

# THOSE ALL-IMPORTANT EXTRAS

BY DON COLBURN

EG&G Washington Analytical Services Center, Inc.  
2150 Fields Road  
Rockville, Maryland 20850

*Last month we brought you Don Colburn's EXOS — A Software Development Tool Kit for the 6500 Microprocessor Family. This article gives you a couple of extra tools for your software development, a flashlight and a sledge hammer. —SMR*

## A FLASHLIGHT FOR YOUR SOFTWARE DEVELOPMENT TOOL KIT

One of the most important and most often used tools in a software development environment is the capability to display, in a usable format, the contents of memory. A good tool provides the data formatted in such a way that the address of any displayed byte is readily apparent without

having to count in from the left. The following program was written on a 6502 based CGRS system utilizing EXOS® and provides a stand alone version of the EXOS "DISPLAY" command. The provided code begins at hex address \$0200 and is entered by utilizing the TIM monitor to initiate execution at that address. Upon entry the user is prompted with a '>' to enter, in hex, the starting and ending address of the range of memory to be displayed. Following entry of a carriage return, the display is output. As may be seen in the accompanying example, a header field is output every 16 lines, thus providing column headers. The starting address of the first memory location in the current line is displayed in the first column in hex. This is followed, on the same line, by both the hexadecimal and ASCII representation of the following 16 bytes. Lines of data are generated until the ending address has been displayed. At this point, the monitor is re-entered.

Translation of this display algorithm to another machine may be easily accomplished due to the indepth level of commenting.

```
.R F003 50 1F 50 55 FF
.: 0200
.G
> 0200 0301
```

### EXAMPLE OF DISPLAY COMMAND

```
00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
0200 D8 20 48 02 20 8A 72 20 71 02 A2 00 86 FF 78 20 . H. .r a.....x
0210 8A 72 20 92 02 20 7A 72 20 A4 02 20 77 73 A0 00 .r . .r . . ws..
0220 R1 EE 20 B1 72 20 97 73 20 C1 70 90 15 A5 EE 29 . .r .s .p....)
0230 0F D0 E8 20 BD 02 58 E6 FF A9 10 C5 FF F0 C5 4C . . .X.....L
0240 0E 02 20 B4 02 4C BD 02 20 8A 72 A9 3E 20 C6 72 . .L.. .r.> .r
0250 20 77 73 20 A4 73 20 87 73 20 77 73 20 A4 73 20 ws .s .s ws .s
0260 87 73 20 E9 72 C9 D0 D0 DF A6 E4 D0 DB 20 8A 72 .s .r.....r
0270 60 20 8A 72 20 89 02 A0 00 98 20 B1 72 20 77 73 \ .r .....r ws
0280 C8 C0 10 D0 F4 20 8A 72 60 A2 05 20 77 73 CA D0 .....r\.. ws..
0290 FA 60 A5 EE 85 F4 A5 EF 85 F5 60 A5 F4 85 EE A5 \.....).....
02A0 F5 85 EF 60 A5 EE 29 0F F0 09 85 FD 0A 65 FD AA .....\.....e..
02B0 20 8B 02 60 A9 11 E5 EE 29 0F D0 EE 60 20 9B 02 .....\.....).....
02C0 A2 02 20 8B 02 20 E0 02 20 EB 02 20 C6 72 20 97 . . . . .r .r
02D0 73 20 C1 70 90 07 A5 EE 29 0F D0 EC 60 4C 86 70 s .f.....)\L.F
02E0 A5 EE 29 0F F0 04 AA 20 8B 02 60 A0 00 B1 EE C9 .....\.....).....
02F0 20 90 05 C9 7F B0 01 60 A9 2E 60 00 00 00 00 00 .....)\.....

00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
0300 2C D7
```

## A SLEDGE HAMMER FOR YOUR SOFTWARE DEVELOPMENT TOOL KIT

Integration at any Disk System into a software development environment has a tremendous impact upon the entire system. It is because of this impact, and the rapid rate at which technology tends to obsolete today's "state of the art" hardware, that one must be careful not to tie the Disk System to a specific cpu or bus. The PerSci 1070 disk controller with a 277 dual drive provides complete independence from both the resident cpu and bus. The new CGRS S100 F10 Disk Controller/2 serial/4 parallel IO card allows the 1070 controller to be interfaced to the S100 bus for use by any cpu.

The following listing is based upon the September '77 Interface Age articles which detail the PerSci controller hardware as well as flow charts and listings for a 8080 driver. This Program is written for a 650X TIM<sup>®</sup> based system with the PerSci controller addressed at Hex \$6000. Both the Flow Charts and the logic descriptions from the articles apply to this code.

EXOS<sup>®</sup> is a Trademark of RCS Associates, NY.

TIM is a trademark of MOS Technology, PA.

```

EXOS ASSEMBLER VER 3.4
SAVE SYMBOL TABLE Y/43 N
SYMBOL TABLE STARTS $2000
ENABLE RDR. HIT ANY KEY

; THIS PROGRAM DISPLAYS MEMORY CONTENTS IN AN EASILY
; READABLE FORMAT IN BOTH HEX AND ASCII.
; IT REQUIRES A TIM BASED 6500 SYSTEM WITH MEMORY
; FROM $0200 TO 02FA
;
; TIM Z-PAGE LOCATIONS
; WRAP = $E4 ; ADDRESS WRAP FLAG
; TMP0 = $EE ; TEMPORARY REGISTERS
; TMP1 = $F4
; TMP6 = $F4
; TMP11 = $F5
; TMP12 = $F6
; X TEMP SAVE
; LCNT = $FF
;
; TIM SUBROUTINES
;
; CRLF = $728A ; CRLF TO CONSOLE
; DCMPL = $70C1 ; DCL SUBTRACT TMP2-TMP0
; INCTMP = $7197 ; INCREMENT (TMP0-TMP1) BY 1
; RLOC = $72E9 ; READ CHAR, PUT TMP0, CV=1 IF SPACE
; SPC = $7377 ; PRINT SPACE (PROTECTS ALL REGS)
; START = $7086 ; ENTER TIM
; T2T2 = $7387 ; TMP0 -> TMP2
; WROA = $729A ; WRITE ADDRESS FROM TMP0
; WROB = $72B1 ; CONVERT CHAR(ASCII) TO HEX(A,X) ASCII
; WRI = $72C6 ; PRINT 1 CHAR
;
; .ORG $0200
;
; DSPMEM CLD ; SET BINARY MODE
0200 D8 DSPMEM
0201 20 0202 ; JSR GETRNG ; FETCH DISPLAY RANGE
0202 20 8A72 ; JSR CRLF ; PRINT CRLF
0203 20 0202 ; JSR PRHDR ; PRINT HEADER
0204 82 00 ; LDA #0
0205 8F 00 ; STA LCNT
0206 78 DSPMEM2 SET ; DISABLE INTERRUPTS
0207 20 8A72 ; JSR CRLF ; NEXT LINE
0208 20 0202 ; JSR SAVSAD ; SAVE STARTING ADDRESS
0209 20 9A72 ; JSR WROA ; OUTPUT STARTING ADDRESS
0210 20 0202 ; JSR PRNSP ; COMPUTE, OUTPUT LINE SPACES
0211 20 7773 ; JSP SPC ; 1 MORE SPACE
0212 40 00 ; LDI #0
0213 40 00 ; LDI (TMP0),Y ; CLRA INDEX
0214 20 8172 ; JSP WROB ; PRINT A IN HEX
0215 20 9773 ; JSP INCTMP ; INCR S.A.
0216 20 0202 ; JSP DCMPL ; SUB S.A. FROM E.A.
0217 20 0202 ; BCC EXLINE ; IF E.A. < S.A. THEN EXIT
0218 20 0202 ; LDA TMP0 ; UNTIL 4 LSB'S OF TMP0 = 0
0219 20 0202 ; AND $0F ; AND $0F
0220 20 0202 ; BNE DSPMEM3 ; CONVERT PRINT NEXT LOCATION
0221 20 0202 ; JSP PRVASC ; END OF HEX LINE, PRINT ASCII
0222 20 0202 ; CLI ; ALLOW INTERRUPTS
0223 20 0202 ; INC LCNT ; NEXT LINE
0224 20 0202 ; LDA #16 ; IF LINE COUNT = 16
0225 20 0202 ; CMP LCNT ; THEN PRINT HEADER
0226 20 0202 ; BEQ DSPMEM1 ; JSP DSPMEM2 ; ELSE CONTINUE
0227 4C 0E02 ; JSP PRNSP ; OUTPUT TRAILING SPACES
0228 20 0202 ; EXLINE
0229 20 0202 ;
0230 20 0202 ;
0231 20 0202 ;
0232 20 0202 ;
0233 20 0202 ;
0234 20 0202 ;
0235 20 0202 ;
0236 20 0202 ;
0237 20 0202 ;
0238 20 0202 ;
0239 20 0202 ;
0240 20 0202 ;
0241 20 0202 ;
0242 20 0202 ;
0243 20 0202 ;
0244 20 0202 ;
0245 4C 0202 ;
0246 20 8A72 ;
0247 20 8A72 ;
0248 A9 3E ; LDA #3E ; NEW LINE
0249 20 0202 ; JSP WRI ; OUTPUT PROMPT SPACE
0250 20 7773 ; JSP SPC ; READ ADDRESS H.S. BYTE
0251 20 8172 ; JSP WROB ; SKAP TMP0,TMP2
0252 20 7773 ; JSP SPC
0253 20 8A72 ; JSP RD0A ; READ ADDRESS L.S. BYTE
0254 20 9A72 ; JSP T2T2 ; SWAP BACK TMP0,TMP2
0255 20 0202 ; JSP RD0C ; WAIT FOR CR
0256 C9 0D ; CMP #0D
0257 20 0202 ; BNE GETRNG ; IF NOT CR, THEN REPRMPT
0258 46 0D ; LDA #0D ; ELSE IF ADDRESS WRAP,
0259 20 0202 ; BNE GETRNG ; REPRMPT
0260 20 8A72 ; JSP CRLF ; RETURN
0261 20 8A72 ;
0262 20 8A72 ;
0263 20 8A72 ;
0264 20 0202 ; JSP PRNSP ; START 5 SPACES IN
0265 20 0202 ; JSP WRI ; DATA COUNT
0266 20 0202 ; JSP WROB ; PRINT DATA IN HEX
0267 20 8A72 ; JSP SPC ; SPACE
0268 20 7773 ; JSP SPC ; BUMP COUNT
0269 20 0202 ; JSP WRI ; UNTIL COUNT = 16
0270 20 0202 ; BNE PRHDR ; PRINT NEXT DATA
0271 20 8A72 ; JSP CRLF ; THEN NEXT LINE
0272 20 8A72 ;
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0990 20
```

```

0289 A2 05 PESP5 LDX #5 ; COUNT = 5
028B A2 07 PESPAC JSR SPC ; UNTIL COUNT = 0, OUTPUT SPACES
028F CA DEX BNE PRSPAC ; THEN RETURN
0291 60 RTS
0292 A5 FE ;
0294 85 F4 LDA TMP6 ; SAVE S.A.(TMP6) IN TEMP6
0296 85 F4 STA TMP6
0298 85 F5 STA TMP61 ; THEN RETURN
029A 60 RTS
029B A5 F4 ;
029D 85 FE RESAD LDA TMP6 ; RESTORE S.A.(TMP6) IN TMP6
029F A5 F5 STA TMP6
02A1 85 F5 STA TMP61 ; THEN RETURN
02A3 60 RTS
02A4 A5 FE PRINSP LDA TMP6 ; PICKUP L.S. BYTE OF ADDRESS
02A6 29 0F AND #SOF ; MASK OFF 4 LSN'S
02A8 F0 00 BEQ PRINSP2 ; IF 0, RETURN
02AA 85 FD PRINSP1 STA SAVX ; ELSE HOLD COUNT
02AC 0A ASL A ; COUNT = COUNT * 3
02AD 65 FB ANDX SAVX ; X = #SPACES
02AE 85 FD STA SAVX
02B0 20 8B02 PRINSP2 RTS
02B3 60 RTS
02B4 A9 11 PRINSP LDA #11 ; MASK WITH INC ADJUSTMENT
02B6 E5 EE AND #SOF ; SPACE CALCULATION
02B8 29 0F BEQ PRINSP1 ; MAX = 16
02BA D0 EE RTS ; COUNT TO COUNT AND OUTPUT SPACES
02BC 60 RTS ; IF COUNT = 0, RETURN
02BD 20 9B02 PRVASC JSR RESAD ; RESTORE S.A.
02C0 A2 02 LDX #2
02C2 20 8B02 JSR PRSPAC ; PRINT 2 SPACES
02C5 20 8B02 JSR PRVASC ; COMPUTE SPACES INTO ASCII FIELD
02C8 20 0202 ASCII ; IF A NOT ASCII, A = '.'
02CB 00 00 JSR PRINSP ; PRINT CHARACTER
02CE 20 9773 JSR INCTMP ; BUMP POINTER
02D1 20 C170 JSR DCMPC ; TEST FOR E.A. < S.A.
02D4 90 00 BCC ASC2 ; IF < EXIT
02D6 A5 FE LDA TMP6 ; UNTIL 4 LSN'S = 0
02D8 29 0F AND #SOF
02DA D0 EC ANDX ASCII ; DO FOR NEXT LOCATION
02DC 60 RTS ; RETURN
02DD 4C 8670 JNF START ; ENTER IYH
02DE 60 RTS
02E0 A5 EE PRVASC LDA TMP6 ; PRINT SPACES IN ASCII FIELD
02E2 29 0F AND #SOF ; MAX 16
02E4 F0 00 BEQ ASP2 ; IF NONE, RETURN
02E6 AA ASP1 TAX
02E7 20 8B02 JSR PRSPAC ; ELSE PRINT SPACES, X-COUNT
02EA 60 RTS
02EB 00 VALASC LDA #0
02ED 85 EE LDA (TMP6),Y ; LOAD CHAR
02EF C9 20 CMP #S20
02F1 90 00 BCC PRPR ; CRY CLR IF < $20
02F3 C9 7F CMP #S7F
02F5 B0 00 BCS PRPR ; CRY SET IF > = $7F
02F7 60 RTS
02F8 A9 2E LDAB* ; LOAD '*'
02FA 60 RTS
02FB .END

```

\*\*DEFINED \*\*  
 ASCII 02C8  
 ASCII 02D0  
 ASP1 02E6  
 ASP2 02EA  
 CLRF 728A  
 DCMPC 70C1  
 DCMPL 0200  
 DSPMEM 0204  
 DSPMEM1 0204  
 DSPMEM2 0204  
 DSPMEM3 0218  
 EXLINE 0242  
 INCTMP 0248  
 INCTMP 7397  
 LCNT 00FF  
 LCNT 0284  
 PRINSP 0271  
 PRINSP1 0271  
 PRINSP2 024A  
 PRINSP1 02A4  
 PRINSP2 02B3  
 PRPR 02F8  
 PRSPAC 028B  
 PRSP5 0289  
 PRVASC 02ED  
 PRVASC 02E7  
 RLOC 73A4  
 RLOC 73A4  
 RESAD 02B6  
 RESAD 0292  
 SAVSAD 0292  
 SAVX 00FD  
 SPC 7377  
 START 7086  
 TAX 02E6  
 TMP6 00F4  
 TMP61 00F5  
 TMP6 00F5  
 T2T2 7387  
 VALASC 02EB  
 VALASC 02E7  
 WRAP 0084  
 WRAP 729A  
 WRAP 729A  
 WRAP 729A  
 WRT 7266  
 1F06  
 EX08 1.2

\*\* UNDEFINED \*\*  
 "EXDOS" - EXTENDED DIGS OPERATING SYSTEM  
 FOR 65XX & PERSCI MODEL 277 8"  
 DUAL DISC/ 1070 CONTROLLER  
 REVISION 1.1, 9 JAN 78  
 ASC ASSOCIATES, FAIRFAX, VA. 22030  
 TIN 2-PAGE REGISTERS  
 ASCII = \$D1 ; FLAG FOR ASCII DISPLAY, ON = 00  
 ECHO = \$D6 ; ECHO = 00  
 ECHOPT = \$D7 ; ECHO FLAG  
 SAVAR = \$D8  
 SAVAR = \$D9  
 MAJOR = \$E1  
 MINOR = \$E2  
 MINOR = \$E3  
 MINOR = \$E4  
 MINOR = \$E5  
 MINOR = \$E6  
 MINOR = \$E7  
 MINOR = \$E8  
 MINOR = \$E9  
 MINOR = \$EA  
 MINOR = \$EB  
 MINOR = \$EC  
 MINOR = \$ED  
 MINOR = \$EE  
 MINOR = \$EF  
 MINOR = \$F0  
 MINOR = \$F1  
 MINOR = \$F2  
 MINOR = \$F3  
 MINOR = \$F4  
 MINOR = \$F5  
 MINOR = \$F6  
 MINOR = \$F7  
 MINOR = \$F8  
 MINOR = \$F9  
 MINOR = \$FA  
 MINOR = \$FB  
 MINOR = \$FC  
 MINOR = \$FD  
 MINOR = \$FE  
 MINOR = \$FF

```

0000      TMP30 = $F2
0000      TMP31 = $F3
0000      TMP40 = $F4
0000      TMP41 = $F5
0000      LDCNT = $FF
0000      :
0000      : TIM S/R'S
0000      :
0000      PRICR = $72C6
0000      PRICRF = $728A
0000      PRISPC = $7377
0000      RLADR = $73A4
0000      RLDR = $73B0
0000      INCTML = $7397
0000      RESTART = $7086
0000      PRIYBT = $72B1
0000      PRIADR = $729A
0000      DRLSUB = $70C1
0000      :
0000      : EXDOS CONSTANTS
0000      :
0000      SOH = $01 ; READ FROM DISC
0000      EOT = $04 ; DONE
0000      ENQ = $05 ; WRITE TO DISC
0000      ACK = $06 ; PRECEEDS DONE (EOT)
0000      NAK = $15 ; FATAL ERROR (MSG FOLLOWS)
0000      RS = $1E ; RELATIVE NODE RECORD SEPARATOR
0000      STRG = $0100; COMMAND BUFFER DATA REG
0000      DATA = $0000; DISC CONTROLLER DATA REG
0000      DSIAI = $6001; DISC CONTROLLER STATUS REG
0000      :
0000      : .ORG $1200
0000      :
0000      : ***** ENTRY VECTORS *****
0000      :
1200      4C 0212 ENTER JMP ENTRY
1203      4C 0212 ENTER JMP ENTRY
0000      :
0000      : ***** MAIN COMMAND LOOP - DRIVE *****
0000      :
0000      : ENTER FROM EXOS 'DISC' CMD & RETURN TO EXOS
0000      : WHEN COMPLETE
0000      :
1206      D8 DRIVE CLD
1207      20 0212 JSR INPLN ; INPUT LINE FROM KEYBOARD
120A      20 0212 JSR DLINE ; READ & SEND LINE TO DISC
120B      20 0212 DEOT ; SEND TO DISC CONTROLLER FOR PROCESS
120F      20 0212 JSR DOUTC ; AS A CONTROL BYTE
1212      20 0212 JSR DINP ; INPUT BYTE FROM DISC FOR STATUS
1215      80 00 DGET RCS DCTRL2 ; WAS CONTROL BYTE
1217      20 C672 PRDATA JSR PRICR ; ELSE WAS DATA, SO ECHO
1218      4C 1212 JMP DGET ; & LOOP FOR NEXT BYTE
121D      4C 0212 DCTRL2 JMP DCTRL
0000      :
0000      : ***** INPUT LINE - INPLN *****
0000      :
0000      : INPUT LINE TO (BUFFER) STRG. TEST FOR BKSPC, ESC
0000      : DELETE & CR. ALSO TEST FOR READ/WRITE CMD
0000      :
1220      20 0212 INPLN JSR PRSTGC ; .BYTE 'EXDOS 1.1',4
1223      455844 JSR PRCLRN ; JSR PRSTRG
122D      20 0212 JSR PRSTRG ; .BYTE 'EXDOS 1.1',4
1233      436244 JSR PRSTRG ; .BYTE 'EXDOS 1.1',4
123A      A2 00 LDX #0
0000      :
123C      86 D8 STX SAVXR ; STO X
123E      20 0212 LDX SAVXR ; RCL X
1241      A6 D8 LDX SAVXR ; RCL X
1243      C9 08 CMP #8 ; TEST FOR BACK SPACE
1245      D0 00 BNE INPLN2 ; WAS NOT BACK-SPACE, SO DELETE CHAR
1247      C9 08 CMP #8 ; WAS BACK-SPACE, SO DELETE CHAR
1248      10 F2 DEX INPLN1 ; DECREMENT INPLN1
1249      10 F2 DEX INPLN1 ; DECREMENT INPLN1
124A      10 F2 DEX INPLN1 ; DECREMENT INPLN1
124B      10 F2 DEX INPLN1 ; DECREMENT INPLN1
124C      C9 5C CMP #5C ; TEST FOR CANCEL
124E      D0 00 BNE INPLN4 ; NOT CANCEL, CONTINUE
1250      F0 CE EQ INPLN4 ; WAS CANCEL, RESET LINE
1252      C9 1B CMP #1B ; TEST FOR ESCAPE
1254      D0 00 BNE INPLN5 ; NOT ESCAPE, SO CONTINUE
1256      4C 0212 JMP RESET ; SET STRG TO ZERO
1259      4C 0212 JSR PRSTGC ; SET STRG TO ZERO
125B      4C 0212 JSR PRSTRG ; SET STRG TO ZERO
125D      20 0212 JSR PRCLRN ; SET STRG TO ZERO
125F      20 0212 JSR PRCLRN ; SET STRG TO ZERO
1268      4C 0212 JMP INPLN ; RE-ENTER EXDOS
0000      :
126E      C9 0D CMP #0D ; TEST FOR CR, DONE ?
1270      D0 00 BNE INPLN7 ; IF NOT CR, STO CHAR
1272      A9 04 LDA #EOT ; PUT EOT IN BUFFER AS MARK
1274      9D 0001 STA STRG,X ; SET END AT STRG FOR READ/WRITE
1276      C9 00 CMP #0 ; TEST FOR END OF STRG
1277      C9 00 CMP #0 ; TEST FOR END OF STRG
1278      C9 00 CMP #0 ; TEST FOR END OF STRG
1279      C9 00 CMP #0 ; TEST FOR END OF STRG
127A      C9 00 CMP #0 ; TEST FOR END OF STRG
127B      C9 00 CMP #0 ; TEST FOR END OF STRG
127C      F0 00 BEQ TARGET ; READ CMD
127E      C9 4C BEQ #1 ; LOAD (READ FILE)
1280      F0 00 BEQ TARGET ; INPUT (READ SECTOR)
1282      C9 49 CMP #1 ; INPUT (READ SECTOR)
1284      F0 00 BEQ TARGET ; INPUT (READ SECTOR)
1286      C9 57 CMP #N ; WRITE CMD
1288      C9 57 CMP #N ; WRITE CMD
1289      C9 57 CMP #N ; WRITE CMD
128A      C9 57 CMP #N ; WRITE CMD
128B      C9 57 CMP #N ; WRITE CMD
128C      F0 00 BEQ TARGET ; WRITE CMD
128E      C9 4F CMP #0 ; SAVE (WRITE FILE)
1290      D0 00 BNE INPLN6 ; SKIP IF NOT R/W CMD
1292      20 0212 RANGE JSR PRCLRN ; RETURN
1295      4C 0212 JMP ADRC ; GET SA - EA & RETURN
1298      4C 0212 TARGET JSR PRCLRN ; GET TA & RETURN
1299      4C 0212 JMP GETADR ; GET TA & RETURN
0000      :
129E      20 0212 INPLNG JSR PRCLRN ; RETURN
12A1      60 RTS
0000      :
12A2      9D 0001 STA STRG,X ; STO IN STRG BUFFER
12A3      E8 20 INX ; INC CHAR COUNTER
12A5      20 0212 JSR PRSTRG ; INC CHAR COUNTER
12A6      20 0212 JSR PRSTRG ; INC CHAR COUNTER
12A7      20 0212 JSR PRSTRG ; INC CHAR COUNTER
12A8      F0 A6 BEQ INPLN3 ; IF 2, RESTART LINE
12A9      D0 90 BNE INPLN1 ; ELSE GET NEXT CHAR
0000      :
0000      : ***** SEND LINE TO DISC - DLINE *****
0000      :
0000      : READ LINE (CHAR) FROM BUFFER (STRG) &
0000      : SEND TO DISC CONTROLLER FOR PROCESS
0000      :
12AC      A2 00 DLINE LDX #0 ; INIT AT STRG_0
12AE      BD 0001 DLINE1 LDA STRG,X ; GET CHAR FROM BUFFER
12B1      C9 04 CMP #EOT ; EOT, DONE?
12B3      F0 00 BEQ DLINEX ; EXIT IF DONE
12B5      20 0212 JSR DOUTN ; ELSE SEND CHAR TO DISC WHEN READY
12B8      E8 INX ; INC BUFFER POINTER
12B9      D0 F3 BNE DLINE1 ; LOOP FOR NEXT CHAR UNTIL EOT
12BB      60 DLINEX RTS
0000      :
0000      : ***** TEST FOR CONTROL CHAR - DCTRL *****
0000      :

```

[illegible]

|      |         |            |                                               |      |         |                |    |
|------|---------|------------|-----------------------------------------------|------|---------|----------------|----|
| 1386 | DO EA   | BNE RDCH3  | 8 TIMES (BITS)                                | 1504 | 20 0213 | JSR PRDHR      |    |
| 1387 | 9 2F    | AND #1     | 8 TIMES (BITS)                                | 1500 | 42 00   | LX #0          |    |
| 1388 | 20 7F   | AND #5F    | CLR PARITY                                    | 150F | 86 FF   | STX LNCHT      |    |
| 1389 | 20 0213 | RDCH6      | 1 STOP BIT DELAY                              | 1511 | 20 0114 | D2             |    |
| 1390 | 138F 18 | RDCH5      | CLR FLAG                                      | 1517 | 20 0215 | JSR SAVSD      |    |
| 1391 | 4300 4  | JMP ECHORD | ECHO STOP BIT                                 | 1514 | 20 9A72 | JSR P1ADR      |    |
| 1392 | 20 2073 | RDCH6      | JMP DELAY1                                    | 151A | 20 0215 | JSR PR1SP      |    |
| 1393 | 1393 20 | JMP DELAY1 | DELAY 2 - 1/2 BIT TIMES                       | 151D | 20 7773 | JSR PR1SP      | D3 |
| 1394 | 42 2073 |            |                                               | 1520 | 20 7773 | JSR PR1SP      |    |
| 1395 |         |            |                                               | 1522 | 81 EE   | LDA (THPIL0),Y |    |
| 1396 |         |            |                                               | 1522 | 20 B172 | JSR PR1BT      |    |
| 1397 |         |            |                                               | 1517 | 20 9773 | JSR LNCHT1     |    |
| 1398 |         |            |                                               | 152A | 20 C170 | JSE DBLSUB     |    |
| 1399 | 20 0213 |            | SPEED CHANGE ROUTINE                          | 152D | 90 00   | BCC DX         |    |
| 1400 |         |            |                                               | 152F | 85 EE   | LDA THPIL0     |    |
| 1401 | 1399 20 | JSR PR1TRG | .BITE' 110/300(1200/2400 BAUD = 10/MD/HI/XH ? | 152F | 85 EE   | AND #0F        |    |
| 1402 | 139C 20 | JSR RD1CHR | READ 1ST CHAR (H,I,D OR 0 ?)                  | 1531 | 20 1E   | AND #0F        |    |
| 1403 | 20 6413 | CMP #4H    | READ 2D CHAR (H,I,D OR 0 ?)                   | 1535 | 20 0215 | JSR PRVASC     |    |
| 1404 | 20 6413 | CMP #4H    |                                               | 1538 | 20 0215 | JSR BRFAK      |    |
| 1405 | 13CE F0 | BEQ SPD1X  |                                               | 1538 | 20 0215 | JSR LNCHT      |    |
| 1406 | 13CE F0 | CMP #1     |                                               | 153D | A9 10   | LDA #16        |    |
| 1407 | 13D2 F0 | BEQ SPD1H  |                                               | 153F | C5 FF   | CMP LNCHT      |    |
| 1408 | 13D4 C9 | CMP #1D    |                                               | 1541 | 70 C4   | BEQ D1         |    |
| 1409 | 13D6 F0 | BEQ SPDMD  |                                               | 1541 | 70 C4   | CMP LNCHT      |    |
| 1410 | 13D8 C9 | CMP #0     |                                               | 1545 | 20 15   | JSR PR1SP      |    |
| 1411 | 13D8 C9 | CMP #0     |                                               | 1546 | 20 0215 | JSE PR1SP      | DX |
| 1412 | 13D8 C9 | CMP #0     |                                               | 1546 | 20 0215 | JSE PR1SP      |    |
| 1413 | 13D8 C9 | CMP #0     |                                               | 1549 | 4C 0215 | JMP PRVASC     |    |
| 1414 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1415 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1416 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1417 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1418 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1419 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1420 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1421 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1422 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1423 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1424 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1425 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1426 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1427 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1428 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1429 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1430 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1431 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1432 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1433 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1434 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1435 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1436 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1437 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1438 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1439 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1440 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1441 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1442 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1443 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1444 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1445 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1446 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1447 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1448 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1449 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1450 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |
| 1451 | 13D8 C9 | CMP #0     |                                               |      |         |                |    |

```

158F A0 11      ; PREXSP LDA #S11
1591 E5 EF      SEC TMP1LO
1593 29 0F      AND #S0F
1595 D0 EE      BNE LNI
1597 60          RTS

1598 A5 D1      ; PREVASC LDA ASCII
159A D0 00      BNE ASC2
159C 20 00      LDA #S02
159E A2 01      LDX #2
15A1 20 6615    JSR PRSPAC
15A4 20 0215    JSR PRVSP
15A7 20 0215    JSR VALASC
15AA 20 0672    JSR PRICR
15AD 20 9773    JSR INCTHI
15B0 20 0170    JSR DBLSUB
15B3 20 0000    BCC ASCX
15B5 A5 EF      LDA TMP1LO
15B8 29 0F      AND #S0F
15BB D0 EC      BNE ASC1
15BE 20 C170    JSR DBLSUB
15C0 60 00      BCC ASCX
15C4 A5 EF      JSR JMP RESTART
15C6 29 0F      PREVASC LDA TMP1LO
15C8 70 00      AND #S0F
15CA AA        BEQ ASP2
15CC 60 00      TAX
15CE 60 00      JSR PRSPAC
15D0 4C 8670    ASP2 RTS
15D2 40 00      ; VALASC LDX #0
15D4 B1 EF      LDA (TMP1LO),Y
15D6 C9 20      CMP #S20
15D8 7F 00      BCC PRPR
15DA C9 7F      CMP #S7F
15DC B0 00      BCS PRPR
15DE 60 00      RTS
15E0 A9 01      ; RELAX LDA #1
15E2 2C 026F    BIT SEREG
15E4 D0 00      BNE NOKEY
15E6 60 00      RTS
15E8 2C 026E    BIT SEREG
15EA D0 FE      BNE NOKEY
15EC 02 FF      LDX #SFF
15EE 00 00      TAX
15F0 4C 8670    JMP RESTART

15F2 20 0114    ; PSTGTC JSR PRCLRN
15F4 20 0215    PSTGTC JSR STOXV3
15F6 18 00      EXTASC CLC
15F8 68 00      PLA
15FA 69 01      ADC #1
15FC 68 00      STA AUXPCL
15FE 68 00      PHA
15FF 69 00      ADC #0
1601 48 00      PHA
1602 85 E1      STA AUXTCH
1604 A5 E0      LDA AUXPCL
1606 48 00      PHA

1607 A0 00      LDY #0
1609 E1 E0      LDA (AUXPCL),Y
160B F4 00      CMP #4
160D 00 00      BEQ STRGX
160F 20 C672    CLR FELCHR
1611 18 00      CCR
1613 90 E3      BCC EXTASC
1615 20 0216    STNGX JSR RCLXY3
1618 00 00      ; STOXV3 STX SAVR3
1619 86 DE      STX SAVR3
161B 84 DF      RTS
161D 60 00      ; RCLXY3 LDX SAVR3
161F A6 DE      RCLXY3 LDY SAVR3
1620 A4 DF      LDY SAVR3
1622 60 00      RTS
1623 20 F515    ; AIRRG JSR PSTRG
1625 20 F515    .BYTE 202404
1627 20 F515    JSR RDIADR
1629 20 8773    JSR T2T2
162B 20 8773    JSR T2T2
162D 20 F515    .BYTE 202404
162F 20 F515    JSR PSTRG
1631 20 A473    JSR RDIADR
1633 20 8773    JSR T2T2
1635 20 8773    JSR RDICHR
1637 20 6413    JSR PRCLRN
1639 60 00      RTS
163A 20 0114    ; GETADR JSR PSTRG
163C 20 F515    .BYTE 1658
163E 20 2020    TARGET ADR $*,4
1640 20 B373    JSR RDLVY
1642 85 F3      STA TMP3HI
1644 20 B373    JSR RDLVY
1646 20 B373    JSR RDLVY
1648 95 F2      STA TMP3LO
164A 85 F2      STA TMP3LO
164C 4C 4E16    JMP ENCX

; ***** INIT ROUTINES *****
; ENTRY CLD
; LDA #0
; STA ECHO ; TURN ECHO ON
; STA ASCII ; ASCII ON
; LDA #2
; STA RELIS
; STA RELIS
; JMP SPEED
; RENTRY JMP DRIVE
; END OF EXDOS FILE #02

```