PEEK (65)

The Unofficial OSI Users Journal

P.O. Box 347
Owings Mills, Md. 21117
(301) 363-3268

$1.75
MAY 1983
Vol.4, No.5

INSIDE

Column One

First, two items of business.

1. Fortunately, my terminal screen is a "non-glare" type which doesn't reflect very well, so I don't have to see how red my face is. Repeat after me, Al, 10 times:
Ken Wortz
Ken Wortz
Ken Wortz...

Sorry for misspelling your name last month, Ken!

Second, another

CALL FOR ARTICLES

As usual, our readers are supplying us with great material to print, but also as usual, we want more. Specifically, we want articles on business uses of OSI's computers, especially the new 300 series (but don't hesitate to write something about ANY OSI computer being used for ANY purpose!)

Someone recently asked if the new series 300 computers are based on the OSI 48-pin bus. The answer is, Yes, but...

The 300 series computers run CP/M, on a Z-80 chip, writing and reading standard IBM 3741 format floppy disks. This means any board you have will plug right into the bus, but many of them won't work right. Here's why:

The CA-10 X board, for example, is addressed at CF00. This means in order to send a character out through the CA-10, you have to "store" the ASCII code for that character in "memory location" CF00. The OSI 470 floppy disk controller is also memory mapped, addressed into a RAM area.

On a 300 series machine running standard CP/M, those areas are true RAM. Store a character at CF00 and all you have done is change memory location CF00. Nothing goes out any I/O. The same is true for the 470 board.

Also, many OSI machines use rather slow dynamic RAM, whereas a 4 MHz Z80 requires faster static RAM. So the RAM boards from your C2OEM won't work (but the RAM from a 2 MHz C3 will work).

So the bottom line is, some RAM boards will work, some won't. Virtually none of the various I/O boards will work (though you could write a routine to drive a CA-10 or 430 board at FB00 without eating into your RAM area too greatly...but then you would have to make sure you didn't also have RAM addressed at FB00...probably wouldn't be worth it.

This issue contains another in the series of articles by Steve Hendrix on OSI's version of Microsoft Basic. We pondered a bit whether to print this article, because it is highly technical. However, looking over the past few month's PEEK(65)'s, we noted that MANY of our articles of late have been highly technical.

Now, reading the article pasted up and ready to be sent to the printer, I am glad we did it. It is certainly interesting, and must have taken Steve a tremendous amount of work to compile and write. We seem to have become (largely by default) the OSI technical forum for Basic-in-ROM machines. With this I have no problem.

What I do have a problem with is the severe lack of business-oriented material we receive. As noted in the "Call for Articles" above, we do want more business articles, and will pay for them. So if you think Steve's stuff is too technical, too hobby-oriented, don't gripe -- write something. After all, it is you the readers and writers of this journal who determine what we print.

al

THE INTERNAL FORMAT USED BY MICROSOFT BASIC

by: Steven P. Hendrix
Route 8, Box 81E
New Braunfels, TX 78130

In this article I will show how Microsoft BASIC handles its internal storage on the Ohio Scientific Challenger 1P. Though I will address only this specific machine, most other systems using Microsoft BASIC use similar schemes. By knowing something of how program lines and data are stored internally, you can choose among alternate ways of doing a job to optimize memory use and/or speed. If you're really ambitious, you can take advantage of this knowledge by fooling BASIC into taking some shortcuts. You can blend machine language with BASIC to gain the speed of machine language and still have the power of BASIC available. If nothing else, you can satisfy a little of that urge to find out what makes it tick.

The key to BASIC's memory usage lies in a table in page zero. This table contains pointers to different segments of memory, and BASIC adjusts these pointers as necessary to allow each segment to grow as necessary. Each pointer points to the beginning of the associated area, and the area includes a contiguous block of memory up to but not including the location pointed to by the next pointer. The various pointers are shown in Table 1.

Table 1
Memory Pointers

$0079-$007A	Program
$007B-$007C	Simple Variables
$007D-$007E	Arrays
$007F-$0080	Free space
$0081-$0082	Strings
$0083-$0084	Scratch pointer
$0085-$0086	End of read-write memory

opyright ©1983 by PEEK (65) Inc. All Rights Reserved.
published monthly
Editor - Al Peabody
Technical Editor - Brian Hartson
Circulation & Advertising Mgr. - Karin Q. Gieske
Production Dept. - A. Fusselbaugh, Ginny Mays

Subscription Rates

US (surface)	$15
Canada & Mexico (1st class)	$23
So. & Cen. America (Air)	$35
Europe (Air)	$35
Other Foreign (Air)	$40

All subscriptions are for 1 year and are payable in advance in US Dollars.

For back issues, subscriptions, change of address or other information, write to:

PEEK (65)
P.O. Box 347
Owings Mills, MD 21117

Mention of products by trade name in editorial material or advertisements contained herein in no way constitutes endorsements of the product or products by this magazine or the publisher.

These pointers are initialized during a cold start by a routine in read-only memory (ROM). On this system, most 16-bit numbers are stored with the high-order byte in the higher-numbered memory location, consistent with the way the processor (a 6502) deals with addresses. On other systems, this sequence may differ according to the processor's protocol, and the exact location of this table will be different, but the sequence of entries usually remains the same. I will now describe the format used in each section individually.

PROGRAM

Program lines are stored in order by line number, as you would expect. When you insert a new line, BASIC searches for the appropriate place in the program for the new line, moves all lines beyond it up in memory far enough to allow room for the new line, and inserts it in its assigned place. If you have a very long program loaded, you can see both the delay caused by the line search and the delay caused by moving many lines around in memory. It takes about a 32K system to allow a long enough program to see these effects. When you enter a line to be placed in such a long program, the system is "locked" until the line is actually entered (it will not respond to a keyboard entry). To see the delay in finding the line, enter a line near the end of the program and press another key immediately after pressing RETURN. You will see that it takes a noticeable amount of time before BASIC accepts the keystroke. To see the delay of moving higher - numbered lines, enter a line near the beginning of the program similarly.

The internal format of a program line is shown byte-by-byte in Figure 1. The first line starts at the byte pointed to by the "Program" pointer. The byte immediately preceeding this byte must contain a zero. The first two bytes are a pointer to the beginning of the succeeding line, for use in rapid searches for a specific line. The next two bytes contain the line number in binary. Next comes the compressed text of the line, and finally a zero byte to indicate the end of the line.

Figure 1
Program Line

```
    Program
    Pointer
    ($0079)
       |                                                      \
       |                                        -------------->
      \|/                                       |             /
       v                                        |
-----------------------------------------------------------------
|   |   | pointer |      |                  |   |   | pointer |
|   | 0 |   to    | line | --- text ---     | 0 |   |   to    |
|   |   | line #2 |  ##  |                  |   |   | line #3 |
-----------------------------------------------------------------
          |                                       ^
          |                                      /|\
          |                                       |
          -----------------------------------------
```

The text in each line is compressed to a form which saves a little bit of space, but primarily is easier for BASIC to interpret. Each reserved word is analyzed and compressed to a single-byte token before the line is entered in the program. All other text is left stored as ASCII characters. Bit 7 (the high-order bit) of each byte indicates whether that byte is ASCII or a token for a reserved word. Thus, bytes representing ASCII will have values less than 128 (decimal), and reserved words will have values of 128 or greater. Table 2 lists the reserved words and the token values for each.

Table 2
Reserved Words

	Token Value	Word		Token Value	Word		Token Value	Word		Token Value	Word
80	128	END	88	136	GOTO	90	144	ON	98	152	CONT
81	129	FOR		137	RUN		145	NULL		153	LIST
	130	NEXT	8A	138	IF		146	WAIT		154	CLEAR
	131	DATA	8B	139	RESTORE		147	LOAD		155	NEW
	132	INPUT		140	GOSUB	94	148	SAVE		156	TAB(
	133	DIM		141	RETURN		149	DEF		157	TO
	134	READ		142	REM		150	POKE		158	FN
87	135	LET	8F	143	STOP	97	151	PRINT	9F	159	SPC(

Token Value	Word	Token Value	Word
160	THEN	178	POS
161	NOT	179	SQR
162	STEP	180	RND
163	+	181	LOG
164	-	182	EXP
165	*	183	COS
166	/	184	SIN
167	^	185	TAN
168	AND	186	ATN
169	OR	187	PEEK
170	>	188	LEN
171	=	189	STR$
172	<	190	VAL
173	SGN	191	ASC
174	INT	192	CHR$
175	ABS	193	LEFT$
176	USR	194	RIGHT$
177	FRE	195	MID$

The pointer field is used to indicate the end of the program. The last line of the program points to the two bytes which would be the pointer field in the next line. That pointer field instead consists of two zero bytes, which are included in the program space. Most routines which test for the end of the program simply test the high-order byte for a zero. The variable pointer points to the byte immediately after this end-of-program mark.

VARIABLES

All non-subscripted variables are stored in this area. This includes numerical variables, string variables, and user defined functions (DEF FNxx ....). Each entry consists of 6 bytes; the first two bytes contain the name of the variable and its type, and the other four variables contain the appropriate type of information.

BASIC considers only the first two characters of a variable name. The "$" indicating a string variable is not counted in these two characters. The ASCII values of the first two characters are stored in the first two bytes of the variable. If a variable name is a single letter, the second is made zero. If it is a string variable, bit 7 of the second character is set to a 1, effectively adding 128 to that value. If the variable is a function identifier, bit 7 of the first byte is similarly set. Since this sytem prohibits user-defined string functions, bit 7 of both characters may not be set.

The value of a numeric variable is stored in floating-point format in the four-byte data field of the variable. The format in variables differs slightly from the format used in the "accumulators", where BASIC does its arithmetic. The main accumulator is at $00AC-$00B0. The byte at $00AC is the base-2 exponent, with 128 added to insure a positive value. Thus, negative exponents are represented by values of zero thru 127, with zero being the most negative, and positive exponents are represented by values from 128 thru 255, with 255 being the most positive. The mantissa appears in $00AD-$00AF, with the most significant byte in $00AD (contrary to the standard of high byte in the higher-numbered memory). The binary point is assumed to appear just prior to the first bit of the mantissa. Thus, the number 1141 (decimal) is converted to a mantissa and exponent in base 2, .10001110101 and 1011, respectively. The sign is stored in bit 7 of $00B0, with a zero meaning positive and a 1 meaning negative. Thus, 1141 would appear in the accumulator as:

```
  $AC       $AD       $AE
10001011  10001110  10100000

      $AF       $B0
    00000000  00000000
```

For another example, let's look at a fraction. Choosing .0703125 will keep the binary representation simple. This would be represented in binary as .00010010. Converting this to the normalized form (with the first 1 appearing just after the binary point) results in a mantissa of .1001 and an exponent of -11 (binary). Adding 128 (decimal) gives an exponent of 01111101. Thus the internal representation would be:

```
  $AC       $AD       $AE
01111101  10010000  00000000

      $AF       $B0
    00000000  00000000
```

Either of these numbers may be negated simply by replacing bit 7 of $00B0 with a 1 since negative numbers are given as a sign and magnitude.

Since bit 7 of $AD is always a 1 in the normalized form, we need not actually store that bit in variables. If we replace bit 7 of $AD with bit 7 of $B0, we need only store 4 bytes for each complete floating point number, and this is the actual format used. Numbers are expanded to the full 5-byte format when loading them to the accumulator simply for ease in manipulating them. There is also a second accumulator at $00B3-$00B7, using the same format. All two-operand functions such as +, -, * and / use this second accumulator to save one operand while analyzing the second operand, and operate on the two numbers directly from the accumulators, leaving the result in the accumulator at $00AC-$00B0.

Strings are stored using three bytes of the four byte field as a descriptor of the string. The actual text of the string is placed elsewhere in memory. If the string is a literal string appearing in a program, the text is left in the program and referenced from there. Otherwise, the required number of bytes are allocated from the high end of the free space and added to the string space. If B$ is 6 characters long, a simple statement like A$=B$ or even B$=B$ will cause 6 bytes to be removed from the free space and added to the string space. The string space which was used by the old string in A$ or B$, respectively, is simply discarded. It remains part of the string space, unavailable to BASIC. Ultimately, this process will use up all available memory if a program does many string operations. When this happens, a routine commonly known as a "garbage collector" is called to determine what memory is still in use, and move the active strings back to the high end of memory, returning the unused space (the "garbage") back to the system as free memory. There does not seem to be a clever way of doing this; most systems use a rather brute-force approach which takes a significant amount of time. This explains occasional long pauses in a program, during which you will be unable to stop execution with a ctrl-C (called BREAK or STOP on most other systems). If you can design your program to minimize the number of string assignments, you can speed them up quite a bit. The garbage collector on this system has a small bug, causing it to crash with some strange effects when using string arrays. The problem is that the garbage collector expects entries in a string array to be only 3 bytes long but they are actually 4 bytes. Various companies are marketing replacement BASIC 3 ROMs which contain a corrected garbage collector.

Now that the string is actually stored in memory, the descriptor in the string variable must point to it. The first byte is the length of the string in bytes. Since the largest number which can be stored in one byte is 255, string length is limited to a maximum of 255 bytes. The next two bytes are the address of the first byte of the string. The fourth byte is not used and is normally set to 0. If I type A$="ABCD" in the immediate mode, memory will look something like this:

```
Variable
Pointer
$007B-7C   $0304
              |
              |
             \|/
              v
     ------------------------------------------------------------
              | $41 | $80 | $04 | $FC | $7F | $00 |
     ------------------------------------------------------------
                 NAME     LENGTH   POINTER
                                      |
                                      |
                                     \|/
                                      v
                             --------------------------------
                              | $41 | $42 | $43 | $44 |
                             --------------------------------

                                 A     B     C     D
```

When strings are operated on, two bytes in the accumulator ($00AE and $00AF) point to the string descriptor. If the string is an immediate string or a processed string which is not yet stored as a string variable, a descriptor is built at $0068-$006A.

For a function, bit 7 of the first character byte is set to a 1. The first two bytes of the value field point to the text just after the equals sign in the function definition. Since functions are only allowed in a program (not in the immediate mode) under this interpreter, this pointer will always point within the program space.

The other two bytes of the value field contain the first two characters of the name of the function's dummy variable (the variable appearing inside the parenthesis in the definition). When the function is called, the value in the parenthesis is analyzed. The value of the dummy variable is saved on the stack, and then the dummy variable is assigned the value which actually appeared in the parenthesis. The expression appearing after the equals sign in the function definition is then analyzed as an arithmetic expression and the value left in the accumulator for processing as the value of the function. Lastly, the original value of the dummy variable is popped from the stack and restored. In the following example, I will define a function S which will return the square of a number, using the dummy variable X.

```
      DEF FN S(X) = X * X

      The entry in the variable table would appear something
like this:

         ------------------------------------------------------------
                          | $D3 | $00 | $0C | $03 | $58 | $00 |
         ------------------------------------------------------------

                           FN  S  null  pointer    X     null
                                           |
                                           |
                                          \|/
                                           v
------------------------------------------------------------------------
$95 | $9E | $53 | $28 | $58 | $29 | $AB | $58 | $A5 | $58 | $00
------------------------------------------------------------------------

DEF   FN    S     (     X     )     =     X     *     X
```

ARRAYS

Storage of arrays is in many ways similar to simple variables, with a few changes as necessary to allow for subscripts. The first array is stored at the beginning of the array area, and the name is stored just like a normal variable. String arrays are flagged by bit 7 of the second character, just as in simple variables. The next two bytes give the total number of bytes allocated to this array in bytes. Since arrays are of variable length, this is necessary for searching through the array area to find a specific array name. If the first array is not the desired one, simply skip over the given number of bytes to find the beginning of the next array name. The number of bytes given is the total number of bytes including the name and these two bytes themselves.

The next byte is the number of dimensions in this array. Arrays with 255 dimensions (subscripts) may be stored, but this is restricted in practice by the fact that this interpreter limits lines to 71 characters. In practice, then, arrays with some 30 subscripts may be declared, but a program using arrays with more than about 3 subscripts is rare. The interpreter detects that a variable designates an array by the left parenthesis. Thus, it is possible to have a simple variable X and an array X with no conflict. Arrays are further distinguished by the number of subscripts, so it is also possible to have an array X(A,B) and an array X(A,B,C) with no conflicts. If an array is referenced without being dimensioned, this and most other Microsoft interpreters will automatically dimension it with the number of dimensions given, with a maximum subscript of 10 in each dimension. Thus, if you reference an array with the wrong number of dimensions, you will create an entirely separate array with the new number of dimensions.

Next come a set of byte pairs giving the size of the array in each dimension. These are given with the high byte in lower memory, unlike most other two-byte items. The number given is the actual number of elements in that dimension, so if an array is dimensioned 10, the number given will be 11 (there is a 0th element). You can also

think of this as the lowest number which is not a valid subsript in this dimension. There is one pair of bytes for each subscript, given in reverse order of the subscripts.

The actual elements of the array come next, four bytes per element. In a numeric array, the values are stored as in a numeric variable, and in a string array, they are stored as in string variables. The order is most easily visualized as follows: holding all subscripts except the first constant at zero, run through all possible values of the first subscript from zero to the maximum value. Then increment the next subscript and again run through all possible values of the first subscript. When the second subscript reaches its maximum value, reset it to zero and increment the next subscript, and so on. Another way of describing it would be to equate a two-dimensional array to a table of numbers in row-column format. If the rows are stored as blocks, the first subscript is the column number and the second is the row number. Of course, you may visualize arrays in your programs in any convenient mannner with no effect on how your program operates. The order of storage for an array dimensioned as DIM A(2,3) would be A(0,0), A(1,0), A(0,1), A(1,1), A(0,2), A(1,2).

STACK ENTRIES

At times, BASIC makes use of the hardware stack of the processor. In particular, GOSUBs and FOR-NEXT loops require saving information in such a way that the most recent is recovered first. The stack on this system is 256 bytes long but some other items share a portion of the stack space, limiting BASIC to about 205 bytes. Thus, if you do too many GOSUBs before RETURNing, or nest FOR loops too deeply, you will cause an error. Unfortunately, they chose to use the OM error (Out of Memory) to signal this, rather than assigning another error code. This is why some programs get this error even though there is still ample free memory on the system.

The entry for a GOSUB is fairly simple. The items pushed onto the stack are just those necessary to return and resume processing on the line containing the GOSUB. First the address of the byte after the GOSUB is pushed onto the stack, high byte first. Then the line number of that line is pushed on, also high byte first. This is necessary so that any error message caused in the line with the GOSUB after returning can include the correct line number. Lastly, the GOSUB token itself ($8C) is pushed onto the stack. In returning from a GOSUB, the interpreter must strip any subsequent FOR loop entries from the stack in reaching the GOSUB entry, closing any loops which were opened in that subroutine.

Figure 2.
GOSUB Stack Entry

```
High byte  \   Address of byte after GOSUB
Low byte   /   (1st char of subroutine line #)

High byte  \   Line number of the line
Low byte   /   containing the GOSUB

$8C Stack marker (GOSUB token)

----------       <-- Stack pointer
```

The stack entry for a FOR loop is, as you might expect, a good deal more involved. First, the address of the end of the FOR statement is pushed on the stack, high byte first. This is where the processor will loop back to upon reaching a NEXT statement. Next, the line number of the line containing the FOR statement is pushed, high byte first. The reason for this is the same as in the case of GOSUB. The loop limit (limiting value of the control variable) goes on the stack next, in floating point form just as it would appear in a variable. The byte which would appear highest in memory goes on the stack first, followed by the next lower bytes in order. The next item is a single byte giving the direction of stepping of the control variable. It is $FF for a negative step, $00 for a zero step, and $01 for a positive step. This is considered both in determining whether to add or subtract and also in determining if the loop variable has passed its limit. Next is four bytes giving the step size, as if it were stored in the accumulator and the byte at $AF were pushed first, followed in sequence by $AE, $AD, and $AC. The last real entry is the address of the loop control variable, pushed onto the stack high byte first. This is the address of the value field of the appropriate variable, so it makes no difference to the FOR loop logic whether this is a simple variable or an element of an array. The entry is finished out with a FOR token ($81) to mark this as a FOR loop entry.

Figure 3.
FOR Loop Stack Entry

```
Low byte    \    Address of the end
High byte   /    of the FOR statement

High byte   \    Line number containing
Low byte    /    the FOR statement

$00AF       \
$00AE        \   Loop
$00AD        /   Limit
$00AC       /

Step direction

Mantissa    \
Mantissa     \   Step size
Mantissa     /   (Absolute value)
Exponent    /

High byte    \   Address of the loop
Low byte     /   control variable

$81 Stack marker  (FOR token)

-------        <--  Stack Pointer
```

Note that throughout the stack entry, parameters are entered in exactly the form that they will be used during execution of the loop. The address of the FOR allows a direct jump back to that point, without requiring a search for the FOR or, as in the case of a GOTO, a complete scan of the program to find a specific line number. For this reason, a FOR loop runs faster than an equivalent loop set up with an IF statement, especially in a long program. The loop limit will be compared against the value stored in a variable, so it is stored in exactly the same form as the value in a variable. The step size will be loaded into the accumulator for arithmetic, so it is stored in that format (note that you can treat bit 7 of the step direction as its sign).

An Example

For one example of a way you can speed up your program by understanding the internal storage, take the FOR loop. The FOR alerts the interpreter that the program will later be returning here, allowing it to save the location on the stack as above. It is possible to make the FOR loop mimic other types of loop logic, such as a loop which will exit based on a variable reaching a specified value. Take this program segment as an example:

```
120 INPUT A$
130 IF A$ <> "QUIT" THEN 120
```

This example looks trivial, but the basic logic matches a pattern which appears frequently in BASIC programs. Where the jump is to a preceeding line, this tends to be very slow, because the interpreter must first recognize that the line number is prior to the current line, and then must start from the beginning of the program and search for the appropriate line. This can take a great deal of time in a long program.

Now consider the following alternate way of coding the same logic:

```
110 FOR BV = 0 TO 0 STEP 0
120 INPUT A$
130 BV = (A$ = "QUIT")
140 NEXT
```

Since this loop includes a keyboard input, that will determine overall loop execution time, rather than the speed of the interpretation. The basic principle remains valid for many other types of loop which will terminate upon a particular condition being met, but which do not obviously lend themselves to the FOR loop structure.

The first example is straight forward. If the user types in the word "QUIT" the loop will terminate; otherwise, it will just continue asking for more inputs. The second example contains the same logic in a disguised version. Line 110 sets up the loop and presets BV to zero. Line 120 receives the user's input as before. Line 130 is the first "tricky" part. The expression (A$ = "QUIT") is a boolean expression which can be assigned a numerical value. Different interpreters use different numbers to represent "TRUE", with -1 and 1 being the most common. Virtually all BASIC interpreters, however, use zero for "FALSE". Thus, if the user inputs anything other than "QUIT", BV is set to zero; if he types "QUIT", it is set to 1.

Now consider the task of the NEXT statement in line 140. It must retrieve the value of the loop variable (BV), add or subtract the appropriate step size, and compare the result with the loop limit. Since the step size was zero, BV being exactly equal to the limit of 0 will cause the loop to repeat, while any other value will cause the loop to terminate. Therefore, if the input string is a "QUIT", BV has some non zero value, and the loop terminates; if not, BV will be zero and the loop repeats. Compare this logic to the first example. This way of coding does require more actual code and is more difficult to read, but balancing this is the fact that it runs faster and does not depend on line numbers, which permits easier renumbering of programs.

CONCLUSION

By now I hope to have you curious enough to poke (or PEEK) around a bit in your own system. Many of the popular personal computers use an internal format almost identical to this, and those which differ are usually close enough to be recognizable. Aside from the satisfaction of better understanding your system, you can use this information to devise ways of doing things better or faster on your system, such as inserting one string into the middle of another without a lot of MID$ operations, or even making one array overlap another! The information on the internal storage of variables and program is particularly useful to those of us who program frequently in a combination of BASIC and machine language. I can't recall writing a program of any real size without such a mixture in a long time. Good luck finding out what makes your system tick!

★

INDIRECT FILES IN 65D

by: Charles Stewart
3033 Marvin Dr.
Adrian, MI 49221

This is one of the more valuable but difficult commands to understand and master for the new disk user. The purpose of the indirect file is to allow the user to partition memory in RAM i.e. to have more than one program in memory thus allowing you to merge programs together. This all sounds rather confusing, allow me to try and simplify.

Consider the computer like a file cabinet. We know we can put things into or take items out. Under normal operation when we have a program loaded from the disk, it starts at HEX location $327E and continues until the requested program is loaded. This is fine if all we want to do is run one program, but suppose you would like to run some of the various utilities available such as the Variable Table Maker (vtm), line renumber, etc., and others available from the major software houses. Most of these are basic programs which are designed with line numbers starting at 60000 and above, and requires the user to load this program on the top of the subject program. You can have your utilities on cassette and load with the IO command, which is fine but there is a simpler way!

The indirect file command solves the problem!

In my analogy of the file cabinet, you add whatever you desire into your file, but on the computer we must determine where to put the program, see if there is enough free space for it, etc. The following is a step by step example of how to utilize the indirect file commands.

1. Load the first program from the disk in the normal manner. i.e. DISK!"LOAD EXAMPLE"

2. Peek the location 133 and note the contents, i.e. PRINT (PEEK(133)). Location 133 contains the highest page available in memory found during boot up. We will call this HP in our calculation.

3. Determine the number of unused pages in memory -- this can be obtained by the command PRINT INT(FRE(X)/256) we will call this UN for unused.

4. The starting page of the work space is 51 on 5 1/4" Disks 3.0 to 3.2 operating systems.

5. Determine the number of pages used by the program to be moved to the indirect file.

Pages used=(HP)-51-(UN)

If (UN) is greater than the pages left, then there isn't sufficient room to move programs to the indirect file.

6. Once we have determined pages used by the program, we are ready to set up the vectors for the indirect file move. You must poke locations 9554 and 9368 with the page number that you wish to start the transfer. Determine this by the following formula.

Page Number=(HP)-(UN)

Poke locations 9554 and 9368 with the page number in the immediate mode. For those who haven't discovered it, the immediate mode is a command recognized by the basic interpreter without a line number typed in from the keyboard followed by hitting the return key. RUN is an immediate mode command.

7. Type LIST but do not hit return key yet!

8. With the shift key held down, press the K key (Shift K).

9. Press RETURN and wait for the listing to end.

10. With the SHIFT key depressed type M, a double bracket will appear.

11. With the SHIFT key still depressed, strike the P, release the shift and press the RETURN, i.e. shift M K RETURN.

12. You now have the program in the indirect file. Clear the workspace with the 'NEW' command and load the program you wish to merge in the normal manner.

13. When the 2nd program is loaded execute a CONTROL X

Continued on page 19

A BASIC EXTENSION PROCESSOR FOR BASIC IN ROM (BEP)

By: Gerdt Vilholm
Prinsessegade 4 B, St.
DK 1422 Copenhagen K
Denmark

This program makes it easier to make extensions to BASIC In ROM through a patch into the Parser routine at addr. 00BC. It has, however, provisions to avoid the problems earlier described by Ed Carlson and Michael Mahoney in MICRO.

I have moved the screen driver to the MONITOR-EPROM, and therefore, the space above Coldstart (on my Superboard) can be used for BEP. If you have one of the monitors with its own screen driver, you can put BEP into Basic No. 4 EPROM, and change the JMP at BF2D for your own screen-driver.

The code at BCFF is the patch, which on Coldstart will be placed in the Parser at 00CD. At 00D0 will be placed a JMP BF30 - a vector which allows further extensions to be added.

BEP will recognize the extension-operators !,#,%,& and ' when they appear in a BASIC line or in immediate mode.

The processor status will then be saved, and the return address will be pulled off the stack and saved:

00D8-D9	Return address (R)
00DA	Accumulator
00DB	X-reg.
00DC	Y-reg.
00DD	P-reg.

R will also appear in X(LO)

```
BCFF 4CF5BE JMP   BEF5  Patch in
BD02 4C30BF JMP   BF30  00BC routine

BD0A 900000             32768 in FLOAT
BD0D 00

Basic Extension Processor. Enter at BEF5

BECE A411   LDYZ    11  Convert binary in
BED0 A512   LDAZ    12  11-12 to FLOAT
BED2 48     PHA         in FPA 1
BED3 297F   ANDIM   7F
BED5 20C1AF JSR   AFC1  make FLOAT
BED8 68     PLA         If HI bit not set
BED9 10D1   BPL   BEAC  then RTS
BEDB A90A   LDAIM   0A  if HI bit set,
BEDD A0BD   LDYIM   BD  then add 32768
BEDF 4C6CB4 JMP   B46C
BEE2 A512   LDAZ    12  Convert hexstring
BEE4 48     PHA         pointed to by C3-4
BEE5 A511   LDAZ    11  into FLOAT in FPA 1
BEE7 48     PHA
BEE8 2064BE JSR   BE64  hex to bin.
BEEB 20CEBE JSR   BECE  bin to Float
BEEE 68     PLA
BEEF 8511   STAZ    11  restore 11-12
BEF1 68     PLA
BEF2 8512   STAZ    12
BEF4 60     RTS
BEF5 38     SEC         BEP Enter
BEF6 E930   SBCIM   30  Do number test
BEF8 38     SEC
BEF9 E9D0   SBCIM   D0
BEFB 9043   BCC   BF40  RTS - it is number
BEFD F041   BEQ   BF40  RTS - end of st.mnt
BEFF 08     PHP
BF00 C928   CMPIM   28
BF02 B03B   BCS   BF3F  it is between 28-2F
BF04 C924   CMPIM   24
BF06 F037   BEQ   BF3F  it is $
BF08 C922   CMPIM   22
BF0A F033   BEQ   BF3F  it is "
BF0C 85DA   STAZ    DA  it is !,#,%,& or '
BF0E 86DB   STXZ    DB  save entire proces-
BF10 84DC   STYZ    DC  sor-status
BF12 68     PLA
BF13 85DD   STAZ    DD  save P-reg
BF15 68     PLA
BF16 85D8   STAZ    D8  save Return addr.
BF18 AA     TAX         put also R into
BF19 68     PLA         X (LO) and Y (HI)
BF1A 85D9   STAZ    D9
BF1C A8     TAY
BF1D A5DA   LDAZ    DA
```

Continued

and Y(HI) and A contains the operator. The Parser is called from many different places in BASIC, and therefore, R is checked to see if the call came from a place which is allowed to call the extensions. If no match is found in EPROM, a JMP is made to the vector at 00D0. You can point this vector to your own extensions, only remember that when a match to R is not found, a JMP BF30 should be executed. This will restore registers and return to BASIC.

Some extensions are built into BEP to allow hexadecimal arithmetic. These extensions will use the hex to binary conversion I have enclosed in the Coldstart-routine in my last article.

The new functions are:

1. Arithmetic expression

   A=&ABFF+&7F
   POKE &02FE,&AA
   X=PEEK(&F000) AND &0F
   and many others.

2. PRINT&X will print variable X as a 4-character hexnumber. PRINT <X will print only the 2 least significant hexdigits. You can use tablulation, commas, and semicolons as usual.

3. X=VAL(M$) will yield the correct value if M$ contains a valid hexnumber preceded by & such as "&F0AB".

4. A$=STR$&(X) will yield a 4-character hexstring with the value of variable X. A$=STR$<(X) does the same, but only the 2 LSD just as in PRINT. & is used instead of $ to avoid confusion with string variable names.

When you make a patch into the Parser, you may expect a slight slowdown of execution. I have, however, made the patch at a late point, where tokens and alphabetics already have left. They will, therefore, not be delayed. A test showed, that a program containing lots of numbers would be delayed 1.3 percent. But then I substituted hex for all the decimal numbers, and now the test program would run 30 percent faster!

The checking of R allows you to interfere almost anywhere in BASIC, but some guidelines can be given for making your own extensions: If you want an extension operator to work as a command on its own, R should read A5F8.

If you want an initial keyword to do a special task, such

```
BF1F C926   CMPIM  26   is ch. &
BF21 F01E   BEQ    BF41 then enter hexrout.
BF23 4CDEBF JMP    BFDE else enter Vector
BF26 20E2BE JSR    BEE2 VAL, hex to Float
BF29 4CEEB3 JMP    B3EE Re-enter VALroutine
BF2C EA     NOP
BF2D 4C71F8 JMP    F871 Patch for new CRT
BF30 A6DB   LDXZ   DB   Restore Processor-
BF32 A4DC   LDYZ   DC   registers if search
BF34 A5D9   LDAZ   D9   has failed
BF36 48     PHA
BF37 A5D8   LDAZ   D8
BF39 48     PHA
BF3A A5DD   LDAZ   DD
BF3C 48     PHA
BF3D A5DA   LDAZ   DA
BF3F 28     PLP         And go back
BF40 60     RTS         to Basic
BF41 E0A6   CPXIM  A6   & found, search R
BF43 D004   BNE    BF49
BF45 C0AB   CPYIM  AB   R=ABA6?
BF47 F099   BEQ    BEE2 Arith. Expression
BF49 C0A8   CPYIM  A8
BF4B D008   BNE    BF55
BF4D E02E   CPXIM  2E   R=A82E?
BF4F F04F   BEQ    BFA0 PRINT&
BF51 E0BF   CPXIM  BF   R=A8BF?
BF53 F04B   BEQ    BFA0 PRINT&
BF55 E02C   CPXIM  2C
BF57 D004   BNE    BF5D
BF59 C0AC   CPYIM  AC   R=AC2C?
BF5B F05E   BEQ    BFBB STR$&
BF5D E0EA   CPXIM  EA
BF5F D004   BNE    BF65
BF61 C0B3   CPYIM  B3   R=B3EA?
BF63 F0C1   BEQ    BF26 VAL hex
BF65 4CDEBF JMP    BFDE Else Vector
BF68 C9C2   CMPIM  C2   Make hexstring
BF6A F005   BEQ    BF71 from binary
BF6C A512   LDAZ   12   in 11-12
BF6E 2073BF JSR    BF73 if Ac=02, string
BF71 A511   LDAZ   11   will be 2 ch.
BF73 48     PHA         else 4ch.
BF74 4A     LSRA
BF75 4A     LSRA
BF76 4A     LSRA
BF77 4A     LSRA
BF78 207EBF JSR    BF7E
BF7B 68     PLA
BF7C 290F   ANDIM  0F
BF7E 18     CLC
BF7F 6930   ADCIM  30
BF81 C93A   CMPIM  3A
BF83 9002   BCC    BF87
BF85 6906   ADCIM  06
BF87 91AD   STAIY  AD   AD-E is indirect-
BF89 C8     INY         pointer to string
BF8A 60     RTS
BF8B 20BC00 JSR    00BC If next ch. is <
BF8E C9AC   CMPIM  AC   then put 02 into
BF90 D007   BNE    BF99 00FF
BF92 A902   LDAIM  02
BF94 85FF   STAZ   FF
BF96 4CBC00 JMP    00BC
BF99 A904   LDAIM  04   else put 04 there
BF9B 85FF   STAZ   FF
BF9D 4CC200 JMP    00C2 RTS via 00C2
BFA0 208BBF JSR    BF8B PRINT&
BFA3 20ADAA JSR    AAAD Evaluate expr.
BFA6 2008B4 JSR    B408 FLOAT to BIN.
BFA9 A001   LDYIM  01   Set pointer to
BFAB 84AE   STYZ   AE   0100 and Y=00
BFAD 88     DEY
BFAE 84AD   STYZ   AD
BFB0 A5FF   LDAZ   FF   Get length 2 or 4
BFB2 2068BF JSR    BF68 make hexstring
BFB5 208CBA JSR    BA8C end string 00
BFB8 4C4DA8 JMP    A84D Re-enter PRINT
BFBB 68     PLA         STR$&
BFBC C97A   CMPIM  7A   Check token
BFBE D01B   BNE    BFDB Exit if different
```

cont.page 13

SOFTWARE REVIEW

GANDER SOFTWARE'S FINANCIAL PLANNER

by: Gary L. Gesmundo

A new software house has been heard from, and if this package is any indication, OSI users can feel pleased.

Gander Software's Financial Planner consists of 6 basic programs that provide analysis of "Ordinary" loans and annuities, "Annuity Due" transactions, present and future values, and sinking funds. Also included is an interest conversion program that allows conversions of nominal rates to effective rates of return based on the usual compounding periods (semi-annual to continuous).

When in use, the program resembles many other spread sheets. However, it's not intended to provide the same kind of utility, nor is the user required to learn any math or "language" to use it.

Rather than require user input of formulae, definition of "cells", etc., this program provides the formatting and math for the types of problems identified.

In all but the interest conversion and amortization programs, the user can play "What If".

When a "What If" program is entered, the user first "loads" one problem. This is a dummy, serving to initialize the arrays used for "What If". For example, in the Loan/Annuity Analysis, the user first enters information for the compounding periods, loan amount, term, and interest rate, after which the payment is calculated by the program.

Once the first problem has been entered, the user can go to the "What If" mode/menu.

In "What If", the user can change any variable, and have the program re-solve for any other variable (the only exception being that re-solve for compounding periods is not allowed, for obvious reasons relating to the real world, though the compounding periods can be changed and any other variable re-solved).

When in the "What-If" mode, the original problem is preserved at the top of the screen, and each time the user asks for another "What-If," the most recent problem is duplicated, up to 10 versions on the screen at one time.

You can play "What-If" as many times as you like within one problem, but the program's great value comes from duplicating the problems, changing your variables successively, and then comparing the answers.

The programmer has built in some nice "extras" that render these programs very useful. For example, in the Loan/Annuity Program, for a simple key-stroke, you can get the Future value of any of the "What-If" problems on the screen, thus telling you what you could earn with your dollars if you invested instead of borrowed. You can compare any two "What-Ifs" on the screen and get the net difference; and, in the loan program, generate an instant amortization schedule, i.e., fetch an instant pay-off for a date certain.

Finally, in all the "What-If" programs, the user can save any specified "What-Ifs" to disk, and each program provides a print-out of the "What-Ifs" on the screen, and other useful information.

The Amortization Schedule is, frankly, about the best I've seen. It is driven by records created in the Loan/Annuity program and allows remarkable flexibility. For instance, it copes with balloon payments specified in the Loan program, but will also create its own if you tell it there is a payoff required at a date certain. Extra features include specification of calendar or fiscal years, the ability to specify increased payments of either a known percentage or dollar amount, to specify a title for the schedule, and YTD and Totals-to-Date summaries of interest and principal paid. All page breaks come at a year's end, and a print-out of the revised payment schedule, if any, is provided.

One of the most unusual features of the schedule is that the entire history is tracked in months and years, not just by payment numbers.

The interest conversion program previously noted is not a "What-If." It provides the answers, up to 10 at a time, allows comparisons, and dumps to the printer a history of the problems on the screen, plus the net return on $1,000.00 for one year at the rates in those problems. Included is a math calculator you can access without disturbing screen contents.

The conversion program also allows the creation, with printer, of hard copy interest rate tables. There is an "auto-increment" mode that allows the user to specify a base interest rate, and an increment. The program then solves those, up to 10, displays them all, and lets you print. In approximately 2 minutes I had created a hard copy table, for example, of the various effective rates between 12.00% and 12.90%. Pretty slick.

The hardware required is a 48 K OSI dual floppy, with serial terminal. When you get your program, you get just a program disk. It contains the utilities necessary to create your own data files to back up disks, etc. The program appears to use a modified BEXEC* which supports most non-ANSI terminals, and includes a set up routine for others.

Within the menu, which the user must date on the way in, is a routine that accurately calculates the day of the week (can be re-set), and prints to screen or printer a calendar for the month and year in the menu. One can also specify the printer port enabled.

The user manual is concise, but thorough, and well laid out, done in the "walk through" style, includes many copies of screen displays, and even contains a glossary of financial and computerese terms. Unfortunately, it does not include an index, something I hope software documenters soon get around to providing.

The general feel of the programs, and documentation, is professional. The screens are attractive, well mannered, and error trapping is very good.

As indicated earlier this package does not have the power of many spread sheets. It doesn't do everything, but what it does it does very well. For the banker, accountant, investor, and business man who does not want to learn to use a spreadsheet, but just wants answers, these programs provide them, quickly and accurately.

My overall impression is that this package, though not cheap at $400.00 retail, will help dealers sell computers.

continued from page 11

as SAVE!, R should read the address minus one of the keywords routine. If you want a secondary keyword to do something special, such as X=INT%, R should read AC2C. Then pull from the stack the token shifted one bit left - see the code at BFBB. This token can also be found in 00DB. Don't forget to push the token back on stack, if the match fails.

I hope to come back with some more extensions in a later article.

```
BFC0 203BBF JSR   BF3B Check for <
BFC3 20F5AB JSR   ABF5 Evaluate (expr.)
BFC6 20B0AA JSR   AAB0 Check datatype
BFC9 2008B4 JSR   B408 FPA 1 to bin
BFCC A5FF   LDAZ    FF get length 2 or 4
BFCE 20A4B0 JSR   B0A4 allocate string
BFD1 A000   LDYIM   00
BFD3 A5FF   LDAZ    FF length
BFD5 2063BF JSR   BF63 make string
BFD8 4CEDB0 JMP   B0ED check string-RTS
BFDB 48     PHA        token on stack again
BFDC A5DA   LDAZ    DA restore Ac
BFDE 4CDC00 JMP   00DC Enter RAMvector
```

★ ★ ★

ETX/ACK FOR CP/M

By Al Peabody

Computers are fast. Printers are slow. This creates a problem. If you just let your computer spew out data to the printer as fast as it can, most of it will be lost. But if you slow it down to the printer's slowest speed as it is doing a carriage return, you will grow old waiting for things to print.

As a result, and particularly for letter-quality printers, which vary greatly in speed depending on what they are doing, a "protocol" must be established to allow the printer to move as rapidly as it can while not losing data.

About the simplest way is to use a "hardware handshake," meaning that the printer, when turned on and ready to run, outputs a voltage on one of its connector pins, saying, "I'm ready, send me something." Then, when the computer sends the printer enough data that the printer's buffer memory is almost full, the voltage is turned off. Later, when most of the data in the buffer has been printed, the "handshake line" is turned back on, and the computer can start sending more data.

This simple arrangement has several shortcomings. First of all, the computer has to have the appropriate circuitry to refrain from sending characters to the printer unless the "ready" signal is hot. Secondly, certain programs work faster when they can detect a positive signal from the printer and interrupt whatever else they are doing to act on it, rather than detecting a voltage. Word-

Star, for instance, works so much faster when it uses its "Port Driver" rather than a simple handshake that it becomes genuinely possible to edit one file while another is busily printing, even in a single-user system.

The problem is that WordStar, and other programs which use a "Port Driver," require that the printer return a signal to tell them when it is ready for more. Then they can send more quickly, and get back to whatever else they were doing.

In my own case, I recently purchased a Diablo printer. I hooked it up to my OSI + D&N-80 CP/M computer, and liked the pretty output. But I was unable to take full advantage of some of my programs because they used the "list" device driver in CP/M to send each character to the printer, and that driver has no provision for inputting information from the printer to determine when it is ready for another character -- so the sophisticated "software protocol" I wanted to use was impossible.

Being a man who doesn't know the meaning of the word "impossible" (it has more than three syllables), I determined to rewrite the list device driver to incorporate ETX/ACK protocol.

The list device driver is part of the BIOS, the hardware dependent part of CP/M written by Lifeboat, or OSI, or D&N, or whoever produced your CP/M, not by Digital Research. Everyone's will, therefore, be somewhat different, but in a way it will be the same: it has to do the same thing, so the code must be similar. To find the list driver in your CP/M, you must DDT the system, saved as "CPM56.COM."

You know the address of your printer output board: perhaps FB00 if you have a CA-10, B0 if you have a D&N 1600, or whatever. Look through CP/M's code and disassemble it until you find driver which outputs to that address in a small loop, by inputting the status port, checking it against a constant, then outputting to the data port. CAUTION: do this whole process ONLY on a backup disk you can afford to bomb!

Once you have found the area you are looking for, you are 1/3 of the way there. You must now find another area of code which will never be called, to insert your ETX/ACK routine. I used the device #8 driver, which outputs characters to the CA-10 board at CF00H. I have no such board, so it won't be used.

Now you must insert, right AFTER the instruction which sends a byte out to your printer, a subroutine CALL instruction pointing to the ETX/ACK routine you will install. I found I only had to move one byte of code down to make room, since the next routine in my BIOS was the DEV#8 driver I wanted to replace. The only instruction I had to move was the RET (return) instruction following the "byte output" instruction. I considered it unlikely that any other code (outside the routine I was modifying) would jump to a return, since a jump instruction takes more room than another RET would!

Okay, where are we? We have found the output routine we want to modify and inserted a subroutine call, so that each time CP/M outputs a character to the printer, we will jump to our subroutine. So what must the subroutine do? This:

1. Increment a counter keeping track of how many bytes we have sent out;

2. When that counter reaches a certain value (depending on the size of your printer's buffer),

a. output an ETX character (CHR$(3));

b. wait for the printer to return an ACK (CHR$(6));

3. Then return to the calling point.

Some CP/M's have BIOSes written in 8080 assembler, some in Z80 assembler, so I can't give you source code which you can plug right in.

However, you already have routines (look for them!) which check the status of the port and output a character to the port. Now all you need to do is be sure you use them, and be sure you DON'T write your routine so that it outputs a byte (the ETX character) by calling the routine which you have modified to jump right back to the routine you are writing, or you might get in an endless loop, with the routine calling itself until the stack overflows and the computer crashes...

My Diablo now prints happily, either in WordStar or by using the LST: device.

★

HOW TO BUILD A DATA SEPARATOR AND USE IT TO INTERFACE A C1P WITH SASI-COMPATIBLE DRIVES

By: Jim McConkey
7304 Centennial Rd.
Rockville, MD 20855

Like Cassette Corner, I have recently gone disk. However, in my quest to upgrade at the lowest possible cost, I didn't use OSI's 610 board or an MPI drive.

I am presently running with a C1P rev D with Progressive Computing's true 32 mod (which also lets me use 16 x 64), a BMC green phosphor monitor, an IDS-225 graphics printer and a homebrew expansion cage. The expansion consists of another power supply, address and control buffering, a real time clock, a hardware random number generator, 24K of RAM, a floppy disk controller and drive and still more yet to come.

The floppy controller was built from scratch with minor modifications from the SAMS manual for OSI's 610 board. I scratched the 610's memory section and instead designed a new memory expansion based on the fairly new TMM2016 2Kx8 RAMs, which are about half as expensive as the usual 2114s. 24K was chosen for two reasons. First, that's all that would fit on a card and second, the last 8K will be used in a 256x256 dot-addressable graphics board, which will give me a total of 40K.

As you may know, the IBM PC is supplied with two SS/DD drives (Tandon TM100-1). Many PC buyers (especially in my area) replace the SS/DD drives with DS/DD drives and sell the old drives cheap. I picked up an ex-PC drive for just over $100. A couple quick calls to my local OSI suppliers showed that none knew how to use a Tandon drive or where I could find the required data separator. Not to be deterred, I designed my own data separator and figured out how to connect the Tandon.

The Tandon TM100-1 uses the Shugart Associates Standard Interface (SASI). Needless to say, the Shugart SA-400 (SS/SD) also uses the SASI, along with several other manufactureres. I have tried the connections presented here with both the TM100-1 and the SA400 and both work fine.

Tandon and Shugart drives, like the MPI, do not separate read data from the read clock, so a data separator is required. The schematic for my data separator is shown in figure 1, and the associated logic diagram is shown in figure 2.

The read data signal from the drives consists of a string of negative-going pulses about 1 usec wide. A zero is represented by one pulse in an 8 usec (the data clock rate is 125KHz) bit cell while a one is represented by two pulses evenly spaced in a bit cell.

Flip-flop IC1a is configured rather unusually to function as an inverter. One shot IC2 is set for 6 usec and is non-retriggerable. This lets it ignore the extra pulses which indicate ones and occur 4 usec apart. This recovers the clock.

Flip-flop IC1b recovers the data. Since the rising edge of the inverted input pulses now is centered in the low portion of the separated clock, a string of pulses every 8usec, indicating zeros, clocks zeros through this flip-flop. If a pulse follows another by 4usec, indicating a one, the separated clock is still high and a one gets clocked through the flip-flop. The separated clock and data then go to their respective pins on the 610 board.

Calibrating the separator is very much the same as calibrating the 610 board. Connect the separator's input to pin 9 of J3 on the 610 board and connect a scope to the separated clock output line. Adjust the trimmer for a 6usec positive-going pulse.

Now that we have a data separator, the rest is easy, just a simple matter of making a cable to connect the 610 board's J3 with the disk drive's 34 pin edge connector. Your local OSI dealer can probably supply you with a Molex connector to plug onto J3. A SASI-compatible 34 pin edge connector can be had at your local Radio Shack (part #276-1564) for about $5 each. In addition, you will also need a suitable length of 24 conductor ribbon cable, preferably shielded if the cable will be long.

Figure 3 shows the proper connections for two single-sided drives (TM100-1, SA400 or similar). If you just wish to use one drive, ignore the connections for the second drive. Figure 4 shows the connections for a single double-sided drive (TM100-2, SA450 or similar). The switch shown in the connections turns the motor(s) on when closed. The drives have a socket for jumpers, which may or may not have a shunt dip or dip switch installed. There should be a jumper in the proper drive select position. If you're using an SA4X0, a jumper in the MH position (marked on the PC board) will cause the head to be loaded when the motor is turned on via the switch. Due to its advanced head design, the TM100 head is ALWAYS loaded when the door is closed and there is no provision for raising it. All other shunts should be open.

The last consideration is power. The TM100-1 and SA400 both require +5v at about 600mA and +12v at about 900mA. The power connection is made via a 4 pin polarized Molex connector. With a little work, the Radio Shack #274-234 ($1.09) may be pressed into service. The pins are a little large and need to be crimped a little. You will also need to shave a corner off. The connections are shown in fig. 5.

HOW TO BUILD A DATA SEPARATOR by JIM McCONKEY

FIGURE 1.
DATA SEPARATOR SCHEMATIC

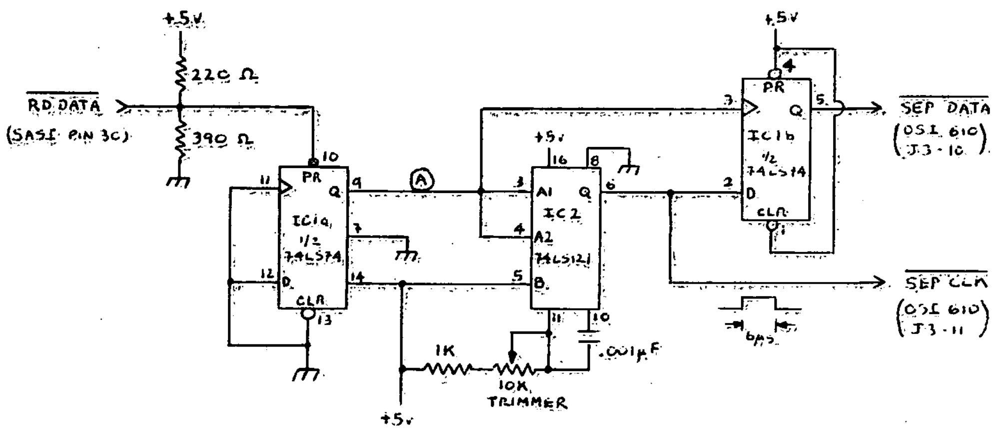


FIGURE 2.
DATA SEPARATOR TIMING

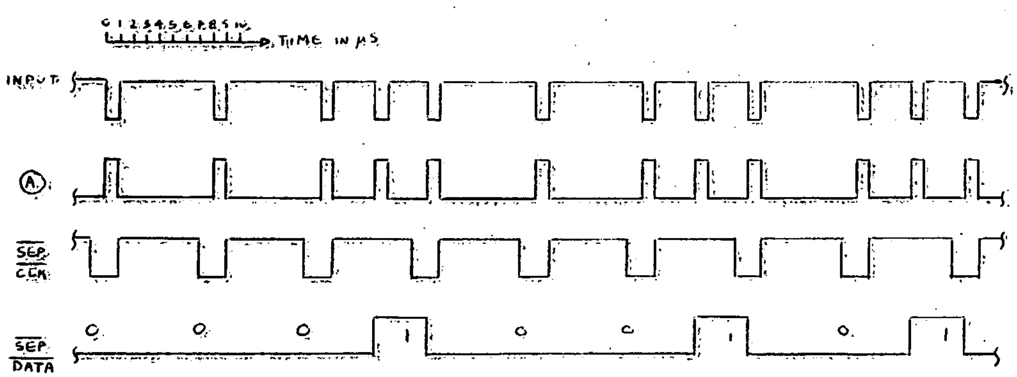
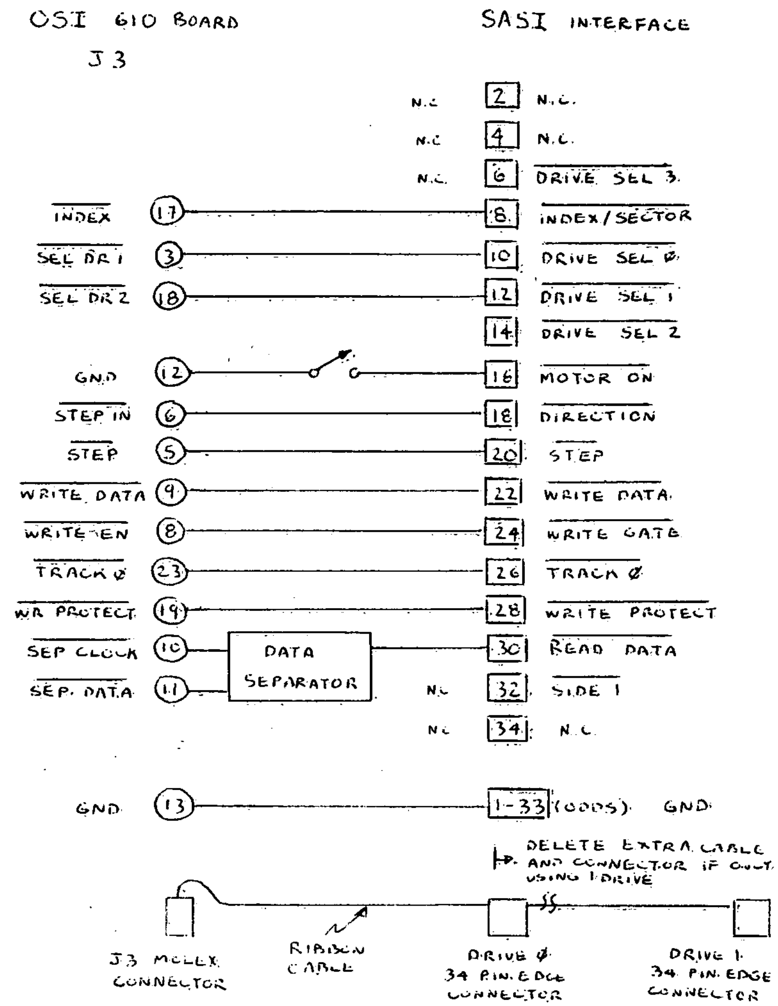
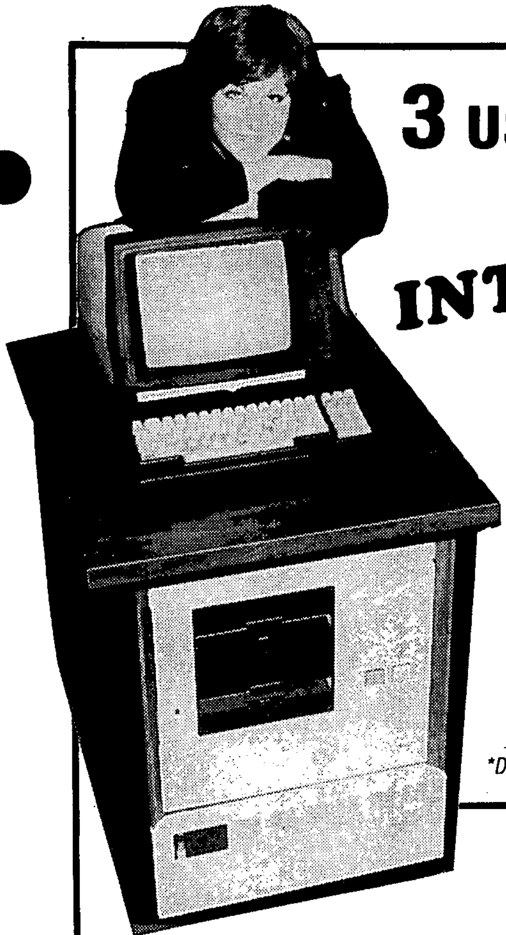


FIGURE 3.
SINGLE SIDED DRIVE CONNECTIONS



Continued on page 18



3 USERS-80 Mega Bytes —$8990.00*

INTRODUCTORY SPECIAL

WITH DUAL FLOPPIES
BRAND NEW —
1 YEAR WARRANTY ON HARD DISK!
REGULAR $10,990.00

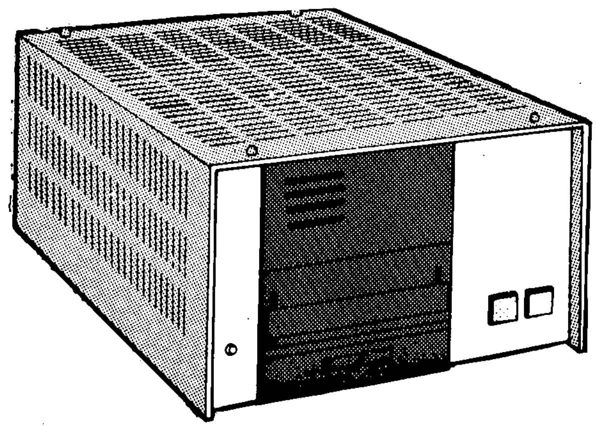
- 90 Days on Power Supply, Floppy Drives — Circuit Boards.
- Configured for Time-Share @ 2 MHZ
- Includes: 2 Serial Printer Ports with Handshake, Improved Cooling, and Ball Bearing Roller Chassis Rails

ALSO AVAILABLE WITH 3 MULTI-PROCESSOR Denver Boards with 64K each user and Centronics Parallel Printer Port at

$9990.00

DEALER DISCOUNTS AVAILABLE

8" HARD DISK SYSTEMS



SINGLE BOX TABLE TOP WITH IMPROVED COOLING 10 M/B HARD DISK AND 8" FLOPPY DISK **2 USERS** AND **2 SERIAL PRINTER PORTS**

$5990.00

AS ABOVE WITH 2 MULTI-PROCESSOR 64K DENVER BOARDS PLUS CENTRONIC PARALLEL INTERFACE **$6990.00**

OR INSTALLED IN CABINET AS ABOVE
WITH DUAL FLOPPIES PLUS 10 M/B.

STD. BOARD TYPE	1 USER w/ Centronics Printer Port	$6490.00
	2 USER w/ 2 Serial Printer Ports	$6990.00
DBI MULTI PROC.	2 USER w/Centronics Printer Port	$7790.00
	3 USER w/Centronics & Serial Printer Ports	$8990.00

MULTI-PROCESSOR DEVELOPMENT SYSTEM SPECIAL

- 5 M/B Hard Disk-1 8" Floppy
- 1 Centronics Parallel Printer Port
- 1 Serial Printer Port, 1 Modem Port
- 2 DB-1 Multi-Processors
- Complete Programmer Manual and Software Overlays

SPECIAL ONLY **$5990.00**

CLOSE OUTS

C4P—$350.00, C4PMF—$699.00, C4P DMF 48K—$1199.00, C8P-DF—$1499.00 C2-OEM—$1799.00, CM-2—$69.00, CM-10—$89.00, CM-11—$499.00, CA-9—$129.00, CA-10-1—$149.00, 510 CPU—$299.00, OSI C4P Disk Programs, Regular $29-$49 — *NOW* $9.00 each.

Call or Write for Bargains List!

WHERE WE STILL LOVE OS-65U — AND SUPPORT IT!

Space-Com International

22991 LA CADENA DRIVE, LAGUNA HILLS, CALIFORNIA 92653

ORDER TODAY (714) **951-4648** SOME QUANTITIES LIMITED

Continued from page 16

FIGURE 4.
DOUBLE SIDED DRIVE CONNECTIONS

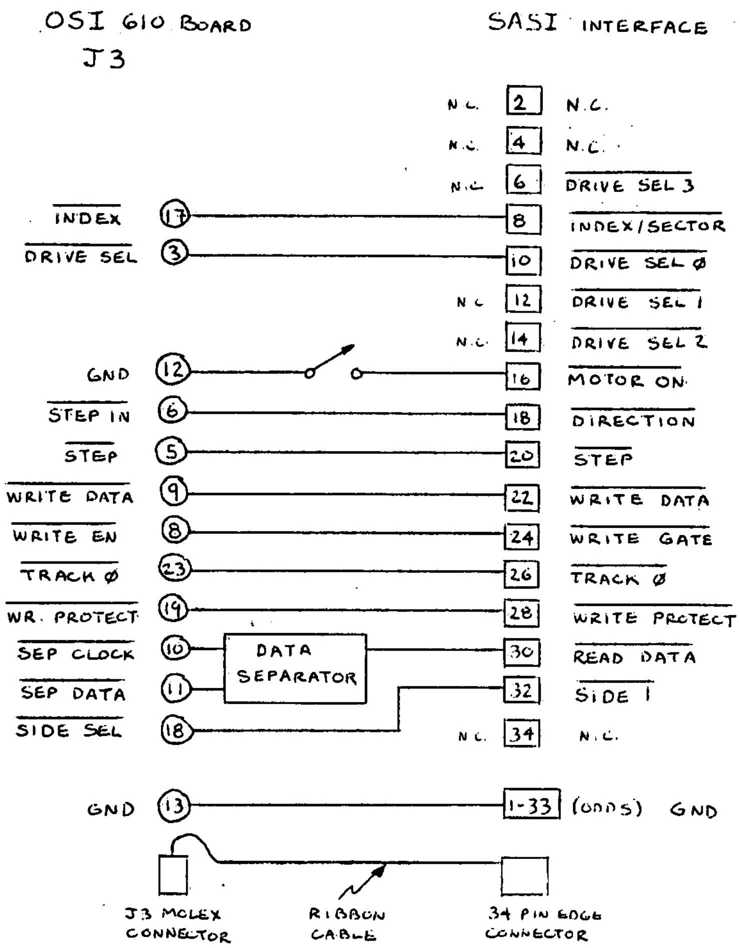
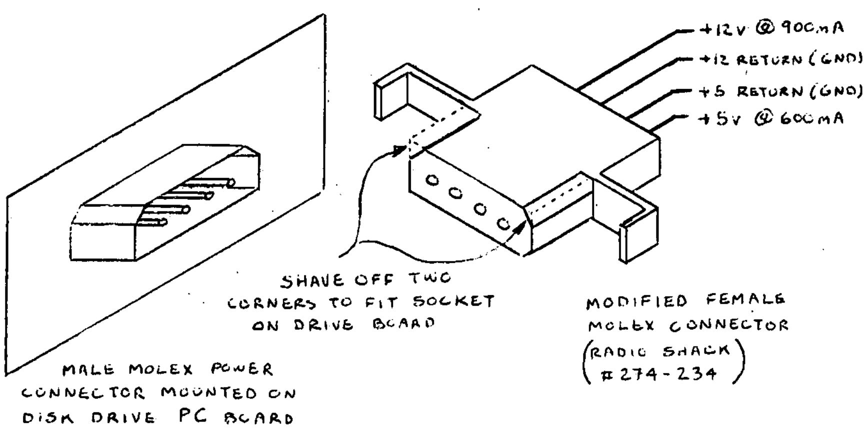


FIGURE 5.
POWER CONNECTIONS



That's it. Don't worry about all the unused pins on J3. The disk boot routine ignores them and I assume OS-65D does also. I have been using HEXDOS and it also seems to ignore the unused lines. You don't have to worry about the unused SASI lines either. They are pulled up on the drive board. Mount the data separator wherever convenient.

Hopefully, I have saved several people from pulling out their hair over trying to use Tandon or Shugart drives with a C1P or just trying to find a data separator. ★

Continued from page 8

(with the CTRL key depressed press the X key) and you will see the program in the indirect file loading just as if you typed it in from the keyboard, but a lot faster I'll bet. Please note that any line numbers that are the same will be replaced by the line from the indirect file program, so if you wish to merge 2 programs that may overlap with line numbers, you should first renumber one of them.

14. Save or run the program.

LETTERS

ED:

I have an earlier version of WP6502 (copyright 1979, serial #815522) that I have been happy with, but with some reservations. If I updated to the latest version I would want to be sure it didn't have the same problems (of course, mine was only $75). I recall the disclaimer in the manual that said it will work only with the standard out-of- the-box variety machine. But that's exactly what I have: a 32K C8P-DF, with a C.Itoh 8510a matrix printer. The only modifications I've made have been to hardware to permit direct audio and video connection to my 12" Sony, including a new power switch with an extra pole that permits me to ground the controlling relay in the Sony. That way, I can leave the computer connected to the television. If the computer is off, I get regular TV. If the computer is on, I have a monitor. Anyway, since my modifications had been limited to hardware, and not the 65D operating system, I was a little annoyed with the bugs that appeared.

The most spectacular of these bugs was the tendency on occasion to write continuous garbage over and over on the same line, with no possible recovery. This could happen whether or not I was outputting to the screen or to the printer. I could sometimes fix this by rearranging some of the text or imbedded commands, but never to the point where I could spot a pattern.

The other problems were easier. It took some experimentation to discover that it takes two 'y's to activate the hold-at-the-top-of-a-page command. Nothing in the manual suggested that. In fact, the manual says quite the opposite. That, if I want to hold the printer, I should simply press return. If not, I should press N.

Aside from the above, which I've had to live with, I've really enjoyed using WP6502 for correspondence. But of course, I'd like to know if there are any fixes for the garbage out problem. It seems unlikely I'm the only one who's had the experience.

I've enjoyed PEEK(65) and look forward to receiving it. Keep up the good work. Us OSIers need all the help we can get.

Don L. Heimbach
Fullerton, CA 92633

* * * * *

ED:

My hardware consists of OSI C4P w/48K, Dual 5" Disks and Epson MX-80 Dot-Matrix printer. My software consists of OS65D3 Version 3.2 (I don't like V3.3), word processor WP6502 V1.2 (I don't like V1.3), DQ Secretary and DQ Justify.

I have learned to get a great deal of service from my system. The DQ Secretary is particularly convenient for commanding the disks and loading and saving programs and text.

I have made two hardware modifications. I have installed a Disk Switch (DSK-SW) from D&N Micro Products, Inc., and I have installed a SYNKEY ROM from Micro-Interface. Both are installed inside my computer and out of sight. The DSK-SW turns off the disk drives except when I am reading or writing from or to a disk. This saves wear on the disks and drives. The SYNKEY ROM normalizes my keyboard, so I can write conveniently with lower case characters.

Now I can keep a disk in each of my drives A & B, and I only need to have the operating system, OS65D3, on the "A" disk for "booting up". This leaves me tracks 01 to 11 free for programs and text storage on the "B" disk. (Of course, I must maintain track 12 for the disk directory.) This is all very convenient. For my routine work I can leave my disks in the drives continuously.

I have only one problem that

bugs me. So far, I can't use track 00 on the "B" disk! The track 00 doesn't have an address or leader or whatever is required for the disk operating system to recognize it. I have "created" an entry in the directory for it. I call it TRACKO, and it is printed whenever I call for the directory. The system seems to respond satisfactorily when I command SAVE, TRACKO, but when I command LOAD, TRACKO, the DQ-Secretary responds "NOT FOUND".

Now my question is: Is there some way to write a header or initialize track 00, so that I can read data from it?

Carl M. King
Sarasota, FL 33579

CARL:

As far as I know there is no way to initialize track 00 so that data can be read from it. Maybe a reader can help!

Dick McGuire

* * * * *

ED:

We are relatively new on the Challenger II, and we are still in the save by tape stage.

I am trying to do a program of accounts maintenance for tape. I know this is a relatively slow method using tape. However, I believe in starting at the ground level and working up to disk.

My problems are, of course, the GC problem, and therefore, I am interested in the different poke routines to change addresses to fix the problems encountered.

I hope to expand my machine using the SEB 3S4 by Orion Software, but I am a little skeptical in that I won't be able to use software I already have, or does this make any difference?

Donald W. Leith
Hawthorne, WI 54842

Donald:

Account maintenance with a cassette based system?! I am frequently amazed at what people get their computers to do!

Who has experience with the Orion SEB 3S4?

Al.

* * * * *

ED:

I recently purchased a copy of OS65D 3.3 and ran into the same problem described by Tim Lowe in the January issue. That is, that the modem routine just doesn't work on version 3.3. If version 3.2 or earlier (3.2 is supplied on tutorial disk 2) is booted you can load and run this program just fine. Incidentally, the section from line 500 - 990 just sets up the 48 characters line, so if you've already got that, deleting these lines and changing 3000 to a Rem will make it leave the display alone.

Brick Rule
Sarasota, FL 33582

* * * * *

ED:

I would like to know the location of the subroutine which monitors the keyborad in V3.3 and the location of the value of the key depressed in memory. In V3.2 the subroutine begins at 252B and the memory location of the ASCII value is 9815.

A. J. Smith
Amherst, OH 44001

* * * * *

ED:

Here is a generalized file sort routine for OS65-D for MDMS data files. The sort is entirely done in memory and the size of the file is only limited by memory and disk space. The sort is based on the shell algorithm and is of order N. LOG $_2$ N.

OS65-D MDMS

```
10   REM FISORT - WRITTEN BY DAVID W. HANABURGH
20   REM                    YALE CORDAGE
30   REM                    YARMOUTH, ME 04096
70   POKE173,96:POKE2893,28:POKE2888,0:POKE8722,0
80   POKE2972,13:POKE2976,13
90   DEFFNX(X)=VAL(EN$(X))
100  DEFFNA(X)=X*NB+1
110  PRINT"THIS ROUTINE SORTS ANY FILE ON ANY SPECIFIED FIELD
120  PRINT"THE SORT KEY MUST BE A NUMERIC STRING AND THE FILE
130  PRINT"STRUCTURE MUST BE AN MDMS DATA FILE
140  FORI=OTO6:PRINT:NEXT
150  INPUT"FILE TO BE SORTED";F$
160  INPUT"SORTED ON WHICH FIELD";FD
170  INPUT"IGNORE O'S";AN$
180  IFLEFT$(AN$,1)="Y"THENSK=-1
200  PRINT:PRINT:PRINT"PLACE DISK WITH FILE IN DRIVE A - PLACE
        BACKUP IN DRIVE B
210  PRINT"SORTED FILE WILL BE ON DRIVE B
220  INPUT"PRESS ENTER";AN$
230  GOSUB1000:REM OPEN FILE
240  DIMKY(EN-1),IT(EN-1),EN$(NF)
250  FORI=1TOEN-1
260  IT(I)=I
270  DISK GET,FNA(I)
275  GOSUB2100:REM READ RECORD
280  KY(I)=FNX(FD)
290  NEXT
300  GOSUB3000
305  K=1
310  FORI=1TOEN-1
320  IFSKANDKY(I)=OTHENNEXT
330  DISK GET,FNA(IT(I))
340  GOSUB2100:REM READ RECORD
350  DISK!"SE B
360  DISK GET,FNA(K)
370  GOSUB2200:REM WRITE RECORD
380  K=K+1
390  DISK!"SE A
400  NEXT
410  IFNOTSKTHENEND
420  GOSUB1000
430  PRINT#6,FI$:PRINT#6,NB:PRINT#6,NF
440  PRINT#6,PH:PRINT#6,K
450  DISK PUT
999  END
1000 REM OPEN FILE - GET PARAMETERS
1010 DISK!"SE A
1015 DISK OPEN,6,F$
1030 POKE12076,6:POKE12042,32
1040 INPUT#6,FI$:INPUT#6,NB:INPUT#6,NF
1050 INPUT#6,PH:INPUT#6,EN
1060 RETURN
2100 REM READ RECORD
2110 FORJ=1TONF
2120 INPUT#6,EN$(J)
2130 NEXT
2140 RETURN
2200 REM WRITE RECORD
2210 FORJ=1TONF
2220 PRINT#6,EN$(J)
2230 NEXT
2240 DISK PUT
2250 RETURN
3000 REM SORT ROUTINE
3010 GAP=EN
3020 IFGAP<=1THENRETURN
3030 GAP=INT(GAP/2)
3040 PRINT"SORTING
3045 RX=EN-1
3050 HE=RX-GAP:SW=-1
3070 FORI=OTOHE
3080 PT=I+GAP
3090 IFKY(PT)<KY(I)THENGOSUB
                          3500
3110 NEXT
3120 IFSWTHEN3020
3130 GOTO3050
3500 A=KY(I):KY(I)=KY(PT):
                    KY(PT)=A
3510 A=IT(I):IT(I)=IT(PT):
                    IT(PT)=A
2520 SW=0
3530 RETURN
```

David W. Hanaburgh
Yarmouth, ME 04096

* * * * *

ED:

About one year ago, I wrote to PEEK(65) asking a few questions. I was hoping to get a reply by mail, because I had not yet subscribed. A reply was never received! None of my questions were answered.

About a month ago came a flyer advertising PEEK(65). A check for a subscription and all the back issues went out. Only five days later, all of what I ordered was at my door. Great service!

It took me a while to read through a number of them, but I finally came to the May 1982 issue. In one of the letters to the editor, someone described a system exactly like mine! Upon reading on, I must have turned twelve shades of red. It was my above mentioned letter that I thought I never got a reply to.

It's been a while since that first letter, and a lot of learning later. The Aardvark Journal was a lot of help, but since it's demise, PEEK(65) will now be my main source of OSI information. In the May 1982 issue, I mentioned that I may be able to contribute to your (our) magazine. The following information should be of some help.

In the March 1983 PEEK(65), readers needed help using Radio Shack printers. I bought (and regret) a R.S. DMP-100 on sale. I had the same trouble as other OSI users had with double spaced lines. The cure when using OS65D3.0 & OS65D3.3 was to modify the machine code I/O routine. The program included will do this.

It's been about six months since I wrote it, and my memory of it will not allow a lot of detail. Essentially, I interrupted the cassette/ printer I/O routine, and jumped to this little routine placed in some free space just in front of the I/O routine. When the machine sends a character to the I/O routine, it compares what is sent to a hex $0A (LF). The machine doesn't send a character if a LF is encountered but instead it now performs a RTS from the I/O routine. The computer will continue on and then send another character to the I/O routine and the whole above mentioned sequence will repeat itself.

The program has worked for quite a while and I haven't had any problem with it. Others can write to me and let me know how it has worked for them. I can see it now, a new EPROM that will do this automatically. Naa.

My present project is trying to interface my Heathkit H-89 to my C1PMF as a terminal. My C1P will then have a 80 x 24 character display! Wow! When life exists, the possibilities are endless...

```
10    REM PROGRAM TO REMOVE
      LINEFEEDS FROM I/O
      ROUTINE OF
20    REM OS65D3.3 OR 3.0
30    REM BY DAVID L. KUHN
40    REM 109 SHAW AVENUE
50    REM LEWISTOWN, PA. 17044
60    REM
70    FOR X=9394 TO 9404
80    READ A
90    POKEX,A
100   NEXT
110   FOR X=9430 TO 9432
120   READ A
130   POKE X,A
140   NEXT:END
150   DATA 201,10
160   DATA 208,1,96
170   DATA 141,01,240
180   DATA 76,217,36
190   DATA 76,178,36
```

David L. Kuhn
Lewistown, PA 17044

* * * * *

ED:

Our company is a structural steel and miscellaneous iron contractor in New Jersey and we own both a C2 and C3 OEM, which we use to prepare invoices, estimate, and do project bookkeeping.

We would be highly interested in corresponding with any general contractor or subcontractor currently using OS65U for business use.

Martin King
3-25 Dorothy St.
Fair Lawn, NJ 07410

Martin:

Why not write an article about some of those things and send it to Peek?

Al

* * * * *

ED:

I had the same problem as Tim Lowe had in the January issue. When I called CompuServe I got back a bunch of letters and symbols. The symbol would be that of the letters' ASCII number plus 128. For example, a space (32) would come back as a filled in square (161). Maybe the machine code people can make something of that.

My system is a SBII series 2, 32K, 5 1/4 Disk, and a Radio Shack Modem I. Way back in PEEK, I found a simple terminal program for cassette and that would work fine. Then, by accident, I discovered I could use OS65D3.2 and make the OSI Modem program work. 3.3 wouldn't work.

When I phone, both CIS and OSI said the other was at fault and needed to change their system.

If you use the 12 x 48 screen, you need to change line 60 and add 62:

```
60 DISK!''CA  25A0=11,1'':
POKE55296,1:FORI=1TO32:PRINT:
NEXT
```

62 PRINT'' MODEM IS READY''

I can't explain this, but maybe it will help someone until an explanation comes a-long.

Jack Vaughn
Beaumont, TX 77707

* * * * *

ED:

Help, please! Is there a feasible and economical way to increase the RAM on the Ohio Scientific C3-OEM? Mine is the optional 56K machine. Most of my applications use CP/M 2.2 which was configured at 49K by Lifeboat. I want to add a spreadsheet program. I tried CalcStar but it runs out of memory quickly. I tried ScratchPad which can store out-of-memory portions of the matrix to diskette, but my machine does not have enough memory to install the program.

I read that CP/M 3.0 is available for banked systems with greater than 64K and I assume it could be configured to handle a separate additional RAM, if there is a way to add it. Or am I barking up the wrong tree?

Mitchell McNabb
Pascagoula, MS 39567

MITCHELL:

An interesting problem which many of us have been fighting for some time. There are several solutions, none completely satisfactory:

The reason for the problem is that the old OSI I/O boards (470 disk controller, CA-10 serial I/O, etc.) were memory mapped into locations below 64K, so that those locations could not be used for true RAM. Lifeboat cleverly wrote their CP/M BIOS in a section of high memory not used by the boards, so that they could use the full 48K low RAM available. However, as you note, some programs such as spreadsheets really need more.

The radical solution is to buy a D&N-80 board (or a new OSI computer!) which uses the entire 64K, and also reads and writes standard CP/M 8" disk format.

In your particular case, load a COPY of your Scratchpad disk into your A drive, and type:

```
A>ERA SP.COM
A>REN SP.COM=SPSMALL.COM
```

"SPSMALL" is a special version of scratchpad supplied for computers with memory shortage problems. This program will do virtually everything regular Scratchpad will do, but uses less RAM. I have seen it work fine on an OSI with 56K.

Al

* * * * *

ED:

There are a large number of micro-computers in use in New Zealand, in schools, homes and small businesses, with a substantial portion being OSI systems.

We have recently been asked for a word processing package for the C1PMF Series II system, which allows database word processing.

To date, we have been unable to locate such a software package despite keenly reading PEEK(65) and other microcomputer journals.

I would sincerely appreciate being contacted by any OSI user who knows of a word processing program with the capabilities, which we could buy.

R. I. McLean
P.O. BOX 492
Wellington, New Zealand

MR McLEAN:

It is my understanding that WP6502 will work on a C1PMF. However, I am not sure what you mean by "database word processing." If you mean merging of names and variables from a database into form letters created by a word processor, I believe WP6502 will do this as well, working with MDMS.

Readers, who knows whether it will for sure?

Al

* * * * *

WANTED

Regression package (or social sciences statistical package that includes a regression package) for use on the OSI OS-65U V1.3 (floppy disk) operating system. Contact Peek (65).

* * * * *

Wanted: A copy of Edward H. Carlson's book, "ALL ABOUT OSI BASIC IN ROM", second edition. Please contact: Don Cwynar, 3900 Royena Avenue, Reading, PA 19605.

USER GROUP NOTES:

Central Pennsylvania Ohio Scientific Users Group Forming. Contact: Dave Fisher, 610 S. 20th St., Harrisburg, PA 17104 or call (717) 236-0479.

AD$

PEEK (65)
The Unofficial OSI Users Journal

P.O. Box 347
Owings Mills, Md. 21117

BULK RATE
U.S. POSTAGE
PAID
Owings Mills, MD
PERMIT NO. 18

DELIVER TO:

16:8