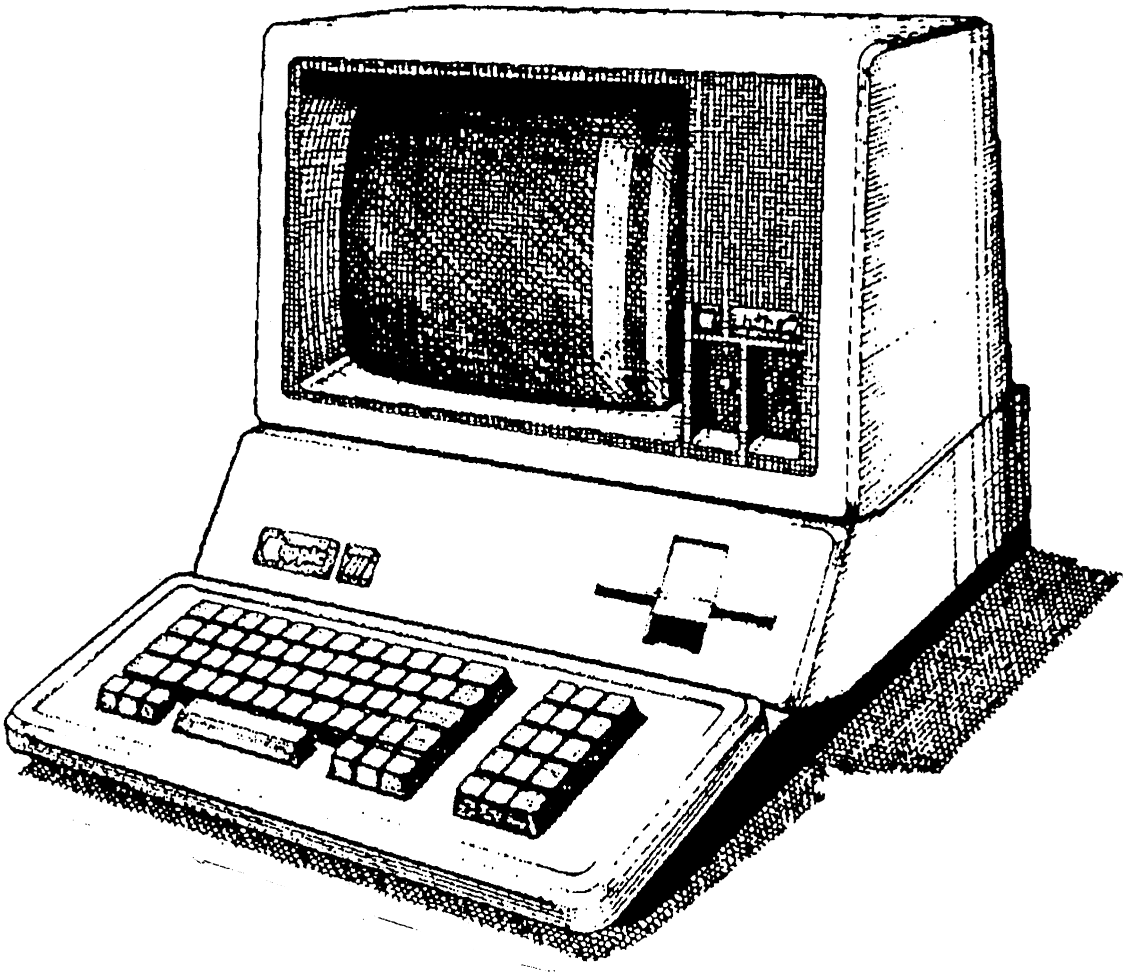
SEE DOC#193

Apple /// Computer Information



DOCUMENT NAME

APPLE /// BOOT ROM LISTING
(DISKS INCLUDED)

ROM Rev. 1
Jan. 1980

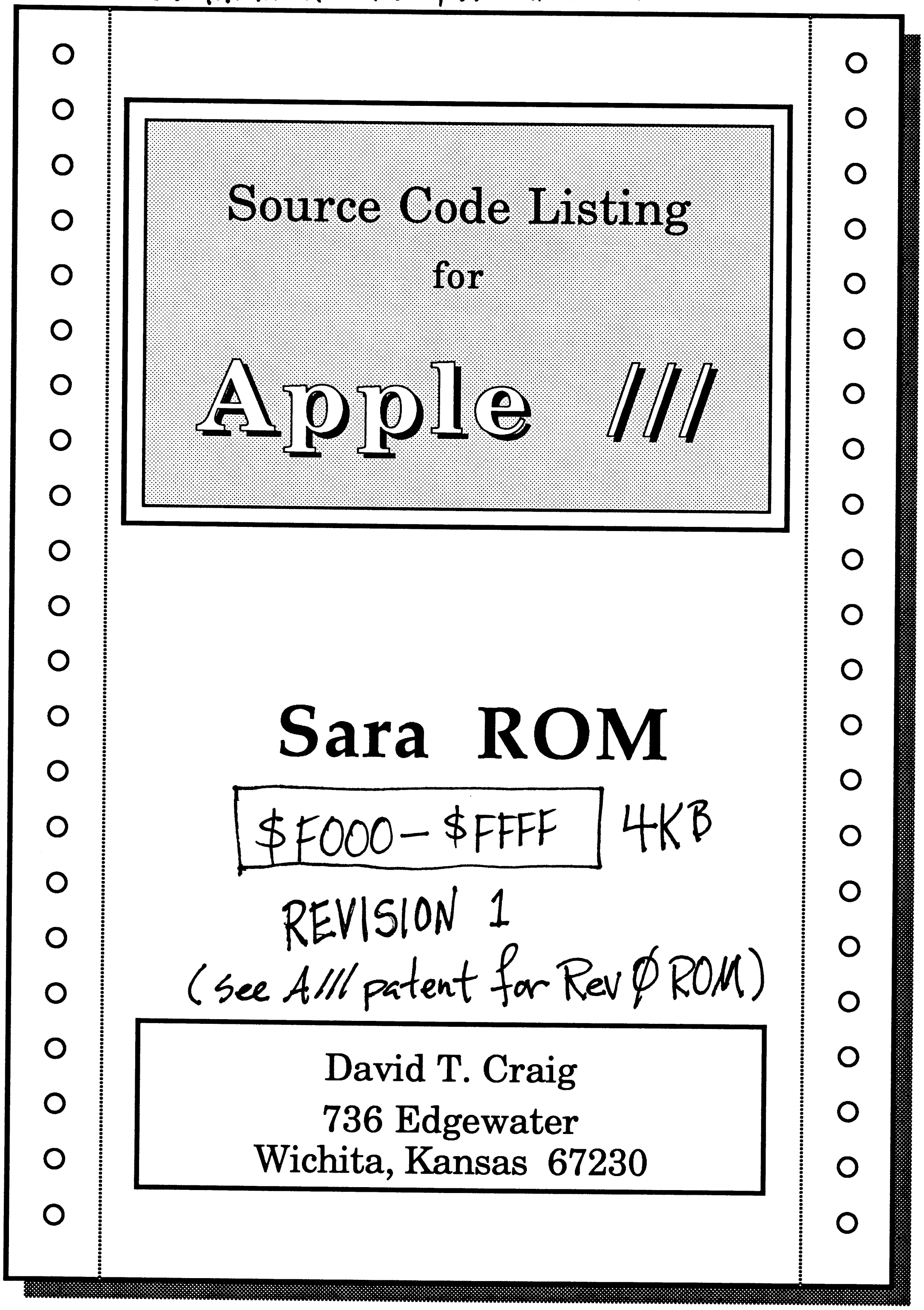
#

85

Ex Libris David T. Craig

"_43.PICT" 748 KB 2001-09-10 dpi: 600h x 600v pix: 4344h x 5811v

Assembler: Apple /// Pascal TLA 6502 Assembler 41 pages
(converted to TLA format most likely by Scott Stinson)



# Source Code Listing
for
Apple ///

Sara ROM

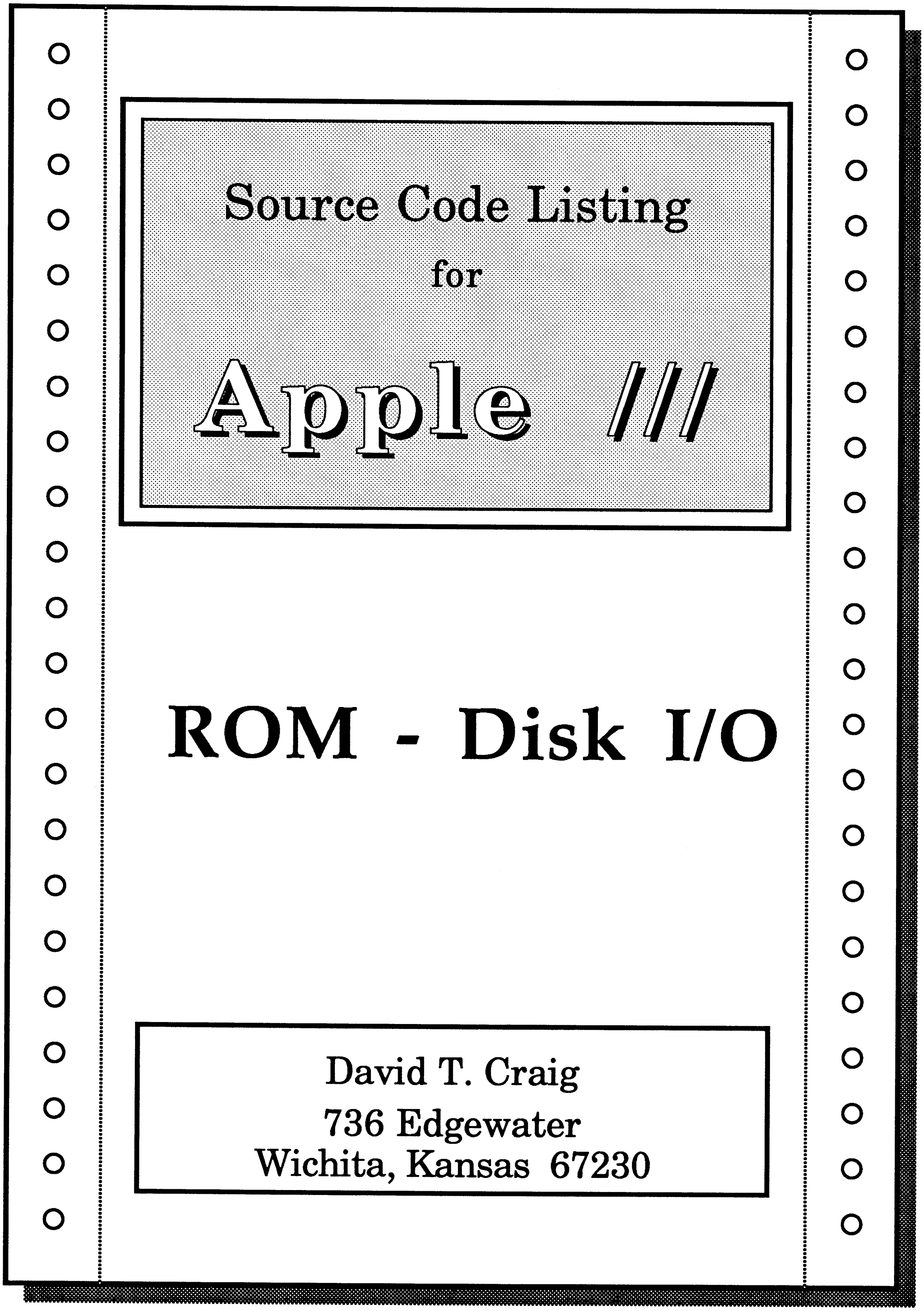
$F000 - $FFFF 4KB

REVISION 1
(see A/// patent for Rev Ø ROM)

David T. Craig
736 Edgewater
Wichita, Kansas 67230

Copyrighted Jan. 1980

"_44.PICT" 779 KB 2001-09-10 dpi: 600h x 600v pix: 3929h x 6107v

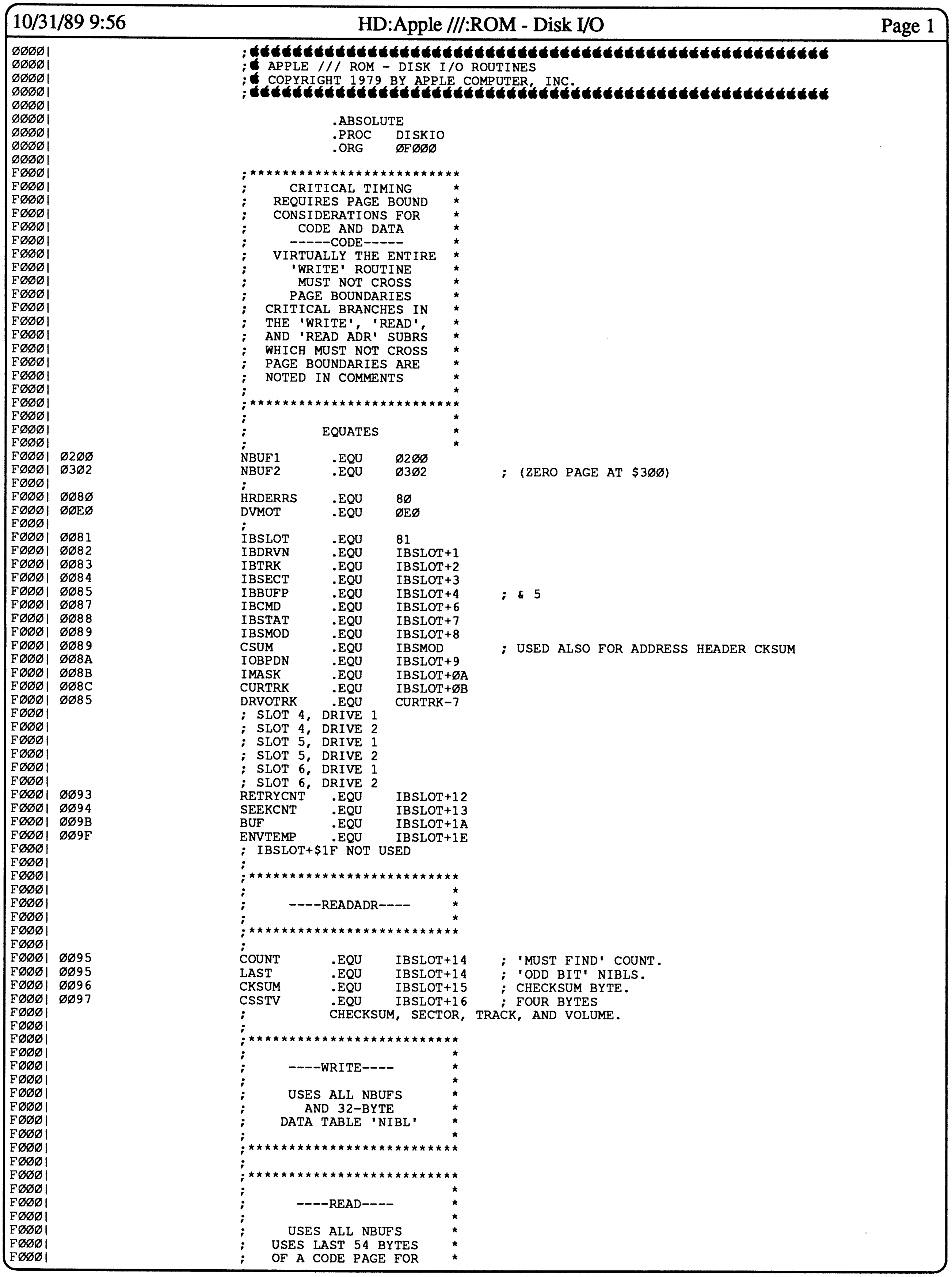


# Source Code Listing
for
Apple ///

ROM - Disk I/O

David T. Craig
736 Edgewater
Wichita, Kansas 67230

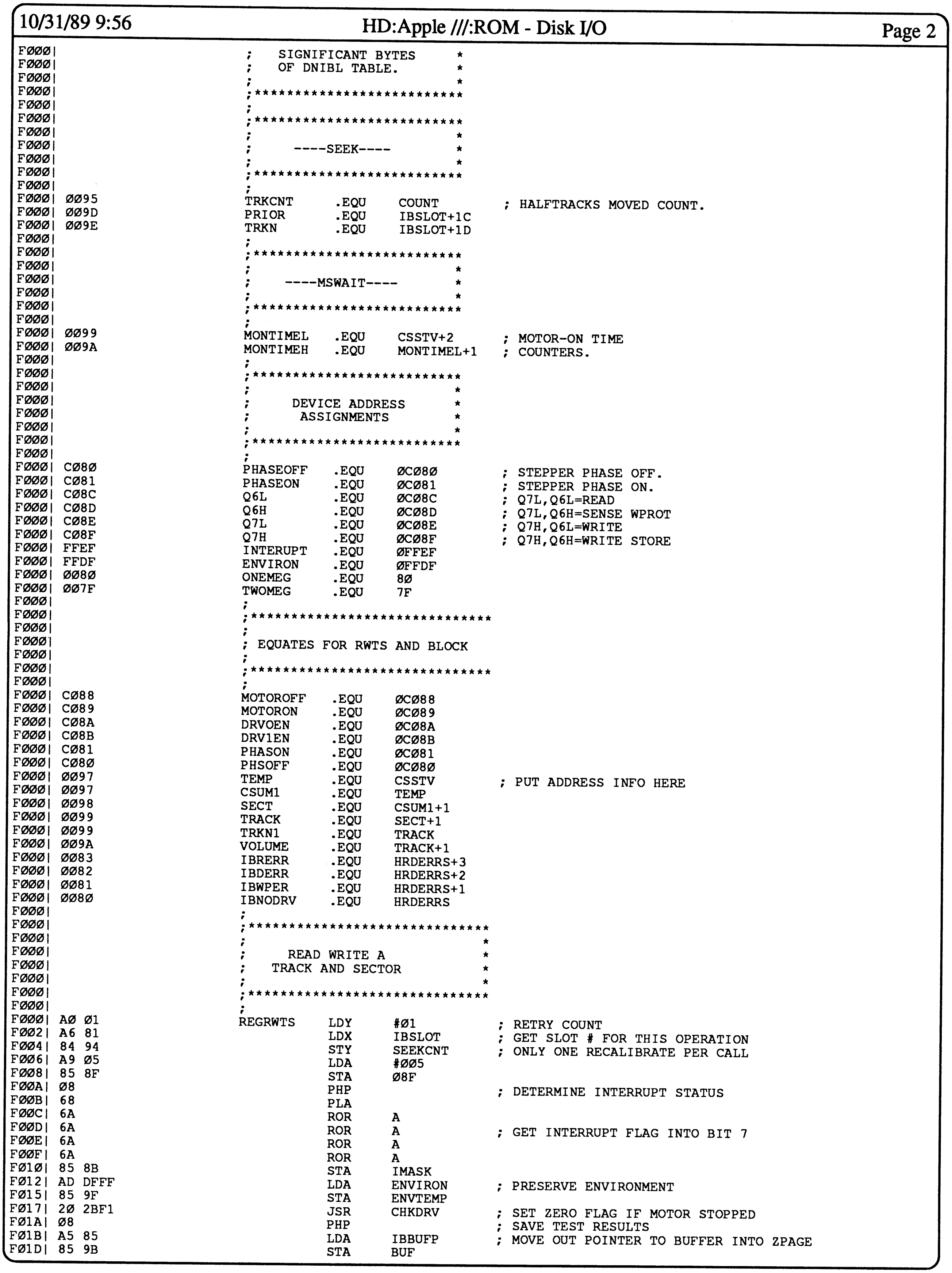
“_45.PICT” 639 KB 2001-09-10 dpi: 600h x 600v pix: 3811h x 5420v



10/31/89 9:56 HD:Apple ///:ROM - Disk I/O Page 1

```
ØØØØ|                       ;
ØØØØ|                       ; APPLE /// ROM - DISK I/O ROUTINES
ØØØØ|                       ; COPYRIGHT 1979 BY APPLE COMPUTER, INC.
ØØØØ|                       ;
ØØØØ|
ØØØØ|                                  .ABSOLUTE
ØØØØ|                                  .PROC   DISKIO
ØØØØ|                                  .ORG    ØFØØØ
ØØØØ|
FØØØ|                       ;**************************
FØØØ|                       ;     CRITICAL TIMING     *
FØØØ|                       ;   REQUIRES PAGE BOUND   *
FØØØ|                       ;   CONSIDERATIONS FOR    *
FØØØ|                       ;      CODE AND DATA      *
FØØØ|                       ;     -----CODE-----      *
FØØØ|                       ;   VIRTUALLY THE ENTIRE  *
FØØØ|                       ;     'WRITE' ROUTINE     *
FØØØ|                       ;      MUST NOT CROSS     *
FØØØ|                       ;     PAGE BOUNDARIES     *
FØØØ|                       ;  CRITICAL BRANCHES IN   *
FØØØ|                       ;  THE 'WRITE', 'READ',   *
FØØØ|                       ;  AND 'READ ADR' SUBRS   *
FØØØ|                       ;  WHICH MUST NOT CROSS   *
FØØØ|                       ;  PAGE BOUNDARIES ARE    *
FØØØ|                       ;  NOTED IN COMMENTS      *
FØØØ|                       ;                         *
FØØØ|                       ;**************************
FØØØ|                       ;                         *
FØØØ|                       ;          EQUATES        *
FØØØ|                       ;                         *
FØØØ| Ø2ØØ                  NBUF1      .EQU    Ø2ØØ
FØØØ| Ø3Ø2                  NBUF2      .EQU    Ø3Ø2         ; (ZERO PAGE AT $3ØØ)
FØØØ|                       ;
FØØØ| ØØ8Ø                  HRDERRS    .EQU    8Ø
FØØØ| ØØEØ                  DVMOT      .EQU    ØEØ
FØØØ|                       ;
FØØØ| ØØ81                  IBSLOT     .EQU    81
FØØØ| ØØ82                  IBDRVN     .EQU    IBSLOT+1
FØØØ| ØØ83                  IBTRK      .EQU    IBSLOT+2
FØØØ| ØØ84                  IBSECT     .EQU    IBSLOT+3
FØØØ| ØØ85                  IBBUFP     .EQU    IBSLOT+4     ; & 5
FØØØ| ØØ87                  IBCMD      .EQU    IBSLOT+6
FØØØ| ØØ88                  IBSTAT     .EQU    IBSLOT+7
FØØØ| ØØ89                  IBSMOD     .EQU    IBSLOT+8
FØØØ| ØØ89                  CSUM       .EQU    IBSMOD       ; USED ALSO FOR ADDRESS HEADER CKSUM
FØØØ| ØØ8A                  IOBPDN     .EQU    IBSLOT+9
FØØØ| ØØ8B                  IMASK      .EQU    IBSLOT+ØA
FØØØ| ØØ8C                  CURTRK     .EQU    IBSLOT+ØB
FØØØ| ØØ85                  DRVOTRK    .EQU    CURTRK-7
FØØØ|                       ; SLOT 4, DRIVE 1
FØØØ|                       ; SLOT 4, DRIVE 2
FØØØ|                       ; SLOT 5, DRIVE 1
FØØØ|                       ; SLOT 5, DRIVE 2
FØØØ|                       ; SLOT 6, DRIVE 1
FØØØ|                       ; SLOT 6, DRIVE 2
FØØØ| ØØ93                  RETRYCNT   .EQU    IBSLOT+12
FØØØ| ØØ94                  SEEKCNT    .EQU    IBSLOT+13
FØØØ| ØØ9B                  BUF        .EQU    IBSLOT+1A
FØØØ| ØØ9F                  ENVTEMP    .EQU    IBSLOT+1E
FØØØ|                       ; IBSLOT+$1F NOT USED
FØØØ|                       ;
FØØØ|                       ;**************************
FØØØ|                       ;                         *
FØØØ|                       ;     ----READADR----     *
FØØØ|                       ;                         *
FØØØ|                       ;**************************
FØØØ|                       ;
FØØØ| ØØ95                  COUNT      .EQU    IBSLOT+14    ; 'MUST FIND' COUNT.
FØØØ| ØØ95                  LAST       .EQU    IBSLOT+14    ; 'ODD BIT' NIBLS.
FØØØ| ØØ96                  CKSUM      .EQU    IBSLOT+15    ; CHECKSUM BYTE.
FØØØ| ØØ97                  CSSTV      .EQU    IBSLOT+16    ; FOUR BYTES
FØØØ|                       ;          CHECKSUM, SECTOR, TRACK, AND VOLUME.
FØØØ|                       ;
FØØØ|                       ;**************************
FØØØ|                       ;                         *
FØØØ|                       ;     ----WRITE----       *
FØØØ|                       ;                         *
FØØØ|                       ;     USES ALL NBUFS      *
FØØØ|                       ;       AND 32-BYTE       *
FØØØ|                       ;    DATA TABLE 'NIBL'    *
FØØØ|                       ;                         *
FØØØ|                       ;**************************
FØØØ|                       ;
FØØØ|                       ;**************************
FØØØ|                       ;                         *
FØØØ|                       ;      ----READ----       *
FØØØ|                       ;                         *
FØØØ|                       ;     USES ALL NBUFS      *
FØØØ|                       ;   USES LAST 54 BYTES    *
FØØØ|                       ;   OF A CODE PAGE FOR    *
```

"_46.PICT" 551 KB 2001-09-10 dpi: 600h x 600v pix: 4675h x 6189v



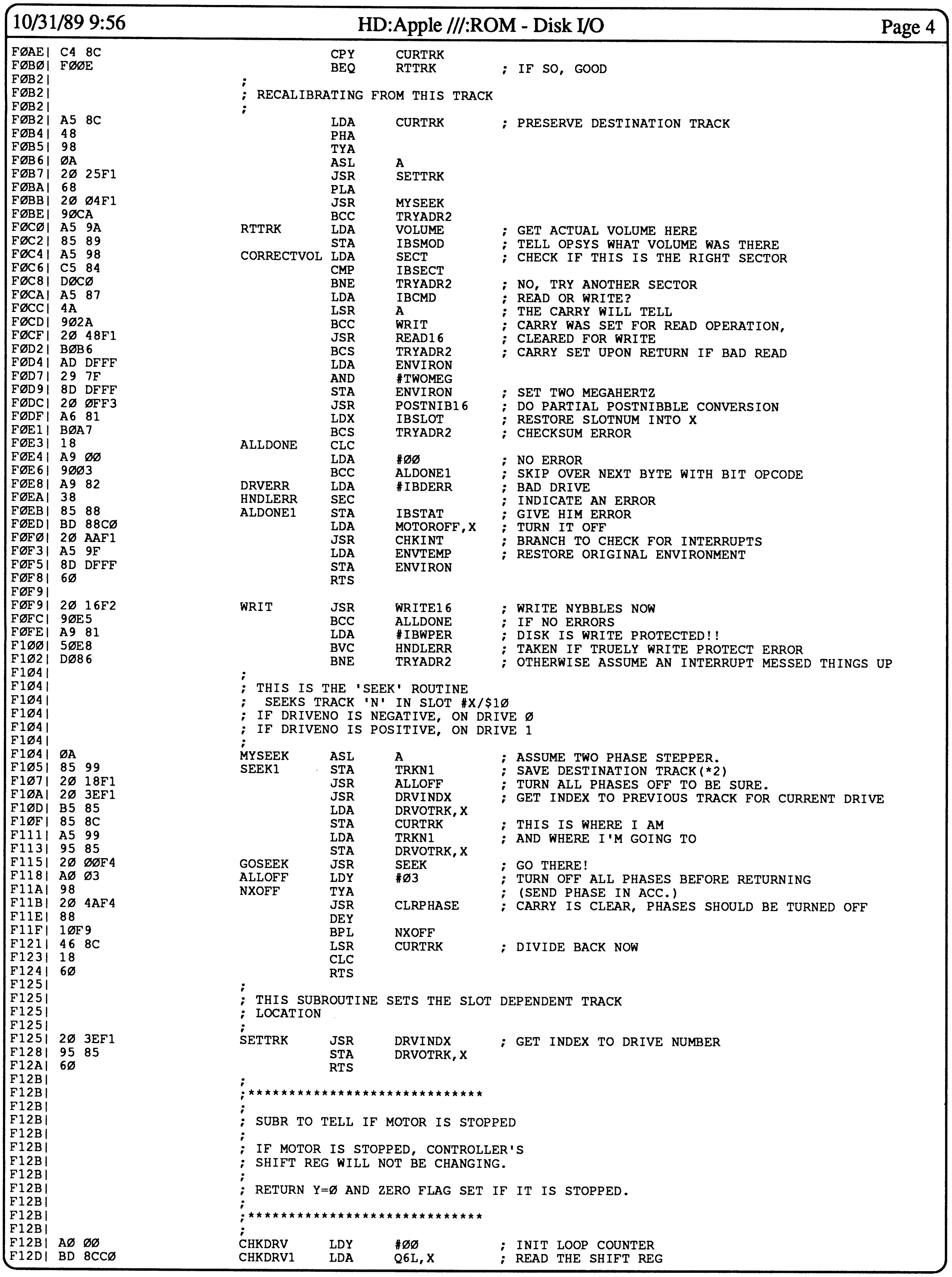
10/31/89 9:56 HD:Apple ///:ROM - Disk I/O Page 2

```
FØØØ|                       ;   SIGNIFICANT BYTES     *
FØØØ|                       ;   OF DNIBL TABLE.       *
FØØØ|                       ;                         *
FØØØ|                       ;**************************
FØØØ|                       ;
FØØØ|                       ;**************************
FØØØ|                       ;                         *
FØØØ|                       ;     ----SEEK----        *
FØØØ|                       ;                         *
FØØØ|                       ;**************************
FØØØ|                       ;
FØØØ| ØØ95                  TRKCNT     .EQU    COUNT          ; HALFTRACKS MOVED COUNT.
FØØØ| ØØ9D                  PRIOR      .EQU    IBSLOT+1C
FØØØ| ØØ9E                  TRKN       .EQU    IBSLOT+1D
FØØØ|                       ;
FØØØ|                       ;**************************
FØØØ|                       ;                         *
FØØØ|                       ;    ----MSWAIT----       *
FØØØ|                       ;                         *
FØØØ|                       ;**************************
FØØØ|                       ;
FØØØ| ØØ99                  MONTIMEL   .EQU    CSSTV+2        ; MOTOR-ON TIME
FØØØ| ØØ9A                  MONTIMEH   .EQU    MONTIMEL+1     ; COUNTERS.
FØØØ|                       ;
FØØØ|                       ;**************************
FØØØ|                       ;                         *
FØØØ|                       ;     DEVICE ADDRESS      *
FØØØ|                       ;      ASSIGNMENTS        *
FØØØ|                       ;                         *
FØØØ|                       ;**************************
FØØØ|                       ;
FØØØ| CØ8Ø                  PHASEOFF   .EQU    ØCØ8Ø          ; STEPPER PHASE OFF.
FØØØ| CØ81                  PHASEON    .EQU    ØCØ81          ; STEPPER PHASE ON.
FØØØ| CØ8C                  Q6L        .EQU    ØCØ8C          ; Q7L,Q6L=READ
FØØØ| CØ8D                  Q6H        .EQU    ØCØ8D          ; Q7L,Q6H=SENSE WPROT
FØØØ| CØ8E                  Q7L        .EQU    ØCØ8E          ; Q7H,Q6L=WRITE
FØØØ| CØ8F                  Q7H        .EQU    ØCØ8F          ; Q7H,Q6H=WRITE STORE
FØØØ| FFEF                  INTERUPT   .EQU    ØFFEF
FØØØ| FFDF                  ENVIRON    .EQU    ØFFDF
FØØØ| ØØ8Ø                  ONEMEG     .EQU    8Ø
FØØØ| ØØ7F                  TWOMEG     .EQU    7F
FØØØ|                       ;
FØØØ|                       ;******************************
FØØØ|                       ;
FØØØ|                       ; EQUATES FOR RWTS AND BLOCK
FØØØ|                       ;
FØØØ|                       ;******************************
FØØØ|                       ;
FØØØ| CØ88                  MOTOROFF   .EQU    ØCØ88
FØØØ| CØ89                  MOTORON    .EQU    ØCØ89
FØØØ| CØ8A                  DRVOEN     .EQU    ØCØ8A
FØØØ| CØ8B                  DRV1EN     .EQU    ØCØ8B
FØØØ| CØ81                  PHASON     .EQU    ØCØ81
FØØØ| CØ8Ø                  PHSOFF     .EQU    ØCØ8Ø
FØØØ| ØØ97                  TEMP       .EQU    CSSTV          ; PUT ADDRESS INFO HERE
FØØØ| ØØ97                  CSUM1      .EQU    TEMP
FØØØ| ØØ98                  SECT       .EQU    CSUM1+1
FØØØ| ØØ99                  TRACK      .EQU    SECT+1
FØØØ| ØØ99                  TRKN1      .EQU    TRACK
FØØØ| ØØ9A                  VOLUME     .EQU    TRACK+1
FØØØ| ØØ83                  IBRERR     .EQU    HRDERRS+3
FØØØ| ØØ82                  IBDERR     .EQU    HRDERRS+2
FØØØ| ØØ81                  IBWPER     .EQU    HRDERRS+1
FØØØ| ØØ8Ø                  IBNODRV    .EQU    HRDERRS
FØØØ|                       ;
FØØØ|                       ;******************************
FØØØ|                       ;                             *
FØØØ|                       ;      READ WRITE A           *
FØØØ|                       ;    TRACK AND SECTOR         *
FØØØ|                       ;                             *
FØØØ|                       ;******************************
FØØØ|                       ;
FØØØ| AØ Ø1                 REGRWTS    LDY     #Ø1            ; RETRY COUNT
FØØ2| A6 81                            LDX     IBSLOT         ; GET SLOT # FOR THIS OPERATION
FØØ4| 84 94                            STY     SEEKCNT        ; ONLY ONE RECALIBRATE PER CALL
FØØ6| A9 Ø5                            LDA     #ØØ5
FØØ8| 85 8F                            STA     Ø8F
FØØA| Ø8                               PHP                    ; DETERMINE INTERRUPT STATUS
FØØB| 68                               PLA
FØØC| 6A                               ROR     A
FØØD| 6A                               ROR     A              ; GET INTERRUPT FLAG INTO BIT 7
FØØE| 6A                               ROR     A
FØØF| 6A                               ROR     A
FØ1Ø| 85 8B                            STA     IMASK
FØ12| AD DFFF                          LDA     ENVIRON        ; PRESERVE ENVIRONMENT
FØ15| 85 9F                            STA     ENVTEMP
FØ17| 2Ø 2BF1                          JSR     CHKDRV         ; SET ZERO FLAG IF MOTOR STOPPED
FØ1A| Ø8                               PHP                    ; SAVE TEST RESULTS
FØ1B| A5 85                            LDA     IBBUFP         ; MOVE OUT POINTER TO BUFFER INTO ZPAGE
FØ1D| 85 9B                            STA     BUF
```

```
FØ1F| A5 86                      LDA     IBBUFP+1
FØ21| 85 9C                      STA     BUF+1
FØ23| A9 EØ                      LDA     #DVMOT
FØ25| 85 9A                      STA     MONTIMEH
FØ27| A5 82                      LDA     IBDRVN         ; DETERMINE DRIVE ONE OR TWO
FØ29| C5 8A                      CMP     IOBPDN         ; SAME DRIVE USED BEFORE
FØ2B| 85 8A                      STA     IOBPDN         ; SAVE IT FOR NEXT TIME
FØ2D| Ø8                         PHP                    ; KEEP RESULTS OF COMPARE
FØ2E| 6A                         ROR     A              ; GET DRIVE NUMBER INTO CARRY
FØ2F| BD 89CØ                    LDA     MOTORON,X      ; TURN ON THE DRIVE
FØ32| 9ØØ1                       BCC     DRIVSEL        ; BRANCH IF DRIVE 1 SELECTED
FØ34| E8                         INX                    ; SELECT DRIVE 2
FØ35| BD 8ACØ         DRIVSEL    LDA     DRVOEN,X
FØ38| 2Ø 4CF3                    JSR     SET1MEG        ; INSURE ONE MEGAHERTZ OPERATION
FØ3B| 28                         PLP                    ; WAS IT SAME DRIVE?
FØ3C| FØØA                       BEQ     OK
FØ3E| 28                         PLP                    ; MUST INDICATE DRIVE OFF BY SETTING ZERO FLAG
FØ3F| AØ Ø7                      LDY     #Ø7            ; DELAY 15Ø MS BEFORE STEPPING
FØ41| 2Ø 56F4         DRVWAIT    JSR     MSWAIT         ; (ON RETURN A=Ø)
FØ44| 88                         DEY
FØ45| DØFA                       BNE     DRVWAIT
FØ47| Ø8                         PHP                    ; NOW ZERO FLAG SET
FØ48| A5 83           OK         LDA     IBTRK          ; GET DESTINATION TRACK
FØ4A| A6 81                      LDX     IBSLOT         ; RESTORE PROPER X (SLOT*16)
FØ4C| 2Ø Ø4F1                    JSR     MYSEEK         ; AND GO TO IT
FØ4F|                 ; NOW AT THE DESIRED TRACK   WAS THE MOTOR ON TO START WITH?
FØ4F| 28                         PLP                    ; WAS MOTOR ON?
FØ5Ø| DØ17                       BNE     TRYTRK         ; IF SO, DON'T DELAY, GET IT TODAY!
FØ52|                 ;
FØ52|                 ; MOTOR WAS OFF, WAIT FOR IT TO SPEED UP
FØ52|                 ;
FØ52| AØ 12           MOTOF      LDY     #12            ; WAIT EXACTLY 1ØØ US FOR EACH COUNT
FØ54| 88              CONWAIT    DEY                    ; IN MONTIME
FØ55| DØFD                       BNE     CONWAIT
FØ57| E6 99                      INC     MONTIMEL       ; COUNT UP TO ØØØØ
FØ59| DØF7                       BNE     MOTOF
FØ5B| E6 9A                      INC     MONTIMEH
FØ5D| 3ØF3                       BMI     MOTOF
FØ5F|                 ;
FØ5F|                 ;******************************
FØ5F|                 ; MOTOR SHOULD BE UP TO SPEED
FØ5F|                 ; IF IT STILL LOOKS STOPPED THEN
FØ5F|                 ; THE DRIVE IS NOT PRESENT.
FØ5F|                 ;
FØ5F|                 ;******************************
FØ5F|                 ;
FØ5F| 2Ø 2BF1                    JSR     CHKDRV         ; IS DRIVE PRESENT?
FØ62| DØØ5                       BNE     TRYTRK         ; YES, CONTINUE
FØ64| A9 8Ø           NODRIVERR  LDA     #IBNODRV       ; NO, GET TELL EM NO DRIVE
FØ66| 4C EAFØ                    JMP     HNDLERR
FØ69|                 ;
FØ69|                 ; NOW CHECK IF IT IS NOT THE FORMAT DISK COMMAND,
FØ69|                 ;  LOCATE THE CORRECT SECTOR FOR THIS OPERATION
FØ69|                 ;
FØ69| A5 87           TRYTRK     LDA     IBCMD          ; GET COMMAND CODE #
FØ6B| FØ76                       BEQ     ALLDONE        ; IF NULL COMMAND, GO HOME TO BED
FØ6D| C9 Ø3                      CMP     #Ø3            ; COMMAND IN RANGE?
FØ6F| BØ72                       BCS     ALLDONE        ; NO, DO NOTHING!
FØ71| 6A                         ROR     A              ; SET CARRY=1 FOR READ, Ø FOR WRITE
FØ72| BØØB                       BCS     TRYTRK2        ; MUST PRENIBBLIZE FOR WRITE
FØ74| AD DFFF                    LDA     ENVIRON
FØ77| 29 7F                      AND     #TWOMEG        ; SHIFT TO HIGH SPEED!
FØ79| 8D DFFF                    STA     ENVIRON
FØ7C| 2Ø C4F2                    JSR     PRENIB16
FØ7F| AØ 7F           TRYTRK2    LDY     #7F            ; ONLY 127 RETRIES OF ANY KIND
FØ81| 84 93                      STY     RETRYCNT
FØ83| A6 81           TRYADR     LDX     IBSLOT         ; GET SLOT NUM INTO X-REG
FØ85| 2Ø B9F1                    JSR     RDADR16        ; READ NEXT ADDRESS FIELD
FØ88| 9Ø22                       BCC     RDRIGHT        ; IF READ IS RIGHT, HURRAH!
FØ8A| 2Ø AAF1         TRYADR2    JSR     CHKINT         ; BRANCH TO CHECK FOR INTERRUPTS
FØ8D| C6 93                      DEC     RETRYCNT       ; ANOTHER MISTAKE!!
FØ8F| 1ØF2                       BPL     TRYADR         ; WELL, LET IT GO THIS TIME
FØ91| C6 94                      DEC     SEEKCNT        ; ONLY RECALIBRATE ONCE!
FØ93| DØ53                       BNE     DRVERR         ; TRIED TO RECALIBRATE A SECOND TIME, ERROR!
FØ95| A5 8F                      LDA     Ø8F            ; ANOTHER MISTAKE!!
FØ97| 3ØEA                       BMI     TRYADR         ; WELL, LET IT GO THIS TIME
FØ99| A5 8C                      LDA     CURTRK
FØ9B| 48                         PHA                    ; SAVE TRACK WE REALLY WANT
FØ9C| A9 6Ø                      LDA     #6Ø            ; RECALIBRATE ALL OVER AGAIN!   ERROR!
FØ9E| 2Ø 25F1                    JSR     SETTRK         ; PRETEND TO BE ON TRACK 8Ø
FØA1| A9 ØØ                      LDA     #ØØ
FØA3| 2Ø Ø4F1                    JSR     MYSEEK         ; MOVE TO TRACK ØØ
FØA6| 68              GOCAL1     PLA
FØA7| 2Ø Ø4F1         GOCAL      JSR     MYSEEK         ; GO TO CORRECT TRACK THIS TIME!
FØAA| 9ØD7                       BCC     TRYADR         ; LOOP BACK, TRY AGAIN ON THIS TRACK
FØAC|                 ;
FØAC|                 ; HAVE NOW READ AN ADDRESS FIELD CORRECTLY.
FØAC|                 ; MAKE SURE THIS IS THE TRACK, SECTOR, AND VOLUME DESIRED.
FØAC|                 ;
FØAC| A4 99           RDRIGHT    LDY     TRACK          ; ON THE RIGHT TRACK?
```

CMD

1 -> Read
2 -> Write



10/31/89 9:56 HD:Apple ///:ROM - Disk I/O Page 4

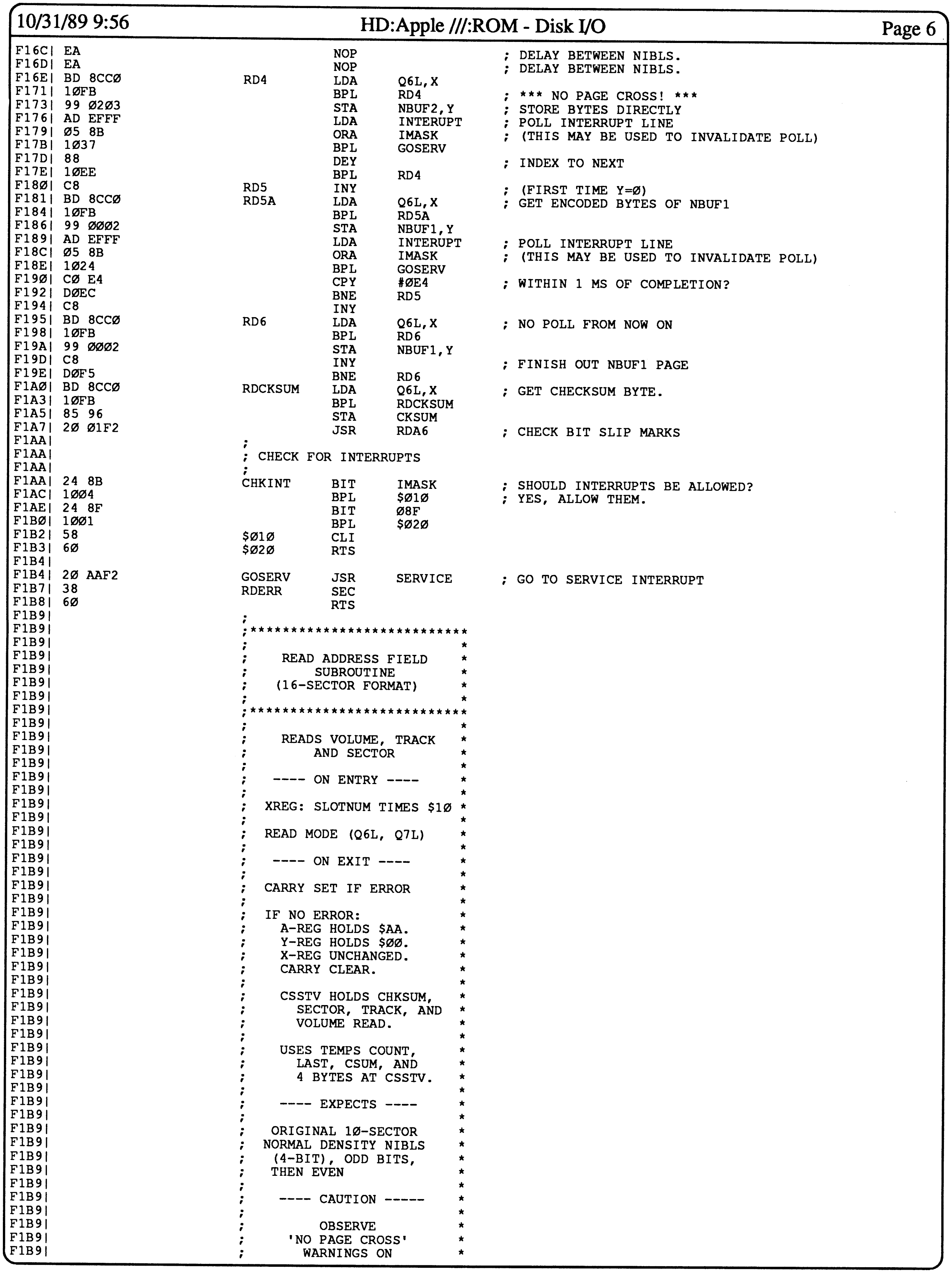
```
FØAE| C4 8C                    CPY     CURTRK
FØBØ| FØØE                     BEQ     RTTRK        ; IF SO, GOOD
FØB2|               ;
FØB2|               ; RECALIBRATING FROM THIS TRACK
FØB2|               ;
FØB2| A5 8C                    LDA     CURTRK       ; PRESERVE DESTINATION TRACK
FØB4| 48                       PHA
FØB5| 98                       TYA
FØB6| ØA                       ASL     A
FØB7| 2Ø 25F1                  JSR     SETTRK
FØBA| 68                       PLA
FØBB| 2Ø Ø4F1                  JSR     MYSEEK
FØBE| 9ØCA                     BCC     TRYADR2
FØCØ| A5 9A         RTTRK      LDA     VOLUME       ; GET ACTUAL VOLUME HERE
FØC2| 85 89                    STA     IBSMOD       ; TELL OPSYS WHAT VOLUME WAS THERE
FØC4| A5 98         CORRECTVOL LDA     SECT         ; CHECK IF THIS IS THE RIGHT SECTOR
FØC6| C5 84                    CMP     IBSECT
FØC8| DØCØ                     BNE     TRYADR2      ; NO, TRY ANOTHER SECTOR
FØCA| A5 87                    LDA     IBCMD        ; READ OR WRITE?
FØCC| 4A                       LSR     A            ; THE CARRY WILL TELL
FØCD| 9Ø2A                     BCC     WRIT         ; CARRY WAS SET FOR READ OPERATION,
FØCF| 2Ø 48F1                  JSR     READ16       ; CLEARED FOR WRITE
FØD2| BØB6                     BCS     TRYADR2      ; CARRY SET UPON RETURN IF BAD READ
FØD4| AD DFFF                  LDA     ENVIRON
FØD7| 29 7F                    AND     #TWOMEG
FØD9| 8D DFFF                  STA     ENVIRON      ; SET TWO MEGAHERTZ
FØDC| 2Ø ØFF3                  JSR     POSTNIB16    ; DO PARTIAL POSTNIBBLE CONVERSION
FØDF| A6 81                    LDX     IBSLOT       ; RESTORE SLOTNUM INTO X
FØE1| BØA7                     BCS     TRYADR2      ; CHECKSUM ERROR
FØE3| 18            ALLDONE    CLC
FØE4| A9 ØØ                    LDA     #ØØ          ; NO ERROR
FØE6| 9ØØ3                     BCC     ALDONE1      ; SKIP OVER NEXT BYTE WITH BIT OPCODE
FØE8| A9 82         DRVERR     LDA     #IBDERR      ; BAD DRIVE
FØEA| 38            HNDLERR    SEC                  ; INDICATE AN ERROR
FØEB| 85 88         ALDONE1    STA     IBSTAT       ; GIVE HIM ERROR
FØED| BD 88CØ                  LDA     MOTOROFF,X   ; TURN IT OFF
FØFØ| 2Ø AAF1                  JSR     CHKINT       ; BRANCH TO CHECK FOR INTERRUPTS
FØF3| A5 9F                    LDA     ENVTEMP      ; RESTORE ORIGINAL ENVIRONMENT
FØF5| 8D DFFF                  STA     ENVIRON
FØF8| 6Ø                       RTS
FØF9|
FØF9| 2Ø 16F2       WRIT       JSR     WRITE16      ; WRITE NYBBLES NOW
FØFC| 9ØE5                     BCC     ALLDONE      ; IF NO ERRORS
FØFE| A9 81                    LDA     #IBWPER      ; DISK IS WRITE PROTECTED!!
F1ØØ| 5ØE8                     BVC     HNDLERR      ; TAKEN IF TRUELY WRITE PROTECT ERROR
F1Ø2| DØ86                     BNE     TRYADR2      ; OTHERWISE ASSUME AN INTERRUPT MESSED THINGS UP
F1Ø4|               ;
F1Ø4|               ; THIS IS THE 'SEEK' ROUTINE
F1Ø4|               ;  SEEKS TRACK 'N' IN SLOT #X/$1Ø
F1Ø4|               ; IF DRIVENO IS NEGATIVE, ON DRIVE Ø
F1Ø4|               ; IF DRIVENO IS POSITIVE, ON DRIVE 1
F1Ø4|               ;
F1Ø4| ØA            MYSEEK     ASL     A            ; ASSUME TWO PHASE STEPPER.
F1Ø5| 85 99         SEEK1      STA     TRKN1        ; SAVE DESTINATION TRACK(*2)
F1Ø7| 2Ø 18F1                  JSR     ALLOFF       ; TURN ALL PHASES OFF TO BE SURE.
F1ØA| 2Ø 3EF1                  JSR     DRVINDX      ; GET INDEX TO PREVIOUS TRACK FOR CURRENT DRIVE
F1ØD| B5 85                    LDA     DRVOTRK,X
F1ØF| 85 8C                    STA     CURTRK       ; THIS IS WHERE I AM
F111| A5 99                    LDA     TRKN1        ; AND WHERE I'M GOING TO
F113| 95 85                    STA     DRVOTRK,X
F115| 2Ø ØØF4       GOSEEK     JSR     SEEK         ; GO THERE!
F118| AØ Ø3         ALLOFF     LDY     #Ø3          ; TURN OFF ALL PHASES BEFORE RETURNING
F11A| 98            NXOFF      TYA                  ; (SEND PHASE IN ACC.)
F11B| 2Ø 4AF4                  JSR     CLRPHASE     ; CARRY IS CLEAR, PHASES SHOULD BE TURNED OFF
F11E| 88                       DEY
F11F| 1ØF9                     BPL     NXOFF
F121| 46 8C                    LSR     CURTRK       ; DIVIDE BACK NOW
F123| 18                       CLC
F124| 6Ø                       RTS
F125|               ;
F125|               ; THIS SUBROUTINE SETS THE SLOT DEPENDENT TRACK
F125|               ; LOCATION
F125|               ;
F125| 2Ø 3EF1       SETTRK     JSR     DRVINDX      ; GET INDEX TO DRIVE NUMBER
F128| 95 85                    STA     DRVOTRK,X
F12A| 6Ø                       RTS
F12B|               ;
F12B|               ;*****************************
F12B|               ;
F12B|               ; SUBR TO TELL IF MOTOR IS STOPPED
F12B|               ;
F12B|               ; IF MOTOR IS STOPPED, CONTROLLER'S
F12B|               ; SHIFT REG WILL NOT BE CHANGING.
F12B|               ;
F12B|               ; RETURN Y=Ø AND ZERO FLAG SET IF IT IS STOPPED.
F12B|               ;
F12B|               ;*****************************
F12B|               ;
F12B| AØ ØØ         CHKDRV     LDY     #ØØ          ; INIT LOOP COUNTER
F12D| BD 8CCØ       CHKDRV1    LDA     Q6L,X        ; READ THE SHIFT REG
```

"_49.PICT" 681 KB 2001-09-10 dpi: 600h x 600v pix: 4663h x 6177v

```
F13Ø| 2Ø 3DF1                       JSR     CKDRTS       ; DELAY
F133| 48                            PHA
F134| 68                            PLA
F135| DD 8CCØ                       CMP     Q6L,X        ; HAS SHIFT REG CHANGED?
F138| DØØ3                          BNE     CKDRTS       ; YES, MOTOR IS MOVING
F13A| 88                            DEY                  ; NO, DEC RETRY COUNTER
F13B| DØFØ                          BNE     CHKDRV1      ; AND TRY 256 TIMES
F13D| 6Ø                  CKDRTS    RTS                  ; THEN RETURN
F13E|                     ;
F13E| 48                  DRVINDX   PHA                  ; PRESERVE ACC.
F13F| 8A                            TXA                  ; GET SLOT(*$1Ø)/8
F14Ø| 4A                            LSR     A
F141| 4A                            LSR     A
F142| 4A                            LSR     A
F143| Ø5 82                         ORA     IBDRVN       ; FOR DRIVE Ø OR 1
F145| AA                            TAX                  ; INTO X FOR INDEX TO TABLE
F146| 68                            PLA                  ; RESTORE ACC.
F147| 6Ø                            RTS
F148|                     ;
F148|                     ;******************************
F148|                     ;
F148|                     ; NOTE: FORMATTING ROUTINES
F148|                     ;       NOTE INCLUDED FOR SOS
F148|                     ;
F148|                     ;******************************
F148|                     ;
F148|                     ;*************************
F148|                     ;                        *
F148|                     ;   READ SUBROUTINE      *
F148|                     ;  (16-SECTOR FORMAT)    *
F148|                     ;                        *
F148|                     ;*************************
F148|                     ;                        *
F148|                     ;   READS ENCODED BYTES  *
F148|                     ;  INTO NBUF1 AND NBUF2  *
F148|                     ;                        *
F148|                     ;  FIRST READS NBUF2     *
F148|                     ;          HIGH TO LOW,  *
F148|                     ;  THEN READS NBUF1      *
F148|                     ;          LOW TO HIGH.  *
F148|                     ;                        *
F148|                     ;   ---- ON ENTRY ----   *
F148|                     ;                        *
F148|                     ;  X-REG: SLOTNUM        *
F148|                     ;         TIMES $1Ø.     *
F148|                     ;                        *
F148|                     ;  READ MODE (Q6L, Q7L   *
F148|                     ;                        *
F148|                     ;   ---- ON EXIT ----    *
F148|                     ;                        *
F148|                     ;  CARRY SET IF ERROR    *
F148|                     ;                        *
F148|                     ;  IF NO ERROR:          *
F148|                     ;     A-REG HOLDS $AA.   *
F148|                     ;     X-REG UNCHANGED.   *
F148|                     ;     Y-REG HOLDS $ØØ.   *
F148|                     ;     CARRY CLEAR.       *
F148|                     ;   ---- CAUTION -----   *
F148|                     ;                        *
F148|                     ;        OBSERVE         *
F148|                     ;    'NO PAGE CROSS'     *
F148|                     ;      WARNINGS ON       *
F148|                     ;     SOME BRANCHES!!    *
F148|                     ;                        *
F148|                     ;   ---- ASSUMES ----    *
F148|                     ;                        *
F148|                     ;   1 USEC CYCLE TIME    *
F148|                     ;                        *
F148|                     ;*************************
F148|
F148| AØ 2Ø               READ16    LDY     #2Ø          ; 'MUST FIND' COUNT.
F14A| 88                  RSYNC     DEY                  ; IF CAN'T FIND MARKS.
F14B| FØ6A                          BEQ     RDERR        ; THEN EXIT WITH CARRY SET
F14D| BD 8CCØ             RD1       LDA     Q6L,X        ; READ NIBL.
F15Ø| 1ØFB                          BPL     RD1          ; *** NO PAGE CROSS! ***
F152| 49 D5               RSYNC1    EOR     #ØD5         ; DATA MARK1?
F154| DØF4                          BNE     RSYNC        ; LOOP IF NOT.
F156| EA                            NOP                  ; DELAY BETWEEN NIBLS.
F157| BD 8CCØ             RD2       LDA     Q6L,X
F15A| 1ØFB                          BPL     RD2          ; *** NO PAGE CROSS! ***
F15C| C9 AA                         CMP     #ØAA         ; DATA MARK 2?
F15E| DØF2                          BNE     RSYNC1       ; (IF NOT, IS IT DM1?)
F16Ø| AØ 55                         LDY     #Ø55         ; INIT NBUF2 INDEX.
F162|                     ;                   ( ADDED NIBL DELAY)
F162| EA                            NOP                  ; DELAY BETWEEN NIBLS.
F163| BD 8CCØ             RD3       LDA     Q6L,X
F166| 1ØFB                          BPL     RD3          ; *** NO PAGE CROSS! ***
F168| C9 AD                         CMP     #ØAD         ; DATA MARK 3?
F16A| DØE6                          BNE     RSYNC1       ; (IF NOT, IS IT DM1?)
F16C|                     ;               (CARRY SET IF DM3!)
```

← Seems like "Note" should be "Not"

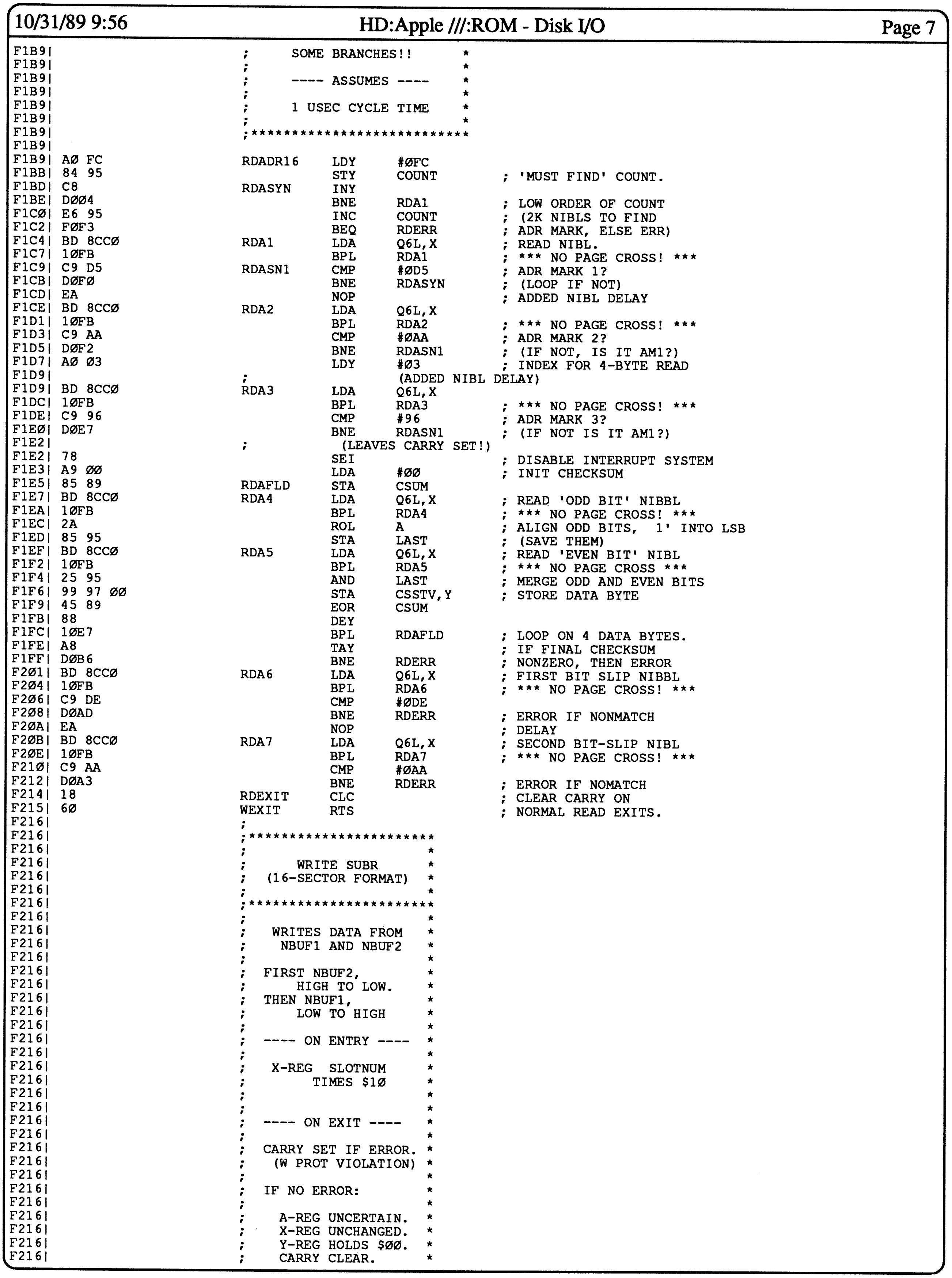
“_50.PICT” 533 KB 2001-09-10 dpi: 600h x 600v pix: 4639h x 6177v



10/31/89 9:56 HD:Apple ///:ROM - Disk I/O Page 6

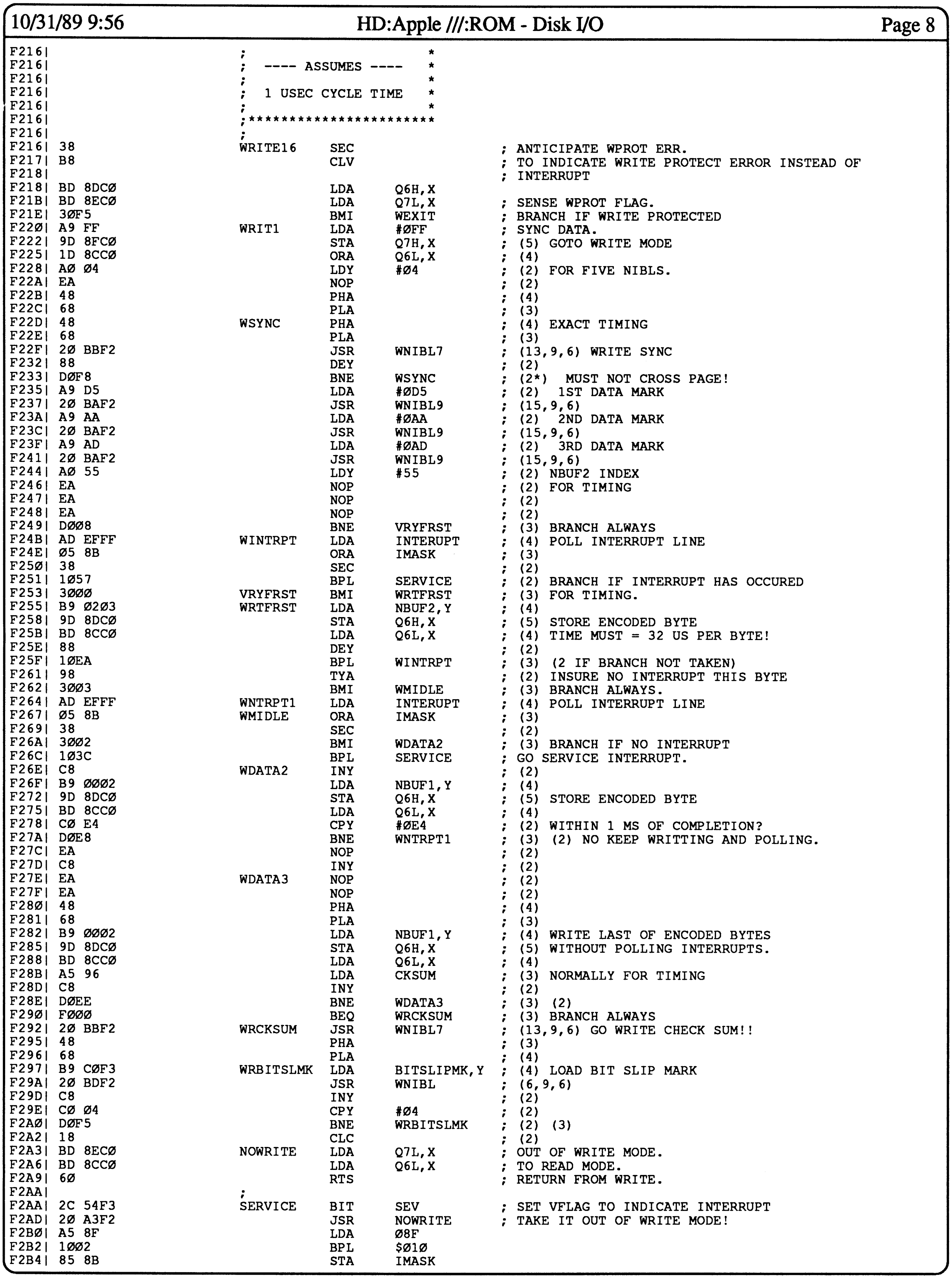
```
F16C| EA                         NOP                 ; DELAY BETWEEN NIBLS.
F16D| EA                         NOP                 ; DELAY BETWEEN NIBLS.
F16E| BD 8CCØ         RD4        LDA      Q6L,X
F171| 1ØFB                       BPL      RD4        ; *** NO PAGE CROSS! ***
F173| 99 Ø2Ø3                    STA      NBUF2,Y    ; STORE BYTES DIRECTLY
F176| AD EFFF                    LDA      INTERUPT   ; POLL INTERRUPT LINE
F179| Ø5 8B                      ORA      IMASK      ; (THIS MAY BE USED TO INVALIDATE POLL)
F17B| 1Ø37                       BPL      GOSERV
F17D| 88                         DEY                 ; INDEX TO NEXT
F17E| 1ØEE                       BPL      RD4
F18Ø| C8              RD5        INY                 ; (FIRST TIME Y=Ø)
F181| BD 8CCØ         RD5A       LDA      Q6L,X      ; GET ENCODED BYTES OF NBUF1
F184| 1ØFB                       BPL      RD5A
F186| 99 ØØØ2                    STA      NBUF1,Y
F189| AD EFFF                    LDA      INTERUPT   ; POLL INTERRUPT LINE
F18C| Ø5 8B                      ORA      IMASK      ; (THIS MAY BE USED TO INVALIDATE POLL)
F18E| 1Ø24                       BPL      GOSERV
F19Ø| CØ E4                      CPY      #ØE4       ; WITHIN 1 MS OF COMPLETION?
F192| DØEC                       BNE      RD5
F194| C8                         INY
F195| BD 8CCØ         RD6        LDA      Q6L,X      ; NO POLL FROM NOW ON
F198| 1ØFB                       BPL      RD6
F19A| 99 ØØØ2                    STA      NBUF1,Y
F19D| C8                         INY                 ; FINISH OUT NBUF1 PAGE
F19E| DØF5                       BNE      RD6
F1AØ| BD 8CCØ         RDCKSUM    LDA      Q6L,X      ; GET CHECKSUM BYTE.
F1A3| 1ØFB                       BPL      RDCKSUM
F1A5| 85 96                      STA      CKSUM
F1A7| 2Ø Ø1F2                    JSR      RDA6       ; CHECK BIT SLIP MARKS
F1AA|                 ;
F1AA|                 ; CHECK FOR INTERRUPTS
F1AA|                 ;
F1AA| 24 8B           CHKINT     BIT      IMASK      ; SHOULD INTERRUPTS BE ALLOWED?
F1AC| 1ØØ4                       BPL      $Ø1Ø       ; YES, ALLOW THEM.
F1AE| 24 8F                      BIT      Ø8F
F1BØ| 1ØØ1                       BPL      $Ø2Ø
F1B2| 58              $Ø1Ø       CLI
F1B3| 6Ø              $Ø2Ø       RTS
F1B4|
F1B4| 2Ø AAF2         GOSERV     JSR      SERVICE    ; GO TO SERVICE INTERRUPT
F1B7| 38              RDERR      SEC
F1B8| 6Ø                         RTS
F1B9|                 ;
F1B9|                 ;****************************
F1B9|                 ;                          *
F1B9|                 ;    READ ADDRESS FIELD    *
F1B9|                 ;        SUBROUTINE        *
F1B9|                 ;   (16-SECTOR FORMAT)     *
F1B9|                 ;                          *
F1B9|                 ;****************************
F1B9|                 ;                          *
F1B9|                 ;    READS VOLUME, TRACK   *
F1B9|                 ;        AND SECTOR        *
F1B9|                 ;                          *
F1B9|                 ;   ---- ON ENTRY ----     *
F1B9|                 ;                          *
F1B9|                 ;  XREG: SLOTNUM TIMES $1Ø *
F1B9|                 ;                          *
F1B9|                 ;  READ MODE (Q6L, Q7L)    *
F1B9|                 ;                          *
F1B9|                 ;   ---- ON EXIT ----      *
F1B9|                 ;                          *
F1B9|                 ;  CARRY SET IF ERROR      *
F1B9|                 ;                          *
F1B9|                 ;  IF NO ERROR:            *
F1B9|                 ;    A-REG HOLDS $AA.      *
F1B9|                 ;    Y-REG HOLDS $ØØ.      *
F1B9|                 ;    X-REG UNCHANGED.      *
F1B9|                 ;    CARRY CLEAR.          *
F1B9|                 ;                          *
F1B9|                 ;    CSSTV HOLDS CHKSUM,   *
F1B9|                 ;      SECTOR, TRACK, AND  *
F1B9|                 ;      VOLUME READ.        *
F1B9|                 ;                          *
F1B9|                 ;    USES TEMPS COUNT,     *
F1B9|                 ;      LAST, CSUM, AND     *
F1B9|                 ;      4 BYTES AT CSSTV.   *
F1B9|                 ;                          *
F1B9|                 ;    ---- EXPECTS ----     *
F1B9|                 ;                          *
F1B9|                 ;   ORIGINAL 1Ø-SECTOR     *
F1B9|                 ;  NORMAL DENSITY NIBLS    *
F1B9|                 ;   (4-BIT), ODD BITS,     *
F1B9|                 ;   THEN EVEN              *
F1B9|                 ;                          *
F1B9|                 ;    ---- CAUTION -----    *
F1B9|                 ;                          *
F1B9|                 ;         OBSERVE          *
F1B9|                 ;     'NO PAGE CROSS'      *
F1B9|                 ;       WARNINGS ON        *
```

"_51.PICT" 521 KB 2001-09-10 dpi: 600h x 600v pix: 4639h x 6190v



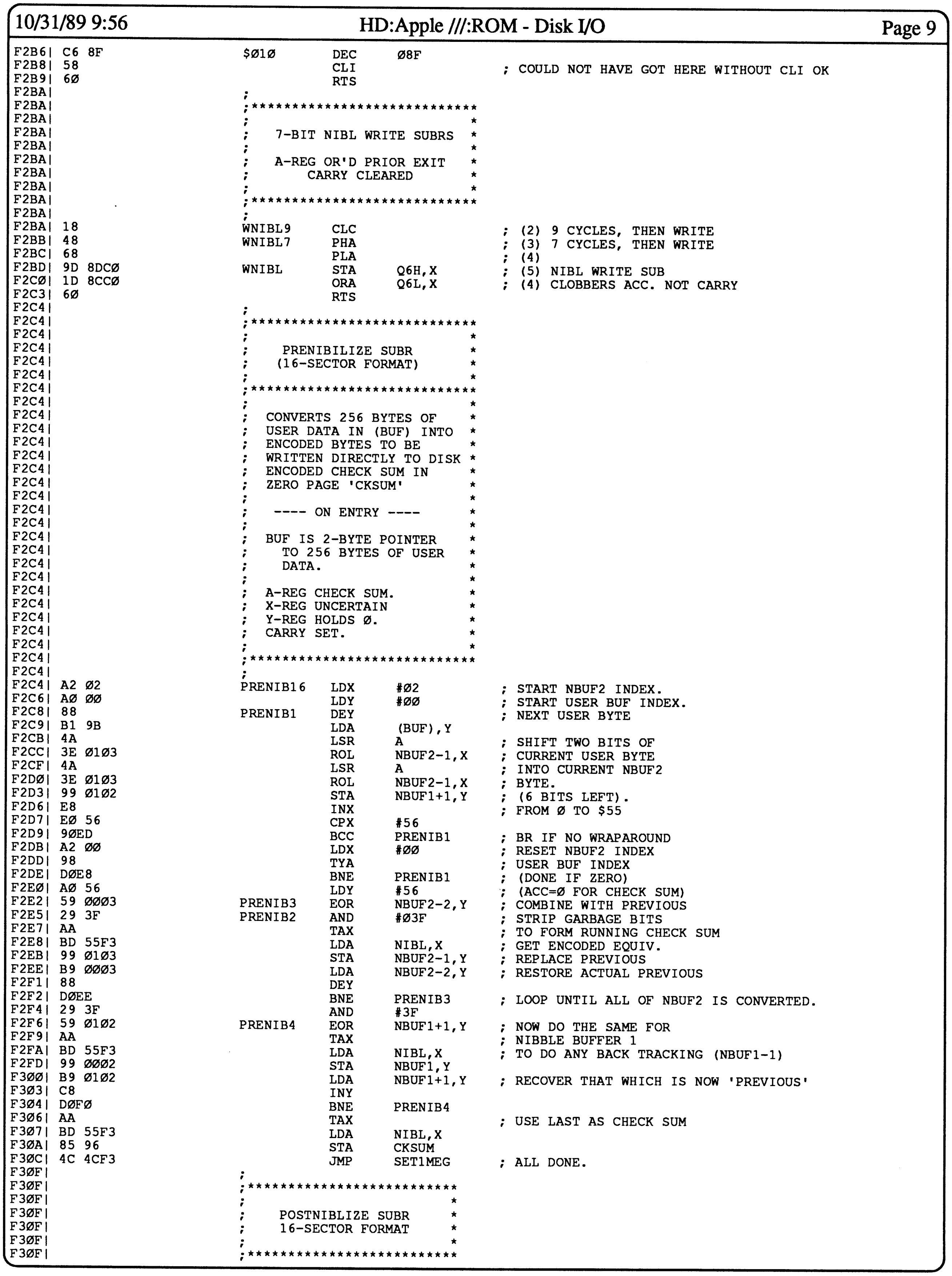
10/31/89 9:56 HD:Apple ///:ROM - Disk I/O Page 7

```
F1B9|                       ;     SOME BRANCHES!!      *
F1B9|                       ;                          *
F1B9|                       ;     ---- ASSUMES ----    *
F1B9|                       ;                          *
F1B9|                       ;     1 USEC CYCLE TIME    *
F1B9|                       ;                          *
F1B9|                       ;***************************
F1B9|
F1B9| AØ FC                 RDADR16    LDY     #ØFC
F1BB| 84 95                            STY     COUNT        ; 'MUST FIND' COUNT.
F1BD| C8                    RDASYN     INY
F1BE| DØØ4                             BNE     RDA1         ; LOW ORDER OF COUNT
F1CØ| E6 95                            INC     COUNT        ; (2K NIBLS TO FIND
F1C2| FØF3                             BEQ     RDERR        ; ADR MARK, ELSE ERR)
F1C4| BD 8CCØ               RDA1       LDA     Q6L,X        ; READ NIBL.
F1C7| 1ØFB                             BPL     RDA1         ; *** NO PAGE CROSS! ***
F1C9| C9 D5                 RDASN1     CMP     #ØD5         ; ADR MARK 1?
F1CB| DØFØ                             BNE     RDASYN       ; (LOOP IF NOT)
F1CD| EA                               NOP                  ; ADDED NIBL DELAY
F1CE| BD 8CCØ               RDA2       LDA     Q6L,X
F1D1| 1ØFB                             BPL     RDA2         ; *** NO PAGE CROSS! ***
F1D3| C9 AA                            CMP     #ØAA         ; ADR MARK 2?
F1D5| DØF2                             BNE     RDASN1       ; (IF NOT, IS IT AM1?)
F1D7| AØ Ø3                            LDY     #Ø3          ; INDEX FOR 4-BYTE READ
F1D9|                       ;                  (ADDED NIBL DELAY)
F1D9| BD 8CCØ               RDA3       LDA     Q6L,X
F1DC| 1ØFB                             BPL     RDA3         ; *** NO PAGE CROSS! ***
F1DE| C9 96                            CMP     #96          ; ADR MARK 3?
F1EØ| DØE7                             BNE     RDASN1       ; (IF NOT IS IT AM1?)
F1E2|                       ;           (LEAVES CARRY SET!)
F1E2| 78                               SEI                  ; DISABLE INTERRUPT SYSTEM
F1E3| A9 ØØ                            LDA     #ØØ          ; INIT CHECKSUM
F1E5| 85 89                 RDAFLD     STA     CSUM
F1E7| BD 8CCØ               RDA4       LDA     Q6L,X        ; READ 'ODD BIT' NIBBL
F1EA| 1ØFB                             BPL     RDA4         ; *** NO PAGE CROSS! ***
F1EC| 2A                               ROL     A            ; ALIGN ODD BITS,  1' INTO LSB
F1ED| 85 95                            STA     LAST         ; (SAVE THEM)
F1EF| BD 8CCØ               RDA5       LDA     Q6L,X        ; READ 'EVEN BIT' NIBL
F1F2| 1ØFB                             BPL     RDA5         ; *** NO PAGE CROSS ***
F1F4| 25 95                            AND     LAST         ; MERGE ODD AND EVEN BITS
F1F6| 99 97 ØØ                         STA     CSSTV,Y      ; STORE DATA BYTE
F1F9| 45 89                            EOR     CSUM
F1FB| 88                               DEY
F1FC| 1ØE7                             BPL     RDAFLD       ; LOOP ON 4 DATA BYTES.
F1FE| A8                               TAY                  ; IF FINAL CHECKSUM
F1FF| DØB6                             BNE     RDERR        ; NONZERO, THEN ERROR
F2Ø1| BD 8CCØ               RDA6       LDA     Q6L,X        ; FIRST BIT SLIP NIBBL
F2Ø4| 1ØFB                             BPL     RDA6         ; *** NO PAGE CROSS! ***
F2Ø6| C9 DE                            CMP     #ØDE
F2Ø8| DØAD                             BNE     RDERR        ; ERROR IF NONMATCH
F2ØA| EA                               NOP                  ; DELAY
F2ØB| BD 8CCØ               RDA7       LDA     Q6L,X        ; SECOND BIT-SLIP NIBL
F2ØE| 1ØFB                             BPL     RDA7         ; *** NO PAGE CROSS! ***
F21Ø| C9 AA                            CMP     #ØAA
F212| DØA3                             BNE     RDERR        ; ERROR IF NOMATCH
F214| 18                    RDEXIT     CLC                  ; CLEAR CARRY ON
F215| 6Ø                    WEXIT      RTS                  ; NORMAL READ EXITS.
F216|                       ;
F216|                       ;***********************
F216|                       ;                      *
F216|                       ;      WRITE SUBR      *
F216|                       ;  (16-SECTOR FORMAT)  *
F216|                       ;                      *
F216|                       ;***********************
F216|                       ;                      *
F216|                       ;   WRITES DATA FROM   *
F216|                       ;    NBUF1 AND NBUF2   *
F216|                       ;                      *
F216|                       ;  FIRST NBUF2,        *
F216|                       ;      HIGH TO LOW.    *
F216|                       ;  THEN NBUF1,         *
F216|                       ;      LOW TO HIGH     *
F216|                       ;                      *
F216|                       ;  ---- ON ENTRY ----  *
F216|                       ;                      *
F216|                       ;   X-REG  SLOTNUM     *
F216|                       ;        TIMES $1Ø     *
F216|                       ;                      *
F216|                       ;                      *
F216|                       ;  ---- ON EXIT ----   *
F216|                       ;                      *
F216|                       ;  CARRY SET IF ERROR. *
F216|                       ;   (W PROT VIOLATION) *
F216|                       ;                      *
F216|                       ;  IF NO ERROR:        *
F216|                       ;                      *
F216|                       ;    A-REG UNCERTAIN.  *
F216|                       ;    X-REG UNCHANGED.  *
F216|                       ;    Y-REG HOLDS $ØØ.  *
F216|                       ;    CARRY CLEAR.      *
```



```
F216|                       ;                      *
F216|                       ;  ---- ASSUMES ----   *
F216|                       ;                      *
F216|                       ;  1 USEC CYCLE TIME   *
F216|                       ;                      *
F216|                       ;***********************
F216|                       ;
F216| 38                    WRITE16    SEC                 ; ANTICIPATE WPROT ERR.
F217| B8                               CLV                 ; TO INDICATE WRITE PROTECT ERROR INSTEAD OF
F218|                                                      ; INTERRUPT
F218| BD 8DCØ                          LDA     Q6H,X
F21B| BD 8ECØ                          LDA     Q7L,X       ; SENSE WPROT FLAG.
F21E| 3ØF5                             BMI     WEXIT       ; BRANCH IF WRITE PROTECTED
F22Ø| A9 FF                 WRIT1      LDA     #ØFF        ; SYNC DATA.
F222| 9D 8FCØ                          STA     Q7H,X       ; (5) GOTO WRITE MODE
F225| 1D 8CCØ                          ORA     Q6L,X       ; (4)
F228| AØ Ø4                            LDY     #Ø4         ; (2) FOR FIVE NIBLS.
F22A| EA                               NOP                 ; (2)
F22B| 48                               PHA                 ; (4)
F22C| 68                               PLA                 ; (3)
F22D| 48                    WSYNC      PHA                 ; (4) EXACT TIMING
F22E| 68                               PLA                 ; (3)
F22F| 2Ø BBF2                          JSR     WNIBL7      ; (13,9,6) WRITE SYNC
F232| 88                               DEY                 ; (2)
F233| DØF8                             BNE     WSYNC       ; (2*)  MUST NOT CROSS PAGE!
F235| A9 D5                            LDA     #ØD5        ; (2)  1ST DATA MARK
F237| 2Ø BAF2                          JSR     WNIBL9      ; (15,9,6)
F23A| A9 AA                            LDA     #ØAA        ; (2)  2ND DATA MARK
F23C| 2Ø BAF2                          JSR     WNIBL9      ; (15,9,6)
F23F| A9 AD                            LDA     #ØAD        ; (2)  3RD DATA MARK
F241| 2Ø BAF2                          JSR     WNIBL9      ; (15,9,6)
F244| AØ 55                            LDY     #55         ; (2) NBUF2 INDEX
F246| EA                               NOP                 ; (2) FOR TIMING
F247| EA                               NOP                 ; (2)
F248| EA                               NOP                 ; (2)
F249| DØØ8                             BNE     VRYFRST     ; (3) BRANCH ALWAYS
F24B| AD EFFF               WINTRPT    LDA     INTERUPT    ; (4) POLL INTERRUPT LINE
F24E| Ø5 8B                            ORA     IMASK       ; (3)
F25Ø| 38                               SEC                 ; (2)
F251| 1Ø57                             BPL     SERVICE     ; (2) BRANCH IF INTERRUPT HAS OCCURED
F253| 3ØØØ                  VRYFRST    BMI     WRTFRST     ; (3) FOR TIMING.
F255| B9 Ø2Ø3               WRTFRST    LDA     NBUF2,Y     ; (4)
F258| 9D 8DCØ                          STA     Q6H,X       ; (5) STORE ENCODED BYTE
F25B| BD 8CCØ                          LDA     Q6L,X       ; (4) TIME MUST = 32 US PER BYTE!
F25E| 88                               DEY                 ; (2)
F25F| 1ØEA                             BPL     WINTRPT     ; (3)  (2 IF BRANCH NOT TAKEN)
F261| 98                               TYA                 ; (2) INSURE NO INTERRUPT THIS BYTE
F262| 3ØØ3                             BMI     WMIDLE      ; (3) BRANCH ALWAYS.
F264| AD EFFF               WNTRPT1    LDA     INTERUPT    ; (4) POLL INTERRUPT LINE
F267| Ø5 8B                 WMIDLE     ORA     IMASK       ; (3)
F269| 38                               SEC                 ; (2)
F26A| 3ØØ2                             BMI     WDATA2      ; (3) BRANCH IF NO INTERRUPT
F26C| 1Ø3C                             BPL     SERVICE     ; GO SERVICE INTERRUPT.
F26E| C8                    WDATA2     INY                 ; (2)
F26F| B9 ØØØ2                          LDA     NBUF1,Y     ; (4)
F272| 9D 8DCØ                          STA     Q6H,X       ; (5) STORE ENCODED BYTE
F275| BD 8CCØ                          LDA     Q6L,X       ; (4)
F278| CØ E4                            CPY     #ØE4        ; (2) WITHIN 1 MS OF COMPLETION?
F27A| DØE8                             BNE     WNTRPT1     ; (3)  (2) NO KEEP WRITTING AND POLLING.
F27C| EA                               NOP                 ; (2)
F27D| C8                               INY                 ; (2)
F27E| EA                    WDATA3     NOP                 ; (2)
F27F| EA                               NOP                 ; (2)
F28Ø| 48                               PHA                 ; (4)
F281| 68                               PLA                 ; (3)
F282| B9 ØØØ2                          LDA     NBUF1,Y     ; (4) WRITE LAST OF ENCODED BYTES
F285| 9D 8DCØ                          STA     Q6H,X       ; (5) WITHOUT POLLING INTERRUPTS.
F288| BD 8CCØ                          LDA     Q6L,X       ; (4)
F28B| A5 96                            LDA     CKSUM       ; (3) NORMALLY FOR TIMING
F28D| C8                               INY                 ; (2)
F28E| DØEE                             BNE     WDATA3      ; (3)  (2)
F29Ø| FØØØ                             BEQ     WRCKSUM     ; (3) BRANCH ALWAYS
F292| 2Ø BBF2               WRCKSUM    JSR     WNIBL7      ; (13,9,6) GO WRITE CHECK SUM!!
F295| 48                               PHA                 ; (3)
F296| 68                               PLA                 ; (4)
F297| B9 CØF3               WRBITSLMK  LDA     BITSLIPMK,Y ; (4) LOAD BIT SLIP MARK
F29A| 2Ø BDF2                          JSR     WNIBL       ; (6,9,6)
F29D| C8                               INY                 ; (2)
F29E| CØ Ø4                            CPY     #Ø4         ; (2)
F2AØ| DØF5                             BNE     WRBITSLMK   ; (2)  (3)
F2A2| 18                               CLC                 ; (2)
F2A3| BD 8ECØ               NOWRITE    LDA     Q7L,X       ; OUT OF WRITE MODE.
F2A6| BD 8CCØ                          LDA     Q6L,X       ; TO READ MODE.
F2A9| 6Ø                               RTS                 ; RETURN FROM WRITE.
F2AA|                       ;
F2AA| 2C 54F3               SERVICE    BIT     SEV         ; SET VFLAG TO INDICATE INTERRUPT
F2AD| 2Ø A3F2                          JSR     NOWRITE     ; TAKE IT OUT OF WRITE MODE!
F2BØ| A5 8F                            LDA     Ø8F
F2B2| 1ØØ2                             BPL     $Ø1Ø
F2B4| 85 8B                            STA     IMASK
```

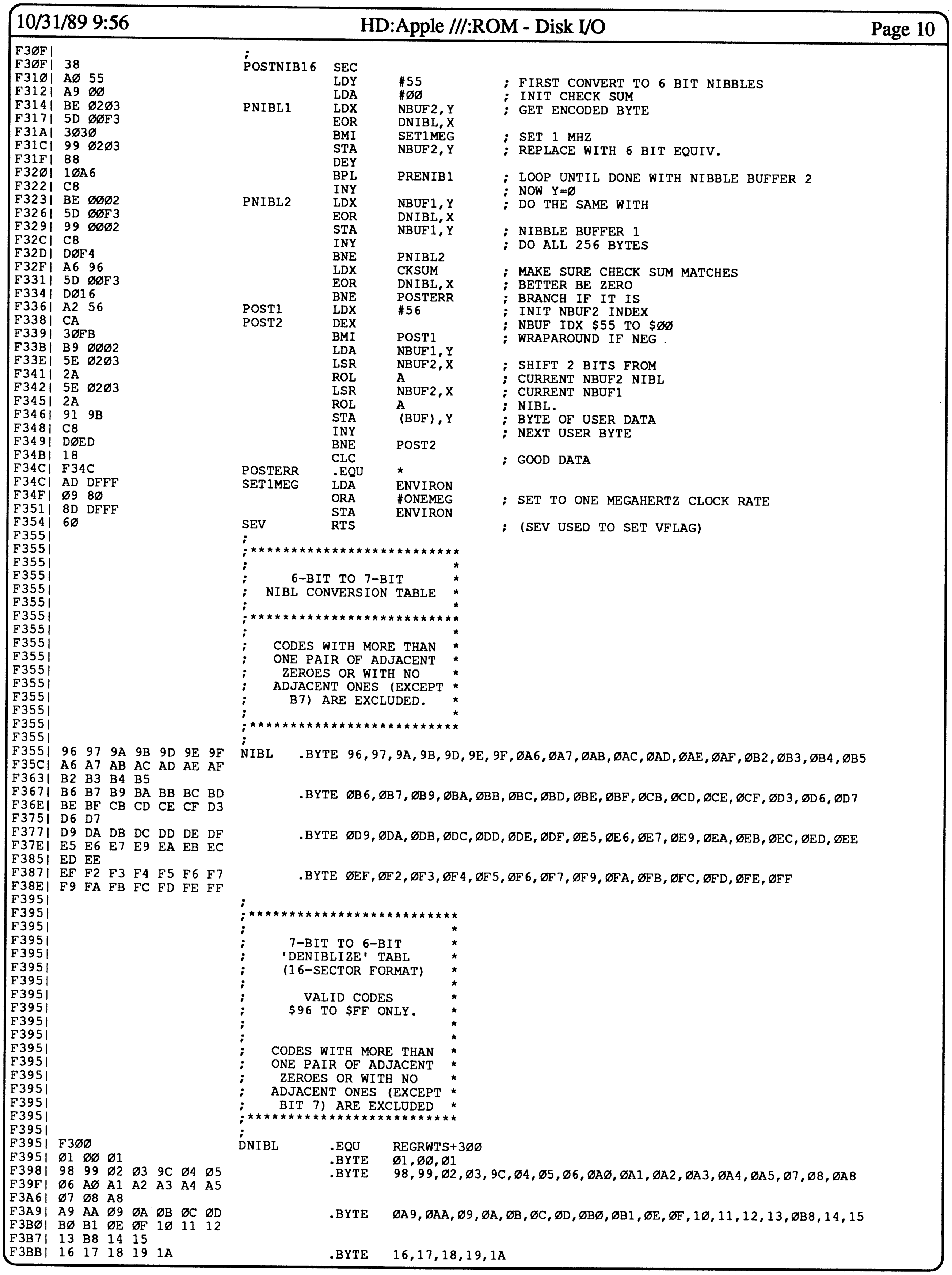
“_53.PICT” 657 KB 2001-09-10 dpi: 600h x 600v pix: 4639h x 6166v



10/31/89 9:56 HD:Apple ///:ROM - Disk I/O Page 9

```
F2B6| C6 8F           $Ø1Ø      DEC     Ø8F
F2B8| 58                        CLI                  ; COULD NOT HAVE GOT HERE WITHOUT CLI OK
F2B9| 6Ø                        RTS
F2BA|                 ;
F2BA|                 ;****************************
F2BA|                 ;                          *
F2BA|                 ;   7-BIT NIBL WRITE SUBRS  *
F2BA|                 ;                          *
F2BA|                 ;   A-REG OR'D PRIOR EXIT   *
F2BA|                 ;       CARRY CLEARED       *
F2BA|                 ;                          *
F2BA|                 ;****************************
F2BA|                 ;
F2BA| 18              WNIBL9    CLC                  ; (2) 9 CYCLES, THEN WRITE
F2BB| 48              WNIBL7    PHA                  ; (3) 7 CYCLES, THEN WRITE
F2BC| 68                        PLA                  ; (4)
F2BD| 9D 8DCØ         WNIBL     STA     Q6H,X        ; (5) NIBL WRITE SUB
F2CØ| 1D 8CCØ                   ORA     Q6L,X        ; (4) CLOBBERS ACC. NOT CARRY
F2C3| 6Ø                        RTS
F2C4|                 ;
F2C4|                 ;****************************
F2C4|                 ;                          *
F2C4|                 ;    PRENIBILIZE SUBR      *
F2C4|                 ;   (16-SECTOR FORMAT)     *
F2C4|                 ;                          *
F2C4|                 ;****************************
F2C4|                 ;                          *
F2C4|                 ;  CONVERTS 256 BYTES OF   *
F2C4|                 ;  USER DATA IN (BUF) INTO *
F2C4|                 ;  ENCODED BYTES TO BE     *
F2C4|                 ;  WRITTEN DIRECTLY TO DISK *
F2C4|                 ;  ENCODED CHECK SUM IN    *
F2C4|                 ;  ZERO PAGE 'CKSUM'       *
F2C4|                 ;                          *
F2C4|                 ;   ---- ON ENTRY ----     *
F2C4|                 ;                          *
F2C4|                 ;  BUF IS 2-BYTE POINTER   *
F2C4|                 ;    TO 256 BYTES OF USER  *
F2C4|                 ;    DATA.                 *
F2C4|                 ;                          *
F2C4|                 ;  A-REG CHECK SUM.        *
F2C4|                 ;  X-REG UNCERTAIN         *
F2C4|                 ;  Y-REG HOLDS Ø.          *
F2C4|                 ;  CARRY SET.              *
F2C4|                 ;                          *
F2C4|                 ;****************************
F2C4|                 ;
F2C4| A2 Ø2           PRENIB16  LDX     #Ø2          ; START NBUF2 INDEX.
F2C6| AØ ØØ                     LDY     #ØØ          ; START USER BUF INDEX.
F2C8| 88              PRENIB1   DEY                  ; NEXT USER BYTE
F2C9| B1 9B                     LDA     (BUF),Y
F2CB| 4A                        LSR     A            ; SHIFT TWO BITS OF
F2CC| 3E Ø1Ø3                   ROL     NBUF2-1,X    ; CURRENT USER BYTE
F2CF| 4A                        LSR     A            ; INTO CURRENT NBUF2
F2DØ| 3E Ø1Ø3                   ROL     NBUF2-1,X    ; BYTE.
F2D3| 99 Ø1Ø2                   STA     NBUF1+1,Y    ; (6 BITS LEFT).
F2D6| E8                        INX                  ; FROM Ø TO $55
F2D7| EØ 56                     CPX     #56
F2D9| 9ØED                      BCC     PRENIB1      ; BR IF NO WRAPAROUND
F2DB| A2 ØØ                     LDX     #ØØ          ; RESET NBUF2 INDEX
F2DD| 98                        TYA                  ; USER BUF INDEX
F2DE| DØE8                      BNE     PRENIB1      ; (DONE IF ZERO)
F2EØ| AØ 56                     LDY     #56          ; (ACC=Ø FOR CHECK SUM)
F2E2| 59 ØØØ3         PRENIB3   EOR     NBUF2-2,Y    ; COMBINE WITH PREVIOUS
F2E5| 29 3F           PRENIB2   AND     #Ø3F         ; STRIP GARBAGE BITS
F2E7| AA                        TAX                  ; TO FORM RUNNING CHECK SUM
F2E8| BD 55F3                   LDA     NIBL,X       ; GET ENCODED EQUIV.
F2EB| 99 Ø1Ø3                   STA     NBUF2-1,Y    ; REPLACE PREVIOUS
F2EE| B9 ØØØ3                   LDA     NBUF2-2,Y    ; RESTORE ACTUAL PREVIOUS
F2F1| 88                        DEY
F2F2| DØEE                      BNE     PRENIB3      ; LOOP UNTIL ALL OF NBUF2 IS CONVERTED.
F2F4| 29 3F                     AND     #3F
F2F6| 59 Ø1Ø2         PRENIB4   EOR     NBUF1+1,Y    ; NOW DO THE SAME FOR
F2F9| AA                        TAX                  ; NIBBLE BUFFER 1
F2FA| BD 55F3                   LDA     NIBL,X       ; TO DO ANY BACK TRACKING (NBUF1-1)
F2FD| 99 ØØØ2                   STA     NBUF1,Y
F3ØØ| B9 Ø1Ø2                   LDA     NBUF1+1,Y    ; RECOVER THAT WHICH IS NOW 'PREVIOUS'
F3Ø3| C8                        INY
F3Ø4| DØFØ                      BNE     PRENIB4
F3Ø6| AA                        TAX                  ; USE LAST AS CHECK SUM
F3Ø7| BD 55F3                   LDA     NIBL,X
F3ØA| 85 96                     STA     CKSUM
F3ØC| 4C 4CF3                   JMP     SET1MEG      ; ALL DONE.
F3ØF|                 ;
F3ØF|                 ;*************************
F3ØF|                 ;                        *
F3ØF|                 ;    POSTNIBLIZE SUBR     *
F3ØF|                 ;    16-SECTOR FORMAT     *
F3ØF|                 ;                        *
F3ØF|                 ;*************************
```

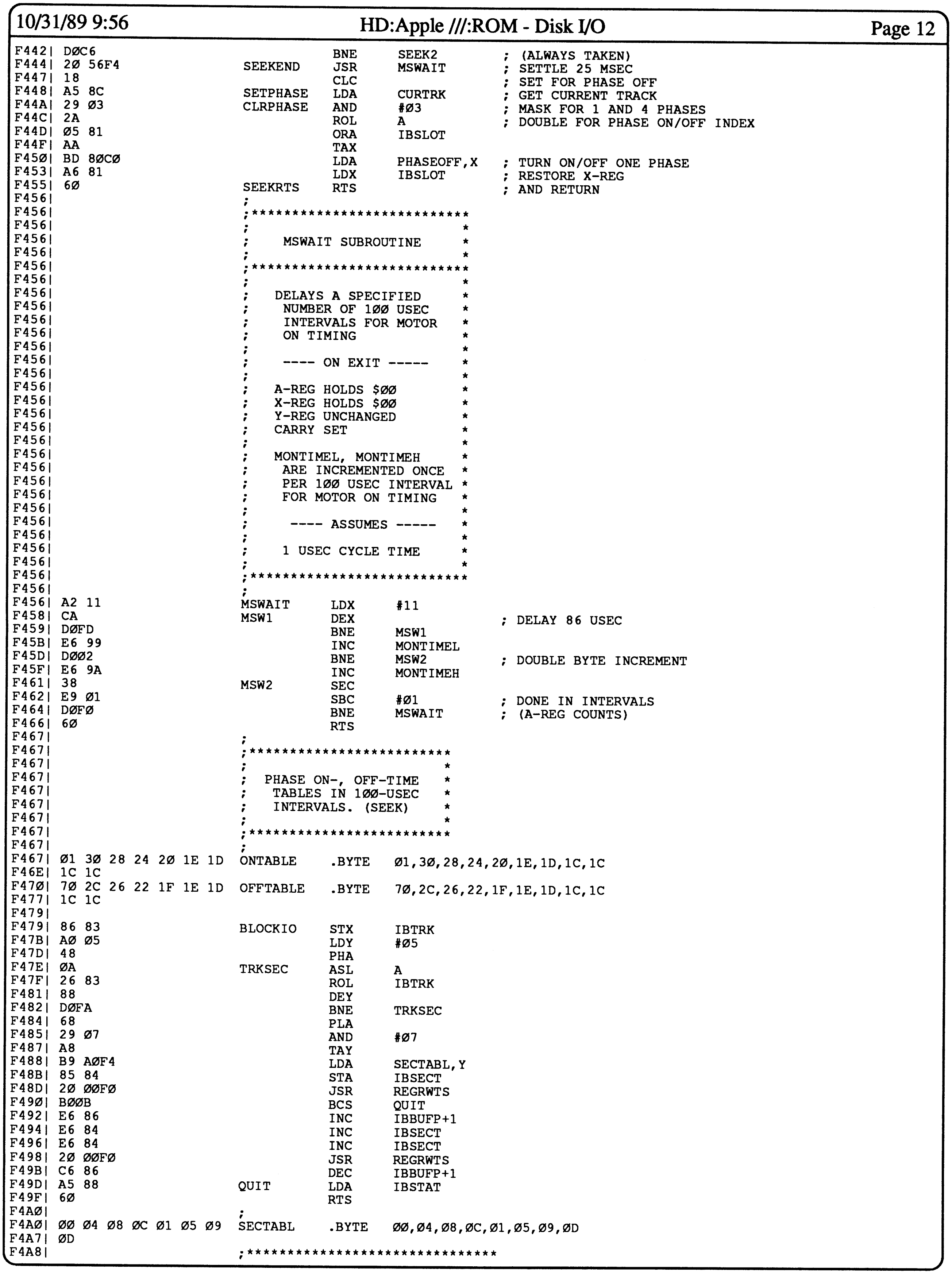
“_54.PICT” 578 KB 2001-09-10 dpi: 600h x 600v pix: 4627h x 6178v



```
F3ØF|                          ;
F3ØF| 38                       POSTNIB16  SEC
F31Ø| AØ 55                               LDY    #55          ; FIRST CONVERT TO 6 BIT NIBBLES
F312| A9 ØØ                               LDA    #ØØ          ; INIT CHECK SUM
F314| BE Ø2Ø3                  PNIBL1     LDX    NBUF2,Y      ; GET ENCODED BYTE
F317| 5D ØØF3                             EOR    DNIBL,X
F31A| 3Ø3Ø                                BMI    SET1MEG      ; SET 1 MHZ
F31C| 99 Ø2Ø3                             STA    NBUF2,Y      ; REPLACE WITH 6 BIT EQUIV.
F31F| 88                                  DEY
F32Ø| 1ØA6                                BPL    PRENIB1      ; LOOP UNTIL DONE WITH NIBBLE BUFFER 2
F322| C8                                  INY                 ; NOW Y=Ø
F323| BE ØØØ2                  PNIBL2     LDX    NBUF1,Y      ; DO THE SAME WITH
F326| 5D ØØF3                             EOR    DNIBL,X
F329| 99 ØØØ2                             STA    NBUF1,Y      ; NIBBLE BUFFER 1
F32C| C8                                  INY                 ; DO ALL 256 BYTES
F32D| DØF4                                BNE    PNIBL2
F32F| A6 96                               LDX    CKSUM        ; MAKE SURE CHECK SUM MATCHES
F331| 5D ØØF3                             EOR    DNIBL,X      ; BETTER BE ZERO
F334| DØ16                                BNE    POSTERR      ; BRANCH IF IT IS
F336| A2 56                    POST1      LDX    #56          ; INIT NBUF2 INDEX
F338| CA                       POST2      DEX                 ; NBUF IDX $55 TO $ØØ
F339| 3ØFB                                BMI    POST1        ; WRAPAROUND IF NEG .
F33B| B9 ØØØ2                             LDA    NBUF1,Y
F33E| 5E Ø2Ø3                             LSR    NBUF2,X      ; SHIFT 2 BITS FROM
F341| 2A                                  ROL    A            ; CURRENT NBUF2 NIBL
F342| 5E Ø2Ø3                             LSR    NBUF2,X      ; CURRENT NBUF1
F345| 2A                                  ROL    A            ; NIBL.
F346| 91 9B                               STA    (BUF),Y      ; BYTE OF USER DATA
F348| C8                                  INY                 ; NEXT USER BYTE
F349| DØED                                BNE    POST2
F34B| 18                                  CLC                 ; GOOD DATA
F34C| F34C                     POSTERR    .EQU   *
F34C| AD DFFF                  SET1MEG    LDA    ENVIRON
F34F| Ø9 8Ø                               ORA    #ONEMEG      ; SET TO ONE MEGAHERTZ CLOCK RATE
F351| 8D DFFF                             STA    ENVIRON
F354| 6Ø                       SEV        RTS                 ; (SEV USED TO SET VFLAG)
F355|                          ;
F355|                          ;*************************
F355|                          ;                        *
F355|                          ;      6-BIT TO 7-BIT    *
F355|                          ;   NIBL CONVERSION TABLE *
F355|                          ;                        *
F355|                          ;*************************
F355|                          ;                        *
F355|                          ;    CODES WITH MORE THAN *
F355|                          ;    ONE PAIR OF ADJACENT *
F355|                          ;     ZEROES OR WITH NO   *
F355|                          ;    ADJACENT ONES (EXCEPT *
F355|                          ;      B7) ARE EXCLUDED.  *
F355|                          ;                        *
F355|                          ;*************************
F355|                          ;
F355| 96 97 9A 9B 9D 9E 9F     NIBL   .BYTE 96,97,9A,9B,9D,9E,9F,ØA6,ØA7,ØAB,ØAC,ØAD,ØAE,ØAF,ØB2,ØB3,ØB4,ØB5
F35C| A6 A7 AB AC AD AE AF
F363| B2 B3 B4 B5
F367| B6 B7 B9 BA BB BC BD            .BYTE ØB6,ØB7,ØB9,ØBA,ØBB,ØBC,ØBD,ØBE,ØBF,ØCB,ØCD,ØCE,ØCF,ØD3,ØD6,ØD7
F36E| BE BF CB CD CE CF D3
F375| D6 D7
F377| D9 DA DB DC DD DE DF            .BYTE ØD9,ØDA,ØDB,ØDC,ØDD,ØDE,ØDF,ØE5,ØE6,ØE7,ØE9,ØEA,ØEB,ØEC,ØED,ØEE
F37E| E5 E6 E7 E9 EA EB EC
F385| ED EE
F387| EF F2 F3 F4 F5 F6 F7            .BYTE ØEF,ØF2,ØF3,ØF4,ØF5,ØF6,ØF7,ØF9,ØFA,ØFB,ØFC,ØFD,ØFE,ØFF
F38E| F9 FA FB FC FD FE FF
F395|                          ;
F395|                          ;*************************
F395|                          ;                        *
F395|                          ;     7-BIT TO 6-BIT     *
F395|                          ;    'DENIBLIZE' TABL    *
F395|                          ;    (16-SECTOR FORMAT)  *
F395|                          ;                        *
F395|                          ;       VALID CODES      *
F395|                          ;     $96 TO $FF ONLY.   *
F395|                          ;                        *
F395|                          ;                        *
F395|                          ;    CODES WITH MORE THAN *
F395|                          ;    ONE PAIR OF ADJACENT *
F395|                          ;     ZEROES OR WITH NO   *
F395|                          ;    ADJACENT ONES (EXCEPT *
F395|                          ;     BIT 7) ARE EXCLUDED *
F395|                          ;*************************
F395|                          ;
F395| F3ØØ                     DNIBL      .EQU    REGRWTS+3ØØ
F395| Ø1 ØØ Ø1                            .BYTE   Ø1,ØØ,Ø1
F398| 98 99 Ø2 Ø3 9C Ø4 Ø5                .BYTE   98,99,Ø2,Ø3,9C,Ø4,Ø5,Ø6,ØAØ,ØA1,ØA2,ØA3,ØA4,ØA5,Ø7,Ø8,ØA8
F39F| Ø6 AØ A1 A2 A3 A4 A5
F3A6| Ø7 Ø8 A8
F3A9| A9 AA Ø9 ØA ØB ØC ØD                .BYTE   ØA9,ØAA,Ø9,ØA,ØB,ØC,ØD,ØBØ,ØB1,ØE,ØF,1Ø,11,12,13,ØB8,14,15
F3BØ| BØ B1 ØE ØF 1Ø 11 12
F3B7| 13 B8 14 15
F3BB| 16 17 18 19 1A                      .BYTE   16,17,18,19,1A
```

"_55.PICT" 632 KB 2001-09-10 dpi: 600h x 600v pix: 4616h x 6213v

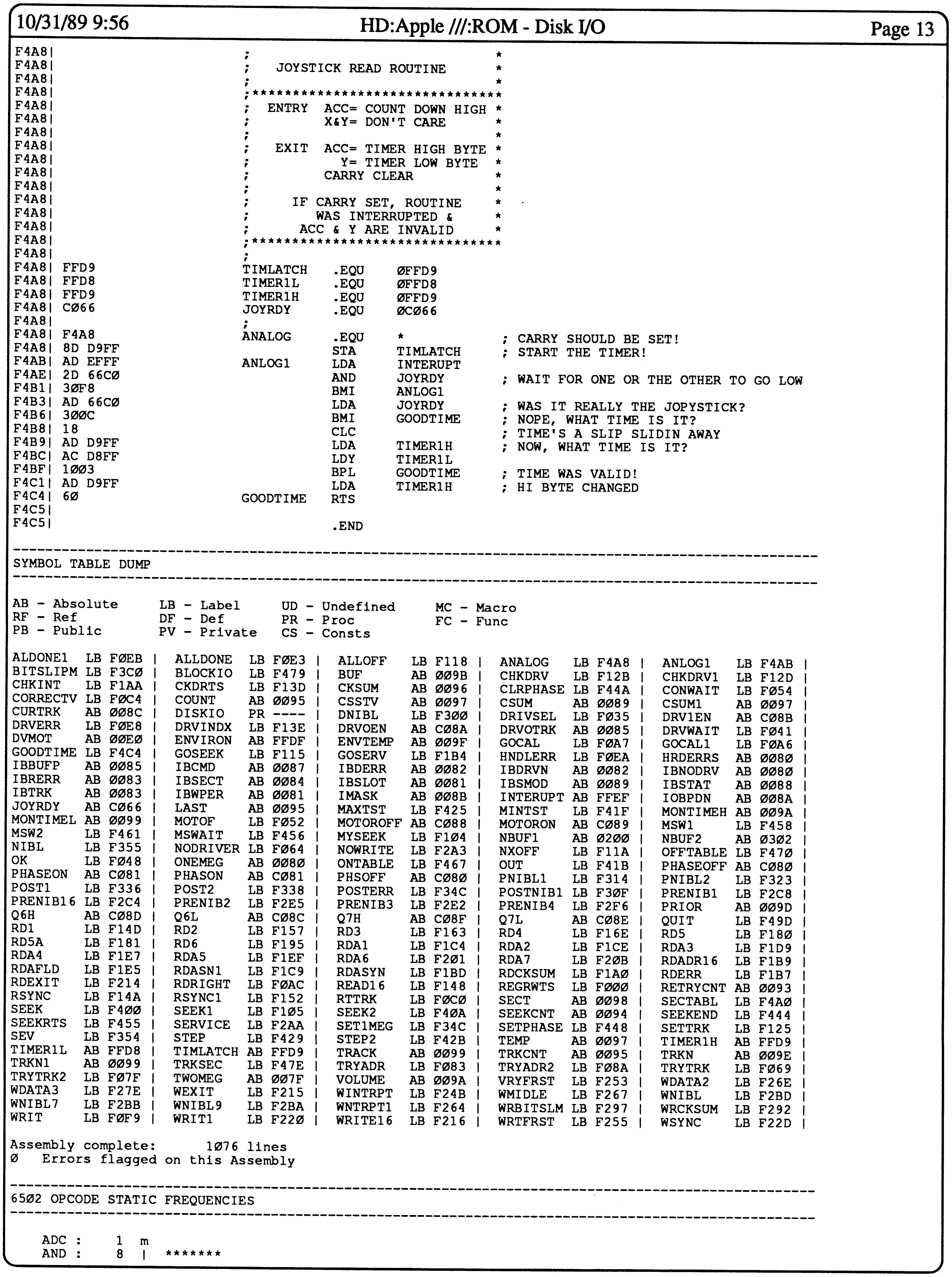
```
F3CØ| DE AA EB FF C4 C5 C6   BITSLIPMK  .BYTE   ØDE,ØAA,ØEB,ØFF,ØC4,ØC5,ØC6,ØC7,ØC8,ØC9,ØCA,1B,ØCC,1C,1D,1E
F3C7| C7 C8 C9 CA 1B CC 1C
F3CE| 1D 1E
F3DØ| DØ D1 D2 1F D4 D5 2Ø              .BYTE   ØDØ,ØD1,ØD2,1F,ØD4,ØD5,2Ø,21,ØD8,22,23,24,25,26,27,28,ØEØ,ØE1
F3D7| 21 D8 22 23 24 25 26
F3DE| 27 28 EØ E1
F3E2| E2 E3 E4 29 2A 2B E8              .BYTE   ØE2,ØE3,ØE4,29,2A,2B,ØE8,2C,2D,2E,2F,3Ø,31,32,ØFØ,ØF1,33,34
F3E9| 2C 2D 2E 2F 3Ø 31 32
F3FØ| FØ F1 33 34
F3F4| 35 36 37 38 F8 39 3A              .BYTE   35,36,37,38,ØF8,39,3A,3B,3C,3D,3E,3F
F3FB| 3B 3C 3D 3E 3F
F4ØØ|
F4ØØ|                        ;************************
F4ØØ|                        ;                       *
F4ØØ|                        ;  FAST SEEK SUBROUTINE *
F4ØØ|                        ;                       *
F4ØØ|                        ;************************
F4ØØ|                        ;                       *
F4ØØ|                        ;   ---- ON ENTRY ----  *
F4ØØ|                        ;                       *
F4ØØ|                        ;  X-REG HOLDS SLOTNUM  *
F4ØØ|                        ;         TIMES $1Ø     *
F4ØØ|                        ;                       *
F4ØØ|                        ;  A-REG HOLDS DESIRED  *
F4ØØ|                        ;         HALFTRACK.    *
F4ØØ|                        ;                       *
F4ØØ|                        ;  CURTRK HOLDS DESIRED *
F4ØØ|                        ;          HALFTRACK.   *
F4ØØ|                        ;                       *
F4ØØ|                        ;   ---- ON EXIT ----   *
F4ØØ|                        ;                       *
F4ØØ|                        ;  A-REG UNCERTAIN.     *
F4ØØ|                        ;  Y-REG UNCERTAIN.     *
F4ØØ|                        ;  X-REG UNDISTURBED.   *
F4ØØ|                        ;                       *
F4ØØ|                        ;  CURTRK AND TRKN HOLD *
F4ØØ|                        ;      FINAL HALFTRACK. *
F4ØØ|                        ;                       *
F4ØØ|                        ;  PRIOR HOLDS PRIOR    *
F4ØØ|                        ;    HALFTRACK IF SEEK  *
F4ØØ|                        ;    WAS REQUIRED.      *
F4ØØ|                        ;                       *
F4ØØ|                        ;  MONTIMEL AND MONTIMEH *
F4ØØ|                        ;    ARE INCREMENTED BY *
F4ØØ|                        ;    THE NUMBER OF      *
F4ØØ|                        ;    1ØØ USEC QUANTUMS  *
F4ØØ|                        ;    REQUIRED BY SEEK   *
F4ØØ|                        ;    FOR MOTOR ON TIME  *
F4ØØ|                        ;    OVERLAP.           *
F4ØØ|                        ;                       *
F4ØØ|                        ; --- VARIABLES USED --- *
F4ØØ|                        ;                       *
F4ØØ|                        ;  CURTRK, TRKN, COUNT, *
F4ØØ|                        ;    PRIOR, SLOTTEMP    *
F4ØØ|                        ;    MONTIMEL, MONTIMEH *
F4ØØ|                        ;                       *
F4ØØ|                        ;************************
F4ØØ|                        ;
F4ØØ| 85 9E                  SEEK       STA     TRKN          ; SAVE TARGET TRACK
F4Ø2| C5 8C                             CMP     CURTRK        ; ON DESIRED TRACK?
F4Ø4| FØ42                              BEQ     SETPHASE      ; YES, ENERGIZE PHASE AND RETURN
F4Ø6| A9 ØØ                             LDA     #ØØ
F4Ø8| 85 95                             STA     TRKCNT        ; HALFTRACK COUNT.
F4ØA| A5 8C                  SEEK2      LDA     CURTRK        ; SAVE CURTRK FOR
F4ØC| 85 9D                             STA     PRIOR         ; DELAYED TURN OFF.
F4ØE| 38                                SEC
F4ØF| E5 9E                             SBC     TRKN          ; DELTA-TRACKS.
F411| FØ31                              BEQ     SEEKEND       ; BR IF CURTRK=DESTINATION
F413| BØØ6                              BCS     OUT           ; (MOVE OUT, NOT IN)
F415| 49 FF                             EOR     #ØFF          ; CALC TRKS TO GO.
F417| E6 8C                             INC     CURTRK        ; DECR CURRENT TRACK (OUT)
F419| 9ØØ4                              BCC     MINTST        ; (ALWAYS TAKEN).
F41B| 69 FE                  OUT        ADC     #ØFE          ; CALC TRACKS TO GO.
F41D| C6 8C                             DEC     CURTRK        ; DECR CURRENT TRACK (OUT)
F41F| C5 95                  MINTST     CMP     TRKCNT
F421| 9ØØ2                              BCC     MAXTST        ; AND 'TRKS MOVED'
F423| A5 95                             LDA     TRKCNT
F425| C9 Ø9                  MAXTST     CMP     #Ø9
F427| BØØ2                              BCS     STEP2         ; IF TRKCNT>$Ø8 LEAVE Y ALONE (Y=$Ø8)
F429| A8                     STEP       TAY                   ; ELSE SET ACCELERATION INDEX IN Y
F42A| 38                                SEC
F42B| 2Ø 48F4                STEP2      JSR     SETPHASE
F42E| B9 67F4                           LDA     ONTABLE,Y     ; FOR 'ONTIME'
F431| 2Ø 56F4                           JSR     MSWAIT        ; (1ØØ USEC INTERVALS)
F434| A5 9D                             LDA     PRIOR
F436| 18                                CLC                   ; FOR PHASE OFF
F437| 2Ø 4AF4                           JSR     CLRPHASE      ; TURN OFF PRIOR PHASE
F43A| B9 7ØF4                           LDA     OFFTABLE,Y    ; THEN WAIT 'OFFTIME'
F43D| 2Ø 56F4                           JSR     MSWAIT        ; (1ØØ USEC INTERVALS)
F44Ø| E6 95                             INC     TRKCNT        ; 'TRACKS MOVED' COUNT.
```



10/31/89 9:56 HD:Apple ///:ROM - Disk I/O Page 12

```
F442| DØC6                            BNE     SEEK2         ; (ALWAYS TAKEN)
F444| 2Ø 56F4              SEEKEND    JSR     MSWAIT        ; SETTLE 25 MSEC
F447| 18                              CLC                   ; SET FOR PHASE OFF
F448| A5 8C                SETPHASE   LDA     CURTRK        ; GET CURRENT TRACK
F44A| 29 Ø3                CLRPHASE   AND     #Ø3           ; MASK FOR 1 AND 4 PHASES
F44C| 2A                              ROL     A             ; DOUBLE FOR PHASE ON/OFF INDEX
F44D| Ø5 81                           ORA     IBSLOT
F44F| AA                              TAX
F45Ø| BD 8ØCØ                         LDA     PHASEOFF,X    ; TURN ON/OFF ONE PHASE
F453| A6 81                           LDX     IBSLOT        ; RESTORE X-REG
F455| 6Ø                   SEEKRTS    RTS                   ; AND RETURN
F456|                      ;
F456|                      ;***************************
F456|                      ;                          *
F456|                      ;    MSWAIT SUBROUTINE     *
F456|                      ;                          *
F456|                      ;***************************
F456|                      ;                          *
F456|                      ;   DELAYS A SPECIFIED     *
F456|                      ;    NUMBER OF 1ØØ USEC    *
F456|                      ;    INTERVALS FOR MOTOR   *
F456|                      ;    ON TIMING             *
F456|                      ;                          *
F456|                      ;    ---- ON EXIT -----    *
F456|                      ;                          *
F456|                      ;   A-REG HOLDS $ØØ        *
F456|                      ;   X-REG HOLDS $ØØ        *
F456|                      ;   Y-REG UNCHANGED        *
F456|                      ;   CARRY SET              *
F456|                      ;                          *
F456|                      ;   MONTIMEL, MONTIMEH     *
F456|                      ;    ARE INCREMENTED ONCE  *
F456|                      ;    PER 1ØØ USEC INTERVAL *
F456|                      ;    FOR MOTOR ON TIMING   *
F456|                      ;                          *
F456|                      ;     ---- ASSUMES -----   *
F456|                      ;                          *
F456|                      ;    1 USEC CYCLE TIME     *
F456|                      ;                          *
F456|                      ;***************************
F456|                      ;
F456| A2 11                MSWAIT     LDX     #11
F458| CA                   MSW1       DEX                   ; DELAY 86 USEC
F459| DØFD                            BNE     MSW1
F45B| E6 99                           INC     MONTIMEL
F45D| DØØ2                            BNE     MSW2          ; DOUBLE BYTE INCREMENT
F45F| E6 9A                           INC     MONTIMEH
F461| 38                   MSW2       SEC
F462| E9 Ø1                           SBC     #Ø1           ; DONE IN INTERVALS
F464| DØFØ                            BNE     MSWAIT        ; (A-REG COUNTS)
F466| 6Ø                              RTS
F467|                      ;
F467|                      ;************************
F467|                      ;                       *
F467|                      ;  PHASE ON-, OFF-TIME  *
F467|                      ;   TABLES IN 1ØØ-USEC  *
F467|                      ;   INTERVALS. (SEEK)   *
F467|                      ;                       *
F467|                      ;************************
F467|                      ;
F467| Ø1 3Ø 28 24 2Ø 1E 1D ONTABLE    .BYTE   Ø1,3Ø,28,24,2Ø,1E,1D,1C,1C
F46E| 1C 1C
F47Ø| 7Ø 2C 26 22 1F 1E 1D OFFTABLE   .BYTE   7Ø,2C,26,22,1F,1E,1D,1C,1C
F477| 1C 1C
F479|
F479| 86 83                BLOCKIO    STX     IBTRK
F47B| AØ Ø5                           LDY     #Ø5
F47D| 48                              PHA
F47E| ØA                   TRKSEC     ASL     A
F47F| 26 83                           ROL     IBTRK
F481| 88                              DEY
F482| DØFA                            BNE     TRKSEC
F484| 68                              PLA
F485| 29 Ø7                           AND     #Ø7
F487| A8                              TAY
F488| B9 AØF4                         LDA     SECTABL,Y
F48B| 85 84                           STA     IBSECT
F48D| 2Ø ØØFØ                         JSR     REGRWTS
F49Ø| BØØB                            BCS     QUIT
F492| E6 86                           INC     IBBUFP+1
F494| E6 84                           INC     IBSECT
F496| E6 84                           INC     IBSECT
F498| 2Ø ØØFØ                         JSR     REGRWTS
F49B| C6 86                           DEC     IBBUFP+1
F49D| A5 88                QUIT       LDA     IBSTAT
F49F| 6Ø                              RTS
F4AØ|                      ;
F4AØ| ØØ Ø4 Ø8 ØC Ø1 Ø5 Ø9 SECTABL    .BYTE   ØØ,Ø4,Ø8,ØC,Ø1,Ø5,Ø9,ØD
F4A7| ØD
F4A8|                      ;*******************************
```

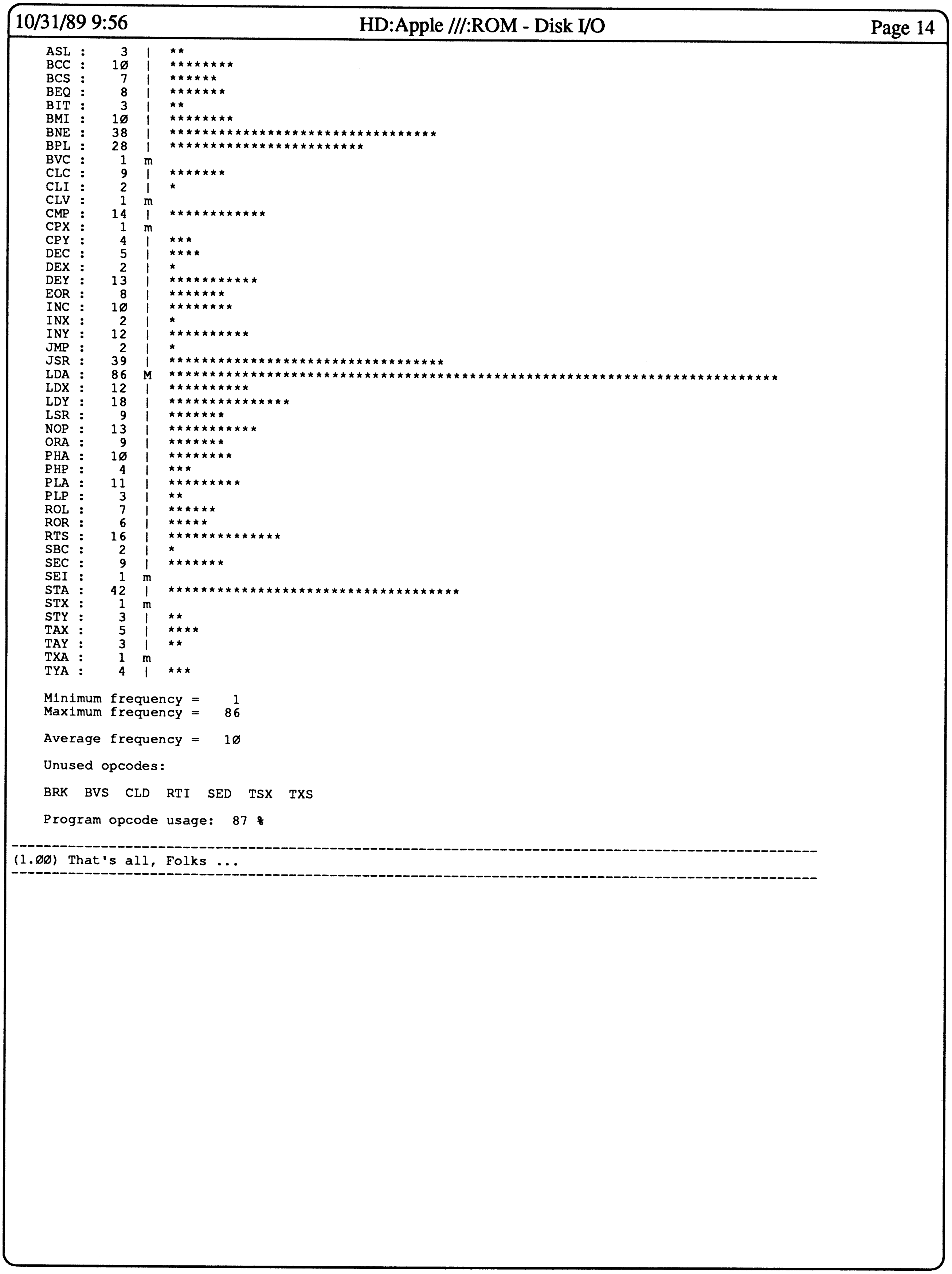
"_57.PICT" 513 KB 2001-09-10 dpi: 600h x 600v pix: 4627h x 6201v



10/31/89 9:56 HD:Apple ///:ROM - Disk I/O Page 13

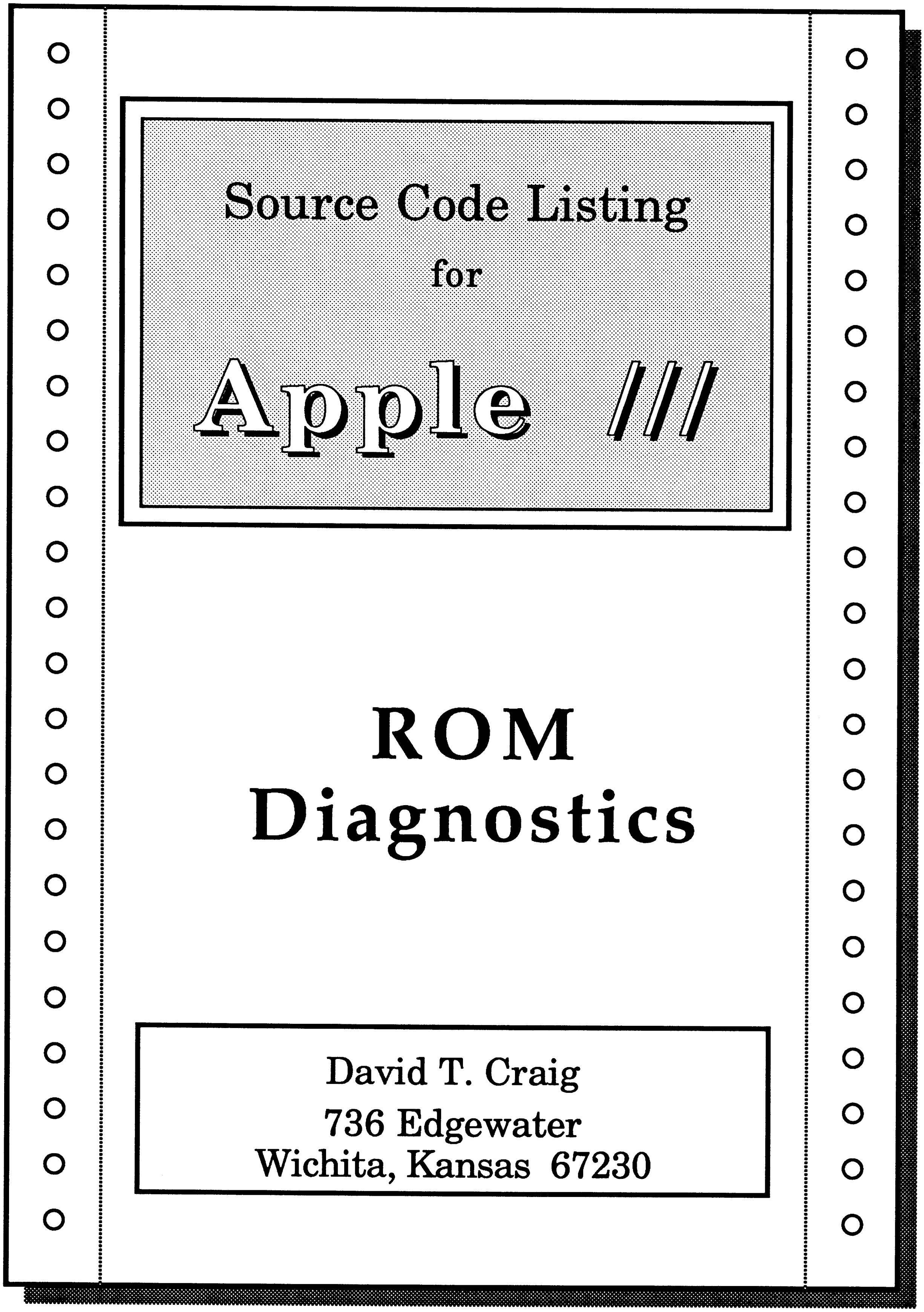
```
F4A8|                          ;                              *
F4A8|                          ;   JOYSTICK READ ROUTINE      *
F4A8|                          ;                              *
F4A8|                          ;******************************
F4A8|                          ;  ENTRY  ACC= COUNT DOWN HIGH *
F4A8|                          ;         X&Y= DON'T CARE      *
F4A8|                          ;                              *
F4A8|                          ;   EXIT  ACC= TIMER HIGH BYTE *
F4A8|                          ;           Y= TIMER LOW BYTE  *
F4A8|                          ;         CARRY CLEAR          *
F4A8|                          ;                              *
F4A8|                          ;     IF CARRY SET, ROUTINE    *
F4A8|                          ;        WAS INTERRUPTED &     *
F4A8|                          ;      ACC & Y ARE INVALID     *
F4A8|                          ;******************************
F4A8|                          ;
F4A8| FFD9                     TIMLATCH   .EQU    ØFFD9
F4A8| FFD8                     TIMER1L    .EQU    ØFFD8
F4A8| FFD9                     TIMER1H    .EQU    ØFFD9
F4A8| CØ66                     JOYRDY     .EQU    ØCØ66
F4A8|                          ;
F4A8| F4A8                     ANALOG     .EQU    *          ; CARRY SHOULD BE SET!
F4A8| 8D D9FF                             STA     TIMLATCH   ; START THE TIMER!
F4AB| AD EFFF                  ANLOG1     LDA     INTERUPT
F4AE| 2D 66CØ                             AND     JOYRDY     ; WAIT FOR ONE OR THE OTHER TO GO LOW
F4B1| 3ØF8                                BMI     ANLOG1
F4B3| AD 66CØ                             LDA     JOYRDY     ; WAS IT REALLY THE JOPYSTICK?
F4B6| 3ØØC                                BMI     GOODTIME   ; NOPE, WHAT TIME IS IT?
F4B8| 18                                  CLC                ; TIME'S A SLIP SLIDIN AWAY
F4B9| AD D9FF                             LDA     TIMER1H    ; NOW, WHAT TIME IS IT?
F4BC| AC D8FF                             LDY     TIMER1L
F4BF| 1ØØ3                                BPL     GOODTIME   ; TIME WAS VALID!
F4C1| AD D9FF                             LDA     TIMER1H    ; HI BYTE CHANGED
F4C4| 6Ø                       GOODTIME   RTS
F4C5|
F4C5|                                     .END

--------------------------------------------------------------------------------------------
SYMBOL TABLE DUMP
--------------------------------------------------------------------------------------------

AB - Absolute      LB - Label       UD - Undefined     MC - Macro
RF - Ref           DF - Def         PR - Proc          FC - Func
PB - Public        PV - Private     CS - Consts

ALDONE1  LB FØEB | ALLDONE  LB FØE3 | ALLOFF   LB F118 | ANALOG   LB F4A8 | ANLOG1   LB F4AB |
BITSLIPM LB F3CØ | BLOCKIO  LB F479 | BUF      AB ØØ9B | CHKDRV   LB F12B | CHKDRV1  LB F12D |
CHKINT   LB F1AA | CKDRTS   LB F13D | CKSUM    AB ØØ96 | CLRPHASE LB F44A | CONWAIT  LB FØ54 |
CORRECTV LB FØC4 | COUNT    AB ØØ95 | CSSTV    AB ØØ97 | CSUM     AB ØØ89 | CSUM1    AB ØØ97 |
CURTRK   AB ØØ8C | DISKIO   PR ---- | DNIBL    LB F3ØØ | DRIVSEL  LB FØ35 | DRV1EN   AB CØ8B |
DRVERR   LB FØE8 | DRVINDX  LB F13E | DRVOEN   AB CØ8A | DRVOTRK  AB ØØ85 | DRVWAIT  LB FØ41 |
DVMOT    AB ØØEØ | ENVIRON  AB FFDF | ENVTEMP  AB ØØ9F | GOCAL    LB FØA7 | GOCAL1   LB FØA6 |
GOODTIME LB F4C4 | GOSEEK   LB F115 | GOSERV   LB F1B4 | HNDLERR  LB FØEA | HRDERRS  AB ØØ8Ø |
IBBUFP   AB ØØ85 | IBCMD    AB ØØ87 | IBDERR   AB ØØ82 | IBDRVN   AB ØØ82 | IBNODRV  AB ØØ8Ø |
IBRERR   AB ØØ83 | IBSECT   AB ØØ84 | IBSLOT   AB ØØ81 | IBSMOD   AB ØØ89 | IBSTAT   AB ØØ88 |
IBTRK    AB ØØ83 | IBWPER   AB ØØ81 | IMASK    AB ØØ8B | INTERUPT AB FFEF | IOBPDN   AB ØØ8A |
JOYRDY   AB CØ66 | LAST     AB ØØ95 | MAXTST   LB F425 | MINTST   LB F41F | MONTIMEH AB ØØ9A |
MONTIMEL AB ØØ99 | MOTOF    LB FØ52 | MOTOROFF AB CØ88 | MOTORON  AB CØ89 | MSW1     LB F458 |
MSW2     LB F461 | MSWAIT   LB F456 | MYSEEK   LB F1Ø4 | NBUF1    AB Ø2ØØ | NBUF2    AB Ø3Ø2 |
NIBL     LB F355 | NODRIVER LB FØ64 | NOWRITE  LB F2A3 | NXOFF    LB F11A | OFFTABLE LB F47Ø |
OK       LB FØ48 | ONEMEG   AB ØØ8Ø | ONTABLE  LB F467 | OUT      LB F41B | PHASEOFF AB CØ8Ø |
PHASEON  AB CØ81 | PHASON   AB CØ81 | PHSOFF   AB CØ8Ø | PNIBL1   LB F314 | PNIBL2   LB F323 |
POST1    LB F336 | POST2    LB F338 | POSTERR  LB F34C | POSTNIB1 LB F3ØF | PRENIB1  LB F2C8 |
PRENIB16 LB F2C4 | PRENIB2  LB F2E5 | PRENIB3  LB F2E2 | PRENIB4  LB F2F6 | PRIOR    AB ØØ9D |
Q6H      AB CØ8D | Q6L      AB CØ8C | Q7H      AB CØ8F | Q7L      AB CØ8E | QUIT     LB F49D |
RD1      LB F14D | RD2      LB F157 | RD3      LB F163 | RD4      LB F16E | RD5      LB F18Ø |
RD5A     LB F181 | RD6      LB F195 | RDA1     LB F1C4 | RDA2     LB F1CE | RDA3     LB F1D9 |
RDA4     LB F1E7 | RDA5     LB F1EF | RDA6     LB F2Ø1 | RDA7     LB F2ØB | RDADR16  LB F1B9 |
RDAFLD   LB F1E5 | RDASN1   LB F1C9 | RDASYN   LB F1BD | RDCKSUM  LB F1AØ | RDERR    LB F1B7 |
RDEXIT   LB F214 | RDRIGHT  LB FØAC | READ16   LB F148 | REGRWTS  LB FØØØ | RETRYCNT AB ØØ93 |
RSYNC    LB F14A | RSYNC1   LB F152 | RTTRK    LB FØCØ | SECT     AB ØØ98 | SECTABL  LB F4AØ |
SEEK     LB F4ØØ | SEEK1    LB F1Ø5 | SEEK2    LB F4ØA | SEEKCNT  AB ØØ94 | SEEKEND  LB F444 |
SEEKRTS  LB F455 | SERVICE  LB F2AA | SET1MEG  LB F34C | SETPHASE LB F448 | SETTRK   LB F125 |
SEV      LB F354 | STEP     LB F429 | STEP2    LB F42B | TEMP     AB ØØ97 | TIMER1H  AB FFD9 |
TIMER1L  AB FFD8 | TIMLATCH AB FFD9 | TRACK    AB ØØ99 | TRKCNT   AB ØØ95 | TRKN     AB ØØ9E |
TRKN1    AB ØØ99 | TRKSEC   LB F47E | TRYADR   LB FØ83 | TRYADR2  LB FØ8A | TRYTRK   LB FØ69 |
TRYTRK2  LB FØ7F | TWOMEG   AB ØØ7F | VOLUME   AB ØØ9A | VRYFRST  LB F253 | WDATA2   LB F26E |
WDATA3   LB F27E | WEXIT    LB F215 | WINTRPT  LB F24B | WMIDLE   LB F267 | WNIBL    LB F2BD |
WNIBL7   LB F2BB | WNIBL9   LB F2BA | WNTRPT1  LB F264 | WRBITSLM LB F297 | WRCKSUM  LB F292 |
WRIT     LB FØF9 | WRIT1    LB F22Ø | WRITE16  LB F216 | WRTFRST  LB F255 | WSYNC    LB F22D |

Assembly complete:      1Ø76 lines
Ø   Errors flagged on this Assembly

--------------------------------------------------------------------------------------------
65Ø2 OPCODE STATIC FREQUENCIES
--------------------------------------------------------------------------------------------

    ADC :     1  m
    AND :     8  |  *******
```

"_58.PICT" 861 KB 2001-09-10 dpi: 600h x 600v pix: 4627h x 6189v



```
ASL :    3  |  **
BCC :   1Ø  |  ********
BCS :    7  |  ******
BEQ :    8  |  *******
BIT :    3  |  **
BMI :   1Ø  |  ********
BNE :   38  |  *********************************
BPL :   28  |  ************************
BVC :    1  m
CLC :    9  |  *******
CLI :    2  |  *
CLV :    1  m
CMP :   14  |  ************
CPX :    1  m
CPY :    4  |  ***
DEC :    5  |  ****
DEX :    2  |  *
DEY :   13  |  ***********
EOR :    8  |  *******
INC :   1Ø  |  ********
INX :    2  |  *
INY :   12  |  **********
JMP :    2  |  *
JSR :   39  |  **********************************
LDA :   86  M  **************************************************************************
LDX :   12  |  **********
LDY :   18  |  ***************
LSR :    9  |  *******
NOP :   13  |  ***********
ORA :    9  |  *******
PHA :   1Ø  |  ********
PHP :    4  |  ***
PLA :   11  |  *********
PLP :    3  |  **
ROL :    7  |  ******
ROR :    6  |  *****
RTS :   16  |  **************
SBC :    2  |  *
SEC :    9  |  *******
SEI :    1  m
STA :   42  |  ************************************
STX :    1  m
STY :    3  |  **
TAX :    5  |  ****
TAY :    3  |  **
TXA :    1  m
TYA :    4  |  ***

Minimum frequency =     1
Maximum frequency =    86

Average frequency =    1Ø

Unused opcodes:

BRK  BVS  CLD  RTI  SED  TSX  TXS

Program opcode usage:  87 %
```

```
--------------------------------------------------------------------------------------------------
(1.ØØ) That's all, Folks ...
--------------------------------------------------------------------------------------------------
```



Source Code Listing

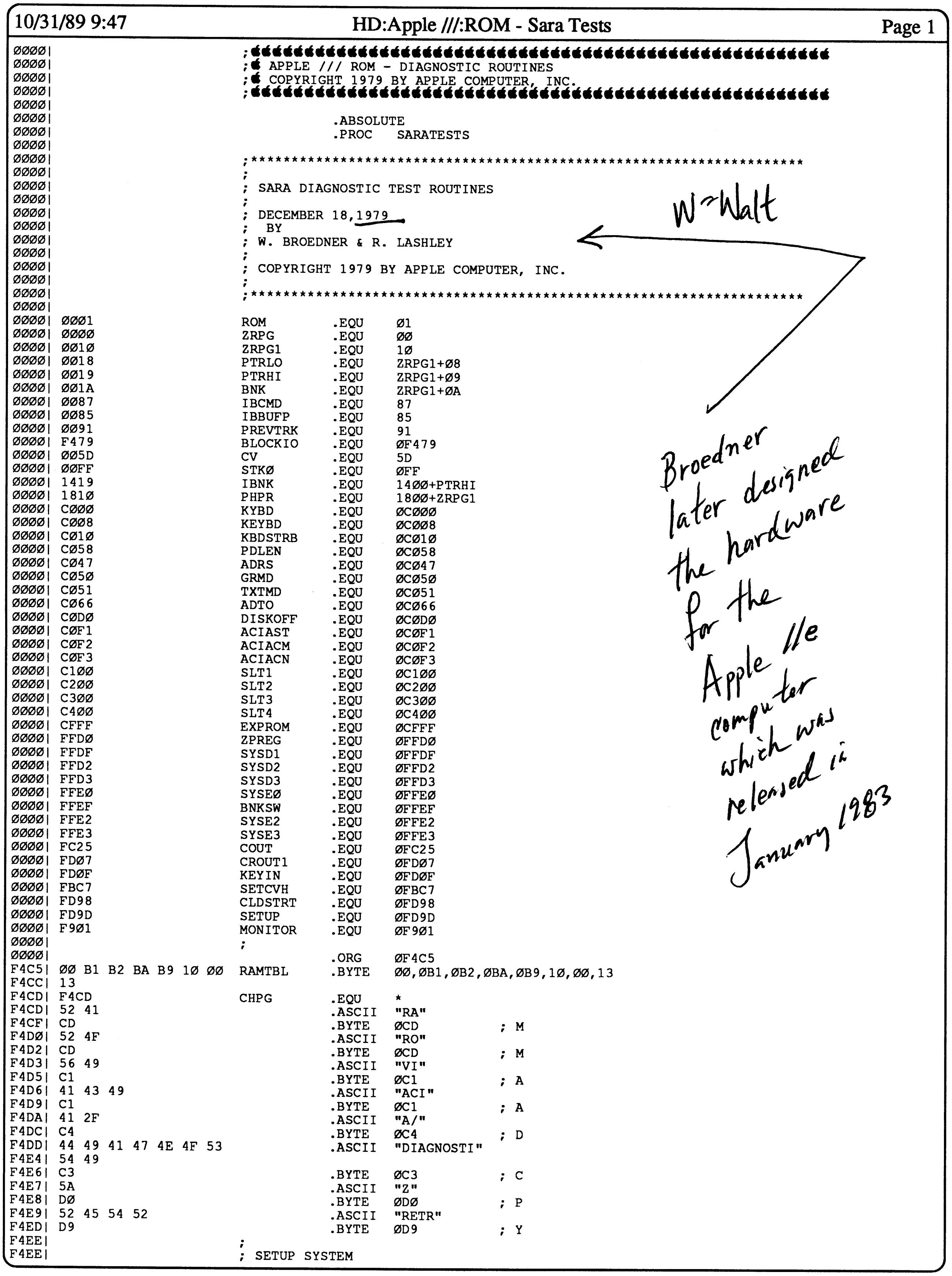
for

Apple ///

ROM Diagnostics

David T. Craig
736 Edgewater
Wichita, Kansas 67230

“_60.PICT” 645 KB 2001-09-10 dpi: 600h x 600v pix: 3835h x 5385v



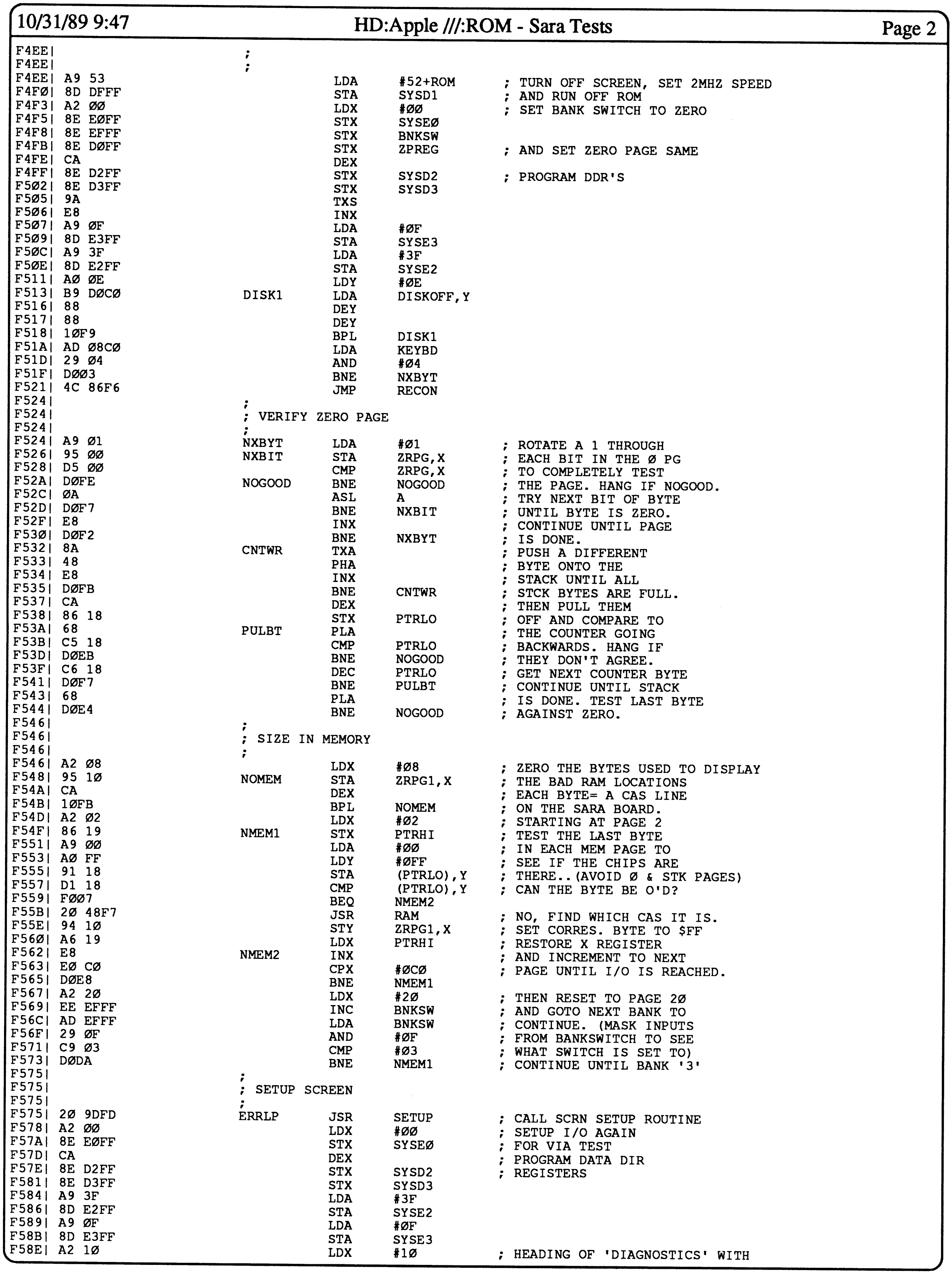
10/31/89 9:47 HD:Apple ///:ROM - Sara Tests Page 1

```
ØØØØ|                      ;
ØØØØ|                      ; APPLE /// ROM - DIAGNOSTIC ROUTINES
ØØØØ|                      ; COPYRIGHT 1979 BY APPLE COMPUTER, INC.
ØØØØ|                      ;
ØØØØ|
ØØØØ|                                   .ABSOLUTE
ØØØØ|                                   .PROC   SARATESTS
ØØØØ|
ØØØØ|                      ;********************************************************************
ØØØØ|                      ;
ØØØØ|                      ; SARA DIAGNOSTIC TEST ROUTINES
ØØØØ|                      ;
ØØØØ|                      ; DECEMBER 18,1979
ØØØØ|                      ;  BY
ØØØØ|                      ; W. BROEDNER & R. LASHLEY
ØØØØ|                      ;
ØØØØ|                      ; COPYRIGHT 1979 BY APPLE COMPUTER, INC.
ØØØØ|                      ;
ØØØØ|                      ;********************************************************************
ØØØØ|
ØØØØ| ØØØ1                 ROM          .EQU     Ø1
ØØØØ| ØØØØ                 ZRPG         .EQU     ØØ
ØØØØ| ØØ1Ø                 ZRPG1        .EQU     1Ø
ØØØØ| ØØ18                 PTRLO        .EQU     ZRPG1+Ø8
ØØØØ| ØØ19                 PTRHI        .EQU     ZRPG1+Ø9
ØØØØ| ØØ1A                 BNK          .EQU     ZRPG1+ØA
ØØØØ| ØØ87                 IBCMD        .EQU     87
ØØØØ| ØØ85                 IBBUFP       .EQU     85
ØØØØ| ØØ91                 PREVTRK      .EQU     91
ØØØØ| F479                 BLOCKIO      .EQU     ØF479
ØØØØ| ØØ5D                 CV           .EQU     5D
ØØØØ| ØØFF                 STKØ         .EQU     ØFF
ØØØØ| 1419                 IBNK         .EQU     14ØØ+PTRHI
ØØØØ| 181Ø                 PHPR         .EQU     18ØØ+ZRPG1
ØØØØ| CØØØ                 KYBD         .EQU     ØCØØØ
ØØØØ| CØØ8                 KEYBD        .EQU     ØCØØ8
ØØØØ| CØ1Ø                 KBDSTRB      .EQU     ØCØ1Ø
ØØØØ| CØ58                 PDLEN        .EQU     ØCØ58
ØØØØ| CØ47                 ADRS         .EQU     ØCØ47
ØØØØ| CØ5Ø                 GRMD         .EQU     ØCØ5Ø
ØØØØ| CØ51                 TXTMD        .EQU     ØCØ51
ØØØØ| CØ66                 ADTO         .EQU     ØCØ66
ØØØØ| CØDØ                 DISKOFF      .EQU     ØCØDØ
ØØØØ| CØF1                 ACIAST       .EQU     ØCØF1
ØØØØ| CØF2                 ACIACM       .EQU     ØCØF2
ØØØØ| CØF3                 ACIACN       .EQU     ØCØF3
ØØØØ| C1ØØ                 SLT1         .EQU     ØC1ØØ
ØØØØ| C2ØØ                 SLT2         .EQU     ØC2ØØ
ØØØØ| C3ØØ                 SLT3         .EQU     ØC3ØØ
ØØØØ| C4ØØ                 SLT4         .EQU     ØC4ØØ
ØØØØ| CFFF                 EXPROM       .EQU     ØCFFF
ØØØØ| FFDØ                 ZPREG        .EQU     ØFFDØ
ØØØØ| FFDF                 SYSD1        .EQU     ØFFDF
ØØØØ| FFD2                 SYSD2        .EQU     ØFFD2
ØØØØ| FFD3                 SYSD3        .EQU     ØFFD3
ØØØØ| FFEØ                 SYSEØ        .EQU     ØFFEØ
ØØØØ| FFEF                 BNKSW        .EQU     ØFFEF
ØØØØ| FFE2                 SYSE2        .EQU     ØFFE2
ØØØØ| FFE3                 SYSE3        .EQU     ØFFE3
ØØØØ| FC25                 COUT         .EQU     ØFC25
ØØØØ| FDØ7                 CROUT1       .EQU     ØFDØ7
ØØØØ| FDØF                 KEYIN        .EQU     ØFDØF
ØØØØ| FBC7                 SETCVH       .EQU     ØFBC7
ØØØØ| FD98                 CLDSTRT      .EQU     ØFD98
ØØØØ| FD9D                 SETUP        .EQU     ØFD9D
ØØØØ| F9Ø1                 MONITOR      .EQU     ØF9Ø1
ØØØØ|                      ;
ØØØØ|                                   .ORG     ØF4C5
F4C5| ØØ B1 B2 BA B9 1Ø ØØ RAMTBL       .BYTE    ØØ,ØB1,ØB2,ØBA,ØB9,1Ø,ØØ,13
F4CC| 13
F4CD| F4CD                 CHPG         .EQU     *
F4CD| 52 41                             .ASCII   "RA"
F4CF| CD                                .BYTE    ØCD          ; M
F4DØ| 52 4F                             .ASCII   "RO"
F4D2| CD                                .BYTE    ØCD          ; M
F4D3| 56 49                             .ASCII   "VI"
F4D5| C1                                .BYTE    ØC1          ; A
F4D6| 41 43 49                          .ASCII   "ACI"
F4D9| C1                                .BYTE    ØC1          ; A
F4DA| 41 2F                             .ASCII   "A/"
F4DC| C4                                .BYTE    ØC4          ; D
F4DD| 44 49 41 47 4E 4F 53              .ASCII   "DIAGNOSTI"
F4E4| 54 49
F4E6| C3                                .BYTE    ØC3          ; C
F4E7| 5A                                .ASCII   "Z"
F4E8| DØ                                .BYTE    ØDØ          ; P
F4E9| 52 45 54 52                       .ASCII   "RETR"
F4ED| D9                                .BYTE    ØD9          ; Y
F4EE|                      ;
F4EE|                      ; SETUP SYSTEM
```

W=Walt

Broedner later designed the hardware for the Apple //e computer which was released in January 1983

"_61.PICT" 629 KB 2001-09-10 dpi: 600h x 600v pix: 4639h x 6213v

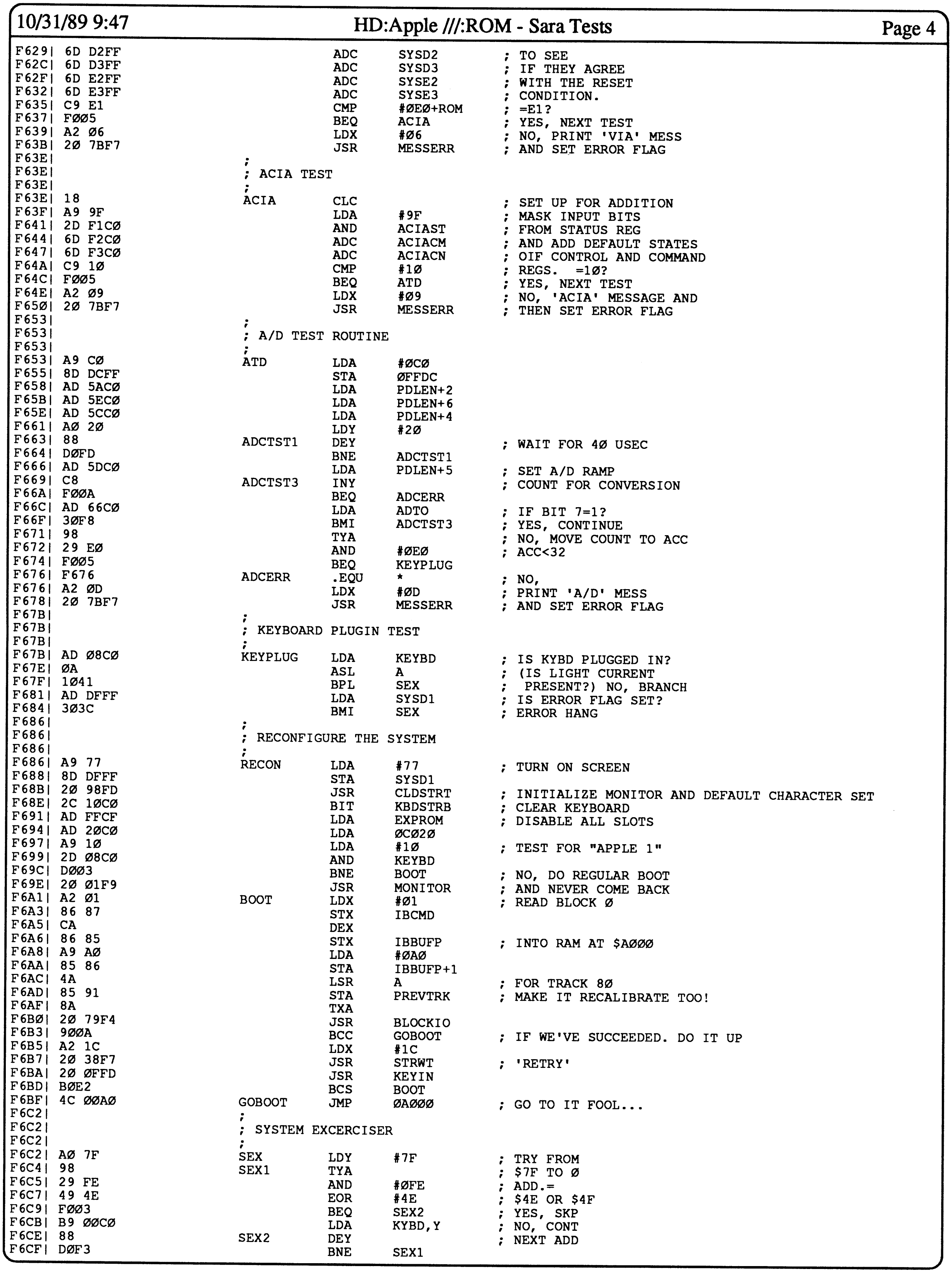


10/31/89 9:47 HD:Apple ///:ROM - Sara Tests Page 2

```
F4EE|                 ;
F4EE|                 ;
F4EE| A9 53                    LDA   #52+ROM      ; TURN OFF SCREEN, SET 2MHZ SPEED
F4FØ| 8D DFFF                  STA   SYSD1        ; AND RUN OFF ROM
F4F3| A2 ØØ                    LDX   #ØØ          ; SET BANK SWITCH TO ZERO
F4F5| 8E EØFF                  STX   SYSEØ
F4F8| 8E EFFF                  STX   BNKSW
F4FB| 8E DØFF                  STX   ZPREG        ; AND SET ZERO PAGE SAME
F4FE| CA                       DEX
F4FF| 8E D2FF                  STX   SYSD2        ; PROGRAM DDR'S
F5Ø2| 8E D3FF                  STX   SYSD3
F5Ø5| 9A                       TXS
F5Ø6| E8                       INX
F5Ø7| A9 ØF                    LDA   #ØF
F5Ø9| 8D E3FF                  STA   SYSE3
F5ØC| A9 3F                    LDA   #3F
F5ØE| 8D E2FF                  STA   SYSE2
F511| AØ ØE                    LDY   #ØE
F513| B9 DØCØ     DISK1        LDA   DISKOFF,Y
F516| 88                       DEY
F517| 88                       DEY
F518| 1ØF9                     BPL   DISK1
F51A| AD Ø8CØ                  LDA   KEYBD
F51D| 29 Ø4                    AND   #Ø4
F51F| DØØ3                     BNE   NXBYT
F521| 4C 86F6                  JMP   RECON
F524|             ;
F524|             ; VERIFY ZERO PAGE
F524|             ;
F524| A9 Ø1       NXBYT        LDA   #Ø1          ; ROTATE A 1 THROUGH
F526| 95 ØØ       NXBIT        STA   ZRPG,X       ; EACH BIT IN THE Ø PG
F528| D5 ØØ                    CMP   ZRPG,X       ; TO COMPLETELY TEST
F52A| DØFE        NOGOOD       BNE   NOGOOD       ; THE PAGE. HANG IF NOGOOD.
F52C| ØA                       ASL   A            ; TRY NEXT BIT OF BYTE
F52D| DØF7                     BNE   NXBIT        ; UNTIL BYTE IS ZERO.
F52F| E8                       INX                ; CONTINUE UNTIL PAGE
F53Ø| DØF2                     BNE   NXBYT        ; IS DONE.
F532| 8A          CNTWR        TXA                ; PUSH A DIFFERENT
F533| 48                       PHA                ; BYTE ONTO THE
F534| E8                       INX                ; STACK UNTIL ALL
F535| DØFB                     BNE   CNTWR        ; STCK BYTES ARE FULL.
F537| CA                       DEX                ; THEN PULL THEM
F538| 86 18                    STX   PTRLO        ; OFF AND COMPARE TO
F53A| 68          PULBT        PLA                ; THE COUNTER GOING
F53B| C5 18                    CMP   PTRLO        ; BACKWARDS. HANG IF
F53D| DØEB                     BNE   NOGOOD       ; THEY DON'T AGREE.
F53F| C6 18                    DEC   PTRLO        ; GET NEXT COUNTER BYTE
F541| DØF7                     BNE   PULBT        ; CONTINUE UNTIL STACK
F543| 68                       PLA                ; IS DONE. TEST LAST BYTE
F544| DØE4                     BNE   NOGOOD       ; AGAINST ZERO.
F546|             ;
F546|             ; SIZE IN MEMORY
F546|             ;
F546| A2 Ø8                    LDX   #Ø8          ; ZERO THE BYTES USED TO DISPLAY
F548| 95 1Ø       NOMEM        STA   ZRPG1,X      ; THE BAD RAM LOCATIONS
F54A| CA                       DEX                ; EACH BYTE= A CAS LINE
F54B| 1ØFB                     BPL   NOMEM        ; ON THE SARA BOARD.
F54D| A2 Ø2                    LDX   #Ø2          ; STARTING AT PAGE 2
F54F| 86 19       NMEM1        STX   PTRHI        ; TEST THE LAST BYTE
F551| A9 ØØ                    LDA   #ØØ          ; IN EACH MEM PAGE TO
F553| AØ FF                    LDY   #ØFF         ; SEE IF THE CHIPS ARE
F555| 91 18                    STA   (PTRLO),Y    ; THERE..(AVOID Ø & STK PAGES)
F557| D1 18                    CMP   (PTRLO),Y    ; CAN THE BYTE BE O'D?
F559| FØØ7                     BEQ   NMEM2
F55B| 2Ø 48F7                  JSR   RAM          ; NO, FIND WHICH CAS IT IS.
F55E| 94 1Ø                    STY   ZRPG1,X      ; SET CORRES. BYTE TO $FF
F56Ø| A6 19                    LDX   PTRHI        ; RESTORE X REGISTER
F562| E8          NMEM2        INX                ; AND INCREMENT TO NEXT
F563| EØ CØ                    CPX   #ØCØ         ; PAGE UNTIL I/O IS REACHED.
F565| DØE8                     BNE   NMEM1
F567| A2 2Ø                    LDX   #2Ø          ; THEN RESET TO PAGE 2Ø
F569| EE EFFF                  INC   BNKSW        ; AND GOTO NEXT BANK TO
F56C| AD EFFF                  LDA   BNKSW        ; CONTINUE. (MASK INPUTS
F56F| 29 ØF                    AND   #ØF          ; FROM BANKSWITCH TO SEE
F571| C9 Ø3                    CMP   #Ø3          ; WHAT SWITCH IS SET TO)
F573| DØDA                     BNE   NMEM1        ; CONTINUE UNTIL BANK '3'
F575|             ;
F575|             ; SETUP SCREEN
F575|             ;
F575| 2Ø 9DFD     ERRLP        JSR   SETUP        ; CALL SCRN SETUP ROUTINE
F578| A2 ØØ                    LDX   #ØØ          ; SETUP I/O AGAIN
F57A| 8E EØFF                  STX   SYSEØ        ; FOR VIA TEST
F57D| CA                       DEX                ; PROGRAM DATA DIR
F57E| 8E D2FF                  STX   SYSD2        ; REGISTERS
F581| 8E D3FF                  STX   SYSD3
F584| A9 3F                    LDA   #3F
F586| 8D E2FF                  STA   SYSE2
F589| A9 ØF                    LDA   #ØF
F58B| 8D E3FF                  STA   SYSE3
F58E| A2 1Ø                    LDX   #1Ø          ; HEADING OF 'DIAGNOSTICS' WITH
```

“_62.PICT” 639 KB 2001-09-10 dpi: 600h x 600v pix: 4627h x 6201v

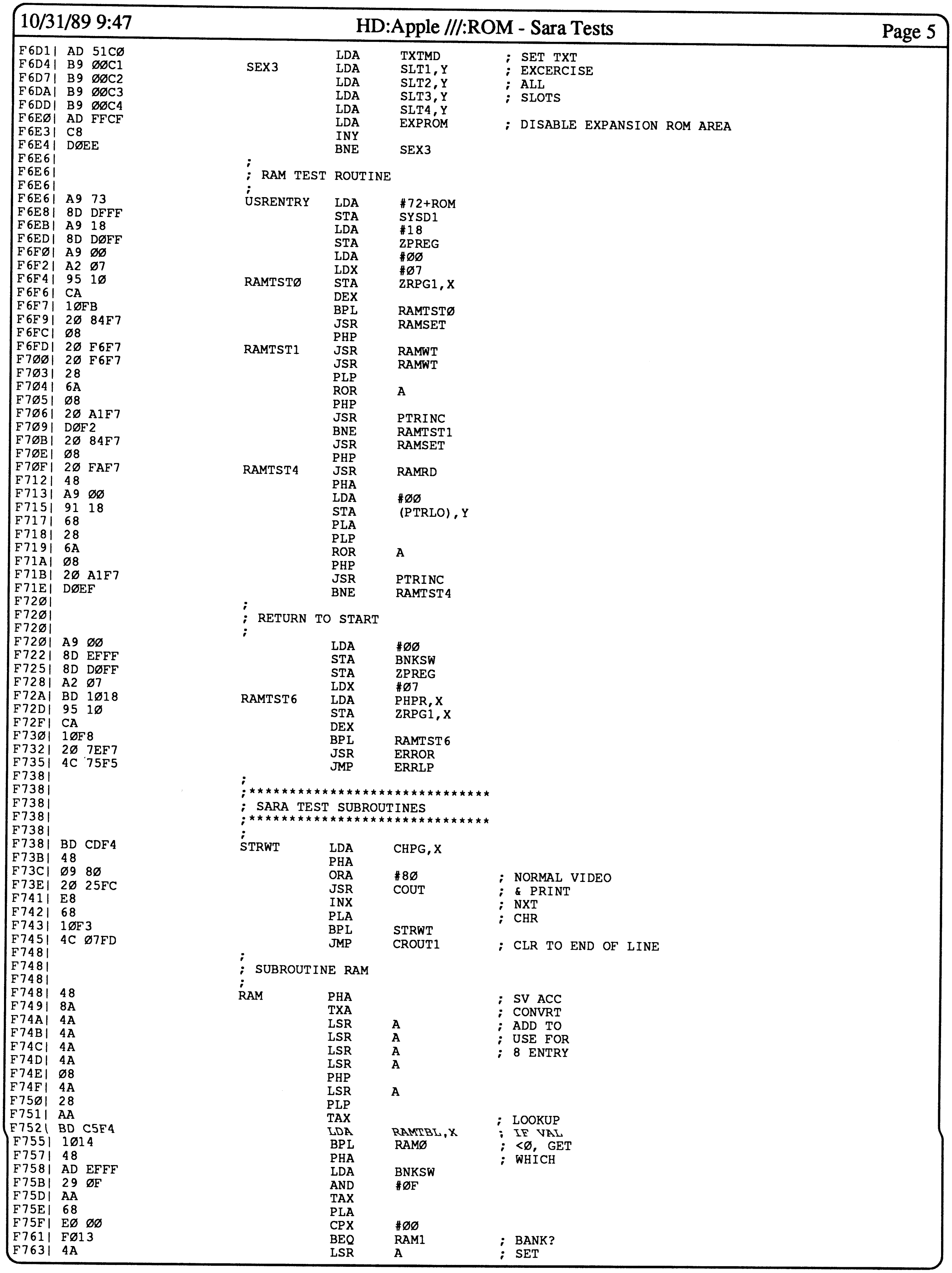
```
F59Ø| 2Ø 38F7                 JSR     STRWT       ; THIS SUBROUTINE
F593| A2 ØØ          ERRLP1   LDX     #ØØ         ; PRINT 'RAM'
F595| 86 5D                   STX     CV          ; SET CURSOR TO 2ND LINE
F597| A9 Ø4                   LDA     #Ø4         ; SPACE CURSOR OUT 3
F599| 2Ø C7FB                 JSR     SETCVH      ; (X STILL=Ø ON RETURN)
F59C| 2Ø 38F7                 JSR     STRWT       ; THE SAME SUBROUTINE
F59F| A2 Ø7                   LDX     #Ø7         ; FOR BYTES 7 - Ø IN
F5A1| F5A1           RAMWT1   .EQU    *
F5A1| B5 1Ø                   LDA     ZRPG1,X     ; OUT EACH BIT AS A
F5A3| AØ Ø8                   LDY     #Ø8         ; ' ' OR '1' FOR INDICATE BAD OR MISSING RAM
F5A5| ØA             RAMWT2   ASL     A           ; CHIPS SUBROUTINE 'RAM'        RAM
F5A6| 48                      PHA                 ; SETS UP THESE BYTES
F5A7| A9 AE                   LDA     #ØAE        ; LOAD A '.' TO ACC.
F5A9| 9ØØ2                    BCC     RAMWT4
F5AB| A9 31                   LDA     #31         ; LOAD A '1' TO ACC.
F5AD| 2Ø 25FC        RAMWT4   JSR     COUT        ; AND PRINT IT
F5BØ| 68                      PLA                 ; RESTORE BYTE
F5B1| 88                      DEY                 ; AND ROTATE ALL 8
F5B2| DØF1                    BNE     RAMWT2      ; TIMES
F5B4| 2Ø Ø7FD                 JSR     CROUT1      ; CLEAR TO END OF LINE.
F5B7| CA                      DEX
F5B8| 1ØE7                    BPL     RAMWT1
F5BA|                ;
F5BA|                ; ZPG & STK TEST
F5BA|                ;
F5BA| 9A                      TXS
F5BB| 8C EFFF                 STY     BNKSW
F5BE| 98             ZP1      TYA
F5BF| 8D DØFF                 STA     ZPREG
F5C2| 85 FF                   STA     STKØ
F5C4| C8                      INY
F5C5| 98                      TYA
F5C6| 48                      PHA
F5C7| 68                      PLA
F5C8| C8                      INY
F5C9| CØ 2Ø                   CPY     #2Ø
F5CB| DØF1                    BNE     ZP1
F5CD| AØ ØØ                   LDY     #ØØ
F5CF| 8C DØFF                 STY     ZPREG
F5D2| 86 18                   STX     PTRLO
F5D4| E8             ZP2      INX
F5D5| 86 19                   STX     PTRHI
F5D7| 8A                      TXA
F5D8| D1 18                   CMP     (PTRLO),Y
F5DA| DØØ6                    BNE     ZP3
F5DC| EØ 1F                   CPX     #1F
F5DE| DØF4                    BNE     ZP2
F5EØ| FØØ5                    BEQ     ROMTST
F5E2| F5E2           ZP3      .EQU    *           ; CHIP IS THERE, BAD ZERO AND STACK
F5E2| A2 1A                   LDX     #1A         ; SO PRINT 'ZP' MESSAGE
F5E4| 2Ø 7BF7                 JSR     MESSERR     ; & SET FLAG (2MHZ MODE)
F5E7|                ;
F5E7|                ; ROM TEST ROUTINE
F5E7|                ;
F5E7| A9 ØØ          ROMTST   LDA     #ØØ         ; SET POINTERS TO
F5E9| A8                      TAY                 ; $FØØØ
F5EA| A2 FØ                   LDX     #ØFØ
F5EC| 85 18                   STA     PTRLO
F5EE| 86 19                   STX     PTRHI       ; SET X TO $FF
F5FØ| A2 FF                   LDX     #ØFF        ; FOR WINDOWING I/O
F5F2| 51 18          ROMTST1  EOR     (PTRLO),Y   ; COMPUTE CHKSUM ON
F5F4| E4 19                   CPX     PTRHI       ; EACH ROM BYTE,
F5F6| DØØ6                    BNE     ROMTST2     ; WINDOW OUT
F5F8| CØ BF                   CPY     #ØBF        ; RANGES FFCØ-FFEF
F5FA| DØØ2                    BNE     ROMTST2
F5FC| AØ EF                   LDY     #ØEF
F5FE| C8             ROMTST2  INY
F5FF| DØF1                    BNE     ROMTST1
F6Ø1| E6 19                   INC     PTRHI
F6Ø3| DØED                    BNE     ROMTST1
F6Ø5| A8                      TAY                 ; TEST ACC. FOR Ø
F6Ø6| FØØ5                    BEQ     VIATST      ; YES, NEXT TEST
F6Ø8| A2 Ø3                   LDX     #Ø3         ; PRINT 'ROM' AND
F6ØA| 2Ø 7BF7                 JSR     MESSERR     ; SET ERROR
F6ØD|                ;
F6ØD|                ; VIA TEST ROUTINE
F6ØD|                ;
F6ØD| 18             VIATST   CLC                 ; SET UP FOR ADDING BYTES
F6ØE| D8                      CLD
F6ØF| AD EØFF                 LDA     SYSEØ       ; MASK OFF INPUT BITS
F612| 29 3F                   AND     #3F         ; AND STORE BYTE IN
F614| 85 18                   STA     PTRLO       ; TEMPOR. LOCATION
F616| AD EFFF                 LDA     BNKSW       ; MASK OFF INPUT BITS
F619| 29 4F                   AND     #4F         ; AND ADD TO STORED
F61B| 65 18                   ADC     PTRLO       ; BYTE IN TEMP. LOC.
F61D| 6D DØFF                 ADC     ZPREG       ; ADD REMAINING
F62Ø| 85 18                   STA     PTRLO       ; REGISTERS OF THE
F622| AD DFFF                 LDA     SYSD1       ; VIA'S
F625| 29 5F                   AND     #5F         ; (MASK THIS ONE)
F627| 65 18                   ADC     PTRLO       ; AND TEST
```



10/31/89 9:47 HD:Apple ///:ROM - Sara Tests Page 4

```
F629| 6D D2FF                 ADC     SYSD2         ; TO SEE
F62C| 6D D3FF                 ADC     SYSD3         ; IF THEY AGREE
F62F| 6D E2FF                 ADC     SYSE2         ; WITH THE RESET
F632| 6D E3FF                 ADC     SYSE3         ; CONDITION.
F635| C9 E1                   CMP     #ØEØ+ROM      ; =E1?
F637| FØØ5                    BEQ     ACIA          ; YES, NEXT TEST
F639| A2 Ø6                   LDX     #Ø6           ; NO, PRINT 'VIA' MESS
F63B| 2Ø 7BF7                 JSR     MESSERR       ; AND SET ERROR FLAG
F63E|                ;
F63E|                ; ACIA TEST
F63E|                ;
F63E| 18             ACIA     CLC                   ; SET UP FOR ADDITION
F63F| A9 9F                   LDA     #9F           ; MASK INPUT BITS
F641| 2D F1CØ                 AND     ACIAST        ; FROM STATUS REG
F644| 6D F2CØ                 ADC     ACIACM        ; AND ADD DEFAULT STATES
F647| 6D F3CØ                 ADC     ACIACN        ; OIF CONTROL AND COMMAND
F64A| C9 1Ø                   CMP     #1Ø           ; REGS.  =1Ø?
F64C| FØØ5                    BEQ     ATD           ; YES, NEXT TEST
F64E| A2 Ø9                   LDX     #Ø9           ; NO, 'ACIA' MESSAGE AND
F65Ø| 2Ø 7BF7                 JSR     MESSERR       ; THEN SET ERROR FLAG
F653|                ;
F653|                ; A/D TEST ROUTINE
F653|                ;
F653| A9 CØ          ATD      LDA     #ØCØ
F655| 8D DCFF                 STA     ØFFDC
F658| AD 5ACØ                 LDA     PDLEN+2
F65B| AD 5ECØ                 LDA     PDLEN+6
F65E| AD 5CCØ                 LDA     PDLEN+4
F661| AØ 2Ø                   LDY     #2Ø
F663| 88             ADCTST1  DEY                   ; WAIT FOR 4Ø USEC
F664| DØFD                    BNE     ADCTST1
F666| AD 5DCØ                 LDA     PDLEN+5       ; SET A/D RAMP
F669| C8             ADCTST3  INY                   ; COUNT FOR CONVERSION
F66A| FØØA                    BEQ     ADCERR
F66C| AD 66CØ                 LDA     ADTO          ; IF BIT 7=1?
F66F| 3ØF8                    BMI     ADCTST3       ; YES, CONTINUE
F671| 98                      TYA                   ; NO, MOVE COUNT TO ACC
F672| 29 EØ                   AND     #ØEØ          ; ACC<32
F674| FØØ5                    BEQ     KEYPLUG
F676| F676           ADCERR   .EQU    *             ; NO,
F676| A2 ØD                   LDX     #ØD           ; PRINT 'A/D' MESS
F678| 2Ø 7BF7                 JSR     MESSERR       ; AND SET ERROR FLAG
F67B|                ;
F67B|                ; KEYBOARD PLUGIN TEST
F67B|                ;
F67B| AD Ø8CØ        KEYPLUG  LDA     KEYBD         ; IS KYBD PLUGGED IN?
F67E| ØA                      ASL     A             ; (IS LIGHT CURRENT
F67F| 1Ø41                    BPL     SEX           ;  PRESENT?) NO, BRANCH
F681| AD DFFF                 LDA     SYSD1         ; IS ERROR FLAG SET?
F684| 3Ø3C                    BMI     SEX           ; ERROR HANG
F686|                ;
F686|                ; RECONFIGURE THE SYSTEM
F686|                ;
F686| A9 77          RECON    LDA     #77           ; TURN ON SCREEN
F688| 8D DFFF                 STA     SYSD1
F68B| 2Ø 98FD                 JSR     CLDSTRT       ; INITIALIZE MONITOR AND DEFAULT CHARACTER SET
F68E| 2C 1ØCØ                 BIT     KBDSTRB       ; CLEAR KEYBOARD
F691| AD FFCF                 LDA     EXPROM        ; DISABLE ALL SLOTS
F694| AD 2ØCØ                 LDA     ØCØ2Ø
F697| A9 1Ø                   LDA     #1Ø           ; TEST FOR "APPLE 1"
F699| 2D Ø8CØ                 AND     KEYBD
F69C| DØØ3                    BNE     BOOT          ; NO, DO REGULAR BOOT
F69E| 2Ø Ø1F9                 JSR     MONITOR       ; AND NEVER COME BACK
F6A1| A2 Ø1          BOOT     LDX     #Ø1           ; READ BLOCK Ø
F6A3| 86 87                   STX     IBCMD
F6A5| CA                      DEX
F6A6| 86 85                   STX     IBBUFP        ; INTO RAM AT $AØØØ
F6A8| A9 AØ                   LDA     #ØAØ
F6AA| 85 86                   STA     IBBUFP+1
F6AC| 4A                      LSR     A             ; FOR TRACK 8Ø
F6AD| 85 91                   STA     PREVTRK       ; MAKE IT RECALIBRATE TOO!
F6AF| 8A                      TXA
F6BØ| 2Ø 79F4                 JSR     BLOCKIO
F6B3| 9ØØA                    BCC     GOBOOT        ; IF WE'VE SUCCEEDED. DO IT UP
F6B5| A2 1C                   LDX     #1C
F6B7| 2Ø 38F7                 JSR     STRWT         ; 'RETRY'
F6BA| 2Ø ØFFD                 JSR     KEYIN
F6BD| BØE2                    BCS     BOOT
F6BF| 4C ØØAØ        GOBOOT   JMP     ØAØØØ         ; GO TO IT FOOL...
F6C2|                ;
F6C2|                ; SYSTEM EXCERCISER
F6C2|                ;
F6C2| AØ 7F          SEX      LDY     #7F           ; TRY FROM
F6C4| 98             SEX1     TYA                   ; $7F TO Ø
F6C5| 29 FE                   AND     #ØFE          ; ADD.=
F6C7| 49 4E                   EOR     #4E           ; $4E OR $4F
F6C9| FØØ3                    BEQ     SEX2          ; YES, SKP
F6CB| B9 ØØCØ                 LDA     KYBD,Y        ; NO, CONT
F6CE| 88             SEX2     DEY                   ; NEXT ADD
F6CF| DØF3                    BNE     SEX1
```

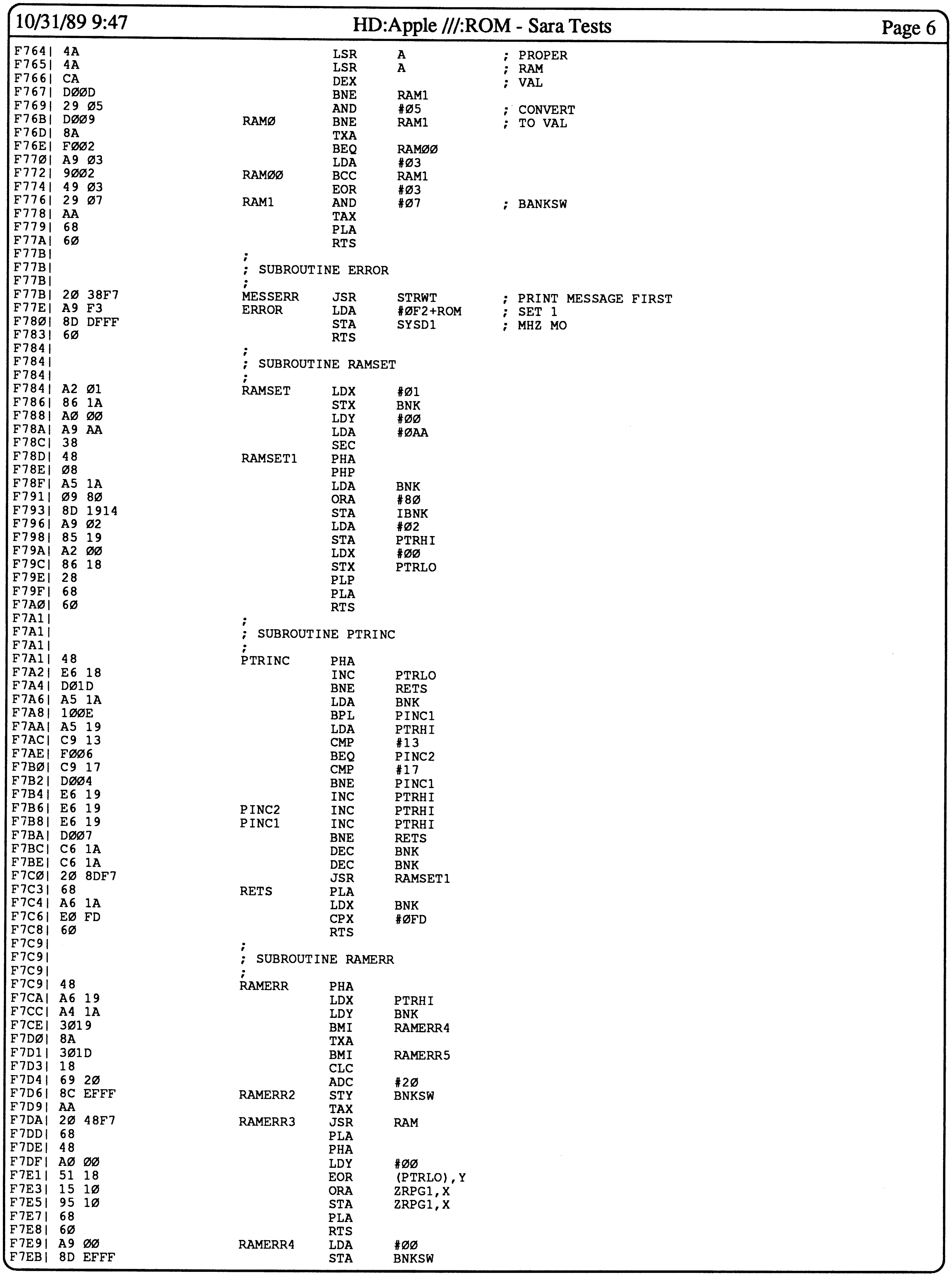
“_64.PICT” 615 KB 2001-09-10 dpi: 600h x 600v pix: 4663h x 6201v



10/31/89 9:47 HD:Apple ///:ROM - Sara Tests Page 5

```
F6D1| AD 51CØ                LDA    TXTMD        ; SET TXT
F6D4| B9 ØØC1      SEX3      LDA    SLT1,Y       ; EXCERCISE
F6D7| B9 ØØC2                LDA    SLT2,Y       ; ALL
F6DA| B9 ØØC3                LDA    SLT3,Y       ; SLOTS
F6DD| B9 ØØC4                LDA    SLT4,Y
F6EØ| AD FFCF                LDA    EXPROM       ; DISABLE EXPANSION ROM AREA
F6E3| C8                     INY
F6E4| DØEE                   BNE    SEX3
F6E6|              ;
F6E6|              ; RAM TEST ROUTINE
F6E6|              ;
F6E6| A9 73        USRENTRY  LDA    #72+ROM
F6E8| 8D DFFF                STA    SYSD1
F6EB| A9 18                  LDA    #18
F6ED| 8D DØFF                STA    ZPREG
F6FØ| A9 ØØ                  LDA    #ØØ
F6F2| A2 Ø7                  LDX    #Ø7
F6F4| 95 1Ø        RAMTSTØ   STA    ZRPG1,X
F6F6| CA                     DEX
F6F7| 1ØFB                   BPL    RAMTSTØ
F6F9| 2Ø 84F7                JSR    RAMSET
F6FC| Ø8                     PHP
F6FD| 2Ø F6F7      RAMTST1   JSR    RAMWT
F7ØØ| 2Ø F6F7                JSR    RAMWT
F7Ø3| 28                     PLP
F7Ø4| 6A                     ROR    A
F7Ø5| Ø8                     PHP
F7Ø6| 2Ø A1F7                JSR    PTRINC
F7Ø9| DØF2                   BNE    RAMTST1
F7ØB| 2Ø 84F7                JSR    RAMSET
F7ØE| Ø8                     PHP
F7ØF| 2Ø FAF7      RAMTST4   JSR    RAMRD
F712| 48                     PHA
F713| A9 ØØ                  LDA    #ØØ
F715| 91 18                  STA    (PTRLO),Y
F717| 68                     PLA
F718| 28                     PLP
F719| 6A                     ROR    A
F71A| Ø8                     PHP
F71B| 2Ø A1F7                JSR    PTRINC
F71E| DØEF                   BNE    RAMTST4
F72Ø|              ;
F72Ø|              ; RETURN TO START
F72Ø|              ;
F72Ø| A9 ØØ                  LDA    #ØØ
F722| 8D EFFF                STA    BNKSW
F725| 8D DØFF                STA    ZPREG
F728| A2 Ø7                  LDX    #Ø7
F72A| BD 1Ø18      RAMTST6   LDA    PHPR,X
F72D| 95 1Ø                  STA    ZRPG1,X
F72F| CA                     DEX
F73Ø| 1ØF8                   BPL    RAMTST6
F732| 2Ø 7EF7                JSR    ERROR
F735| 4C 75F5                JMP    ERRLP
F738|              ;
F738|              ;******************************
F738|              ; SARA TEST SUBROUTINES
F738|              ;******************************
F738|              ;
F738| BD CDF4      STRWT     LDA    CHPG,X
F73B| 48                     PHA
F73C| Ø9 8Ø                  ORA    #8Ø          ; NORMAL VIDEO
F73E| 2Ø 25FC                JSR    COUT         ; & PRINT
F741| E8                     INX                 ; NXT
F742| 68                     PLA                 ; CHR
F743| 1ØF3                   BPL    STRWT
F745| 4C Ø7FD                JMP    CROUT1       ; CLR TO END OF LINE
F748|              ;
F748|              ; SUBROUTINE RAM
F748|              ;
F748| 48           RAM       PHA                 ; SV ACC
F749| 8A                     TXA                 ; CONVRT
F74A| 4A                     LSR    A            ; ADD TO
F74B| 4A                     LSR    A            ; USE FOR
F74C| 4A                     LSR    A            ; 8 ENTRY
F74D| 4A                     LSR    A
F74E| Ø8                     PHP
F74F| 4A                     LSR    A
F75Ø| 28                     PLP
F751| AA                     TAX                 ; LOOKUP
F752| BD C5F4                LDA    RAMTBL,X     ; IF VAL
F755| 1Ø14                   BPL    RAMØ         ; <Ø, GET
F757| 48                     PHA                 ; WHICH
F758| AD EFFF                LDA    BNKSW
F75B| 29 ØF                  AND    #ØF
F75D| AA                     TAX
F75E| 68                     PLA
F75F| EØ ØØ                  CPX    #ØØ
F761| FØ13                   BEQ    RAM1         ; BANK?
F763| 4A                     LSR    A            ; SET
```

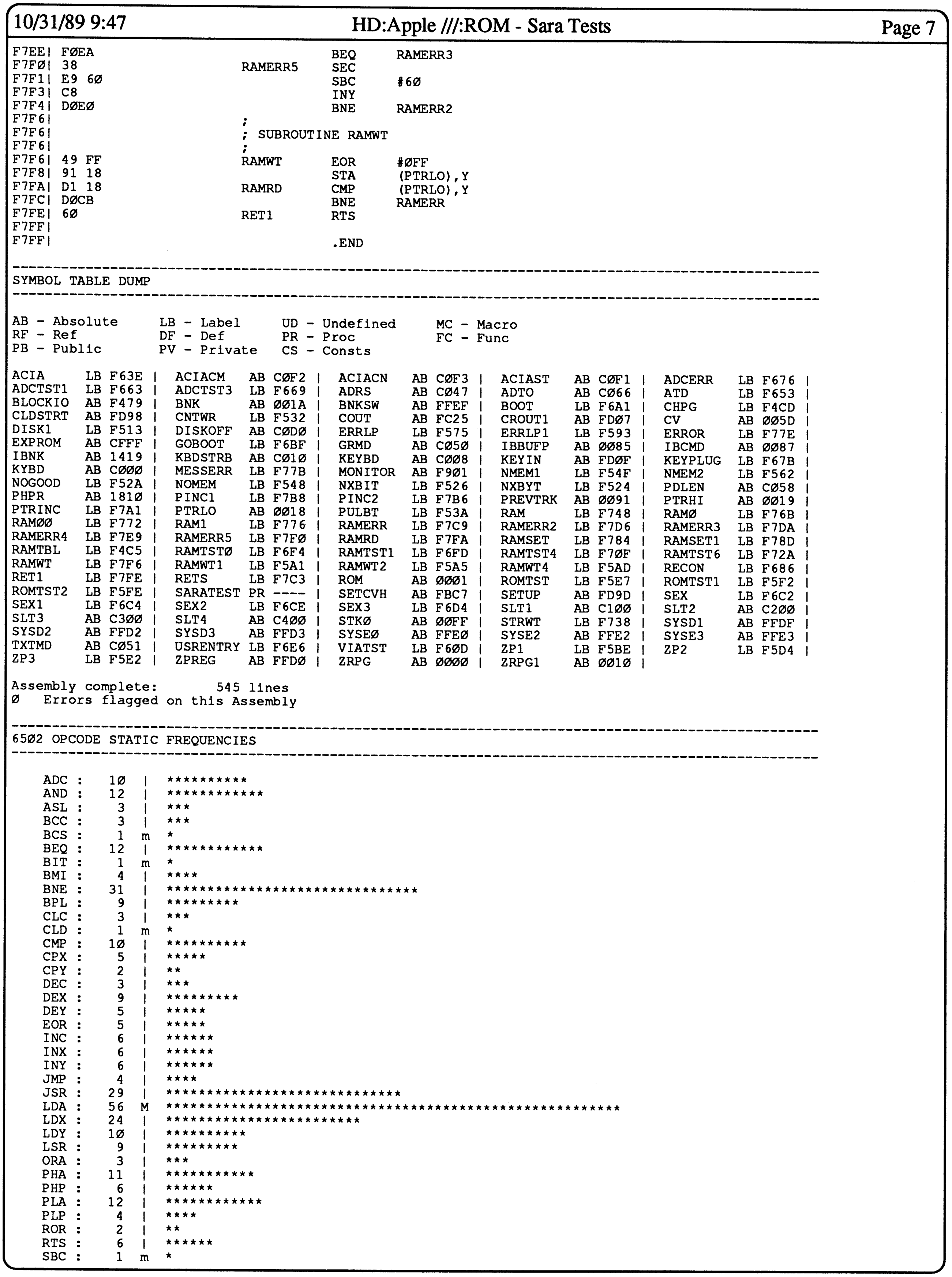
"_65.PICT" 470 KB 2001-09-10 dpi: 600h x 600v pix: 4640h x 6201v



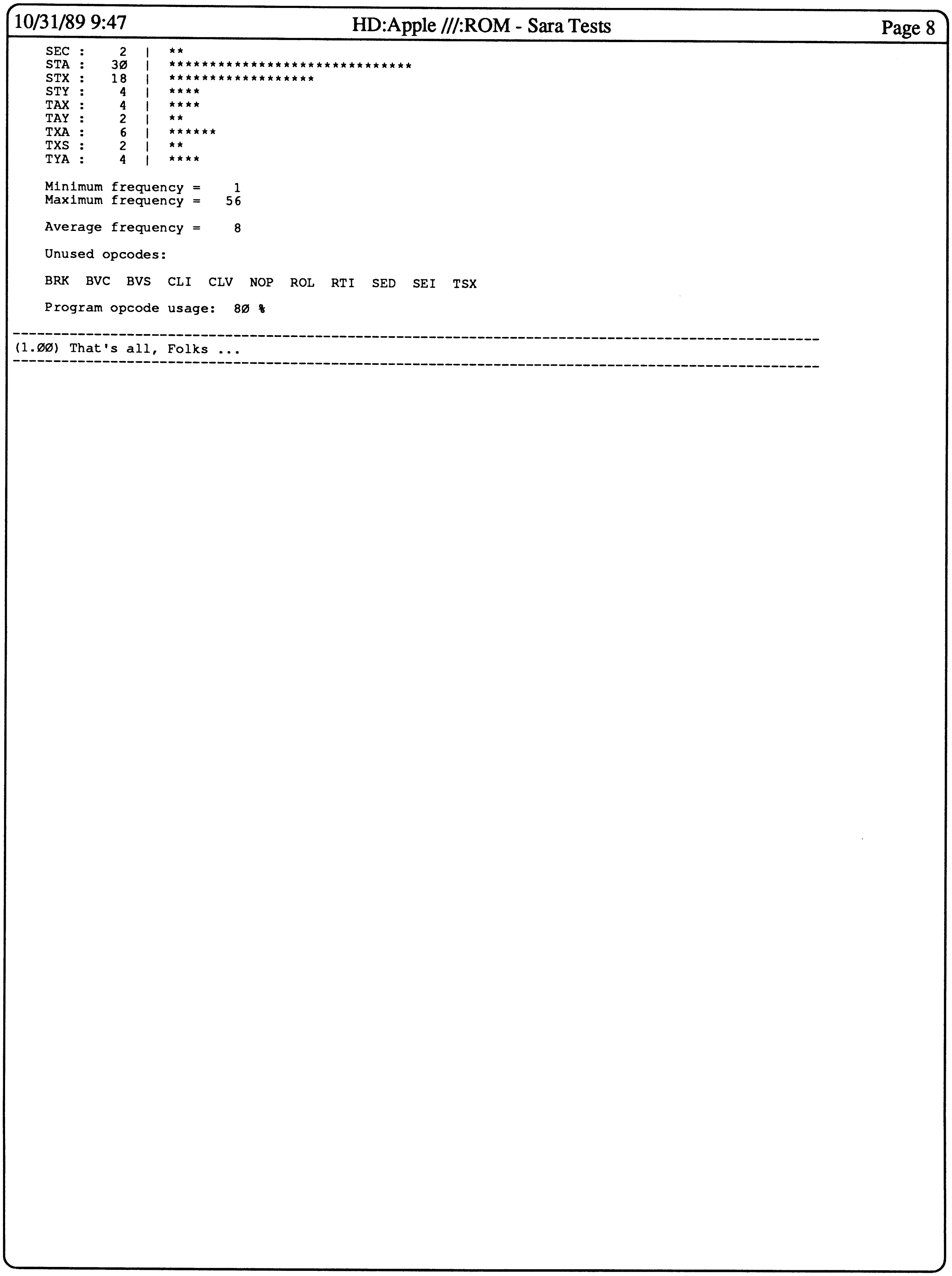
10/31/89 9:47 HD:Apple ///:ROM - Sara Tests Page 6

```
F764| 4A                   LSR    A          ; PROPER
F765| 4A                   LSR    A          ; RAM
F766| CA                   DEX               ; VAL
F767| DØØD                 BNE    RAM1
F769| 29 Ø5                AND    #Ø5        ; CONVERT
F76B| DØØ9       RAMØ      BNE    RAM1       ; TO VAL
F76D| 8A                   TXA
F76E| FØØ2                 BEQ    RAMØØ
F77Ø| A9 Ø3                LDA    #Ø3
F772| 9ØØ2       RAMØØ     BCC    RAM1
F774| 49 Ø3                EOR    #Ø3
F776| 29 Ø7      RAM1      AND    #Ø7        ; BANKSW
F778| AA                   TAX
F779| 68                   PLA
F77A| 6Ø                   RTS
F77B|            ;
F77B|            ; SUBROUTINE ERROR
F77B|            ;
F77B| 2Ø 38F7    MESSERR   JSR    STRWT      ; PRINT MESSAGE FIRST
F77E| A9 F3      ERROR     LDA    #ØF2+ROM   ; SET 1
F78Ø| 8D DFFF              STA    SYSD1      ; MHZ MO
F783| 6Ø                   RTS
F784|            ;
F784|            ; SUBROUTINE RAMSET
F784|            ;
F784| A2 Ø1      RAMSET    LDX    #Ø1
F786| 86 1A                STX    BNK
F788| AØ ØØ                LDY    #ØØ
F78A| A9 AA                LDA    #ØAA
F78C| 38                   SEC
F78D| 48         RAMSET1   PHA
F78E| Ø8                   PHP
F78F| A5 1A                LDA    BNK
F791| Ø9 8Ø                ORA    #8Ø
F793| 8D 1914              STA    IBNK
F796| A9 Ø2                LDA    #Ø2
F798| 85 19                STA    PTRHI
F79A| A2 ØØ                LDX    #ØØ
F79C| 86 18                STX    PTRLO
F79E| 28                   PLP
F79F| 68                   PLA
F7AØ| 6Ø                   RTS
F7A1|            ;
F7A1|            ; SUBROUTINE PTRINC
F7A1|            ;
F7A1| 48         PTRINC    PHA
F7A2| E6 18                INC    PTRLO
F7A4| DØ1D                 BNE    RETS
F7A6| A5 1A                LDA    BNK
F7A8| 1ØØE                 BPL    PINC1
F7AA| A5 19                LDA    PTRHI
F7AC| C9 13                CMP    #13
F7AE| FØØ6                 BEQ    PINC2
F7BØ| C9 17                CMP    #17
F7B2| DØØ4                 BNE    PINC1
F7B4| E6 19                INC    PTRHI
F7B6| E6 19      PINC2     INC    PTRHI
F7B8| E6 19      PINC1     INC    PTRHI
F7BA| DØØ7                 BNE    RETS
F7BC| C6 1A                DEC    BNK
F7BE| C6 1A                DEC    BNK
F7CØ| 2Ø 8DF7              JSR    RAMSET1
F7C3| 68         RETS      PLA
F7C4| A6 1A                LDX    BNK
F7C6| EØ FD                CPX    #ØFD
F7C8| 6Ø                   RTS
F7C9|            ;
F7C9|            ; SUBROUTINE RAMERR
F7C9|            ;
F7C9| 48         RAMERR    PHA
F7CA| A6 19                LDX    PTRHI
F7CC| A4 1A                LDY    BNK
F7CE| 3Ø19                 BMI    RAMERR4
F7DØ| 8A                   TXA
F7D1| 3Ø1D                 BMI    RAMERR5
F7D3| 18                   CLC
F7D4| 69 2Ø                ADC    #2Ø
F7D6| 8C EFFF    RAMERR2   STY    BNKSW
F7D9| AA                   TAX
F7DA| 2Ø 48F7    RAMERR3   JSR    RAM
F7DD| 68                   PLA
F7DE| 48                   PHA
F7DF| AØ ØØ                LDY    #ØØ
F7E1| 51 18                EOR    (PTRLO),Y
F7E3| 15 1Ø                ORA    ZRPG1,X
F7E5| 95 1Ø                STA    ZRPG1,X
F7E7| 68                   PLA
F7E8| 6Ø                   RTS
F7E9| A9 ØØ      RAMERR4   LDA    #ØØ
F7EB| 8D EFFF              STA    BNKSW
```

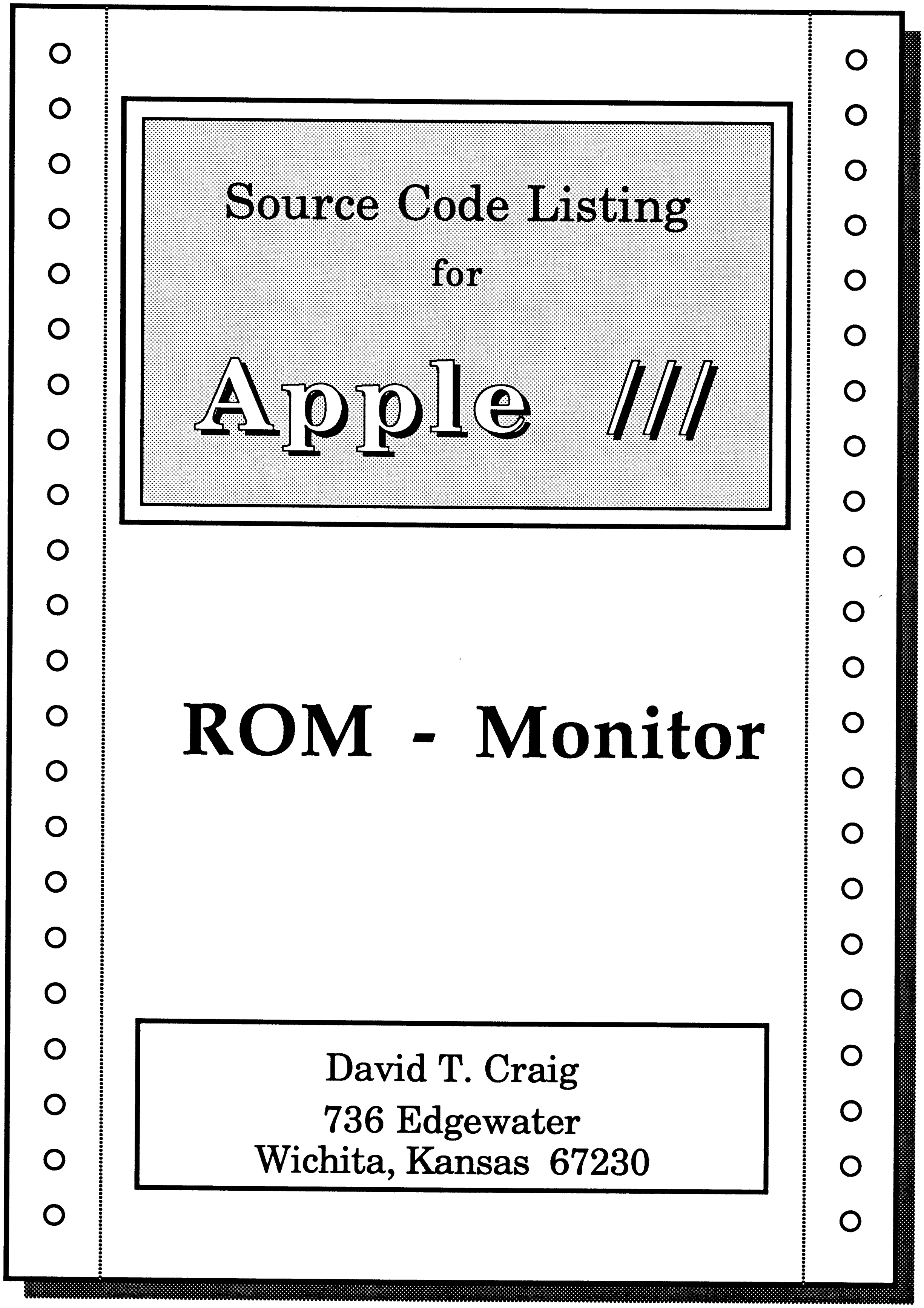
“_66.PICT” 451 KB 2001-09-10 dpi: 600h x 600v pix: 4627h x 6189v



```
F7EE| FØEA                          BEQ     RAMERR3
F7FØ| 38                RAMERR5     SEC
F7F1| E9 6Ø                         SBC     #6Ø
F7F3| C8                            INY
F7F4| DØEØ                          BNE     RAMERR2
F7F6|                   ;
F7F6|                   ; SUBROUTINE RAMWT
F7F6|                   ;
F7F6| 49 FF             RAMWT       EOR     #ØFF
F7F8| 91 18                         STA     (PTRLO),Y
F7FA| D1 18             RAMRD       CMP     (PTRLO),Y
F7FC| DØCB                          BNE     RAMERR
F7FE| 6Ø                RET1        RTS
F7FF|
F7FF|                               .END

---------------------------------------------------------------------------------------------------
SYMBOL TABLE DUMP
---------------------------------------------------------------------------------------------------

AB - Absolute      LB - Label      UD - Undefined     MC - Macro
RF - Ref           DF - Def        PR - Proc          FC - Func
PB - Public        PV - Private    CS - Consts

ACIA     LB F63E | ACIACM    AB CØF2 | ACIACN   AB CØF3 | ACIAST   AB CØF1 | ADCERR   LB F676 |
ADCTST1  LB F663 | ADCTST3   LB F669 | ADRS     AB CØ47 | ADTO     AB CØ66 | ATD      LB F653 |
BLOCKIO  AB F479 | BNK       AB ØØ1A | BNKSW    AB FFEF | BOOT     LB F6A1 | CHPG     LB F4CD |
CLDSTRT  AB FD98 | CNTWR     LB F532 | COUT     AB FC25 | CROUT1   AB FDØ7 | CV       AB ØØ5D |
DISK1    LB F513 | DISKOFF   AB CØDØ | ERRLP    LB F575 | ERRLP1   LB F593 | ERROR    LB F77E |
EXPROM   AB CFFF | GOBOOT    LB F6BF | GRMD     AB CØ5Ø | IBBUFP   AB ØØ85 | IBCMD    AB ØØ87 |
IBNK     AB 1419 | KBDSTRB   AB CØ1Ø | KEYBD    AB CØØ8 | KEYIN    AB FDØF | KEYPLUG  LB F67B |
KYBD     AB CØØØ | MESSERR   LB F77B | MONITOR  AB F9Ø1 | NMEM1    LB F54F | NMEM2    LB F562 |
NOGOOD   LB F52A | NOMEM     LB F548 | NXBIT    LB F526 | NXBYT    LB F524 | PDLEN    AB CØ58 |
PHPR     AB 181Ø | PINC1     LB F7B8 | PINC2    LB F7B6 | PREVTRK  AB ØØ91 | PTRHI    AB ØØ19 |
PTRINC   LB F7A1 | PTRLO     AB ØØ18 | PULBT    LB F53A | RAM      LB F748 | RAMØ     LB F76B |
RAMØØ    LB F772 | RAM1      LB F776 | RAMERR   LB F7C9 | RAMERR2  LB F7D6 | RAMERR3  LB F7DA |
RAMERR4  LB F7E9 | RAMERR5   LB F7FØ | RAMRD    LB F7FA | RAMSET   LB F784 | RAMSET1  LB F78D |
RAMTBL   LB F4C5 | RAMTSTØ   LB F6F4 | RAMTST1  LB F6FD | RAMTST4  LB F7ØF | RAMTST6  LB F72A |
RAMWT    LB F7F6 | RAMWT1    LB F5A1 | RAMWT2   LB F5A5 | RAMWT4   LB F5AD | RECON    LB F686 |
RET1     LB F7FE | RETS      LB F7C3 | ROM      AB ØØØ1 | ROMTST   LB F5E7 | ROMTST1  LB F5F2 |
ROMTST2  LB F5FE | SARATEST  PR ---- | SETCVH   AB FBC7 | SETUP    AB FD9D | SEX      LB F6C2 |
SEX1     LB F6C4 | SEX2      LB F6CE | SEX3     LB F6D4 | SLT1     AB C1ØØ | SLT2     AB C2ØØ |
SLT3     AB C3ØØ | SLT4      AB C4ØØ | STKØ     AB ØØFF | STRWT    LB F738 | SYSD1    AB FFDF |
SYSD2    AB FFD2 | SYSD3     AB FFD3 | SYSEØ    AB FFEØ | SYSE2    AB FFE2 | SYSE3    AB FFE3 |
TXTMD    AB CØ51 | USRENTRY  LB F6E6 | VIATST   LB F6ØD | ZP1      LB F5BE | ZP2      LB F5D4 |
ZP3      LB F5E2 | ZPREG     AB FFDØ | ZRPG     AB ØØØØ | ZRPG1    AB ØØ1Ø |

Assembly complete:       545 lines
Ø   Errors flagged on this Assembly

---------------------------------------------------------------------------------------------------
65Ø2 OPCODE STATIC FREQUENCIES
---------------------------------------------------------------------------------------------------

    ADC :   1Ø  |  **********
    AND :   12  |  ************
    ASL :    3  |  ***
    BCC :    3  |  ***
    BCS :    1  m  *
    BEQ :   12  |  ************
    BIT :    1  m  *
    BMI :    4  |  ****
    BNE :   31  |  *******************************
    BPL :    9  |  *********
    CLC :    3  |  ***
    CLD :    1  m  *
    CMP :   1Ø  |  **********
    CPX :    5  |  *****
    CPY :    2  |  **
    DEC :    3  |  ***
    DEX :    9  |  *********
    DEY :    5  |  *****
    EOR :    5  |  *****
    INC :    6  |  ******
    INX :    6  |  ******
    INY :    6  |  ******
    JMP :    4  |  ****
    JSR :   29  |  *****************************
    LDA :   56  M  ********************************************************
    LDX :   24  |  ************************
    LDY :   1Ø  |  **********
    LSR :    9  |  *********
    ORA :    3  |  ***
    PHA :   11  |  ***********
    PHP :    6  |  ******
    PLA :   12  |  ************
    PLP :    4  |  ****
    ROR :    2  |  **
    RTS :    6  |  ******
    SBC :    1  m  *
```



```
    SEC :    2  |  **
    STA :   3Ø  |  ******************************
    STX :   18  |  ******************
    STY :    4  |  ****
    TAX :    4  |  ****
    TAY :    2  |  **
    TXA :    6  |  ******
    TXS :    2  |  **
    TYA :    4  |  ****

    Minimum frequency =    1
    Maximum frequency =   56

    Average frequency =    8

    Unused opcodes:

    BRK  BVC  BVS  CLI  CLV  NOP  ROL  RTI  SED  SEI  TSX

    Program opcode usage:  8Ø %

--------------------------------------------------------------------------------------------------
(1.ØØ) That's all, Folks ...
--------------------------------------------------------------------------------------------------
```

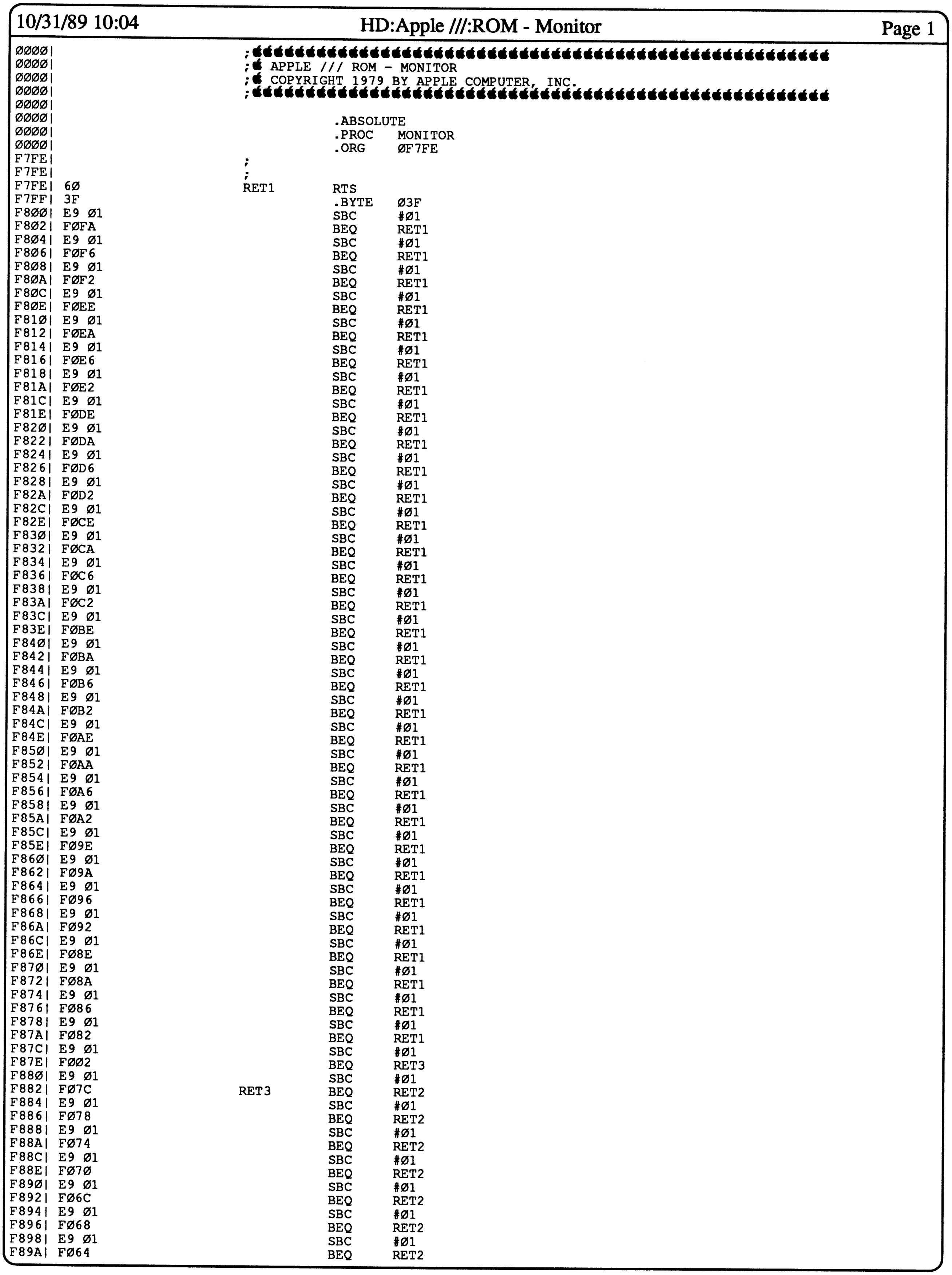


# Source Code Listing
for
Apple ///

ROM - Monitor

David T. Craig
736 Edgewater
Wichita, Kansas 67230

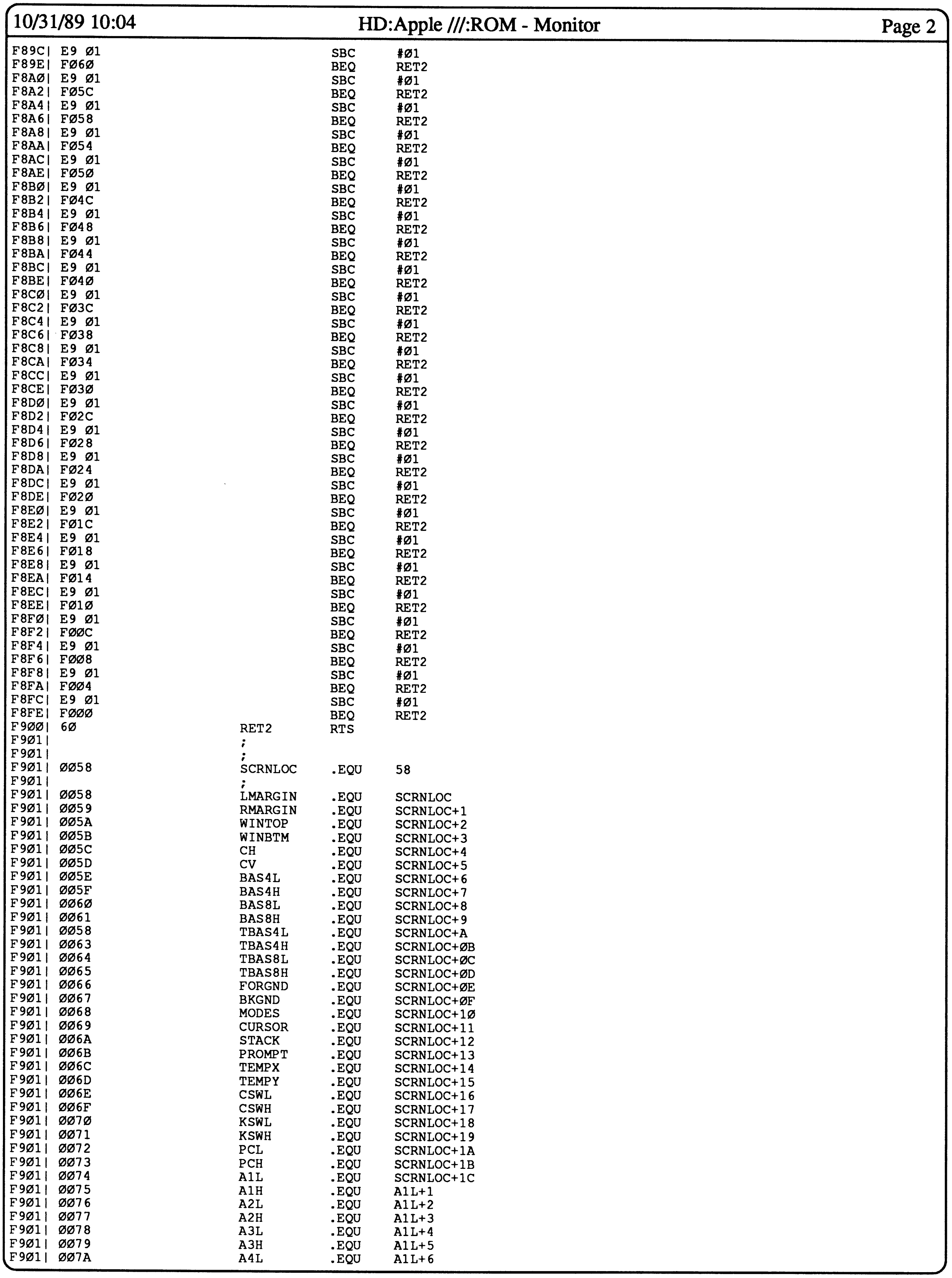
"_69.PICT" 647 KB 2001-09-10 dpi: 600h x 600v pix: 3847h x 5408v



10/31/89 10:04 HD:Apple ///:ROM - Monitor Page 1

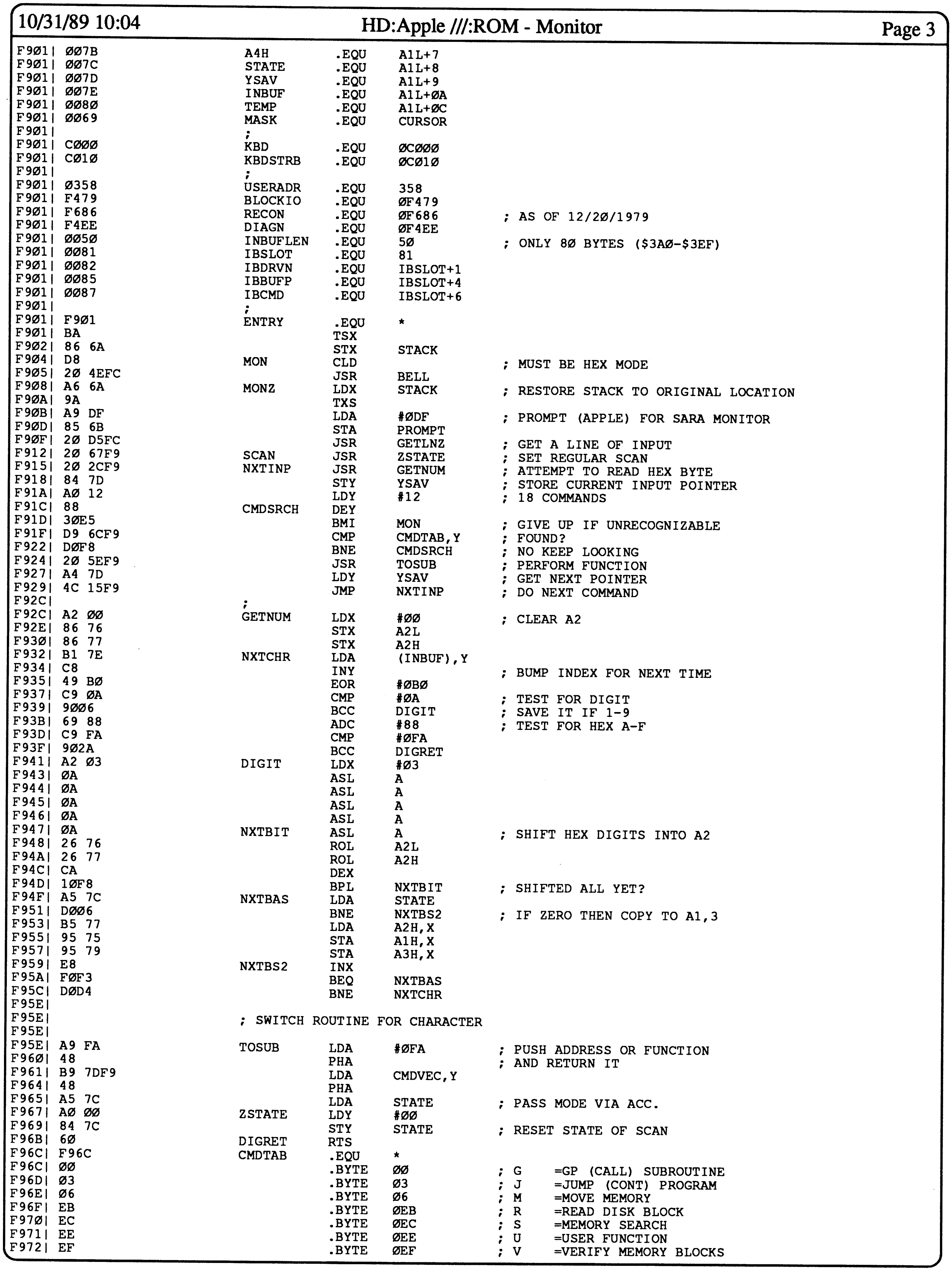
```
ØØØØ|                    ;
ØØØØ|                    ; APPLE /// ROM - MONITOR
ØØØØ|                    ; COPYRIGHT 1979 BY APPLE COMPUTER, INC.
ØØØØ|                    ;
ØØØØ|
ØØØØ|                             .ABSOLUTE
ØØØØ|                             .PROC    MONITOR
ØØØØ|                             .ORG     ØF7FE
F7FE|                    ;
F7FE|                    ;
F7FE| 6Ø                 RET1     RTS
F7FF| 3F                          .BYTE    Ø3F
F8ØØ| E9 Ø1                       SBC      #Ø1
F8Ø2| FØFA                        BEQ      RET1
F8Ø4| E9 Ø1                       SBC      #Ø1
F8Ø6| FØF6                        BEQ      RET1
F8Ø8| E9 Ø1                       SBC      #Ø1
F8ØA| FØF2                        BEQ      RET1
F8ØC| E9 Ø1                       SBC      #Ø1
F8ØE| FØEE                        BEQ      RET1
F81Ø| E9 Ø1                       SBC      #Ø1
F812| FØEA                        BEQ      RET1
F814| E9 Ø1                       SBC      #Ø1
F816| FØE6                        BEQ      RET1
F818| E9 Ø1                       SBC      #Ø1
F81A| FØE2                        BEQ      RET1
F81C| E9 Ø1                       SBC      #Ø1
F81E| FØDE                        BEQ      RET1
F82Ø| E9 Ø1                       SBC      #Ø1
F822| FØDA                        BEQ      RET1
F824| E9 Ø1                       SBC      #Ø1
F826| FØD6                        BEQ      RET1
F828| E9 Ø1                       SBC      #Ø1
F82A| FØD2                        BEQ      RET1
F82C| E9 Ø1                       SBC      #Ø1
F82E| FØCE                        BEQ      RET1
F83Ø| E9 Ø1                       SBC      #Ø1
F832| FØCA                        BEQ      RET1
F834| E9 Ø1                       SBC      #Ø1
F836| FØC6                        BEQ      RET1
F838| E9 Ø1                       SBC      #Ø1
F83A| FØC2                        BEQ      RET1
F83C| E9 Ø1                       SBC      #Ø1
F83E| FØBE                        BEQ      RET1
F84Ø| E9 Ø1                       SBC      #Ø1
F842| FØBA                        BEQ      RET1
F844| E9 Ø1                       SBC      #Ø1
F846| FØB6                        BEQ      RET1
F848| E9 Ø1                       SBC      #Ø1
F84A| FØB2                        BEQ      RET1
F84C| E9 Ø1                       SBC      #Ø1
F84E| FØAE                        BEQ      RET1
F85Ø| E9 Ø1                       SBC      #Ø1
F852| FØAA                        BEQ      RET1
F854| E9 Ø1                       SBC      #Ø1
F856| FØA6                        BEQ      RET1
F858| E9 Ø1                       SBC      #Ø1
F85A| FØA2                        BEQ      RET1
F85C| E9 Ø1                       SBC      #Ø1
F85E| FØ9E                        BEQ      RET1
F86Ø| E9 Ø1                       SBC      #Ø1
F862| FØ9A                        BEQ      RET1
F864| E9 Ø1                       SBC      #Ø1
F866| FØ96                        BEQ      RET1
F868| E9 Ø1                       SBC      #Ø1
F86A| FØ92                        BEQ      RET1
F86C| E9 Ø1                       SBC      #Ø1
F86E| FØ8E                        BEQ      RET1
F87Ø| E9 Ø1                       SBC      #Ø1
F872| FØ8A                        BEQ      RET1
F874| E9 Ø1                       SBC      #Ø1
F876| FØ86                        BEQ      RET1
F878| E9 Ø1                       SBC      #Ø1
F87A| FØ82                        BEQ      RET1
F87C| E9 Ø1                       SBC      #Ø1
F87E| FØØ2                        BEQ      RET3
F88Ø| E9 Ø1                       SBC      #Ø1
F882| FØ7C               RET3     BEQ      RET2
F884| E9 Ø1                       SBC      #Ø1
F886| FØ78                        BEQ      RET2
F888| E9 Ø1                       SBC      #Ø1
F88A| FØ74                        BEQ      RET2
F88C| E9 Ø1                       SBC      #Ø1
F88E| FØ7Ø                        BEQ      RET2
F89Ø| E9 Ø1                       SBC      #Ø1
F892| FØ6C                        BEQ      RET2
F894| E9 Ø1                       SBC      #Ø1
F896| FØ68                        BEQ      RET2
F898| E9 Ø1                       SBC      #Ø1
F89A| FØ64                        BEQ      RET2
```

“_70.PICT” 480 KB 2001-09-10 dpi: 600h x 600v pix: 4639h x 6189v



```
F89C| E9 Ø1                          SBC     #Ø1
F89E| FØ6Ø                           BEQ     RET2
F8AØ| E9 Ø1                          SBC     #Ø1
F8A2| FØ5C                           BEQ     RET2
F8A4| E9 Ø1                          SBC     #Ø1
F8A6| FØ58                           BEQ     RET2
F8A8| E9 Ø1                          SBC     #Ø1
F8AA| FØ54                           BEQ     RET2
F8AC| E9 Ø1                          SBC     #Ø1
F8AE| FØ5Ø                           BEQ     RET2
F8BØ| E9 Ø1                          SBC     #Ø1
F8B2| FØ4C                           BEQ     RET2
F8B4| E9 Ø1                          SBC     #Ø1
F8B6| FØ48                           BEQ     RET2
F8B8| E9 Ø1                          SBC     #Ø1
F8BA| FØ44                           BEQ     RET2
F8BC| E9 Ø1                          SBC     #Ø1
F8BE| FØ4Ø                           BEQ     RET2
F8CØ| E9 Ø1                          SBC     #Ø1
F8C2| FØ3C                           BEQ     RET2
F8C4| E9 Ø1                          SBC     #Ø1
F8C6| FØ38                           BEQ     RET2
F8C8| E9 Ø1                          SBC     #Ø1
F8CA| FØ34                           BEQ     RET2
F8CC| E9 Ø1                          SBC     #Ø1
F8CE| FØ3Ø                           BEQ     RET2
F8DØ| E9 Ø1                          SBC     #Ø1
F8D2| FØ2C                           BEQ     RET2
F8D4| E9 Ø1                          SBC     #Ø1
F8D6| FØ28                           BEQ     RET2
F8D8| E9 Ø1                          SBC     #Ø1
F8DA| FØ24                           BEQ     RET2
F8DC| E9 Ø1                          SBC     #Ø1
F8DE| FØ2Ø                           BEQ     RET2
F8EØ| E9 Ø1                          SBC     #Ø1
F8E2| FØ1C                           BEQ     RET2
F8E4| E9 Ø1                          SBC     #Ø1
F8E6| FØ18                           BEQ     RET2
F8E8| E9 Ø1                          SBC     #Ø1
F8EA| FØ14                           BEQ     RET2
F8EC| E9 Ø1                          SBC     #Ø1
F8EE| FØ1Ø                           BEQ     RET2
F8FØ| E9 Ø1                          SBC     #Ø1
F8F2| FØØC                           BEQ     RET2
F8F4| E9 Ø1                          SBC     #Ø1
F8F6| FØØ8                           BEQ     RET2
F8F8| E9 Ø1                          SBC     #Ø1
F8FA| FØØ4                           BEQ     RET2
F8FC| E9 Ø1                          SBC     #Ø1
F8FE| FØØØ                           BEQ     RET2
F9ØØ| 6Ø                   RET2      RTS
F9Ø1|                      ;
F9Ø1|                      ;
F9Ø1| ØØ58                 SCRNLOC   .EQU    58
F9Ø1|                      ;
F9Ø1| ØØ58                 LMARGIN   .EQU    SCRNLOC
F9Ø1| ØØ59                 RMARGIN   .EQU    SCRNLOC+1
F9Ø1| ØØ5A                 WINTOP    .EQU    SCRNLOC+2
F9Ø1| ØØ5B                 WINBTM    .EQU    SCRNLOC+3
F9Ø1| ØØ5C                 CH        .EQU    SCRNLOC+4
F9Ø1| ØØ5D                 CV        .EQU    SCRNLOC+5
F9Ø1| ØØ5E                 BAS4L     .EQU    SCRNLOC+6
F9Ø1| ØØ5F                 BAS4H     .EQU    SCRNLOC+7
F9Ø1| ØØ6Ø                 BAS8L     .EQU    SCRNLOC+8
F9Ø1| ØØ61                 BAS8H     .EQU    SCRNLOC+9
F9Ø1| ØØ58                 TBAS4L    .EQU    SCRNLOC+A
F9Ø1| ØØ63                 TBAS4H    .EQU    SCRNLOC+ØB
F9Ø1| ØØ64                 TBAS8L    .EQU    SCRNLOC+ØC
F9Ø1| ØØ65                 TBAS8H    .EQU    SCRNLOC+ØD
F9Ø1| ØØ66                 FORGND    .EQU    SCRNLOC+ØE
F9Ø1| ØØ67                 BKGND     .EQU    SCRNLOC+ØF
F9Ø1| ØØ68                 MODES     .EQU    SCRNLOC+1Ø
F9Ø1| ØØ69                 CURSOR    .EQU    SCRNLOC+11
F9Ø1| ØØ6A                 STACK     .EQU    SCRNLOC+12
F9Ø1| ØØ6B                 PROMPT    .EQU    SCRNLOC+13
F9Ø1| ØØ6C                 TEMPX     .EQU    SCRNLOC+14
F9Ø1| ØØ6D                 TEMPY     .EQU    SCRNLOC+15
F9Ø1| ØØ6E                 CSWL      .EQU    SCRNLOC+16
F9Ø1| ØØ6F                 CSWH      .EQU    SCRNLOC+17
F9Ø1| ØØ7Ø                 KSWL      .EQU    SCRNLOC+18
F9Ø1| ØØ71                 KSWH      .EQU    SCRNLOC+19
F9Ø1| ØØ72                 PCL       .EQU    SCRNLOC+1A
F9Ø1| ØØ73                 PCH       .EQU    SCRNLOC+1B
F9Ø1| ØØ74                 A1L       .EQU    SCRNLOC+1C
F9Ø1| ØØ75                 A1H       .EQU    A1L+1
F9Ø1| ØØ76                 A2L       .EQU    A1L+2
F9Ø1| ØØ77                 A2H       .EQU    A1L+3
F9Ø1| ØØ78                 A3L       .EQU    A1L+4
F9Ø1| ØØ79                 A3H       .EQU    A1L+5
F9Ø1| ØØ7A                 A4L       .EQU    A1L+6
```

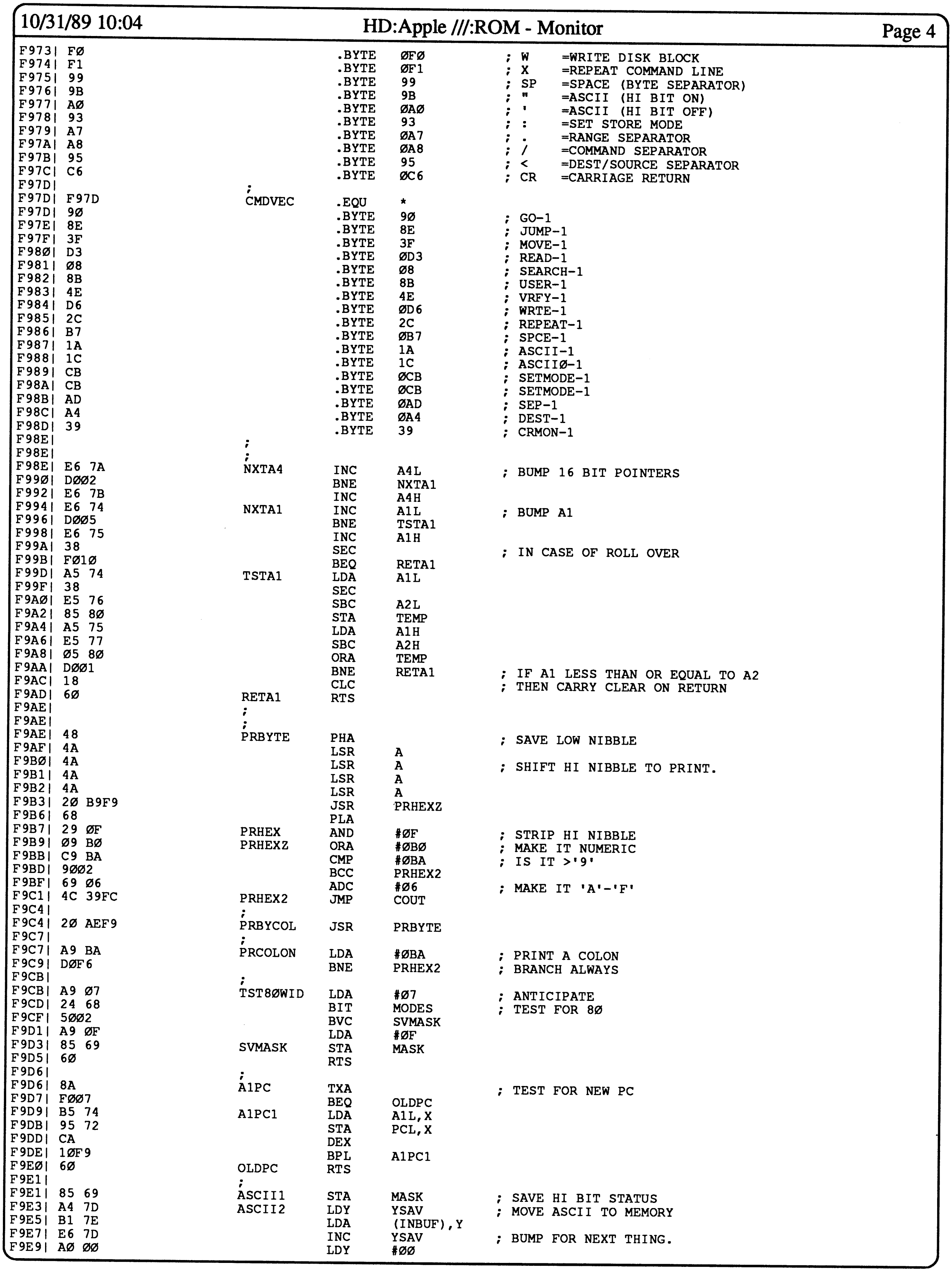
"_71.PICT" 516 KB 2001-09-10 dpi: 600h x 600v pix: 4651h x 6178v



10/31/89 10:04 HD:Apple ///:ROM - Monitor Page 3

```
F9Ø1| ØØ7B            A4H        .EQU     A1L+7
F9Ø1| ØØ7C            STATE      .EQU     A1L+8
F9Ø1| ØØ7D            YSAV       .EQU     A1L+9
F9Ø1| ØØ7E            INBUF      .EQU     A1L+ØA
F9Ø1| ØØ8Ø            TEMP       .EQU     A1L+ØC
F9Ø1| ØØ69            MASK       .EQU     CURSOR
F9Ø1|                 ;
F9Ø1| CØØØ            KBD        .EQU     ØCØØØ
F9Ø1| CØ1Ø            KBDSTRB    .EQU     ØCØ1Ø
F9Ø1|                 ;
F9Ø1| Ø358            USERADR    .EQU     358
F9Ø1| F479            BLOCKIO    .EQU     ØF479
F9Ø1| F686            RECON      .EQU     ØF686           ; AS OF 12/2Ø/1979
F9Ø1| F4EE            DIAGN      .EQU     ØF4EE
F9Ø1| ØØ5Ø            INBUFLEN   .EQU     5Ø              ; ONLY 8Ø BYTES ($3AØ-$3EF)
F9Ø1| ØØ81            IBSLOT     .EQU     81
F9Ø1| ØØ82            IBDRVN     .EQU     IBSLOT+1
F9Ø1| ØØ85            IBBUFP     .EQU     IBSLOT+4
F9Ø1| ØØ87            IBCMD      .EQU     IBSLOT+6
F9Ø1|                 ;
F9Ø1| F9Ø1            ENTRY      .EQU     *
F9Ø1| BA                         TSX
F9Ø2| 86 6A                      STX      STACK
F9Ø4| D8              MON        CLD                      ; MUST BE HEX MODE
F9Ø5| 2Ø 4EFC                    JSR      BELL
F9Ø8| A6 6A           MONZ       LDX      STACK           ; RESTORE STACK TO ORIGINAL LOCATION
F9ØA| 9A                         TXS
F9ØB| A9 DF                      LDA      #ØDF            ; PROMPT (APPLE) FOR SARA MONITOR
F9ØD| 85 6B                      STA      PROMPT
F9ØF| 2Ø D5FC                    JSR      GETLNZ          ; GET A LINE OF INPUT
F912| 2Ø 67F9         SCAN       JSR      ZSTATE          ; SET REGULAR SCAN
F915| 2Ø 2CF9         NXTINP     JSR      GETNUM          ; ATTEMPT TO READ HEX BYTE
F918| 84 7D                      STY      YSAV            ; STORE CURRENT INPUT POINTER
F91A| AØ 12                      LDY      #12             ; 18 COMMANDS
F91C| 88              CMDSRCH    DEY
F91D| 3ØE5                       BMI      MON             ; GIVE UP IF UNRECOGNIZABLE
F91F| D9 6CF9                    CMP      CMDTAB,Y        ; FOUND?
F922| DØF8                       BNE      CMDSRCH         ; NO KEEP LOOKING
F924| 2Ø 5EF9                    JSR      TOSUB           ; PERFORM FUNCTION
F927| A4 7D                      LDY      YSAV            ; GET NEXT POINTER
F929| 4C 15F9                    JMP      NXTINP          ; DO NEXT COMMAND
F92C|                 ;
F92C| A2 ØØ           GETNUM     LDX      #ØØ             ; CLEAR A2
F92E| 86 76                      STX      A2L
F93Ø| 86 77                      STX      A2H
F932| B1 7E           NXTCHR     LDA      (INBUF),Y
F934| C8                         INY                      ; BUMP INDEX FOR NEXT TIME
F935| 49 BØ                      EOR      #ØBØ
F937| C9 ØA                      CMP      #ØA             ; TEST FOR DIGIT
F939| 9ØØ6                       BCC      DIGIT           ; SAVE IT IF 1-9
F93B| 69 88                      ADC      #88             ; TEST FOR HEX A-F
F93D| C9 FA                      CMP      #ØFA
F93F| 9Ø2A                       BCC      DIGRET
F941| A2 Ø3           DIGIT      LDX      #Ø3
F943| ØA                         ASL      A
F944| ØA                         ASL      A
F945| ØA                         ASL      A
F946| ØA                         ASL      A
F947| ØA              NXTBIT     ASL      A               ; SHIFT HEX DIGITS INTO A2
F948| 26 76                      ROL      A2L
F94A| 26 77                      ROL      A2H
F94C| CA                         DEX
F94D| 1ØF8                       BPL      NXTBIT          ; SHIFTED ALL YET?
F94F| A5 7C           NXTBAS     LDA      STATE
F951| DØØ6                       BNE      NXTBS2          ; IF ZERO THEN COPY TO A1,3
F953| B5 77                      LDA      A2H,X
F955| 95 75                      STA      A1H,X
F957| 95 79                      STA      A3H,X
F959| E8              NXTBS2     INX
F95A| FØF3                       BEQ      NXTBAS
F95C| DØD4                       BNE      NXTCHR
F95E|
F95E|                 ; SWITCH ROUTINE FOR CHARACTER
F95E|
F95E| A9 FA           TOSUB      LDA      #ØFA            ; PUSH ADDRESS OR FUNCTION
F96Ø| 48                         PHA                      ; AND RETURN IT
F961| B9 7DF9                    LDA      CMDVEC,Y
F964| 48                         PHA
F965| A5 7C                      LDA      STATE           ; PASS MODE VIA ACC.
F967| AØ ØØ           ZSTATE     LDY      #ØØ
F969| 84 7C                      STY      STATE           ; RESET STATE OF SCAN
F96B| 6Ø              DIGRET     RTS
F96C| F96C            CMDTAB     .EQU     *
F96C| ØØ                         .BYTE    ØØ              ; G    =GP (CALL) SUBROUTINE
F96D| Ø3                         .BYTE    Ø3              ; J    =JUMP (CONT) PROGRAM
F96E| Ø6                         .BYTE    Ø6              ; M    =MOVE MEMORY
F96F| EB                         .BYTE    ØEB             ; R    =READ DISK BLOCK
F97Ø| EC                         .BYTE    ØEC             ; S    =MEMORY SEARCH
F971| EE                         .BYTE    ØEE             ; U    =USER FUNCTION
F972| EF                         .BYTE    ØEF             ; V    =VERIFY MEMORY BLOCKS
```

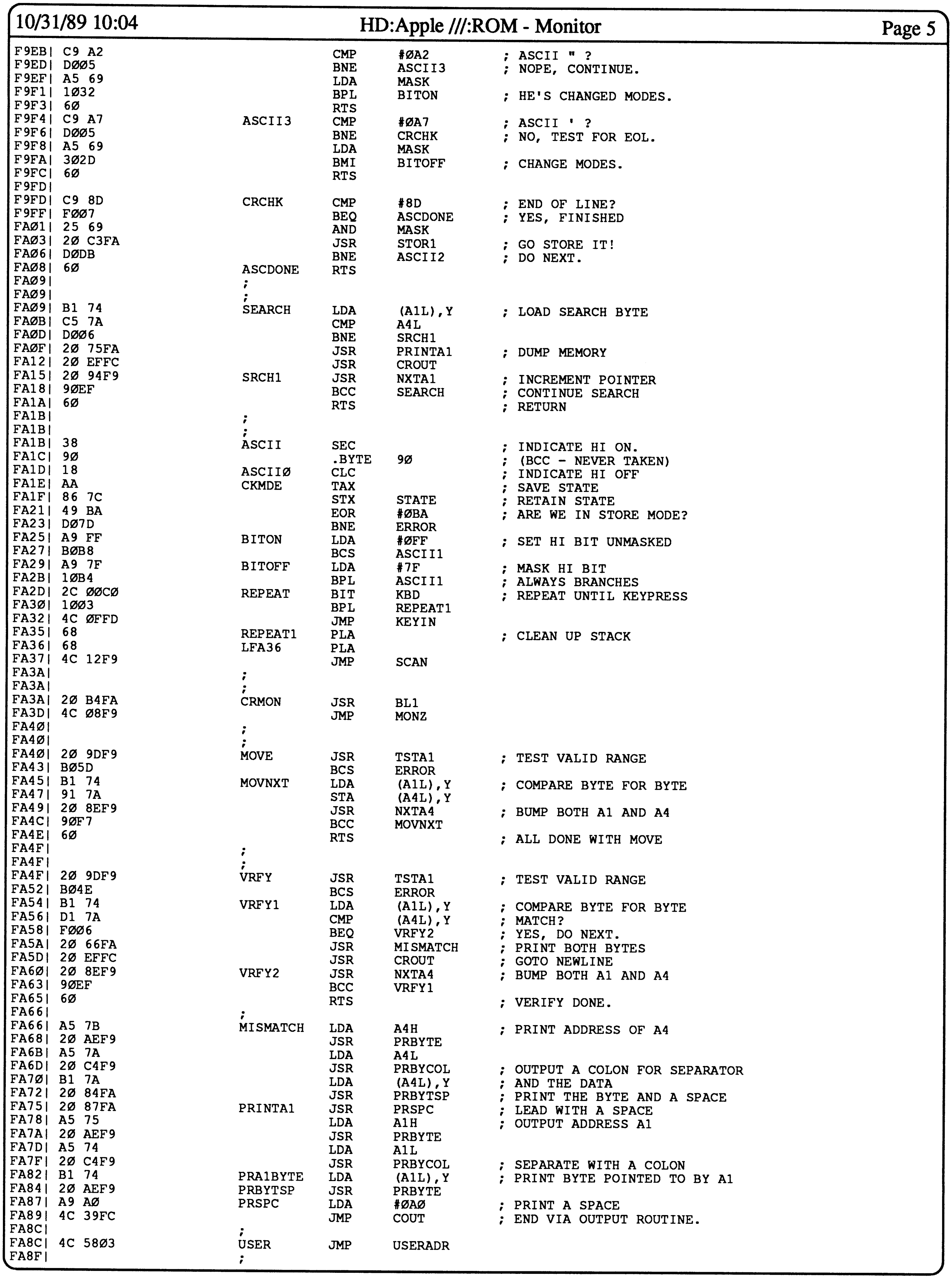
“_72.PICT” 603 KB 2001-09-10 dpi: 600h x 600v pix: 4663h x 6202v



10/31/89 10:04 HD:Apple ///:ROM - Monitor Page 4

```
F973| FØ                      .BYTE   ØFØ         ; W     =WRITE DISK BLOCK
F974| F1                      .BYTE   ØF1         ; X     =REPEAT COMMAND LINE
F975| 99                      .BYTE   99          ; SP    =SPACE (BYTE SEPARATOR)
F976| 9B                      .BYTE   9B          ; "     =ASCII (HI BIT ON)
F977| AØ                      .BYTE   ØAØ         ; '     =ASCII (HI BIT OFF)
F978| 93                      .BYTE   93          ; :     =SET STORE MODE
F979| A7                      .BYTE   ØA7         ; .     =RANGE SEPARATOR
F97A| A8                      .BYTE   ØA8         ; /     =COMMAND SEPARATOR
F97B| 95                      .BYTE   95          ; <     =DEST/SOURCE SEPARATOR
F97C| C6                      .BYTE   ØC6         ; CR    =CARRIAGE RETURN
F97D|            ;
F97D| F97D       CMDVEC       .EQU    *
F97D| 9Ø                      .BYTE   9Ø          ; GO-1
F97E| 8E                      .BYTE   8E          ; JUMP-1
F97F| 3F                      .BYTE   3F          ; MOVE-1
F98Ø| D3                      .BYTE   ØD3         ; READ-1
F981| Ø8                      .BYTE   Ø8          ; SEARCH-1
F982| 8B                      .BYTE   8B          ; USER-1
F983| 4E                      .BYTE   4E          ; VRFY-1
F984| D6                      .BYTE   ØD6         ; WRTE-1
F985| 2C                      .BYTE   2C          ; REPEAT-1
F986| B7                      .BYTE   ØB7         ; SPCE-1
F987| 1A                      .BYTE   1A          ; ASCII-1
F988| 1C                      .BYTE   1C          ; ASCIIØ-1
F989| CB                      .BYTE   ØCB         ; SETMODE-1
F98A| CB                      .BYTE   ØCB         ; SETMODE-1
F98B| AD                      .BYTE   ØAD         ; SEP-1
F98C| A4                      .BYTE   ØA4         ; DEST-1
F98D| 39                      .BYTE   39          ; CRMON-1
F98E|            ;
F98E|            ;
F98E| E6 7A      NXTA4        INC     A4L         ; BUMP 16 BIT POINTERS
F99Ø| DØØ2                    BNE     NXTA1
F992| E6 7B                   INC     A4H
F994| E6 74      NXTA1        INC     A1L         ; BUMP A1
F996| DØØ5                    BNE     TSTA1
F998| E6 75                   INC     A1H
F99A| 38                      SEC                 ; IN CASE OF ROLL OVER
F99B| FØ1Ø                    BEQ     RETA1
F99D| A5 74      TSTA1        LDA     A1L
F99F| 38                      SEC
F9AØ| E5 76                   SBC     A2L
F9A2| 85 8Ø                   STA     TEMP
F9A4| A5 75                   LDA     A1H
F9A6| E5 77                   SBC     A2H
F9A8| Ø5 8Ø                   ORA     TEMP
F9AA| DØØ1                    BNE     RETA1       ; IF A1 LESS THAN OR EQUAL TO A2
F9AC| 18                      CLC                 ; THEN CARRY CLEAR ON RETURN
F9AD| 6Ø         RETA1        RTS
F9AE|            ;
F9AE|            ;
F9AE| 48         PRBYTE       PHA                 ; SAVE LOW NIBBLE
F9AF| 4A                      LSR     A
F9BØ| 4A                      LSR     A           ; SHIFT HI NIBBLE TO PRINT.
F9B1| 4A                      LSR     A
F9B2| 4A                      LSR     A
F9B3| 2Ø B9F9                 JSR     PRHEXZ
F9B6| 68                      PLA
F9B7| 29 ØF      PRHEX        AND     #ØF         ; STRIP HI NIBBLE
F9B9| Ø9 BØ      PRHEXZ       ORA     #ØBØ        ; MAKE IT NUMERIC
F9BB| C9 BA                   CMP     #ØBA        ; IS IT >'9'
F9BD| 9ØØ2                    BCC     PRHEX2
F9BF| 69 Ø6                   ADC     #Ø6         ; MAKE IT 'A'-'F'
F9C1| 4C 39FC    PRHEX2       JMP     COUT
F9C4|            ;
F9C4| 2Ø AEF9    PRBYCOL      JSR     PRBYTE
F9C7|            ;
F9C7| A9 BA      PRCOLON      LDA     #ØBA        ; PRINT A COLON
F9C9| DØF6                    BNE     PRHEX2      ; BRANCH ALWAYS
F9CB|            ;
F9CB| A9 Ø7      TST8ØWID     LDA     #Ø7         ; ANTICIPATE
F9CD| 24 68                   BIT     MODES       ; TEST FOR 8Ø
F9CF| 5ØØ2                    BVC     SVMASK
F9D1| A9 ØF                   LDA     #ØF
F9D3| 85 69      SVMASK       STA     MASK
F9D5| 6Ø                      RTS
F9D6|            ;
F9D6| 8A         A1PC         TXA                 ; TEST FOR NEW PC
F9D7| FØØ7                    BEQ     OLDPC
F9D9| B5 74      A1PC1        LDA     A1L,X
F9DB| 95 72                   STA     PCL,X
F9DD| CA                      DEX
F9DE| 1ØF9                    BPL     A1PC1
F9EØ| 6Ø         OLDPC        RTS
F9E1|            ;
F9E1| 85 69      ASCII1       STA     MASK        ; SAVE HI BIT STATUS
F9E3| A4 7D      ASCII2       LDY     YSAV        ; MOVE ASCII TO MEMORY
F9E5| B1 7E                   LDA     (INBUF),Y
F9E7| E6 7D                   INC     YSAV        ; BUMP FOR NEXT THING.
F9E9| AØ ØØ                   LDY     #ØØ
```

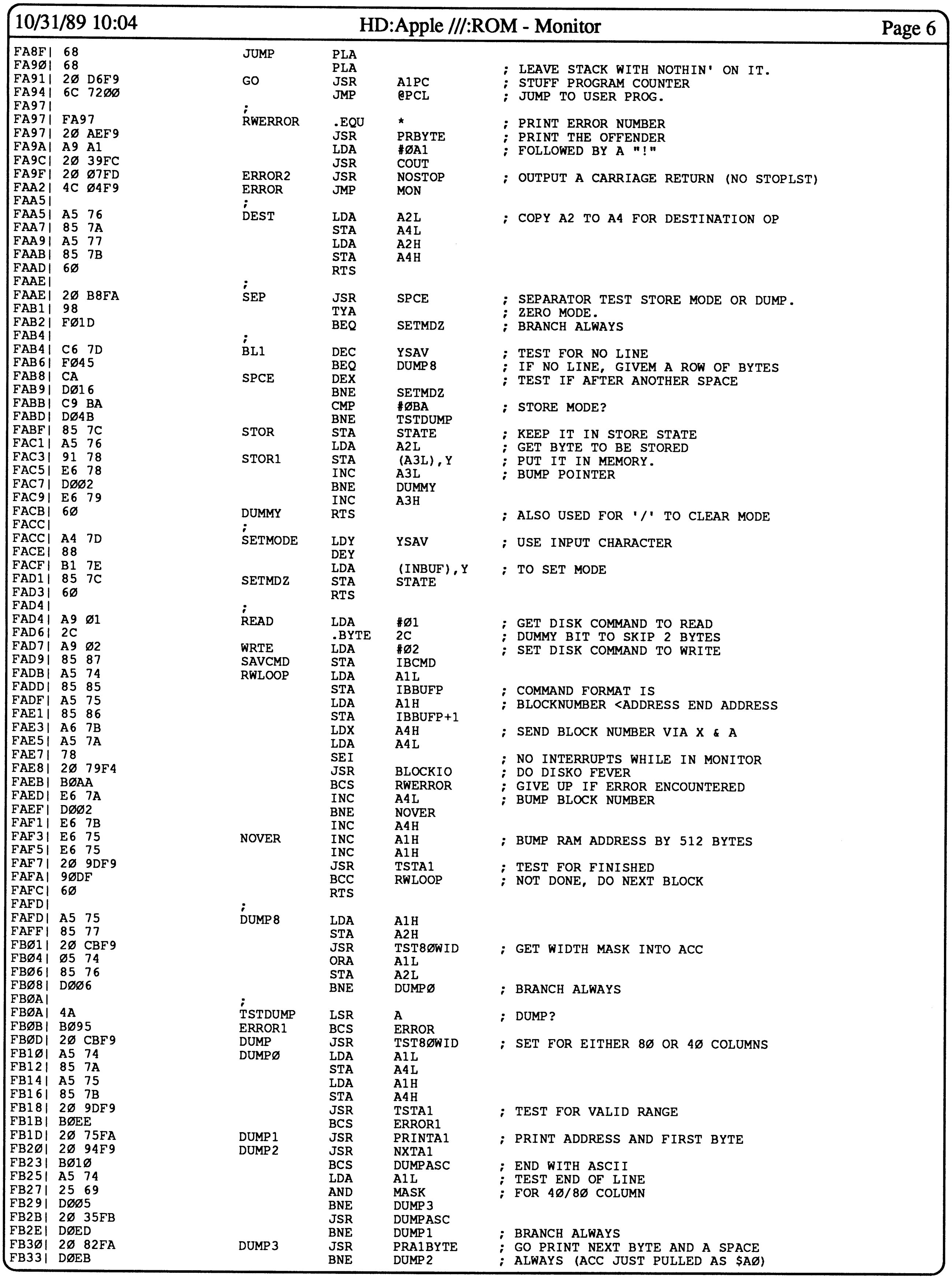
"_73.PICT" 550 KB 2001-09-10 dpi: 600h x 600v pix: 4674h x 6202v



10/31/89 10:04 HD:Apple ///:ROM - Monitor Page 5

```
F9EB| C9 A2                          CMP     #ØA2          ; ASCII " ?
F9ED| DØØ5                           BNE     ASCII3        ; NOPE, CONTINUE.
F9EF| A5 69                          LDA     MASK
F9F1| 1Ø32                           BPL     BITON         ; HE'S CHANGED MODES.
F9F3| 6Ø                             RTS
F9F4| C9 A7              ASCII3      CMP     #ØA7          ; ASCII ' ?
F9F6| DØØ5                           BNE     CRCHK         ; NO, TEST FOR EOL.
F9F8| A5 69                          LDA     MASK
F9FA| 3Ø2D                           BMI     BITOFF        ; CHANGE MODES.
F9FC| 6Ø                             RTS
F9FD|
F9FD| C9 8D              CRCHK       CMP     #8D           ; END OF LINE?
F9FF| FØØ7                           BEQ     ASCDONE       ; YES, FINISHED
FAØ1| 25 69                          AND     MASK
FAØ3| 2Ø C3FA                        JSR     STOR1         ; GO STORE IT!
FAØ6| DØDB                           BNE     ASCII2        ; DO NEXT.
FAØ8| 6Ø                 ASCDONE     RTS
FAØ9|                    ;
FAØ9|                    ;
FAØ9| B1 74              SEARCH      LDA     (A1L),Y       ; LOAD SEARCH BYTE
FAØB| C5 7A                          CMP     A4L
FAØD| DØØ6                           BNE     SRCH1
FAØF| 2Ø 75FA                        JSR     PRINTA1       ; DUMP MEMORY
FA12| 2Ø EFFC                        JSR     CROUT
FA15| 2Ø 94F9            SRCH1       JSR     NXTA1         ; INCREMENT POINTER
FA18| 9ØEF                           BCC     SEARCH        ; CONTINUE SEARCH
FA1A| 6Ø                             RTS                   ; RETURN
FA1B|                    ;
FA1B|                    ;
FA1B| 38                 ASCII       SEC                   ; INDICATE HI ON.
FA1C| 9Ø                             .BYTE   9Ø            ; (BCC - NEVER TAKEN)
FA1D| 18                 ASCIIØ      CLC                   ; INDICATE HI OFF
FA1E| AA                 CKMDE       TAX                   ; SAVE STATE
FA1F| 86 7C                          STX     STATE         ; RETAIN STATE
FA21| 49 BA                          EOR     #ØBA          ; ARE WE IN STORE MODE?
FA23| DØ7D                           BNE     ERROR
FA25| A9 FF              BITON       LDA     #ØFF          ; SET HI BIT UNMASKED
FA27| BØB8                           BCS     ASCII1
FA29| A9 7F              BITOFF      LDA     #7F           ; MASK HI BIT
FA2B| 1ØB4                           BPL     ASCII1        ; ALWAYS BRANCHES
FA2D| 2C ØØCØ            REPEAT      BIT     KBD           ; REPEAT UNTIL KEYPRESS
FA3Ø| 1ØØ3                           BPL     REPEAT1
FA32| 4C ØFFD                        JMP     KEYIN
FA35| 68                 REPEAT1     PLA                   ; CLEAN UP STACK
FA36| 68                 LFA36       PLA
FA37| 4C 12F9                        JMP     SCAN
FA3A|                    ;
FA3A|                    ;
FA3A| 2Ø B4FA            CRMON       JSR     BL1
FA3D| 4C Ø8F9                        JMP     MONZ
FA4Ø|                    ;
FA4Ø|                    ;
FA4Ø| 2Ø 9DF9            MOVE        JSR     TSTA1         ; TEST VALID RANGE
FA43| BØ5D                           BCS     ERROR
FA45| B1 74              MOVNXT      LDA     (A1L),Y       ; COMPARE BYTE FOR BYTE
FA47| 91 7A                          STA     (A4L),Y
FA49| 2Ø 8EF9                        JSR     NXTA4         ; BUMP BOTH A1 AND A4
FA4C| 9ØF7                           BCC     MOVNXT
FA4E| 6Ø                             RTS                   ; ALL DONE WITH MOVE
FA4F|                    ;
FA4F|                    ;
FA4F| 2Ø 9DF9            VRFY        JSR     TSTA1         ; TEST VALID RANGE
FA52| BØ4E                           BCS     ERROR
FA54| B1 74              VRFY1       LDA     (A1L),Y       ; COMPARE BYTE FOR BYTE
FA56| D1 7A                          CMP     (A4L),Y       ; MATCH?
FA58| FØØ6                           BEQ     VRFY2         ; YES, DO NEXT.
FA5A| 2Ø 66FA                        JSR     MISMATCH      ; PRINT BOTH BYTES
FA5D| 2Ø EFFC                        JSR     CROUT         ; GOTO NEWLINE
FA6Ø| 2Ø 8EF9            VRFY2       JSR     NXTA4         ; BUMP BOTH A1 AND A4
FA63| 9ØEF                           BCC     VRFY1
FA65| 6Ø                             RTS                   ; VERIFY DONE.
FA66|                    ;
FA66| A5 7B              MISMATCH    LDA     A4H           ; PRINT ADDRESS OF A4
FA68| 2Ø AEF9                        JSR     PRBYTE
FA6B| A5 7A                          LDA     A4L
FA6D| 2Ø C4F9                        JSR     PRBYCOL       ; OUTPUT A COLON FOR SEPARATOR
FA7Ø| B1 7A                          LDA     (A4L),Y       ; AND THE DATA
FA72| 2Ø 84FA                        JSR     PRBYTSP       ; PRINT THE BYTE AND A SPACE
FA75| 2Ø 87FA            PRINTA1     JSR     PRSPC         ; LEAD WITH A SPACE
FA78| A5 75                          LDA     A1H           ; OUTPUT ADDRESS A1
FA7A| 2Ø AEF9                        JSR     PRBYTE
FA7D| A5 74                          LDA     A1L
FA7F| 2Ø C4F9                        JSR     PRBYCOL       ; SEPARATE WITH A COLON
FA82| B1 74              PRA1BYTE    LDA     (A1L),Y       ; PRINT BYTE POINTED TO BY A1
FA84| 2Ø AEF9            PRBYTSP     JSR     PRBYTE
FA87| A9 AØ              PRSPC       LDA     #ØAØ          ; PRINT A SPACE
FA89| 4C 39FC                        JMP     COUT          ; END VIA OUTPUT ROUTINE.
FA8C|                    ;
FA8C| 4C 58Ø3            USER        JMP     USERADR
FA8F|                    ;
```

"_74.PICT" 615 KB 2001-09-10 dpi: 600h x 600v pix: 4615h x 6190v



```
FA8F| 68                JUMP     PLA
FA9Ø| 68                         PLA                   ; LEAVE STACK WITH NOTHIN' ON IT.
FA91| 2Ø D6F9           GO       JSR      A1PC         ; STUFF PROGRAM COUNTER
FA94| 6C 72ØØ                    JMP      @PCL         ; JUMP TO USER PROG.
FA97|                   ;
FA97| FA97              RWERROR  .EQU     *            ; PRINT ERROR NUMBER
FA97| 2Ø AEF9                    JSR      PRBYTE       ; PRINT THE OFFENDER
FA9A| A9 A1                      LDA      #ØA1         ; FOLLOWED BY A "!"
FA9C| 2Ø 39FC                    JSR      COUT
FA9F| 2Ø Ø7FD           ERROR2   JSR      NOSTOP       ; OUTPUT A CARRIAGE RETURN (NO STOPLST)
FAA2| 4C Ø4F9           ERROR    JMP      MON
FAA5|                   ;
FAA5| A5 76             DEST     LDA      A2L          ; COPY A2 TO A4 FOR DESTINATION OP
FAA7| 85 7A                      STA      A4L
FAA9| A5 77                      LDA      A2H
FAAB| 85 7B                      STA      A4H
FAAD| 6Ø                         RTS
FAAE|                   ;
FAAE| 2Ø B8FA           SEP      JSR      SPCE         ; SEPARATOR TEST STORE MODE OR DUMP.
FAB1| 98                         TYA                   ; ZERO MODE.
FAB2| FØ1D                       BEQ      SETMDZ       ; BRANCH ALWAYS
FAB4|                   ;
FAB4| C6 7D             BL1      DEC      YSAV         ; TEST FOR NO LINE
FAB6| FØ45                       BEQ      DUMP8        ; IF NO LINE, GIVEM A ROW OF BYTES
FAB8| CA                SPCE     DEX                   ; TEST IF AFTER ANOTHER SPACE
FAB9| DØ16                       BNE      SETMDZ
FABB| C9 BA                      CMP      #ØBA         ; STORE MODE?
FABD| DØ4B                       BNE      TSTDUMP
FABF| 85 7C             STOR     STA      STATE        ; KEEP IT IN STORE STATE
FAC1| A5 76                      LDA      A2L          ; GET BYTE TO BE STORED
FAC3| 91 78             STOR1    STA      (A3L),Y      ; PUT IT IN MEMORY.
FAC5| E6 78                      INC      A3L          ; BUMP POINTER
FAC7| DØØ2                       BNE      DUMMY
FAC9| E6 79                      INC      A3H
FACB| 6Ø                DUMMY    RTS                   ; ALSO USED FOR '/' TO CLEAR MODE
FACC|                   ;
FACC| A4 7D             SETMODE  LDY      YSAV         ; USE INPUT CHARACTER
FACE| 88                         DEY
FACF| B1 7E                      LDA      (INBUF),Y    ; TO SET MODE
FAD1| 85 7C             SETMDZ   STA      STATE
FAD3| 6Ø                         RTS
FAD4|                   ;
FAD4| A9 Ø1             READ     LDA      #Ø1          ; GET DISK COMMAND TO READ
FAD6| 2C                         .BYTE    2C           ; DUMMY BIT TO SKIP 2 BYTES
FAD7| A9 Ø2             WRTE     LDA      #Ø2          ; SET DISK COMMAND TO WRITE
FAD9| 85 87             SAVCMD   STA      IBCMD
FADB| A5 74             RWLOOP   LDA      A1L
FADD| 85 85                      STA      IBBUFP       ; COMMAND FORMAT IS
FADF| A5 75                      LDA      A1H          ; BLOCKNUMBER <ADDRESS END ADDRESS
FAE1| 85 86                      STA      IBBUFP+1
FAE3| A6 7B                      LDX      A4H          ; SEND BLOCK NUMBER VIA X & A
FAE5| A5 7A                      LDA      A4L
FAE7| 78                         SEI                   ; NO INTERRUPTS WHILE IN MONITOR
FAE8| 2Ø 79F4                    JSR      BLOCKIO      ; DO DISKO FEVER
FAEB| BØAA                       BCS      RWERROR      ; GIVE UP IF ERROR ENCOUNTERED
FAED| E6 7A                      INC      A4L          ; BUMP BLOCK NUMBER
FAEF| DØØ2                       BNE      NOVER
FAF1| E6 7B                      INC      A4H
FAF3| E6 75             NOVER    INC      A1H          ; BUMP RAM ADDRESS BY 512 BYTES
FAF5| E6 75                      INC      A1H
FAF7| 2Ø 9DF9                    JSR      TSTA1        ; TEST FOR FINISHED
FAFA| 9ØDF                       BCC      RWLOOP       ; NOT DONE, DO NEXT BLOCK
FAFC| 6Ø                         RTS
FAFD|                   ;
FAFD| A5 75             DUMP8    LDA      A1H
FAFF| 85 77                      STA      A2H
FBØ1| 2Ø CBF9                    JSR      TST8ØWID     ; GET WIDTH MASK INTO ACC
FBØ4| Ø5 74                      ORA      A1L
FBØ6| 85 76                      STA      A2L
FBØ8| DØØ6                       BNE      DUMPØ        ; BRANCH ALWAYS
FBØA|                   ;
FBØA| 4A                TSTDUMP  LSR      A            ; DUMP?
FBØB| BØ95              ERROR1   BCS      ERROR
FBØD| 2Ø CBF9           DUMP     JSR      TST8ØWID     ; SET FOR EITHER 8Ø OR 4Ø COLUMNS
FB1Ø| A5 74             DUMPØ    LDA      A1L
FB12| 85 7A                      STA      A4L
FB14| A5 75                      LDA      A1H
FB16| 85 7B                      STA      A4H
FB18| 2Ø 9DF9                    JSR      TSTA1        ; TEST FOR VALID RANGE
FB1B| BØEE                       BCS      ERROR1
FB1D| 2Ø 75FA           DUMP1    JSR      PRINTA1      ; PRINT ADDRESS AND FIRST BYTE
FB2Ø| 2Ø 94F9           DUMP2    JSR      NXTA1
FB23| BØ1Ø                       BCS      DUMPASC      ; END WITH ASCII
FB25| A5 74                      LDA      A1L          ; TEST END OF LINE
FB27| 25 69                      AND      MASK         ; FOR 4Ø/8Ø COLUMN
FB29| DØØ5                       BNE      DUMP3
FB2B| 2Ø 35FB                    JSR      DUMPASC
FB2E| DØED                       BNE      DUMP1        ; BRANCH ALWAYS
FB3Ø| 2Ø 82FA           DUMP3    JSR      PRA1BYTE     ; GO PRINT NEXT BYTE AND A SPACE
FB33| DØEB                       BNE      DUMP2        ; ALWAYS (ACC JUST PULLED AS $AØ)
```

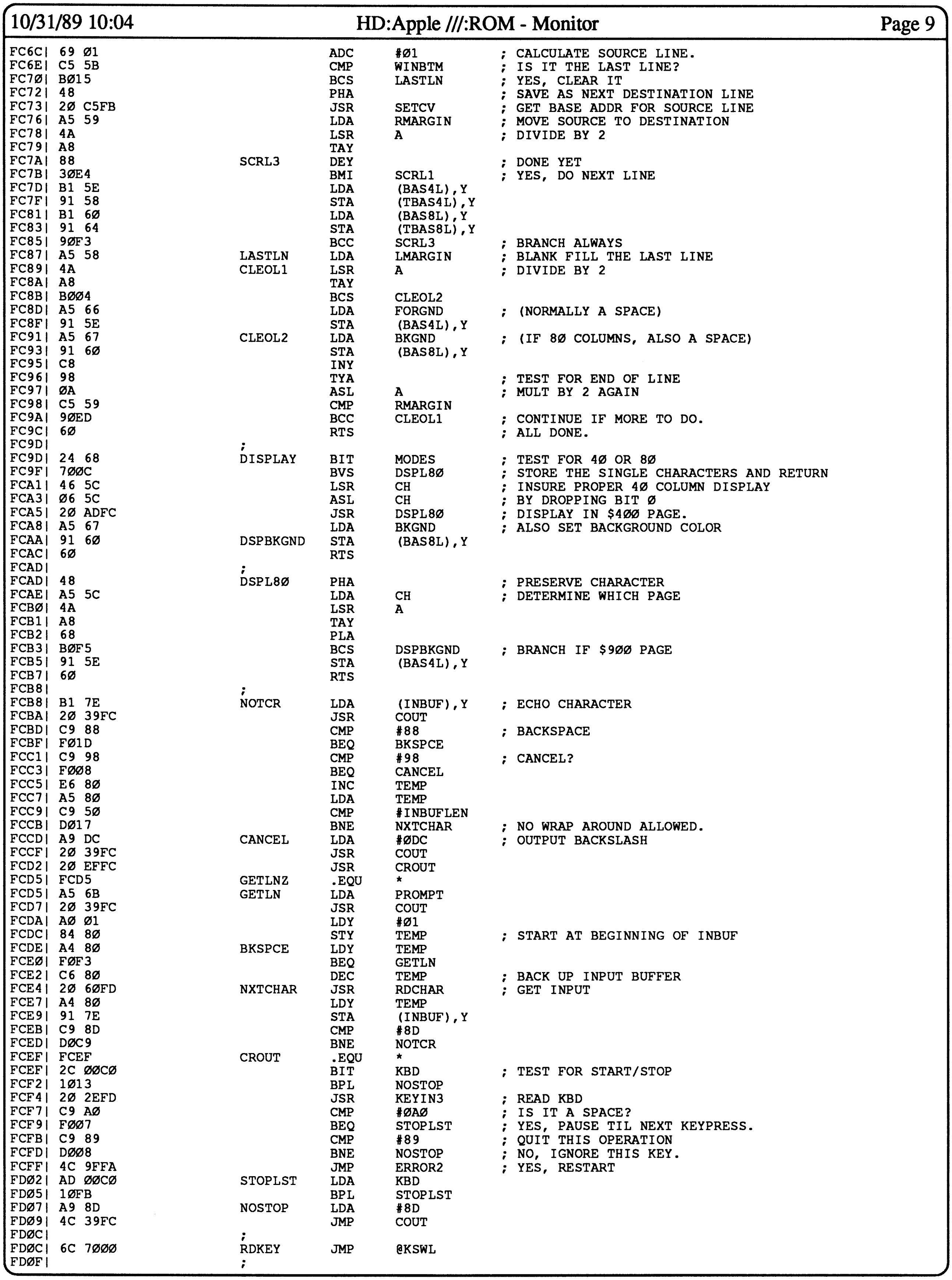
"_75.PICT" 658 KB 2001-09-10 dpi: 600h x 600v pix: 4639h x 6201v

```
FB35|                  ;
FB35| A5 7A            DUMPASC   LDA    A4L          ; RESET TO BEGINNING OF LINE
FB37| 85 74                      STA    A1L
FB39| A5 7B                      LDA    A4H
FB3B| 85 75                      STA    A1H
FB3D| 2Ø 87FA                    JSR    PRSPC        ; PRINT AN EXTRA SPACE
FB4Ø| AØ ØØ            ASC1      LDY    #ØØ          ; TO INDEX MEMORY INDIRECT
FB42| B1 74                      LDA    (A1L),Y
FB44| Ø9 8Ø                      ORA    #8Ø          ; SET NORMAL VIDEO
FB46| C9 AØ                      CMP    #ØAØ         ; TEST FOR CONTROL CHARACTERS
FB48| BØØ2                       BCS    ASC2         ; OK TO PRINT NON CONTROLS
FB4A| A9 AE                      LDA    #ØAE         ; OTHERWISE PRINT A SPACE
FB4C| 2Ø 39FC          ASC2      JSR    COUT         ; PUT IT OUT
FB4F| 2Ø 8EF9                    JSR    NXTA4        ; BUMP BOTH A1 AND A4
FB52| BØØ6                       BCS    ASC3         ; FINISHED
FB54| A5 74                      LDA    A1L          ; TEST END OF LINE
FB56| 25 69                      AND    MASK
FB58| DØE6                       BNE    ASC1         ; NOT DONE, PRINT NEXT
FB5A| 4C EFFC          ASC3      JMP    CROUT
FB5D|                  ;
FB5D|                  ;
FB5D| 38               COL8Ø     SEC                 ; INDICATE 8Ø COLUMNS
FB5E| AD 53CØ                    LDA    ØCØ53        ; GOTO 8Ø COLUMN MODE
FB61| BØØ4                       BCS    SET8Ø        ; BRANCH ALWAYS
FB63|                  ;
FB63| 18               COL4Ø     CLC                 ; INDICATE 4Ø COLUMNS DESIRED
FB64| AD 52CØ                    LDA    ØCØ52        ; GOTO 4Ø COLUMN MODE
FB67| A5 68            SET8Ø     LDA    MODES
FB69| Ø9 4Ø                      ORA    #4Ø          ; ASSUME 8Ø
FB6B| BØØ2                       BCS    SET8ØA       ; AND BRANCH IF IT IS
FB6D| 29 BF                      AND    #ØBF         ; BUT FIX FOR 4Ø IF NOT
FB6F| 85 68            SET8ØA    STA    MODES
FB71| Ø9 7F                      ORA    #7F          ; ISOLATE BIT 7
FB73| 29 AØ                      AND    #ØAØ         ; (BIT 7 SETS NORMAL/INVERSE)
FB75| 85 66                      STA    FORGND
FB77| BØØ2                       BCS    SET8ØB       ; AGAIN ASSUMES 8Ø COLUMNS
FB79| A9 FØ                      LDA    #ØFØ         ; IF NOT, SET FOR/BACKGROUND COLOR
FB7B| 85 67            SET8ØB    STA    BKGND
FB7D|                  ;
FB7D| A5 58            CLSCRN    LDA    LMARGIN      ; SET CURSOR TO TOP LEFT OF WINDOW
FB7F| 85 5C                      STA    CH
FB81| A5 5A                      LDA    WINTOP
FB83| 85 5D                      STA    CV           ; NOW DROP INTO CLEAR END OF PAGE
FB85|                  ;
FB85| A5 5C            CLEOP     LDA    CH           ; SAVE CURRENT CURSOR POSITION
FB87| 48                         PHA
FB88| A5 5D                      LDA    CV
FB8A| 48                         PHA
FB8B| 2Ø C5FB                    JSR    SETCV
FB8E| 2Ø A2FB          CLEOP1    JSR    CLEOL        ; CLEAR TO END OF FIRST LINE
FB91| A5 58                      LDA    LMARGIN
FB93| 85 5C                      STA    CH
FB95| 2Ø DDFB                    JSR    CURDOWN      ; GOTO NEXT LINE
FB98| 9ØF4                       BCC    CLEOP1
FB9A| 68                         PLA
FB9B| A8                         TAY
FB9C| 68                         PLA                 ; RESTORE CURSOR POSITION
FB9D| 85 5C                      STA    CH
FB9F| 98                         TYA                 ; GET OLD CV IN ACC AGAIN
FBAØ| BØ23                       BCS    SETCV        ; BRANCH ALWAYS
FBA2|                  ;
FBA2| A5 5C            CLEOL     LDA    CH           ; CLEAR TO END OF LINE FIRST
FBA4| 4C 89FC                    JMP    CLEOL1
FBA7|                  ;
FBA7| C9 8Ø            CONTROL   CMP    #8Ø
FBA9| 9Ø65                       BCC    DISPLAYX     ; IF INVERSE
FBAB| C9 8D            TSTCR     CMP    #8D          ; IF CARRIAGE RETURN THEN NEW LINE
FBAD| DØ3A                       BNE    TSTBACK
FBAF| 2Ø A2FB          CARRAGE   JSR    CLEOL        ; FIRST CLEAR TO THE END OF THIS LINE
FBB2| 2Ø D7FB                    JSR    SETCHZ       ; RESET CURSOR AND GOTO NEXT LINE (CARRY IS SET)
FBB5| 4C 16FC                    JMP    NXTLIN       ; THEN GOTO THE NEXT LINE.
FBB8|                  ;
FBB8|                  ;
FBB8| A5 5D            CURUP     LDA    CV           ; TEST FOR TOP OF SCREEN
FBBA| C6 5D                      DEC    CV           ; ANTICIPATE 'NOT' TOP
FBBC| C5 5A                      CMP    WINTOP
FBBE| DØØ2                       BNE    CURUP1       ; IT'S NOT TOP, CONTINUE
FBCØ| A5 5B                      LDA    WINBTM       ; WRAP AROUND TO BOTTOM
FBC2| 38               CURUP1    SEC                 ; DECREMENT BY ONE
FBC3| E9 Ø1                      SBC    #Ø1
FBC5| 85 5D            SETCV     STA    CV           ; SAVE NEW VERTICAL LINE
FBC7| FBC7             BASCALC   .EQU   *
FBC7| FBC7             CURDN1    .EQU   *
FBC7| A5 5D                      LDA    CV           ; GET VALUES FOR FIRST PAGE ($4ØØ)
FBC9| 1Ø4E                       BPL    BASCALC1     ; ALWAYS
FBCB|                  ;
FBCB| 24 68            CURIGHT   BIT    MODES        ; TEST FOR 8Ø OR 4Ø
FBCD| 7ØØ2                       BVS    RIGHT1
FBCF| E6 5C                      INC    CH
FBD1| E6 5C            RIGHT1    INC    CH           ; BUMP CURSOR HORIZONTAL
```

"_76.PICT" 657 KB 2001-09-10 dpi: 600h x 600v pix: 4615h x 6213v

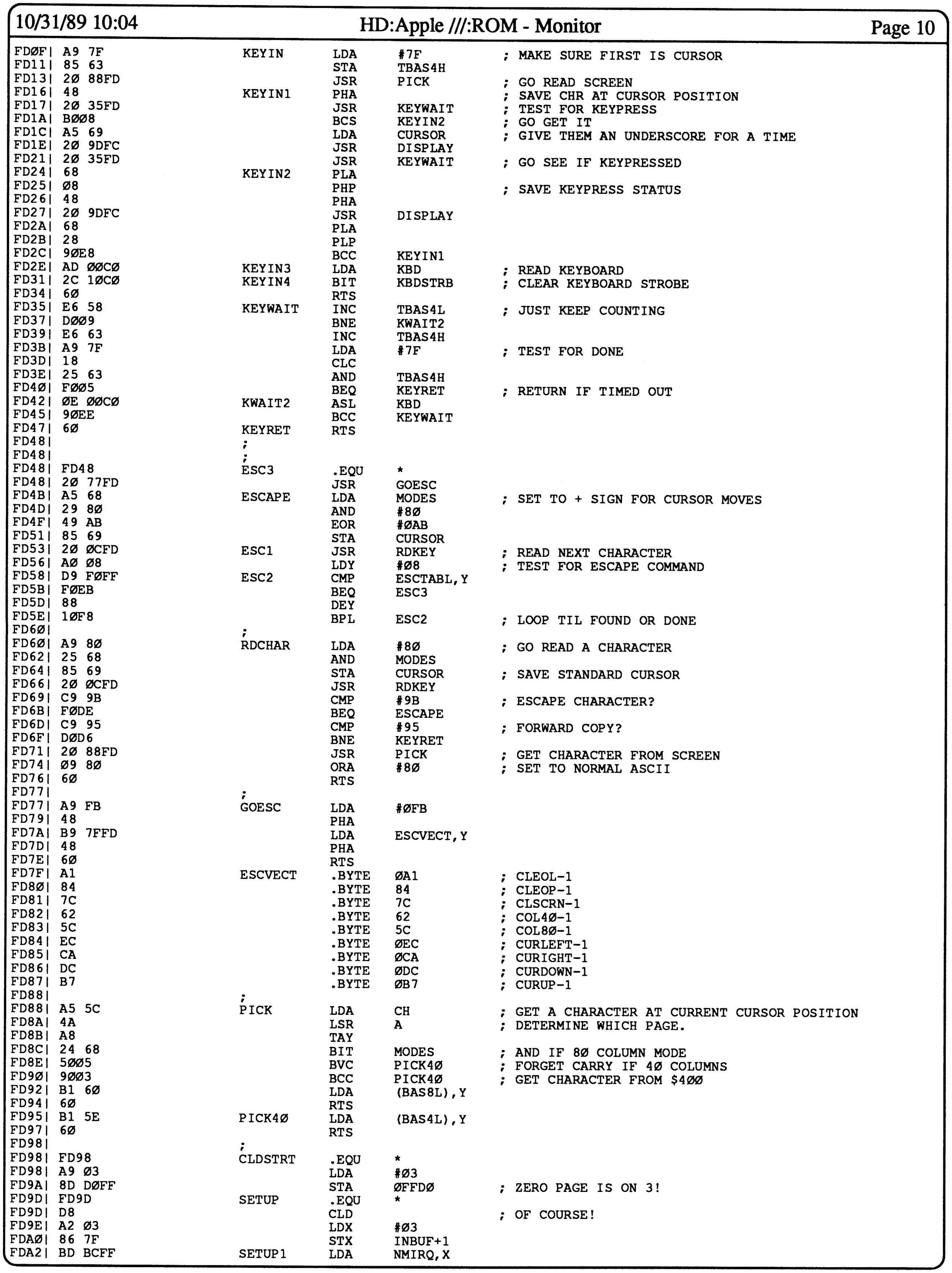
```
FBD3| A5 5C                   LDA    CH          ; TEST FOR NEW LINE
FBD5| C5 59                   CMP    RMARGIN
FBD7| A5 58         SETCHZ    LDA    LMARGIN     ; JUST IN CASE WE HAVE.
FBD9| 9Ø5D                    BCC    CTRLRET
FBDB| 85 5C         SETCVH    STA    CH          ; CURSOR AT START OF NEXT LINE
FBDD|               ; DROP INTO CURDOWN FOR WRAP AROUND
FBDD|               ;
FBDD| E6 5D         CURDOWN   INC    CV          ; MOVE CURSOR DOWN ONE LINE
FBDF| A5 5D                   LDA    CV          ; ANTICIPATE NOT BOTTOM
FBE1| C5 5B                   CMP    WINBTM      ; TEST FOR BOTTOM
FBE3| 9ØE2                    BCC    CURDN1
FBE5| A5 5A                   LDA    WINTOP
FBE7| BØDC                    BCS    SETCV       ; BRANCH ALWAYS
FBE9|               ;
FBE9| C9 88         TSTBACK   CMP    #88         ; BACKSPACE?
FBEB| DØ5D                    BNE    TSTBELL
FBED| 24 68         CURLEFT   BIT    MODES       ; TEST FOR FOURTY OR EIGHTY MODE
FBEF| 7ØØ2                    BVS    LEFT8Ø
FBF1| C6 5C                   DEC    CH
FBF3| C6 5C         LEFT8Ø    DEC    CH
FBF5| 3ØØ6                    BMI    LEFTUP
FBF7| A5 5C                   LDA    CH          ; TEST FOR WRAP AROUND
FBF9| C5 58                   CMP    LMARGIN
FBFB| 1Ø3B                    BPL    CTRLRET
FBFD| 2Ø B8FB       LEFTUP    JSR    CURUP
FCØØ| A5 59                   LDA    RMARGIN
FCØ2| 85 5C                   STA    CH          ; SAVE NEW CURSOR POSITION
FCØ4| DØE7                    BNE    CURLEFT     ; BRANCH ALWAYS
FCØ6|               ;
FCØ6| C9 AØ         COUT2     CMP    #ØAØ        ; IS IT CONTROL CHARACTER
FCØ8| 9Ø9D                    BCC    CONTROL
FCØA| 24 68                   BIT    MODES       ; TEST FOR INVERSE
FCØC| 3ØØ2                    BMI    DISPLAYX    ; NO PUT IT OUT
FCØE| 29 7F                   AND    #7F         ; STRIP HI BIT
FC1Ø| 2Ø 9DFC       DISPLAYX  JSR    DISPLAY
FC13|               ;
FC13| 2Ø CBFB       INCHORZ   JSR    CURIGHT     ; MOVE CURSOR RIGHT
FC16| BØ43          NXTLIN    BCS    SCROLL      ; IT'S BOTTOM, RESET CH=Ø AND SCROLL
FC18| 6Ø                      RTS                ; RESET CH ONLY
FC19|               ;
FC19| Ø8            BASCALC1  PHP                ; CALC BASE ADR IN BAS4L,H
FC1A| 48                      PHA
FC1B| 4A                      LSR    A           ; FOR GIVEN LINE NO.
FC1C| 29 Ø3                   AND    #Ø3         ; Ø<=LINE NO.<$17
FC1E| Ø9 Ø4                   ORA    #Ø4         ; ARG=ØØØABCDE, GENERATE
FC2Ø| 85 5F                   STA    BAS4H       ; BAS4H=ØØØØØ1CD
FC22| 49 ØC                   EOR    #ØC
FC24| 85 61                   STA    BAS8H
FC26| 68                      PLA                ; AND
FC27| 29 18                   AND    #18         ; BAS4L=EABABØØØ
FC29| 9ØØ2                    BCC    BSCLC2
FC2B| 69 7F                   ADC    #7F
FC2D| 85 5E         BSCLC2    STA    BAS4L
FC2F| ØA                      ASL    A
FC3Ø| ØA                      ASL    A
FC31| Ø5 5E                   ORA    BAS4L
FC33| 85 5E                   STA    BAS4L
FC35| 85 6Ø                   STA    BAS8L       ; SAME FOR PAGE 2
FC37| 28                      PLP
FC38| 6Ø            CTRLRET   RTS
FC39|               ;
FC39| 48            COUT      PHA                ; SAVE CHARACTER
FC3A| 84 6D                   STY    TEMPY
FC3C| 86 6C                   STX    TEMPX
FC3E| 2Ø 47FC                 JSR    COUT1
FC41| A4 6D                   LDY    TEMPY
FC43| A6 6C                   LDX    TEMPX
FC45| 68                      PLA
FC46| 6Ø                      RTS
FC47| 6C 6EØØ       COUT1     JMP    @CSWL       ; NORMALLY COUT1
FC4A|               ;
FC4A| C9 87         TSTBELL   CMP    #87         ; BELL?
FC4C| DØØ4                    BNE    LNFD        ; NO TEST FOR FORM FEED
FC4E| AE 4ØCØ       BELL      LDX    ØCØ4Ø       ; SOUND BELL
FC51| 6Ø                      RTS
FC52| C9 8A         LNFD      CMP    #8A         ; LINE FEED?
FC54| DØE2                    BNE    CTRLRET
FC56| 2Ø DDFB                 JSR    CURDOWN     ; MOVE CURSOR DOWN A LINE
FC59| 9ØDD                    BCC    CTRLRET     ; BRANCH IF NO SCROLL NECESSARY.
FC5B|               ;
FC5B| A5 5A         SCROLL    LDA    WINTOP      ; START WITH TOP LINE
FC5D| 48                      PHA                ; SAVE IT FOR NOW
FC5E| 2Ø C5FB                 JSR    SETCV       ; GET BASCALC FOR THIS LINE
FC61| A2 Ø3         SCRL1     LDX    #Ø3         ; MOVE CURRENT BASCALC AS DESTINATION
FC63| B5 5E         SCRL2     LDA    BAS4L,X
FC65| 95 58                   STA    TBAS4L,X    ; (TEMPORARY BASE ADDR.)
FC67| CA                      DEX
FC68| 1ØF9                    BPL    SCRL2
FC6A| 68                      PLA                ; GET DESTINATION LINE
FC6B| 18                      CLC
```

"_77.PICT" 613 KB 2001-09-10 dpi: 600h x 600v pix: 4627h x 6189v



10/31/89 10:04 HD:Apple ///:ROM - Monitor Page 9

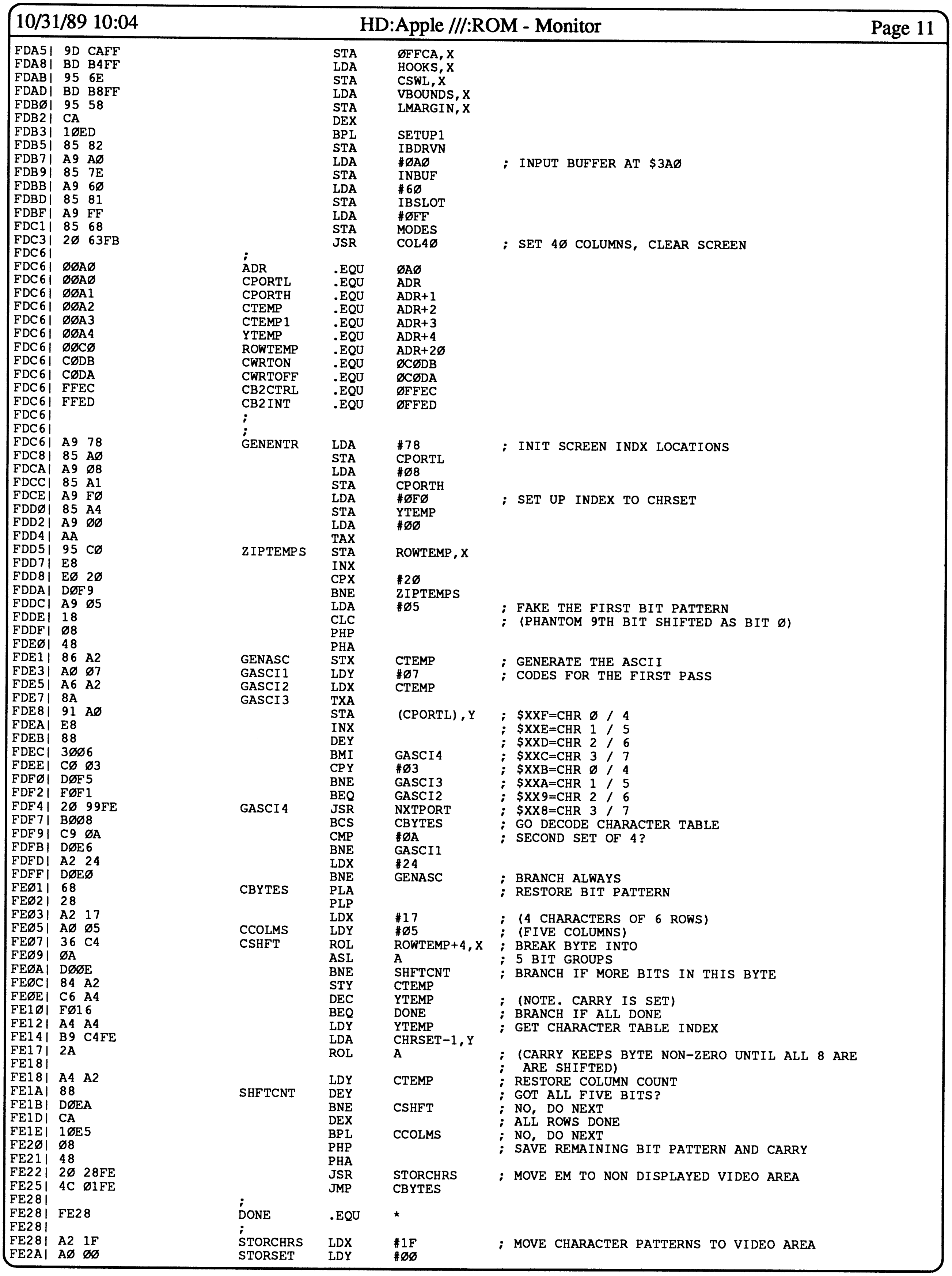
```
FC6C| 69 Ø1                           ADC      #Ø1         ; CALCULATE SOURCE LINE.
FC6E| C5 5B                           CMP      WINBTM      ; IS IT THE LAST LINE?
FC7Ø| BØ15                            BCS      LASTLN      ; YES, CLEAR IT
FC72| 48                              PHA                  ; SAVE AS NEXT DESTINATION LINE
FC73| 2Ø C5FB                         JSR      SETCV       ; GET BASE ADDR FOR SOURCE LINE
FC76| A5 59                           LDA      RMARGIN     ; MOVE SOURCE TO DESTINATION
FC78| 4A                              LSR      A           ; DIVIDE BY 2
FC79| A8                              TAY
FC7A| 88                  SCRL3       DEY                  ; DONE YET
FC7B| 3ØE4                            BMI      SCRL1       ; YES, DO NEXT LINE
FC7D| B1 5E                           LDA      (BAS4L),Y
FC7F| 91 58                           STA      (TBAS4L),Y
FC81| B1 6Ø                           LDA      (BAS8L),Y
FC83| 91 64                           STA      (TBAS8L),Y
FC85| 9ØF3                            BCC      SCRL3       ; BRANCH ALWAYS
FC87| A5 58               LASTLN      LDA      LMARGIN     ; BLANK FILL THE LAST LINE
FC89| 4A                  CLEOL1      LSR      A           ; DIVIDE BY 2
FC8A| A8                              TAY
FC8B| BØØ4                            BCS      CLEOL2
FC8D| A5 66                           LDA      FORGND      ; (NORMALLY A SPACE)
FC8F| 91 5E                           STA      (BAS4L),Y
FC91| A5 67               CLEOL2      LDA      BKGND       ; (IF 8Ø COLUMNS, ALSO A SPACE)
FC93| 91 6Ø                           STA      (BAS8L),Y
FC95| C8                              INY
FC96| 98                              TYA                  ; TEST FOR END OF LINE
FC97| ØA                              ASL      A           ; MULT BY 2 AGAIN
FC98| C5 59                           CMP      RMARGIN
FC9A| 9ØED                            BCC      CLEOL1      ; CONTINUE IF MORE TO DO.
FC9C| 6Ø                              RTS                  ; ALL DONE.
FC9D|                     ;
FC9D| 24 68               DISPLAY     BIT      MODES       ; TEST FOR 4Ø OR 8Ø
FC9F| 7ØØC                            BVS      DSPL8Ø      ; STORE THE SINGLE CHARACTERS AND RETURN
FCA1| 46 5C                           LSR      CH          ; INSURE PROPER 4Ø COLUMN DISPLAY
FCA3| Ø6 5C                           ASL      CH          ; BY DROPPING BIT Ø
FCA5| 2Ø ADFC                         JSR      DSPL8Ø      ; DISPLAY IN $4ØØ PAGE.
FCA8| A5 67                           LDA      BKGND       ; ALSO SET BACKGROUND COLOR
FCAA| 91 6Ø               DSPBKGND    STA      (BAS8L),Y
FCAC| 6Ø                              RTS
FCAD|                     ;
FCAD| 48                  DSPL8Ø      PHA                  ; PRESERVE CHARACTER
FCAE| A5 5C                           LDA      CH          ; DETERMINE WHICH PAGE
FCBØ| 4A                              LSR      A
FCB1| A8                              TAY
FCB2| 68                              PLA
FCB3| BØF5                            BCS      DSPBKGND    ; BRANCH IF $9ØØ PAGE
FCB5| 91 5E                           STA      (BAS4L),Y
FCB7| 6Ø                              RTS
FCB8|                     ;
FCB8| B1 7E               NOTCR       LDA      (INBUF),Y   ; ECHO CHARACTER
FCBA| 2Ø 39FC                         JSR      COUT
FCBD| C9 88                           CMP      #88         ; BACKSPACE
FCBF| FØ1D                            BEQ      BKSPCE
FCC1| C9 98                           CMP      #98         ; CANCEL?
FCC3| FØØ8                            BEQ      CANCEL
FCC5| E6 8Ø                           INC      TEMP
FCC7| A5 8Ø                           LDA      TEMP
FCC9| C9 5Ø                           CMP      #INBUFLEN
FCCB| DØ17                            BNE      NXTCHAR     ; NO WRAP AROUND ALLOWED.
FCCD| A9 DC               CANCEL      LDA      #ØDC        ; OUTPUT BACKSLASH
FCCF| 2Ø 39FC                         JSR      COUT
FCD2| 2Ø EFFC                         JSR      CROUT
FCD5| FCD5                GETLNZ      .EQU     *
FCD5| A5 6B               GETLN       LDA      PROMPT
FCD7| 2Ø 39FC                         JSR      COUT
FCDA| AØ Ø1                           LDY      #Ø1
FCDC| 84 8Ø                           STY      TEMP        ; START AT BEGINNING OF INBUF
FCDE| A4 8Ø               BKSPCE      LDY      TEMP
FCEØ| FØF3                            BEQ      GETLN
FCE2| C6 8Ø                           DEC      TEMP        ; BACK UP INPUT BUFFER
FCE4| 2Ø 6ØFD             NXTCHAR     JSR      RDCHAR      ; GET INPUT
FCE7| A4 8Ø                           LDY      TEMP
FCE9| 91 7E                           STA      (INBUF),Y
FCEB| C9 8D                           CMP      #8D
FCED| DØC9                            BNE      NOTCR
FCEF| FCEF                CROUT       .EQU     *
FCEF| 2C ØØCØ                         BIT      KBD         ; TEST FOR START/STOP
FCF2| 1Ø13                            BPL      NOSTOP
FCF4| 2Ø 2EFD                         JSR      KEYIN3      ; READ KBD
FCF7| C9 AØ                           CMP      #ØAØ        ; IS IT A SPACE?
FCF9| FØØ7                            BEQ      STOPLST     ; YES, PAUSE TIL NEXT KEYPRESS.
FCFB| C9 89                           CMP      #89         ; QUIT THIS OPERATION
FCFD| DØØ8                            BNE      NOSTOP      ; NO, IGNORE THIS KEY.
FCFF| 4C 9FFA                         JMP      ERROR2      ; YES, RESTART
FDØ2| AD ØØCØ             STOPLST     LDA      KBD
FDØ5| 1ØFB                            BPL      STOPLST
FDØ7| A9 8D               NOSTOP      LDA      #8D
FDØ9| 4C 39FC                         JMP      COUT
FDØC|                     ;
FDØC| 6C 7ØØØ             RDKEY       JMP      @KSWL
FDØF|                     ;
```



10/31/89 10:04 HD:Apple ///:ROM - Monitor Page 10

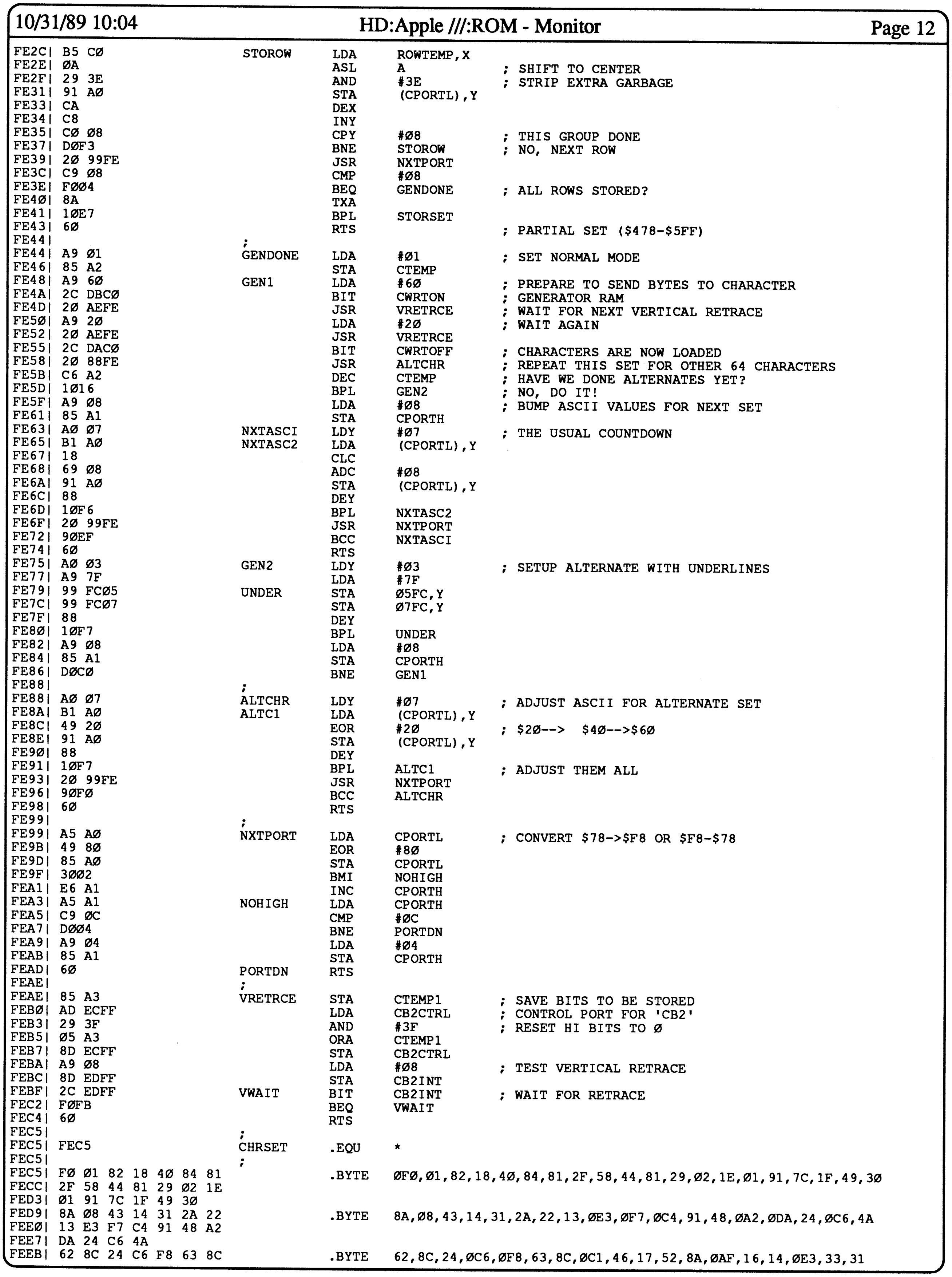
```
FDØF| A9 7F              KEYIN       LDA     #7F            ; MAKE SURE FIRST IS CURSOR
FD11| 85 63                          STA     TBAS4H
FD13| 2Ø 88FD                        JSR     PICK           ; GO READ SCREEN
FD16| 48                 KEYIN1      PHA                    ; SAVE CHR AT CURSOR POSITION
FD17| 2Ø 35FD                        JSR     KEYWAIT        ; TEST FOR KEYPRESS
FD1A| BØØ8                           BCS     KEYIN2         ; GO GET IT
FD1C| A5 69                          LDA     CURSOR         ; GIVE THEM AN UNDERSCORE FOR A TIME
FD1E| 2Ø 9DFC                        JSR     DISPLAY
FD21| 2Ø 35FD                        JSR     KEYWAIT        ; GO SEE IF KEYPRESSED
FD24| 68                 KEYIN2      PLA
FD25| Ø8                             PHP                    ; SAVE KEYPRESS STATUS
FD26| 48                             PHA
FD27| 2Ø 9DFC                        JSR     DISPLAY
FD2A| 68                             PLA
FD2B| 28                             PLP
FD2C| 9ØE8                           BCC     KEYIN1
FD2E| AD ØØCØ            KEYIN3      LDA     KBD            ; READ KEYBOARD
FD31| 2C 1ØCØ            KEYIN4      BIT     KBDSTRB        ; CLEAR KEYBOARD STROBE
FD34| 6Ø                             RTS
FD35| E6 58              KEYWAIT     INC     TBAS4L         ; JUST KEEP COUNTING
FD37| DØØ9                           BNE     KWAIT2
FD39| E6 63                          INC     TBAS4H
FD3B| A9 7F                          LDA     #7F            ; TEST FOR DONE
FD3D| 18                             CLC
FD3E| 25 63                          AND     TBAS4H
FD4Ø| FØØ5                           BEQ     KEYRET         ; RETURN IF TIMED OUT
FD42| ØE ØØCØ            KWAIT2      ASL     KBD
FD45| 9ØEE                           BCC     KEYWAIT
FD47| 6Ø                 KEYRET      RTS
FD48|                    ;
FD48|                    ;
FD48| FD48               ESC3        .EQU    *
FD48| 2Ø 77FD                        JSR     GOESC
FD4B| A5 68              ESCAPE      LDA     MODES          ; SET TO + SIGN FOR CURSOR MOVES
FD4D| 29 8Ø                          AND     #8Ø
FD4F| 49 AB                          EOR     #ØAB
FD51| 85 69                          STA     CURSOR
FD53| 2Ø ØCFD            ESC1        JSR     RDKEY          ; READ NEXT CHARACTER
FD56| AØ Ø8                          LDY     #Ø8            ; TEST FOR ESCAPE COMMAND
FD58| D9 FØFF            ESC2        CMP     ESCTABL,Y
FD5B| FØEB                           BEQ     ESC3
FD5D| 88                             DEY
FD5E| 1ØF8                           BPL     ESC2           ; LOOP TIL FOUND OR DONE
FD6Ø|                    ;
FD6Ø| A9 8Ø              RDCHAR      LDA     #8Ø            ; GO READ A CHARACTER
FD62| 25 68                          AND     MODES
FD64| 85 69                          STA     CURSOR         ; SAVE STANDARD CURSOR
FD66| 2Ø ØCFD                        JSR     RDKEY
FD69| C9 9B                          CMP     #9B            ; ESCAPE CHARACTER?
FD6B| FØDE                           BEQ     ESCAPE
FD6D| C9 95                          CMP     #95            ; FORWARD COPY?
FD6F| DØD6                           BNE     KEYRET
FD71| 2Ø 88FD                        JSR     PICK           ; GET CHARACTER FROM SCREEN
FD74| Ø9 8Ø                          ORA     #8Ø            ; SET TO NORMAL ASCII
FD76| 6Ø                             RTS
FD77|                    ;
FD77| A9 FB              GOESC       LDA     #ØFB
FD79| 48                             PHA
FD7A| B9 7FFD                        LDA     ESCVECT,Y
FD7D| 48                             PHA
FD7E| 6Ø                             RTS
FD7F| A1                 ESCVECT     .BYTE   ØA1            ; CLEOL-1
FD8Ø| 84                             .BYTE   84             ; CLEOP-1
FD81| 7C                             .BYTE   7C             ; CLSCRN-1
FD82| 62                             .BYTE   62             ; COL4Ø-1
FD83| 5C                             .BYTE   5C             ; COL8Ø-1
FD84| EC                             .BYTE   ØEC            ; CURLEFT-1
FD85| CA                             .BYTE   ØCA            ; CURIGHT-1
FD86| DC                             .BYTE   ØDC            ; CURDOWN-1
FD87| B7                             .BYTE   ØB7            ; CURUP-1
FD88|                    ;
FD88| A5 5C              PICK        LDA     CH             ; GET A CHARACTER AT CURRENT CURSOR POSITION
FD8A| 4A                             LSR     A              ; DETERMINE WHICH PAGE.
FD8B| A8                             TAY
FD8C| 24 68                          BIT     MODES          ; AND IF 8Ø COLUMN MODE
FD8E| 5ØØ5                           BVC     PICK4Ø         ; FORGET CARRY IF 4Ø COLUMNS
FD9Ø| 9ØØ3                           BCC     PICK4Ø         ; GET CHARACTER FROM $4ØØ
FD92| B1 6Ø                          LDA     (BAS8L),Y
FD94| 6Ø                             RTS
FD95| B1 5E              PICK4Ø      LDA     (BAS4L),Y
FD97| 6Ø                             RTS
FD98|                    ;
FD98| FD98               CLDSTRT     .EQU    *
FD98| A9 Ø3                          LDA     #Ø3
FD9A| 8D DØFF                        STA     ØFFDØ          ; ZERO PAGE IS ON 3!
FD9D| FD9D               SETUP       .EQU    *
FD9D| D8                             CLD                    ; OF COURSE!
FD9E| A2 Ø3                          LDX     #Ø3
FDAØ| 86 7F                          STX     INBUF+1
FDA2| BD BCFF            SETUP1      LDA     NMIRQ,X
```

"_79.PICT" 594 KB 2001-09-10 dpi: 600h x 600v pix: 4627h x 6177v



```
FDA5| 9D CAFF                   STA     ØFFCA,X
FDA8| BD B4FF                   LDA     HOOKS,X
FDAB| 95 6E                     STA     CSWL,X
FDAD| BD B8FF                   LDA     VBOUNDS,X
FDBØ| 95 58                     STA     LMARGIN,X
FDB2| CA                        DEX
FDB3| 1ØED                      BPL     SETUP1
FDB5| 85 82                     STA     IBDRVN
FDB7| A9 AØ                     LDA     #ØAØ           ; INPUT BUFFER AT $3AØ
FDB9| 85 7E                     STA     INBUF
FDBB| A9 6Ø                     LDA     #6Ø
FDBD| 85 81                     STA     IBSLOT
FDBF| A9 FF                     LDA     #ØFF
FDC1| 85 68                     STA     MODES
FDC3| 2Ø 63FB                   JSR     COL4Ø          ; SET 4Ø COLUMNS, CLEAR SCREEN
FDC6|                 ;
FDC6| ØØAØ            ADR       .EQU    ØAØ
FDC6| ØØAØ            CPORTL    .EQU    ADR
FDC6| ØØA1            CPORTH    .EQU    ADR+1
FDC6| ØØA2            CTEMP     .EQU    ADR+2
FDC6| ØØA3            CTEMP1    .EQU    ADR+3
FDC6| ØØA4            YTEMP     .EQU    ADR+4
FDC6| ØØCØ            ROWTEMP   .EQU    ADR+2Ø
FDC6| CØDB            CWRTON    .EQU    ØCØDB
FDC6| CØDA            CWRTOFF   .EQU    ØCØDA
FDC6| FFEC            CB2CTRL   .EQU    ØFFEC
FDC6| FFED            CB2INT    .EQU    ØFFED
FDC6|                 ;
FDC6|                 ;
FDC6| A9 78           GENENTR   LDA     #78            ; INIT SCREEN INDX LOCATIONS
FDC8| 85 AØ                     STA     CPORTL
FDCA| A9 Ø8                     LDA     #Ø8
FDCC| 85 A1                     STA     CPORTH
FDCE| A9 FØ                     LDA     #ØFØ           ; SET UP INDEX TO CHRSET
FDDØ| 85 A4                     STA     YTEMP
FDD2| A9 ØØ                     LDA     #ØØ
FDD4| AA                        TAX
FDD5| 95 CØ           ZIPTEMPS  STA     ROWTEMP,X
FDD7| E8                        INX
FDD8| EØ 2Ø                     CPX     #2Ø
FDDA| DØF9                      BNE     ZIPTEMPS
FDDC| A9 Ø5                     LDA     #Ø5            ; FAKE THE FIRST BIT PATTERN
FDDE| 18                        CLC                    ; (PHANTOM 9TH BIT SHIFTED AS BIT Ø)
FDDF| Ø8                        PHP
FDEØ| 48                        PHA
FDE1| 86 A2           GENASC    STX     CTEMP          ; GENERATE THE ASCII
FDE3| AØ Ø7           GASCI1    LDY     #Ø7            ; CODES FOR THE FIRST PASS
FDE5| A6 A2           GASCI2    LDX     CTEMP
FDE7| 8A              GASCI3    TXA
FDE8| 91 AØ                     STA     (CPORTL),Y     ; $XXF=CHR Ø / 4
FDEA| E8                        INX                    ; $XXE=CHR 1 / 5
FDEB| 88                        DEY                    ; $XXD=CHR 2 / 6
FDEC| 3ØØ6                      BMI     GASCI4         ; $XXC=CHR 3 / 7
FDEE| CØ Ø3                     CPY     #Ø3            ; $XXB=CHR Ø / 4
FDFØ| DØF5                      BNE     GASCI3         ; $XXA=CHR 1 / 5
FDF2| FØF1                      BEQ     GASCI2         ; $XX9=CHR 2 / 6
FDF4| 2Ø 99FE         GASCI4    JSR     NXTPORT        ; $XX8=CHR 3 / 7
FDF7| BØØ8                      BCS     CBYTES         ; GO DECODE CHARACTER TABLE
FDF9| C9 ØA                     CMP     #ØA            ; SECOND SET OF 4?
FDFB| DØE6                      BNE     GASCI1
FDFD| A2 24                     LDX     #24
FDFF| DØEØ                      BNE     GENASC         ; BRANCH ALWAYS
FEØ1| 68              CBYTES    PLA                    ; RESTORE BIT PATTERN
FEØ2| 28                        PLP
FEØ3| A2 17                     LDX     #17            ; (4 CHARACTERS OF 6 ROWS)
FEØ5| AØ Ø5           CCOLMS    LDY     #Ø5            ; (FIVE COLUMNS)
FEØ7| 36 C4           CSHFT     ROL     ROWTEMP+4,X    ; BREAK BYTE INTO
FEØ9| ØA                        ASL     A              ; 5 BIT GROUPS
FEØA| DØØE                      BNE     SHFTCNT        ; BRANCH IF MORE BITS IN THIS BYTE
FEØC| 84 A2                     STY     CTEMP
FEØE| C6 A4                     DEC     YTEMP          ; (NOTE. CARRY IS SET)
FE1Ø| FØ16                      BEQ     DONE           ; BRANCH IF ALL DONE
FE12| A4 A4                     LDY     YTEMP          ; GET CHARACTER TABLE INDEX
FE14| B9 C4FE                   LDA     CHRSET-1,Y
FE17| 2A                        ROL     A              ; (CARRY KEEPS BYTE NON-ZERO UNTIL ALL 8 ARE
FE18|                                                  ;  ARE SHIFTED)
FE18| A4 A2                     LDY     CTEMP          ; RESTORE COLUMN COUNT
FE1A| 88              SHFTCNT   DEY                    ; GOT ALL FIVE BITS?
FE1B| DØEA                      BNE     CSHFT          ; NO, DO NEXT
FE1D| CA                        DEX                    ; ALL ROWS DONE
FE1E| 1ØE5                      BPL     CCOLMS         ; NO, DO NEXT
FE2Ø| Ø8                        PHP                    ; SAVE REMAINING BIT PATTERN AND CARRY
FE21| 48                        PHA
FE22| 2Ø 28FE                   JSR     STORCHRS       ; MOVE EM TO NON DISPLAYED VIDEO AREA
FE25| 4C Ø1FE                   JMP     CBYTES
FE28|                 ;
FE28| FE28            DONE      .EQU    *
FE28|                 ;
FE28| A2 1F           STORCHRS  LDX     #1F            ; MOVE CHARACTER PATTERNS TO VIDEO AREA
FE2A| AØ ØØ           STORSET   LDY     #ØØ
```

"_80.PICT" 622 KB 2001-09-10 dpi: 600h x 600v pix: 4675h x 6202v



```
FE2C| B5 CØ                 STOROW     LDA     ROWTEMP,X
FE2E| ØA                               ASL     A               ; SHIFT TO CENTER
FE2F| 29 3E                            AND     #3E             ; STRIP EXTRA GARBAGE
FE31| 91 AØ                            STA     (CPORTL),Y
FE33| CA                               DEX
FE34| C8                               INY
FE35| CØ Ø8                            CPY     #Ø8             ; THIS GROUP DONE
FE37| DØF3                             BNE     STOROW          ; NO, NEXT ROW
FE39| 2Ø 99FE                          JSR     NXTPORT
FE3C| C9 Ø8                            CMP     #Ø8
FE3E| FØØ4                             BEQ     GENDONE         ; ALL ROWS STORED?
FE4Ø| 8A                               TXA
FE41| 1ØE7                             BPL     STORSET
FE43| 6Ø                               RTS                     ; PARTIAL SET ($478-$5FF)
FE44|                       ;
FE44| A9 Ø1                 GENDONE    LDA     #Ø1             ; SET NORMAL MODE
FE46| 85 A2                            STA     CTEMP
FE48| A9 6Ø                 GEN1       LDA     #6Ø             ; PREPARE TO SEND BYTES TO CHARACTER
FE4A| 2C DBCØ                          BIT     CWRTON          ; GENERATOR RAM
FE4D| 2Ø AEFE                          JSR     VRETRCE         ; WAIT FOR NEXT VERTICAL RETRACE
FE5Ø| A9 2Ø                            LDA     #2Ø             ; WAIT AGAIN
FE52| 2Ø AEFE                          JSR     VRETRCE
FE55| 2C DACØ                          BIT     CWRTOFF         ; CHARACTERS ARE NOW LOADED
FE58| 2Ø 88FE                          JSR     ALTCHR          ; REPEAT THIS SET FOR OTHER 64 CHARACTERS
FE5B| C6 A2                            DEC     CTEMP           ; HAVE WE DONE ALTERNATES YET?
FE5D| 1Ø16                             BPL     GEN2            ; NO, DO IT!
FE5F| A9 Ø8                            LDA     #Ø8             ; BUMP ASCII VALUES FOR NEXT SET
FE61| 85 A1                            STA     CPORTH
FE63| AØ Ø7                 NXTASCI    LDY     #Ø7             ; THE USUAL COUNTDOWN
FE65| B1 AØ                 NXTASC2    LDA     (CPORTL),Y
FE67| 18                               CLC
FE68| 69 Ø8                            ADC     #Ø8
FE6A| 91 AØ                            STA     (CPORTL),Y
FE6C| 88                               DEY
FE6D| 1ØF6                             BPL     NXTASC2
FE6F| 2Ø 99FE                          JSR     NXTPORT
FE72| 9ØEF                             BCC     NXTASCI
FE74| 6Ø                               RTS
FE75| AØ Ø3                 GEN2       LDY     #Ø3             ; SETUP ALTERNATE WITH UNDERLINES
FE77| A9 7F                            LDA     #7F
FE79| 99 FCØ5               UNDER      STA     Ø5FC,Y
FE7C| 99 FCØ7                          STA     Ø7FC,Y
FE7F| 88                               DEY
FE8Ø| 1ØF7                             BPL     UNDER
FE82| A9 Ø8                            LDA     #Ø8
FE84| 85 A1                            STA     CPORTH
FE86| DØCØ                             BNE     GEN1
FE88|                       ;
FE88| AØ Ø7                 ALTCHR     LDY     #Ø7             ; ADJUST ASCII FOR ALTERNATE SET
FE8A| B1 AØ                 ALTC1      LDA     (CPORTL),Y
FE8C| 49 2Ø                            EOR     #2Ø             ; $2Ø-->  $4Ø-->$6Ø
FE8E| 91 AØ                            STA     (CPORTL),Y
FE9Ø| 88                               DEY
FE91| 1ØF7                             BPL     ALTC1           ; ADJUST THEM ALL
FE93| 2Ø 99FE                          JSR     NXTPORT
FE96| 9ØFØ                             BCC     ALTCHR
FE98| 6Ø                               RTS
FE99|                       ;
FE99| A5 AØ                 NXTPORT    LDA     CPORTL          ; CONVERT $78->$F8 OR $F8-$78
FE9B| 49 8Ø                            EOR     #8Ø
FE9D| 85 AØ                            STA     CPORTL
FE9F| 3ØØ2                             BMI     NOHIGH
FEA1| E6 A1                            INC     CPORTH
FEA3| A5 A1                 NOHIGH     LDA     CPORTH
FEA5| C9 ØC                            CMP     #ØC
FEA7| DØØ4                             BNE     PORTDN
FEA9| A9 Ø4                            LDA     #Ø4
FEAB| 85 A1                            STA     CPORTH
FEAD| 6Ø                    PORTDN     RTS
FEAE|                       ;
FEAE| 85 A3                 VRETRCE    STA     CTEMP1          ; SAVE BITS TO BE STORED
FEBØ| AD ECFF                          LDA     CB2CTRL         ; CONTROL PORT FOR 'CB2'
FEB3| 29 3F                            AND     #3F             ; RESET HI BITS TO Ø
FEB5| Ø5 A3                            ORA     CTEMP1
FEB7| 8D ECFF                          STA     CB2CTRL
FEBA| A9 Ø8                            LDA     #Ø8             ; TEST VERTICAL RETRACE
FEBC| 8D EDFF                          STA     CB2INT
FEBF| 2C EDFF               VWAIT      BIT     CB2INT          ; WAIT FOR RETRACE
FEC2| FØFB                             BEQ     VWAIT
FEC4| 6Ø                               RTS
FEC5|                       ;
FEC5| FEC5                  CHRSET     .EQU    *
FEC5|                       ;
FEC5| FØ Ø1 82 18 4Ø 84 81             .BYTE   ØFØ,Ø1,82,18,4Ø,84,81,2F,58,44,81,29,Ø2,1E,Ø1,91,7C,1F,49,3Ø
FECC| 2F 58 44 81 29 Ø2 1E
FED3| Ø1 91 7C 1F 49 3Ø
FED9| 8A Ø8 43 14 31 2A 22             .BYTE   8A,Ø8,43,14,31,2A,22,13,ØE3,ØF7,ØC4,91,48,ØA2,ØDA,24,ØC6,4A
FEEØ| 13 E3 F7 C4 91 48 A2
FEE7| DA 24 C6 4A
FEEB| 62 8C 24 C6 F8 63 8C             .BYTE   62,8C,24,ØC6,ØF8,63,8C,ØC1,46,17,52,8A,ØAF,16,14,ØE3,33,31
```

"_81.PICT" 619 KB 2001-09-10 dpi: 600h x 600v pix: 4651h x 6177v

```
FEF2| C1 46 17 52 8A AF 16
FEF9| 14 E3 33 31
FEFD| C6 F8 DC 73 3F 46 17            .BYTE   ØC6,ØF8,ØDC,73,3F,46,17,62,8C,21,ØE6,18,6A,8D,61,ØCF,18,62
FFØ4| 62 8C 21 E6 18 6A 8D
FFØB| 61 CF 18 62
FFØF| 74 D1 B9 18 49 4C 91            .BYTE   74,ØD1,ØB9,18,49,4C,91,ØCØ,ØF3,Ø9,2C,91,ØCØ,14,1D,8C,ØEF,Ø7
FF16| CØ F3 Ø9 2C 91 CØ 14
FF1D| 1D 8C EF Ø7
FF21| 17 43 88 31 84 1E DF            .BYTE   17,43,88,31,84,1E,ØDF,ØB,31,84,ØF8,ØFE,77,3E,3E,17,62,8C,ØFD
FF28| ØB 31 84 F8 FE 77 3E
FF2F| 3E 17 62 8C FD
FF34| C7 5Ø E3 ØB 51 C5 E8            .BYTE   ØC7,5Ø,ØE3,ØB,51,ØC5,ØE8,ØC8,73,18,ØC,42,3E,Ø1,Ø2,2Ø,42,3E
FF3B| C8 73 18 ØC 42 3E Ø1
FF42| Ø2 2Ø 42 3E
FF46| 41 18 8C Ø8 ØØ 7Ø EE            .BYTE   41,18,8C,Ø8,ØØ,7Ø,ØEE,ØØ,11,11,21,11,Ø2,ØEØ,3C,21,31,Ø2,ØEØ
FF4D| ØØ 11 11 21 11 Ø2 EØ
FF54| 3C 21 31 Ø2 EØ
FF59| 1C ØØ C8 B9 8Ø 62 14            .BYTE   1C,ØØ,ØC8,ØB9,8Ø,62,14,1F,46,ØA2,ØDE,43,2C,Ø4,88,ØBE,ØFF,ØCE
FF6Ø| 1F 46 A2 DE 43 2C Ø4
FF67| 88 BE FF CE
FF6B| 7D 37 49 88 95 18 98            .BYTE   7D,37,49,88,95,18,98,Ø9,62,ØD1,44,ØE8,88,ØFB,Ø2,9Ø,4Ø,ØØ,1Ø
FF72| Ø9 62 D1 44 E8 88 FB
FF79| Ø2 9Ø 4Ø ØØ 1Ø
FF7E| EØ Ø3 Ø2 ØØ 4Ø ØØ ØØ            .BYTE   ØEØ,Ø3,Ø2,ØØ,4Ø,ØØ,ØØ,Ø8,ØØ,ØØ,28,1Ø,42,44,25,82,ØB8,2F,48
FF85| Ø8 ØØ ØØ 28 1Ø 42 44
FF8C| 25 82 B8 2F 48
FF91| 25 44 1Ø 82 Ø2 ØØ 2F            .BYTE   25,44,1Ø,82,Ø2,ØØ,2F,5A,4Ø,45,Ø2,8E,64,5Ø,9Ø,Ø1,3E,26,42,8Ø
FF98| 5A 4Ø 45 Ø2 8E 64 5Ø
FF9F| 9Ø Ø1 3E 26 42 8Ø
FFA5| 21 8Ø ØØ Ø5 ØØ F8 8Ø            .BYTE   21,8Ø,ØØ,Ø5,ØØ,ØF8,8Ø,ØØ,Ø5,Ø8,ØF8,8Ø,28,Ø5,88
FFAC| ØØ Ø5 Ø8 F8 8Ø 28 Ø5
FFB3| 88
FFB4|                       ;
FFB4| FFB4                  HOOKS     .EQU    *
FFB4| Ø6FC                            .WORD   COUT2
FFB6| ØFFD                            .WORD   KEYIN
FFB8| FFB8                  VBOUNDS   .EQU    *
FFB8| ØØ 5Ø ØØ 18                     .BYTE   ØØ,5Ø,ØØ,18
FFBC|                       ;
FFBC| 4C 86F6               NMIRQ     JMP     RECON        ; IN DIAGNOSTICS
FFBF| 4Ø                              RTI
FFCØ|                       ;
FFCØ| 43 4F 5Ø 59 52 49 47            .ASCII  "COPYRIGHT JANUARY, 198Ø  APPLE COMPUTER INC..JRH"
FFC7| 48 54 2Ø 4A 41 4E 55
FFCE| 41 52 59 2C 2Ø 31 39
FFD5| 38 3Ø 2Ø 2Ø 41 5Ø 5Ø
FFDC| 4C 45 2Ø 43 4F 4D 5Ø
FFE3| 55 54 45 52 2Ø 49 4E
FFEA| 43 2E 2E 4A 52 48
FFFØ|                       ;
FFFØ| CC DØ D3 B4 B8 88 95  ESCTABL   .BYTE   ØCC,ØDØ,ØD3,ØB4,ØB8,88,95,8A,8B,ØØ
FFF7| 8A 8B ØØ
FFFA|                       ;
FFFA| CAFF                  NMI       .WORD   ØFFCA
FFFC| EEF4                  RESET     .WORD   DIAGN        ; NOTHING
FFFE| CDFF                  IRQ       .WORD   ØFFCD
ØØØØ|
ØØØØ|                                 .END
```

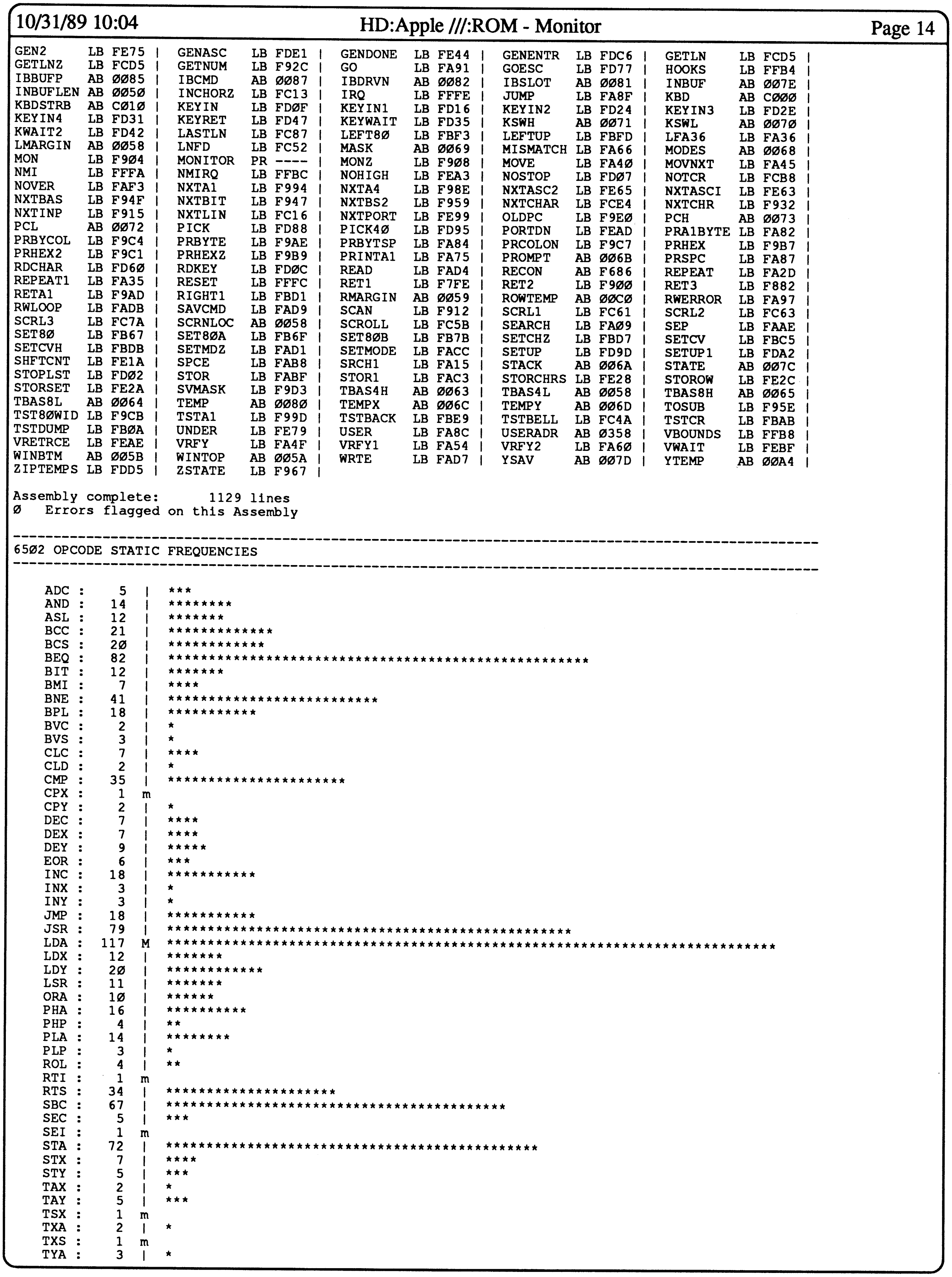
J. R. Huston
(also worked
on SOS)

```
--------------------------------------------------------------------------------------------
SYMBOL TABLE DUMP
--------------------------------------------------------------------------------------------

AB - Absolute       LB - Label        UD - Undefined      MC - Macro
RF - Ref            DF - Def          PR - Proc           FC - Func
PB - Public         PV - Private      CS - Consts

A1H      AB ØØ75 | A1L      AB ØØ74 | A1PC     LB F9D6 | A1PC1    LB F9D9 | A2H      AB ØØ77 |
A2L      AB ØØ76 | A3H      AB ØØ79 | A3L      AB ØØ78 | A4H      AB ØØ7B | A4L      AB ØØ7A |
ADR      AB ØØAØ | ALTC1    LB FE8A | ALTCHR   LB FE88 | ASC1     LB FB4Ø | ASC2     LB FB4C |
ASC3     LB FB5A | ASCDONE  LB FAØ8 | ASCII    LB FA1B | ASCIIØ   LB FA1D | ASCII1   LB F9E1 |
ASCII2   LB F9E3 | ASCII3   LB F9F4 | BAS4H    AB ØØ5F | BAS4L    AB ØØ5E | BAS8H    AB ØØ61 |
BAS8L    AB ØØ6Ø | BASCALC  LB FBC7 | BASCALC1 LB FC19 | BELL     LB FC4E | BITOFF   LB FA29 |
BITON    LB FA25 | BKGND    AB ØØ67 | BKSPCE   LB FCDE | BL1      LB FAB4 | BLOCKIO  AB F479 |
BSCLC2   LB FC2D | CANCEL   LB FCCD | CARRAGE  LB FBAF | CB2CTRL  AB FFEC | CB2INT   AB FFED |
CBYTES   LB FEØ1 | CCOLMS   LB FEØ5 | CH       AB ØØ5C | CHRSET   LB FEC5 | CKMDE    LB FA1E |
CLDSTRT  LB FD98 | CLEOL    LB FBA2 | CLEOL1   LB FC89 | CLEOL2   LB FC91 | CLEOP    LB FB85 |
CLEOP1   LB FB8E | CLSCRN   LB FB7D | CMDSRCH  LB F91C | CMDTAB   LB F96C | CMDVEC   LB F97D |
COL4Ø    LB FB63 | COL8Ø    LB FB5D | CONTROL  LB FBA7 | COUT     LB FC39 | COUT1    LB FC47 |
COUT2    LB FCØ6 | CPORTH   AB ØØA1 | CPORTL   AB ØØAØ | CRCHK    LB F9FD | CRMON    LB FA3A |
CROUT    LB FCEF | CSHFT    LB FEØ7 | CSWH     AB ØØ6F | CSWL     AB ØØ6E | CTEMP    AB ØØA2 |
CTEMP1   AB ØØA3 | CTRLRET  LB FC38 | CURDN1   LB FBC7 | CURDOWN  LB FBDD | CURIGHT  LB FBCB |
CURLEFT  LB FBED | CURSOR   AB ØØ69 | CURUP    LB FBB8 | CURUP1   LB FBC2 | CV       AB ØØ5D |
CWRTOFF  AB CØDA | CWRTON   AB CØDB | DEST     LB FAA5 | DIAGN    AB F4EE | DIGIT    LB F941 |
DIGRET   LB F96B | DISPLAY  LB FC9D | DISPLAYX LB FC1Ø | DONE     LB FE28 | DSPBKGND LB FCAA |
DSPL8Ø   LB FCAD | DUMMY    LB FACB | DUMP     LB FBØD | DUMPØ    LB FB1Ø | DUMP1    LB FB1D |
DUMP2    LB FB2Ø | DUMP3    LB FB3Ø | DUMP8    LB FAFD | DUMPASC  LB FB35 | ENTRY    LB F9Ø1 |
ERROR    LB FAA2 | ERROR1   LB FBØB | ERROR2   LB FA9F | ESC1     LB FD53 | ESC2     LB FD58 |
ESC3     LB FD48 | ESCAPE   LB FD4B | ESCTABL  LB FFFØ | ESCVECT  LB FD7F | FORGND   AB ØØ66 |
GASCI1   LB FDE3 | GASCI2   LB FDE5 | GASCI3   LB FDE7 | GASCI4   LB FDF4 | GEN1     LB FE48 |
```

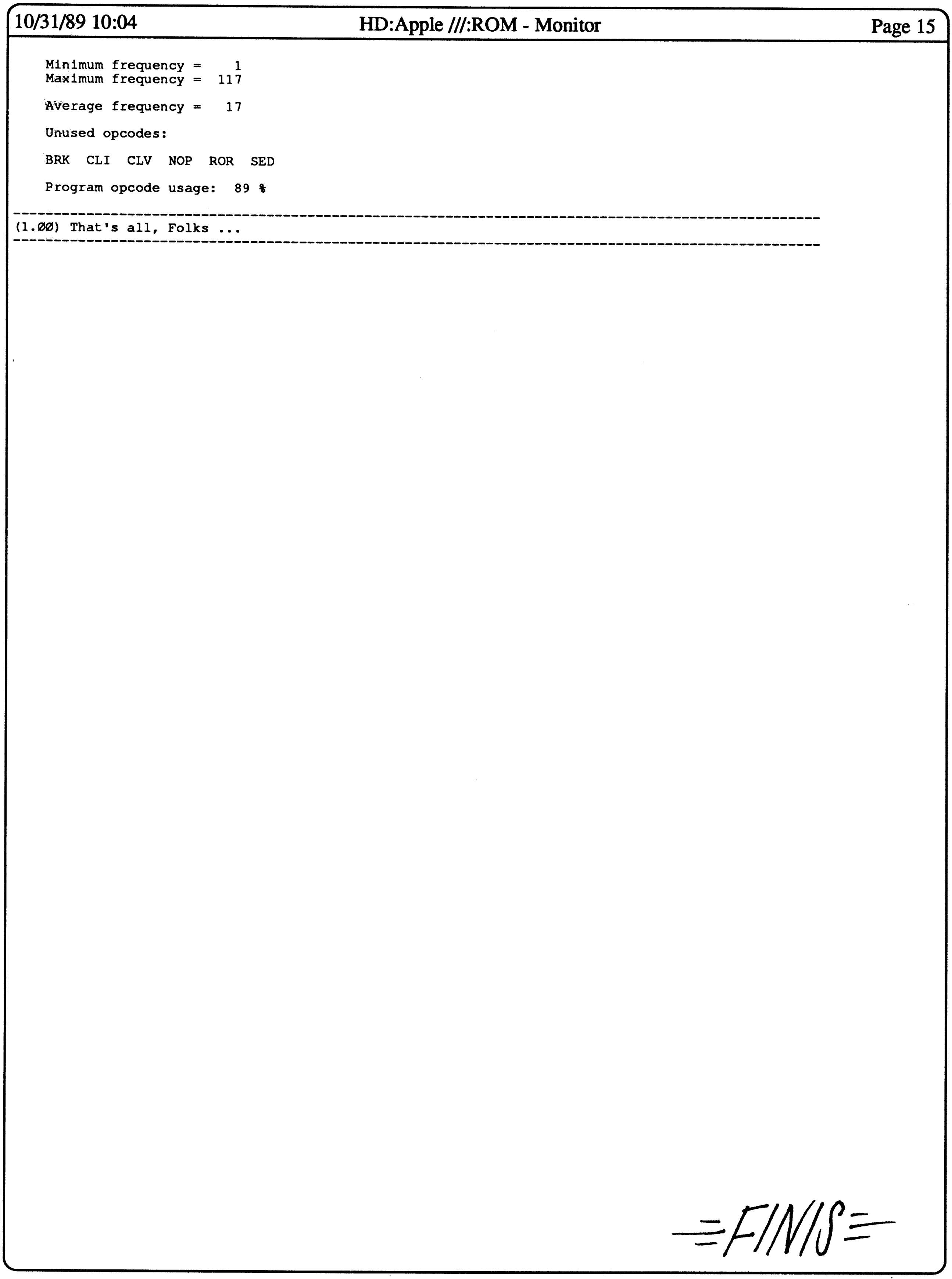
J=James
R=Richard

aka
Dick
Huston

“_82.PICT” 886 KB 2001-09-10 dpi: 600h x 600v pix: 4687h x 6190v



```
GEN2      LB FE75 |  GENASC   LB FDE1 |  GENDONE  LB FE44 |  GENENTR  LB FDC6 |  GETLN    LB FCD5 |
GETLNZ    LB FCD5 |  GETNUM   LB F92C |  GO       LB FA91 |  GOESC    LB FD77 |  HOOKS    LB FFB4 |
IBBUFP    AB ØØ85 |  IBCMD    AB ØØ87 |  IBDRVN   AB ØØ82 |  IBSLOT   AB ØØ81 |  INBUF    AB ØØ7E |
INBUFLEN  AB ØØ5Ø |  INCHORZ  LB FC13 |  IRQ      LB FFFE |  JUMP     LB FA8F |  KBD      AB CØØØ |
KBDSTRB   AB CØ1Ø |  KEYIN    LB FDØF |  KEYIN1   LB FD16 |  KEYIN2   LB FD24 |  KEYIN3   LB FD2E |
KEYIN4    LB FD31 |  KEYRET   LB FD47 |  KEYWAIT  LB FD35 |  KSWH     AB ØØ71 |  KSWL     AB ØØ7Ø |
KWAIT2    LB FD42 |  LASTLN   LB FC87 |  LEFT8Ø   LB FBF3 |  LEFTUP   LB FBFD |  LFA36    LB FA36 |
LMARGIN   AB ØØ58 |  LNFD     LB FC52 |  MASK     AB ØØ69 |  MISMATCH LB FA66 |  MODES    AB ØØ68 |
MON       LB F9Ø4 |  MONITOR  PR ---- |  MONZ     LB F9Ø8 |  MOVE     LB FA4Ø |  MOVNXT   LB FA45 |
NMI       LB FFFA |  NMIRQ    LB FFBC |  NOHIGH   LB FEA3 |  NOSTOP   LB FDØ7 |  NOTCR    LB FCB8 |
NOVER     LB FAF3 |  NXTA1    LB F994 |  NXTA4    LB F98E |  NXTASC2  LB FE65 |  NXTASCI  LB FE63 |
NXTBAS    LB F94F |  NXTBIT   LB F947 |  NXTBS2   LB F959 |  NXTCHAR  LB FCE4 |  NXTCHR   LB F932 |
NXTINP    LB F915 |  NXTLIN   LB FC16 |  NXTPORT  LB FE99 |  OLDPC    LB F9EØ |  PCH      AB ØØ73 |
PCL       AB ØØ72 |  PICK     LB FD88 |  PICK4Ø   LB FD95 |  PORTDN   LB FEAD |  PRA1BYTE LB FA82 |
PRBYCOL   LB F9C4 |  PRBYTE   LB F9AE |  PRBYTSP  LB FA84 |  PRCOLON  LB F9C7 |  PRHEX    LB F9B7 |
PRHEX2    LB F9C1 |  PRHEXZ   LB F9B9 |  PRINTA1  LB FA75 |  PROMPT   AB ØØ6B |  PRSPC    LB FA87 |
RDCHAR    LB FD6Ø |  RDKEY    LB FDØC |  READ     LB FAD4 |  RECON    AB F686 |  REPEAT   LB FA2D |
REPEAT1   LB FA35 |  RESET    LB FFFC |  RET1     LB F7FE |  RET2     LB F9ØØ |  RET3     LB F882 |
RETA1     LB F9AD |  RIGHT1   LB FBD1 |  RMARGIN  AB ØØ59 |  ROWTEMP  AB ØØCØ |  RWERROR  LB FA97 |
RWLOOP    LB FADB |  SAVCMD   LB FAD9 |  SCAN     LB F912 |  SCRL1    LB FC61 |  SCRL2    LB FC63 |
SCRL3     LB FC7A |  SCRNLOC  AB ØØ58 |  SCROLL   LB FC5B |  SEARCH   LB FAØ9 |  SEP      LB FAAE |
SET8Ø     LB FB67 |  SET8ØA   LB FB6F |  SET8ØB   LB FB7B |  SETCHZ   LB FBD7 |  SETCV    LB FBC5 |
SETCVH    LB FBDB |  SETMDZ   LB FAD1 |  SETMODE  LB FACC |  SETUP    LB FD9D |  SETUP1   LB FDA2 |
SHFTCNT   LB FE1A |  SPCE     LB FAB8 |  SRCH1    LB FA15 |  STACK    AB ØØ6A |  STATE    AB ØØ7C |
STOPLST   LB FDØ2 |  STOR     LB FABF |  STOR1    LB FAC3 |  STORCHRS LB FE28 |  STOROW   LB FE2C |
STORSET   LB FE2A |  SVMASK   LB F9D3 |  TBAS4H   AB ØØ63 |  TBAS4L   AB ØØ58 |  TBAS8H   AB ØØ65 |
TBAS8L    AB ØØ64 |  TEMP     AB ØØ8Ø |  TEMPX    AB ØØ6C |  TEMPY    AB ØØ6D |  TOSUB    LB F95E |
TST8ØWID  LB F9CB |  TSTA1    LB F99D |  TSTBACK  LB FBE9 |  TSTBELL  LB FC4A |  TSTCR    LB FBAB |
TSTDUMP   LB FBØA |  UNDER    LB FE79 |  USER     LB FA8C |  USERADR  AB Ø358 |  VBOUNDS  LB FFB8 |
VRETRCE   LB FEAE |  VRFY     LB FA4F |  VRFY1    LB FA54 |  VRFY2    LB FA6Ø |  VWAIT    LB FEBF |
WINBTM    AB ØØ5B |  WINTOP   AB ØØ5A |  WRTE     LB FAD7 |  YSAV     AB ØØ7D |  YTEMP    AB ØØA4 |
ZIPTEMPS  LB FDD5 |  ZSTATE   LB F967 |

Assembly complete:      1129 lines
Ø   Errors flagged on this Assembly

---------------------------------------------------------------------------------------------------
65Ø2 OPCODE STATIC FREQUENCIES
---------------------------------------------------------------------------------------------------

    ADC :    5  |  ***
    AND :   14  |  ********
    ASL :   12  |  *******
    BCC :   21  |  *************
    BCS :   2Ø  |  ************
    BEQ :   82  |  ****************************************************
    BIT :   12  |  *******
    BMI :    7  |  ****
    BNE :   41  |  **************************
    BPL :   18  |  ***********
    BVC :    2  |  *
    BVS :    3  |  *
    CLC :    7  |  ****
    CLD :    2  |  *
    CMP :   35  |  **********************
    CPX :    1  m
    CPY :    2  |  *
    DEC :    7  |  ****
    DEX :    7  |  ****
    DEY :    9  |  *****
    EOR :    6  |  ***
    INC :   18  |  ***********
    INX :    3  |  *
    INY :    3  |  *
    JMP :   18  |  ***********
    JSR :   79  |  **************************************************
    LDA :  117  M  **************************************************************************
    LDX :   12  |  *******
    LDY :   2Ø  |  ************
    LSR :   11  |  *******
    ORA :   1Ø  |  ******
    PHA :   16  |  **********
    PHP :    4  |  **
    PLA :   14  |  ********
    PLP :    3  |  *
    ROL :    4  |  **
    RTI :    1  m
    RTS :   34  |  *********************
    SBC :   67  |  ******************************************
    SEC :    5  |  ***
    SEI :    1  m
    STA :   72  |  **********************************************
    STX :    7  |  ****
    STY :    5  |  ***
    TAX :    2  |  *
    TAY :    5  |  ***
    TSX :    1  m
    TXA :    2  |  *
    TXS :    1  m
    TYA :    3  |  *
```



```
    Minimum frequency =    1
    Maximum frequency =  117

    Average frequency =   17

    Unused opcodes:

    BRK  CLI  CLV  NOP  ROR  SED

    Program opcode usage:  89 %

-----------------------------------------------------------------------------------------------
(1.ØØ) That's all, Folks ...
-----------------------------------------------------------------------------------------------
```

=FINIS=

 Apple /// Computer Information DEC 1997

APPLE /// REV 1 ROM HEX DUMP

Source
ROM file as found with Chris Smolinski's Macintosh SARA emulator application

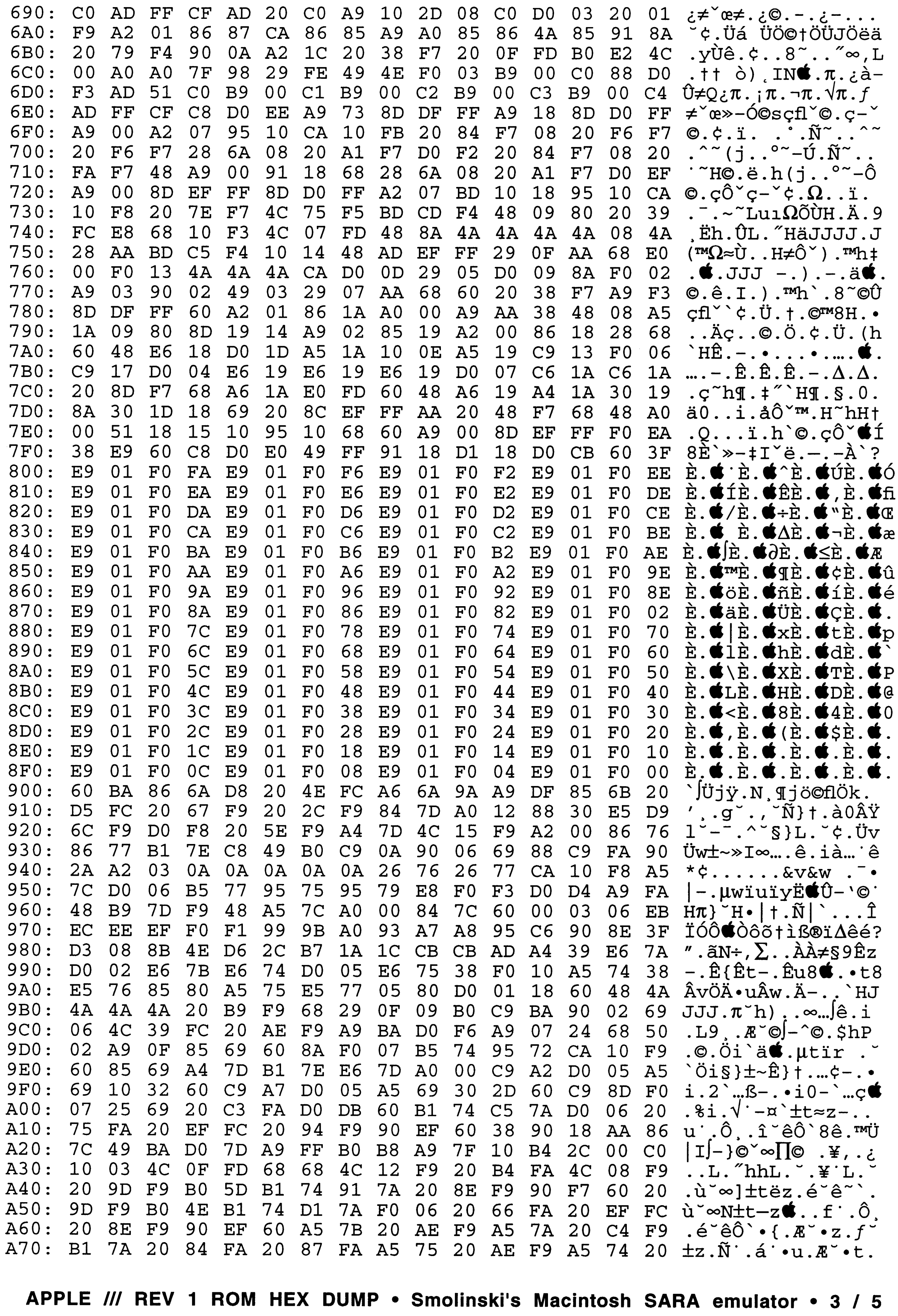
This hex dump, which was produced by the Apple Macintosh MPW DumpFile tool, lists the Apple /// Revision 1 ROM. This 4KB ROM occupies addresses $F000-$FFFF.

Printed: Dec. 1997/David T. Craig

```
File                    : ROM
Data Fork Length        : 4096
Resource Fork Length    : 2670

Dumping Data Fork from offset 0 to 4095

   0:  A0  01  A6  81  84  94  A9  05  85  8F  08  68  6A  6A  6A  6A  †.¶ÅÑî©.Öè.hjjjj
  10:  85  8B  AD  DF  FF  85  9F  20  2B  F1  08  A5  85  85  9B  A5  Öã≠ﬂˇÖü.+Ò.•ÖÖõ•
  20:  86  85  9C  A9  E0  85  9A  A5  82  C5  8A  85  8A  08  6A  BD  ÜÖú©‡Öö•Ç≈äÖä.jΩ
  30:  89  C0  90  01  E8  BD  8A  C0  20  4C  F3  28  F0  0A  28  A0  â¿ê.ËΩä¿.LÛ(.(†
  40:  07  20  56  F4  88  D0  FA  08  A5  83  A6  81  20  04  F1  28  ..VÙà–˙.•É¶Å..Ò(
  50:  D0  17  A0  12  88  D0  FD  E6  99  D0  F7  E6  9A  30  F3  20  –.†.à–˝Êô–˜Êö0Û.
  60:  2B  F1  D0  05  A9  80  4C  EA  F0  A5  87  F0  76  C9  03  B0  +Ò–.©ÄLÍ•áv….∞
  70:  72  6A  B0  0B  AD  DF  FF  29  7F  8D  DF  FF  20  C4  F2  A0  rj∞.≠ﬂˇ) çﬂˇ.ƒÚ†
  80:  7F  84  93  A6  81  20  B9  F1  90  22  20  AA  F1  C6  93  10   Ñì¶Å.πÒê".™Ò∆ì.
  90:  F2  C6  94  D0  53  A5  8F  30  E6  A5  8C  48  A9  60  20  25  Ú∆î–S•è0Ê•åH©`.%
  A0:  F1  A9  00  20  04  F1  68  20  04  F1  90  D3  A4  99  C4  8C  Ò©...Òh..Òê”§ôƒå
  B0:  F0  0E  A5  8C  48  98  0A  20  25  F1  68  20  04  F1  90  CA  .•åHò..%Òh..Òê
  C0:  A5  9A  85  89  A5  98  C5  84  D0  C0  A5  87  4A  90  2A  20  •öÖâ•ò≈Ñ–¿•áJê*.
  D0:  48  F1  B0  B6  AD  DF  FF  29  7F  8D  DF  FF  20  0F  F3  A6  HÒ∞∂≠ﬂˇ) çﬂˇ..Û¶
  E0:  81  B0  A7  18  A9  00  90  03  A9  82  38  85  88  BD  88  C0  Å∞ß.©.ê.©Ç8ÖàΩà¿
  F0:  20  AA  F1  A5  9F  8D  DF  FF  60  20  16  F2  90  E5  A9  81  .™Ò•üçﬂˇ`..ÚêÂ©Å
 100:  50  E8  D0  C4  0A  85  99  20  18  F1  20  3E  F1  B5  85  85  PË–ƒ.Öô..Ò.>ÒµÖÖ
 110:  8C  A5  99  95  85  20  00  F4  A0  03  98  20  4A  F4  88  10  å•ôïÖ..Ù†.ò.JÙà.
 120:  F9  46  8C  18  60  20  3E  F1  95  85  60  A0  00  BD  8C  C0  ˘Få.`.>ÒïÖ`†.Ωå¿
 130:  20  3D  F1  48  68  DD  8C  C0  D0  03  88  D0  F0  60  48  8A  .=ÒHh›å¿–.à–`Hä
 140:  4A  4A  4A  05  82  AA  68  60  A0  20  88  F0  6A  BD  8C  C0  JJJ.Ç™h`†.àjΩå¿
 150:  10  FB  49  D5  D0  F4  EA  BD  8C  C0  10  FB  C9  AA  D0  F2  .˚I’–ÙÍΩå¿.˚…™–Ú
 160:  A0  55  EA  BD  8C  C0  10  FB  C9  AD  D0  E6  EA  EA  BD  8C  †UÍΩå¿.˚…≠–ÊÍÍΩå
 170:  C0  10  FB  99  02  03  AD  EF  FF  05  8B  10  37  88  10  EE  ¿.˚ô..≠Ôˇ.ã.7à.Ó
 180:  C8  BD  8C  C0  10  FB  99  00  02  AD  EF  FF  05  8B  10  24  »Ωå¿.˚ô..≠Ôˇ.ã.$
 190:  C0  E4  D0  EC  C8  BD  8C  C0  10  FB  99  00  02  C8  D0  F5  ¿‰–Ï»Ωå¿.˚ô..»–ı
 1A0:  BD  8C  C0  10  FB  85  96  20  01  F2  24  8B  10  04  24  8F  Ωå¿.˚Öñ..Ú$ã..$è
 1B0:  10  01  58  60  20  AA  F2  38  60  A0  FC  84  95  C8  D0  04  ..X`.™Ú8`†¸Ñï»–.
 1C0:  E6  95  F0  F3  BD  8C  C0  10  FB  C9  D5  D0  F0  EA  BD  8C  ÊïÛΩå¿.˚…’–ÍΩå
 1D0:  C0  10  FB  C9  AA  D0  F2  A0  03  BD  8C  C0  10  FB  C9  96  ¿.˚…™–Ú†.Ωå¿.˚…ñ
 1E0:  D0  E7  78  A9  00  85  89  BD  8C  C0  10  FB  2A  85  95  BD  –Áx©.ÖâΩå¿.˚*ÖïΩ
 1F0:  8C  C0  10  FB  25  95  99  97  00  45  89  88  10  E7  A8  D0  å¿.˚%ïôó.Eâà.Á®–
 200:  B6  BD  8C  C0  10  FB  C9  DE  D0  AD  EA  BD  8C  C0  10  FB  ∂Ωå¿.˚…ﬁ–≠ÍΩå¿.˚
 210:  C9  AA  D0  A3  18  60  38  B8  BD  8D  C0  BD  8E  C0  30  F5  …™–£.`8∏Ωç¿Ωé¿0ı
 220:  A9  FF  9D  8F  C0  1D  8C  C0  A0  04  EA  48  68  48  68  20  ©ˇùè¿.å¿†.ÍHhHh.
 230:  BB  F2  88  D0  F8  A9  D5  20  BA  F2  A9  AA  20  BA  F2  A9  ªÚà–¯©’.∫Ú©™.∫Ú©
 240:  AD  20  BA  F2  A0  55  EA  EA  EA  D0  08  AD  EF  FF  05  8B  ≠.∫Ú†UÍÍÍ–.≠Ôˇ.ã
 250:  38  10  57  30  00  B9  02  03  9D  8D  C0  BD  8C  C0  88  10  8.W0.π..ùç¿Ωå¿à.
 260:  EA  98  30  03  AD  EF  FF  05  8B  38  30  02  10  3C  C8  B9  Íò0.≠Ôˇ.ã80..<»π
 270:  00  02  9D  8D  C0  BD  8C  C0  C0  E4  D0  E8  EA  C8  EA  EA  ..ùç¿Ωå¿¿‰–ËÍ»ÍÍ
 280:  48  68  B9  00  02  9D  8D  C0  BD  8C  C0  A5  96  C8  D0  EE  Hhπ..ùç¿Ωå¿•ñ»–Ó
 290:  F0  00  20  BB  F2  48  68  B9  C0  F3  20  BD  F2  C8  C0  04  ..ªÚHhπ¿Û.ΩÚ»¿.
2A0:  D0 F5 18 BD 8E C0 BD 8C C0 60 2C 54 F3 20 A3 F2  –ı.Ωé¿Ωå¿`,TÛ.£Ú
2B0:  A5 8F 10 02 85 8B C6 8F 58 60 18 48 68 9D 8D C0  •è..Öã∆èX`.Hhùç¿
2C0:  1D 8C C0 60 A2 02 A0 00 88 B1 9B 4A 3E 01 03 4A  .å¿`¢.†.à±õJ>..J
2D0:  3E 01 03 99 01 02 E8 E0 56 90 ED A2 00 98 D0 E8  >..ô..Ë‡VêÌ¢.ò–Ë
2E0:  A0 56 59 00 03 29 3F AA BD 55 F3 99 01 03 B9 00  †VY..)?™ΩUÛô..π.
2F0:  03 88 D0 EE 29 3F 59 01 02 AA BD 55 F3 99 00 02  .à–Ó)?Y..™ΩUÛô..
300:  B9 01 02 C8 D0 F0 AA BD 55 F3 85 96 4C 4C F3 38  π..»–™ΩUÛÖñLLÛ8
310:  A0 55 A9 00 BE 02 03 5D 00 F3 30 30 99 02 03 88  †U©.æ..].Û00ô..à
320:  10 F2 C8 BE 00 02 5D 00 F3 99 00 02 C8 D0 F4 A6  .Ú»æ..].Ûô..»–Ù¶
330:  96 5D 00 F3 D0 16 A2 56 CA 30 FB B9 00 02 5E 02  ñ].Û–.¢V 0˚π..^.
340:  03 2A 5E 02 03 2A 91 9B C8 D0 ED 18 AD DF FF 09  .*^..*ëõ»–Ì.≠ﬂˇ.
350:  80 8D DF FF 60 96 97 9A 9B 9D 9E 9F A6 A7 AB AC  Äçﬂˇ`ñóöõùûü¶ß´¨
360:  AD AE AF B2 B3 B4 B5 B6 B7 B9 BA BB BC BD BE BF  ≠ÆØ≤≥¥µ∂∑π∫ªºΩæø
370:  CB CD CE CF D3 D6 D7 D9 DA DB DC DD DE DF E5 E6  ÀÕŒœ”÷◊Ÿ/¤<>ﬁﬂÂÊ
380:  E7 E9 EA EB EC ED EE EF F2 F3 F4 F5 F6 F7 F9 FA  ÁÈÍÎÏÌÓÔÚÛÙıˆ˜˘˙
390:  FB FC FD FE FF 01 00 01 98 99 02 03 9C 04 05 06  ˚¸˝˛ˇ...òô..ú...
3A0:  A0 A1 A2 A3 A4 A5 07 08 A8 A9 AA 09 0A 0B 0C 0D  †°¢£§•..®©™.....
3B0:  B0 B1 0E 0F 10 11 12 13 B8 14 15 16 17 18 19 1A  ∞±......∏.......
3C0:  DE AA EB FF C4 C5 C6 C7 C8 C9 CA 1B CC 1C 1D 1E  ﬁ™Îˇƒ≈∆«»… .Ã...
3D0:  D0 D1 D2 1F D4 D5 20 21 D8 22 23 24 25 26 27 28  –—“.‘’.!ÿ"#$%&'(
3E0:  E0 E1 E2 E3 E4 29 2A 2B E8 2C 2D 2E 2F 30 31 32  ‡·‚„‰)*+Ë,-./012
3F0:  F0 F1 33 34 35 36 37 38 F8 39 3A 3B 3C 3D 3E 3F  Ò345678¯9:;<=>?
400:  85 9E C5 8C F0 42 A9 00 85 95 A5 8C 85 9D 38 E5  Öû≈åB©.Öï•åÖù8Â
410:  9E F0 31 B0 06 49 FF E6 8C 90 04 69 FE C6 8C C5  û1∞.IˇÊåê.i˛∆å≈
420:  95 90 02 A5 95 C9 09 B0 02 A8 38 20 48 F4 B9 67  ïê.•ï….∞.®8.HÙπg
430:  F4 20 56 F4 A5 9D 18 20 4A F4 B9 70 F4 20 56 F4  Ù.VÙ•ù..JÙπpÙ.VÙ
440:  E6 95 D0 C6 20 56 F4 18 A5 8C 29 03 2A 05 81 AA  Êï–∆.VÙ.•å).*.Å™
450:  BD 80 C0 A6 81 60 A2 11 CA D0 FD E6 99 D0 02 E6  ΩÄ¿¶Å`¢. –˝Êô–.Ê
460:  9A 38 E9 01 D0 F0 60 01 30 28 24 20 1E 1D 1C 1C  ö8È.–`.0($.....
470:  70 2C 26 22 1F 1E 1D 1C 1C 86 83 A0 05 48 0A 26  p,&".....ÜÉ†.H.&
480:  83 88 D0 FA 68 29 07 A8 B9 A0 F4 85 84 20 00 F0  Éà–˙h).®π†ÙÖÑ..
490:  B0 0B E6 86 E6 84 E6 84 20 00 F0 C6 86 A5 88 60  ∞.ÊÜÊÑÊÑ..∆Ü•à`
4A0:  00 04 08 0C 01 05 09 0D 8D D9 FF AD EF FF 2D 66  ........çŸˇ≠Ôˇ-f
4B0:  C0 30 F8 AD 66 C0 30 0C 18 AD D9 FF AC D8 FF 10  ¿0¯≠f¿0..≠Ÿˇ¨ÿˇ.
4C0:  03 AD D9 FF 60 00 B1 B2 BA B9 10 00 13 52 41 CD  .≠Ÿˇ`.±≤∫π...RAÕ
4D0:  52 4F CD 56 49 C1 41 43 49 C1 41 2F C4 44 49 41  ROÕVI¡ACI¡A/ƒDIA
4E0:  47 4E 4F 53 54 49 C3 5A D0 52 45 54 52 D9 A9 53  GNOSTI√Z–RETRŸ©S
4F0:  8D DF FF A2 00 8E E0 FF 8E EF FF 8E D0 FF CA 8E  çﬂˇ¢.é‡ˇéÔˇé–ˇ é
500:  D2 FF 8E D3 FF 9A E8 A9 0F 8D E3 FF A9 3F 8D E2  “ˇé”ˇöË©.ç„ˇ©?ç‚
510:  FF A0 0E B9 D0 C0 88 88 10 F9 AD 08 C0 29 04 D0  ˇ†.π–¿àà.˘≠.¿).–
520:  03 4C 86 F6 A9 01 95 00 D5 00 D0 FE 0A D0 F7 E8  .LÜˆ©.ï.’.–˛.–˜Ë
530:  D0 F2 8A 48 E8 D0 FB CA 86 18 68 C5 18 D0 EB C6  –ÚäHË–˚ Ü.h≈.–Î∆
540:  18 D0 F7 68 D0 E4 A2 08 95 10 CA 10 FB A2 02 86  .–˜h–‰¢.ï. .˚¢.Ü
550:  19 A9 00 A0 FF 91 18 D1 18 F0 07 20 48 F7 94 10  .©.†ˇë.—...H˜î.
560:  A6 19 E8 E0 C0 D0 E8 A2 20 EE EF FF AD EF FF 29  ¶.Ë‡¿–Ë¢.ÓÔˇ≠Ôˇ)
570:  0F C9 03 D0 DA 20 9D FD A2 00 8E E0 FF CA 8E D2  .….–/.ù˝¢.é‡ˇ é“
580:  FF 8E D3 FF A9 3F 8D E2 FF A9 0F 8D E3 FF A2 10  ˇé”ˇ©?ç‚ˇ©.ç„ˇ¢.
590:  20 38 F7 A2 00 86 5D A9 04 20 DB FB 20 38 F7 A2  .8˜¢.Ü]©..¤˚.8˜¢
5A0:  07 B5 10 A0 08 0A 48 A9 AE 90 02 A9 31 20 39 FC  .µ.†..H©Æê.©1.9¸
5B0:  68 88 D0 F1 20 07 FD CA 10 E7 9A 8C EF FF 98 8D  hà–Ò..˝ .ÁöåÔˇòç
5C0:  D0 FF 85 FF C8 98 48 68 C8 C0 20 D0 F1 A0 00 8C  –ˇÖˇ»òHh»¿.–Ò†.å
5D0:  D0 FF 86 18 E8 86 19 8A D1 18 D0 06 E0 1F D0 F4  –ˇÜ.ËÜ.ä—.–.‡.–Ù
5E0:  F0 05 A2 1A 20 7B F7 A9 00 A8 A2 F0 85 18 86 19  .¢..{˜©.®¢Ö.Ü.
5F0:  A2 FF 51 18 E4 19 D0 06 C0 BF D0 02 A0 EF C8 D0  ¢ˇQ.‰.–.¿ø–.†Ô»–
600:  F1 E6 19 D0 ED A8 F0 05 A2 03 20 7B F7 18 D8 AD  ÒÊ.–Ì®.¢..{˜.ÿ≠
610:  E0 FF 29 3F 85 18 AD EF FF 29 4F 65 18 6D D0 FF  ‡ˇ)?Ö.≠Ôˇ)Oe.m–ˇ
620:  85 18 AD DF FF 29 5F 65 18 6D D2 FF 6D D3 FF 6D  Ö.≠ﬂˇ)_e.m“ˇm”ˇm
630:  E2 FF 6D E3 FF C9 E1 F0 05 A2 06 20 7B F7 18 A9  ‚ˇm„ˇ…·.¢..{˜.©
640:  9F 2D F1 C0 6D F2 C0 6D F3 C0 C9 10 F0 05 A2 09  ü-Ò¿mÚ¿mÛ¿….¢.
650:  20 7B F7 A9 C0 8D DC FF AD 5A C0 AD 5E C0 AD 5C  .{˜©¿ç<ˇ≠Z¿≠^¿≠\
660:  C0 A0 20 88 D0 FD AD 5D C0 C8 F0 0A AD 66 C0 30  ¿†.à–˝≠]¿».≠f¿0
670:  F8 98 29 E0 F0 05 A2 0D 20 7B F7 AD 08 C0 0A 10  ¯ò)‡.¢..{˜≠.¿..
680:  41 AD DF FF 30 3C A9 77 8D DF FF 20 98 FD 2C 10  A≠ﬂˇ0<©wçﬂˇ.ò˝,.
```

APPLE /// REV 1 ROM HEX DUMP • Smolinski's Macintosh SARA emulator • 2 / 5

“_86.PICT” 1174 KB 2001-09-10 dpi: 600h x 600v pix: 4178h x 6178v



```
690:  C0 AD FF CF AD 20 C0 A9 10 2D 08 C0 D0 03 20 01  ¿≠ˇœ≠.¿©.-.¿–...
6A0:  F9 A2 01 86 87 CA 86 85 A9 A0 85 86 4A 85 91 8A  ˘¢.Üá ÜÖ©†ÖÜJÖëä
6B0:  20 79 F4 90 0A A2 1C 20 38 F7 20 0F FD B0 E2 4C  .yÙê.¢..8˜..˝∞‚L
6C0:  00 A0 A0 7F 98 29 FE 49 4E F0 03 B9 00 C0 88 D0  .†† ò)˛IN.π.¿à–
6D0:  F3 AD 51 C0 B9 00 C1 B9 00 C2 B9 00 C3 B9 00 C4  Û≠Q¿π.¡π.¬π.√π.ƒ
6E0:  AD FF CF C8 D0 EE A9 73 8D DF FF A9 18 8D D0 FF  ≠ˇœ»–Ó©sçflˇ©.ç–ˇ
6F0:  A9 00 A2 07 95 10 CA 10 FB 20 84 F7 08 20 F6 F7  ©.¢.ï. .˚.Ñ˜..ˆ˜
700:  20 F6 F7 28 6A 08 20 A1 F7 D0 F2 20 84 F7 08 20  .ˆ˜(j..°˜–Ú.Ñ˜..
710:  FA F7 48 A9 00 91 18 68 28 6A 08 20 A1 F7 D0 EF  ˙˜H©.ë.h(j..°˜–Ô
720:  A9 00 8D EF FF 8D D0 FF A2 07 BD 10 18 95 10 CA  ©.çÔˇç–ˇ¢.Ω..ï. 
730:  10 F8 20 7E F7 4C 75 F5 BD CD F4 48 09 80 20 39  .¯.~˜LuıΩÕÙH.Ä.9
740:  FC E8 68 10 F3 4C 07 FD 48 8A 4A 4A 4A 4A 08 4A  ¸Ëh.ÛL.˝HäJJJJ.J
750:  28 AA BD C5 F4 10 14 48 AD EF FF 29 0F AA 68 E0  (™Ω≈Ù..H≠Ôˇ).™h‡
760:  00 F0 13 4A 4A 4A CA D0 0D 29 05 D0 09 8A F0 02  ..JJJ –.).–.ä.
770:  A9 03 90 02 49 03 29 07 AA 68 60 20 38 F7 A9 F3  ©.ê.I.).™h`.8˜©Û
780:  8D DF FF 60 A2 01 86 1A A0 00 A9 AA 38 48 08 A5  çflˇ`¢.Ü.†.©™8H.•
790:  1A 09 80 8D 19 14 A9 02 85 19 A2 00 86 18 28 68  ..Äç..©.Ö.¢.Ü.(h
7A0:  60 48 E6 18 D0 1D A5 1A 10 0E A5 19 C9 13 F0 06  `HÊ.–.•...•.…..
7B0:  C9 17 D0 04 E6 19 E6 19 E6 19 D0 07 C6 1A C6 1A  ….–.Ê.Ê.Ê.–.∆.∆.
7C0:  20 8D F7 68 A6 1A E0 FD 60 48 A6 19 A4 1A 30 19  .ç˜h¶.‡˝`H¶.§.0.
7D0:  8A 30 1D 18 69 20 8C EF FF AA 20 48 F7 68 48 A0  ä0..i.åÔˇ™.H˜hH†
7E0:  00 51 18 15 10 95 10 68 60 A9 00 8D EF FF F0 EA  .Q...ï.h`©.çÔˇÍ
7F0:  38 E9 60 C8 D0 E0 49 FF 91 18 D1 18 D0 CB 60 3F  8È`»–‡Iˇë.—.–À`?
800:  E9 01 F0 FA E9 01 F0 F6 E9 01 F0 F2 E9 01 F0 EE  È.˙È.ˆÈ.ÚÈ.Ó
810:  E9 01 F0 EA E9 01 F0 E6 E9 01 F0 E2 E9 01 F0 DE  È.ÍÈ.ÊÈ.‚È.ﬁ
820:  E9 01 F0 DA E9 01 F0 D6 E9 01 F0 D2 E9 01 F0 CE  È./È.÷È.“È.Œ
830:  E9 01 F0 CA E9 01 F0 C6 E9 01 F0 C2 E9 01 F0 BE  È. È.∆È.¬È.æ
840:  E9 01 F0 BA E9 01 F0 B6 E9 01 F0 B2 E9 01 F0 AE  È.∫È.∂È.≤È.Æ
850:  E9 01 F0 AA E9 01 F0 A6 E9 01 F0 A2 E9 01 F0 9E  È.™È.¶È.¢È.û
860:  E9 01 F0 9A E9 01 F0 96 E9 01 F0 92 E9 01 F0 8E  È.öÈ.ñÈ.íÈ.é
870:  E9 01 F0 8A E9 01 F0 86 E9 01 F0 82 E9 01 F0 02  È.äÈ.ÜÈ.ÇÈ..
880:  E9 01 F0 7C E9 01 F0 78 E9 01 F0 74 E9 01 F0 70  È.|È.xÈ.tÈ.p
890:  E9 01 F0 6C E9 01 F0 68 E9 01 F0 64 E9 01 F0 60  È.lÈ.hÈ.dÈ.`
8A0:  E9 01 F0 5C E9 01 F0 58 E9 01 F0 54 E9 01 F0 50  È.\È.XÈ.TÈ.P
8B0:  E9 01 F0 4C E9 01 F0 48 E9 01 F0 44 E9 01 F0 40  È.LÈ.HÈ.DÈ.@
8C0:  E9 01 F0 3C E9 01 F0 38 E9 01 F0 34 E9 01 F0 30  È.<È.8È.4È.0
8D0:  E9 01 F0 2C E9 01 F0 28 E9 01 F0 24 E9 01 F0 20  È.,È.(È.$È..
8E0:  E9 01 F0 1C E9 01 F0 18 E9 01 F0 14 E9 01 F0 10  È..È..È..È..
8F0:  E9 01 F0 0C E9 01 F0 08 E9 01 F0 04 E9 01 F0 00  È..È..È..È..
900:  60 BA 86 6A D8 20 4E FC A6 6A 9A A9 DF 85 6B 20  `∫Üjÿ.N¸¶jö©flÖk.
910:  D5 FC 20 67 F9 20 2C F9 84 7D A0 12 88 30 E5 D9  ’¸.g˘.,˘Ñ}†.à0ÂŸ
920:  6C F9 D0 F8 20 5E F9 A4 7D 4C 15 F9 A2 00 86 76  l˘–¯.^˘§}L.˘¢.Üv
930:  86 77 B1 7E C8 49 B0 C9 0A 90 06 69 88 C9 FA 90  Üw±~»I∞….ê.ià…˙ê
940:  2A A2 03 0A 0A 0A 0A 0A 26 76 26 77 CA 10 F8 A5  *¢......&v&w .¯•
950:  7C D0 06 B5 77 95 75 95 79 E8 F0 F3 D0 D4 A9 FA  |–.µwïuïyËÛ–‘©˙
960:  48 B9 7D F9 48 A5 7C A0 00 84 7C 60 00 03 06 EB  Hπ}˘H•|†.Ñ|`...Î
970:  EC EE EF F0 F1 99 9B A0 93 A7 A8 95 C6 90 8E 3F  ÏÓÔÒôõ†ìß®ï∆êé?
980:  D3 08 8B 4E D6 2C B7 1A 1C CB CB AD A4 39 E6 7A  ”.ãN÷,∑..ÀÀ≠§9Êz
990:  D0 02 E6 7B E6 74 D0 05 E6 75 38 F0 10 A5 74 38  –.Ê{Êt–.Êu8.•t8
9A0:  E5 76 85 80 A5 75 E5 77 05 80 D0 01 18 60 48 4A  ÂvÖÄ•uÂw.Ä–..`HJ
9B0:  4A 4A 4A 20 B9 F9 68 29 0F 09 B0 C9 BA 90 02 69  JJJ.π˘h)..∞…∫ê.i
9C0:  06 4C 39 FC 20 AE F9 A9 BA D0 F6 A9 07 24 68 50  .L9¸.Æ˘©∫–ˆ©.$hP
9D0:  02 A9 0F 85 69 60 8A F0 07 B5 74 95 72 CA 10 F9  .©.Öi`ä.µtïr .˘
9E0:  60 85 69 A4 7D B1 7E E6 7D A0 00 C9 A2 D0 05 A5  `Öi§}±~Ê}†.…¢–.•
9F0:  69 10 32 60 C9 A7 D0 05 A5 69 30 2D 60 C9 8D F0  i.2`…ß–.•i0-`…ç
A00:  07 25 69 20 C3 FA D0 DB 60 B1 74 C5 7A D0 06 20  .%i.√˙–¤`±t≈z–..
A10:  75 FA 20 EF FC 20 94 F9 90 EF 60 38 90 18 AA 86  u˙.Ô¸.î˘êÔ`8ê.™Ü
A20:  7C 49 BA D0 7D A9 FF B0 B8 A9 7F 10 B4 2C 00 C0  |I∫–}©ˇ∞∏© .¥,.¿
A30:  10 03 4C 0F FD 68 68 4C 12 F9 20 B4 FA 4C 08 F9  ..L.˝hhL.˘.¥˙L.˘
A40:  20 9D F9 B0 5D B1 74 91 7A 20 8E F9 90 F7 60 20  .ù˘∞]±tëz.é˘ê˜`.
A50:  9D F9 B0 4E B1 74 D1 7A F0 06 20 66 FA 20 EF FC  ù˘∞N±t—z..f˙.Ô¸
A60:  20 8E F9 90 EF 60 A5 7B 20 AE F9 A5 7A 20 C4 F9  .é˘êÔ`•{.Æ˘•z.ƒ˘
A70:  B1 7A 20 84 FA 20 87 FA A5 75 20 AE F9 A5 74 20  ±z.Ñ˙.á˙•u.Æ˘•t.
```

APPLE /// REV 1 ROM HEX DUMP • Smolinski's Macintosh SARA emulator • 3 / 5

"_87.PICT" 1185 KB 2001-09-10 dpi: 600h x 600v pix: 4201h x 6130v

```
A80: C4 F9 B1 74 20 AE F9 A9 A0 4C 39 FC 4C F8 03 68  ƒ˘±t.Æ˘©†L9¸L¯.h
A90: 68 20 D6 F9 6C 72 00 20 AE F9 A9 A1 20 39 FC 20  h.÷˘lr..Æ˘©°.9¸.
AA0: 07 FD 4C 04 F9 A5 76 85 7A A5 77 85 7B 60 20 B8  .˝L.˘•vÖz•wÖ{`.∏
AB0: FA 98 F0 1D C6 7D F0 45 CA D0 16 C9 BA D0 4B 85  ˙ò.∆}E –.…∫–KÖ
AC0: 7C A5 76 91 78 E6 78 D0 02 E6 79 60 A4 7D 88 B1  |•vëxÊx–.Êy`§}à±
AD0: 7E 85 7C 60 A9 01 2C A9 02 85 87 A5 74 85 85 A5  ~Ö|`©.,©.Öá•tÖÖ•
AE0: 75 85 86 A6 7B A5 7A 78 20 79 F4 B0 AA E6 7A D0  uÖÜ¶{•zx.yÙ∞™Êz–
AF0: 02 E6 7B E6 75 E6 75 20 9D F9 90 DF 60 A5 75 85  .Ê{ÊuÊu.ù˘êfl`•uÖ
B00: 77 20 CB F9 05 74 85 76 D0 06 4A B0 95 20 CB F9  w.À˘.tÖv–.J∞ï.À˘
B10: A5 74 85 7A A5 75 85 7B 20 9D F9 B0 EE 20 75 FA  •tÖz•uÖ{.ù˘∞Ó.u˙
B20: 20 94 F9 B0 10 A5 74 25 69 D0 05 20 35 FB D0 ED  .î˘∞.•t%i–..5˚–Ì
B30: 20 82 FA D0 EB A5 7A 85 74 A5 7B 85 75 20 87 FA  .Ç˙–Î•zÖt•{Öu.á˙
B40: A0 00 B1 74 09 80 C9 A0 B0 02 A9 AE 20 39 FC 20  †.±t.Ä…†∞.©Æ.9¸.
B50: 8E F9 B0 06 A5 74 25 69 D0 E6 4C EF FC 38 AD 53  é˘∞.•t%i–ÊLÔ¸8≠S
B60: C0 B0 04 18 AD 52 C0 A5 68 09 40 B0 02 29 BF 85  ¿∞..≠R¿•h.@∞.)øÖ
B70: 68 09 7F 29 A0 85 66 B0 02 A9 F0 85 67 A5 58 85  h. )†Öf∞.©Ög•XÖ
B80: 5C A5 5A 85 5D A5 5C 48 A5 5D 48 20 C5 FB 20 A2  \•ZÖ]•\H•]H.≈˚.¢
B90: FB A5 58 85 5C 20 DD FB 90 F4 68 A8 68 85 5C 98  ˚•XÖ\.>˚êÙh®hÖ\ò
BA0: B0 23 A5 5C 4C 89 FC C9 80 90 65 C9 8D D0 3A 20  ∞#•\Lâ¸…Äêe…ç–:.
BB0: A2 FB 20 D7 FB 4C 16 FC A5 5D C6 5D C5 5A D0 02  ¢˚.◊˚L.¸•]∆]≈Z–.
BC0: A5 5B 38 E9 01 85 5D A5 5D 10 4E 24 68 70 02 E6  •[8È.Ö]•].N$hp.Ê
BD0: 5C E6 5C A5 5C C5 59 A5 58 90 5D 85 5C E6 5D A5  \Ê\•\≈Y•Xê]Ö\Ê]•
BE0: 5D C5 5B 90 E2 A5 5A B0 DC C9 88 D0 5D 24 68 70  ]≈[ê,•Z∞<…à–]$hp
BF0: 02 C6 5C C6 5C 30 06 A5 5C C5 58 10 3B 20 B8 FB  .∆\∆\0.•\≈X.;.∏˚
C00: A5 59 85 5C D0 E7 C9 A0 90 9D 24 68 30 02 29 7F  •YÖ\–Á…†êù$h0.)
C10: 20 9D FC 20 CB FB B0 43 60 08 48 4A 29 03 09 04  .ù¸.À˚∞C`.HJ)...
C20: 85 5F 49 0C 85 61 68 29 18 90 02 69 7F 85 5E 0A  Ö_I.Öah).ê.i Ö^.
C30: 0A 05 5E 85 5E 85 60 28 60 48 84 6D 86 6C 20 47  ..^Ö^Ö`(`HÑmÜl.G
C40: FC A4 6D A6 6C 68 60 6C 6E 00 C9 87 D0 04 AE 40  ¸§m¶lh`ln.…á–.Æ@
C50: C0 60 C9 8A D0 E2 20 DD FB 90 DD A5 5A 48 20 C5  ¿`…ä–,.>˚ê>•ZH.≈
C60: FB A2 03 B5 5E 95 62 CA 10 F9 68 18 69 01 C5 5B  ˚¢.µ^ïb .˘h.i.≈[
C70: B0 15 48 20 C5 FB A5 59 4A A8 88 30 E4 B1 5E 91  ∞.H.≈˚•YJ®à0‰±^ë
C80: 62 B1 60 91 64 90 F3 A5 58 4A A8 B0 04 A5 66 91  b±`ëdêÛ•XJ®∞.•fë
C90: 5E A5 67 91 60 C8 98 0A C5 59 90 ED 60 24 68 70  ^•gë`»ò.≈YêÌ`$hp
CA0: 0C 46 5C 06 5C 20 AD FC A5 67 91 60 60 48 A5 5C  .F\.\.≠¸•gë``H•\
CB0: 4A A8 68 B0 F5 91 5E 60 B1 7E 20 39 FC C9 88 F0  J®h∞ıë^`±~.9¸…à
CC0: 1D C9 98 F0 08 E6 80 A5 80 C9 50 D0 17 A9 DC 20  .…ò.ÊÄ•Ä…P–.©<.
CD0: 39 FC 20 EF FC A5 6B 20 39 FC A0 01 84 80 A4 80  9¸.Ô¸•k.9¸†.ÑÄ§Ä
CE0: F0 F3 C6 80 20 60 FD A4 80 91 7E C9 8D D0 C9 2C  Û∆Ä.`˝§Äë~…ç–…,
CF0: 00 C0 10 13 20 2E FD C9 A0 F0 07 C9 89 D0 08 4C  .¿....˝…†.…â–.L
D00: 9F FA AD 00 C0 10 FB A9 8D 4C 39 FC 6C 70 00 A9  ü˙≠.¿.˚©çL9¸lp.©
D10: 7F 85 63 20 88 FD 48 20 35 FD B0 08 A5 69 20 9D   Öc.à˝H.5˝∞.•i.ù
D20: FC 20 35 FD 68 08 48 20 9D FC 68 28 90 E8 AD 00  ¸.5˝h.H.ù¸h(êË≠.
D30: C0 2C 10 C0 60 E6 62 D0 09 E6 63 A9 7F 18 25 63  ¿,.¿`Êb–.Êc© .%c
D40: F0 05 0E 00 C0 90 EE 60 20 77 FD A5 68 29 80 49  ...¿êÓ`.w˝•h)ÄI
D50: AB 85 69 20 0C FD A0 08 D9 F0 FF F0 EB 88 10 F8  ´Öi..˝†.ŸˇÎà.¯
D60: A9 80 25 68 85 69 20 0C FD C9 9B F0 DE C9 95 D0  ©Ä%hÖi..˝…õﬁ…ï–
D70: D6 20 88 FD 09 80 60 A9 FB 48 B9 7F FD 48 60 A1  ÷.à˝.Ä`©˚Hπ ˝H`°
D80: 84 7C 62 5C EC CA DC B7 A5 5C 4A A8 24 68 50 05  Ñ|b\Ï <∑•\J®$hP.
D90: 90 03 B1 60 60 B1 5E 60 A9 03 8D D0 FF D8 A2 03  ê.±``±^`©.ç–ˇÿ¢.
DA0: 86 7F BD BC FF 9D CA FF BD B4 FF 95 6E BD B8 FF  Ü ΩºˇùˇΩ¥ˇïnΩ∏ˇ
DB0: 95 58 CA 10 ED 85 82 A9 A0 85 7E A9 60 85 81 A9  ïX .ÌÖÇ©†Ö~©`ÖÅ©
DC0: FF 85 68 20 63 FB A9 78 85 A0 A9 08 85 A1 A9 F0  ˇÖh.c˚©xÖ†©.Ö°©
DD0: 85 A4 A9 00 AA 95 B4 E8 E0 20 D0 F9 A9 05 18 08  Ö§©.™ï¥Ë‡.–˘©...
DE0: 48 86 A2 A0 07 A6 A2 8A 91 A0 E8 88 30 06 C0 03  HÜ¢†.¶¢äë†Ëà0.¿.
DF0: D0 F5 F0 F1 20 99 FE B0 08 C9 0A D0 E6 A2 24 D0  –ıÒ.ô˛∞.….–Ê¢$–
E00: E0 68 28 A2 17 A0 05 36 B8 0A D0 0E 84 A2 C6 A4  ‡h(¢.†.6∏.–.Ñ¢∆§
E10: F0 16 A4 A4 B9 C4 FE 2A A4 A2 88 D0 EA CA 10 E5  .§§πƒ˛*§¢à–Í .Â
E20: 08 48 20 28 FE 4C 01 FE A2 1F A0 00 B5 B4 0A 29  .H.(˛L.˛¢.†.µ¥.)
E30: 3E 91 A0 CA C8 C0 08 D0 F3 20 99 FE C9 08 F0 04  >ë† »¿.–Û.ô˛….
E40: 8A 10 E7 60 A9 01 85 A2 A9 60 2C DB C0 20 AE FE  ä.Á`©.Ö¢©`,¤¿.Æ˛
E50: A9 20 20 AE FE 2C DA C0 20 88 FE C6 A2 10 16 A9  ©..Æ˛,/¿.à˛∆¢..©
E60: 08 85 A1 A0 07 B1 A0 18 69 08 91 A0 88 10 F6 20  .Ö°†.±†.i.ë†à.^.
```

APPLE /// REV 1 ROM HEX DUMP • Smolinski's Macintosh SARA emulator • 4 / 5

```
E70: 99 FE 90 EF 60 A0 03 A9 7F 99 FC 05 99 FC 07 88 ô˛êÔ`†.© ô¸.ô¸.à
E80: 10 F7 A9 08 85 A1 D0 C0 A0 07 B1 A0 49 20 91 A0 .˜©.Ö°–¿†.±†I.ë†
E90: 88 10 F7 20 99 FE 90 F0 60 A5 A0 49 80 85 A0 30 à.˜.ô˛ê`•†IÄÖ†0
EA0: 02 E6 A1 A5 A1 C9 0C D0 04 A9 04 85 A1 60 85 A3 .Ê°•°….–.©.Ö°`Ö£
EB0: AD EC FF 29 3F 05 A3 8D EC FF A9 08 8D ED FF 2C ≠Ïˇ)?.£çÏˇ©.çÌˇ,
EC0: ED FF F0 FB 60 F0 01 82 18 40 84 81 2F 58 44 81 Ìˇ˚`.Ç.@ÑÅ/XDÅ
ED0: 29 02 1E 01 91 7C 1F 49 30 8A 08 43 14 31 2A 22 )...ë|.I0ä.C.1*"
EE0: 13 E3 F7 C4 91 48 A2 DA 24 C6 4A 62 8C 24 C6 F8 .„˜ƒëH¢/$∆Jbå$∆¯
EF0: 63 8C C1 46 17 52 8A AF 16 14 E3 33 31 C6 F8 DC cå¡F.RäØ..„31∆¯<
F00: 73 3F 46 17 62 8C 21 E6 18 6A 8D 61 CF 18 62 74 s?F.bå!Ê.jçaœ.bt
F10: D1 B9 18 49 4C 91 C0 F3 09 2C 91 C0 14 1D 8C EF —π.ILë¿Û.,ë¿..åÔ
F20: 07 17 43 88 31 84 1E DF 0B 31 84 F8 FE 77 3E 3E ..Cà1Ñ.ﬂ.1Ñ¯˛w>>
F30: 17 62 8C FD C7 50 E3 0B 51 C5 E8 C8 73 18 0C 42 .bå˝«P„.Q≈Ë»s..B
F40: 3E 01 02 20 42 3E 41 18 8C 08 00 70 EE 00 11 11 >...B>A.å..pÓ...
F50: 21 11 02 E0 3C 21 31 02 E0 1C 00 C8 B9 80 62 14 !..‡<!1.‡..»πÄb.
F60: 1F 46 A2 DE 43 2C 04 88 BE FF CE 7D 37 49 88 95 .F¢ﬁC,.àæˇŒ}7Ià ï
F70: 18 98 09 62 D1 44 E8 88 FB 02 90 40 00 10 E0 03 .ò.b—DËà˚.ê@..‡.
F80: 02 00 40 00 00 08 00 00 28 10 42 44 25 82 B8 2F ..@.....(.BD%Ç∏/
F90: 48 25 44 10 82 02 00 2F 5A 40 45 02 8E 64 50 90 H%D.Ç../Z@E.édPê
FA0: 01 3E 26 42 80 21 80 00 05 00 F8 80 00 05 08 F8 .>&BÄ!Ä...¯Ä...¯
FB0: 80 28 05 88 06 FC 0F FD 00 50 00 18 4C 86 F6 40 Ä(.à.¸.˝.P..LÜ^@
FC0: 00 00 00 00 00 00 00 00 00 00 4C 86 F6 40 00 00 ..........LÜ^@..
FD0: 03 F7 FF FF D3 F3 FF FE 9D 4E FF 00 00 00 80 F7 .˜ˇˇ”Ûˇ˛ùNˇ...Ä˜
FE0: C0 70 3F 0F C4 38 FE FE 77 77 FF 00 20 18 80 70 ¿p?.ƒ8˛˛wwˇ...Äp
FF0: CC D0 D3 B4 B8 88 95 8A 8B 00 CA FF EE F4 CD FF Ã–”¥∏àïäã. ˇÓÙÕˇ
```

###

differs from my ROM listing —
copyright notice is gone and
some maybe code is here.

APPLE /// REV 1 ROM HEX DUMP • Smolinski's Macintosh SARA emulator • 5 / 5

"_89.PICT" 591 KB 2001-09-10 dpi: 600h x 600v pix: 4450h x 6154v