

BackPack

Standard Features:

- Full power to PET/CBM for a minimum of 15 minutes
- Installs within PET/CBM cabinet
- No wiring changes necessary
- Batteries recharged from PET/CBM integral power supply

Specifications:

- **Physical Size:** 5.5" x 3.6" x 2.4"
- **Weight:** 4.5 lbs.
- **Time to reach full charge:** 16 hours
- **Duration of outputs:** Minimum of 15 min.
- **Voltages:** +16, +9, -12, -9
- **Battery Life Expectancy:** 3 to 5 years
- **Battery On-Off Switch**

For Use With:

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

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BackPack comes fully assembled and tested. Instructions included.

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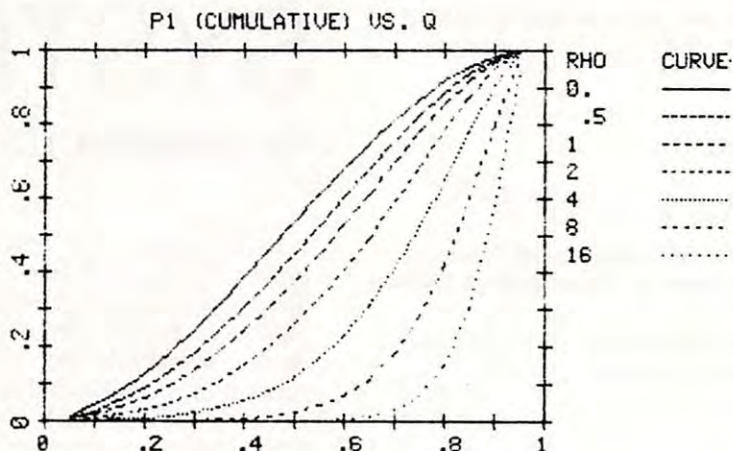
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P1 (CUMULATIVE) FOR K = 4, N = 2

Q	ALPHA = 0.	.125	.25	.5	1	2	4
	RHO = 0.	.5	1	2	4	8	16
.05	.01425	.009084	.005788	.002348	.000384	.000010	0.
.1	.04125	.027168	.017882	.007733	.001437	.000048	0.
.15	.0795	.054073	.036744	.016922	.003556	.000152	0.
.2	.1275	.089520	.062769	.030748	.007286	.000393	.000001
.25	.18375	.133113	.096259	.050097	.013354	.000905	.000003
.3	.24675	.184334	.137399	.075886	.022702	.001920	.000012
.35	.315	.242528	.186226	.109026	.036524	.003843	.000036
.4	.387	.306890	.242600	.150374	.056293	.007343	.000105
.45	.46125	.376454	.306162	.200670	.083772	.013505	.000294
.5	.53625	.450075	.376292	.260451	.120989	.024037	.000789
.55	.6105	.526417	.452062	.329933	.170164	.041539	.002047
.6	.6825	.603934	.532179	.408871	.233544	.069831	.005153
.65	.75075	.680856	.614922	.496369	.313095	.114267	.012580
.7	.81375	.755166	.698075	.590643	.409995	.181859	.029745
.75	.870000	.824586	.778845	.688731	.523808	.280823	.067864
.8	.918000	.886549	.853775	.786115	.651201	.418694	.148293
.85	.956250	.938185	.918646	.876272	.784011	.597341	.305922
.9	.983250	.976292	.968362	.950105	.906358	.801642	.578264
.95	.997500	.997315	.996833	.995255	.990437	.975744	.928547

Figure 3



PE FOR K = 4, N = 2

M	ALPHA = 0.	.125	.25	.5	1	2	4
	RHO = 0.	.5	1	2	4	8	16
2	.509553	.454439	.408615	.338910	.259034	.218670	.288887
4	.759892	.708395	.661886	.582550	.469299	.362902	.359455

8 bytes, 6 or 7 bits high. These routines are made available in this manner in case you would like to mix text and graphics in a more sophisticated manner than a simple dump.

Following the transfer vector is the data area. The values here specify how the Visible Memory is to be dumped and where it is. SDUMP is assembled to work with the 460 Paper Tiger, but by making the changes described in lines 25-27, the code will work on the Paper Tiger 440. Presumably, with similarly minor changes, SDUMP will also work on the newest Paper Tiger, the 445.

The following should be noted about SDUMP and its use: The only code in SDUMP that is specific to a particular version of BASIC is that in OUTCH, lines 235-280. This code was given to me

by Greg Yob — thanks Greg. It outputs the character in the ACC directly to the device whose number is in RDEV, at location \$600E in the data area. Because this code bypasses the PET's file system and directly accesses the IEEE-488 routines, the device does not even have to be opened.

Each routine in SDUMP checks to see if the stop key is pressed, using the routine STOPTS at lines 281-292. If so, the routine quits and returns to the routine which called it. Because of the way the Paper Tigers enter and exit graphics mode, it is possible for them to be left in graphics mode when the stop key is pressed. If this happens, you will know it when it does, the easiest method of recovering is to turn the printer off, then on.

You should not have a CMD operation open

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```

4000 REM PLOT X IN (XA,XB) NX WIDE, Y IN (YA,YB) NY HIGH, KEY PK
4005 IF PK=0 THEN RETURN
4010 CLEAR
4060 CX=NX/(XB-XA):REM CONVERSION CONSTANTS
4070 CY=NY/(YB-YA)
4090 FOR JR=1 TO NR:REM GET THE DATA POINTS
4100 DOTL DO(JR,1),DO(JR,2)
4110 FOR JQ=1 TO NQ
4120 X=QS(JQ)
4130 IX=INT(.5+(X-XA)*CX)
4140 IF IX<0 THEN IX=0:REM MAKE SURE X OK
4150 IF IX>NX THEN IX=NX
4160 IX=IX+OX
4210 IF PK=1 THEN Y=DD(JQ,JR):REM PK=1 FOR P1 DENS DIST
4220 IF PK=2 THEN Y=CD(JQ,JR):REM PK=2 FOR P1 CUM DIST
4300 REM CONVERT Y LIKE X
4310 IY=INT(.5+(Y-YA)*CY)
4320 IF IY<0 THEN IY=0:REM FORCE ON PLOT
4330 IF IY>NY THEN IY=NY
4335 IY=IY+OY
4340 IF JQ=1 THEN MOVE IX,IY
4350 DRAW IX,IY
4480 NEXT JQ
4490 NEXT JR
4495 DOTL 1,0
4500 REM PRODUCE THE PLOT
4510 MOVE OX,OY:REM BORDER
4520 DRAW OX+NX,OY:DRAW OX+NX,OY+NY
4530 DRAW OX,OY+NY:DRAW OX,OY
4590 MOVE OX+NX/2-3*(LEN(PL$)+6),OY+NY+10
4592 CHAR PL$;" VS. Q"
4594 PL$=""
4600 REM DISPLAY RHO AND DOTS
4610 IX=OX+NX+10:IY=OY+NY-7
4620 MOVE IX,IY:CHAR "RHO" CURVE"
4630 FOR I=1 TO NR
4640 V=RS(I):GOSUB2002
4650 IY=IY-12:MOVE IX,IY
4660 CHAR V$
4670 DOTL DO(I,1),DO(I,2):LINE IX+42,IY+3,319,IY+3
4680 NEXT I
4690 DOTL 1,0
4700 REM DRAW A GRID
4702 TL=3:REM TIC LENGTH
4705 DX=.1:REM X GRID SPACING (ALWAYS)
4710 DY=10:REM Y SPACING - HAVE TO SEARCH
4715 IF YB/5<DY THEN DY=DY/10:GOTO4715
4720 EX=INT(XB/DX+.01):EY=INT(YB/DY+.01):REM POINTS ON GRID
4725 FX=1:IF EX>5 THEN FX=2:IF EX>10 THEN FX=5:IF EX>20 THEN FX=10
4730 FY=1:IF EY>5 THEN FY=2:IF EY>10 THEN FY=5:IF EY>20 THEN FY=10
4735 FOR I=0 TO EY:OZ=OY+I*DY*CY:LINE OX-TL,OZ,OX+TL,OZ:REM Y AXIS
4737 LINE OX+NX-TL,OZ,OX+NX+TL,OZ
4740 IF I=FY*INT(I/FY) THEN CHROT 1:MOVE OX-TL-5,OZ-3:CHAR MID$(STR$(I*DY),2)
4745 NEXT I
4750 FOR I=0 TO EX:OZ=OX+I*DX*CX:LINE OZ,OY-TL,OZ,OY+TL:REM X AXIS
4752 LINE OZ,OY+NY-TL,OZ,OY+NY+TL
4755 IF I=FX*INT(I/FX) THEN CHROT 0:MOVE OZ-3,OY-TL-10:CHAR MID$(STR$(I*DX),2)
4760 NEXT I
4900 REM PRODUCE THE PLOT
4910 PRINT:PRINT
4920 CMD3:REM REGULAR OUT TO THE SCREEN
4930 SYS(LP):REM THERE IT GOES
4940 CMD1:REM BACK TO THE PRINTER
4950 RETURN

```

Listing 1

to the Paper Tiger when SDUMP is called, because of the way this command is interpreted in the IEEE-488 system. To avoid this, open a unit to the screen (device 3) and switch to this unit before invoking SDUMP. For example:

```

OPEN 1,4:REM PRINTER FILE
OPEN 2,3:REM SCREEN FILE
CMD 1:REM OUTPUT TO PRINTER
.....

```

```

CMD 2:REM DIVERT OUTPUT
SYS(96*256):REM DUMP VISIBLE MEMORY
CMD 1:REM RESUME PRINTER OUTPUT

```

The byte in the data area called EORVAL (at \$6011) is exclusive-ored with each Visible Memory byte when it is accessed for dumping. This gives a visible indication of the progress of the dump which I find entertaining. It is actually an instance

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of Cohen's first law of interactive computing — "Always let the operator know that something is going on."

However, this leaves the screen reversed when the dump finishes. If you do not like this, there are (at least) two possibilities: (1) Set EORVAL to zero (\$00); the exclusive or will then not change anything. (2) If you are using the Keyword Graphics Package, follow the call to SDUMP with a 'SCFLIP 0,0,319,199'; this will reverse the whole screen, restoring its original condition.

To load SDUMP together with the MTU keyword Graphics Package, when reserving memory space, do a 'POKE 53,96' instead of 'POKE 53,98' for a 32K system, and similarly for smaller systems. This will reserve the two pages needed by SDUMP.

Listing 2

```

9100 REM MTU VISIBLE MEMORY TO IDS 460 PAPER TIGER SCREEN DUMP
9110 PRINT#U:REM SPACE
9120 PRINT#U,CHR$(3);:REM ENTER GRAPHICS MODE
9130 VM=256*PEEK(832):REM START OF VISIBLE MEMORY
9140 PVMEM
9142 GRSHRT
9145 S=7:REM ROWS PER GROUP
9150 FOR R0=0 TO 199 STEP S:REM S ROWS AT A TIME
9160 :R1=R0+S-1:REM END OF ROW GROUP
9170 :IF R1>199 THEN R1=199
9180 :FOR C=0 TO 39:REM A BYTE (8 BIT COLUMNS) AT A TIME
9190 : :FOR I=0 TO 7:REM CLEAR VALUES TO BE PRINTED
9200 : : :P(I)=0
9210 : :NEXT I
9220 : :V=VM+C:REM LOC OF BYTE
9225 : :P2=1:REM POWER OF 2 TO ADD
9230 : :FOR R=R0 TO R1:REM SCAN THE ROWS
9235 : : :PRINT C;R
9240 : : :B=PEEK(V):REM GET THE BYTE (8 BITS)
9250 : : :V=V+40:REM LOC OF BYTE BELOW
9260 : : :IF B=0 THEN 9315:REM FASTER IF EMPTY
9270 : : :M=1:REM MASK (2^(7-I))
9280 : : :REM ACCUMULATE VALUES FOR PRINTING
9290 : : :FOR I=7 TO 0 STEP -1
9295 : : : :IF (B AND M)<>0 THEN P(I)=P(I)+P2
9300 : : : :M=M+M
9310 : : :NEXT I
9315 : : :P2=P2+P2
9320 : :NEXT R:REM DO THE ROWS
9330 :REM NOW, PRINT THE 8 COLUMNS OF ROWS
9340 :FOR I=0 TO 7
9350 : :PRINT#U,CHR$(P(I));
9360 : :IF P(I)=3 THEN PRINT#U,CHR$(P(I));:REM 3 IS SPECIAL
9370 :NEXT I
9390 :NEXT C:REM END OF COLUMN LOOP
9400 :PRINT#U,CHR$(3);CHR$(14);:REM GRAPHICS LINE FEED/RETURN
9410 :VM=VM+S*40:REM DOWN S ROWS
9420 :NEXT R0:REM END OF ROW GROUP LOOP
9430 :PRINT#U,CHR$(3);CHR$(2):REM LEAVE GRAPHICS MODE
9439 :JX
9440 :VISMEM
9450 :RETURN:REM DONE

```

Listing 3

```

00001 0000 SDUMP.ASM - MTU TO IDS PAPER TIGER 460 (440) SCREEN DUMP
00002 0000
00003 0000 BY MARTIN J. COHEN, DECEMBER 1980
00004 0000
00005 0000 ANYONE WHO WANTS TO CAN USE THIS PROGRAM,
00006 0000 ALTHOUGH SOME ACKNOWLEDGEMENT WOULD BE APPRECIATED
00007 0000
00008 0000
00009 0000 APPROXIMATE TIME NEEDED TO DUMP VISIBLE MEMORY:
00010 0000
00011 0000 AT 1200 BAUD, 1 MIN, 30 SEC
00012 0000 AT 9600 BAUD, 45 SEC (WITH 3 MS DELAY SET BY NMSDLV, BELOW)
00013 0000
00014 0000 THE ACTUAL CPU TIME NEEDED IS ABOUT 3 SECONDS!!
00015 0000
00016 0000
00017 0000 * = $6000 ; TWO PAGES BELOW KGP CODE
00018 6000
00019 6000 4C 18 60 JMP OUTVM ; SKIP DATA AREA AND DUMP THE VIS MEM
00020 6003 4C 8D 60 JMP OUTROW ; OUTPUT ROW STARTING AT VM
00021 6006 4C DF 60 JMP OUTCOL ; OUTPUT A COLUMN OF 8 BYTES
00022 6009
00023 6009 DATA AREA ...
00024 6009
00025 6009 NOTE - TO RUN THIS ROUTINE ON A 440 INSTEAD OF A 460,
00026 6009 CHANGE THE FOLOWING VALUES AS INDICATED (VALUES IN DECIMAL):
00027 6009 RPFXC=0, RREP=33, RVAL=6, REND=2, RXGR=11.
00028 6009
00029 6009 14 RPFXC .BYTE 20 ; NUMBER OF BLANK PREFIX COLUMNS (440:0)
00030 600A 02 RPFXR .BYTE 2 ; NUMBER OF BLANK PREFIX ROWS
00031 600E 1C RREP .BYTE 28 ; MAIN REPETITION COUNT (440:33)
00032 600C 07 RVAL .BYTE 7 ; ROWS TO OUTPUT IN MAIN LOOP (440:6)

```


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```

00033 600D 04      ; ROWS TO OUTPUT AT END (440:2)
00034 600E        ; THE TOTAL NUMBER OF ROWS OUTPUT = RREP*RVAL + REND = 200
00035 600E 04      RDEV .BYTE 4      ; OUTPUT DEVICE
00036 600F 0E      RXGR .BYTE 14     ; GRAPHICS RETURN (440:11)
00037 6010 03      NMSDLY .BYTE 3    ; MS TO DELAY AFTER EACH BYTE
00038 6011 FF      EORVAL .BYTE $FF   ; VALUE TO EOR WITH SCREEN LOC ($FF TO
FLIP, 0 TO SKIP)
00039 6012 90      VMPAGE .BYTE $90   ; STARTING PAGE OF VISIBLE MEMORY
00040 6013        ;
00041 6013 00 00    VM .WORD 0        ; LOCAL STORAGE - LOC OF A VIS MEM ROW
00042 6015 28      BYTEPL .BYTE 40    ; BYTES PER VM LINE
00043 6016 00      RREPX .BYTE 0      ; STORAGE FOR REP COUNT
00044 6017 00      RVALX .BYTE 0      ; STORAGE FOR ROW COUNT
00045 6018        ;
00046 6018        ; OUTVM - OUTPUT THE WHOLE VISIBLE MEMORY
00047 6018        ;
00048 6018 AD 12 60 OUTVM LDA VMPAGE    ; SET LOC OF VM
00049 601E 8D 14 60 STA VM+1
00050 601E A9 00    LDA #0
00051 6020 8D 13 60 STA VM
00052 6023 AD 0B 60 LDA RREP        ; SET MAJOR REP COUNT
00053 6026 8D 16 60 STA RREPX
00054 6029 20 88 60 JSR ENTRGR      ; ENTER GRAPHICS MODE
00055 602C AE 0A 60 LDX RPFXR      ; SEE IF ANY PREFIX ROWS
00056 602F F0 06    BEQ OUTVM1
00057 6031 20 C5 60 OUTVM0 JSR OUTRET    ; IF SO, OUTPUT THEM
00058 6034 CA      DEX
00059 6035 D0 FA    BNE OUTVM0
00060 6037        ;
00061 6037        OUTVM1 = *
00062 6037 20 BA 61 JSR STOPTS      ; CHECK FOR STOP KEY
00063 603A B0 3A    BCS OUTVMF
00064 603C 20 B1 60 JSR OUTPFX      ; OUTPUT A LINE P
00065 603F AD 0C 60 LDA RVAL        ; SET ROW COUNT
00066 6042 8D 17 60 STA RVALX
00067 6045 20 8D 60 JSR OUTROW      ; OUTPUT A ROW
00068 6048 20 C5 60 JSR OUTRET      ; OUTPUT A RETURN
00069 604B AE 0C 60 LDX RVAL        ; SET VM = VM+RVAL*40
00070 604E 18      OUTVM2 CLC
00071 604F AD 13 60 LDA VM
00072 6052 6D 15 60 ADC BYTEPL
00073 6055 8D 13 60 STA VM
00074 6058 AD 14 60 LDA VM+1
00075 605B 69 00    ADC #0
00076 605D 8D 14 60 STA VM+1
00077 6060 CA      DEX
00078 6061 D0 EB    BNE OUTVM2
00079 6063        ;
00080 6063 CE 16 60 DEC RREPX      ; COUNT ROWS
00081 6066 D0 CF    BNE OUTVM1
00082 6068        ;
00083 6068 20 B1 60 JSR OUTPFX      ; START OF LAST ROW
00084 606B AD 0D 60 LDA REND        ; NUMBER OF ROWS
00085 606E F0 06    BEQ OUTVMF      ; SKIP IF NONE
00086 6070 8D 17 60 STA RVALX
00087 6073 20 8D 60 JSR OUTROW      ; THERE IT GOES
00088 6076        OUTVMF = *
00089 6076 20 C5 60 JSR OUTRET
00090 6079 20 7D 60 JSR EXITGR      ; LEAVE GRAPHICS MODE
00091 607C 60      RTS              ; DONE
00092 607D        ;
00093 607D        ; EXITGR - LEAVE GRAPHICS MODE
00094 607D        ;
00095 607D A9 03    EXITGR LDA #3
00096 607F 20 6D 61 JSR OUTCH
00097 6082 A9 02    LDA #2
00098 6084 20 6D 61 JSR OUTCH
00099 6087 60      RTS
00100 6088        ;
00101 6088        ; ENTRGR - ENTER GRAPHICS MODE
00102 6088        ;
00103 6088 A9 03    ENTRGR LDA #3
00104 608A 4C 6D 61 JMP OUTCH
00105 608D        ;
00106 608D        ; OUTROW - OUTPUT THE ROW POINTED TO BY VM, RVALX DEEP
00107 608D        ;
00108 608D AD 13 60 OUTROW LDA VM      ; SET WHERE TO START
00109 6090 8D D1 60 STA V

```



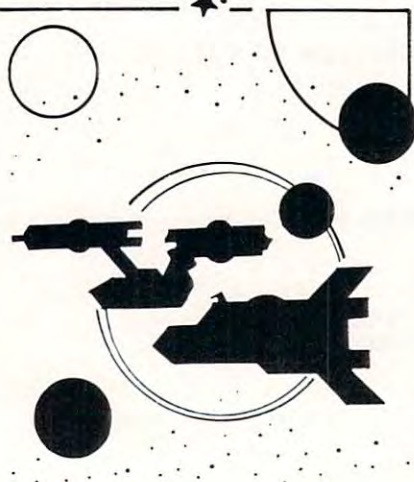
```

00110 6093 AD 14 60 LDA VM+1
00111 6096 8D D2 60 STA V+1
00112 6099 AE 15 60 LDX BYTEPL ; DO 40 COLUMNS
00113 609C AD 17 60 OUTR1 LDA RVALX ; SET DEPTH COUNT
00114 609F 8D D3 60 STA R
00115 60A2 20 DF 60 JSR OUTCOL ; OUTPUT THOSE 8
00116 60A5 EE D1 60 INC V ; BUMP LOC
00117 60A8 D0 03 BNE OUTR2
00118 60AA EE D2 60 INC V+1
00119 60AD CA OUTR2 DEX ; COUNT
00120 60AE D0 EC BNE OUTR1
00121 60B0 60 RTS ; DONE
00122 60B1 ;
00123 60B1 ; OUTPFX - OUTPUT RPFXC SPACES TO START LINE
00124 60B1 ;
00125 60B1 AE 09 60 OUTPFX LDX RPFXC
00126 60B4 F0 0E BEQ OUTPF2 ; CHECK FOR NONE
00127 60B6 20 7D 60 JSR EXITGR
00128 60B9 A9 20 LDA #32 ; LOAD THE SPACE
00129 60BB 20 6D 61 OUTPF1 JSR OUTCH ; OUTPUT IT
00130 60BE CA DEX ; UNTIL DONE
00131 60BF D0 FA BNE OUTPF1
00132 60C1 20 88 60 JSR ENTRGR
00133 60C4 60 OUTPF2 RTS ; THAT'S ALL
00134 60C5 ;
00135 60C5 ; OUTRET - OUTPUT A GRAPHICS RETURN
00136 60C5 ;
00137 60C5 A9 03 OUTRET LDA #3
00138 60C7 20 6D 61 JSR OUTCH
00139 60CA AD 0F 60 LDA RXGR
00140 60CD 20 6D 61 JSR OUTCH
00141 60D0 60 RTS
00142 60D1 ;
00143 60D1 ; OUTCOL - OUTPUT 8 COLUMNS OF BITS
00144 60D1 ;
00145 60D1 ; PARAMETERS (BELOW) ARE V AND R
00146 60D1 ;
00147 60D1 00 00 V .WORD 0 ; LOC IN VISIBLE MEMORY
00148 60D3 00 R .BYTE 0 ; NUMBER OF ROWS TO PROCESS
00149 60D4 PO * = *+8 ; RESULT TO OUTPUT
00150 60DC ;
00151 60DC 00 P2 .BYTE 0 ; POWER OF 2 BIT
00152 60DD 00 B .BYTE 0 ; STORAGE FOR A BYTE
00153 60DE 00 M .BYTE 0 ; A MASK
00154 60DF ;
00155 60DF PGZ = 1 ; PAGE ZERO LOCATION TO USE
00156 60DF ;
00157 60DF 48 OUTCOL PHA ; SAVE REGS
00158 60E0 8A TXA
00159 60E1 48 PHA
00160 60E2 98 TYA
00161 60E3 48 PHA
00162 60E4 A5 01 LDA PGZ ; SAVE PAGE ZERO AREA
00163 60E6 48 PHA
00164 60E7 A5 02 LDA PGZ+1
00165 60E9 48 PHA
00166 60EA 20 BA 61 JSR STOPTS ; SEE IF STOP PRESSED
00167 60ED B0 72 BCS MOVEPF ; IF SO, QUIT NOW
00168 60EF A9 00 LDA #0 ; ZERO P(0:7)
00169 60F1 A2 07 LDX #7
00170 60F3 9D D4 60 CLP2 STA PO,X
00171 60F6 CA DEX
00172 60F7 10 FA BPL CLP2
00173 60F9 ;
00174 60F9 A9 01 LDA #1 ; SET P2 TO 1
00175 60FB 8D DC 60 STA P2
00176 60FE AD D1 60 LDA V ; STORE VM LOC
00177 6101 85 01 STA PGZ
00178 6103 AD D2 60 LDA V+1
00179 6106 85 02 STA PGZ+1
00180 6108 A0 00 RLOOP LDY #0
00181 610A B1 01 LDA (PGZ)Y ; GET VM BYTE
00182 610C 8D DD 60 STA B ; SAVE IT
00183 610F 4D 11 60 EOR EORVAL ; REVERSE IT FOR SHOW
00184 6112 91 01 STA (PGZ)Y
00185 6114 A5 01 LDA PGZ ; POINT TO NEXT ROW
00186 6116 18 CLC
00187 6117 6D 15 60 ADC BYTEPL

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Get Fireworks From Your PET*!



TREK-X

TREK-X Command the Enterprise as you scour the quadrant for enemy warships. This package not only has superb graphics, but also includes programming for optional sound effects. A one-player game for the PET 8K. Order No. 0032P \$7.95.

DUNGEON OF DEATH

DUNGEON OF DEATH Battle evil demons, cast magic spells, and accumulate great wealth as you search for the Holy Grail. You'll have to descend into the Dungeon of Death and grope through the suffocating darkness. If you survive, glory and treasure are yours. For the PET 8K. Order No. 0064P \$7.95.

ARCADE I

ARCADE I This package combines an exciting outdoor sport with one of America's most popular indoor sports:

- **Kite Fight** — It's a national sport in India. After you and a friend have spent several hours maneuvering your kites across the screen of your PET, you'll know why!
- **Pinball** — By far the finest use of the PET's exceptional graphics capabilities we've ever seen, and a heck of a lot of fun to boot.

Requires an 8K PET. Order No. 0074P \$7.95.

CODE NAME: CIPHER

CODE NAME: CIPHER

Enjoy that same feeling of intrigue and discovery with the Code Name: Cipher package. Included are:

- **Memory Game** — Would you like to match your memory against the computer's? You can with the Memory Game.
- **Codemaster** — One player types in a word, phrase, or sentence, and the PET translates that message into a cryptogram. The other player must break the code and solve the cryptogram in the shortest time possible.
- **Deceitful Mindmaster** — This isn't your ordinary Mastermind-type game. You must guess the five letters in the hidden code word.
- **Code Breaker** — Cracking this code won't be as easy as cracking walnuts. You'll need to flex your mental muscles to win this game.

If you want a mental challenge, then Code Name: Cipher is for you. For the 8K PET. Order No. 0112P. \$7.95.

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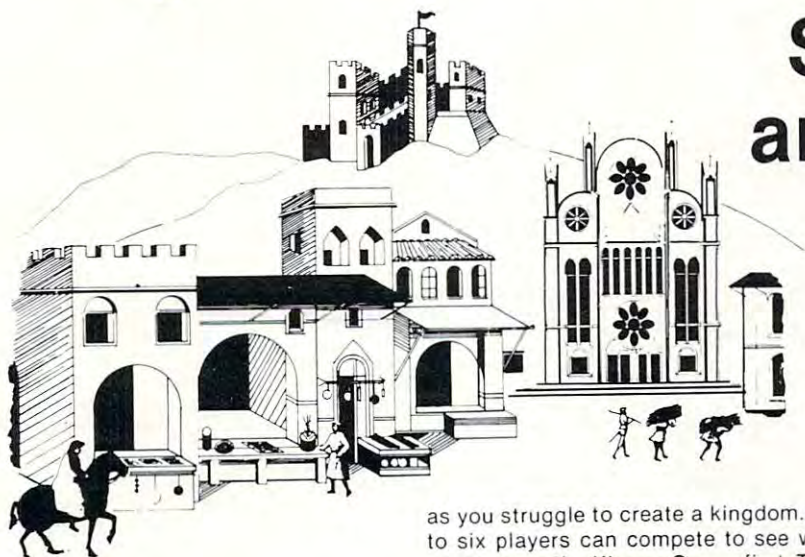
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SANTA PARAVIA AND FIUMACCIO
Become the ruler of a medieval city-state

as you struggle to create a kingdom. Up to six players can compete to see who will become the King or Queen first. This program requires a PET 16K. Order No. 0175P.\$9.95.

The most captivating and engrossing program ever made for the PET*

It is the dawn of the 15th Century; you rule a tiny Italian city-state. Your goal: The Crown!

Up to six players can compete as rulers of neighboring cities. You control the grain harvest, feed your serfs, set tax rates, dispense justice and invest in public works.

The future of your realm will depend on your decisions. If they are wise, your city-state will grow and you will acquire loftier titles. If your rule is incompetent, your people will starve and you may be invaded by your neighbors.

How will *you* rule your kingdom? Will you be an enlightened leader—or an unscrupulous despot? Only you can answer that question—with Santa Paravia and Fiumaccio.

CHIMERA

CHIMERA If you think the legendary Chimera was hard to handle, wait until you try the Chimera package. Included are:

- Reflex**—Round and round the little white ball rolls. Only fast reflexes can guide it into the center of the maze.
- Dragon**—You'll have to shoot down those pesky, fire-breathing dragons with your cannon. If you succeed your castle will be safe, if not it will mean a call to your fire insurance company. For one player.
- Dungeon**—A very punctual guard comes down to the dungeon every day to torture you. This means that you have only thirty seconds to dig your way under the castle to freedom. For one player.
- Dragon Hunt**—You must go forth and slay a fire-breathing dragon. The only thing that will protect you from the flames is your shield, if you know when to use it. For one player.
- Dropoff**—You must make your opponent's men "dropoff" the board by moving and firing your own men. For one or two players. Order No. 0110P. \$9.95.

PET DEMO I

PET DEMO I You can give yourself, your family, and your friends hours of fun and excitement with this gem of a package.

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- Chase**—You must find the black piece as you search through the ever-changing maze.
- Flying Pheasant**—Try to shoot the flying pheasant on the wing.
- Sitting Ducks**—Try to get your archer to shoot as many ducks as possible for a high score.
- Craps**—It's Snake Eyes, Little Joe, or Boxcars as you roll the dice and try to make your point.
- Gran Prix 2001**—Drivers with experience ranging from novice to professional will enjoy this multi-leveled race game.
- Fox and Hounds**—It's you against the computer as your four hounds try to capture the computer's fox.

For true excitement, you'll need a PET 8K. Order No. 0035P \$7.95.

DOW JONES

DOW JONES Up to six players can enjoy this exciting stock market game. You can buy and sell stock in response to changing market conditions. Get a taste of what playing the market is all about. Requires a PET with 8K. Order No. 0026P \$7.95.

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00188 611A 85 01      STA PGZ
00189 611C A5 02      LDA PGZ+1
00190 611E 69 00      ADC #0
00191 6120 85 02      STA PGZ+1
00192 6122
00193 6122 A9 01      LDA #1          ; SET MASK TO 1
00194 6124 8D DE 60    STA M
00195 6127 A2 07      LDX #7          ; FOR I = 7 TO 0 STEP -1
00196 6129 AD DD 60    ILOOP LDA B          ; IF B AND M (>) 0
00197 612C 2D DE 60    AND M
00198 612F F0 09      BEQ ILOOP1
00199 6131 BD D4 60    LDA PO,X          ; P(I)=P(I)+P2
00200 6134 0D DC 60    ORA P2
00201 6137 9D D4 60    STA PO,X
00202 613A 0E DE 60    ILOOP1 ASL M          ; SHIFT MASK LEFT
00203 613D CA          DEX          ; SEE IF DONE
00204 613E 10 E9      BPL ILOOP
00205 6140
00206 6140 0E DC 60    ASL P2          ; DOUBLE P2
00207 6143 CE D3 60    DEC R          ; SEE IF OUTER LOOP DONE
00208 6146 D0 C0      BNE RLOOP
00209 6148
00210 6148          ; OUTPUT PO(0:7)
00211 6148
00212 6148 A0 00      LDY #0
00213 614A 20 BA 61    MOVEP JSR STOPTS          ; SEE IF STOP PRESSED
00214 614D B0 12      BCS MOVEPF          ; IF SO, QUIT HERE
00215 614F B9 D4 60    LDA PO,Y
00216 6152 20 6D 61    JSR OUTCH          ; OUTPUT A CHARACTER
00217 6155 C9 03      CMP #3          ; SEE IF 3
00218 6157 D0 03      BNE MOVEP1
00219 6159 20 6D 61    JSR OUTCH          ; IF SO, DO IT AGAIN
00220 615C C8          MOVEP1 INY
00221 615D C0 08      CPY #8          ; ONLY DO 8
00222 615F D0 E9      BNE MOVEP
00223 6161
00224 6161 68          MOVEPF PLA          ; RESTORE PAGE ZERO AREA
00225 6162 85 02      STA PGZ+1
00226 6164 68          PLA
00227 6165 85 01      STA PGZ
00228 6167 68          PLA          ; RESTORE REGS
00229 6168 A8          TAY
00230 6169 68          PLA
00231 616A AA          TAX
00232 616B 68          PLA
00233 616C
00234 616C 60          RTS
00235 616D
00236 616D          ; OUTCH - OUTPUT A CHARACTER TO DEVICE RDEV
00237 616D
00238 616D          ; THIS ROUTINE WAS SUPPLIED BY GREG YOB - THANKS MUCH
00239 616D
00240 616D 8E B7 61    OUTCH STX OUTCHX          ; SAVE REGS
00241 6170 8C B8 61    STY OUTCHY
00242 6173 48          PHA
00243 6174 A5 D4      LDA $D4          ; SAVE CURRENT DEVICE
00244 6176 8D B9 61    STA TMPDEV
00245 6179 AD 0E 60    LDA RDEV          ; SET MY DEVICE
00246 617C 85 D4      STA $D4
00247 617E 20 BA F0    JSR $F0BA          ; LISTEN
00248 6181 20 2D F1    JSR $F12D          ; ATTENTION
00249 6184          OUTCH1 = *
00250 6184 20 BA 61    JSR STOPTS          ; SEE IF STOP PRESSED
00251 6187 B0 11      BCS OUTCH2          ; IF SO, EXIT FROM HERE
00252 6189 A9 00      LDA #0          ; CLEAR STATUS
00253 618B 85 96      STA $96
00254 618D 68          PLA          ; REGET CHAR
00255 618E 48          PHA
00256 618F 85 A5      STA $A5          ; STORE WHERE IT SHOULD BE
00257 6191 20 EE F0    JSR $F0EE          ; OUTPUT
00258 6194 A5 96      LDA $96          ; SEE IF TIMED OUT
00259 6196 25 01      AND 1
00260 6198 D0 EA      BNE OUTCH1          ; IF SO, TRY AGAIN
00261 619A          OUTCH2 = *
00262 619A 20 83 F1    JSR $F183          ; UNLISTEN
00263 619D AD B9 61    LDA TMPDEV          ; RESTORE DEVICE
00264 61A0 85 D4      STA $D4
00265 61A2 AE 10 60    LDX NMSDLY          ; DELAY A FEW MS

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00266 61A5 F0 08      BEQ OUTCHF
00267 61A7 A0 C8      OUTCH3 LDY #200      ; 1 MS INNER LOOP (LOOP IS 5 CYCLES LONG)
00268 61A9 88          OUTCH4 DEY
00269 61AA D0 FD      BNE OUTCH4
00270 61AC CA          DEY
00271 61AD D0 F8      BNE OUTCH3
00272 61AF            OUTCHF = *
00273 61AF AE B7 61    LDX OUTCHX      ; AND REGS
00274 61B2 AC B8 61    LDY OUTCHY
00275 61B5 68          PLA
00276 61B6 60          RTS      ; DONE
00277 61B7            ;
00278 61B7 00          OUTCHX .BYTE 0
00279 61B8 00          OUTCHY .BYTE 0
00280 61B9 00          TMPDEV .BYTE 0
00281 61BA            ;
00282 61BA            ; STOPTS - SET CARRY IF STOP KEY PRESSED
00283 61BA            ;
00284 61BA            ; TAKEN FROM PAGE 5 OF MTU DOCUMENTATION FOR K-1002-6C
00285 61BA            ;
00286 61BA AD 12 E8    STOPTS LDA $E812      ; LOOK AT KEYBOARD
00287 61BD C9 EF      CMP #$EF      ; TEST FOR STOP KEY
00288 61BF 18          CLC      ; CARRY CLEAR FOR NO STOP
00289 61C0 D0 01      BNE STOPT1
00290 61C2 38          SEC      ; CARRY SET FOR YES STOP
00291 61C3 60          STOPT1 RTS
00292 61C4            ;
00293 61C4            .END
ERRORS = 00000

```

SYMBOL TABLE

SYMBOL VALUE

B	60DD	BYTEPL	6015	CLP2	60F3	ENTRGR	6088
EORVAL	6011	EXITGR	607D	ILOOP	6129	ILOOP1	613A
M	60DE	MOVEP	614A	MOVEP1	615C	MOVEPF	6161
NMSDLY	6010	OUTCH	616D	OUTCH1	6184	OUTCH2	619A
OUTCH3	61A7	OUTCH4	61A9	OUTCHF	61AF	OUTCHX	61B7
OUTCHY	61B8	OUTCOL	60DF	OUTPF1	60BB	OUTPF2	60C4
OUTPF1	60B1	OUTR1	609C	OUTR2	60AD	OUTRET	60C5
OUTROW	608D	OUTVM	6018	OUTVM0	6031	OUTVM1	6037
OUTVM2	604E	OUTVMF	6076	P2	60DC	PGZ	0001
PO	60D4	R	60D3	RDEV	600E	REND	600D
RLOOP	6108	RPFXC	6009	RPFXR	600A	RREP	600B
RREP1	6016	RVAL	600C	RVALX	6017	RXGR	600F
STOPT1	61C3	STOPTS	61BA	TMPDEV	61B9	V	60D1
VM	6013	VMPAGE	6012				

END OF ASSEMBLY

CROSS REFERENCE		PAGE		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100		101		102		103		104		105		106		107		108		109		110		111		112		113		114		115		116		117		118		119		120		121		122		123		124		125		126		127		128		129		130		131		132		133		134		135		136		137		138		139		140		141		142		143		144		145		146		147		148		149		150		151		152		153		154		155		156		157		158		159		160		161		162		163		164		165		166		167		168		169		170		171		172		173		174		175		176		177		178		179		180		181		182		183		184		185		186		187		188		189		190		191		192		193		194		195		196		197		198		199		200		201		202		203		204		205		206		207		208		209		210		211		212		213		214		215		216		217		218		219		220		221		222		223		224		225		226		227		228		229		230		231		232		233		234		235		236		237		238		239		240		241		242		243		244		245		246		247		248		249		250		251		252		253		254		255		256		257		258		259		260		261		262		263		264		265		266		267		268		269		270		271		272		273		274		275		276		277		278		279		280		281		282		283		284		285		286		287		288		289		290		291		292		293		294		295		296		297		298		299		300		301		302		303		304		305		306		307		308		309		310		311		312		313		314		315		316		317		318		319		320		321		322		323		324		325		326		327		328		329		330		331		332		333		334		335		336		337		338		339		340		341		342		343		344		345		346		347		348		349		350		351		352		353		354		355		356		357		358		359		360		361		362		363		364		365		366		367		368		369		370		371		372		373		374		375		376		377		378		379		380		381		382		383		384		385		386		387		388		389		390		391		392		393		394		395		396		397		398		399		400		401		402		403		404		405		406		407		408		409		410		411		412		413		414		415		416		417		418		419		420		421		422		423		424		425		426		427		428		429		430		431		432		433		434		435		436		437		438		439		440		441		442		443		444		445		446		447		448		449		450		451		452		453		454		455		456		457		458		459		460		461		462		463		464		465		466		467		468		469		470		471		472		473		474		475		476		477		478		479		480		481		482		483		484		485		486		487		488		489		490		491		492		493		494		495		496		497		498		499		500		501		502		503		504		505		506		507		508		509		510		511		512		513		514		515		516		517		518		519		520		521		522		523		524		525		526		527		528		529		530		531		532		533		534		535		536		537		538		539		540		541		542		543		544		545		546		547		548		549		550		551		552		553		554		555		556		557		558		559		560		561		562		563		564		565		566		567		568		569		570		571		572		573		574		575		576		577		578		579		580		581		582		583		584		585		586		587		588		589		590		591		592		593		594		595		596		597		598		599		600		601		602		603		604		605		606		607		608		609		610		611		612		613		614		615		616		617		618		619		620		621		622		623		624		625		626		627		628		629		630		631		632		633		634		635		636		637		638		639		640		641		642		643		644		645		646		647		648		649		650		651		652		653		654		655		656		657		658		659		660		661		662		663		664		665		666		667		668		669		670		671		672		673		674		675		676		677		678		679		680		681		682		683		684		685		686		687		688		689		690		691		692		693		694		695		696		697		698		699		700		701		702		703		704		705		706		707		708		709		710		711		712		713		714		715		716		717		718		719		720		721		722		723		724		725		726		727		728		729		730		731		732		733		734		735		736		737		738		739		740		741		742		743		744		745		746		747		748		749		750		751		752		753		754		755		756		757		758		759		760		761		762		763		764		765		766		767		768		769		770		771		772		773		774		775		776		777		778		779		780		781		782		783		784		785		786		787		788		789		790		791		792		793		794		795		796		797		798		799		800		801		802		803		804		805		806		807		808		809		810		811		812		813		814		815		816		817		818		819		820		821		822		823		824		825		826		827		828		829		830		831		832		833		834		835		836		837		838		839		840		841		842		843		844		845		846		847		848		849		850		851		852		853		854		855		856		857		858		859		860		861		862		863		864		865		866		867		868		869		870		871		872		873		874		875		876		877		878		879		880		881		882		883</	
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Machine Language: Getting To The Machine Language Program

Jim Butterfield
Toronto, Canada

Your PET/CBM is a Basic machine. To run machine language you have to leave Basic — perhaps for a temporary period — and enter the machine language program. You'll often want Basic and Machine Language to work together. Where time is not critical, many things code easily into Basic. But where speed is important, or the job is beyond Basic's normal powers, you'll want to use machine language inserts. At that time, your computer will want to go into machine language.

There are four standard methods of doing this: some are more complex than others. Each has its own advantages and drawbacks.

The SYS command and the USR function call machine language whenever Basic desires to do so. This may be done with a direct command or from a program. The machine language program acts as a subroutine, and may return to the Basic calling point when it has done the job.

The more complex "wedge" method calls a machine language routine frequently whenever Basic is running. It doesn't wait for the Basic program to call it in; it seems to run simultaneously with Basic.

The interrupt method taps the PET's internal interrupt scheme. Every sixtieth of a second — whether Basic is running or not — PET's interrupt kicks in and does a number of quick jobs, such as checking the keyboard and flashing the cursor. Machine language programs which tap the interrupt seem to run continuously, even when Basic is not active.

The Machine Language Monitor has a Go (.G) command which allows you to start a machine language program directly. The program is not called as a subroutine, so it must find its own way back to the MLM when it is finished.

Each of the four methods will be discussed briefly here.

SYS And USR

SYS and USR create direct calls from Basic to a machine language program. This program runs only when called, and when it is finished it will hopefully return control to Basic and allow Basic

execution to continue.

SYS is a command. You say SYS 7143, for example, as a direct command or within a program, and machine language at decimal address 7143 will start executing. SYS is quite convenient when you have several machine language programs to be run at different times: you just give the address of each one as you call it.

USR is a function, not a command. You cannot say USR(0) alone any more than you can say SQR(0): it must be part of a command. You might say any of: PRINT USR(0); X = USR(99); IF USR(7) = 3 THEN ... or any similar syntax.

When Basic encounters the USR function within a Basic statement, it will start to execute machine language at a present address. Hopefully you will have set the address to point at the program you want to run; you do this by POKEing the desired address into locations 1 and 2. Once you've done this, USR will fire you into the desired machine code every time you use it.

The argument of the USR function — that's the value enclosed in brackets — is available to the machine language program if it wants to use it. This value may be found in the floating point accumulator, which is at hexadecimal B0 to B45 in original ROMs or at 5E to 63 in subsequent PET/CBM machines. It's store in floating point notation, which is devilishly hard to read if you don't know the system and not that easy if you do. When a simple number like 5 comes up as hexadecimal 83 A0 00 00 00 20 you may be happy to reach for a built-in conversion routine that yields a much more readable fixed-point value of 00 05.

If you use the USR argument you may also leave a value in the same floating point accumulator just before you return to Basic. This value will be picked up by Basic as the value computed by the USR function.

To summarize: SYS lets you pick any of several machine language programs. USR takes you to a fixed location and allows you to pass a single value to and from machine language if you want. The SYS command seems simpler to the beginner, but USR is also straightforward once you get used to it.

The Wedge, Or Infiltrating Basic

This advanced technique gives the effect of a Basic "supervisor" which watches Basic run and occasionally kicks in with some of its own activities. It doesn't need to be called from Basic: once implanted, it will be there and active any time Basic is running.

It's a powerful method of extending Basic. Many systems use it: disk monitors, including the Commodore "wedge" DOS; Basic enhancers such as the Programmer's Toolkit or Basic Aid; and Brett Butler's TRACE as published in **COMPUTE!**,



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EXECUTE^{BS} SCROLL^{ed} OUT^{ed} SET^{ed} SEND^{BS} PRINT USING^{BS} BEEP^{BS}

```
100 GOSUB 180
105 PRINT USING C$, A, B$
130 INPUT "TIME", D$
131 INPUT "DAY", E$
160 IF B<>C THEN 105
180 FOR X=IT09
183 PRINT Y(X):NEXT
184 RETURN
200 I=X/19
READY
RENUMBER 110, 10, 105-184
READY
LIST
100 GOSUB 150
110 PRINT USING C$, A, B$
120 INPUT "TIME", D$
130 INPUT "DAY", E$
140 IF B<>C THEN 110
150 FOR X=IT09
160 PRINT Y(X):NEXT
170 RETURN
200 I=X/19
READY
```

```
MERGE D1 "BUY NOW"
SEARCHING FOR BUY NOW*
LOADING
READY
RENUMBER 100, 10
READY
FIND BS
110 PRINT USING A$, BS, BS - C$ - D$
200 BS="NOW IS THE TIME"
READY
```

```
500 BA=BA-1
590 RA=123*5X/92-BA*10
600 IF BA=143 THEN 580
610 RETURN
620 C$="PROFIT $, #### DAILY"
630 PRINT USING C$, PI
640 D$="LOSS $, #### DAILY"
650 PRINT USING D$, LI
RUN
PROFIT $1, 238.61 DAILY
LOSS $ 0.00 DAILY
READY
```

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issue 1.

How does it work? It's done by infiltrating a Basic subroutine called CHRGET which is located in page zero. This subroutine is called every time the Basic interpreter wants to get a character from your Basic program. By making very careful changes to this subroutine, you can force the Basic interpreter to do a little extra work for you.

It's not simple. But with a little persistence and a lot of bravery, you can train Basic to do some clever new tricks.

Interrupt

Sixty times a second, PET's normal activity freezes. An interrupt signal causes a completely independent program to run. When the interrupt program completes, the computer's normal programs unfreeze and continue exactly where they left off.

This powerful mechanism allows PET to do several important jobs. The jiffy clock is updated; the keyboard is checked for activity; the stop key is checked and its condition logged; the cursor is flashed when necessary; and the cassette motors are started or stopped. All of this is invisible to the main program, which clanks along happily without even noticing the interruptions.

The interrupt mechanism works all the time, even when Basic isn't running. If you add your own machine language program to the interrupt sequences, it too will work all the time — sixty times a second. It's ideal for watching special input/output ports, flashing parts of the screen, and similar jobs.

You can get at the interrupt routine quite easily. There is a memory location called the Hardware Interrupt Vector: in original ROMs, it's at hexadecimal 0219 and 021A; in new ROM systems it's at hex 0090 and 0091. In either case, the locations contain an address which points to the interrupt routine. If you change the address, the interrupt mechanism will go wherever you say, sixty times a second. At the end of your coding, don't forget to jump to the regular interrupt program so that the keyboard, clock, etc. still work properly.

Changing the address of the Hardware Interrupt vector has a small problem. Like all addresses, it comes in two chunks: a low order byte and a high order byte. If you have just changed the low order part and are about to change the second part when the interrupt strikes, you have a disaster on your hands. The address that the interrupt finds at that moment will be nonsense — part old address and part new.

Avoid this problem by making use of the SEI (Set Interrupt disable) instruction to lock out the interrupt while you are changing the vector. Don't forget to restore the interrupt with a CLI (Clear Interrupt disable) when you've finished putting

the address in place.

It seems odd, but cassette tape can neither read or write after you have changed the interrupt vector from its usual address; and LOADs from disk may "hang" without saying READY. Be sure to make provision to restore the vector if you do much input or output.

Machine Language Monitor

In the Machine Language Monitor, you can type .G for Go and go directly to any machine language program you like. You will go with a direct jump (JMP) command, which means that the program is not treated as a subroutine. You can't get back with a return (RTS) instruction; instead, you will likely use a Break (BRK) command to reconnect with the monitor.

The Go command and associated BRK instructions are useful in debugging programs. After your program is written, replace several of the instructions in your program with Break commands. Try to scatter the Break commands evenly throughout your program, especially at the start of logical program "modules". Now perform Go to the start of your program. You should come back to the monitor almost instantly with the first Break point. If so, you've reached that program step safely; replace the Break instruction with the command that originally belonged there. Now you can Go to that address, and the program will resume and continue to the next Break. As you go through the program piece by piece, check that the registers contain the values you expect; if appropriate, check key memory locations, too.

If the PET misbehaves or goes terribly quiet, at least you will have isolated the portion of the program that is doing it to you. On the next test, you can set your break points closer together in that area, and pin the problem down step by step.

Summary

There are several ways to link your PET to machine language programs. Beginners will want to stay with the SYS command and the USR function until they have gained confidence. They should learn the Machine Language Monitor (.G) and Break (BRK) functions as quickly as possible to help in checking out programs.

The advanced functions — wedge and interrupt — will be there when they are needed. ©

Odds & Ends on the 2040 Disk

Jim Butterfield

The disk has almost more brains than the PET. It contains two separate microprocessors, each of which has its own ROM program; the micros talk to each other via a shared block of memory.

80 COLUMN GRAPHICS



The image on the screen was created by the program below.

```

10 VISMEM: CLEAR
20 P=160: Q=100
30 XP=144: XR=1.5*3.1415927
40 YP=56: YR=1: ZP=64
50 XF=XR/XP: YF=YF/YR: ZF=XR/ZP
60 FOR ZI=-Q TO Q-1
70 IF ZI<-ZP OR ZI>ZP GOTO 150
80 ZT=ZI*XP/ZP: ZZ=ZI
90 XL=INT(.5+SQR(XP*XP-ZT*ZT))
100 FOR XI=-XL TO XL
110 XT=SQR(XI*XI+ZT*ZT)*XF: XX=XI
120 YY=(SIN(XT)+.4*SIN(3*XT))*YF
130 GOSUB 170
140 NEXT XI
150 NEXT ZI
160 STOP
170 X1=XX+ZZ*P
180 Y1=YY+ZZ*Q
190 GMODE 1: MOVE X1,Y1: WRPIX
200 IF Y1=0 GOTO 220
210 GMODE 2: LINE X1,Y1-1,X1,0
220 RETURN
    
```

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A Thirteen Line BASIC Delete

Arthur C. Hudson
Ottawa, Ontario

Here is a short program written entirely in BASIC, which allows you to delete any group of lines from an existing program. Typically the increment is 1, so that all lines in the group are deleted, but this is not necessary.

To use the Basic Delete, just screen merge it with your existing program. Hopefully no conflict of line numbers will occur, if there is conflict, then some renumbering will be required. After the merge, RUN7878, and as instructed, modify the listed line 7892 to define the start, the end and the increment. Then press return twice, and the delete process will begin. The line number being deleted is displayed and you may press BREAK (RUN/STOP) at any time.

As an example of using an increment other than unity, you could write all or part of a program using even numbers for the useful statements and odd numbers for the remarks. Save on tape or disk, and then automatically delete all the remarks and save again. Finally the original can be brought back, and all even numbered statements deleted. This gives a program consisting only of the remarks. Each of these three versions can have its uses.

Somewhat complicated programming techniques are used here, and the statements must be entered carefully. Note that after you have modified the automatically listed line 7896 and pressed RETURN, the cursor will rest on a direct statement, RUN7882. In this way, a second RETURN will initiate the delete process.

The program uses the dynamic keyboard feature of the PET. (See **COMPUTE!** Issue 4 page 58 and the earlier reference - Louder - cited therein). It uses bins 834 and 835 in the second cassette buffer, but this does not prevent use of the second cassette.

One of the more interesting problems in this type of program is that PET suffers from amnesia the moment it executes a delete (all variables set to 0). It is for this reason that parameters have to be embedded in a program statement, and also N, the number of the line currently being deleted, must be poked into memory before the deletion and retrieved after it.

Note that in line 7892 the word 'INCREMENT' is spelled incorrectly. Don't try to fix it, or PET will see the word REM inside it and bomb out. Don't think you can get away with substituting 'step' for 'incrment', because PET will object to the use of ST, a reserved word. Finally don't try incr'ment,

PET doesn't like this either, (not alphanumeric).

The first time that the Basic Delete is used, the asterisks in SN7896 will be replaced by numbers. There is of course no need to replace the asterisks when executing a SAVE.

My version of this program uses about 330 bytes. It is certainly possible to trim this down by about 50 bytes.

If You Have OLD ROM

Referring to statements numbered 7884 and 7886; for 623 and 624 substitute 527 and 528. For 158 substitute 525. These bins relate to the keyboard buffer. Note that Harvey Davis's article is written for old ROM, so the conversions given above apply in reverse, if you have new ROM.

Reference:

Algebraic Input for the PET, Harvey Davis, **COMPUTE!** Vol. 1, Issue 4, page 58.

```
10 PRINT"13A THIRTEEN LINE BASIC DELETE
12 PRINT"1ARTHUR C. HUDSON
14 PRINT"111 AMBERLY PLACE
16 PRINT"1OTTAWA,ONT.
18 PRINT"1CANADA
20 PRINT"1K1J 7J9
22 PRINT"1PHONE (613) 749 5475
30 PRINT"1KEY IN CONT":STOP
7878 PRINT"1MODIFY SN7896,THEN CR
7880 PRINT"1RUN7882111":LIST7896
7882 POKE835,0:POKE834,0:GOTO7894
7884 POKE623,13:POKE624,13
7886 POKE158,2:PRINT"111GOTO7894
7888 PRINT"1N111";N=N+IN
7890 D=INT(N/256):POKE835,D
7892 POKE834,N-D*256:END
7894 N=256*PEEK(835)+PEEK(834)
7896 FIRST=0000:LAST=0000:INCRMENT=01
7898 IF N > LA THEN STOP
7900 IF N < FI THEN N=FI
7902 GOTO7884
READY.
```

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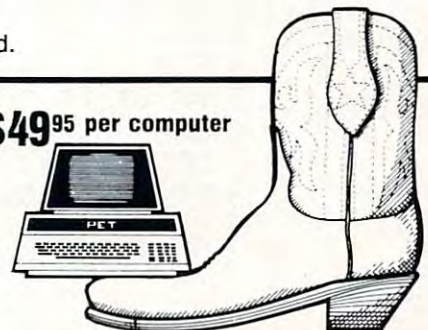
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Calculated Bar-graph Routines On The PET

Edward F. Heite
Camden-Wyoming, Delaware

To exploit the CBM printer's graphic potentials, programmers need a few routines that haven't been published yet. The "Keyprint" program (**COMPUTE!**, issue 7, page 84) is okay for dumping 40 columns to the printer, if you have the right ROM. But if you want to manipulate the full 80 columns and create complicated graphs, you need a way to calculate the length of the bar.

A calculated bar can be created as a string variable, by concatenating a graphic string to the desired length with a FOR ... NEXT loop. Listing 1 is a dummy program to demonstrate this process.

Line 1 sets B\$ to an empty value. Line 2 defines C\$ as a single graphic character. In line 3, the value of the bar is set at 20; in actual programs, this would be a calculated value. Line 4 sets the FOR ... NEXT loop to the value of J, and thus determines the length of the bar. Line 5 concatenates B\$-C\$ to create a new value for B\$. Line 5 keeps adding symbols to B\$ until the loop reaches the value of J. After the loop has cycled the required number of times, B\$ is a bar of length J, which in this case is 20.

In normal program use, a series of these routines would create the bars. Then the printer routine would use them in a report; lines 7-9 are a typical printer routine.

LISTING 1

```
1 B$=""
2 C$="█"
3 J=20
4 FOR X=1 TO J
5 B$=C$+B$
6 NEXT X
7 OPEN 1,4,0
8 PRINT#1, B$
9 CLOSE 1
```

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The Revised Pet/CBM Personal Computer Guide

Jim Butterfield
Toronto, Canada

This article deals with the changes and new features of the well-known Osborne/McGraw-Hill guide. As such, it isn't a full scale review. Many PET/CBM users are familiar with the first edition; it was the first truly comprehensive user guide for their machine. As such, they were less likely to complain about its faults, which were few, and more likely to be thankful that such a book finally existed.

A Stronger Style

The new edition is a major revision. The previous casual, almost folksy style ("Assuming you have just brought your PET home in a box, you must unpack it") has been replaced by a much tougher down-to-business style. The name PET has been almost universally replaced by CBM. The new book socks it to you with a much more hard-hitting style.

The organization of the book is stronger. Chapters have been reorganized, and additional Basic programming material inserted. There's a stronger grouping of data with headings, subheadings and detail. The Preface suggests, "Even if you have never programmed a computer before, this book will teach you how to write your own Basic programs ... Chapters 4, 5 and 8 teach BASIC programming." That's 190 pages of Basic material, the last 50 of which are essentially reference. It may be rather too terse for many learners, but it's all there.

File Foulup?

The book covers the newer 4.0 ROM system. This is quite a feat considering how recent this system is. Unfortunately, some of this new material appears to have been prepared hastily.

The new Relative data files are discussed, but the book gets the whole thing wrong. It would be well for readers to stay away from this section entirely: relative files are easy to handle, but not in the manner the book suggests. It seems that the authors have confused the carriage return character

with the IEEE-488 EOI line; somehow the comma gets dragged in as a field delimiter and we end up with a mess. Worse and worse: playing with the comma makes numeric file variables difficult to handle, and we end up with pages of explanation on how to cope with this. It would have been so easy if we'd started off on the right foot: for writing, one PRINT# statement writes one record; for reading, EOI (as detected in the ST value) signals the last field within a record. And no commas, please.

Appendices

The tables in Appendix A do a fair job of trying to sort out the various codes used by the PET. Between screen formats, PET ASCII, true ASCII and keywords, they take some unscrambling.

For a book which makes some effort to be up-to-date on such things as 4.0 machines, I was surprised to see the out-of-date list of CBM newsletters and references given in appendix D. The PET Gazette and PET User Notes were still listed, and there was no sign of **COMPUTE!** magazine. And I really thought that Commodore Canada's excellent Transactor should have been on the list.

Table F-3 near the end of the book is a curious piece of work. It seems that the authors got hold of the symbol table from Commodore/Microsoft's assembly and sorted and printed it for both Upgrade and 4.0 ROMs. It's fascinating: I suspect that it

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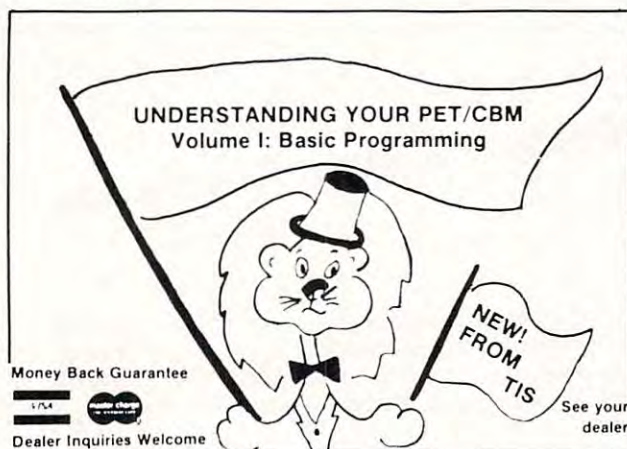
shows the original Commodore/Microsoft symbolic names for memory addresses: for example, the Floating Point Accumulator at hexadecimal 005E seems to be called FAC. But mixed in with these is a series of values which don't represent addresses at all. For example, hex 35 is the memory address of part of the top-of-Basic-memory pointer. But 35 is shown in the table as ERRFC, which happens to be the value loaded into the X register just before printing an ?ILLEGAL QUANTITY error message. Oddities in this computer-generated table: non-existent addresses are printed as 0000 rather than being left blank; and locations for which the authors apparently had no explanation are marked "X". It's a lovely table — I wish I could figure out why it's there.

Summing up.

Like its predecessor, the new book is a prodigious work. Its stronger style will improve its value as a reference, although some readers may miss the more casual approach of the first edition.

It's certainly the most comprehensive guide to using CMB/PET machines that is available today. The book is well organized and clearly written. It's generously fitted with examples, programs, diagrams and tables. Apart from the problems dealing with Relative files, the book is a sound approach to using the computer.

[**PET/CBM Personal Computer Guide**, Second Edition: by Adam Osborne and Carroll S. Donahue. Published by Osborne/McGraw-Hill, Berkeley, California.] ©



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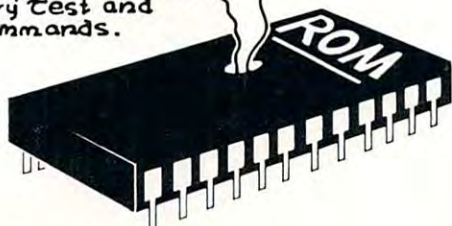
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Un-Compactor

Robert W. Baker
Atco, NJ

Since my Compactor program was published in the Nov./Dec. '80 issue of **COMPUTE!**, I've had several requests for a companion program to un-Compact programs. The program shown here will do just that!

The program reads a BASIC program file from disk on drive 0 and creates a new copy on drive 1. The new program filename is the same as the original except for a "U" suffix to indicate an un-compacted version. As with Compactor, load the newly created program file and enter a CLR command from the keyboard to correct the program links. Then save the program back to disk as usual. Un-compactor does not generate correct link values when writing the new program file, it merely writes a dummy value to reserve space for a link. This saves a fair amount of extra work not really needed in the program. The CLR command will force BASIC to correct the program links for you.

The program takes any multi-statement lines (statements separated by colons) and breaks them into separate program lines with new line numbers. The new line numbers are generated by adding one to the original line for each new line generated. This procedure is followed for however many statements exist in the line, as long as new line numbers can be generated without reaching the next line number in the original program. If that point is reached, the remainder of the original line is then copied as part of the last line generated with any appropriate separating colons.

The program must take into account certain BASIC tokens or keywords since they effect whether or not a particular line can be broken into separate lines. Thus, any data following a GOTO, END, RUN, IF, RETURN, REM, STOP, LIST, or CONT token is copied unchanged to the end of the current program line. Also, once a quote is detected, the line must be copied until another quote or end of the program line is reached.

Hope this proves to be of help, especially to those currently using Compactor. This program allows you to effectively re-create programs that were compacted. Now you can get a compacted program in Un-compactor to help speed up program execution. As usual, I'll supply copies of the program on cassette for \$2 to cover costs.

```
10 FOR X=1 TO 10
11 PRINT X
12 NEXT
20 PRINT
21 PRINT
22 PRINT
30 REM TEST FILE FOR UNCOMPACTOR
40 A=1
41 B=2
42 C=3
43 D=4
44 E=5:F=6:G=7
45 X=10
46 Y=20
47 Z=30
100 END:THAT ALL!
READY.
```

- SAMPLE LISTING
OUTPUT FILE FROM UNCOMPACTOR

```
10 FOR X=1 TO 10: PRINT X: NEXT
20 PRINT:PRINT:PRINT
30 REM TEST FILE FOR UNCOMPACTOR
40 A=1:B=2:C=3:D=4:E=5:F=6:G=7
45 X=10:Y=20:Z=30
100 END:THAT ALL!
READY.
```

- SAMPLE LISTING
INPUT FILE TO UNCOMPACTOR

```
30 REM          UN - COMPACTOR
50 REM          BY: ROBERT W. BAKER
70 REM 15 WINDSOR DR., ATCO, NJ 08004
100 :
110 GOTO 270
120 :
130 REM >>>>> SUBROUTINES <<<<<<<
140 :
150 GOSUB 160: V1=V
160 GET#5,C$: GOSUB 190
170 IF C$="" THEN V=0: RETURN
180 V=ASC(C$): RETURN
190 INPUT#15,EN,EM$,ET,ES
200 IF EN=0 THEN RETURN
210 PRINT "âDISK ERROR":PRINT
220 PRINT EN;EM$;ET;ES
230 GOTO 1030
240 :
250 REM ***** INITIALIZATION *****
260 :
270 PRINT"â";SPC(10);"UN-COMPACTORââ
280 PRINT"âINPUTâ FILE IN âDRIVE #0â
290 PRINT"âOUTPUTâ FILE IN âDRIVE #1ââ
300 INPUT"âINPUT FILENAMEâ";FL$
310 DIM C(256)
320 OPEN 15,8,15
330 OPEN 5,8,5,"0:"+FL$+",P,R"
340 GOSUB 190
350 PRINT:PRINT"OK, WORKING ON LINE# -
      ^.....â
360 FO$=LEFT$(FL$,14)+"/U"
```



```

370 PRINT#15,"S1:"+FO$
380 OPEN 6,8,6,"1:"+FO$+",P,W"
390 GOSUB 190
400 GOSUB 150: PRINT#6,CHR$(V1);C$;
410 F=1: GOTO 580
420 :
430 REM ***** OUTPUT THIS LINE#
440 :
450 LN=NL: IF LK=0 THEN 1010
460 PRINT LN,
470 PRINT#6,CHR$(1);CHR$(1);
480 PRINT#6,CHR$(LL);CHR$(LH);
490 :
500 REM ***** READ THIS BASIC PGM LINE
510 :
520 X=1
530 GOSUB 160: C(X)=V
540 IF V>0 THEN X=X+1: GOTO 530
550 :
560 REM ***** GET NEXT LINK & LINE#
570 :
580 GOSUB 150: LK=V+V1: IF LK=0 THEN 600
590 GOSUB 150: NL=V1+(256*V): LL=V1:
    - LH=V
600 IF F THEN F=0: GOTO 450
610 :
620 REM ***** BREAK UP LINE IF POSSIBLE
630 :
640 X=1
650 :
660 REM SKIP IF NOT COLON
670 :
680 IF C(X)<>58 THEN 810
690 IF X=1 THEN 950
700 LN=LN+1: IF LN>=NL THEN 950
710 PRINT#6,CHR$(0);CHR$(1);CHR$(1);
720 H=INT(LN/256): L=LN-(256*H)
730 PRINT#6,CHR$(L);CHR$(H);
740 X=X+1: IF C(X)=32 OR C(X)=58 THEN -
    -740
750 GOTO 680
760 :
770 REM COPY REST OF LINE IF ---
780 REM GOTO, END, RUN, IF, RETURN
790 REM REM, STOP, LIST, CONT
800 :
810 IF C(X)<128 OR C(X)>155 THEN 910
820 IF C(X)=128 OR C(X)>153 THEN 850
830 IF C(X)<137 OR C(X)>144 THEN 910
840 IF C(X)=140 OR C(X)=141 THEN 910
850 PRINT#6,CHR$(C(X));
860 IF C(X)>0 THEN X=X+1: GOTO 850
870 GOTO 450
880 :
890 REM SKIP IF NOT QUOTE
900 :
910 IF C(X)<>34 THEN 950
920 PRINT#6,CHR$(C(X)); : X=X+1
930 IF C(X)=34 OR C(X)=0 THEN 950
940 GOTO 920
950 PRINT#6,CHR$(C(X));
960 IF C(X)>0 THEN X=X+1: GOTO 680
970 GOTO 450
980 :
990 REM *** END OF BASIC PROGRAM
1000 :
1010 PRINT#6,CHR$(0);CHR$(0);
1020 PRINT"END DONE":PRINT:PRINT
1030 CLOSE 5: CLOSE 6: CLOSE 15
READY.

```

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Using the Hardware Interrupt Vector on the Pet

Eric Brandon

The operating system of the PET is divided into several distinct parts. Some of these get and process your BASIC statements; others deal with all Input/Output operations, and some update the clock, flash the cursor and take care of other sundry details every 60th of a second. This article will show you how to change the operation of the latter to suit your own needs.

Every 60th of a second the PET gets a signal on its IRQ interrupt. When this occurs, it saves all registers and goes to the memory locations specified in locations 537 and 538 (144 and 145 on new ROMs). It executes the machine language program there, and upon hitting an RTI instruction, reloads all of its registers and continues with whatever it was doing. By changing the hardware Interrupt Vector at 537 and 538 (144 and 145 new ROMs) we can make the PET execute our program every 60th of a second, while BASIC operates normally.

I have included here two sample programs using this technique, one is for ROM 2.0 (old ROMs) and the other is for ROM 3.0. What they do, is that after a SYS 826, the contents of the BASIC Input Buffer are constantly displayed on the top two lines of the screen. Hitting the ampersand (&), BREAKs the machine language program, and hitting the slash to the right of the ampersand on the keyboard, clears the buffer if you find that it is getting too cluttered. These programs were written only as examples of using the Hardware Interrupt Vector and are meant to show you how to use this with your own programs. Before we proceed, I wish to clarify just one feature of my assembler; the plus sign on lines 11 and 37 means add one to the value of the symbol. On most assemblers this should be substituted with HIV 1.

Lines 2-6 simply set the values of some symbols. INBUF is the first memory location of the BASIC Input Buffer. KEY is the location that contains the keyboard matrix value of the key presently depressed. INTRPT is the routine to which the Hardware Interrupt Vector usually points. HIV is the location of the first byte of the two byte Hardware Interrupt Vector. Finally, SCRNL is the top lefthand corner of the screen.

Lines 7-13 are essential and should be looked at in detail. Line 7 has the Set Interrupt Mask instruction. This is necessary to prevent the PET from being interrupted with only one byte of the pointer changed. Line 12 clears the interrupt mask. If the mask wouldn't be cleared, the PET would "hang up" and need to be turned off. Lines 8-11 make the pointer point to 0347 (0345 new ROMs). Note that the least significant byte goes in 537 (144 new ROMs), and that the most significant byte goes in 538 (145 new ROMs). The RTS in line 13 returns you to BASIC after your SYS. The effect of an SYS 826 is to make the cursor reappear nearly immediately, but now the PET executes the machine language program at 0347 (0345 new ROMs) every 60th of a second. The actual operation of the program is quite straightforward to anyone familiar with machine language programming.

Lines 33-39 are the standard procedure for setting the Hardware Interrupt Vector back to normal. Note that POKE 537,133:POKE 538,230 (POKE 144,46:POKE 145,230 new ROMs) has the same effect. This procedure must be done before any cassette I/O.

The last thing that deserves notice are lines 25,32, and 39. The only safe way to leave a program that has been called by the Hardware Interrupt Vector is to jump somewhere into the interrupt handling routine. Since it begins at E685 (E62E new ROMs), that is where you will most often go. You cannot end your program with a RTS or a BRK.

I learned this technique from disassembling KEYPRINT by Charles Brannon, a program in a previous issue of **COMPUTE!**. I hope you find this useful, and if you have any questions, you can write me at:

Eric Brandon
36 Hartfield Road
Islington, Ontario
Canada
M9A 3C9


```
INPBUF = $0200
KEY = $0097
INTRPT = $E62E
HIV = $0090
SCRN = $8000
START = $0345
LOOP = $0351
CLEAR = $035F
LOOP2 = $0363
NORMAL = $036E
```

```

1      *      = $33A
2      INPBUF = $200
3      KEY    = 151
4      INTRPT = $E62E
5      HIV    = 144
6      SCRN   = $8000
7      033A 78      SEI
8      033B A9 45    LDA #$45
9      033D 85 90    STA HIV
10     033F A9 03     LDA #$03
11     0341 85 91     STA HIV+
12     0343 58       CLI
13     0344 60       RTS
14     0345 A5 97     START LDA KEY
15     0347 C9 45     CMP #69
16     0349 F0 14     BEQ CLEAR
17     034B C9 4D     CMP #77
18     034D F0 1F     BEQ NORMAL
19     034F A2 00     LDX #0
20     0351 BD 00 02  LOOP LDA INPBUF,X
21     0354 9D 00 80  STA SCRN,X
22     0357 E8       INX
23     0358 E0 50     CPX #80
24     035A D0 F5     BNE LOOP
25     035C 4C 2E E6  JMP INTRPT
26     035F A2 00     CLEAR LDX #0
27     0361 A9 20     LDA #32
28     0363 9D 00 02  LOOP2 STA INPBUF,X
29     0366 E8       INX
30     0367 E0 50     CPX #80
31     0369 D0 F8     BNE LOOP2
32     036B 4C 2E E6  JMP INTRPT
33     036E 78       NORMAL SEI
34     036F A9 2E     LDA #$2E
35     0371 85 90     STA HIV
36     0373 A9 E6     LDA #$E6
37     0375 85 91     STA HIV+
38     0377 58       CLI
39     0378 4C 2E E6  JMP INTRPT
```

```
INPBUF = $000A
KEY = $0203
INTRPT = $E685
HIV = $0219
SCRN = $8000
START = $0347
LOOP = $0354
CLEAR = $0361
LOOP2 = $0365
NORMAL = $036F
```

```

1      *      = $33A
2      INPBUF = $0A
3      KEY    = 515
4      INTRPT = $E685
5      HIV    = 537
6      SCRN   = $8000
7      033A 78      SEI
8      033B A9 47    LDA #$47
9      033D 8D 19 02 STA HIV
10     0340 A9 03     LDA #$03
11     0342 8D 1A 02 STA HIV+
12     0345 58       CLI
13     0346 60       RTS
14     0347 AD 03 02  START LDA KEY
15     034A C9 45     CMP #69
16     034C F0 13     BEQ CLEAR
17     034E C9 4D     CMP #77
18     0350 F0 1D     BEQ NORMAL
19     0352 A2 00     LDX #0
20     0354 B5 0A     LOOP LDA INPBUF,X
21     0356 9D 00 80  STA SCRN,X
22     0359 E8       INX
23     035A E0 50     CPX #80
24     035C D0 F6     BNE LOOP
25     035E 4C 85 E6  JMP INTRPT
26     0361 A2 00     CLEAR LDX #0
27     0363 A9 20     LDA #32
28     0365 95 0A     LOOP2 STA INPBUF,X
29     0367 E8       INX
30     0368 E0 50     CPX #80
31     036A D0 F9     BNE LOOP2
32     036C 4C 85 E6  JMP INTRPT
33     036F 78       NORMAL SEI
34     0370 A9 85     LDA #$85
35     0372 8D 19 02 STA HIV
36     0375 A9 E6     LDA #$E6
37     0377 8D 1A 02 STA HIV+
38     037A 58       CLI
39     037B 4C 85 E6  JMP INTRPT
```

NEW ROM (3.0) VERSION OLD ROM VERSION ©

Odds & Ends on the 2040 Disk


Jim Butterfield

The disk's ID is written over 600 times. There's no quick way of changing it — just copy everything over to a new disk if you really need to do this.

Odds & Ends on the 2040 Disk

Jim Butterfield

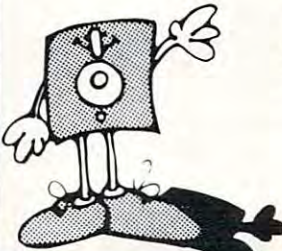
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Pet As An IEEE-488 Logic Analyzer

Jim Butterfield
Toronto, Canada

If you'd like to see what's going on on the GPIB — and if you can borrow an extra PET and IEEE interface cable — this program will help.

It shows the current status of four of the GPIB control lines, plus a log of the last nine characters transmitted on the bus.

The four control lines are NRFD, NDAC, DAV, and EOI. It would be nice to show ATN too, but I couldn't fit this in: it's detected in a rather odd way in the PET so that fitting it in is rather too tricky for this simple program.

The last nine characters are shown in "screen format". This means that you'll have to do a little translation work to sort out what some of them mean. On the other hand, it allows you to see characters that otherwise wouldn't be printed. A carriage return, for example, shows up as a lower case m; this

is a little confusing at the start, but you'll quickly get used to it and it's handy to see everything that goes through. Don't forget that original model PETs may show upper and lower case reversed.

I had hoped to show which characters were accompanied by the EOI signal. It turned out that time is critical — the bus works very fast — and that adding this feature would cut down the number of displayed characters from nine to five. I opted for the bigger count, and dropped the EOI log feature.

The high speed of the bus makes it difficult to watch the control lines in real time. When the "active" PET is exchanging information with disk or printer everything is happening very fast, and the "logic analyzer" PET will show an amazing flurry of activity on the control lines. Only when the activity stops or hangs up will you be able to see the lines in their static conditions.

You may use the program to chase down real GPIB problems, or just to gain insight on how the bus works. Either way, it will come in handy if you can borrow that extra PET unit.

Even at the speed of program operation, a few signals come too fast to catch on the fly. If you must see everything in the select and unselect sequences, you'll have to cut down the number of characters displayed. Try changing the contents of \$04F0 to, say, 5 if you want to do this.

```

; IEEE WATCH      JIM BUTTERFIELD
110: 04B0          *= $4B0
120: 04B0          DFLAG = $B1
130: 04B0          DNNSAV = $B2
140: 04B0          EOISAV = $B3
200: 04B0 46 B1    START LSR DFLAG
210: 04B2 78      SEI
220: 04B3 AD 12 E8 MAIN LDA $E812
230: 04B6 C9 EF    CMP #$EF
240: 04B8 D0 02    BNE CONT
250: 04BA 58      CLI
250: 04BB 60      RTS
280: 04BC AC 10 E8 CONT LDY $E810 ;EOI
290: 04BF AD 40 E8 LDA $E840 ;DAV, NRFD, NDAC
300: 04C2 AE 20 E8 LDX $E820 ;DATA
310: 04C5 29 C1    AND #$C1 ;EXTRACT BITS
320: 04C7 C5 B2    CMP DNNSAV
330: 04C9 D0 11    BNE DNN
340: 04CB 98      TYA
350: 04CC 29 40    AND #$40 ;EXTRACT EOI
360: 04CE 0A      ASL A
370: 04CF 49 A0    EOR #$A0
380: 04D1 C5 B3    EOI CMP EOISAV
390: 04D3 F0 DE    BEQ MAIN
400: 04D5 85 B3    STA EOISAV
410: 04D7 8D 61 80 STA $8061
420: 04DA D0 D7    BNE MAIN
;ACTIVITY SEEN - UPDATE SCREEN
430: 04DC 85 B2    DNN STA DNNSAV

```



```

440: 04DE 29 80      AND  #$80
450: 04E0 49 A0      EOR  #$A0
460: 04E2 8D 52 80    STA  $8052
470: 04E5 10 1D      BPL  NDAY          ; NO DAY SEEN
500: 04E7 A4 B1      LDY  DFLAG
510: 04E9 30 1B      BMI  DCONT          ; DAY SEEN BEFORE
520: 04EB 85 B1      STA  DFLAG
530: 04ED 85 B2      STA  DNNSAV
540: 04EF A0 00      LDY  #0
550: 04F1 B9 A2 80 SCROL LDA  $80A2,Y
560: 04F4 99 A1 80    STA  $80A1,Y
570: 04F7 C8          INY
580: 04F8 C0 08      CPY  #8
590: 04FA D0 F5      BNE  SCROL
600: 04FC 8A          TXA
600: 04FD 49 FF      EOR  #$FF
600: 04FF 8D A9 80    STA  $80A9
610: 0502 B0 AF      BCS  MAIN
640: 0504 85 B1      NDAY STA  DFLAG
650: 0506 A5 B2      DCONT LDA  DNNSAV
660: 0508 29 40      AND  #$40          ; NRFD
670: 050A 0A          ASL  A
680: 050B 49 A0      EOR  #$A0
690: 050D 8D 57 80    STA  $8057
700: 0510 A5 B2      LDA  DNNSAV
710: 0512 29 01      AND  #$1          ; NDAC
720: 0514 4A          LSR  A
730: 0515 6A          ROR  A
740: 0516 49 A0      EOR  #$A0
750: 0518 8D 5C 80    STA  $805C
760: 051B D0 96      BNE  MAIN

```

```

10 REM IEEE WATCH
20 REM JIM BUTTERFIELD
30 POKE59468,14:PRINT"D DAY NRFD
NDAC EOI":PRINT" ↑ ↑ ↑ ↑"
40 PRINT"=123456789=0"
50 SYS1200
READY.

```

Odds & Ends on the 2040 Disk

Jim Butterfield

Yes, the disk checks every write by reading the block back and verifying every byte for correctness. You can depend on a good write having gotten to the diskette correctly.

Odds & Ends on the 2040 Disk

Jim Butterfield

The first files written to disk will cluster around track 18, the directory track. This minimizes head movement on a lightly-used disk. By the same token, you might arrange to write your most-used programs and files first on the disk, to save both time and wear and tear.

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Running 40 Column Programs On A CBM 8032

Chuan Chee
St. Catherine's
Ontario Canada

Good news for those who own a Commodore 80 column CBM. I have developed a method of making the computer act almost like a 40 column PET.

Over the years, many programs have been developed for PET 2001 computers. There had been one ROM upgrade from BASIC 1.0 to 2.0 but many people and software companies got over that hurdle. Now Commodore has introduced a BASIC 4.0 for their PET 40XX and CBM 80XX computers. Again many programmers must change any SYS commands into the ROM locations. However, some programs can still run on the PET 40XX because the programmers were careful enough to avoid any of the ROM routines; especially the BASIC part as opposed to the Operating System. Luckily, most of the first 1024 bytes remained the same as promised by Commodore.

80 Column Problem

But hold on before you start attacking your programs, the CBM 80XX is a completely different animal — it has an 80 column CRT (or screen). All the programs are assuming that there are 40 bytes per line as in the case of a PET, but a CBM has 80. Therefore, any programs that store characters on the CRT memory will have every other line on columns 41 to 80. This is certainly a disaster.

The Solution

In solving this problem, there must be some way of convincing the microcomputer that there are only 40 bytes per line as in the PET. Commodore was wise enough to implement their newly developed Video Interface Controller (or CRT Controller) into the CBM. They are also using this chip in the VIC 20 (Video Interface Computer). When the power is turned on, the operating system instructs the chip to do various functions such as the height of the 25 lines in normal or graphics modes. My program instructs the Controller to display 40 bytes per line and shift the first column to the right to center the display instead of being on the left side of the CRT.

That is just fine for the programs that store characters on the CRT. But what about those that simply PRINT. Now whenever the PRINT finishes a line (40 characters) of output, the ROM routines will make the next PRINT occur 80 bytes from the start of the current PRINT line. This will make the output appear on every other line.

Well, there just happens to be an "Output a byte on the CRT" jump vector at locations \$00EB to \$00EC. The CBM 4032 program will change this vector to intercept any character before it gets printed. The routines included in the program were modified from a PET 4032 Operating System ROM, set so that it will behave exactly like a 40 column PET. It will handle RETURN, cursor movements, INST, DEL, and even wrap around lines properly.

Bonuses Not Available On A Pet

There are several features that make this simulation of a PET 40XX even better since they are not available on any PET computer. Such bonuses include the automatic repeat of the cursor control and editing keys and the use of the REPEAT key with all other keys. There will also be the usual warning "bell" when six characters from the end of the line. To disable the "bell", type POKE 231.0. This RAM location contains the duration time of the "bell" which usually is 16. Try poking various values and notice how the duration changes.

I also decided to keep the functions of "Q" and ":" during scrolling the same as before because those who are used to them should not have to use the RVS key. Along the same lines, the ESC key is still fully functional. By the way, did you know that the ESC key not only gets you out of quote and insert modes but also the reverse mode, thus functioning similar to the OFF key?

The CBM 4032 Program

The program is in two parts — a BASIC and a data part. After turning on the computer or typing NEW, type in the BASIC part exactly as shown without any extra spaces. LIST it again to be sure. Next, get into the Machine Language Monitor by SYS4 and type in the data, making sure not to make any mistakes. The next important step is to save the program through the Monitor by .S "0:CBM 4032",08,0400,07A8 for a disk drive or .S "CBM 4032",01.0400,07A8 for a tape cassette drive. Now exit the Monitor and prepare to RUN the program.

The data is actually the machine language routines required. The BASIC portion will transfer it into the second half of the 2K CRT memory. As it transfers the data, you will see "garbage" appear on the CRT. This is an ideal spot to put the routines because the CRT will only use 40 bytes per line by 25 lines (= 1000 bytes), the second half of the CRT memory will never be printed on.

After the transfer, the BASIC portion will SYS 33876 (\$8454) to have the routines set up the necessary parameters. It will give the CRT Controller the proper instructions and then CLR the CRT. A READY. will appear on the CRT and control is returned to the user. Now you are ready to RUN any programs meant for a 40 column PET with the proper ROM charges if necessary.

If for any reason you wish to go back to the original 80 column format, you can switch off and on the CBM. Alternatively, you can type SYS 58982 (\$E666) and press both SHIFTs and the quote keys simultaneously. The latter method will again display the data on the second half of the CRT but you risk printing or typing over it.

Conclusion

Essentially, any program that can RUN on a PET 40XX, that is with BASIC 4.0, will work with this program. There is no need to alter the program to add anything extra to the programs to artificially perform what this program does. The only side effect is that the characters appear narrower than usual but the advantage of having the program displayed far exceeds this small deviation.

I would like to thank **Batteries Included**, in Toronto for allowing me to use their computers for the development of this program.

```
10 REM * CBM 4032 - BY CHUAN CHEE *
20 REM SEE ARTICLE IN COMPUTE!
30 A=32672:FOR I=1136 TO 1998:
  POKEI+A,PEEK(I):NEXT:SYS33876
READY.
```

C*

```
      PC  IRQ  SR  AC  XR  YR  SP
.; B780 E455 34 33 38 36 FA
.;
.; 0470 31 14 1F 0F 28 05 19 21
.; 0478 00 07 00 00 10 00 00 00
.; 0480 00 00 00 28 50 78 A0 C8
.; 0488 F0 18 40 68 90 B8 E0 08
.; 0490 30 58 80 A8 D0 F8 20 48
.; 0498 70 98 C0 20 53 62 7D 80
.; 04A0 94 A0 B3 C2 20 02 19 20
.; 04A8 03 08 15 01 0E 20 03 08
.; 04B0 05 05 20 20 78 A9 6F A2
.; 04B8 84 85 EB 86 EC 86 A7 58
.; 04C0 20 75 84 A2 00 86 A7 A9
.; 04C8 10 A2 84 20 86 E0 60 20
.; 04D0 4F 85 4C 9D E1 A0 83 A2
.; 04D8 18 98 9D 3B 84 E0 14 F0
.; 04E0 08 E0 0D F0 04 E0 07 D0
.; 04E8 01 88 CA 10 EC E8 86 9F
.; 04F0 86 C4 A9 20 9D 00 80 9D
.; 04F8 00 81 9D 00 82 9D 00 83
.; 0500 CA D0 F1 A0 00 84 C6 84
.; 0508 D8 A6 D8 BD 3B 84 09 80
```

```
.; 0510 85 C5 BD 22 84 85 C4 A9
.; 0518 27 85 D5 E0 18 F0 09 BD
.; 0520 3C 84 30 04 A9 4F 85 D5
.; 0528 A5 C6 C9 28 90 04 E9 28
.; 0530 85 C6 60 09 40 A6 9F F0
.; 0538 02 09 80 A6 DC F0 02 C6
.; 0540 DC 20 06 E6 E6 C6 A4 D5
.; 0548 C4 C6 B0 30 A6 D8 C0 4F
.; 0550 D0 0B 20 1D 85 20 67 86
.; 0558 A9 00 85 C6 60 E0 18 D0
.; 0560 09 20 8B 86 C6 A3 C6 D8
.; 0568 A6 D8 1E 3C 84 5E 3C 84
.; 0570 20 1D 85 A5 C6 48 20 A9
.; 0578 84 68 85 C6 60 E0 17 B0
.; 0580 08 BD 3D 84 09 80 9D 3D
.; 0588 84 60 A0 27 A6 D8 D0 05
.; 0590 86 C6 68 68 60 BD 3A 84
.; 0598 30 06 CA BD 3A 84 A0 4F
.; 05A0 CA 86 D8 85 C5 BD 22 84
.; 05A8 85 C4 84 C6 84 D5 60 A9
.; 05B0 00 85 AC A5 D9 29 7F C9
.; 05B8 1B D0 07 68 68 4C BD E3
.; 05C0 EA EA A4 C6 A5 D9 30 68
.; 05C8 C9 0D D0 03 4C 7E 86 C9
.; 05D0 20 90 08 29 3F 20 6A E1
.; 05D8 4C D5 84 A6 DC F0 03 4C
.; 05E0 D9 84 C9 14 D0 10 88 84
.; 05E8 C6 10 06 20 2A 85 4C 5C
.; 05F0 E2 68 68 4C 51 E2 A6 CD
.; 05F8 F0 03 4C D9 84 C9 12 D0
.; 0600 03 85 9F 60 C9 13 D0 03
.; 0608 4C A3 84 C9 1D D0 10 C8
.; 0610 84 C6 88 C4 D5 90 07 20
.; 0618 67 86 A9 00 85 C6 60 C9
.; 0620 11 D0 FB 18 98 69 28 C5
.; 0628 D5 90 F1 F0 EF 4C 67 86
.; 0630 29 7F C9 7F D0 02 A9 5E
.; 0638 C9 20 90 03 4C D3 84 C9
.; 0640 0D D0 03 4C 7E 86 A6 CD
.; 0648 D0 2F C9 14 D0 27 A4 D5
.; 0650 B1 C4 C9 20 D0 04 C4 C6
.; 0658 D0 07 C0 4F F0 16 20 ED
.; 0660 86 A4 D5 88 B1 C4 C8 91
.; 0668 C4 88 C4 C6 D0 F5 A9 20
.; 0670 91 C4 E6 DC 60 A6 DC F0
.; 0678 05 09 40 4C D9 84 C9 11
.; 0680 D0 2A A5 C6 C9 28 90 05
.; 0688 E9 28 85 C6 60 A6 D8 F0
.; 0690 FB BD 3A 84 10 07 C6 D8
.; 0698 20 A9 84 90 EF CA CA 86
.; 06A0 D8 20 A9 84 A5 C6 18 69
.; 06A8 28 85 C6 60 C9 12 D0 04
.; 06B0 A9 00 85 9F C9 1D D0 08
.; 06B8 88 84 C6 10 EE 20 2A 85
.; 06C0 C9 13 D0 E7 4C 75 84 38
.; 06C8 46 A3 A6 D8 E8 E0 19 D0
.; 06D0 03 20 8B 86 BD 3B 84 10
.; 06D8 F3 86 D8 4C A9 84 A9 00
.; 06E0 85 DC 85 9F 85 CD 85 C6
```



```

.: 06E8 4C 67 86 A0 00 84 C4 A9
.: 06F0 80 85 C8 85 C5 A9 28 2C
.: 06F8 3C 84 30 02 A9 50 85 C7
.: 0700 B1 C7 91 C4 C8 D0 F9 E6
.: 0708 C8 E6 C5 A9 84 C5 C8 D0
.: 0710 EF A9 E8 85 C4 C6 C5 A9
.: 0718 20 C6 C4 C6 C7 91 C4 D0
.: 0720 F8 A2 19 86 D8 A2 00 C6
.: 0728 D8 BD 3B 84 29 7F BC 3C
.: 0730 84 10 02 09 80 9D 3B 84
.: 0738 E8 E0 19 D0 EC A9 83 8D
.: 0740 53 84 AD 3B 84 10 DE 20
.: 0748 0B E4 A6 D8 60 A6 D8 E8
.: 0750 E0 18 F0 36 90 03 4C 01
.: 0758 85 A2 17 BD 3C 84 09 80
.: 0760 85 C8 BC 3B 84 30 02 29
.: 0768 7F 9D 3C 84 98 09 80 85
.: 0770 C5 A0 27 BD 23 84 85 C7
.: 0778 BD 22 84 85 C4 B1 C4 91
.: 0780 C7 88 10 F9 CA E4 D8 D0
.: 0788 D2 E8 BD 3B 84 09 80 85
.: 0790 C5 29 7F 9D 3B 84 BD 22
.: 0798 84 85 C4 A0 27 A9 20 91
.: 07A0 C4 88 10 FB 58 4C A9 84

```

READY.

READY.

C*

```

      PC  IRQ  SR  AC  XR  YR  SP
.; B780 E455 34 33 38 36 FA

```

```

8454 78          SEI
8455 A9 6F      LDA #$6F
8457 A2 84      LDX #$84
8459 85 EB      STA $EB
845B 86 EC      STX $EC
845D 86 A7      STX $A7
845F 58          CLI
8460 20 75 84   JSR $8475
8463 A2 00      LDX #$00
8465 86 A7      STX $A7
8467 A9 10      LDA #$10
8469 A2 84      LDX #$84
846B 20 86 E0   JSR $E086
846E 60          RTS

```

```

846F 20 4F 85   JSR $854F
8472 4C 9D E1   JMP $E19D

```

```

8475 A0 83      LDY #$83
8477 A2 18      LDX #$18
8479 98          TYA
847A 9D 3B 84   STA $843B,X

```

```

847D E0 14      CPX #$14
847F F0 08      BEQ $8489
8481 E0 0D      CPX #$0D
8483 F0 04      BEQ $8489
8485 E0 07      CPX #$07
8487 D0 01      BNE $848A
8489 88          DEY
848A CA          DEX
848B 10 EC      BPL $8479
848D E8          INX
848E 86 9F      STX $9F
8490 86 C4      STX $C4
8492 A9 20      LDA #$20
8494 9D 00 80   STA $8000,X
8497 9D 00 81   STA $8100,X
849A 9D 00 82   STA $8200,X
849D 9D 00 83   STA $8300,X
84A0 CA          DEX
84A1 D0 F1      BNE $8494

```

```

84A3 A0 00      LDY #$00
84A5 84 C6      STY $C6
84A7 84 D8      STY $D8
84A9 A6 D8      LDX $D8
84AB BD 3B 84   LDA $843B,X
84AE 09 80      ORA #$80
84B0 85 C5      STA $C5
84B2 BD 22 84   LDA $8422,X
84B5 85 C4      STA $C4
84B7 A9 27      LDA #$27
84B9 85 D5      STA $D5
84BB E0 18      CPX #$18
84BD F0 09      BEQ $84C8
84BF BD 3C 84   LDA $843C,X
84C2 30 04      BMI $84C8
84C4 A9 4F      LDA #$4F
84C6 85 D5      STA $D5
84C8 A5 C6      LDA $C6
84CA C9 28      CMP #$28
84CC 90 04      BCC $84D2
84CE E9 28      SBC #$28
84D0 85 C6      STA $C6
84D2 60          RTS

```

```

84D3 09 40      ORA #$40
84D5 A6 9F      LDX $9F
84D7 F0 02      BEQ $84DB
84D9 09 80      ORA #$80
84DB A6 DC      LDX $DC
84DD F0 02      BEQ $84E1
84DF C6 DC      DEC $DC
84E1 20 06 E6   JSR $E606
84E4 E6 C6      INC $C6
84E6 A4 D5      LDY $D5
84E8 C4 C6      CPY $C6
84EA B0 30      BCS $851C
84EC A6 D8      LDX $D8

```


84EE	C0	4F	CPY	#\$4F	8555	29	7F	AND	#\$7F
84F0	D0	0B	BNE	\$84FD	8557	C9	1B	CMP	#\$1B
84F2	20	1D	JSR	\$851D	8559	D0	07	BNE	\$8562
84F5	20	67	JSR	\$8667	855B	68		PLA	
84F8	A9	00	LDA	#\$00	855C	68		PLA	
84FA	85	C6	STA	\$C6	855D	4C	BD E3	JMP	\$E3BD
84FC	60		RTS		8560	EA		NOP	
84FD	E0	18	CPX	#\$18	8561	EA		NOP	
84FF	D0	09	BNE	\$850A	8562	A4	C6	LDY	\$C6
.					8564	A5	D9	LDA	\$D9
.					8566	30	68	BMI	\$85D0
8501	20	8B	JSR	\$868B	8568	C9	0D	CMP	#\$0D
8504	C6	A3	DEC	\$A3	856A	D0	03	BNE	\$856F
8506	C6	D8	DEC	\$D8	856C	4C	7E 86	JMP	\$867E
8508	A6	D8	LDX	\$D8	856F	C9	20	CMP	#\$20
850A	1E	3C	ASL	\$843C,X	8571	90	08	BCC	\$857B
850D	5E	3C	LSR	\$843C,X	8573	29	3F	AND	#\$3F
8510	20	1D	JSR	\$851D	8575	20	6A E1	JSR	\$E16A
8513	A5	C6	LDA	\$C6	8578	4C	D5 84	JMP	\$84D5
8515	48		PHA		857B	A6	DC	LDX	\$DC
8516	20	A9	JSR	\$84A9	857D	F0	03	BEQ	\$8582
8519	68		PLA		857F	4C	D9 84	JMP	\$84D9
851A	85	C6	STA	\$C6	8582	C9	14	CMP	#\$14
851C	60		RTS		8584	D0	10	BNE	\$8596
.					8586	88		DEY	
.					8587	84	C6	STY	\$C6
851D	E0	17	CPX	#\$17	8589	10	06	BPL	\$8591
851F	B0	08	BCS	\$8529	858B	20	2A 85	JSR	\$852A
8521	BD	3D	LDA	\$843D,X	858E	4C	5C E2	JMP	\$E25C
8524	09	80	ORA	#\$80	8591	68		PLA	
8526	9D	3D	STA	\$843D,X	8592	68		PLA	
8529	60		RTS		8593	4C	51 E2	JMP	\$E251
.					8596	A6	CD	LDX	\$CD
.					8598	F0	03	BEQ	\$859D
852A	A0	27	LDY	#\$27	859A	4C	D9 84	JMP	\$84D9
852C	A6	D8	LDX	\$D8	859D	C9	12	CMP	#\$12
852E	D0	05	BNE	\$8535	859F	D0	03	BNE	\$85A4
8530	86	C6	STX	\$C6	85A1	85	9F	STA	\$9F
8532	68		PLA		85A3	60		RTS	
8533	68		PLA		85A4	C9	13	CMP	#\$13
8534	60		RTS		85A6	D0	03	BNE	\$85AB
8535	BD	3A	LDA	\$843A,X	85A8	4C	A3 84	JMP	\$84A3
8538	30	06	BMI	\$8540	85AB	C9	1D	CMP	#\$1D
853A	CA		DEX		85AD	D0	10	BNE	\$85BF
853B	BD	3A	LDA	\$843A,X	85AF	C8		INY	
853E	A0	4F	LDY	#\$4F	85B0	84	C6	STY	\$C6
8540	CA		DEX		85B2	88		DEY	
8541	86	D8	STX	\$D8	85B3	C4	D5	CPY	\$D5
8543	85	C5	STA	\$C5	85B5	90	07	BCC	\$85BE
8545	BD	22	LDA	\$8422,X	85B7	20	67 86	JSR	\$8667
8548	85	C4	STA	\$C4	85BA	A9	00	LDA	#\$00
854A	84	C6	STY	\$C6	85BC	85	C6	STA	\$C6
854C	84	D5	STY	\$D5	85BE	60		RTS	
854E	60		RTS		85BF	C9	11	CMP	#\$11
.					85C1	D0	FB	BNE	\$85BE
.					85C3	18		CLC	
854F	A9	00	LDA	#\$00	85C4	98		TYA	
8551	85	AC	STA	\$AC	85C5	69	28	ADC	#\$28
8553	A5	D9	LDA	\$D9	85C7	C5	D5	CMP	\$D5

85C9 90 F1	BCC \$85BC	863B 90 EF	BCC \$862C
85CB F0 EF	BEQ \$85BC	863D CA	DEX
85CD 4C 67 86	JMP \$8667	863E CA	DEX
.		863F 86 D8	STX \$D8
.		8641 20 A9 84	JSR \$84A9
85D0 29 7F	AND #\$7F	8644 A5 C6	LDA \$C6
85D2 C9 7F	CMP #\$7F	8646 18	CLC
85D4 D0 02	BNE \$85D8	8647 69 28	ADC #\$28
85D6 A9 5E	LDA #\$5E	8649 85 C6	STA \$C6
85D8 C9 20	CMP #\$20	864B 60	RTS
85DA 90 03	BCC \$85DF	864C C9 12	CMP #\$12
85DC 4C D3 84	JMP \$84D3	864E D0 04	BNE \$8654
85DF C9 0D	CMP #\$0D	8650 A9 00	LDA #\$00
85E1 D0 03	BNE \$85E6	8652 85 9F	STA \$9F
85E3 4C 7E 86	JMP \$867E	8654 C9 1D	CMP #\$1D
85E6 A6 CD	LDX \$CD	8656 D0 08	BNE \$8660
85E8 D0 2F	BNE \$8619	8658 88	DEY
85EA C9 14	CMP #\$14	8659 84 C6	STY \$C6
85EC D0 27	BNE \$8615	865B 10 EE	BPL \$864B
85EE A4 D5	LDY \$D5	865D 20 2A 85	JSR \$852A
85F0 B1 C4	LDA (\$C4),Y	8660 C9 13	CMP #\$13
85F2 C9 20	CMP #\$20	8662 D0 E7	BNE \$864B
85F4 D0 04	BNE \$85FA	8664 4C 75 84	JMP \$8475
85F6 C4 C6	CPY \$C6	.	
85F8 D0 07	BNE \$8601	.	
85FA C0 4F	CPY #\$4F	8667 38	SEC
85FC F0 16	BEQ \$8614	8668 46 A3	LSR \$A3
85FE 20 ED 86	JSR \$86ED	866A A6 D8	LDX \$D8
8601 A4 D5	LDY \$D5	866C E8	INX
8603 88	DEY	866D E0 19	CPX #\$19
8604 B1 C4	LDA (\$C4),Y	866F D0 03	BNE \$8674
8606 C8	INY	8671 20 8B 86	JSR \$868B
8607 91 C4	STA (\$C4),Y	8674 BD 3B 84	LDA \$843B,X
8609 88	DEY	8677 10 F3	BPL \$866C
860A C4 C6	CPY \$C6	8679 86 D8	STX \$D8
860C D0 F5	BNE \$8603	867B 4C A9 84	JMP \$84A9
860E A9 20	LDA #\$20	.	
8610 91 C4	STA (\$C4),Y	.	
8612 E6 DC	INC \$DC	867E A9 00	LDA #\$00
8614 60	RTS	8680 85 DC	STA \$DC
8615 A6 DC	LDX \$DC	8682 85 9F	STA \$9F
8617 F0 05	BEQ \$861E	8684 85 CD	STA \$CD
8619 09 40	ORA #\$40	8686 85 C6	STA \$C6
861B 4C D9 84	JMP \$84D9	8688 4C 67 86	JMP \$8667
861E C9 11	CMP #\$11	.	
8620 D0 2A	BNE \$864C	.	
8622 A5 C6	LDA \$C6	868B A0 00	LDY #\$00
8624 C9 28	CMP #\$28	868D 84 C4	STY \$C4
8626 90 05	BCC \$862D	868F A9 80	LDA #\$80
8628 E9 28	SBC #\$28	8691 85 C8	STA \$C8
862A 85 C6	STA \$C6	8693 85 C5	STA \$C5
862C 60	RTS	8695 A9 28	LDA #\$28
862D A6 D8	LDX \$D8	8697 2C 3C 84	BIT \$843C
862F F0 FB	BEQ \$862C	869A 30 02	BMI \$869E
8631 BD 3A 84	LDA \$843A,X	869C A9 50	LDA #\$50
8634 10 07	BPL \$863D	869E 85 C7	STA \$C7
8636 C6 D8	DEC \$D8	86A0 B1 C7	LDA (\$C7),Y
8638 20 A9 84	JSR \$84A9	86A2 91 C4	STA (\$C4),Y


```

86A4 C8
86A5 D0 F9
86A7 E6 C8
86A9 E6 C5
86AB A9 84
86AD C5 C8
86AF D0 EF
86B1 A9 E8
86B3 85 C4
86B5 C6 C5
86B7 A9 20
86B9 C6 C4
86BB C6 C7
86BD 91 C4
86BF D0 F8
86C1 A2 19
86C3 86 D8
86C5 A2 00
86C7 C6 D8
86C9 BD 3B 84
86CC 29 7F
86CE BC 3C 84
86D1 10 02
86D3 09 80
86D5 9D 3B 84
86D8 E8
86D9 E0 19
86DB D0 EC
86DD A9 83
86DF 8D 53 84
86E2 AD 3B 84
86E5 10 DE
86E7 20 0B E4
86EA A6 D8
86EC 60
.
.
86ED A6 D8
86EF E8
86F0 E0 18
86F2 F0 36
86F4 90 03
86F6 4C 01 85
86F9 A2 17
86FB BD 3C 84
86FE 09 80
8700 85 C8
8702 BC 3B 84
8705 30 02
8707 29 7F
8709 9D 3C 84
870C 98
870D 09 80
870F 85 C5
8711 A0 27
8713 BD 23 84
8716 85 C7
8718 BD 22 84
871B 85 C4

```

```

INX
BNE $86A0
INC $C8
INC $C5
LDA #$84
CMP $C8
BNE $86A0
LDA #$E8
STA $C4
DEC $C5
LDA #$20
DEC $C4
DEC $C7
STA ($C4),Y
BNE $86B9
LDX #$19
STX $D8
LDX #$00
DEC $D8
LDA $843B,X
AND #$7F
LDY $843C,X
BPL $86D5
ORA #$80
STA $843B,X
INX
CPX #$19
BNE $86C9
LDA #$83
STA $8453
LDA $843B
BPL $86C5
JSR $E40B
LDX $D8
RTS

```

```

LDX $D8
INX
CPX #$18
BEQ $872A
BCC $86F9
JMP $8501
LDX #$17
LDA $843C,X
ORA #$80
STA $C8
LDY $843B,X
BMI $8709
AND #$7F
STA $843C,X
TYA
ORA #$80
STA $C5
LDY #$27
LDA $8423,X
STA $C7
LDA $8422,X
STA $C4

```

```

871D B1 C4
871F 91 C7
8721 88
8722 10 F9
8724 CA
8725 E4 D8
8727 D0 D2
8729 E8
872A BD 3B 84
872D 09 80
872F 85 C5
8731 29 7F
8733 9D 3B 84
8736 BD 22 84
8739 85 C4
873B A0 27
873D A9 20
873F 91 C4
8741 88
8742 10 FB
8744 58
8745 4C A9 84
.
.
READY.

```

```

LDA ($C4),Y
STA ($C7),Y
DEY
BPL $871D
DEX
CPX $D8
BNE $86FB
INX
LDA $843B,X
ORA #$80
STA $C5
AND #$7F
STA $843B,X
LDA $8422,X
STA $C4
LDY #$27
LDA #$20
STA ($C4),Y
DEY
BPL $873F
CLI
JMP $84A9

```

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Part I

If you have a personal computer of any kind, you probably already appreciate the power of a general-purpose computer system to serve as a controller. While tying up your APPLE or PET to control the thermostat may not seem overly attractive, you can usually try out a control idea or scheme using your existing computer system and small amount of custom I/O. Eventually, however, you will want to dedicate a separate computer system to your controller application.

It wasn't so long ago that such a thought would be prohibitive. Computer systems were dream machines that cost several thousands of dollars. Of course, if you have a console type computer system which includes a CRT and perhaps one or more disks, then your console system can easily cost three or more thousand dollars. On the other hand, a great many controller applications require little more than a handful of chips that cost well under \$100. In fact, if your application has any merit and a significant market, it may be quite possible to integrate the design into a single-chip microcomputer costing only a couple of dollars, and you can be on your way to making your first million.

While your particular application may never make you rich, it is fairly easy to put together a prototype or a one-of-a-kind microcontroller system for a reasonable price. A 6502 will cost less than \$10. A 2716 will cost about the same. Figure \$5 for a 128 x 8 RAM chip, (Motorola 6810), or \$8 for a pair of 2114's for 1K of RAM. A 6522 for \$8 will provide sixteen bits of I/O and a pair of timers (suitable for a real-time clock). Finally, a few more dollars for a crystal and some TTL for address decoding, and the electronic parts cost will come to not much more than \$50.

If the parts really cost as little as mentioned, what's to prevent anyone with a little knowledge of computers from designing and building his own microcontrollers? The answer is absolutely nothing.

But there is one small catch. While the cost of the end product may be minimal or even negligible, most companies or individuals who design microcomputer systems do it with the aid of a microprocessor "development system". Commercial development systems start at about \$5,000, but typically range from \$15,000 to \$25,000.

In my book, **Microcomputer Design and Troubleshooting**, which is being typeset and will be in print in the Fall (Howard Sams, and the Blacksburg Series), I address the question of what comprises a typical development system, but more importantly, what is minimally required to put together your own low-budget development system. While the reader will want to read about the details in the book when it is published, the highlights of that discussion will be brought out here, in this first installment of several in which I will outline the procedures and equipment necessary to put together and bring up, your own microcomputer controllers.

The Development System

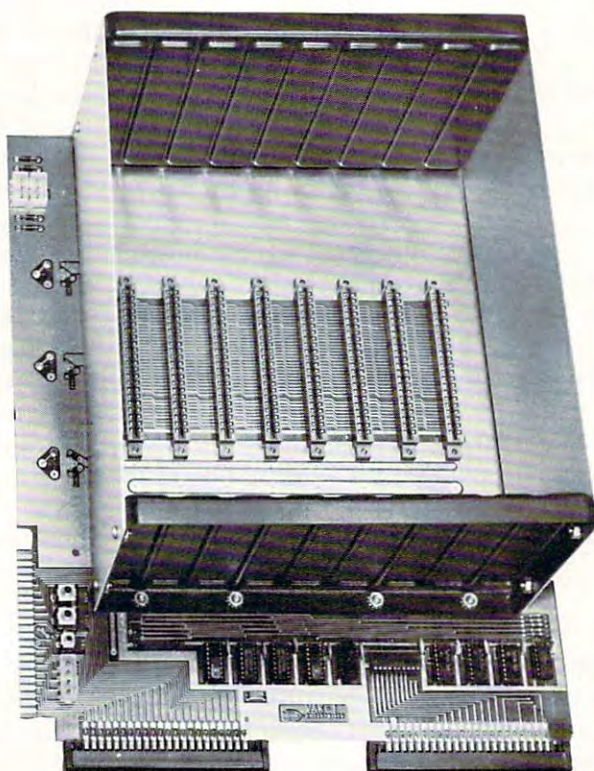
A development system is the hardware and software required to check out and debug both the hardware and software of a prototype microprocessor system. Ironically, the hardware and software debugging capabilities are not always reflected by the systems very high cost. Software debugging capabilities are usually satisfactory, provided that the system has an "optional" processor emulator module which typically costs \$2,000 or more. Even with the emulator, the hardware debugging capabilities may be mediocre at best.

Typically, a commercial development system consists of the following items:

1. Microcomputer with software
2. Console device (CRT or Teletypewriter)
3. RAM memory blocks
4. Floppy disk(s)
5. Printer
6. EPROM programmer (with software)
7. Emulator (processor)

Why should such a system cost \$15,000? The reason for the high cost is the law of supply and demand; there just aren't that many people in the world who need a microprocessor development system. However, except for some specialized software like an editor and assembler, the first five items in the list are not appreciably different than what you get in a BASIC oriented console computer system like a PET or APPLE. And, of course,

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editors and assemblers are easy to come by for most console systems. On the other hand, not many microprocessor development systems will allow you to run a program in BASIC, or Pascal, or FORTH. In other words, while a personal computer can be turned into a development system, a development system usually does not make a very good personal computer. It should be made clear, however, that a personal computer is not a development system without items 6 and 7 in the list above (or their equivalent). The EPROM programmer is easy. Such accessories are available for very reasonable prices. If you don't mind stuffing a blank board, you can put together your own universal EPROM programmer for less than \$30. However, the "emulator" function is not quite so available.

The function of an emulator is to provide the prototype controller with the attributes of an operating system. Suppose you want to make a controller out of an existing single-board computer like a KIM or SYM. After attaching any additional I/O hardware required, you can hand assemble a controller program and enter it into the KIM or SYM's RAM using its built-in operating system. Programs under development can be saved on tape. Software debug functions are even available to get the program running. But what do you do if your prototype controller is not like a KIM or SYM? What if it has no keyboard or display, or any means (operating system) of entering a program into itself? There are two solutions to this problem. One is to use (abuse) an EPROM programmer. The second is to use some kind of emulator.

The first solution mentioned is actually used by owners of commercial development systems, who do not have an emulator module. It works as follows. First, a program is developed and entered into RAM in the development system's microcomputer. The RAM contents are now burned into an EPROM. The EPROM is now plugged into the prototype system and an attempt made to reset the prototype system and run the program. If the program does not run as expected, the program is modified and a second EPROM is programmed. In the meantime, the old EPROM is being erased. While this method can eventually produce a working program it is very tedious and inefficient. To give you some idea of how really dumb this method is, consider using the same method to write a program in BASIC. That is, suppose you had to enter the program into RAM, burn the RAM contents into an EPROM and then plug the EPROM into a special socket to try out your program. Yet that is essentially what many, if not most, people do to bring up controllers. Clearly there must be a much better way.

The second approach is to give the prototype system a virtual operating system with some kind

of emulator. Commercial development systems generally emulate the prototype's processor. Such a processor emulator is a very complex hardware and software system, usually requiring two or three large PC boards which live in the development system's card rack. The emulator physically connects to the prototype via a cable which plugs into the prototype's processor socket. The development system is used to create a program in a block of RAM. The emulator allows the block of RAM to be executed as if it resided in the prototype system. In addition, the program can be stepped, the register contents displayed, breakpoints set, etc. Effectively, the emulator runs considerable software "in the cracks" between prototype program instructions. One consequent limitation of this scheme, however, is that many emulators are unable to execute prototype programs at the full processor speed.

While a processor emulator can be quite useful for debugging software, it is somewhat less suitable for finding hardware bugs. Unfortunately, many users attempt to debug complicated software before even knowing whether the hardware is 100% functional. As mentioned, a processor emulator is very expensive, typically two or three thousand dollars, and cannot be used independently of the development system for which it was designed. Fortunately, another kind of emulator can be built that is usable with almost any computer system having an operating system, including one as simple as a KIM. Instead of emulating the prototype's processor, this emulator emulates the prototype system's ROM or EPROM. It is nothing more than a small block of RAM that can be alternately addressed as part of the host computer system, or via the EPROM socket in the prototype system. Aside from the fact that an EPROM emulator can be an efficient tool for debugging both hardware and software, the best thing about an EPROM emulator is that it can be put together for less than \$100.

An EPROM emulator is used as follows. A program is assembled and placed into the emulator RAM block using your computer's operating system. Throwing a switch on the emulator now causes the RAM block to be addressed from a cable and plug inserted into the empty EPROM socket on the prototype system. If a change is required, the switch is flipped back into the host system position and any changes made in the emulator RAM. There is never any need to burn an EPROM until the program is completely debugged. At any point along the way, the RAM contents can be preserved on tape or disk.

In the next column, we will see what it takes to put together an EPROM emulator, and use it to debug both hardware and software. A very workable microprocessor development system can be had with as little as a KIM, an EPROM programmer,

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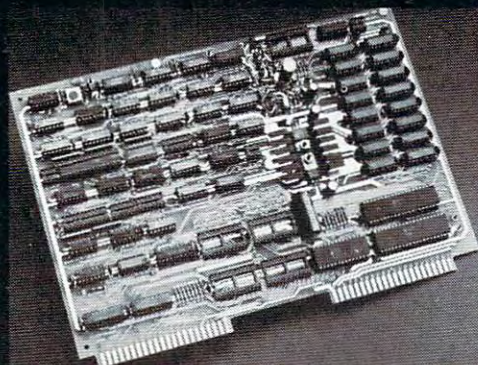


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A Kim-I Music File In Microsoft Basic

Part 1.

Anthony T. Scarpelli
N. Windham ME

Getting The System Together

If you have a KIM-I, don't have a printer, but do have a memory mapped video display, here's how I solved the problem of getting a software routine to cause an ASCII keyboard to act like a serial teletypewriter with all the KIM-I's teletype operations. There's nothing that seems complicated about what I did, but it sure took some mental gyrations to get it working. Yet I did learn a lot about the KIM monitor routines which I'll tell you about. Also how to implement BASIC, and how to implement a Music File which I wrote for my wife. Here's the story.

I had a KIM-I up and running and was learning a lot about assembly language programming, when the opportunity of getting a high resolution video monitor for cheap came along. I bought a SWTP keyboard, and while I was at one of the computer fairs last year I purchased Microtechnology's 8K visible memory and a main frame. The price was good and it was completely compatible with the KIM. It's a dynamic memory system, but is completely invisible to normal computer use, and it has a standard video output. It works beautifully, and is fairly high in resolution with 64,000 bits as dots on the screen. Writing a "1" in a memory location lights up a dot, and, of course, a "0" turns the dot off. Microtechnology's SWIRL software routine shows the system off and provides hours of viewing enjoyment; and when company comes over it's great for showing off your computer.

Microtechnology also has a text display routine whereby, after an ASCII number is put into the accumulator, a subroutine call to the text display puts the ASCII character on the monitor screen. It provides a 53 character by 18 line display, with both upper and lower case letters. Having a software character generator gives you complete control over the configuration of the letters. For instance, I changed all my lower case letters, which I didn't need, into a table of 26 lines, dots, and other shapes for drawing on the screen. Also, the whole screen can be saved on tape. My wife was very pleased as a valentine message formed from a

randomly patterned screen. Hypertape loaded the screen in under three minutes.

I also purchased from Microtechnology their bare board 16K memory, and purchased the I.C.'s and components at other sources. You can save about a hundred dollars this way, but you do have to get a few extra memory chips in case a bad one comes up and you do have to do all of your own soldering, and testing. If you go this route you might have a fault in the bare board. In the one I bought, a part of the PCB pattern wasn't etched away so I had no -5v supply. After I fixed the problem the board worked perfectly the first time running and onwards, and I have nothing but praises for the design.

Then came the job of getting my keyboard with parallel output ASCII to go serial. It turned out to be not too difficult when I found an interface in a series of articles by John Blankenship in Kilobaud. In the March '78 issue he shows how to build a parallel to serial interface for the KIM-I. It merely takes the parallel output of the keyboard, using three I.C.'s and a transistor, and the KIM's power and clock, and converts it to a serial output which is presented to the printer input of the KIM. It worked very well.

Then what? Well, here comes the hard part. In order to get the KIM to accept a printer input, you connected pins "21" and "V" on the applications connector, hit the RS button, press the RUBOUT key on your keyboard and type away. The only problem is that any ASCII characters that come in don't go anywhere except to the printer output of the same connector. The ASCII number is put into the accumulator, but how do you call up a subroutine in some other part of memory to display it? The solution wasn't too difficult. You write a little program that jumps to KIM's own GETCH subroutine which then puts the printer ASCII character into the accumulator, then jumps to the character display subroutine, then jumps back to the GETCH etc. You start out by going to the memory location where the program starts on the KIM keyboard, short the two pins together (best to get a switch to do this), hit RS, then RUBOUT, and G on the keyboard, and away you go. You're finally writing on the CRT. Now what?

With this method that's about all you can do because you are in a program of your own creation and are using KIM's ROM routines, and you have to stay there until you hit ST (stop). What I really wanted to do was have my keyboard act just like a printer: change memory, display it, and all the other things the user manual said you can do with a printer. I asked myself, how easily can this be done? More likely, how difficult is it. There were two possibilities open to me: hardware or software. My old teacher said you never learn enough by going the easy route. I didn't know whether hard-

ware or software was the most difficult, but I chose software. You can judge the result; I probably would have bought a printer.

To go the software route meant rewriting some of the subroutines in the KIM's ROM. To show you what routines I had to include, let's go over what happens in the KIM when you hit RS. So get out your user manual, follow the diagrams and let's go.

First look at the listings starting at 1C22 in the User Manual and also at fig. 1.

1. When the RS (reset) button is pressed the data at locations 1FFC & 1FFD, which happens to be the address 1C22, is put into the program counter. This is the entry point for the program in ROM of the 6530-002. This address is fixed and cannot be changed. It is the KIM entry via RST.

2. The first thing that happens is the stack pointer is initialized to FF.

3. Then we go to a subroutine called INITS at 1E88. In INITS, the first thing done is to put 01 into the X register and then put it into the top of the stack at 00FF.

Next, the X-index gets 00 and is stored in PADD which is the 6530-002 A ports data direction register. This is at address 1741 and makes all the ports inputs so they can accept data from TTY or KB (keyboard).

Next X-index gets 3F and is stored at 1743 which is the 6530-002 B ports data direction register, PBDD, and it makes ports PB6 and PB7 inputs, and all the rest outputs. PB7 is connected to the audio tape interface circuits and is prepared to accept program loading from tape.

Next X-index is loaded with 07 and is stored in SBD (1742) which is the data to be sent out from the 6530-002 data ports. So PB 0, 1, & 2 now have 1's on them. PB0 is for TTY data out. PB 1, 2, 3, & 4 go to the 74145 I.C.'s inputs. With a 1 on 1 & 2 and 0 on 3 & 4, all the outputs of the 74145 are high except 03. This goes out to application connections A-V. When this pin is connected to A-21 (PA0), PA0 becomes low. This indicates TTY mode.

Next decimal mode is cleared and the interrupt disable status is set. Then a return from this subroutine.

4. Next back at 1C2A, FF is stored at 17F3 (CNTH 30) which is the TTY count, and 01 is stored in the accumulator. Then SAD (1740) is tested, specifically PA0. If it is not equal to zero, that is, if it's high, the program branches to START. PA7 is tested also. This is the input from the TTY keyboard. It tests for a rubout bit. PA7 is normally a one and the program will keep on testing this input until a zero is detected and also PA0 in case the TTY mode is not wanted any more.

If a zero is detected, the accumulator is loaded with FC and the carry flag is cleared, then 01 is

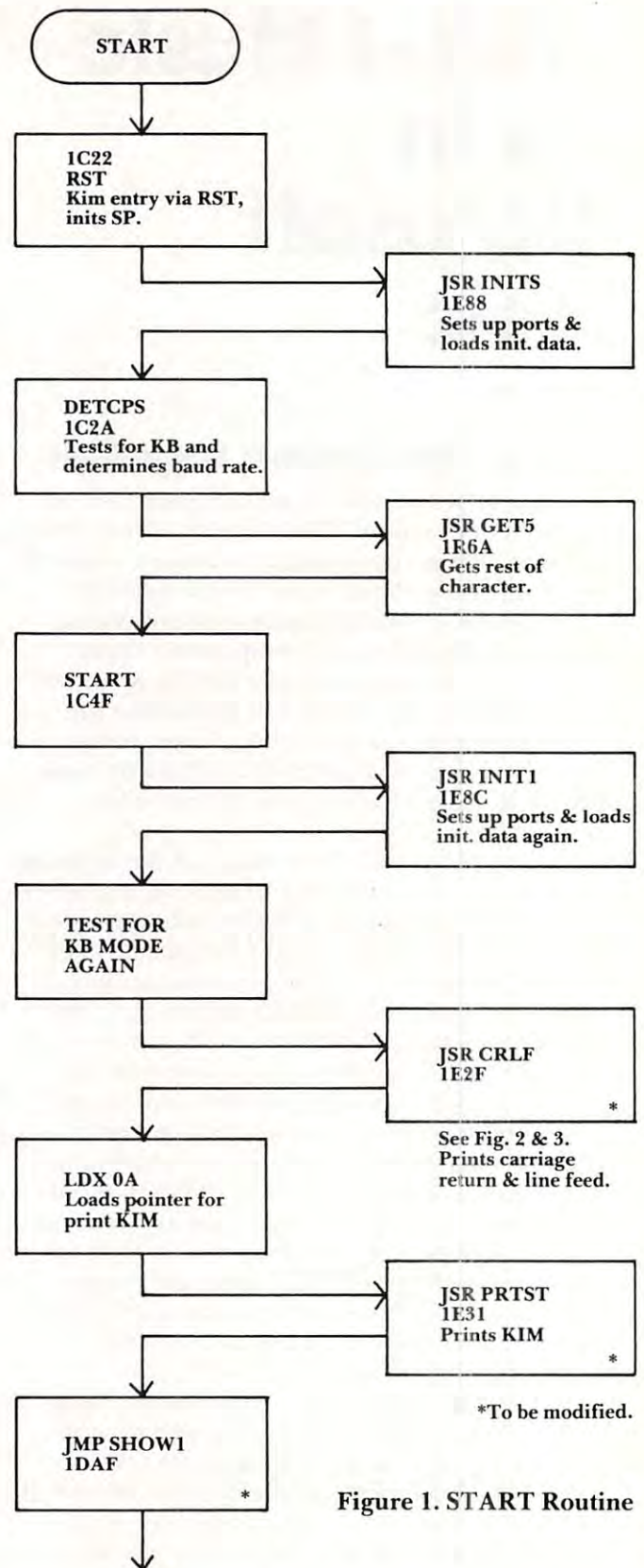


Figure 1. START Routine

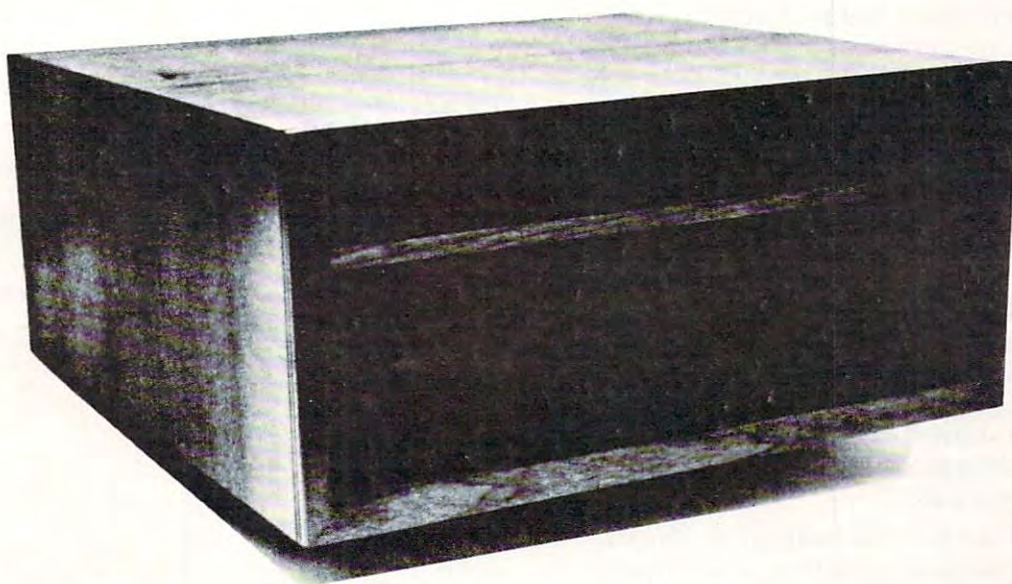
added to the accumulator (FC). If the carry flag is not set it will branch to DET 2. It will the first time around anyway. This part (DET 2) first loads Y-index with SAD (1740) and if the rubout bit is still there (a 0 at PA7) then it goes back to DET 3 and another 01 is added to the accumulator. When the



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accumulator reaches FF and 01 is added, the carry flag is set and CNTH30 (17F3) is incremented, it becomes 00. As long as the rubout bit is there the accumulator keeps on increasing and increases CNTH30. As soon as the bit ends the accumulator is stored in CNTL30 (17F2) and X-index gets an 08. Then the program goes to subroutine GET5 at 1E6A, where it goes to DEHALF (1EEB).

5. DEHALF first gets the high byte count time at CNTH30 and stores it in TIMH (17F4), then gets CNTL30. The accumulator and TIMH are shifted right (divides by two). If the 0 bit had a 0 the carry flag is cleared and a branch is taken to DE2, otherwise the accumulator is OR'd with 80 and it branches to DE4. If the DE2 branch was taken the carry flag has been set and next 01 is subtracted from the accumulator. The time is reduced and back with RTS. What is happening here is the keyboard baud rate in CNTL30 and CNTH30 is halved to get in the middle of the bit, then delayed one whole bit to read the next bit of the character. Cute, huh.

6. Back at 1E6D (GET2), the accumulator is loaded with SAD and the bit number 7 only is saved. 00FE is shifted right, then OR'd with the accumulator and stored in 00FE. Another delay and the process is repeated until the whole character is retrieved, then another half delay, X-index is loaded with TMPX (00FD), and the accumulator gets CHAR which is the ASCII character. The accumulator is rotated left then shifted right, which gets rid of any parity bit that might be stuck on the character. Then a return to START.

7. START. First is a jump to subroutine INIT1 (1E8C) which is the same as before, it sets up the ports. The accumulator is loaded with 01, and SAD is tested again for TTY or KB mode. If there's a 1 in PA0 it branches to KB mode. If no KB mode, it then jumps to CRLF, Fig. 2 & 3, (1E2F), which

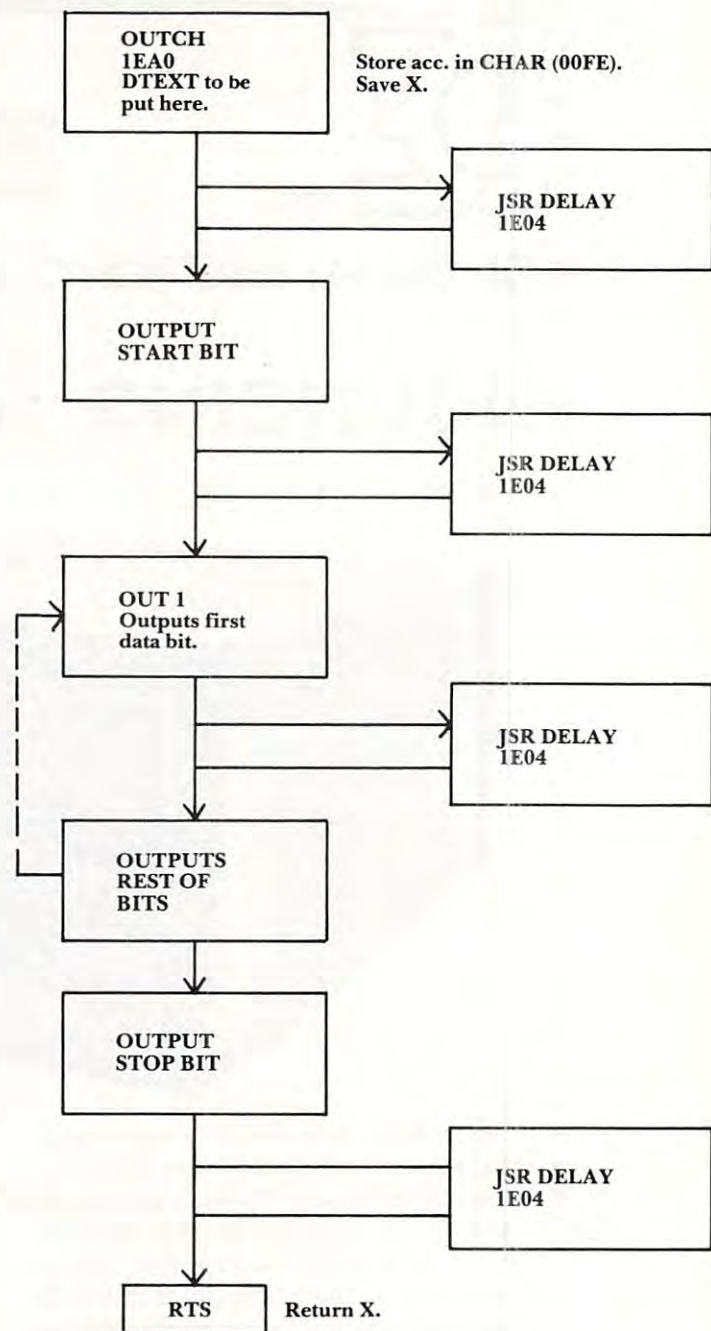
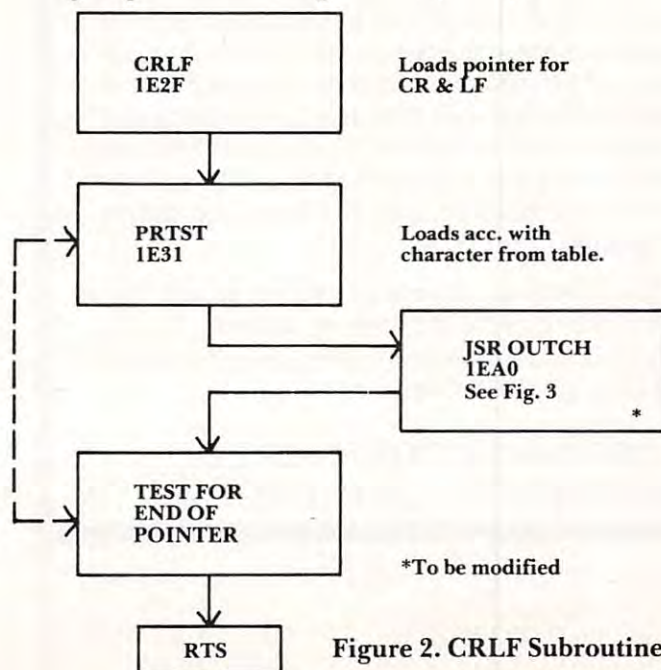


Figure 3. OUTCH Subroutine

prints a carriage return, then a line feed, then JSR PRTST prints "KIM", then jumps to SHOW1 (1DAF), Fig. 4, and then back to CLEAR, Fig. 7.

8. CLEAR. The accumulator gets loaded with 00 and is stored in INL & INH. The program tests for a character in GETCH, Fig. 8. In GETCH it stays in a loop waiting for a start bit. After the start bit, the rest of the character is retrieved and loaded into the accumulator, the program then comes back, and we test for KB mode again. If no KB the character is changed into a hex number in PACK, Fig. 9, and then in SCAN, Fig. 10, the program determines if the hex number is an execute key. If not, it will get another character.

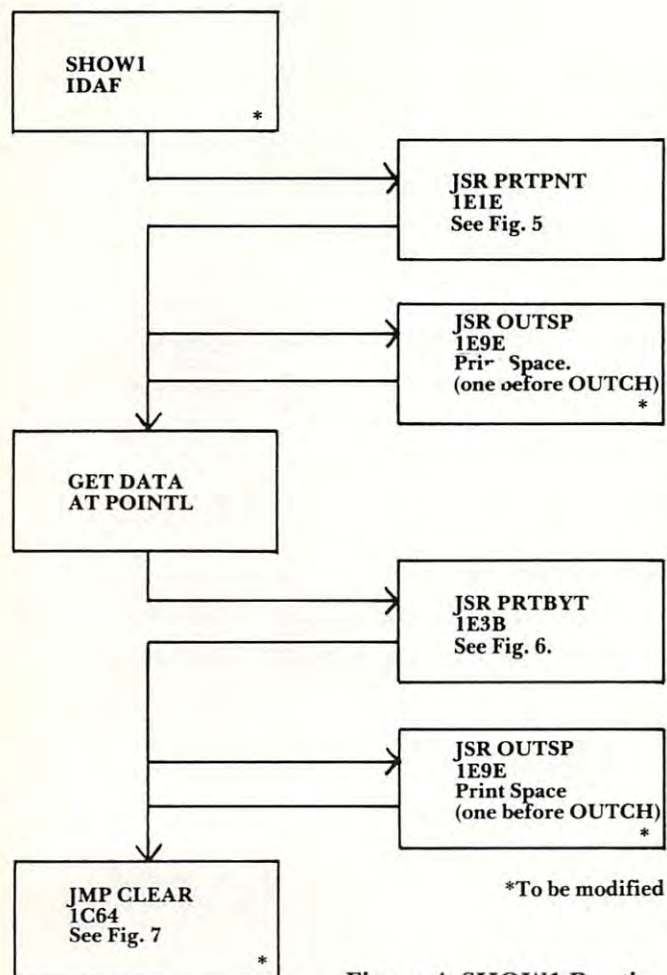
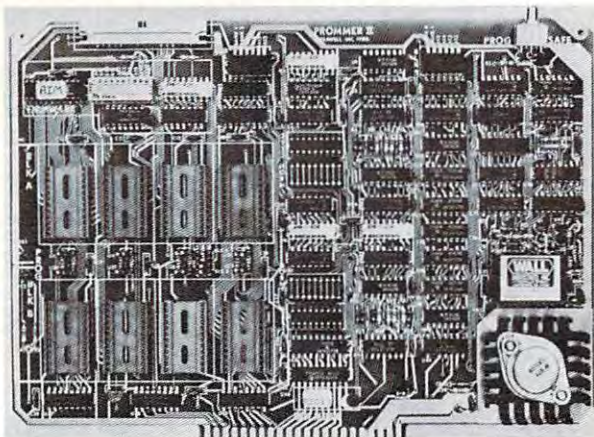


Figure 4. SHOW1 Routine

So this is the program I need to simulate a teletype. The problem now becomes, what are the subroutines I have to rewrite and which ones of the KIM's ROM subroutines can I use. Obviously, any part of the program that refers to a ROM address has to be rewritten, such as in a JMP. Also when the accumulator gets the ASCII character that is to be displayed, the program that does the displaying, in this case called DTEXT (the Microtechnology software routine), has to be addressed at the right point, and thus any subroutines involved here have to be rewritten. So definitely the subroutine OUTCH has to be changed to add DTEXT. We get to OUTCH from CRLF so that has to be rewritten. CRLF is addressed from START which is part of the whole RST routine. As you can see it starts to get involved. So if you go this route table I lists all the KIM ROM routines that must be rewritten. Of course in this rewriting, some branches have to be changed as well as addresses. (A SASE sent to me will get you a list of the changed addresses.)

Now my keyboard acts just as a teletype, and I can display all the teletype outputs from the KIM on the CRT. First I go to the RST program address, the one I rewrote, on the KIM display, switch to teletype mode, hit RS on the KIM, then press the rubout key on the keyboard. The SWTP keyboard doesn't have an actual rubout key, but there are two spare keys, one of which can be wired as rubout. Then I press the G key which puts me into

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the RST program, (rewritten). When the rubout key is pressed again the CRT will display "KIM" and also the address of the RST program; now we are as a teletype with all its functions. Simple, wasn't it.

Next time I'll go into the actual file program that creates a music file, and then can search it for any of a number of subjects.

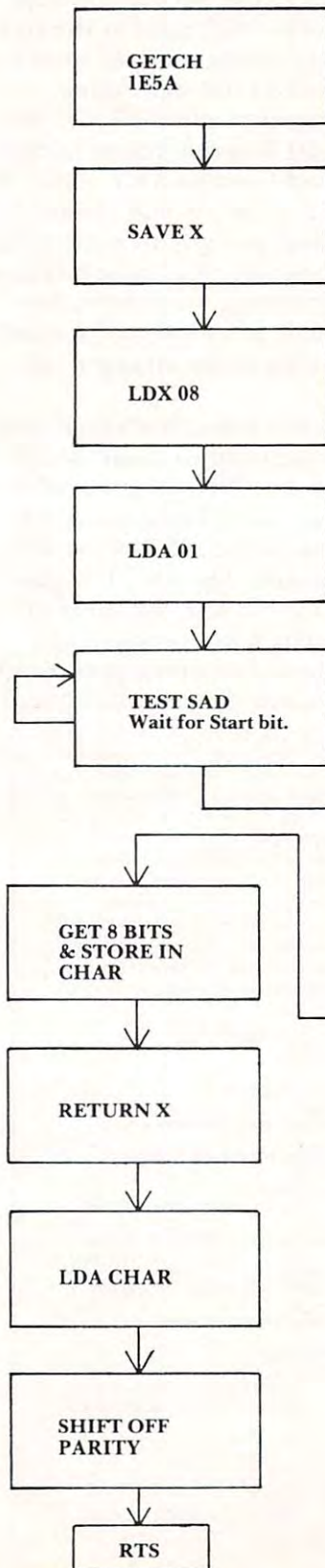


Figure 8. GETCH Subroutine

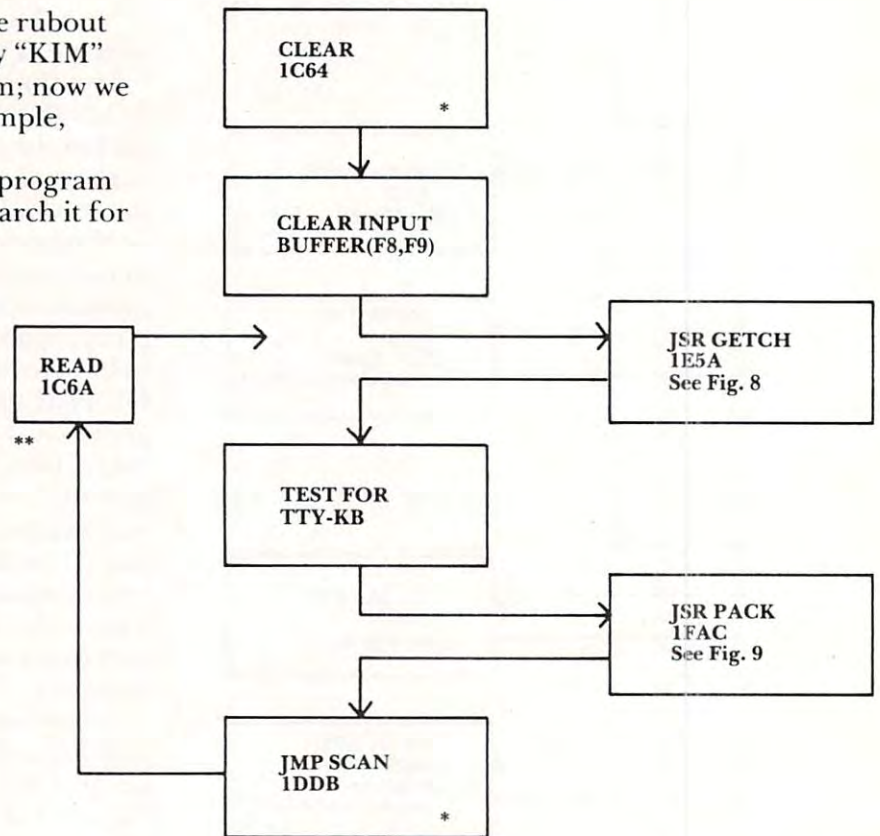


Figure 7. CLEAR Routine

*To be modified

**Re-entrance from SCAN

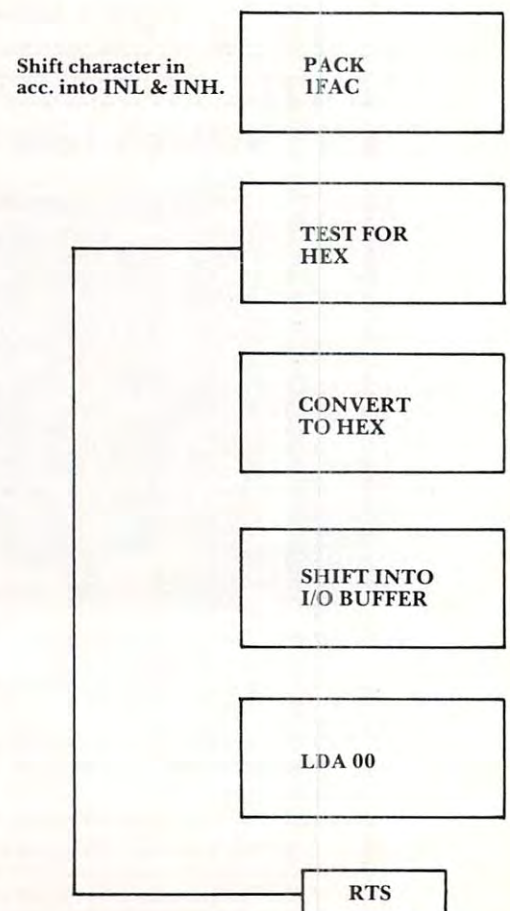


Figure 9. PACK Subroutine

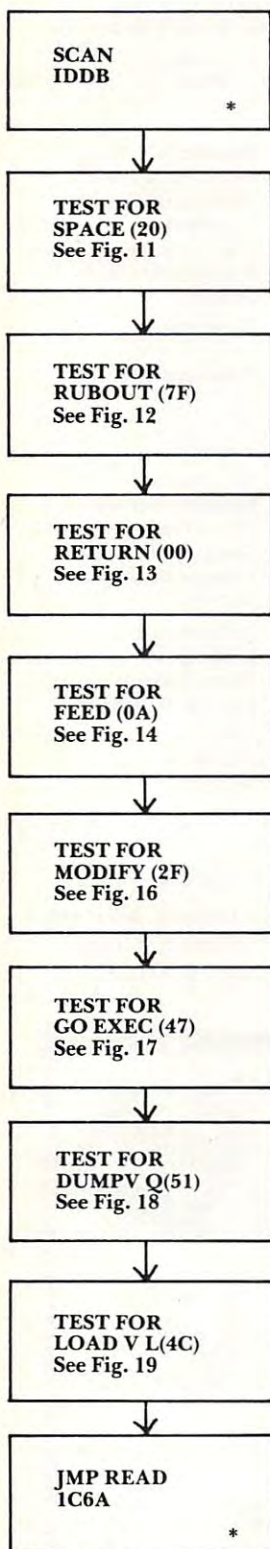


Figure 10.
SCAN Routine

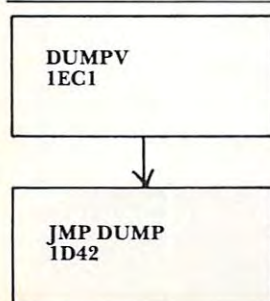


Figure 18. Dump
"V" Routine

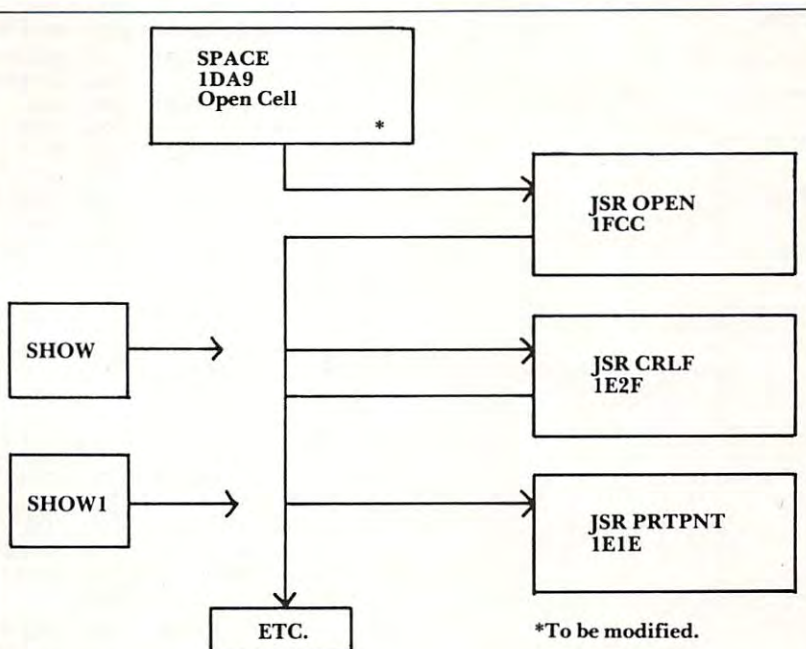


Figure 11. SPACE Routine

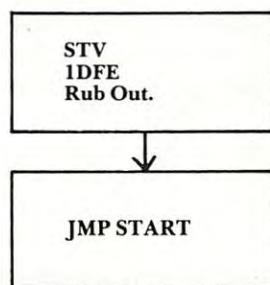


Figure 12. STV Routine

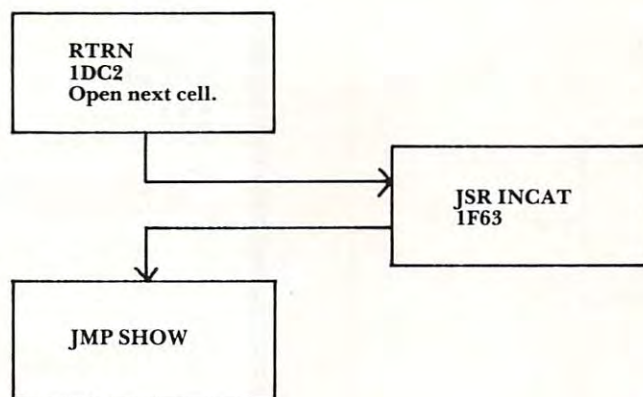


Figure 13. RTRN Routine

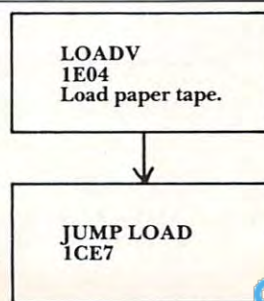


Figure 19. Load "V"
Routine

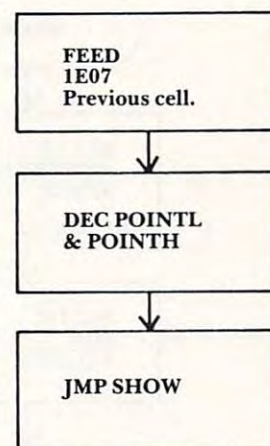


Figure 14. FEED
Routine

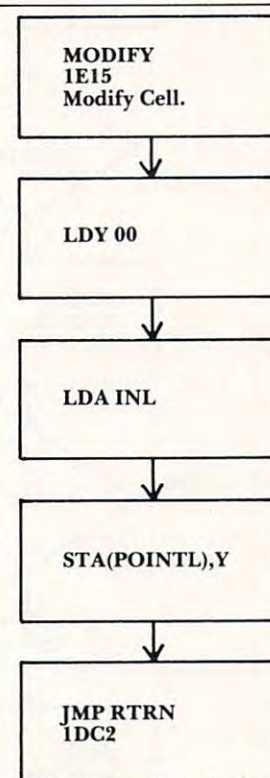


Figure 16. MODIFY
Routine

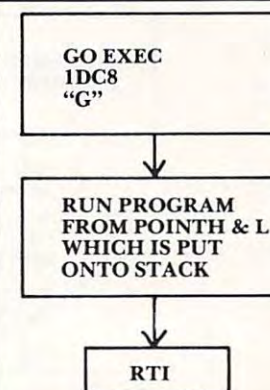


Figure 17. GOEXEC
Routine

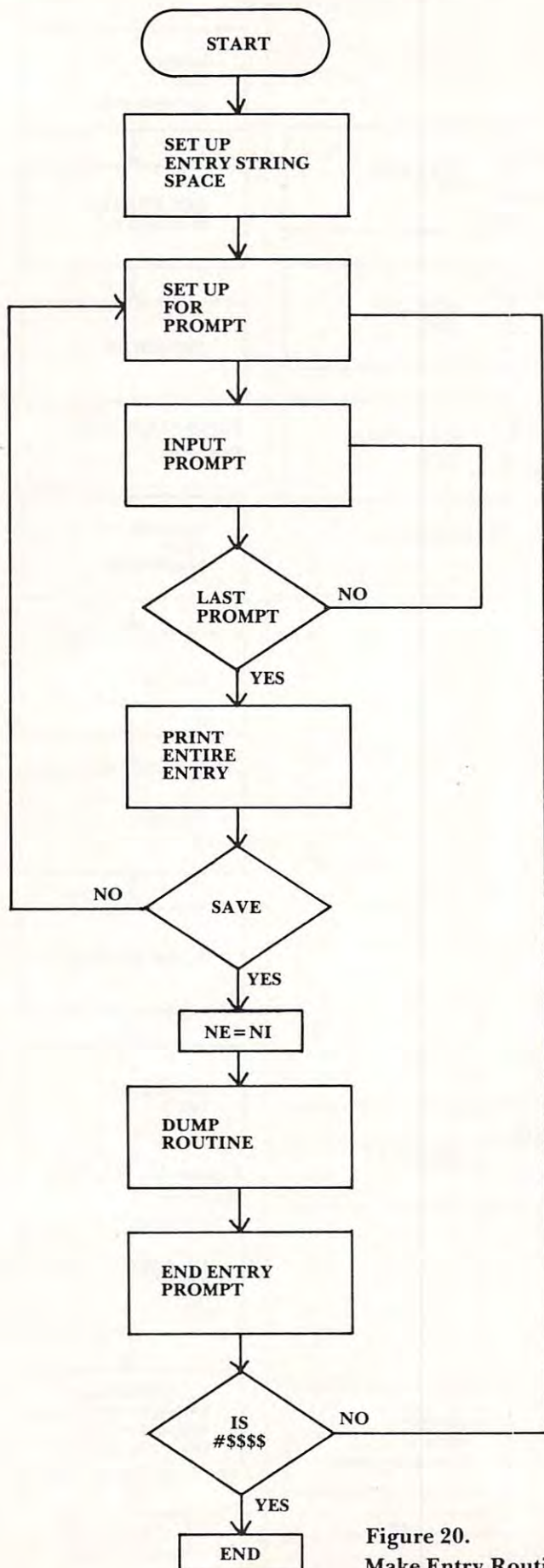


Figure 20.
Make Entry Routine

Assembly Language Program for Cassette DUMP & LOAD

0300 A5 01	DELAY	LDA DELTIM	Load delay
02 85 EE		STA TIMEA	value.
04 A9 30	DECB	LDA 30	Load
06 8D 04 17		STA 1704	timer.
09 2C 07 17	TEST	BIT 1707	Test timer.
0C 10 FB		BPL TEST	Branch if not run out.
0E C6 ED		DEC TIMEB	Reduce time value.
10 D0 F2		BNE DELB	Start again.
12 C6 EE		DEC TIMEA	Reduce delay value.
14 D0 EE		BNE DELA	Branch if not done.
16 60		RTS	Return.
0317 A9 02	TWRITE	LDA #02	Turn tape on.
19 10 02		BPL TAPE	
1B A9 01	TREAD	LDA #01	Turn tape off.
1D 4D 03 17	TAPE	EOR 1703	
20 8D 03 17		STA 1703	
23 60		RTS	Return.
0324 20 17 03	WRITE	JSR TWRITE	Turn tape on.
27 20 00 03		JSR DELAY	Delay for tape speed.
2A 20 00 02		JSR HYPER	Record in hypertape.
2D 20 17 03		JSR TWRITE	Turn tape off.
30 20 8C 1E		JSR INITI	Open ports again.
33 60		RTS	Return.
03D5 20 1B 03	READ	JSR TREAD	Turn on tape.
D8 20 36 03		JSR LOADT	Load tape.
DB 20 1B 03		JSR TREAD	Turn off tape.
DE 20 8C 1E		JSR INITI	Open ports again.
E1 60		RTS	Return.

Note: HYPER is taken from The First Book of KIM page 119 relocated to address 0200.

LOADT is taken from the KIM-I User Manual Program listing page 6 relocated from address 1871-1931 to 0334-03D4.

If you wish to use the same routines in the same addresses as I did, send a SASE and I'll let you know what locations have to be changed in those listings to get it to run right. ©

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CAPUTE!

Corrections/Clarifications

From Raymond Diedrichs ("Pet File I/O In Machine Language", April, 1981, Issue 11, pp. 144-145):

"In the machine language open statement, the following lines are missing:

```
LDA #DEVICE-NUMBER
STA $D4
LDA #SECONDARY-ADDRESS
STA $D3.
```

They should appear directly below the line which reads:

```
STA $D2.
```

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And here's the missing listing from Charles Brannon's "String Arrays in Atari BASIC," April, 1981, Issue 11, p. 103.

```
100 REM SIMPLE BAR GRAPH PROGRAM
110 GRAPHICS 0
120 PRINT "NUMBER OF COMPANIES";
130 INPUT NC
140 MAXLEN=20: DIM A$(MAXLEN*NC), L(NC),
    -A(NC), T$(MAXLEN)
150 FOR I=1 TO NC
160 T$="": REM 20 -
    -SPACES
170 E=I: GOSUB 200000
180 PRINT "ENTER THE NAME OF COMPANY "; I
190 INPUT T$: GOSUB 200000
200 PRINT "AMOUNT FOR "; T$;
210 INPUT A: A(I)=A: IF A>HI THEN HI=A
220 PRINT: NEXT I
230 GRAPHICS 0
240 FOR I=1 TO NC
250 E=I: GOSUB 300000
260 PRINT: PRINT T$
270 FOR J=1 TO (A(I)/HI)*30
280 PRINT CHR$(160);
290 NEXT J
300 NEXT I
310 END
200000 L=LEN(T$): IF L>MAXLEN THEN -
    -L=MAXLEN
20010 L(E)=L: START=(E-1)*MAXLEN+1
20020 A$(START, START+L-1)=T$: RETURN
300000 START=(E-1)*MAXLEN+1
30010 T$=A$(START, START+L(E)-1): RETURN
READY.
```

Program Listings for COMPUTE

Cursor control characters will appear in source listings as shown below:

```
h=HOME , H=CLEAR SCREEN
v=DOWN CURSOR , ^=UP CURSOR
>=RIGHT CURSOR, <=LEFT CURSOR
r=REVERSE , R=REVERSE OFF
```

Graphics (i.e. shifted) characters will appear as the unshifted alphanumeric character with an underline. This does not apply to the cursor control characters. The Spinwriter thimble doesn't have a backarrow symbol, so a "~" is used instead.

The "~" is used to indicate the beginning of a continuation line. It is also used to indicate the end of a line which ends with a space. This prevents any spaces from being hidden.

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Why does a computer pour the drinks at the Carvery, a downtown Toronto restaurant? Jim Butterfield, who is a small shareholder in the establishment, has no comment. Neither does he explain why the machine always pours him doubles.

Atari Launches Major Software Acquisition Program

Sunnyvale, California — April 3, 1981 — A major new effort to expand the library of consumer-oriented software for its personal computer systems is being launched by Atari, Inc. Atari is looking for high quality programs that can be used immediately, and easily, by people with little or no training in the use of computers.

"We want to acquire software in the areas of personal finance, self-improvement, education and home entertainment. We are encouraging the creation and

marketing of software by vendors and developers, and want to help market appropriate materials from outside authors," Bruce W. Irvine, vice president of software for Atari's Computer Division said. "To start things off, we are sponsoring a \$100,000 contest for software authors."

The acquisition program involves the creation of Atari Software Acquisition Program regional centers where qualified developers can work with Atari equipment and receive technical assistance, and Atari Program Exchange, a free quarterly catalog of user-written software to be distributed to Atari computer owners. In addition, Atari will offer periodic technical seminars for qualified software authors to familiarize them with the inner workings of Atari computer products and enable them to write programs that take advantage of all the advanced features of the ATARI 400™ and 800™ computers.

"We recognize that a broad selection of readily available software is a critical key to the ultimate consumer market. No one company can create the amount of material needed to properly address the market, so we are going to do our best to encourage our users and software vendors to create programs compatible with Atari computers. Often, a user or developer is an expert in a field we don't know much about; with our assistance, that person can make his or her programs available to the wide audience they deserve," Irvine added.

Acquisition Centers

Beginning with an initial installation in the Sunnyvale area which will open in mid-May, Atari will

develop software acquisition centers in geographical areas where there are high concentrations of programmers and users, such as metropolitan areas with technical universities. No timetable has been announced for the opening of these additional facilities.

Qualified developers will be able to use the centers on an appointment only basis. Design of the centers will help insure the privacy of material under development. Each center will be equipped with Atari computers and peripherals, all necessary reference materials and technical manuals. Center staff will help answer technical questions and review and evaluate completed software.

Once a program is completed, Atari may be interested in marketing it under the company name, or accept it for listing in the Atari Program Exchange catalog. Or, developers may wish to market the program on their own.



Pet User Group Celebrates Third Birthday

As shown in the birthday cake picture above, SPHINX celebrated their third year with a full sized Pet cake (complete with keyboard and message on the screen) at their meeting March 14, 1981 at the Lawrence Hall of

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Science, Berkeley, California.

Originally formed by Niel Busey and Milt Lee, SPHINX, (Society For Pet Handlers Information Exchange), cooperated with Lawrence Hall of Science in putting out a newsletter which contained basic information about the Pet when there was little from the manufacturer.

Although the newsletter has been discontinued, they are still active in exchanging programs. At the sixth West Coast Computer Fair, April 5, 1981, a proposal was made that librarians from user groups across the United

States trade programs on a disk basis. To this end SPHINX would like to receive 2040 or 4040 format disks from other groups and will return the diskette(s) with programs from our library (currently 13 diskettes and growing.)

Other current SPHINX projects are a nationwide Pet/CBM telephone network for Pet users with modems. Some interest in sponsoring this has been shown by Commodore. SPHINX also plans to start a library for the VICcolor computer because of the tape and software compatibil-

ity. Many of their programs will run on a VIC with minor or no modifications.

For further information, please write to SPHINX C/O their sponsor:

PC Computers
10166 San Pablo Ave.
El Cerrito, CA 94530

Meetings in the Bay Area are the only way SPHINX currently exchanges individual programs — the second Thursday of the month at Lawrence Hall of Science, Chem. Lab, Berkeley, CA at 7:00 p.m.



New Low-cost 80-Column Dot Matrix Printer

MICROTEK, Inc. has announced a new low-cost (under \$300) 80-column dot matrix printer. Dubbed the "BYTEWRITER-1", the printer accepts single sheet or roll paper up to 8½ inches wide and prints at 60 lines per minute using a 7 x 7 dot matrix.

The BYTEWRITER-1 interface is similar but not identical to a Centronics parallel interface, and has been designed specifically to operate with the Apple II, the Atari 400/800, and all models of the TRS-80. Using a print mechanism and logic board designed and manufactured in the U.S., the unit is priced at \$299 (interface cable slightly extra). MICROTEK is directing its marketing efforts towards the personal computing and hobbyist segments of the market, and will sell the printer direct only. The

BYTEWRITER-1 carries a 90-day limited warranty. Delivery is from stock to 60 days.

For further information, contact Diane Barney-Laukat at MICROTEK, INC., 9514 Chesapeake Drive., San Diego, California 92123. (714)-278-0633.



High Performance Data Communications System

Norcross, Georgia — Hayes Microcomputer Products, Inc., announces the Hayes Stack Smartmodem high performance data communications system for small computers.

The Smartmodem, an FCC-approved direct-connect device, is designed for use with RS-232C compatible computers or terminals to communicate via the telephone system with other computers or time sharing systems.

A unique feature is that the Smartmodem can be program

controlled in any language by ASCII character strings.

This intelligent datacomm system analyzes and executes commands and in response sends result codes which, at the user's discretion, can be English words or decimal digits. The Smartmodem has auto dial and auto answer capabilities. A special design feature is that all circuitry required for auto dial and auto answer is installed within the Smartmodem. This eliminates the need for any auxiliary equipment and makes the Smartmodem a stand-alone system.

The Hayes Stack Smartmodem can be connected to any telephone system in the U.S. since dialing can be either Touch-Tone* or pulse. Furthermore, both dialing modes can be combined within a command with pulse being used, for example, to access a PBX board and Touch-Tone for dialing an outside number after the second dial tone is received.

An audio monitor permits the user to follow the progress of the call and be alerted to wrong numbers and busy signals. If a busy signal is encountered, by entering a repeat command, the Smartmodem will automatically redial the number at any time.

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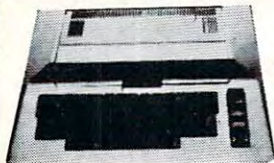
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positioning of seven option switches. Four of these options can be overridden by software command. LED status indicators on the front panel of the unit provide a visual check of the Smartmodem's operational status.

In addition, the unique "Set" commands allow the user to select (and change) various operational parameters such as dialing speed, escape code character and number of rings to answer on.

In announcing the release of the Smartmodem, Glenn Sirkis, Hayes Vice President, stated, "The Smartmodem, offers all the classic

modem functions *plus* some special features — e.g., pulse and Touch-Tone dialing — that are available only with a limited number of modems. Add to this the features that are unique to the Smartmodem — e.g., programmable in any language and Set commands for customized operation — and you'll know why we believe the Smartmodem is everything you could ever want in a 300 baud modem."

The Smartmodem has a Two Year Limited Warranty. The suggested retail price for the Hayes Stack Smartmodem system

is \$279.00. Included in this price are the Smartmodem unit, a power pack, one modular telephone cable to connect the unit to the telephone line and an owner's manual.

The Smartmodem is the first product in a new series that features the exclusive Hayes Stack design. This compact design permits other Hayes components to be stacked on top of the Smartmodem, thereby eliminating clutter.

TM Trademark of Hayes Microcomputer Products, Inc.
* Trademark of American Telephone and Telegraph.

New Professional Applications Package For The Medical Profession

Charles Mann & Associates, Micro Software Division, has announced the release of a new professional applications package for the Medical Profession called "Medirec". The Medirec system is a total Medical History and Report Preparation System. The professional using the system can prepare office input forms, enter patient and family histories, record patient visit symptoms, diagnosis, and treatments, prepare referral requests, prepare patient history summaries, and prepare referral reports. The program compliments the firm's existing Medical Billing Package.

Medirec is designed with today's professional practice liability in mind. The system allows the diskette recording of up to 550 professional visits per diskette. Individual patient records can be recalled, linked together and printed either in whole or in part. The system allows the practitioner to search past history files for common symptoms, diagnosis or the administration of conflicting drug treatments.

The system can recall records for past due follow treatment, prepare reminder notices, prepare liability release forms and print file folder labels. The system comes with a full featured address data base system and a programmable form letter writing element. The system can be programmed to prepare referral report letters, and requests for specialist treatment.

The Medirec system requires a 48K Apple II, Apple II +, or Apple III, an 80 column printer, and two disk drives. A special Corvus Systems hard disk version is also available for system configurations up to 40MB of on line storage.

The system is available from over 700 CMA dealers worldwide for an introductory price of \$199.95 (Corvus version \$249.95). Preview Documentation is available for \$25.00. Additional information and dealer location information can be obtained from Charles Mann & Associates, Micro Software Division, 7594 San Remo Trail, Yucca Valley, CA 92284. Phone (714) 365-9718.

NYSAEDS Conference

On October 18, 19 and 20, 1981, The New York State Association for Educational Data Systems

(NYSAEDS) will hold its annual conference in Syracuse, NY. NYSAEDS, an affiliate of AEDS, is composed of people who have a common interest in computers and education.

The theme of this year's conference is "Software". The keynote speaker is Marge Kosel from MECC and the banquet speaker is Dr. Earl Joseph (Futurist) from Sperry Rand. A variety of workshops will be held concerning the uses of microcomputer software in education.

For further information, please contact Don Ross, Ardsley High School, Ardsley, NY 10502.



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"The beat covered by Creative Computing is one of the most important, explosive and fast-changing."—Alvin Toffler



David Ahl, Founder and
Publisher of Creative Computing

You might think the term "creative computing" is a contradiction. How can something as precise and logical as electronic computing possibly be creative? We think it can be. Consider the way computers are being used to create special effects in movies—image generation, coloring and computer-driven cameras and props. Or an electronic "sketchpad" for your home computer that adds animation, coloring and shading at your direction. How about a computer simulation of an invasion of killer bees with you trying to find a way of keeping them under control?

Beyond Our Dreams

Computers are not creative per se. But the way in which they are used can be highly creative and imaginative. Five years ago when *Creative Computing* magazine first billed itself as "The number 1 magazine of computer applications and software," we had no idea how far that idea would take us. Today, these applications are becoming so broad, so all-encompassing that the computer field will soon include virtually everything!

In light of this generality, we take "application" to mean whatever can be done with computers, *ought* to be done with computers or *might* be done with computers. That is the meat of *Creative Computing*.

Alvin Toffler, author of *Future Shock* and *The Third Wave* says, "I read *Creative Computing* not only for information about how to make the most of my own equipment but to keep an eye on how the whole field is emerging."

Creative Computing, the company as well as the magazine, is uniquely light-hearted but also seriously interested in all aspects of computing. Ours is the magazine of software, graphics, games and simulations for beginners and relaxing professionals. We try to present the new and important ideas of the field in a way that a 14-year old or a Cobol programmer can under-

stand them. Things like text editing, social simulations, control of household devices, animation and graphics, and communications networks.

Understandable Yet Challenging

As the premier magazine for beginners, it is our solemn responsibility to make what we publish comprehensible to the newcomer. That does not mean easy; our readers like to be challenged. It means providing the reader who has no preparation with every possible means to seize the subject matter and make it his own.

However, we don't want the experts in our audience to be bored. So we try to publish articles of interest to beginners and experts at the same time. Ideally, we would like every piece to have instructional or informative content—and some depth—even when communicated humorously or playfully. Thus, our favorite kind of piece is accessible to the beginner, theoretically non-trivial, interesting on more than one level, and perhaps even humorous.

David Gerrold of *Star Trek* fame says, "Creative Computing with its unpretentious, down-to-earth lucidity encourages the computer user to have fun. *Creative Computing* makes it possible for me to learn basic programming skills and use the computer better than any other source."

Hard-hitting Evaluations

At *Creative Computing* we obtain new computer systems, peripherals, and software as soon as they are announced. We put them through their paces in our Software Development Center and also in the environment for which they are intended—home, business, laboratory, or school.

Our evaluations are unbiased and accurate. We compared word processing printers and found two losers among highly promoted makes. Conversely, we found one computer had far more than its advertised capability. Of 16 educational packages,

only seven offered solid learning value.

When we say unbiased reviews we mean it. More than once, our honesty has cost us an advertiser—temporarily. But we feel that our first obligation is to our readers and that editorial excellence and integrity are our highest goals.

Karl Zinn at the University of Michigan feels we are meeting these goals when he writes, "Creative Computing consistently provides value in articles, product reviews and systems comparisons... in a magazine that is fun to read."

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Manhattan Software Announces Four Atari Game Programs

Manhattan Software, long a publisher of programs for the TRS-80, has begun issuing a series of programs for the Atari Computer. The first four releases are:

Gin Rummy 3.0, with color card graphics and sound, which plays a full regulation game of Gin, and can hold its own against even skilled Gin players. Prices at \$19.95, the program requires 32K memory and one joystick.

Casino Blackjack/Counter, a realistic simulation of playing at a casino table — card graphics show five hands dealt, and the user plays the center hand while the computer plays the rest. A major purpose of the program is to teach card-counting, a method which is claimed to give the player a statistical advantage over the house in some situations. Priced at \$19.95, for 24K and one joystick.

Labyrinth Run, a test of skill and coordination, using the joystick to

guide a fast-moving runner through twists, turns, reverses and slaloms, with thunderous crashes when the runner hits a wall. Three skill levels. \$14.95, the game requires two joysticks.

These programs are available at dealers, and direct from Manhattan Software, P.O. Box 35, Pacific Palisades, CA 90272. Telephone (213) 454-8290.

Atari Adds Missile Command To Its Video Computer System Game Library

Missile Command™, a popular coin operated video game currently in arcades, is now available in a home video game version, it was announced today by Atari, Inc., creator and manufacturer of both products.

Largely due to Missile Command's success as an arcade game and in response to considerable consumer demand, Atari designed the game cartridge for its Video Computer System™ programmable TV game.

The Missile Command game cartridge is a one or two player game that uses joysticks and offers 34 game variations.

According to Michael J. Moone, president of the Consumer Electronics Division, "Missile Command is one of the most challenging skill and action video games ever created. We believe its popularity will be as pervasive as that of its predecessors, Space Invaders and Asteroids."

The game begins with wave after wave of enemy missiles raining down on an earth missile base and 6 surrounding cities. The player, as base commander, is responsible for protecting and defending the territory from enemy attack. To combat each wave of enemy missiles, the base commander is given 30 guided

defense missiles which when exploded in the path of attacking missiles destroys them. Each successive wave of attacking missiles comes faster than the previous one and the game continues until all cities and the missile base are lost.

Additional features include game difficulty adjustment to correspond to player skill levels, slow game variations designed for young children and screen color changes as game progresses to reduce eyestrain during extended game play.

Suggested retail price is \$31.95 and cartridges will be available nationwide by April.

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

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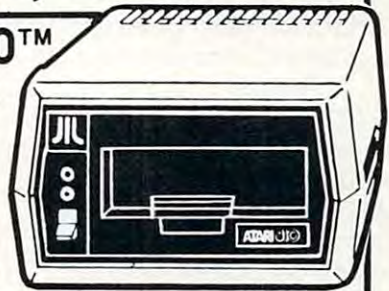
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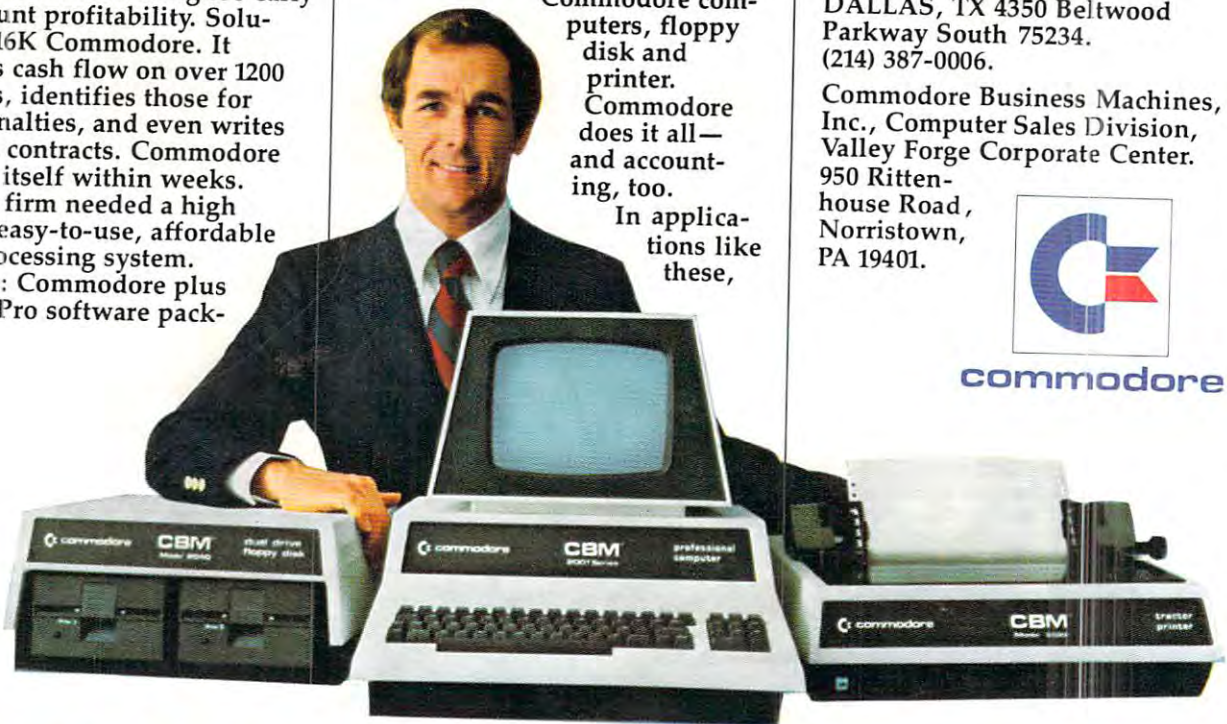
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