## HX-2O ASSEMBLER

![Memory Map](image)

### Memory Map

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Note: The memory map shows the initial state of the HX-2O assembler's memory, with most addresses initialized to 0.
### Memory Map

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1-1

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Memory map
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1-2
MCASS N-CASSETTE COUNTER PULSE STATUS/WRITE PROTECT DETECT
NPIN PIN VALUE FOR SERIAL I/F
NKBIQI 0 IF KYBD INTERRUPT
NLWUPR 0 IF BATTERY LOW
NEXIRQ 0 IF EXTERNAL INTERRUPT
SLURW 1 DURING CASSETTE + RS232 I/O
NCTS CTS VALUE FOR RS232 I/F
NDSR DSR VALUE FOR RS232 I/F

SERTX SERIAL I/F TX LINE (USED BY MPU)
SERRX SERIAL I/F RX LINE (USED BY MPU)
SLUSER 1=SERIAL -> SLAVE MPU
0=SERIAL -> SERIAL I/F
RSTX RS232 I/F TX LINE (SOFTWARE GENERATED)
BARCOD BARCODE READER DATA INPUT

ICF 1=INPUT CAPTURE VALUE MATCH
OCF 1=OUTPUT COMPARE VALUE MATCH
TUF 1=TIMER OVERFLOW (EVERY 1/9 SECOND)
EICI 1=ENABLE ICF INTERRUPT
EOCI 1=ENABLE OCF INTERRUPT
ETOI 1=ENABLE TUF INTERRUPT
IEDG ICF EDGE VALUE (0=1->0, 1=0->1)
OLUL OUTPUT VALUE TO RSTX ON OCF

SS1,SS0 SERIAL BAUD RATE:
00 - 48.4K BPS (SLAVE-MPU & SERIAL I/F)
01 - 4.8K BPS
10 - 600 BPS
11 - 150 BPS

RDRF 1=RECEIVE DATA REGISTER FULL
OFE 1=FRAMING ERROR
TDRE 1=TRANSMIT DATA REGISTER EMPTY
RRE 1=ENABLE RDRF INTERRUPT
RRE 1=ENABLE RECEIVER
TIE 1=ENABLE TDRE INTERRUPT
TE 1=ENABLE TRANSMITTER
WU 1=ENABLE WAKE-UP MODE

RAME 1=ENABLE MPU RAM FROM 8H00-8HFF
0=ENABLE EXTERNAL RAM

NKSC7 KEYBOARD SCAN LINES, 0=ENABLE LINE
to
NKSC8

NKRTNH9 KEYBOARD RETURN LINES, 0=KEY PRESSED
to
NKRTNH8
PLG2  PLUG2 VALUE ON M-CASSETTE I/F
PLG1  PLUG1 VALUE ON M-CASSETTE I/F
NPOUT POUT VALUE FOR SERIAL I/F
KYMASK 1=MASK KEYBOARD INTERRUPT
CND  1=LCD COMMAND, 0=LCD DATA
LCNND  0=ENABLE NONE, 1-6=ENABLE LCD:

DOT COLUMN:
0-39 40-79 80-119
+-+-+-+-+-
: 1 : 2 : 3 : LINES 0,1
+-+-+-+-+-
: 4 : 5 : 6 : LINES 2,3
+-+-+-+-+-

MBY_50 LCD BUSY & SERIAL DATA OUT
PSW  1=POWER SWITCH ON

UIP  1=RTC SECOND UPDATE IN PROGRESS
NSCTE 1=INHIBIT RTC COUNTING
RS3 - R58 PERIODIC INTERRUPT RATE:
0000 NONE
0011 8192 Hz
0100 4096 Hz
: :
1110 4 Hz
1111 2 Hz

TIMSET 1=INHIBIT UPDATE CYCLE
PIE  1=ENABLE PERIODIC INTERRUPT
AIE  1=ENABLE ALARM INTERRUPT
UEI  1=ENABLE UPDATE CYCLE INTERRUPT

IRQF  1=RTC INTERRUPT
PF  1=PERIODIC INTERRUPT
AF  1=ALARM INTERRUPT
UF  1=UPDATE INTERRUPT

VRT  1=POWER OK
### Page Zero Variables (0H4E - 0HFF)

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</table>
OWN 1=EXECUTE SUBROUTINE AT (DWNADDR,DWNADDR+1) ON POWER DOWN
UP 1=EXECUTE SUBROUTINE AT (WAADDR,WAAADDR+1) ON POWER UP BY CLOCK INTERRUPT (NOT CURRENT VERSION)

BASIC 1=BASIC APN FILE EXISTS
REFRM 1=FILE REFORM SUBROUTINE EXISTS
MENU 1=MENU SYSTEM INITIALIZED

BRKRS 1=TURN RS232 POWER OFF ON BREAK
SERPWR 1=SERIAL I/F POWER ON
RSPUR 1=RS232 POWER ON
RSPSE 1=RS232 READ PAUSE (SLAVE BUSY)

LANG 1=INTERPRETER MODE
0=MACHINE CODE MODE

SCRN 1=PHYSICAL LCD SCREEN
0=VIRTUAL SCREEN

SBRK 1=SLAVE I/O BROKEN BY BREAK
BRCD 1=BARCODE POWER ON
CART 1=CARTRIDGE POWER ON
SPKR 1=BUZZER IN USE
RSDR 1=RS232 READING
MCWR 1=M-CASSETTE IN USE
ECWR 1=E-CASSETTE IN USE
PRNTR 1=M-PRINTER IN USE

BRK 1=BREAK KEY PRESSED
PAUSE 1=PAUSE KEY PRESSED
PUOFF 1=POWER SWITCH TURNED OFF
PULM 1=BATTERY LOW
CKINT 1=CLOCK INTERRUPT
RSER 1=SERIAL I/F IN USE
TRSLV 1=COMMUNICATION WITH SLAVE MPU IN PROGRESS
TRLCO 1=COMMUNICATION WITH LCD IN PROGRESS

PROTIO 1=ENABLE ACCESS TO 0-8H4D
BSBANK MEMORY BANK FOR BASIC INTERPRETER
MNBANK MEMORY BANK FOR MENU

IUBANK CURRENT MEMORY BANK

PRTRON SOFTWARE PRINTER ON/OFF SWITCH
PRTRSE 1=SOFTWARE PRINTER SWITCH
0=HARDWARE PRINTER SWITCH

DIPSEL 1=SOFTWARE DIP SWITCH
0=HARDWARE DIP SWITCH

SOFTDIP SOFTWARE DIP SWITCH
System Variables (8H100-8H119,8H21B)

CLKVCT EQU &H100 ;CLOCK INTERRUPT VECTOR
EXTVCT EQU &H103 ;EXTERNAL INTERRUPT VECTOR
TRIVCT EQU &H106 ;TRAP INTERRUPT VECTOR
SCI VCT EQU &H109 ;SERIAL INTERRUPT VECTOR
TUVCT EQU &H10C ;TIMER TUF INTERRUPT VECTOR
OCFVCT EQU &H10F ;TIMER OCF INTERRUPT VECTOR
ICFVCT EQU &H112 ;TIMER ICF INTERRUPT VECTOR
IRQVCT EQU &H115 ;IRQ1 INTERRUPT VECTOR
SJVECT EQU &H118 ;SWI VECTOR
NNIVCT EQU &H11B ;NMI INTERRUPT VECTOR
FONTGPN EQU &H11E ;ADDRESS OF FONTS FOR &HE0-&HFF
BRKADR EQU &H120 ;ADDRESS OF BREAK SUBROUTINE (LANG=0)
MENADR EQU &H122 ;ADDRESS OF MENU SUBROUTINE (LANG=0)
PAUDR EQU &H124 ;ADDRESS OF PAUSE SUBROUTINE (LANG=0)
CT3ADR EQU &H126 ;ADDRESS OF ’PF3 SUBROUTINE
CT4ADR EQU &H128 ;ADDRESS OF ’PF4 SUBROUTINE
CT5ADR EQU &H12A ;ADDRESS OF ’PF5 SUBROUTINE
RAMADR EQU &H12C ;TOP OF RAM + 1
PRMCNT EQU &H12E ;AMOUNT OF DATA IN PROM FILE
WAKADDR EQU &H130 ;ADDRESS OF POWER UP SUBROUTINE
DUNADR EQU &H132 ;ADDRESS OF POWER DOWN SUBROUTINE
BASICA EQU &H134 ;ADDRESS OF 1ST APN FILE
BASICP EQU &H136 ;ADDRESS OF BASIC PROGRAMS
RFSMADR EQU &H138 ;ADDRESS OF FILE REFORM SUBROUTINE
SERSIOTS EQU &H21B ;SERIAL INTERRUPT COPY OF SIOTS

Menu Variables (8H13A-8H13F)

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Keyboard Locations

KSTK5Z EQU &H140 ;KEY STACK SIZE 1-15
KICNT1 EQU &H141 ;TIME TO AUTO REPEAT x (KICNMT)
KICNT2 EQU &H142 ;AUTO REPEAT TIME INTERVAL x (KICNMT)
KICNMT EQU &H143 ;SAMPLING TIME x CLOCK PERIOD
NKKYTB EQU &H145 ;KEY SCAN TABLE
OLDKTB EQU &H14F ;PREVIOUS SCAN TABLE
CHKKT EQU &H159 ;NEW KEY PRESS SCAN TABLE
KVISA D EQU &H163 ;POWER ON KEY INPUT ADDRESS
KVISFL EQU &H165 ;POWER ON KEY STACK STATUS
; &HA - DATA IN STACK, END FETCH
; &HB - DATA IN STACK, FETCH
; ELSE - NO DATA IN STACK
KVISCN EQU &H166 ;NO OF CHARS IN POWER ON STACK 0 - 255
KVISP N EQU &H167 ;NO OF CHARS INPUT FROM PUR ON STACK
STKCNT EQU &H168 ;NO OF CHARS IN KEYBOARD STACK
KYIMOD EQU &H169 ;MODE:
.MBPPF EQU &H00 ;B7 1 = BREAK, PAUSE OR PF KEY INPUT
.CTRL EQU &H10 ;B6 1 = CTRL INPUT
SHIFT EQU &H20 ;B5 1 = SHIFT INPUT
.GRAPHIC EQU &H10 ;B4 1 = GRAPHIC INPUT
.LURLET EQU 4 ;B2 1 = LOWER CASE MODE
.NUMKEY EQU 2 ;B1 1 = NUMERIC MODE
KVISTS EQU &H16A ;KEY STATUS 0 - INHIBIT
; 1 - AUTO REPEAT
; -1 - ENABLE
KYRPFL EQU &H16B ;AUTO REPEAT SCAN COUNT
KYIRPK EQU &H16C ;AUTO REPEAT SCAN POSITION
CKYRD EQU &H16D ;KEY CODE (PF KEY IS 2 BYTES)
PKYSTK EQU &H16F ;POWER ON KEY STACK (16 BYTES)
KYIST K EQU &H181 ;KEY STACK (15 BYTES)
Micro Printer Locations

PRTFNT EQU \&H190 ; 6 BYTE FONT WORK AREA
PRTCNT EQU \&H196 ; COUNT OF CHARACTERS IN
                ; PRINTER BUFFER 0..24
PRTBUF EQU \&H197 ; 24 BYTE BUFFER

RS232 Locations

RSBAUD EQU \&H1AF ; RS232 TX BIT TIME:
                ; 300 BPS = \&H000
                ; 4800 BPS = \&H00
RSCRC EQU \&H1B1 ; CRC POLYNOMIAL:
                ; CCITT = \&H8408
                ; CRC-16 = \&H8001
RSBCC EQU \&H1B3 ; CRC VALUE 0=OK
RSWDL EQU \&H1B5 ; WORD LENGTH 5..8
RSMOD EQU \&H1B6 ; MODE:
                ; .PRTY EQU \&H40 ; B7,6 = 2/3 NO PARITY
                ; 1 ODD PARITY
                ; 0 EVEN PARITY
                ; .CKCTS EQU \&H20 ; B5 = 1 DO NOT CHECK CTS
                ; .CKDSR EQU \&H10 ; B4 = 1 DO NOT CHECK DSR
                ; .RTSON EQU \&H100 ; B3 = 1 RTS ON
                ; .CHKCD EQU \&H4 ; B2 = 1 DO NOT CHECK CD
                ; .STPBIT EQU \&H1 ; B1,0 = STOP BITS 1..3
RSSTS EQU \&H1B7 ; STATUS:
                ; .ABD EQU \&H00 ; B7 = 1 RECEIVE BUFFER OVERFLOW
                ; .TXE EQU \&H40 ; B6 = 1 TRANSMIT ERROR
                ; .RZE EQU \&H20 ; B5 = 1 RECEIVE ERROR
                ; .RXOR EQU \&H4 ; B4 = 1 OVERRUN ERROR
                ; .PTVE EQU \&H2 ; B3 = 1 PARITY ERROR
                ; .CDOFF EQU \&H1 ; B2 = 1 CARRIER DISCONNECTION
RSBFAD EQU \&H1BB ; RECEIVE BUFFER ADDRESS
RSBFTP EQU \&H1BA ; END OF RECEIVE BUFFER ADDRESS + 1
RSBFSZ EQU \&H1BC ; RECEIVE BUFFER SIZE
RSIPTR EQU \&H1BE ; RECEIVE INPUT POINTER
RSIPTR EQU \&H1CC ; POINTER TO LAST DATA Fetched
RSDCNT EQU \&H1C2 ; NUMBER OF DATA IN RECEIVE BUFFER
Serial I/F Locations

SRFMT EQU &H1C4 ; FNT DATA
SRSDV EQU &H1C5 ; DID DATA
SRSTDV EQU &H1C6 ; SID DATA
SRFNC EQU &H1C7 ; FNC DATA
SRSIZ EQU &H1C8 ; SIZ DATA
SRACK EQU &H1C9 ; ACK FROM DESTN DEV
SRTL EQU &H1CA ; BLOCK TX COUNT
SRTIM EQU &H1CB ; TIME OUT FOR CHAR (mS)
SRSTN EQU &H1CC ; TIME OUT FOR BLOCK (mS)
SRTCH EQU &H1CD ; TIME OUT FOR ACK (mS)
SRMOD EQU &H1CE ; 0 - MASTER, 1 - SLAVE
SRDET EQU &H1CF ; IDLE TIME AFTER EOT (mS)
SRECN EQU &H1D0 ; NO OF RECEIVED DATA
SREM EQU &H1D1 ; ERROR FLAG
SRUL EQU &H1D2 ; RESERVED
SRPTR EQU &H1D3 ; ADDRESS OF RECEIVE DATA BLOCK

Cassette and MicroCassette Locations

Note: External Cassette locations are labelled with names starting with "CAS". Microcassette locations are labelled with names starting with "MCS".

CASMOD EQU &H1D5 ; MODE:
CASMOD EQU &H1DE ;
10STS EQU 4 ;
FMTSTS EQU 1 ;
CASBLK EQU &H1D6 ; BLOCK NUMBER
CASCLK EQU &H1ED ;
CASCRC EQU &H1D8 ; CRC VALUE FOR BLOCK
MCSCRC EQU &H1EF ;
CASTMP EQU &H1DA ; UNUSED
MCSTMP EQU &H1F1 ;
CASSGM EQU &H1DC ; GAP STOP MODE:
MCSSGM EQU &H1F3 ;
CASSTS EQU &H1DD ; STATUS:
MCSTS EQU &H1F4 ;
. IOBF0 EQU &H1B0 ; B7 = 1 BUFFER OVERFLOW
. IORDE EQU &H1B0 ; B6 = 1 READ ERROR
. IORWE EQU &H1B0 ; B5 = 1 WRITE ERROR
. MCSNU EQU &H1B0 ; B4 = 1 MCS COUNTER NOT UPDATED
. IOE0F EQU 1 ; B0 = 1 EOF
CASBUF EQU &H1DE ; START OF BUFFER
MC Buf EQU &H1F5 ;

1-11
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**Header Locations**

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<td></td>
<td>&quot;S&quot; SHORT GAP</td>
</tr>
<tr>
<td></td>
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<td>&quot;L&quot; LONG GAP</td>
</tr>
<tr>
<td></td>
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<td>&quot; &quot; STOP BETWEEN BLOCKS</td>
</tr>
<tr>
<td>CASBLNG</td>
<td>EQU &amp;H2EA</td>
<td>5 DIGIT ASCII BLOCK LENGTH EG 256</td>
</tr>
<tr>
<td>MCSBLNG</td>
<td>EQU &amp;H33E</td>
<td></td>
</tr>
<tr>
<td>CASDATE</td>
<td>EQU &amp;H2F4</td>
<td>DATE (MMDYY) 6 BYTE ASCII</td>
</tr>
<tr>
<td>MCSDATE</td>
<td>EQU &amp;H34B</td>
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</tr>
<tr>
<td>CASTIME</td>
<td>EQU &amp;H2FA</td>
<td>TIME (HHMMSS) 6 BYTE ASCII</td>
</tr>
<tr>
<td>MCSSTIME</td>
<td>EQU &amp;H34E</td>
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<td>CASVOLN</td>
<td>EQU &amp;H386</td>
<td>VOLUME NO</td>
</tr>
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<td>MCSVOLN</td>
<td>EQU &amp;H35A</td>
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<tr>
<td>CASSNAM</td>
<td>EQU &amp;H388</td>
<td>SYSTEM NAME &quot;HX-20&quot;</td>
</tr>
<tr>
<td>MCSNAM</td>
<td>EQU &amp;H35C</td>
<td></td>
</tr>
</tbody>
</table>

1-12
PROM Cartridge Locations

PRMSTS EQU &H208 ;PROM CARTRIDGE STATUS:
                ;B7 = 1 IF POWER ON
                ;B0 = 1 IF OPEN
PRMAADR EQU &H209 ;PROM ADDRESS
PRMSAD  EQU &H208 ;PROM FILE START ADDRESS
PRMEND  EQU &H20D ;PROM FILE END ADDRESS + 1

Memory Dump/Load Locations

DLDSADR EQU &H20F ;FIRST ADDRESS
DLDEADR EQU &H211 ;LAST ADDRESS
DLDOFF  EQU &H213 ;OFFSET
DLDSSTR  EQU &H215 ;EXECUTION ADDRESS
DLDDVCE  EQU &H217 ;DEVICE NAME
DLDSSTS  EQU &H218 ;STATUS
DLDSPTR  EQU &H219 ;DEVICE TABLE POINTER:
                ; + 0,1 WORK AREA ADDRESS
                ; + 2,3 OPEN READ ADDRESS
                ; + 4,5 OPEN SEARCH ADDRESS
                ; + 6,7 READ BYTE ADDRESS
                ; + 8,9 CLOSE ADDRESS
                ; + 10,11 OPEN WRITE ADDRESS
                ; + 12,13 WRITE BYTE ADDRESS

Screen Locations

PSBUF  EQU &H220 ;80 BYTE PHYSICAL SCREEN BUFFER
SCRTOP  EQU &H270 ;ADDRESS OF VIRTUAL SCREEN BUF
SCRBOT  EQU &H272 ;END OF VIRTUAL BUFFER + 1
DSTOP  EQU &H274 ;ADDR OF PHYS SCR ON VIR SCRN
VSCRX  EQU &H276 ;VIR SCR WIDTH
VSCRY  EQU &H277 ;VIR SCR DEPTH
CURX  EQU &H278 ;CURSOR X COORD
CURY  EQU &H279 ;CURSOR Y COORD
SCRXL  EQU &H27A ;SCROLL STEP X
SCRLY  EQU &H27B ;SCROLL STEP Y
CURMG  EQU &H27C ;SCROLL MARGIN
UPSD  EQU &H27D ;SCROLL SPEED
DISPX  EQU &H27E ;PHYSICAL SCREEN X
DISPY  EQU &H27F ;PHYSICAL SCREEN Y
DISSTS  EQU &H280 ;STATUS:
            .SCRWR  EQU &H80 ;B7 = UPDATE ENTIRE SCREEN
            .CSRQN  EQU &H40 ;B6 = CURSOR ON
            .CSREN  EQU &H00 ;B5 = ENABLE CURSOR
            .SCRLW  EQU &H10 ;B4 = DELAY DURING SCROLLING
            .SCRLD  EQU 1 ;B0 = DISABLE L/R SCROLLING
LCDSMP  EQU &H281 ;5 BYTE WORK AREA
CHFONT  EQU &H286 ;6 BYTE FONT WORK AREA

1-13
BRKADR  EQU &H2A0  ;BREAKPOINT ADDRESS
BRKINS  EQU &H2A2  ;BREAKPOINT INSTRUCTION
MNDSSTS  EQU &H2A3  ;STORES DISSTS ON ENTRY
MNWK     EQU &H2A4  ;23 BYTE WORK AREA
MNPC     EQU &H2AF  ;PC VALUE
MNRTNADR  EQU &H2C1  ;B CMD RETURN ADDRESS
MNPSBUF  EQU &H2C3  ;ADDR OF END OF LINE OF PSBUF
MNROPT   EQU &H2C5  ;FLAG FOR R OPTION
MINTMP   EQU &H2C6  ;10 BYTE WORK AREA

ROM Vectors

RUNUJKYTB  EQU &HFFD0  ;ADDRESS OF NUKYTB
RUPRTCNT  EQU &HFFD2  ;ADDRESS OF PRTCNT
RUCASCNT  EQU &HFFD4  ;ADDRESS OF CASCNT
RUNMCSCNT  EQU &HFFD6  ;ADDRESS OF MCSCNT
RURSDDCNT  EQU &HFFD8  ;ADDRESS OF RSDCNT
RULCOPS  EQU &HFFDA  ;ADDRESS OF PSBUF
RUVIOBUF  EQU &HFFDC  ;ADDRESS OF 260 BYTE BUFFER
RUVUSPD  EQU &HFFDE  ;ADDRESS OF USPD
RUVCAHDR  EQU &HFFE0  ;ADDRESS OF CASHDR
RUVMSHDR  EQU &HFFE2  ;ADDRESS OF MCSHDR
RUVKIVMOD  EQU &HFFE4  ;ADDRESS OF KIVMOD
RUTRAP  EQU &HFEF  ;TRAP INTERRUPT ADDRESS
RUSCI  EQU &HFFF0  ;SCI INTERRUPT ADDRESS
RUTOF  EQU &HFFF2  ;TOF INTERRUPT ADDRESS
RUOCF  EQU &HFFF4  ;OCF INTERRUPT ADDRESS
RUICF  EQU &HFFF6  ;ICF INTERRUPT ADDRESS
RVIRQ1  EQU &HFFF8  ;IRQ1 INTERRUPT ADDRESS
RVSWI  EQU &HFFFA  ;SWI INTERRUPT ADDRESS
RUNMI  EQU &HFFFC  ;NMI INTERRUPT ADDRESS
RURESET  EQU &HFFE  ;RESET ADDRESS

RVNMPCKL  EQU &HFFB5  ;3 BYTE CLK INT VECTOR
RVNMPEXT  EQU &HFFB8  ;3 BYTE EXT INT VECTOR
RVNMTRP  EQU &HFFB8  ;3 BYTE TRAP INT VECTOR
RVNMPSER  EQU &HFB8  ;3 BYTE SCI INT VECTOR
RVNMTOF  EQU &HFC0  ;3 BYTE TOF INT VECTOR
RVNMPICF  EQU &HFC4  ;3 BYTE OCF INT VECTOR
RVNMPICF  EQU &HFC7  ;3 BYTE ICF INT VECTOR
RVNMPICF  EQU &HFC9  ;3 BYTE IRQ INT VECTOR
Section 2
ROM calls
<table>
<thead>
<tr>
<th>LABEL</th>
<th>ADDRESS</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>INITKY</td>
<td>$\text{HFFA0}$</td>
<td>INITIALIZE KEY INPUT</td>
</tr>
<tr>
<td>ENTRY:</td>
<td>NONE</td>
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</tr>
<tr>
<td>EXIT:</td>
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<tr>
<td>PRESERVED:</td>
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<tr>
<td>KVSTS</td>
<td>$\text{HFF9D}$</td>
<td>READ KEY STATUS</td>
</tr>
<tr>
<td>ENTRY:</td>
<td>NONE</td>
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<tr>
<td>EXIT:</td>
<td>(A) NO OF CHARs IN KEY STACK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(C) IO ERROR FLAG 1=ERROR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Z) 1 IF (A)=0</td>
<td></td>
</tr>
<tr>
<td>PRESERVED:</td>
<td>(B), (X)</td>
<td></td>
</tr>
<tr>
<td>KVIN</td>
<td>$\text{HFF9A}$</td>
<td>GET KEY INPUT</td>
</tr>
<tr>
<td>ENTRY:</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>EXIT:</td>
<td>(A) KEY INPUT (1 BYTE CODES)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(D) KEY INPUT (PF1 - PF10)</td>
<td></td>
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<tr>
<td></td>
<td>(C) IO ERROR FLAG 1=ERROR</td>
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</tr>
<tr>
<td>PRESERVED:</td>
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<tr>
<td>KVSCN</td>
<td>$\text{HFF6A}$</td>
<td>SCAN KEY MATRIX</td>
</tr>
<tr>
<td>ENTRY:</td>
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</tr>
<tr>
<td>EXIT:</td>
<td>NUKYTb IS UPDATED</td>
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<td>PRESERVED:</td>
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<tr>
<td>INIPKY</td>
<td>$\text{HFF22}$</td>
<td>INITIALIZE POWER ON KEY STACK</td>
</tr>
<tr>
<td>ENTRY:</td>
<td>(X) ADDR OF POWER ON STRING</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(B) NO OF CHARs IN STRING</td>
<td></td>
</tr>
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<td>EXIT:</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>PRESERVED:</td>
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<tr>
<td>LABEL</td>
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<td>DESCRIPTION</td>
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<tr>
<td>DSPLCN</td>
<td>&amp;HFF49</td>
<td>DISPLAY ON LCD OR CLEAR LCD</td>
</tr>
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<td>ENTRY:</td>
<td>(B)</td>
<td>NUMBER OF CHARACTERS</td>
</tr>
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<td>CLEAR SCREEN IF (B)=0</td>
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</tr>
<tr>
<td></td>
<td>(X) IF (B)&gt;0 ADDRESS OF DATA</td>
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</tr>
<tr>
<td></td>
<td>+0 X CO-ORDINATE 0..19</td>
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</tr>
<tr>
<td></td>
<td>+1 Y CO-ORDINATE 0..3</td>
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</tr>
<tr>
<td></td>
<td>+2 -&gt; DISPLAY DATA</td>
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</tr>
<tr>
<td>EXIT:</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
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<td></td>
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<tr>
<td>DSPLCH</td>
<td>&amp;HFF4C</td>
<td>DISPLAY A CHARACTER ON PHYSICAL SCREEN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AND UPDATE PHYSICAL SCREEN BUFFER</td>
</tr>
<tr>
<td>ENTRY:</td>
<td>(A)</td>
<td>DISPLAY DATA</td>
</tr>
<tr>
<td></td>
<td>(X) X-COORD : Y-COORD</td>
<td></td>
</tr>
<tr>
<td>EXIT:</td>
<td>(X)</td>
<td>UPDATED DISPLAY POSITION</td>
</tr>
<tr>
<td>PRESERVED:</td>
<td>(A),(B)</td>
<td></td>
</tr>
<tr>
<td>DISPIT</td>
<td>&amp;HFF5B</td>
<td>DISPLAY A CHARACTER ON PHYSICAL SCREEN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>THE PHYSICAL SCREEN BUFFER IS NOT USED</td>
</tr>
<tr>
<td>ENTRY:</td>
<td>(A)</td>
<td>DISPLAY DATA</td>
</tr>
<tr>
<td></td>
<td>(X) X-COORD : Y-COORD</td>
<td></td>
</tr>
<tr>
<td>EXIT:</td>
<td>(X)</td>
<td>UPDATED DISPLAY POSITION</td>
</tr>
<tr>
<td>PRESERVED:</td>
<td>(A),(B)</td>
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<tr>
<td>RDCFNT</td>
<td>&amp;HFF67</td>
<td>READ FONT PATTERN</td>
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<tr>
<td>ENTRY:</td>
<td>(A)</td>
<td>CHARACTER CODE</td>
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<tr>
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<td>(X) ADDRESS OF 6 BYTE WORK AREA</td>
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</tr>
<tr>
<td>EXIT:</td>
<td></td>
<td>FONT PATTERN IN WORK AREA</td>
</tr>
<tr>
<td>PRESERVED:</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>LABEL</td>
<td>ADDRESS</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>LCDADDR</td>
<td>&amp;HFF52</td>
<td>SELECT LCD CHIP IN COMMAND MODE</td>
</tr>
</tbody>
</table>
| ENTRY: (A) DOT COLUMN 0..119  
   (B) ROW 0..3 |
| EXIT: (A) DOT COLUMN + BANK NO  
   (B) CHIP NO + 8 |
| PRESERVED: (X) |
| TXRXLC | &HFF55 | TRANSMIT COMMAND OR DATA TO LCD |
| ENTRY: (A) COMMAND/DATA BYTE |
| EXIT: NONE |
| PRESERVED: (A),(B),(X) |
| LCDMOD | &HFF50 | DESELECT LCD OR CHANGE MODE |
| ENTRY: (D) &H800 SELECT DATA MODE  
   &H800 SELECT COMMAND MODE  
   &HF00 DESELECT LCD |
| EXIT: NONE |
| PRESERVED: NONE |
| VIRSCR | &HFF5E | VIRTUAL SCREEN ROUTINE |
| ENTRY: (X) ADDRESS OF DATA PACKET |
| EXIT: DATA PACKET MAY BE UPDATED |
| PRESERVED: NONE |
| RCULCD | &HFF61 | RECOVER VIRTUAL SCREEN |
| ENTRY: NONE |
| EXIT: NONE |
| PRESERVED: NONE |
### Serial I/F ROM Calls

<table>
<thead>
<tr>
<th>LABEL</th>
<th>ADDRESS</th>
<th>DESCRIPTION</th>
</tr>
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<tbody>
<tr>
<td>SRONF</td>
<td>&amp;HFF73</td>
<td>TURN SERIAL I/F POWER ON OR OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: (A) 0 - TURN POWER OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 - TURN POWER ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXIT: (A) ERROR CODE - 0 OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C IO ERROR 1=ERROR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Z 1 IF (A)=0</td>
</tr>
<tr>
<td></td>
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<td>PRESERVED: (B),(X)</td>
</tr>
<tr>
<td>SROUT</td>
<td>&amp;HFF70</td>
<td>SERIAL I/F BLOCK TRANSMISSION</td>
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<td></td>
<td>ENTRY: (A) 0 - TRANSMIT ONLY</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 - TRANSMIT &amp; RECEIVE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(X) ADDRESS OF PACKET</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXIT: PACKET MAY BE UPDATED</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(A) ERROR CODE 0 - OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C IO ERROR 1=ERROR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Z 1 IF (A)=0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRESERVED: NONE</td>
</tr>
<tr>
<td>SRIN</td>
<td>&amp;HFF6D</td>
<td>SERIAL I/F BLOCK RECEPTION</td>
</tr>
<tr>
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<td></td>
<td>ENTRY: (X) ADDRESS OF PACKET</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXIT: PACKET MAY BE UPDATED</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(A) ERROR CODE 0 - OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(B) IF A=0, 0=HEADER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1=NO HEADER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C IO ERROR 1=ERROR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Z 1 IF (A)=0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRESERVED: NONE</td>
</tr>
<tr>
<td>SRINI</td>
<td>&amp;HFF1C</td>
<td>INITIALIZE SERIAL I/F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: (A) 0=MASTER, 1=SLAVE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXIT: NONE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRESERVED: NONE</td>
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</table>

2-4
<table>
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<tr>
<th>LABEL</th>
<th>ADDRESS</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSMST</td>
<td>&amp;HFF88</td>
<td>SET RS232 PARAMETERS</td>
</tr>
</tbody>
</table>

**ENTRY:**

- (A) MODE:
  - B7: EVEN PARITY
  - B6: ODD PARITY
  - B5: NO PARITY
  - B4: CHECK CTS, 0 NOT
  - B3: CHECK DSR, 1 NOT
  - B2: RTS ON, 0 OFF
  - B1: NO OF STOP BITS 1..3

- (B) BIT RATE & WORD LENGTH:
  - B7-B4: BIT RATE 0-7
  - B3-B0: WORD LENGTH 5-8

**EXIT:**

- NONE

**PRESERVED:**

- (A), (B), (X)

| RSONF  | &HFF85  | TURN RS232 I/F POWER ON OR OFF |

**ENTRY:**

- (A) 0 - TURN POWER OFF
- 1 - TURN POWER ON

**EXIT:**

- (A) ERROR CODE 0 OK
- C 10 ERROR 1=ERROR
- Z 1 IF (A)=0

**PRESERVED:**

- (B), (X)

| RSOPEN | &HFF82  | OPEN RS232 FOR INPUT |

**ENTRY:**

- (D) RECEIVE BUFFER SIZE
- (X) RECEIVE BUFFER ADDRESS

**EXIT:**

- (A) ERROR CODE 0=OK
- C 10 ERROR FLAG 1=ERROR

**PRESERVED:**

- NONE
<table>
<thead>
<tr>
<th>LABEL</th>
<th>ADDRESS</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSCLOS</td>
<td>&amp;HFF7F</td>
<td>CLOSE RS232 INPUT</td>
</tr>
<tr>
<td>ENTRY:</td>
<td>NONE</td>
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</tr>
<tr>
<td>EXIT: (A)</td>
<td>ERROR CODE 0=OK</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>IO ERROR FLAG 1=ERROR</td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td>1 IF (A)=0</td>
<td></td>
</tr>
<tr>
<td>PRESERVED:</td>
<td>(B),(X)</td>
<td></td>
</tr>
<tr>
<td>RSGSTS</td>
<td>&amp;HFF7C</td>
<td>GET RS232 INPUT STATUS</td>
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<tr>
<td>ENTRY:</td>
<td>NONE</td>
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</tr>
<tr>
<td>EXIT: (A)</td>
<td>B7=1 IF RECEIVE BUFFER FULL</td>
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</tr>
<tr>
<td>(B)</td>
<td>B6=1 IF RECEIVE ERROR</td>
<td></td>
</tr>
<tr>
<td>B2=1 IF OVERRUN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1=1 IF PARITY ERROR</td>
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<td></td>
</tr>
<tr>
<td>B0=1 IF CARRIER DISCONNECT</td>
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<tr>
<td>PRESERVED:</td>
<td>(X)</td>
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<tr>
<td>RSGET</td>
<td>&amp;HFF79</td>
<td>READ ONE CHARACTER FROM RS232 BUFFER</td>
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<td>EXIT: (A)</td>
<td>RECEIVED DATA</td>
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<tr>
<td>(B)</td>
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</tr>
<tr>
<td>0=OK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1=BUFFER FULL/BUFFER EMPTY</td>
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</tr>
<tr>
<td>ELSE IO ERROR</td>
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<td></td>
</tr>
<tr>
<td>C</td>
<td>IO ERROR 1=ERROR</td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td>1 IF (B)=0</td>
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<tr>
<td>PRESERVED:</td>
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<tr>
<td>RSPUT</td>
<td>&amp;HFF76</td>
<td>TRANSMIT CHARACTER TO RS232 I/F</td>
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<td>ENTRY:</td>
<td>(A) CHARACTER</td>
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<tr>
<td>EXIT: (B)</td>
<td>ERROR CODE:</td>
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</tr>
<tr>
<td>0 OK</td>
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<td></td>
</tr>
<tr>
<td>1 DSR OFF</td>
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<td></td>
</tr>
<tr>
<td>2 CTS OFF</td>
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<td></td>
</tr>
<tr>
<td>3 DSR &amp; CTS OFF</td>
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<td></td>
</tr>
<tr>
<td>C</td>
<td>IO ERROR 1=ERROR</td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td>1 IF (B)=0</td>
<td></td>
</tr>
<tr>
<td>PRESERVED:</td>
<td>(A),(X)</td>
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</table>

2-6
### Cassette & Microcassette ROM Calls

<table>
<thead>
<tr>
<th>LABEL</th>
<th>ADDRESS</th>
<th>DESCRIPTION</th>
</tr>
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<tbody>
<tr>
<td>CHKRS</td>
<td>&amp;HFF16</td>
<td>RESTARTS INTERRUPTED RS232 INPUT</td>
</tr>
<tr>
<td></td>
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<td>ENTRY: NONE</td>
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<td>EXIT: NONE</td>
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<td>PRESERVED: (A),(B),(X),(CCR)</td>
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<tr>
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<tbody>
<tr>
<td>RMTONIF</td>
<td>&amp;HFF46</td>
<td>TURN EXTERNAL CASSETTE REMOTE ON/OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: (A) 0 OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXIT: (A) ERROR CODE 0 - OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C 10 ERROR 1=ERROR</td>
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<tr>
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<tr>
<th>LABEL</th>
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<tbody>
<tr>
<td>MCSMAN</td>
<td>&amp;HFF0D</td>
<td>ENTERS MANUAL MICROCASSETTE MODE (^PFI)</td>
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<td></td>
<td>EXIT: (A) ERROR CODE 0 - OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C 10 ERROR FLAG 1=ERROR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Z 1 IF (A)=0</td>
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<tr>
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<td>PRESERVED: NONE</td>
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<thead>
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<tbody>
<tr>
<td>MCSREW</td>
<td>&amp;HFEF5</td>
<td>REWIND MICROCASSETTE TO START OF TAPE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: NONE</td>
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<tr>
<td></td>
<td></td>
<td>EXIT: (A) ERROR CODE 0 - OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(X) TAPE COUNTER VALUE</td>
</tr>
<tr>
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<td>C 10 ERROR FLAG 1=ERROR</td>
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<tr>
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<td>Z 1 IF (A)=0</td>
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2-7
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<thead>
<tr>
<th>LABEL</th>
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<tbody>
<tr>
<td>MCSSEK</td>
<td>&amp;HFEF2</td>
<td>WIND MICROCASSETTE TO SPECIFIED COUNT</td>
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<tr>
<td>ENTRY:</td>
<td>(X) TAPE COUNT</td>
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<tr>
<td>EXIT:</td>
<td>(A) ERROR CODE 0 = OK&lt;br&gt;(X) TAPE COUNTER VALUE&lt;br&gt;C 10 ERROR FLAG 1=ERROR&lt;br&gt;Z 1 IF (A)=0</td>
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<tr>
<td>PRESERVED:</td>
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<tr>
<td>MCSCHT</td>
<td>&amp;HFEF0</td>
<td>SETS OR READS M-CASSETTE COUNTER VALUE</td>
</tr>
<tr>
<td>ENTRY:</td>
<td>(A) 0 = READ, 1=SET&lt;br&gt;(X) COUNTER VALUE (A=1)</td>
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</tr>
<tr>
<td>EXIT:</td>
<td>(X) COUNTER VALUE (A=0)&lt;br&gt;C 10 ERROR 1=ERROR</td>
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<tr>
<td>PRESERVED:</td>
<td>(B)</td>
<td></td>
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<tr>
<td>CASOPNR</td>
<td>&amp;HFEF23</td>
<td>OPENS SPECIFIED CASSETTE FILE FOR INPUT</td>
</tr>
<tr>
<td>MCSOPNR</td>
<td>&amp;HFEF0A</td>
<td>OPENS SPECIFIED M-CASS FILE FOR INPUT</td>
</tr>
<tr>
<td>ENTRY:</td>
<td>(X) PACKET ADDRESS:&lt;br&gt;+0 STOP MODE:&lt;br&gt; 0 STOP&lt;br&gt;1 NOT STOP&lt;br&gt;-1 AUTOMATIC&lt;br&gt;+1,+2 ADDR OF 260 BYTE BUF&lt;br&gt;+3..+10 8 BYTE FILENAME&lt;br&gt;+11..+18 8 BYTE FILETYPE</td>
<td></td>
</tr>
<tr>
<td>EXIT:</td>
<td>(A) ERROR CODE 0=OK&lt;br&gt;C 10 ERROR FLAG 1=ERROR&lt;br&gt;Z 1 IF (A)=0</td>
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</tr>
<tr>
<td>PRESERVED:</td>
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<tr>
<td>LABEL</td>
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<tr>
<td>-------</td>
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<td>-------------</td>
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<tr>
<td>CASRCH</td>
<td>&amp;HFF40</td>
<td>OPENS FIRST CASSETTE FILE FOR INPUT</td>
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<tr>
<td>MCSRCH</td>
<td>&amp;HFF07</td>
<td>OPENS FIRST M-CASS FILE FOR INPUT</td>
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</table>

**ENTRY:** (X)  PACKET ADDRESS:

+0  STOP MODE:

  0 STOP
  1 NOT STOP
  -1 AUTOMATIC

+1,2  ADDR OF 260 BYTE BUF
+3,+10  8 BYTE FILENAME
+11,+18  8 BYTE FILETYPE
+19,+35  SPARE

**EXIT:** PACKET:

+19,+27  8 BYTE FOUND FILENAME
+28,+35  8 BYTE FOUND FILETYPE

(A)  ERROR CODE 0=OK

C  IO ERROR FLAG 1=ERROR

Z  1 IF (A)=0

**PRESERVED:** NONE

---

<table>
<thead>
<tr>
<th>CASRD</th>
<th>&amp;HFF3D</th>
<th>READ ONE CHAR FROM E-CASS FILE</th>
</tr>
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<tbody>
<tr>
<td>MCSRD</td>
<td>&amp;HFF04</td>
<td>READ ONE CHAR FROM M-CASS FILE</td>
</tr>
</tbody>
</table>

**ENTRY:** NONE

**EXIT:** (A)  CHARACTER

(B)  ERROR CODE:

  0 - OK
  1 - EOF

ELSE IO ERROR

C  IO ERROR FLAG 1=ERROR

Z  1 IF (B)=0

**PRESERVED:** (X)

---

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<table>
<thead>
<tr>
<th>LABEL</th>
<th>ADDRESS</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>CSOPNW</td>
<td>1&amp;FF3A</td>
<td>OPENS CASSETTE FILE FOR OUTPUT</td>
</tr>
<tr>
<td>MCSOPNW</td>
<td>1&amp;FF01</td>
<td>OPENS M-CASS FILE FOR OUTPUT</td>
</tr>
</tbody>
</table>

**ENTRY:** (X)  
**PACKET ADDRESS:**  
+0  STOP MODE:  
  0 STOP  
  1 NOT STOP  
+1,2  ADDR OF 260 BYTE BUF  
+3..+10 8 BYTE FILENAME  
+11..+18 8 BYTE FILETYPE  

**EXIT:** (A)  
**ERROR CODE**  
0 OK  
C IO ERROR FLAG 1=ERROR  
Z 1 IF (A)=0  

**PRESERVED:** NONE

<table>
<thead>
<tr>
<th>CSUR</th>
<th>1&amp;FF37</th>
<th>WRITES ONE CHAR TO E-CASS FILE</th>
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<tr>
<td>MCSUR</td>
<td>1&amp;FEEF</td>
<td>WRITES ONE CHAR TO M-CASS FILE</td>
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**ENTRY:** (A)  
**CHARACTER**  

**EXIT:** (B)  
**ERROR CODE**  
0 OK  
C IO ERROR FLAG 1=ERROR  
Z 1 IF (B)=0  

**PRESERVED:** (A),(X)

<table>
<thead>
<tr>
<th>CSCLS</th>
<th>1&amp;FF34</th>
<th>CLOSE CASSETTE FILE</th>
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<tr>
<td>MCSCLS</td>
<td>1&amp;FEB7</td>
<td>CLOSE M-CASS FILE</td>
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**ENTRY:** NONE  

**EXIT:** (A)  
**ERROR CODE**  
0 OK  
C IO ERROR FLAG 1=ERROR  
Z 1 IF (A)=0  

**PRESERVED:** NONE

2-10
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<thead>
<tr>
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<tr>
<td>PRTRCHR</td>
<td>$0FF97</td>
<td>PRINT ONE CHAR ON MICROPRINTER</td>
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<td>ENTRY: (A) CHARACTER</td>
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<td>EXIT: C IO ERROR FLAG 1=ERROR</td>
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<td>PRESERVED: (A),(B),(X)</td>
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<tr>
<td>PRTRLN</td>
<td>$0FF94</td>
<td>PRINT ONE LINE ON MICROPRINTER</td>
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<td>ENTRY: (X) ADDRESS OF 24 CHAR BUFFER</td>
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<td>EXIT: C IO ERROR FLAG 1=ERROR</td>
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<td>PRESERVED: (A),(B),(X)</td>
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<tr>
<td>PRTDOT</td>
<td>$0FF91</td>
<td>PRINT ONE DOT LINE ON MICROPRINTER</td>
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<td>ENTRY: (X) ADDRESS OF 24 BYTE BUFFER</td>
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<td>$0B00$DOT 0 .. $55$DOT 5</td>
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<td></td>
<td>$0B01$DOT 6 .. $55$DOT 11</td>
</tr>
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<td>$0B23$DOT 138 .. $55$DOT 143</td>
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<td>EXIT: C IO ERROR FLAG 1=ERROR</td>
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<td>PRESERVED: (A),(B),(X)</td>
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<tr>
<td>PRTLFD</td>
<td>$0FFBE</td>
<td>FEED PAPER ON MICROPRINTER</td>
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<td>ENTRY: (A) NUMBER OF DOT LINES FEED</td>
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<td>EXIT: C IO ERROR FLAG 1=ERROR</td>
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<td>PRESERVED: (A),(B),(X)</td>
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<tr>
<td>PRTSCR</td>
<td>$0FF8B</td>
<td>PRINT PHYSICAL LCD SCREEN (^PF2)</td>
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<td>ENTRY: NONE</td>
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<td>EXIT: C IO ERROR FLAG 1=ERROR</td>
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<tr>
<td></td>
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<td>PRESERVED: (A),(B),(X)</td>
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<tr>
<td>LABEL</td>
<td>ADDRESS</td>
<td>DESCRIPTION</td>
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<tr>
<td>---------</td>
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<tr>
<td>PRMOPN</td>
<td>&amp;HFEED</td>
<td>OPEN ROM FILE FOR INPUT</td>
</tr>
<tr>
<td>ENTRY:</td>
<td>(A) 0 - FILENAME NOT RETURNED</td>
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<td>1 - RETURN OPENED FILENAME</td>
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<tr>
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<td>(X) PACKET ADDRESS:</td>
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<tr>
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<td>+0..+7 FILENAME</td>
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<tr>
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<td>+8..+15 FILETYPE</td>
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<tr>
<td></td>
<td>+16..+31 UNUSED (A=1)</td>
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<tr>
<td>EXIT:</td>
<td>PACKET: (A=1)</td>
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<tr>
<td></td>
<td>+16..+23 OPENED FILENAME</td>
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<tr>
<td></td>
<td>+24..+31 OPENED FILETYPE</td>
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<tr>
<td></td>
<td>(A) ERROR CODE 0=OK</td>
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<td></td>
<td>C IO ERROR FLAG 1=ERROR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z 1 IF (A)=0</td>
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</tr>
<tr>
<td>PRESERVED:</td>
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<tr>
<td>PRMRD</td>
<td>&amp;HFEED</td>
<td>READ ONE BYTE FROM PROM FILE</td>
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<td>EXIT:</td>
<td>(A) BYTE READ</td>
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<td>(B) ERROR CODE:</td>
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<tr>
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<td>0 - OK</td>
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</tr>
<tr>
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<td>1 - EOF</td>
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<td>C IO ERROR FLAG 1=ERROR</td>
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<td>Z 1 IF (B)=0</td>
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<td>PRMCLS</td>
<td>&amp;HFEED</td>
<td>CLOSE PROM FILE</td>
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<tr>
<td>EXIT:</td>
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<td>(B),(X)</td>
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</table>
### Label: PRMDIR

- ADDRESS: &HFE3
- Description: READ PROM DIRECTORY RECORD

#### ENTRY:
- (A) DIRECTORY RECORD NO. 0..63
- (X) ADDR OF 32 BYTE WORK AREA

#### EXIT:
- WORK AREA:
  - DIRECTORY RECORD (A=0)
- ERROR CODE 0=OK
- C 10 ERROR FLAG 1=ERROR
- Z 1 IF (A)=0

#### PRESERVED: NONE

### Memory Dump/Load ROM Calls

<table>
<thead>
<tr>
<th>LABEL</th>
<th>ADDRESS</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>DMPOPEN</td>
<td>&amp;HFE0</td>
<td>OPEN FILE FOR MEMORY DUMP TO DEVICE</td>
</tr>
</tbody>
</table>

#### ENTRY:
- (B) DEVICE NAME:
  - "M" - M-CASS
  - "C" - E-CASS
  - "0" - RS232 (110 BAUD)
  - "6" - RS232 (4800 BAUD)
- (X) PACKET ADDRESS: (27 BYTE)
- +0 TAPE STOP MODE:
  - 0 - STOP
  - 1 - DO NOT STOP
- +1,2 ADDRESS OF 260 BYTE BUF
- +3..+10 8 BYTE FILENAME
- +11..+18 8 BYTE FILETYPE
- +19,20 DUMP START ADDRESS
- +21,22 DUMP END ADDRESS
- +23,24 DUMP OFFSET
- +25,26 PROGRAM EXEC ADDRESS

#### EXIT:
- ERROR CODE 0=OK
- C 10 ERROR FLAG 1=ERROR

#### PRESERVED: NONE
<table>
<thead>
<tr>
<th>LABEL</th>
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<th>DESCRIPTION</th>
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<tr>
<td>DMPBIN</td>
<td>8HFFEDD</td>
<td>DUMP MEMORY TO FILE</td>
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<tr>
<td>ENTRY:</td>
<td>NONE</td>
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</tr>
<tr>
<td>EXIT:</td>
<td>C</td>
<td>IO ERROR FLAG 1=ERROR</td>
</tr>
<tr>
<td>PRESERVED:</td>
<td>NONE</td>
<td></td>
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<tr>
<td>LODOPH</td>
<td>8HFEDEA</td>
<td>OPEN FILE FOR MEMORY LOAD FROM DEVICE</td>
</tr>
<tr>
<td>ENTRY:</td>
<td>(A) 0 - DO NOT RETURN FILENAME</td>
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</tr>
<tr>
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<td>1 - RETURN OPENED FILENAME</td>
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</tr>
<tr>
<td></td>
<td>(B) DEVICE NAME:</td>
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</tr>
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<td>&quot;M&quot; - M-CASS</td>
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<tr>
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<td>&quot;C&quot; - E-CASS</td>
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<td>&quot;P&quot; - ROM CARTRIDGE</td>
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<td>&quot;0&quot; - RS232 (110 BAUD)</td>
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<td>&quot;6&quot; - RS232 (4800 BAUD)</td>
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<td>(X)</td>
<td>PACKET ADDRESS:</td>
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<tr>
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<td>+0 TAPE STOP MODE:</td>
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<tr>
<td></td>
<td>0 - STOP</td>
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</tr>
<tr>
<td></td>
<td>1 - DO NOT STOP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-1 - AUTOMATIC</td>
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<tr>
<td></td>
<td>+1,2 ADDRESS OF 268 BYTE BUF</td>
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</tr>
<tr>
<td></td>
<td>+3..+10 8 BYTE FILENAME</td>
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</tr>
<tr>
<td></td>
<td>+11..+10 8 BYTE FILETYPE</td>
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</tr>
<tr>
<td></td>
<td>+19,20 LOWER ADDRESS LIMIT</td>
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<tr>
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<td>+21,22 UPPER ADDRESS LIMIT</td>
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<td>+23,24 LOAD OFFSET</td>
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<tr>
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<td>+25..+34 SPARE (A=1)</td>
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<td>EXIT:</td>
<td>PACKET:</td>
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<tr>
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<td>+19..+26 FOUND FILENAME</td>
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<tr>
<td></td>
<td>+27..+34 FOUND FILETYPE</td>
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<tr>
<td>(A)</td>
<td>ERROR CODE 0=OK</td>
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<tr>
<td>C</td>
<td>IO ERROR FLAG 1=ERROR</td>
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<tr>
<td>LODBIN</td>
<td>8HFEDE7</td>
<td>LOAD MEMORY FROM FILE</td>
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<tr>
<td>ENTRY:</td>
<td>(A) 0 - LOAD FILE INTO MEMORY</td>
<td></td>
</tr>
<tr>
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<td>1 - DO NOT LOAD - VERIFY</td>
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<td>EXIT:</td>
<td>(X) PROGRAM EXEC ADDR</td>
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<td>(A)</td>
<td>ERROR CODE 0=OK</td>
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### Miscellaneous ROM Calls

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<tr>
<td>SNSCOM</td>
<td>&amp;HFF19</td>
<td>SEND BYTE TO SLAVE MPU</td>
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<td>ENTRY: (A) BYTE</td>
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<td>EXIT: (A) SLAVE RETURN CODE</td>
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<td>C IO ERROR FLAG 1=ERROR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRESERVED: (B), (X)</td>
</tr>
<tr>
<td>BEEP</td>
<td>&amp;HFF64</td>
<td>SOUND BUZZER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: (A) TONE 0..56</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(B) DURATION (UNITS: .1S) 0..255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXIT: C IO ERROR FLAG 1=ERROR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRESERVED: (A), (B), (X)</td>
</tr>
<tr>
<td>SLEEP</td>
<td>&amp;HFFA9</td>
<td>ENTER SLEEP MODE UNTIL INTERRUPT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: NONE</td>
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<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>PRESERVED: (A), (B), (X)</td>
</tr>
<tr>
<td>CHKPLG</td>
<td>&amp;HFF2E</td>
<td>ASCERTAIN PLUG IN CARTRIDGE TYPE</td>
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<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>0 - ROM CARTRIDGE</td>
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<tr>
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<td>1 - UNDEFINED</td>
</tr>
<tr>
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<td>2 - NONE</td>
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<tr>
<td></td>
<td></td>
<td>3 - UNDEFINED</td>
</tr>
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<td></td>
<td></td>
<td>4-7 - MICROCASSETTE</td>
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<tr>
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<td></td>
<td>C IO ERROR FLAG 1=ERROR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRESERVED: (B), (X)</td>
</tr>
<tr>
<td>PWROFF</td>
<td>&amp;HFFAC</td>
<td>TURN POWER OFF - NO EXIT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: NONE</td>
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2-15
<table>
<thead>
<tr>
<th>LABEL</th>
<th>ADDRESS</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>PURDUN</td>
<td>$&amp;HFF1F</td>
<td>DISPLAYS &quot;CHARGE BATTERY!&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RETURNS ONLY IF BATTERY RECOVERS,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OTHERWISE TURNS POWER OFF</td>
</tr>
<tr>
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</tr>
<tr>
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<td>REQINI</td>
<td>$&amp;HFF13</td>
<td>COLD START - EXIT VIA RESET VECTOR</td>
</tr>
<tr>
<td>ENTRY:</td>
<td>NONE</td>
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<tr>
<td>WRTP26</td>
<td>$&amp;HFFED4</td>
<td>WRITE DATA TO P26 AND P26DAT</td>
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<tr>
<td>ENTRY:</td>
<td>(A) PORT MASK - 1=ALTER BIT</td>
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<td>(B) PORT DATA</td>
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<td>(A), (B), (X)</td>
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<tr>
<td>BREKIO</td>
<td>$&amp;HFFA3</td>
<td>IO BREAK PROCESSING, SET BRK AND SBRK</td>
</tr>
<tr>
<td>ENTRY:</td>
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</tr>
<tr>
<td>EXIT:</td>
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<td>RSTIO</td>
<td>$&amp;HFFA6</td>
<td>RESTART BROKEN IO</td>
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<tr>
<td>ENTRY:</td>
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</tr>
<tr>
<td>EXIT:</td>
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<tr>
<td>PRESERVED:</td>
<td>(X)</td>
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<tr>
<td>CMTIO</td>
<td>$&amp;HFFAF</td>
<td>RESET BRK &amp; SBRK, RESTART RS232 INPUT</td>
</tr>
<tr>
<td>ENTRY:</td>
<td>NONE</td>
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</tr>
<tr>
<td>EXIT:</td>
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<td></td>
</tr>
<tr>
<td>PRESERVED:</td>
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<td></td>
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<tr>
<td>LABEL</td>
<td>ADDRESS</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>INITIO</td>
<td>$0FFCD</td>
<td>CALLS HSTIO, Initializes keyboard, LCD, calls RSTIO, ascertains cartridge type, enables interrupts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: NONE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXIT: NONE</td>
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<tr>
<td></td>
<td></td>
<td>PRESERVED: NONE</td>
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<tr>
<td>HSTIO</td>
<td>$0FED1</td>
<td>INITIALIZE IO SYSTEM EXCEPT KVBD &amp; LCD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: NONE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXIT: NONE</td>
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<tr>
<td></td>
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<td>PRESERVED: NONE</td>
</tr>
<tr>
<td>HEXBIN</td>
<td>$0FF2B</td>
<td>2 DIG ASCII HEX NO -&gt; 1 BYTE BINARY NO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: (D) 2 DIGIT ASCII HEX NUMBER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXIT: (A) BINARY NO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(B) ERROR CODE 0 - OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 1 IF (B)=0</td>
</tr>
<tr>
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<tr>
<td>BINDEC</td>
<td>$0FF20</td>
<td>2 BYTE UNSIGNED BIN -&gt; 5 BYTE ASCII DEC</td>
</tr>
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<td></td>
<td>ENTRY: (D) 2 BYTE UNSIGNED BINARY NO</td>
</tr>
<tr>
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<td></td>
<td>(X) ADDRESS OF 5 BYTE WORK AREA</td>
</tr>
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<td></td>
<td>EXIT: WORK AREA CONTAINS 5 DIGIT ASCII DECIMAL NUMBER</td>
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<td>PRESERVED: NONE</td>
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<tr>
<td>RDCLK</td>
<td>$0FF31</td>
<td>READ TIME &amp; DATE FROM RTC</td>
</tr>
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<td>ENTRY: (X) ADDRESS OF 6 BYTE WORK AREA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXIT: WORK AREA: (BCD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 MONTH 01..2H12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+1 DAY 01..2H31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+2 YEAR 00..2H99</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+3 HOUR 00..2H23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+4 MINUTES 00..2H59</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+5 SECONDS 00..2H59</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRESERVED: NONE</td>
</tr>
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2-17
<table>
<thead>
<tr>
<th>LABEL</th>
<th>ADDRESS</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>WRCLK</td>
<td>&amp;HE1E3</td>
<td>WRITES THE DATE &amp; TIME TO THE RTC</td>
</tr>
<tr>
<td></td>
<td>&amp;HFEF8</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: (X) ADDRESS OF 6 BYTE PACKET:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+0 MONTH 01..&amp;H12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+1 DAY 01..&amp;H31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+2 YEAR 00..&amp;H99</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+3 HOUR 00..&amp;H23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+4 MINUTES 00..&amp;H59</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+5 SECONDS 00..&amp;H59</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXIT: NONE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRESERVED: NONE</td>
</tr>
<tr>
<td>MNITOR</td>
<td>&amp;HFF18</td>
<td>CALL MONITOR AS SUBROUTINE</td>
</tr>
<tr>
<td></td>
<td>&amp;HDF7</td>
<td>USER MAY OPT TO NEVER RETURN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: NONE</td>
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<tr>
<td></td>
<td></td>
<td>EXIT: NONE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRESERVED: NONE</td>
</tr>
<tr>
<td>MNTRP</td>
<td>&amp;HFFBB</td>
<td>MONITOR TRAP ENTRY POINT</td>
</tr>
<tr>
<td></td>
<td>&amp;HDFFA</td>
<td>USER MAY OPT TO NEVER RETURN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: NONE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXIT: NONE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRESERVED: NONE</td>
</tr>
<tr>
<td>MENU</td>
<td>&amp;HFF25</td>
<td>MENU ENTRY POINT - NO RETURN</td>
</tr>
<tr>
<td></td>
<td>&amp;HDFD</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: NONE</td>
</tr>
<tr>
<td>BRKIN</td>
<td>&amp;HFFB2</td>
<td>MENU ENTRY POINT ON BREAK - NO RETURN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: NONE</td>
</tr>
<tr>
<td>SCRCHR</td>
<td>&amp;HFF4F</td>
<td>WRITE ONE CHAR TO VIRTUAL SCREEN</td>
</tr>
<tr>
<td></td>
<td>&amp;HDF1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ENTRY: (A) CHARACTER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXIT: (X) NEW X-COORD:NEW Y-COORD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRESERVED: NONE</td>
</tr>
</tbody>
</table>

2-18
Virtual Screen Functions

Subroutine VIRSCR handles the Virtual screen on the LCD or Display controller. All calls to VIRSCR must pass the address of a data packet. The possible contents and functions of the packet are given below. Note that if you use the display controller you must reserve 4 bytes of unused RAM before the packet. The packet may be updated on return from VIRSCR. The packet is normally in RAM. Note also that all control codes except $812 have the function defined in section 1.5 of HX-28 BASIC REFERENCE MANUAL. Code $812 inserts a single space character at the cursor position. The Size of the Screen Buffer is \((\text{WIDTH} \times (\text{LENGTH} + 1)) + 1\) bytes.

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$804</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>DEVICE NO:</td>
<td>$0 = OK, $1 = DEV NO ERR</td>
</tr>
<tr>
<td></td>
<td>$822 = LCD</td>
<td>$2 = NOT READY</td>
</tr>
<tr>
<td></td>
<td>$830 = EXT DISPLAY</td>
<td></td>
</tr>
</tbody>
</table>

**Select Device**

| 0    | $805  |      |
| 1    | $0 = OK, $1 = IO ERROR |      |

**Initialize Display Controller**

| 0    | $806  |      |
| 1    | DEVICE NO |      |

**Get Device No**

| 0    | $807  |      |
| 1    | WIDTH -1 | $0 = OK, $1 = SIZE ERR |
| 2    | LENGTH -1 | $2 = ADDR ERR |
| 3,4  | BUFFER ADDRESS (LCD) |      |

**Set Screen Size**

| 0    | $808  |      |
| 1    | WIDTH -1 |      |
| 2    | LENGTH -1 |      |

**Get Screen Size**

| 0    | $809  |      |
| 1    | WIDTH -1 |      |
| 2    | LENGTH -1 |      |

**Get Physical Screen Size**

<p>| 0    | $810  |      |
| 1    | WIDTH -1 |      |
| 2    | LENGTH -1 |      |</p>
<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>&amp;HBA</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>X-COORD</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Y-COORD</td>
</tr>
</tbody>
</table>

Get Upper Left Corner Window Position

| 0    | &HBC  |      |
| 1    |       | X-COORD |
| 2    |       | Y-COORD |

Get Cursor Position on Virtual Screen

| 0    | &HBD  | CURSOR MARGIN |

Get Cursor Margin

| 0    | &HBE  | HORIZONTAL SCROLL VALUE |
| 1    |       | VERTICAL SCROLL VALUE |

Get Scroll Steps

| 0    | &HBF  | DOT STATUS:    |
| 1    |       | LCD: 0 = OFF, -1 = ON |
|      |       | DISPLAY: COLOUR CODE |
| 2    | X-COORD (MSB) |
| 3,4  | Y-COORD |

Get Physical Screen Dot Status

| 0    | &H91  | (X-COORD ) - FIRST LINE |
| 1    |       | (Y-COORD ) |
| 2    |       | PHYSICAL SCREEN WIDTH-1 |
| 3    |       | Y-COORD - LAST LINE |

Get Logical line range

<p>| 0    | &amp;H92  | CHARACTER |
| 1    |       | NEW X-COORD |
| 2    |       | NEW Y-COORD |</p>
<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Set Display Controller Mode</strong></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>8H93</td>
<td>0 = OK, -1 = IO ERROR</td>
</tr>
<tr>
<td>1</td>
<td>MODE:</td>
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</tr>
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<td></td>
<td>0 - GRAPHIC MODE</td>
<td></td>
</tr>
<tr>
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<td>1 - TEXT MODE</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>GRAPHIC MODE:</td>
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<tr>
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<td>0 - TEXT MODE</td>
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</tr>
<tr>
<td></td>
<td>1 - 4 COLOUR MODE</td>
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</tr>
<tr>
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<td>2 - 2 COLOUR MODE</td>
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</tr>
<tr>
<td>3</td>
<td>BACKGROUND COLOUR</td>
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<td><strong>Get Characters from Virtual Screen</strong></td>
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<td>8H97</td>
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<td>START X-COORD</td>
<td>CHARACTER1 ...</td>
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<td>2</td>
<td>START Y-COORD</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>NO OF CHARACTERS</td>
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<td><strong>Display Character on Virtual Screen</strong></td>
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<td>NEW CURSOR X-COORD</td>
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<td></td>
<td>NEW CURSOR Y-COORD</td>
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<td>FIRST Y-COORD OF LINE</td>
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<tr>
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<td></td>
<td>CONTAINING CURSOR</td>
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<tr>
<td>4</td>
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<td>CONTAINING CURSOR</td>
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<td><strong>Set Window Position</strong></td>
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<tr>
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</tr>
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<td>X-COORD OF WINDOW</td>
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</tr>
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<td>Y-COORD OF WINDOW</td>
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<td><strong>Set Cursor Position</strong></td>
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<td>Y-COORD OF CURSOR</td>
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<td><strong>Set Cursor Margin</strong></td>
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<td>CURSOR MARGIN VALUE</td>
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<td><strong>Set Scroll Step Values</strong></td>
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<td>HORIZONTAL SCROLL STEP</td>
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<td>VERTICAL SCROLL STEP</td>
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<td>Byte</td>
<td>Entry</td>
<td>Exit</td>
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<td>--------------------------------------------</td>
<td>-------------------------------------------</td>
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<tr>
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<td>Disable Left/Right Scrolling (Listing)</td>
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<td>Enable Left/Right Scrolling</td>
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<td>Set/Reset Dot on Graphic Screen</td>
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</tr>
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<td>X-COORD</td>
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<td>Y-COORD</td>
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<td>5</td>
<td>DOT STATUS:</td>
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<td>LCD: 0 OFF, -1 ON</td>
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<td>DISP: COLOUR CODE</td>
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</tr>
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<td>Draw Line on Graphic Screen</td>
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</tr>
<tr>
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<td>8HC8</td>
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</tr>
<tr>
<td>1,2</td>
<td>START X-COORD</td>
<td></td>
</tr>
<tr>
<td>3,4</td>
<td>START Y-COORD</td>
<td></td>
</tr>
<tr>
<td>5,6</td>
<td>END X-COORD</td>
<td></td>
</tr>
<tr>
<td>7,8</td>
<td>END Y-COORD</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>LINE STATUS:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SEE DOT STATUS ABOVE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Start New Logical Line</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>8HC9</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>LINE Y-COORD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clear Graphic Screen</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>8HCA</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>COLOUR (DISP)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Set LCD Scroll Speed</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>8HCB</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>SCROLL SPEED (0-9)</td>
<td></td>
</tr>
</tbody>
</table>
Disk Drive Functions

Subroutine SROUT is used to transmit and receive data packets with the TF-20. All calls to SROUT must pass the address of a data packet. The possible contents and functions of the packet are given below. Note that the first three bytes of the packet are as follows:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>&amp;H31</td>
<td>for drive &quot;A:&quot; or &quot;B:&quot;</td>
</tr>
<tr>
<td>2</td>
<td>&amp;H32</td>
<td>for drive &quot;C:&quot; or &quot;D:&quot;</td>
</tr>
<tr>
<td>2</td>
<td>&amp;H20</td>
<td></td>
</tr>
</tbody>
</table>

The packet is normally in RAM and is updated on return. Note that the first three bytes will be changed on return to:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>&amp;H20</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>&amp;H31</td>
<td>for drive &quot;A:&quot; or &quot;B:&quot;</td>
</tr>
<tr>
<td></td>
<td>&amp;H32</td>
<td>for drive &quot;C:&quot; or &quot;D:&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>&amp;H0D</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

### Initialize TF-20

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>&amp;H0F</td>
</tr>
<tr>
<td>4</td>
<td>&amp;H0E</td>
</tr>
<tr>
<td>5</td>
<td>FCB ADDR IN BX20 (MSB) ; RETURN CODE</td>
</tr>
<tr>
<td>6</td>
<td>FCB ADDR IN BX20 (LSB) ;</td>
</tr>
<tr>
<td>7</td>
<td>DRIVE CODE (1-A, 2-B) ;</td>
</tr>
<tr>
<td>8-15</td>
<td>FILENAME</td>
</tr>
<tr>
<td>16-16</td>
<td>FILETYPE</td>
</tr>
<tr>
<td>19</td>
<td>EXTENT (USUALLY 0)</td>
</tr>
</tbody>
</table>

### Open File

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>&amp;H10</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>FCB ADDR IN BX20 (MSB) ; RETURN CODE</td>
</tr>
<tr>
<td>6</td>
<td>FCB ADDR IN BX20 (LSB) ;</td>
</tr>
</tbody>
</table>

### Close File

2-23
<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Directory Search</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>$8H11</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$8HC</td>
<td>$8H20</td>
</tr>
<tr>
<td>5</td>
<td>DRIVE CODE</td>
<td>RETURN CODE</td>
</tr>
<tr>
<td>6-13</td>
<td>FILENAME</td>
<td>FCB (32 BYTES)</td>
</tr>
<tr>
<td>14-16</td>
<td>FILETYPE</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>EXTENT</td>
<td></td>
</tr>
<tr>
<td>18-37</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subsequent Directory Search</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>$8H12</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>$8H20</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>RETURN CODE</td>
</tr>
<tr>
<td>6-37</td>
<td></td>
<td>FCB (32 BYTES)</td>
</tr>
<tr>
<td><strong>Delete File</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>$8H13</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$8HC</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>DRIVE CODE</td>
<td>RETURN CODE</td>
</tr>
<tr>
<td>6-13</td>
<td>FILENAME</td>
<td></td>
</tr>
<tr>
<td>14-16</td>
<td>FILETYPE</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>EXTENT</td>
<td></td>
</tr>
<tr>
<td><strong>Create File</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>$8H16</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$8HE</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>FCB ADDR IN HX20 (MSB)</td>
<td>RETURN CODE</td>
</tr>
<tr>
<td>6</td>
<td>FCB ADDR IN HX20 (LSB)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>DRIVE CODE</td>
<td></td>
</tr>
<tr>
<td>8-15</td>
<td>FILENAME</td>
<td></td>
</tr>
<tr>
<td>16-18</td>
<td>FILETYPE</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>EXTENT</td>
<td></td>
</tr>
<tr>
<td><strong>File Rename</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>$8H17</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$8HF</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>DRIVE CODE</td>
<td>RETURN CODE</td>
</tr>
<tr>
<td>6-13</td>
<td>FILENAME</td>
<td></td>
</tr>
<tr>
<td>14-16</td>
<td>FILETYPE</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>EXTENT</td>
<td></td>
</tr>
<tr>
<td>18-20</td>
<td>UNUSED</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>DRIVE CODE</td>
<td></td>
</tr>
<tr>
<td>22-29</td>
<td>FILENAME</td>
<td></td>
</tr>
<tr>
<td>30-32</td>
<td>FILETYPE</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>EXTENT</td>
<td></td>
</tr>
<tr>
<td>34-36</td>
<td>UNUSED</td>
<td></td>
</tr>
</tbody>
</table>

2-24
### Read Random Data Record

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>&amp;H21</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>&amp;H82</td>
</tr>
<tr>
<td>5</td>
<td>FCB ADDR IN HX28 (MSB); EXTENT</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>FCB ADDR IN HX28 (LSB); CURRENT RECORD NO</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>RECORD NO (LSB)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>RECORD NO (MSB)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>10-134</td>
<td></td>
<td></td>
</tr>
<tr>
<td>135</td>
<td>RETURN CODE</td>
<td></td>
</tr>
</tbody>
</table>

### Write Random Data Record

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>&amp;H22</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>&amp;H04</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>FCB ADDR IN HX28 (MSB); EXTENT</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>FCB ADDR IN HX28 (LSB); CURRENT RECORD NO</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>DATA (128 BYTES)</td>
<td></td>
</tr>
<tr>
<td>8-134</td>
<td></td>
<td></td>
</tr>
<tr>
<td>135</td>
<td>RECORD NO (LSB)</td>
<td></td>
</tr>
<tr>
<td>136</td>
<td>RECORD NO (MSB)</td>
<td></td>
</tr>
<tr>
<td>137</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

### Get File Size Calculation

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>&amp;H23</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>FCB ADDR IN HX28 (MSB); EXTENT</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>FCB ADDR IN HX28 (LSB); CURRENT RECORD NUMBER</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>RECORD NO (LSB)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>RECORD NO (MSB)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0 - OK, &gt;0 OVERFLOW</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>RETURN CODE</td>
<td></td>
</tr>
</tbody>
</table>

### Disk Copy

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>&amp;H7A</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>DRIVE CODE</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>LAST TRACK COPIED (MSB)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0..39 ERROR, -1 OK</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>RETURN CODE</td>
<td></td>
</tr>
<tr>
<td>Byte</td>
<td>Entry</td>
<td>Exit</td>
</tr>
<tr>
<td>------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>3</td>
<td>8H7B</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>8H22</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>DRIVE CODE</td>
<td>RETURN CODE</td>
</tr>
<tr>
<td>6</td>
<td>TRACK NO 0..39</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>SECTOR NO 1..64</td>
<td></td>
</tr>
<tr>
<td>8-135</td>
<td>DATA (128 BYTES)</td>
<td></td>
</tr>
</tbody>
</table>

**Direct Write to disk**

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>8H7F</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>8H00</td>
</tr>
<tr>
<td>5</td>
<td>DRIVE CODE</td>
<td>DATA (128 BYTES)</td>
</tr>
<tr>
<td>6</td>
<td>TRACK NO 0..39</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>SECTOR NO 1..64</td>
<td></td>
</tr>
<tr>
<td>8-132</td>
<td></td>
<td></td>
</tr>
<tr>
<td>133</td>
<td></td>
<td>RETURN CODE</td>
</tr>
</tbody>
</table>

**Direct Read from disk**

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>8H7C</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>DRIVE CODE</td>
<td>LAST TRACK COPIED (MSB)</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>LAST TRACK COPIED (LSB)</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>0..39 ERROR, -1 OK</td>
</tr>
<tr>
<td>8-132</td>
<td></td>
<td>RETURN CODE</td>
</tr>
</tbody>
</table>

**Format Disk**

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>8H7D</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>5,6</td>
<td>0</td>
<td>0 ERROR, -1 OK</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>RETURN CODE</td>
</tr>
</tbody>
</table>

**System Disk Generation**

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>8H7E</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>DRIVE CODE</td>
<td>FREE AREA SIZE 2K UNITS</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>RETURN CODE</td>
</tr>
</tbody>
</table>

**Get Disk free Area**

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>8H00</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>&amp;Hnn -&gt; BOOTnn.SYS</td>
<td>RETURN CODE</td>
</tr>
<tr>
<td>6-260</td>
<td></td>
<td>READ DATA (255 BYTES)</td>
</tr>
<tr>
<td>Byte</td>
<td>Entry</td>
<td>Exit</td>
</tr>
<tr>
<td>------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>3</td>
<td>&amp;H81</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>&amp;H0D</td>
<td>:2</td>
</tr>
<tr>
<td>5-12</td>
<td>FILENAME</td>
<td></td>
</tr>
<tr>
<td>13-15</td>
<td>FILETYPE</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>RELOCATE FLAG:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 - NO RELOCATION</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 - RELOC FROM START</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 - RELOC FROM END</td>
<td></td>
</tr>
<tr>
<td>17,18</td>
<td>STARTING/ENDING ADDR</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>RETURN CODE</td>
<td></td>
</tr>
<tr>
<td>6,7</td>
<td>FILE SIZE</td>
<td></td>
</tr>
</tbody>
</table>

### Load Close

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>&amp;H82</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>:0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>RETURN CODE</td>
</tr>
</tbody>
</table>

### Read one block

<table>
<thead>
<tr>
<th>Byte</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>&amp;H83</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>&amp;H82</td>
</tr>
<tr>
<td>5</td>
<td>RECORD NO (MSB)</td>
<td>RECORD NO (MSB)</td>
</tr>
<tr>
<td>6</td>
<td>RECORD NO (LSB)</td>
<td>RECORD NO (LSB)</td>
</tr>
<tr>
<td>7-134</td>
<td>DATA (128 BYTES)</td>
<td></td>
</tr>
<tr>
<td>135</td>
<td>RETURN CODE: -1=EOF</td>
<td></td>
</tr>
</tbody>
</table>

### FCB Format

Byte: 0     Drive Code 0 = Default Drive 1..4 = "A:".."D:"
1-8     Filename
9-11    Filetype
12     Extent 0..31
13     System use
14     System use
15     Record count within extent
16-31   Extent Map
32     Record no read/write
33     No of records in file (LSB)
34     No of records in file (MSB)
35     0=Ok, >0 Error
**LCD commands**

\&H00  Display off  
\&H09  Display on  
\&H64  Set write mode. Data is written to LCD memory  
\&H60  Set read mode. Data is read from LCD memory  
\&H6C  Set AND mode. Data is ANDed with LCD memory  
\&H68  Set OR mode. Data is ORed with LCD memory

**Keyboard Scan Table Map**

<table>
<thead>
<tr>
<th>BYTE:</th>
<th>0</th>
<th>1</th>
<th>2</th>
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ROM Subroutine Return Codes

0  No Error
1  RS232 Driver off
   RS232 Receive Buffer full
   RS232 Receive Buffer Empty
   Cassette/M-Cass EOF
200 Microcassette not connected
201 Read Error
202 File not found
203 File I/O error
204 File not open for input
205 File error
206 File format error
207 File not open
208 File already Open
209 File found is not specified file
20C Load of binary file outside limits
211 Output Error
214 File not open for output
219 Binary dump/load device name error
2A0 PROM Cartridge not connected
2A1 File not found
2A2 File already open
2A3 File not open
   Invalid PROM directory number
2A4 Invalid PROM Header
2A5 Invalid PROM data
2B0 Serial I/F time out
2B1 Serial I/F Device error
2B2 Serial I/F communication error
2B3 Serial I/F driver off
2C0 RS232 Parity error
2C1 RS232 CD off
2FA Disk read error
2FB Disk write error
2FC Disk select error
2FD ) Disk Write protect error
2FE )
2FF Disk file not found