

# PET USER'S GROUP NEWSLETTER

VOLUME 0

NUMBER 1

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## N-O-T-E-S

On February 8, Lawrence Hall of Science hosted the third meeting of the PET User's Group. There were about 45 people, mostly adults, with eight PETs purring away demonstrating and copying new programs. One new program by Harry Saal called MAXIT was especially interesting. It is a number game where two players or player against computer take turns extracting numbers, positive and negative, from a matrix board to add to their score. The game seems even for both contestants, but when pitted against the computer, Harry's program seems to use multiple-move look-ahead and plays a strong offensive and defensive game. Bravo Harry!

At the same meeting, Neil Bussey demonstrated the adding of a keyboard to the PET. Refer to page 3 of this newsletter for a description on how you can do the same.

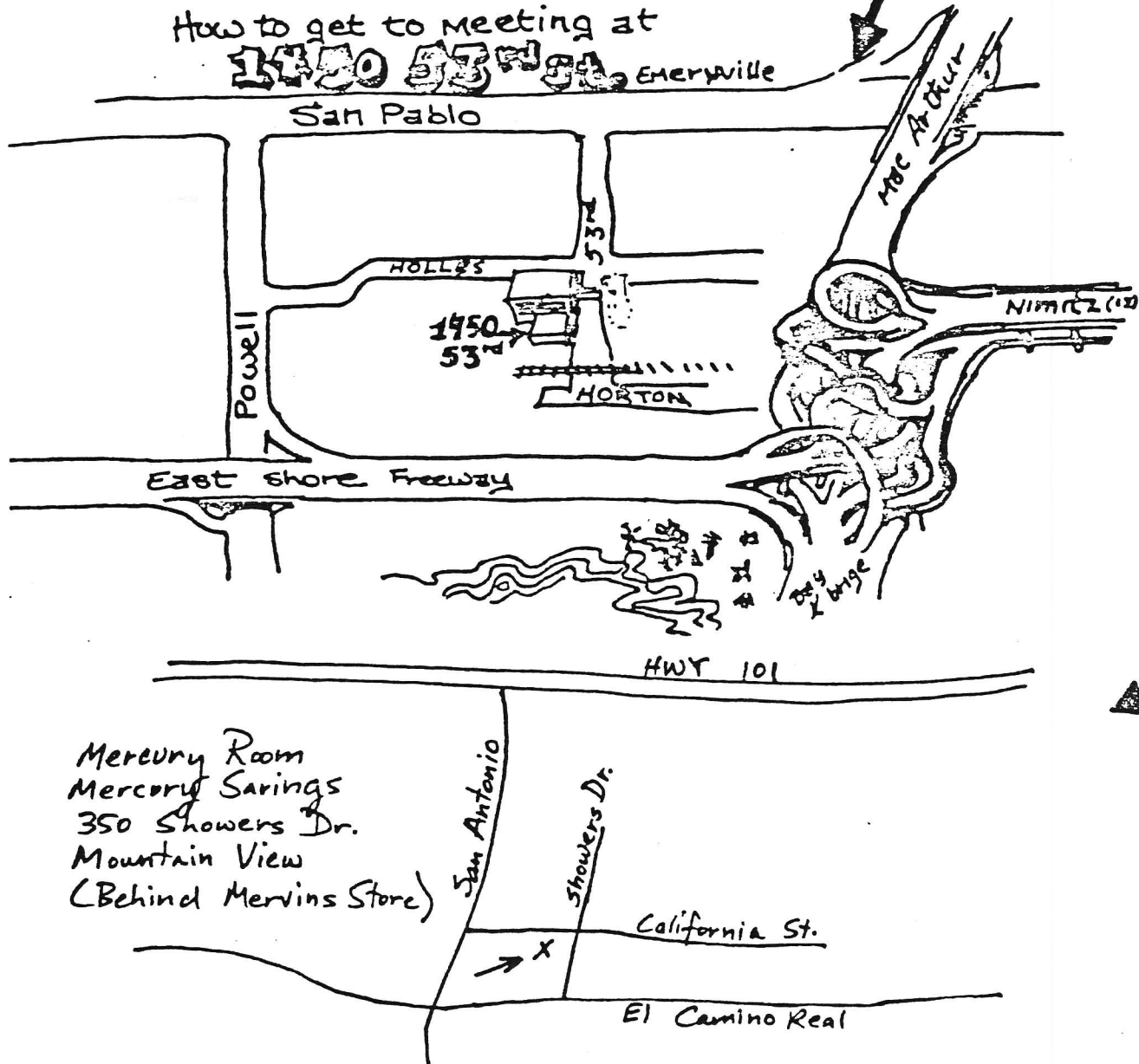
The editor was unable to attend the fourth meeting on March 1 at Mercury Savings in Mountain View, but the Chronicle did not miss the meeting! Check page 4 of the Friday, March 3 paper for a nearly full page spread of the last P.U.G. meeting.

Who did not attend the Second West Coast Computer Faire? If you did not then you were certainly in the minority. Along with many PET users there were several new PET-support products. Peruse the back pages of this newsletter for hardware and software products available for your PET. From music to memory extenders to 6502 assemblers to serial RS232 interfaces! Space permitting, the newsletter will announce new products that are adaptable to the PET.

C-A-L-L T-O M-E-E-T-I-N-G

----> The first East Bay PET User's Group  
TIME: 7:00 pm 14 March 1978  
WHERE: The old Shell Building in Emeryville (see map)

----> The fifth (South Bay) PET User's Group  
TIME: 7:00 pm 30 March 1978  
WHERE: Mercury Savings and Loan, San Antonio Road, Mt. View (see map)



A-N-D G-E-T-T-I-N-G B-I-G-G-E-R

This Newsletter can be the voice of both Bay Area PET User's Groups. However, the mailing list is now nearing 100 names, and with the increasing number of pages per issue means that the cost of reproduction and mailing is growing too high for the Lawrence Hall to maintain. Possible solutions could be subscription rates to cover just the above mentioned costs, or contributions from P.U.G. members and/or PET product manufacturers. If you have any useful suggestions or would like to volunteer your or your company's services, please call or write Pete Rowe, Lawrence Hall of Science, U.C. Berkeley, CA 94720, (415) 642-3598.

SO YOU DON'T LIKE THE KYBD THAT CAME WITH YOUR PET? !!

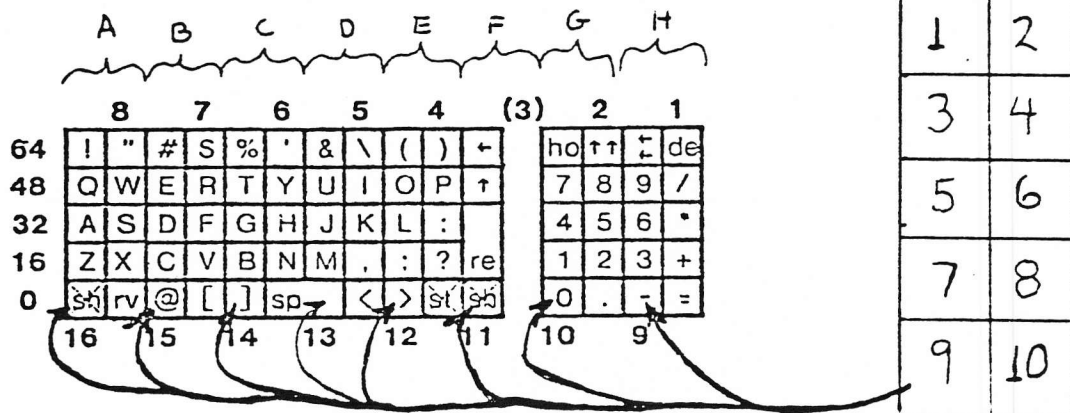
WELL IT HAS PROVEN TO BE A SNAP TO ADD ON YOUR OWN KYBD. AND I DO MEAN ADD ON, NOT REPLACE.!

SINCE ENCODING THE KYBD INFORMATION FOR THE PET IS DONE BY THE BASIC UNDER THE 60 CYCLE INTERRUPT, THERE IS ONLY ONE OF TEN LINES STROBED OUT TO THE EXISTING KYBD(10 BY 8) MATRIX AT A TIME. THE BASIC THEN LOOKS TO SEE IF THERE IS A RETURN OF THIS STROBE ON ANY OF THE EIGHT RETURNING LINES FROM THE MATRIX, CAUSED BY A DEPRESSED KEY. IF THERE IS NO RETURN OF THE STROBE, THE BASIC CHOOSES ANOTHER OF THE TEN LINES TO STROBE UNTILL IT HAS GONE THROUGH THE FULL TEN, WHEN, IF THERE HAVE BEEN NO KEYS PRESSED, IT WILL PUT A (255 OR FF) IN LOCATION (515 OR 0203). IF A KEY HAD BEEN DEPRESSED, A SIMPLE CONTACT WAS MADE FROM ONE OF THE TEN STROBE LINES TO ONE OF THE EIGHT RETURN LINES. THE BASIC WOULD HAVE INSERTED A VALUE IN LOCATION 515 EQUIVALENT TO THE ADDITION OF THE DECIMAL NUMBERS OF THE ROW AND COLUMN OF THE LEFT HAND DIAGRAM BELOW.

THE KYBD PLUG/RECEPTACLE ON THE MOTHER BOARD HAS NUMBERED STROBE LINES AND LETTERED RETURN LINES. IF YOU ARRANGE YOUR ADD-ON KEYBOARD STROBE LINE CONNECTIONS TO FOLLOW THE PATTERN OF THE RIGHT HAND DIAGRAM BELOW SO THAT THEY MAKE CONTACT WITH THE RETURN LINE SHOWN BY LETTERED GROUPINGS OVER THE LEFT DIAGRAM, YOU CAN THEN CONNECT YOUR EIGHTEEN LINES TO THE EXISTING KYBD PLUG AND STILL RETAIN THE GRAPHICS KEYPAD ON THE PET !!!!!

AS AN EXAMPLE: A  $\pi$ 4 STROBE LINE CONNECTED TO, AND RETURNED BY AN "E" LINE WILL PRINT A "P". PLEASE NOTE THAT THERE ARE EIGHT NUMBER/LETTER COMBINATIONS THAT THE BASIC IGNORES.

*NP*



For more information or comments contact: Neil Bussey (415)451-6364  
Richard Tobey(408)733-0688

## USING THE PET'S 8 BIT PARALLEL I/O PORT

by Dan Fylstra, 22 Heitz St., Boston, MA 02134

The PET employs the IEEE 488 bus for general purpose interfacing of external devices. But for "quick and dirty" interfacing problems, it may be simpler and cheaper to use the 8 bit parallel I/O port. This port is capable of handling many common peripherals including an ASCII keyboard, a printer or a paper tape reader. But only one device can be connected to the port at a time without some external switching logic.

The 8 bit port is actually part of an MOS Technology MCS6522 Versatile Interface Adapter (VIA). You can get a copy of the VIA data sheet from MOS Technology, 950 Pittenhouse Rd, Norristown, PA 19401, (215) 666-7950. But most of the VIA's features apparently are used for the PET itself, leaving only an 8 bit port and two handshake lines, which are really quite simple to use. This discussion will limit itself to input through the 8 bit port, which I have actually tested with a REACO optical paper tape reader. But the essential information for output through the port will be included.

The new PET user manual briefly describes the 8 bit port edge connector: pins A and H are grounded, pin B is CA1, the input handshake line, pin M is CR2, the output handshake line, and pins C through L are the 8 data lines, with C being the high order (leftmost) and L the low order bit. When the PET is turned on, the 8 data bits are programmed to act as inputs and CA1 is programmed to recognize a negative transition (from 1 to 0). If the handshake or data strobe line on your peripheral device produces a positive transition, you can reprogram CA1 with the BASIC statement:

```
POKE 59468,PEEK(59468) OR 1
```

which changes the CA1 control bit in the VIA's Peripheral Control Register (address 59468) from 0 to 1.

When a transition occurs on CA1, meaning that data is ready to be read from the data lines, the next to low order bit in the VIA's Interrupt Flag Register (the CA1 flag bit) will be set. You can test for this with the BASIC statement:

```
WAIT 59469,2
```

which takes the contents of the Interrupt Flag Register, ANDs

it with 2 or binary 00000010, and tests the result, repeating the test until the result is nonzero. (Note that execution of the WAIT statement cannot be interrupted with the RUN/STOP key, so you should have a way of manually creating a transition on CA1 when you're testing the interface.)

After execution of the WAIT statement, the data present at the 8 bit port is ready to be read with the BASIC statement:

```
D=PEEK(59457)
```

which reads the VIA's Port A and stores the data in the BASIC variable D as an unsigned integer between 0 and 255. A side effect of the PEEK is to reset the CA1 flag bit in the Interrupt Flag Register, thereby setting things up for execution of the next WAIT statement.

Thus, to read a whole line of ASCII characters ending with a carriage return (binary 00001101 or 13) into a string variable, you could use the following program segment:

```
10 A$=""
20 FOR I=1 TO 72
30 WAIT 59469,2
40 D=PEEK(59457) AND 127
50 IF D=13 THEN 80
60 A$=A$+CHR$(D)
70 NEXT I
80 ? A$
```

Here statement 20 simply limits the number of characters read to 72; statement 40 masks the data read to 7 bits to eliminate any parity bit; and statement 60 uses string concatenation to convert the data into a single string. Although the PET's internal character code is essentially ASCII, some character code translation will be needed in most practical applications. This can easily be done with an array in BASIC.

To use the 8 bit port for output, you must first program the data lines to act as outputs with the BASIC statement:

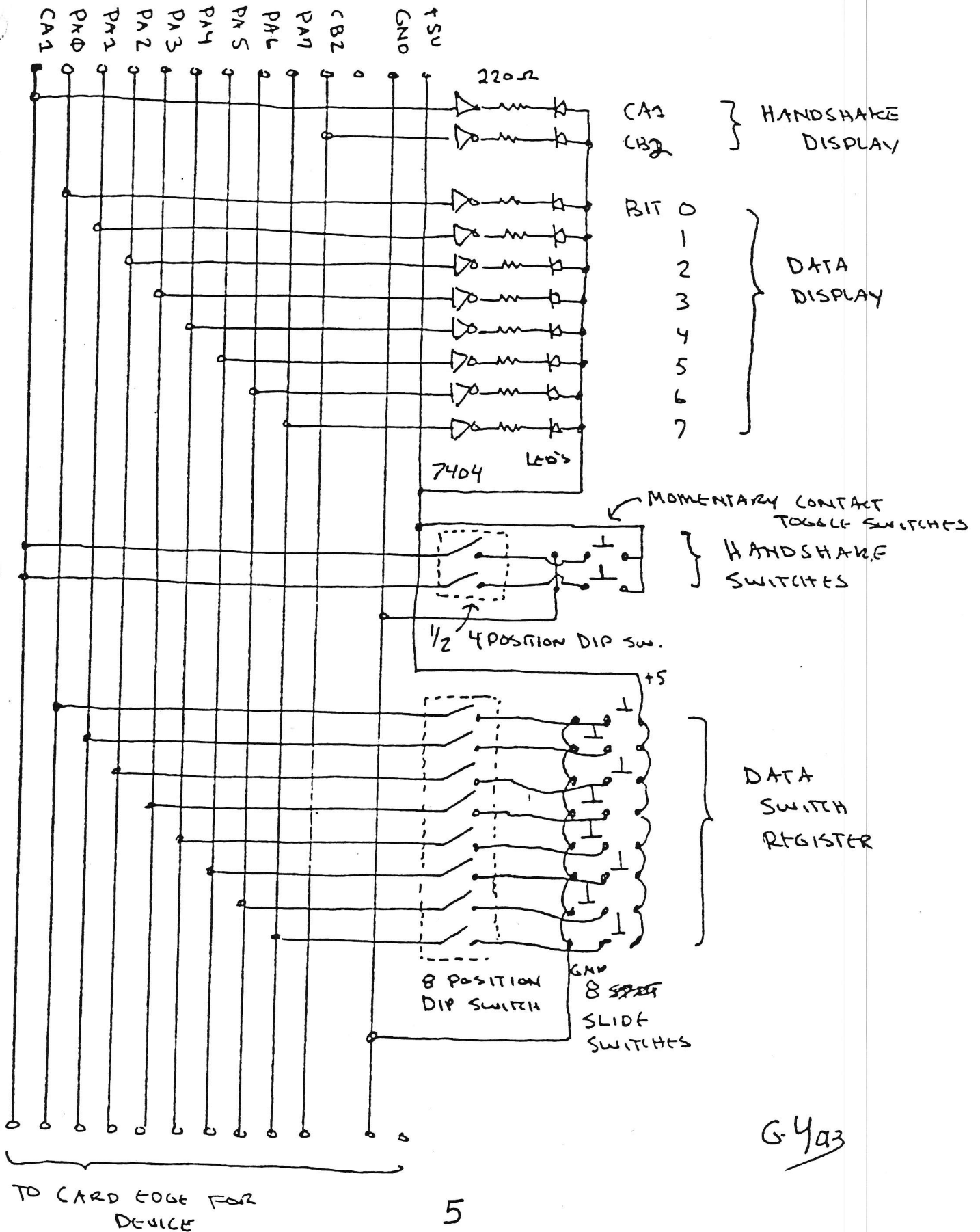
```
POKE 59459,255
```

which sets all bits of the VIA's Data Direction Register A to 1s. Handshaking is considerably less convenient, since only the CB2 line is brought to the edge connector. You can force CB2 to a logic 1 with the BASIC statement:

```
POKE 59468,PEEK(59468) OR 224 and reset it to 0 with:
POKE 59468,PEEK(59468) AND 31 OR 192
```



PARALLEL USER PORT (INDICATOR & SWITCH REGISTER)



G-4a3

## PET Character Set

*Kim Rubin  
Physics Dept  
University of California, Berkeley*

The characters on the PET consist of an 8 x 8 cell of *off* (blank,0) or *on* (lit,1) dots. The cells are contiguous both horizontally (40 wide) and vertically (24 high), thus simplifying line or continuous graphics.

Upper case letters and numbers are represented in a 6 x 7 subcell; the remaining two columns and one row provide nominal inter-character and -row spacing.

The half-ASCII (visual) set implemented consists of 64 symbols. PET adds 64 special symbols to total 128. The high order bit in the word is used by the hardware to produce inverse video (blank symbols on lit background), for a total of 256 distinct symbols viewable at once.

There is a second *font* of 128 symbols in the character ROM. (Bit 1 of location 59468 controls font.) Thus the ROM stores two fonts of 128 characters each, with inverse provided by hardware.

The character storage format in the MOS Technology 6520 character generator ROM is straight forward (binary). The eight outputs O1-O8 form one row of one symbol. The LSB O1 is on the right, O8 is on the left when facing PET screen. A high (1) turns the beam on. The 6520 has 11 address lines A0-A10. (2K x 8) A0-A2 are the row number: 0 is at the top, 7 is at the bottom of the character. A3-A9 are from the symbol (bits 0-6 of the screen memory). A10 determines the font.

The 6520 ROM may be replaced by PROM (not pin compatible) to form different character sets, or fonts. One Intel 8716 is ideal as it is also 2K x 8 and +5 volts only, but I used two 8708s and external power supplies and decoder. In any case an adapter board is necessary.

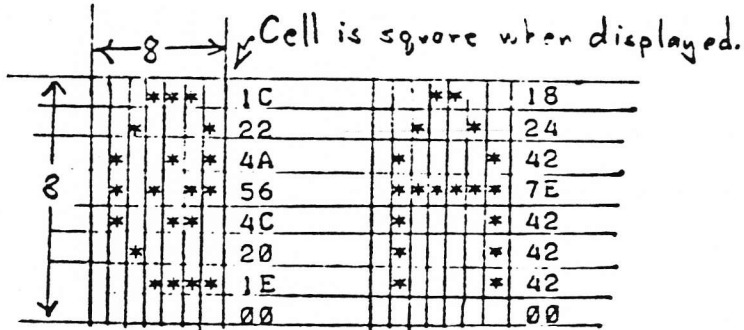
Uses might include:

1. left-right reversal for display applications,
2. foreign language character sets,
3. music notes and symbols,
4. choreographic symbols,
5. special game symbols (pieces of stars, ships, moons, explosions, tanks, paddles, etc.),
6. Printed Circuit Board Layout symbols (implemented),
7. extra large characters (16 x 16 cell),
8. higher mathematics symbols,
9. chemical symbols,
10. pictures of food, animals, road signs, etc. for testing or teaching,
11. reversal to lower case normal/upper case shifted for terminal simulations.

The only limitation to the number of fonts that may be stored "on line" at once is the number of PROMS that can be fit on one adapter board. The PET user port bits may be used to select additional fonts above two.

Below is a coding example. The @ and A are actually the first two characters in the 6520 ROM. Anyone wishing to make up his/her own character set should get a pencil, eraser, ruler and a large stack of cheap graph paper—"engineering paper" works well—use 1/8 inch per dot, and twelve cells to a sheet. Then code the penciled in light/dark patterns into hex, and feed to a PROM programmer.

(People wishing to do this should contact me. I may be able to provide prom programming, adapter boards, and maybe even proms.)



HEX: 1C 22 4A 56 4C 20 1E 00 18 24 42 7E 42 42 42 00

P-E-T B-U-L-L-E-T-I-N-S

If you own a PET, you should have 10 bulletins from Commodore. To obtain copies of these bulletins you can call or write:

Manager, Software Customer Applications

Commodore Business Machines, Inc.  
901 California Ave.  
Palo Alto, CA 94304  
(415) 326-4000

*NO ANSWER*

3-11-78 JFGARRETT  
(415) 327-4030  
4031

No.	Description	No. of pages
1	PET CASSETTE FILES	29
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# Pet Memory Map

0000-0002 JUMP, USER ADDRESS  
 0005 CURSOR COLUMN  
 000A-005A BASIC INPUT BUFFER  
 005C BASIC INPUT BUFFER POINTER  
 005E CURRENT RESULT TYPE (FF)STRING (00)NUMERIC  
 005F " " " (80)INTEGER(00)FLOATING POINT  
 007A-007B START OF BASIC STATEMENTS  
 007C-007D START OF VARIABLE TABLE  
 007E-007F END OF VARIABLE TABLE  
 0080-0081 START OF AVAILABLE SPACE  
 0082-0083 BOTTOM OF STRINGS (MOVING DOWN)  
 0084-0085 TOP OF STRINGS (MOVING DOWN)  
 0086-0087 TOP OF MEMORY ALLOCATED FOR BASIC WORKING AREA  
 0088-0089 CURRENT PROGRAM LINE NUMBER  
 008A-008B " " " " SAVED BY END  
 008C-008D " " POINTER SAVED BY END  
 0092-0093 DATA STATEMENT POINTER  
 0094-0095 CURRENT VARIABLE SYMBOLS  
 0096-0097 CURRENT VARIABLE STARTING POINT  
 00A0-00AF POINTER ASSOCIATED WITH BASIC BUFF TRANSFER  
 00B0 EXPONENT + \$80  
 00B1 MANTISSA MSB  
 00B2 " " } (FLOATING POINT ACCUMULATOR)  
 00B3 " " }  
 00B4 " " }  
 00B5 " " }  
 00B5 SIGN OF MANTISSA (0 IF ZERO)(+ IF POS.)(- IF NEG)  
 00B9-00C0 DYADIC HOLDING AREA  
 00C2- START OF ROUTINE FOR FETCHING NEXT BASIC CHARACTER  
 00C9-00CA PROGRAM POINTER  
 -00D9 END OF CHARACTER FETCH  
 00E0 SCREEN POSITION ON LINE  
 00E1-00E2 POSITION OF LINE START  
 00E3-00E4 CURRENT TAPE BUFFER POINTER  
 00E5-00E6 END OF CURRENT PROGRAM  
 00EA QUOTE MODE (00 IF NOT IN QUOTE)  
 00EE NUMBER OF CHARACTERS IN FILE NAME  
 00EF GPIB FILE #  
 00F0 GPIB COMMAND  
 00F1 GPIB DEVICE #  
 00F1-00F4 START OF TAPE BUFFER  
 00F5 CURRENT SCREEN LINE #  
 00F6 RUNNING CHECKSUM OF BUFFER  
 00F7-00F8 POINTER TO PROGRAM DURING VERIFY, LOAD  
 00F9-00FA FILENAME STARTING POINTER  
 00FC SERIAL WORD  
 00FD NUMBER OF BLOCKS REMAINING TO WRITE  
 00FE SERIAL WORD BUFFER  
 00FF BASIC

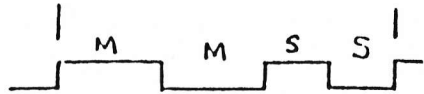
0200-0202 CLOCK H.M.S.  
 0203 MATRIX COORDINATE OF LAST KEY DOWN(255 IF NONE)  
 0204 SHIFT KEY STATUS (1 IF DOWN )  
 0205-0206 JIFFY CLOCK  
 0207 CASSETTE 1 ON SWITCH  
 0208 CASSETTE 2 ON SWITCH  
 0209 KEYSWITCH PIA  
 020B LOAD 0, VERIFY 1  
 020C STATUS  
 020E REVERSE VIDEO  
 020F-0218 KYBD INPUT BUFFER  
 0219-021A HARDWARE INTERRUPT VECTOR  
 021B-021C BREAK INTERRUPT VECTOR  
 0223 KEY IMAGE  
 0225 CURSOR TIMING  
 0228 TAPE WRITL  
 0242-024B LOGICAL NUMBERS OF OPEN FILES  
 024C-0255 DEVICE NUMBERS OF OPEN FILES  
 0256-025F R/W MODES OF OPEN FILES (COMMAND TABLE)  
 0262 GPIB TABLE LENGTH  
 0265 PARITY  
 0268 POINTER IN FILENAME TRANSFER  
 026C SERIAL BIT COUNT  
 0270 TAPE WRITE COUNTDOWN  
 0273 LEADLR COUNTER  
 0275 0 IF FIRST HALF BYTE MARKER NOT WRITTEN  
 0276 0 IF SECOND " " " " " "  
 0279 CHECKSUM WORKING WORD  
 027A-0279 BUFFER FOR CASSETTE #1  
 033A-03F9 " " " " #2  
 0400 START OF BASIC STATEMENTS  
 -1FFF END OF AVAILABLE RAM (8K VERSION )  
 -7FFF END OF AVAILABLE RAM EXPANSION  
 8000-8FFF VIDEO RAM  
 9000-BFFF AVAILABLE ROM EXPANSION AREA  
 C000-E080 MICROSOFT "8K" BASIC  
 E085-E27D SYSTEM SET UP  
 E294-E66A VIDEO DRIVER  
 E668-E694 INTERRUPT HANDLER  
 E685-E75B CLOCK UPDATE, KYBD SCAN(60HZ INT.)  
 E75C-E7D4 KYBD ENCODING TABLE  
 E800-EFFF PIA'S  
 F086-F226 GPIB HANDLER  
 F346-F82C FIDE CONTROL  
 F82D-FD15 TAPE CONTROL  
 FD38-FFB2 DIAGNOSTICS  
 FFC0-FFEC JUMP VECTORS  
 FFFA-FFFF 6502 INTERRUPT VECTORS ( NMI NOT USED IN ORIG VERSIONS)

PET TAPES

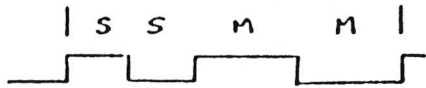
KHL 1/21/78 ①

THE PET ENCODES TAPES IN "Ø RMS"

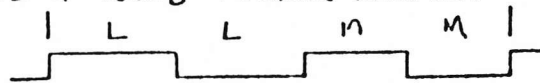
A 1 LOOKS LIKE SO:



A Ø LIKE SO

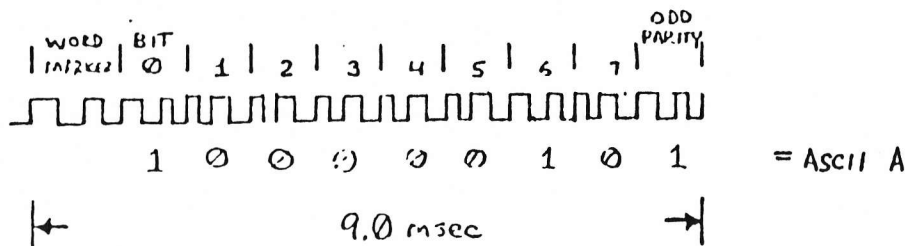


AND A WORD MARKER LIKE SO:



L = LONG =  $336 \pm 5 \mu\text{sec}$  half cycle 1.49 KHZ  
 S = SHORT =  $176 \pm 5 \mu\text{sec}$  " 2.84 KHZ  
 M = MEDIUM =  $256 \pm 5 \mu\text{sec}$  " 1.9 KHZ 2.315 KHZ

THE PET ENCODES WORDS LIKE SO



THE BLOCK END MARKER IS ONE CYCLE OF LONGS, FOLLOWED BY LEADER.

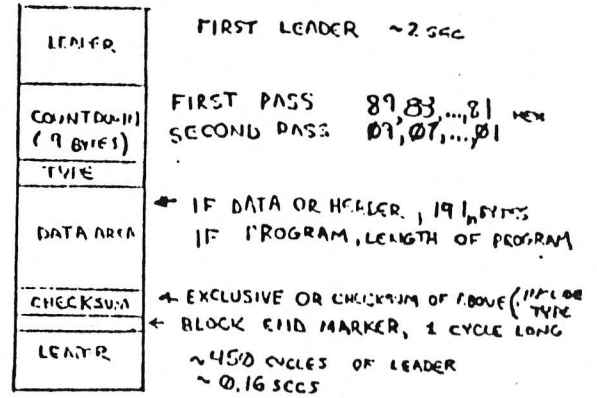
LEADER IS USUALLY OVER 50 CYCLES OF SHORTS.

PROGRAM TYPE FILE

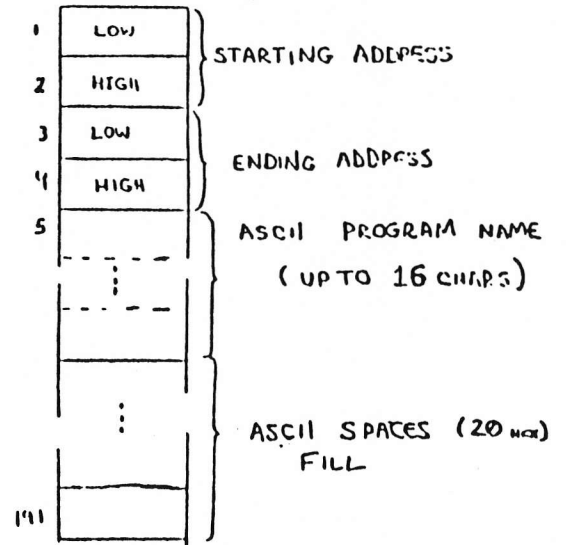
- HEADER 192 BYTES TYPE ①
- REPEATED HEADER TYPE ①
- PROGRAM (ONE LONG BLOCK) TYPE ②
- REPEATED PROGRAM TYPE ②
- END 192 BYTES TYPE ⑤
- REPEATED END TYPE ⑤
- DATA TYPE FILE
- HEADER 192 BYTES TYPE ④
- REPEATED HEADER TYPE ④
- DATA BLOCK 192 BYTES TYPE ②
- REPEATED DATA BLOCK TYPE ②
- DATA BLOCK (SPACE FILL) TYPE ②
- REPEATED DATA BLOCK TYPE ②
- END TYPE ⑤
- REPEATED END TYPE ⑤

KHL 1/27/78 ②

ALL BLOCK TYPES



DATA AREA FOR HEADER AND END BLOCKS TYPE 1, 4, 5



REPEATED BLOCKS ALLOW ERROR CORRECTION

P-E-T S-T-O-P D-I-S-A-B-L-E

At the third P.U.G. meeting, Arthur Luehrmann, Director of the Computer Project at the Lawrence Hall, presented a challenge to programmers for stop disable software that would prevent a user, in the Hall's case, the general public, from breaking out of canned programs. The challenge was met by Richard Tobey and Commodore. Richard's program does more than just disable the stop key and can handle the User Port. Both programs replace the interrupt handler. Richard's program does not have a loader, so here is a general Hex loader with his Hex data:

```
REM ****HEX LOADER****P.ROWE****
REM ****LOADS HEX BYTES INTO****
REM **** PET RAM FROM DATA. ****
```

```
REM **** FORMAT OF DATA: ****
REM line number DATA starting decimal RAM address
REM line number DATA hex byte, hex byte, hex byte, ...
REM line number DATA ..., hex byte, *
```

```
100 READ L (read starting address, decimal)
110 READ A$:C=LEN(A$):IF A$="" THEN END
120 IF C<1 OR C>2 THEN 200
130 A=ASC(A$)-48:B=ASC(RIGHT$(A$,1))-48
140 N=B+7*(B>9)-(C=2)*(16*(A+7*(A>9)))
150 IF N<0 OR N>255 THEN 200
160 POKE L,N:L=L+1:GOTO 110
200 PRINT "BYTE";L;"=[";A$;"] ???":END
```

```
1000 DATA 832
1010 DATA 78,A9,63,8D,19,02,A9,03
1020 DATA 8D,1A,02,58,60,78,A9,85
1030 DATA 8D,19,02,A9,E6,8D,1A,02
1040 DATA 58,60,A9,00,48,48,48,48
1050 DATA 4C,85,E6,AD,4D,E8,29,02
1060 DATA F0,13,AD,41,E8,AE,0D,02
1070 DATA 9D,0F,02,E8,E0,0A,D0,02
1080 DATA A2,00,8E,0D,02,20,5A,03
1090 DATA EA,A9,FF,8D,09,02,4C,7E
1100 DATA E6,*
```

Richard Tobey's Interrupt Handler  
(NOTE: This program only loads the code. See Richard's article for how to use it.)

```
1000 REM COMMODORE DISABLE STOP 1.3
1010 GOSUB 10000
1020 SYS(832):PRINT "clrNOW STOP IS DISABLED"
1030 FOR I=1 TO 50
1040 GET A$:IF A$="" THEN 1040
1050 PRINT A$;
1060 NEXT I
1070 SYS(848):PRINT "NOW STOP IS ENABLED"
1080 GET A$:IF A$="" THEN 1080
1090 PRINT A$;:GOTO 1080
```

```
10000 REM SUBROUTINE TO LOAD MACHINE CODE
10010 REM INTO SECOND CASSETTE BUFFER
10020 FOR I=832 TO 874:READ W:POKE I,W:NEXT
10030 RETURN
10040 DATA 120,169,96,141,25,2,169,3
10050 DATA 96,0,0,0,120,169,133,141
10060 DATA 25,2,169,230,141,26,2,88
10070 DATA 96,0,0,0,32,234,255,169
10080 DATA 255,141,9,2,76,136,230,0
```



HOW TO MAKE THE PET INTERRUPT ROUTINE WORK FOR YOU.

RECAP. During normal operation the PET is interrupted 60 times a second. Amongst other things the interrupt routine updates the display, scans the keyboard and increments the timer.

The interrupt handler in ROM includes a Jump Indirect instruction through RAM which can be modified to point to special User Code.

Several useful features can be added to the PET by adding to the interrupt handling code. Two examples follow:

- a) Extra pre-interrupt code allows parallel input from the User Port.
- b) Extra post-interrupt code suppresses the action of the Stop Key.

A generalized machine code program allowing both pre- and post code is shown in Figure 1 (next page).

The sections of code work together as follows:

Routine XPTON changes the pointer in RAM at 0219, 021A to point to the User Code (labelled PRECODE) instead of the normal interrupt handler in the PET operating system.

Routine XPTOFF changes the pointer back, and should be called before using the cassette.

Routine STAKADJ works in conjunction with the JSR STAKADJ instruction at the end of the PRECODE to make a "pseudo-interrupt" that causes a return to user code section POSTCODE, at the end of the PET interrupt handler, rather than to the originally interrupted program. The JUMP RESTORE instruction at the end of POSTCODE passes execution to the Restore and RTI instructions, corresponding to the original interrupt.

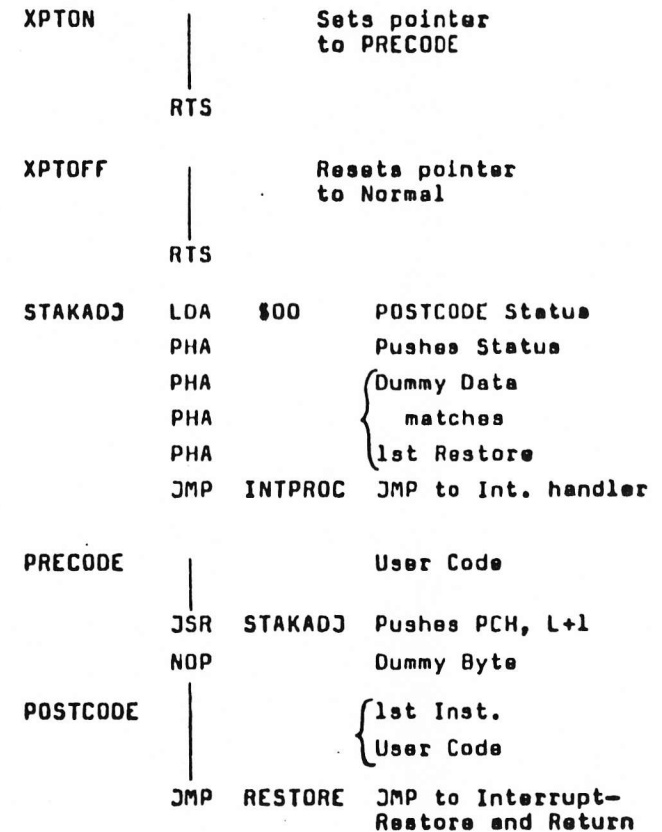


Figure 1.

The actual code in Figure 2 performs one pre-interrupt and one post-interrupt function. (See page 4)

The PRECODE polls the User Port CA1 as a strobe and then loads the User Port PA0 to 7 into the display input buffer as if from the keyboard. This technique is useful for attaching an external keyboard or paper tape reader.

The POSTCODE suppresses the Stop Key Flag from being set (FE into 0209). This technique is useful in a student learning application to prevent breaks in program control when the STOP key is hit accidentally.

The program should be loaded, then the XPTON program is called from Basic by an SYS (832). To resume standard operation, or prior to a cassette Save or Load, call SYS (845) from Basic.

The PRECODE routine shown polls the User Port every interrupt (60 times per second) and assumes normal initialization of the PIA, i.e. CA1 negative edge sets the flag and PA0 to 7 are inputs.

If the PRECODE only is required, then it can be terminated by JMP INTPROC and the POSTCODE is not needed.

If the POSTCODE only is required, the STAKADJ routine must be present and the JSR STAKADJ must still exist in PRECODE.

0340	78	XPTON	SEI		
1	A9,63		LDA	-\$63	Sets Pointer
3	8D,19,02		STA	\$0219	to PRECODE
6	A9,03		LDA	-\$03	
8	8D,1A,02		STA	\$021A	
8	58		CLI		
C	60		RTS		
D	78	XPTOFF	SEI		
E	A9,85		LDA	-\$85	Resets Pointer
0350	8D,19,02		STA	\$0219	to Normal
3	A9,E6		LDA	-\$E6	
5	8D,1A,02		STA	\$021A	
8	58		CLI		
9	60		RTS		
A	A9,00	STAKADJ	LDA	-\$00	
C	48		PHA		Pseudo Interrupt
D	48		PHA		(After JSR)
E	48		PHA		
F	48		PHA		
0360	4C,85,E6		JMP	INTPROC(E685)	
3	AD,4D,E8	PRECODE	LDA	IFR (E84D)	Tests
6	29,02		AND	-\$02	CA1 Flag
8	F0,13		BEQ	C1	if Zero, Exit
A	AD,41,E8		LDA	ORA (E841)	Load User Port
D	AE,00,02		LDX	\$0200	
0370	9D,0F,02		STA	\$020F,X	Store in
3	EB		INX		Keyboard
4	E0,0A		CPX	-\$0A	Buffer,
6	D0,02		BNE	C2	Adjust
8	A2,00		LDX	-\$00	Index
A	8E,00,02	C2	STX	\$0200	
D	20,5A,03	C1	JSR	STAKADJ	Begin Pseudo
0380	EA		NOP		Interrupt
1	A9,FF	POSTCODE	LDA	-\$FF	Return Here
3	8D,09,02		STA	\$0209	Kill Stop Key
6	4C,7E,E6		JMP	RESTORE(E67E)	Flag
9					Exit to Origine
					Program

Figure 2.



### THE ZOL MODIFICATION KIT

This little board allows you to install a Z-80 processor board into a Processor Technology SOL-20. The user must supply a Z-80 board from Cromenco. At press time we are working on getting it going with a Jade Co./Ithaca Audio Z-80 board as well. The ZOL Mod Kit includes a comprehensive manual and sells for \$29.95. It's available now.

### THE MUSIC CASSETTE

Here are 7 new selections for your Processor Technology Music System. You get the complete source for the Star Wars Theme, a 2 Part Invention and a Fugue by Bach, the Flight of the Bumble Bee, a rockin' Boogie Woogie tune, the Minute Waltz by Chopin and a fantastic interpretation of a Scott Joplin piece called The Easy Winners. Supplied in CDS format, the Music Cassette has something to please everybody. It sells for \$19.95 and it's available now.

### THE PETSQUEAK

The PETSQUEAK is a great addition to your PET Computer. Ever noticed how long it takes to load tapes? Tired of watching the screen waiting for READY? Well, the PETSQUEAK will automatically beep when a file header is found or written, and will also beep when the program has finished being loaded or saved. The PETSQUEAK can also be beeped under program control for interactive audible feedback applications. It comes assembled and tested, installs in under a minute and costs only \$19.95. It's available now.

### THE PET-TUNE-YA

If you haven't already guessed, the PET-TUNE-YA is a music board for the PET. It uses the User Port and is actually a high quality 8 bit digital to analog convertor. Our software (supplied) is what turns it into a music generator that can play up to four notes at once. Or you can use it as a DAC for graphics, control and other applications. The PET-TUNE-YA comes assembled and tested and includes a cassette of software. It sells for \$29.95 and will be available by mid-April, if not sooner.

### THE PET VIDEO BUFFER

This board is actually a video combiner that allows conventional video monitors to be used with the PET for larger screen displays. This is particularly useful in classroom situations. It plugs onto the User Port and provides a standard composite video signal out. It comes assembled and tested for \$19.95 and will be available in mid-April.

### THE PET'S MEMO

The PET'S MEMO is short for the PET's Memory Motherboard and is a super simple S-100 bus interface for the PET. What we mean by super simple is that we emulate only enough S-100 signals to allow memory expansion of the PET. It has it's own built in 8 slot motherboard with active terminations and will plug right up against the side of the PET. Like we said, it's super simple but that means low cost to you. No exact price has been established yet, but you can be sure it will be quite reasonable. Available third quarter of 1978.

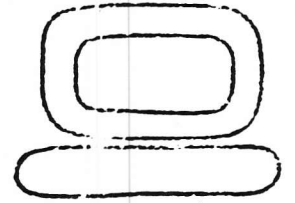
### ORDERING INFORMATION

There is an order form on the back of this page that you may use to order any of our products direct from us, or our products are generally available in your local computer store. We accept Mastercharge, and Visa/BankAmericard orders as well as check or money order. Please feel free to phone us at (615)457-7598 if you have any questions or to place an order.

# 14 MORE PET PRODUCTS



# EXPANDAPET



Mounts  
INSIDE  
or  
OUTSIDE

UP TO 32K RAM  
UP TO 4K EPROM  
2 I/O PORTS — 20 LINES  
S-100 I/O DRIVERS

For the  
COMMODORE  
PET  
or KIM

- Very low power consumption — 32K of RAM dissipates less than 4K of PET RAM.
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- Low power schottky buffering — Expansion port still available.

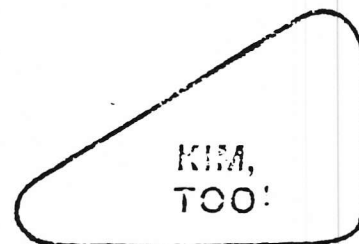
**SYSTEM COMES BUILT AND TESTED WITH:** (Introductory Price \$335.00)

- 16K Low Dissipation RAM
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(408) 733-0688



# Forethought Products

P.O. Box 8066 ☐ Coburg, OR 97401  
(503) 485-8575

Preliminary Information  
February 1978

## ANNOUNCING ...

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### THE PET TO S-100 INTERFACE/MOTHERBOARD

#### FEATURES:

Four slot S-100 motherboard with complete interface circuitry contained ON BOARD. No additional cables, interfaces, back-planes, etc. needed for operation.

On-board DYNAMIC MEMORY CONTROLLER allows use of the new S.D. Sales EXPANDORAM high density (to 32K) / low power memory! Permits full expansion of PET's RAM with a single S-100 slot. And, dynamic memory used with Petsi does not reduce PET's speed in any way.

On-board sockets and decoding circuitry for 8K PROM (2716's) allow easy expansion to additional system firmware as it becomes available.

Single plug-in connection to PET for instant set-up. No internal jumpers or modifications of any kind are needed.

Compact 10" X 5 1/2" size leaves plenty of your work area free.

Complete Petsi interface logic allows use of virtually all S-100 boards including I/O addressed as well as memory addressed boards.

Carefully designed circuit board (with kit builders in mind), complete assembly and operating manual and sockets for all IC's insure trouble-free assembly (and more time to spend with your PET).

#### AVAILABILITY:

With first shipments beginning April 10, 1978, you won't have to wait long for complete expansion for your PET. Orders made after April 10 will be shipped from stock (delays of 2-4 working days may be present for assembled units).

#### PRICE-

PETSI KIT- Circuit board, all components, one 100 pin connector, and complete assembly/operating instructions.

#PETS14-K \$105.00

PETSI ASSEMBLED- Petsi board, FOUR 100 pin connectors (soldered in place), operating instructions, and six month warranty.

#PETS14-A \$160.00

EXPANDORAM - Expandable low power memory board. 8K to 32K RAM on a single S-100 board. Draws only 400ma with 32KI

	KIT		ASSEMBLED
8K	#EXPRAM-K8	\$151	
16K	#EXPRAM-K16	259	
24K	#EXPRAM-K24	364	#EXPRAM-A24 \$414
32K	#EXPRAM-K32	475	#EXPRAM-K32 \$25

NOTE: Maximum additional RAM usable is 32K for 4K PETS and 24K for 8K PETS.

.....  
**SPECIAL !!!** Order a Petsi board along with an EXPANDORAM board and we'll give you the Petsi for \$85! The offer stands for any one of the EXPANDORAMS above, kit or assembled (offer good for limited time only).  
 .....

#### FINE PRINT -

Payment may be made by check (in US funds), VISA / Mastercharge, or COD. Phone orders can be placed at (503) 485-8575 from 10-5 daily (Pacific Coast Time). Add 2% shipping (within USA), WE PAY SHIPPING CHARGES WHEN CHECK OR MONEY ORDER ACCOMPANIES ORDER. Please use street address, we ship via UPS whenever possible.



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**INTRODUCTORY SPECIAL:** Play POKER against your computer. Match wits to corner ONE QUEEN on a graphic chessboard. Enrich your KINGDOM amid wars, famine, earthquakes, assassinations, etc. Test your bravery as a MATADOR in a bullring. Nearly 1000 lines of BASIC. 33% discount price until March 31 for all four .....\$9.95

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**6502 ASSEMBLER IN BASIC** (for PET only): Accepts all standard 6502 instruction mnemonics, pseudo-ops, and addressing modes plus new TEXT pseudo-op. Evaluates binary, octal, hex, decimal, and character constants, symbols and expressions. Uses PET line number and cursor editing features for assembler source code. Supports execution of assembled programs with keyboard and display I/O. Fully documented and easily understood and modified ..... \$24.95

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Card No. \_\_\_\_\_

Expir. Date \_\_\_\_\_ Code Above Name \_\_\_\_\_

Signature \_\_\_\_\_

My computer is a PET  TRS-80  \_\_\_\_\_ K RAM

Its serial number is \_\_\_\_\_ (on rear side of PET, or underside of TRS-80)

Date Ordered \_\_\_\_\_ Date Arrived \_\_\_\_\_

**Personal Software™**

Side A PET	Program Name	Side B TRS-80
_____	KINGDOM	_____
_____	ONE QUEEN	_____
_____	MATADOR	_____
_____	POKER	_____

**Personal Software™**

Side A PET	Program Name	Side B TRS-80
_____	ART AUCTION	_____
_____	MONSTER CHASE	_____
_____	LOST TREASURE	_____
_____	GONE FISHING	_____
_____	SPACE FLIGHT	_____
_____	FOREST FIRE	_____
_____	NAUTICAL NAV	_____
_____	BUSINESS MGT	_____
_____	RARE BIRDS	_____
_____	DIAMOND THIEF	_____

**Using This Cassette**

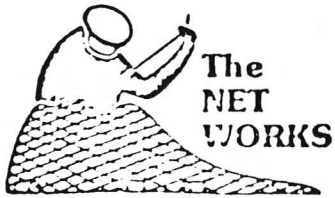
Congratulations on your purchase of this prerecorded **Personal Software™** cassette. We hope you'll find these game programs both entertaining and educational. Complete instructions for using each program will be displayed when the program is run.

This cassette includes versions of each program for both the Commodore PET (Side A) and the Radio Shack TRS-80 (Side B) computers. Enclosed you'll find a program index card which you can cut out and insert in the plastic cassette case. The card lists the programs in the order in which they appear on tape, with space for you to fill in the index counter settings where each program is found. (Due to variations in cassette manufacture, duplication and playback, we cannot predict the exact index counter settings where you'll find the programs on your recorder.) PET users can also search for the programs under the names listed on the card.

When loading the programs, be willing to experiment a little. On the TRS-80, try adjusting the volume control until you see the familiar pattern of one and two asterisks on the screen. If your recorder has a tone control, try it at the maximum, minimum and middle settings. On the PET it's possible that a program will be missed on one search but found on the next try. Due to apparent hardware differences among PETs, in some cases one unit will be unable to read a cassette which is read perfectly by another.

If, after several tries, you are unable to load the programs successfully, please mail the cassette back to us with a brief note describing the trouble you had and giving the serial number of your unit (on the rear side of the PET, or the underside of the TRS-80). We will send you a replacement cassette which should have a higher probability of loading successfully. If you're very anxious to get another cassette, call us at (617) 783-0694 and we'll try to help.





# TNW 488/103 LOW SPEED MODEM



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## TNW 488/103 LOW SPEED MODEM

- EXCHANGE SOFTWARE OVER THE TELEPHONE
- PLAY COMPUTER-TO-COMPUTER GAMES
- USE YOUR COMPUTER AS A TERMINAL
- HAVE YOUR COMPUTER DIAL YOUR CALLS
- WORKS WITH COMMODORE PET (Or other IEEE 488 capable computer)
- AUTO ORIGINATE, ANSWER, DIAL

### CAPABILITIES (Software selected/enabled)

Auto Originate/Answer  
 Pulse dialing (timing provided by software)  
 Status word returned by unit includes direct energy envelope (energy on the telephone line, low-pass filtered), so software can, by timing, distinguish "busy" (.5 sec on, .5 sec off) from "no answer" (2 sec on, 4 sec off)  
 Baud rate: 75, 110, 150, 300, or 600 bps (filter optimized for 300 bps)  
 Character length: 5, 6, 7, or 8 bits  
 Number of stop bits: 1, 1.5, or 2  
 Parity: even, odd, or mark  
 Space disconnect: long or short  
 Transmit break  
 Error detection: parity, overrun, and framing  
 SRQ Enable: settable independently for telephoning, character received, and/or ready to accept character for transmission

### MODEM

Follows standard of Bell 103 Frequency Shift Keyed (FSK) modem.  
 (This is THE standard low speed telephone modem convention in the United States.)  
 Digital modulation and demodulation (no adjustments)  
 Transmit level adjustable  
 Receive sensitivity -42 dBm

### TELEPHONE INTERFACE

Directly to a "CBT" type Data Access Arrangement (available from the phone company) or equivalent.  
 (Interface to "CBS" is optional; see below)

### SYSTEM INTERFACE

IEEE Standard Digital Interface for Programmable Instrumentation (IEEE 488-1975) EXCEPT that a 24 pin edge connector is used, with the same pin assignments as on the ribbon connector specified by the specification (same as on Commodore PET). Provides IEEE capabilities SH1, AH1, T2, L2, SR1, and Selective Device Clear.

### POWER REQUIREMENT

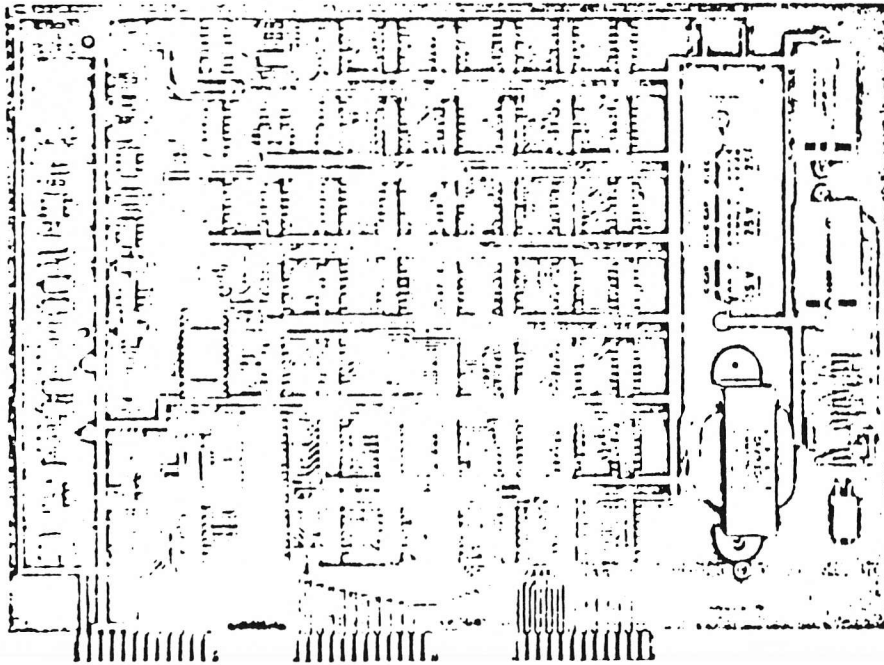
Ordinary 115V 60Hz (power cord included). Power supplies for +5, +12, and -12 VDC are provided on the card.

### IMPLEMENTATION

A single 8" x 11" double-sided circuit board. Employs TR1602 UART and Motorola MC6860 modem chip. IEEE 488 interface is implemented in low power Schottky (LS) TTL SSI/MSI.

### OPTIONS

Available as assembled and tested board with documentation and 90 day warranty (\$320) or as bare board (no components) with documentation (\$60)  
 Cabinet (\$35)  
 Interface to "CBS" type Data Access Arrangement (\$10)  
 IEEE 488 Interface cable (1 meter long, "PET style" connectors) (\$20)  
 Telephone interface cable (6 meters long) (\$15)



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ADDRESS _____	INTERFACE TO "CBS" TYPE DATA ACCESS ARRANGEMENT	___ \$ 10.00 ___
CITY, STATE _____ ZIP _____	TNW488/103 MODEM MODULE (BARE BOARD & DOCUMENTATION)	___ \$ 60.00 ___
TELEPHONE _____	CABINET (FOR TNW488/1030)	___ \$ 35.00 ___
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<input type="checkbox"/> 25% PARTIAL PAYMENT ENCLOSED (SHIPMENT COD)	TELEPHONE INTERFACE CABLE (6 METERS LONG)	___ \$ 15.00 ___
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