$,2)):A=J-256*INT(J/256)
21 POKE I,A:NEXT
22 IFQV=1THEN25
23 PRINT"ITCORRECTING FOR BASIC 4.0..."
24 FORI=1TO28:READA,D:POKESA+A,D:NEXT
25 PRINT"ITACTIVATE OR CANCEL ITAPPEND/RENUM"
26 A$=MID$(STR$(SA),2):QV%=MID$(STR$(4+2*(QV=1)),2)
27 PRINTTAB(18)"IT--WITH: IT'SYS("A$")'
28 PRINT"ITSAVE NOW (WITH MONITOR) ON TAPE#1:
29 A$="AP/REN"+QV%+"-"+A$
30 PRINT"IT.S "CHR$(34)A$CHR$(34)",01";
31 X=SA/4096:GOSUB33:X=EA/4096:GOSUB33:PRINT:PRINT
32 SYS1024
33 PRINT",,":FORJ=1TO4:X%=X:X=(X-X%)*16:IFX%>9THENX%=X%+7
34 PRINTCHR$(X%+48):NEXTJ:RETURN
35 DATA 173, L767, H766, 133, 52, 173
36 DATA L763, H762, 133, 53, 162, 3
37 DATA 181, 120, 72, 189, L748, H747
38 DATA 149, 120, 104, 157, L742, H741
39 DATA 202, 208, 241, 76, 121, 197
40 DATA 96, 201, 60, 208, 8, 72
41 DATA 165, 119, 201, 0, 240, 8
42 DATA 104, 201, 58, 176, 239, 76
43 DATA 125, 0, 32, 112, 0, 201
44 DATA 65, 240, 7, 201, 82, 208
45 DATA 237, 76, L282, H281, 162, 1
46 DATA 134, 212, 202, 134, 209, 134
47 DATA 157, 169, 2, 133, 219, 32
48 DATA 112, 0, 170, 240, 23, 201
49 DATA 34, 208, 246, 166, 119, 232
50 DATA 134, 218, 32, 112, 0, 170
51 DATA 240, 8, 201, 34, 240, 4
52 DATA 230, 209, 208, 242, 32, 86
53 DATA 246, 32, 18, 248, 32, 10
54 DATA 244, 165, 209, 240, 8, 32
55 DATA 148, 244, 208, 8, 76, 110
56 DATA 245, 32, 166, 245, 240, 248
57 DATA 224, 1, 208, 235, 165, 150
58 DATA 41, 16, 208, 127, 162, 24
59 DATA 173, 124, 2, 201, 4, 240
60 DATA 7, 162, 0, 32, L128, H127
61 DATA 240, 108, 32, L123, H122, 56
62 DATA 165, 42, 233, 2, 133, 42
63 DATA 165, 43, 233, 0, 133, 43
64 DATA 160, 0, 177, 42, 240, 24
65 DATA 32, L91, H90, 32, 110, 242
66 DATA 169, 13, 32, 210, 255, 169
67 DATA 63, 32, 210, 255, 162, 1
68 DATA 32, L83, H82, 76, 119, 195
69 DATA 32, L70, H69, 177, 42, 208
70 DATA 3, 32, L63, H62, 173, 125
71 DATA 2, 56, 237, 123, 2, 170
72 DATA 173, 126, 2, 237, 124, 2
73 DATA 168, 165, 42, 56, 233, 2
74 DATA 141, 123, 2, 165, 43, 233
75 DATA 0, 141, 124, 2, 138, 24
76 DATA 109, 123, 2, 141, 125, 2
77 DATA 152, 109, 124, 2, 141, 126
78 DATA 2, 197, 53, 144, 3, 76
79 DATA 85, 195, 32, 185, 243, 76
80 DATA 221, 243, 32, L2, H1, 230
81 DATA 42, 208, 2, 230, 43, 96
82 DATA 189, L11, H10, 240, 6, 32
83 DATA 210, 255, 232, 208, 245, 96
84 DATA 13, 78, 79, 84, 32, 65
85 DATA 76, 76, 32, 66, 65, 83
86 DATA 73, 67, 32, 80, 82, 79
87 DATA 71, 82, 65, 77, 32, 0
88 DATA 13, 65, 80, 80, 69, 78
89 DATA 68, 73, 78, 71, 32, 0
90 DATA 13, 82, 69, 78, 85, 77
91 DATA 66, 69, 82, 73, 78, 71
92 DATA 13, 0, 32, 112, 0, 240
93 DATA 33, 176, 249, 32, 115, 200
94 DATA 72, 166, 17, 164, 18, 134
95 DATA 62, 132, 63, 104, 240, 24
96 DATA 32, 112, 0, 240, 19, 176
97 DATA 249, 32, 115, 200, 166, 17

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98 DATA 134, 66, 208, 12, 169, 100
 99 DATA 133, 62, 169, 0, 133, 63
 100 DATA 169, 10, 133, 66, 162, 36
 101 DATA 32, L-115, H-116, 169, 254, 133
 102 DATA 33, 169, 127, 133, 34, 165
 103 DATA 40, 133, 31, 165, 41, 133
 104 DATA 32, 32, L292, H291, 160, 3
 105 DATA 177, 31, 145, 33, 185, 92
 106 DATA 0, 145, 31, 136, 192, 1
 107 DATA 208, 242, 177, 31, 240, 16
 108 DATA 32, L301, H300, 170, 136, 177
 109 DATA 31, 133, 31, 134, 32, 32
 110 DATA L267, H266, 208, 220, 169, 255
 111 DATA 200, 145, 33, 200, 145, 33
 112 DATA 165, 40, 133, 119, 165, 41
 113 DATA 133, 120, 208, 3, 32, L277
 114 DATA H276, 32, L274, H273, 208, 3
 115 DATA 76, 57, 196, 32, L266, H265
 116 DATA 32, L263, H262, 32, L260, H25
 117 DATA 170, 240, 233, 162, 4, 221
 118 DATA L262, H261, 240, 5, 202, 208
 119 DATA 248, 240, 238, 165, 119, 72
 120 DATA 165, 120, 72, 32, 112, 0
 121 DATA 176, 230, 32, 115, 200, 32
 122 DATA L51, H50, 104, 133, 120, 104
 123 DATA 133, 119, 160, 0, 162, 0
 124 DATA 189, 1, 1, 240, 15, 72
 125 DATA 32, 112, 0, 144, 3, 32
 126 DATA L82, H81, 104, 145, 119, 232
 127 DATA 208, 236, 32, 112, 0, 176
 128 DATA 8, 32, L102, H101, 32, 118
 129 DATA 0, 144, 248, 201, 44, 240
 130 DATA 192, 208, 175, 32, L134, H133
 131 DATA 169, 0, 133, 33, 169, 128
 132 DATA 133, 34, 160, 1, 177, 33
 133 DATA 197, 18, 240, 21, 201, 255
 134 DATA 208, 24, 133, 95, 133, 94
 135 DATA 165, 94, 133, 96, 162, 144
 136 DATA 56, 32, 85, 219, 76, 233
 137 DATA 220, 136, 177, 33, 197, 17
 138 DATA 240, 236, 32, L96, H95, 32
 139 DATA L116, H115, 208, 212, 32, L62
 140 DATA H61, 160, 0, 177, 31, 200
 141 DATA 145, 31, 32, L90, H89, 208
 142 DATA 8, 230, 42, 208, 2, 230
 143 DATA 43, 136, 96, 164, 31, 208
 144 DATA 2, 198, 32, 198, 31, 76
 145 DATA L-29, H-30, 32, L28, H27, 160
 146 DATA 1, 177, 33, 136, 145, 33
 147 DATA 32, L56, H55, 240, 5, 32
 148 DATA L65, H64, 208, 239, 164, 42
 149 DATA 208, 2, 198, 43, 198, 42

163 DATA 28, 240, 29, 181, 107, 149, 110, 87, 113, 73, 120, 211, 125, 173
 164 DATA 128, 229, 184, 162, 202, 237, 203, 179, 264, 205, 265, 179, 267, 248
 165 DATA 270, 28, 271, 244, 352, 246, 353, 184, 374, 246, 375, 184, 481, 173
 166 DATA 482, 180, 519, 246, 520, 184, 608, 127, 609, 205, 611, 147, 612, 207
 READY.

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150 DATA 96, 165, 42, 133, 31, 165
 151 DATA 43, 133, 32, 165, 119, 133
 152 DATA 33, 165, 120, 133, 34, 96
 153 DATA 165, 62, 133, 94, 165, 63
 154 DATA 133, 95, 96, 165, 94, 24
 155 DATA 101, 66, 133, 94, 144, 2
 156 DATA 230, 95, 96, 165, 31, 197
 157 DATA 33, 208, 4, 165, 32, 197
 158 DATA 34, 96, 32, L2, H1, 230
 159 DATA 33, 208, 2, 230, 34, 96
 160 DATA 160, 0, 230, 119, 208, 2
 161 DATA 230, 120, 177, 119, 96, 137
 162 DATA 138, 141, 167, 76

STP-488 A Smart Terminal Program For An IEEE-488 Modem

Earl Wuchter
N. Catasauqua, PA

When the time comes that you decide to hook up to a commercial sharing network, or take advantage of some of the hundreds of free systems in operation across the country, you will have to make a hardware/software selection. The options facing you are as confusing as they are numerous. The program given here may help you decide.

The most straightforward way to go is with an IEEE modem, either the Commodore 8010 or the STAR 488. My personal choice was the STAR, but I think that the 8010 is identical. The STAR 488 has all the features a modem should have. It has both originate and answer modes and a half/full duplex switch. There is also a test (analog echo) mode. In addition, there are LEDs to indicate carrier detect, xmit, rcv, and test.

You must select a terminal program that is compatible with the hardware. The PET does not use true ASCII, so the program must do some conversions if you want to send or receive lower case. Some IEEE to RS-232 interface devices do this conversion for you. STP-488 will probably not work with that type of interface.

It is possible to communicate with an IEEE modem in BASIC, but if you try to write a terminal program, you will most likely be disappointed with the results. The simplest BASIC "dumb" terminal program will be hard

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; SMART TERMINAL FOR PET AND IEEE MODEM
;
; EARL WUCHTER
; 1610 WASHINGTON ST.
; CATASAUQUA, PA 18032
; JUNE 81
;
;-- ROM ROUTINES USED (VER 3.0 & 4.0)
; $FFC6 SET INPUT DEVICE. X=FILE NO.
; $FFC9 SET OUTPUT DEVICE. X=FILE NO.
; $FFCC RESTORE DEFAULT I/O DEVICES.
; $FFD2 PRINT (A) ASCII
; $FFE4 GET ONE FROM KYBD BUFF
; $F2E2 CLOSE FILE A (4.0)
; $F2AE CLOSE FILE A (3.0)
; $BB1D PRINT A STRING (4.0)
; $CA1C PRINT A STRING (3.0)
;-- SYSTEM VARIABLES (VER 3.0 & 4.0)
; $35 PTR (HI) TO TOP OF MEMORY
; $96 ST (I/O STATUS)
; $9B STOP AND RVS FLAG
; $9E KEYBOARD BUFFER CHAR COUNT
; $A7 ENABLE CURSOR FLASH
; $C4 ADDR OF CURRENT SCREEN LINE
; $C6 CURSOR POSITION ON LINE
; $CD QUOTE FLAG
; $D1 FILENAME LENGTH FOR OPEN FILE
; $D2 FILE NO. FOR OPEN
; $D3 SECONDARY ADDR FOR OPEN
; $D4 DEVICE NO. FOR OPEN
;-- ZERO PAGE USED FOR PROGRAM WORK SPACE
BPT = $11 BUFFER POINTER
CTRL = $40 CTRL FLAG
CCNT = $41 CHARACTER COUNT
LCNT = $42 LINE COUNT
ASAVE = $43 RAW CHARACTER
VER = $44 ROM VERSION INDICATOR
MODE = $45 SAVES ORIGINAL UC/LC STATUS
;-- CBM/ASCII STUFF
RVS = $12 RVS USED IN PLACE OF CTRL KEY
OFF = $92
CR = $0D
;
; NOTE: ASSEMBLER QUIRK:
; > RETURNS LOW BYTE OF ARGUMENT
; < RETURNS HIGH BYTE
;
;== $0400
BYT $00,$0B,$04 BASIC LINE 1 SYS1037
BYT $1,$00,$9E,'1037',00
;
BYT $0,$00
;
LDA 59468 SAVE ORIGINAL MODE
STA MODE
LDA #14 SELECT LOWER CASE MODE
STA 59468 POKE 59468,14
LDA #05 SET UP TO OPEN A FILE
STA $D2 FILENO=5
STA $D4 DEVICE=5 (MODEM)
LDA #00
STA $D1 NO FILE NAME
STA $D3 SECONDARY ADDR
STA $9E CLEAR KYBD BUFFER COUNT
JSR RESET SET BUFFER POINTER
STA (BPT),Y INSERT INITIAL EOF
LDA $FFE5 TEST FOR 3.0 OR 4.0 ROM
AND #04
STA VER 0=3.0 4=4.0

```

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* * If power-on message = ### COMMODORE BASIC ### you have 3.0 Basic.
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pressed to keep up with a steady stream of incoming characters without losing some. It may have to ignore the keyboard as long as characters are coming in, which means you can't interrupt the other system. BASIC is certainly not fast enough to do the communication and also store text in memory.

On the other hand, a machine language program can be made as elaborate as you like. The biggest problem with a machine language program is writing it. PET I/O routines are very good, but not easy to trace. STP-488 does the equivalent of BASIC file handling commands by calling the appropriate routines in ROM. This technique was described by Raymond Diedrichs in the April 81 issue of **COMPUTE!**.

STP-488 begins with the familiar SYS 1037. If you are not up on this trick, there are two things to know: You may not change the BASIC line, and you cannot copy the program without using the (machine language) monitor. You can list it, but you won't see much.

The program was designed to be as powerful and easy to use as possible without becoming too large to be keyed in manually. In order to achieve this goal, some frills such as a help option had to be omitted.

I have tested the program on a variety of PETs. It works with Upgrade and 4.0 ROM, with graphic and business keyboards, in 40 and 80 column machines. The function of the shift keys varies slightly depending on the type of keyboard used.

Program Features

1. STP-488 Loads and runs like BASIC.
2. It works with Upgrade and 4.0 ROMS.
3. Monitor style operation.
4. Upper/lower case sent and received.
5. CAPS LOCK (modified).
6. CTRL characters may be sent.
7. Automatic storage of received text.

```

71 0431 F0 06      BEQ  INIT2
72 0433 20 63 F5    JSR  $F543    4.0 OPEN 5,5,0
73 0436 4C 3C 04    JMP  QUERY
74 0439 20 24 F5    INIT2  JSR  $F524    3.0 OPEN
75                  ;
76 043C A9 14      ; QUERY LDA  #>PROMPT
77 043E A0 06      LDY  #<PROMPT
78 0440 20 09 05    JSR  PRMSG  PRINT PROMPT LINE
79 0443 20 E4 FF    GETANS JSR  $FFE4    GET ONE CHAR
80 0446 29 7F      AND  #$7F    ACCEPT UC OR LC
81 0448 C9 41      CMP  #'A'    WAIT FOR AN
82 044A 90 F7      BCC  GETANS  - ALPHA CHAR
83 044C A2 06      LDX  #06     2*( N.COMMANDS-1)
84 044E DD 15 06    CHECK  CMP  CMDS,X  CMDS EMBEDDED IN PROMPT STRING
85 0451 F0 07      BEQ  OKCMD   FOUND A MATCH
86 0453 CA         DEX         TO SLASH DELIMITER
87 0454 CA         DEX         TO NEXT CMD CHAR
88 0455 10 F7      BPL  CHECK   TRY AGAIN
89 0457 4C 43 04    JMP  GETANS  WAIT FOR A VALID REPLY
90 045A A9 04      OKCMD  LDA  #<(QUERY-1)  PUSH ADDR
91 045C 48         PHA         - FOR EASY
92 045D A9 3B      LDA  #>(QUERY-1)  - RTS TO
93 045F 48         PHA         - MONITOR
94 0460 BD 21 06    LDA  PGMA+1,X  PUSH ADDR OF
95 0463 48         PHA         - ROUTINE FOR
96 0464 BD 20 06    LDA  PGMA,X    - JUMP VIA RTS
97 0467 48         PHA
98 0468 60      RTS         JUMP TO ROUTINE
99                  ;
100 0469 68      ; EXIT  PLA         PULL RETURN ADDR
101 046A 68      PLA         - TO MONITOR
102 046B A5 45      LDA  MODE     RETURN SCREEN TO
103 046D 8D 4C E8    STA  59468    - ORIGINAL MODE
104 0470 A9 05      LDA  #05     CLOSE 5
105 0472 A6 44      LDX  VER
106 0474 F0 06      BEQ  EXIT3
107 0476 20 E2 F2    JSR  $F2E2    4.0 CLOSE
108 0479 4C CC FF    JMP  $FFCC    RESTORE DEFAULT I/O
109 047C 20 AE F2    EXIT3 JSR  $F2AE    3.0 CLOSE
110 047F 4C CC FF    JMP  $FFCC    RESTORE DEFAULT I/O
111                  ;
112 0482 A9 2A      ; ONLINE LDA  #>MSG1  PRINT ONLINE
113 0484 A0 06      LDY  #<MSG1
114 0486 20 09 05    JSR  PRMSG
115 0489 A9 00      LDA  #00
116 048B 85 40      STA  CTRL     RESET CTRL FLAG
117 048D 20 7C 05    MAIN  JSR  RECV   RECIEVE AND ECHO
118 0490 F0 03      BEQ  INKEY   WHEN NOTHING
119 0492 20 49 05    JSR  STORE   CHAR TO BUFFER
120 0495 20 13 05    INKEY JSR  TSTOP  CHANCE TO EXIT
121 0498 20 C6 05    JSR  KYBD   TRY THE KEYBOARD
122 049B F0 F0      BEQ  MAIN    WHEN NOTHING
123 049D 20 BB 05    JSR  XMIT   SEND IT OUT
124 04A0 4C BD 04    JMP  MAIN    LOOP
125                  ;
126 04A3 A9 0D      ; FORWRD LDA  #CR    NO MSG NECESSARY
127 04A5 20 D2 FF    JSR  $FFD2    PRINT CR
128 04A8 A2 13      PAGE  LDX  #19    20 LINES PER 'PAGE'
129 04AA 86 42      STX  LCNT     SET THE COUNTER
130 04AC A2 27      LOOP1  LDX  #27    SET CHAR COUNTER
131 04AE 86 41      STX  CCNT     - FOR LONG LINES
132 04B0 20 24 05    LOOP  JSR  TSTOP2 STOP KEY TEST
133 04B3 20 4F 05    JSR  FETCH   RETRIEVE NEXT CHAR
134 04B6 F0 39      BEQ  EOFMSG  END OF TEXT
135 04B8 20 6C 05    JSR  PRINT   DISPLAY IT
136 04BB C9 0D      CMP  #CR    END OF LINE ?
137 04BD F0 04      BEQ  EOL     YES
138 04BF C6 41      DEC  CCNT     COUNT CHARACTER
139 04C1 10 ED      BPL  LOOP     NOT END OF LINE
140 04C3 C6 42      EOL  DEC  LCNT   COUNT THE LINE
141 04C5 10 E5      BPL  LOOP1    WHEN NOT END OF PAGE

```

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PEDISK II

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FAST — The *Pedisk* system loads directly to main memory from the disk and loads — saves information at least 3 times faster than any other disk available.

SIMPLE — A simple command syntax makes its BASIC commands easy to use. At the same time, its sophisticated indexed, sequential, or relative file handling makes it powerful.

RELIABLE — The ultra-simple circuit design with its LSI disk controller chip provides maximum timing margins for error free operation.

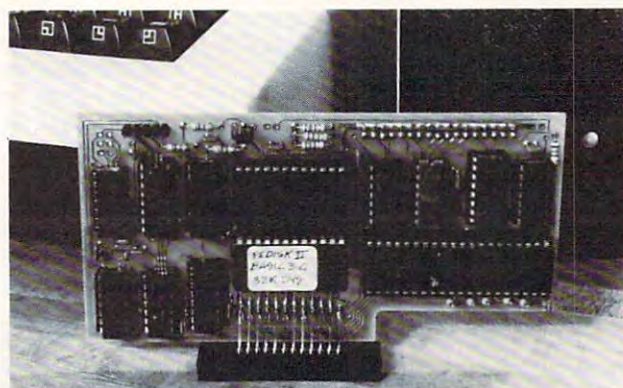
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Introducing **PEDISK II**, a low cost high performance floppy disk system consisting of: 1) **PEDISK II** controller, 2) flat disk cable, 3) Disk Drive Assembly, and 4) PDOS II software. The **PEDISK II** is a full function peripheral that provides high speed program storage and a sophisticated file handling package.

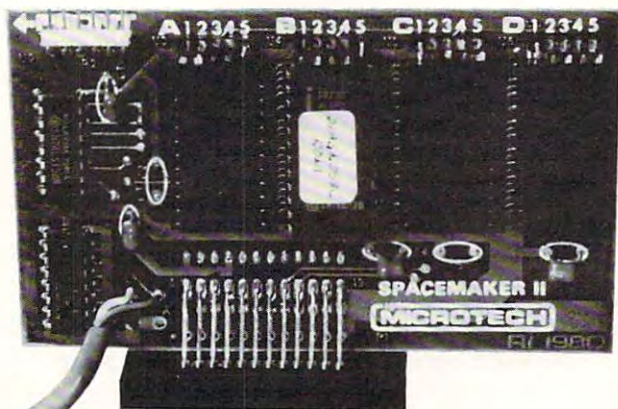
The small **PEDISK II** controller board mounts inside any 2000, 4000, or 8000 series machine. Standard systems are available with one or two disk drives. An optional third drive can also be added. The **PEDISK II** System can be operated simultaneously with any Commodore disk system for data exchange purposes.

The PDOS II software links BASIC by adding a new repertoire of disk commands. !OPEN, !CLOSE, !INPUT, and !PRINT provide the basis of the powerful file handling package. !LOAD, !SAVE and !RUN allow complete disk control. PDOS II also offers a full DOS-mode of operation for all disk diagnostic and utility functions. Diskette format, backup, diagnostic, and reorganization capabilities are provided.



PEDISK II CONTROLLER BOARD

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8. Allows creation of discrete files.

9. Easy review of files with page control.

In general, the program operates as follows: A prompt line "o/r/f/x/?" is displayed and you make your selection by touching the proper key. You may use upper or lower case commands. There will not be a flashing cursor at this point. The options are Online, Rewind, Forward, and Exit. The STOP key gets you out of the online and forward modes and returns you to the prompt line. Exit takes you back to the PET READY mode, so there are really only three program functions.

In the online mode, a flashing cursor will appear. All characters received (including the echoes of those sent) will be stored in a buffer. This buffer is circular, and extends from address \$0700 to the upper limit of memory. During program initialization an EOF (end-of-file) mark is put into the first buffer location. When the STOP key is used to go offline, another EOF is inserted and its address is printed for reference.

The Rewind function moves the buffer pointer backwards to the previous EOF and again prints the address.

The Forward function reprints the stored information from the current location up to the next EOF. Forward will print twenty screen lines and pause until you hit any key. The STOP key can be used to get back to the prompt mode. It will not insert an EOF when used in Forward, but will leave the pointer at the current location.

There is no fast forward function that will jump you to the next EOF without printing, but if you know the address of the EOF you want to reach, you can get there quickly with one or more rewind commands.

File Control

Going in and out of the online mode does not break the line. You stop sending and receiving,

```

142 04C7 20 E4 FF KWAIT JSR $FFE4 WAIT FOR A KEY
143 04CA F0 FB BEQ KWAIT - BEFORE DOING
144 04CC D0 DA BNE PAGE - NEXT PAGE
145
;
146 04CE A9 34 ; REWIND LDA #MSG2 PRINT REWIND
147 04D0 A0 06 LDY #MSG2
148 04D2 20 09 05 JSR PRMSG
149 04D5 A2 00 LDX #00 FOR INDEXED INDIRECT
150 04D7 A0 06 LDY #TOP HIGH PAGE OF THIS PGM
151 04D9 C6 11 REW2 DEC BPT DECREMENT POINTER LO
152 04DB A5 11 LDA BPT TEST FOR PAGE CHANGE
153 04DD C9 FF CMP #FF
154 04DF D0 0C BNE REW3 OK, NO PAGE CHANGE
155 04E1 C6 12 DEC BPT+1 DECREMENT PAGE
156 04E3 C4 12 CPY BPT+1 LOWER THAN LIMIT ?
157 04E5 D0 06 BNE REW3 NO, NO WRAP
158 04E7 A5 35 LDA $35 HIMEM PAGE
159 04E9 85 12 STA BPT+1
160 04EB C6 12 DEC BPT+1 PTR= HIMEM-1
161 04ED A1 11 REW3 LDA (BPT,X) LOOK FOR EOF
162 04EF D0 E8 BNE REW2 NO, KEEP TRYING
163 04F1 A9 3E EOFMSG LDA #MSG5 PRINT EOF
164 04F3 A0 06 LDY #MSG5
165 04F5 20 09 05 JSR PRMSG
166 04F8 A5 12 LDA BPT+1 PRINT EOF ADDR
167 04FA 20 33 05 JSR WROB
168 04FD A5 11 LDA BPT
169 04FF 20 33 05 JSR WROB
170 0502 A9 44 LDA #MSG5B PRINT OFF,CRLF,
171 0504 A0 06 LDY #MSG5B
172 0506 4C 09 05 JMP PRMSG
173
;
174 0509 A6 44 PRMSG LDX VER
175 050B F0 03 BEQ PRM3
176 050D 4C 1D BB JMP $BBD 4.0 PRINT STRING
177 0510 4C 1C CA PRM3 JMP $CA1C 3.0
178
;
179 0513 A6 9B TSTOP LDX $9B FROM ONLINE
180 0515 E0 EF CPX #EF 9B IS STOP/RVS FLAG
181 0517 D0 19 BNE STOP4 WHEN NOT STOP
182 0519 A9 00 LDA #00 INSERT EOF
183 051B 20 49 05 JSR STORE - THEN PRINT
184 051E 20 F1 04 JSR EOFMSG - EOF ADDR
185 0521 4C 2A 05 JMP STOP3
186 0524 A2 EF TSTOP2 LDX #EF FROM REPLAY
187 0526 E4 9B CPX $9B
188 0528 D0 08 BNE STOP4
189 052A A9 00 LDA #00
190 052C 85 9E STOP3 STA $9E CLEAR KYBD BUFFER
191 052E E6 A7 INC $A7 DISABLE CURSOR FLASH
192 0530 68 PLA RETURN TO MONITOR
193 0531 68 PLA
194 0532 60 STOP4 RTS
195
;
196 0533 48 WROB PHA CONVERT HEX TO ASCII
197 0534 4A LSRA SHIFT HIGH
198 0535 4A LSRA - NYBBLE TO
199 0536 4A LSRA - LOW END
200 0537 4A LSRA
201 0538 20 3E 05 JSR HEXASC - THEN CONVERT AND PRINT
202 053B 68 PLA - ONE HEX DIGIT
203 053C 29 0F AND #0F DO THE LOW NYBBLE
204 053E 09 30 HEXASC ORA #30 ADD THE ASCII BITS
205 0540 C9 3A CMP #3A GREATER THAN 9 ?
206 0542 90 02 BCC HEXASC2 NO
207 0544 69 86 ADC #86 YES, ADD 7 & UC
208 0546 4C D2 FF HEXASC2 JMP $FFD2 PRINT ONE HEX DIGIT
209
;
210 0549 20 55 05 STORE JSR PTRUP PUT CHAR INTO
211 054C 91 11 STA (BPT),Y BUFFER
212 054E 60 RTS

```

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but this is transparent to the remote system. Because of this, and the fact that the STOP key inserts an EOF, it is possible to isolate particular sections of text for use later.

For example, suppose you want to send the command "TYPE GOOD.NEWS" and isolate the returned file. Type the command, but do not send the RETURN that ends it. Next, hit STOP to insert an EOF and give you the prompt line. You could now rewind if desired, but it is not necessary. Next, go online again and send the RETURN. When the entire file has been received and the other system has sent its ready prompt, hit STOP and immediately go online again. Your file is now bracketed by EOF marks and can be rewound and replayed at will.

Isolated files can be saved on tape by using the monitor. This program, or a similar one, will be needed to read them.

The Keyboard

The program will put your PET into the lower case mode. On exit, the original mode will be restored.

The function of the shift keys will be modified. They will function more like the CAPS LOCK key found on some terminals. On graphic keyboards, they will affect only the alpha characters and the "high specials" (left bracket, backslash, right bracket, up arrow, and left arrow). These last characters, when shifted, represent respectively those characters having ASCII codes 7B through 7F. Because the PET does not have symbols corresponding to these codes, they will be displayed as PET graphics. If a shifted left arrow (ASCII del) is sent, the echo will be ignored.

With a business keyboard, the action of the shift keys is slightly different. For keys with one symbol, the action will be as described above. For keys with two symbols, shift will behave normally.

```

213 ;
214 054F 20 55 05 ; FETCH JSR PTRUP FETCH NEXT CHAR
215 0552 B1 11 LDA (BPT),Y - FROM BUFFER
216 0554 60 RTS
217 ;
218 0555 E6 11 PTRUP INC BPT INCREMENT PTR
219 0557 D0 10 BNE RET2 WHEN NO PAGE CHANGE
220 0559 E6 12 INC BPT+1 INCR PAGE
221 055B A4 12 LDY BPT+1 TEST PAGE VS
222 055D C4 35 CPY $35 - HINEM (HIGH)
223 055F D0 08 BNE RET2 NO WRAP
224 0561 A0 07 RESET LDY B<TOP+1 RESET BUFFER PTR TO
225 0563 84 12 STY BPT+1 - START OF BUFFER
226 0565 A0 00 LDY #00 - WHICH BEGINS ON PAGE
227 0567 84 11 STY BPT - FOLLOWING THIS PGM
228 0569 A0 00 RET2 LDY #00 FOR STORE & FETCH
229 056B 60 RTS
230 ;
231 056C 48 ; PRINT PHA BEFORE PRINTING, ERASE
232 056D A9 20 LDA #$20 - FLASHING CURSOR
233 056F A4 C6 LDY $C6 CURSOR COLUMN
234 0571 91 C4 STA ($C4),Y C4 IS ADDR OF LINE START
235 0573 68 PLA RESTORE ORIGINAL CHAR
236 0574 20 D2 FF JSR $FFD2 PRINT IT
237 0577 A2 00 LDX #00 RESET THE
238 0579 86 CD STX $CD - QUOTE FLAG
239 057B 60 RTS
240 ;
241 ;
242 057C A2 05 RECV LDX #05 INPUT FROM FILE 5
243 057E 20 C6 FF JSR $FFC6 DEVICE = MODEM
244 0581 20 E4 FF JSR $FFE4 GET#5
245 0584 A6 96 LDX $96 TEST ST (STATUS)
246 0586 D0 2F BNE NULL NOT OK
247 0588 29 7F AND #$7F MASK PARITY BIT
248 058A C9 0D CMP #CR CR IS THE ONLY
249 058C F0 1E BEQ ECHO - SPECIAL CHARACTER
250 058E C9 20 CMP #$20 - ACCEPTED. REJECT
251 0590 90 25 BCC NULL - CONTROL CHARS
252 0592 C9 7F CMP #$7F REJECT DEL
253 0594 B0 21 BCS NULL IF SENT, NO ECHO
254 0596 C9 60 CMP #160 IS IT LOWERCASE ?
255 0598 90 08 BCC UCIN NO, GOTO UC CONVERSION
256 059A 29 DF AND #$DF MASK ASCII LC BIT
257 059C C9 5B CMP #'Z'+1 LEFT BRACKET
258 059E B0 0A BCS ORB7 SHIFT HIGH SPECIAL
259 05A0 90 0A BCC ECHO LC BECOMES SHIFTED
260 05A2 C9 41 CMP #'A' IS IT LESS THAN 'A'
261 05A4 90 06 BCC ECHO YES, NO CHANGE
262 05A6 C9 5B CMP #'Z'+1
263 05A8 B0 02 BCS ECHO YES, DON'T SHIFT IT
264 05AA 09 80 ORB7 ORA #$80 UC ALPHA BECOMES SHIFTED
265 05AC 20 6C 05 ECHO JSR PRINT DISPLAY INCOMING CHAR
266 05AF 48 FIX PHA
267 05B0 20 CC FF JSR $FFCC RESTORE DEFAULT I/O
268 05B3 68 PLA
269 05B4 09 00 ORA #00 TO SET FLAGS
270 05B6 60 RTS RETURN CHAR IN (A)
271 05B7 A9 00 NULL LDA #00 FOR TESTS
272 05B9 F0 F4 BEQ FIX
273 ;
274 05BB A2 05 XMIT LDX #05 FILENO.
275 05BD 20 C9 FF JSR $FFC9 SET OUTPUT DEV =MODEM
276 05C0 20 D2 FF JSR $FFD2 PRINT#5
277 05C3 4C CC FF JMP $FFCC RESTORE I/O AND RTS
278 ;
279 05C6 46 A7 KYBD LSR $A7 ENABLE CURSOR FOR GET
280 05C8 20 E4 FF JSR $FFE4 FROM KYBD BUFFER
281 05CB F0 3E BEQ RETR2 NOTHING THERE
282 05CD 85 43 STA ASAVE RAW CHARACTER

```

BackPack

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- Installs within PET/CBM cabinet
- No wiring changes necessary
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- **Duration of outputs:** Minimum of 15 min.
- **Voltages:** +16, +9, -12, -9
- **Battery Life Expectancy:** 3 to 5 years
- **Battery On-Off Switch**

For Use With:

- Commodore PET/CBM 2001 and 4000 series computer
- Commodore PET/CBM 8000 series computer (screen size will not be normal on battery back-up)
- Commodore C2N Cassette Drive

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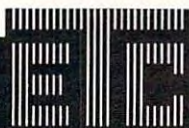
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Control Characters

Control (CTRL) characters can be sent, but will be ignored when they are received. CTRL characters serve no purpose on the PET system except to make the cursor do funny things. The only exception is carriage return. Line feed (CTRL J) may be sent. It is not needed for CRT printing.

To send a CTRL character, first key RVS (shifted or unshifted). It will print on the screen as an inverse check mark, but will not be sent. The next key, however, will be sent as the CTRL equivalent. This is much simpler than it sounds. To send CTRL C, key RVS followed by C. Once RVS has been keyed, it cannot be cancelled. If you hit it accidentally, follow it with an @. This will send a null (00).

Echoes

Some host computers, upon receiving a character, immediately send it back to the terminal. A system that does this is called a "full duplex" system. Those that do not echo each character are called "half duplex" systems.

Hardware terminals normally have a half/full duplex switch. When this switch is set to the half duplex mode, the terminal itself will echo each character keyed back to its printer or CRT. Terminal programs often have a program option to simulate the function of the half/full switch. This option will cause the program to print each character that it sends out.

Many modems have a similar switch. When this switch is in the half duplex position, the modem will echo each character from the terminal back to the terminal.

When you are communicating with a full duplex system you must set all of your switches to full duplex, or you will receive more than one echo for each keyed character. For a half duplex system, one switch must be set to half duplex.

Because the IEEE modem has such a switch, this program does not need one. If you are

```

283 05CF 29 7F
284 05D1 C9 12
285 05D3 D0 11
286 05D5 85 40
287 05D7 20 D2 FF
288 05DA A9 8A
289 05DC 20 D2 FF
290 05DF A9 92
291 05E1 20 D2 FF
292 05E4 D0 14
293 05E6 A4 40
294 05E8 C0 12
295 05EA D0 06
296 05EC C6 40
297 05EE 29 1F
298 05F0 D0 19
299 05F2 C9 0D
300 05F4 F0 15
301 05F6 C9 20
302 05F8 B0 03
303 05FA A9 00
304 05FC 60
305 05FD C9 41
306 05FF 90 8A
307 0601 A6 43
308 0603 30 09
309 0605 C9 5B
310 0607 B0 02
311 0609 09 20
312 060B 09 00
313 060D 60
314 060E C9 5B
315 0610 B0 F7
316 0612 90 F7
317
318 0614 0D
319 0615 4F 2F 52
320 0618 2F 46 2F
321 061B 58 2F 3F
322 061E 20 00
323
324 0620 81 04
325 0622 CD 04
326 0624 A2 04
327 0626 68 04
328 0628 46 06
329
330 062A 12 4F 4E
331 062D 4C 49 4E
332 0630 45 92 0D
333 0633 00
334 0634 12 52 45
335 0637 57 49 4E
336 063A 44 92 20
337 063D 00
338 063E 12 45 4F
339 0641 46 20 00
340 0644 92 0D 00
341
342 0647 EA
343 0648
TOTAL ASSEMBLER ERRORS = 0
TOTAL WARNINGS = 0
AND #07F MASK CBM SHIFT BIT
CMP #RVS CTRL KEY ?
BNE KYBD4 WHEN NOT
STA CTRL SET CTRL FLAG =012
JSR $FFD2 PRINT RVS
LDA #0BA CHECK MARK
JSR $FFD2
LDA #0FF TURN RVS OFF
JSR $FFD2 - FOR ECHO
BNE NULL2 BRANCH ALWAYS
LDY CTRL CTRL FLAG SET ?
CPY #RVS
BNE TSTCR NO,
DEC CTRL YES, UNSET IT
AND #01F PREPARE CTRL CHAR
BNE RETRN2 AND SEND IT BACK
TSTCR CMP #CR
BEQ RETRN2
CMP #020 LESS THAN SPACE ? (CURSOR CTRL)
BCS TESTA NO,
LDA #00 YES, IGNORE IT
RTS
TESTA CMP #'A' SPECIAL OR NUMERIC ?
BCS RETRN2 YES, RETURN UNSHIFTED
LDX ASAVE
BMI SHFTED FOR UC ALPHA AND HIGH SPEC.
CMP #'Z'+1 LEFT BRACKET
BCS RETRN2 YES, DONT SHIFT HIGH SPECIALS
ORB5 ORA #020 INSERT LC BIT FOR UNSHIFTED
RETRN2 ORA #00 RETURN WITH CHAR IN (A)
RTS AND FLAGS SET
SHFTED CMP #'Z'+1 IF HIGH SPECIAL,
BCS ORB5 SEND SHIFTED
BCC RETRN2 SEND UC ALPHA WITHOUT SHIFT
;
PROMPT BYT CR
CMDS BYT '0/R/F/X/? ',00
;
PGMA WORD ONLINE-1
WORD REWIND-1
WORD FORWARD-1
WORD EXIT-1
WORD TOP-1 FOR A PATCH
;
MSG1 BYT RVS,'ONLINE',OFF,CR,00
;
MSG2 BYT RVS,'REWIND',OFF,' ',00
;
MSG5 BYT RVS,'EOF ',00
MSG5B BYT OFF,CR,00
;
TOP NOP
END
COMPUTED PGM END ADDR

```

connecting to a remote system for the first time, and you are not sure what type of system it is, set the modem switch to full duplex. If each character you send appears twice, flip the modem switch to

half duplex.

Test the program thoroughly before attempting to go online with any system. Then, before using a commercial network, get some experience by calling a

CBBS (Computer Bulletin Board System). These free systems are set up by clubs (or by very special individuals). Check with your local computer club for details. You may have so much fun that you will forget about the commercial networks.

For Hackers And Bit Twiddlers

Being one of you myself, I have provided the means to add another program function. The ? in the prompt can be changed to any character you want. The search count byte at 044D can be increased to 8. The address table for the routines contains a dummy entry. What more do you need? Don't forget to change the value of TOP in the Rewind and Reset routines.

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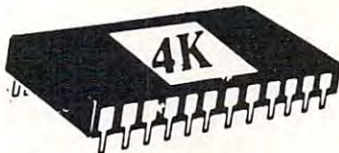
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4.0 Garbage Collection: A Small Bug

Jim Butterfield
Toronto, Canada

One of the nicest things about 4.0 Basic is that garbage collection problems are completely eliminated. Well, not quite ...

The following problem is a rare bug. A number of things must come together within your processor before it has a chance of happening:

— You must be almost completely out of memory space. By this, I don't mean that the processor has gotten to the point where it needs to do a garbage collection; rather, the processor must have very little space left even after the collection. The processor must be on the edge of saying OUT OF MEMORY.

— You must be in the process of concatenating at least three strings. "Concatenating" is a good word to use when you want to impress your friends (pronounce it with emphasis on the cat). It means: joining together. A three-way concatenation might be coded as: `M$ = A$ = B$ = C$` or `PRINT J$ = " " = M$`. The `=` sign does the concatenation; it joins the strings together.

Seeing The Bug

Now we know the rules, let's inspect the bug. Remember, it only happens on 4.0 Basic machines, so users with earlier ROMs won't be able to join in the fun.

Try the following program:

```
100 X = FRE(0)/5-10
110 DIM A(X)
120 Z$ = Z$ + "X" + "="
130 PRINT Z$:GOTO 120
```

The first two lines guarantee that we will have very little working memory, and that the program will very quickly stop with an OUT OF MEMORY message. The calculation of line 100 is a great leveller: whether you have 8, 16 or 32K, you'll run out of memory very promptly.

The last two lines build a string which continually increases in size. `Z$` progressively becomes: `X =`, then `X = X =`, then `X = X = X =` and so on. But as you will see when you run the program, something goes badly amiss just before the OUT OF MEMORY halt. Variable `Z$` starts to pick up completely wrong values.

Why It Happens

If the computer was performing a two-way concatenation (e.g. `Z$ = Z$ + "X"`), it would join the

two strings together and store the result. No problem. But with three or more strings to put together, PET must save an intermediate result — and that's where it gets into trouble.

The intermediate result is held in memory, of course. But since it's not permanent, the garbage collection procedure pays no attention to it. Most strings are moved, but not the intermediate one. To make the situation even more complex: the computer, ignoring the temporary string, loses track of how much space is really available in which to stage the concatenation. If it had all the facts, it would decide that it didn't have enough space for the job, and would report OUT OF MEMORY immediately. Instead, it tries the job — even though there isn't enough memory — and ends up botching it.

What To Do About It

There are several easy ways out of this problem.

It's likely that Commodore will make a corrected ROM available in the near future to clean up the problem permanently. In the meantime; however, you can get around the potential dangers with a little coding.

One way is to make sure that you'll never run the processor out of memory. If there's any doubt, you could sprinkle a few memory tests of your own into your program. For example, a line like `IF FRE(0)/768 THEN PRINT "OUT OF MEMORY" : STOP` would guarantee that you would always have space for three jumbo-sized strings in memory — or would stop if you didn't.

Another way is to avoid multi-way concatenations. So long as you join only two strings together at a time, you'll be safe. For example, try changing line 120 in the test program above to: `Z$ = Z$ + "X"` : `Z$ = Z$ + "="`. The problem will go away. ©

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(The SUB-it has no system software or hardware to supervise access to the IEEE bus. The system is thus unprotected from user-created problems. Any user—even a rank novice—has full access to all commands

and to the disk and bus. This situation can, of course be corrected partially by the Proctor, completely by the Regent.)

The SUB-it prevents inadvertent disruption when one unit in a system is loading and another is being used.

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Q. How expensive are these classroom miracles?

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Using The Monitor On The Pet

Eric Brandon

Supposedly, everyone knows how to use the monitor in the PET computer, right? A lot of people seem confused to me, however, and many authors of articles seem to feel they have to explain how to SAVE their programs using the monitor, how to enter their programs using the monitor, and so on.

There are basically two versions of the monitor, one is for the Original ROM PET, and must be LOADED from tape. The monitors in the upgrade ROM and BASIC 4.0 ROM are identical to the user, and can be entered with an SYS 4 or SYS 1024 from BASIC. Where there are differences in usage, I will point them out.

One difference I should point out right here, however, is that, with the Original ROM monitor, it is difficult to program in BASIC and use the monitor at the same time, since BASIC programs reside in the same area of memory as the monitor. One way to overcome this problem is presented in **COMPUTE! #4** ("Relocate PET Monitor Almost Anywhere") and **COMPUTE! #5** ("After the Monitor's Moved"), both by Roy Busdiecker.

When you first enter the monitor, what you see is a letter (either "B" or "C"), followed by an asterisk. A "B" indicates you have entered it via a machine language BRK instruction such as when you use SYS 1024. A "C" indicates you have Called the monitor directly. The only time you really need to Call the monitor is when you want to enter it on the BASIC 4.0 ROM without canceling a CMD instruction. This is done with a SYS 54386. A further explanation of this can be found in **COMPUTE! #11** ("Working With BASIC 4.0") by Jim Butterfield.

The next thing you see is a list of the 6502's registers. This list can also be called up by the "R" command, and looks like this:

PC	IRQ	SR	AC	XR	YR	SP
0401	E62E	32	04	5E	00	FE

The hexadecimal numbers are in left to right order: the Program Counter, the Interrupt ReQuest vector, the Status Register, the ACcumulator, the X Register, the Y Register, and the Stack Pointer. You can move the cursor over any of these values, and change them to whatever you wish by simply overstriking the old numbers. The Original ROM monitor does not supply you with the value of the IRQ vector; this can be found at \$0219 and \$021A.

One of the commands available to you at this point is "M". This command allows you to see the value of memory locations in hexadecimal format. For example, to view the bytes from \$033A to \$0400, you would type:

M 033A 0400

You can stop such a listing by hitting the STOP key. You may also use the cursor to overstrike the hex numbers with any values you wish. You must hit RETURN over each line, however, to enter the changes into memory.

Another command available is "G". This means Go, and is used to execute machine language programs. If you wished to execute a program beginning at \$033A, for example, you would type in:

G 033A

This is equivalent to SYS 826. If you enter just "G", you will execute instructions beginning where the Program Counter is pointing.

The "L" command will LOAD bytes from tape or disk. The format is:

L "NAMEPROG",DN

where DN is the device number (01 for tape, 08 for disk) in hex. For the original ROM, the format is:

L DN,NAMEPROG

Note that no quotation marks are necessary. An advantage of LOADING from the monitor is that certain pointers are conserved. If, for instance, you LOADED (from BASIC) a machine language program into the second cassette buffer, and then typed in a line of BASIC, your machine would hang up since your variable pointer would be below \$0400, the beginning of your BASIC program! Using the monitor, however, you would not have any of these problems. If you must LOAD machine language from BASIC, type "NEW:CLR" after LOADING.

The "S" command is used to SAVE memory to tape or disk. The format is:

S "NAMEPROG",DN,BADD,EADD

where DN is the device number, BADD is the beginning address in hex, and EADD is the ending address *plus one* in hex. For instance, to SAVE a program called TEST that resides from \$033A to \$03C0 onto drive 0 of the disk, you would type in:

S "0:TEST",08,033A,03C1

The format for the Original ROM monitor is different. To SAVE the same program to tape you would type in:

S 01,TEST,033A,03C1

As with LOAD, no quotation marks are necessary.

The last command is "X" which means eXit. It takes you out of the monitor and returns you to BASIC. This command should be taught to every computer science student, since they somehow manage to end up in the monitor despite the fact

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that they don't know how to leave BASIC.

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Odds And Ends

Louis C. Ray
Los Angeles, CA

In issue 6 of **COMPUTE!** Jim Butterfield described the various ROM sets that are available for the CBM/PET computers and the Commodore disk systems. On the strength of that article I proceeded to acquire the BASIC 3.0 ROMs for my model 2001-8 PET and a 2040 disk with DOS 2.1.

I wanted to use the "relative file mode" of the DOS 2.1 program in the 2040 disk drive. However, the manuals from Commodore do not indicate how the relative positioning feature can be called from a computer without BASIC 4.0. Unfortunately, my Commodore computer is an old model with static RAMs that cannot be easily upgraded to use the BASIC 4.0 ROMs. Phone calls to several Commodore district offices yielded no help, although most of Commodore folks were friendly and sympathetic.

After some experimentation, I have discovered the syntax necessary for the RECORD command of BASIC 4.0 to be simulated by BASIC 3.0. It is as follows:

PRINT#15,"P"ch/rc1/rch/b

where **ch** is the channel open to the relative file (in binary)

rc1 is the low order half of the record number (in binary)

rch is the high order half of the record number (in binary)

b is the byte pointer (in binary)

If not given, a 1 is assumed for the byte pointer.

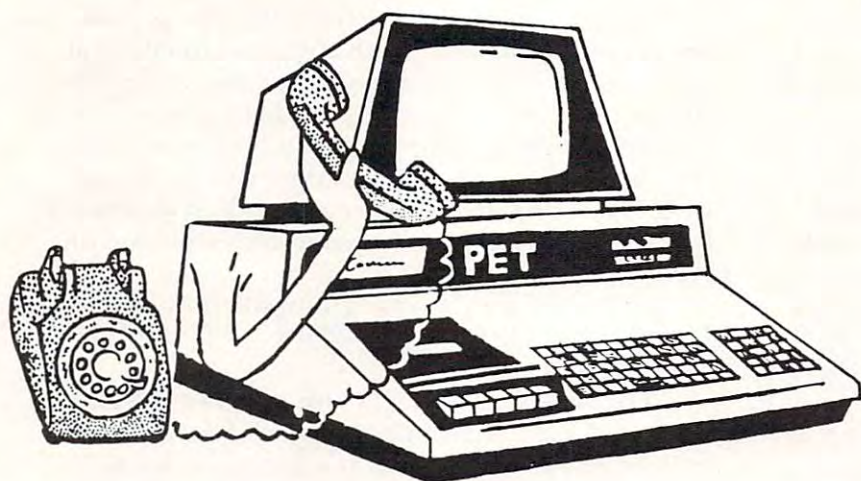
The following short program shows how I get the "relative files" with my PET.

```
10 OPEN15:8,15:LF=10
20 OPENLF,8,LF,"0:TEST,L80,W"
22 INPUT"RECORD NUMBER ":RN%
23 IFRN%>254ORRN%<0THEN22
24 PRINT#15,"P":CHR$(LF):CHR$(RN%):CHR$(0)
25 GOSUB400:IFEN=50THENS00
26 INPUT"READ OR WRITE W":C$
27 IFLEFT$(C$,1)="R"GOTO500
28 IFLEFT$(C$,1)="A"THEN50
29 GOTO600
50 CLOSE3
60 STOP
400 INPUT#15,EN,EM$,ET,ES
405 IFEN=0THENRETURN
410 PRINTEN:EM$:ET:ES:RETURN
420 CLOSE3:CLOSE15:STOP
500 INPUT#LF,A$
510 PRINTA$:GOTO22
600 PRINT"TYPE LINE":INPUT" ":A$
610 PRINT#LF,A$:CHR$(13)
620 GOTO22
```

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2040 Disk Program Listing

David M. Conley
Santee, CA

This is a program for the PET and the 2040 disk drive, that will list, in alphabetical order, every file and program on all your disks. This is done in a two-step process.

The first step is to read the directory off of each disk, one by one, and put this data onto a disk, as a sequential file. The disk being read goes in drive 0, and the file is put on the disk in drive 1. The PET checks the name you give each disk against a list of legal names, and will refuse a bad name. When it writes a file, the PET first scratches any *old* file with the same name. This makes updates automatic.

When you are done inputting/updating the disk directory files, Input an up arrow for the disk name, and the PET will start sorting the names.

This sorting routine and a print-out routine are in the second part of the program. It reads each file in drive 1, using the list of names in the DATA statements, and, on the first pass, gets all the programs that start with any non-alphabetical character. It then sorts these programs, and prints them out in order. Then it goes through the files again, this time getting all the ones that start with "A", sorts and prints them. It does this all the way to "Z", and then stops. The end result of all this is a listing of ALL the programs and files you have on ALL your disks.

In this format, this program will show Program Name, Type, Disk name, and Size, and is set up to use the 2022 printer.

For large disk libraries, this program is SLOW! To speed it up, you can have the PET look for several letters at once, which will require fewer passes through the files to get all the data. This uses up lots of memory though, so don't try to do too much at once, or you'll run out of memory. Putting too many names into the PET will also

```

- ONE AT A TIME      + THREE AT A TIME
-----
- 720 REM ** THIS SORTS FOR 1 LETTER AT A TIME
+ 720 REM ** THIS SORTS FOR 3 LETTERS AT A TIME

- 840 PRINT"Q":FOR I=1 TO 27:E$=MID$(A$,I,1)
+ 840 PRINT"Q":FOR I=1 TO 27 STEP 3:E$=MID$(A$,I,1)

+ 842 G$=MID$(A$,(I+1),1)
+ 844 H$=MID$(A$,(I+2),1)

- 850 PRINT"LOOKING FOR "E$"/S
+ 850 PRINT"LOOKING FOR "E$", "G$" & "H$"/S

- 980 IF E$<>"*" THEN 1000
+ 980 IF E$="*" THEN 990

+ 982 IF G$="*" THEN 990
+ 984 IF H$="*" THEN 990
+ 986 GOTO 1000

- 1000 IF MID$(F$,2,1)=E$ THEN C$(J)=F$:J=J+1:PRINT"*";
+ 1000 IF MID$(F$,2,1)=E$ THEN C$(J)=F$:J=J+1:PRINT"*";GOTO 1010

+ 1002 IF MID$(F$,2,1)=G$ THEN C$(J)=F$:J=J+1:PRINT"*";GOTO 1010
+ 1004 IF MID$(F$,2,1)=H$ THEN C$(J)=F$:J=J+1:PRINT"*";GOTO 1010
-----
- ONE AT A TIME      + THREE AT A TIME

```

drastically increase the time required to sort these names.

Shown below are the changes necessary to look for three letters at a time.

If you have a different printer, insert its routine in the appropriate spot. Do the same thing for the sort routine, if you have a better one. It's probably better to have a disk reserved for this program and data files only. It'll save the 2040 a little time when it looks for a file.

```

100 REM ** BY D. M. CONLEY 3/81
110  -
120 REM * THIS PROGRAM READS AND STORES -
    -THE DIRECTORY FROM A DISK AS A SEQ
130 REM * FILE ON THE DISK IN DRIVE #1. -
    - THE DISK BEING READ GOES IN -
    -DRIVE #0.
140  -
150 N=152: DIM D$(N): OPEN 15,8,15
160 PRINT "*****TO START PRINT OUT,
    - INPUT '^'
170 INPUT "*****DISK NO. 2<<<"; B$
180 IF B$="2" THEN PRINT "*****":
    -GOTO 170
190 IF B$="^" THEN CLR: GOTO 740
200 READ E$
210 IF E$="END" THEN PRINT "*****THAT'S -
    -NOT A GOOD DISK NAME: TRY AGAIN!
220 IF E$="END" THEN RESTORE: GOTO 170
230 IF E$<>B$ THEN 200
240 RESTORE
250  -
260 REM ** READ DIRECTORY
270  -
280 PRINT#15,"I0": REM ** INITIALIZE -
    -DRIVE 0
290 PRINT#15,"M-E"CHR$(212)CHR$(237):
    -REM ** DIRECTORY LOAD PATCH
300 PRINT "***** DIRECTORY FROM DRIVE -
    -0 *****"
310 B=30: C$="S0: *": OPEN 2,8,0,C$
320 GOSUB 1410: GET#2,A$: GET#2,A$: I$=""
330 IF ST<>0 GOTO 520
340 FOR A=1 TO B: GET#2,A$: IF A$="" -
    -THEN A$=CHR$(0)
350 I$=I$+A$: NEXT A: G=ASC(MID$(I$,3,1)):
    -G=G+ASC(MID$(I$,4,1))*256
360 IF B=30 THEN 510
370 FOR I=6 TO 27: IF MID$(I$,I,1)<>CHR$(
    -34) THEN NEXT: GOTO 510
380 D$=MID$(I$,5,27)
390 IF LEFT$(D$,1)=" " THEN J=LEN(D$):
    -D$=RIGHT$(D$, (J-1)): GOTO 390
400 D$=D$+B$+STR$(G): K=K+1
410 FA=0: F=0: FOR X=1 TO LEN(D$):
    -X$=MID$(D$,X,1)
420 IF X$=CHR$(34) AND F=0 THEN F=1:
    -GOTO 480
430 IF X$=CHR$(34) THEN F=0: GOTO 480
440 IF F THEN 480
450 IF X$<>" " THEN FA=0: GOTO 480
460 IF X$=" " AND FA=0 THEN X$="*": FA=1
470 IF X$=" " THEN NEXT X
480 X1$=X1$+X$: NEXT X
490 D$=X1$: X1$=""
500 D$(K)=D$: PRINT D$
510 D$="": I$="": B=32: IF A$<>"S" THEN 330
520 PRINT: C$="READ DIRECTORY": GOSUB 1410

```



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```

530 C$="CLOSE 2": CLOSE 2:GOSUB 1410:
    -PRINT"↓"
540 REM ** PRINT#15,"I1":GOSUB 1420
    - (THIS IS NOT NORMALLY NEEDED"
550 OPEN 1,8,15
560 E$="S1: "+B$+" ":REM ** SCRATCH OLD
    -FILE
570 PRINT#1,E$
580 CLOSE 1
590
600 E$="@1: "+B$+" ,S,W"
610 OPEN 2,8,2,E$
620 FOR X=1 TO K
630 PRINT#2,D$(X)CHR$(13);:REM *** PUT
    -FILE ON DISK
640 NEXT X
650 PRINT#2,"*CHR$(13);
660 CLOSE 2:GOSUB 1410:K=0:GOTO 160
670
680
690
700 REM *** THIS HALF OF THE PROGRAM
    -PRINTS OUT THE DIRECTORYS
710
720 REM ** THIS SORTS FOR 1 LETTER AT A
    -TIME
730
740 A$="*ABCDEFGHIJKLMNOPQRSTUVWXYZ":
    -N=1000:DIM C$(N)
750
760 REM 'N' IS THE MAX NO. OF PROGRAMS
    -THAT START WITH THE SAME LETTER
    -IN YOUR
770 REM DISKS. BE SURE 'N' IS LARGE
    -ENOUGH....BETTER TOO BIG THAN TOO
    -SMALL!
780
790 OPEN 15,8,15:PRINT#15,"I1"
800 GOSUB 1410:J=1
810 OPEN4,4:PRINT#4,"H"
820 PRINT#4,"          PROGRAM NAME
    - TYPE          DISK SIZE
830 PRINT#4,"          CCCCCCCCCCCCCCCCCC
    -CCCCCCCCCCCCCCCCCCCC":CLOSE4
840 PRINT#4"H":FOR I=1 TO 27:E$=MID$(A$,I,
    -1)
850 PRINT"↓↓↓LOOKING FOR "E$"'S
860 PRINT"          ('*' =
    -FILE FOUND)
870 READ B$
880 PRINT:PRINT"SEARCHING DISK #B$;
890 IF B$="END" THEN RESTORE:GOTO 1030
900 D$="1: "+B$+" ,S,R"
910 OPEN 2,8,2,D$:GOSUB 1410
920 GET#2,F1$:IF F1$=CHR$(13) THEN 940
930 F$=F$+F1$:GOTO 920
940 IF ST THEN CLOSE 2:GOTO 870
950 T=LEN(F$):IF LEFT$(F$,1)="*" THEN
    -F$=RIGHT$(F$, (T-1)):GOTO 950
960 REM ** THE ABOVE LINE ELEMINATES
    -A OBSCURE PROBLEM THAT CAUSES A
    -"*"
970 REM ** TO BE THE 1ST CHARACTER IN
    -F$. I DON'T KNOW WHY IT DOES IT!
980 IF E$<>"*" THEN 1000
990 T=ASC(MID$(F$,2,1)):IF T<65 OR T>90
    -THEN C$(J)=F$:J=J+1:PRINT"*";:
    -GOTO 1010
1000 IF MID$(F$,2,1)=E$ THEN C$(J)=F$:
    -J=J+1:PRINT"*";
1010 F$="":GOTO 920
1020
1030 REM ** START SORT
1040 TP=1:LOWER(1)=1:UPPER(1)=J
1050 IF TP<=0 THEN 1240
1060 LB=LOWER(TP):UB=UPPER(TP):TP=TP-1
1070 IF UB<=LB THEN 1050
1080 L=LB:K=UB:TEMP$=C$(L)
1090 IF K<1 THEN 1120
1100 IF TEMP$>=C$(K) THEN 1120
1110 K=K-1:GOTO 1090
1120 IF K<=L THEN C$(L)=TEMP$:GOTO 1190
1130 C$(L)=C$(K):L=L+1
1140 IF L>K THEN 1170
1150 IF C$(L)>=TEMP$ THEN 1170
1160 L=L+1:GOTO 1140
1170 IF K>L THEN C$(K)=C$(L):K=K-1:
    -GOTO 1100
1180 C$(K)=TEMP$:L=K
1190 TP=TP+1
1200 IF L-LB<UB-L THEN LOWER(TP)=L+1:
    -UPPER(TP)=UB:UB=L-1:GOTO 1070
1210 LOWER(TP)=LB:UPPER(TP)=L-1:LB=L+1
1220 GOTO 1070
1230
1240 L=0:OPEN4,4:FOR K=1 TO J
1250 X1$=C$(K):IF X1$="" THEN 1310
1260 D$="":F=0:FOR X=1 TO LEN(X1$)
1270 X$=MID$(X1$,X,1):IF X$="*" THEN
    -F=F+1:GOTO 1340
1280 D$=D$+X$
1290 NEXT X
1300 IF C$(K)<>"*" THEN PRINT#4,"
    - ";D$:C$(K)="":L=L+1
1310 NEXT K:PRINT:PRINT"FOUND"L"ITEMS":
    -CLOSE4
1320 J=1:NEXT I
1330 END
1340 IF F=1 AND LEN(D$)<20 THEN D$=D$+"
    -":GOTO 1340
1350 IF F=2 AND LEN(D$)<32 THEN D$=D$+"
    -":GOTO 1350
1360 IF F=3 AND LEN(D$)<38 THEN D$=D$+"
    -":GOTO 1360
1370 GOTO 1290
1380
1390 REM ** INPUT FROM ERROR CHANNEL
1400
1410 INPUT#15,EN,EM$,ET$,ES$:IF EN=0
    -THEN RETURN
1420 IF EN=1 THEN RETURN
1430 PRINT"ERROR #"EN"EM$;:IF EN<30
    -THEN PRINT" ON "ET$".ES$;
1440 PRINT"↓":END
1450
1460 BELOW IS THE LIST OF ACCEPTABL
    -E NAMES FOR DISKS. THESE ARE
    -MINE.
1470 PUT YOUR OWN IN PLACE OF
    -THESE.
1480 "END" MUST ALWAYS BE THE LAST
    -NAME.
1490
1500 DATA 00,1A,1B,2A,2B,3A,3B,4A,4B,5A,
    -5B,6A,6B,7A,7B,8A,8B,9A,9B
1510 DATA 10A,10B,11A,11B,12A,12B,13A,
    -13B,14A,14B,15A,15B,16A,16B,17A,
    -17B
1520 DATA 18A,18B,19A,19B,20A,20B,21A,
    -21B,22A,22B,23A,23B,24A,24B,25A,
    -25B
1530 DATA 26A,26B,27A,27B,28A,28B,29A,
    -29B,30A,30B
1540 DATA END

```

If you can't get the complete print-out in one sitting, you can easily continue later from where you had to stop. Say, for example, you just got the print-out for the "E"s, and you had to stop. To start up again from where you stopped, change the FOR... TO... statement in line 840 to read FOR I = 7 TO 27. This will cause the PET to start looking for the 7th letter in A\$, which is an "F".

The Data is stored as C\$(1) to C\$(K) in the sort and print routine. After it prints, a letter sort could be saved as a tape or disk file if you wanted, using a routine similar to the one in lines 610 to 660.

Beware of the dreaded Garbage Collection Routine! Because of all the string manipulation, after this program runs for a while, Garbage Collection can eat up a LOT of time. If you have a solution to this problem (No, I don't want to buy a set of 4.0 ROMs), let me know.

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All About LOADing Pet Cassettes

Louis F. Sander
Pittsburgh, PA

This article, based on long experience and on material from many sources, summarizes the major points about PET's LOAD command as it applies to cassette tapes. Disk LOADing is rather different and is not covered here. If you don't yet have a disk drive, or if you have any questions about LOADing from tape, read on.

The Pet Cassette

To understand LOADing, it's helpful to understand what is recorded on the tape itself. It's extremely useful for you to *hear* the recorded material, and you can easily do so by connecting an audio amplifier between the tape drive connector's READ and GND pins. Your CB2 amplifier will do nicely, if you have one. Here is what you'll find on every PET tape:

1. Ten seconds of high-pitched leader tone. This tone prepares PET for LOADing the program, but mainly it was put there to insure that the tape's non-magnetic leader passed by before anything important was recorded. Only a second or so of the tone is required to initiate a LOAD, so you can often save some time by winding your tape past most of it before LOADing. Your audio amplifier or an external recorder will make this step a cinch.
2. A three-second, 192-byte tape header, consisting of one byte to differentiate program and data tapes, four bytes telling PET the starting and ending addresses of the LOAD, and 187 bytes containing the program name plus trailing spaces as needed. (Although the program name can be up to 187 bytes long, most are much shorter because only the first 16 characters print on the screen when FOUND, and because 77 characters at most can be entered as a name in immediate mode.) All this data is recorded twice in the header and if you listen carefully you can hear the tiny gap between the two copies.
3. Two more seconds of leader tone, followed by ...
4. The program itself, repeated twice, with an audible gap between the copies. If the program is in BASIC, each keyword is recorded as a one-byte abbreviation, or "token," to save

space in memory and on the tape. On this part of the tape, each 1K of program takes about 18 seconds of playing time, so a 1K program takes about 33 seconds to LOAD, including leader, header, etc.

Many Pet owners like to use C-10 cassettes, recording only one or two programs per side, to save unproductive SEARCHING time. But longer cassettes can hold any number of programs, and PET's ability to LOAD them selectively by name, in immediate or program mode, allows very large and complex programs to be cut into pieces which even the smallest PET can digest.

The LOAD Command

When executed, LOAD transfers a program from tape to PET's memory. A LOAD command can be executed in immediate mode by typing it in on the keyboard or by pressing the shifted RUN/STOP key. LOADing can be done in program mode by executing a line containing a LOAD command, or by POKEing the keyboard buffer. There are important differences in the way PET handles these four methods of execution, and they will be described in detail later. Whatever method is used to execute the LOAD, if the tape is not positioned at the start of a program when the LOAD is attempted, PET will ignore what it reads until it finds the next program header on the tape.

The format for LOAD is:

LOAD ("program name") (,device number)

The items in parentheses are optional. The device number can be either 1 or 2, indicating a LOAD from TAPE #1 or TAPE #2. It can also be a numeric variable or expression whose value, after going through the INT function, is either of those numbers. If it is omitted, TAPE #1 is automatically selected. If used, the program name can be enclosed in quotes, or can be specified as a string variable. If no program name is specified, PET will LOAD the next program it finds on the selected tape.

If a program name *has* been specified, PET will search for that name before LOADing. The search is on a character-by-character basis, and a match is made whenever each character in "program name" is found in the corresponding position in the name of the FOUND program. This means that LOAD "CAT" will load CAT, CATNIP, CATAPULT, or any other program whose name begins with CAT. Programs such as TOMCAT will *not* cause a match, because the letters in CAT will not be found in the right positions. Programs like CA won't match either, because there is nothing to match with the T.

This method of searching can be useful when you enter

LOAD "STAR"

because you're not sure if your program is called STARWARS or STARFIGHTER, but it can some-

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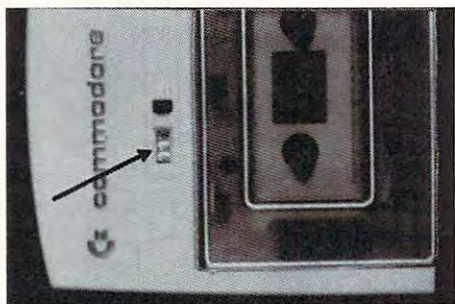
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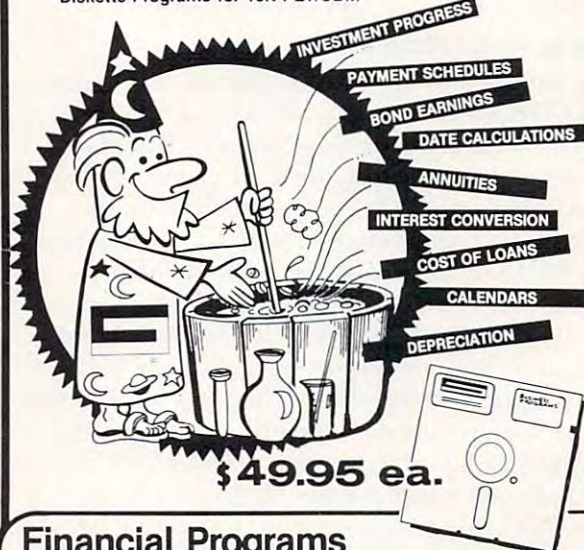
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times cause PET to load an unwanted program, such a STARVATION.

The following examples show LOAD's valid formats and the resulting screen dialogue:

PET LOAD Command Formats

To LOAD From TAPE #1	To LOAD From TAPE #2*	Action
LOAD	LOAD "",2	LOAD the next program found on the tape.
LOAD "WIMP"	LOAD "WIMP",2	Search for the program names WIMP, and LOAD it when found.
LOAD A\$	LOAD A\$,2	Search for the program with the same name as A\$, and LOAD it when found.
LOAD A\$,J-3	LOAD A\$,J-3	Search for A\$ on TAPE #(J-3) and LOAD it when found. 1<(J-3)<3

*An alternate way of specifying TAPE #1 is to use this format with a 1 rep

LOAD Command Screen Dialogue

LOAD "WIMP"	This is your command. All else is PET's response.
PRESS PLAY ON TAPE #1	Shown only if no tape controls are down when LOAD is executed.
OK	Shown when you press a tape control.
SEARCHING FOR WIMP	The tape has started to move.
FOUNDSPACEWARS	PET has read the header of a program named SPACEWARS.
FOUND WIM	Not a match with "WIMP," since fourth character is missing.
FOUND	Found an unnamed program. No match.
FOUNDSPACEWIMP	Not a match, since first character doesn't match.
FOUND WIMPOLESTREET	A match, since all letters searched for are in the right place.
LOADING	WIMPOLESTREET is being loaded into memory.
READY.	The LOAD is complete.

LOADing In Immediate Mode

Pressing the shifted RUN/STOP key in immediate mode LOADs and automatically RUNs the next program on TAPE #1; this is probably the most common method of LOADing PET programs.

LOAD can also be executed in immediate mode by typing the command onto the screen and pressing RETURN. Any of the previously illustrated command formats can be used in this way. In every case, the word LOAD can be abbreviated by typing an L and a shifted O, (even if the shifted O puts a graphics character on the screen). Try this trick if you haven't used it already — it's a good one. Programs loaded by typing in LOAD or 'L shifted O' do *not* automatically begin executing when the LOAD is complete. You must type in RUN (or 'R shifted U'), then press RETURN to start them.

You can find the names of all programs on a tape by entering LOAD "XYZ", where XYZ is any combination of letters *not* starting the name of a program on the tape. If you do this, PET will search

the tape from beginning to end, showing you the first 16 characters of the name of each program it finds along the way.

When a program is LOAded in immediate mode, all the appropriate prompts and messages appear on the screen, and the new program completely replaces the old one in memory. On completion of the LOAD, PET performs a CLR, which initializes all variables except TI and TI\$, destroys all arrays previously set up, and closes all logical files.

LOADing Under Program Control

There are two ways of having one PET program LOAD another. The first is to have the original program POKE a 131 into the keyboard buffer, then terminate. This is the equivalent of stopping the first program and pressing shifted RUN/STOP in immediate mode. In an Original ROM PET this might be done by:

```
9150 POKE 527,131 : POKE 525,1 : END
```

The Upgrade ROM version of this would be:

```
9150 POKE 623,131 : POKE 158,1 : END
```

When either of these lines es executed, PET will immediately LOAD and RUN the next program it finds on TAPE #1. All the appropriate screen messages will appear, the new program will completely replace the old one in memory, and a CLR will be performed at the end of the LOAD, just as though shifted RUN/STOP had been pressed.

The second method of LOADing under program control is to use the LOAD command, in any of its previously mentioned formats, in a program line. For example:

```
140 LOAD "WIMP" —or— 150 LOAD A$,2
```

This method has some properties which are at once useful and troublesome:

1. LOAD in a program line stops execution of the current program, LOADs the specified program from wherever it is found on the tape, and begins executing it at once.
2. If PLAY is already pressed, no messages appear on the screen to disturb its appearance. If PLAY has *not* been pressed, the PRESS PLAY message, but no others, will appear on the screen.
3. No CLR is performed after the LOAD, and the start of variables pointer is not reset, so the values of all numeric variables in the new program will be the same as those in the old one. This process is sometimes called "passing parameters" from one program to another. As an example of how it works, if variable KM had a value of 4986 in the old program, and the first line of the new one is 10 PRINT KM, the number 4986 will be printed on the screen. Without the passing parameter feature, of course, KM would have an initial value of 0 in

the new program, and the 0 would be printed on the screen.

4. String variables will be passed to the new program, but only if they have been "operated on" in the old one. The line:

```
150 A$="KATHLEEN"
```

will *not* get KATHLEEN into the new program unless it has been followed by something like:

```
155 A$=A$+""
```

5. User-defined functions will not be reliably passed from the old program to the new one.

6. One program or a whole series of programs can be loaded in this way, but none of them can be longer than the program most recently loaded by one of the other methods, (that is from immediate mode or by POKEing the keyboard buffer). This is an absolute requirement, caused by the fact that the start of variables pointer is not reset by the program mode LOAD. Programs violating this restriction may LOAD all right, but they will not RUN properly, if they RUN at all. You can set the pointer yourself to get around the restriction, if that's your cup of tea.

The above set of properties allows the creative programmer to write very large programs of appreciable complexity, and to break them into sub-programs, each of which will fit into PET's memory. The first program can fill the screen with graphics or whatever, make some calculations and, based on their result, ask PET to LOAD any one of many other programs from either tape drive. Because the screen messages are suppressed, the PET operator will not see the LOAD taking place. Nor will he have to take action to RUN the new program. And, because numeric and string parameters can be passed from one program to the next, the second program can work on input, or results, from the first, and on ad infinitum. The only price for this flexibility is the length restriction mentioned above, and the fact that strings need to be operated on in order to be passed from program to program.

Machine Language

The material in this article applies in full only when you are LOADING programs written in BASIC. PET handles machine language programs (MLP) somewhat differently, and a discussion of the differences is beyond our scope at this time. Suffice it to say that the LOAD formats and LOAD execution methods we've described here will load MLPs into PET's memory, but afterwards things begin to differ. MLPs are never automatically RUN by a LOAD command. And the status of memory pointers and other programs afterwards is likely to be quite different from what is seen with BASIC.

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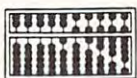


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equipped to delve into these matters on his own and, if he pays careful attention to PET's memory pointers, he's likely to be able to get LOAD to do anything he wants.

LOAD Errors And Other Problems

During a LOAD, PET compares the two copies of the program on the tape. If, for some reason, it finds them different, it tries to decide which copy is correct, and it is often able to do so. But sometimes PET can't correct the errors, and in these cases you'll get a ?LOAD ERROR message. Other times, PET will find and print the program name, but will not LOAD the program. Or it may miss the program name altogether and merrily keep SEARCHING to the end of the tape.

When any of these things happen, you should rewind your tape and try again. If things don't work properly the second time, you should take corrective action. Clean and demagnetize your tape head, as described in **COMPUTE! #10** ("Getting the Most From Your PET Cassette Deck," page 42) and elsewhere in the PET literature. If this doesn't correct the problem, try LOADING the program several times. If you are at last successful, make sure the program runs properly, SAVE it on a fresh tape, and consider discarding the first copy. Usually the combination of cleaning/demagnetizing/new program copy will cure any persistent LOADING difficulties. If not, you, and perhaps your service dealer, will have to look further.

Along these lines, it's impossible to over emphasize the value of *listening* to your LOADs, since most error situations can be easily heard on the tape. Without trying, I have developed the ability to *hear* most bad loads, and you can do it, too. The ear is an amazingly sensitive organ, even to digital input. Advanced PET troubleshooters can also make use of the STATUS word, and of PEEKing tape error locations.

A word on head alignment is in order here. If you consistently have trouble LOADING tapes created on other PETs, it is likely that your tape deck's read/write head, or the one on the other PET, is out of alignment. **COMPUTE! #8**, contains some good instructions on correcting this problem. ("Detecting Loading Problems and Correcting Alignment on your PET," page 114). Incidentally, head misalignment is *very* easy to detect by ear. ©

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OUTPUT CONTROL to DISK or PRINTER: in addition to displaying on the CRT, you can direct output to either disk or printer.

HARDCOPY: allows screen displays to be either printed or stored on disk.

FIND: searches all or any part of a program for text or command strings or variable names. Either exact search or wild card search supported.

RENUMBER: the SM-KIT can renumber all or any part of a program. The selective renumbering allows you to move blocks of code within your program.

VARIABLE DUMP: displays the contents of floating point, integer, and string variables (both simple and array). Can display all variables or any selected variables.

TRACE: SM-KIT can trace program execution either continuously or step by step starting with any line number. Selected program variables can be displayed while tracing.

DISK COMMANDS: as in DOS Support (Universal Wedge), the "shorthand" versions of disk commands may be used for displaying disk directory, initializing, copying, scratching files, load and run, etc.

LOAD: SM-KIT can load all or part of BASIC or machine language programs. It can append to a program in memory, overwrite any part of a program, load starting with any absolute memory location, and load without changing variable pointers.

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Linelist

G. H. Watson
Physics Department
University of Delaware
Newark, DE

When examining a PET BASIC program for the first time it is certainly convenient to have a listing produced by a printer. No printer means that you must list the program on the screen. When the screen is full, each new line which is listed will scroll an earlier line off the top of the screen. At most, you may view 24 lines of your program. This would be acceptable if only you could stop the listing, examine the contents, and then continue. The listing process may be slowed by depressing the OFF/RVS key and stopped by hitting the RUN/STOP key, but unfortunately no provision was made for an indefinite pause and then continue.

If you have suffered from typing LIST line#-line# over and over or you have tired of trying to strike the STOP key at just the right instant, then LINELIST may be the answer to your problems. LINELIST is a BASIC "loader" for a fairly short machine language program (140 bytes). By loading and running LINELIST, a program will be created at the top of memory — usually just below screen memory and where ASCII strings are stored. With an appropriate SYS command, a listing will be created just as though LIST were entered. The important distinction is that the listing may be halted by holding down the SHIFT key. When the shift key is released, the listing continues. Depressing SHIFT/LOCK frees both hands to copy the program onto paper. Further, one additional line is listed each time another key is struck; I use INST/DEL to avoid having some of the keystrokes displayed when the listing is completed.

How does this program work? Most of the LINELIST machine code is identical to the LIST routine stored in ROM. "Why not just use a JSR instruction to connect to the BASIC LIST routine?" you may ask. This indeed was my original intention; unfortunately no corresponding RTS exists to facilitate return from the subroutine call. Luckily, the part of the LIST routine we are interested in is relocatable — the absolute address of the code is not referenced. So the routine can be "downloaded" into RAM where the necessary changes may be made.

First the loader program reads the top of memory pointer at \$34, \$35 and moves the pointer down to make room for 140 bytes. Then eight bytes are loaded which are responsible for setting up the pointer which starts the listing process at the start of BASIC. The pointer at \$28, \$29 (start

of BASIC) is transferred to \$5C, \$5D (block transfer pointer #2):

```
A5 28 LDA *TXTTAB
85 5C STA *LOWTR
A5 29 LDA *TXTTAB+1
85 5D STA *LOWTR+1
/TXTTAB=0028      /LOWTR=005C
```

Through PEEK and POKE statements, the required part of the LIST routine is downloaded — \$C5DC-\$C657 for BASIC 2.0 (upgrade ROM) and \$B657-\$B6DD for BASIC 4.0.

In order to provide the pause feature, the listing routine must be diverted after each line is printed. The patch is made by replacing the stop key test (JSR ISCNTC - 20 E1 FF) present in the transplanted ROM routine with a JSR to the pause subroutine. The loader program keeps track of where the new subroutine resides and replaces \$FFE1 with the correct address (which depends on the top of memory pointer). The PAUSE subroutine is short:

```
20 E1 FF PAUSE JSR ISCNTC
A5 98 WAIT LDA *SHFKEY
D0 FC BNE WAIT
60 RTS
/ISCNTC=FFE1      /SHFKEY=98
```

If SHFKEY contains a one, the SHIFT key is depressed; not depressed if zero. Finally, the loader program displays the SYS command which will produce the listing.

With just four bytes (A5 98 D0 FC) any machine language program may have a pause feature. This may also be added to a BASIC program with the following statement: WAIT 152,1,1. As an example, the previous statement placed as line 505 in DISK DISASSEMBLER will allow you to control the output with the SHIFT key.

I hope you will find this program useful. With a small amount of programming (16 bytes along with changing 2 bytes), it is possible to get a dramatic effect. Perhaps you will find a different application which requires moving a ROM routine into RAM. Please share it with us if you do.

```
100 REM LINELIST/2.0 G.H.WATSON 4/81
110 :
120 REM READ TOP OF MEMORY
130 M=PEEK(52)+256*PEEK(53)
140 :
150 REM SFT NEW TOP OF MEMORY
160 M=M-140:X=M:GOSUB400
170 POKE 52,L:POKE 53,H
180 :
190 REM BEGIN AT START OF BASIC
200 FOR J=0TO7:READ A:POKE M+J,A:NEXT
210 :
220 REM DOWNLOAD ROM ROUTINE FOR LIST
230 FOR J=0TO123:A=PEEK(50652+J)
```

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```
240 POKE M+J+8,A:NEXT
250 :
260 REM PATCH LINELIST TO ROUTINE
270 X=M+J+8:GOSUB400
280 POKE M+23,L:POKE M+24,H
290 FOR J=0TO7:READ A:POKE X+J,A:NEXT
300 :
310 PRINT"LINELIST: SYS";M:END
320 :
400 H=INT(X/256):L=X-H*256:RETURN
410 :
500 DATA 165,40,133,92,165,41,133,93
510 DATA 32,225,255,165,152,208,252,96
```

For BASIC 4.0 change the following lines to:

```
160 M=M-151:X=M:GOSUB400
```

```
230 FOR J=0TO134:A=PEEK(46679+J)
```

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Power On/Error Indicator For CBM Disks

Jim Butterfield
Toronto, Canada

This is a simple, inexpensive little board that you mount in your Commodore 2040 or 4040 disk unit. It does two things:

- The red error light on the disk unit becomes two-colour: red for error, green for power on;
- When an error occurs, the light turns to a flickering red, and there is a low-level audible alarm.

The first effect — the red/green light — is similar to that of the 8050 disk unit. It's very handy for reminding you that the power is on.

The second item — flickering light and audible alarm — is very useful, particularly to beginning disk users. Instead of having to remember to look at the disk unit to see if everything is going well, the unit will let you know that there's a problem.

The disk will continue to sound the alarm until the error condition is cleared, either by doing another operation or by interrogating the error status. I know one user who can't stand to have his disk yipping at him, and has disabled the sounder unit. He's an exception: the sound is quite low level, and most of us find that it's useful to have problems called to our attention.

Installation

Putting the Indicator into your 2040 is not difficult,

and requires no permanent changes to your disk unit. You can always put everything back exactly the way it was. The board mounts onto one of the disk boards by means of a screw which replaces an existing screw. You'll need to remove the old LED light — a matter of loosening the locking ring — and replace it with the new two-colour unit.

It can be done without technical expertise, but it's probably better to have someone on hand with a little experience. My disk is quite an early unit, and I found two small problems: the mounting screw wouldn't fit into its matching nut until I loosened the whole disk circuit board and positioned the nut properly; and the mounting screw didn't get a satisfactory ground from the board it was mounted on ... I had to run in a separate ground wire. Neither of these are serious problems, and I understand that they are unlikely to occur on more recent models of 2040 and 4040.

I had a little trouble with the locking ring, but that was my usual clumsiness. I dropped it on the floor and spent half an hour finding it in my shag carpet.

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Richard Olivo

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It is designed around two relatively inexpensive, high-performance integrated circuits from Analog Devices, Inc. (Box 280, Norwood, MA 02062). I chose these devices for their ease of use (they require no external parts), their speed, and their moderate cost. Analog-to-digital conversion is performed by the AD570 (\$29), an 8-bit device with an input range of +5 to -5 volts and a 25-microsecond conversion time. Digital-to-analog output is provided by the 8-bit AD558 (\$11), which has an output range of 0 to 10 volts and which requires about 2 microseconds to produce a full-scale change in the output voltage. The data lines of these two devices are connected to the 6522's ports A and B, with control lines CA1 and CA2 also used. Control lines CB1 and CB2 are free; we use them to receive trigger pulses (CB1) and to output sync pulses (CB2). I added circuitry to protect CB1 and CB2 against inadvertent application of non-TTL voltages, but this protection could be omitted. The interface also provides preamplification of the input with variable gain from 1 to 1000 (in 1,2,5 steps), a zero-offset adjustment, and a choice between direct- or capacitor-coupling for the input. The output connector is switchable between the preamplifier's output and the output of the digital-to-analog converter. The full interface circuitry is shown in Figure 1.

Although programs for data collection can become lengthy, the actual routines for analog input and output are brief. Output through the digital-to-analog converter is extremely simple, since the device is connected in its transparent (unlatched) mode. In this mode, a byte written to Port B appears immediately as a steady analog voltage at the converter. The AD570 input conver-

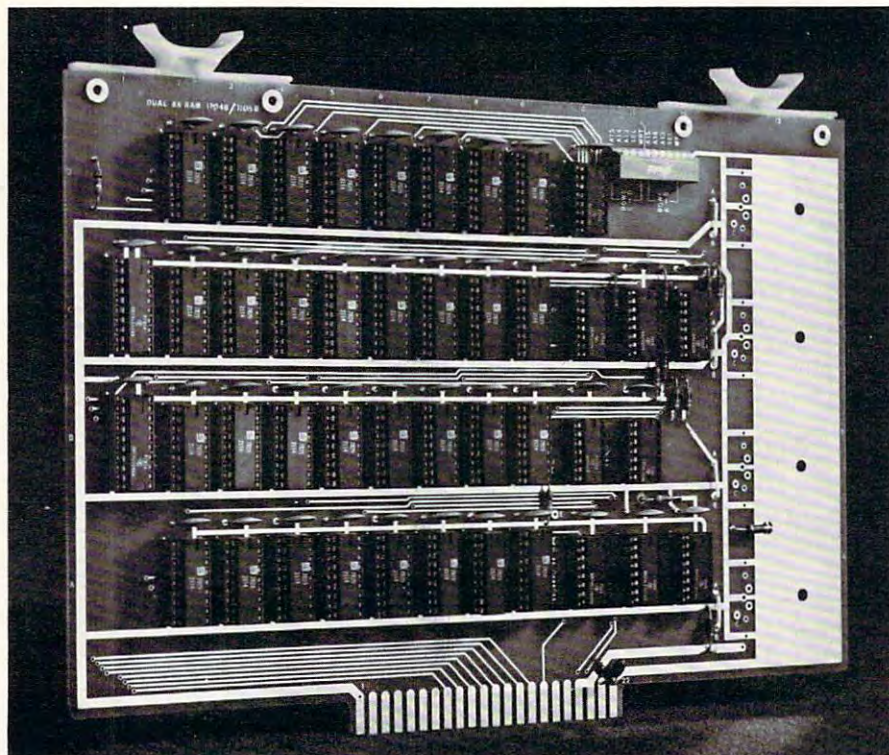
ter, on the other hand, requires control lines to start conversion and to detect that data are ready. In my circuit, control line CA2 initiates conversion by supplying a TTL pulse, which must last at least two microseconds. Conversion begins on the falling phase of the pulse, which also blanks the AD570's data lines. After 25 microseconds, the end of conversion and the appearance of new data are signalled by the \overline{DR} line (pin 17 of the AD570, connected to control line CA1); this line goes low and remains low until the next conversion is initiated. Thus, a routine to acquire a byte of analog data must accomplish four tasks: it must initiate conversion by making CA2 go high and then low, it must update a storage vector to be used to place the new data in memory, it must examine CA1 to check if the new data are ready, and finally it must read Port A and store the data in memory. If the storage buffer is more than one page of memory (as in my system), the minimum practical sampling interval approaches 100 microseconds, even though the converter itself requires only 25 microseconds. The remainder of the time is taken up by the software.

In my program, data sampling is interrupt driven. Timer T1 on the AIM's 6522 versatile interface adapter is set to generate interrupts at 100-microsecond intervals and, at each interrupt, an interrupt service routine is executed to acquire one byte of data. Prior to enabling interrupts, however, a series of initialization steps must be carried out. The data-direction registers are set to make Port A an input and Port B an output; the auxiliary control register is set to place timer T1 in free-running mode with the output to PB7 disabled; the peripheral control register makes CA1 interrupt on a negative transition (used to indicate that data are ready); T1 is loaded with the two-byte value of the sampling interval, expressed in microseconds; the address of the interrupt service routine is placed in the AIM's IRQV2 (or whichever address the 6502 jumps through when an interrupt occurs); and the interrupt enable register is set up to allow timer T1 to interrupt. Details of how to use interrupts may be found in the AIM User's Guide, the 6500 Programming Manual, or in Leventhal's *6502 Assembly Language Programming* (Osborne/McGraw-Hill). In addition, if data are to be saved in memory, a storage index and a storage vector on page zero must be given their initial values prior to the first interrupt.

Once initialization is finished and the interrupt has been enabled, the microprocessor will jump to

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Your 36K of free address space is the AIM's most valuable and limited resource. With today's large capacity RAM boards, ROM boards, disk systems, video boards, and other expansion accessories it is easy to deplete this resource before the application requirement is satisfied. MTU has solved this problem.

THE BANKER MEMORY contains 32K of RAM, 4 PROM sockets for 2716/2732/2332, a PROM programmer, 40 bits of parallel I/O, and 4 timers from two 6522 I/O chips. Addressing is extremely flexible with the RAM independently addressable in 4K blocks, PROM's independently addressable, and I/O addressable anywhere on a 64 byte boundary (even in AIM's I/O area at AXXX by adding a single jumper to the AIM).

This may sound familiar, but read on! Unlike other AIM compatible memory boards, THE BANKER MEMORY has on-board bank-switching logic! The four 8K blocks of RAM plus the 4 PROM sockets make up 8 **resources**, each associated with a bit in an Enable Register. Through this Enable Register resources may be turned on and off under software control. When a resource is off, its address space is freed for other uses. You can even put BANKER resources at the same address and switch among them for virtually unlimited RAM and PROM expansion! You can even have multiple page zero's and stacks! Do you need 160K byte of memory? It only takes 5 of THE BANKER MEMORY boards and you end up with 5 page zeros and stacks to boot!

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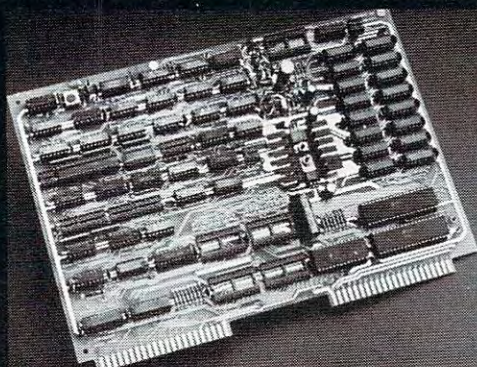
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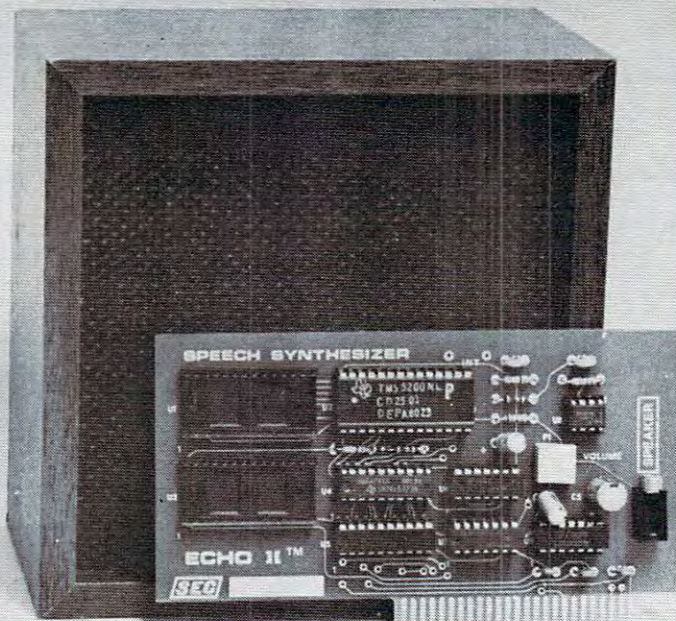
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The ECHO][™ comes complete with speaker, instruction manual, and a disk containing a speech editor, sample programs, and a sample vocabulary. Suggested list price is \$225.

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New Products



Commodore Business Machines To Sponsor National Careers For The Disabled Symposium

King of Prussia, PA, Aug. 6, 1981 — The first National Careers for the Disabled Symposium, offering first-hand information to career-oriented disabled persons, will be sponsored by Commodore Business Machines, Inc., in association with Careers for Disabled, Inc., and be held at the Convention Center in Baltimore, Md., December 4-6, 1981.

The symposium will reach out to the many thousands of people who, because of their disabilities, and in some cases lack of skills, have been kept out of the mainstream of the work force and society.

Each workshop will include a special lecture on "how to" obtain training and then market new or existing skills in areas such as computer technology, starting your own business, continuing your education, sales, government and unions, finance, printing and the graphic arts, clerical, travel

and leisure, food services, communications, and repair trades.

In announcing that Commodore has agreed to sponsor the symposium, James Finke, president and chief operating officer of the company, said, "Today, business leaders must assume leadership rolls in helping assimilate millions of handicapped people into the work force. It is our belief that their symposium will be an important first step in bringing about this reality."

Additional information on and reservation forms for the first National Careers for the Disabled Symposium are available by contacting Careers for the Disabled, 261 Madison Avenue, Suite 1102, New York, NY 10016.

Atari Video Computer System™ Service Network Formed

Sunnyvale, CA — Atari, Inc., announced the formation of a nationwide independent service network to provide convenient warranty service for the Atari Video Computer System (VCS™). The network, which will include 500 service locations by the end of 1981, will be composed of inde-

pendent electronics retail and repair centers, trained and authorized by Atari to service the Atari VCS. In addition, the centers will become retail outlets for Atari VCS hand controllers: joysticks, paddles and keyboards.

"With the number of Atari VCS owners growing daily, we need more service centers in more places across the U.S.," said Michael J. Moone, president of Atari's Consumer Electronics Division. "By recruiting and training independent shops to service our product, Atari can better serve the more than 2.5 million Atari VCS owners in this country."

Previously, all VCS service had been performed by Atari's own regional service centers located in Somerset, New Jersey and Sunnyvale, California. These centers will continue to operate as support for the independent service network. They will be joined by two more Atari regional Centers in Chicago and Dallas later this year.

The Atari Video Computer System is a programmable home video entertainment unit that utilizes over 40 interchangeable game and educational cartridges. The VCS can be played on any home TV set.

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Atari Memory Price Drop

Mosaic has announced that they are reducing the prices on two major memory products for the ATARI Computers.

The 8K to 16K RAM Expansion Kit will retail for \$49.95, down from \$79.00. The Mosaic 32K RAM will retail for \$179.95, down from \$219.95.

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Family Oriented Software Developed

New York, NY — Apple Computer Inc. and the Children's Television Workshop, creators of "Sesame Street," have combined talents to design, develop and distribute 20 software programs for use on Apple personal

computers.

The programs are an outgrowth of 50 educational games developed by the Children's Television Workshop (CTW), and were tested over the past year at the Sesame Place Computer Gallery, a component of the newly created "playground of the future" in Langhorne, Penn.

The Children's Computer workshop, a division of CTW and directed by Joyce Hakansson, decided to adapt the 50 games used at Sesame Place into 20 marketable programs to allow public access to these informal educational programs. Apple will publish the programs, then distribute them through its more than 1,000 U.S. computer retail dealers under the Special Delivery Software label.

"CTW used Apple computers at Sesame Place because of their 16-color graphics and sound capabilities. The new programs rely on these capabilities," said

Hakansson.

"Developing the software programs is a natural extension of our interest in blending entertainment and education on television. This is our first step into electronic publishing, a field which we believe will make a significant impact on informal education," said CTW President Joan Ganz Cooney.

The games, entertaining in their use of sound, color and animation, are primarily aimed at the three-to-13-year-old age group. They are designed to acquaint children with computers.

Program concepts include tests of motor skills, reading, vocabulary, math, logic and problem solving and creative and artistic challenges.

"The programs have been thoroughly researched and their appeal has been proven through regular use by visitors at Sesame Place," said Mike Kane, marketing

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Software available for F-8, 6800, 8085, 8080, Z-80, 6502, 1802, 2650, 6809 based systems.

EPROM type is selected by a personality module which plugs into the front of the programmer. Power requirements are 115 VAC 50/60 Hz. at 15 watts. It is supplied with a 36-inch ribbon cable for connecting to microcomputer. Requires 1½ I/O ports. Priced at \$169.00 with one set of software. (Additional software on disk and cassette for various systems.) Personality modules are shown below.

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manager for Apple's Personal Computer Division.

"Apple is deeply involved in the education market and we insist that educational software for the home be of the same high quality as programs designed for classrooms," Kane added.

CompuMart Announces New Summer/Fall Catalog

CompuMart Corp. has just published its new summer/fall microcomputer catalog.

The 48-page catalog features pricing and technical information for microcomputers and microcomputer systems from Apple, Commodore, Hewlett-Packard, Rockwell International, Texas Instruments, and other manufacturers. Books, accessories, and peripherals (including 13 printers from 5 manufacturers) are listed.

To obtain your free copy of

this catalog, write to CompuMart Corp., P.O. Box 568, Dept. 004, Cambridge, MA 02139.

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BRAIN BOX — The Computer Tutor announces the release of 200 educational programs on 30 titles. These are available on floppy disks and cassettes for Apple and PET microcomputers.

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For your free catalog, write BRAIN BOX, 601 West 26 Street, New York, NY 10001 or call 212/989-3573.

New Axlon* Memory System For Atari* 800 Announced

Sunnyvale, CA — Axlon Incorporated of Sunnyvale announced the release of its 128K memory system for the Atari 800, making it a powerful personal computer.

According to John Vurich, Axlon's president, the system, called the RAMDISK™ Memory System, comes with software that makes the new system function like a disk device. The system can also be programmed as bank selectable RAM memory.

The RAMDISK Memory System, when utilized as an additional disk device in conjunction with an Atari 810* Disk Drive, is compatible with existing software written for the Atari 800 system. Function for function, the RAMDISK system is up to 20 times faster than the Atari 810.

The RAMDISK Memory System can also be utilized as bank selectable RAM memory. The system is organized into

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eight (8) 16K pages which can be selected under program control. Larger and more complex programming applications are now feasible utilizing bank selection.

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The RAMDISK module is installed in the second RAM slot in the Atari 800 with 16K RAM modules in the first and third RAM slots providing 160K bytes of RAM memory. Installation is accomplished in a matter of minutes and requires no modifications to the Atari 800 computer.

The RAMDISK Memory System includes the 128K RAMDISK module, operating manual, DOS Memory Management Software and utility software. The RAMDISK Memory System is available at Atari dealerships

nationwide. The suggested retail price of the system is \$699.00.

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Market Information Now Provided To CompuServe

Columbus, Ohio — Archer Commodities, Inc. is now a provider of commodity market information on the CompuServe Information Service.

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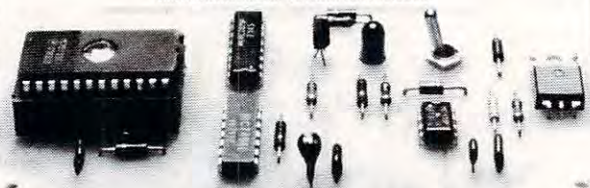
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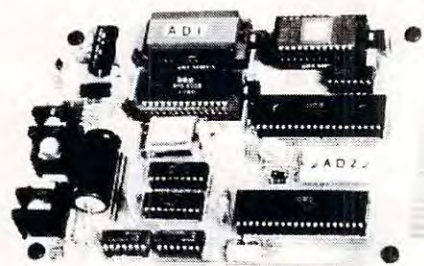
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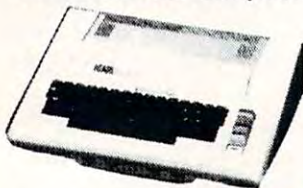
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The Command-O extends Commodore's 8032 advanced screen editing features to the ultimate. You can now SCROLL up and down, insert or delete entire lines, delete the characters to the left or right of the cursor, select TEXT or GRAPHICS modes or ring the 8032 bell. You can even redefine the window to adjust it by size and position on your screen. And you can define any key to equal a sequence of up to 90 key strokes.

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Math And Engineering Aids

Software is now available for performing higher mathematics and engineering of a general nature on the PET/CBM computers without extensive programming. The user merely programs his functions, which may be of any length from simple statements to complicated routines. These programs then integrate between inputted selected limits, to generate definite integrals, indefinite (functional) integrals, line integrals (plane or space curves), double or triple integrals, surface or volume integrals, or convolutions. Other programs do curve fitting to generate the best curve of the user-selected type to fit user-inputted data, analyze functions for derivatives, maxima, minima, points of inflection, roots and values, generate functions with specified real or complex roots, etc.

Another program plots the user's functions or data sets, with axis labels, automatic or selected scaling and range, optional grids, with either data points or connecting lines or both plotted. Plot is on screen or printer. Data sets may be saved on cassette or disk, and/or generated by user's own program with subroutine provided.

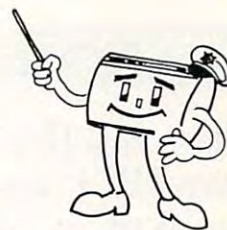
Another program allows very rapid writing of complicated or simple many-variable programs without syntax concerns. Independent variables have input-changeable default values. Data sets so generated may be printed and/or saved on cassettes or disk.

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A great learning experience for those new to machine language programming but who want to master it easily. Twelve-page manual included but we also recommend the book, "6502 Assembler Language Programming," by Lance A. Leventhal at \$17.00 direct from Skyles.

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SEE SKYLES ... CBM/PET? SEE SKYLES

32K Byte RAM/ROM Expansion

PROTRONICS has announced a new 32K Dynamic Random Access Memory (DRAM) board for the PET/SYM/KIM/AIM-65.

The 32K DRAM board contains sixteen RAM chips and five 24-Pin PROM sockets. The PROM sockets are for 2716/2516 2K type PROMs or 2732/2532 4K type PROMs (PROMS not included). This enables a total on-board memory expansion of 52K Bytes possible.

The Board also uses a new type of 16K DRAM chip which is pin compatible with the new 64K DRAM chips. This enables future on-board expansion to 128K of RAM (bank selectable, of course).

This Board has direct compatibility with the KIM-4 Buss which is used on most expansion chassis, such as those made by HDE, SEAWELL and other manufacturers.

It can connect directly to your computer with an adaptor cable which is available from PROTRONICS.

Addressing circuitry on board allows RAM to be configured in a contiguous 32K block placed above or below 8000 HEX. 4K blocks of RAM can be disabled using a Dip shunt (supplied) or a Dip switch. ROM configuration circuitry allows five 2K or 4K type PROMs to be located anywhere in the memory map. All configuration is done with short jumper plug wires (supplied) or with wire wrapping techniques.

Both the RAM & ROM are fully buffered to the data buss.

On-board circuitry synchronizes to the processor's clock to enable the refresh period to occur during cycles that are unused by the processor.

The Board requires only +5 Volts at 550 mA typical (without PROMs), which is supplied from the host computer through the expansion connector. There are

no on-board voltage generators to go bad.

It all fits on a 6x4.5" board, allowing construction of a two board computer system. (Board 1: CPU, I/O. Board 2: RAM, ROM).

PROTRONICS recommends that if you already have 4K or 8K of static RAM and wish to keep it in your system, reconfigure the static RAM above 8000 HEX.

(Most computers have this capability. Refer to your computer's reference manual.)

The 32K DRAM Board documentation includes a section for constructing your own power supply. This optional project will supply +12, +5, -5 or -12 volts for under \$30 (including cabinet). (The 32K DRAM Board requires only +5 Volts to operate.)

Suggested retail price is \$289.88 (U.S. Prices), for more information write or call: PROTRONICS, 1516 E. Tropicana STE 7A, Las Vegas, NV 89109, (702) 361-6331.

Expanded Game Line

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"Monty Plays the Scrabble Brand Crossword Game" is a new member of the Personal Software Strategy Game line of programs for personal computers. The new program joins the "Monty Plays Monopoly" program. Both Monty programs were written by Ritam corporation and are computerized opponents, rather than computer reproductions of the games themselves.

"Monty Plays the Scrabble Brand Crossword Game" plays the Selchow and Righter board game with up to three human opponents. A Scrabble game set is required.

In operation, the Monty program turns a personal computer into a skilled game player with a vocabulary of over 54,000 words on diskette.

Graphic presentation of the Monty character, board positions

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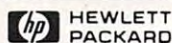
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and scores, plus sound effects, heighten involvement with the program. For example, the four levels of difficulty which the program allows the user to choose are illustrated by Monty's increasingly academic garb, from a simple sport shirt to collegiate cap-and-gown.

Monty is available for use in 48K byte Apple II and II Plus computers with Applesoft Basic and one disk drive. Suggested retail price for the Monty game is \$34.95.

Note: Scrabble is a registered trademark of Selchow & Righter; Monopoly is a registered trademark of Parker Bros.; Apple II, II Plus and Applesoft are trademarks of Apple Computer Inc.; Monty is a trademark of Ritam Corporation. Personal Software and Strategy Game are trademarks of Personal Software Inc. Monty is not sponsored or endorsed by Parker Bros. or Selchow and Righter.

Spelling For Very Young Learners

In July Edu-Ware Services, Inc. releases a new product under the EDU-WARE label, SPELLING

BEE. Designed for children in kindergarten through third grade, SPELLING BEE meets three objectives: 1) develop computer literacy, that is, allow new learners to interact comfortably with the computer; 2) link the abstract verbal symbol (word) to the concrete (picture); 3) build basic spelling skills while identifying specific groupings (i.e. consonants, vowels, two- and three-letter words).

SPELLING BEE's high resolution graphics and musical sound effects appeal to capture a child's interest. Documentation speaks directly to parents and teachers, while EDU-Ware's Illustrated Children's Guide introduces youngsters to computer operation.

A System Generator allows the parent or teacher to tailor this system's length and emphasis to the individual child's needs. SPELLING BEE's demonstration mode allows the parent to review all spelling words before the child begins. As the child works within

the tutorial, the system ignores incorrect responses. Only correct responses are reinforced. Then a drill mode tests the learner's performance, recording this information for the parent or teacher.

The system requires Applesoft, 48K, and DOS 3.3. It retails for \$29.95.

For further information contact EDU-WARE Services, Inc., 22222 Sherman Way, Suite 203, Canoga Park, CA 91303 (213) 346-6783.

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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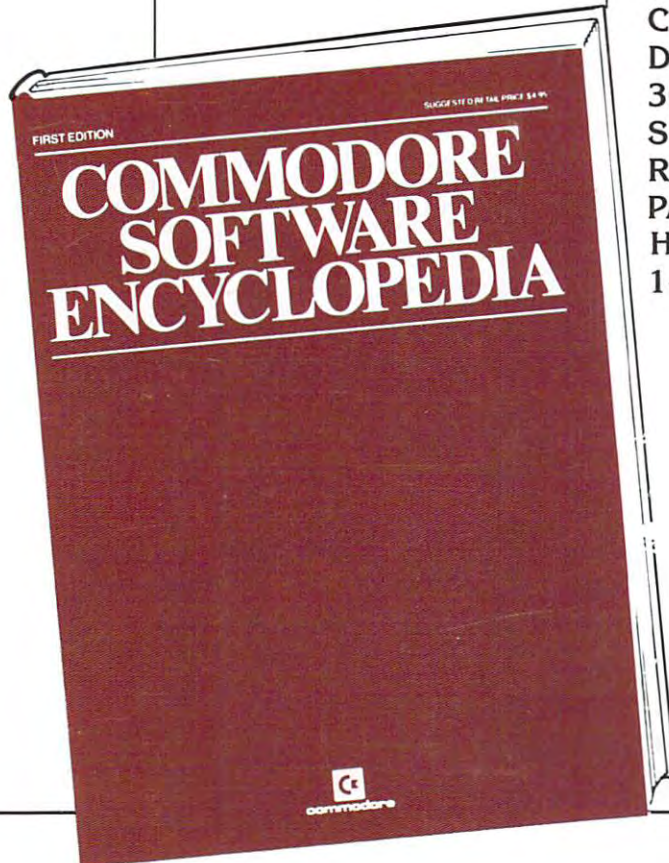
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