SUPPLEMENT TO

Beneath Apple ProDOS

For ProDOS 8, Versions 1.2 and 1.3

by Don D. Worth and Pieter M. Lechner

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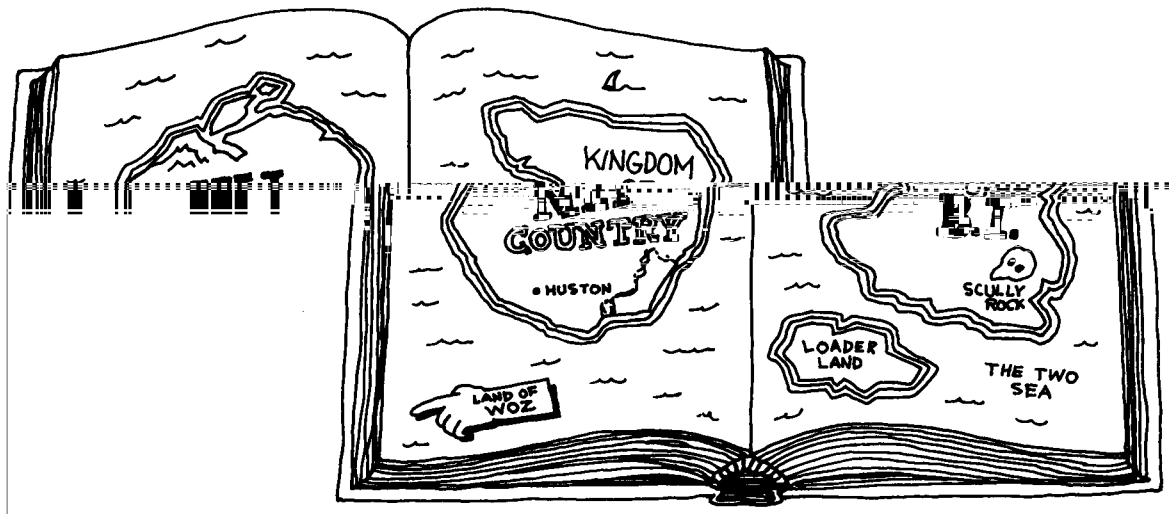


A ProDOS ATLAS

INTRODUCTION

This supplement documents the actual ProDOS 8 logic at nearly a byte by byte level. It is intended to aid experienced programmers in designing customized interfaces to ProDOS 8, and to provide implicit documentation of the ProDOS 8 functions. All assembly language programmers will find this supplement useful in learning about how an operating system works. This information is presented in the spirit of helping the user to understand ProDOS 8 better. The authors do not endorse indiscriminant modification of the ProDOS components. Whenever possible, standardized interfaces to ProDOS should be used to avoid the uncontrolled modifications which plagued Apple's previous operating system, DOS 3.3.

External system programs and utilities such as the Apple II System Utilities are not covered here, nor are disk controller ROM's covered other than the Disk II controllers available from Apple.

The information presented here is for the release of the ProDOS operating system called ProDOS 8, Versions 1.2 and 1.3. Previous supplements to Beneath Apple ProDOS documented the structure of Versions 1.0.1, 1.0.2, and 1.1.1 of ProDOS.

UNDERSTANDING THE LISTINGS

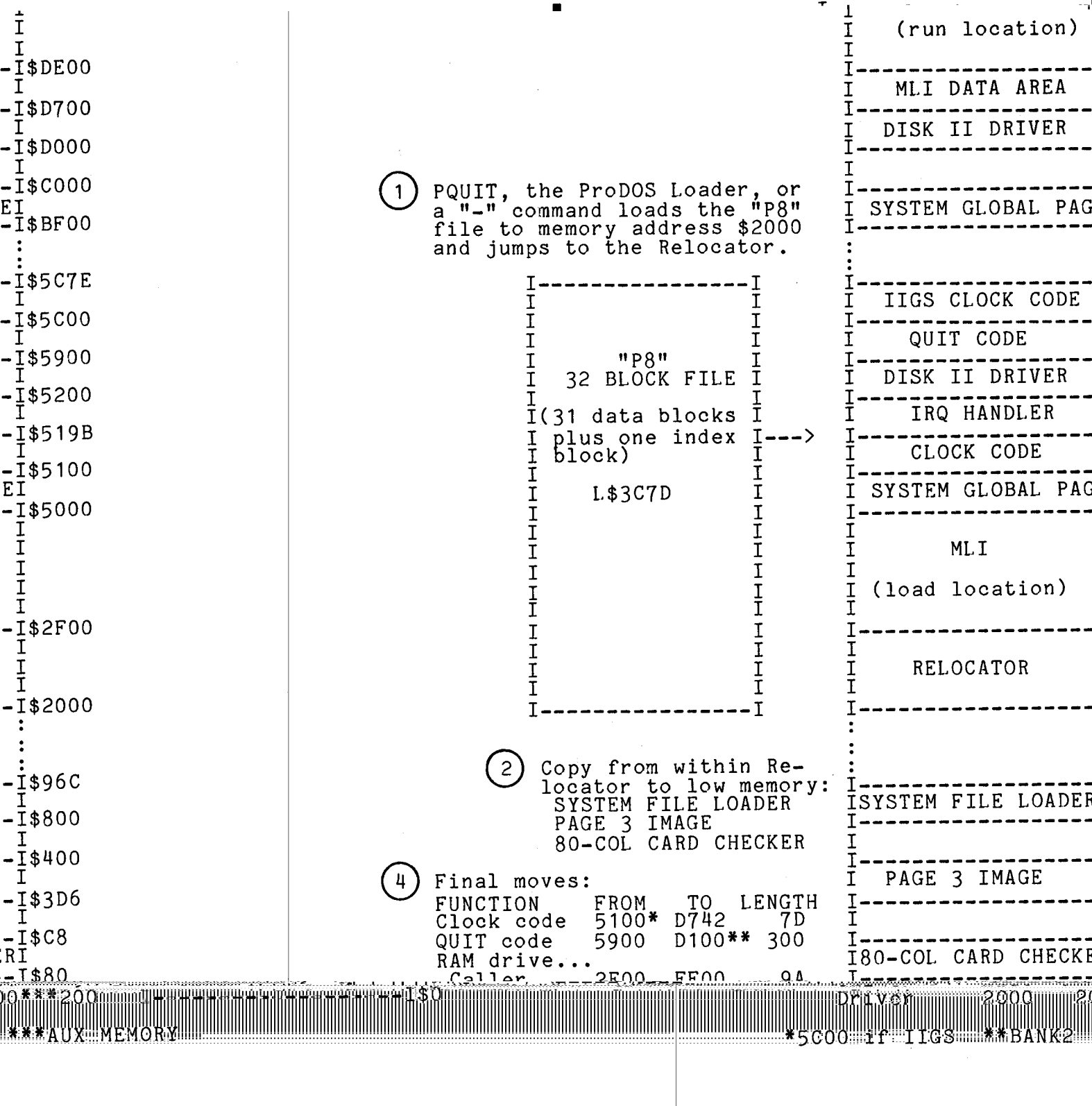
The listings which follow describe the major ProDOS 8 components in great detail. Each module is presented separately and consists of a section defining external addresses referenced by the program (such as zero page usage, I/O select addresses, and global page fields) followed by a section describing the instructions and data in the module. Divisions between major sections and subroutines are indicated with a row of asterisks (*) and additional comments.

Each detail line gives the address of the instruction or data field being described, followed by comments. Within the comments, the following notation is used to indicate references by instructions:

(address)	A store or load reference to a memory or I/O location.
>>address	A branch or jump to an address.
<address>	A call to a subroutine at the indicated address.
-->address	A pointer to an address.

Page titles give the address of the next instruction or data area in the module to be described. These may be used to quickly locate a particular area within the component.

HOW PRODOS 8 Versions 1.2 and 1.3 ARE LOADED AND RELOCATED



```
ProDOS Loader -- V1.
-----------------------
ADDR    DESCRIPTION/
-----------------------

0800    MODULE START
          **********
          *
          *  PRODOS
          *    THIS
          *  INTO ME
          *  ITS PUR
          *  FILE IN
          *  (PRODOS
          *
          *  VERSION
          *  VERSION
          *  (THE LO
          *   WAS IN
          *
          **********

          *** EXTERN

0027      ROM BOOT SU
002B      ROM BOOT SU
003D      ROM BOOT SU
0040      ROM BOOT SU
0041      ROM BOOT SU
            -- BLOCK
0042      COMMAND NUM
0043      SLOT * 16
0044      I/O BUFFER
0045
0046      BLOCK TO RE
0047
            ---------
0048      POINTER TO
0049
004A      VOL DIR ENT
004B
004C      ADDR OF SEC
004D
004E      INDEX INTO
0050      TRACK SEEK
0051      TRACK PHASE
0052      BLOCK READE
0053      CURRENT TRA
0054
0060      BUFFER POIN
0061
05AE      SCREEN CENT
2000      LOAD POINT
C080      DISK ARM PH
C088      TURN DISK I
C089      TURN DISK I
```

```
                                  *
ADER                              *
CODE IS LOADED FROM BLOCK 0       *
MORY AT $800.                     *
POSE IS TO LOAD THE "PRODOS"      *
O $2000 AND JUMP TO IT.           *
RELOCATOR IS AT $2000)            *
                                  *
1.2 -- 6 SEP 86                   *
1.3 -- 2 DEC 86                   *
ADER IS STILL THE SAME AS IT      *
VERSION 1.0.1)                    *
                                  *
**********************************

AL ADDRESSES ***

BRTN BUFFER PAGE ADDR
BRTN SLOT * 16
BRTN SECTOR TO READ
BRTN CURRENT TRACK
BRTN TRACK TO READ
READ PARAMETER LIST --
BER (1 = READ)

ADDRESS ($44/$45)

AD ($46/$47)
-----------------------
LOCK READ ROUTINE

R POINTER/FIRST INDEX PAGE

OND PAGE OF INDEX BLOCK

NDEX BLOCK PAGES
HASE-ON INDEX
WANTED
R RETRY COUNT
CX PHASE/PHASE-OFF INDEX

ER

R LINE
OR RELOCATOR
ASED
RIVE OFF
RIVE ON
```



```
CONTENTS
-----------------------------------------

NG ADDRESS
**********
```



```
0800    SIGNATURE BYTE
        (A $03 IS STORED
                -- APPL
          THIS CODE (BLO
          BOOTED ON AN A
          ROM JUMPS TO
          $800 ON AN API
          THUS AN APPLE
          INSTRUCTION (
          ON CARRY, AND
          APPLE II).  M
          PROVIDING US

0801 ********** MAIN EN
            ON ENTRY, X
                      A

  0801  ENTRY POINT FOR
  0802  ALWAYS TAKEN (A
  0804  JUMP TO APPLE /
  0807  SAVE SLOT*16
  0809  READING SECTOR
  080B  REMEMBER THIS..
  080D  MAKE $CX FROM S
  0815  AND SAVE AT $49
  0819  $48/49 --> $CXF
  081C  CHECK $CXFF
  081D  BOOT ROM FOR DI
  081F  NO, NOT A 5.25"
  0821  GOT BOTH SECTOR
  0823  NO, STOP AT SEC
  0825  STORE ON PARM (
  0828  SKIP SECTOR 1 (
  082A  DUMMY UP $CX5C
  0830  AND CALL ROM SE
          ******** LOAD
          (ENTIRE LOADE
  0831  CURRENT TRACK I
  0833  $48/49 --> $CX0
  0837  COPY A PORTION
  0839  TO MY BLOCK REA
  083D  FROM $9F7 TO $A
  0843  MODIFY SOME BRA
  0846  TO SUIT MY ERRO
```

```
                                  7
-----------------------------------------
6 SEP 86              NEXT OBJECT ADDR: 0800
-----------------------------------------
ENTS
-----------------------------------------
STER
R SCREEN
**********

$01 MEANS BOOT ROUTINE FOLLOWS)
ERE DURING A 5.25" FLOPPY BOOT)
E /// BOOTING --
CK 0) IS LOADED AT $A000 WHEN
PLE ///.  THE APPLE /// BOOT
A000.  WHAT IS SHOWN HERE AS
LE II IS $A000 ON AN APPLE ///.
/// EXECUTES A HARMLESS
RA $38,X), THEN DOES NOT BRANCH
UMPS TO $A132 ($932 ON AN
NY THANKS TO DAV HOLLE FOR
ITH THIS APPLE /// INFORMATION.
RY ****************************************
= SLOT*16
= SECTOR NUMBER

APPLE II
PLE II) >>0807
 LOGIC  >>A132

S NEXT?

OT*16

IN ROM BOOT

X II?
FLOPPY >>085B
S OF LOADER? >>0831
OR 3
0800)
GET SEC.2)
AS RETURN ADDRESS
CTOR READ SUBRTN

PRODOS ********************
R IN MEMORY NOW)

S ZERO
0

OF DISKETTE BOOT ROM
ER SUBROUTINE (0994)
/E
CHES IN THE COPIED CODE (091D)
R HANDLING TASTES (0924)
```

```
ProDOS Loader -- V1.2 --
-----------------------
ADDR    DESCRIPTION/CONT
-----------------------

C08C      SHIFT DATA REG
```

```
ProDOS Loader -- V1.2 -- 6 SEP 86                NEXT OBJECT ADDR: 084C
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  084C  AND COPY SECTOR READ SUBROUTINE EXIT CODE (092B)
  084F  TO $A7F TO $A85 (0A7F)
  0855  $48/49 --> DISKETTE BLOCK READER SUBRTN
  0859  AT $0986
  085B  ---
  085D  LEGAL DISK ROM?
  085F  NO, ERROR >>0890
  0861  STORE LSB OF BLOCK READER
  0863  STORE ZEROS IN SEVERAL THINGS
  086E  COMMAND = 1 (READ BLOCK)
  0871  BLOCK NUMBER = 2 (VOL DIRECTORY)
  0875  $60/61 --> $C00 (BUFFER)
  0877  $4A/4B --> $C00 (FIRST ENTRY)
  0879  READ VOLUME DIRECTORY BLOCKS <0912>
  087C  ERROR? >>08E6
  087E  MOVE UP TWO PAGES IN MEMORY
  0882  NEXT BLOCK NUMBER
  0886  NOW AT BLOCK 6?
  0888  NO, GO READ NEXT ONE >>0879
  088A  YES, CHECK LINK FOR VALIDITY (0C00)
  088D  IT SHOULD BE ZERO FOR VOL DIR (0C01)
  0890  BAD VOLUME DIR IF NOT ZERO >>08FF
  0892  NO, INDEX PAST LINK AND VOL HDR
  0894  AND BEGIN >>0898
  0896  IF ALREADY PROCESSING, USE ENTRY LSB
  0898  ---
  0899  ADD ENTRY LENGTH TO FIND NEXT ENTRY (0C23)
  089D  STILL IN SAME PAGE? >>08AC
  089F  NO, BUMP ENTRY MSB
  08A3  IS IT ODD? (SECOND PAGE OF A BLOCK?)
  08A4  YES... >>08AC
  08A6  NO, JUST FINISHED LAST BLOCK?
  08A8  YES, ERROR -- FILE NOT FOUND >>08FF
  08AA  ELSE, START JUST PAST LINKS
  08AC  UPDATE LSB OF ENTRY POINTER
  08AE  GET NAME LENGTH (0902)
  08B1  MASK OFF STORAGE TYPE
  08B4  COMPARE NAME WITH "PRODOS"
  08B9  NOT A MATCH?  >>0896
  08BE  IF NAME MATCHES, IS IT A SAPLING FILE?
  08C2  IF NOT, I CAN'T HANDLE IT >>08FF
  08C6  GET FILE TYPE
  08C8  SHOULD BE A PRODOS SYS FILE
  08CA  IF NOT, I GIVE UP >>08FF
  08CD  ALL IS WELL, COPY KEY BLOCK NUMBER
  08CF  TO $46/47
  08D6  $4A/4B AND $60/61 --> $1E00
  08D8  (BUFFER TO HOLD KEY BLOCK)
  08E1  $4C/4D --> $1F00 (SECOND PAGE)
  08E3  READ A BLOCK <0912>
  08E6  ERROR? >>08FF
```

```
ProDOS Loader -- V1.2 -- 6 SEP 86                NEXT OBJECT ADDR: 08EA
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  08EA  BUMP TO NEXT BLOCK BUF
  08EE  $4E = OFFSET INTO INDEX ER
  08F0  GET NEXT BLOCK NUMBER  BLOCK
  08F8  BLOCK NUMBER = 0? (END ROM INDEX BLOCK
  08FA  NOT YET, READ A BLOCK  OF FILE)
  08FC  ELSE, JUMP TO RELOCATO >08E3
                                AT $2000 >>2000
  08FF  ERROR JUMP >>093F

0902 *********** KERNEL NAME ***********************************

  0902  LENGTH OF KERNEL'S NAME
  0903  'PRODOS         ' "PRO OS" (KERNEL NAME)

0912 *********** COPY BLOCK REA D BUFFER PTR *************************

  0912  COPY $60/61 --> $44/45
  0914  (BLOCK READ BUFFER POI N
  091A  THEN GO TO BLOCK I/O RO TER)
                                UTINE >>0048

091D *********** ROM SECTOR REA D OFFSETS ****************************
           OFFSETS INTO ROM S CTOR READ SUBROUTINE
           TO BRANCH DISPLAC ENTS WHICH NEED TO
           BE CHANGED FOR LOA ER'S PURPOSES

  091D

         ******** NEW BRANCH O FFSETS FOR ABOVE ***

  0924  ---

092B *********** SECTOR READ EX IT CODE ******************************
           COPIED TO END OF  ISKETTE SECTOR READ CODE

  092B  GET SLOT*16
  092D  AND EXIT NORMALLY
  092E  RETURN
  092F  RESTART BLOCK READ OPER ATION >>09BC

0932 *********** APPLE /// BOO  CODE *********************************

A132    THIS IS $A132 WHEN BOO ED ON APPLE ///
  0932  MAKE IT LOOK LIKE A JSR
  0938  LOAD IN BLOCK 1 (WE WAN  FROM $A000
  093C  GO TO APPLE /// BLOCK RT SOS, NOT PRODOS)
                                EAD ROUTINE >>F479
```

```
ProDOS Loader -- V1.2 -- 6 SEP 86                NEXT OBJECT ADDR: 093F
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

093F ************ ERROR HANDLER ***************************************

  093F  HOME CURSOR/CLEAR SCREEN <FC58>
  0944  COPY "UNABLE TO LOAD PRODOS" MESSAGE (0950)
  0947  TO SCREEN (05AE)
  094D  THEN GO TO SLEEP FOREVER >>094D

  0950  ---
  0950  '*** UNABLE TO LOAD PRODOS ***'

096D ************ MOVE ARM TO NEXT PHASE ******************************

  096D  GET CURRENT PHASE
  096F  CONVERT TO NEXT ARM PHASE
  0972  ADD SLOT*16
  0975  SELECT NEXT ARM PHASE THIS DRIVE (C080)
  097A  ---
  097C  DELAY LONG ENOUGH FOR ARM TO MOVE
  0983  WHEN FINISHED, RETURN WITH X = SLOT*16
  0985  RETURN

0986 ************ DISKETTE BLOCK READ ROUTINE *************************
          $44/$45 --> BUFFER
          $46/$47 = BLOCK NO.

  0986  GET BLOCK NO. LSB
  0988  ISOLATE SECTOR REMAINDER
  098C  SKEW SECTOR BY 2
  0992  AND STORE SECTOR WANTED
  0994  GET MSB
  0996  AND HIGH BIT OF TRACK
  0999  MERGE WITH LOW PART OF TRACK
  099C  STORE TRACK WANTED
  099F  TRACK*2 IS PHASE WANTED
  09A3  SET PAGE ADDRESS OF BUFFER
  09A7  TURN DRIVE MOTOR ON (C089)
  09AA  READ SECTOR <09BC>
  09AD  NEXT PAGE
  09B1  SKEW TO NEXT SECTOR
  09B5  READ SECOND SECTOR OF BLOCK <09BC>
  09B8  THEN TURN MOTOR OFF AND EXIT (C088)
  09BB  RETURN

          ******** DISKETTE SECTOR READ ROUTINE ***

  09BC  GET CURRENT TRACK
  09BF  CONVERT TO PHASE
  09C5  GET CURRENT PHASE
  09C7  STORE FOR PHASE OFF
  09CA  SUBTRACT PHASE WANTED TO DETERMINE...
  09CC  DIRECTION -- ON CORRECT TRACK NOW? >>09E2
```

```
ProDOS Loa--------                              Y BUFFER
----------SCRIPTIO-OLUME DIRECTOR-IELD
ADDR    DE-------ENTRY LENGTH F-----

          ADJUST
  09D0  NO DOWN AN
  09D4  OR=
  09D6  --EX ARM O
  09D7  SE PROPER
  09DD  IN IL WE A
  09E0  UN=
  09E2  --TRY COUN
  09E4  RE=
  09E7  --WE'R RETR
  09E9  LOOKIES EX
  09EB  RETRIES FO
  09EF  RECK DATA
  09F2  CHOP UNTIL
  09F5  LO
          ********
          GINNING
09F7    BEEZ $C65E
        (SCX63-$CX
        ($
          IT CODE
0A7F    EXCPIED HE
        (C
          ****** S
0A86 ****T USED
  0A86  NG
          ****** W
0C00 *****
          ART OF W
0C00    ST SET TO
0C23    OF
```



```
                                                NEXT OBJECT ADDR: 09D0
..2 -- 6 SEP 86
S/CONTENTS

 PHASE UP...
D...                                    96D>
E PHASE... <09F>
DIRECTION <096
RE THERE >>09C
T OF 127
 COUNT
AJSTED? >>09B
R A $D5 HEADER
 REGISTER (C08
 DATA IS VALID
                                    UTINES ************
 SECTOR READ R
                                    NES
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 2000
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

2000    MODULE STARTING ADDRESS

          *********************************
          *                               *
          *  PRODOS RELOCATOR             *
          *       LOADED AS THE FIRST     *
          *       PORTION OF THE PRODOS   *
          *       IMAGE AT $2000.         *
          *                               *
          *  VERSION 1.2 -- 6 SEP 86      *
          *                               *
          *********************************

          ******** ZERO PAGE ADDRESSES ************

000A    AUTOSTART ROM CHECKSUM POINTER
000B
000C    CONFIGURATION BYTE (MACHID TO BE)
0010    GENERAL PURPOSE POINTER
0011
0012    DISK TYPE (0=DISK II, 4=PROFILE)
0013     AND INPUT RELOC RANGE POINTER
0014    VOL DIR ENTRY POINTER FOR RELOCATOR
0015     AND OUTPUT RANGE PTR
0016    LENGTH OF RELOCATION RANGE
0017
0018    INPUT RELOCATION RANGE POINTER
0019
001A    END OF INPUT RANGE
001B
003C    GENERAL PURPOSE POINTER
003D
003E    GENERAL PURPOSE POINTER
003F
0040    RAMDRIVE OUTPUT POINTER
0041
0042    VARIOUS USES: PARM TO AUXMOVE,
0043     UNIT/SLOT PASSED TO RELOCATOR
0046    BLOCK NUMBER TO RAMDRIVE
0047

          ******** EXTERNAL ADDRESSES *************

0080    MACHID BUILD SUBRTN FOR 128K
0101    SAVE AUX STACK POINTER (IN AUX STACK)
0280    GENERAL PURPOSE BUFFER
0281    BUFFER+1
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 2000
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

          ******** SCREEN LINE ADDRESSES **********

04B8    SCREEN BUFFER ROW 10
05A9    SCREEN BUFFER ROW 12
05AD    SCREEN BUFFER ROW 12
06B6    SCREEN BUFFER ROW 14
07A8    SCREEN BUFFER ROW 16
07AD    SCREEN BUFFER ROW 16
07D0    SCREEN BUFFER ROW 24

          ******** MISCELLANEOUS ADDRESSES *********

0800    ENTRY OF INTERP LOADER
0C00    VOLUME DIRECTORY BUFFER
0C23    ENTRY LENGTH
          -- RAMDRIVE VOLUME DIRECTORY --
0E04    VOLUME HDR, VOLUME NAME
0E22    VOLUME HDR, ACCESS-TOTAL BLOCKS
2000    START OF SYSTEM PROGRAMS
2C00    RAMDRIVE DEVICE DRIVER LOAD ADDRESS
2A00    DIFFERENCE OF RAMDRIVE LOAD AND RUN LOCATIONS
BFFF    TOP OF 48K RAM

          ******** SYSTEM GLOBAL PAGE *************

BF00    ENTRY POINT FOR MLI
BF03    QUIT VECTOR
BF06    DATE/TIME
BF10    DEVICE HANDLER TABLES
BF30    LAST DEVICE USED
BF31    NUMBER OF ACTIVE DISK DEVICES
BF32    ACTIVE DISKS SEARCH LIST
BF98    MACHINE TYPE FLAGS
BF99    SLOT WHICH CONTAIN CARDS WITH ROM
BFFF    MLI VERSION NUMBER

          ******** I/O PORT ADDRESSES *************

C000    80 STORE OFF
C001    80 STORE ON
C002    READ MAIN RAM
C003    READ AUX RAM
C004    WRITE MAIN RAM
C005    WRITE AUX RAM
C008    MAIN STACK/ZERO PAGE
C009    ALTERNATE STACK/ZERO PAGE
C00A    INTERNAL SLOT 3 ROM
C00B    PERIPHERAL SLOT 3 ROM
C00C    80 COLUMN DISPLAY OFF
C018    READ 80STORE SWITCH
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 2000
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

C030    SPEAKER
C054    USE MAIN MEMORY PART OF 80-COL CARD
C055    USE AUX MEMORY PART OF 80-COL CARD
C068    IIGS STATEREG STATUS BYTE
C081    WRITE-ENABLE HIGH RAM
C082    MOTHERBOARD ROM READ ENABLE
C083    READ/WRITE RAM 2ND 4K BANK
C08B    READ/WRITE RAM 1ST 4K BANK

        ******** INTERNAL C3ROM ADDRESSES *******

C311    MOVE TO/FROM AUXMEM SUBROUTINE
C314    TRANSFER TO/FROM AUXMEM SUBROUTINE

        ******** SLOT ROM ADDRESSES *************

C305    SLOT3 I.D. BYTE
C307    SLOT3 I.D. BYTE
C30B    SLOT3 I.D. BYTE
C30C    SLOT3 I.D. BYTE
C3FA    SLOT3 I.D. BYTE
CFFF    RESET I/O CARD ROMS

        ******** PRODOS ADDRESSES ***************

D000    START OF QUITCODE MEMORY AREA (BANK2)
DFF1    ENHANCED ROM FLAG
FDB8    VERSION NUMBER (FOR SUBDIRECTORIES)
FEFF    GS VIDEO FLAG
FF00    RAMDRIVE CALLER ADDRESS

        ******** MONITOR ROM ********************

FB1E    PADDLE READ SUBROUTINE
FB2F    MONITOR INIT ROUTINE
FBB3    ROM VERSION BYTE
FBC0    SECONDARY VERSION BYTE (0-3)
FC58    CLEAR SCREEN
FE1F    THIS ROUTINE CHECKS FOR IIGS
FE84    SET NORMAL VIDEO
FE89    IN#0
FE93    PR#0

2000 *********** PRODOS RELOCATOR MAIN ENTRY *************************

  2000  JUMP OVER PQUIT ENTRY >>2006
  2003  SET FLAG INDICATING PQUIT ENTRY (IIGS) (21D1)
  2006  STORE SLOT IN ML1 ONLINE PARMS
  200B  PRINT "APPLE II PRODOS..." <25B1>
  200E  SET UP FOR COMMON MOVES (226E)
  2014  RELOCATE SOME ROUTINES & DATA TO LOW MEMORY <28B0>
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 2017
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  2017  RELOCATION ERROR >>203C
  201D  BE SURE 48K OF MAIN MEMORY EXISTS (BFFF)
  2024  IF NOT, ERROR >>204E
  2029  MAKE DOUBLY SURE  (BFFF)
  202C  ERROR THIS TIME >>204E
  202E  SELECT MOTHERBOARD ROMS (C082)
  2031  DETERMINE MACHINE TYPE <251F>
  2036  PICK UP CONFIGURATION BYTE
  2038  64K OR MORE MEMORY?
  203A  YES, WE HAVE 64K RAM >>203F
  203C  ERROR.  MUST HAVE 64K OR MORE!! >>2227

        ******** RELOCATE PRODOS ***************

  203F  SET UP FOR MLI MOVE (2270)
  2045  COPY/RELOCATE PRODOS ITSELF <28B0>
  2048  GET PRODOS VERSION NUMBER  (BFFF)
  204B  AND PUT IT IN MLI DATA AREA. (FDB8)
  204E  RELOCATION ERROR! >>20AC
  2050  ENABLE MOTHERBOARD ROMS AGAIN (C082)
  2053  CHECK ROM I.D. BYTE (FBB3)
  2056  APPLE //e FAMILY?
  2058  NO, LEAVE I.D. BYTE AS IS >>208E
  205C  TEST ANOTHER ROM I.D. BYTE (FBC0)
  205F  SAVE BIT TEST RESULTS
  2060  GET MACHID
  2062  STRIP BITS THAT IDENTIFY MODEL
  2067  IT'S A //e IF BITS 6 & 7 ARE HIGH >>2075
  2069  ---
  206A  EITHER A //c OR A FUTURE SYSTEM
  206C  CHECK HIGH BITS OF $FBC0 AGAIN
  206D  BIT 7 ON? >>2073
  206F  YES, FUTURE SYSTEM.
  2073  IF BIT 6 ON, IT'S A FUTURE SYSTEM. >>2077
  2075  ---
  2077  REPLACE UPDATED MACHID
  207D  LOOK AT ROM. THIS A IIGS? <FE1F>
  2080  NO, CARRY STILL SET. >>208E
  2082  YES, SET IIGS FLAG. (2278)
  2085  ENTER FROM PQUIT? (21D1)
  2088  YES, THIS IS NOT INITIAL BOOT. >>208E
         NOW SET OS_BOOT TO ZERO, INDICATING THAT PRODOS8
         WAS THE OPERATING SYSTEM INITIALLY BOOTED.
  208A  65816 INSTRUCTION: STA $E100BD
  208E  COPY BOOT DEVICE ID TO READ BLOCK PARMS (2262)
  2094  AND AS LAST DEVICE USED (BF30)
  2097  DETERMINE PERIPHERAL CARD CONFIGURATION <265F>
  209A  BOOT DEVICE TO... (2269)
  209D  GLOBAL PAGE LAST DEVICE USED (BF30)
  20A0  ENABLE READ/WRITE HIGH RAM, BANK 1 <2518>
  20A9  COPY CLOCK CODE TO DEVICE DRIVER AREA <28B0>
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 20AC
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  20AC  ERROR? =>>20DA
  20AE  CHECK MACHINE TYPE AGAIN (BF98)
  20B1  GOT 64K OR MORE?
  20B5  NO. >>20DD
  20B7  YES, QUIT VECTOR --> $FCA9
  20C1  WRITE TO HIGH RAM (BANK2) (C083)
  20CA  POINT TO QUIT CODE TABLE (2275)
  20CD  MOVE QUIT CODE TO HIGH RAM <28B0>
  20D2  STORE QUIT VECTOR START PAGE (D000)
  20D5  ENABLE READ/WRITE HIGH RAM, BANK 1 <2518>
  20DA  RELOCATION ERROR >>2227
  20DD  GET MACHID YET AGAIN (BF98)
  20E0  128K?
  20E4  NO.  >>20FC
  20E6  YES; SET UP AUX RAM
  20E8  SAVE STATUS REG IN ACCUM
  20EA   DISABLE INTERRUPTS
  20EB  PREPARE TO WRITE TO AUX STACK AREA (C009)
  20EE  AUX STACK POINTER SET TO $FF (0101)
  20F1  BACK TO MAIN Z-PAGE, STACK (C008)
  20F4  RESTORE STATUS REG
  20F9  ESTABLISH RAM DRIVE IN AUX MEM <2B00>

        ******** SET UP FOR IRQ (ENHANCED ROM) **

  20FC  READ ROM (C081)
  20FF  GET ROM'S IRQ VECTOR (FFFE)
  2105  ENABLE READ/WRITE HIGH RAM, BANK 1 <2518>
  2108  CARRY CLEAR IF IRQ VECTOR IN C3 ROM
  210A  FLAG FOR "OLD ROM"
  210C  IT'S AN OLD ROM >>2127
  210E  SWITCH TO AUX STACK & HIGH RAM (C009)
  2113  INITIALIZE AUX STACK POINTER TO $FF (0101)
  2116  PUT IRQ VECTOR IN AUX HIGH RAM (FFFF)
  211C  BACK TO MAIN HIGH RAM & Z-PAGE (C008)
  211F  PUT IRQ VECTOR IN MAIN HIGH RAM (FFFF)
  2125  INDICATE ENHANCED IRQ LOGIC ON BOARD
  2127  STORE FLAG IN MLI DATA AREA (DFF1)

        ******** LOOK FOR SLOT 3 VIDEO CARD *****

  212A  ---
  212C  SET GS VIDEO FLAG=0 (FEFF)
  212F  THIS A IIGS? (2278)
  2132  NO. >>213A
  2134  YES, SET GS VIDEO FLAG (IN MLI) (FEFF)
  2137  AND DON'T BOTHER SEARCHING SLOT 3. >>21A5
  213A  ENABLE INTERNAL VIDEO FIRMWARE (C00A)
  213D  CHECK FOR ROM  (BF99)
  2140  IN SLOT 3.
  2142  ROM EXISTS? >>2147
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 2144
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  2144  NO.  ROM. >>21AD
  2147  LOOK AT THE SLOT 3 ROM (C00B)
  214A  AT  OFFSET +$05 (C305)
  214D  THIS MUST BE A $38
        D AT OFFSET +$07 (C307)
        THIS MUST BE AN $18
        D AT OFFSET +$0B (C30B)
        THIS MUST BE A 1
        D AT OFFSET +$0C (C30C)
  2151  ANY INDICATE AN 80-COL CARD.
  2154  THE CK MACHINE TYPE (BF98)
  2158  ANY THIS AN APPLE III?
  215B  THE   IT'S GOT 80-COL CAPABILITY >>21A5
  215F  ANY ER MANUFACTURERS MUST FOLLOW THE RULES! (C3FA)
  2164  IN  T HAVE BIT INSTRUCTION AT $C3FA
  2168  CAN D BOY, YOU FOLLOWED THE RULES! >>21A5
  216D  IS  E CONTROL BACK TO MOTHERBOARD ROM (C00A)
  216F  OK  N ON 80-COL (C001)
  2171  CAN CK FOR AUX MEM. (C055)
  2174  WAS A BYTE AT AUX $400 (0400)
  2176  GOT ACCUMULATOR LEFT
  2178  GIV DO THE SAME WITH $400 (0400)
  217B  TUR LL THE SAME? (0400)
  217E  CAN NO 80-COL MEMORY >>2196
  2183  PUT FT TO THE RIGHT
  2186  THE LL THE SAME? (0400)
  2187  ANY K TO MAIN MEMORY (C054)
  218A  STA N OFF 80-COL (C000)
  218D  NO,  80-COL MEMORY FOUND? >>21A5
  218F  SET  SO TURN OFF 80-COL FLAG (BF98)
  2193  STI MACHINE I.D. BYTE.
  2196  BAC AYS BRANCH >>21AA
  2199  THE N ON 80-COL FLAG (BF98)
  219C  WAS ANY S A IIGS? (2278)
  219E  NO,  >>21C8
  21A1  IN , ENABLE IIGS CLOCK DRIVER
  21A3  A   ADDRESS OF RELOCATE TABLE (2276)
  21A5  PUT IIGS CLOCK CODE (2277)
  21AD  THI PUT THE CODE AT $D742 <28B0>
  21B0  NO  ICATE CLOCK EXISTS IN MACHID (BF98)
  21B2  YES ER FROM PQUIT? (21D1)
  21B7  GET  >>21D2
  21BA  FOR , ENABLE ROM FOR READ (C082)
  21BD  AND URN
  21C0  INI
  21C8  ENT
  21CB  NO
  21CD  YES
  21D0  RET

  21D1  PQU IT FLAG. (0 = PRODOS 8 WAS INITIAL BOOT)
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86            NEXT OBJECT ADDR: 21D1
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

        ******** GET VOL LABEL ******************

  21D2  MLI: ONLINE DEVICE CALL <BF00>
  21D8  ERROR? >>2227
  21DD  VALID VOLUME NAME?
  21DF  IF NOT, ERROR >>2227
  21E2  ELSE, BUMP LENGTH BY ONE
  21E7  AND PREFIX NAME BY A "/"
  21EC  MLI: SET PREFIX <BF00>
  21F2  ERROR? >>2227

        ******** READ VOLUME DIRECTORY **********

  21F4  ---
  21F5  $14/15 --> $C00
  21FB  ---
  2200  BLOCK = 2 (VOLUME DIRECTORY) (226C)
  2206  MLI: READ BLOCK <BF00>
  220C  ERROR? >>2227
  2210  GET NEXT BLOCK NUMBER
  2216  IF ZERO, END OF VOLUME DIRECTORY >>2224
  221E  ADD TWO PAGES (ONE BLOCK) TO POINTER
  2220  AND STOP AT $1400 IN ANY CASE
  2222  ELSE, READ NEXT BLOCK AS WELL >>21FB
  2224  WHEN DONE, JUMP TO SYSTEM FILE LOADER >>0800

2227 *********** ERROR HANDLER ***************************************

  2227  ENABLE MOTHERBOARD ROMS (C082)
  222A  CLEAR SCREEN <FC58>
  222F  PRINT "RELOCATION/CONFIG ERROR" (223B)
  2238  THEN SLEEP FOREVER  >>2238

223B *********** DATA ************************************************

  223B  ---
  223B  '** RELOCATION / CONFIGURATION ERROR **'

  2261  MLI: ONLINE PARMS
  2262          SLOT*16 AND DRIVE
  2263          READ THEM TO $281

  2265  MLI: SET PREFIX PARMS
  2266          PREFIX IS AT $280

  2268  MLI: READ BLOCK PARMS
  2269          DEVICE
  226A          BUFFER
  226C          BLOCK NUMBER
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86            NEXT OBJECT ADDR: 226C
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  226E  ADDRESS OF COMMON MOVES
  2270  ADDRESS OF PRODOS RELOC
  2272  ADDRESS OF THUNDERCLOCK RELOC TABLE
  2274  ADDRESS OF QUIT CODE R TABLE
  2276  ADDRESS OF IIGS CLOCK D DRIVER RELOC TABLE
                                LOC TABLE
  2278  IIGS FLAG. IF NON-ZERO, RIVER RELOC TABLE

2279 *********** RELOCATION TA THIS IS A IIGS.
          +0:     00 - ZERO BLOC
                  01 - COPY BLOCKS ***********************************
                  02 - RELOCATE K OF MEMORY
                  03 - RELOCATE K
                  04 - RELOCATE MSB ADDRESSES
          +1/2:   ADDR OF OUTPU 2 BYTE ADDRS
          +3/4:   LENGTH OF BLO INSTRUCTIONS
          +5/6:   ADDR OF INPUT BLOCK
          +7:     NUM RANGES TO K IN BYTES
          +8:               START BLOCK (IF ANY)
          +8+COUNT:         END P CORRECT FOR (-1)
          +8+COUNT+COUNT:ADDIT PAGES
                                AGE ADDRESSES
          ******** COMMON MOVE VB CORRECTION FACTOR

  2279  COPY (SYSTEM FILE LOADS TABLE *************
  227A          TO =$800
  227C          LEN=$213        ER)
  227E          FRM=$22DB
  2280  COPY (PAGE 3 IMAGE)
  2281          TO =$3D6
  2283          LEN=$2A
  2285          FRM=$24EE
  2287  COPY (CHECKSUM)
  2288          TO =$0A
  228A          LEN=$02
  228C          FRM=$14
  228E  COPY (CHECK FOR 80-COL
  228F          TO =$80
  2291          LEN=$46          CARD)
  2293          FRM=$256B
  2295  END OF TABLE

        ******** QUIT CODE M

  2296  COPY (QUIT CODE)        OVE TABLE ***********
  2297          TO =$D100
  2299          LEN=$300
  229B          FRM=$5900
  229D  END OF TABLE
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 229D
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

        ******** PRODOS RELOC TABLE *************

 229E  COPY (IRQ HANDLER)
 229F          TO =$FF9B
 22A1          LEN=$65
 22A3          FRM=$519B
 22A5  COPY (SYSTEM GLOBAL PAGE)
 22A6          TO =$BF00
 22A8          LEN=$100
 22AA          FRM=$5000
 22AC  ZERO (PRODOS KERNEL DATA AREA)
 22AD          ADR=$D700
 22AF          LEN=$700
 22B1  COPY (PRODOS KERNEL)
 22B2          TO =$DE00
 22B4          LEN=$2100
 22B6          FRM=$2F00
 22B8  COPY (DISKETTE DRIVER)
 22B9          TO =$D000
 22BB          LEN=$700
 22BD          FRM=$5200
 22BF  END OF TABLE

        ******** THUNDERCLOCK TABLE *************

 22C0  COPY (THUNDERCLOCK CODE)
 22C1          TO =$D742
 22C3          LEN=$7D
 22C5          FRM=$5100
 22C7  RELOCATE INSTRUCTIONS
 22C8          TO =$D742
 22CA          LEN=$69
 22CC          FRM=$D742
 22CE          FOR ADDRS=$C1XX-$C1XX
 22D1          ADJUST BY=$S0
 22D2  END OF TABLE

        ******** IIGS CLOCK TABLE *************

 22D3  COPY (IIGS CLOCK CODE)
 22D4          TO =$D742
 22D6          LEN=$7D
 22D8          FRM=$5C00
 22DA  END OF TABLE
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 22DB
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

22DB ******** SYSTEM FILE LOADER ************************************
          (COPIED TO AND RUN AT $800)

 22DB  MLI: GET.FILE.INFO CALL <BF00>
 22DF  FIRST SEE IF THERE IS AN A "ATINT" FILE
 22E1  NO ERRORS >>22EA
 22E3  IS ERROR "FILE NOT FOUND"?
 22E5  YES, THAT'S OK. >>232C
 22E7  NO, OTHER ERROR >>232F

 22EA  GET FILE TYPE OF FILE FOUND (088D)
 22ED  IS IT "ATINIT" FILE?
 22EF  NO, ERROR >>232F
 22F1  MLI: OPEN CALL <BF00>
 22F7  FILE DOESN'T OPEN >>232F
 22F9  MLI: GET_EOF CALL <BF00>
 22FF  CAN'T FIND EOF >>232F
 2301  HIGH BYTE OF EOF (0A01)
 2304  FILE TOO BIG >>232F
 2306  MEDIUM BYTE OF EOF (0A00)
 2309  MAX FILE SIZE IS $9800
 230B  FILE TOO BIG >>232F
 230D  PUT IN READ PARMS (0A07)
 2310  GET LOW BYTE OF EOF (09FF)
 2313  PUT IN READ PARMS (0A06)
 2316  MLI: READ CALL <BF00>
 231C  READ ERROR >>232F
 231E  MLI: CLOSE CALL <BF00>
 2324  CLOSE ERROR >>232F
 2326  READ ROM (C082)
 2329  GO TO APPLICATION <2000>

 232C  NOW LOOK FOR SYSTEM FILE >>08A8

 232F  PRINT ERROR MESSAGE: (233D)
 2332  "UNABLE TO LOAD ATINIT FILE" (233D)
 233B  SLEEP FOREVER >>233B

 233D  MSG LENGTH
 233E  "**     UNABLE TO LOAD ATINIT FILE     **"

 2364  GET_FILE_INFO PARMS (FOR ATINIT FILE)
       (LOCATED AT $889 WHEN EXECUTED)
 2365  PATHNAME ADDRESS
 2368  FILE TYPE

 2376  OPEN PARMS FOR ATINT FILE
        (AT $89B WHEN EXECUTED)
 2377  PATHNAME ADDRESS
 2379  I/O BUFFER AT $1400
 237B  REFNUM=1
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 237B
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  237C  ---
  237D  "ATINIT"

2383 ******** LOOK FOR NORMAL SYSTEM FILE ****************************
        (THIS CODE EXECUTES AT $8A8)

  2383  $10/11 --> VOLUME DIRECTORY ENTRIES
  2385  INITIALLY AT $C00
  2387  OFFSET BEYOND LINKS (+4)
  2389  JUMP OVER NEXT INSTRUCTION >>238D

          ******** SCAN DIRECTORY FOR SYSTEM FILE *

  238B  PICK UP LSB
  238D  ---
  238E  BUMP BY ENTRY LENGTH (0C23)
  2391  UPDATE LSB
  2393  PAGE OVERFLOW? >>23A7
  2395  NO, ROOM FOR ONE MORE ENTRY? (0C23)
  239A  NO, CHECK MSB
  239D  START OF A BLOCK? >>23A9
  239F  NO, AT END OF DIRECTORY?
  23A1  YES, FILE NOT FOUND IN DIRECTORY >>23C1
  23A3  NO, START NEW BLOCK AT +4
  23A5  AND UPDATE LSB
  23A7  BUMP MSB
  23A9  ---
  23AD  "SYSTEM" FILE TYPE?
  23AF  NO, TRY ANOTHER. >>238B
  23B2  INACTIVE ENTRY?
  23B4  IF SO, SKIP IT >>238B
  23B8  SAVE NAME LENGTH AT $280 (0280)
  23BD  MUST BE AT LEAST 8 CHARS LONG >>238B
  23BF  JUMP AROUND ERROR CODE >>23C3
  23C1  ERROR - SYSTEM FILE NOT FOUND >>2430

  23C3  ---
  23C6  IS THIS ".SYSTEM"?
  23C8  (SEE $24E7) (0A0C)
  23CC  NO, SKIP ENTRY >>238B
  23D0  CHECK ALL CHARACTERS IN NAME >>23C6

          ******** LOAD SYSTEM FILE AT $2000 ******

  23D2  ---
  23D4  ---
  23D5  COPY NAME TO $281
  23DC  AND TO "UNABLE TO LOAD" MSG (09E2)
  23E4  ADD BLANK AT END OF NAME
  23E6  IN MESSAGE (09E3)
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 23EA
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  23EA  NAMELEN + ERRORMSGLEN
  23EC  SAVE AT $24D1 (09F6)
  23EF  MLI: OPEN .SYSTEM FILE <BF00>
  23F5  OPEN ERROR >>243D
  23F7  MLI: GET EOF <BF00>
  23FD  CAN'T GET EOF >>243D
  23FF  GET HIGH BYTE (0A01)
  2402  FILE TOO BIG! >>2457
  2404  GET MEDIUM BYTE (0A00)
  2407  MUST BE LESS THAN $9800 BYTES
  2409  TOO BIG. >>2457
  240B  STORE LENGTH IN MLI READ PARMS (0A07)
  240E  GET LOW BYTE (09FF)
  2411  AND STORE IN READ PARMS. (0A06)
  2414  MLI: READ SYSTEM FILE INTO $2000 <BF00>
  241A  NO READ ERRORS >>2422
  241C  ERROR, BAD BUFFER?
  241E  YES, FILE WAS TOO LARGE >>2457
  2420  ELSE, "UNABLE TO LOAD ..." >>243D
  2422  MLI: CLOSE SYSTEM FILE  <BF00>
  2428  CLOSE ERROR >>243D
  242A  ENABLE MOTHERBOARD ROM (C082)
  242D  AND JUMP TO BEGINNING OF FILE >>2000

2430 *********** ERROR HANDLERS ***************************************

  2430  ---
  2432  PRINT "UNABLE TO FIND A .SYSTEM FILE" (0989)
  243B  THEN GO TO SLEEP >>2462

  243D  GET NAME LENGTH (09F6)
  2440  LINE LENGTH
  2443  LESS NAME LENGTH (09F6)
  2446  DIVIDED BY 2
  2447  GIVES OFFSET TO CENTER THE LINE (09F6)
  244B  PRINT "UNABLE TO LOAD ..." (09D1)
  2455  GO TO SLEEP FOREVER >>2462

  2457  ---
  2459  PRINT "SYSTEM PROGRAM TOO LARGE" (09B1)
  2462  GO TO SLEEP FOREVER >>2462

2464 *********** DATA AREA ********************************************

  2464  '**  UNABLE TO FIND A ".SYSTEM" FILE  ** '
  248C  '**  SYSTEM PROGRAM TOO LARGE  **'
  24AC  '** UNABLE TO LOAD X.SYSTEM **********'
  24D1  NAME LEN +13H (LEN OF MSG)
```

```
SEP 86                    NEXT OBJECT ADDR: 24D1
-------------------------------------------------

ProDOS Relocator -- V1.2 -- 6
-------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------

                          AT $9F7 WHEN EXECUTING)


  24D2  MLI: OPEN PARM LIST (
  24D3  PATHNAME IS AT $280
  24D5  I/O BUFFER AT $1400
  24D7  REFNUM=1                    T (AT $9FD)

  24D8  MLI: GET EOF PARM LIS
  24D9  REFNUM=1
  24DA  EOF MARK POSITION           02)

  24DD  MLI: READ LIST (AT $A
  24DE  REFNUM=1                    )
  24DF  READ INTO $2000
  24E1  LENGTH (FROM EOF MARK
  24E3  ACTUAL LENGTH READ          A0A)
                                    LES
  24E5  MLI: CLOSE LIST (AT $
  24E6  REFNUM=0, CLOSE ALL F

  24E7  '.SYSTEM'                   M FILE LOADER ***************************

24EE ************ END OF SYSTE     R IMAGE *********************************
                                    3FF)
24EE ************ PAGE 3 VECTO     AT $3D6 THAT IS USED
                    ($3D6-$       RIVER IN AUX HIGH RAM)
          (INCLUDES A ROUTINE
           TO CALL A DEVICE         8)
                                    G AT $42
                                    (C009)
  24EE  FROM MAIN Z-PAGE, (C
  24F1  GET X+1 VALUES START        S (AT $3E3) ARE PATCHED
  24F3  AND PUT IN AUX Z-PAGE       VICE DRIVER IN AUX
  24F6  AT SAME LOCATION.           RIVER IS INSTALLED.
           THE NEXT THREE BY        ERROR (IF NOT INSTALLED)
           WITH A JUMP TO A DR      008)
           HIGH RAM WHEN THE
  24FB  "NO DEVICE CONNECTED"       THAT CALLS
  24FE  BACK TO MAIN Z-PAGE (C      DRIVER.  THIS
  2501  RETURN                     E INSTALLED
  2502  ADDRESS OF MLI ROUTIN      HE GLOBAL PAGE.
         THE RAM-BASED DEVICE
         ADDRESS IS USED AS T
         DRIVER'S ADDRESS IN
  2508  BRK HANDLER AT $FA59        59
  250A  RESET AT $FF59                >>FF59
  250C  POWER UP BYTE               FF59
  250D  & VECTOR TO $FF59 >>FF      GLOBAL PAGE)
  2510  CTL-Y VECTOR TO $FF59
  2513  NMI VECTOR TO $FF59 >>
  2516  IRQ HANDLER AT $BFEB
```

```
1.2 -- 6 SEP 86                NEXT OBJECT ADDR: 2518
-------------------------------------------------
ONTENTS
-------------------------------------------------

H RAM FOR READ/WRITE ****************************

$C08B (C08B)


RMINE MACHINE ID ********************************
=ØØ.. Ø... APPLE II
  Ø1.. Ø... APPLE II+
  1Ø.. Ø... APPLE IIe or IIGS
  1Ø.. 1... APPLE IIc
  11.. Ø... APPLE /// EMULAT.
  ..Ø1 .... 48K RAM
  ..1Ø .... 64K RAM
  ..11 .... 128K RAM
  .... ..1. 8Ø COL CARD
  .... ...1 COMPATIBLE CLOCK

G AT FIRST
E (F8B3)

>>254B


IIGS?
>>254B

2518 ******* SET HIG
  2518  TWO READS OF
  251E  RETURN

251F *********** DET
                $ØC
  251F  ASSUME NOTHIN
  2523  GET A ROM BYT
  2526  APPLE II?
  2528  YES, SET BIT      OM1 >>2545
  252A  NO,
  252C  APPLE IIE OR
  252E  YES, SET BIT      MODE?
  2530  NO,
  2532  APPLE II+?
  2534  NO, STRANGE M     KNOWN MACHINE
  2539  REALLY A II+?     O INSTR AT $80
  253B  YES >>254B        >>2568
  253F  /// EMULATION    ABLE HIGH RAM (BANK1) <2518>
  2543  ---               AM EXISTS (D000)
  2544  RETURN            ARK IN MACHID
  2545  OTHERWISE, UNF
  2547  CREATE INVALI     FOR AUXILIARY RAM ***************************
  2549  AND GO THERE      TO $80 TO ALLOW BANK SWITCH)
  254B  UPDATE MACHID     H MACHID IN ACCUMULATOR)
  254D  READ/WRITE ENA
  2552  SEE IF HIGH RA
  2564  IF PRESENT, ME      OR II+ >>25A4

256B *********** LOOK      LATER.  CHECK FOR 128K.
          (CODE MOVED       MORY (C005)
          (ENTERED W        N AT $C00 (0C00)
                            800)
  256B  UPDATE MACHID
  256D  IF PLUS, IS II
  256F  IT'S A IIe CR
  2571  BANK TO AUX ME
  2577  STORE A PATTER
  257A  AND AT $800 (0
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86            NEXT OBJECT ADDR: 2580
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  2580  MAKE SURE P
  2582  IT DIDN'T
  2584  NOW SHIFT $
  2587  AND SHIFT T
  2588  ARE THEY ST
  258B  NO, AUX RAM
  258D  DID $800 MO
  2590  NO, SO WE H
  2592   DON'T HAVE
  2595  ---
  2596  BANK BACK T
  259C  ONLY 64K >>
  25A0  NO, INDICAT
  25A2  IN MACHID
  25A4  SET UP $A/B
  25A6  IN MOTHERBO
  25A9  $B NOW $FB
  25AB  SOMETHING W
  25AD  $A NOW $09
  25AF  ---
  25B0  RETURN TO C

25B1 ********** DI

  25B1  CLICK SPEAK
  25B4  STORE IN MA
  25B7  80 COL DISP
  25BA  SET NORMAL
  25BD  CALL MONITO
  25C0  SET VIDEO F
  25C3  SET KEYBD
  25C6  OUT OF DECI
  25C7  CLEAR SCREE
  25CC  PRINT "APPL
  25D7  PRINT "PROD
  25E2  PRINT 12 BL
  25ED  PRINT "COPY
  25F6  CLICK SPEAK
  25F9  DONE

25FA ********** DA

  25FA  'APPLE //'
  2602  'PRODOS 8
  2620  '
  262C  'COPYRIGHT
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86            NEXT OBJECT ADDR: 2650
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  2653  8 BYTES FOR SMARTPORT STATUS CALL
  265B  DRIVER ADDRESS
  265D  SPACES LEFT ON DEVICE LIST
  265E  SLOT 2 FLAG (0 = PRODOS STORAGE DEVICE IN SLOT 2)

265F ********** DETERMINE SLOT CONFIGURATION ************************

  265F  ---
  2661  ZERO SOME THINGS
  2668  DEVCNT=$FF (NO DEVICES YET) (BF31)
  266B  ALL 14 DEVICES ARE UNASSIGNED
  2670  FIRST CHECK SLOT 2
  2674  IS A STORAGE DEVICE IN SLOT 2? <2898>
  2677  IF NOT, SET A FLAG (265E)
  267A  NOW POINT TO SLOT 7
  267E  STORAGE DEVICE IN SLOT? <2898>
  2681  NO. >>26DF
  2683  GET $CSFF BYTE
  2685  LOOKS LIKE 16 SECTOR DISK II. >>26AC
  2687  LOOK LIKE 13 SECTOR DISK II?
  2689  YES, DON'T USE IT. >>26DF

        ***** NON-DISK II STORAGE DEVICE ********

  268B  CsFF BYTE = LOW BYTE OF DEVICE ADDRESS (265B)
  268E  CHECK BYTE AT OFFSET 7
  2690  TO SEE IF IT'S A SMARTPORT
  2692  NOT A SMARTPORT INTERFACE >>2697
  2694  GO DO SMARTPORT STUFF >>2844
  2697  ---
  2699  GET $CSFE (STATUS BYTE)
  269B  CAN WE AT LEAST READ STATUS AND DATA?
  269F  ANTICIPATE FAILURE
  26A0  CAN'T READ IT. NO SENSE USING IT. >>26DF
  26A2  PUT LEFT NIBBLE OF STATUS BYTE IN $12 <288D>
  26A6  PUSH CLC, INDICATING ONE DRIVE
  26A7  CARRY SET IF 2 OR 4 DRIVES
  26A8  GET HIGH BYTE OF SLOT ROM
  26AA  ALWAYS BRANCH INTO DISK II PROCESSING >>26B9

        ***** LOOKS LIKE A DISK II **************

  26AC  $12 = 0 FOR DISK II
  26AF  PUSH SEC ON STACK (DISK II HAS 2 DRIVES)
  26B0  GET LOW BYTE OF DISK II DRIVER ($00) (27D8)
  26B3  SAVE IT IN RELOC DATA AREA (265B)
  26B6  GET HIGH BYTE OF DISK II DRIVER ($D0) (27D9)
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 26B6
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

        ***** COMMON PROCESSING ***************

 26B9   SAVE DEVICE ADDRESS HIGH BYTE (265C)
 26BC   ESTABLISH DEVICE DRIVER IN GLOBAL PAGE <2814>
 26BF   ONLY ONE DRIVE?
 26C0   YES, GO TO NEXT SLOT >>26DE
        IF TWO DRIVES WERE ASSIGNED, MOVE THEM TO
        THE BOTTOM OF THE LIST IN REVERSE ORDER
 26DE   ---
        CARRY IS NOW CLEAR IF A PRODOS STORAGE DEVICE
        WAS FOUND IN THIS SLOT.  OTHERWISE, CARRY IS SET.
 26DF   GO MARK SLTBYT TO SHOW ROMS IN SLOT <2768>
 26E2   MOVE DOWN ONE SLOT
 26E8   WE'VE DONE ALL SLOTS >>26ED
 26EA   CHECK NEXT SLOT >>267E
 26F3   STASHED ANY DEVICES AT BOTTOM OF LIST? (265D)
 26F6   NO. >>271A
 26F8   YES, MOVE THEM BACK
 2700   IN REVERSE ORDER.
 2715   DONE WHEN X=Y (265D)
 271A   ---
 271C   START AT BOTTOM OF SEARCH LIST (BF31)
 271F   GET A DEVICE FROM LIST (BF32)
 2722   PUT IT ON THE STACK
 2725   IS IT THE CURRENT SLOT? (BF30)
 2729   NO, KEEP LOOKING >>272D
 272B   YES, TAKE IT OFF THE STACK
 272C   INDICATE CURRENT SLOT FOUND
 272D   ---
 272E   MORE TO CHECK >>271F
 2730   GET DEVICE COUNT (BF31)
 2734   CURRENT SLOT NOT FOUND! >>274A
 2736   PUT CURRENT DRIVE AT (BF30)
 2739   BOTTOM OF SEARCH LIST (BF32)
 273D   ONLY ONE DEVICE ON LIST >>2751
 2740   ONLY ONE DRIVE ON BOOT SLOT >>274A
 2742   CHANGE DRIVE NUMBER
 2744   STORE OTHER DRIVE NEXT TO LAST (BF32)
 2748   CURRENT SLOT ONLY SLOT ON LINE >>2751
 274A   GET OTHER DEVICES
 274B   MOVE THEM AHEAD OF CURRENT DRIVE (BF32)
 274F   STILL MORE TO DO  >>274A

 2751   DO CHECKSUM ON ROM <27EA>
 2754   DOESN'T SAY "APPLE II"! >>275A
 2756   WE'RE HAPPY, STORE FINISHED MACHID (BF98)
 2759   AND LEAVE
 275A   UNKNOWN MACHINE, SO DIE HORRIBLY! >>2545
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 275A
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

275D ******** PUT A DEVICE ON DEVICE LIST ***************************

 275D   COMBINE DSSS with IIII
 2762   BUMP DEVICE COUNT BY ONE
 2763   AND ADD DRIVE TO SYSTEM SEARCH LIST (BF32)
 2766   ROLL LEFT ANTICIPATING ROLL RIGHT
 2767   RETURN

2768 *********** IDENTIFY I/O CARD ***********************************

 2768   WE ALREADY FOUND ROM IN THIS SLOT >>27C9
 276C   CHECK SIGNATURE ON CARD FOR THUNDERCLOCK
 2771   NOT IT >>278D
 2777   THUNDERCLOCK, WHICH SLOT?
 2779   SAVE SLOT NUMBER (LESS 1)
 277B   IN CLOCK CODE RELOCATION TABLE (22D1)
 2780   ENABLE CLOCK/CALENDAR JUMP IN GLOBALS (BF06)
 2785   NO MACHID! >>2751
 2787   INDICATE THAT A CLOCK IS PRESENT
 2789   AND UPDATE MACHID
 278B   GO MARK ROM IN THIS SLOT >>27C9
        CHECK FOR PASCAL 1.1 PROTOCOL
 278D   ---
 2791   $Cs05 = $38?
 2793   DOESN'T GET TO FIRST BASE >>27B8
 2799   $Cs07 = $18?
 279B   NO. >>27B8
 27A1   $Cs0B = $01?
 27A3   NO, BAD SIGNATURE >>27B8
 27A8   YES, GET LEFT NIBBLE
 27AA   80 COLUMN CARD?
 27AC   NO, UNKNOWN CARD >>27B8
 27B0   NO MACHID! >>2751
 27B2   MARK 80 COLUMN CARD PRESENT
 27B4   AND UPDATE MACHID
 27B6   GO MARK ROM IN THIS SLOT >>27C9

 27B8   UNKNOWN CARD, CHECK ROM TO
 27BC   SEE IF IT WILL HOLD A VALUE
 27C2   FOR SOME TIME.

 27C9   WE FOUND ROM IN THIS SLOT
 27CB   CONVERT SLOT NUMBER
 27CE   TO A BIT POSITION (27E2)
 27D1   AND OR INTO SLTBYT (BF99)
 27D7   RETURN TO CALLER
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 27D7
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

27D8 *********** DATA AREA *********************************************

  27D8  DISK II DEVICE DRIVER ENTRY POINT

  27DA  DEVICE SIGNATURE FOR:
  27DC  +Ø,+2,+4,+6 = THUNDERCLOCK
  27DE  +1,+3,+5,+7 = DISK
  27EØ  (+7 NOT CHECKED)

  27E2  BIT POSITION TABLE FOR SLOTS
  27E5   (ALSO USED IN CHECKSUM CALCS)

27EA *********** COMPUTE AUTOSTART ROM CHECKSUM **********************

  27EA  ---
  27EB  GET ZERO IN INDEX REGISTER (27E2)
  27EE  POINT TO $FBØ9 ("APPLE II" IN ROM)
  27FØ  MAKE SURE UPPER CASE
  27F5  UPDATE CHECKSUM (27E2)
  27F8  PUT HIGH BIT IN CARRY (27E2)
  27FC  DO 8 BYTES IN ALL (27E5)
  28Ø1  ACCUM = $Ø8
  28Ø5  ACCUM = $8Ø
  28Ø7  TURN ON HIGH BIT (27E2)
  28ØA  ADD A FUDGE FACTOR
  28ØC  OH NO! A CLONE! >>2811
  28ØE  PASSED THE TEST...RETURN WITH MACHID
  2810  RETURN
  2811  ELSE, RETURN WITH ZERO MACHID
  2813  RETURN

2814 ***DEVICE DRIVER IN GLOBAL PAGE *********************************

  2814  SAVE CARRY (NUMBER OF DRIVES)
  2815  GET HIGH BYTE OF SLOT ADDRESS
  2817  MAKE IT SLOT NUMBER
  2819  TIMES 2
  281A  USE LATER IN Y-REG
  281B  NOW GET SLOT*16 IN ACCUM
  281D  NOW HAVE ØSSSØØØØ (DRIVE 1)
  281E  PUT DEVICE ID ON DEVICE LIST <275D>
  2821  GET BACK CARRY (NUMBER OF DRIVES)
  2822  ROLL CARRY INTO ACCUM
  2823  ONLY ONE DRIVE. >>2829
  2825  TWO DRIVES. BUMP DEVICE COUNT
  2826  AND PUT SECOND DRIVE ON SEARCH LIST (BF32)
  2829  STORE FINAL DEVICE COUNT (BF31)
  282C  SHIFT DRIVE INDICATOR BACK TO CARRY
  282D  GET LOW BYTE OF DEVICE DRIVER ADDRESS (265B)
  2830  PUT IN GLOBAL PAGE FOR DRIVE 1 (BF10)
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 2833
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  2833  ONLY ONE DRIVE >>2838
  2835  PUT IN GLOBAL PAGE FOR DRIVE 2 (BF20)
  2838  GET HIGH BYTE OF DEVICE DRIVER ADDRESS (265C)
  283B  PUT IN GLOBAL PAGE FOR DRIVE 1 (BF11)
  283E  ONLY ONE DRIVE >>2843
  2840  PUT IN GLOBAL PAGE FOR DRIVE 2 (BF21)
  2843  RETURN

2844 ******** HANDLE SMART PORT ***************************************

  2844  PUT LEFT NIBBLE OF STATUS BYTE IN $12 <288D>
  2847  GET HIGH BYTE OF SLOT ROM ADDRESS
  2849  STORE IT IN RELOC DATA AREA (265C)
  284C  GET PRODOS ENTRY, LOW BYTE (265B)
  2850  ADD THREE TO GET SMARTPORT ENTRY
  2852  POKE INTO SMARTPORT CALL (285C)
  2858  POKE THE HIGH BYTE, TOO. (285D)
  285B  SELF MODIFIED TO CALL THE SMARTPORT <ØØØØ>
  285E  WITH A STATUS COMMAND.
  285F  PARMLIST AT $28AB
  2861  GET NUMBER OF DEVICES ON LINE (2653)
  2864  NONE ON LINE! >>288A
  2866  INDICATE IF DRIVE 2 EXISTS.
  2868  PUT DRIVER ADDRESS IN GLOBAL PAGE <2814>
  286D  IS THIS SLOT 5?
  286F  NO. >>288A
  2871  SLOT 2 BEING USED BY STORAGE DEVICE? (265E)
  2874  YES, TWO DRIVES IS ALL YOU GET! >>288A
  2876  GET NUMBER OF DEVICES AGAIN (2653)
  2879  MORE THAN TWO DRIVES?
  287B  NO. >>288A
  287D  SET CARRY IF DRIVE 4 EXISTS.
  287F  PUT THEM IN SLOT 2
  2883  PUT DRIVER ADDRESS IN GLOBAL PAGE <2814>
  288A  GO PROCESS NEXT SLOT >>26DE

288D ******** CONVERT STATUS FOR ID BYTE *******************************

  288D  GET STATUS BYTE
  2891  SHIFT LEFT NIBBLE TO RIGHT NIBBLE
  2895  PUT IT IN $12
  2897  RETURN

2898 ******** CHECK FOR PRODOS STORAGE DEVICE ***************************

  2898  RESET I/O CARD ROMS (CFFF)
  289D  CHECK 3 BYTES ON CONTROLLER ROM
  28A2  ANTICIPATE FAILURE
  28A3  NOT A PRODOS STORAGE DEVICE >>28AA
  28A9  SUCCESS--THIS IS A PRODOS STORAGE DEVICE.
  28AA  RETURN
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 28AA
----------------------------------------------------------------------
ADDR   DESCRIPTION/CONTENTS
----------------------------------------------------------------------

28AB ***** SMARTPORT CALL ************************
       *** COMMAND LIST FOR SM

 28AB   3 PARAMETERS
 28AC   OVERALL STATUS CALL
 28AD   PUT STATUS DATA AT $2653
 28AF   STATUS CODE IS $00

28B0 ***** ...NE ****************************
       ****** RELOCATION ROUTINE
         (X/Y REGS CONTAIN TABLE ADDR)

 28B0   SA
 28B4   SAVE PASSED TABLE ADDRESS
 28B7   ACCESS IIGS STATEREG BYTE TO (C068)
 28BC   TURN OFF SLOT ROM, ENSURE ROM BANK 0
 28BE   GE
 28C0   GET OPERATION CODE          ...SS)
 28C2   VALID OPERATION? (4 OR LE
 28C6   SO, ERROR >>2936
 28D0   $14/15 --> OUTPUT BLOCK
 28D9   $16/17 --> LENGTH
 28DA   NEGATIVE LENGTH? >>2938
 28DC   CHECK OPERATION CODE
 28DF   ZERO BLOCK? >>2941            INPUT BLOCK
 28E9   SO, $12/13 = $18/19 -->       BLOCK
 28F6   $1A/1B --> END OF INPUT B
 28F8   COPY BLOCK ONLY? >>2965        CODE (2A8F)
 28FE   SAVE RELOCATION OPERATION CHECK (2A90)
 2902   SAVE NUMBER OF RANGES TO
 2905   CC-
 290E   COPY START PAGES TO TABLE
 290F   AN-
 291A   AND END PAGES
 291B   AN-                             ACTORS
 2923   AND FINALLY, RELOCATION F       <296B>
 2926   BUMP TO NEXT TABLE ENTRY        A8F)
 292B   RESTORE OPERATION CODE (2       293B
        RELOCATE INSTRUCTIONS? >>

292D ***** ADDRESSES ****************************
       ****** 2/3 - RELOCATE A           D>

 2922
 2930   NO, RELOCATE ADDRESS <29C
 2933   COPY BLOCK <2976>                WELL >>28BC
 2936   AND CONTINUE IF ALL WENT
 2937   NORMAL EXIT
 2938   RETURN
        JUMP TO ERROR EXIT >>2A03
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 2938
----------------------------------------------------------------------
ADDR   DESCRIPTION/CONTENTS
----------------------------------------------------------------------

293B *********** 4 - RELOCATE INSTRUCTIONS ***************************

 293B   RELOCATE INSTRUCTIONS <29DF>
 293E   AND THEN COPY BLOCK >>2930

2941 *********** Ø - ZERO BLOCK **************************************

 2941   BUMP TABLE POINTER TO NEXT ENTRY <296B>
 2946   GET NUMBER OF PAGES TO DO
 2948   NO FULL PAGES? >>2956
 294B   ZERO AN ENTIRE PAGE
 2950   BUMP PAGE POINTER
 2952   AND DECREMENT LENGTH
 2956   GET LENGTH OF PARTIAL LAST PAGE
 2958   NO PARTIAL PAGE? >>2962
 295B   ZERO PARTIAL PAGE TOO
 2962   DONE, GET NEXT TABLE ENTRY >>28BC

2965 *********** 1 - COPY BLOCK **************************************

 2965   BUMP TABLE POINTER <296B>
 2968   AND GO COPY BLOCK >>2930

296B *********** ADVANCE TABLE POINTER *******************************

 296B   ADD FINAL ENTRY INDEX..
 296F   TO TABLE ENTRY ADDRESS
 2975   RETURN

2976 *********** COPY BLOCK ******************************************

 2976   ---
 297A   INPTR < OUTPTR? >>2987
 297C   NO, GREATER? >>29AA
 297E   MSB'S ARE EQUAL, CHECK LSB'S ALSO
 2986   EXIT IF EQUAL
 2987   INPTR < OUTPTR, COPY LAST PAGES FIRST
 298B   BUMP BOTH INPTR AND OUTPTR BY...
 298D   LENGTH-1 TO POINT AT LAST BYTE
 2995   START WITH SHORT LAST PAGE LENGTH
 2999   ---
 299A   COPY BYTES BACKWARDS THROUGH MEMORY
 29A1   DROP ADDRESSES AND LENGTH BY 256
 29A7   AND CONTINUE UNTIL FINISHED >>2999
 29A9   RETURN
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 29A9
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  29AA  INPTR > OUTPTR, COPY PAGES FORWARD
  29AC  HOW MANY FULL PAGES LEFT?
  29AE  NONE? >>29BF
  29B0  COPY A FULL PAGE
  29B7  AND BUMP ADDRESSES
  29BB  DECREMENT LENGTH BY 256
  29BD  AND DO ALL PAGES >>29B0
  29BF  GET LENGTH OF LAST PAGE
  29C1  EVEN PAGE BOUNDARY? >>29CC
  29C3  NO, COPY SHORT LAST PAGE
  29CC  RETURN

29CD *********** ADDR/PAGE RELOCATE ***********************************

  29CD  GET TABLE ENTRY TYPE (2A8F)
  29D1  GET PAGE TO RELOCATE
  29D3  RELOCATE A SINGLE ADDRESS <2A0B>
  29D6  BUMP BY 1 OR 2 BYTES (2A8F)
  29D9  ADVANCE POINTER <2A27>
  29DC  AND CONTINUE UNTIL COMPLETE >>29CD
  29DE  RETURN

29DF *********** INSTRUCTIONS RELOCATE ********************************

  29DF  ---
  29E1  GET 6502 OPCODE
  29E3  COMPUTE INSTRUCTION LENGTH <2A3A>
  29E6  INVALID OPCODE? >>29F9
  29E8  3 BYTE INSTRUCTIONS?
  29EA  NO >>29F3
  29EC  YES, 3 BYTE ADDRESS TO CORRECT
  29EE  RELOCATE ADDRESS <2A0B>
  29F1  AND ADVANCE BY 3 BYTES
  29F3  NEXT INSTRUCTION <2A27>
  29F6  CONTINUE UNTIL FINISHED >>29DF
  29F8  RETURN

        ******** INVALID OPCODE *****************

  29F9  POP THE STACK
  29FB  RETURN WITH POINTER TO BAD INSTRUC.
  29FF  DIE HORRIBLY
  2A02  RETURN

2A03 ************ ERROR RETURN ***************************************
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: 2A03
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  2A03  RETURN WITH POINTER
  2A07  EXIT WITH ERROR CODE
  2A0A  RETURN

2A0B *********** RELOCATE ABSOLUTE ADDRESS ****************************

  2A0B  GET PAGE NUMBER TO CHECK
  2A0D  GET NUMBER OF RANGES (LESS ONE) (2A90)
  2A10  IS IT PRIOR TO START OF THIS RANGE? (2A91)
  2A13  YES? >>2A1C
  2A15  NO, IS IS AFTER END OF RANGE? (2A99)
  2A18  NO? >>2A20
  2A1C  ---
  2A1D  CHECK EACH RANGE >>2A10
  2A1F  RETURN

  2A20  ---
  2A21  ADD FUDGE FACTOR TO ADDRESS (2AA1)
  2A24  AND UPDATE IT
  2A26  RETURN

2A27 ************ BUMP POINTER TO NEXT ADDR ****************************

  2A27  ---
  2A28  ADD LENGTH TO POINTER
  2A2F  CHECK TO SEE IF WE ARE DONE
  2A35  ---
  2A39  RETURN

2A3A ************ COMPUTE INSTRUCTION LENGTH ***************************

  2A3A  A-REG CONTAINS OPCODE
  2A3B  ISOLATE LAST TWO BITS FOR LATER
  2A40  USE LAST 6 BITS AS TABLE INDEX
  2A42  GET BYTE WITH 4 LENGTHS IN IT (2A4F)
  2A45  ---
  2A46  USING TOP TWO BITS AS INDEX... >>2A4C
  2A48  SHIFT DOWN THE PROPER LENGTH
  2A4C  AND ISOLATE IT IN A-REG
  2A4E  RETURN

2A4F ************ 6502 OP LENGTH TABLE *********************************
          EACH BYTE CONTAINS FOUR 2 BIT LENGTHS

  2A4F  ---
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86            NEXT OBJECT ADDR: 2A8B
ADDR    DESCRIPTION/CONTENTS
--------------------------------------------------------------------

2A8F ********** RELOCATION DATA ************************************

  2A8F  RELOCATION CODE (3,2,1)
  2A90  NUMBER OF RANGES
  2A91  START OF RANGE PAGES
  2A99  END OF RANGE PAGES +1
  2AA1  ADDITIVE FACTORS

2AA9 ********** 2AA9-2AFF NOT USED **********************************

  2AA9  NOT USED
  2AEC

2B00 **********
        (THIS * SET UP RAMDRIVE IN AUXMEM ***************************
         IN  ROUTINE PUTS THE RAMDRIVE DEVICE DRIVER
         IN EMORY, PUTS THE ADDRESS OF THE DRIVER
         ADD THE DEVICE DRIVER ADDRESS LIST, AND
          THE RAMDRIVE TO THE ONLINE DEVICE LIST.)
  2B00
  2B02  RELOCA
  2B05  TO HIG E RAMDRIVE CALLER NOW AT.. (2E00)
  2B0D  NOW PRE RAM AT.. (FF00)
  2B0F  RAMDRIV PARE TO MOVE
  2B11  INTO A E DEVICE DRIVER
  2B14  $3C/$3 X RAM AT $200.
  2B18  $3E/$2 --> $2C00
  2B1D  $42/43 --> $2DFF
  2B23  COPY MA --> $200
  2B24  USE AU IN MEM TO AUX MEM
  2B29  SLOT 3 MOVE TO COPY IT <C311>
  2B2C  IS AT DRIVE 2 DEVICE DRIVER.. (BF26)
  2B31  BUMP D FF00
  2B37  ADD DE VICE COUNT (BF31)
  2B3C  RETURN VICE TO ONLINE DEVICE LIST

2B3D **********

  2B3D  ---     2B3D-2BFF NOT USED **********************************
  2B7D

2C00 ********** RA
        (COP MDRIVE (/RAM) DEVICE DRIVER ***************************
        (THIS ED TO AND RUN AT $200 IN AUX RAM)
         IT  IS THE MAIN PART OF THE DEVICE DRIVER.
         W S CALLED BY THE RAMDRIVE CALLER
          CH IS LOCATED AT $FF00 IN MAIN MEMORY.)
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86            NEXT OBJECT ADDR: 2C00
--------------------------------------------------------------------
NTS
--------------------------------------------------------------------

ProDOS Relocator -- V1.2 SETTING (C018)
--------------------------ITE (C000)
ADDR    DESCRIPTION/CONTETERS
--------------------------3BD)
                          FORMAT COMMAND? (03BC)
                          OGIC >>2C4F
  2C00  SAVE THE 80STORE
  2C04  FORCE RAM READ/WR RAMDRIVE **********
  2C09  COPY INPUT PARAME
  2C0B  TO AUX PAGE 3. (WANTED
  2C11  FIRST TIME IN OR RE ACTUAL DIRECTORY
  2C14  NO, SKIP FORMAT Y BLOCK <0333>
                          ($F3,"RAM")  (03D2)
          ******** FORMAT RY BLOCK (0E04)
                          ME BITMAP
  2C16  YES, SAVE BLOCK
  2C18  PAGES $E AND $F
  2C1A  ZERO THE DIRECTOP (03C2)
  2C1F  COPY VOLUME NAME BYTE TO ZERO (03C2)
  2C22  TO VOLUME DIRECTO
  2C28  LAST BYTE IN VOLU (03D6)
  2C2A  IS AN $FE (03D3) RY BLOCK (0E22)
  2C2D  $FF TO ACCUM.    COMMAND? (03BC)
  2C30  14 $FF'S TO BITMA
  2C36  SET FIRST BITMAP NTINUE WITH READ/WRITE (03BC)
  2C39  COPY 8 BYTES     BER (03C1)
  2C3B  OF DIRECTORY DATA
  2C3E  TO VOLUME DIRECT RITE RAMDRIVE BLOCK ******
  2C44  WAS THIS A FORMAT
  2C47  YES, DONE. >>2CA BER TO PAGE NUMBER (03C1)
  2C49  NO, SET FLAG & C RAM?
  2C4C  RESTORE BLOCK N
                          ? (VOLUME BIT MAP)
          ******** READ/W
                          HONY BITMAP BLOCK >>038C
  2C4F  CONVERT BLOCK NUM/WRITE >>0342
  2C55  THIS PAGE IN HIGH
  2C57  YES >>2C63       RITE IN AUX HIGH RAM *****
  2C59  NO, IS IT BLOCK
  2C5B  NO >>2C60
  2C5D  YES, DUMMY UP A F <02E5>
  2C60  ELSE, NORMAL READ TE STATUS

          ******** READ/WMBER
                          VOLVE BANK1?
  2C63  SAVE PAGE NUMBER C73
  2C64  FIND IT IN MEMORY $DXXX
  2C67  REMEMBER READ/WRI AUX HIGH RAM >>2C79
  2C68  WRITING? >>2CB8 HIGH RAM (C083)
  2C6A  GET SAVED PAGE NU IT (C083)
  2C6B  DOES OPERATION IN
  2C6D  NO, USE BANK2 >>2
  2C6F  YES, FORCE IT TO
  2C71  AND USE BANK1 OF
  2C73  USE BANK2 OF AUX
  2C76  AND WRITE ENABLE
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86                NEXT OBJECT ADDR: 2C79
-------------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------------

  2C79  SAVE PAGE NUMBER IN BLOCK (Ø
  2C7C  PRESERVE HIS BUFFER ADDR (Ø3
  2C8Ø  DURING THE FOLLOWING TRANSFE
  2C83  SELECT AUX HIGH RAM (C009)
  2C88  USE RAMDRIVE BUFFER AS AN "I
  2C8B  AREA WHEN TRANSFERING TO/FRO
  2C8D  PRETEND THAT WAS CALLER'S BU
  2C9Ø  AND SET UP POINTERS AGAIN <Ø
  2C94  COPY BLOCK TO OR FROM RAMDRI
  2C9F  THEN BACK TO MAIN ZERO PAGE
  2CA2  RESTORE CALLER'S BUFFER ADDR
  2CA9  READING OR WRITING?
  2CAA  IF WRITING, DONE >>2CB5
  2CAC  IF READING, WRITE ENABLE HIG
  2CB2  AND COPY RAMDRIVE BUFFER TO
  2CB5  THEN EXIT >>Ø3DE
  2CB8  IF WRITING, COPY HIS BLOCK T
  2CBB  THEN COPY RAMDRIVE BUFFER TO

2CBE ********** COPY BLOCK IN MAIN

  2CBE  THIS ENTRY IS FOR THE RAMDRI
  2CCØ  THIS ENTRY ASSUMES AUX MEM P
  2CC3  THIS ENTRY ASSUMES PAGE NUMB
  2CC6  WRITING TO RAMDISK? >>2CDB
  2CC8  NO, WRITE TO MAIN 48K RAM (C
  2CCC  COPY BLOCK AUX MEM --> MAIN
  2CD7  WRITE TO AUX MEM AGAIN (C005
  2CDA  DONE (RETURN HERE AFTER FOLL
  2CDB  ---
  2CDD  GO BACK TO MAIN MEM PART OF
  2CEØ  TO COPY MAIN MEM --> AUX MEM

2CE5 ********** SET BUFFER AND BLOC

  2CE5  GET COMMAND (Ø3BD)
  2CE8  READ OR WRITE?
  2CE9  WRITE? >>2DØ8
  2CEB  NO, GET HIGH BYTE OF BUFFER
  2CF2  AND LOW BYTE OF BUFF ADDRESS
  2CF5  $42/43 --> FIRST PAGE OF BUF
  2CF7  $4Ø/41 --> SECOND PAGE OF BU
  2CF9  GET PAGE NUMBER (Ø3C1)
  2CFE  $3C/3D --> BLOCK IN RAMDRIVE
  2DØØ  $3E/3F --> SECOND PAGE OF SA
  2DØ6  ALWAYS BRANCH AROUND WRITE
```

```
                                    NEXT OBJECT ADDR: 2C79
-------------------------------------------------------------------------------
3C1)
3Ø)
3F  (Ø3BF)
 BETWEEN" (Ø3CØ)
 AUX HIGH RAM.
FFER (Ø3BF)
2E5>
 BUFFER
CØ8)
SS (Ø3BF)

H RAM (BANK1) (CØ8B)
IS BUFFER <Ø2BE>

 RAMDRIVE BUFFER <Ø2BE>
AUX HIGH RAM >>Ø26A

48K ******************************
VE BUFFER
AGE NUMBER IN ACCUM (Ø3C1)
ER ALREADY SET <Ø2E5>

2D42
MEM
OWING JUMP)

RIVER (Ø3ED)

K ADDRESSES **********************

TO BE READ (Ø3C0)
(Ø3BF)
FER
FFER

ODE >>2D23
```

```
                                    NEXT OBJECT ADDR: 2DØ6
-------------------------------------------------------------------------------
ProDOS Relocator -- V1.2 -- 6 SEP 86
-------------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------------

                                    EMORY ADDRESS OF BUFFER TO BE WRITTEN (Ø3BF)
  2DØ8  WRITE?  (Ø3CØ)              D PAGE OF SAME
  2DØF  $3C/3D --> MAIN             IN RAMDRIVE
  2D12  $3E/3F --> SECO             D PAGE OF SAME
  2D19  $42/43 --> BLOC             ADDRESSES
  2D1B  $4Ø/41 --> SECO
  2D23  SET SECOND PAGE
  2D27  EXIT                        A DUMMY BLOCK OF ZEROES**********************

2D28 ********** SEND H              FFER IN CASE READING <Ø331>
                                    RIVE BUFFER AND HIS BUFFER <Ø2C3>
  2D28  ZERO RAMDRIVE B
  2D2B  COPY BETWEEN RA
  2D2E  AND EXIT >>Ø3DE             LOCK BUFFER **********************************

2D31 ********** ZERO B
                                    CATED BY ACCUM. (Ø3C1)
  2D31  ZERO RAMDRIVE B             INTERS <Ø2E5>
  2D33  ZERO BLOCK INDI             OF BLOCK
  2D36  SET UP BUFFER P
  2D3A  ZERO BOTH PAGES
  2D41  AND EXIT                    RITE IN LOW 48K ******************************

2D42 ********** READ/W              DIRECTORY)?

  2D42  BLOCK 2 (VOLUME             BLOCK 7
  2D44  NO >>2D4A                   OW >>2D58
  2D46  YES, CONVERT IT             BLOCK 8?
  2D48  AND GO DO I/O N             DUMMY ZERO BLOCK. >>2D28
  2D4A  ELSE, LESS THAN
  2D4C  YES, RETURN WIT             K NUMBER
  2D4E  START MSB AT ZE             GH $5F?
  2D5Ø  GET ORIGINAL BL
  2D52  BLOCK $5Ø THROU             Ø THROUGH $F
  2D54  NO >>2D58                   RU $1FFF IN RAMDRIVE. >>Ø385
  2D56  YES, ADJUST TO              $8 THRU $5C
  2D58  AND USE $1AØØ T
  2D5B  ELSE, FOR BLOCK             7 ($11)
  2D5C  SUBTRACT 8                  IT
  2D5E  AND DIVIDE BY 1             >>2D5E
  2D64  XREG IS QUOTIEN             AINDER
  2D65  HAS TO BRANCH!!
  2D68  AND AREG IS REM
  2D69  REMAINDER OF 17             BLOCK GOES
  2D6B  NO >>2D73                   AREA
  2D6D  YES, EVERY 17TH             QUOTIENT
  2D6E  IN $1ØØØ-$1BFF              2D85
  2D6F  BY ADDING 8 TO              START AT $2XXX)
  2D71  AND GO DO IT >>             NIBBLE OF BYTE
  2D73  BUMP QUOTIENT
  2D75  SHIFT IT TO TOP
```

```
ProDOS Relocator -- V1.2 -- 6 SEP 86                NEXT OBJECT ADDR: 2D7D
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  2D7D  GOT A REMAINDER? >>2D81
  2D7F  IF SO, DECREMENT TOP NIBBLE
  2D81  THEN ADD INTO TOP N (NOT USING 1)
  2D82  TO FORM $10 THRU $F (Ø3C1)
  2D85  BLOCK*2 FOR PAGE NUMBER
  2D86  COPY THE BLOCK <Ø2C0>
  2D89  THEN EXIT >>Ø3DE

2D8C ********** READ/WRITE BITMAP BLOCK *****************************

  2D8C  USE RAMDRIVE BUFFERS
  2D91  SET UP BUFFER POINTERS (NO ACTUAL BITMAP BLOCK)
  2D94  WRITING? >>2DA9   FERS <Ø2E5>
  2D96  NO, READING = ZERO
  2D9B  COPY BITMAP IMAGE THE RAMDRIVE BUFFER <Ø336>
  2DA3  COPY BLOCK BACK TO RAMDRIVE BUFFER (Ø3C2)
  2DA6  THEN EXIT >>Ø3DE  CALLER'S BUFFER <Ø2C3>

  2DA9  WRITING, COPY HIS B
  2DAC  SET UP BUFFER POINTUFFER TO RAMDRIVE BUFFER <Ø2C3>
  2DB1  COPY 16 BITMAP BYTERS <Ø2E5>
  2DB3  INTO PAGE 3 BITMAPS FROM RAMDRIVE BUFFER
  2DB9  THEN EXIT >>Ø3DE  IMAGE (Ø3C2)

2DBC ********** RAM DRIVE DATA (AT $3BC) *****************************

  2DBC  FIRST TIME ENTRY F
  2DBD  COMMAND FROM PARM AG
  2DBE  UNIT NUMBER FROM PA IST
  2DBF  BUFFER ADDRESS FRO RM LIST
  2DC1  BLOCK NUMBER FROM P PARM LIST
                  ARM LIST

  2DC2  BIT MAP IMAGE FOR R
                  AM DRIVE

  2DD2  RAMDRIVE VOLUME NAM
  2DD3  'RAM'             E
  2DD6  ACCESS, ENTRY LENG
  2DD8  NUMBER OF ENTRIES  H
  2DD9  FILE COUNT
  2DDB  BIT MAP BLOCK POINT
  2DDD  BLOCKS ON DISK     R

2DDE ********** EXIT TO MA IN MEMORY *********************************

  2DDE  WRITE ENABLE HIGH R
  2DE5  RESTORE 80STORE STA AM (BANK1) (C08B)
  2DE7  80STORE WAS ON (C00 TUS >>2DEA
  2DEA  GO AROUND MEMORY US 1)
  2DED  LOW-ORDER BYTE AND  D BY XFER >>03EF
  2DEE  HIGH-ORDER BYTE USE
  2DEF  RETURN TO $FF44 (NO D BY XFER ROUTINE
                  RMAL EXIT)
```



```
==S Relocator -- V1.2 -- 6 SEP 86
ProDO   DESCRIPTION/CONTENTS
-----
ADDR                                              NEXT OBJECT ADDR: 2DFB
-------------------------------------------------------------------------
    B  USE ROM XFER ROUTINE TO DO IT >>C314
    E  TWO BYTES NOT USED
  2D
  2D******* RAMDRIVE CALLER (RUNS AT $FF00) *
      (USED TO CALL MAIN PART OF RAMDRIVE
2E00   DRIVER WHICH IS AT $200 IN AUX MEMO
       ROUTINE AT $FF65 IS USED TO TRANSFE
       FROM MAIN TO AUX MEM.)                ***********************
                                              DEVICE
                                             ORY.
                                             ER DATA
    0  ---
    3  SAVE ZPAGE STUFF I WILL CLOBBER
  2E0 5  FROM $3C THRU $47 (FF84)
  2E0 D  SAVE $3ED/E THAT XFER ROUTINE WILL CLO
  2E  6  COMMAND = STATUS?
  2E0 8  IF SO, SIMPLE EXIT WILL DO >>2E44
  2E  A  ELSE, TOO BIG A COMMAND NUM?
  2E  C  IF SO, ERROR >>2E3B              BBER (03ED)
  2E  E  ELSE, INVERT BITS OF CMD
  2E1 0  AND SAVE IT
  2E1 2  FORMAT? >>2E2C
  2E2 4  NO, CHECK BLOCK NUMBER
  2E2 8  MUST BE <128 FOR RAMDRIVE
  2E2 C  GOING TO $200 IN AUX MEMORY
  2E2
  2E2 8  USE XFER ROUTINE TO GET THERE >>C314
FF33
  2E3 B  I/O ERROR RETURN CODE
    D  EXIT >>2E41
  2E3 F  WRITE PROTECTED RETURN CODE
  2E3 1  ---
  2E3 2  ERROR EXIT >>2E47
  2E4 4  NORMAL EXIT, RETURN CODE IS 0
  2E4 7  ---
  2E4 B  RESTORE ZERO PAGE (FF84)
  2E4 3  AND $3ED/E (FF82)
  2E4 6  HARMLESS INSTRUCTION MAKES SURE $FF58
  2E5
  2E5      NOTE: THERE ARE ONLY THREE SURE THIN
                 DEATH, TAXES, AND AN RTS AT $5
    4   AND EXIT TO CALLER WHEN THRU
                                              IS AN RTS (6060)
  2E6********** COPY MAIN TO AUX BLOCK ******GS IN LIFE:
      (CALLED FROM AUX MEM HANDLER)           F58.
2E65

    5  WRITE IN AUX 48K (C005)                ***********************
FF65 A  COPY BOTH PAGES OF BLOCK
  2E6 5  WRITE IN MAIN 48K AGAIN (C004)
  2E6 A  GO TO $2DA IN AUX MEMORY TO RETURN (03
  2E7 F  RETURN TO AUX MEM HANDLER AGAIN >>FF33
  2E7
  2E7
                                              ED)
```

```
ProDOS Relocator -
-----------------
ADDR    DESCRIPTI
-----------------

2E82 ********** E
                  V1.2 -- 6 SEP 86            NEXT OBJECT ADDR: 2E7F
FF82
  2E82  SAVE $3ED 2N/CONTENTS
FF83
                  ------------------------------------------------

FF84
  2E84  ZERO PAGE DATA AREA *********************************************

2E90 ********** $
          (NOTE: T $3EE
           FOR THI
           IS RESI

  2E90  NOT USED  SAVE AREA

2F00 ********** $2E90-$2EFF NOT USED ********************************
                THE AREA FROM $FF90-FF99 IS RESERVED
2F00    MLI LOAD I /RAM CALLER.  FROM $FF9B TO $FFFF
                ERVED FOR THE IRQ HANDLER.)


                START OF MLI LOAD IMAGE ****************************

                MAGE AT $2F00
```

```
ProDOS Relocator -- V1.3 -- 2 DEC 86            NEXT OBJECT ADDR: 2000
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

2000    MODULE STARTING ADDRESS

          *********************************
          *                               *
          *  PRODOS RELOCATOR             *
          *       LOADED AS THE FIRST     *
          *       PORTION OF THE PRODOS   *
          *       IMAGE AT $2000.         *
          *                               *
          *  VERSION 1.3 -- 2 DEC 86      *
          *                               *
          *********************************

          THE 1.3 VERSION OF THE PRODOS RELOCATOR IS
          INSTRUCTION FOR INSTRUCTION THE SAME FROM
          $2000 TO $25F5 AND FROM $2B00 TO $2EFF.
          SOME ADDRESSES IN THESE AREAS CHANGE BECAUSE
          THEY ARE ADDRESSES WITHIN THE MODIFIED PORTION
          OF THE RELOCATOR OR THE MLI.

          ONLY THE MODIFIED PORTION OF THE RELOCATOR
          ($25B1 TO $2AFF) IS DOCUMENTED HERE FOR VERSION 1.3.
          REFER TO THE 1.2 VERSION IN OTHER PARTS OF
          THE RELOCATOR.

25B1    ---

25B1 *********** DISPLAY LOAD MESSAGE *********************************

  25B1  CLICK SPEAKER (C030)
  25B4  STORE IN MAIN MEMORY  (C00C)
  25B7  80 COL DISPLAY OFF (C000)
  25BA  SET NORMAL VIDEO <FE84>
  25BD  CALL MONITOR INITIALIZATION <FB2F>
  25C0  SET VIDEO PR#0 <FE93>
  25C3  SET KEYBD IN#0 <FE89>
  25C6  OUT OF DECIMAL MODE
  25C7  CLEAR SCREEN <FC58>
  25CC  PRINT "APPLE //" (2605)
  25D7  PRINT "PRODOS 8 " ETC. ON ROW 12 (260D)
  25E2  PRINT 12 BLANKS ON ROW 14 (262B)
  25ED  PRINT "COPYRIGHT" ETC. ON ROW 23 (2637)
  25F8  PRINT "ALL RIGHTS RESERVED" ON ROW 24 (265E)
  2601  CLICK SPEAKER AGAIN (C030)
  2604  DONE
```

```
ProDOS Relocator -- V
-------------------------------------------------------------------------
ADDR    DESCRIPTION/1.3 -- 2 DEC 86            NEXT OBJECT ADDR: 2605
-------------------------------------------------------------------------
                 =ONTENTS
2605 ********** DATA----------------------------------------------------

  2605  'APPLE II'    AREA *****************************************
  260D  'PRODOS 8 V1
  262B  '
  2637  'COPYRIGHT AP3          2-DEC-86'
  265E  'ALL RIGHTS R'
                 PLE COMPUTER, INC., 1983-86'
  2672  8 BYTES FOR SESERVED.'
  267A  DRIVER ADDRES
  267C  SPACES LEFT OMARTPORT STATUS CALL
  267D  SLOT 2 FLAG (S
                 N DEVICE LIST
267E ********** DRIV0 = PRODOS STORAGE DEVICE IN SLOT 2)

  267E  ---          IRMINE SLOT CONFIGURATION ***********************
  2680  ZERO SOME THI
  2687  DEVCNT=$FF (N
  268A  ALL 14 DEVICNGS
  268F  FIRST CHECK SO DEVICES YET) (BF31)
  2693  IS A STORAGE S ARE UNASSIGNED
  2696  IF NOT, SET SLOT 2
  2699  NOW POINT TO DEVICE IN SLOT 2? <28D4>
  269D  STORAGE DEVI FLAG (267D)
  26A0  NO. >>26FE SLOT 7
  26A2  GET $CSFF BYTE IN SLOT? <28D4>
  26A4  LOOKS LIKE 1
  26A6  LOOK LIKE 13E
  26A8  YES, DON'T WS SECTOR DISK II. >>26CB
                 SECTOR DISK II?
        ***** NON-E IT. >>26FE

  26AA  CsFF BYTE = ISK II STORAGE DEVICE ********
  26AD  CHECK BYTE A
  26AF  TO SEE IF LOW BYTE OF DEVICE ADDRESS (267A)
  26B1  NOT A SMARTP OFFSET 7
  26B3  GO DO SMARTPS A SMARTPORT
  26B6  ---          ORT INTERFACE >>26B6
  26B8  GET $CSFE (SORT STUFF >>2863
  26BA  CAN WE AT LE
  26BE  ANTICIPATE TATUS BYTE)
  26BF  CAN'T READ AST READ STATUS AND DATA?
  26C1  PUT LEFT NIBAILURE
  26C5  PUSH CLC, TN. NO SENSE USING IT. >>26FE
  26C6  CARRY SET IF LE OF STATUS BYTE IN $12 <28C9>
  26C7  GET HIGH BYDICATING ONE DRIVE
  26C9  ALWAYS BRANG 2 OR 4 DRIVES
                 OF SLOT ROM
                 INTO DISK II PROCESSING >>26D8
```

```
ProDOS Relocator - V1.3 -- 2 DEC 86            NEXT OBJECT ADDR: 2844
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  2844  TWO DRIVES. BUMP DEVICE COUNT
  2845  AND PUT SECOND DRIVE ON SEARCH LIST (BF32)
  2848  STORE FINAL DEVICE COUNT (BF31)
  284B  SHIFT DRIVE INDICATOR BACK TO CARRY
  284C  GET LOW BYTE OF DEVICE DRIVER ADDRESS (267A)
  284F  PUT IN GLOBAL PAGE FOR DRIVE 1 (BF10)
  2852  ONLY ONE DRIVE >>2857
  2854  PUT IN GLOBAL PAGE FOR DRIVE 2 (BF20)
  2857  GET HIGH BYTE OF DEVICE DRIVER ADDRESS (267B)
  285A  PUT IN GLOBAL PAGE FOR DRIVE 1 (BF11)
  285D  ONLY ONE DRIVE >>2862
  285F  PUT IN GLOBAL PAGE FOR DRIVE 2 (BF21)
  2862  RETURN

2863 ******** HANDLE SMART PORT ***************************************

  2863  PUT LEFT NIBBLE OF STATUS BYTE IN $12 <28C9>
  2866  GET HIGH BYTE OF SLOT ROM ADDRESS
  2868  STORE IN RELOC DATA AREA (267B)
  286B  GET PRODOS ENTRY, LOW BYTE (267A)
  286E  POKE INTO PRODOS CALL (2895)
  2872  ADD THREE TO GET SMARTPORT ENTRY
  2874  POKE INTO SMARTPORT CALL (2898)
  287A  POKE IN HIGH BYTE TO SMARTPORT CALL (2899)
  287D  AND TO PRODOS CALL (2896)
  2880  CONVERT HIGH BYTE TO UNIT NUMBER
  2884  STORE UNIT NUMBER
  2886  PRODOS STATUS CALL
  2888  STORE AS COMMAND CODE
  288C  ALSO ZERO BLOCK NUMBER
  2890  SET BUFFER ADDRESS SET TO $1000
  2892  JUST IN CASE IT'S NEEDED.
  2894  SELF-MODIFIED TO CALL PRODOS DEVICE DRIVER. <0000>
  2897  SELF-MODIFIED TO CALL THE SMARTPORT <0000>
  289A  WITH A STATUS COMMAND.
  289B  PARMLIST AT $28AB
  289D  GET NUMBER OF DEVICES ON LINE (2672)
  28A0  NONE ON LINE! >>28C6
  28A2  INDICATE IF DRIVE 2 EXISTS.
  28A4  PUT DRIVER ADDRESS IN GLOBAL PAGE <2833>
  28A9  IS THIS SLOT 5?
  28AB  NO >>28C9
  28AD  SLOT 2 BEING USED BY A STORAGE DEVICE? (267D)
  28B0  YES, TWO DRIVES IS ALL YOU GET! >>28C6
  28B2  GET NUMBER OF DEVICES AGAIN (2672)
  28B5  MORE THAN TWO DRIVES?
  28B7  NO >>28C9
  28B9  SET CARRY IF DRIVE 4 EXISTS.
  28BB  PUT THEM IN SLOT 2
  28BF  PUT DRIVER ADDRESS IN GLOBAL PAGE <2833>
  28C6  GO PROCESS NEXT SLOT >>26FD
```

```
ProDOS Relocator -- V1.3 -- 2 DEC 86          NEXT OBJECT ADDR: 28C6
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

28C9 ******** CONVERT STATUS FOR ID BYTE ******************************

  28C9  GET STATUS BYTE
  28CD  SHIFT LEFT NIBBLE TO RIGHT NIBBLE
  28D1  PUT IT IN $12
  28D3  RETURN

28D4 ******** CHECK FOR PRODOS STORAGE DEVICE ************************

  28D4  RESET I/O CARD ROMS (CFFF)
  28D9  CHECK 3 BYTES ON CONTROLLER ROM
  28DE  ANTICIPATE FAILURE
  28DF  NOT A PRODOS STORAGE DEVICE >>28E6
  28E5  SUCCESS--THIS IS A PRODOS STORAGE DEVICE.
  28E6  RETURN

28E7 ******** COMMAND LIST FOR SMARTPORT CALL ************************

  28E7  3 PARAMETERS
  28E8  OVERALL STATUS CALL
  28E9  PUT STATUS DATA AT $2653
  28EB  STATUS CODE IS $00

28EC ********** RELOCATION ROUTINE **********************************
           (X/Y REGS CONTAIN TABLE ADDR)

  28EC  SAVE PASSED TABLE ADDRESS
  28F0  ACCESS IIGS STATEREG BYTE TO (C068)
  28F3  TURN OFF SLOT ROM, ENSURE ROM BANK 0
  28F8  ---
  28FA  GET OPERATION CODE
  28FC  VALID OPERATION? (4 OR LESS)
  28FE  NO, ERROR >>2972
  2902  $14/15 --> OUTPUT BLOCK
  290C  $16/17 --> LENGTH
  2915  NEGATIVE LENGTH? >>2974
  2917  CHECK OPERATION CODE
  2918  ZERO BLOCK? >>297D
  291B  NO, $12/13 = $18/19 --> INPUT BLOCK
  2925  $1A/1B --> END OF INPUT BLOCK
  2932  COPY BLOCK ONLY? >>29A1
  2934  SAVE RELOCATION OPERATION CODE (2ACB)
  293A  SAVE NUMBER OF RANGES TO CHECK (2ACC)
  293E  ---
  293F  COPY START PAGES TO TABLE
  294A  ---
  294B  AND END PAGES
  2956  ---
  2957  AND FINALLY, RELOCATION FACTORS
  295F  BUMP TO NEXT TABLE ENTRY <29A7>
```

```
ProDOS Relocator -- V1.3 -- 2 DEC 86          NEXT OBJECT ADDR: 2962
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  2962  RESTORE OPERATION CODE (2ACB)
  2967  RELOCATE INSTRUCTIONS? >>2977

2969 ********** 2/3 - RELOCATE ADDRESSES ***************************

  2969  NO, RELOCATE ADDRESS <2A09>
  296C  COPY BLOCK <29B2>
  296F  AND CONTINUE IF ALL WENT WELL >>28F8
  2972  NORMAL EXIT
  2973  RETURN
  2974  JUMP TO ERROR EXIT >>2A3F

2977 ********** 4 - RELOCATE INSTRUCTIONS **************************

  2977  RELOCATE INSTRUCTIONS <2A1B>
  297A  AND THEN COPY BLOCK >>296C

297D ********** 0 - ZERO BLOCK ***************************************

  297D  BUMP TABLE POINTER TO NEXT ENTRY <29A7>
  2982  GET NUMBER OF PAGES TO DO
  2984  NO FULL PAGES? >>2992
  2987  ZERO AN ENTIRE PAGE
  298C  BUMP PAGE POINTER
  298E  AND DECREMENT LENGTH
  2992  GET LENGTH OF PARTIAL LAST PAGE
  2994  NO PARTIAL PAGE? >>299E
  2997  ZERO PARTIAL PAGE TOO
  299E  DONE, GET NEXT TABLE ENTRY >>28F8

29A1 ********** 1 - COPY BLOCK ***************************************

  29A1  BUMP TABLE POINTER <29A7>
  29A4  AND GO COPY BLOCK >>296C

29A7 ********** ADVANCE TABLE POINTER ********************************

  29A7  ADD FINAL ENTRY INDEX..
  29AB  TO TABLE ENTRY ADDRESS
  29B1  RETURN

29B2 ********** COPY BLOCK ******************************************

  29B2  ---
  29B6  INPTR < OUTPTR? >>29C3
  29B8  NO, GREATER? >>29E6
  29BA  MSB'S ARE EQUAL, CHECK LSB'S ALSO
  29C2  EXIT IF EQUAL
  29C3  INPTR < OUTPTR, COPY LAST PAGES FIRST
  29C7  BUMP BOTH INPTR AND OUTPTR BY...
  29C9  LENGTH-1 TO POINT AT LAST BYTE
```

```
ProDOS Relocator -- V1.3 -- 2 DEC 86          NEXT OBJECT ADDR: 29D1
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  29D1  START WITH SHORT LAST PAGE LENGTH
  29D5  ---
  29D6  COPY BYTES BACKWARDS THROUGH MEMORY
  29DD  DROP ADDRESSES AND LENGTH BY 256
  29E3  AND CONTINUE UNTIL FINISHED >>29D5
  29E5  RETURN

  29E6  INPTR > OUTPTR, COPY PAGES FORWARD
  29E8  HOW MANY FULL PAGES LEFT?
  29EA  NONE? >>29FB
  29EC  COPY A FULL PAGE
  29F3  AND BUMP ADDRESSES
  29F7  DECREMENT LENGTH BY 256
  29F9  AND DO ALL PAGES >>29EC
  29FB  GET LENGTH OF LAST PAGE
  29FD  EVEN PAGE BOUNDARY? >>2A08
  29FF  NO, COPY SHORT LAST PAGE
  2A08  RETURN

2A09 *********** ADDR/PAGE RELOCATE **********************************

  2A09  GET TABLE ENTRY TYPE  (2ACB)
  2A0D  GET PAGE TO RELOCATE
  2A0F  RELOCATE A SINGLE ADDRESS <2A47>
  2A12  BUMP BY 1 OR 2 BYTES (2ACB)
  2A15  ADVANCE POINTER <2A63>
  2A18  AND CONTINUE UNTIL COMPLETE >>2A09
  2A1A  RETURN

2A1B *********** INSTRUCTIONS RELOCATE ******************************

  2A1B  ---
  2A1D  GET 6502 OPCODE
  2A1F  COMPUTE INSTRUCTION LENGTH <2A76>
  2A22  INVALID OPCODE? >>2A35
  2A24  3 BYTE INSTRUCTIONS?
  2A26  NO >>2A2F
  2A28  YES, 3 BYTE ADDRESS TO CORRECT
  2A2A  RELOCATE ADDRESS <2A47>
  2A2D  AND ADVANCE BY 3 BYTES
  2A2F  NEXT INSTRUCTION <2A63>
  2A32  CONTINUE UNTIL FINISHED >>2A1B
  2A34  RETURN

        ******** INVALID OPCODE *****************

  2A35  POP THE STACK
  2A37  RETURN WITH POINTER TO BAD INSTRUC.
  2A3B  DIE HORRIBLY
  2A3E  RETURN
```

```
ProDOS Relocator -- V1.3 -- 2 DEC 86          NEXT OBJECT ADDR: 2A3E
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

2A3F *********** ERROR RETURN ***************************************

  2A3F  RETURN WITH POINTER
  2A43  EXIT WITH ERROR CODE
  2A46  RETURN

2A47 *********** RELOCATE ABSOLUTE ADDRESS ***************************

  2A47  GET PAGE NUMBER TO CHECK
  2A49  GET NUMBER OF RANGES (LESS ONE) (2ACC)
  2A4C  IS IT PRIOR TO START OF THIS RANGE? (2ACD)
  2A4F  YES? >>2A58
  2A51  NO, IS IS AFTER END OF RANGE? (2AD5)
  2A54  NO? >>2A5C
  2A58  ---
  2A59  CHECK EACH RANGE >>2A4C
  2A5B  RETURN

  2A5C  ---
  2A5D  ADD FUDGE FACTOR TO ADDRESS (2ADD)
  2A60  AND UPDATE IT
  2A62  RETURN

2A63 *********** BUMP POINTER TO NEXT ADDR ***************************

  2A63  ---
  2A64  ADD LENGTH TO POINTER
  2A6B  CHECK TO SEE IF WE ARE DONE
  2A71  ---
  2A75  RETURN

2A76 *********** COMPUTE INSTRUCTION LENGTH ***************************

  2A76  A-REG CONTAINS OPCODE
  2A77  ISOLATE LAST TWO BITS FOR LATER
  2A7C  USE LAST 6 BITS AS TABLE INDEX
  2A7E  GET BYTE WITH 4 LENGTHS IN IT (2A8B)
  2A81  ---
  2A82  USING TOP TWO BITS AS INDEX... >>2A88
  2A84  SHIFT DOWN THE PROPER LENGTH
  2A88  AND ISOLATE IT IN A-REG
  2A8A  RETURN

2A8B *********** 6502 OP LENGTH TABLE ********************************
          EACH BYTE CONTAINS FOUR 2 BIT LENGTHS
```

```
ProDOS Relocator -- V1.3 -- 2 DEC 86            NEXT OBJECT ADDR: 2A8B
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------


  2A8B  ---

2ACB ********** RELOCATION DATA ************************************

  2ACB  RELOCATION CODE (3,2,1)
  2ACC  NUMBER OF RANGES
  2ACD  START OF RANGE PAGES
  2AD0
  2AD5  END OF RANGE PAGES +1
  2ADD  ADDITIVE FACTORS

2AE5 ********** 2AE5-2AFF NOT USED **********************************

  2AE5  NOT USED

          THE REST OF THE RELOCATOR IS IDENTICAL
          TO VERSION 1.2
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: D700
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

D700    MODULE STARTING ADDRESS

          ****************************************
          *                                      *
          *  PRODOS MACHINE LANGUAGE INTERFACE   *
          *       THIS CODE IS MOVED INTO HIGH   *
          *       RAM ($DE00-$FEFF) BY THE       *
          *       PRODOS RELOCATOR.              *
          *       IT PERFORMS ALL FILE MANAGEMENT *
          *       AND OTHER SYSTEM FUNCTIONS AND *
          *       SUPPORTS THE HARDWARE IN A     *
          *       DEVICE INDEPENDENT WAY.        *
          *                                      *
          *  VERSION 1.2 -- 6 SEP 86             *
          *                                      *
          ****************************************

D700 ********** ZERO PAGE USAGE ***************************************

0040    Pointer to caller's parmlist
0041
          -- device driver parmlist --
0042    Command
0043    Unit Number
0044    Buffer Pointer
0045
0046    Block Number
0047
          ----------------------------
0048    I/O Pointer - Index Block or..
0048    pointer into $F600 work buffer or..
0048    caller's pathname buffer pointer
0049
004A    I/O Pointer - Data Block
004B
004C    I/O Pointer - Data Block
004D
004E    I/O Pointer - Caller's Data or..
004E    buffer pointer passed in parmlist or..
004E    old I/O buffer
004F

D700 *********** MLI ERROR CODES ***************************************

0000    No Error
0001    Bad call type
0004    Bad parameter count
0025    Interrupt Table full
0027    I/O Error
0028    No device connected
002B    Write protected
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: D700
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

002E    Volume switched
0040    Invalid pathname syntax
0042    Too many files open
0043    Invalid REF NUM
0044    Nonexistent path
0045    Volume not mounted
0046    File not found
0047    Duplicate file name
0048    Disk full
0049    Volume Directory full
004A    Incompatible ProDOS version
004B    Unsupported storage type
004C    End of file
004D    Position past EOF
004E    Access error
0050    File already open
0051    File count bad
0052    Not a ProDOS disk
0053    Bad parameter
0055    VCB overflow
0056    Bad buffer address
0057    Duplicate volume mounted
005A    Bad volume bit map

D700 ********** SCREEN LOCATIONS ***************************************

0750    For direct movement of text to screen
07D0
07F1
07F2
07F3
07F4
07F5
07F6
07F7
07F8    Slot in use

D700 ********** RELOCATOR VARIABLE *************************************

2278    Flag=1 when running on a IIGS

D700 ********** SYSTEM GLOBAL PAGE EQUATES *****************************

BF00    Jump to MLI entry point
BF03    JSPARE (Jump to $EECF, QUIT code)
BF06    DATETIME vector
BF09    Jump to System Error
BF0C    Jump to System Death Handler
BF0F    System Error number
BF10    Device Driver address table
BF30    Slot/Drive last device
```

```
ProDOS MLI -- V1
----------------
ADDR    DESCRIP
----------------

BF31    Count (-
BF32    List of
BF58    Memory I
BF70    Open fi
BF7E    Open fi
BF80    Interru
BF82    Interru
BF84    Interru
BF86    Interru
BF88    A reg s
BF89    X reg s
BF8A    Y reg s
BF8B    S reg s
BF8C    P reg s
BF8E    Interru
BF90    Date/Ti
BF94    File op
BF95    Backup
BF96    Tempora
BF9A    Prefix
BF9B    MLI act
BF9C    Last ML
BF9E    MLI X r
BF9F    MLI Y r
BFA0    HIGH RA
BFD0    Interru
BFF4    Bank sw

D700 **********

C00C    Reset 8
C029    IIGS NE
C051    Set TEX
C053    Set Mix
C054    Display
C056    Set LOR
C083    Read/Wr
C08B    Read/Wr
CFFF    Reset a

D700 **********
           ---
           | L
           ---
         Prefi
         negat
         wrapp
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: D918
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  D918  not used
  D919  not used
  D91A  Bit Map Pointer
          Block offset into multi-block bitmap of
  D91C  next free bit.
  D91E  Count of open files

  D920  VCB1 through VCB7

DA00 ********** BITMAP BUFFER ***************************************

  DA00  Buffer 1st half

  DB00  Buffer 2nd half

DC00 ********** PRIMARY BUFFER ***************************************
         (Used for several things. DIRECTORY block offsets are
         mapped into it below)

  DC00  Pointer Fields
          *** DIRECTORY HEADER ***
  DC04  Type/Length  (TTTTLLLL)
  DC05  Volume Name  (Max 15)
  DC14  Reserved
  DC1C  Creation Datetime
  DC20  Version
  DC21  Min Version
  DC22  Access Byte
  DC23  Entry Length
  DC24  Entries per Block
  DC25  File Count
  DC27  Bitmap Pointer
DC29    Entry number within parent's block
  DC29  Total Blocks
  DC2A  Length of entries in parent
  DC2B  (remainder of first page of block)
  DD00  (second page of block)

DE00 ********** MLI MAIN ENTRY POINT *********************************

  DE00  Clear decimal mode
  DE01  Retrieve status byte from stack
  DE02  and store it in global page. (BF96)
  DE05  Save Registers (BF9F)
  DE0B  Set ($40) -> Address of function code -1
  DE0F  Set CMDADR -> True return address
  DE1C  Retrieve status byte, (BF96)
  DE1F  push it onto the stack,
  DE20  and pull it into status register.
  DE24  Init Global Page System error to 0 (BF0F)
  DE28  Get Function Code
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: DE2B
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  DE2B  Build hash index into Command Table (X reg)
  DE34  Is this function code valid?
  DE39  No >>DEB1
  DE3C  Set ($40) -> Parameter list
  DE49  Get parameter count required (FD4D)
  DE4C  None? >>DE6A
  DE4E  Is parameter count correct?
  DE50  No >>DEB5
  DE52  Check class of function (FD2D)
  DE55  Quit?
  DE57  yes >>DE67
  DE59  no,
  DE5A  $8X - Calls to I/O Drivers >>DE70
  DE5C  $CX/DX - Non System calls >>DE7B
  DE5E  Else, $4X - Interrupt support
  DE5F  Isolate type (0=ALLOC, 1=DEALLOC, 2=SPECIAL)
  DE61  Call Interrupt Support <DEFD>
  DE64  Then Exit to Caller >>DE82
  DE67  Go to quit code via global page >>BF03

DE6A ************************************************************
         ****** MLI GET_TIME CALL ******
         **********************************

  DE6A  Call Date/Time driver <BF06>
  DE6D  and exit to caller >>DE82

DE70 ************************************************************
         ****** MLI READ_BLOCK CALL *******
         ****** MLI WRITE_BLOCK CALL ******
         **********************************
         $80 - Read Block
         $81 - Write Block

  DE70  ---
  DE71  Set $42 -> 1 for READ, 2 for WRITE
  DE75  Do Block I/O <DEBC>
  DE78  Then Exit to Caller >>DE82

DE7B ********** $CX and $DX CALLS ***********************************

  DE7B  ---
  DE7C  Isolate function Index
  DE7F  Perform function and exit to caller <E03E>

DE82 ********** EXIT TO CALLER ***************************************
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT O
-------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------

  DE82  Clear Backup
  DE8A  Error occurred?
  DE8D  Save test results
  DE8E  Disable interrupts
  DE8F  Roll out most recent "active" bit (BF9B)
  DE92  Get test results back
  DE93  Store in X reg
  DE94  Set up Return Address on stack (BF9D)
  DE9C  Put test results on stack
  DE9E  Put error code in A reg
  DE9F  Restore X reg (BF9E)
  DEA2  Restore Y reg (BF9F)
  DEA5  Put error code on stack
  DEA6  Get RAM/ROM orientation (BFF4)
  DEA9  Exit via RAM Global Page >>BFA0

DEAC ********** NO DEVICE CONNECTED ******************

  DEAC  ---
  DEAE  Call System Error Handler (Global Page) <BF09>

DEB1 ********** BAD SYSTEM CALL NUMBER ***************

  DEB1  ---
  DEB3  Branch always taken >>DEB7

DEB5 ********** BAD PARAMETER COUNT ******************

  DEB5  ---
  DEB7  Call System Error Handler <DEE1>
  DEBA  Exit to Caller >>DE82

DEBC ********** BLOCK I/O SETUP ***********************************

  DEBC  ---
  DEBE  Save Old Processor Flags
  DEBF  Disable Interrupts
  DEC0  Copy Parameters to $43-$47
  DEC8  Save Starting Buffer Page in $4F
  DECD  Find last page + 1
  DED0  Round up if Buffer not page aligned >>DED3
  DED3  Is this Memory already in use? <FC63>
  DED6  Yes, then exit with error >>DEE0
  DED8  No, do Block I/O <DEE4>
  DEDB  Error? >>DEE0
  DEDD  No, then exit normally
  DEDF  RETURN
  DEE0  Error Exit
  DEE1  Call System Error Handler <BF09>
```



```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: DEE1
-------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------

DEE4 ********** Block I/O ********************************************

  DEE4  ---
  DEE6  Force off unused UNIT bits
  DEED  Put Drive number in X reg
  DEF1  Put Device Handler Address in Jump Vector (FEBD)
  DEFA  Exit through Device Handler >>FEBD

DEFD ********** Interrupt Handler ************************************
          ALLOC/DEALLOC

  DEFD  Save Call Type
  DEFF  Install unclaimed interrupt handler?
  DF01  No, normal ALLOC/DEALLOC >>DF09
  DF03  Yes, install a handler for unclaimed interrupts. <FD23>
  DF06  Error? >>DF35
  DF08   No, done.
  DF09  Test bit 0
  DF0A  1=DEALLOC >>DF38

          ALLOC

  DF0C  ---
  DF0E  Look for empty slot (BF7E)
  DF15  His Address better be non-zero
  DF19  Store Address of His routine in Global Page (BF7E)
  DF22  And return the position number we used
  DF28  Exit
  DF29  Skip this Vector
  DF2B  Last one?
  DF2D  No, check another >>DF0E
  DF2F  Yes, Table Full Error
  DF31  Always taken >>DF35
  DF33  Bad Parameter Error
  DF35  Call System Error Handler <BF09>

          DEALLOC

  DF38  ---
  DF3A  Get Position Number
  DF3C  Can't be zero >>DF33
  DF40  Or greater than 4 >>DF33
  DF43  Make Index into Table from it
  DF46  And zero His Vector (BF7E)
  DF4D  Then Exit
```

```
DFC7  And stack (BF8B)
DFD7  Is this enhanced ROM? (DFF1)
DFDA  Yes, skip some stuff we used to have to do >>DFEE
DFDC  Reload X and Y (BF8A)
DFE2  Disable I/O ROMS (CFFF)
DFE5  Replace active slot number (C100)
DFEE  Exit from Interrupt >>BFD0

DFF1  ENHANCE FLAG. Set to 1 by RELOCATOR if new type ROM found.
        (That is, if ROM IRQ Vector jumps below $D000)
DFF2  Unclaimed IRQ Count.  Incremented when an interrupt
        is unclaimed (256 tries are allowed).
```

```
E044  Times 2
E045  Store Command NumberNG OR **********
E04A  And use it to index NG FUNCTIONS ****
E04E  Set up Jump Vector w
E051  ..handler address (F(FE7F)
E057  Signal Backup requirhis command (FD95)
E05C  PATHNAME not require
E05E  Required - parse and times 2 (FE7B)
E061  Bad Name? >>E07A   into Address Table
E063  Reference Number in ith this function
E066  No >>E06D          D6E)
E068  Yes - check it out ked after call
E06B  Bad Number? >>E07A d? >>E063
E06D  Date/Time in list 2 ( validity check <
                        list2 (FE7B)
                        E1C7>
                        FE7B)
```


NEXT OBJECT ADDR: DFF3

****

****


```
ProDOS MLI -- V1.2 -- 6 SEP 86              NEXT OBJECT ADDR: DF4D
----------------------------------------------------------------
ADDR   DESCRIPTION/CONTENTS
----------------------------------------------------------------

DF4E ********** IRQ Handler ***************************************

  DF4E  ---
  DF50  Save A reg from Monitor (BF88)
  DF53  And X,Y,S and P (BF89)
  DF5D  Is this ROM enhanced? (DFF1)
  DF60  Yes, skip three pulls >>DF6E
  DF67  And RTI Address (BF8E)
  DF6E  Replace stack to original condition
  DF72  Save active slot index (DFE7)
  DF75  In bottom half of stack?
  DF78  Yes, pop off 16 bytes and save them
  DF7A  ---
  DF81  Save $FA - $FF (top of zero page)
  DF83  ---
  DF8B  Is there a User Vector #1 (BF81)
  DF8E  No >>DF95
  DF90  Yes, call it <DFF3>
  DF93  His interrupt? >>DFBD
  DF95  Is there a User Vector #2 (BF83)
  DF98  No >>DF9F
  DF9A  Yes, call it <DFF6>
  DF9D  His interrupt? >>DFBD
  DF9F  Is there a User Vector #3 (BF85)
  DFA2  No >>DFA9
  DFA4  Yes, call it <DFF9>
  DFA7  His interrupt? >>DFBD
  DFA9  Is there a User Vector #4 (BF87)
  DFAC  No, didn't find service routine. >>DFB3
  DFAE  Yes, call it <DFFC>
  DFB1  His interrupt? >>DFBD
  DFB3  Allow 256 tries, (DFF2)
  DFB8  then indicate error type 1 and
  DFBA  call System Death Handler. <BF0C>
  DFBD  Interrupt Serviced
  DFBF  Restore zero page (FDBD)
```

```
ProDOS MLI -- V1.2 -- 6 SEP
----------------------------
ADDR   DESCRIPTION/CONTENTS
----------------------------                0750)
                                             (FDE6)

  DFF3  User Interrupt Handl 86
  DFF6  User Interrupt Handl
  DFF9  User Interrupt Handl
  DFFC  User Interrupt Handl

DFFF ********** SYSTEM ERROR
                       er #1 >>BF80       ***********************
  DFFF  Save Error Code (BF0er #2 >>BF82   *
  E003  Pop out of subroutiner #3 >>BF84
  E004  Exit to caller with er #4 >>BF86
  E008  RETURN
                         HANDLER *********
E009 ********** SYSTEM DEATH
                            F)
  E009  Save Error number ine              s (FEBD)
  E00A  Turn off 80 column cError Code (BF0F)
  E00D  Select standard Text
  E010  Are we running on a
  E013  No. >>E01A        HANDLER ********0081>
  E015  Yes, initialize IIGS
  E017  by clearing NEWVIDEO X-REG
  E01F  ---               ard (C00C)
  E021  Blank next to last display (C051)
  E024  print "INSERT SYSTEMIIGS? (2278)
  E027  on bottom row of scr
  E02D  Get error number bac video
  E02E  Expect errors in ram. (C029)
  E030  Make it ASCII
  E038  Put error number on ow of screen and (
  E03B  Infinite loop >>E033 DISK AND RESTART"
                         een. (07D0)
E03E ********** PERFORM FILLk
        ******* HOUSEKEEPige 00 to 0F

  E03E  Save function index screen (07F7)
  E041  Get INFO flags for
```

```
                    /"?
                    81
                    ndicate fully qualified name (FE84)
                    ast "/"
                    of Index level is -1 initially (D700)
Beneath Apple ProD  haracter of Index level (counter) (FE80)
                    upcoming Index level in name (FE82)
                    of name yet? (FE66)
                    0F6
ProDOS MLI -- Ve    next character in his name
--------------      /"?
ADDR    DESCRIP     10B
--------------      wer case?
                    21
  E070  No >>E      orce upper case
  E072  Yes - p     my Pathname buffer (D700)
  E075  Call Fe     Index level counter (FE80)
  E078  If no e     characters may be A-Z,0-9 or . >>E0DE
  E07A  Else -      Index level counter (FE80)
  E07D  Return      haracter must be alphabetic >>E0EA
  E07E  Indirec     "?
                    et next character >>E0BC
E081 ********       it special or control character
       *****        Bad Pathname then >>E0F2
                    meric?
  E081  Set ($      et next character >>E0BC
  E08C  ---         lphabetic?
  E090  Assume      et next character >>E0BC
  E093  No Path
  E096  Check
  E098  Zero is
  E09C  Nor is
  E09E  Save le
  E0A1  Length
  E0A5  Get fir
  E0A9  Is it
  E0AB  No >>E0
  E0AD  Yes -
  E0B0  Bump p
  E0B1  ---
  E0B3  Length
  E0B6  First
  E0B9  Start
  E0BC  At end
  E0BF  Yes >>
  E0C1  No - g
  E0C7  Is it
  E0C9  Yes >>
  E0CB  No - l
  E0CD  No >>E
  E0CF  Yes -
  E0D1  Copy t
  E0D4  Increm
  E0D7  Subseq
  E0D9  Increm
  E0DC  First
  E0DE  Is it
  E0E0  Yes -
  E0E2  No - i
  E0E4  Yes -
  E0E6  Is it
  E0E8  Yes -
  E0EA  Is it
  E0F0  If so
  E0F2  Else
                    partial Pathname (FE84)
                    name in my area yet (D700)
                    length of caller's Pathname
                    no good >>E0F2
                    65 or more >>E0F2
                    ength (FE66)
                    + 1 (FE66)
                    st character of his name
```

```
  E124  Fully qualified name? (FE84)
  E126  Yes >>E12B
  E12  No - Got a Prefix (BF9A)
  E12  No - error >>E0F2
  E12  Else, okay to exit

E12C ***************************************************************
       ****** MLI SET_PREFIX CALL ******
       *********************************

  E12C
  E12
  E13
  E13
  E13
  E13

  E13
  E13
  E14
  E14
  E14
  E14
  E15
  E15
  E15
  E15
  E15

  Copy Pathname <E081>
  It's okay >>E13B
  Check length of Volume name (D700)
  If zero - no Prefix wanted (BF9A)
  Exit with no error
  RETURN

  Get File entry for last index <E593>
  Okay? >>E144
  Invalid Pathname?
  No - Out now! >>E182
  Sub Directory file? (FE27)
  No, error >>E180
  Fully qualified path? (FE84)
  Yes >>E155
  No - use old Prefix also (BF9A)
  ---
  Compute new Prefix Index (FE66)
  Does new Prefix exceed 64 characters?
  Yes - Bad Path error >>E0F2
  Store new Prefix pointer (BF9A)
```



```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: E070
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------
                    ---------------------------------------------------
                    ***** CHECK CALLER'S PATHNAME  *********************
                    ****** COPY TO MY AREA          ******
                    ---------------------------------------------------
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: E0F3
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  E0F3  Bad Pathname
  E0F5  RETURN
  E0F6  ---
  E0F8  Any characters in last Index level? (FE80)
  E0FB  Yes >>E101
  E0FD  No, zero characters in it (FE80)
  E100  And toss out last "/"
  E101  ---
  E103  Mark end of name with $00 (D700)
  E105  Name too long? >>E0F2
  E107  No - save final length (FE66)
  E10A  Set X -> 0
  E10C  Last Index more than 15 characters?
  E10F  Yes - then no good >>E0F2
  E111  Save output Index (FE85)
  E113  Store length of previous Index level (FE82)
  E116  Just before it in buffer (D700)
  E118  Restore output index (FE85)
  E11B  And continue >>E0B1
  E11D  End of Name
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: E165
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------
                Number of Prefix Directory (FE67)
                ck for Prefix Directory (FE68)
  E165  Set Device= to top of Path buffer (D700)
  E16B  Save Keyblgy old Prefix if one exists) (D700)
  E174  Copy Prefi ly
  E177  (preceded l
  E17F  Exit norma pe Error

  E180  Bad File Ty
  E182  ---
  E183  RETURN      ***************************************************
                    I GET_PREFIX CALL ******
E184 ***************************************
          ****** ML
          ********  > Data Buffer
                    = 64 (max)
  E184  Set ($4E) eck buffer storage <FC46>
  E190  Set Length 82
  E19A  Validity ch index (BF9A)
  E19D  Error? >>E - Length = Ø >>E1AB
  E1A1  Get Prefix for length
  E1A5  No Prefix? rst byte of buffer
  E1A7  Complement fix exit >>E1C5
  E1AB  Store in f
  E1AD  If null Pr to caller's buffer replacing (D700)
  E1AF  ---  name length bytes with "/"
  E1B0  Copy Prefi
  E1B3  index leve a "/"
  E1BD  ---
  E1C1  End it wit ly
  E1C5  ---
  E1C6  Exit norma IDITY CHECK REFERENCE NUMBER **********************
                    (PASSED BY CALLER)
E1C7 ********** VA
                  ce Number
                  n no good >>E228
  E1C7  Get Refere n no good >>E228
  E1CB  If zero thence Number
  E1CF  If > 8 the 32
  E1D1  Save Refer s offset into FCB's (FE5A)
  E1D2  Multiply b ference Number
  E1D8  Result giv l Block active this Reference? (D800)
  E1DC  Get back Reference Number >>E223
  E1DD  File Contr Number (D80B)
  E1E0  No - Bad R address in Global Page <FC00>
  E1E2  Get Buffer >>E214
  E1E5  Find Buffe , save Page Pointer in $48
  E1EB  No Buffer? k in $49
  E1ED  Buffer ok vice used in Global Page (D801)
  E1F1  Second blo ing up pointers (FEA5)
  E1F3  Set last st Block of Buffer (data)
  E1F9  Finish set
  E1FC  ($4A) ->
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: E1FE
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  E1FE  ($48) -> 2nd Block of Buffer (index)
  E200  ---
  E201  Search all Volume Control Blocks (D910)
  E204  for the one which goes with requested unit (D801)
  E209  ---
  E20F  Can't find matching Volume Control Block
  E211  So die with error type $0A <BF0C>
  E214  No Buffer in open File Control Block
  E216  So die with error type $0B <BF0C>
  E219  Is Volume mounted? (D900)
  E21C  No, keep looking >>E209
  E21E  Save Volume Control Block index (FE59)
  E222  Exit normally

  E223  ---
  E225  This looks wrong!!!! (FE5A)
  E228  Bad Reference Number error
  E22B  RETURN

E22C ***************************************************************
          ****** MLI ONLINE CALL ******
          ****************************

  E22C  Set ($4E) -> Data Buffer  <F1F5>
  E22F  Set Length = Ø
  E239  Get Unit Number
  E23B  Do all Units? >>E244
  E23D  No, just one
  E23F  Set length = 16 (FEA2)
  E242  Always taken >>E249
  E244  If all Units
  E246  Set Length = 256 (maximum) (FEA3)
  E249  Is Buffer in main RAM? <FC46>
  E24C  No, then exit >>E281
  E24E  Yes, zero out Buffer
  E253  ---
  E258  Index into Data Buffer = $00 (FE82)
  E25D  Get Unit Number again
  E25F  Isolate valid bits
  E261  Specific Unit requested? >>E282
  E263  No, copy Device List from Global Page <E847>
  E266  Save Device Count (FE85)
  E269  Get last Device (FE92)
  E26C  Generate return data for it <E282>
  E26F  Bump data buffer index by 16 (FE82)
  E278  Get next Device (FE85)
  E27C  And go do it >>E266
  E27E  When done, exit
  E281  RETURN
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: E281
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  E282  Save Device Number (BF30)
  E285  Scan for the Volume Control Block <E859>
  E288  Error? >>E2C5
  E28A  No
  E28E  Read block 2 (Volume Directory) <EBC9>
  E291  Get Volume Control Block offset (FE59)
  E294  Volume Directory read OK >>E2A5
  E296  Bad read, save error number
  E297  Any file open? (D911)
  E29A  Yes >>E2A2
  E29C  Zero out this VCB entry (D900)
  E2A2   Put error number in Accum
  E2A3  Always taken >>E2C5

  E2A5  Volume name exist? (D900)
  E2A8  No >>E2AF
  E2AA  Yes, Files open? (D911)
  E2AD  Yes >>E2BB
  E2AF  No, set up Volume Control Block for new VOL <E8B4>
  E2B2  Error?  >>E2C5
  E2B4  No
  E2B6  Was a duplicate Volume Control Block found? (FE7D)
  E2B9  Yes, then error >>E2C5
  E2BB  See if the same Volume is still there (FE59)
  E2C1  If not, Disk Switch Error
  E2C3  Else, all is well - continue >>E2E3

E2C5 ********** ERROR ************************************************
          Store code in data buffer entry

  E2C5  ---
  E2C6  Store Device Number in entry <E2F8>
  E2CB  Store error code next
  E2CD  Duplicate Volume error?
  E2CF  No - done >>E2E1
  E2D2  Store Device Number for duplicate next (FE7E)
  E2DA  No Duplicate now
  E2E1  Exit with error
  E2E2  RETURN

E2E3 ********** MAKE ONLINE VOLUME ENTRY ****************************

  E2E3  Get name length for loop index (D900)
  E2EC  Copy name to Buffer entry (D900)
  E2F3  Done yet? (FE80)
  E2F6  No, do another >>E2EC
  E2F8  Yes, find current Buffer entry (FE82)
  E2FB  Store Device number (BF30)
  E303  Return to caller
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: E303
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

E304 *************************************************************
          ****** MLI CREATE CALL ******
          ****************************

  E304  Follow Path to File <E5A6>
  E307  Error? - I'm expecting one >>E30D
  E309  If File was found - Duplicate error
  E30B  ---
  E30C  Return to caller

  E30D  File not found?
  E30F  No, then a real error occurred >>E30B
  E311  Yes, get requested storage type
  E315  Is it 00, $01, $02 or $03?
  E317  Yes, carry on >>E31D
  E319  Is it $0D?
  E31B  No, then exit with error >>E32D
  E31D  Get status of this device (BF30)
  E323  Exit on error >>E330
  E325  Is there a free Directory entry? (FE63)
  E328  No >>E331
  E32A  Yes - continue >>E3BF

  E32D  Indicate Bad Storage Type
  E330  Return to caller

  E331  Is this the Volume Directory? (FE0E)
  E337  No, we can extgnd it >>E33D
  E339  Yes, indicate Volume Directory Full error
  E33C  Return to caller

          * EXTEND DIRECTORY FILE *

  E33D  Save old current Block number
  E343  Allocate a Block on Disk <EA9C>
  E346  Save the number
  E347  Replace BLKNUM
  E34D  Was there a free Block?
  E34E  No, then exit >>E330
  E350  Yes, set up forward pointer in old one (DC02)
  E353  to point to it (DC03)
  E356  and Write old Directory Block <EBD5>
  E359  Error? Yes, then exit >>E330
  E35D  Set BLKNUM -> new Block number
  E362  Back point to old Directory Block (DC02)
  E368  Loop until done >>E35D
  E36C  Zero remainder of Block Buffer (DC02)
  E36F  (including forward pointer) (DD00)
  E373  Loop until done >>E36C
  E375  Write new Directory Block <EBD5>
```

```
ADDR    DESCRIPTION/CONTENTS
---------------------------------------------------------------
  E378  Error? Yes, then exit
  E37A  Set BLKNUM -> Parent Directory block number (FE0E)
  E380  Read Block with
  E383  Entry number with exit >>E330
  E386  None relocatable ent Directory block number (FE0E)
  E388  Set ($48) -> Dir ny entry <EBC9>
  E38A  Skip link pointe in the Parent Dir. block (FE10)
  E38C  ---
  E38D  Count entries  er
  E390  Skip to next (FE s
  E399  Save LSB
  E39D  Add 1 to Blocks
  E39F  and $200 to EOF 1)
  E3A2  in entry
  E3A8  Loop until done sed
  E3AA  Write back Block ark (FD96)
  E3AD  Error? then exit
  E3AF  Start all over >E39D
                        to Parent Directory <EBD5>
E3B2 ********** ZERO $F6 >>E3BE
                        w that there's room >>E304
  E3B2  Zero $F600 Block
  E3BE  Return to caller 0 ******************************************

E3BF ********** BUILD E Buffer

  E3BF  Call Zero $F600
  E3C2  Copy Datetime (CW FILE ***************************************
  E3C4  to my variables
  E3D0  Loop until done routine <E3B2>
  E3D2  Did he give Date eation)
  E3D3  Yes, carry on >>
  E3D5  No, then use  >>E3C4
  E3D7  System Datetime time (Creation)?
  E3E0  If Storage type E3E0
  E3E2  force it to $D
  E3E8  else use a $0D instead (BF90)
  E3EA  Find File name is $00, $01, $02 or $03
  E3ED  OR Storage type
  E3F0  Store Type/Leng
  E3F3  Isolate name Le (FE82)
  E3F7  Copy File name to name length (D700)
  E405  Copy caller's Ac h (FE27)
          NOTE: This length
  E40D  and copy File to File Entry Buffer (FE82)
  E412  ---  cess Byte
  E413  and AUX TYPE!  uld be validity checked!!!
  E41C  Copy Version and pe
  E41F  constants to en
  E428  Indicate I Block
  E42D  Copy Directory  Min_Version (0,0) (FDB8)
                        ry (FE43)
                         used
                        leader Block number (FE22)
```



```
ADDR    DESCRIPTION/CONTENTS
---------------------------------------------------------------
  E43C  Is this a Seedling file?                NEXT OBJECT ADDR: E43C
  E43E  Yes >>E475
  E440  No, Directory file - Build Header
  E442  Copy completed Directory entry (
  E445  to $F600 buffer first (DC04)
  E449  Loop until done >>E442
  E44B  Make Storage type $E in Header it
  E450  Put "HUSTON" (Author) in Reserved in $F600
  E458  and Version, Min_Version, Access E27)
  E45B  Entry-length, File count and (DC2
  E45E  Parent pointer from constants
  E45F  Loop until done >>E452              self
  E463  EOF = $200 (FE3D)                    area
  E466  Copy Parent Block entry number ( (FDB8)
  E46D  Loop until done >>E466               0)
  E46F  Copy Parent entry Length (FE19)
  E475  Allocate a new disk block  <EA9C>
  E478  error? >>E4B1
  E47A  Store it in key pointer of entry E24)
  E480  and in BLKNUM for I/O
  E484  Write zeroed (or DIR HDR) key blo
  E487  error? >>E4B1
  E489  Bump parent's file count (FE1B)
  E491  Go update directory <E4B2>          (FE38)
  E494  error? >>E4B1
  E496  Checkpoint Volume Bit Map and exit <EBD5>

E499 ********** POINT $48/49 AT DIRECTORY

  E499  $48/$49 --> Entry
  E49D  Skip link pointers (+4)              t >>EB76
  E49F  File entry number counter (FE26)
  E4A2  ---                                  ENTRY **********************
  E4A3  Skip to proper entry
  E4A6  Add entry length (FE19)
  E4AB  (bump MSB)
  E4AF  (store LSB)
  E4B1  RETURN

E4B2 ********** UPDATE DIRECTORY(S) *****

  E4B2  System date available? (BF90)
  E4B5  no, forget it >>E4C2
  E4B9  yes, copy to last modified date
  E4C2  turn on BUBIT (backup) if approp*****************************
  E4CB  set DEVNUM of parent (FE21)
  E4D1  and BLKNUM (FE24)
  E4D7  reread DIR block containing entry
  E4DA  error? >>E4B1                        ield (BF90)
  E4DC  Point to proper entry in buffer iate (FE45)
  E4E3  Copy constructed entry to buffer

                                             <EBC9>

                                            E499>
                                             (FE27)
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: E4EE
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  E4EE  Is this block the DIR HDR
  E4F9  no, write this modified d block?
  E4FC  error? >>E4B1             irectory block <EBD5>
  E504  and then read DIR HDR blo
  E507  error? >>E4B1             k <EBC9>
  E509  in any case..
  E50B  copy back update file cou
  E514  and ACCESS byte (with Bacnt to HDR (FE1B)
  E51A  re-write the HDR block <Ekup) (FE18)
  E51D  error? >>E573             BD5>
  E51F  is this the VOL DIR? (DC04
  E526  yes, all done -- exit >>E
  E528  Is subdirectory, get PARE591
  E52B  store in variable area (ENT_ENTRY, (DC29)
  E52E  Get PARENT_ENTRY_LENGTH, 26)
  E531  store in variable area (F(DC2A)
  E534  get parent block number (19)
  E53A  read Parent Directory blDC27)
  E53D  error? >>E573             ck <EBC9>
  E53F  find entry for this subdi
  E542  system date available? (irectory <E499>
  E545  no >>E554                 F90)
  E547  yes,
  E54B  copy system date/time to.
  E54E  modified date/time in ent. (BF90)
  E554  write it back <EBD5>      ry
  E557  error? >>E573
  E55B  BLKNUM = HDR block number
  E564  same block we have now?
  E568  yes, go back and date st
  E56A  no,                       mp >>E51F
  E56E  read HDR block <EBD9>
  E571  and go back to date stamp
  E573  error? then exit          Parent DIR >>E51F

E574 ********** NOT ProDOS VOLUM
                                  ERROR ******************************

  E574  ---
  E577  RETURN

E578 ********** IS THIS ProDOS V
                                  LUME? ******************************

  E578  Does previous block ptr =
  E586  no, not a ProDOS volume - 0? (DC00)
  E588  else, (DC04)              >>E574
  E58D  does VOL DIR's STORAGE TY -
  E58F  no, error >>E574          YPE - $E or $F?
  E591  else, ok
  E592  RETURN
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: E592
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------


E593 ********** GET FILE ENTRY ***************************************

  E593  follow path to it's end <E5A6>
  E596  error? >>E5A5
  E59B  copy file entry
  E5A3  and exit
  E5A5  RETURN

E5A6 ********** FOLLOW PATH TO A FILE ********************************

  E5A6  get base dir's data <E723>
  E5A9  error? >>E5FC
  E5AB  another subdirectory in the path? >>E5D4
  E5AD  no, at end of path
  E5AF  $48/$49 --> $F604 (HDR)
  E5B7  copy part of HDR to file entry
  E5C1  File type = $F (Directory) (FDB0)
  E5C4  BLOCK = 2 (FE27)
  E5C7  No. blocks used = 4
  E5C8  EOF = $800
  E5CC  TYPE = subdirectory ($D0)
  E5D1  return to caller
  E5D3  RETURN

          *** SCAN DIRECTORY FOR FILE ***

  E5D4  indicate no free entry found as yet
  E5D9  signal in HDR block
  E5DA  zero count of names examined
  E5DF  find name in block <E6CD>
  E5E2  got it! >>E644
  E5E4  not yet, how many entries expected? (FE60)
  E5E7  less entry number I just searched (FE5F)
  E5EC  more file entries left to search? >>E5FE
  E5FA  no, directory error
  E5FC  ---
  E5FD  RETURN

  E5FE  yes, update entries left counter (FE60)
  E603  back to first buffer page ($49)
  E605  check next block pointer (DC02)
  E60D  if zero, directory error >>E5FA
  E612  read next block of directory <EBC9>
  E615  no errors, loop back for more >>E5DA
  E617  exit if error
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: E617
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

        *** NO MORE FILE ENTRIES ***

  E618  free entry found
  E61B  yes >>E638
  E61D  no, check pointers
  E620  is there another b (DC02)
  E625  no... >>E638
  E627  yes, free entry w lock after this one? >>E627
  E630  first in that bloc ll be.. (FE24)
  E635  indicate free entr
  E638  find next index ha y available (FE63)
  E63B  exiting with error me <E764>
  E63C  no more indicies
  E63E  else, path not fou h path, file not found >>E641
  E640  RETURN              nd

  E641  file not found err
  E643  RETURN              or

        *** FOUND FILE E NTRY ***

  E644  advance to next su
  E647  end -- save entry bdir in path <E75D>
  E64B  get type of entry no. and exit >>E6B5
  E64F  subdir?
  E651  no, bad path then
  E655  copy key block no. >>E63B
  E657  to BLKNUM
  E65A  and to current DIR
  E664  go read key block  block no (FE22)
  E667  error? >>E68D      of subdirectory <EBD9>
  E66C  new file count (FF
  E675  check minimum ve s 0)
  E678  too new? >>E68B    ion (DC21)
  E680  count bits in rese
  E681  --- >>E684         rved field of DIR hdr
  E684  ---
  E687  there must be 5 b
  E689  (there are) >>E68 ts on (normally $75)
  E68B  or else, incompat
  E68D  ---
  E68E  RETURN              ole file format

  E68F  copy DIR HDR <E695
  E692  and go scan for ne
                            xt level >>E5D4
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: E692
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

E695 ********* COPY DIRECTORY HDR ***********************************

  E695  Copy:
  E697  CREATION, VERSION, MIN_VERS, ACCESS, (DC1C)
  E69A  ENTRY_LEN, ENTRIES_PER_BLK, FILE_COUNT (FE12)
  E6A0  volume directory? (DC04)
  E6A7  if so, exit now >>E6B4
  E6AB  else, copy PARENT_POINTER, (DC27)
  E6AE  PARENT_ENTRY_NO., and PARENT_ENTRY_LEN (FE0E)
  E6B4  RETURN

E6B5 ********* SAVE DIR ENTRY NO. & BLOCK ***************************

  E6B5  compute entry number (FE1A)
  E6BE  save it  (FE26)
  E6C3  and the block it's in (FE24)
  E6CC  exit

E6CD ********* SEARCH ONE DIR BLOCK FOR FILE ************************

  E6CD  get entries in this block (FE1A)
  E6D3  $48/$49 --> first entry
  E6D9  ---
  E6DB  skip HDR? >>E710
  E6DD  no, non empty entry?
  E6E1  yes >>E6F0
  E6E3  no, do we need one? (FE63)
  E6E6  no >>E710
  E6E8  yes, remember it <E6B5>
  E6EB  don't need another one now (FE63)
  E6EE  skip to next entry >>E710
  E6F0  get length of name
  E6F2  count it (FE5F)
  E6F5  save it for loop (FE80)
  E6FB  same len as we are wanting? (D700)
  E6FE  no, skip it >>E710
  E700  ---
  E704  compare names (D700)
  E70E  we found it! exit
  E70F  RETURN

  E710  skip to next entry (FE62)
  E714  end of block? if so, exit >>E70F
  E71A  bump $48/$49 by entry len
  E721  and go check next >>E6D9
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: E721
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

E723 ********* GET DIRECTORY DATA ***********************************

  E723  find base directory <E77C>
  E726  error? >>E77B
  E72C  zero out my variables (FE0E)
  E732  set up device number (BF30)
  E738  copy DIR HDR to my variables <E695>
  E741  copy TOTAL BLOCKS from VCB (D912)
  E747  copy BIT MAP Pointer from VCB (D91A)
  E74D  copy Block No. of this directory (0046)
  E753  make second copy of file count (FE1B)
  E75D  advance to next subdir in path <E764>
  E760  and update index (FE82)
  E763  RETURN

E764 ********* ADVANCE TO NEXT DIR NAME *****************************

  E764  get this DIR's index (FE82)
  E76B  add len of name to move index to next name (FE82)
  E76F  still in prefix portion? >>E777
  E771  no, now starting caller's path suffix (BF30)
  E774  save last DEVNUM accessed (FE67)
  E777  return with len of next dir in path (D700)
  E77B  RETURN

E77C ********* FIND BASE DIRECTORY ***********************************

  E77C  ---
  E77E  get old PFIXPTR (BF9A)
  E781  fully qualified pathname? (FE84)
  E784  no >>E787
  E786  yes, no old PFIXPTR anymore
  E787  save old prefix index (FE83)
  E78A  DEVNUM=0 (BF30)
  E78D  ---

          *** SCAN VCB'S FOR A MOUNTED VOLUME ***

  E78F  scan (D900)
  E792  got one >>E79F
  E799  else, bump to next VCB

          *** FIND LAST DIR IN PREFIX OR TOL DIR ***

  E79F  store name length (FE80)
  E7A2  same name as in pathname? (D700)
  E7A5  no -- skip it >>E794
  E7B3  save VCB index (FE59)
  E7B6  DEVNUM = VCB's unit no. (D910)
  E7BC  BLOCK = 2 (read VOLDIR if no old PFIX)
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: E7C4
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  E7C4  get old prefix index (FE83)
  E7C7  ---
  E7C8  accumulate a new index (FE82)
  E7CB  no previous prefix? >>E7DD
  E7CE  find last name in prefix (D700)
  E7D3  read prefix directory instead of vol dir (FE68)
  E7DD  read block <EBD9>
  E7E0  error? >>E7E7
  E7E2  is this the right directory? <E881>
  E7E5  Yes--exit. >>E80B

          *** IF NOT THERE, REMOUNT ALL VOLS ***
          *** AND CHECK THEM                 ***

  E7E7  open files? (FE59)
  E7ED  yes, give up now >>E808
  E7EF  else, (FE83)
  E7F2  put back old prefix length (FE82)
  E7F5  copy DVCLST from global page <E847>
  E7FB  use last device accessed first >>E80C
  E7FD  if none, get last in my device table (BF31)
  E808  volume not found error
  E80B  RETURN

  E80C  ---
  E80F  search for device in device table (FE92)
  E817  device not found >>E808
  E819  when found, make it active device  (BF30)
  E81E  remove it from table (FE92)
  E821  find its VCB <E859>
  E824  not found? >>E846
  E826  volume mounted there? (FE59)
  E82C  no >>E833
  E82E  yes, open files here? (D911)
  E831  yes, skip it -- get next unit >>E7FD
  E833  else read block 2 (vol dir)
  E837  read volume directory <EBC9>
  E83A  error? >>E7FD
  E83C  mount volume on VCB <E8A7>
  E83F  error? >>E7FD
  E841  is this his chosen volume? <E881>
  E844  no, try again >>E7FD
  E846  yes, exit

E847 ********* COPY GLBL DEVLST TO MY TABLE **************************

  E847  start with last device (BF31)
  E84A  get a unit number (BF32)
  E84F  copy it to device table (FE92)
  E855  return count of devices (BF31)
  E858  RETURN
```

```
ADDR    DESCRIPTION/CONTENTS
---------------------------

E859 ********* SCAN VCB'S FOR

  E859  ---
  E85D  scan VCB's for a give
  E864  not it? >>E86B
  E866  is it, save VCB index
  E869  and exit normally
  E86A  RETURN

  E86B  else, volume mounted
  E86E  yes >>E874
  E871  no, save VCB index to
  E874  ---
  E876  bump to next VCB
  E878  and go look at it >>E
  E87A  not found...
  E87B  any free entries? if
  E87D  else, all is well --
  E87E  VCB table full error
  E880  RETURN

E881 ********* COMPARE DIR NA

  E881  ---
  E886  check DIR type (DC04)
  E889  VOL DIR or SUB DIR?
  E88B  neither >>E894
  E88D  yes..
  E88F  store len of its name
  E892  and go on >>E899
  E894  error exit
  E895  RETURN

  E896  compare directory nam
  E89C  no match? >>E894
  E8A5  they match! exit
  E8A6  RETURN

E8A7 ********* MOUNT NEW VOL!

  E8A7  volume mounted? (FE59
  E8AD  no, continue >>E8B4
  E8AF  yes, same one as one
  E8B2  if so exit, else fal
```

```
                                NEXT OBJECT ADDR: E858
-------------------------------------------------------

-------------------------------------------------------

DEVICE NO. ****************************


n device number

 (FE59)



here? (D900)

 empty unit (FE59)


85D

not, error >>E87E
return empty VCB


ME WITH PATH LVL ************************


(FE80)


es (DC04)



ME ************************************

)

wanted? <E90C>
 thru >>E90B
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                NEXT OBJECT ADDR: E8B4
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

E8B4 ********* SET UP VCB FROM VOLDIR ********************************

  E8B4  zero out VCB
  E8BF  is this a ProDOS volume? <E578>
  E8C2  no -- exit >>E90B
  E8C4  duplicate vol in VCB's? <E930>
  E8C7  yes -- exit with that one instead >>E90A
  E8C9  get new volume's name length (DC04)
  E8D0  add to VCB index (FE59)
  E8D4  and copy to VCB name field in empty VCB (DC04)
  E8DF  store in VCB name len field (D900)
  E8E2  copy DEVNUM to VCB unit field (BF30)
  E8E8  copy total blocks to VCB (DC29)
  E8F4  copy block no. of vol dir to VCB
  E8FE  copy bit map block no. to VCB (DC27)
  E90A  exit
  E90B  RETURN

E90C ********* COMPARE VOL NAMES TO MAKE ****************************
          ****** SURE THEY MATCH            ******

  E90C  Get length (DC04)
  E911  Same in VCB? (D900)
  E914  Save VCB offset (FE58)
  E917  Different from VCB >>E924
  E919  Store len to use as buffer index
  E91A  Add length to VCB offset to get (FE58)
  E91D  index into VCB (last char of name)
  E921  Compare names (D900)
  E924  SEC if no match
  E92B  CLC if match
  E92C  Restore VCB offset to X-REG (FE58)
  E92F  RETURN

E930 ********* LOOK FOR DUPLICATE VOL ********************************

  E930  start with first VCB
  E932  ---
  E933  this VCB has same name? <E90C>
  E936  no >>E947
  E938  yes, files open? (D911)
  E93B  yes >>E951
  E93F  no, mark VCB empty (NAME=0) (D900)
  E942  (UNIT=0) (D910)
  E945  and exit with no error >>E94F
  E947  else,
  E949  bump to next VCB
  E94D  and loop >>E932
  E94F  exit no errors
  E950  RETURN
```



```
ProDOS MLI -- V1.2 -- 6 SEP 8
-----------------------------
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: E950
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  E951  save flag (FE7D)
  E954  and VCB index of duplicate vol (FE7E)
  E957  exit with error
  E958  RETURN

E959 ********* SEE IF A QUANTITY OF FREE  ****************************
          ****** BLOCKS IS AVAILABLE ON VOL ******

  E959  any free blocks counted in VCB? (FE59)
  E962  yes >>E9B6

          *** COMPUTE VCB FREE BLOCK COUNT ***

  E964  no, how many bit map blocks are there? <EA08>
  E967  save it (less 1) (FE64)
  E96C  zero scratch (will count free blocks) (FE4E)
  E972  no block found yet
  E977  checkpoint bit map buffer <EB76>
  E97A  error? >>E9CA
  E97F  BLKNUM = bit map pointer (D91A)
  E989  read block to buffer <EBD9>
  E98C  error? >>E9CA
  E98E  count free blocks marked <E9CB>
  E991  drop no. remaining to do (FE64)
  E994  none left? >>E99F
  E996  some, BLKNUM = BLKNUM + 1
  E99C  go process that >>E989

  E99F  did we find a free bit? (FE59)
  E9A5  no -- volume full >>E9C7
  E9A7  save VCB bitmap block offset (D91C)
  E9AA  save free block count in VCB also (FE4F)
  E9B6  are there enough to satisfy request? (D914)
  E9C5  yes, exit
  E9C6  RETURN

  E9C7  volume full error
  E9CA  RETURN

E9CB ********* SCAN AND COUNT BITMAP BLOCKS ***************************

  E9CB  scan through both buffer pages
  E9D2  counting one bits  <E9F8>
  E9DD  ---
  E9E0  found free block already? (FE63)
  E9E3  if so -- done >>E9F7
  E9E5  any blocks found yet? (FE4E)
  E9EB  no >>E9F7
  E9ED  yes, compute total no. of bitmap blocks <EA08>
  E9F1  less number remaining (FE64)
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: E9F4
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  E9F4  gives bitm
  E9F7  exit        ap block with first free bit (FE63)

E9F8 ********* COU
                  NT ONE BITS IN A BYTE ******************************

  E9F8  shift and.
  E9FB  count bits..
  EA03  exit when   that are on (FE4E)
  EA07  RETURN      byte goes to zero

EA08 ********* COMP
                  PUTE NO. BITMAP BLKS -1 ****************************

  EA08  get blocks
  EA14  ---         on vol count (-1) (FE59)
  EA15  isolate to
  EA16  for bit ma  nibble of block count
  EA19  RETURN      p block count

EA1A ********* FRE
                  E A BLOCK ON DISK **********************************

  EA1A  save MSB (
  EA1D  and LSB   (FE64)
  EA21  block numb
  EA24  volume siz  er passed too big for (D913)
  EA28  yes, error  e? (FE64)
  EA2B  no, get bi  >>EA98
  EA31  save it (i  t position for block no.
  EA35  divide blo  E63)
  EA38  giving byt  ck no. by 8 (FE64)
  EA41  save byte   e offset as remainder
  EA44  make quoti  offset (FE6A)
  EA47  remember    ent/2 into block index (FE64)
  EA4A  read bit m  hich page in that block (FE6C)
  EA4D  error? >>M  ap block (after checkpoint) <EB43>
  EA4F  are we at   A97
  EA55  yes! >>EA   proper block of bitmap yet? (FE71)
  EA57  no -- chec  D
  EA5A  error? >>C  kpoint <EB76>
  EA5C  indicate    A97
  EA65  DEVNUM of   lock wanted in VCB (FE64)
  EA68  read actu   bitmap (FE6E)
  EA6B  error? >>E  block directly <EB87>
  EA6D  get byte    A97
  EA70  which pag   offset into page (FE6A)
  EA73  get bit pa  ? (FE6C)
  EA76  page 0? >>  ttern to set (FE63)
  EA78  no, turn    EA80
  EA7E  and contin  it on in page 1 (DB00)
  EA80  turn bit o  e >>EA86
  EA86  mark bitma  n in page 0 (DA00)
  EA8E  count bloc  p needs checkpoint
                    R freed (FE8A)
```

```
EB03  indicate bitmap needs checkpoint
EB0B  one less block available in VCB (FE59
EB20  ---
EB21  return with new block no. (FE4E)
EB27  RETURN

EB28 ********* GET NEXT BITMAP BLOCK *********

EB28  use blocks of vol to compute (FE59)
EB2B  number of blocks in bitmap (D913)
EB32  just scanned last block? (D91C)
EB35  yes, no space >>EB72
EB37  no, get next block (D91C)
EB40  checkpoint old one <EB76>

EA96  exit normally
EA97  RETURN

EA98  bad bitmap error
EA9B  RETURN

EA9C ********* FIND A FREE DISK BLOCK AND ***
         ****** AND ALLOCATE IT

EA9C  go read bitmap <EB43>
EA9F  error? >>EAC4
EAA1  first page Ø
EAA6  scan 1st page of bitmap for free bloc
EAAE  bump tm page 1 of buffer (FE6C)
EAB1  bump page offset (FE6B)
EAB4  scan 2nd page too (DBØØ)
EABC  bump page (FE6B)
EABF  get next block <EB28>
EAC2  continue  >>EAA1
EAC4  error exit

EAC5  save byte index (FE6A)
EAC8  shift combination of page no. and (FE
EACB  byte offset left 3 bits to make (FE4F
EACE  room for bit position.
EADD  depending on buffer page ... (FE6C)
EAE2  reload bit pattern from page Ø... (DB
EAE7  or page 1 (DAØØ)
EAEA  shift bit pattern, bumping block no.
EAEB  until a one bit is found >>EAFØ
EAFØ  then shift it back the way it was
EAF1  (with that bit turned off) >>EAFØ
EAF3  store LSB of block no. (FE4E)
EAF6  store updated byte back in proper pag

EB43 ********* READ

EB43  have we rea
EB4C  yes >>EB5C
EB4E  no, checkpo
EB51  error? >>EB
EB56  get new bit
EB5C  was bitmap
EB5F  yes >>EB66
EB61  no, read it
EB64  error? >>EB
EB66  save bitmap
EB69  (page numbe
EB70  exit
EB71  RETURN

EB72  disk full e
EB75  RETURN

EB76 ********* CHEC

EB76  ---
EB77  needs check
EB7A  no >>EB71
EB7C  yes, write
EB7F  error? >>EB
EB81  doesn't nee
EB86  exit

EB87 ********* READ

EB87  save DEVNUM
EB8A  copy block
EB94  BITMAP BLOC
EBA2  set up read

        *** READ

EBA4  save I/O co
EBAA  device = bi
EBB0  block = bit
EBBA  point to bi
EBBD  do the I/O
EBC2  restore old
EBC5  ok? >>EBC8
EBC7  no, error e
EBC8  RETURN

EA96  NEXT OBJECT ADDR: EA96

ProDOS MLI -- V1.2
ADDR  DESCRIPTION/CONTENTS

EB40  NEXT OBJECT ADDR: EB40

-- 6 SEP 86
CONTENTS

BITMAP BLOCK *********

bitmap for this unit yet? (FE59)

nt bitmap of some other unit <EB76>
1
ap unit no. (D91Ø)
odified? (FE6D)

<EB87>
1
block offset times 2 (FE59)
) (D91C)

ror

POINT VOLUME BITMAP *********

oint? (FE6D)

t <EBD1>
1
checkpoint now

BITMAP *********

(FE6E)
offset wanted (FE59)
K = BITMAP PTR + BLOCK OFFSET (D91A)
command

OR WRITE BITMAP ***

mmand
map device  (FE6E)
map block (FE6F)
map buffer (EA82)
<EBDF>
DEVNUM (BF30)

xit
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: EBC8
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------


EBC9 ********* READ BLOCK DESIGNATED BY A,X **************************

  EBC9  Put low byte of block number in BLKNUM
  EBCB  and high byte in BLKNUM+1
  EBCD  Read a block <EBD9>
  EBD0  RETURN

EBD1 ********* WRITE BITMAP ***************************************

  EBD1  set up write command
  EBD3  and go do it  >>EBA4

EBD5 ********* WRITE BLOCK ***************************************

  EBD5  set up write command
  EBD7  and go do it >>EBDB

EBD9 ********* READ BLOCK ****************************************

  EBD9  set up read command

EBDB ********* READ OR WRITE BLOCK *******************************

  EBDB  save I/O command
  EBDD  where is my buffer?
  EBDF  save flags
  EBE0  and disable
  EBE3  Set low byte of Buffer pointer
  EBE5  to zero
  EBE7  Initialize Global Page System error to 0 (BF0F)
  EBEA  set I/O transfer occured flag
  EBEF  set unit to do I/O on (BF30)
  EBF4  do block I/O <DEE4>
  EBF7  error? >>EBFC
  EBF9  no errors, restore things and exit
  EBFB  RETURN

  EBFC  error exit
  EBFE  RETURN

EBFF ************************************************************
          ****** MLI GET_MARK CALL ******
          **************************

  EBFF  copy mark to caller's list from FCB (FE5A)
  EC0F  exit with no errors
  EC10  RETURN
```



```
ProDOS MLI --
-------------
ADDR    DESCR

  EC11  bad p
  EC14  RETUR

EC15 ********
        ***
        ***

  EC15  set u
  EC1D  copy
  EC1F  new m
  EC24  make
  EC29  else,
  EC2C  ---

        *** MLI SET_MARK CALL ******
        ****************************

  EC32  get o
  EC35  find
  EC3D  compu
  EC41  block
  EC47  earli
  EC4B  too f
  EC50  MSB's
  EC55  then

  EC58  check
  EC5B  zero?
  EC5D  seedl
  EC61  no, s
  EC64  This
        (The
         wher
  EC66  This
  EC69  retur
  EC6C  RETUR

        ***

  EC6D  copy
  EC73  old
  EC78  no >>
  EC7A  yes,
  EC7D  error
  EC7F  see i
  EC82  the c
  EC91  yes >
  EC95  yes >
  EC97  no, s
  EC9A  check
```

```
V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: EC10
-------------------------------------------------------------
PTION/CONTENTS
-------------------------------------------------------------

sition error

                                                        ******
ser's mark to temporary
rk variable (FE70)
re it will not exceed EOF (D815)
error >>EC11

STILL IN SAME DATA BLOCK? ***

d mark (FE5A)
its block no. (*2) (D813)
e distance in pages from old mark's (FE73)
to new mark (FE4E)
r -- need new data block >>EC58
ar forward -- need new block >>EC58
match? (D814)
mark is still in this block >>ED79

storage type (D807)
>>EC64
ng, sapling or tree?
pecial handling for DIR files >>EDAB

a bug!!!
mediate addressing mode was used
e absolute addressing was intended.)
with bad REFNUM error

ata block needs writing? (D808)
EC7F
o so <EE83>
? >>ECE8
new mark is outside the range of (FE5A)
urrent index block (D814)
>ECB1
>ECB1
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: EC9B
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  EC9B  sapling or tree are ok >>ED16

          *** SEEDLING ***

  EC9D  seedling, check position (FE73)
  ECA0  if position is outside of block 0..
  ECA4  promote to sapling >>ED04
  ECA6  else, (D80C)
  ECAE  go get key block (seedling data block) >>ED6F

          *** NEED TO CHANGE DATA BLOCKS ***

  ECB1  does old index block need dumping? (D808)
  ECB6  no >>ECBD
  ECB8  yes, do so <EE97>
  ECBB  error? >>ECE8
  ECBD  check storage type (FE5E)
  ECC0  tree file?
  ECC2  yes >>ECE9
  ECC4  no, sapling (FE74)
  ECC9  is position in first index block?
  ECCC  no, need master index, subindex and data >>ED2F
  ECCE  yes, first index, reset flags <ED9F>
  ECD1  is this a seedling?
  ECD2  if so, see if in first block >>EC9D

          *** SAPLING ***

  ECD4  no, sapling, read its only index block <EE2A>
  ECD7  error? >>ECE8
  ECDC  set block no. of index block
  ECE6  Always branch >>ED16

  ECE8   Error exit

          *** TREE FILE/NEED ANOTHER INDEX BLOCK ***

  ECE9  reset flags <ED9F>
  ECEC  read master index block <EE2A>
  ECEF  error? >>ECE8
  ECF1  make index into block from (FE74)
  ECF4  MSB_of_position/2
  ECFA  is there a subindex there?
  ECFC  yes! >>ED09
  ED02  no, fall thru to make one

          *** GET NEW INDEX BLOCK ***
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: ED04
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------


  ED04  need an index and data block
  ED06  go allocate them >>ED2F

  ED09  set up block no. of subindex
  ED11  read it <EE0D>
  ED14  error? >>ECE8

          *** SAPLING/TREE - THIS INDEX BLOCK ***

  ED16  make block no. out of position (FE74)
  ED1F  use as an index to examine index block
  ED21  entry
  ED27  if its zero...
  ED2B  need new data block
  ED2F  set flags for what to allocate (FE5A)
  ED38  new index block being created?
  ED3A  zero data block in any case <ED57>
  ED3D  if not index block that's it >>ED79
  ED3F  Zero the Index Block I/O Buffer <ED45>
  ED42  and continue >>ED79

ED45 ********* ZERO INDEX BLOCK I/O BUFFER ***************************

  ED45  ---
  ED48  Zero first page
  ED4F  and second page of Index Block I/O buffer
  ED54  Restore pointer to beginning of buffer
  ED56  RETURN

ED57 ********* ZERO OUT DATA BLK I/O BUFFER ***************************

  ED57  ---
  ED5A  Zero first page
  ED61  and second page of data block I/O buffer
  ED66  Restore pointer to beginning of buffer
  ED68  RETURN

ED69 ********* READ FILE DATA BLOCK **********************************

  ED69  set block no. LSB
  ED6B  copy MSB drom index entry
  ED6F  ---
  ED71  read new data block <EDF4>
  ED74  error? >>ED9E
  ED76  reset block allocation flags <ED9F>
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: ED76
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

          *** GOT DATA BLOCK WANTED ***

  ED79  ---
  ED8Ø  save previous mark in my variables (D812)
  ED86  set new mark in the FCB (FE72)
  ED91  ($4A/$4B --> data block buffer)
  ED93  $4C/$4D --> start of the page in
  ED95  the data block buffer which contains (FE73)
  ED98  the mark.
  ED9E  exit

ED9F ********* RESET BLOCK ALLOC FLAGS *******************************

  ED9F  get flags (FE5A)
  EDA5  turn off low 3 bits (allocate no new
  EDA7  blocks to file) (D808)
  EDAA  RETURN

EDAB ********* SET DIR FILE POSITION *********************************

  EDAB  DIR file?
  EDAD  yes! >>EDB4
  EDAF  no, bad storage type error
  EDB1  go to SYSERR <BF09>
  EDB4  else, get page distance (FE4E)
  EDB7  make it into blocks (divide by 2)
  EDBE  new position beyond old? (FE73)
  EDC1  yes >>EDD1
  EDC3  else, use previous mark
  EDC5  copy to BLKNUM <EDDF>
  EDC8  error? >>EDEE
  EDCA  count it (FE62)
  EDCD  more to skip? >>EDC3
  EDCF  no, got it >>ED79
  EDD1  use next_block pointer in DIR block
  EDD3  copy to BLKNUM <EDDF>
  EDD6  error? >>EDEE
  EDD8  count it (FE62)
  EDDB  more to skip >>EDD1
  EDDD  got it now! >>ED79

          *** COPY LINK TO BLKNUM ***

  EDDF  copy block number link
  EDE1  to BLKNUM
  EDE4  if non zero,
  EDEA  then go read block. >>EDFØ
  EDEC  else, EOF error
  EDEE  ---
  EDEF  RETURN
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: EDEF
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

EDFØ ********* READ FILE BLOCK ***************************************

  EDFØ  set block number to read
  EDF4  store read I/O command
  EDF8  read to $48/$49 buffer
  EDFA  read the block <EE50>
  EDFD  error? >>EE0C
  EE02  copy block no. just read to FCB
  EE0C  exit

EE0D ********* READ SUB-INDEX BLOCK **********************************

  EE0D  set read I/O command
  EE11  read to $48/$49 buffer
  EE13  read the block <EE5Ø>
  EE16  error? >>EE26
  EE1B  save BLKNUM in FCB as current index
  EE1D  block. (D80E)
  EE26  exit

EE27 ********* WRITE KEY INDEX BLOCK **********************************

  EE27  set write I/O command
  EE29  Use bit instruction to skip over two bytes

EE2A ********* READ KEY INDEX BLOCK ***********************************

  EE2A  ---

EE2C ********* READ OR WRITE KEY INDEX BLOCK **************************

  EE2C  save command
  EE2F  block no. is key block in FCB (FE5A)
  EE34  use $48/$49 buffer

          *** I/O BLOCK ***

  EE36  set I/O command
  EE38  and block no. (D800)
  EE42  must be non-zero block number
  EE46  or horrible death!
  EE4B  fall through to read/write block (D801)

          *** SET UP AND DO FILE BLOCK I/O ***

  EE5Ø  (xreg = buff ptr in zero page)
  EE51  disable
  EE52  set up buffer pointer
  EE5D  get DEVNUM from FCB (D801)
  EE63  set I/O transfer has occurred flag
```

```
EE83 ********* CHECKPOINT DATA BLOCK BUFFER ************************

  EE83  buffer pointer at $4A/$4B
  EE85  point to block no. in FCB
  EE8D  go write buffer to disk <EE36>
  EE90  error? >>EEB4
  EE94  go turn off $40 flag in FCB and exit >>EEAB

EE97 ********* CHECKPOINT INDEX BLOCK BUFFER ************************

  EE97  checkpoint volume bitmap <EB76>
  EE9A  use $48/$49 buffer
  EE9C  block no. is current index block in FCB
  EEA2  set to write
  EEA4  go write it to disk <EE36>
  EEA7  error?  >>EEB4
  EEA9  no longer needs checkpoint
  EEAB  set flags accordingly (FE5A)
  EEB4  and exit

EEB5 ************************************************************
       ****** MLI OPEN CALL ******
       **************************

  EEB5  search path for file <E593>
  EEB8  found it? >>EEBE
  EEBA  no, bad path error
  EEBC  exit >>EEC5
  EEBE  else, see if FCB already open on file <EF9B>
  EEC1  for write. if not, continue. >>EECB
  EEC3  else, file already open error
  EEC5  ---
  EEC6  RETURN
```

```
EEFB  and copy to FCB (D807)
EEFE  get access (FE45)
EF03  DIR file?
EF05  no >>EF09                                          50
EF07  yes, we are only reading (I ho
EF09  update access flag in FCB (D8Z
EF0E  write protected? >>EF15
EF10  no, another FCB open on this f          NEXT OBJECT ADDR: EEC6
EF13  yes, no touchie >>EEC3

EF15  storage type must be < $4
EF19  or equal to $D
EF1B  else, storage type error >>EEC
EF1D  ---                                        ype
EF1F  copy key block, blocks used, e
EF21  EOF mark to FCB (FE5A)
EF31  BLKNUM = key block number
EF36  store REFNUM in FCB (FE62)
EF3C  go check and assign I/O buffer
EF3F  error? >>EF65
EF41  go find VCB and set buff ptrs
EF44  set current level in FCB (BF94
EF4A  seedling, sapling or tree? (D8
EF4F  no, skip next stuff >>EF7C          (FE5A)
EF51  yes, make current mark in FCB
EF53  first index block to force a r
EF56  index blocks and BLOCK Ø.
EF5A  zero mark wanted, however (FE7
EF60  go set mark to zero <EC32>
EF63  ok? >>EF81
EF65  no, save the error code             pe)
EF69  got and I/O buffer? (D80B)          9)
EF6C  no >>EF74
EF6E  yes, free it <FCØE>                 ile? (FE5F)
EF74  mark FCB not in use
EF7A  exit with error
EF7B  RETURN
                                          7
                                          nd
                                          <FBB1>
                                          <E1E2>
                                          )
                                          Ø7)
                                          outside
                                          ead of all (D814)
                                          2)
```



```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: EE68
ADDR    DESCRIPTION/CONTENTS

  EE68  set unit no. from DEVNUM (BF30)
  EE6D  no errors have occurred yet
  EE72  do block I/O <DEE4>
  EE75  error? >>EE7A
  EE77  no, exit normally
  EE79  RETURN

  EE7A  else, exit with error
  EE7C  RETURN

EE7D ********* CHECKPOINT BITMAP & KEY BLOCK ************************

  EE7D  checkpoint bitmap buffer <EB76>
  EE80  go write key block for file >>EE27
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86
ADDR    DESCRIPTION/CONTENTS

  EEC7  Error -- unsupported storage t
  EECA  RETURN

  EECB  get FCB index (FE5A)
  EED1  free FCB found? >>EED7
  EED3  no, all FCB's in use error
  EED6  RETURN

  EED7  zero out unused FCB
  EEE2  copy file ID fields to FCB
  EEE5  (DEVNUM, DIR HDR BLK, DIR BLK
  EEE8  DIR ENTRY NO.)
  EEF3  isolate storage type (FE27)
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: EF7B
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  EF7C  el
  EF7F  er
  EF81  bu
  EF87  in
  EF8F  pu
  EF99  ex
  EF9A  RE

EF9B *****
        se, read key block to I/O buffer <EDF4>
  EF9B  cl  c2 ?>>EF65
  EFA6  --  p open file count in VCB (FE59)
  EFA7  fo  cate files are open in VCB (D911)
  EFAA  ye  REF NUM in caller's parmlist (FE5A)
  EFAC  no  with no errors
  EFAF  FC  RN
  EFB2  ye
  EFB4  no  *** FIND A FCB ******************************************
  EFB7  sa
  EFBA  fl  ac flags and index byte
  EFBF  an
  EFC1  --  no a free FCB yet? (FE5B)
  EFC7  co  >>EFAF
  EFCA  is  bump entry count (FE62)
  EFCD  no  in use? (D800)
  EFD3  ins >>EFC1
  EFD6  wr
  EFDB  if  e index to free FCB (FE5A)
  EFDD  el  g that we found one
  EFDE  RE  skip this FCB >>EFDF

  EFDF  re  pare file ID's to see if this FCB (D800)
  EFE3  bu  open on the requested file. (FE20)
  EFE5  an  match? >>EFDF
  EFE7  wh  icate FCB already open on file (FE5F)
  EFE8  RE  e enabled? (D809)
        no  allow multiple open access to file >>EFDF
EFE9 *****se, error exit
        RN

        urn index to start of FCB
  EFE9  pc  to next FCB
  EFEC  cc  loop >>EFA6
  EFEF  sa  done, exit normally
  EFF0  se  URN
  EFF4  re
  EFF6  ye  ************************************************************
  EFF8  nc  ******  MLI READ CALL  ******
  EFFC  wi  **************************
  EFFE  ye
        to data buffer <F1F5>
        y request length <F1DA>
        e access
        up marks <F207>
        d access permitted?
        >>EFFC
        access error
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: F001
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  F001  LENGTH = EOF - current_mark (D815)
  F019  are we already at EOF? (FEA2)
  F01C  no >>F02E
  F01E  yes, EOF error

  F023  else, zero length request? (FEA2)
  F029  no >>F02E
  F02B  yes, set mark and exit >>F0E1

  F02E  validity check data buffer <FC46>
  F031  no good? >>F020
  F033  ok, get storage type for file <F200>
  F036  standard kind of file?
  F038  yes >>F03D
  F03A  no, DIR file >>F1A3

  F03D  else, set mark (to read proper buffers) <EC32>
  F040  error? >>F020
  F042  set up buffer indexing <F0F8>
  F045  move all that can be moved out of data buff <F122>
  F048  newline or len=0: exit now! >>F02B
  F04A  newline enabled? continue block by block >>F03D
  F04C  at least 1 block's worth left to be read? (FE76)
  F050  if not, never mind >>F03D
  F052  if so, store block count wanted (FE77)
  F055  get FCB flags <F5D6>
  F058  data block modified?
  F05A  yes, continue block by block for now >>F03D

          *** FAST DIRECT READ ROUTINE ***

  F05C  signal no read occurred yet (FE7A)
  F05F  read directly into caller's data buffer
  F067  set mark/read data block to caller's buff <EC32>
  F06A  error? >>F0D5
  F06C  bump buffer pointer to next location
  F070  drop length remaining by 512 bytes (FE76)
  F076  bump mark (FE73)
  F07E  and mark's MSB as necessary (FE74)
  F081  check if we are out of index block (FE74)
  F087  drop counter of multi-blocks (FE77)
  F08A  and keep on >>F099
  F08C  end of multi-block read, put ptrs back <F195>
  F08F  more to read? (FE75)
  F095  no, exit through finish-up >>F0E1
  F097  yes, conventional block by block read then >>F03D
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: F097
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  F099  crossed index block? go do set mark >>F067
  F09B  make index block offset from mark (FE74)
  F0A4  BLKNUM = next block in index block
  F0AA  zero entry?
  F0B2  if so, no direct read can occur until next (FE7A)
  F0B5  set-mark/read >>F0BA
  F0B7  get MSB of BLKNUM
  F0BA  (put index ptr back)
  F0BE  finish setting BLKNUM MSB
  F0C0  if no read occurred within setmark, (FE7A)
  F0C3  go back to setmark call >>F067
  F0C7  disable
  F0C8  do I/O to caller's buffer directly
  F0CC  do block I/O directly <DEE4>
  F0CF  error? >>F0D4
  F0D2  go back for more >>F06C

          *** ERROR CLEANUP ***

  F0D4  ---
  F0D5  ---
  F0D6  set buffer ptrs/VCB <F195>
  F0DA  ---
  F0DB  finish up I/O <F0E1>
  F0DF  exit with error
  F0E0  RETURN

F0E1 ********* I/O FINISH UP ***************************************

  F0E1  ---
  F0E4  return actual length read in caller's list (FEA2)
  F0F5  and exit by setting new mark >>EC32

F0F8 ********* SET UP BUFFER INDEXING *******************************

  F0F8  ---
  F0FC  back up pointer to data buffer by an
  F0FE  amount equal to the LSB of the mark (FE72)
  F101  (which makes indexing easier)
  F107  newline mode enabled? (D81F)
  F10B  no, CLC >>F117
  F10D  yes, SEC
  F10E  copy newline mask (FE79)
  F111  and newline character (D80A)
  F117  first char index is LSB of mark in YREG (FE72)
  F11A  $4C/$4D --> page containing mark
  F11E  request count LSB in XREG (FE75)
  F121  exit
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: F121
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

F122 ********* COPY FROM I/O BLOCK BUFF ******************************
          ****** TO DATA BUFFER            ******
          EXITS IF:    LENGTH GOES TO ZERO
                       NEXT BLOCK IS NEEDED
                       NEWLINE IS FOUND
          ON EXIT: OVERFLOW FLAG SET IF DONE
                   OVERFLOW ZERO IF NEXT BLOCK NEEDED

  F122  ---
  F123  partial page to move? >>F12D
  F125  no, any full pages left? (FE76)
  F128  no, read complete >>F17C
  F12A  yes, drop MSB of request length (FE76)
  F12D  ---
  F12E  copy one byte $4C --> $4E
  F132  check for newline if carry set >>F165
  F134  ---
  F135  end of requested chunk >>F150
  F137  ---
  F139  more bytes to copy >>F12E
  F13B  end of page, bump pointers
  F13F  bump new mark (FE73)
  F147  finished first page of block buffer?
  F14B  if so, continue >>F12E
  F14E  no, need another block from disk  >>F17F
  F150  another page in request length? (FE76)
  F153  no >>F16F
  F156  more in this block-page? >>F15E
  F158  no, on last page of block?
  F15C  no >>F161
  F15E  yes, drop request len by one page (FE76)
  F161  back up to next byte again
  F162  go copy next page >>F137

  F165  check for newline
  F16D  not it, never mind! >>F134
  F16F  else, were we done with page?
  F170  no >>F17C
  F172  yes, bump pointer
  F174  and mark (FE73)
  F17C  set overflow flag (read completed) (F194)

  F17F  update mark LSB (FE72)
  F184  bump request count if necessary
  F185  update count LSB (FE75)
  F18B  point beyond data in caller's buffer
  F193  ---
  F194  and exit
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: F194
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

F195 ********* CLEANUP AFTER DIRECT I/O *****************************

  F195  restore caller's data buffer pointer
  F1A0  go set buffers/find VCB and exit >>E1E2

F1A3 ********* DIRECTORY FILE READ ***********************************

  F1A3  set mark/read <EC32>
  F1A6  error? >>F1D7
  F1A8  set up buffer indexing <F0F8>
  F1AB  move data from I/O buffer <F122>
  F1AE  need next block? >>F1A3
  F1B0  no, finish up I/O <F0E1>
  F1B3  ok? exit >>F1D5
  F1B5  not ok. EOF error?
  F1B8  no, out now >>F1D6
  F1BA  yes, point beyond EOF anyway? <ED79>
  F1BD  zero out data block I/O buffer <ED57>
  F1C5  dummy up an empty DIR block with previous (D810)
  F1C8  pointer and no forward pointer in I/O
  F1CA  buffer.
  F1CC  zero out current block no. (D810)
  F1D5  return to caller
  F1D6  RETURN

  F1D7  finish up and error exit >>F0DA

F1DA ********* COPY CALLER'S I/O LENGTH ******************************

  F1DA  copy request length to LENGTH and
  F1DC  a temporary variable
  F1ED  pick up ACCESS flcgs for file (FE5A)
  F1F3  exit to caller
  F1F4  RETURN

F1F5 ********* POINT $4E/$4F TO CALLER'S *****************************
          ****** DATA BUFFER               ******

  F1F5  set up pointer
  F200  YREG --> FCB (FE5A)
  F203  AREG = storage type (D807)
  F206  exit

F207 ********* COPY FILE MARK AND COMPUTE ****************************
          ****** AND COMPARE END MARK       ******
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: F207
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  F207  ---
  F20D  copy file mark (D812)
  F213  and set previous mark also (FE55)
  F216  add length giving new mark in scratch area (FEA2)
  F21D  (3 byte addition)
  F225  will new mark exceed EOF? (FE4E)
  F233  return with carry set accordingly

F234 ********* SET NEW MARK & EOF ************************************

  F234  set up indexes <F266>
  F237  set new EOF in FCB (FE52)
  F23D  and new mark (FE55)
  F243  save new mark in scratch variable too (FE4E)
  F24A  does mark exceed EOF? <F266>
  F24D  if so, we must extend EOF <F225>
  F253  save old EOF (D815)
  F25B  set new EOF to mark if necessary (FE4E)
  F261  ---
  F265  exit

  F266  subroutine to set 3 byte indexes
  F26D  RETURN

F26E *************************************************************
          ****** MLI WRITE CALL ******
          ****************************

  F26E  copy request length <F1DA>
  F272  copy file mark <F207>
  F275  extend EOF if needed <F250>
  F279  write access enabled?
  F27B  yes >>F281
  F27D  no, access error
  F281  check status of this device <F431>
  F284  error? >>F2C1
  F286  request length = 0? (FEA2)
  F28C  no  >>F291
  F28E  yes, exit through finish-up >>F0E1

  F291  find caller's data buffer <F1F5>
  F294  check storage type
  F296  if DIR file, error >>F27D
  F298  set mark/read blocks <EC32>
  F29B  error? >>F2C1
  F29D  get FCB flags <F5D6>
  F2A0  any new blocks needed?
  F2A2  no >>F306
  F2A4  yes, allocating them
  F2A6  ---
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                NEXT OBJECT ADDR: F2A7
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  F2A7  count number of blocks needed
  F2AA  store number needed (FE5C)
  F2BØ  see if the blocks are available <E959>
  F2B3  no, disk full >>F2C1
  F2B5  yes, get FCB flags <F5D6>
  F2B8  master index block needed?
  F2BA  no >>F2C9
  F2BC  yes, go add it <F381>
  F2BF  and go on if no errors >>F2D5

  F2C1  error,
  F2C2  set new mark/EOF <F234>
  F2C6  and finish I/O, exit with error >>FØDA

  F2C9  check FCB flags again <F5D6>
  F2CC  need sub-index block?
  F2CE  no >>F2D5
  F2DØ  yes, go do it <F3BD>
  F2D3  error? >>F2C1
  F2D5  buy a new block for data <F411>
  F2D8  error? >>F2C1
  F2DA  get FCB flags <F5D6>
  F2DD  indicate index buffer changed
  F2DF  no new blocks needed now
  F2E1  update FCB dlags (D8Ø8)
  F2E7  make index block offset from mark
  F2EF  store new block no. in index block (FE4F)
  F2FC  and store it as current data block (FE5A)
  F3Ø6  set up buffer indexing <FØF8>
  F3Ø9  start writing <F311>
  F3ØC  go see if more blocks are needed >>F298
  F3ØE  I/O finish up when done  >>FØE1

F311 ********* COPY WRITE DATA TO I/O BLOCK ***************************

  F311  ---
  F314  lower request count by 1 (FE76)
  F31C  ---
  F31D  copy partial page from caller's data
  F31F  to I/O block buffer
  F324  ---
  F327  next page in caller's area
  F32B  bump mark by $1ØØ (FE73)
  F333  still in same I/O block page?
  F337  yes >>F31C
  F33A  no, clear overflow (I/O incomplete) >>F361
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                NEXT OBJECT ADDR: F33A
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  F33C  any complete pages left to write? (FE76)
  F33F  no >>F351
  F341  yes, more in this page?
  F342  yes >>F34A
  F344  no, first block-page?
  F348  no >>F34D
  F34A  yes, one less complete page to do (FE76)
  F34D  readjust index
  F34E  continue with full page >>F324

  F351  ---
  F352  a few bytes left to write? >>F35E
  F354  no, bump data buffer by $1ØØ
  F356  and mark (FE73)
  F35E  set overflow (I/O complete) (F194)
  F361  store LSB of mark (FE72)
  F364  and of request count (FE75)
  F368  indicate data block modifed <F5D6>
  F36B  and DIR entry needs update
  F371  advance pointer into caller's buffer (FE72)
  F37C  set FCB flag to indicate write occurred <FA2C>
  F38Ø  exit

F381 ********* ADD NEW MASTER INDEX BLOCK ****************************
          (MAKE A TREE FILE)

  F381  add higher level <F3CA>
  F384  error? >>F3C9
  F386  get storage type <F2ØØ>
  F389  tree?
  F38B  yes >>F392
  F38D  no, add another level <F3CA>
  F39Ø  error? >>F3C9
  F392  buy another block <F411>
  F395  error? >>F3C9
  F397  maie offset into current index block (FE74)
  F39A  from current mark
  F39C  point index to new block (FE4E)
  F3AB  also save as current data block (FE5A)
  F3B5  checkpoint bitmap & key block <EE7D>
  F3B8  error >>F3C9
  F3BA  Zero out new index block >>ED45

F3BD ********* ADD NEW INDEX BLOCK ***********************************

  F3BD  check storage type <F2ØØ>
  F3C2  seedling? >>F3CA
  F3C4  no, read key index block <EE2A>
  F3C7  and go add data block >>F392
  F3C9  exit if error occurs
```

```
Number to original value

ProDOS MLI -- V1.2 -- 6
ADDR    DESCRIPTION/CON

        *** ADD A HIG

  F3CA  buy a block <F4
  F3CD  error? >>F410
  F3D2  save old key bl
  F3DA  make new block
  F3E7  and current ind
  F3F0  store pointer t
  F3F3  in first positi
  F3FA  checkpoint bitm
  F3FD  error? >>F410
  F3FF  get storage typ
  F404  upgrade it to n
  F407  indicate DIR en
  F410  exit

F411 ********* BUY A DI

  F411  allocate a disk
  F414  error? >>F430
  F416  get FCB flags <11>
  F419  indicate DIR en
  F422  add 1 to blocks
  F42F  ---
  F430  exit

F431 ********* DO STATU

  F431  get FCB flags <
  F434  any buffers in e
  F436  if so, assume i
  F438  no, (D801)
  F43B  select new devi

        *** STATUS CAS

  F43E  Save Unit Numbe
  F440  Save Block Numb
  F446  Indicate Status
  F44A  Indicate Block
  F44E  Go do I/O <DEE4
  F451   Restore Block
  F459   Exit

F471  no, active FCB
F474  no >>F486
F476  yes, flush it
F479  error? >>F4C7
F47B  no, close spec
F480  is this a clos
F482  yes, ignore er
F484  no, stop on er
F486  bump FCB index
F48C  and continue >
F48E  when all FCBs
F491  no error  >>F4
F493  error exit

        *** CLOSE SP

F494  flush it <F4FA
F497  error? >>F4C7
F499  get buffer numb
F49F  free its pages
F4A2  error? >>F4C7
F4A4  release FCB
F4AC  set DEVNUM (D8
F4B2  find VCB for d
F4B5  decrement coun
F4BB  some are open.
F4BD  if all are clo
F4C0  "files open" f
F4C5  ---
F4C6  exit

F4C7  Branch to hand

SEP 86                    NI
ENTS

ER INDEX LEVEL TO FILE **
ek number (D80C)
e key block (D80C)
x block in FCB (D80F)
old key block
n of new index
p and new key block <EE7

<F200>
xt higher type (D807)
y needs update (D808)

ock <EA9C>                XT OBJECT ADDR: F3C9

y needs update
in use for file

F NO I/O YET **********

5D6>
se? (I/O activity)
ts ok >>F42F

e (BF30)

***

er on stack

ific FCB <F499>
-all?
ors >>F486
or >>F4C7
to next one (FE5D)
F465
hecked, load error number (FE89)
5

CIFIC FILE ***

er (FE5D)
<FC11>
l)
vice <E859>
of open files in VCB (FE5C)
>>F4C5
sed, turn off (D911)
ag

e close error >>F4F7

ProDOS MLI -- V1.2 -- 6
ADDR    DESCRIPTION/CON

F45A **********

        ****** MLI CL
        **********

  F45A  check REF NUM
  F45E  specific close

        *** CLOSE ALL

  F460  no errors yet
  F465  store FCB inde
  F469  get its level
  F46C  if below syste
  F46F  yes, skip it >

SEP 86                    NEXT OBJECT ADDR: F45A
ENTS

OSE CALL ******
**********

>>F494

OPEN FILES ***

FE89)
(FE5D)
D81B)
LEVEL, skip it (BF94)
F486
(D800)
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: F4C7
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

F4C9 ************************************************************
         ****** MLI FLUSH CALL ******
         ****************************

  F4C9  flush specific file?
  F4CD  yes >>F4FA
  F4CF  no, clear flush-all error code (FE89)
  F4D2  do all FCBs
  F4D4  set FCB index for next FCB (FE5D)
  F4D8  is this file open? (D800)
  F4DB  no >>F4E2
  F4DD  yes, flush it <F4F2>
  F4E0  error? >>F4F7
  F4E2  bump to next FCB (FE5D)
  F4E8  and go flush it too >>F4D4
  F4EA  ---
  F4EB  return with error code if any (FE89)
  F4F1  RETURN

F4F2 ********** FLUSH A FILE & UPDATE DIRECTORY **********************

  F4F2  find buffer/VCB <E1E2>
  F4F5  no error? >>F504
  F4F7  go handle close error >>F5C7

  F4FA  zero out close-all error
  F4FF  validity check REF NUM <E1C7>
  F502  error? >>F4F7
  F504  is write access allowed? (D809)
  F509  no, exit >>F4EA
  F50B  has a write occured since last flush? (D81C)
  F50E  yes >>F517
  F510  no, <F5D6>
  F513  does anything need flushing anyway?
  F515  no, then exit now >>F4EA
  F517  else, get FCB flags <F5D6>
  F51A  has data buffer changed?
  F51C  no >>F523
  F51E  yes, checkpoint it <EE83>
  F521  error? >>F4F7
  F523  get flags again <F5D6>
  F526  has index buffer changed?
  F528  nm >>F52F
  F52A  yes, checkpoint it <EE97>
  F52D  error? >>F4F7
  F52F  ---
  F536  copy file identifier data to my variables (D800)
  F540  set DEVNUM (BF30)
  F543  BLKNUM = current DIR block (FE25)
  F549  read DIR block <EBC9>
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: F54C
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  F54C  error? >>F4F7
  F54E  copy directory header <E695>
  F551  are we in block with this file's entry? (FE27)
  F55A  no >>F561
  F55F  yes >>F568
  F561  no, set new block number
  F565  read it <EBD9>
  F568  point at directory entry in block <E499>
  F56B  copy file entry from directory <E598>
  F571  copy blocks_used count to entry (D818)
  F57F  copy new EOF (D815)
  F58A  and new key block no. (D80C)
  F593  isolate new storage type (D805)
  F59D  combine it with name length (FE2A)
  F5A5  and update type/len field in entry (FE2A)
  F5A8  write entry back to directory <E4B2>
  F5AB  error? >>F5C7
  F5B0  turn off "write occurred" flag (D81C)
  F5B8  same bitmap in memory (FE24)
  F5BE  no, exit now >>F5C5
  F5C0  yes, checkpoint it also <EB76>
  F5C5  no errors, exit
  F5C6  RETURN

F5C7 ********** CLOSE ERROR ***************************************

  F5C7  is this a close or flush all?
  F5CC  no >>F5D4
  F5D0  yes, save error code (FE89)
  F5D3  RETURN

  F5D4  else, real error right now
  F5D5  RETURN

F5D6 ********** GET FCB FLAGS ************************************

  F5D6  load FCB flags (FE5D)
  F5D9  from FCB (D808)
  F5DC  and exit

F5DD ********** FILE ACCESS ERROR ********************************

  F5DD  exit with file access error code
  F5E0  RETURN

F5E1 ************************************************************
         ****** MLI SET_EOF CALL ******
         ******************************
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: F5E1
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------


  F5E1  get storage type <F200>
  F5E4  if DIR file...
  F5E6  its an access error >>F5DD
  F5E8  else, save type for truncate to
  F5E9  mess with.
  F5EF  write access permitted? (D809)
  F5F4  no, error >>F5DD
  F5F6  check device status <F431>
  F5F9  error? >>F5DD
  F602  copy EOF from FCB (D815)
  F610  copy caller's new EOF
  F61B  compare old EOF to new (FE55)
  F621  if less than or equal to... >>F628
  F623  if greater... >>F63D

          *** OLD EOF <= NEW EOF ***
          *** NO TRUNCATE NEEDED ***

  F628  new eof beyond old
  F62F  copy caller's EOF to FCB
  F63A  exit by indicating flush needed >>FA2C

          *** OLD EOF > NEW EOF ***
          *** TRUNCATE FILE     ***

  F63D  flush first <F4FA>
  F640  error? >>F5E0
  F642  $43/$49 --> end of data block I/O buffer
  F64C  compare current mark to new EOF (FE5D)
  F659  it is prior to EOF >>F672
  F661  if past EOF, force mark back to EOF (FE5D)
  F672  construct EOF block number and (FE75)
  F675  byte offset into block from new (FE91)
  F678  EOF mark. (FE76)
  F690  on a block boundary? (FE92)
  F693  yes >>F6B2
  F695  no, (FE90)
  F699  decrement block by 1
  F6A7  but don't let it fall below 0
  F6B2  copy key block number (FE5D)
  F6C1  set blocks freed to zero
  F6C9  truncate file at new EOF <FA3E>
  F6CC  save status
  F6D4  set new key block in FCB (FE8A)
  F6DA  drop FCB block count by number (D818)
  F6DD  of blocks freed in truncate routine.  (FE8D)
  F6EA  copy new storage type (FE8C)
  F6F7  turn off all block allocation flags <ED9F>
  F6FA  update VCB free block count <F9BD>
  F704  copy mark (D812)
```

```
ProDOS ML
---------I
ADDR    D
---------ES
                                                  NEXT OBJECT ADDR: F70C
-------------------------------------------------------------------------
  F70C  f -- V1.2 -- 6 SEP 86
  F713  g ---------------------
  F716  n CRIPTION/CONTENTS          lity (D812)
  F718  i ---------------------
  F71E  b
  F71F  c e current mark to infi status
  F722  F set mark <EC32>
  F725  n errors? >>F71F          628>
  F727  i error, indicate in save
  F72D  b continue
  F72E  - y caller's EOF to FCB <d status
  F730  e sh and update <F4FA>
        * errors? >>F72E
F731 ***** error, indicate in save
        * continue
        *                                  ************************************
        *c                                  ******
        *                                   ******
  F731  -- ************************
  F736  co ***** MLI GET_EOF CALL
  F742  ex ************************ D815)
        i
F743 *****
        *
        *y EOF to caller's list  ************************************
        *t -- no errors           ******
        *                         ******
  F743  -- ************************
  F745  co ***** MLI NEW_LINE CALL
  F74E  an ************************
  F754  re
        *
F755 *****
        *y newline mask
        * newline character      ************************************
        *rn, no errors           CALL ******
        *                        ************
  F755  ge ************************
  F758  ok ***** MLI GET_FILE_INFO
  F75A  no ************************
  F75D  no
  F75F  el
  F761  wi the file entry <E593>
  F766  no >>F79C
  F76C  go bad path?
  F76F  VC real error >>F7B9
  F775  co , make it VOL DIR type pdate the (FE5C)
  F781  co name length = 0 (FE2A)
  F78F  to free blocks needed (FE5 915)
  F79C  sh through the motions to to AUX_ID (D913)
  F7A8  co block count. <E964>     (FE5F)
  F7B9  an blocks free from VCB ible (FE2A)
        d total blocks on volume rmlist (FDD7)
        - free = blocks_used
        t type down from high
        the data to caller's
        exit
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: F7B9
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

F7BA ************************************************************
         ****** MLI SET FILE INFO CALL ******
         ************************************

  F7BA  get the file entry <E593>
  F7BD  error? >>F7E4
  F7BF  indicate backup needed now (BF95)
  F7CE  copy 13 parms from caller's list to (FDD7)
  F7D1  file entry staging area >>F7D8
  F7D8  ---
  F7DD  if any spurious access bits are on...
  F7E1  access error!
  F7E4  RETURN

  F7E5  else, anything in his modification date?
  F7E9  no >>F7EE
  F7EB  yes, go update directory >>E4C2

  F7EE  no, use system date then update directory >>E4B2

F7F1 ************************************************************
         ****** MLI RENAME CALL ******
         ****************************

  F7F1  follow path to file <E5A6>
  F7F4  ok? >>F833
  F7F6  no, bad name?
  F7F8  no, real error >>F812

         *** RENAME VOLUME ***

  F7FA  yes, copy new name <F917>
  F7FD  error? >>F812
  F7FF  get first length (D700)
  F803  get next (D700)
  F806  bad path if more than one name for vol  >>F887
  F80B  files open on volume? (D911)
  F80E  no, continue >>F814
  F810  yes, file open error
  F812  ---
  F813  RETURN

  F814  make type/len for a VOL DIR HDR
  F81B  write new name to VOL HDR <F908>
  F81E  error? >>F889
  F825  copy new name to device's VCB (D700)
  F831  exit, no errors
  F832  RETURN
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: F832
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

         *** RENAME FILE ***

  F833  get path index <F925>
  F836  copy old name with prefix to my buffer (D700)
  F842  copy new name to buffer <F917>
  F845  error? >>F889
  F847  get path index <F925>
  F84D  compare all levels of names up to and (DC00)
  F850  including the last. Find first which
  F851  differ.
  F855  save indicies into names which point to (FE84)
  F858  final name. (FE85)
  F85B  ---
  F865  exit if they match completely
  F866  RETURN

  F867  index to differing new name (FE84)
  F86A  point past it (D700)
  F872  must be the last! (D700)
  F875  it isn't >>F887
  F877  it is, (FE85)
  F87A  do the same with the old name  (DC00)
  F885  difference is only in last index? >>F88B
  F887  no, bad path error
  F889  ---
  F88A  RETURN

  F88B  names good. follow path to new file <E5A6>
  F88E  better get an error >>F894
  F890  if found, duplicate name in directory
  F893  RETURN

  F894  if error, better be file not found
  F896  or else its really an error... >>F889
  F898  copy old pathname again <E081>
  F89B  get its file entry <E593>
  F89E  error? >>F889
  F8A0  search FCB's <EF9B>
  F8A5  exit if the file is open for write >>F889
  F8AA  does ACCESS permit rename?
  F8AC  yes >>F8B2
  F8AE  no, access error
  F8B0  ---
  F8B1  RETURN

  F8B2  get type/len from entry (FE2A)
  F8B7  DIR file?
  F8B9  yes, ok >>F8C3
  F8BB  seedling, sapling or tree?
  F8BD  yes, ok >>F8C3
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: F8BF
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  F8BF  else, compatibility error
  F8C3  copy new path again <F917>
  F8C6  error? >>F889
  F8C8  get length of last name (FE84)
  F8D3  copy it and name to file entry buffer (D700)
  F8E3  combine new len with type (D700)
  F8E9  DIR file?
  F8EB  no, go update entry and exit >>F905
  F8ED  yes, (FE3B)
  F8F3  read key block of this subdirectory  <EBC9>
  F8F6  error? >>F889
  F8FB  copy new name to DIR HDR (D700)
  F900  and update directory's key block <F908>
  F903  error? >>F889
  F905  go update directory entry and exit >>E4C2

F908 ********* COPY PATH TO BUFF & WRITE *****************************

  F908  copy type/len and path to my buffer
  F914  go write the block >>EBD5

F917 ********* POINT TO NEW NAME *************************************
         COPY TO BUFFER

  F917  $48/$49 --> second pathname
  F922  go copy it >>E08C

F925 ********* LOAD PATH INDEX ***************************************

  F925  load pathname index
  F92C  (including prefix if any) (BF9A)
  F92F  ---
  F931  RETURN

F932 *************************************************************
         ****** MLI DESTROY CALL ******
         ******************************

  F932  get file entry <E593>
  F935  error? >>F97E
  F937  find FCB if any <EF9B>
  F93A  FCB open? (FE62)
  F93D  yes, file open error >>F97C
  F93F  no free blocks needed
  F947  go compute VCB free block count <E959>
  F94A  ok? >>F950
  F94C  error, disk full?
  F94E  no, real error >>F97E
  F950  DESTROY enabled in ACCESS? (FE48)
  F955  yes >>F95C
  F957  no, access error
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: F95C
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  F95C  check status of device  (BF30)
  F962  error? >>F97E
  F964  point to key block (FE3B)
  F973  DIR file?
  F977  no >>F980
  F979  yes, handle differently >>F9D8

  F97C  File open error
  F97E  ---
  F97F  RETURN

          *** DESTROY NON-DIRECTORY FILE ***

  F980  save the storage type (FE8C)
  F987  set EOF to zero (FE8C)
  F98D  byte offset = $200
  F992  "truncate" the file at EOF=0 <FA3E>
  F995  if error >>F97E
  F997  free the key block in volume bitmap (FE8B)
  F9A0  error >>F97E
  F9A2  mark the file as deleted in DIR
  F9A7  decrement file count in DIR (FE1E)
  F9B2  checkpoint volume bit map <EB76>
  F9B5  error >>F97E
  F9B7  update free block count in VCB <F9BD>
  F9BA  and go update the directory >>E4B2

          *** SUBROUTINE TO UPDATE FREE BLOCK ***
          *** COUNT IN VCB                    ***

  F9BD  add blocks freed to total free blocks (FE5C)
  F9C0  in VCB. (FE8D)
  F9D2  start next search for free blocks at
  F9D4  start of bitmap. (D91C)
  F9D7  exit

          *** DESTROY DIRECTORY FILE ***

  F9D8  DIR file?
  F9DA  no, error >>FA27
  F9DC  read volume bitmap block <EB43>
  F9DF  error? >>FA26
  F9E1  BLKNUM = key block pointer (FE3B)
  F9EB  read it <EBD9>
  F9EE  errors? >>FA26
  F9F0  if DIR has any files... (DC25)
  F9FA  access error
  F9FF  write back block marking entry free (DC04)
  FA05  error? >>FA26
  FA07  if "next_pointer" is zero.... (DC02)
  FA11  go back and pretend it's a seedling >>F997
```

```
 -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: FA92
------------------------------------------------------------
SCRIPTION/CONTENTS
------------------------------------------------------------

-
date master index counter (FE93)
r all 8 entries: (FE94)
set BLKNUM, (FE95)
(exit when a Ø entry is found), >>FA5D
read the sub-index block, <EBD9>
(quit if error), >>FABD
zero all its blocks, <FB7D>
(quit if error), >>FABD
and loop until all 8 are done. >>FA98
en go back and reread master index >>FA5D
rmal exit
TURN

w go free all the sub-index blocks (FE8F)
ich follow EOF <FB7F>
 error >>FABD
ite back master index <EBD5>
 error >>FABD
F in first subindex? (FE8F)
 so, demote to sapling file >>FAE6
se, BLKNUM = subindex block which (DCØØ)
ntains the EOF mark
xit if none there) >>FABC
se, read the final subindex block <EBD9>
d treat it as a sapling file >>FAFØ
less there is an error.

mote tree to sapling <FB5B>
 error >>FABD

*** TRUNCATE SAPLING FILE ***

ad index block <FB4F>
 error >>FABD
dex of last block in the file (FE9Ø)
d one to point past end of file
 zero, no blocks to free >>FBØØ
ro blocks past EOF <FB7F>
 error >>FABD
ite back modified index block <EBD5>
 error >>FABD
dex of last block in file (FE9Ø)
is index block is empty! >>FB1A
t BLKNUM of last data block (DCØØ)
o block allocated?) >>FABC
ad in last data block <EBD9>
d treat it as a seedling file >>FB29
less error occurred.
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: FB9F
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FB1A  more index blocks (tree file)? (FE8F)
  FB1D  yes, must be tree file >>FB05
  FB1F  no, demote to seedling <FB5B>
  FB22  if error >>FB4E

        *** TRUNCATE SEEDLING FILE ***

  FB24  read key block <FB4F>
  FB27  error? >>FB4E
  FB29  EOF in first page?   (FE92)
  FB2C  yes >>FB34
  FB2E  EOF in second page?
  FB2F  no, exactly 256 bytes >>FB4D
  FB31  get byte offset (FE91)
  FB34  ---
  FB36  zero bytes in second page  (DD00)
  FB3C  EOF in first page? (FE92)
  FB3F  no, we're done. >>FB4A
  FB41  yes, zero bytes in first page, too (FE91)
  FB4A  then write block back and exit >>EBD5

  FB4D  exit normally
  FB4E  RETURN

FB4F ********** READ INDEX BLOCK ************************

  FB4F  Put index block number in A,X (FE8A)
  FB55  Go read the block >>EBC9

FB5B ********** DEMOTE FILE TO SMALLER FILE TYPE*********

  FB5B  get high byte of index block (FE8B)
  FB5E  and low byte (FE8A)
  FB61  free the index block in the volume bitmap <EA1A>
  FB64  if error >>FB7C
  FB66  Establish first block of old index block (DC00)
  FB69  as new index block. (FE8A)
  FB73  reduce storage type by one (FE8C)
  FB7B  and exit
  FB7C  RETURN

FB7D ********** FREE ALL BLOCKS IN AN INDEX BLK *********

  FB7D  ---
  FB7F  save BLKNUM
  FB85  Save Y-register (index within block) (FE68)
  FB90  if it is non-zero....
  FB97  free the block in the volume bitmap <EA1A>
  FB9A  if error >>FBAB
  FB9C  Restore index to Y-reg (FE68)
  FB9F  zero this entry
  FBA7  ---
  FBA8  loop through all ent
  FBAB  save error message,
  FBAD  restore old BLKNUM
  FBB3  and exit                    ies  >>FB85
                                    f any
FBB4 ********** ALLOCATE I/O

  FBB4  ---
  FBB6  get I/O buffer page  FFER ***********************************
  FBB9  can't be below $800
  FBBB  else, error >>FBFF          ber
  FBBD  can't be above $BC00
  FBBF  else, error >>FBFF
  FBC4  $4A/$4B --> I/O buff
  FBC8  must be page aligned
  FBCE  ---
  FBCF  check each page of I
  FBD2  prior allocation in         >>FBFF
  FBDF  ---
  FBE0  if ok, mark each page       O buffer for <FC3A>
  FBE3  in system memory bit        ystem bit map (BF58)
  FBF0  assign buffer number
  FBF8  and save buffer locat       as allocated <FC3A>
  FBFD  exit                        p (BF58)
  FBFE  RETURN                      (REFNUM*2) in FCB (D800)
                                    ion in buffer list
  FBFF  bad I/O buffer error
  FC02  RETURN

FC03 ********** LOCATE I/O BU

  FC03  ---
  FC04  AREG contains buffer  FFER ***********************************
  FC07  move buffer pointer t
  FC10  exit                        number *2 (BF6E)
                                    NXTBUF variable (FEA8)
FC11 ********** FREE I/O BUFF

  FC11  is buffer already fre
  FC16  yes, exit >>FC38            ER ***********************************
  FC1A  zero its address in s
  FC27  ---                         e? <FC03>
  FC28  free each page in buf
  FC2B  by marking system bi        stem global page (BF6F)
  FC38  exit
  FC39  RETURN                      fer <FC3A>
                                     map
```

```
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------

FC3A ********** LOCATE BIT MAP POSITION ***********
        (GIVEN PAGE NUMBER)

  FC3A  XREG contains page number
  FC3B  compute page number times 8
  FC3E  use as offset for bitmask (FDCB)
  FC45  page number / 8 = byte offset
  FC46  into bitmap
  FC48  exit

FC49 ********** CHECK BUFFER VALIDITY **************
                START > $200    END < $BF00

  FC49  get buffer address (MSB)
  FC4D  must be >$200 else error >>FBFF
  FC4F  get length (FEA6)
  FC55  compute last page no. of buffer
  FC5A  ---
  FC61  may not extend into $BF00
  FC63  else, error >>FBFF

        *** CHECK IF BLOCK OF MEMORY IS FREE ***

  FC66  ---
  FC67  see if this page is allocated <FC3A>
  FC6D  if so, error >>FBFF
  FC6F  else, check other paee also
  FC73  then exit if both have been checked
  FC74  RETURN

FC75 ***********************************************
        ****** MLI GET_BUFF CALL ******
        ******************************

  FC75  get next available buffer
  FC7A  put its address in caller's parmlist
  FC82  and exit
  FC83  RETURN

FC84 ***********************************************
        ****** MLI SET_BUFF CALL ******
        ******************************

  FC84  mark his buffer allocated
  FC89  error? >>FCAB
  FC8B  get old buffer address (FEA9)
  FC95  free old buffer's pages in map <FC20>
  FC9C  copy old buffer contents
  FC9E  to new buffer
  FCAA  then exit
```



```
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------

  FCAB  RETURN

FCAC ********** GO TO QUIT CODE HANDLER ***************************

  FCAC  enable 2nd 4K bank of language card (C083)
  FCAF  (Quit code lives at $D100-$D3FF) (C083)
  FCB4  Get first four bytes of page 0,  (0000)
  FCB7  save them on the stack
  FCBB  Set ($00) -> $D100
  FCBD  Set ($02) -> $1000
  FCC9  Set Y = 0
  FCCA  3 pages of code to copy
  FCCC  ---
  FCCD  copy quit code handler to $1000
        The next five lines of code were added for this version (1.2).
        Fortunately they did not survive the next version (1.3).
        Let's hope that whoever wrote this "fancy" code
        is now working for Commodore.
  FCDD  pull 4 saved bytes off stack
  FCDE  and restore them to page 0 (FF04)
  FCE4  enable HIGH RAM BANK1 (C08B)
  FCE7  (MLI) (C08B)
  FCEC  point RESET vector at $1000 (03F2)
  FCF4  set power-up byte properly
  FCF9  go to quit code handler at $1000 >>1000

FCFC ********** ACCESS RAM-BASED DEVICE DRIVER ************************
                This (undocumented?) routine allows a device driver
                to reside in BANK2 of auxiliary high RAM (they normally
                reside in slot ROM).  When the device driver is set up,
                the address of this routine, which may be found at $3EA,
                becomes the address of the device driver.  Bytes $3E4 and $3E5
                are changed to the address of the real driver in aux high RAM.
                This routine must call the page 3 routine at $3D6
                because the MLI is in main high RAM and will be
                swapped out.  The page 3 routine calls the real driver
                and returns here with the error code, if any.

  FCFC  Get current P-reg in accumulator,
  FCFE  then save it on the stack
  FCFF  clear overflow flag
  FD00  interrupts disabled?
  FD02  no >>FD07
  FD04  yes, set overflow flag (FD25)
  FD07  disable interrupts
  FD08  enable RAM, BANK2 (C083)
  FD0E  set carry, indicating error
  FD0F  indicate 6 bytes to move to aux z-page
  FD11  Call real driver thru page 3 routine <03D6>
  FD14  store error number (BF0F)
  FD17  enable RAM, BANK1 (C08B)
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: FD1D
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FD1D  restore original P-reg
  FD1F  if error number is zero, (BF00)
  FD22  then indicate no error; >>FD25
  FD24  otherwise indicate error
  FD25  RETURN

FD26 ********** INSTALL A SPECIAL IRQ HANDLER ************************
          This routine calls a subroutine located
          at $D400 in BANK2 of high RAM.  It is called when
          an MLI command $42 is executed.  Its purpose
          is to install a routine that handles unclaimed
          interrupts.  Apparently the user has to
          provide the routine at $D400.

  FD26  Switch to BANK2 of high RAM, (C083)
  FD29  execute the program there, <D400>
  FD2C  then back to BANK1 (C08B)
  FD2F   and return.

FD30 ****************************************************************
          *       DATA AREA                 *
          ***********************************

FD30 ********** MLI COMMAND TABLE ************************************
          IN HASH CODE ORDER: IF COMMAND IS...
          ABCD EFGH (IN BINARY BITS)
          INDEX IS COMPUTED AS:
             000D EFGH
            +0000 ABCD

  FD30  GET BUF
  FD31  UNUSED
  FD32  UNUSED
  FD33  UNUSED
  FD34  ALLOC INTERRUPT
  FD35  DEALLOC INTERRUPT
  FD37  UNUSED
  FD38  READ BLOCK
  FD39  WRITE BLOCK
  FD3A  GET TIME
  FD3B  EXIT
  FD3C  CREATE
  FD3D  DESTROY
  FD3E  RENAME
  FD3F  SET FILE INFO
  FD40  GET FILE INFO
  FD41  ON LINE
  FD42  SET PREFIX
  FD43  GET PREFIX
  FD44  OPEN
  FD45  NEWLINE
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: FD46
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FD46  READ
  FD47  WRITE
  FD48  CLOSE
  FD49  FLUSH
  FD4A  SET MARK
  FD4B  GET MARK
  FD4C  UNUSED
  FD4D  SET EOF
  FD4E  GET EOF
  FD4F  SET BUF

FD50 ********** PARAMETER COUNT TABLE *********************************

  FD50  GET BUF
  FD51  UNUSED
  FD52  UNUSED
  FD53  UNUSED
  FD54  ALLOC INTERRUPT
  FD55  DEALLOC INTERRUPT
  FD57  UNUSED
  FD58  READ BLOCK
  FD59  WRITE BLOCK
  FD5A  GET TIME
  FD5B  EXIT
  FD5C  CREATE
  FD5D  DESTROY
  FD5E  RENAME
  FD5F  SET FILE INFO
  FD60  GET FILE INFO
  FD61  ON LINE
  FD62  SET PREFIX
  FD63  GET PREFIX
  FD64  OPEN
  FD65  NEWLINE
  FD66  READ
  FD67  WRITE
  FD68  CLOSE
  FD69  FLUSH
  FD6A  SET MARK
  FD6B  GET MARK
  FD6C  UNUSED
  FD6D  SET EOF
  FD6E  GET EOF
  FD6F  SET BUF

FD70 ********** MLI COMMAND ADDRESS TABLE *****************************
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: FD70
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------


  FD70  CREATE
  FD72  DESTROY
  FD74  RENAME
  FD76  SET FILE INFO
  FD78  GET FILE INFO
  FD7A  ON LINE
  FD7C  SET PREFIX
  FD7E  GET PREFIX
  FD80  OPEN
  FD82  NEWLINE
  FD84  READ
  FD86  WRITE
  FD88  CLOSE
  FD8A  FLUSH
  FD8C  SET MARK
  FD8E  GET MARK
  FD90  SET EOF
  FD92  GET EOF
  FD94  SET BUF
  FD96  GET BUF

FD98 ********** MLI COMMAND INFO BYTE *********************************

          PATHNAME FLAG
          | REFERENCE NUMBER FLAG
          | | DATETIME STAMP FLAG
          | | |      COMMAND NUMBER
          | | |      |
  FD98    1 0 1  - 00
  FD99    1 0 1  - 01
  FD9A    1 0 1  - 02
  FD9B    1 0 1  - 03
  FD9C    1 0 0  - 04
  FD9D    0 0 0  - 05
  FD9E    0 0 0  - 06
  FD9F    0 0 0  - 07
  FDA0    1 0 0  - 08
  FDA1    0 1 0  - 09
  FDA2    0 1 0  - 0A
  FDA3    0 1 0  - 0B
  FDA4    0 0 1  - 0C
  FDA5    0 0 1  - 0D
  FDA6    0 1 0  - 0E
  FDA7    0 1 0  - 0F
  FDA8    0 1 0  - 10
  FDA9    0 1 0  - 11
  FDAA    0 1 0  - 12
  FDAB    0 1 0  - 13
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: FDAB
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

FDAC ********** CONSTANTS - DATA AREA *********************************

  FDAC  Blocks Used
  FDAE  End of File
  FDB1  Special ID (Mus
  FDB2  'HUSTON!'                t be 5 bits on)
  FDB9  Previous Block  Author's name
          ---           of Vol Dir Key Block
          THE FOLLOWING
  FDBB  Version of ProD IS COPIED TO SUBDIR HDR+$20
  FDBC  Minimum Version OS
  FDBD  Access Byte     D
  FDBE  Entry Length    |Rn|B|000|W|R)
  FDBF  Entries per Blo
  FDC0  File Count      ck
  FDC2  Parent LSB (cop
          ---           ied to SUBDIR HDR +$20)
  FDC3  File Type  (Dir
  FDC4  Block Number    ectory)
  FDC6  Number of Block
  FDC8  End of File     s

FDCB ********** BITMASK TABLE ***************************************

  FDCB  10000000
  FDCC  01000000
  FDCD  00100000
  FDCE  00010000
  FDCF  00001000
  FDD0  00000100
  FDD1  00000010
  FDD2  00000001

FDD3 ********** OFFSETS INTO FILE CONTROL BLOCKS **********************
FDD3 ***(FCB's are at $D800-$D8FF)**********************************

  FDD3  Key Block

  FDD5  # Blocks Used

  FDD7  End of File

FDDA ********** SET/GET FILE_INFO OFFSETS *****************************

  FDDA  Access
  FDDB  File Type
  FDDC  Aux Type
  FDDE  Storage Type
  FDDF  Blocks Used (MS
                    SB on means GET only no SET
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: FDE0
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FDE1  Datetime (Last Mod)

  FDE5  Datetime (Creation)

FDE9 ********** FATAL ERROR MESSAGE ***********************************

  FDE9  ' INSERT SYSTEM DISK AND RESTART  -ERR 0 '

  FE11  ---

FE11 ********** VARIABLES - DATA AREA *********************************

  FE11  Parent Pointer Block
  FE13  Parent Entry Number
  FE14  Parent Entry Length
  FE15  Datetime (Creation)
  FE19  Version
  FE1A  Min Version
  FE1B  Access Byte
  FE1C  Entry Length
  FE1D  Entries per Block
  FE1E  File Count
  FE20  Bit Map Pointer
  FE22  Total Blocks
          THE FOLLOWING 6 BYTES UNIQUELY IDENTIFY
          A FILE:
  FE24  Device Number
  FE25  Current Directory Block Number (HDR)
  FE27  Block Number of File Entry in Directory
  FE29  File Entry Number in Directory

FE2A ********** FILE ENTRY BUFFER **************************************

  FE2A  Type/Length  (TTTTLLLL)
  FE2B  File Name (Max 15) >>000F
  FE3A  File Type
  FE3B  Key Pointer
  FE3D  Blocks Used
  FE3F  End of File
  FE42  Datetime (Creation)
  FE46  Version
  FE47  Min Version
  FE48  Access Attribute
  FE49  Aux Type (Load Address/Record Length)
  FE4B  Datetime (Last Mod)
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: FE4D
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FE4F  Header Pointer

FE51 ********** Variable Work Area **************************************

  FE51  3 Byte Scratch

  FE54  ---

  FE55  End of File

  FE58  Previous Mark

  FE5B  Compare Vol Name Scratch
  FE5C  Offset into VCB Table ($D900)
  FE5D  Offset into FCB Table ($D800)
  FE5E  Free FCB found Flag

  FE5F  Number of Free Blocks needed

  FE61  Storage Type
          Number of Entries Examined or..
  FE62  FCB already open flag
  FE63  File Count

  FE65  Entries/Block Loop Count/Free FCB's refnum
          Free Entry Found Flag (if > 0) or..
          # of 1st bitmap block with free bit on or..
  FE66  bit for free
  FE67  # Blocks in Bitmap left to search
  FE68  Y Register temp
  FE69  Pathname Length
  FE6A  Devnum for Prefix Directory Header
  FE6B  Block of Prefix Directory Header
  FE6D  Bitmap Byte Offset in Page
  FE6E  Bitmap Page Offset
  FE6F  Bitmap Buffer Page (0 or 1)
  FE70  Bitmap Flag (if $80, needs writing)
  FE71  Bitmap DEVNUM
  FE72  Bitmap Block Number
  FE74  Bitmap Block offset for Multiblock Bitmaps

          New Mark to be Positioned to for Set Mark
          or New Moving Mark (for READ)
  FE75  or New EOF for SET_EOF

  FE78  Request Count (Read/Write etc.)
  FE7A  Multi-Block I/O count
  FE7B  Newline character
  FE7C  Newline mask
  FE7D  I/O Transfer occurred flag
```

```
ProDOS MLI -- V1.2 -- 6 SEP 86                    NEXT OBJECT ADDR: FE7E
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FE7E  MLI Command * 2
  FE7F  ORed into Access Flags ($2Ø - Backup)
  FE8Ø  Duplicate Volume Flag (if $FF)
  FE81  Duplicate Volume's VCB index
  FE82  MLI function code (low 5 bits)
          Characters in current Pathname indx lvl or
  FE83  ONLINE: volname len - loop index
  FE84  new pathname: index to last name
          old pathname: index to last name or..
  FE85  ONLINE: index to data buffer
  FE86  Old PFIXPTR value
  FE87  Pathname fully qualified flag (if $FF)
          Pathname: temp save area for index or..
  FE88  ONLINE: DEVCNT
  FE89  close-all error code
  FE8A  Set EOF: new Key Block pointer
  FE8C  New storage type (SET_EOF)
  FE8D  Freed Blocks count
  FE8F  EOF Block number (MSB then LSB)
  FE91  EOF byte offset into Block
  FE93  EOF - Master index counter
  FE94  Save area for index into table below

FE95 ********** DEVICE TABLE BUILT BY ONLINE **************************
          (also used by SET_EOF to keep track of
          8 blocks to be freed at a time)

  FE95  device table part one
  FE9D  device table part two

  FEA5  length of path, etc.
  FEA8  next buffer address
  FEAA  16 byte stack save area
  FEBA  6 byte zero page save area
  FECØ  Jump Vector, used for indirect jumps

FEC2 *********** $FEBF-$FEFF NOT USED *********************************
  FEC2  not used
```

```
ADDR    DESCRIPTION/CONTENTS
--------------------------------------------------------------------------------

MODULE STARTING ADDRESS

*****************************************
*                                       *
*   PRODOS MACHINE LANGUAGE INTERFACE   *
*                                       *
*     VERSION 1.3 -- 2 DEC 86           *
*                                       *
*****************************************

THE 1.3 VERSION OF THE PRODOS 8 MLI IS THE SAME
AS VERSION 1.2, INSTRUCTION FOR INSTRUCTION,
FROM THE START ($DE00) TO ADDRESS $F992.  SOME
BYTES BEFORE $F992 CHANGE BECAUSE THEY REFER TO
ADDRESSES GREATER THAN $F992.

ONLY THE PART OF THE MLI FROM $F980 TO $FEFF IS
DOCUMENTED HERE FOR VERSION 1.3.  REFER TO THE
1.2 VERSION FOR THE FIRST PART OF THE MLI.


*** DESTROY NON-DIRECTORY FILE ***

ve the storage type (FEB5)
 EOF to zero  (FEB5)
te offset = $200
rn on destroy flag  (FEEB)
uncate" the file at EOF=0 <FA44>
n off the destroy flag (FEEB)
or during truncation >>F97E
ee the key block in volume bitmap <EA1A>
or >>F97E
k the file as deleted in DIR
crement file count in DIR (FE47)
eckpoint volume bit map <EB76>
or >>F97E
ate free block count in VCB <F9C3>
o update the directory >>E4B2

*** SUBROUTINE TO UPDATE FREE BLOCK ***
    COUNT IN VOLUME CONTROL BLOCK   ***
locks freed to total free blocks (FE85)
VCB. (FEB6)
t next search for free blocks at
art of bitmap. (D91C)
```

F980 --

```
F980  se
F987  se
F98D  by
F992  t
F995  "t
F998  t
F99B  e
F9A3  f
F9A6  e
F9A8  m
F9AD  d
F9B8  c
F9BB  e
F9BD  u
F9C0  a


F9C3  a
F9C6  i
F9D8  s
F9DA  s
F9DD  e
```



```
ADDR    DESCRIPTION/CONTENTS
--------------------------------------------------------------------------------

        *** DESTROY DIRECTORY FILE ***

  F9DE  DIR file?
  F9E0  no, error >>FA2D
  F9E2  read volume bitmap block <EB43>
  F9E5  error? >>FA2C
  F9E7  BLKNUM = key block pointer (FE64)
  F9F1  read it <EBD9>
  F9F4  errors? >>FA2C
  F9F6  if DIR has any files... (DC25)
  FA00  access error
  FA05  write back block marking entry free (DC04)
  FA0B  error? >>FA2C
  FA0D  if "next_pointer" is zero.... (DC02)
  FA17  go back and pretend it's a seedling >>F99D
  FA19  else, (DC03)
  FA1C  free next block  <EA1A>
  FA1F  error? >>FA2C
  FA21  BLKNUM = next block (DC02)
  FA27  read it <EBC9>
  FA2A  if ok, continue in loop >>FA0D
  FA2C  else, error exit

  FA2D  incompatible file format error

FA32 ********* SET WRITE OCCURRED FLAG ******************************

  FA32  save some registers
  FA35  indicate write occurred (FE86)
  FA40  restore registers and exit
  FA43  RETURN

FA44 ********** TRUNCATE FILE AT EOF *********************************

  FA44  check storage type*16 (FEB5)
  FA47  seedling?
  FA49  yes >>FA58
  FA4B  no, sapling?
  FA4D  yes >>FA5B
  FA4F  no, tree?
  FA51  yes >>FA5E
  FA53  General error--wrong storage type
  FA55  jump to system death <BF0C>

  FA58  go to seedling truncate >>FB2F
```

```
ProDOS MLI -- V1.3 -- 2 DEC                                NEXT OBJECT ADDR: FA58
-------------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------------

  FA5B  go to sapling trunc
  FA5E  truncate tree,
  FA60  at most 128 blocks
  FA63  read the master ind
  FA66  error? >>FAC8
  FA68  at EOF yet? (FEBC)                    dex (FEBC)
  FA6E  yes >>FAC9

          *** FREE WHOLE    ate >>FAF6
          (free 8 subindex
          master index bloc
          share its buffer  n master
                            x <FB5A>
  FA70  copy up to 8 non-ze
  FA72  numbers to (DC00)
  FA75  a handy table (FEBE
  FA86  ---
  FA8F  if there weren't 8  DEX BLOCKS A
  FA92  remainder of the t  blocks each
  FA98  ---                 x is read/s)
  FA99  update master index                   zero (FEBE)
  FA9E  for all 8 entries:
  FAA1    set BLKNUM, (FE9E  o index blo
  FAA9    (exit when a 0 en                   BC)
  FAB0    read the sub-inde
  FAB3    (quit if error),
  FAB5    zero all its bloc  left to do), >>FA63
          or swap pages (if  le (FEC6)       D9>
  FAB8    (quit if error),
  FABA    write the former   counter (FE     ating) <FB95>
  FAC3    and loop until al (FEBD)
  FAC5  then go back and re
  FAC7  normal exit          try is found    back out, <EBD5>
  FAC8  RETURN               x block, <E8. >>FA9E
                             >>FAC8          index >>FA63
  FAC9  now go free all the  ks (if trunc
  FACD  which follow EOF <F  destroying)
  FAD0  if error >>FAC8      >>FAC8
  FAD2  write back master    index block     locks (FEB8)
  FAD5  if error >>FAC8      l 8 are done
  FAD7  EOF in first subin   read master
  FADA  if so, demote to se
  FADC  else, BLKNUM = sub
  FADF  contains the EOF ma
  FAE4  (exit if none there  sub-index >>FAF1
  FAEB  else, read the fina  B97>            hich (DC00)
  FAEE  and treat it as a s
  FAF0  unless there is an   ndex <EB95>
                                             lock <EBD9>
                             ex? (FE98)      >>FAFB
                             pling file
                             ndex block
                             rk
                             ) >>FAC7
                             l subindex
                             apling file
                             error.
```

```
ProDOS MLI -- V1.3 -- 2 DEC                                NEXT OBJECT ADDR: FAF0
-------------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------------

  FAF1  Demote tree to sapling <FB63>
  FAF4  if error >>FAC8

          *** TRUNCATE SAPLING FILE ***

  FAF6  read index block <FB5A>
  FAF9  if error >>FAC8
  FAFB  index of last block in the file (FEB9)
  FAFE  add one to point past end of file
  FAFF  if zero, no blocks to free >>FB0B
  FB01  zero blocks past EOF (when truncating) <FB97>
        or swap bytes for all but first block (when destroying).
  FB04  if error >>FAC8
  FB06  write back modified index block <EBD5>
  FB09  if error >>FAC8
  FB0B  index of last block in file (FEB9)
  FB0E  this index block is empty! >>FB25
  FB10  Get BLKNUM of last data block (DC00)
  FB18  (no block allocated?) >>FAC7
  FB1F  read in last data block <EBD9>
  FB22  and treat it as a seedling file >>FB34
  FB24  unless error occurred.

  FB25  more index blocks (tree file)? (FEB8)
  FB28  yes, must be tree file >>FB10
  FB2A  no, demote to seedling <FB63>
  FB2D  if error >>FB59

          *** TRUNCATE SEEDLING FILE ***

  FB2F  read key block <FB5A>
  FB32  error? >>FB59
  FB34  EOF in first page? (FEBB)
  FB37  yes >>FB3F
  FB39  EOF in second page?
  FB3A  no, exactly 256 bytes >>FB58
  FB3C  get byte offset (FEBA)
  FB3F  ---
  FB41  zero bytes in second page  (DD00)
  FB47  EOF in first page? (FEBB)
  FB4A  no, we're done. >>FB55
  FB4C  yes, zero bytes in first page, too (FEBA)
  FB55  then write block back and exit >>EBD5

  FB58  exit normally
  FB59  RETURN
```

```
ProDOS MLI -- V1.3 -- 2 DEC 86                    NEXT OBJECT ADDR: FB59
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

FB5A ********** READ INDEX BLOCK ************************************

  FB5A  Put index block number in A,X (FEB3)
  FB60  Go read the block >>EBC9

FB63 ********** DEMOTE FILE TO SMALLER FILE TYPE**********************

  FB63  get high byte of index block  (FEB4)
  FB66  save it on stack
  FB68  get low byte (FEB3)
  FB6B  save it, too
  FB6C  free the index block in the volume bitmap <EA1A>
  FB6F  restore the block number of the index block
  FB70  to zero page.
  FB75  if error writing bitmap >>FB94
  FB77  New index block is first block (DC00)
  FB7A  from old index block. (FEB3)
  FB83  For first entry in old index block,
  FB85  zero the block number (if truncating) <FBC7>
        or swap the bytes (if destroying).
  FB89  reduce storage type by one (FEB5)
  FB91  Write the deleted index block back out. <EBD5>
  FB94  RETURN

FB95 ******** FREE ALL BLOCK NUMBERS IN ******************************
           ***      AN INDEX BLOCK       ***

  FB95  ---

FB97 ******** FREE BLOCK NUMBERS BEYOND EOF **************************

  FB97  save BLKNUM
  FB9D  Save Y-register (index within block) (FE91)
  FBA8  if it is non-zero....
  FBAF  free the block in the volume bitmap <EA1A>
  FBB2  if error >>FBBE
  FBB4  Restore index to Y-reg (FE91)
  FBB7  zero this entry (when truncating) or <FBC7>
        swap the two bytes (when destroying).
  FBBA  ---
  FBBB  loop through all entries >>FB9D
  FBBE  save error message, if any
  FBC0  restore old BLKNUM
  FBC6  and exit
```

```
ProDOS MLI -- V1.3 -- 2 DEC 86                    NEXT OBJECT ADDR: FBC7
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

FBC7 ********* ZERO OR SWAP INDEX BLOCK BYTES ***********************

  FBC7  --- >>0001
  FBC7  This a destroy operation? (FEEB)
  FBCA  Yes, swap the two bytes. >>FBCF
  FBCC   No, zero both bytes.
  FBCD  A 65C02 instruction!!! >>FBD5
        Note: we think this 65C02 instruction (BRA)
        snuck in by accident.  It is the only
        65C02 instruction in all of ProDOS and
        means the 1.3 version won't run on Apple IIs
        that don't have a 65C02.  But it is easy to
        patch this--just change the byte at $FBCD
        ($4CCD in the load image) from $80 to $F0,
        because BEQ works fine here.
  FBCF  Save higher page byte in X-register (DD00)
  FBD2  Get lower page byte in A-reg and (DC00)
  FBD5  store A-reg in higher page byte. (DD00)
  FBD8  Get X-register and
  FBD9  put it in lower page byte. (DC00)
  FBDC  RETURN

FBDD ********** ALLOCATE I/O BUFFER ***********************************

  FBDD  ---
  FBDF  get I/O buffer page number
  FBE2  can't be below $800
  FBE4  else, error >>FC28
  FBE6  can't be above $BC00
  FBE8  else, error >>FC28
  FBED  $4A/$4B --> I/O buffer
  FBF1  must be page aligned >>FC28
  FBF7  ---
  FBF8  check each page of I/O buffer for <FC63>
  FBFB  prior allocation in system bit map (BF58)
  FC08  ---
  FC09  if ok, mark each page as allocated <FC63>
  FC0C  in system memory bit map (BF58)
  FC19  assign buffer number (REFNUM*2) in FCB (D800)
  FC21  and save buffer location in buffer list
  FC26  exit
  FC27  RETURN

  FC28  bad I/O buffer error
  FC2B  RETURN
```

```
ProDOS MLI -- V1.3 -- 2 DEC 86                    NEXT OBJECT ADDR: FC2C
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

FC2C ********** LOCATE I/O BUFFER ************************************

  FC2C  ---
  FC2D  AREG contains buffer number *2 (BF6E)
  FC3Ø  move buffer pointer to NXTBUF variable (FED1)
  FC39  exit

FC3A ********** FREE I/O BUFFER *************************************

  FC3A  is buffer already free? <FC2C>
  FC3F  yes, exit >>FC61
  FC43  zero its address in system global page (BF6F)
  FC5Ø  ---
  FC51  free each page in buffer <FC63>
  FC54  by marking system bit map
  FC61  exit
  FC62  RETURN

FC63 ********** LOCATE BIT MAP POSITION ******************************
         (GIVEN PAGE NUMBER)

  FC63  XREG contains page number
  FC64  compute page number times 8
  FC67  use as offset for bitmask (FDF4)
  FC6E  page number / 8 = byte offset
  FC6F  into bitmap
  FC71  exit

FC72 ********** CHECK BUFFER VALIDITY *********************************
                START > $200    END < $BF00

  FC72  get buffer address (MSB)
  FC76  must be >$200 else error >>FC28
  FC78  get length (FECF)
  FC7E  compute last page no. of buffer
  FC83  ---
  FC8A  may not extend into $BF00
  FC8C  else, error >>FC28

        *** CHECK IF BLOCK OF MEMORY IS FREE ***

  FC8F  ---
  FC90  see if this page is allocated <FC63>
  FC96  if so, error >>FC28
  FC98  else, check other paee also
  FC9C  then exit if both have been checked
  FC9D  RETURN
```

```
ProDOS MLI -- V1.3 -- 2 DEC 86                    NEXT OBJECT ADDR: FC9D
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

FC9E ************************************************************
         ****** MLI GET_BUFF CALL ******
         ********************************

  FC9E  get next available buffer
  FCA3  put its address in caller's parmlist
  FCAB  and exit
  FCAC  RETURN

FCAD ************************************************************
         ****** MLI SET_BUFF CALL ******
         ********************************

  FCAD  mark his buffer allocated
  FCB2  error? >>FCD4
  FCB4  get old buffer address (FED2)
  FCBE  free old buffer's pages in map <FC49>
  FCC5  copy old buffer contents
  FCC7  to new buffer
  FCD3  then exit
  FCD4  RETURN

FCD5 ********* GO TO QUIT CODE HANDLER *******************************

  FCD5  enable 2nd 4K bank of language card (C083)
  FCD8  (Quit code lives at $D100-$D3FF) (C083)
  FCDD  Get first four bytes of page 0, (0000)
  FCE0  save them on the stack
  FCE4  Set ($00) -> $D100
  FCE6  Set ($02) -> $1000
  FCF2  Set Y = 0
  FCF3  3 pages of code to copy
  FCF5  ---
  FCF6  copy quit code handler to $1000
  FD04  pull 4 saved bytes off stack
  FD0D  enable HIGH RAM BANK1 (C08B)
  FD10  (MLI) (C08B)
  FD15  point RESET vector at $1000 (03F2)
  FD1D  set power-up byte properly
  FD22  go to quit code handler at $1000 >>1000

FD25 ********* ACCESS RAM-BASED DEVICE DRIVER ***********************
          This (undocumented?) routine allows a device driver
          to reside in BANK2 of auxiliary high RAM (they normally
          reside in slot ROM).  When the device driver is set up,
          the address of this routine, which may be found at $3EA,
          becomes the address of the device driver.  Bytes $3E4 and $3E5
          are changed to the address of the real driver in aux high RAM.
          This routine must call the page 3 routine at $3D6
          because the MLI is in main high RAM and will be
```

```
ProDOS MLI -- V1.3 -- 2 DEC 86                    NEXT OBJECT ADDR: FD25
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------
                  pped out.  The page 3 routine calls the real driver
              sw  returns here with the error code, if any.
              an
                  rent P-reg in accumulator,
  FD25  Get cu  ve it on the stack
  FD27  then s  verflow flag
  FD28  clear   pts disabled?
  FD29  interr  30
  FD2B  no >>F  t overflow flag (FD4E)
  FD2D  yes, s  interrupts
  FD30  disabl  RAM, BANK2 (C083)
  FD31  enable  y, indicating error
  FD37  set ca  e 6 bytes to move to aux z-page
  FD38  indica  al driver thru page 3 routine <03D6>
  FD3A  Call r  error number (BF0F)
  FD3D  store   RAM, BANK1 (C08B)
  FD40  enable  original P-reg
  FD46  restor  or number is zero, (BF0F)
  FD48  if err  dicate no error; >>FD4E
  FD4B  then i  se indicate error
  FD4D  otherw
  FD4E  RETURN

              * INSTALL UNCLAIMED IRQ HANDLER ************************
FD4F **********routine calls a subroutine located
          This  400 in BANK2 of high RAM.  It is called
          at $  MLI command $42 is executed.  Its purpose
          when  install a routine that handles unclaimed
          is t  rupts.  Apparently the user must supply
          inte  outine at $D400.
          the

                to BANK2 of high RAM, (C083)
  FD4F  Switch  the program there, <D400>
  FD52  execut  k to BANK1 (C08B)
  FD55  then b  eturn.
  FD58   and r

              ***************************************************
FD59 **********  DATA AREA                  *
          *     ****************************
          ******

              * MLI COMMAND TABLE *************************************
FD59 **********ASH CODE ORDER: IF COMMAND IS...
          IN H  EFGH (IN BINARY BITS)
          ABCD  K IS COMPUTED AS:
          INDE  0D EFGH
             0  400 ABCD
            +0
                 INTERRUPT
  FD59  GET BU
  FD5A  UNUSED
  FD5B  UNUSED
  FD5C  UNUSED
  FD5D  ALLOC
```

```
ProDOS MLI -- V1.3 -- 2 DEC 86                    NEXT OBJECT ADDR: FD5E
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------
  FD5E  DEALLOC INTERRUPT
  FD60  UNUSED
  FD61  READ BLOCK
  FD62  WRITE BLOCK
  FD63  GET TIME
  FD64  EXIT
  FD65  CREATE
  FD66  DESTROY
  FD67  RENAME
  FD68  SET FILE INFO
  FD69  GET FILE INFO
  FD6A  ON LINE
  FD6B  SET PREFIX
  FD6C  GET PREFIX
  FD6D  OPEN
  FD6E  NEWLINE
  FD6F  READ
  FD70  WRITE
  FD71  CLOSE
  FD72  FLUSH
  FD73  SET MARK
  FD74  GET MARK
  FD75  UNUSED
  FD76  SET EOF
  FD77  GET EOF
  FD78  SET BUF

FD79 ********** PARAMETER COUNT TABLE ********************************

  FD79  GET BUF
  FD7A  UNUSED
  FD7B  UNUSED
  FD7C  UNUSED
  FD7D  ALLOC INTERRUPT
  FD7E  DEALLOC INTERRUPT
  FD80  UNUSED
  FD81  READ BLOCK
  FD82  WRITE BLOCK
  FD83  GET TIME
  FD84  EXIT
  FD85  CREATE
  FD86  DESTROY
  FD87  RENAME
  FD88  SET FILE INFO
  FD89  GET FILE INFO
  FD8A  ON LINE
  FD8B  SET PREFIX
  FD8C  GET PREFIX
  FD8D  OPEN
  FD8E  NEWLINE
  FD8F  READ
```

```
ProDOS MLI -- V1.3 -- 2 DEC 86                    NEXT OBJECT ADDR: FD90
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FD90  WRITE
  FD91  CLOSE
  FD92  FLUSH
  FD93  SET MARK
  FD94  GET MARK
  FD95  UNUSED
  FD96  SET EOF
  FD97  GET EOF
  FD98  SET BUF

FD99 ********** MLI COMMAND ADDRESS TABLE ****************************

  FD99  CREATE
  FD9B  DESTROY
  FD9D  RENAME
  FD9F  SET FILE INFO
  FDA1  GET FILE INFO
  FDA3  ON LINE
  FDA5  SET PREFIX
  FDA7  GET PREFIX
  FDA9  OPEN
  FDAB  NEWLINE
  FDAD  READ
  FDAF  WRITE
  FDB1  CLOSE
  FDB3  FLUSH
  FDB5  SET MARK
  FDB7  GET MARK
  FDB9  SET EOF
  FDBB  GET EOF
  FDBD  SET BUF
  FDBF  GET BUF

FDC1 ********** MLI COMMAND INFO BYTE *********************************

          PATHNAME FLAG
          | REFERENCE NUMBER FLAG
          | | DATETIME STAMP FLAG
          | | |     COMMAND NUMBER
          | | |     |
  FDC1    1 0 1  - 00
  FDC2    1 0 1  - 01
  FDC3    1 0 1  - 02
  FDC4    1 0 1  - 03
  FDC5    1 0 0  - 04
  FDC6    0 0 0  - 05
  FDC7    0 0 0  - 06
  FDC8    0 0 0  - 07
  FDC9    1 0 0  - 08
  FDCA    0 1 0  - 09
  FDCB    0 1 0  - 0A
```

```
ProDOS MLI -- V1.3 -- 2 DEC 86                    NEXT OBJECT ADDR: FDCC
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FDCC    0 1 0  - 0B
  FDCD    0 0 1  - 0C
  FDCE    0 0 1  - 0D
  FDCF    0 1 0  - 0E
  FDD0    0 1 0  - 0F
  FDD1    0 1 0  - 10
  FDD2    0 1 0  - 11
  FDD3    0 1 0  - 12
  FDD4    0 1 0  - 13

FDD5 ********** CONSTANTS - DATA AREA ********************************

  FDD5  Blocks Used
  FDD7  End of File
  FDDA  Special ID (Must be 5 bits on)
  FDDB  'HUSTON!'       Author's name
  FDE2  Previous Block of Vol Dir Key Block
          ---
          THE FOLLOWING IS COPIED TO SUBDIR HDR+$20
  FDE4  Version of ProDOS
  FDE5  Minimum Version
  FDE6  Access Byte  (D|Rn|B|000|W|R)
  FDE7  Entry Length
  FDE8  Entries per Block
  FDE9  File Count
  FDEB  Parent LSB (copied to SUBDIR HDR +$20)
          ---
  FDEC  File Type  (Directory)
  FDED  Block Number
  FDEF  Number of Blocks
  FDF1  End of File

FDF4 ********** BITMASK TABLE ***************************************

  FDF4  10000000
  FDF5  01000000
  FDF6  00100000
  FDF7  00010000
  FDF8  00001000
  FDF9  00000100
  FDFA  00000010
  FDFB  00000001

FDFC ********** OFFSETS INTO FILE CONTROL BLOCKS *********************
FDFC ***(FCB's are at $D800-$D8FF)**********************************

  FDFC  Key Block
```

ProDOS MLI -- V1.3 -- 2 DEC 86

ADDR	DESCRIPTION/CONTENTS
	.
FDFE	# Blocks Used
FE00	End of File
FE03	********** SET/GET FILE_INFO OFFS
FE03	Access
FE04	File Type
FE05	Aux Type
FE07	Storage Type
FE08	Blocks Used (MSB on means GET
FE0A	Datetime (Last Mod)
FE0E	Datetime (Creation)
FE12	********** FATAL ERROR MESSAGE **
FE12	' INSERT SYSTEM DISK AND RESTA
FE3A	---
FE3A	********** VARIABLES - DATA AREA
FE3A	Parent Pointer Block
FE3C	Parent Entry Number
FE3D	Parent Entry Length
FE3E	Datetime (Creation)
FE42	Version
FE43	Min Version
FE44	Access Byte
FE45	Entry Length
FE46	Entries per Block
FE47	File Count
FE49	Bit Map Pointer
FE4B	Total Blocks
	THE FOLLOWING 6 BYTES UNIQUE
	A FILE:
FE4D	Device Number
FE4E	Current Directory Block Number
FE50	Block Number of File Entry in
FE52	File Entry Number in Directory
FE53	********** FILE ENTRY BUFFER ****
FE53	Type/Length (TTTTLLLL)
FE54	File Name (Max 15) >>000F
FE63	File Type
FE64	Key Pointer
FE66	Blocks Used

'T' OBJECT ADDR: FDFD

NEX

ETS **********

only no SET

RT -ERR Ø '

FE96 Bitmap Byte Offset in ($0900)
FE97 Bitmap Page Offset ($0800)
FE98 Bitmap Buffer Page (Ø
FE99 Bitmap Flag (if $80, n
FE9A Bitmap DEVNUM
FE9B Bitmap Block Number
FE9D Bitmap Block offset fo

Y IDENTIFY

(HDR)
Directory

eeded

mined or..

f/Free FCB's refnum
(if > Ø) or..
with free bit on or..

o search

tory Header
y Header
Page

1)
eeds writing)

Multiblock Bitmaps

ProDOS MLI -- V1.3 -- 2 DEC 86

ADDR	DESCRIPTION/CONTENTS
FE68	End of File
FE6B	Datetime (Creation)
FE6F	Version
FE70	Min Version
FE71	Access Attribute
FE72	Aux Type (Load Address/
FE74	Datetime (Last Mod)
FE78	Header Pointer
FE7A	********** Variable Work F
FE7A	3 Byte Scratch
FE7D	---
FE7E	End of File
FE81	Previous Mark
FE84	Compare Vol Name Scrat
FE85	Offset into VCB Table
FE86	Offset into FCB Table
FE87	Free FCB found Flag
FE88	Number of Free Blocks
FE8A	Storage Type
	Number of Entries Ex
FE8B	FCB already open flag
FE8C	File Count
FE8E	Entries/Block Loop Cou
	Free Entry Found Fla
	# of 1st bitmap bloc
FE8F	bit for free
FE90	# Blocks in Bitmap lef
FE91	Y Register temp
FE92	Pathname Length
FE93	Devnum for Prefix Dire
FE94	Block of Prefix Direct

ecord Length)

rea **********

NEXT OBJECT ADDR: FE68

```
ProDOS MLI -- V1.3 -- 2 DEC 86                    NEXT OBJECT ADDR: FE9D
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

          New Mark to be Positioned to for Set Mark
          or New Moving Mark (for READ)
  FE9E  or New EOF for SET_EOF

  FEA1  Request Count (Read/Write etc.)
  FEA3  Multi-Block I/O count
  FEA4  Newline character
  FEA5  Newline mask
  FEA6  I/O Transfer occurred flag
  FEA7  MLI Command * 2
  FEA8  ORed into Access Flags ($20 - Backup)
  FEA9  Duplicate Volume Flag (if $FF)
  FEAA  Duplicate Volume's VCB index
  FEAB  MLI function code (low 5 bits)
          Characters in current Pathname indx lvl or
  FEAC  ONLINE: volname len - loop index
  FEAD  new pathname: index to last name
          old pathname: index to last name or..
  FEAE  ONLINE: index to data buffer
  FEAF  Old PFIXPTR value
  FEB0  Pathname fully qualified flag (if $FF)
          Pathname: temp save area for index or..
  FEB1  ONLINE: DEVCNT
  FEB2  close-all error code
  FEB3  Set EOF: new Key Block pointer
  FEB5  New storage type (SET_EOF)
  FEB6  Freed Blocks count
  FEB8  EOF Block number (MSB then LSB)
  FEBA  EOF byte offset into Block
  FEBC  EOF - Master index counter
  FEBD  Save area for index into table below

FEBE ********** DEVICE TABLE BUILT BY ONLINE ************************
          (also used by SET_EOF to keep track of
          8 blocks to be freed at a time)

  FEBE  device table part one
  FEC6  device table part two

  FECE  length of path, etc.
  FED1  next buffer address
  FED3  16 byte stack save area
  FEE3  6 byte zero page save area

  FEE9  ---
  FEE9  Jump Vector, used for indirect jumps
  FEEB  Destroy flag (1 = destroy operation)
```

```
ProDOS MLI -- V1.3 -- 2 DEC 86                    NEXT OBJECT ADDR: FEEB
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

FEEC ********** $FEEC-$FEFF NOT USED *******************************
  FEEC  not used
```

```
ProDOS System Global Page -- V1.2                NEXT OBJECT ADDR: BF00
--------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
--------------------------------------------------------------------------

BF00    MODULE STARTING ADDRESS

          ***********************************
          *                                 *
          * PRODOS SYSTEM GLOBAL PAGE       *
          *                                 *
          *    VERSION 1.2 -- 6 SEP 86      *
          *    VERSION 1.3 -- 2 DEC 86      *
          *                                 *
          ***********************************

BF00 ******** MLI AND IRQ HANDLER EQUATES ****************************

DE00    Main MLI entry point.
DEAC    Address for no device connected.
DF4E    IRQ handler within MLI.
DFFF    System error handler.
E009    System death handler.
FFD8    Patch in ProDOS IRQ Handler.

BF00 *********** JUMP VECTORS ***************************************

  BF00  ENTRY       JMP to MLI. >>BF4B
  BF03  JSPARE      System death address. >>BF03
  BF06  DATETIME    JMP To Date/Time routine (RTS if no clock).
  BF07              Normal clock code address.
  BF09  SYSERR      JMP to system error handler. >>DFFF
  BF0C  SYSDEATH    JMP to system death handler. >>E009
  BF0F  SERR        System error number.

BF10 ********** DEVICE INFORMATION **********************************

  BF10  DEVADR01    Slot 0 reserved.
  BF12  DEVADR11    Slot 1, drive 1 device driver address.
  BF14  DEVADR21    Slot 2, drive 1 device driver address.
  BF16  DEVADR31    Slot 3, drive 1 device driver address.
  BF18  DEVADR41    Slot 4, drive 1 device driver address.
  BF1A  DEVADR51    Slot 5, drive 1 device driver address
  BF1C  DEVADR61    Slot 6, drive 1 device driver address.
  BF1E  DEVADR71    Slot 7, drive 1 device driver address.
  BF20  DEVADR02    Slot 0 reserved.
  BF22  DEVADR12    Slot 1, drive 2 device driver address.
  BF24  DEVADR22    Slot 2, drive 2 device driver address.
  BF26  DEVADR32    /RAM device address (128K required).
  BF28  DEVADR42    Slot 4, drive 2 device driver address.
  BF2A  DEVADR52    Slot 5, drive 2 device driver address
  BF2C  DEVADR62    Slot 6, drive 2 device driver address.
  BF2E  DEVADR72    Slot 7, drive 2 device driver address.
```

```
ProDOS System Global Page -- V1.2                NEXT OBJECT ADDR: BF2E
--------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
--------------------------------------------------------------------------

  BF30  DEVNUM      Slot and drive (DSSS0000) of last device.
  BF31  DEVCNT      Count (minus 1) of active devices
  BF32  DEVLST      List of active devices (slot, drive, and
                    identification--DSSSIIII).

  BF40  "(C)APPLE'83"           Copyright notice.

BF4B ******** PATCHES TO ORIGINAL GLOBAL PAGE ************************

  BF4B  MLIENT1     Push status reg on stack.
  BF4C              Disable interrupts
  BF4D              Go to MLIENT1. >>BFB7

  BF50  AFTIRQ      Read high RAM, BANK1 (C08B)
  BF53              and continue IRQ exit. >>FFD8

  BF58  BITMAP      Bitmap of low 48K of memory.

  BF70  BUFFER1     Open file 1 buffer address.
  BF72  BUFFER2     Open file 2 buffer address.
  BF74  BUFFER3     Open file 3 buffer address.
  BF76  BUFFER4     Open file 4 buffer address.
  BF78  BUFFER5     Open file 5 buffer address.
  BF7A  BUFFER6     Open file 6 buffer address.
  BF7C  BUFFER7     Open file 7 buffer address.
  BF7E  BUFFER8     Open file 8 buffer address.

BF80 *********** INTERRUPT INFORMATION *******************************

  BF80  INTRUPT1    Interrupt handler address (highest priority).
  BF82  INTRUPT2    Interrupt handler address.
  BF84  INTRUPT3    Interrupt handler address.
  BF86  INTRUPT4    Interrupt handler address (lowest priority).
  BF88  INTAREG     A-register savearea.
  BF89  INTXREG     X-register savearea.
  BF8A  INTYREG     Y-register savearea.
  BF8B  INTSREG     S-register savearea.
  BF8C  INTPREG     P-register savearea.
  BF8D  INTBANKID   Bank ID byte (ROM, RAM1, or RAM2).
  BF8E  INTADDR     Interrupt return address.

BF90 *********** GENERAL SYSTEM INFO *********************************

  BF90  DATE        YYYYYYYM MMMDDDDD.
  BF92  TIME        ...HHHHH ..MMMMMM.
  BF94  LEVEL       Current file level.
  BF95  BUBIT       Backup bit.
  BF96  SPARE1      Currently unused.
  BF98  MACHID      Machine ID byte.
                    00.. 0...  II
```

```
ProDOS System Global Page -- V1.2                NEXT OBJECT ADDR: BF99
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

                    01.. 0...  II+
                    10.. 0...  IIe or IIGS
                    11.. 0...  Future expansion
                    00.. 1...  Future expansion
                    01.. 1...  Future expansion
                    10.. 1...  IIc
                    11.. 1...  Future expansion
                    ..00 ....  Unused
                    ..01 ....  48K
                    ..10 ....  64K
                    ..11 ....  128K
                    .... .X..  Reserved
                    .... ..0.  No 80-column display
                    .... ..1.  80-column display
                    .... ...0  No compatible clock
                    .... ...1  Compatible clock present

  BF99  SLTBYT      Slot ROM map (bit on indicates ROM present)
  BF9A  PFIXPTR     Prefix flag (0 indicates no active prefix).
  BF9B  MLIACTV     MLI active flag (1... .... indicates active.
  BF9C  CMDADR      Last MLI call return address.
  BF9E  SAVEX       X-register savearea for MLI calls.
  BF9F  SAVEY       Y-register savearea for MLI calls.

BFA0 ******** HANDLE BANK SWITCHING AFTER IRQ ***** ******************
        (Enter reading high RAM, BANK1)

  BFA0  EXIT        $E000 same as save byte? (E000)
  BFA3              Yes, check for BANK1/BANK2 >>BFAA
  BFA5              No, enable ROM (C082)
  BFA8              and exit now. >>BFB5
  BFAA  EXIT1       Get RAM save byte for $D000. (BFF5)
  BFAD              Is it the same as BANK1? (D000)
  BFB0              Yes, exit now. >>BFB5
  BFB2              No, switch to BANK2. (C083)
  BFB5  EXIT2       Restore A-Register and
  BFB6              return from the interrupt.

BFB7 ******** MLI ENTRY, CONTINUED **********************************

  BFB7  MLICONT     Carry set will
  BFB8              roll flag bit into MLIACTV. (BF9B)
  BFBB              Save high memory configuration (E000)
  BFBE              by storing $E000 in BNKBYT1 (BFF4)
  BFC1              and $D000 (D000)
  BFC4              in BNKBYT2. (BFF5)
  BFC7              Then enable high RAM, BANK1 (C08B)
  BFCA              for read and write. (C08B)
  BFCD              Jump to actual MLI. >>DE00
```

```
ProDOS System Global Pag
-------------------------me -- V1.2                NEXT OBJECT ADDR: BFCD
ADDR    DESCRIPTION/CON-------------------------------------------------
-----------------------ENTS
                        -------------------------------------------------

BFD0 ********** INTERRU
                      PT ROUTINES **********************************
  BFD0  IRQXIT      Dete
  BFD3              Hig rmine state of high memory. (BF8D)
  BFD5              High RAM, BANK1 enabled. >>BFE2
  BFD7              Syst RAM, BANK2 enabled. >>BFDF
  BFD8              Yes em have only 48K?
  BFDA              Enab only ROM in high memory. >>BFE7
  BFDD              Alwale ROM. (C081)
  BFDF  IRQXIT1     Swi ys branch. >>BFE7
  BFE2  IRQXIT2     Presch to BANK2. (C083)
  BFE4              (Lat et BANKID for ROM.
  BFE7  ROMXIT      Rester reset if high RAM interrupt). (BF8D)
  BFEA              ex ore accumulator and  (BF88)
                      .
  BFEB  IRQENT      Enab
  BFEE              for le high RAM, BANK1 (C08B)
  BFF1              Jumpread and write. (C08B)
                      into MLI. >>DF4E
BFF4 ********** DATA **
                      **********************************************

  BFF4  BNKBYT1     Stor
  BFF5  BNKBYT2     Storage for byte at $E000.
  BFF6              $Bage for byte at $D000.
                    -$BFFB currently not used.
BFFC ********** VERSION
                    INFORMATION **********************************
  BFFC  IBAKVER     Mini
  BFFD  IVERSION    Versum version of Kernel needed for this interpreter.
  BFFE  KBAKVER     Curon number of this in interpreter.
  BFFF  KVERSION    MLI ently undefined. Reserved for future use.
                     =2 ersion number:
                     =3 n Version 1.2
                      . in Version 1.3
```

```
ProDOS QUIT Code -- V1.2 -- 6 SEP 86            NEXT OBJECT ADDR: 1000
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

1000    MODULE STARTING ADDRESS

            ************************************
            *                                  *
            * QUIT Code                        *
            *     Stored in BANK2 of High RAM  *
            *     at $D100.  A move routine in *
            *     the MLI moves the code to    *
            *     $1000 and JMPs to it when a  *
            *     QUIT command is issued.      *
            *                                  *
            * VERSION 1.2 -- 6 SEP 86          *
            *   Move routine at $FCA9          *
            *                                  *
            * VERSION 1.3 -- 2 DEC 86          *
            *   Move routine at $FCD5          *
            *                                  *
            ************************************

1000 ********** ZERO PAGE EQUATES ***********************************

0024    Cursor Horizontal
0025    Cursor Vertical

1000 ********** EXTERNAL EQUATES *************************************

0280    Prefix Buffer
1800    Buffer
2000    Buffer
BF00    MLI Entry
BF58    Bitmap

1000 ********** SOFT SWITCHES ****************************************

C000    Keyboard
C000    Disable 80 column store
C00C    Disable 80 column card
C00E    Select standard character set
C082    ROM select

1000 ********** MONITOR EQUATES **************************************

FE84    Initialize 40-column display
FC58    Home
FC9C    Clear to end of line
FD0C    Read a key
FD8E    Output a Carriage Return
FDED    Output a Character
FE84    Set Normal display
FE89    Set Keyboard
FE93    Set Video
```

```
ProDOS QUIT Code -- V1.2 -- 6 SEP 86            NEXT OBJECT ADDR: 1000
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

FF3A    Sound Bell

1000 ********** INITIALIZATION ***************************************

  1000  Select ROM (C082)
  1003  Disable 80 column card (C00C)
  1006  Select standard character set    (C00E)
  1009  Clear 80-column store    (C000)
  100C  Set Normal display (white on black) <FE84>
  100F  Initialize 40-column display <FE84>
  1012  Set Video <FE93>
  1015  Set Keyboard <FE89>

1018 ********** INITIALIZE MEMORY BITMAP ******************************

  1018  Mark pages $0, $1, $4 through $7
  101A  and $BF as in use

102D ********** DISPLAY CURRENT PREFIX ********************************

  102D  Clear Screen and Home cursor <FC58>
  1030  Go down 1 line <FD8E>
  1033  Point to prompt number 1
  1035  and print it out   <11D6>
  1038  Position to line 3
  103F  Call MLI (GET_PREFIX) <BF00>
  1042  Data: GET_PREFIX command number
  1043  Data: Pointer to Parameter list
  1045  Get length of Prefix (0280)
  1048  Put a 0
  104A  at the end of the Prefix (0281)
  104D  Check prefix length... (0280)
  1050  If length=0, there is no current Prefix >>105D
  1052  If non-zero, display the current Prefix (0280)
  1057  on the video screen (05FF)

105D ********** GET PREFIX NAME ***************************************

  105D  Initialize counter
  1064  Read a key <FD0C>
  1067  Is it CARRIAGE RETURN?
  1069  Yes, then accept Prefix >>10BD
  106B  No, then save character
  106C  Clear to end of line <FC9C>
  106F  Retrieve character
  1070  Is it ESCAPE?
  1072  Yes, start all over again >>102D
  1074  Is it CANCEL?
  1076  Yes, start all over again >>102D
  1078  Is it TAB?
  107A  Yes, sound Bell, get another character >>1093
```

```
S QUIT Code -- V1.2 -- 6 SEP 86            NEXT OBJECT ADDR: 107C
-------------------------------------------------------------------
   DESCRIPTION/CONTENTS
-------------------------------------------------------------------

C  Is it DELETE?
E  Yes. >>1084
0  Is it BACKSPACE?
2  No, keep checking >>1091
4  Yes, is there room to move back?
6  No, don't try >>108B
8  Decrement cursor horizontal position
A  Decrement counter
B  Clear to end of line <FC9C>
E  Try again >>1064

1  Continue if greater or equal to BACKSPACE >>1099
3  Else, sound Bell <FF3A>
6  Try again >>1064

9  Is it less than or equal to "Z"?
B  Yes, keep checking >>109F
D  Turn off lowercase
F  Is it less than "."?
1  Yes, Invalid - try again >>1093
3  Is it greater than "Z"?
5  Yes, Invalid - try again >>1093
7  Is it less than or equal to "9"?
9  Yes, keep checking >>10AF
B  Is it less than "A"?
D  Yes, Invalid - try again >>1093
F  Else, valid character - increment counter
0  Found 39 characters?
2  Yes, then start all over >>1076
4  Put valid character in buffer (0280)
7  and Print it <FDED>
A  Go back for more >>1064

D  Check counter
F  If 0 then go on >>10D3
1  Else, save length (0280)
4  Call MLI (SET_PREFIX) <BF00>
7  Data: SET_PREFIX command number
8  Data: Pointer to Parameter list
A  Carry on if no error >>10D3
C  Sound Bell <FF3A>
F  Force branch to
1  always be taken >>1076

********** GET APPLICATION NAME **********************************

3  Clear Screen and Home cursor <FC58>
6  Go down 1 line <FD8E>
9  Point to prompt number 2
B  and print it out <11D6>
E  Position to line 3
```

```
ProDOS QUIT Code -- V1.2 -- 6 SEP 86            NEXT OBJECT ADDR: 10E5
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

10E5  Initialize counter
10E7  Wait for keypress <FD0C>
10EA  Is it ESCAPE?
10EC  No, keep checking  >>10F4
10EE  Yes, get Cursor horizontal position
10F0  If not 0 try again >>10D3
10F2  If 0 start all over again >>10D1
10F4  Is it CANCEL?
10F6  Yes, try again >>10D3
10F8  Is it TAB?
10FA  Yes, sound Bell - try again >>1109
10FC  Is it DELETE?
10FE  Yes >>1104
1100  Is it BACKSPACE?
1102  No, keep checking >>1107
1104  Yes, then handle it >>11C0

1107  Continue if greater than BACKSPACE >>110F
1109  Sound Bell <FF3A>
110C  Go back and try again >>10E7

110F  Is it CARRIAGE RETURN?
1111  Yes, then go load Application >>113C
1113  Is it less than or equal to "Z"?
1115  Yes, keep checking >>1119
1117  Turn off lower case
1119  Is it less than "."?
111B  Yes, Invalid - try again >>1109
111D  Is it greater than "Z"?
111F  Yes, Invalid - try again >>1109
1121  Is it less than or equal to "9"?
1123  Yes, keep checking >>1129
1125  Is it less than "A"?
1127  Yes, Invalid - try again >>1109
1129  Else, valid character - save it
112A  Clear to end of line <FC9C>
112D  Retrieve character
112E  and Print it <FDED>
1131  Increment counter
1132  Found 39 characters?
1134  Yes, start again >>10F6
1136  No, save character in buffer (0280)
1139  and go get another >>10E7

113C ********** LOAD AND EXECUTE APPLICATION ************************

113C  Output a blank
1141  Store length of Application name (0280)
1144  Call MLI (GET_FILE_INFO) <BF00>
1147  Data: GET_FILE_INFO command number
1148  Data: Pointer to Parameter list
```

```
ProDOS QUIT Code -- V1.2 -- 6 SEP 86            NEXT OBJECT ADDR: 114A
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  114A  Continue if no error >>114F
  114C  Else, go to Error Handler >>11E2

  114F  Get File Type (12A5)
  1152  Is it ProDOS System file?
  1154  Yes, continue >>115B
  1156  No, indicate Error $01
  1158  Go to Error Handler >>11E2

  115B  Set Reference number to 0
  1160  Call MLI (CLOSE) <BF00>
  1163  Data: CLOSE command number
  1164  Data: Pointer to Parameter list
  1166  Continue if no error >>116B
  1168  Else, go to Error Handler >>11E2
  116B  Get Access Byte (12A4)
  1170  Yes, >>1177
  1172  No, Indicate Error $27
  1174  Go to Error Handler >>11E2

  1177  Call MLI (OPEN) <BF00>
  117A  Data: OPEN command number
  117B  Data: Pointer to Parameter list
  117D  Continue if no error >>1182
  117F  Else, go to Error Handler >>11E2

  1182  Get Reference Number (12B8)
  1185  and update READ and (12BC)
  1188  GET_EOF parameter lists (12C4)
  118B  Call MLI (GET_EOF) <BF00>
  118E  Data: GET_EOF command number
  118F  Data: Pointer to Parameter list
  1191  If error, handle it >>11E2

  1193  Is EOF mark less than $10000 (12C7)
  1196  Yes, continue on >>119C
  1198  No, Indicate Error $27
  119A  Go to Error Handler >>11E2

  119C  Transfer EOF to Request count (12C5)
  119F  in READ parameter list (12BF)
  11A8  Call MLI (READ) <BF00>
  11AB  Data: READ command number
  11AC  Data: Pointer to Parameter list
  11AE  Save status of READ
  11AF  Call MLI (CLOSE) <BF00>
  11B2  Data: Get_Prefix command number
  11B3  Data: Pointer to Parameter list
  11B5  Continue if no error >>11BB
  11B7  Else, retrieve status
  11B8  and go to Error Handler >>11E2
```

```
ProDOS QUIT Code -- V1.2 -- 6 SEP 86            NEXT OBJECT ADDR: 11BA
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

        This area of the code was mo
        Version 1.2, and a bug was
        We are not sure it is safe t
        the P-register is non-zero;
        may not force the required
        Also, there is a misplaced l
        will cause read errors to be

  11BA  Was READ good?
  11BB  No, go to Error Handler >>11
  11BD  Yes, execute application >>

11C0 ********** BACKSPACE ROUTINE **

  11C0  Get cursor position horizont
  11C2  If 0 exit routine >>11D3
  11C4  Decrement counter
  11C5  Output a space
  11CA  Move cursor back 2 spaces
  11CE  Output a space <FDED>
  11D1  Move cursor back 1 space
  11D3  Return to get another chara

11D6 ********** PRINT TEXT ROUTINE

  11D6  Get a character (1211)
  11D9  If it is 0 then exit >>11E1
  11DB  Output it <FDED>
  11DE  Increment offset
  11DF  Get another character >>11D
  11E1  Return to caller

11E2 ********** PRINT ERROR MESSAGE

  11E2  Save Accumulator (Error Num
  11E4  Position to line 12
  11EB  Get Error number
  11ED  Is it 1?
  11EF  No, keep checking >>11F5
  11F1  Yes, point to error message
  11F3  and go print it >>120B
  11F5  Is it $40?
  11F7  Yes, print error message 3
  11F9  Is it $44?
  11FB  Yes, print error message 3
  11FD  Is it $45?
  11FF  Yes, print error message 3
  1201  Is it $46?
  1203  Yes, print error message 3
  1205  Point to error message 2
  1207  and go print it >>120B
```

```
  1209  Point to
  120B  Print Er
  120E  Get app
                  -- V1.2 -- 6 SEP 86              NEXT OBJECT ADDR: 1209
1211 **********  ION/CONTENTS
                  ----------------------------------------------------

        Prompt
  1211  'ENTER P  error message 3
                  ror message <11D6>
        Prompt    ication name again >>10DE
  1239  'ENTER P
                  ASCII TEXT ****************************************
        Error1
  125C  Ring Bel  1
  125D  'NOT A P  REFIX (PRESS "RETURN" TO ACCEPT)'

        Error2    2
  1273  Ring Bel  ATHNAME OF NEXT APPLICATION'
  1274  'I/O ERR

        Error3    1
  128A  Ring Be   YPE "SYS" FILE'
  128B  'FILE/PA

12A1 **********   1
                  )R              '
        GET_F
  12A1  Parmcou   1
  12A2  Pathname  H NOT FOUND  '
  12A4  Access
  12A5  File Type ARAMETER LISTS ***************************************
  12A6  Aux Type
  12A8  Storage T E_INFO Parmlist
  12A9  Blocks Us
  12AB  Datetime
  12AF  Datetime

        OPEN Pa
                  ype
  12B3  Parmcount ed
  12B4  Pathname  (modified)
  12B6  I/O Buffe (creation)
  12B8  Reference
                  rmlist
        CLOSE P

  12B9  Parmcount
  12BA  Reference r
                    Number

                  armlist


                    Number
```



```
        READ Parmlist

  12BB  Parmcount
  12BC  Reference Number
  12BD  Data Buffer
  12BF  Request Count
  12C1  Transfer Count

        GET_EOF Parmlist

  12C3  Parmcount
  12C4  Reference Number
  12C5  EOF Mark

        GET/SET_PREFIX Parmlist

  12C8  Parmcount
  12C9  Pathname

12CB ********** $12CB-$12FF UNUSED *********************************

  12CB  These unused bytes are $D3CB-$D3FF in high RAM
  12FF  and $5BCB-$5BFF when loaded as part of "PRODOS" file.
```

```
ADDR    DESCRIP
--------------
                Driver -- V1.2 -- 6 SEP 86       NEXT OBJECT ADDR: D000
D000    MODULE  ------------------------------------------------------------
                TION/CONTENTS
                ------------------------------------------------------------
                ******
                *
                *  5.2 STARTING ADDRESS
                *
                ********************************
                *                              *
                *                              *
                *  VER" DISK DEVICE DRIVER     *
                *   (S                         *
                *    RESIDES AT $D000-$D6FF    *
                *                              *
                ******                         *
                     SION 1.2 -- 6 SEP 86      *
D000 **********  ME AS IN VERSION 1.1.1)       *
                ********************************

003A    Checksu
003A    Workbyt ZERO PAGE EQUATES ***********************************
003E    Slot (T
0042    Command
0043    Unit Nu
0044    I/O Buf
0045    I/O Buf mporary)
0046    Block N
0047    Block N ber
                fer Pointer (low)
D000 **********fer Pointer (high)
                ber (low)
1000    Dummy N mber (high)
1100    Dummy I
        INTERNAL EQUATES ************************************
D000 **********
                lock Buffer (1st half)
C080    Phase 0 lock Buffer (2nd half)
C088    Motor O
C089    Motor O EXTERNAL EQUATES ************************************
C08A    Drive S
C08C    Read Da  Off
C08D    Write M ff
C08E    Set Rea
C08F    Set Wri lect
C0EC    Read Da  Register
                ata Register
D000 **********  Mode
                 Mode
                 Register (slot 6)
  D000  Clear
  D001  Clear
  D004  Five N
  D005  fit up
  D009  Check
  D00C  If not
  D00E  Conver
                .25" DISK DRIVER ENTRY ****************************
                imal mode
                ses in case IWM device in this slot <D6BE>
                s so code below will
                against Table at $D196
                idity of calling parameters  <D6D0>
                valid exit with error >>D034
                Block Number to a Track and Sector
```

```
Disk II Device
--------------
ADDR    DESCRIPriver -- V1.2 -- 6 SEP 86       NEXT OBJECT ADDR: D010
        ------------------------------------------------------------
                ION/CONTENTS
                ------------------------------------------------------------
  D010  ---
  D014  0000000
  D015
  D017          CTTTTABC
  D018          .     .      . >>D010
  D01A  00TTTTT       .
  D01C  ---             .    . >>D01C
  D020  Preserv 0000BC0A
  D021  Execute
  D024  Restore  Sector Number
  D025  No, the command <D038>
  D027  Increme Sector Number - Was prior action ok?
  D029  Increme.. exit >>D030
  D02B  Execute  Buffer Pointer
  D02E  Decremen Sector Number by 2 for rest of Block
  D030  Get err command <D038>
  D033  Return n Buffer Pointer (to start of block)
                or number (if any - 0 indicates no error) (D358)
D034 **********to caller

  D034  Indicat I/O ERROR ROUTINE ***********************************
  D036  Set Car
  D037  Return e "I/O Error"
                by flag
D038 **********to caller

  D038  Set rec MAIN CODE *************************************************
  D03D  Preserv
  D040  Get "Una ibration count to 1
  D042  Strip de sector number (D357)
  D044  Preserv "num"   DSSS0000
  D046  Check bit Drive 0SSS0000
  D049  See if e slot number
  D04C  Save tem slot change, turn off motor if so <D69B>
  D04F  Initial motor is on <D4DA>
  D054  See if s results
  D057  Update ize counter for delay routine (D370)
  D05A  Save ta slot or drive has changed (D359)
  D05B  Put dri "current" unit number (D359)
  D05C  Turn mot results
  D062  Select ve number in Carry flag
  D065  Check t or on (C089)
  D066  Yes, th appropriate drive (C08A)
  D069  Wait fo st results - Same slot/drive?
  D06B  to comp en skip delay >>D072
  D072  Is comm new Drive
  D074  Yes, th up to speed <D385>
  D076  Get tra and a status request?
  D079  And go en do not move disk arm >>D07C
  D07C  Check ck number for current request (D356)
  D07D  Yes, th there <D10C>
                st results - Was motor on?
                en skip delay >>D08E
```

```
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------
  D07F  Wait for D
  D081  come up to rive to
  D089  Is motor @ speed <D385>
  D08C  No, then e n yet? <D4DA>
  D08E  Is command xit with error >>D0EA
  D090  Yes, then  a "status" request?
  D092  Is command determine status >>D0FD
  D093  Yes, then  a "read" request?
  D095  Prepare da continue on >>D098
  D098  ---        ta for write (prenibblize) <D5F0>
  D09A  Initialize
  D09D  ---        "retry" count at 64 (D369)
  D09F  Read an ad
  D0A2  Yes, then dress field - Good read? <D398>
  D0A4  Decrement  continue on >>D0BE
  D0A7  Yes, then "retry" count - More to try? (D369)
  D0A9  No, just t try again >>D09D
  D0AB  Decrement  case indicate "I/O Error"
  D0AE  No, then  "recalibration" count - More to try? (D36A)
  D0B0  Get "curre xit with error >>D0EA
  D0B3  Preserve i nt" track (D35A)
  D0B4  Double it  t
  D0B5  add 16 to  and
  D0B7  Reinitiali it for recalibration
  D0BC  Branch alw ze Retry Count
  D0C1  Was the r ays taken >>D0CC
  D0C4  Yes, then  ght track found? (D35A)
  D0C6  Get "curre continue on >>D0D5
  D0C9  Preserve i nt" track (D35A)
  D0CA  Get track  t
  D0CB  Double it  we found
  D0CC  Put new va
  D0CF  Get track  lue in Device Track Table <D4D3>
  D0D0  And go the we want
  D0D3  Branch alw re <D10C>
  D0D8  Was the ri ays taken >>D09D
  D0DB  No, then t ght sector found? (D357)
  D0DF  Is command ry again >>D0A4
  D0E0  Yes, then  a "write" request?
  D0E2  Read the d go do it >>D0F4
  D0E5  No, then t ata - Good read? <D3FD>
  D0E7  Indicate  ry again >>D0A4
  D0E9  BNE Instr o errors
  D0EA  Indicate e ction, never taken
  D0EB  Preserve e rror
  D0EE  Get Slot  rror number (D358)
  D0F0  Turn Motor
  D0F3   Return to off (C088)
         caller
```



```
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------
                 WRITE REQUEST **********************
                                                  T ADDR: D0F3
                 od write? <D500>                 ------------
                 >>D0E7
D0F4 ********** HANDLE -protect error"            ------------
                 aken >>D0EA
  D0F4  Write data  Go
  D0F7  Yes, then exi TUS ********************************
  D0F9  Indicate "write
  D0FB  Branch always
                 otect" status (C08E)
D0FD ********** GET STA arry flag
                 e (C08C)
  D0FD  Get Slot numb priate status >>D0F7
  D102  Check "write-p                            ************
  D105  Put result in DESIRED TRACK **********************
  D106  Select read mod
  D109  Exit with approx number for proper phase
                 ation track * 2 (D36F)
D10C ********** LOCATE off <D125>
                 Device Track Table <D4F1>
  D10C  Double the trac)
  D10D  Preserve desire track (D35A)              ************
  D110  Turn all phases track (D36F)
  D113  Get offset int rack Table (D359)
  D116  Get track (D359 ired track <D133>
  D119  Update "curren e number, starting with 3
  D11C  Get destinatio
  D11F  Update Device T D18A>
  D122  Move arm to des number - More to do?
  D125  Initialize phas ue until all phases done >>D127
  D127  ---             ber by 2 (D35A)
  D128  Clear a phase:<
  D12B   Decrement phas
  D12C  Yes, then conti ROUTINE **********************
  D12E  Divide track nu
  D132  Return to call to find (D372)
                 here? (D35A)
D133 ********** ARE MOV propriate phase and exit >>D187
                 count (halftracks) (D36B)
  D133  Preserve track t" track for comparisons (D371)
  D136  Are we already to find to compute delta-tracks ************
  D139  Yes, then set here? (D372)
  D13D  Initialize phas prior phase and exit >>D183
  D143  Preserve "curre racks - go move arm out >>D155
  D146  Subtract track racks - Get absolute value delta-t
  D147  Are we already t phase to move in (D35A)
  D14A  Yes, then clear ken >>D15A
  D14C  Positive delta- value delta-tracks less 1
  D14E  Negative delta t phase to move out (D35A)
  D150  Increment curre
  D153  Branch always
  D155  Compute absolut
  D157  Decrement curre                                racks less 1
```

```
Disk II Device Driver -- V1.2 -- 6 SEP 86        NEXT OBJECT ADDR: D15A
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  D15A  Compare delta-tracks with phases moved (D36B)
  D15D  Use smaller value for offset to delay tables >>D162
  D162  Are we pointing at last table value yet?
  D164  Yes, then continue to use current offset  >>D168
  D166  Else, use new offset
  D167  Set Carry flag for set phase operation
  D168  Set a phase <D187>
  D16B  Get delay value from table (D373)
  D16E  Delay <D385>
  D171  Get prior phase number (D371)
  D174  Clear Carry flag for clear phase operation
  D175  Clear a phase <D18A>
  D178  Get delay value from table (D37C)
  D17B  Delay <D385>
  D17E  Increment phases moved (D36B)
  D183  Delay <D385>
  D187  Get "current" phase number (D35A)
  D18A  Use low two bits only, zero to three - 000000PP
  D18C  Multiply by two and bring in Carry   - 00000PPC
  D18D  Merge in slot number                 - 0SSS0PPC
  D18F  Put in X-reg for following operation
  D190  Toggle appropriate phase (C080)
  D193  Restore slot number to X-reg
  D195  Return to caller

D196 ********** TABLE 1 ***********************************************
         Read Translate Table with Prenibblize
         Bit mask Tables and Epilog Table in
         unused areas

  D196  Read Translate

          Bit Mask 1
  D1A0  00000000
  D1A1  10000000
  D1A2  01000000
  D1A3  11000000

  D1A4  Read Translate

          Bit Mask 2
  D1C0  00000000
  D1C1  00100000
  D1C2  00010000
  D1C3  00110000

  D1C4  Epilog Table ($DE,$AA,$EB)
```

```
Disk II Device Driver -- V1.2 -- 6 SEP 86        NEXT OBJECT ADDR: D1C4
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  D1C7   Read Translate

          Bit Mask 3
  D1E0  00000000
  D1E1  00001000
  D1E2  00000100
  D1E3  00001100

  D1E4  Read Translate

D200 ********** TABLE 2 ***********************************************

         Write Translate Table
                Every 4th byte starting at $D203

         Postnibblize Bit mask Tables
                Bit mask 1 (Every 4th byte starting at $D200
                Bit mask 2 (Every 4th byte starting at $D201
                Bit mask 3 (Every 4th byte starting at $D202

  D200  Entry for Bit Mask 1
  D201  Entry for Bit Mask 2
  D202  Entry for Bit Mask 3
  D203  Entry for Write Translate

D300 ********** AUXILIARY BUFFER ***************************************

  D300  Auxiliary Buffer ($56 bytes) >>0056

D356 ********** VARIABLE AREA ******************************************

  D356  Track number
  D357  Sector number
  D358  Error number

          Disk Device Track Table
D359    Table Entry
  D359  Current Unit
  D35A  Current Track
  D35B  Slot 1, Devices 1 & 2
  D35D  Slot 2, Devices 1 & 2
  D35F  Slot 3, Devices 1 & 2
  D361  Slot 4, Devices 1 & 2
  D363  Slot 5, Devices 1 & 2
  D365  Slot 6, Devices 1 & 2
  D367  Slot 7, Devices 1 & 2
```

```
Disk II Device Driver -- V1.2 -- 6 SEP 86       NEXT OBJECT ADDR: D367
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  D369  Retry count (initially 64)
  D36A  Recalibration count (initially 1)
D36B    Counter for Read Address routine
D36B    Temporary storage for Read Address routine
  D36B  Track counter for Arm Move routine
  D36C  Checksum computation
  D36D  Volume found
  D36E  Sector found
D36F    Delay counter (low byte)
  D36F  Track found
D370    Checksum found
  D370  Delay counter (high byte)
  D371  Prior Track
  D372  Track number for Arm Move routine

D373 ********** PHASEON/PHASEOFF TABLES ******************************

  D373  Phase on table (delays for disk head acceleration)

  D37C  Phase off table (delays for disk head deacceleration)

D385 ********** WAIT ROUTINE ***************************************

  D385  Wait about 100 times A-register (microseconds)
  D387  ---
  D392  ---
  D397  Return to caller

D398 ********** READ ADDRESS FIELD **********************************

  D398  Initialize "must find" count at $FCFC
  D39D  Increment count (low order byte) - Zero yet?
  D39E  No, skip ahead >>D3A5
  D3A0  Increment count (high order byte) - Zero yet? (D36B)
  D3A3  Yes, exit and indicate Read Error >>D3FB
  D3A5  Read data register (C08C)
  D3A8  Loop until data valid  >>D3A5
  D3AA  Is it first address mark ($D5)?
  D3AC  No, then increment "must find" count >>D39D
  D3AE  Delay for data latch to clear
  D3AF  Read data register (C08C)
  D3B2  Loop until data valid >>D3AF
  D3B4  Is it second address mark ($AA)?
  D3B6  No, then see if it's first address mark >>D3AA
  D3B8  Initialize count for four byte read
  D3BA  Read data register (C08C)
  D3BD  Loop until data valid >>D3BA
  D3BF  Is it third address mark ($96)?
  D3C1  No, then see if it's first address mark >>D3AA
  D3C3  Set Interupt flag
```

```
Disk II Device Driver -- V1.2 -- 6 SEP 86       NEXT OBJECT ADDR: D3C4
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  D3C4  Initialize checksum
  D3C9  Read "odd" encoded byte     1X1X1X1X (C08C)
  D3CE  Align "odd" bits            X1X1X1X1
  D3CF  Save for later (D36B)
  D3D2  Read "even" encoded byte    1X1X1X1X (C08C)
  D3D7  Combine bytes               XXXXXXXX (D36B)
  D3DA  Preserve data (Volume,Track,Sector,Checksum) (D36D)
  D3DD  Do checksum computation (D36C)
  D3E0  Decrement counter - Finished field yet?
  D3E1  No, do some more >>D3C6
  D3E3  Is checksum computation zero?
  D3E4  No, then exit with carry set >>D3FB
  D3E6  Read data register (C08C)
  D3E9  Loop until data valid >>D3E6
  D3EB  Is it first trailing byte ($DE)?
  D3ED  No, then exit with carry set >>D3FB
  D3EF  Delay for data latch to clear
  D3F0  Read data register (C08C)
  D3F3  Loop until data vaild >>D3F0
  D3F5  Is it second trailing byte ($AA)?
  D3F7  No, then exit with carry set >>D3FB
  D3F9  Clear the Carry flag (no error)
  D3FA  Return to caller
  D3FB  Set the Carry flag (error occured)
  D3FC  Return to caller

D3FD ********** READ DATA (ON THE FLY) ROUTINE  **********************

  D3FD  Convert slot number to an
  D3FE  absolute reference (i.e. $60 -> $EC)
  D400  Modify code for current slot number (D45A)
  D403  (i.e. $C08C,X -> $C0EC) (D473)
  D40F  Get data buffer pointers
  D413  Modify code for current Buffer address (D4AF)
  D416  Provides access to top 3rd of Buffer (D4B0)
  D41A  Subtract $54 from current address
  D41F  Modify code for current address - $54  (D497)
  D422  Provides access to middle 3rd of Buffer (D498)
  D426  Subtract $57 from current address
  D42B  Modify code for current address - $AB (D470)
  D42E  Provides access to bottom 3rd of Buffer (D471)

  D431  Initialize must find count at $20
  D433  Decrement count - More to do?
  D434  No, then exit >>D46D
  D436  Read data register (C08C)
  D439  Loop until data valid >>D436
  D43B  Is is 1st header mark ($D5)?
  D43D  No, then try again >>D433
  D43F  Delay for register to clear
  D440  Read data register (C08C)
```

```
Disk II Device Driver -- V1.2 -- 6 SEP 86        NEXT OBJECT ADDR: D443
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  D443  Loop until data valid >>D440
  D445  Is is 2nd header mark ($AA)?
  D447  No, then see if it is 1st header mark >>D43B
  D449  Delay for register to clear
  D44A  Read data register (C08C)
  D44D  Loop until data valid >>D44A
  D44F  Is is 3rd header mark ($AD)?
  D451  No, then see if it is 1st header mark >>D43B
  D453  Initialize offset into data buffer
  D457  Initialize checksum
  D459  Read a data byte (C0EC)
  D45E  Translate it (D100)
  D461  Store it in Auxiliary buffer (D256)
  D464  Compute running checksum
  D466  Increment offset - More to do?
  D467  Yes, then continue >>D457
  D469  Reinitialize offset into data buffer
  D46B  Branch always taken >>D472
  D46D  Set carry flag indicating error
  D46E  Return to caller
  D46F  Store byte in Primary buffer (bottom third) (1000)
  D472  Read a data byte (C0EC)
  D477  Translate it and merge in (D100)
  D47A  bits from Auxiliary buffer (D256)
  D480  Increment offset - done yet?
  D481  No, then do another >>D46F
  D483  Save last byte for later, no time now
  D484  Strip off last two bits   XXXXXX00
  D486  Reinitialize offset
  D488  Read a byte (C0EC)
  D48D  Translate it and merge in (D100)
  D490  bits from Auxiliary buffer (D256)
  D496  Store byte in Primary buffer (middle third) (1000)
  D499  Increment offset - done yet?
  D49A  No, then do another >>D488
  D49C  Read a byte (C0EC)
  D4A1  Strip off last two bits   XXXXXX00
  D4A3  Reinitialize offset
  D4A5  Translate byte and merge in (D100)
  D4A8  bits from Auxiliary buffer (D254)
  D4AE  Store byte in Primary buffer (top third) (1000)
  D4B1  Read a byte (C0EC)
  D4B6  Increment offset - done yet?
  D4B7  No, then do another >>D4A5
  D4B9  Strip off last two bits   XXXXXX00
  D4BB  Is checksum valid? (D100)
  D4BE  No, then exit with error >>D4CC
  D4C0  Get slot number
  D4C2  Read data register (C08C)
  D4C5  Loop until data valid >>D4C2
  D4C7  Is it 1st trailing mark ($DE)?
```

```
Disk II Device Driver -- V1.2 -- 6 SEP 86        NEXT OBJECT ADDR: D4CA
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  D4CA  Yes, then continue with carry clear >>D4CD
  D4CC  Set Carry flag indicating error
  D4CD  Get byte we stored away, we have time now
  D4CE  Set proper offset
  D4D0  Store byte in Primary buffer (offset $55)
  D4D2  Return to caller

D4D3 ********** UPDATE DEVICE TRACK TABLE ****************************

  D4D3  Get offset into Device Track Table <D4F1>
  D4D6  Update Device Track Table (D359)
  D4D9  Return to caller

D4DA ********** DETERMINE IF DRIVE IS ON (DATA CHANGING)**************

  D4DA  Get slot number
  D4DC  Initialize counter
  D4DE  Read data register (C08C)
  D4E1  Delay 25 cycles <D4F0>
  D4E6  Has data register changed? (C08C)
  D4E9  Yes, then exit >>D4F0
  D4EB  Just in case indicate No Device Connected Error
  D4ED  Decrement count - 256 tries yet?
  D4EE  No, try again >>D4DE
  D4F0  Return to caller

D4F1 ********** CONVERT SLOT/DRIVE TO TABLE OFFSET *******************

  D4F1  Preserve A-register
  D4F2  Get Unit number        DSSS0000
  D4F4  Divide by 16           0000DSSS
  D4F8  Put Drive into Carry   0000DSSS  D
  D4FA  Strip out Drive        00000SSS  D
  D4FC  Roll left              0000SSSD
  D4FD  Put result in X-register
  D4FE  Restore A-register
  D4FF  Return to caller

D500 ********** WRITE DATA ROUTINE ***********************************

  D500  Set Carry flag (anticipate error)
  D504  Is diskette "write-protected"? (C08E)
  D507  No, then continue on >>D50C
  D509  Go to error routine >>D5DF
  D50C  Put transition byte from secondary buffer (D300)
  D50F  into zero page for timing
  D511  Use $FF for "sync" byte
  D513  Write first "sync" byte (C08F)
  D519  Set counter for four more
  D51C  Delay so that writes occur
  D51D  Exactly on 40 cycle loops
```

```
D541  Lookup ta byte (Auxiliary buffer) (D300)
D544  Get s ive-or with previous data byte (D2FF)
D546  Write sult in X-reg for table lookup
D54C  Decrem "disk byte" in table (D203)
D54D  No, th ot
D54F  Get ... "disk byte" (C08D)
D551  Initia ent index - Done with Auxiliary buffer?
D553  Exclus en another byte >>D53A
D556  Strip  st byte of Auxiliary buffer
D558  Put re lize index into Primary buffer
D559  Lookup ive-or with next data byte (1000)
D55C  Get s  out last two bits  XXXXXX00
D55E  Write sult in X-reg for table lookup
D564  Get da "disk byte" in table (D203)
D567  Increm ot
D568  No, t "disk byte" (C08D)
D56A  Did b ta byte (Primary buffer) (1000)
D56C  Yes, ent offset, end of this page?
D56E  Did b en continue on >>D553
D570  Yes, ffer start on page boundary?
D572  Carry hen go write checksum >>D5C0
D573  Get t ffer start one past page boundary?
D575  Write hen go write last byte >>D5B3
D57B  Get se indicates odd or even buffer end
D57D  Delay ansition byte
D57E  Increm it (C08D)
D57F  Yes, c ond transition byte
D581  Exclus 2 cycles for correct timing
D584  Strip  ent offset, buffer end on odd byte?
D586  Put re o see if we're done then >>D599
D587  Lookup ive-or with next data byte (1100)
D58A  Get s  out last two bits  XXXXXX00
D58C  Write sult in X-reg for table lookup
D592  Get da "disk byte" in table (D203)
D595  Increm ot
D596  Exclus "disk byte" (C08D)
D599  End o ta byte (Primary buffer - page 2) (1100)
D59B  Strip  ent offset
      ive-or with next data byte (1100)
      buffer? - Put result in carry
      out last two bits  XXXXXX00
```

```
D5B6  Writ
D5BC  Dela
D5C0  Use
D5C2  Look
D5C5  Get
D5C7  Writ
D5CD  Init ce Driver -- V1.2 -- 6 SEP 86       NEXT OBJECT ADDR: D59D
D5CF  Dela ----------------------------------------------------------
D5D3  Load RIPTION/CONTENTS
D5D6  Go w ----------------------------------------------------------
D5D9  Inc
D5DA  Done result in X-reg for table lookup
D5DC  No, up "disk byte" in table (D203)
D5DE  Clea slot
D5DF  Sele e "disk byte" (C08D)
D5E5  Retr data byte (Primary buffer - page 2) (1100)
      ement offset - Done yet?
D5E6 ******then do another >>D581
      then go write checksum >>D5B1
D5E6  Wait >>D5C0
D5E7  Wait last byte
D5E9  Put  e it (C08D)
D5EC  And  y 14 cycles for correct timing
D5EF  Retr last byte in Primary buffer as checksum
      up "disk byte" (D203)
D5F0 ******slot
      e "disk byte" (C08D)
D5F0  Get  ialize offset into "epilog" table
D5F5  Add  y 11 cycles for correct timing
D5F7  To   "epilog" from table ($DE,$AA,$EB,$FF) (D1C4)
D5FA  Sto  rite it <D5E9>
D601  Sub  ement offset
D603  To   all four yet?
D606  Sto  then do another >>D5D3
D60D  Sub  r Carry flag (no error)
D60F  To   ct read mode (C08E)
D612  Stor rn to caller
D618  Init
D61A  Get  *** WRITE A BYTE SUBROUTINE ****************************
D61D  Get
D61F  Put   9 cycles before write
       7 cycles before write
      A-register in data register (C08D)
      write data register (C08C)
      rn to caller

      *** PRENIBLIZE BLOCK ROUTINE ****************************

      buffer pointer
      $2 to buffer address
      ccess top third of buffer >>D5FA
      e result in code below (D630)
      ract $54 from buffer address
      ccess middle third of buffer >>D606
      e result in code below (D625)
      ract $AA from buffer address
      ccess bottom third of buffer >>D612
      e result in code below (D61B)
      ialize offset
      data byte (bottom third)    XXXXXXXX (1000)
      last two bits               000000AB
      in X-reg for table lookup
```



```
Disk II Device
==========
ADDR    DESCR
--------
          Driver -- V1.2 -- 6 SEP 86       NEXT OBJECT ADDR: D51E
  D51E  ----------------------------------------------------------
  D520  Write PTION/CONTENTS
  D523  Decrem ----------------------------------------------------------
  D524  No, th
  D526  Write "sync" byte <D5E7>
  D52B  Write ent counter, done yet?
  D530  Write en do another >>D51E
  D535  Initia first data mark ($D5)
  D536  Initia second data mark ($AA)
  D538  Branch third data mark ($AD)
  D53A  Get da lize checksum
  D53D  Exclus lize index into Auxiliary buffer
  D540  Put re always taken >>D53D
```

```
Disk II Devi
----------
ADDR    DESC

  D59D  Put=
  D59E  Look
  D5A1  Get
  D5A3  Writ
  D5A9  Get
  D5AC  Incr
  D5AD  No,
  D5AF  Yes,
  D5B1  ---
```

```
Disk II Device Driver -- V1.2 -- 6 SEP 86        NEXT OBJECT ADDR: D620
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  D620  Use lookup to reposition bits    0000BA00 (D1E0)
  D623  Save result on stack
  D624  Get data byte (middle third)     XXXXXXXX (1056)
  D627  Get last two bits                000000CD
  D629  Put in X-reg for table lookup
  D62A  Get current value from stack     0000BA00
  D62B  Merge in new bits using table    00DCBA00 (D1C0)
  D62E  Save result on stack
  D62F  Get data byte (top third)        XXXXXXXX (10AC)
  D632  Get last two bits                000000EF
  D634  Put in X-reg for table lookup
  D635  Get current value from stack     00DCBA00
  D636  Merge in new bits using table    FEDCBA00 (D1A0)
  D639  Save result on stack
  D63A  Get offset into primary buffer
  D63B  Compute offset into Auxiliary buffer
  D63D  Put in X-reg
  D63E  Get data byte just created       FEDCBA00
  D63F  Store it in Auxiliary buffer (D300)
  D642  Increment offset primary buffer, done yet?
  D643  No, then do another >>D61A
  D645  Get low order byte of buffer
  D647  Subtract 1 (offset to last byte in buffer)
  D648  Save it for later
  D64A  Get low order byte of buffer
  D64C  Modify code in Write Data Routine (offset) (D552)
  D64F  Buffer on page boundary? - Yes, skip ahead >>D65F
  D651  Else, compute offset to last byte
  D653  Before page boundary
  D654  Get byte (page boundary -1)
  D656  Point at next byte (page boundary)
  D657  Exclusive-or them together       XXXXXXXX
  D659  Strip off last two bits          XXXXXX00
  D65B  Put in X-reg for table lookup
  D65C  Get "disk byte" from table (transition byte) (D203)
  D65F  Save result (0 indicates page boundary)
  D661  Buffer on page boundary? - Yes skip ahead >>D66F
  D663  Get offset to last byte in buffer
  D665  Carry indicates odd or even buffer start
  D666  Get byte (page boundary)
  D668  Did buffer start on odd byte? - Yes skip >>D66D
  D66A  Point at next byte (page boundary +1)
  D66B  Exclusive-or them together
  D66D  Save result
  D66F  Point at last byte in buffer
  D671  Get last byte in buffer          XXXXXXXX
  D673  Strip off last two bits          XXXXXX00
  D675  Save result ("checksum byte")
  D677  Get high order byte of buffer
  D679  Modify code in Write Data Routine (D555)
  D68C  Get slot number for this operation
```

```
Disk II Device Driver -- V1.2 -- 6 SEP 86        NEXT OBJECT ADDR: D68E
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  D68E  Modify code in Write Data Routine (D55D)
  D69A  Return to caller

D69B ********** DETERMINE IF SLOT/DRIVE HAS CHANGED ******************

  D69B  Compare unit number with "current" unit number (D359)
  D69E  Put "current" drive in Carry
  D69F  Has slot changed? - No, then exit >>D6BD
  D6A9  Get "current" slot
  D6AB  Put in X-register
  D6AC  Exit if Slot 0 >>D6BD
  D6AE  Is "current" motor is on? <D4DC>
  D6B1  No, then exit >>D6BD
  D6B8  Wait until "current" motor is off (D370)
  D6BB  Or else timeout >>D6A6
  D6BD  Return to caller

D6BE ******** CLEAR IWM PHASES ***************************************

  D6BE  Get unit number
  D6C0  Strip drive bit
  D6C2  Put slot*16 in X-Register
  D6C3  Clear phases in case there is (C080)
  D6C6  one of them new-fangled storage (C082)
  D6C9  devices sharing this slot  (C084)
  D6CC  with my (t)rusty old Disk II. (C086)
  D6CF  Return to caller

D6D0 ********** CHECK CALLING PARAMETERS ******************************
            Note: For 40-track drives, change byte at $D6E3
                  from $18 to $40

  D6D0  Check command code
  D6D2  Is it greater or equal to 4?
  D6D4  Yes, indicate error >>D6E6
  D6D6  Get Block Number
  D6DA  Is Block Number good? (D356)
  D6DD  Yes, if less than $100 >>D6E8
  D6E0  No, if greater than or equal to $200 >>D6E6
  D6E4  No, if greater than or equal to $118 >>D6E8
  D6E6  Indicate error
  D6E7  Return to caller
  D6E8  All is well
  D6E9  Return to caller

D6EA ******** $D6EA-$D6FF NOT USED **********************************

  D6EA  Not used
```

```
Disk II Device Driver -- V1.3 -- 2 DEC 86        NEXT OBJECT ADDR: D6BE
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

        ****************************************
        *                                      *
        *  5.25" DISK DEVICE DRIVER            *
        *                                      *
        *      RESIDES AT $D000-$D6FF          *
        *                                      *
        *  VERSION 1.3 -- 2 DEC 86             *
        *                                      *
        ****************************************

         The Disk II Device Driver for Version 1.3 changes only
         in one routine--the "clear phases" subroutine.
         Phases are now cleared with a "LDA" instead of
         a "STA" to eliminate bus fights that potentially cause
         unwanted writing to the 5.25" disk.

D6BE ******** CLEAR IWM PHASES ***************************************

  D6BE  Get unit number
  D6C0  Strip drive bit
  D6C2  Put slot*16 in X-Register
  D6C3  Turn off 8 phases
  D6CF  Return to caller

D6D0 ********** CHECK CALLING PARAMETERS ****************************
           Note: For 40-track drives, change byte at $D6E3
                 from $18 to $40.

  D6D0  Check command code
  D6D2  Is it greater or equal to 4?
  D6D4  Yes, indicate error >>D6E6
  D6D6  Get Block Number
  D6DA  Is Block Number good? (D356)
  D6DD  Yes, if less than $100 >>D6E8
  D6E0  No, if greater than or equal to $200 >>D6E6
  D6E4  No, if greater than or equal to $118 >>D6E8
  D6E6  Indicate error
  D6E7  Return to caller
  D6E8  All is well
  D6E9  Return to caller

D6EA ******** $D6EA-$D6FF NOT USED ***********************************

  D6EA  Not used
```

```
IRQ Handler -- V1.2 -- 6 SEP 86                NEXT OBJECT ADDR: FF9B
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

FF9B    MODULE STARTING ADDRESS
            ************************************
            *                                  *
            * IRQ Handler                      *
            *     Resides at $FF9B.  Put       *
            *     there by ProDOS Relocator.   *
            *                                  *
            * VERSION 1.2 -- 6 SEP 86          *
            * VERSION 1.3 -- 2 DEC 86          *
            * (The IRQ Handler is still the    *
            *  same as it was in Version 1.0.1) *
            *                                  *
            ************************************

FF9B ********** GLOBAL PAGE EQUATES **********************************

BF56    Temporary storage 1
BF57    Temporary storage 2
BF88    A register savearea
BF8D    Bank ID byte
BFD3    IRQ exit code

FF9B ********** EXTERNAL EQUATES ***********************************

D000    RAM/ROM test byte
C082    ROM Select
C08B    BANK1 Select

FF9B ********** IRQ CODE ******************************************

  FF9B  Put A-Register on stack
  FF9C  Get Accumulator value from $45
  FF9E  and save it (BF56)
  FFA1  Replace $45 with A-Register
  FFA2  since it may have been destroyed
  FFA4  Load Status register
  FFA5  Restore onto stack
  FFA6  Isolate B flag - Was it a BRK?
  FFA8  Yes, skip Interrupt stuff >>FFC2
  FFAA  Else, Check location $D000 (D000)
  FFAD  Do we have RAM active
  FFAF  Yes, indicate so >>FFB3
  FFB1  Else, indicate ROM
  FFB3  Update Bank ID byte (BF8D)
  FFB6  Also save temporarily (BF57)
  FFB9  Push ($BF50) address of
  FFBB  routine to bank in Ram and
  FFBC  call IRQ on the stack
  FFBF  Push a new P-Register on stack with
  FFC1  the Interrupt Disable flag set
  FFC2  Push ($FA41) address less 1 of
```

```
IRQ Handler -- V1.2 -- 6 SEP 86                NEXT OBJECT ADDR: FFC4
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  FFC4  Monitor IRQ on the stack
  FFC8  Select ROM - execution continues in ROM (C082)

            ******* RESET CODE ***************

  FFCB  Push ($FA61) address less 1 of (FFD7)
  FFCE  Hardware Reset routine on to stack
  FFD3  Exit via select ROM code above >>FFC8

  FFD6  Address (-1) of Hardware Reset routine

            ******* IRQ CODE *****************
          Called via $BF50 in System Global Page

  FFD8  Save Accumulator in Global page (BF88)
  FFDB  Restore $45 with original value (BF56)
  FFE0  Select RAM (read & write) (C08B)
  FFE3  use BANK1 (C08B)
  FFE6  Get Bank ID byte (BF57)
  FFE9  Leave via Global Page IRQ exit code >>BFD3

FFEC *********** $FFEC-$FFF9 UNUSED *********************************

  FFEC  These unused bytes are at $4FEC-$4FF9 when
  FFF9  loaded as part of the "PRODOS" file.

FFFA ********** VECTORS ********************************************

  FFFA  NMI Vector
  FFFC  Reset Vector
  FFFE  IRQ Vector
```

```
ThunderClock Code -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: D742
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

D742    MODULE STARTING ADDRESS

            ************************************
            *                                  *
            * CLOCK Code (for ThunderClock)    *
            *     If a ThunderClock or its     *
            *     equivalent is located, then  *
            *     this code is loaded into the *
            *     ProDOS data area at $D742.   *
            *                                  *
            * VERSION 1.2 -- 6 SEP 86, and     *
            * VERSION 1.3 -- 2 DEC 86          *
            *                                  *
            ************************************

D742 ********** ZERO PAGE EQUATES ***********************************

003A    Binary month (1=JAN, 2=FEB, etc.)
003B    Binary day of week (0=Sunday, 1=Monday, etc.)
003C    Binary day of the month (1-31)
003D    Binary hour of the day (0-23)
003E    Binary minute of the hour (0-59)

D742 ********** EXTERNAL EQUATES *************************************

0200    Input Buffer
BF90    Global page year-month-day
BF92    Global page hours-minutes

D742 ********** CLOCK CODE ENTRY POINT *******************************

  D742  Get slot ROM high byte (D750)
  D745  Get a screen hole byte for this slot (0538)
  D748  and save it on the stack
        The two JSR addresses that follow will be
        modified by ProDOS Relocator so that they
        will access the correct slot ROM.
  D74B  Write an $A3 to the clock (consult your Thunderclock manual) <C10B>
  D74E  Read the clock. <C108>
        Reading the clock results in an ASCII string
        being placed in the input buffer.  A sample
        string might be "07,06,04,22,46,57", which is
        July (month 07) Saturday (day-of-week 6)
        the 4th (day of month 4) 10 PM (hour 22)
        46 minutes and 57 seconds after the hour.
```

```
ThunderClock Code -- V1.2 -- 6 SEP 86          NEXT OBJECT ADDR: D751
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

D751 ******* CONVERT ASCII TO BINARY *********************************

  D751  ---
  D752  Five values to convert (ProDOS ignores seconds)
  D754  Y-reg is index into
  D756  the input buffer (0200)
  D759  Strip ASCII from ten's digit
  D75D  by 10
  D762  Add in one's digit (0201)
  D766  and subtract off ASCII,
  D768  then store as binary in Z-page
  D76A  Skip over comma
  D76B  and two digits
  D76E  More values to convert >>D756

D770 ******* NOW CONVERT TO PRODOS DATE, TIME ***********************

  D770  Save month in Y-reg
  D771  three low bits of month
  D774  three high bits of accum,
  D775  combine with day of month,
  D777  and store in low byte of DATE (MMMDDDDD) (BF90)
  D77A  Save carry (high bit of month)
  D77B  Add day of the month
  D77D  to table value to get Julian date (D7AB)
  D780  Late September? >>D784
  D782  Yes, add 3 and carry (see notes below)
  D784  Compute Julian date MOD 7
  D785  ---
  D78B  Subtract day-of-week to get year index
  D78D  Index positive? >>D791
  D78F  No, make it positive
  D791  Index to Y-Reg
  D792  Get year from year table (D7B8)
  D795  Get high bit of month in carry
  D796  roll it into accumulator
  D797  to get high byte of DATE (YYYYYYYM) (BF91)
  D79A  Put hour
  D79C  in high byte of TIME (BF93)
  D79F  Put minutes
  D7A1  in low byte of TIME (BF92)
  D7A8  Restore saved screen hole value (0538)
  D7AB  RETURN

D7AC ******* JULIAN TABLE *****************************************

  D7AC  January
  D7AD  February
  D7AE  March
  D7AF  April
  D7B0  May
```

```
ThunderClock Code -- V1.2
-------------------------
ADDR    DESCRIPTION/CONTEN
-------------------------

  D7B1  June
  D7B2  July
        If month>7, value
        less than Julian,
        is added along wit
  D7B3  August
  D7B4  September
         Note: For Julian
               is three mo
               so that it
  D7B5  October
  D7B6  November
  D7B7  December

D7B8 ******* YEAR TABLE **
        This table is good

  D7B8  1990
  D7B9  1989
  D7BA  1988 (March to Dec
  D7BB  1988 (January and
  D7BC  1987
  D7BD  1986
  D7BE  1991
```

nt

```
 6 SEP 86           NEXT OBJECT ADDR: D7B1
-----------------------------------------
S
-----------------------------------------

in table is one
because a carry
h the day of the month


ates>255, the table value
e than the low byte should be,
will properly divide by 7.


****************************************
 for the years 1986-91


ember)
February)
```

```
        *    an AP
        *    code
        *    ProDOS
        *
        * VERSION
        * VERSION
        *
        **********
```

```
V1.2 -- 6 SEP 86                NEXT OBJECT ADDR: D742
-----------------------------------------------------
/CONTENTS
-----------------------------------------------------
TING ADDRESS
```

```
D742 ******** GLOB
BF90     ProDOS DAT
BF92     ProDOS TIM
```

```
D742 ******** IIGS **************************
                                              *
K Code                                        *
DOS 8 is booted on                            *
le IIGS, then this                            *
s loaded into the                             *
 data area at $D742.                          *
                                              *
.2 -- 6 SEP 86, and                           *
.3 -- 2 DEC 86                                *
                                              *
**********************************************
```

```
C068     One byte s
```

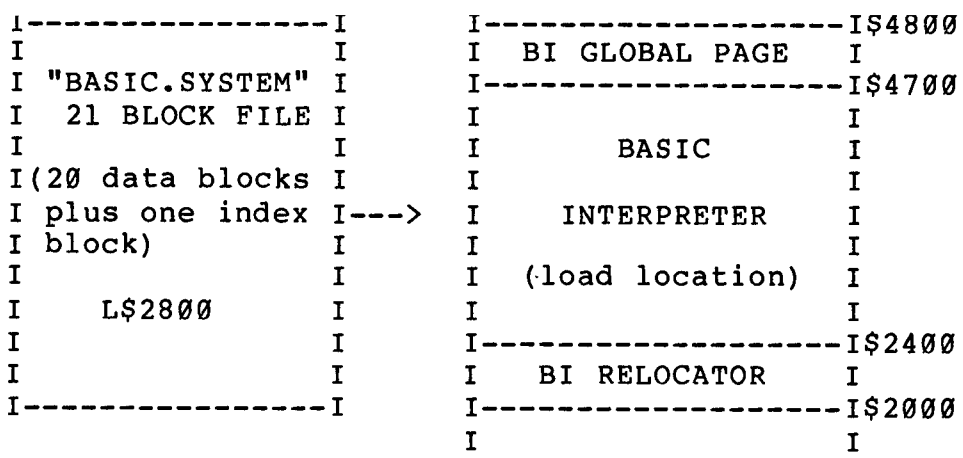
```
D742 ******** CLOC
  D742  8-bit memo
  D744  Get IIGS S
  D747  save it te
  D74A  Make sure
  D750  Get out o
  D751  16-bit me
  D756  Push 4 nu
  D75A  Tool = Rea
  D75D  Jump to th
  D761  8-bit mem
  D763  Get pre-ca
  D766  and resto
  D769  Throw away
  D76B  Store min
  D76F  Store hou
  D772  Get year
  D773  and store
  D776  Get day of
  D777  in range
  D778  and save
  D77B  Get month
  D77C  in range
  D77D  and shift
  D782  Combine wi
  D785  and store
```

```
L PAGE VALUES ************************************

 word, YYYYYYYMMMMDDDDD.
 word, 000HHHHH00MMMMMM.

 SOFT SWITCH **************************************

ts 8 soft switches.

K CODE ENTRY POINT *******************************

y and index operations.
TATEREG Status Byte,  (C068)
porarily.  (D790)
e're in bank 0.
 emulation mode.
ry and index operations.
 words on the stack.
dTimeHex.  (0D03)
e tool dispatcher.  <E10000>
y operations.
ll Status Byte  (D790)
e all soft switches.  (C068)
 seconds.
es in ProDOS Global Page.  (BF92)
s in ProDOS Global Page.  (BF93)

it temporarily.  (BF91)
 month
-31
t temporarily.  (BF90)

-12
it left five bits.
th the date  (BF90)
in Global Page as MMMDDDDD.  (BF90)
```



```
IIGS Clock Code ---
-------------------
ADDR    DESCRIPTION
-------------------

D742    MODULE STAR

        **********
        *
        * IIGS CLO
        *    If Pr
```

```
IIGS Clock Code -- V1.2 -- 6 SEP 86              NEXT OBJECT ADDR: D788
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

  D788  Roll high bit of month into year to put  (BF91)
         YYYYYYYM in Global Page.
  D78B  Throw away day of week
  D78C  and null byte.
  D78E  Back to emulation mode.
  D78F  RETURN

  D790  Saved STATEREG Byte.

  D791  Vanity code.

  D7A1  $D7A1 to $D7BE not used, set to 0.
```



(3) The BI Relocator searches for a "STARTUP" file in the same directory as "BASIC.SYSTEM". If found, it loads and executes the "STARTUP" program. Otherwise, it prints out a greeting and cold starts BASIC by jumping to the BASIC entry point at $BE00.

```
BI Relocator -- V1.1 -- 18 JUN 84              NEXT OBJECT ADDR: 2000
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

2000    MODULE STARTING ADDRESS

          ****************************************
          *                                      *
          *  PRODOS BASIC INTERPRETER RELOCATOR  *
          *       LOADED AS THE FIRST TWO BLOCKS *
          *       OF BASIC.SYSTEM AT $2000.      *
          *       THIS ROUTINE MOVES THE BASIC   *
          *       INTERPRETER TO $9A00-$BCFF.    *
          *                                      *
          *  BASIC VERSION 1.1 -- 18 JUN 84      *
          *                                      *
          *  DISTRIBUTED WITH PRODOS 8 VERSIONS  *
          *     1.1.1, 1.2, and 1.3.             *
          *                                      *
          ****************************************

          ******** ZERO PAGE ADDRESSES ************

0000    "FROM" POINTER FOR COPY
0001
0002    "TO" POINTER FOR COPY
0003
0036    CSWL VECTOR
0038    KSWL VECTOR
006F    APPLESOFT START OF STRINGS
0073    APPLESOFT HIMEM
00F2    APPLESOFT TRACE FLAG

          ******** EXTERNAL ADDRESSES *************

0200    PATHNAME BUFFER
0280    PREFIX BUFFER
0281    START OF PREFIX NAME

03D0    WARMSTART VECTOR
03D3    COLDSTART VECTOR
03F0    BRK HANDLER ADDRESS
03F1
03F2    RESET HANDLER ADDRESS
03F3
03F4    POWER-UP BYTE
03F5    APPLESOFT & VECTOR
03F8    CTL-Y VECTOR

          ******** SCREEN LINE ADDRESSES **********
```

```
BI Relocator -- V1.1 -- 18 JUN 84              NEXT OBJECT ADDR: 2000
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

0400    FIRST SCREEN BUFFER LINE
0480    SCREEN BUFFER LINE
0628    SCREEN BUFFER LINE

          ******** BASIC GLOBAL PAGE **************

BC7A    BASIC INTERPRETER VERSION NUMBER
BE00    BASIC INTERPRETER ENTRY POINT
BE03    BI COMMAND SCANNER (SYNTAX)
BE10    COUT VECTORS FOR EACH SLOT
BE20    KSWL VECTORS FOR EACH SLOT
BE3C    DEFAULT SLOT NO.
BE3D    DEFAULT DRIVE NO.
BEFB    HIMEM

          ******** SYSTEM GLOBAL PAGE *************

BF00    MACHINE LANGUAGE INTERFACE ENTRY
BF30    LAST DEVICE USED
BF58    MEMORY MAP
BF98    MACHINE TYPE FLAGS
BF99    SLOTS WHICH CONTAINS CARDS WITH ROM
BF9A    IF 0, NO PREFIX ACTIVE
BFFD    INTERPRETER VERSION NUMBER

          ******** ROM ADDRESSES ******************

E000    APPLESOFT ENTRY POINT
FA59    BRK HANDLER
FB2F    INIT SCREEN, MONITOR, ETC.
FC58    CLEAR SCREEN, HOME CURSOR
FDED    STANDARD CHARACTER OUT
FDF0    CHARACTER OUTPUT TO SCREEN
FE84    SET NORMAL CHARACTER ATTRIBUTE

2000 *********** BASIC INTERP RELOCATOR ENTRY ************************

  2000  JUMP OVER STARTUP FILENAME >>2047
  2006  STARTUP FILENAME LENGTH (7)
  2007  'STARTUP'
  200E  ALLOW FOR 64 CHAR FILENAME

  2047  $00 --> $2400
  204B  $02 --> $9A00
  2055  COPY 35 PAGES
  2058  COPY INTERP TO HIGH MEMORY AT $9A00 <20C4>
  205D  PAGE FOLLOWING INTERP IMAGE IS...
  205F  BASIC GLOBAL PAGE IMAGE
  2061  COPY THAT TO $BE00 <20C4>
  2064  TO GET 40-COL DISPLAY, SEND A CTRL-U
```

```
BI Relocator -- V1.1 -- 18 JUN 84              NEXT OBJECT ADDR: 2066
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  2066  OUT THE NORMAL OUTPUT VECTOR. <FDED>
  2069  SET NORMAL CHARACTER ATTRIBUTE <FE84>
  206C  INITIALIZE SCREEN/WINDOW <FB2F>
  206F  CLEAR SCREEN/HOME CURSOR  <FC58>
  2076  SET BITMAP TO MARK LOWER 48K FREE (BF58)
  207C  EXCEPT PAGES 0 AND 1 AND
  207E   TEXT PAGES 4 THROUGH 7 (BF58)
  2086  MARK $9000-$BFFF IN USE..
  2091  EXCEPT FOR $BA00-$BDFF ARE FREE
  2096  LOOK AT LANGUAGE IN ROM (E000)
  2099  IS IT APPLESOFT?
  209B  NO, THEN CAN'T RUN INTERP >>20B1
  20A0  GOT AT LEAST 64K?
  20A2  NO, THIS ONLY WORKS IN 64K >>20B1
  20A6  SET MY CSWL/KSWL FOR INTERP INIT (221A)
  20AC  COPY ALL 4 BYTES >>20A6
  20AE  THEN GO TO BASIC COLDSTART >>E000
          (WE WILL GET CONTROL AT $20D4 AGAIN)

20B1 *********** ERROR EXIT ***************************************

  20B1  ---
  20B3  PRINT "UNABLE TO EXECUTE BASIC SYSTEM" (223F)
  20BC  ALLOW REBOOT IF RESET PRESSED (03F4)
  20C2  GO TO SLEEP FOREVER >>20C2

20C4 *********** COPY PAGES ($0/1-->$2/3) ****************************

  20C4  ---
  20C5  COPY FROM $0/1
  20C7  TO $2/3
  20CA  A PAGE AT A TIME >>20C4
  20D0  COUNT PAGES
  20D3  RETURN

20D4 *********** CSWL INTERCEPT / CONTINUE ***************************

  20D4  "]" APPLESOFT PROMPT?
  20D6  NO...DON'T PRINT WHATEVER IT IS >>20D3
  20D8  YES, APPLESOFT DONE SETTING UP (BE10)
  20DB  POINT CSWL TO STANDARD OUTPUT
  20E2  CHECK LAST DEVICE USED (BF30)
  20E5  SET ONLINE PARAMETER TO THIS (2238)
  20EB  DRIVE ONE OR TWO? >>20EE
  20EE  STORE DEFAULT DRIVE (D) (BE3D)
  20F2  ISOLATE SLOT FROM DEVICE NO.
  20F7  AND STORE DEFAULT SLOT (S) (BE3C)
  20FE  GET SLOT BYTE SHOWING CARDS PRESENT (BF99)
  2102  PICK OFF ITS BITS ONE BY ONE
  2108  SET OUTVECS AND INVECS TO $CS00 (BE10)
  210B  FOR ALL SLOTS WITH ROMS IN THEM (BE20)
```

```
BI Relocator -- V1.1 -- 18 JUN 84              NEXT OBJECT ADDR: 2115
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  2115  ---
  211B  SET HIMEM TO $9600
  211D  IN VARIOUS PLACES
  2124  GOT A DEFAULT PREFIX? (BF9A)
  2127  NO >>214E
  2129  YES, MLI: GET PREFIX <BF00>
  212F  ERROR? >>218B
  2136  BACKSCAN PREFIX FOR "/"'S (0280)
  213B  AND COUNT THEM IN $223E (223E)
  213E  ---
  213F  FOR A COUNT OF SUBLEVELS >>2136
  2146  MORE THAN JUST VOLUME NAME? >>216F
  2148  NO, MLI: SET PREFIX <BF00>
  214E  MLI: ONLINE <BF00>
  2154  ERROR? >>218B
  2156  GET VOL NAME LENGTH  (0281)
  215B  NONE THERE? >>218B
  215F  ADD ONE TO NAME LENGTH (0280)
  2164  AND PREFIX IT WITH A "/" (0281)
  2167  MLI: SET PREFIX <BF00>
  216D  ERROR? >>218B

        ******** FIND STARTUP FILE **************

  216F  MLI: GET_FILE_INFO <BF00>
  2172  FIND "STARTUP" FILE
  2175  ERROR? >>218B
  217A  SAVE LENGTH OF STARTUP FILE NAME (2236)
  217D  COPY NAME TO $200 (2006)
  2186  FIRST COMMAND WILL BE "-STARTUP"
  218B  CHECK NUMBER OF SUBLEVELS (223E)
  2190  MORE THAN JUST VOL? >>2198
  2192  MLI: SET PREFIX <BF00>
  2198  ANY STARTUP FILE NAME? (2236)
  219B  YES, SKIP MESSAGE >>21C1
  219D  SET TRUE KSWL <2209>
  21A2  PRINT '          PRODOS BASIC 1.1' (2267)
  21AD  PRINT '       COPYRIGHT ... (2283)
  21B6  SKIP THREE LINES

        ******** FINISH UP AND GO TO BI *********

  21C1  ---
  21C3  COPY WARMSTART JMP TO PAGE 3 (21FF)
  21C9  AND COLDSTART (03D3)
  21CC  AND CTL-Y (03F8)
  21CF  POINT & VECTOR (2206)
  21D2  TO $BE03 (CMD SCANNER) (03F5)
  21D8  COPY BRK HANDLER JMP ALSO (2202)
  21E7  AND RESET JMP (03F2)
  21F2  SET POWER-UP BYTE ACCORDINGLY (03F4)
```

```
BI Relocator -- V1.1 -- 18 JUN 84                NEXT OBJECT ADDR: 21F7
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  21F7  SET APPLESOFT IN NON-TRACE MODE
  21F9  GET INTERPRETER VERSION NUMBER, (BC7A)
  21FC  PUT IT, AN SYSTEM GLOBAL PAGE. (BFFD)
  21FF  GO TO INTERPRETER >>BE00

        ******* VECTOR ADDRESSES ***************

  2202  BREAK HANDLER ADDRESS FOR PAGE 3
  2204  RESET HANDLER IS BASIC INTERP
  2206  APPLESOFT & GOES TO BI CMD SCANNER >>BE03

2209 ********** FIRST KSWL INTERCEPT *********************************

  2209  SET KSWL TO CURRENT DEVICE HANDLER (BE20)
  2213  RETURN TO LENGTH OF FIRST COMMAND (2006)
  2217  FOLLOWED BY A RETURN
  2219  RETURN

221A ********** DATA ************************************************

  221A  CSWL (2006) INTERCEPT ADDR
  221C  KSWL (2009) INTERCEPT ADDR

  221E  GET FILE INFO PARMLIST
  221F  FILE NAME IS AT $2006
  2221  15 BYTES RESERVED FOR OTHER GET_FILE PARMS (NOT USED)
  2230  THIS BYTE NOT USED

  2231  SET PREFIX PARM LIST
  2232  FOR PREFIX AT $2234

  2234  NULL PREFIX

  2235  "/"

  2236  SAVED LEVELS INDEX

  2237  ONLINE PARM LIST
  2239  PUT VOLUME NAME AT $281

  223B  SET PREFIX PARM LIST
  223C  PREFIX LENGTH AT $280

  223E  NUMBER OF SUBLEVELS IN PREFIX +1
  223F  '***  UNABLE TO EXECUTE BASIC SYSTEM  ***'
  2267  '          PRODOS BASIC 1.1'
  2283  '  COPYRIGHT APPLE, 1983-84'
```

```
BI Relocator -- V1.1 -- 18 JUN 84                NEXT OBJECT ADDR: 2283
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

22A3 ********** $22A3-$23FF NOT USED *********************************

  22A3  NOT USED

2400 ********** START OF BI IMAGE ************************************

2400    BASIC INTERP IMAGE
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: 9A00
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

9A00    MODULE STARTING ADDRESS

          ****************************************
          *                                      *
          *  PRODOS BASIC INTERPRETER (BI)       *
          *       THIS CODE STARTS IN THE THIRD  *
          *       BLOCK OF THE FILE BASIC.SYSTEM.*
          *       IT PERFORMS COMMAND HANDLING   *
          *       FOR ALL BUILT-IN PRODOS COM-   *
          *       MANDS AND SUPPORTS BASIC'S FILE*
          *       HANDLING.                      *
          *                                      *
          *  VERSION 1.1 -- 18 JUN 84            *
          *                                      *
          *  DISTRIBUTED WITH PRODOS VERSIONS    *
          *    1.1.1, 1.2, AND 1.3.              *
          *                                      *
          ****************************************

          ******** ZERO PAGE ADDRESSES ************

0024    CURSOR HORIZONTAL
0028    SCREEN LINE BASE ADDR
0029
0033    MONITOR PROMPT CHARACTER
0036    CRT DISPLAY VECTOR (CSWL)
0037
0038    KEYBOARD INPUT VECTOR (KSWL)
0039
003A    SCRATCH POINTER AND LOOP COUNTER
003B
003C    SCRATCH POINTER AND LOOP COUNTER
003D
003E    POINTER TO APPLESOFT VARIABLES
003F
0050    APPLESOFT: LINE NUMBER
0051
0067    APPLESOFT: START OF PROGRAM PTR
0068
0069    APPLESOFT: LOMEM (START OF VARS)
006A
006B    APPLESOFT: START OF ARRAY VARS PTR
006C
006E    APPLESOFT: START OF FREEAREA PTR
006D
006F    APPLESOFT: START OF STRINGS PTR
0070
0073    APPLESOFT: HIMEM (END OF STRINGS)
0074
0075    APPLESOFT: CURRENT LINE BEING EXECUTED
0076
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: 9A00
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

009B    APPLESOFT: ADDR OF LINE AFTER FINDLINE
009C
00AF    APPLESOFT: END OF PROGRAM PTR
00B0
00B8    APPLESOFT: START OF PROGRAM PTR
00B9
00D6    APPLESOFT: PROGRAM LOCKED (PROTECTED)
00D8    APPLESOFT: ONERR ACTIVE FLAG
00DE    APPLESOFT: ONERR CODE
00F2    APPLESOFT: TRACE ACTIVE FLAG
00F8    APPLESOFT: INTERNAL STACK

          ******** EXTERNAL ADDRESSES *************

0100    START OF 6502 STACK
0200    KEYBOARD INPUT LINE BUFFER
03F4    POWERON RESET FLAG

          ******** BI GLOBAL PAGE *****************

BE06    EXTERNAL COMMAND ENTRY TO BI
BE0C    PRINT ERROR MESSAGE ENTRY TO BI
BE0F    PRODOS ERROR CODE
BE10    OUTPUT VECTORS FOR ALL SLOTS
BE30    CURRENT OUTPUT VECTOR
BE32    CURRENT INPUT VECTOR
BE34    PRODOS INTERCEPT VECTORS (INPUT/OUTPUT)
BE38    BI'S INTERNAL REDIRECTION VECTORS
BE3C    DEFAULT SLOT
BE3D    DEFAULT DRIVE
BE3E    A REGISTER SAVE AREA
BE3F    X REGISTER SAVE AREA
BE40    Y REGISTER SAVE AREA
BE41    TRACE FLAG (APPLESOFT TRACE ON/OFF)
BE42    IMMEDIATE COMMANDS=0, DEFERRED=1
BE43    EXEC FILE ACTIVE=$80
BE44    READ FILE ACTIVE=$80
BE45    WRITE FILE ACTIVE=$80
BE46    READING PREFIX ACTIVE=$80
BE47    DIRECTORY FILE BEING ACCESSED
BE49    FREE STRING SPACE DURING GARBAGE COLLECT
BE4A    BUFFERED I/O BYTE COUNT
BE4B    INDEX INTO INPUT COMMAND LINE
BE4C    LAST OUTPUT CHAR TO PREVENT RECURSION
BE4D    NUMBER OF OPEN NON-EXEC FILES
BE4E    EXEC FILE BEING CLOSED FLAG
BE4F    READ FILE IS TRANSLATED DIRECTORY
BE50    VECTOR TO EXTERNAL COMMAND HANDLER
BE52    LENGTH-1 OF EXTERNAL COMMAND STRING
BE53    COMMAND NUMBER
BE54    PARAMETERS ALLOWED FOR THIS COMMAND
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: 9A00
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

          (SEE BIT DEFINITIONS IN TABLE LATER)
BE56    PARAMETERS FOUND WITH THIS COMMAND
          (SAME BIT DEFINITIONS AS FOR PBITS)
BE58    A KEYWORD VALUE
BE5A    B KEYWORD VALUE
BE5D    E KEYWORD VALUE
BE5F    L KEYWORD VALUE
BE61    S KEYWORD VALUE
BE62    D KEYWORD VALUE
BE63    F KEYWORD VALUE
BE65    R KEYWORD VALUE
BE68    @ KEYWORD VALUE
BE6A    T KEYWORD VALUE
BE6B    SLOT NUMBER FROM IN# OR PR#
BE70    ISSUE MLI CALL AND XLATE ERROR CODES
          MLI PARM LIST FIELDS
BEA3    CREATE: ACCESS CODE
BEA4    CREATE: FILE ID
BEA5    CREATE: AUX ID
BEA7    CREATE: FILE KIND
BEB4    SET/GET FILE INFO: PARM COUNT
BEB7    SET/GET FILE INFO: ACCESS CODE
BEB8    SET/GET FILE INFO: FILE ID
BEB9    SET/GET FILE INFO: AUX ID
BEBB    SET/GET FILE INFO: FILE KIND
BEBC    SET/GET FILE INFO: BLOCKS USED
BEBE    SET/GET FILE INFO: MODIFY DATE/TIME
BEC7    ONLINE/GET/SET MARK/EOF/BUF: REF NUM
BEC8    ONLINE/GET/SET MARK/EOF/BUF: MARK/BUF
BECE    OPEN: SYSTEM BUFFER
BED0    OPEN: REF NUM RETURNED
BED2    NEWLINE: REF NUM
BED3    NEWLINE: NEW LINE CHAR (ALWAYS CR)
BED6    READ/WRITE: REF NUM
BED7    READ/WRITE: DATA ADDRESS
BED9    READ/WRITE: LENGTH OF DATA
BEDB    READ/WRITE: ACTUAL LENGTH TRANSMITTED
BEDE    CLOSE/FLUSH: REF NUM
BEFB    BASIC HIMEM VALUE

        ******** SYSTEM GLOBAL PAGE *************

BF03    QUIT VECTOR
BF30    LAST DEVICE USED
BF58    MEMORY UTILIZATION BIT MAP
BF94    OPEN FILE LEVEL
BF9A    PREFIX ACTIVE FLAG (IF NONZERO)
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: 9A00
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

        ******** INPUT/OUTPUT LOCATIONS *********

        ******
                STROBE
C000    KEYBOARD STROBE CLEAR
C010    KEYBOARD ROMS
CFFF    RESET

        ******** APPLESOFT ROM LOCATIONS ********

        ******
                RESTART ENTRY
D43F    APPLESOFT BY NUMBER IN APPLESOFT
D61A    FIND LIN TERS IN APPLESOFT
D665    SET POI NEW APPLESOFT STATEMENT
D7D2    EXECUTE  CMD EXECUTE
D820    APPLESOF SIGNAL ERROR
D865    APPLESOF PRINT DECIMAL NUMBER
ED24    APPLESOF SET NORMAL CHARS
F273    APPLESOF

        ******** MONITOR ROM LOCATIONS **********

        ******
                CLEAR SCREEN/HOME CURSOR
FC58    MONITOR CLEAR TO EOL
FC9C    MONITOR READ KEY (NO CURSOR)
FD10    MONITOR TOR
FDED    COUT VEC

                BASIC INTERPRETER LOAD POINT ************************
9A00 ********** POINT IS AT $ABF1, WARMDOS)
          (ENTRY

                REMOVE KSWL/CSWL INTERCEPTS *************************
9A00 **********

  9A00  ---     CSWL/KSWL WITH CURRENT (BE30)
  9A01  REPLACE EVICE DRIVER VECTORS
  9A04  ACTUAL
  9A16  RETURN

                RESET MODE/SET BI INTERCEPTS ************************
9A17 **********
                DIATE COMMAND MODE
  9A17  SET IMM ET I/O VECTORS <9F76>
  9A19  AND GO  LREADY SET?
  9A1C  KSWL/C  CHECK CSWL >>9A26
  9A21  NO? THE TINUE >>9AA3
  9A23  YES, CO LREADY SET?
  9A26  CSWL/H  TINUE >>9AA3
  9A2B  YES, CO CURRENT INTERCEPTS FIRST >>9A8D
  9A2D  NO, SA
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: 9AA2
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------


9AA3 *********** SET CSWL/KSWL INTERCEPTS ****************************

  9AA3  ---
  9AA4  COPY VDOSIO VECTORS (BE34)
  9AA7  TO CSWL
  9AB1  AND KSWL
  9AB9  EXIT TO CALLER

9ABA *********** INPUT INTERCEPT: MODE = Ø ***************************
         (IMMEDIATE MODE)

  9ABA  IS EXEC FILE ACTIVE? (BE43)
  9ABD  NO >>9AC5
  9ABF  YES, SAVE REGISTERS <9F62>
  9AC2  AND GO READ EXEC FILE FOR INPUT COMMANDS >>9BAF

  9AC5  NO EXEC FILE, RESTORE REAL CSWL/KSWL  <9AØØ>
  9AC8  NO, READ A KEY FROM KEYBOARD <FD1Ø>
  9ACB  RETURN?
  9ACD  NO, EXIT >>9AEB
  9ACF  YES, SAVE REGISTERS <9F62>
  9AD2  STORE IT IN LINE BUFFER (Ø2ØØ)
          --> THIS ENTRY CALLED BY EXEC TO PROCESS
              A COMMAND STRING STORED AT $2ØØ
  9AD5  GO PROCESS THE COMMAND STRING <A677>
  9AD8  CHECK COMMAND NUMBER RETURNED FROM PARSE (BE53)
  9ADB  EXIT BI RIGHT NOW? >>9AE8
  9ADD  NO, COMMAND RETURNED WITH ERROR CODE? >>9AFØ
  9ADF  NO, RESTORE Y REG (BE4Ø)
  9AE2  RETURN A BACKSPACE TO CALLER OF KEYBOARD
  9AE4  AND A LINE INDEX OF ZERO
  9AE6  EXIT THE BI >>9AEB

  9AE8  RESTORE CALLER'S REGISTERS <9F6C>
  9AEB  AND EXIT BI BY INSTALLING INTERCEPTS >>9A8D

9AEE *********** ERROR HANDLER ***************************************

  9AEE  ERROR=3, "NO DEVICE CONNECTED"
  9AFØ  MAIN ENTRY: STORE ERROR CODE (BEØF)
  9AF3  AND IN APPLESOFT ONERR
  9AF5  CHECK BI STATE (BE42)
  9AF8  MEMORIZE WHETHER IT'S IMMEDIATE MODE
  9AFD  SET A HIGH FILE LEVEL FOR NON-EXEC FILES (BF94)
  9B02  NO ACTIVE READ/WRITE FILES OR PREFIX READ (BE44)
  9BØB  CLOSE ALL OPEN FILES AT OR ABOVE (BEDE)
  9BØE  FILE LEVEL = $ØF
  9B1Ø  MLI: CLOSE (ALL) <BE7Ø>
  9B13  ERROR? >>9B27
  9B15  WRITE ANY DATA I HAVE BUFFERED <AØØØ>
```

```
BASIC Interpret[illegible]  BI  V1.[illegible]  18 JUN 84      NEXT OBJECT ADDR: 9A2F
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

9A2F *********** OUTPUT INTERCEPT: MODE = Ø ***************************
         (IMMEDIATE MODE)

  9A2F  "#" CHARACTER? (9F61)
  9A32  NO... RESTORE X REG (BE3F)
  9A34  ELSE, PUT BACK FOR SD812 AS RETURN ADDR (Ø1Ø3)
  9A38  CHECK FOR TRACE, PRINTING #LINENO)
  9A3B  (APPLESOFT TRACING? >>9A6E
  9A44  NOT TRACING? DEFERRED MODE=4
  9A46  ELSE, GO PRINT THE "#" (9F61)
  9A4B  GET SET X REG (BE3F)
  9A4E  RESTORE THE OTHER OUTPUT HANDLER >>B7F1
  9A51  AND GO

        SAME AS LAST OUTPUT THO? (BE4C)
  9A54  NOT A RETRY NEXT TIME THRU) (BE4C)
  9A57  (SAVE IT IS WELL >>9A74
  9A5A  NO, ALL ERRS IN A ROW?
  9A5C  TWO RETRYS IS WELL >>9A74
  9A5E  NO, ALL HORIZONTAL CURSOR POSN CHANGED?
  9A6Ø  HAS HOME? >>9A69
  9A62  YES... ANYTHING IN PATHNAME BUFFER? (BCBD)
  9A64  ELSE, NON-ALPHA,
  9A67  (MUST BE A REG
  9A69  RESTORE IS THERE,. >>9A74
  9A6B  PATHNAME ARE RECURSING INFINITELY, EXIT!
  9A6D  ELSE, APPLESOFT TRACING AFTER ALL, RESTORE X (BE3F)
  9A6E  WE WERE TRACING, THEN FALL THRU TO EXIT (9F61)
  9A71  AND A

        ECHO OUTPUT CHAR AND EXIT ***************************
9A74 *********

        REAL CSWL/KSWL VECTORS <9AØØ>
  9A74  PUT BACK CHARACTER <FDED>
  9A77  OUTPUT A RETURN?
  9A7A  WAS IT A NOW >>9A8D
  9A7C  NO, EXIT IS APPLESOFT TRACING?
  9A7E  ELSE, 8B
  9A82  YES >> R MY TRACE FLAG (PSEUDO TRACE NOW) (BE41)
  9A84  NO, CL PLESOFT TO TRACE FOR MY BENEFIT ONLY
  9A87  FORCE A REG AND FALL THRU TO EXIT BI
  9A8B  RESTOR

        SAVE ACTUAL IN/OUT VECTORS ***************************
9A8D *********

  9A8D  ---  H TO VECIN
  9A8E  COPY K H TO VECOUT
  9A98  AND CS CBAL PAGE (BEFB)
  9A9A  IN BI
```

BASIC Interpreter (BI) -- V1.1 --18 JUN 84 NEXT OBJECT ADDR: 9B18

ADDR DESCRIPTION/CONTENTS

```
9B18  ERROR? >>9B27
9B1A  PUT FILE LEVEL BACK TO ZERO
9B22  NOW FLUSH ALL OPEN FILES
9B24  MLI: FLUSH (ALL) <BE70>
9B27  ---
9B28  ASSUME MODE WILL BE 4 (DEFERRED)
9B2A  MEMORIZE WHETHER BASIC ONERR ACTIVE
9B2C  DEFERRED MODE CURRENTLY? >>9B30
9B2E  NO, STILL IMMEDIATE MODE (MODE=0)
9B30  ---
9B31  SET MODE AS DEFINED ABOVE <9F76>
9B34  RESTORE BI'S CSWL/KSWL INTERCEPTS <9AA3>
9B37  GET ERROR CODE (BE0F)
9B3B  BASIC ONERR ACTIVE? THEN GO HANDLE IT >>9B4D
9B3E  NO, JUST PRINT ERROR MESSAGE <BE0C>
9B41  CLOSE EXEC FILE IF ONE IS OPEN <B2FB>
9B45  DEFERRED MODE?  >>9B53
9B47  IMMED. MODE, PRINT RETURN AND... <9FAB>
9B4A  WARMSTART APPLESOFT >>D43F

9B4D  RESTORE STACK FOR BASIC
9B52  PASS ERROR CODE TO BASIC
9B53  ---
9B55  JUMP INTO APPLESOFT ERROR HANDLER >>D865

9B58 ********** RETURN TO IMMED. MODE ********************************

9B58  CLEAR APPLESOFT ERRNUM
9B5C  WILL LOOK FOR "#" FROM APPLESOFT
9B61  SET NORMAL VIDEO IN APPLESOFT <F273>
9B64  RESTORE TRUE CSWL/KSWL <9A00>
9B67  TRY TO WRITE BUFFERED DATA <9FF4>
9B6A  RESET MODE/SET UP BI'S INTERCEPTS <9A17>
9B6D  RESTORE REGISTERS <9F6C>
9B70  GO TO PROCESS IMMED. INPUT REQUEST >>9ABA

9B73 ********** INPUT INTERCEPT: MODE=4 OR 8 ************************

9B73  SAVE REGISTERS <9F62>
9B76  PREFIX INPUT ACTIVE? (BE46)
9B79  NO >>9B7E
9B7B  YES, GO DO SPECIAL HANDLING >>9D67
9B7E  ELSE, IS READ FILE ACTIVE? (BE44)
9B81  NO >>9B86
9B83  YES, GO DO SPECIAL HANDLING FOR THAT >>9C16
9B86  ELSE, IS EXEC FILE ACTIVE? (BE43)
9B89  NO >>9BAF
9B8B  YES, GET PROMPT CHARACTER
9B8D  IT BETTER NOT BE A "]"
9B8F  IT IS, RETURN TO IMMEDIATE MODE >>9B58
9B91  ELSE, SET TRUE CSWL/KSWL <9A00>
```

BASIC Interpreter (BI) -- V1.1 --18 JUN 84 NEXT OBJECT ADDR: 9B94

ADDR DESCRIPTION/CONTENTS

```
9B94  AND PASS CALLER'S AREG TO REMOVE CURSOR (BE3E)
9B97  RESTORE Y-REGISTER (BE40)
9B9A  REMOVE CURSOR AND GET A KEYPRESS <FD10>
9B9D  BACKSPACE?
9B9F  NO, EXIT BI >>9BAC
9BA1  YES, CHECK PROMPT
9BA3  IF ITS A ">"...
9BA5  THEN EXIT WITH THE BACKSPACE >>9BAA
9BA8  ELSE, IF AT START OF LINE, REPROMPT >>9B94
9BAA  MIDDLE OF LINE, RETURN A BACKSPACE
9BAC  EXIT BI TO CALLER >>9A8D

9BAF ********** READ EXEC FILE ************************************

9BAF  REMOVE CURSOR FROM SCREEN
9BB1  CHECK PROMPT CHARACTER
9BB3  IF ITS A ">"...
9BB5  DO THINGS DIFFERENTLY >>9BF2
9BB7  CHECK KEYBOARD (C000)
9BBA  NO KEY READY?  >>9BCD
9BBC  GOT A KEY, IS IT CONTROL-C?
9BBE  NO, IGNORE IT >>9BCD
9BC0  YES, CLOSE EXEC FILE <B2FB>
9BC3  IMMEDIATE MODE? (BE42)
9BC6  NO >>9C01
9BC8  YES, CLEAR KEYBOARD STROBE (C010)
9BCB  AND GO START NEW LINE >>9C01
9BCD  SET UP FOR EXEC LINE READ <9D8A>
9BD0  READ A LINE TO $200 <9C6C>
9BD3  ERROR? >>9BFA
9BD5  SAVE REGISTERS <9F62>
9BD8  HOP INTO LOOP >>9BDE
9BDA  ---
9BDB  BACKSCANNING $200 BUFFER (0200)
9BDE  FORCING THE MSB ON
9BE6  RESTORE TRUE CSWL/KSWL <9A00>
9BE9  GO PROCESS COMMAND LINE <9AD5>
9BEC  CHECK COMMAND NUMBER (BE53)
9BEF  IMMEDIATE EXIT? IF NOT, GET NEXT LINE >>9BCD
9BF1  RETURN

        ******** HANDLE EXEC PROMPT > ***********

9BF2  GET SET TO READ EXEC LINE <9D8A>
9BF5  READ SINGLE CHARACTER PER CALL <9C48>
9BF8  NO ERRORS, EXIT TO CALLER NOW >>9BF1
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: 9BF8
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

          ******** EXEC ERROR RECOVERY ************

  9BFA  CLOSE EXEC FILE <B245>
  9BFD  WAS ERROR "END OF DATA"?
  9BFF  NO, REAL ERROR THEN >>9C13
  9C01  ELSE, OK -- JUST STOP EXECING
  9C03  GET CURSOR HORIZONTAL POSITION
  9C05  IF IN MID LINE, PASS SCREEN CHAR BACK >>9C0E
  9C07  ELSE, CHANGE PROMPT TO "]"
  9C0B  AND RETURN WITH A BACKSPACE
  9C0D  RETURN
  9C0E  GET SCREEN CHARACTER UNDER CURSOR
  9C10  AND EXIT THRU KSWL TO GET REAL KEYPRESS >>0038
  9C13  REAL ERROR, GO TO BI'S MAIN ERROR HANDLER >>9AF0

9C16 ********** INPUT FILE ACTIVE **********************************

  9C16  GET PROMPT FROM IMMEDIATE MODE >>9B58
  9C18  IF ITS A "]" CURSOR FROM SCREEN (BE3E)
  9C1C  THEN RESET (C000)
  9C1F  ELSE, REMOVE >>9C31
  9C24  CHECK KEYBOARD IS IT CONTROL-C?
  9C27  NO KEYPRESS >>9C31
  9C29  GOT A KEY, AND EXIT TO CALLER (C010)
  9C2B  NO, IGNORE
  9C2D  CLEAR STROBE
  9C30  RETURN

  9C31  GET PROMPT AGAIN
  9C33  IS THIS A DIRECTORY FILE? (BE47)
  9C36  YES >>9C95
  9C38  NO, IS PROMPT = ">"?
  9C3A  YES, READ A SINGLE BYTE AT A TIME >>9C42
  9C3C  ELSE, READ ENTIRE LINE <9C67>
  9C3F  ERROR? >>9C13
  9C41  RETURN

  9C42  READ SINGLE BYTE FROM INPUT FILE <9C48>
  9C45  ERROR? >>9C13
  9C47  RETURN

9C48 ********** READ NEXT BYTE OF FILE ******************************

  9C48  SAVE CURRENT READ/WRITE COUNT (BED9)
  9C4B  IN L KEYWORD VALUE (BE5F)
  9C50  SET UP TO READ ONE BYTE (BED9)
  9C55  MLI: READ <BE70>
  9C58  ERROR? >>9C66
  9C5A  PUT COUNT BACK TO MAXIMUM AGAIN (BE5F)
  9C60  GET FIRST CHARACTER ON $200 LINE (BED7)
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: 9C63
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  9C63  AND RETURN THAT TO CALLER (0200)
  9C66  RETURN

9C67 ********** READ NEXT LINE OF FILE ******************************

  9C67  REMOVE CURSOR FROM SCREEN (BE3E)
  9C6C  ---
  9C6E  MLI: READ <BE70>
  9C71  ERROR? >>9C66
  9C73  GET LENGTH ACTUALLY TRANSMITTED (BEDB)
  9C76  NOTHING? >>9C8E
  9C79  GOT SOMETHING, FIND END OF DATA (BED7)
  9C7D  FETCH LAST BYTE OF LINE (01FF)
  9C82  IS IT A RETURN CHARACTER?
  9C84  NO, LEAVE LINE ALONE >>9C8E
  9C86  YES, WAS L KEYWORD GIVEN? (BE57)
  9C8B  YES, LEAVE IT BE >>9C8E
  9C8D  ELSE, CHOP OFF THE RETURN ITSELF
  9C8E  AND EXIT WITH A RETURN
  9C90  RESTORING Y REG AS YOU GO (BE40)
  9C94  RETURN

9C95 ********** READING DIR FILE **********************************

  9C95  ">" PROMPT?
  9C97  YES, EXIT RIGHT NOW >>9C8E
  9C99  ELSE, REMOVE CURSOR FROM SCREEN (BE3E)
  9C9E  SET 80 COLUMNS
  9CA5  MLI: GET MARK <BE70>
  9CA8  ERROR? >>9D1F
  9CAA  ARE WE AT BEGINNING OF THIS FILE? (BEC8)
  9CB0  NO, CONTINUE >>9CDF
  9CB2  YES, CAT FLAG = 2
  9CB7  READ DIRECTORY HEADER <B15D>
  9CBA  ERROR? >>9D1F
  9CBC  REF NUM TIMES 32 (BED6)
  9CC7  SET THE L VALUE OF THIS DIR FILE IN (BCFF)
  9CCA  THE OPEN FILE LIST TO THE ENTRY LENGTH (BCB8)
  9CCD  AND THE NUMBER OF ENTRIES PER BLOCK (BD00)

          ******** FORMAT DIRECTORY NAME **********

  9CD0  GO FORMAT NAME OF DIRECTORY <B0B8>
  9CD3  STORE THE LENGTH OF LINE AT $200
  9CD8  PUT A RETURN CHAR AT END OF LINE
  9CDD  AND EXIT TO CALLER
  9CDE  RETURN
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: 9CDE
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

 9CDF  GET CAT FLAG (BE4F)
 9CE2  IF ZERO, GO PROCESS INDIVIDUAL ENTRIES >>9D22
 9CE4  IF MINUS, GO DO SUMMARY LINE OR EXIT >>9CF9
 9CE6  POSITIVE, ASSUME NULL LINE WANTED
 9CE8  DROP CAT FLAG BY ONE (BE4F)
 9CEB  IF ZERO, JUST GO PRINT A BLANK LINE >>9CD3

        ******** FORMAT TITLE LINE **************

 9CED  ELSE, BLANK OUT $200 AND <A66C>
 9CF2  UNPACK "NAME TYPE BLOCKS ETC... <9FB0>

 9CF5  LINE LENGTH IS 80
 9CF7  GO RETURN IT TO CALLER >>9CD3

        ******** FORMAT SUMMARY LINE ************

 9CF9  DO SUMMARY LINE?
 9CFB  NO, JUST EXIT (ALL DONE) >>9D1C
 9CFD  YES, DROP CAT FLAG SO EXIT NEXT TIME (BE4F)
 9D02  CLEAR READ/WRITE COUNT (BED9)
 9D0A  MLI: READ <BE70>
 9D0D  FORMAT BLOCKS FREE AND INUSE SUMMARY LINE  <B0E7>
 9D11  GET REF NUM (BED6)
 9D14  AND COPY TO GET/SET LIST (BEC7)
 9D18  NO ERRORS, EXIT >>9CF5
 9D1A  ERROR, JUMP TO BI ERROR EXIT >>9D1F
 9D1C  "END OF DATA" ERROR
 9D1F  GO TO BI ERROR EXIT >>9AF0

        ******** FORMAT FILE/DIR ENTRIES ********

 9D22  SET DIR ENTRY NUM COUNTER TO -1
 9D27  GET REF NUM (BED6)
 9D2A  *32
 9D2F  USE AS INDEX TO GET ENTRY LENGTH (BCFF)
 9D35  AND ENTRIES PER BLOCK FROM OPEN FILE LIST (BD00)
 9D3B  POSITION ON EVEN BLOCK BOUNDARY (BEC9)
 9D41  AND GET SECTOR OFFSET (BEC8)
 9D45  SKIP FILE/DIR ENTRIES UNTIL POSITIONED TO (BCBB)
 9D48  CURRENT POSITION IN THIS BLOCK (BCB7)
 9D50  READ NEXT DIR ENTRY FROM FILE <B1D1>
 9D53  NO ERROR? >>9D61
 9D55  ERROR, IF RANGE ERROR...
 9D57  NO, TRUE ERROR >>9D1F
 9D59  RANGE ERROR, READY FOR SUMMARY LINE NEXT (BE4F)
 9D5E  RETURN A BLANK LINE THIS TIME >>9CD3
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: 9D5E
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

 9D61  FORMAT FILE/DIR ENTRY INTO $201 <A4C4>
 9D64  AND RETURN IT TO CALLER >>9CF5

9D67 ********** PREFIX INPUT ACTIVE *********************************

 9D67  PROMPT = "]"?
 9D69  NO, ALL IS WELL >>9D6E
 9D6B  YES, RETURN TO IMMEDIATE MODE NOW >>9B58
 9D6E  REMOVE CURSOR FROM SCREEN (BE3E)
 9D75  PREFIX NO LONGER ACTIVE AFTER THIS (BE46)
 9D7B  COPY PATHNAME BUFFER (PREFIX) (BCBC)
 9D7E  TO $200 (01FF)
 9D84  RETURN WITH IT TO BASIC  (BCBC)
 9D89  RETURN

9D8A ********** SETUP TO READ LINE FROM EXEC ************************

 9D8A  SET READ REF NUM FOR EXEC FILE (BCA3)
 9D90  READ TO $200
 9D95  FOR $EF BYTES OF LENGTH
 9D9A  (OR UNTIL A RETURN CHAR)
 9DA2  RETURN

9DA3 ********** OUTPUT INTERCEPT: MODE = C ***************************
        (LOOK FOR CONTROL-D)

 9DA3  SAVE REGISTERS <9F62>
 9DA6  PRINTING A CONTROL-D?
 9DA8  NO >>9DC1
 9DAA  YES, WRITE OUT ANY BUFFERED DATA <9FF4>
 9DAD  NOTHING IN COMMAND LINE (BE4B)
 9DB0  READ FILE INACTIVE (BE44)
 9DB3  WRITE FILE INACTIVE (BE45)
 9DB6  PREFIX READ INACTIVE (BE46)
 9DBB  SET MODE = 8 FROM NOW ON <9F76>
 9DBE  RESTORE REGS AND EXIT >>9F6C

 9DC1  GOT A CONTROL-D...
 9DC3  SET MODE = 4 FROM NOW ON <9F76>
 9DC6  RESTORE REGISTERS <9F6C>
 9DC9  OUTPUT CHARACTER AND EXIT >>B7F1

9DCC ********** OUTPUT INTERCEPT: MODE = 8 ***************************
        (ASSEMBLE COMMAND LINE)

 9DCC  SAVE REGISTERS <9F62>
 9DD2  SAVE CHAR IN COMMAND LINE (0200)
 9DD5  WAS IT A RETURN?
 9DD7  YES, READY TO ROLL >>9DE7
 9DD9  NO, BUMP CHARACTER COUNTER (BE4B)
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: 9DDC
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  9DDC  AND EXIT TO CALLER >>9DE3
  9DDE  OOPS! LINE TOO LONG
  9DE0  "SYNTAX ERROR" >>9AF0
  9DE3  ELSE, RESTORE X REG AND EXIT (BE3F)
  9DE6  RETURN

  9DE7  ---
  9DE9  NULL LINE? >>9DF6
  9DEB  NO, PUT BACK TRUE CSWL/KSWL <9A00>
  9DEE  SYNTAX SCAN CMD LINE <A677>
  9DF1  ERROR? >>9DE0
  9DF3  NO, PUT BACK BI'S INTERCEPTS <9A8D>
  9DF6  ---
  9DF8  MODE = 4 NOW  <9F76>
  9DFB  RESTORE REGS AND EXIT >>9F6C

9DFE ********** WRITE BUFFERED CHARACTER ****************************

  9DFE  SAVE Y REG (BE40)
  9E01  CHECK PROMPT
  9E03  CHECK TO SEE IF WE ARE IN "IF", >>9E11
  9E06  "PRINT", "LIST", OR "CALL" STATEMENTS >>9E11
  9E09  OF AN APPLESOFT PROGRAM >>9E11
  9E0B  IF NOT, EXIT TO CALLER... (BE40)
  9E0E  WITH CHARACTER ECHOED TO SCREEN >>9A74

  9E11  GET INDEX TO TEMPORARILY BUFFERED CHARS (BE4A)
  9E16  STORE INTO BUFFER JUST ABOVE HIMEM
  9E1B  BUMP INDEX (BE4A)
  9E1E  OK >>9E2B
  9E20  BUFFER FULL, SAVE REGISTERS <9F62>
  9E23  WRITE BUFFER OUT TO DISK <9FEE>
  9E26  ERROR? >>9DE0
  9E28  RESTORE REGISTERS <9F6C>
  9E2B  AND EXIT ANYWAY

9E2C ********** OUTPUT INTERCEPT: MODE = 4 **************************
          (INITIAL ENTRY FOR A RUNNING PROGRAM)
          (FLUSH OUT NON COMMAND LINES)

  9E2C  PRINTING A "#"? (9F61)
  9E2F  NO >>9E49
  9E31  YES, SAVE X REGISTER (BE3F)
  9E35  RETURN ADDR IS IN APPLESOFT... (0103)
  9E38  TRACE ROUTINE...
  9E3C  AT $D812? (0104)
  9E41  YES >>9EB6
  9E43  NO, RESTORE REGISTERS (9F61)
  9E49  IS WRITE FILE ACTIVE? (BE45)
  9E4C  NOPE >>9E6C
  9E4E  YES, PRINTING A "]"?
```

```
C Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: 9E50
BAS
---R    DESCRIPTION/CONTENTS
ADD
---
  E50  NO >>9E56
 9E52  YES, SAME AS PROMPT CHARACTER?
 9E54  YES >>9E86
 9E56  NO, PRINTING A RETURN CHAR?
 9E58  NO >>9DFE
 9E5A  YES, GET PROMPT.
 9E60  DOES IT INDICATE RECURSION? >>9DFE
 9E62  YES, WRITE BUFFER OUT <9FF4>
 9E65  OUTPUT FILE INACTIVE NOW (BE45)
 9E6A  EXIT WITH RETURN CHAR >>9E9F
 9E
  6C  ---
 9E6D  INPUT FILE ACTIVE? (BE44)
 9E73  NO >>9E7D
 9E75  YES, CHECK PROMPT
 9E77  OR IN $04=
 9E79  CONTROL-D?
 9E7B  YES >>9EA2
 9E7D  ---
 9E7E  NO, HOW BOUT "]"?
 9E80  NO, EXIT WITH ECHO THEN >>9E9F
 9E82  YES, IS THIS THE PROMPT CHAR?
 9E84  NO, EXIT WITH ECHO >>9E9F
 9E86  YES, SAVE REGISTERS <9F62>
 9E89  CHECK OPEN FILE COUNT (BE4D)
 9E8C  NONE OPEN? >>9E9C
 9E8E  SOME OPEN, WRITE BUFFER OUT <9FF4>
 9E91  INDICATE WRITE FILE INACTIVE NOW (BE45)
 9E94  SET TRUE CSWL/KSWL <9A00>
 9E99  PRINT "FILE(S) STILL OPEN" <BE0C>
 9E9C  RESTORE REGS <9F6C>
 9E9F  AND ECHO EXIT >>9A74
 9E
  EA2  ---
 9EA3  CHAR IS A RETURN?
 9EA5  NO >>9EAA
 9EA7  YES, SAME AS LAST CHAR OUTPUT? (BE4C)
 9EAA  (SAVE IT FOR THIS TEST NEXT TIME) (BE4C)
 9EAD  NOT SAME, NO PROBLEM, THEN >>9EB1
 9EAF  SAME, MARK PROMPT FOR RECURSION
 9EB1  RETURN
 9E
  2 ********** APPLESOFT TRACE INTERCEPT **************************
 9EB
    -(CONTROL PASSES HERE FOR EVERY STATEMENT)
      (EXECUTED WHILE PRODOS IS ACTIVE)

  7B2  BUMP APPLESOFT LINE POINTER
 9E36  ---
 9EBA  MARK PROMPT FOR RECURSION
 9EBC  JUST IN CASE WE DIE IN HERE
 9EBE  RESTORE APPLESOFT'S STACK
```

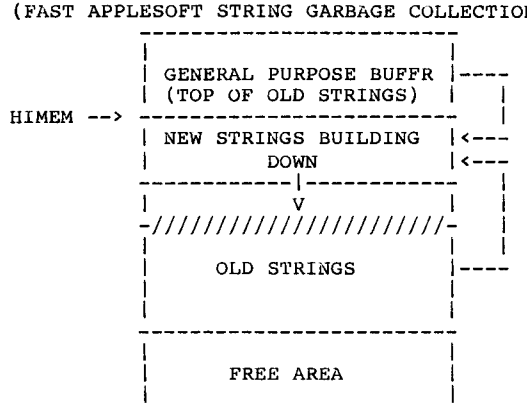
```
Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: 9EC1
-------------------------------------------------------------------
   DESCRIPTION/CONTENTS
-------------------------------------------------------------------

 1  DOES BI KNOW WE ARE TRACING? (BE41)
 4  YES, REAL LIVE TRACE THEN >>9F39

 6  ELSE, PICK UP NEXT TOKEN ON LINE
 A  IS IT A TOKEN? >>9EF1
 C  OR END OF LINE? >>9EEE
 E  NEITHER, DECREMENT STRING SPACE CTR (BE49)
 1  OK >>9EEC
 3  COMPUTE SIZE OF FREESPACE IN PAGES
 7  AT LEAST 3 PAGES AVAILABLE?
 9  YES >>9EE5
 B  NO, WRITE BUFFERED DATA <9FF4>
 E  AND THEN GARBAGE COLLECT <A044>
 3  COMPUTE FREE SPACE NOW
 5  AND SAVE IN STRING SPACE CTR (BE49)
 A  GET NEXT TOKEN
 C  ---
 E  JUMP BACK INTO APPLESOFT TO EXECUTE IT >>D820
 1  STORE TOKEN IN PROMPT
 4  LOOK UP TOKEN IN BI'S TOKEN TABLE (B799)
 7  ITS NOT ONE BI IS INTERESTED IN >>9EEE
 9  IT IS INTERESTING, CHANGE BRANCH (9EFD)
 C  AND JUMP TO ONE OF THE FOLLOWING: >>9EFE

 E  IF OR PRINT: PROMPT = Ø
 Ø  CLEAR OUT LAST CHAR SAVEAREA (BE4C)
 3  GO TO MODE = C NEXT TIME THRU (B803)
 6  (BEGIN LOOKING FOR COMMANDS) (BE38)
 F  NOW GO PROCESS THE IF OR PRINT >>9F2E

 1  LIST: PROMPT = 1
 3  (DON'T LOOK FOR COMMANDS NOW)
 5  GO DO IT >>9F2E

 7  CALL: PROMPT = 2
 9  (DON'T LOOK FOR COMMANDS NOW)
 B  GO DO IT >>9F2E

 D  LET: DECREMENT STRING CTR
 E  AND GO BACK FOR NEXT TOKEN >>9ECE

21  TRACE: TURN TRACE ON (BE41)
24  THEN CONTINUE BELOW >>9F2A

26  NOTRACE: DROP INTO BACKGROUND TRACE (BE41)
29  CHANGE TOKEN TO "TRACE"
2A  FORCE ON APPLESOFT TRACE
2E  ---
2F  GO BACK TO APPLESOFT TO PERFORM IT >>D820
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: 9F2F
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

 9F32  RESUME: CLEAR ONERR CODE
 9F37  GO TO APPLESOFT TO PROCESS IT >>9EEC

        ******** REAL TRACE ACTIVE **************

 9F39  RESTORE TRUE CSWL/KSWL <9AØØ>
 9F3E  PRINT "#" <FDED>
 9F45  USE APPLESOFT TO PRINT CURRENT LINE NO. <ED24>
 9F4A  PRINT A BLANK SPACE <FDED>
 9F4D  PUT BI'S CSWL/KSWL INTERCEPTS BACK <9A8D>
 9F51  THEN GO BACK AND HANDLE AS USUAL  >>9EC6

 9F54  LOOKING FOR A LOWER CASE "c"
 9F58  LOOKING FOR A "#"
 9F5A  STORE CHAR TO SEARCH FOR (9F61)
 9F5E  BRANCH BACK INTO APPLESOFT >>9EEC
 9F60  BREAK IF Y IS ZERO!!!

 9F61  "#" CHARACTER (ASOFT TRACE CHAR)

9F62 *********** SAVE CALLER'S REGISTERS ****************************

 9F62  SAVE A,X AND Y REGS (BE3E)
 9F6B  RETURN

9F6C *********** RESTORE CALLERS REGISTERS **************************

 9F6C  RESTORE A,X AND Y REGS (BE3E)
 9F75  RETURN

9F76 *********** SET MODE AND CSWL/KSWL *****************************

 9F76  STORE "STATE" MODE FROM X REGISTER (BE42)
 9F7B  COPY PROPER CSWL/KSWL VALUES TO REDIRECT... (B7F7)
 9F7E  VECTOR DEPENDING ON CURRENT MODE (BE38)
 9F87  RETURN

9F88 *********** PRINTERR: PRINT ERROR MSG ***************************

 9F88  ---
 9F89  GET INDEX INTO PACKED MESSAGE TEXTS (BA13)
 9F8C  UNPACK MESSAGE INTO $201 <9FB0>
 9F92  SAVE THE LENGTH (BCB6)
 9F95  SKIP A LINE <9FAB>
 9F9A  PRINT A BELL <9FAD>
 9F9D  ---
 9F9F  PRINT CONTENTS OF $201 MSG BUFFER (0201)
 9FAB  PRINT A RETURN CHARACTER
 9FAD  AND EXIT >>FDED
```

```
BASIC Interpreter (BI) -- V1.1 --18
-----------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------


9FB0 ********** UNPACK ERROR MESSA

  9FB0  NOTHING IN BUFFER AT FIRST
  9FB6  GET A NIBBLE FROM PACKED MS
  9FB9  NON-ZERO, COMMON CHARACTER
  9FBB  IF ZERO, GET NEXT NIBBLE <9
  9FBE  AND CONVERT TO UNCOMMON CHA
  9FC0  ---
  9FC1  GET THE LETTER THIS NIBBLE
  9FC4  ZERO? THEN END OF MESSAGE >
  9FC6  GET INDEX INTO OUTPUT BUFFE
  9FC9  AND STORE THE CHARACTER THE
  9FCC  BUMP INDEX (BE4B)
  9FCF  AND CONTINUE >>9FB6
  9FD1  RETURN

9FD2 ********** UNPACK MESSAGE BYT

  9FD2  GET NEXT MSG BYTE (BA48)
  9FD5  WORKING ON SECOND NIBBLE? >
  9FD7  NO, TAB INDICATOR? >>9FDF
  9FD9  NO, ISOLATE HIGH NIBBLE
  9FDD  NEXT TIME GET LOW NIBBLE
  9FDE  RETURN

  9FDF  ---
  9FE0  GET TAB POSITION (BA48)
  9FE3  AND BUMP OUTPUT PTR ACCORDI
  9FE7  THEN GO BACK FOR NEXT NIBBL

  9FE9  BUMP BYTE PTR FOR NEXT TIME
  9FEA  ISOLATE LOW NIBBLE
  9FEC  NEXT TIME GET HIGH NIBBLE
  9FED  RETURN

9FEE ********** WRITE ONE BUFFERED

  9FEE  SET UP COUNT OF 0001
  9FF2  AND JUMP INTO ROUTINE BELOW

9FF4 ********** WRITE BUFFERED DAT

  9FF4  WRITE BUFFERED DATA <A000>
  9FF7  OK? THEN EXIT >>A01C
  9FFA  ERROR, POP OUT OF THIS SUBR
  9FFD  AND GO TO ERROR HANDLER >>9
```

```
9FE9

GLY (BE4B)
 >>9FD2

BYTE ****************************

>>A007

/TEST ERROR **********************

UTINE
AF0
```

```
A02E  FOR A GARBAGE COLLECT WORKAREA (BC7D)
A033  IT IS 3+1 PAGES IN LENGTH (BC7E)
A038  END OF STRING AREA IS AT END OF FREEAREA (BC86)
A040  GO COLLECT CONSTANT STRINGS NOW <A085>
A043  THEN EXIT

A044 ********** "FRE" COMMAND ***************************************
       (FAST APPLESOFT STRING GARBAGE COLLECTION)
```




```
TOP PART OF OLD STRINGS IS SAVED IN THE
GENERAL PURPOSE BUFFER OR IN THE FREE
AREA (WHICHEVER IS LARGER) AND A NEW
COPY OF THE STRINGS IS BUILT JUST BELOW
HIMEM.
```



```
JUN 84      NEXT OBJECT ADDR: 9FAD
--------------------------------

--------------------------------

E ********************************

G <9FD2>
>>9FC0
FD2>
R INDEX

REPRESENTS (BA28)
>9FD1
 (BE4B)
RE (0201)


 ********************************
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: 9FFD
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------


A000 ********** WRITE ALL BUFFERED DATA ****************************

  A000  ---
  A002  GET BUFFERED DATA COUNT (BE4A)
  A005  NONE BUFFERED? >>A01B
  A007  STORE BUFFERED DATA COUNT IN RW PARMS (BED9)
  A00F  MLI: WRITE <BE70>
  A015  NOTHING BUFFERED NOW, COUNT=0 (BE4A)
  A019  ERROR? >>A01C
  A01B  NO, EXIT
  A01C  RETURN

A01D ********** SPECIAL GARBAGE COLLECT ****************************
       (PULL OUT STRING CONSTANTS ALSO)

  A01D  DO GARBAGE COLLECTION NORMALLY FIRST <A044>
  A020  ERROR? >>A043
  A024  START OF STRING AREA = PROGRAM START PTR (BC84)
  A02C  USE GENERAL PURPOSE BUFFER (ABOVE HIMEM)
```

```
A044  STRING
A04B  ASSUME AREA START IS ON PAGE BOUNDARY
A050  IN GENF4 PAGE WORKAREA (BC7E)
A055  STRING:RAL PURPOSE BUFFER ABOVE HIMEM (BC7D)
A059  COMPUTE START PTR IS START OF STRING AREA (BC84)
A05B  AT LEAS NUMBER OF FREE PAGES
A05D  IF NOT T 7?
A05F  DON'T  USE G.P. WORKAREA INSTEAD >>A079
A061  NEW WORSE ALL OF FREE AREA (LEAVE $300)
A066  SET PTRKAREA SIZE IS FREE AREA SIZE-$300 (BC7E)
A06D  COMPUTE TO WORKAREA AT FIRST FREE PAGE
A071  USE SMA NUMBER OF STRING PAGES
A076  AS NEW LLER OF STRING PAGES OR WORKAREA SIZE (BC7E)
A079  END OF WORKAREA SIZE (BC7E)
A085  RECORD STRING AREA IS HIMEM
A089  STRING WHETHER LAST PAGE IS PARTIAL
A08E  ADJUST START MSB IS HIMEM INITIALLY (BC86)
A090  FOR PARLORANGE AND HIRANGE MSB'S
A093  SETTINGTIAL PAGES AT EITHER END, (BC7F)
A09C  SET UP  THEM AT HIMEM FOR NOW.
A09F  $3E/$3FARRAY END MSB +1 FOR COMPARES (BC82)
A0A1  (EACH V --> FIRST VARIABLE (LESS 7 BYTES)
A0AB  SET UP/ARIABLE IS 7 BYTES)
A0B0  GET LORARRAY START LSB FOR COMPARES
A0B3  PRIOR RANGE VALUE (BC7F)
A0B6  YES, TEO STRING AREA? (BC84)
A0B8  ELSE, HEN DONE! >>A0F6
A0BB  AND SAVROP LORANGE BY WORKAREA SIZE (BC7E)
A0BE  NOW DROE THIS VALUE (BC7C)
A0C0  ...THE P IT ALSO BY THE DISTANCE BETWEEN
A0CA  USE THEOLD LORANGE AND THE STRING START PTR (BC7F)
A0CF  TO PROO LOWER OF THE TWO VALUES (BC7C)
A0D2  IS THISUCE THE MAXIMUM SIZED RANGE  (BC7C)
A0D5  NO >>A0 BELOW THE BOTTOM OF THE STRINGS? (BC84)
A0D7  YES, USDC
A0DA  (ADJUSTE THE BOTTOM POINTER INSTEAD (BC84)
A0DC  STORE ING FOR PARTIAL PAGE)
A0DF  COPY SOINAL LORANGE VALUE (BC7F)
A0E2  (TO MAXME PAGES BELOW HIRANGE TO WORKAREA <A195>
A0E4  COLLECTE ROOM FOR NEW STRINGS)
A0E7  ERROR?  SIMPLE STRING VARS FOR THIS RANGE <A0F7>
A0E9  THEN CO>>A0F4
A0EC  NEW HIRLLECT STRING ARRAYS <A12D>
A0F2  CONTINUANGE = OLD LORANGE (BC7F)
          E LOOPING >>A09F
A0F4  IF ERRO
A0F6  EXIT TOR, "RAM TOO LARGE"
          CALLER
```

```
A0F7 ********** COLLECT SIMPLE STRINGS ********

A0F7  ---
A0F8  ADD 7 BYTES TO $3E/$3F PTR FOR NEXT VAR
A102  PTR AT ARRAYS NOW?
A108  IF SO, WE ARE DONE >>A12B
A10A  IS THIS A STRING VARIABLE?
A111  NO >>A0F7
A113  MAKE ABSOLUTELY SURE
A117  GET MSB OF STRING POINTER
A11B  IS IT WITHIN MY RANGE? (BC7F)
A11E  NO >>A0F8
A123  NO >>A0F7
A125  YES, PULL IT OUT AND TACK IT TO HIMEM <**********
A128  ALL WENT WELL, GET NEXT VARIABLE >>A0F8
A12A  IF ERROR, EXIT NOW

A12B  NORMAL EXIT TO CALLER
A12C  RETURN

A12D ********** COLLECT STRING ARRAYS ********

A12D  FIND THE NEXT ARRAY <A15C>
A130  NO MORE? >>A12B
A132  GOT ONE, GET MSB OF ITS STRING PTR
A136  WITHIN MY RANGE? (BC7F)
A139  NO >>A146
A13E  NO >>A146
A140  YES, PULL IT OUT AND TACK IT TO HIMEM
A143  AND CONTINUE WITH NEXT ARRAY ELEMENT >>
A145  ERROR EXIT

A146  ---
A147  BUMP POINTER TO NEXT ARRAY MEMBER
A151  POINTER NOW AT NEXT ARRAY? (BC81)
A154  NO, DO THIS ELEMENT >>A132
A158  NO >>A132
A15A  YES, SET UP TO PROCESS THAT ONE THEN >>A

A15C ********** FIND NEXT STRING ARRAY ********

A15C  ---
A15D  $3E --> ARRAY VARIABLES (BC81)
A164  AT END OF ARRAY VARS
A166  NO, CONTINUE >>A16C
A16A  YES, OUT (CARRY SET, NO MORE ARRAYS) >>
```


NEXT OBJECT ADDR: A0F6

A1B8>

****

A147

A12D

****

A194

BASIC Interpreter (BI) -- V1.1 --18 JUN 84 NEXT OBJECT ADDR: A044

ADDR DESCRIPTION/CONTENTS

BASIC Interpreter (BI) -- V1.1 --18 JUN 84

ADDR DESCRIPTION/CONTENTS

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: A16A
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  A16C  POINT TO ARRAY FOLLOWING THIS (LSB AND...)
  A176  MSB TO X REGISTER
  A17D  CHECK TYPE OF VARIABLE
  A182  SKIP INTEGER AND REAL ARRAYS >>A15C
  A186  GET NUMBER OF DIMENSIONS
  A188  *2 TO SKIP SIZES
  A189  +5 TO SKIP FIXED STUFF AT BEGINNING
  A18D  POINT TO FIRST ARRAY MEMBER
  A191  READY TO ROLL, $3E POINTS TO IT
  A194  RETURN

A195 *********** COPY PAGES TO WORKAREA ******************************
         TO MAKE ROOM FOR NEW STRINGS BEING MOVED
         TO HIMEM, COPY SOME STRING PAGES FROM OLD
         STRING AREA TO THE WORKAREA TO PROTECT THEM.

  A195  $3A/$3B --> FIRST PAGE TO SAVE (BC7C)
  A19A  $3C/$3D --> WORKAREA (BC7D)
  A1A5  COPY N+1 PAGES (SIZE OF WORKAREA) (BC7E)
  A1A9  ---
  A1B7  EXIT WHEN FINISHED

A1B8 *********** PULL STRING OUT ***************************************
         TACK STRING JUST UNDER HIMEM AT CURRENT
         STRING START POINTER.

  A1B8  IS STRING BELOW SAVED AREA? (BC7C)
  A1BB  YES, ITS STILL THERE THEN >>A1C4
  A1BD  ELSE, POINT TO SAVED STRING IN WORKAREA (BC7C)
  A1C4  $3A/$3B --> STRING
  A1CF  DROP STRING START PTR BY LEN OF THIS STRING
  A1D4  UPDATE STRING'S LSB IN VARIABLE PTR
  A1D8  FIX UP MSB OF STRING START PTR ALSO
  A1DD  AND OF VARIABLE PTR
  A1E1  IS THIS A NULL LENGTH STRING?
  A1E3  YES, NO MOVE TO DO >>A1EE
  A1E6  ---
  A1E7  ELSE, COPY STRING OUT
  A1EE  ---
  A1EF  OUT OF FREESPACE? (BC82)
  A1F4  RETURN TO CALLER WITH INDICATION

A1F5 *********** ALLOCATE BUFFER ***************************************

  A1F5  NEED 4 PAGES
```

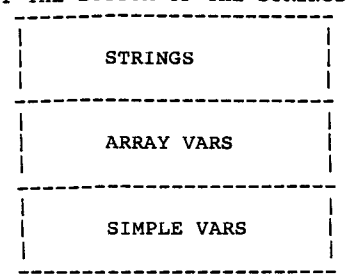
```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: A1F5
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

         ******** GENERAL PURPOSE ALLOCATE *******

  A1F7  STORE THAT (BB47)
  A1FA  GO GARBAGE COLLECT TO GET SPACE <A044>
  A1FD  ERROR? >>A24A
  A201  HOW MANY FREE PAGES ARE THERE?
  A203  ARE THERE ENOUGH? (BB47)
  A206  IF NOT, "RAM TOO LARGE" MSG
  A208  TOO FEW... >>A24A
  A20A  GOT ENOUGH, $3A-->TOP OF FREESPACE
  A211  AND $3C-->NEW TOP AFTER ALLOCATION
  A21B  COMPUTE LENGTH OF STRINGS FOR COPY
  A229  COPY STRINGS DOWN "N" PAGES IN MEMORY <A35B>
  A22F  SUBTRACT "N" FROM STRING ADDRESS MSB'S (BB47)
  A235  ADJUST ALL POINTERS IN SIMPLE & ARRAY VARS <A39F>
  A23A  OLD HIMEM BECOMES BUFF ADDR HIGH WATER MARK (BB49)
  A241  NEW HIMEM IS "N" PAGES LOWER
  A246  FIND PAGE JUST BEYOND A FILE BUFFER (BC88)
  A249  RETURN
  A24A  ---
  A24B  RETURN

A24C *********** FREE BUFFER ***************************************

  A24C  GARBAGE COLLECT STRINGS <A044>
  A24F  ERROR? >>A299
  A255  PUT HIMEM-$100 INTO $3A/3B
  A259  AND HIMEM+$400 INTO $3C/3D
  A25F  (COPY LSB'S)
  A266  BC92 = LENGTH OF STRINGS (BC92)
  A270  COPY STRINGS UP 4 PAGES <A37F>
  A275  PREPARE TO ADJUST THEM BY $400 (BC87)
  A27B  NEW HIMEM+$400
  A27D  ADJUST ALL STRING ADDRS UP BY $400 <A39F>
  A283  ARE WE FREEING BOTTOM-MOST BUFFER?
  A285  YES, DONE! >>A2B3
  A288  CHECK OPEN FILE COUNT (BE4D)
  A28B  NONE OPEN? (HOW CAN THAT BE?) >>A297
  A28D  WHICH FILE'S BUFFER IS NEXT TO HIMEM?
  A292  SEARCH UNTIL IT IS FOUND... >>A29A
  A297  ---
  A299  RETURN IF NO FILE IS USING THIS BUFFER
  A29A  ---
  A29B  GIVE THAT FILE THE BUFFER PASSED TO US (BEC9)
  A29E  (SURE HOPE THAT FILE WAS FLUSHED!) (BC93)
  A2A9  PASS FILE REF NUM TO MLI (BEC7)
  A2AE  MLI: SET NEW BUFFER <BE70>
  A2B1  ERROR? >>A299
  A2B3  ---
  A2B4  RETURN
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: A2B4
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

A2B5 *********** GETBUFR: GET A BUFFER *******************************
          THIS ROUTINE IS CALLED THROUGH AN EXTERNAL
          ENTRY POINT IN THE GLOBAL PAGE.  IT ALLO-
          CATES A FIXED LOCATION BUFFER BETWEEN THE
          BI AND ITS BUFFERS.

  A2B5  ALLOCATE A BUFFER OF ANY SIZE (A=PAGES) <A1F7>
  A2B8  ERROR? >>A300
  A2BD  FIND FIRST PAGE OF BUFFER (BB4A)
  A2C4  GET FILE OPEN COUNT (BE4D)
  A2C7  NONE OPEN? >>A2EA
  A2C9  BUMP BUFFER PAGE PTR BY $400 (BB49)
  A2CD  TO POINT TO PREVIOUSLY ALLOCATED
  A2CF  BUFFER. (BB49)
  A2D2  FIND OPEN FILE WITH THIS BUFFER (BC93)
  A2D7  GOT IT, (BEC9)
  A2DA  SET FILE BUFFER REAL LOW IN MEMORY <A352>
  A2DD  THEN SET IT TO NEW BUFFER LOCATION  <A29B>
  A2E0  BELOW ALL OTHERS (BEC9)
  A2E7  DO THIS FOR EACH OPEN FILE...
  A2E8  THEREBY INSERTING A BLANK BUFFER >>A2D2
  A2ED  IS EXEC FILE ACTIVE? (BE43)
  A2F0  NO, DONE >>A2FF
  A2F2  YES,
  A2F4  MOVE EXEC BUFFER DOWN ALSO <A352>
  A2FD  AND BUMP UP ABOVE IT
  A2FF  EXIT TO CALLER
  A300  RETURN

A301 *********** FREEBUFR: FREE BUFFER *******************************
          THIS ROUTINE IS CALLED THROUGH AN EXTERNAL
          ENTRY POINT IN THE GLOBAL PAGE.  IT FREES
          A FIXED LOCATION BUFFER PREVIOUSLY ALLO-
          CATED BY GETBUFR.

  A301  GET COUNT OF OPEN FILES (BE4D)
  A305  INDEX THIS BY 4 PAGES PER FILE
  A306  ADD TO HIMEM MSB
  A308  SAVE THIS AS TOP OF BUFFERS (BB49)
  A30D  THEN SET UP BOTTOM AS HIMEM MSB (BB4A)
  A310  GET OLD ORIGINAL HIMEM (BEFORE ANY BUFFERS) (BEFB)
  A313  SAME AS THIS ONE?
  A315  THEN NOTHING ELSE TO DO >>A350
  A317  ASSUME NO BUFFERS BY REPLACING OLD HIMEM
  A319  ANY EXEC FILE OPEN? (BE43)
  A31C  NO, CONTINUE >>A323
  A31E  YES, MOVE EXEC BUFFER TO OLD HIMEM <A2F2>
  A321  AND GO MOVE HIMEM DOWN BY $400 >>A341
  A323  ELSE, START WITH TOP BUFFER (BB49)
  A326  ANY OPEN FILES? (BE4D)
```

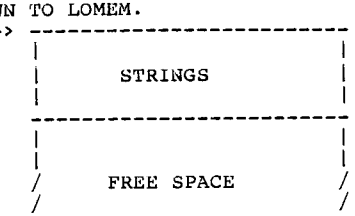
```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: A329
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  A329  IF NOT, WE ARE DONE >>A34D
  A32B  SEARCH FOR OPEN FILE WITH THIS BUFFER (BC93)
  A32E  NOT IT? >>A34A
  A330  GOT IT, GIVE IT NEW HOME AT HIMEM
  A332  AND SET BUFFER LOW <A352>
  A335  THEN TO NEW LOC <A29B>
  A339  DROP TOP BUFFER PTR BY $400 (BB49)
  A341  AND DROP HIMEM BY $400
  A348  AND GO DO NEXT BUFFER >>A323
  A34A  ---
  A34B  (LOOP TO SEARCH FOR OPEN FILES) >>A32B
  A34D  WHEN FINISHED, GARBAGE COLLECT <A044>
  A350  ---
  A351  THEN EXIT NORMALLY TO CALLER

        ******** SET BUFFER BELOW ALL OTHERS ***

  A352  ---
  A353  USE BOTTOM BUFFER PTR (BB4A)
  A356  SET FILE BUFFER <A29B>
  A35A  AND EXIT

A35B *********** COPY BLOCK DOWN IN MEMORY ***************************

  A35B  COPY ALL FULL PAGES DOWN TO THEIR NEW HOME
  A362  COPYING $3A-->$3C
  A369  BUMP BOTH MSB'S
  A36D  DROP PAGE COUNTER (BC93)
  A370  AND CONTINUE >>A362
  A372  NO SHORT LAST PAGE? (BC92)
  A375  THEN EXIT NOW >>A37E
  A377  ELSE, COPY PARTIAL PAGE
  A37E  THEN EXIT

A37F *********** COPY BLOCK UP IN MEMORY *****************************

  A37F  PARTIAL PAGE? (BC92)
  A382  NO, JUST COPY FULL PAGES NOW >>A38B
  A384  YES, COPY SHORT PAGE FIRST <A396>
  A387  DROP BOTH MSB'S
  A38B  PAGE COUNT GONE TO ZERO? (BC93)
  A38E  YES, DONE >>A39E
  A390  ELSE, DROP PAGE COUNT (BC93)
  A393  AND GO COPY A FULL PAGE UP >>A384

  A396  ---
  A397  COPY REMAINDER OF PAGE UP (BACKWARDS)
  A39E  RETURN
```

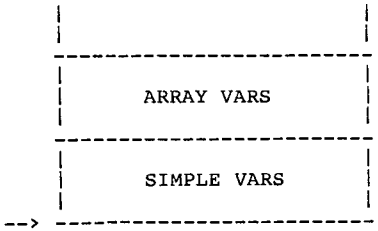
```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: A39E
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

A39F ********** ADJUST ALL STRING ADDRS ****************************
         (BC87 HAS ADDITIVE ADJUSTMENT FACTOR)

  A39F  USE LOMEM PAGE AS MSB FOR $3E/3F
  A3A3  GET LOMEM LSB
  A3A5  AND END OF SIMPLE VARS PAGE
  A3A8  JUMP INTO THE LOOP >>A3AF
  A3AA  ---
  A3AB  SKIP ONE SIMPLE VARIABLE
  A3AF  ---
  A3B1  OVERFLOW? >>A3B5
  A3B3  YES, BUMP MSB
  A3B5  FINISHED WITH SIMPLE VARS?
  A3B9  (CHECK BOTH MSB AND LSB OF PTR)
  A3BB  ---
  A3BC  YES... >>A3D2
  A3BE  NO,
  A3C0  LOOK AT A SIMPLE VARIABLE
  A3C5  SKIP INTEGER AND REAL VARS >>A3AA
  A3C7  (DOUBLE CHECK MSB)
  A3CB  ITS A STRING, POINT TO ITS LEN/ADDR
  A3CC  ADJUST IT IF NECESSARY <A3F9>
  A3CF  THEN SKIP OVER IT >>A3AA

  A3D2  COPY ARRAYS STARTING LSB
  A3D4  (MSB IS IN X REGISTER NOW) (BC81)
  A3D7  ---
  A3D8  FIND A STRING ARRAY <A15C>
  A3DB  NO MORE? THEN DONE... >>A40C
  A3DD  ---
  A3E0  ADJUST ITS ADDRESS IF NEED BE <A3F9>
  A3E6  SKIP TO NEXT STRING ELEMENT OF ARRAY
  A3EE  AT END OF THIS ARRAY YET? (BC81)
  A3F1  NO... >>A3DD
  A3F3  (CHECK MSB ALSO)
  A3F7  YES..., GO GET NEXT ARRAY >>A3D7

A3F9 ********** ADJUST A STRING ADDRESS ****************************

  A3F9  GET STRING LENGTH
  A3FB  IGNORE NULL STRINGS >>A40C
  A3FD  POINT TO MSB OF ADDRESS
  A3FF  IS STRING STORED OUTSIDE OF PROGRAM?
  A403  NO, LEAVE IT ALONE >>A40C
  A405  STORE ABOVE LOMEM, ADD FACTOR TO MSB
  A40C  THEN EXIT
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: A40C
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

A40D ********** COMPRESS ALL ASOFT VARS ****************************
         THIS ROUTINE SQUASHES ALL APPLESOFT VARS
         UP AGAINST THE BOTTOM OF THE STRINGS
         HIMEM -->
```




```
  A40D  GARBAGE COLLECT FIRST <A01D>
  A410  ERROR? >>A471
  A412  COMPUTE LENGTH OF SIMPLE AND ARRAY VARS
  A417  AND SAVE IT (BC89)
  A427  NEXT, COMPUTE LENGTH OF SIMPLE VARS ONLY
  A42B  AND SAVE IT (BC8B)
  A435  SUBTRACT VAR LENGTH FROM STRING START
  A437  TO FIND A PLACE TO PUT THE VARS UNDER (BC92)
  A43A  THE STRINGS (START ON AN EVEN PAGE BOUND)
  A440  $3C/$3D --> PLACE TO PUT VARS
  A447  $3A/$3B --> START OF VARS (ROUNDED TO EVEN
  A449              PAGE ALIGNEMENT)
  A44F  COPY VARS UP AGAINST STRINGS <A37F>
  A454  STORE START OF VARS PTR (BC8E)
  A457  BUMPING PAGE NUMBER BY ONE
  A463  SUBTRACT THIS PTR FROM HIMEM TO COMPUTE (BC90)
  A466  TOTAL LENGTH OF COMBINED VARS/STRINGS
  A468  AND SAVE THIS TOO (BC8D)
  A46B  ALSO, SAVE HIMEM MSB IN CASE THEY ARE MOVED
  A471  DONE, EXIT

A472 ********** REEXPAND COMPRESSED VARS ****************************
         THIS ROUTINE MOVES SIMPLE AND ARRAY VARS
         BACK DOWN TO LOMEM.
         HIMEM -->
```






```
A472  SAVE LENGTH OF SIMPLE AND ARRAY VARS (BC89)
A479  ADD THIS TO START OF COMPRESSED VARS PTR
A47B  TO GIVE START OF STRINGS ($6D/$6E)
A487  $3C/$3D --> LOMEM (WHERE TO PUT SIMPLE VARS)
A48E  $6B/$6C --> WHERE TO PUT ARRAY VARS
A499  $3A/$3B --> START OF COMPRESSED VARS (BC8E)
A4A3  COPY SIMPLE/ARRAY VARS DOWN TO LOMEM <A35B>
A4AA  COMPUTE START OF STRINGS BY ADDING VARS
A4AC  LENGTH TO VARS ORIGIN
A4B5  DID HIMEM MOVE SINCE VARS WERE COMPRESSED?
A4BA  NO... >>A4C2
A4BC  YES, ADJUST BY DIFFERENCE IN HIMEM'S (BC87)
A4BF  GO ADJUST ALL STRING POINTERS <A39F>
A4C2  THEN EXIT
A4C3  RETURN

A4C4 *********** FORMAT CATALOG ENTRY LINE ***************************

A4C4  PUT OUT A BLANK LINE <A66C>
A4C7  DOUBLE QUOTE TO $200
A4CC  GET LENGTH OF NAME (0259)
A4D2  COPY NAME TO LINE (0259)
A4DD  ZERO ACCUMULATOR FOR LATER (BCB1)
A4E0  GET FILE TYPE (0269)
A4E3  I KNOW OF ONLY 13
A4E5  ---
A4E7  LOOK UP FILE TYPE IN TABLE (B989)
A4EA  FOUND IT? >>A4F7
A4F0  FILE TYPE NOT IN MY TABLE
A4F2  PRINT IT IN HEXADECIMAL <A612>
A4F5  AND CONTINUE BELOW >>A53B
A4F7  ELSE, FOR KNOWN TYPES
A4FA  COPY NAME OF TYPE TO THE LINE (B997)
A505  80 COLUMNS PER LINE? (BCB6)
A508  YES... >>A553
A50A  NO,
A50C  BIN FILE?
A50E  YES... >>A525
A510  TXT FILE?
A512  NO... >>A
A514  YES, R V
A51F  CONVERT
A522  SKIP OVE
A525  BIN FILE
A52D  CONVERT
A536  ADD AN
A53B  COPY MS
A549  CONVERT
A550  DO CREATE
A553  ---
A55B  CONVERT
A563  CHECK FOR
A565  UNLOCKED
A567  NO, ADD
A56C  FALL THR
A56E  AND T
A570 ********** S
      X = 0
      Y = $2
A570  ISOLATE
A574  AND STOR
A57B  ISOLATE
A57D  AND STOR
A581  ISOLATE
A587  (MONTH
A58B  (MONTH
A58D  STORE MO
A591  MULTIPLY
A594  AND SAVE
A59A  (DAY =
A5A1  (YEAR MS
A5A3  OTHERWIS
A5A5  BACK UP
A5AA  AND PRIN
A5B4  THEN
A5B5  DATE OK
A5B9  AND MIN
A5BE  MINUTES
A5C0  NO.. >>A
A5C2  YES, US
A5C3  CONVERT
A5C8  THEN P
A5CC  GET HOUR
A5CF  GREATER
A5D1  NOPE >>A
A5D3  YES, USE
```


BASIC Interpreter (BI) -- V1.1 --18 JUN 84 NEXT OBJECT ADDR: A472

ADDR DESCRIPTION/CONTENTS

BASIC Interpreter (BI) -- V1.1 --18 JUN 84 NEXT OBJECT ADDR: A512

ADDR DESCRIPTION/CONTENTS

```
BASIC Interpre
ADDR    DESCRI

  A5D4  10 OR M
  A5D7  IN ANY
  A5DB  IF TWO
  A5DD  IF ONE
  A5DE  ---
  A5E2  CONVER
  A5E6  GET MO
  A5E9  POINT
  A5EC  COPY M
  A5EF  TO LIN
  A5F7  BACKWA
  A5FB  PUT A
  A5FE  TWO PL
  A607  EXIT B

A60A ********
        (FOR
  A60A  ---
  A60B  ADD 10
  A60D  CONVER
  A610  IGNORE
  A611  RETURN

A612 ********
  A612  ---
  A613  ISOLAT
  A615  AND GO
  A619  NOW IS
  A61C  AND F

  A61D  CONVE
  A61F  >9?
  A621  NO >>
  A623  YES,
  A625  AND S
  A628  BUMP
  A629  PRECE
  A62E  RETUR

A62F ********

  A62F  A,X =
  A632  STORE
  A635  DIVID
  A638  GET D
  A63D  STORE
  A640  AND D
  A641  IS QU
  A64A  NO, C
```

```
YEAR (LEFT ZERO FILL) <A60A>
INDEX (*3) (BCB3)
LAST CHARACTER
NTH NAME FROM TABLE (B9BD)
(0201)
DS... >>A5EC
" IN (0201)
CES (0205)
CONVERTING DAY >>A62F

** CONVERT 2 DIGIT NUMBER ****************************
E LEFT ZERO FILL)

TO FORCE SIGNIFICANCE IN TENS
T <A62F>
100'S PLACE

** CONVERT TO HEX ***************************************

OW NIBBLE
CONVERT IT FIRST <A61D>
LATE HIGH NIBBLE
LL THRU TO CONVERT IT ALSO
NIBBLE TO NUMERIC ASCII

625
ONVERT $BA-$BF TO $C1-$C6
RE THE RESULT (0201)
NE INDEX BACK
WITH A $ SIGN

** CONVERT TO DECIMAL ***********************************
NUMBER    Y=INDEX TO LAST FIELD DIGIT (BCB0)
NUMBER IN ACCUMULATOR (BCAF)
BY 10 <A64D>
GIT AND CONVERT IT (BCB2)
IN LINE (0201)
P LINE INDEX BY ONE
ENT NOW ZERO? (BCAF)
NTINUE UNTIL IT IS >>A635
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: A5D4
ADDR    DESCRIPTION/CONTENTS

ORE HOURS (TWO DIGITS?)
CASE, CONVERT HOURS <A62F>
IGITS... >>A5DE
MUST LINE PTR
```

```
A64D  24 BIT SHIFT (3 BYTES)
A651  CLEAR SUM (BCB2)
A654  GO ROL ACCUMULATOR LEFT ONE BIT <AAD7>
A657  ALSO ROL 4TH BYTE OF ACCUM (BCB2)
A65B  IF MSB > 10... (BCB2)
A665  THEN ADD ONE TO ACCUMULATIVE SUM (BCAF)
A668  ---
A669  SHIFT 24 TIMES >>A654
A66B  RETURN
A66C  ---
A676  RETURN

A677 *********** SYNTAX: PARSE COMMAND LINE *************************
        (ALSO EXTERNAL ENTRY FOR COMMAND STRINGS)

A677  INIT COMMAND NUMBER TO -1
A67E  A BLANK ENDS EACH STRING  (BCA9)
A683  AT MOST 8 CHARACTERS IN A COMMAND (BCAA)
A686  PARSE COMMAND ITSELF <AA1B>
A689  GET FIRST LETTER (BCBD)
A68C  MUST BE ALPHABETIC
A68E  IT IS... >>A697
A690  IT'S NOT, IS IT A "-"?
A692  YES, OK THEN... >>A697
A694  ELSE, ITS BAD - SYNTAX ERROR >>A839
A697  SCAN FOR COMMAND IN TABLES <AAE1>
A69A  BAD COMMAND? >>A694
A69C  NO, IMMEDIATE COMMAND MODE? (BE42)
A69F  NO, DEFERRED... >>A6AC
A6A1  IMMEDIATE, EXEC ACTIVE? (BE43)
A6A4  YES, NEVER MIND >>A6AC
A6A6  ERASE TO END OF LINE <FC9C>
A6A9  AND GO TO A NEW LINE ON SCREEN <9FAB>
A6AC  ASSUME NO PARMS AT ALL
A6B4  NO PATH NAME YET (BCBD)
A6B7  NO SECONDARY PATH NAME EITHER (0280)
A6BD  CURRENT SLOT = DEFAULT SLOT (BE61)
A6C3  CURRENT DRIVE = DEFAULT DRIVE (BE62)
A6C8  BUFFER ALLOCATION = HIMEM (BC88)
A6CB  GET LENGTH OF COMMAND NAME (BE52)
A6D0  ALLOW 2 MORE CHARACTERS FOR NOW (BCAA)
A6D3  ARE ANY PARAMETERS PERMITTED? (BE54)
A6D6  NO...MUST BE MON OR NOMON >>A736
A6D8  YES, IN# OR PR#?
A6D9  YES... >>A739
A6DB  ELSE, REPARSE THE COMMAND <AA1B>
A6E0  FOR THIS COMMAND... (BE54)
```



```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: A64C
ADDR    DESCRIPTION/CONTENTS

  A64C  ELSE, EXIT

        ******** DIVIDE ACCUMULATOR BY 10 *******
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: A6E3
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  A6E3  DOES
  A6E5  YES,                    NE? >>A736
  A6E7  MUST BE A
  A6EA
  A6EC  END OF                  ILENAME, LOOK
  A6EE  NO, COM                 TCHING? >>A6EA
  A6F0  NO >>A6
  A6F2  YES,                    FAULT DRIVE <BE70>
  A6F5  "/"?                    BETIC?
  A6F7  YES >>A                 NAMES MUST B
  A6F9  NO, ALP                 SH ANY BLANKS
  A6FB  NO...FIL                CHARACTERS
  A6FD                          FOR KEYWORDS >>A787
  A6FE  DON'T                   T OPERAND ON
  A703  ALLOW 6                 LENGTH (BCBC)
  A709  PARSE N                 ATHNAME#1 (
  A70D  SAVE ITS                KEYWORD TO
  A712  FOUND                   PATHNAME#1 PA
  A715  COPY PA                 GT CHAR (OTHER
  A718  (ASSUME                 OUT OF PATHNAME
  A71F  CHECK N                 R, BAT PARSE
  A722  NOT COM                 A>A798
  A724  RETURN?                 AME EXPECTED
  A726  NO, PAT                 IS WELL >>A762
  A72A  YES, A                  AX ERROR" >>A8
  A72C  NO, "SY                 FILE NAME, P
  A72F  NON AL                  THAN A BLANK)
  A732  IS IT "                 ROK THEN (MIGHT
  A734  NO, ERR                 , REPARSE COM
  A736  YES, ITS                SUND!- ERROR >>
  A739  IN#S/PR#                DDRESS KEYWORD
  A73C  RETURN                  PARSE THAT K
  A73E  "A"?                    OO ACCUMULATOR
  A740  IF SO,                  G ONE BYTE'S
  A742  ELSE, E                 PR#/IN# SLO
  A745  CONVERT                 T FOR PR#/IN#
  A74A  PUT IT                  SLOT # <A960>
  A74F  FOUND                   SA761
  A752  CONVERT                 RTED VALUE (B
  A755  ERROR?                  K >>A791
  A757  GET CO                  GE ERROR"
  A75A  >8?                     ORTH (BCAD)
  A75C  NO, ESS                 VALUE AREA (BCAE)
  A75E  YES, "BA                (BE56)
  A761  RETURN                  THNAME EXPECTE
  A762  SECOND                  H TO NON-BLANK
  A763  NO >>A7                 SLSE ON LINE?
  A765  YES, FL                 ESH ANY BLANKS
  A768  NOT ENG                 ND PATHNAME
  A76B  DON'T                   O
  A772  COPY SE                 D?
                                <AA3A>
                                ? >>A72C
                                OUT OF PATHNAME
                                $281 <AA00>
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: A777
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  A777  SAVE IT'S LENGTH (LESS 1) (0280)
  A77C  FOUND PATHNAME1 AND PATHNAME2 (B
  A780  GET LAST CHARACTER AGAIN <AA3A>(E56)
  A783  IF NOT COMMA OR RETURN, "SYNTAX
  A785  RETURN? >>A798                  ERROR" >>A72C
  A787  NO, COMMA, FLUSH TO NON-BLANK <A
  A78A  SYNTAX ERROR IF TWO COMMAS IN A <A3A>
  A78C  LOOKUP KEYWORD CHAR AND PARSE ERROR >>A72C
  A78F  EXIT NOW?  >>A761               ITS VALUE <A8E8>
  A791  NO, FLUSH TO NON-BLANK <AA3A>
  A794  SYNTAX ERROR IF COMMA OR RETURN
  A796  COMMA? YES, GO GET NEXT KEYWORD NOT FOUND >>A72C
                                        >>A787

  A798  GET PARSED SLOT (BE61)
  A79B  MUST BE NON-ZERO >>A75E
  A79D  AND LESS THAN 8
  A79F  OR ELSE - "RANGE ERROR" >>A75E
  A7A1  CHECK DRIVE TOO (BE62)
  A7A6  MUST BE EITHER 1 OR 2
  A7AD  IS THIS A DEFERRED COMMAND?
  A7B0  NO... >>A7BB
  A7B2  YES, IS A PROGRAM RUNNING? (BE42
  A7B5  YES >>A7BB                      )
  A7B7  NO, "NOT DIRECT COMMAND"
  A7BA  RETURN
  A7BB  EXPECTING NO PATHNAMES? >>A7FD
  A7BD  NO... (BE55)
  A7C0  ARE S AND D VALID FOR THIS CMD?
  A7C2  NO >>A7FD
  A7C4  YES, HAVE WE GOT PATHNAME1? (BE5
  A7C8  YES >>A7D3                      6)
  A7CD  IS PATHNAME REQUIRED?
  A7CF  YES, "SYNTAX ERROR" >>A839
  A7D1  NO, OPTIONAL - NO PREFIX FETCH
  A7D6  DOES PATHNAME1 START WITH A "/"?HEN >>A7FD
  A7D8  YES, FULLY QUALIFIED >>A7DF
  A7DA  NO, IS THERE A PREFIX ACTIVE? (B
  A7DD  NO >>A7F8                       (DF9A)
  A7DF  YES, (BE57)
  A7E2  SLOT/DRIVE GIVEN WITH THIS COMMA
  A7E4  NO, FORGET IT >>A7FD            ND?
  A7E6  YES, DO WE HAVE PATHNAME ALSO? >
  A7E8  NO,                             >A7F8
  A7EA  NULL OUT PATHNAME1 (BCBC)
  A7F2  MARK THAT WE WILL HAVE ONE SOON
  A7F8  ADD PREFIX TO FILENAMES <A83D>, (BE56)
  A7FB  ERROR? >>A83B
  A7FD  GET COMMAND NUMBER (BE53)
  A800  *2 AS INDEX INTO TABLE
  A802  GET ADDRESS OF COMMAND HANDLING
  A80B  AND STORE IT FOR INDIRECT JMP                ROUTINE (B8E9)
                                                     (CAC)
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: A810
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  A810  EXTERNAL COMMAND? IF SO GO NOW! >>A836
  A812  MY OWN COMMAND, "PREFIX"?
  A814  YES, GO NOW >>A836
  A819  S OR D VALID KEYWORDS FOR THIS CMD?
  A81B  NO, GO NOW >>A836
  A820  PATHNAME1 GIVEN WITH THIS COMMAND?
  A821  NO, GO NOW >>A836
  A823  YES, GET FILE INFO FOR PATHNAME1 <B7D0>
  A826  NO ERRORS I HOPE >>A836
  A828  ERROR WAS PATH NOT FOUND?
  A82A  NO, REAL ERROR - SAY SO >>A83B
  A82F  CAN WE CREATE PATHNAME1?
  A831  YES, OK THEN >>A836
  A833  ELSE, "PATH NOT FOUND"
  A835  RETURN
  A836  GO TO COMMAND HANDLING ROUTINE >>BCAB

A839 *********** SYNTAX ERROR ***************************************

  A839  LOAD BI CODE FOR "SYNTAX ERROR"
  A83B  AND RETURN WITH ERROR CONDITION
  A83C  RETURN

A83D *********** ADD PREFIX TO PATHNAMES ****************************

  A83D  GET SLOT NUMBER (BE61)
  A844  PUT SLOT IN HIGH 3 BITS
  A846  ADD DRIVE TO TOP BIT AND SHIFT SLOT DOWN (BE62)
  A84E  ...TO FORM THE UNIT NUMBER (BEC7)
  A853  READ THE PATHNAME PREFIX TO $201 (BEC8)
  A85D  MLI: ONLINE <BE70>
  A860  ERROR? >>A83B
  A865  DEFAULT DRIVE = PARSED DRIVE (BE3D)
  A86B  DEFAULT SLOT = PARSED SLOT (BE3C)
  A871  PATHNAME1 STARTS WITH "/"?
  A873  THEN ITS ALREADY GOT A PREFIX >>A8E6
  A878  ELSE, GET LENGTH OF PATHNAME
  A87A  BUMP IT BY 2 (TO ALLOW FOR /'S)
  A882  WITH PREFIX WILL IT EXCEED 64 CHARS?
  A887  YES, "SYNTAX ERROR" >>A8E7
  A889  NO, UPDATE LENGTH TO INCLUDE PREFIX (BCBC)
  A88F  ---
  A893  AND COPY PATHNAME1 FORWARD TO MAKE ROOM (BCBD)
  A89C  PUT A "/" AT THE BEGINNING
  A8A1  AND AT THE END (BCBD)
  A8A4  COPY PREFIX JUST READ TO START OF PATHNAME1 (0200)
  A8AA  GET COMMAND NUMBER (BE53)
  A8AD  "OPEN"?
  A8AF  YES, DONE NOW! >>A8E6
  A8B1  "APPEND"?
  A8B3  YES, DONE NOW! >>A8E6
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: A8B5
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  A8B5  "EXEC"?
  A8B7  YES, DONE NOW! >>A8E6
  A8B9  ELSE, GET LENGTH OF PATHNAME2 (0280)
  A8BE  COMBINE THIS WITH PREFIX LENGTH (0201)
  A8C1  MORE THAN 64 CHARS?
  A8C6  IF SO, "SYNTAX ERROR" >>A8E7
  A8C8  UPDATE LENGTH (0280)
  A8CB  ---
  A8CF  COPY PATHNAME2 FORWARD TO MAKE ROOM (0281)
  A8D8  PUT A "/" IN FIRST
  A8DD  THEN THE PREFIX AND ANOTHER SLASH (0281)
  A8E6  ---
  A8E7  DONE!

A8E8 *********** KEYWORD LOOKUP ***************************************

  A8E8  ZERO THE ACCUMULATOR <AB37>
  A8EB  NINE POSSIBLE KEYWORDS IN TABLE
  A8ED  COMPARE AGAINST EACH (B96B)
  A8F0  FOUND IT? >>A927
  A8F5  NO, IS IT "T"? (FILE TYPE)
  A8F7  YES, OK THEN  >>A8FC
  A8F9  ELSE, BAD KEYWORD >>A839
  A8FC  IT'S "T", IS IT PERMITTED ON THIS CMD?
  A901  NO, ERROR >>A923
  A906  ELSE, MARK WE HAVE "T" (BE56)
  A90B  START WITH TYPE INDEX OF 0 (BCAD)
  A910  INDICATE WHERE T VALUE IS TO GO (BCAE)
  A913  AND GO PARSE ONE CHAR <AA3A>
  A916  NOTHING THERE??? >>A8F9
  A918  IS IT A $?
  A91A  YES, HE GAVE TYPE IN HEX >>A976
  A91C  IS IT ALPHABETIC?
  A91E  NO, CONVERT DECIMAL TYPE >>A960
  A920  ELSE, GO LOOKUP TYPE NAME IN TABLE >>A9B6

  A923  ---
  A924  "INVALID PARAMETER"
  A926  RETURN

  A927  GET BIT POSITION OF THIS KEYWORD (B975)
  A92A  IGNORE "V" >>A947
  A92C  IS THIS KEYWORD PERMITTED? (BE55)
  A92F  NO, NOT WITH THIS COMMAND ANYWAY >>A923
  A931  S OR D?
  A933  NO >>A941
  A935  YES, ALREADY FOUND IT ON THIS LINE? (BE57)
  A938  YES, DON'T CHANGE DRIVE DEFAULT >>A947
  A93A  ELSE, ASSUME DRIVE = 1
  A941  MARK WE HAVE SLOT/DRIVE (BE57)
  A947  GET SIZE-1 IN BYTES OF VALUE (B97F)
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: A954
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  A954  AND OFFSET TO VALUE IN STORAGE AREA (BCAE)
  A957  FLUSH TO NON-BLANK <AA3A>
  A95A  NOTHING ELSE THERE? >>A9B0
  A95C  IS NEXT CHAR A "$"?
  A95E  YES, GO CONVERT HEX - ELSE, FALL THRU >>A976

A960 *********** CONVERT DECIMAL NUMBER ******************************

  A960  SAVE LINE INDEX (BE4B)
  A963  CONVERT/ADD ONE DECIMAL DIGIT TO ACCUM <AA5C>
  A966  OK.. >>A96C
  A968  OVERFLOW? THEN "RANGE ERROR" >>A9B3
  A96A  BAD DIGIT? THEN "SYNTAX ERROR" >>A9B0
  A96C  RESTORE LINE INDEX (BE4B)
  A96F  FLUSH TO NEXT NON-BLANK <AA3A>
  A972  AND GO BACK TO CONVERT NEXT DIGIT >>A960
  A974  ALL DONE, END OF LINE OR COMMA >>A98F

A976 *********** CONVERT HEX NUMBER **********************************

  A976  FLUSH TO NEXT NON-BLANK (SKIP "$") <AA3A>
  A979  NOTHING LEFT? >>A9B0
  A97B  SAVE LINE INDEX (BE4B)
  A97E  CONVERT HEX DIGIT <AAAE>
  A981  OK.. >>A987
  A983  OVERFLOW? THEN "RANGE ERROR" >>A9B3
  A985  BAD DIGIT? THEN "SYNTAX ERROR" >>A9B0
  A987  RESTORE LINE INDEX (BE4B)
  A98A  FLUSH TO NEXT NON-BLANK <AA3A>
  A98D  AND GO CONVERT NEXT DIGIT >>A97B

A98F *********** STORE KEYWORD VALUE **********************************

  A98F  HOW MANY BYTES TO CHECK?
  A994  ALL HAVE BEEN CHECKED? >>A99E
  A996  NO, INSURE MSB'S OF ACCUM ARE ZERO (BCAF)
  A999  IF NUMBER IS A SHORT INTEGER >>A9B3
  A9A1  COPY ACCUM TO PROPER PARM STORAGE CELL (BCAF)
  A9AB  RESTORE LINE INDEX (BE4B)
  A9AF  AND EXIT

  A9B0  "SYNTAX ERROR" JUMP >>A839
  A9B3  "RANGE ERROR" JUMP >>A75E

A9B6 *********** STORE KEYWORD VALUE **********************************

  A9B6  ---
  A9B8  COPY 3 CHARACTER TYPE TO ACCUM (BCAF)
  A9BE  (COPIED ALL 3?) >>A9C7
  A9C0  (GET NEXT CHAR IGNORING BLANKS) <AA3A>
  A9C5  MUST HAVE 3 CHARACTERS! >>A9B0
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: A9C7
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  A9C7  SAVE LINE INDEX (BE4B)
  A9CA  INITIALIZE NAME INDEX TO ZERO
  A9CF  HAVE ALL 13 BEEN CHECKED?
  A9D1  YES, NO MATCH >>A9B0
  A9D4  ELSE, INDEX*3 (BCAD)
  A9D8  COMPARE TYPE GIVEN (BCAF)
  A9DB  TO TYPES IN TABLE (B997)
  A9DE  (IGNORE MSB'S)
  A9DF  NO MATCH ALREADY... >>A9E9
  A9E3  ELSE,
  A9E5  CHECK ALL THREE CHARS  >>A9D8
  A9E7  THEY ALL MATCH! WE FOUND IT >>A9EE
  A9E9  NOT THE RIGHT ONE, (BCAD)
  A9EC  GO TRY THE NEXT ONE >>A9CA
  A9EE  REVERSE NAME INDEX
  A9F5  AND GET TYPE VALUE FROM TABLE (B989)
  A9F8  STORE IT IN TYPE VALUE STORAGE AREA (BE6A)
  A9FB  RESTORE LINE INDEX (BE4B)
  A9FF  AND EXIT

AA00 *********** COPY PATHNAME2 ***********************************

  AA00  GET NEXT CHARACTER <AA4A>
  AA03  AND STORE IT INDEXED OFF $280 (0280)
  AA07  COMMA?
  AA09  YES, DONE >>AA37
  AA0B  BLANK?
  AA0D  YES, DONE >>AA37
  AA0F  RETURN?
  AA11  YES, OUT NOW >>AA48
  AA13  PATHNAME TOO LONG? (BCAA)
  AA16  NO, CONTINUE COPYING >>AA00
  AA18  ELSE, SET NOT-EQUAL CONDITION
  AA1A  AND EXIT

AA1B *********** COPY COMMAND NAME INTO TXTBUF ***********************

  AA1B  SET INDICIES
  AA1F  GET NEXT NON-BLANK <AA4A>
  AA22  COPY TO TXTBUF (BCBD)
  AA26  COMMA?
  AA28  YES, DONE >>AA37
  AA2A  BLANK?
  AA2C  YES, DONE >>AA37
  AA2E  RETURN?
  AA30  YES, DONE >>AA48
  AA32  AT MAX LENGTH (8)? (BCAA)
  AA35  NO, CONTINUE >>AA1F
  AA37  ELSE, SET NOT-EQUAL CONDITION
  AA39  AND EXIT
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: AA39
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

AA3A ********** FLUSH TO NON-BLANK **********************************
          Z-FLAG SET IF COMMA OR RETURN FOUND
          C-FLAG SET IF COMMA

  AA3A  IGNORE BLANKS
  AA3F  GET NEXT NON-BLANK <AA4A>
  AA42  COMMA?
  AA44  YES, OUT >>AA49
  AA46  RETURN?
  AA48  EXIT INDICATING WHAT WE FOUND
  AA49  RETURN

AA4A ********** GET NEXT CHARACTER **********************************

  AA4A  GET NEXT CHAR IN INPUT LINE (0200)
  AA4D  FORCE OFF MSB
  AA4F  LOWER CASE?
  AA51  NO >>AA55
  AA53  YES, FORCE UPPER CASE
  AA55  BUMP LINE INDEX
  AA56  IS THIS A FLUSH CHARACTER (LIKE BLANK)? (BCA9)
  AA59  YES, GO GET NEXT ONE >>AA4A
  AA5B  ELSE, RETURN WITH IT

AA5C ********** CONVERT DIGIT AND ADD TO ACCUM **********************

  AA5C  NUMERIC?
  AA5E  NO >>AA64
  AA62  YES >>AA68
  AA64  NOT NUMERIC, EXIT WITH CARRY SET
  AA65  AND Z-FLAG RESET
  AA67  RETURN
  AA68  ISOLATE DECIMAL PORTION OF DIGIT
  AA6B  CURRENT VALUE OF ACCUM... (BCB1)
  AA6E  >1,703,936?
  AA70  YES, OVERFLOW >>AA94
  AA74  PUSH ENTIRE ACCUM ONTO STACK (BCAF)
  AA7B  ACCUM*2 (ROL IT ONCE) <AAD7>
  AA7E  ACCUM*4 (AND AGAIN) <AAD7>
  AA84  ---
  AA85  ACCUM*4+ACCUM --> ACCUM*5 (BCAF)
  AA91  FINALLY, ACCUM*5*2 --> ACCUM*10 <AAD7>
  AA94  ---
  AA95  ACCUM OVERFLOW? >>AAAA
  AA97  NO, ADD NEW DIGIT TO ACCUM (BCAF)
  AA9A  AND STORE IT (BCAF)
  AA9D  NO CARRY? >>AAAD
  AAA0  GOT CARRY, PROPAGATE IT THRU ACCUM (BCB0)
  AAAA  OVERFLOW ERROR
  AAAD   NORMAL EXIT
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: AAAD
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

AAAE ********** CONVERT HEX DIGIT AND ADD ***************************

  AAAE  NUMERIC?
  AAB0  NO >>AABE
  AAB4  YES >>AAC4
  AAB6  NON-NUMERIC, HOW BOUT "A" THRU
  AABA  "F"
  AABC  YES! >>AAC2
  AABE  ---
  AABF  NO, GET OUT NOW
  AAC1  RETURN
  AAC2  "A" THRU "F", CONVERT TO $BA-$BF
  AAC4  ISOLATE DIGIT
  AAC8  SHIFT ACCUM 4 BITS LEFT TO MAKE ROOM <AAD7>
  AACB  (WATCH OUT FOR OVERFLOW) >>AAAA
  AAD0  OR IN NEW NIBBLE (BCAF)
  AAD3  AND REPLACE IN ACCUM LSB (BCAF)
  AAD6  DONE

AAD7 ********** SHIFT 3 BYTE ACCUM LEFT A BIT ***********************

  AAD7  SHIFT THE THREE BYTE WORK ACCUM (BCAF)
  AAE0  RETURN

AAE1 ********** SCAN CMD TABLE FOR COMMAND ***************************

  AAE1  START WITH LAST COMMAND IN TABLE
  AAE6  IS IT A "-" COMMAND? (BCBD)
  AAEB  NOPE >>AAF5
  AAED  YES, SPECIAL COMMAND NUMBER (BE53)
  AAF0  ZERO LENGTH COMMAND STRING (BE52)
  AAF3  CONTINUE >>AB12
  AAF5  FIRST COMMANDS IN TABLE ARE 8 CHARS
  AAFA  GET INDEX TO NEXT NAME (B858)
  AAFD  SAME LENGTH AS LAST NAME? >>AB05
  AAFF  NO,
  AB02  NAMES ARE ONE BYTE SHORTER FROM NOW ON (BE52)
  AB05  ---
  AB06  COMPARE HIS NAME TO MY TABLE (BCBD)
  AB0C  NOT IT... >>AB25
  AB10  COMPARE ENTIRE NAME >>AB06

  AB12  FOUND IT! GET COMMAND INDEX (BE53)
  AB15  *2 FOR MOST THINGS
  AB17  PICK UP PERMITTED PARMS BITS (B92A)
  AB23  EXIT HAPPILY
  AB24  RETURN
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: AB24
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------


  AB25  NOT THE ONE, SKIP TO NEXT (BE52)
  AB2E  IF THERE ARE ANY MORE >>AAFA
  AB30  ELSE, NO SUCH COMMAND (BE53)
  AB34  XRETURN THRU $BE06 VECTOR >>BE06

AB37 ********** ZERO THREE BYTE ACCUM ******************************

  AB37  ZERO THE THREE BYTE WORK
  AB39  ...ACCUMULATOR (BCAF)
  AB42  RETURN

AB43 ********** "-" COMMAND ****************************************

  AB43  CHECK FILE TYPE (BEB8)
  AB46  APPLESOFT PROGRAM?
  AB48  YES, "RUN" IT >>ABB2
  AB4A  BINARY FILE?
  AB4C  YES, "BRUN" IT >>AB8D
  AB4E  TEXT FILE?
  AB50  NO >>AB55
  AB52  YES, "EXEC" IT >>B221
  AB55  SYS FILE?
  AB57  YES, GO RUN IT >>AB5D
  AB59  ELSE, "FILE TYPE MISMATCH"
  AB5C  RETURN

        ******** RUN "SYS" FILE *****************

  AB5D  CLOSE ALL OPEN FILES <B4F2>
  AB60  CLOSE EXEC <B2FB>
  AB65  LSB OF A$ IS 00 (BE58)
  AB68  FREE UP ALL OF BI'S MEMORY (BF6B)
  AB7B  A$2000 IS WHERE IT WILL LOAD (BE59)
  AB80  TYPE IS "SYS" (BE6A)
  AB8A  FORCE, T, PATHNAME1, AD PARMS (BE56)
  AB8D  GO DO A STANDARD BRUN >>AE16

AB90 ********** "CHAIN" COMMAND ************************************

  AB90  SQUASH VARIABLES UP AGAINST HIMEM  <A40D>
  AB95  SAVE HIMEM (BC7B)
  AB9C  SET NEW HIMEM BELOW COMBINED VARS
  AB9E  LOAD FILE (LEAVE OTHERS OPEN) <AC03>
  ABA4  RESTORE OLD HIMEM
  ABA6  ERROR? >>AC14
  ABA8  NO, CLEAR VARIABLES <D665>
  ABAB  REEXPAND VARIABLES DOWN AGAINST LOMEM <A472>
  ABB0  THEN GO "RUN" PROGRAM >>ABC7
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: ABB0
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

ABB2 ********** "RUN" COMMAND ***************************************

  ABB2  NO INPUT FILE ACTIVE
  ABB7  NO APPLESOFT ERROR
  ABBC  GOT PATHNAME1?
  ABBD  NO, ERROR >>ABD5
  ABBF  YES, LOAD PROGRAM <AC
  ABC2  ERROR? >>AC14
  ABC4  NO, CLEAR VARIABLES
  ABC7  CLEAR ERROR FLAG
  ABC9  POSITION TO LINE NUM
  ABCC  RESTORE MY INTERCEPTS
  ABCF  CLEAR COMMAND NUMBER
  ABD2  JUMP INTO APPLESOFT

ABD5 ********** CLEAR COMMAND

  ABD5  SET NORMAL (NON-INVE
  ABDA  SEARCH CHARACTER FOR
  ABDF  NO COMMAND NUMBER NO
  ABE2  NO PROMPT
  ABE6  SET MODE=4 (DEFERRED
  ABE9  "SYNTAX ERROR" IF TH

ABEC ********** "LOAD" COMMAND

  ABEC  LOAD PROGRAM <ABFE>
  ABEF  ERROR? IF NOT, FALL

ABF1 ********** WARMDOS: WA

  ABF1  CLEAR APPLESOFT, RES
  ABF4  RESET MODE/SET INTERC
  ABF9  CURSOR HORIZ. = 0 (S
  ABFB  GO WARMSTART APPLESOF

ABFE ********** LOAD A PROGR

  ABFE  CLOSE ALL OPEN FILES
  AC01  ERROR? >>AC14
  AC03  GO LOAD FILE <AC15>
  AC06  ERROR? >>AC14
  AC08  SET LOMEM = ARRAYS =
  AC0A  ALL TO END OF PROGRAM
  AC14  RETURN
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: AC14
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

AC15 *********** READ A PROGRAM FROM A FILE *************************

  AC15  READ REQUESTED
  AC17  TYPE = BAS ASSUMED
  AC19  OPEN THE FILE <B194>
  AC1C  ERROR? >>AC14
  AC20  MLI: GET EOF <BE70>
  AC23  ERROR? >>AC14
  AC27  APPLESOFT PROGRAM START --> READ DATA (BED7)
  AC2A  ADD TO THAT THE EOF MARK TO ... (BEC8)
  AC2D  SET AD PARM --> END OF PROGRAM IMAGE (BE58)
  AC3B  OVERFLOW? >>AC3F
  AC3D  NO, WOULD PROGRAM EXCEED HIMEM?
  AC3F  IF SO...
  AC41  "PROGRAM TOO LARGE" >>AC14
  AC43  ELSE, PICK UP LENGTH AGAIN (BEC8)
  AC49  AND GO READ IT IN <AF98>
  AC4C  ERROR? >>AC14
  AC4E  CLOSE FILE <AF94>
  AC51  ERROR? >>AC14
  AC53  RELOCATE PROGRAM IF NECESSARY <AC61>
  AC5C  COPY AD PARM TO APPLESOFT PGM END PTR
  AC60  RETURN

AC61 *********** RELOCATE APPLESOFT PROGRAM *************************

  AC61  ---
  AC62  WAS APPLESOFT PROGRAM SAVED FROM SAME
  AC64  MEMORY LOCATION? (BEB9)
  AC73  YES, NOTHING TO DO THEN >>ACBA
  AC79  ELSE, LOOP THROUGH PROGRAM
  AC7B  ADJUSTING ALL ADDRESSES TO
  AC7D  THE NEW LOAD LOCATION

AC97 *********** POSITION TO LINE NUMBER ****************************

  AC97  WAS A LINE NUMBER PARM GIVEN? (BE57)
  AC9D  NO, NEVER MIND >>ACBA
  AC9F  COPY L KEYWORD VALUE TO APPLESOFT'S LINE # (BE68)
  ACA9  THEN CALL APPLESOFT TO FIND THE LINE <D61A>
  ACAF  SUBTRACT ONE FROM THE ADDRESS
  ACB1  AND POINT APPLESOFT'S GETCHR SUBROUTINE
  ACB3  AT IT (SO NEXT CHAR READ WILL BE FIRST
  ACB5  CHARACTER ON THE LINE).
  ACBA  RETURN
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: ACBA
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

ACBB *********** "SAVE" COMMAND ***************************************

  ACBB  DOES FILE EXIST ALREADY? >>ACDF
  ACBD  NO, TYPE = BAS
  ACBF  IN T KEYWORD VALUE (BE6A)
  ACC2  AND MLI LIST (BEB8)
  ACC7  ALLOW ALL ACCESSES (READ/WRITE/ETC.) (BEB7)
  ACCC  SAVE PROGRAM START ADDRESS IN (BEA5)
  ACCF  AUXID'S (BEB9)
  ACDA  GO CREATE A NEW FILE <AD46>
  ACDD  ERROR? >>AD28

  ACDF  WRITE ACCESS REQUESTED
  ACE1  BAS TYPE FILE
  ACE3  OPEN IT <B194>
  ACE6  ERROR? >>AD28
  ACEB  SUBTRACT APPLESOFT PTRS TO COMPUTE
  ACED  LENGTH OF PROGRAM.
  ACEE  STORE THIS IN EOF MARK LIST (BEC8)
  ACFB  MSB OF EOF MARK IS 00 (<64K PGM) (BECA)
  AD00  POINT LIST TO PROGRAM AS DATA TO WRITE (BED7)
  AD08  WRITE A RANGE TO DISK FILE <AF9C>
  AD0B  ERROR? >>AD28
  AD0F  MLI: SET EOF (TO TRUNCATE OLD LONGER FILE) <BE70>
  AD12  ERROR? >>AD28
  AD14  CLOSE THE FILE <AF94>
  AD17  ERROR? >>AD28
  AD1B  DOES PROGRAM START MATCH AUXID IN FILE INFO?
  AD20  NO, CHANGE IT >>AD29
  AD28  ELSE, EXIT

  AD29  TO CHANGE IT, (BEB9)
  AD2F  EXIT THRU SET FILE INFO ROUTINE >>B7D9

AD32 *********** "CREATE" COMMAND *************************************

  AD32  AUXID = 0 (A$ OR RECLN)
  AD3D  TYPE KEYWORD GIVEN?
  AD3F  YES >>AD46
  AD43  NO, ASSUME TYPE = DIR (BE6A)

  AD46  *** CREATE FILE ENTRY *** (BE43)
  AD49  EXEC FILE ACTIVE?
  AD4C  HOW MANY FILES ARE OPEN INCLUDING EXEC? (BE4D)
  AD4F  8 OR MORE?
  AD51  YES, ERROR >>AD6E
  AD56  ELSE, SET TYPE IN MLI LIST (BEA4)
  AD59  FULL ACCESS (READ/WRITE/ETC.)
  AD5B  KIND = STANDARD FILE
  AD5D  DIR FILE WANTED?
```

```
  AD5F  NO >>AD63
  AD61  YES, KIND = DIR FILE
  AD63  SET ACCESS (BEA3)
  AD66  AND KIND  (BEA7)
  AD6B  MLI: CREATE (DON'T COME
  AD6E  "RAM TOO LARGE" ERROR
  AD7Ø  RETURN

AD71 ********** "RENAME" COMMAN

  AD71  ---
  AD75  SECOND PATHNAME GIVEN?
  AD78  IF SO, GO MLI: RENAME >>
  AD7A  "SYNTAX ERROR" OTHERWISE

AD7D ********** "DELETE" COMMAN

  AD7D  SETUP MLI: DELETE CALL TO
  AD7F  EXIT THRU MLI CALL >>BE7

AD82 ********** "LOCK" COMMAND

  AD82  GET FILE INFO FOR PATHNA
  AD85  GET ACCESS CODES (BEB7)
  AD88  TURN OFF ALL...
  AD8A  BUT READ
  AD8F  THEN GO SET UPDATED FILETYPE

AD92 ********** "UNLOCK" COMMAN

  AD92  GET FILE INFO FOR PATHNA
  AD95  TURN ON ALL FILE ACCESS
  AD9D  THEN GO SET UPDATED FILE

ADAØ ********** "PREFIX" COMMAN

  ADAØ  SLOT/DRIVE GIVEN ON COMM
  ADA6  IF SO, GOT OPERAND ALREAD
  ADA8  ELSE, (BE56)
  ADAB  CHECK FOR PATHNAME1
  ADAC  AND GO DO MLI: SET PREFIX
  ADAE  IF IT'S THERE >>AD7F
  ADBØ  ELSE, IS BASIC PROGRAM R
  ADB2  IF SO, SET PREFIX ACTIVE
  ADB4  NO, NEW LINE <9FAB>
  ADBC  END OF NAME YET? >>ADC9
  ADBE  NO, COPY NAME IN PATHNAME
  ADC3  TO OUTPUT DEVICE <9FAD>
  ADC9  AND SKIP A BLANK LINE <9
  ADDØ  DONE
```



```
ADDR    DESCRIPTION/CONTENTS

  ADD1  SET PREFIX ACTIVE FLAG
  ADD3  SO BASIC CAN READ THE PREFIX (BE46)
  ADD7  RETURN

ADD8 ********** "BSAVE" COMMAND **********

  ADD8  PATHNAME1 FOUND? >>AE0E
  ADDA  NO, NEW FILE (BE57)
  ADDD  AD, L, AND E POSSIBLE
  ADDF  AD AND EITHER L OR E REQUIRED
  ADE1  OR ELSE ERROR >>AE12
  ADE6  PUT AD IN CREATE PARAMETER LIST (BEA5)
  ADE9  AND IN GET FILE INFO LIST (BEB9)
  ADF7  TYPE = BIN ASSUMED (BE6A)
  AE0Ø  T KEYWORD GIVEN?
  AE02  IF SO, ERROR >>AE12
  AE04  GO CREATE THE FILE <AD46>
  AE07  ERROR? >>AE14
  AE09  GET FILE INFO <B7DØ>
  AE0C  ERROR? >>AE14
  AE0E  WRITING...
  AE1Ø  GO PROCESS LIKE A BLOAD OTHERWISE >>AE25

  AE12  "PATH NOT FOUND" ERROR
  AE14  ---
  AE15  RETURN

AE16 ********** "BRUN" COMMAND **********
         (DOES NOT SET MODE=4 SO DOS COMMANDS MAY
         NOT BE ISSUED AS WITH A BASIC PROGRAM)

  AE16  BLOAD IT FIRST <AE23>
  AE19  ERROR? >>AE14
  AE1B  THEN CALL IT <AE20>
  AE1E  THEN EXIT
  AE1F  RETURN
  AE2Ø  INDIRECT JMP TO BINARY PROGRAM >>BED7

AE23 ********** "BLOAD" COMMAND **********

  AE23  READING...
  AE25  TYPE = BIN
  AE27  OPEN THE FILE <B194>
  AE2A  ERROR? >>AE14
  AE2C  ASSUME USER SPECIFIED AD KEYWORD (BE58)
  AE35  IF SO, USE HIS ADDRESS >>AE47
  AE37  ELSE, USE AD IN FILE INFO AUXID  (BEB9)
  AE4Ø  WAS T KEYWORD GIVEN?
  AE42  YES, INVALID PARM (ONLY BIN IS LEGAL) >>AE78
  AE47  POINT READ/WRITE PARMS TO DATA (BED7)
```

```
  AE4D  PICK UP LENGTH
  AE53  WAS ERR >>AE57
  AE55  NEITHER?
  AE57  BOTH NAUGHT?
  AE59  YES, VEN?
  AE5B  E G. MUST BE 1 FROM L KEYWORD VALUE (BE5F)
  AE5D  NO, ... (BE5D VEN?
  AE5F  YES TE L = /C
  AE63  COM ONE FOR
  AE6F  PLU SURE NO >>AE78
  AE72  MAK
        SE, "RAN >>AE92
  AE74  OR RN
  AE77  RET E - AD) (BE58)
        ALID PAR INCLUSIVE RANGE >>AE72
  AE78  "IN RN BORROW OCCURED >>AE92
  AE7B  RET
        GE ERROR"
  AE7C  --- GET EOF
  AE7E  MLI OR? >>AE9
  AE81  ERR (EOF M" ERROR
  AE83  GET ER NOT E
  AE89  BET >>AE92
  AE8C  NO.
        "PROGRA <BE70>
  AE8E  YES
  AE90  ---URN ARK) (BEC8)
  AE91  RET ACEED 64K (BECA)
        S LENGTH
  AE92  STO WORD GI
  AE9B  B K >AEC4 TOO LARGE"
  AE9D  NO COPY B
  AEA1  YES
  AEAA  --- SET MAR
  AEAC  MLI ERROR? >> TO READ OR WRITE (BED9)
  AEB2  NO OR, RANGE VEN?
  AEB4  ERR >>AE90
  AEB6  NO ING (NOTVALUE TO SET MARK LIST (BE5A)
  AEB8  BSA >AE90
  AEBA  NO FORCE EN <BE70>
  AEBE  MLI TRY SET AEC4
  AEC1  AND RN ERROR?
  AEC3  RET COMMAND
  AEC4  GET ME READ BLOAD/BRUNING)?
  AEC7  ASS VE?
  AEC9  BSA READ IS OF FORWARD TO MARK <BE70>
  AECB  NO, TING MARK AGAIN >>AEAA
  AECD  WRI READ OF
  AECF  MLI OR? >>AE9 NUMBER (BE53)
  AED2  ERR EXIT TH
  AED4  THE
                CORRECT >>AECF
                WRITE <BE70>
                0
                RU CLOSE >>AF94
```



```
AED7 ********** "STORE" COMMAND **************************************

  AED7  PATHNAME1 EXISTS? >>AEEB
  AED9  NO, T = VAR BY DEFAULT
  AEE1  FULL ACCESS (READ/WRITE/ETC.)
  AEE6  CREATE THE FILE <AD46>
  AEE9  ERROR? >>AF39
  AEEB  COMPRESS APPLESOFT VARS AGAINST HIMEM <A40D>
  AEF4  OPEN "VAR" FILE FOR WRITE <B194>
  AEF7  ERROR? >>AF32
  AEF9  POINT TO INTERNAL 5 BYTE HEADER BUFFER <AF3A>
  AEFC  AND WRITE OUT LENGTHS OF VARS <AF9C>
  AEFF  ERROR? >>AF32
  AF01  STORE ADDRESS OF VARS (BC8E)
  AF04  IN READ/WRITE PARM LIST (BED7)
  AF07  AND FILE INFO AUXID (BEB9)
  AF13  GET LENGTH OF VARS (BC91)
  AF19  AND WRITE THEM OUT <AF9C>
  AF1C  ERROR? >>AF32
  AF20  MLI: GET MARK <BE70>
  AF25  MLI: SET NEW EOF (TRUNCATE IF NECESSARY) <BE70>
  AF28  ERROR? >>AF32
  AF2A  SET FILE INFO WITH AD OF VARS <B7D9>
  AF2D  ERROR? >>AF32
  AF2F  CLOSE FILE <AF94>
  AF32  ---
  AF34  REEXPAND VARS BACK AGAIN <A472>
  AF39  RETURN

AF3A ********** SETUP TO READ/WRITE VAR HDR **************************
          APPLESOFT VARIABLES HEADER CONSISTS OF:
          2 BYTE LENGTH OF SIMPLE+ARRAY VARIABLES
          2 BYTE LENGTH OF SIMPLE VARIABLES ONLY
          1 BYTE MSB OF HIMEM FOR THESE VARIABLES

  AF3A  STORE ADDRESS OF 5 BYTE INFO
  AF3C  IN READ/WRITE PARM LIST (BED7)
  AF46  LENGTH = 5
  AF48  RETURN

AF49 ********** "RESTORE" COMMAND **************************************

  AF49  TYPE = VAR
  AF4B  READING
  AF4D  OPEN THE FILE <B194>
  AF50  ERROR? >>AF39
  AF52  SET UP TO READ THE HEADER <AF3A>
  AF55  READ 5 BYTE HEADER <AF98>
  AF58  ERROR? >>AF39
  AF5A  PICK UP WHERE TO READ IN COMPRESSED VARS (BEB9)
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: AF5D
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  AF5D  FROM AUXID (BC8E)
  AF63  ADJUST MSB OF THIS BY THE DIFFERENCE
  AF66  BETWEEN HIMEM'S (NOW AND WHEN STORED) (BC8D)
  AF73  MAKE SURE VARS WON'T OVERLAY PROGRAM
  AF75  IF SO, ERROR >>AF90
  AF7F  COMPUTE LENGTH OF ALL VARS/STRINGS
  AF81  (HIMEM-START) (BC8F)
  AF85  GO READ COMBINED VARS INTO MEMORY <AF98>
  AF88  ERROR? >>AF39
  AF8A  CLOSE THE FILE <AF94>
  AF8D  EXIT BY REEXPANDING THE VARS DOWN >>AF32

  AF90  "PROGRAM TOO LARGE" ERROR
  AF93  RETURN

AF94 ********** CLOSE FILE ****************************************

  AF94  SET MLI CLOSE OPCODE
  AF96  AND GO TO MLI >>AFA4

AF98 ********** READ/WRITE A RANGE ********************************

  AF98  READ MLI OPCODE
  AF9A  JUMP IN >>AF9E
  AF9C  WRITE MLI OPCODE
  AF9E  STORE LENGTH (BEDA)
  AFA4  EXIT THRU MLI:READ OR WRITE >>BE70

AFA7 ********** "PR#" COMMAND ************************************

  AFA7  USE CSWL AND OUTVEC
  AFAC  JUMP TO COMMON CODE >>AFB5

AFAE ********** "IN#" COMMAND ************************************

  AFAE  USE KSWL
  AFB3  AND INVEC

  AFB5  OR IN SLOT GIVEN BY USER (BE6B)
  AFB8  *2 FOR USE AS INDEX INTO TABLE
  AFBD  WAS SLOT PARAMETER GIVEN?
  AFBF  NO... >>AFD2
  AFC1  YES, (BE57)
  AFC4  AD GIVEN? >>AFE7
  AFC6  NO, GET INVEC OR OUTVEC FOR THIS SLOT (BE10)
  AFC9  AND STORE ON AD KEYWORD VALUE (BE58)
  AFD2  VALIDITY CHECK I/O DRIVER <AFF9>
  AFD5  NO GOOD? >>AFE6
  AFD7  GET INDEX TO CSWL OR KSWL (BCA9)
  AFDD  AND REPLACE ONE OR THE OTHER WITH (0036)
  AFE0  HIS ADDRESS (BE59)
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: AFE6
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  AFE6  RETURN

  AFE7  VALIDITY CHECK AD KEYWORD VALUE <AFF9>
  AFEA  NO GOOD? >>AFF8
  AFEC  GOOD, COPY VALUE TO INVEC OR OUTVEC (BE59)
  AFF8  EXIT BUT DON'T REDIRECT I/O NOW

AFF9 ********** VALIDITY CHECK I/O DRIVER **************************

  AFF9  $3A/3B --> NEW HANDLER (FROM AD PARM) (BE58)
  B005  IS DRIVER IN MAIN RAM (BELOW $C000)?
  B007  YES >>B01E
  B009  NO, RESET I/O CARD ROMS (CFFF)
  B00C  USE $3C TO COUNT ITERATIONS
  B00E  TEST ROM AT USER'S ADDRESS
  B014  FOR STABILITY
  B018  256 TIMES
  B01C  MUST BE OK
  B01D  RETURN
  B01E  MAIN RAM I/O DRIVER
  B020  MUST START WITH A "CLD" INSTRUCTION
  B022  OK... >>B01C

  B024  ELSE, "NO DEVICE CONNECTED"
  B027  RETURN

B028 ********** "BYE" COMMAND ************************************

  B028  CLOSE ANY OPEN FILES <B4F2>
  B02B  CLOSE EXEC FILE, IF ANY <B2FB>
  B030  MLI CALL: <BF00>
  B033  QUIT
  B034  USE READ PARMLIST BECAUSE QUIT DOESN'T NEED PARMS.

B036 ********** "CAT" COMMAND *************************************

  B036  39 CHARACTERS PER LINE
  B038  THEN PROCESS LIKE "CATALOG" >>B03C

B03A ********** "CATALOG" COMMAND *********************************

  B03A  79 CHARACTERS PER LINE
  B03C  STORE LINE LENGTH (BCB6)
  B042  TEST FOR T AND
  B044  ....PATHNAME1 GIVEN
  B045  GOT T >>B04A
  B047  NO T, T=0 (ANY TYPE WILL DO) (BE6A)
  B04A  GOT PATHNAME1 >>B051
  B04C  NO PATHNAME1, GET FILE INFO FOR PREFIX <B7D0>
  B04F  ERROR? >>B0B7
  B051  OPEN/READ DIRECTORY HEADER <B14A>
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B054
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  B054  ERROR? >>B0B7
  B056  SKIP TO A NEW LINE <9FAB>
  B059  FORMAT DIRECTORY'S NAME TO
  B05C  PRINT $201 <9F9D>
  B05F  SKIP TO A NEW LINE <9FAB>
  B062  BLANK $201 BUFFER <A66C>
  B067  UNPACK HEADING MESSAGE LINE
  B06A  PRINT IT (40 OR 80 COLUMNS)
  B06D  SKIP TO A NEW LINE <9FAB>
  B073  ANY FILES IN THIS DIRECTORY
  B076  NO  >>B0A3
  B078  YES, READ NEXT ENTRY <B1D1>
  B07B  ERROR? >>B0B7
  B07D  GET TYPE REQUESTED FOR SEAR
  B080  ANY TYPE WILL DO? >>B087
  B082  NO, CHECK TYPE AGAINST THIS
  B085  NOT IT, SKIP IT >>B08D
  B087  ELSE, FORMAT ENTRY TO $201
  B08A  AND PRINT $201 <9F9D>
  B08D  CHECK KEYBOARD (C000)
  B090  FOR A CONTROL-C
  B092  IGNORE ANYTHING ELSE >>B09E

  B094  CONTROL-C, WHAT STATE ARE W
  B097  DEFERRED >>B0A3
  B099  NO, IMMEDIATE, RESET KEYBOA
  B09C  AND EXIT RIGHT NOW >>B0A3

  B09E  ELSE, ANY FILES LEFT IN COU
  B0A1  YES, CONTINUE >>B078
  B0A3  ELSE, CLOSE DIRECTORY <AF94
  B0A6  ERROR? >>B0B7
  B0A8  SKIP TO A NEW LINE <9FAB>
  B0AB  FORMAT BLOCKS FREE AND IN U
  B0AE  ERROR? >>B0B7
  B0B0  PRINT $201 <9F9D>
  B0B3  SKIP A LINE <9FAB>
  B0B7  DONE

B0B8 ********** FORMAT NAME OF DIR

  B0B8  BLANK $201 BUFFER <A66C>
  B0BB  FILE NAME IS AT +1 INTO DIR
  B0BD  GET NAME LENGTH/TYPE (025D)
  B0C2  VOLUME DIRECTORY HEADER?
  B0C4  NO >>B0CA
  B0C6  YES, START NAME WITH "/" (0
  B0CA  ---
  B0CB  ISOLATE NAME LENGTH FROM TY
  B0CD  AND SET UP LENGTH TO COPY (
  B0D2  COPY DIRECTORY NAME TO (025
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B0D7
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  B0D7  ---- (0200)
  B0E1  SET $200 TO MAXIMUM LENGTH
  B0E6  RETURN

B0E7 ********** FORMAT BLOCKS FREE/INUSE **********

  B0E7  POINT MLI ONLINE PARMLIST
  B0E9  TO EXTBUF (PATHNAME1) (BEC8)
  B0F1  COPY DEVICE NUMBER (UNIT) (BF30)
  B0F9  MLI ONLINE <BE70>
  B0FC  ERROR? >>B0B7
  B101  ISOLATE NAME LENGTH FROM BUFFER
  B104  BUMP BY ONE TO INCLUDE "/"
  B105  AND STORE IT AS A PREFIX (BCBC)
  B10A  STORE "/" AS FIRST CHARACTER (BCBD)
  B10D  GET FILE INFO FOR PREFIX <B7D0>
  B110  ERROR? >>B0B7
  B112  BLANK $201 BUFFER <A66C>
  B117  UNPACK "BLOCKS FREE: BLOCKS USED.." <9FB0>
  B11A  ZERO THE THREE BYTE ACCUM <AB37>
  B125  CONVERT AUXID (TOTAL BLOCKS) <A62F>
  B130  CONVERT BLOCKS USED <A62F>
  B137  BLOCKS FREE = TOTAL BLOCKS (BEBC)
  B13E  - BLOCKS USED (BEBD)
  B145  CONVERT BLOCKS FREE <A62F>
  B149  DONE

B14A ********** OPEN/READ DIRECTORY HDR **********

  B14A  READ ONLY
  B14E  CHECK FREE KIND (BEBB)
  B151  VOLUME DIRECTORY?
  B153  NO >>B158
  B155  YES, TYPE = DIR (BEB8)
  B158  OPEN THE FILE <B1A0>
  B15B  ERROR? IF NOT, FALL THRU >>B193

B15D ********** READ DIRECTORY HDR **********

  B15D  BUFFER IS $259
  B169  LENGTH IS $2B (ONE ENTRY) (BED9)
  B173  MLI READ <BE70>
  B176  ERROR? >>B193
  B17A  COPY ENTRY LENGTH, ENTRIES PER BLOCK, (027C)
  B184  AND FILE COUNT FROM DIR HDR (BCB7)
  B188  STORE ENTRY LENGTH IN READ LENGTH NOW (BED9)
  B18B  SET COUNTER TO FIRST ENTRY IN BLOCK (BCBB)
  B18D  MARK = 0 (START OF FILE) (BEC9)
  B193  RETURN
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B193
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

B194 *********** OPEN FILE ***********************************************
          A REGISTER = ACCESS BITS
          X REGISTER = DEFAULT TYPE

  B194  ---
  B198  T KEYWORD GIVEN?
  B19A  NO >>B19F
  B19C  YES, USE KEYWORD VALUE INSTEAD (BE6A)
  B19F  ---
  B1A0  EXISTING FILE OF THIS TYPE? (BEB8)
  B1A3  NO, ERROR >>B1C9
  B1A5  CHECK ACCESS REQUESTED (BEB7)
  B1A8  REQUESTED ACCESS NOT PERMITTED >>B1CD
  B1AA  SET SYSTEM BUFFER IN OPEN PARM LIST (BC88)
  B1B2  LEVEL = $0F (BF94)
  B1B7  MLI: OPEN <BE70>
  B1BA  ERROR? >>B1C8
  B1BF  SAVE REFNUM IN READ/WRITE PARMLIST (BED6)
  B1C2  AND CLOSE PARMLIST (BEDE)
  B1C5  AND GET/SET EOF/MARK LIST (BEC7)
  B1C8  AND EXIT

  B1C9  "FILE TYPE MISMATCH"
  B1CC  RETURN
  B1CD  "FILE LOCKED"
  B1D0  RETURN

B1D1 *********** READ NEXT DIRECTORY ENTRY ***************************

  B1D1  FORCE MARK TO START OF THIS BLOCK (BEC9)
  B1D9  CHECK ENTRY NUMBER (BCBB)
  B1DE  LAST ENTRY IN THIS BLOCK? (BCB8)
  B1E1  NO >>B1ED
  B1E4  YES, ENTRY 0 NEXT TIME (BCBB)
  B1E7  BUMP MARK TO NEXT BLOCK (BEC9)
  B1ED  ---
  B1EF  MARK POSITIONED TO PROPER ENTRY YET? >>B1F8
  B1F1  NO, BUMP POINTER TO NEXT ENTRY (BCB7)
  B1F4  AND CONTINUE IF STILL FIRST PAGE >>B1ED
  B1F6  JUST ENTERED SECOND PAGE >>B1EA
  B1F8  ADD 4 TO PTR TO ADJUST FOR BLOCK PREFIX
  B1FF  MLI: SET MARK <BE70>
  B202  ERROR? >>B21D
  B206  MLI: READ <BE70>
  B209  ERROR? >>B21D
  B20B  BUMP ENTRY COUNTER (BCBB)
  B211  IS THIS ENTRY VALID?
  B213  NO, SKIP OVER IT >>B1D1
  B215  DECREMENT FILE COUNT (BCB9)
  B21D  AND RETURN TO CALLER
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B21D
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

B21E *********** EXTERNAL COMMAND HANDLER ******************************

  B21E  INDIRECT JMP TO XTRNAD VECTOR >>BE50

B221 *********** "EXEC" COMMAND ***************************************

  B221  IS THIS FILE OPEN ALREADY? <B41F>
  B224  NO >>B250
  B226  YES, EXEC CLOSING? (BE4E)
  B229  NO >>B24C
  B22B  SAVE REFNUM (BEC7)
  B230  RESET MARK TO ZERO (BEC8)
  B23B  MLI: SET MARK <BE70>
  B23E  ERROR? >>B245
  B240  GET REFNUM AGAIN (BEC7)
  B243  GO RESTART THIS EXEC FILE FROM ITS START >>B2C3

        ******** CLOSE EXEC FILE ****************

  B245  PRESERVE CALLER'S AREG
  B246  AND CLOSE THE FILE <B2FB>
  B24B  THEN RETURN WITH ERROR

  B24C  "FILE BUSY" ERROR
  B24F  RETURN

        ******** CONTINUE EXEC SETUP ************

  B250  EXEC ACTIVE? (BE43)
  B253  NO >>B25A
  B255  YES, CLOSE IT <B2FB>
  B258  ERROR? >>B263
  B25A  GET FILE TYPE (BEB8)
  B25D  SHOULD BE TXT
  B25F  IT IS >>B265

  B261  ELSE, "FILE TYPE MISMATCH"
  B263  RETURN WITH ERROR
  B264  RETURN

  B265  MOVE STRINGS TO MAKE ROOM FOR A BUFFER <A1F5>
  B268  NO ROOM? >>B263
  B26C  STORE NEW BUFFER ADDRESS IN PARM LIST (BEC8)
  B275  GET COUNT OF OPEN FILES (BE4D)
  B278  NO OTHERS CURRENTLY OPEN? >>B29E
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B278
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

                        EXEC TOPMOST BUFFER *******
        ******** MAKE
                        ...
  B27A  OTHERS ARE OPEN PAGES PER BUFFER)
  B27C  OPENCOUNT*4 (4  BUFFER TO FIND TOP BUFFER (BC88)
  B27E  ADD THIS TO MY  ES TO FIND THE FILE WHICH (BC93)
  B282  SEARCH OPEN FIL UFFER... >>B28B
  B285  IS USING THIS B ND; BREAK!
  B28A  IF IT IS NOT FO...
  B28B  ---             TO THE NEW BUFFER INSTEAD (BC93)
  B28C  MOVE THAT FILE  REFNUM ALSO (BC9B)
  B28F  GET THAT FILE'S <BE70>
  B297  MLI: SET BUFF <9D
  B29A  NO ERRORS? >>B2
  B29C  IF ERROR, BREAK
  B29D  ---
                        NEW EXEC FILE *************
        ******** OPEN
                        ALLOCATION PAGE (BC88)
  B29E  SET NEW BUFFER  T FOR EXEC TOO (BECF)
  B2A1  SET UP OPEN LIS
  B2A6  LEVEL = Ø (BF94 FILE) <BE70>
  B2AB  MLI: OPEN (EXEC
  B2AE  NO ERROR? >>B2E

  B2BØ  ---             BUFFER FIRST <A24C>
  B2B1  IF ERROR, FREE  ERROR
  B2B6  THEN EXIT WITH
                        EXEC (BECF)
  B2B7  SAVE BUFFNO FOR BED0)
  B2BD  AND REFNUM TOO
                        ETE EXEC COMMAND **********
        ******** COMP
                        M (BED6)
  B2C3  SAVE READ REFNU UM (BEC7)
  B2C6  AND GET/SET REF UM (BED2)
  B2C9  AND NEWLINE REF OM AUXID (BE5F)
  B2CF  SET "L" VALUE F UXID IN OPEN FILE TABLE <B3EB>
  B2D8  SAVE PATHNAME/E END OF LINE CHARS (BED3)
  B2DD  IGNORE MSB FOR  <BE70>
  B2E2  MLI: SET NEWLIN IVEN ON COMMAND LINE?
  B2E8  WAS "F" OR "R"
  B2EA  NO >>B2F4       SPECIFIED STARTING PT <B522>
  B2EC  YES, POSITION T F4
  B2EF  NO ERRORS? >>B2 SE EXEC >>B245
  B2F1  IF ERROR, GO CL E
  B2F4  MARK EXEC ACTIV ALLER
  B2FA  AND RETURN TO C
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B2FA
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

B2FB ********** CLOSE EXEC FILE ************************************

  B2FB  EXEC ACTIVE? (BE43)
  B2FE  NO, SKIP IT >>B30B
  B300  INDICATE EXEC FILE CLOSING (BE4E)
  B305  PICK UP REFNUM FOR EXEC (BC9B)
  B308  AND GO CLOSE IT <B4A5>
  B30B  RETURN

B30C ********** "VERIFY" COMMAND ***********************************

  B30C  FILE NOT FOUND? >>B347
  B311  FILE FOUND, WAS A PATHNAME1 GIVEN?
  B313  YES >>B31D
  B315  NO,
  B317  PRINT "(C) APPLE COMPUTER..." <9F8C>
  B31A  AND A NEW LINE <9FAB>
  B31D  THEN EXIT
  B31E  RETURN

B31F ********** FLUSH ALL OPEN FILES *******************************

  B31F  REFNUM = Ø (ALL FILES)
  B321  JUMP INTO FLUSH >>B32F

B323 ********** "FLUSH" COMMAND ************************************

  B323  ---
  B326  WAS PATHNAME1 GIVEN?
  B328  NO, FLUSH ALL FILES >>B32F
  B32A  ELSE, LOOK UP NAME IN OPEN FILE LISTS <B41F>
  B32D  NOT AN OPEN FILE >>B337
  B32F  SAVE REFNUM IN PARM LIST (BEDE)
  B334  MLI: FLUSH <BE70>
  B337  EXIT

B338 ********** "OPEN" COMMAND *************************************

  B338  ---
  B339  LOOK UP NAME IN OPEN FILE LIST <B41F>
  B33C  NOT CURRENTLY OPEN? >>B34B

  B33E  ---
  B33F  IT IS OPEN, "FILE BUSY" ERROR
  B342  RETURN
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B342
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  B343  "FILE TYPE MISMATCH" ERROR
  B346  RETURN

  B347  "PATH NOT FOUND" ERROR
  B349  ---
  B34A  RETURN

  B34B  ---
  B34C  ASSUME "L" IS ZERO
  B353  WAS "L" KEYWORD GIVEN?
  B355  YES, USE HIS VALUE >>B35D
  B357  NO, SET "L" TO ZERO (BE60)
  B360  WAS "T" GIVEN?
  B364  YES, USE HIS TYPE >>B36B
  B366  ELSE, DEFAULT TO "TXT"
  B36B  DOES THE FILE ALREADY EXIST? >>B38E
  B36D  NO, "T" GIVEN? IF SO, ERROR >>B347
  B36F  FORCE TYPE = "TXT" (BEB8)
  B374  FULL ACCESS (BEB7)
  B37A  COPY "L" KEYWORD VALUE (BE5F)
  B37D  TO CREATE (BEA6)
  B380  AND SET FILE INFO LISTS (BEBA)
  B389  GO CREATE THE FILE <AD46>
  B38C  ERROR? >>B349
  B38E  CHECK FILE TYPE (BEB8)
  B391  AGAINST HIS "T" VALUE (BE6A)
  B394  MISMATCH? >>B343
  B396  NO, TYPE = TXT?
  B398  NO >>B3AD
  B39A  YES, GET RECORD LENGTH FROM AUXID (BEBA)
  B3A3  WAS "L" KEYWORD VALUE GIVEN?
  B3A5  YES, USE THAT INSTEAD >>B3AD
  B3A7  OTHERWISE, SAVE AUXID RECORD LEN (BE60)
  B3AD  ALLOCATE A NEW FILE BUFFER <A1F5>
  B3B0  ERROR? >>B349
  B3B2  GET BUFFER PAGE NO. (BC88)
  B3B5  AND STORE IN OPEN LIST (BECF)
  B3BA  LEVEL = 7 (BF94)
  B3BF  MLI: OPEN <BE70>
  B3C2  NO ERRORS? >>B3CB

  B3C4  ---
  B3C5  ERROR, FREE BUFFER FIRST <A24C>
  B3CA  THEN EXIT WITH ERROR CODE

  B3CB  CHECK FILE TYPE AGAIN (BEB8)
  B3CE  "DIR" FILE?
  B3D0  YES >>B3D3
  B3D2  NO
  B3D3  ---
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B3D6
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  B3D6  SET DIR FLAG
  B3D9  BEING OPENED ACCORDINGLY (BE47)
  B3DF  STORE BUFFER COUNT AS AN INDEX (BE4D)
  B3E5  ALSO, THE REF LOCATION IN OPEN FILE LIST (BC94)
  B3E8  AND BUMP OPEN REFNUM (BC9C)
                    EN FILE COUNT AND FALL THRU (BE4D)
B3EB ********** SA
                    VE FILE NAME/RECLEN IN TABLE **********************
  B3EB  MAKE INDEX
  B3F1  GET NAME L
                    ROM REFNUM*32 BYTES
  B3F4  OR IN DIR
                    GTH (Ø28Ø)
  B3F7  AND STORE I
                    AG (BE47)
  B3FD  NAME > OR =
                    OPEN FILE NAME LIST (BCFE)
  B3FF  NO, ... >>B4
                    TO 3Ø BYTES?
  B401  YES, USE 2
  B403  STORE THAT
  B408  COPY "L" KE
                    S A LOOP COUNTER
  B411  ---
                    WORD VALUE TO NAME LIST TOO (BCFF)
  B412  COPY FILE
  B41B  COPY ALL OF
                    ME TO NAME LIST (Ø28Ø)
                    NAME, THEN FALL THRU TO EXIT >>B411
B41D ********** MO
                    ON" AND "NOMON" COMMANDS **************************
  B41D  IGNORE THIS
  B41E  RETURN TO CA
                    COMMANDS AND
                    LLER
B41F ********** LOO
        (RETURNS
                    KUP OPEN FILENAME **********************************
                    REFNUM OF OPEN FILE)
  B41F  ---
  B422  WAS PATHNAME
  B424  YES >>B42A
                    1 GIVEN?

  B426  NO, "SYNTAX
  B429  EXIT WITH "
                    ERROR"
                    RROR
  B42A  ANY FILES C
  B42D  NO, CAN'T F
                    URRENTLY OPEN? (BE4D)
  B42F  YES, CLEAR
                    ND IT THEN >>B448
  B432  STORE FILE
                    EXEC FILE CLOSING FLAG (BE4E)
  B434  GET NEXT OF
                    COUNT AS LOOP COUNTER
  B437  COMPARE FIL
                    NUM (BC9B)
  B43A  NOT THE ONE
                    NAMES <B462>
  B43C  ELSE, WE'VE
                    ? >>B443
  B43E  PICK UP APP
                    GOT IT!
  B441  ---
                    ROPRIATE REFNUM (BC9B)
  B442  AND RETURN
  B443  ELSE, NOT I
                    WITH IT
  B446  AND CONTINU
                    T, TRY NEXT ONE
                    E LOOPING >>B432
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B446
ADDR    DESCRIPTION/CONTENTS
----------------------------------------------------------------

  B448  CAN'T FIND
  B44B  NO, THEN IS IT EXEC ACTIVE? (BE43)
  B450  IS HE LOSING? WE MUST GIVE UP >>B45E
  B453  NO, GIVEUP LOOKING FOR EXEC FILE? <B462>
  B457  YES, EXEC GIVE UP >>B45E
  B45C  AND RETURN FILE CLOSING (BE4E)
        WITH EXEC'S REFNUM >>B43E
  B45E  "FILE NOT
  B461  RETURN WITH "OPEN" ERROR
        IN ERROR CODE
B462 ********** COMPARE FILENAMES **********
  B462  REFNUM*3
  B468  PICK UP 2 FOR FILENAME INDEX
  B470  SAME LENGTH FLAG FROM THIS ENTRY  (BCFE)
  B473  NO, CAN'T BE AS HIS FILENAME? (0280)
  B476  MAKE SURE IT BE IT THEN >>B498
  B47A  IF IT DOES LENGTH DOES NOT EXCEED 29
  B47C  USE $3A ES. ONLY LOOK AT FIRST 29
  B481  COPY "L" AS LOOP COUNTER
  B48A  ---       OF THIS FILE TO KEYWORD (BCA4)
  B48B  COMPARE
  B491  NO MATCH AMES (0280)
  B498  MATCH, E  EXIT WITH Z FLAG CLEAR >>B498
        WITH Z FLAG SET
B499 ********** CLOSE" COMMAND **********
  B499  ---
  B49C  PATHNAME
  B49E  NO, CLOSE GIVEN?
  B4A0  YES, LOOK ALL FILES >>B4F2
  B4A3  NOT FOUND IT UP IN OPEN FILE TABLES <B41F>
  B4A5  FOUND IT >>B441
  B4AB  MARK BUFF STORE REFNUM IN CLOSE LIST (BEDE)
  B4AE  EXEC CLOSE PAGE FREE (BC88)
  B4B1  YES...NOSING? (BE4E)
  B4B3  GET OPEN NEED TO COMPRESS LISTS >>B4CF
  B4B7  SWAP BUF COUNT (LAST OPENED FILE NO.) (BE4D)
  B4C5  AND REFN ERS (BC93)
  B4CF  ---      WS WITH THE LAST OPENED FILE (BC9B)
  B4D1  LEVEL =
  B4D6  MLI: CLO (BE94)
  B4D9  ERROR? >S <BE70>
  B4DB  RELEASE 502
  B4DE  EXEC FIL BUFFER <A24C>
  B4E1  NO >>B4E CLOSING? (BE4E)
  B4E6  YES, EXE
  B4E9  AND NO L NO LONGER ACTIVE (BE43)
  B4ED  RETURN T NSER CLOSING (BE4E)
        CALLER
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84
ADDR    DESCRIPTION/CONTENTS
----------------------------------------------------------------

  B4EE  DROP OPEN FILE COUNT (BE4D)
  B4F1  AND EXIT

B4F2 ********** CLOSE ALL OPEN FILES *****
  B4F2  ANY FILES OPEN? (BE4D)
  B4F5  NO >>B503
  B4F7  YES, EXEC NOT CLOSING (BE4E)
  B4FD  CLOSE LAST FILE OPENED <B4A5>
  B500  IF THAT WORKS, START ALL OVER AGAIN
  B502  EXIT WHEN ALL ARE CLOSED

  B503  ---
  B505  SET CLOSE REFNUM TO ZERO (ALL FILES
  B50A  LEVEL = 7 (LEVEL 0 FILES ALREADY CL
  B50F  EXIT THRU MLI: CLOSE >>BE70

B512 ********** "POSITION" COMMAND *******
  B512  LOOKUP NAME OF FILE <B41F>
  B515  NOT OPEN? >>B57F
  B517  SET REFNUM IN READ/WRITE PARMLIST (
  B51A  AND SET NEWLINE LIST (BED2)
  B51D  DIR FILE? (BE47)
  B520  YES, GET OUT RIGHT NOW! >>B580

  B522  "F" OR "R" GIVEN? (BE57)
  B527  NO, INVALID PARM >>B57D
  B529  BOTH GIVEN?
  B52B  YES, INVALID PARM >>B57D
  B52D  JUST "R" GIVEN?
  B52F  NO, JUST "F" >>B53D
  B531  JUST "R", COPY "R" VALUE TO "F" (BE
  B534  ("R" AND "F" ARE ALIASES) (BE63)
  B53D  SET COUNT TO 239. (MAXIMUM LINE LEN
  B54C  BUFFER IS AT $200 (BED8)
  B54F  ---
  B551  NEW LINE CHAR IS EITHER $0D OR $8D
  B556  MLI: SET NEWLINE <BE70>
  B559  ERROR? >>B57F

        ******** SKIP LINES BY READING THI

  B55B  ---
  B55E  "F" = 0? (BE64)
  B562  YES, DONE  >>B580
  B564  ELSE...
  B566  MLI: READ NEXT FIELD (LINE) <BE70>
  B569  ERROR? >>B57F
  B56E  DECREMENT "F" VALUE BY ONE
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B57B
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  B57B  AND GO CHECK IT AGAIN >>B55B

  B57D  "INVALID PARAMETER" ERROR
  B57F  ---
  B580  EXIT TO CALLER

B581 *********** COMPUTE NEW FILE POSITION ***************************
         (COMPUTES ABSOLUTE FILE POSITION MARK)

  B581  ACCUM = CURRENT RECORD LENGTH (BCA4)
  B595  MARK = 0 (BEC8)

          ******** MARK = "R" * RECLEN ************

  B59E  SHIFT "R" VALUE RIGHT (BE66)
  B5A6  IF LOW BIT OFF, NO ADD >>B5BF
  B5A9  ADD ONE INSTANCE OF RECLEN TO MARK (BCAF)
  B5B8  OVERFLOW? >>B5D2
  B5BD  ACCUM OVERFLOW? >>B5D2
  B5BF  SCALE ACCUM (MULTIPLIER) UP BY 2 (BCAF)
  B5C8  IF "R" NON ZERO... (BE65)
  B5CE  CONTINUE LOOPING >>B59E
  B5D1  ELSE, EXIT TO CALLER

  B5D2  "RANGE ERROR"
  B5D5  RETURN

B5D6 *********** "READ" COMMAND ***************************************

  B5D6  LOOK UP FILE NAME <B41F>
  B5D9  NOT OPEN? >>B62B
  B5DB  ITS OPEN, STORE REFNUM IN READ/WRITE... (BED6)
  B5DE  GET/SET... (BEC7)
  B5E1  AND SET NEWLINE PARMLISTS (BED2)
  B5E4  DIR FILE? (BE47)
  B5E7  YES, SPECIAL HANDLING REQUIRED >>B62C
  B5E9  NO, PRE-POSITION FOR "B", "F", OR "R" <B666>
  B5EC  ERROR POSITIONING? >>B62B
  B5EE  ASSUME "L" = 239.
  B5F5  "L" GIVEN?
  B5F7  NO >>B60C
  B5F9  YES, USE HIS "L" VALUE (BE5F)
  B5FF  UNLESS ITS >256 >>B661
  B603  OR >239. >>B661
  B607  DOUBLE QOUTE IT SO COMMAS COME THRU (0200)
  B60A  READ INTO $201
  B60C  IF NO "L", READ TO $200 (BED7)
  B612  NL CHAR = $0D/$8D (OR NONE IF "L") (BED3)
  B621  MLI: SET NEWLINE <BE70>
  B624  ERROR? >>B62B
  B626  ---
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B628
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  B628  MARK INPUT "READ" FILE ACTIVE (BE44)
  B62B  AND RETURN

          ******** READ DIR FILE ******************

  B62C  SET READ/WRITE LIST REFNUM (BED6)
  B62F  AND GET/SET LIST REFNUM (BEC7)
  B634  READING TO $259 (BED7)
  B63E  INIT CAT FLAG TO FIRST LINE VALUE (BE4F)
  B644  "R" GIVEN?
  B647  NO, DONE >>B626
  B64B  YES, ZERO OUT MARK (BEC8)
  B656  MLI: REWIND FILE <BE70>
  B659  ERROR?  >>B660
  B65D  MARK INPUT FILE ACTIVE (BE44)
  B660  AND EXIT

B661 *********** "RANGE ERROR" ***************************************

  B661  "RANGE ERROR" CODE
  B665  EXIT TO CALLER

B666 *********** PRE-POSITION FOR I/O ********************************

  B666  ---
  B669  "B", "F", OR "R" GIVEN?
  B66B  NO, EXIT >>B6AF
  B66D  "R"?
  B66F  NO >>B67B
  B671  YES, COMPUTE ABSOLUTE POSITION <B581>
  B674  ERROR? >>B661
  B676  NO, SET MARK TO NEW POSITION <B6A8>
  B679  ERROR? >>B6B0
  B67B  "F" GIVEN? (BE57)
  B680  NO >>B687
  B682  SKIP LINES UNTIL "F" = 0 <B53D>
  B685  ERROR? >>B6B0
  B687  "B" GIVEN? (BE57)
  B68C  NO >>B6AF
  B690  MLI: GET MARK <BE70>
  B693  ERROR? >>B6B0
  B699  ADD "B" VALUE TO CURRENT MARK (BE5A)
  B69C  (3 BYTE ADD) (BEC8)
  B6A6  OVERFLOW? >>B661
  B6A8  ---
  B6AA  MLI: SET MARK <BE70>
  B6AD  ERROR? >>B6B0
  B6AF  ---
  B6B0  ---
  B6B2  EXIT TO CALLER
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR
-------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------

B6B3 *********** "WRITE" COMMAND ******************************

  B6B3  LOOKUP OPEN FILE NAME <B41F>
  B6B6  NOT AN OPEN FILE? >>B6C8
  B6B8  STORE READ/WRITE REFNUM (BED6)
  B6BB  AND GET/SET REFNUM (BEC7)
  B6BE  AND NEWLINE REFNUM IN PARM LISTS (BED2)
  B6C1  DIR FILE? (BE47)
  B6C4  NO, OK >>B6CA

  B6C6  YES, "FILE LOCKED" ERROR
  B6C8  ---
  B6C9  EXIT TO CALLER

  B6CA  DATA BUFFER AT $200
  B6D4  PRE-POSITION FOR "B", "F", AND "R" <B666>
  B6D7  NO ERRORS? >>B6ED
  B6D9  WAS ERROR A RANGE ERROR?
  B6DB  NO, REAL ERROR >>B6C8
  B6DD  YES, MY RANGE ERROR OR MLI'S?
  B6DF  MINE... >>B6C8
  B6E1  MLI'S...SET EOF FARTHER INTO FILE
  B6E3  MLI: SET EOF <BE70>
  B6E6  ERROR? >>B6C8
  B6E8  AND THEN TRY AGAIN TO SET MARK <B676>
  B6EB  ERROR? THEN I GIVE UP >>B6C8
  B6ED  BUFFER IS AT HIMEM
  B6F9  INDICATE OUTPUT "WRITE" FILE ACTIVE (BE45)
  B6FD  RETURN TO CALLER

B6FE *********** "APPEND" COMMAND *****************************

  B6FE  ---
  B6FF  LOOK UP NAME IN OPEN FILE LIST <B41F>
  B702  FOUND IT? >>B710
  B705  NO, OPEN IT FIRST <B338>
  B708  ERROR? >>B71E
  B70A  NO, REFNUM NON-ZERO? (BED0)
  B70D  YES, OK >>B711
  B70F  ELSE, BREAK!!!
  B710  ---
  B711  REFNUM TO READ/WRITE PARM LIST (BED6)
  B714  AND GET/SET LIST (BEC7)
  B717  DIR FILE? (BE47)
  B71A  NO >>B720
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B7D7
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------


B7D9 *********** SET FILE INFO ***************************************

  B7D9  MODIFIED TIME/DATE = Ø
  B7E7  SET NUMBER OF PARMS (7)
  B7EC  MLI CODE FOR SET FILE INFO
  B7EE  EXIT THRU MLI: GET/SET FILE INFO >>BEØ

B7F1 *********** BI I/O INDIRECTION VECTORS ***************************

  B7F1  DOSOUT VECTOR >>BE38
  B7F4  DOSIN VECTOR >>BE3A

B7F7 *********** STATE I/O VECTORS TABLE ******************************

  B7F7  IMMEDIATE MODE (STATE=Ø) CSWL/KSWL
  B7FB  DEFERRED MODE (STATE=4) CSWL/KSWL
  B7FF                (STATE=8) CSWL/KSWL
  B8Ø3                (STATE=C) CSWL

B8Ø5 *********** SYSCTBL ***************************************************
         LSB'S OF MLI CALL PARAMETER LISTS IN THE
         BI GLOBAL PAGE ($BEXX)

  B8Ø5  CREATE: $AØ  DESTROY: $AC  RENAME: $AF
  B8Ø8  SFI:    $B4  GFI:     $B4  ONLINE: $C6
  B8ØB  SPFX:   $AC  GPFX:    $AC  OPEN:   $CB
  B8ØE  NEWLINE:$D1  READ:    $D5  WRITE:  $D5
  B811  CLOSE:  $DD  FLUSH:   $DD  SMARK:  $C6
  B814  GMARK:  $C6  SEOF:    $C6  GEOF:   $C6
  B817  SBUF:   $C6  GBUF:    $C6

B819 *********** APPLESOFT TOKENS *************************************
         TOKENS REQUIRING SPECIAL ATTENTION HAVE
         THEIR MSB OFF AND ARE AN OFFSET FROM A
         JMP IN THE TRACE HANDLER IN THE BI

  B819  FIRST IS $8Ø (END)
  B823   CALL
  B833   TRACE, NOTRACE, NORMAL
  B837   INVERSE, FLASH
  B83F   RESUME
  B843   LET, IF
  B853   PRINT, LIST

B859 *********** COMMAND NAME TABLES **********************************
         OFFSETS TO LAST CHARACTER OF EACH COMMAND
         NAME IN THE COMMAND NAME TABLE BELOW.
         COMMANDS ARE ARRANGED ACCORDING TO LENGTH
         WITH THREE BYTE NAMES FIRST.  IF THE MSB
         OF AN INDEX IS ON, THEN THIS IS THE LAST
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B859
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

         NAME OF THE GIVEN LENGTH (NEXT WILL BE
         ONE BYTE LONGER).

  B859  Ø1  IN#       Ø2 PR#       Ø3 CAT
  B85C  Ø4  FRE       Ø5 BYE       Ø6 RUN
  B85F  Ø7  BRUN      Ø8 EXEC      Ø9 LOAD
  B862  ØA  LOCK      ØB OPEN      ØC READ
  B865  ØD  SAVE      ØE BLOAD     ØF BSAVE
  B868  1Ø  CHAIN     11 CLOSE     12 FLUSH
  B86B  13  NOMON     14 STORE     15 WRITE
  B86E  16  APPEND    17 CREATE    18 DELETE
  B871  19  PREFIX    1A RENAME    1B UNLOCK
  B874  1C  VERIFY    1D CATALOG   1E RESTORE
  B877  1F  POSITION

  B878  'BSAVERIFYBLOADELETEBYECATALOGOPE'
  B898  'WRITEXECREATEFRESTORENAMEBRUNLO'
  B8B8  'CKCHAIN#FLUSHREADPOSITIONOMONPR#'
  B8D8  'PREFIXCLOSEAPPEND'

B8E9 *********** COMMAND HANDLER ADDRESS TABLE **********************
         ADDRESSES OF THE COMMAND HANDLER ROUTINES
         FOR EACH COMMAND IN THE ORDER GIVEN ABOVE.

  B8E9  (EXTERNAL)
  B8EB  IN#
  B8ED  PR#
  B8EF  CAT
  B8F1  FRE
  B8F3  BYE
  B8F5  RUN
  B8F7  BRUN
  B8F9  EXEC
  B8FB  LOAD
  B8FD  LOCK
  B8FF  OPEN
  B901  READ
  B903  SAVE
  B905  BLOAD
  B907  BSAVE
  B909  CHAIN
  B90B  CLOSE
  B90D  FLUSH
  B90F  NOMON
  B911  STORE
  B913  WRITE
  B915  APPEND
  B917  CREATE
  B919  DELETE
  B91B  PREFIX
  B91D  RENAME
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B91F
ADDR    DESCRIPTION/CONTENTS

  B91F  UNLOCK
  B921  VERIFY
  B923  CATALOG
  B925 *RESTORE
  B927  POSITION
  B929  "-" COMMAND

B92B ********** PERMITTED KEYWORDS FOR CMDS **********************
         TWO BYTES PER COMMAND IN THE ORDER ABOVE.
         EACH ENTRY HAS 16 BIT SETTINGS FOR THE
         PARAMETERS PERMITTED ON THAT COMMAND.
         8000 = FETCH PREFIX, PATHNAME OPTIONAL
         4000 = SLOT (FOR PR# OR IN#)
         2000 = DEFERRED COMMAND ONLY
         1000 = FILENAME IS OPTIONAL
         0800 = IF FILE NOT FOUND, CREATE IT
         0400 = "T" (FILE TYPE) PERMITTED
         0200 = PATHNAME2 (RENAME) PERMITTED
         0100 = PATHNAME1 EXPECTED
         0080 = "A" (ADDRESS) PERMITTED
         0040 = "B" (BYTE) PERMITTED
         0020 = "E" (END ADDRESS) PERMITTED
         0010 = "L" (LENGTH) PERMITTED
         0008 = "@" (LINE NO.) PERMITTED
         0004 = "S" AND/OR "D" (SLOT/DRIVE)
         0002 = "F" (FIELD) PERMITTED
         0001 = "R" (RECORD) PERMITTED
         ("V" IS IGNORED)

       C        P S D F N T P P A B E L @ S F R
       O        F L E N E | A A | | | | | / | |
       M        X O F O W | T T | | | | | D | |
       M        | T E P F | H H | | | | | | | |
       N        | | R T I | 2 1 | | | | | | | |
       D        | | | | L | | | | | | | | | | |

  B92B  IN#      . X . . . . . . X . . . . . . .
  B92D  PR#      . X . . . . . . X . . . . . . .
  B92F  CAT      X . . X . . . X . . . . . X . .
  B931  FRE      . . . . . . . . . . . . . . . .
  B933  BYE      . . . . . . . . . . . . . . . .
  B935  RUN      . . . X . . . X . . . . X X . .
  B937  BRUN     . . . . . . . X X X X X . X . .
  B939  EXEC     . . . . . . . X . . . . . X X X
  B93B  LOAD     . . . . . . . X . . . . . X . .
  B93D  LOCK     . . . . . . . X . . . . . X . .
  B93F  OPEN     . . X . X X . X . . . X . X . .
  B941  READ     . . X . . . . X . X . X . X X X
  B943  SAVE     . . . . X . . X . . . . . X . .
  B945  BLOAD    . . . . . X . X X X X X . X . .
  B947  BSAVE    . . . . X X . X X X X X . X . .
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B949
ADDR    DESCRIPTION/CONTENTS

  B949  CHAIN    . . . . . . . X . . . . X X . .
  B94B  CLOSE    . . . . . . . X . . . . . . . .
  B94D  FLUSH    . . . . . . . X . . . . . . . .
  B94F  NOMON    . . . . . . . . . . . . . . . .
  B951  STORE    . . . . X . . X . . . . . X . .
  B953  WRITE    . . X . . . . X . X . . . . X X
  B955  APPEND   . . X . X X . X . . . X . X . .
  B957  CREATE   . . . . X X . X . . . . . X . .
  B959  DELETE   . . . . . . . X . . . . . X . .
  B95B  PREFIX   X . . X . . . X . . . . . X . .
  B95D  RENAME   . . . . . . X X . . . . . X . .
  B95F  UNLOCK   . . . . . . . X . . . . . X . .
  B961  VERIFY   . . . X . . . X . . . . . X . .
  B963  CATALOG  X . . X . X . X . . . . . X . .
  B965  RESTORE  . . . . . . . X . . . . . X . .
  B967  POSITION . . X . . . . X . . . . . . X X
  B969  "-"      . . . . . . . X . . . . . X . .

B96B ********** KEYWORD NAME TABLE ***********************************

  B96B  'ABELSDFRV@'

B975 ********** KEYWORD BIT POSITION TABLE **************************
         BIT POSITIONS IN PERMITTED PARMS TABLE
         FOR EACH KEYWORD IN THE ORDER GIVEN IN
         NAME TABLE.  "V" IS 00 (NOT USED)

  B975  ---

B97F ********** KEYWORD SIZE/OFFSET TABLE ***************************
         LOW 2 BITS - SIZE-1 OF VALUE IN BYTES
         HIGH 6 BITS- OFFSET TO LAST BYTE OF VALUE
                      FROM $BE58

  B97F  A: 2 BYTES AT +1
  B980  B: 3 BYTES AT +4
  B981  E: 2 BYTES AT +6
  B982  L: 2 BYTES AT +8
  B983  S: 1 BYTE  AT +9
  B984  D: 1 BYTE  AT +A
  B985  F: 2 BYTES AT +C
  B986  R: 2 BYTES AT +E
  B987  V: 1 BYTE  AT +10  (IGNORED)
  B988  @: 2 BYTES AT +11

B989 ********** FILE TYPES TABLES ************************************
         FILE TYPE CODES, GIVEN IN INVERSE ORDER
         TO FILE TYPE NAMES WHICH FOLLOW.
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: B989
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

  B989  $FF = "SYS"
  B98A  $FE = "REL"
  B98B  $FD = "VAR"
  B98C  $FC = "BAS"
  B98D  $FB = "IVR"
  B98E  $FA = "INT"
  B98F  $F0 = "CMD"
  B990  $0F = "DIR"
  B991  $06 = "BIN"
  B992  $04 = "TXT"
  B993  $EF = "PAS"
  B994  $1A = "AWP"
  B995  $1B = "ASP"
  B996  $19 = "ADB"

  B997  ---
  B997  'ADBASPAWPPASTXTBINDIRCMDINTIVRBASVARRELSYS'

B9C1 *********** MONTH TABLE ***************************************

  B9C1  'JANFEBMARAPRMAYJUNJULAUGSEPOCTNOVDEC'
  B9E5  '<NO DATE>'

B9EE *********** MLIERTBL ******************************************
         MLI ERROR CODES WHICH HAVE BI EQUIVALENTS

  B9EE  ---

BA01 *********** BIERTBL *******************************************
         BI EQUIVALENTS TO MLI ERROR CODES ABOVE
         (IF MLI CODE NOT FOUND, MAPS TO LAST CODE
         IN THIS TABLE, $08 "I/O ERRROR")

  BA01  ---

BA15 *********** INDEXS TO PACKED MESSAGES *************************
         BY BI ERROR NUMBER

  BA15  ---

BA29 *********** COMMON LETTERS IN MESSAGES ************************

  BA29  ---
  BA29  'ACDEFILMNORTU '
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: BA38
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

BA38 *********** LESS COMMON LETTERS *********************************

  BA38  ---
  BA39  'BGHKPSVWXY/().:'

BA48 *********** PACKED MESSAGES *************************************

  BA48   "COPYRIGHT APPLE COMPUTER"

  BA58  " NAME "
  BA5B  TAB($10)
  BA5D  "TYPE  BLOCKS "
  BA66  TAB($1E)
  BA68  "MODIFIED"
  BA6C  TAB($2F)
  BA6E  "CREATED "
  BA72  TAB($40)
  BA74  "ENDFILE SUBTYPE"

  BA7E  "BLOCKS FREE:"
  BA86  TAB($16)
  BA88  "BLOCKS USED:"
  BA91  TAB($2C)
  BA93  "TOTAL BLOCKS:"

  BA9C  "RANGE ERROR"                    ERROR=$2

  BAA3  "NO DEVICE CONNECTED"            ERROR=$3

  BAAE  "WRITE PROTECTED"                ERROR=$4

  BAB7  "END OF DATA"                    ERROR=$5

  BABD  "PATH NOT FOUND"               ERROR=$6,$7
  BAC0

  BAC6  "I/O ERROR"                      ERROR=$8

  BACC  "DISK FULL"                      ERROR=$9

  BAD2  "FILE LOCKED"                    ERROR=$A

  BAD9  "INVALID PARAMETER"              ERROR=$B

  BAE3  "RAM TOO LARGE"                  ERROR=$C

  BAF0  "FILE TYPE MISMATCH"             ERROR=$D
```

```
 (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: BAF8
BASIC Interpreter
ADDR    DESCRIPTION/CONTENTS
                TOO LARGE"              ERROR=$E
  BAFC  "PROGRAM ECT COMMAND"           ERROR=$F
  BB07  "NOT DIR ERROR"                 ERROR=$10
  BB11  "SYNTAX RY FULL"                ERROR=$11
  BB19  "DIRECTO T OPEN"                ERROR=$12
  BB21  "FILE NOT E FILE NAME"          ERROR=$13
  BB29  "DUPLICA ST"                    ERROR=$14
  BB34  "FILE BU STILL OPEN"            ERROR=$15
  BB3B  "FILE(S)
  BB40          VARIABLES ***************************************
BB47 ********** F PAGES TO ALLOCATE/FREE
  BB47  NUMBER O FFERS FOR GARBAGE COLLECTION
  BB48  NOT USED F BUFFERS
  BB49  TOP OF B
  BB4A  BOTTOM O  $BB4B-$BC7A NOT USED ********************************
BB4B **********
  BB4B  NOT USED  VARIABLES ***************************************
BC7B **********  MEM VALUE DURING CHAIN LOAD
                ** GARBAGE COLLECT MARKED GC: ****
  BC7B  SAVED HI GE - WORKSAREASIZE
        ******  AREA MSB
  BC7C  GC: HIRA ER OF PAGES IN WORKAREA
  BC7D  GC: WORK GE (START OF STRINGS TO COPY)
  BC7E  GC: NUMB GE (END OF STRINGS TO COPY)
  BC7F  GC: LORA ART LSB
  BC80  GC: HIRA LING MSB+1
  BC81  ARRAYS S OF STRING AREA (ALSO PGM START)
  BC82  ARRAYS E F STRING AREA
  BC83  GC: STAR T FACTOR FOR STRING POINTERS
  BC85  GC: END  OWING BLOCK BUFFER
  BC87  MSB ADJU ** STORED VARIABLES FILE HEADER ***
  BC88  PAGE FOL LEN OF SIMPLE/ARRAY VARS
        ******  MPLE VARS ONLY
  BC89  COMBINED EN VARS WERE COMBINED
  BC8B  LEN OF S **********************************
  BC8D  HIMEM WH O COMBINED VARIABLES/STRINGS
        ******  COMBINED VARIABLES/STRINGS
  BC8E  POINTER
  BC90  LENGTH O
```

```
BASIC Interpreter (BI) -- V1.1 --18 JUN 84      NEXT OBJECT ADDR: BC92
ADDR    DESCRIPTION/CONTENTS
  BC92  LENGTH OF STRINGS ONLY

  BC94  OPEN FILES' BUFFER MSBS
  BC9B  OPEN EXEC FILE BUFFER MSB

  BC9C  OPEN FILES' REFERENCE NUMBERS
  BCA3  OPEN EXEC FILE REFNUM

  BCA4  CURRENT RECORD LENGTH
  BCA6  NOT USED
  BCA9  CHARACTER TO FLUSH WHEN PARSING (BLANK)
  BCAA  MAXIMUM LENGTH TO PARSE
  BCAB  ADDRESS OF COMMAND HANDLING ROUTINE
  BCAD  SIZE OF KEYWORD VALUE -1 IN BYTES
  BCAE  OFFSET INTO KEYWORD PARMS TO LAST BYTE
  BCAF  GENERAL PURPOSE 4 BYTE ACCUMULATOR
  BCB3  MONTH
  BCB4  DAY
  BCB5  YEAR
  BCB6  ERROR MSG LEN OR LINE LEN FOR CAT/CATALOG
  BCB7  ENTRY LENGTH IN DIRECTORY FILE
  BCB8  ENTRIES PER BLOCK IN DIRECTORY FILE
  BCB9  FILE COUNT FROM DIRECTORY FILE
  BCBB  DIRECTORY ENTRY NUMBER COUNTER

BCBC ********** PATHNAME 1 BUFFER **********************************

  BCBC  COMMAND OR PATH LENGTH
  BCBD  TXBUF (COMMAND OR PATHNAME STRING)
  BCFD  NOT USED

BCFE ********** OPEN FILE NAME TABLE ********************************
          (EACH ENTRY IS 32 BYTES LONG)
          (THERE ARE 8 ENTRIES)

  BCFE  FILE 0: LENGTH OF NAME
  BCFF  FILE 0: L VALUE LSB
  BD00  FILE 0: L VALUE MSB
  BD01  FILE 0: START OF NAME STRING
         (FILE NAME IS STORED BACKWARDS)
  BDFE  LAST 2 BYTES NOT USED
```

BASIC INTERPRETER GLOBAL PAGE

This page of memory is rigidly defined by the ProDOS BI. Fields given here will not move in later versions of ProDOS and may be referenced by external, user-written programs. Future additions to the global page may be made in areas which are marked "Not used".

ProDOS BI Global Page NEXT OBJECT ADDRESS: BE00

ADDR	LABEL	CONTENTS
BE00-BE02	BI.ENTRY	JMP to WARMDOS (BI warmstart vector).
BE03-BE05	DOSCMD	JMP to SYNTAX (BI command line parse and execute).
BE06-BE08	EXTRNCMD	JMP to user-installed external command parser.
BE09-BE0B	ERROUT	JMP to BI error handler.
BE0C-BE0E	PRINTERR	JMP to BI error message print routine. Place error number in A-register.
BE0F	ERRCODE	ProDOS error code (also at $DE, Applesoft ONERR code).
BE10-BE1F	OUTVEC	Default output vector in monitor and for each slot (1-7).
BE20-BE2F	INVEC	Default input vector in monitor for each slot (1-7).
BE30-BE31	VECTOUT	Current output vector.
BE32-BE33	VECTIN	Current input vector.
BE34-BE35	VDOSIO	BI's output intercept address.
BE36-BE37		BI's input intercept address.
BE38-BE3B	VSYSIO	BI's internal redirection by STATE.
BE3C	DEFSLT	Default slot.
BE3D	DEFDRV	Default drive.
BE3E	PREGA	A-register savearea.
BE3F	PREGX	X-register savearea.
BE40	PREGY	Y-register savearea.
BE41	DTRACE	Applesoft TRACE is enabled flag (MSB on).
BE42	STATE	Current intercept state. 0 = immediate command mode. >0 = deferred.
BE43	EXACTV	EXEC file active flag (MSB on).
BE44	IFILACTV	READ file active flag (MSB on).
BE45	OFILACTV	WRITE file active flag (MSB on).
BE46	PFXACTV	PREFIX read active flag (MSB on).
BE47	DIRFLG	File being READ is a DIR file (MSB on).
BE48	EDIRFLG	End of directory flag (no longer used).
BE49	STRINGS	String space count used to determine when to garbage collect.
BE4A	TBUFPTR	Buffered WRITE data length.
BE4B	INPTR	Command line assembly length.
BE4C	CHRLAST	Previous output character (for recursion check).
BE4D	OPENCNT	Number of files open (not counting EXEC).
BE4E	YXFILE	EXEC file being closed flag (MSB on).
BE4F	CATFLAG	Line type to format next in DIR file READ.
BE50-BE51	XTRNADDR	External command handler address.
BE52	XLEN	Length of command name (less one).

ProDOS BI Global Page — NEXT OBJECT ADDRESS: BE53

ADDR	LABEL	CONTENTS
BE53	XCNUM	Number of command: $00 = external $0B = OPEN $15 = WRITE $01 = IN# $0C = READ $16 = APPEND $02 = PR# $0D = SAVE $17 = CREATE $03 = CAT $0E = BLOAD $18 = DELETE $04 = FRE $0F = BSAVE $19 = PREFIX $05 = BYE $10 = CHAIN $1A = RENAME $06 = RUN $11 = CLOSE $1B = UNLOCK $07 = BRUN $12 = FLUSH $1C = VERIFY $08 = EXEC $13 = NOMON $1D = CATALOG $09 = LOAD $14 = STORE $1E = RESTORE $0A = LOCK $1F = POSITION
BE54-BE55	PBITS	Permitted command operands bits: $8000 Prefix needed. Pathname optional. $4000 Slot number only (PR# or IN#). $2000 Deferred command. $1000 File name optional. $0800 If file does not exist, create it. $0400 T: file type permitted. $0200 Second file name required. $0100 First file name required. $0080 AD: address keyword permitted. $0040 B: byte offset permitted. $0020 E: ending address permitted. $0010 L: length permitted. $0008 @: line number permitted. $0004 S or D: slot/drive permitted. $0002 F: field permitted. $0001 R: record permitted. (V always permitted but ignored.)
BE56-BE57	FBITS	Operands found on command line. Same bit assignments as above.
BE58-BE59	VADDR	A keyword value.
BE5A-BE5C	VBYTE	B keyword value.
BE5D-BE5E	VENDA	E keyword value.
BE5F-BE60	VLNTH	L keyword value.
BE61	VSLOT	S keyword value.
BE62	VDRIV	D keyword value.
BE63-BE64	VFELD	F keyword value.
BE65-BE66	VRECD	R keyword value.
BE67	VVOLM	V keyword value (ignored).
BE68-BE69	VLINE	@ keyword value.
BE6A	VTYPE	T keyword value (in hex).
BE6B	VIOSLT	PR# or IN# slot number value.

ProDOS BI Global Page — NEXT OBJECT ADDRESS: BE6C

ADDR	LABEL	CONTENTS
BE6C-BE6D	VPATH1	Primary pathname buffer (address of length byte).
BE6E-BE6F	VPATH2	Secondary pathname buffer (address of length byte).
BE70-BE84	GOSYSTEM	Call the MLI using the parameter tables which follow.
BE85	SYSCALL	MLI call number for this call.
BE86-BE87	SYSPARM	Address of MLI parameter list for this call.
BE88-BE8A		Return from MLI call.
BE8B-BE9E	BADCALL	MLI error return: translate error code to BI error number.
BE9F	BISPARE1	Not used.
BEA0-BEAB	SCREATE	CREATE parameter list.
BEAC-BEAE	SSGPRFX	GET_PREFIX, SET_PREFIX, DESTROY parameter list.
BEAF-BEB3	SRENAME	RENAME parameter list.
BEB4-BEC5	SSGINFO	GET_FILE_INFO, SET_FILE_INFO parameter list.
BEC6-BECA	SONLINE	ONLINE, SET_MARK, GET_MARK, SET_EOF, GET_EOF, SET_BUF, GET_BUF, QUIT parameter list.
BECB-BED0	SOPEN	OPEN parameter list.
BED1-BED4	SNEWLN	SET_NEWLINE parameter list.
BED5-BEDC	SREAD	READ, WRITE parameter list.
BEDD-BEDE	SCLOSE	CLOSE, FLUSH parameter list.
BEDF-BEF4	CCCSPARE	"COPYRIGHT APPLE, 1983"
BEF5-BEF7	GETBUFR	GETBUFR buffer allocation subroutine vector.
BEF8-BEFA	FREEBUFR	FREEBUFR buffer free subroutine vector.
BEFB		Original HIMEM MSB.
BEFC-BEFF		Not used.

```
Disk Controller Boot ROM -- Apple II/II+/IIe    NEXT OBJECT ADDR: C617
-------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------------

  C617  IF MORE THAN ONE BIT ON, TRY ANOTHER PATTERN  >>C614
  C619  FOUND ONE, GET TABLE VALUE
  C61A  AND STORE IT IN TABLE  (0356)
  C61D  INCREMENT TABLE VALUE INDICATOR
  C61E  GET NEXT BIT PATTERN, DONE YET
  C61F  NO, GO CHECK IT OUT  >>C606

C621 *********** DETERMINE SLOT, TURN DRIVE ON ***********************

  C621  CALL A KNOWN RTS  <FF58>
  C624  GET STACK POINTER
  C625  GET HIGH BYTE OF WHERE WE ARE  (0100)
  C628  TIMES 16 TO GET SLOT
  C62C  SAVE SLOT
  C62E  PUT IN X REG FOR INDEX
  C62F  INSURE READ MODE  (C08E)
  C635  SELECT DRIVE 1  (C08A)
  C638  TURN THE MOTOR ON  (C089)

C63B *********** RECALIBRATE DISK ARM *********************************

  C63B  PREPAIR TO STEP THE ARM 80 PHASES
  C63D  TURN A PHASE OFF  (C080)
  C640  PUT COUNTER IN ACCUMULATOR
  C641  CREATE A PHASE NUMBER (0-3)
  C643  DOUBLE IT FOR PROPER INDEX
  C644  COMBINE WITH SLOT FOR FINAL INDEX
  C646  PUT INDEX IN X REGISTER
  C647  TURN A PHASE ON  (C081)
  C64A  DELAY ABOUT 20 MICROSECONDS
  C64F  DECREMENT COUNTER
  C650  LOOP UNTIL ALL 80 ARE DONE  >>C63D

C652 *********** INITIALIZATION ***************************************

  C652  ---
  C654  SECTOR TO FIND -> $00
  C656  TRACK TO FIND -> $00
  C65A  MAIN BUFFER POINTER ($26) -> $0800
  C65C  CLEAR THE CARRY
  C65D  PUSH STATUS ON STACK

C65E *********** SEARCH FOR A VALID HEADER ****************************

  C65E  CHECK DATA REGISTER  (C08C)
  C661  LOOP UNTIL DATA IS VALID  >>C65E
  C663  IS IT A $D5?
  C665  NO, TRY AGAIN  >>C65E
  C667  YES, CHECK REGISTER AGAIN  (C08C)
  C66A  LOOP UNTIL VALID  >>C667
  C66C  IS IT AN $AA
```

```
Disk Controller Boot
--------------------
ADDR    DESCRIPTION/
--------------------
  C66E  NO, SEE IF I
  C670  YES, DELAY E
  C671  CHECK REGIST
  C674  LOOP UNTIL V
  C676  IS IT A $96
  C678  YES, WE FOUN
  C67A  NO, HAVE WE
  C67B  IF NOT, STAR
  C67D  WAS IT AN $A
  C67F  YES, WE FOUN
  C681  NO, START OV

C683 *********** DEC

  C683  INITIALIZE C
  C685  SAVE VALUE I
  C687  READ DATA RE
  C68A  LOOP UNTIL D
  C68C  SHIFT BITS I
  C68D  SAVE FOR LAT
  C68F  READ REGISTE
  C692  LOOP UNTIL V
  C694  COMBINE WITH
  C696  DECREMENT CO
  C697  NO, DO ANOTH
  C699  KEEP THE STA
  C69A  IS THIS SECT
  C69C  NO, START OV
  C69E  GET TRACK FO
  C6A0  IS IT TRACK
  C6A2  NO, START OV
  C6A4  YES, INDICAT

C6A6 *********** REA

  C6A6  INITIALIZE C
  C6A8  ---
  C6AA  READ DATA RE
  C6AD  LOOP UNTIL V
  C6AF  EXCLUSIVE-OR
  C6B4  DECREMENT OF
  C6B5  STORE BYTE I
  C6B8  LOOP UNTIL B
  C6BA  INITIALIZE C
  C6BC  READ DATA RE
  C6BF  LOOP UNTIL V
  C6C1  EXCLUSIVE-OR
  C6C6  STORE BYTE I
  C6C8  INCREMENT OF
  C6C9  LOOP UNTIL B
  C6CB  READ DATA RE
```

```
ROM -- Apple II/II+/IIe    NEXT OBJECT ADDR: C66E
--------------------------------------------------
CONTENTS
--------------------------------------------------
S A $D5  >>C663
R REGISTER TO CLEAR
R  (C08C)
LID  >>C671
 AN ADDRESS HEADER  >>C683
OUND ONE PREVIOUSLY?
 OVER  >>C65C
?
 A DATA HEADER  >>C6A6
ER  >>C65C

E ADDRESS FIELD *********************************
NTER
CODED, WILL BE TRACK ON LAST PASS
ISTER  (C08C)
ATA VALID  >>C687
TO POSITION X1X1X1X1
ER
 FOR NEXT BYTE  (C08C)
LID  >>C68F
REVIOUS 1X1X1X1X AND X1X1X1X1
NTER, DONE YET?
ER  >>C685
K CLEAN!!
N WE WANT?
R  >>C65C
ND
E WANT?
ER  >>C65C
 ADDRESS FOUND, GO LOOK FOR DATA FIELD  >>C65D

 DATA FIELD **************************************
FFSET (AUXILIARY BUFFER)

GISTER  (C08C)
ALID  >>C6AA
 WITH TRANSLATE TABLE  (02D6)
FSET
 AUXILIARY BUFFER  (0300)
FFER FULL  >>C6A8
FSET (MAIN BUFFER)
GISTER  (C08C)
LID  >>C6BC
 WITH TRANSLATE TABLE  (02D6)
 MAIN BUFFER
FSET
UFFER FULL  >>C6BA
GISTER  (C08C)
```

```
Disk Controller Boot ROM -- Apple II/II+/IIe    NEXT OBJECT ADDR: C6CE
--------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
--------------------------------------------------------------------

  C6CE  LOOP UNTIL VALID  >>C6CB
  C6D0  IS CHECKSUM OKAY?  (02D6)
  C6D3  NO, START OVER  >>C65C

C6D5 *********** MERGE MAIN AND AUXILIARY BUFFERS**********************

  C6D5  INITIALIZE OFFSET (MAIN BUFFER)
  C6D7  INITIALIZE OFFSET (AUXILIARY BUFFER)
  C6D9  DECREMENT OFFSET (AUX BUFFER)
  C6DA  IF LESS THAN ZERO RESET IT  >>C6D7
  C6DC  GET BYTE FROM MAIN BUFFER
  C6E1  ROLL IN TWO BITS FROM AUXILIARY BUFFER
  C6E6  SAVE COMPLETED DATA BYTE
  C6E8  INCREMENT OFFSET (MAIN BUFFER)
  C6E9  LOOP UNTIL WHOLE BUFFER IS DONE  >>C6D9

C6EB *********** DETERMINE IF THERE IS MORE TO DO**********************

  C6EB  INCREMENT MAIN BUFFER POINTER
  C6ED  INCREMENT SECTOR NUMBER
  C6F1  IS THERE ANOTHER SECTOR TO LOAD?  (0800)
  C6F6  YES, GO DO IT  >>C6D3
  C6F8  NO, ENTER CODE WE JUST LOADED  >>0801

C6FB *********** UNUSED ***********************************************

  C6FB  5 BYTES AT END OF PAGE ARE UNUSED
```

```
Disk Controller Boot ROM -- Apple IIc          NEXT OBJECT ADDR: C552
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

C552    MODULE STARTING ADDRESS

          ****************************************
          *                                      *
          *  BOOT ROM - APPLE //c CONTROLLER ROM *
          *       THIS CODE RESIDES FROM $C552   *
          *       TO $C6FF. IT LOADS TRACK 0     *
          *       SECTOR 0 INTO RAM AT $800 AND  *
          *       JUMPS TO IT.  IF BOOT FAILS IT *
          *       THEN TRIES TO BOOT SLOT 5,     *
          *       THE PROTOCOL CONVERTER.        *
          *                                      *
          *  THIS IS THE VERSION OF THE IIC ROM  *
          *    THAT SUPPORTS THE UNIDISK 3.5,    *
          *    26 JULY 85.                       *
          *                                      *
          ****************************************

          ******** ZERO PAGE ADDRESSES ************

0001    SLOT PAGE PUT HERE DURING AUTOBOOT
0025    RETRY COUNT (HIGH BYTE)
0026    SECTOR BUFFER POINTER
002B    SLOT NUMBER * 16 FOR INDEX
003C    WORKBYTE
003D    SECTOR WANTED
0040    TRACK FOUND
0041    TRACK WANTED
004F    DRIVE TO BOOT FROM

          ******** EXTERNAL ADDRESSES *************

0300    AUXILIARY BUFFER
0356    TRANSLATE TABLE
07DB    SCREEN LOCATION
0800    SECTORS TO LOAD
0801    ENTRY POINT
C080    PHASE0 OFF
C081    PHASE0 ON
C088    MOTOR OFF
C089    MOTOR ON
C08C    READ DATA REGISTER
C08E    SET READ MODE
C0EA    DRIVE SELECT
FCA8    MONITOR WAIT ROUTINE
```

```
Disk Controller Boot ROM -- Apple IIc          NEXT OBJECT ADDR: C552
-------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-------------------------------------------------------------------

C552 ********** SLOT5 CODE ****************************************

            THE FOLLOWING TWO ROUTINES ARE IN THE $C500
            AREA BUT ARE USED BY THE $C600 LOGIC.

C552 ********** BOOTFAIL ******************************************
            COME HERE IF BOOT FAILS.  PUT MESSAGE ON
            SCREEN AND GO TO SLEEP FOREVER.

  C552  17 CHARACTERS IN MESSAGE
  C557  PUT AT BOTTOM OF SCREEN (07DB)
  C55D  ,THEN GO TO SLEEP >>C55D

  C55F  'Check Disk Drive'

C56F ********** SKIP OVER MISCELLANEOUS CODE **********************

  C56F  SLOT 5 LOGIC IN HERE

C58E ********** BUILD READ TRANSLATE TABLE ***************************

  C58E  INITIALIZE BIT PATTERN
  C590  INITIALIZE TABLE VALUE INDICATOR
  C592  STORE BIT PATTERN
  C595  SHIFT PATTERN LEFT ONE BIT
  C596  ARE THERE ANY TWO ADJACENT BITS ON?
  C598  NO, TRY ANOTHER PATTERN  >>C5AA
  C59A  YES, TURN OFF RIGHTMOST OF EACH GROUP OF ZEROES
  C59C  FLIP BITS, PAIR OF ZERO BITS NOW SINGLE BIT, ETC
  C59E  HIGH BIT ALWAYS ON/TURN OFF BIT WE MISSED BEFORE
  C5A0  --- >>C5AA
  C5A2  SHIFT PATTERN RIGHT, MUST HAVE ONLY ONE BIT ON
  C5A3  IF MORE THAN ONE BIT ON, TRY ANOTHER PATTERN  >>C5A0
  C5A5  FOUND ONE, GET TABLE VALUE
  C5A6  AND STORE IT IN TABLE  (0356)
  C5A9  INCREMENT TABLE VALUE INDICATOR
  C5AA  GET NEXT BIT PATTERN, DONE YET?
  C5AB  NO, GO CHECK IT OUT  >>C592
  C5AD  MAIN BUFFER POINTER ($26) -> $0800
  C5B1  INITIALIZE RETRY COUNT (LOW BYTE)
  C5B3  RETURN TO CALLER

C5B4 ********** SKIP OVER MISCELLANEOUS CODE **********************

  C5B4  SLOT 5 LOGIC IN HERE
```

```
Disk Controller Boot ROM -- A
-----------------------------pple IIc           NEXT OBJECT ADDR: C5F5
ADDR    DESCRIPTION/CONTENTS-----------------------------------------
----------------------------

C5F5 *********** JUMP TO BOO
                            TFAIL ************************************
  C5F5  BRANCH TO BOOTFAIL >
                            >C552
  C5F8  REMAINING 8 BYTES NO
                            T USED BY DISK II >>C576
C600 *********** INITIALIZAT
                            ION **************************************
  C600  SIGNATURE
  C602  SET DRIVE -> 1
  C604  INITIALIZE RETRY COU
                            NT (HIGH BYTE)
C608 *********** SELECT DRI
                            E AND TURN IT ON *************************
  C608  ---
  C60B  INITIALIZE SLOT (6)
  C60D  INITIALIZE DEVICE (I
  C60F  SAVE DRIVE NUMBER ON OR 2)
  C610  INSURE READ MODE  (C STACK
  C616  GET DRIVE NUMBER BAC 089)
  C617  SELECT APPROPRIATE D
  C61A  TURN MOTOR ON  (C089 RIVE  (C0EA)
                            )
C61D *********** RECALIBRATE
                            DISK ARM *********************************
  C61D  PREPAIR TO STEP THE
  C61F  TURN A PHASE OFF  (C ARM 80 PHASES
  C622  PUT COUNTER IN A REG 080)
  C623  CREATE A PHASE NUMBE ISTER
  C625  DOUBLE IT FOR PROPER R (0-3)
  C626  COMBINE WITH SLOT FO INDEX
  C628  PUT INDEX IN X REGIS R FINAL INDEX
  C629  TURN A PHASE ON  (C0 ER
  C62C  DELAY ABOUT 20 MICRO 81)
  C631  DECREMENT COUNTER  SECONDS
  C632  LOOP UNTIL ALL 80 AR
                            E DONE  >>C61F
C634 *********** INITIALIZAT
                            ION **************************************
  C634  ---
  C636  SECTOR TO FIND -> $0
  C638  TRACK TO FIND -> $00
  C63A  BUILD THE TRANSLATE
                            TABLE  <C58E>
C63D *********** COUNT RETRI
                            ES AND INDICATE ERROR IF BOOT FAILS*******
  C63D  INITIALIZE RETRY CO
  C63F  CLEAR THE CARRY     UNT
  C640  PUSH STATUS ON STACK
  C641  KEEP STACK CLEAN
  C642  GET SLOT
```

```
Disk Controller Boot ROM -- Apple IIc          NEXT OBJECT ADDR: C644
-----------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
-----------------------------------------------------------------------

  C644  DECREMEMT RETRY COUNT, TRY AGAIN?
  C646  YES, GO DO IT  >>C656
  C648  NO, TURN DRIVE OFF  (C088)
  C64B  AUTO BOOT FROM SLOT6?
  C64F  NO, FAIL NOW >>C5F5
  C651  MAYBE SLOT 5 WILL TALK TO US >>C500
  C654  TWO BYTES NOT USED >>0002
  C656  ---
  C657  DECREMENT RETRY COUNT (LOW BYTE)
  C658  IF NOT ZERO, TRY AGAIN  >>C65E
  C65A  IF SO, GO DECREMENT RETRY COUNT (HIGH BYTE)  >>C641
  C65C  SPACE FILLER TO POSITION CODE BELOW  >>C63D

C65E *********** SEARCH FOR A VALID HEADER ***************************

  C65E  CHECK DATA REGISTER  (C08C)
  C661  LOOP UNTIL DATA IS VALID  >>C65E
  C663  IS IT A $D5?
  C665  NO, TRY AGAIN  >>C657
  C667  YES, CHECK REGISTER AGAIN   (C08C)
  C66A  LOOP UNTIL VALID  >>C667
  C66C  IS IT AN $AA
  C66E  NO, SEE IF ITS A $D5  >>C663
  C670  YES, DELAY FOR REGISTER TO CLEAR
  C671  CHECK REGISTER  (C08C)
  C674  LOOP UNTIL VALID  >>C671
  C676  IS IT A $96
  C678  YES, WE FOUND AN ADDRESS HEADER  >>C683
  C67A  NO, HAVE WE FOUND ONE PREVIOUSLY?
  C67B  IF NOT, START OVER  >>C63F
  C67D  WAS IT AN $AD?
  C67F  YES, WE FOUND A DATA HEADER  >>C6A6
  C681  NO, START OVER  >>C63F

C683 *********** DECODE ADDRESS FIELD ********************************

  C683  INITIALIZE COUNTER
  C685  SAVE VALUE DECODED, WILL BE TRACK ON LAST PASS
  C687  READ DATA REGISTER  (C08C)
  C68A  LOOP UNTIL DATA VALID  >>C687
  C68C  SHIFT BITS INTO POSITION X1X1X1X1
  C68D  SAVE FOR LATER
  C68F  READ REGISTER FOR NEXT BYTE  (C08C)
  C692  LOOP UNTIL VALID  >>C68F
  C694  COMBINE WITH PREVIOUS 1X1X1X1X AND X1X1X1X1
  C696  DECREMENT COUNTER, DONE YET?
  C697  NO, DO ANOTHER  >>C685
  C699  KEEP THE STACK CLEAN
  C69A  IS THIS SECTOR WE WANT?
  C69C  NO, START OVER  >>C63F
  C69E  GET TRACK FOUND
```

```
C6B4  DECREMENT OFFSET
C6B5  STORE BYTE IN AUXILIARY BUFFER  (Ø2D6)
C6B8  LOOP UNTIL BUFFER FULL  >>C6A8
C6BA  INITIALIZE OFFSET (MAIN BUFFER)
C6BC  READ DATA REGISTER  (C08C)
C6BF  LOOP UNTIL VALID  >>C6BC
C6C1  EXCLUSIVE-OR WITH TRANSLATE TABLE
C6C6  STORE BYTE IN MAIN BUFFER
C6C8  INCREMENT OFFSET                (Ø2D6)
C6C9  LOOP UNTIL BUFFER FULL  >>C6BA
C6CB  READ DATA REGISTER  (C08C)
C6CE  LOOP UNTIL VALID  >>C6CB
C6DØ  IS CHECKSUM OKAY?  (Ø2D6)
C6D3  NO, START OVER  >>C6A2

C6D5 *********** MERGE MAIN AND AUXILIARY B

C6D5  INITIALIZE OFFSET (MAIN BUFFER)
C6D7  INITIALIZE OFFSET (AUXILIARY BUFFER
C6D9  DECREMENT OFFSET (AUX BUFFER)
C6DA  IF LESS THAN ZERO RESET IT  >>C6D7
C6DC  GET BYTE FROM MAIN BUFFER
C6E1  ROLL IN TWO BITS FROM AUXILIARY BUF
C6E6  SAVE COMPLETED DATA BYTE
C6E8  INCREMENT OFFSET (MAIN BUFFER)
C6E9  LOOP UNTIL WHOLE BUFFER IS DONE  >>

C6EB *********** DETERMINE IF THERE IS MORE

C6EB  INCREMENT MAIN BUFFER POINTER
C6ED  INCREMENT SECTOR NUMBER
C6F1  IS THERE ANOTHER SECTOR TO LOAD?  (
C6F6  YES, GO DO IT  >>C6D3
C6F8  NO, ENTER CODE WE JUST LOADED  >>08

C6FB  5 ZERO BYTES AT END OF PAGE
```

```
OBJECT ADDR: C6AØ
-----------------

-----------------

'A FIELD  >>C642
******************

UFFERS***
)
FER

C6D9
TO DO***
(
Ø8ØØ)
Ø1

******************

******************
```


Disk Controller Boot ROM -- Apple IIc

```
ADDR    DESCRIPTION/CONTENTS                    NEX

C6AØ  IS IT TRACK WE WANT?
C6A2  NO, START OVER  >>C63F
C6A4  YES, INDICATE ADDRESS FOUND, GO LO

C6A6 *********** READ DATA FIELD *********

C6A6  INITIALIZE OFFSET (AUXILIARY BUFFE
C6A8  ---
C6AA  READ DATA REGISTER  (C08C)
C6AD  LOOP UNTIL VALID  >>C6AA
C6AF  EXCLUSIVE-OR WITH TRANSLATE TABLE
```

```
K FOR DAT
*********
R)
```

```
Disk II Boot ROM -- Apple IIGS                    NEXT OBJECT ADDR: C600
ADDR    DESCRIPTION/CONTENTS
---------------------------------------------------------------------

C600    MODULE S
                TARTING ADDRESS
        ********
        *       ****************************
        * C600 E                             *
        *    If OM - APPLE IIGS              *
        *    con an Apple IIGS has slot 6    *
        *    the figured for Disk Port,      *
        *    whe this code is executed       *
        *    fro a boot is attempted         *
        *        m slot 6.                   *
        * IIGS E                             *
        *       OM VERSION Ø                 *
        ********                             *
                ****************************
C600 ******** ZE
                ERO PAGE ADDRESSES ************************************
1       SLOT PAG
3       RETRY CO  PUT HERE DURING AUTOBOOT
26      SECTOR UNT (HIGH BYTE)
2B      SLOT NUBUFFER POINTER
3C      WORKBYTMBER * 16
3D      SECTOR
40      TRACK WANTED
41      TRACK WANTED
4F      DRIVE TANTED
                BOOT FROM
C600 ******** E
                XTERNAL ADDRESSES ************************************
0300    AUXILIA
0356    TRANSLATY BUFFER
07F8    SLOT THE TABLE
07FE    UTILITY OWNS C800-CFFF
0800    SECTORS BYTE FOR SLOT 6
0801    ENTRY P  O LOAD
C080    PHASEØ INT
C081    PHASEØ FF
C088    MOTOR ON
C089    MOTOR OFF
C08C    READ DAT
C08E    SET REA  A REGISTER
C0EA    DRIVE SE  MODE
E000    APPLESELECT
FABA    MONITOR  BASIC ENTRY POINT
FCA8    MONITOR  ISK CONTROLLER SEARCH LOOP
                WAIT ROUTINE
```

```
Disk II Boot ROM -- Apple IIGS                    NEXT OBJECT ADDR: C600
ADDR    DESCRIPTION/CONTENTS
---------------------------------------------------------------------

C600 ******** IIGS SOFT SWITCHES ************************************

C025    SLTROMSEL. SLOT ROM CONFIGURATION BYTE
C035    SHADOW.  ENABLES/DISABLES SHADOWING
C068    STATEREG.  ONE BYTE SETS 8 SOFT SWITCHES

C600 ******** C600 ENTRY POINT **************************************

  C600  ---
  C600  SIGNATURE
  C602  SET DRIVE TO DRIVE 1
  C604  INITIALIZE RETRY COUNT (HIGH BYTE)
  C608  PUSH Ø ON STACK
  C60A  SET NORMAL ZERO PAGE
  C60C  SET DATA BANK SAME AS PROGRAM BANK
  C60F  MAKE SLOT 6 CURRENT  (Ø7F8)
  C612  8-BIT MEMORY AND INDEX OPERATIONS
  C616  STORE P-REGISTER IN SCREEN HOLE  (Ø7FE)
  C619  DISABLE INTERRUPTS
  C61A  GO DO SOME TASKS ELSEWHERE IN ROM  <FF5909>
  C61E  RESTORE SLOT*16 TO X-REGISTER
  C620  IF CARRY SET, I/O ERROR  >>C62E

C622 ******** COUNT RETRIES AND INDICATE ERROR ***********************
                        IF BOOT FAILS

  C622  INITIALIZE RETRY COUNT
  C624  DISABLE INTERRUPTS (AGAIN)
  C625  CLEAR CARRY AND
  C626  PUT IT ON THE STACK.
  C627  KEEP STACK EVEN
  C628  GET SLOT*16 IN X-REGISTER
  C62A  DECREMENT RETRY COUNT. TRY AGAIN?
  C62C  YES, GO DO IT  >>C656
  C62E  NO, TURN DRIVE OFF  (C088)
  C631  CALL BOOT ERROR HANDLER  <FF5971>
  C635  ENABLE INTERRUPTS IF OK TO  <C648>
  C638  AUTOBOOT FROM SLOT 6?
  C63D  NO, GO TO BASIC  >>C642
  C63F  YES, RETURN TO SLOT SEARCH LOOP  >>FABA
  C642  JUMP TO BASIC  >>E000

C645 ******** SUBROUTINE TO ENABLE INTERRUPTS ************************

  C645  ALLOW SHADOWING AND I/O  (C035)
  C648  CHECK ORIGINAL P-REGISTER  (Ø7FE)
  C64B  INTERRUPT BIT HIGH?
  C64D  YES, LEAVE INTERRUPTS DISABLED  >>C650
  C64F  NO, ENABLE INTERRUPTS
  C650  RESTORE SECTOR TO ACCUMULATOR
  C652  RETURN
```

Disk II Boot ROM -- Apple IIGS NEXT OBJECT ADDR: C652

```
ADDR    DESCRIPTION/CONTENTS
--------------------------------------------------------------------------------

C653 ******** THREE BYTES NOT USED **********************************

  C653  NOT USED

C656 ******** INCREMENT RETRIES **************************************

  C656  ---
  C657  DECREMENT RETRY COUNT (LOW BYTE)
  C658  IF NOT ZERO, TRY AGAIN  >>C65E
  C65A  ZERO, SO GO DECREMENT HIGH BYTE  >>C627
  C65C  SPACER FILLER TO POSITION CODE BELOW  >>C622

C65E ******** SEARCH FOR A VALID HEADER ******************************

  C65E  CHECK DATA REGISTER  (C08C)
  C661  LOOP UNTIL DATA IS VALID  >>C65E
  C663  IS IT A $D5?
  C665  NO, TRY AGAIN  >>C657
  C667  YES, CHECK REGISTER AGAIN  (C08C)
  C66A  LOOP UNTIL VALID  >>C667
  C66C  IS IT AN $AA?
  C66E  NO, SEE IF IT'S A $D5  >>C663
  C670  YES, DELAY FOR REGISTER TO CLEAR
  C671  CHECK REGISTER  (C08C)
  C674  LOOP UNTIL VALID  >>C671
  C676  IS IT A $96?
  C678  YES, WE FOUND AN ADDRESS HEADER  >>C683
  C67A  NO. ARE WE LOOKING FOR DATA HEADER?
  C67B  NO, SO START OVER  >>C625
  C67D  YES, WAS IT AN #$AD?
  C67F  YES, WE FOUND A DATA HEADER  >>C6A6
  C681  NO, START OVER  >>C625

C683 ******** DECODE ADDRESS FIELD **********************************

  C683  INITIALIZE COUNTER
  C685  SAVE VALUE DECODED, WILL BE TRACK ON LAST PASS
  C687  READ DATA REGISTER  (C08C)
  C68A  LOOP UNTIL DATA VALID  >>C687
  C68C  SHIFT BITS INTO POSITION X1X1X1X1
  C68D  SAVE FOR LATER
  C68F  READ REGISTER FOR NEXT BYTE  (C08C)
  C692  LOOP UNTIL VALID  >>C68F
  C694  COMBINE WITH PREVIOUS 1X1X1X1X AND X1X1X1X1
  C696  DECREMENT COUNTER. DONE YET?
  C697  NO, DO ANOTHER  >>C685
  C699  KEEP STACK CLEAN
  C69A  IS THIS SECTOR WE WANT?
  C69C  NO, START OVER  >>C625
  C69E  GET TRACK FOUND
```

Disk II Boot ROM -- Apple IIGS NEXT OBJECT ADDR: C6A0

```
ADDR    DESCRIPTION/CONTENTS
--------------------------------------------------------------------------------

  C6A0  IS IT TRACK WE WANT?
  C6A2  NO, START OVER  >>C625
  C6A4  YES, INDICATE ADDR FOUND, GO LOOK FOR DATA FIELD  >>C628

C6A6 ******** READ DATA FIELD **************************************

  C6A6  INITIALIZE OFFSET (AUXILIARY BUFFER)
  C6A8  ---
  C6AA  READ DATA REGISTER  (C08C)
  C6AD  LOOP UNTIL VALID  >>C6AA
  C6AF  EXCLUSIVE-OR WITH TRANSLATE TABLE  (02D6)
  C6B4  DECREMENT OFFSET
  C6B5  STORE BYTE IN AUXILIARY BUFFER  (0300)
  C6B8  LOOP UNTIL BUFFER FULL  >>C6A8
  C6BA  INITIALIZE OFFSET (MAIN BUFFER)
  C6BC  READ DATA REGISTER  (C08C)
  C6BF  LOOP UNTIL VALID  >>C6BC
  C6C1  EXCLUSIVE-OR WITH TRANSLATE TABLE  (02D6)
  C6C6  STORE BYTE IN MAIN BUFFER
  C6C8  INCREMENT OFFSET
  C6C9  LOOP UNTIL BUFFER FULL  >>C6BA
  C6CB  READ DATA REGISTER  (C08C)
  C6CE  LOOP UNTIL VALID  >>C6CB
  C6D0  IS CHECKSUM OKAY?  (02D6)
  C6D3  NO, START OVER  >>C6A2

C6D5 ******** MERGE MAIN AND AUXILIARY BUFFERS **********************

  C6D5  INITIALIZE OFFSET (MAIN BUFFER)
  C6D7  INITIALIZE OFFSET (AUXILIARY BUFFER)
  C6D9  DECREMENT OFFSET (AUX BUFFER)
  C6DA  IF LESS THAN ZERO RESET IT  >>C6D7
  C6DC  GET BYTE FROM MAIN BUFFER
  C6E1  ROLL IN TWO BITS FROM AUXILIARY BUFFER
  C6E6  SAVE COMPLETED DATA BYTE
  C6E8  INCREMENT OFFSET (MAIN BUFFER)
  C6E9  LOOP UNTIL WHOLE BUFFER IS DONE  >>C6D9

C6EB ******** DETERMINE IF THERE IS MORE TO DO **********************

  C6EB  INCREMENT MAIN BUFFER POINTER
  C6ED  INCREMENT SECTOR NUMBER
  C6F1  IS THERE ANOTHER SECTOR TO LOAD?  (0800)
  C6F6  YES, GO DO IT  >>C6D3
  C6F8  NO. ENABLE INTERRUPTS  <C645>
  C6FB  AND JUMP TO CODE WE JUST LOADED.  >>0801
```

Beneath

Disk
ADDR

C6F

5909

590
590
590
591
591
591

591C

591
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5936

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593

```
Disk II Boot ROM -- Apple IIGS                    NEXT OBJECT ADDR: 6409
------------------------------------------------------------------------
ADDR    DESCRIPTION/CONTENTS
------------------------------------------------------------------------

  6409  SET MSG CODE=0 ("I/O ERROR")
  640B  IS ERROR CODE ZERO?  (E10FB1)
  640F  NO, KEEP CHECKING  >>6413
  6411  YES, SET MSG CODE=1 ("NOT A STARTUP DISK")
  6413  IS IT "NO DEVICE CONNECTED"?
  6415  NO.  >>6419
  6417  YES, SET MSG CODE=2
  6419  IS IT "CHECK STARTUP DEVICE"?
  641B  NO, CALL IT "I/O ERROR"  >>641F
  641D  YES, SET MSG CODE=3
  641F  PUT MSG CODE IN ACCUM
  6420  AND PRINT IT OUT  <C080>
  6423  INDICATE I/O ERROR
  6425  GET P-REGISTER BACK
  6426  RESTORE MODE BASED ON CARRY
  6427  INDICATE ERROR
  6428  RETURN TO $C600 LOGIC
```

IX A

E PRODOS 8 VERSIONS

hanges to ProDOS 8 that were
sions. Although we believe this
dn't catch. Quite a few changes
save space are not listed here.

RSION

to the 1.1.1 version of ProDOS to
e listed below. Addresses given

ProDOS 16 installed, ProDOS 8 is
DOS 16 Quit Handler). In this case
$2003 instead of $2000. [2000-

is now stored in the MLI
es [2048-2040, page 11].

see if running on a IIGS, and if so sets a
o sets E100BD=0 if ProDOS 8 is the initial
[2079-208D, page 11].
inter to $FF [20E6-20F5, 2111-2115, page 12].

80-column card [212A-2139, page 12].

6. If operating on a IIGS, installs the IIGS Clock Code [21AD-21D0, 22D3-22DA, pages 12 and 14].
7. Now checks for an AppleTalk Initialization File (ATINIT file) before looking for a .SYSTEM file. If the ATINIT file is found, it is loaded and executed, then the search for a .SYSTEM file commences. [22DB-2381, page 14].
8. The list of devices is now ordered differently. It recognizes the SmartPort and allows four Slot 5 SmartPort units to be accessed as Slot 5, Drives 1 and 2 and Slot 2, Drives 1 and 2. If Slot 2 is being used by a storage device, however, only the first two devices on the Slot 5 SmartPort can be accessed. It also changes the search order, making sure that Disk II devices are searched last when a device scan takes place (such as during an MLI ON_LINE call). [2668-271B, 275D-2767, 2814-28AA, pages 17-19].

Diff

APPENDI

DIFFERENCES BETWEEN TH

This Appendix identifies the c
introduced with the 1.2 and 1.3 ver
(especially deletions) that we di
that were apparently made only to

CHANGES INTRODUCED IN THE 1.2 VE

The changes that were made t
produce ProDOS 8, Version 1.2, a

here are Version 1.2 addresses.

Relocator

1. When running on a IIGS wi
entered from ZOUT (the Pro
the Relocator is entered at
2005, page 11].
2. The ProDOS 8 version number
subdirectory header data a

3. Always checks to
flag (2278). Als
boot on a IIGS.
4. Sets aux stack po

9. A bug in the /RAM driver (which we pointed out in the 1.1.1 supplement) that allowed a block read of block 7 (which doesn't exist) has been corrected [2D4B, page 23].
10. The /RAM caller, which operates in high RAM, now contains a $60 (RTS instruction) at address $FF58. Peripheral cards sometimes call that address to figure out which slot they are in, and in case they forget to set ROM for reading, the call will still work. [2E56-2E58, page 24].
11. A subroutine that sets high RAM for reading/writing was created to save space in the code [2518-251E, page 16].

MLI and MLI Global Page

1. The Global Page now pushes the P-Register and disables interrupts before calling the actual MLI [DE01-DE04, DE1C-DE21, BF4B-BF4F, pages 34 and 75].
2. Setting the MLIACTIVE flag a little differently now allows nested calls to the MLI by interrupt routines [DE8F-DE91, page 35].
3. A new MLI command was introduced (command=$82), that allows the user to install a routine to handle unclaimed interrupts [DEFF-DF0B, FD23-FD2C, pages 35 and 63].
4. If there is no unclaimed interrupt handler, ProDOS 8 now counts unclaimed interrupts, and will allow 255 of them to occur before finally issuing a fatal error. This allows a brief time for the unknown interrupt to stop interrupting. [DFB3-DFB7, page 36].
5. If operating on a IIGS and system death occurs, the NEWVIDEO softswitch is set to 0, reinitializing the IIGS video [E013-E016, page 36].
6. Processing for the ON_LINE command now frees the VCB entry for a device that was previously on-line but has been taken off-line [E28A-E2A4, page 39].
7. A subroutine that reads a block where the block number is in the A and X registers was added to save space in the code [EBC9-EBD0, page 47].
8. The error message that results when a file being opened has an illegal storage type has been changed from "incompatible directory format" to "unsupported storage type" [EEC7-EECA, page 50].
9. An error type $C is now indicated when truncating or deleting a file and the file's storage type is illegal [FA4D-FA4E, page 60].
10. To save space in the QuitCode Caller, some in-line code was changed to a loop [FCAF-FCB7, FCD8-FCE0, page 62].

Quit Code

1. Uses standard character set instead of alternate character set [1006-1008, page 77].
2. Sets normal 40-column screen in a safer way, such that screen hole values are preserved [100C-1011, page 77].
3. Message display routine is modified [1033-1034, 11D6-11D1, etc., pages 77 and 79].
4. The method of displaying the current prefix is changed so that it is always written to the same screen location [104D-105C, page 77].
5. User can now backspace with the DELETE key as well as left arrow [107C-107F, 10FC-10FF, page 78].
6. The method of inputting the Application name was modified [10E7-10E9, page 78].

Clock Code

1. The code for the ThunderClock includes a lookup table to determine the year based on the day of the year and the day of the week. This table is only good for a span of five or six years. The table released with Version 1.1.1 was good for the years 1982-1987. The table released with Version 1.2 covers the years 1986-1991. [D7B8-D7BE, page 91].
2. A completely separate clock routine is provided in Version 1.2 in case ProDOS 8 is operating on a IIGS. If so, the IIGS Clock Code is always enabled. It is written in 65816 and calls the ReadTimeHex tool in the tool kit to read the clock. [D742-D790, page 92].

CHANGES INTRODUCED IN THE 1.3 VERSION

The changes that were made to the 1.2 version of ProDOS 8 to produce ProDOS 8, Version 1.3, are listed below. Addresses given here are Version 1.3 addresses.

Relocator

1. The boot message now includes a line that says "ALL RIGHTS RESERVED." Chalk up one for the legal department! [25F6-2671, page 26].
2. A ProDOS Status call now immediately precedes the SmartPort Status Call. This is because the SmartPort interface does not set up its device list until it receives a ProDOS Status call. Earler versions of ProDOS 8 may not always find all SmartPort devices. [286E-2894, page 28].

MLI

1. When files are deleted, previous versions of ProDOS zero out all but the first block of discarded index blocks. Now such index blocks will not be zeroed, but the pages of these blocks will be flipped. That is, the high byte of the block numbers will be exchanged with the low byte of the block numbers. [F992-F99A, FBC7-FBDC, pages 67 and 69].
2. Previous versions of ProDOS forgot, in certain cases, to rewrite index blocks that were being discarded when shortening or deleting files. Now such blocks will always be rewritten to disk in a zeroed (shortened file) or flipped (deleted file) form. [FAB8-FABC, FB91-FB93, pages 68 and 69].
3. A poorly-written loop in the QuitCode Caller that was added for Version 1.2 was rewritten for Version 1.3. The Version 1.2 code might cause problems on a IIGS. [FDØ5-FDØC, page 7Ø].

Disk II Device Driver

1. There is a routine in the Disk II Device Driver that clears phases in case the Disk II device is sharing transmission lines with SmartPort devices. This routine was patched in Version 1.3 so that phases are now cleared with LDA instructions instead of STA instructions. This eliminates bus fights that can, in some situations, cause unwanted writing to the floppy disk. [D6C3-D6CE, page 88].

BUGS IN VERSIONS 1.2 AND 1.3

It is fair to say that both Versions 1.2 and 1.3 of ProDOS 8 are relatively bug free. Perhaps a few escaped our notice, but we know of only three minor bugs, which are as follows:

MLI, Versions 1.2 and 1.3, at EC64 (see p. 47). This bug has been in ProDOS since day 1. Although there is no easy way to correct the problem (because a three-byte instruction is needed where there are only two bytes), any serious problems can be avoided by putting NOP's at EC64 and EC65 (3D64 and 3D65 in load location). This bug can only take effect when a storage type Ø is found (not likely unless disk swapping) and a lot of files are open simultaneously.

MLI, Version 1.2 only, at FCD8 (see p. 62). A loop that indexes around the 64K boundary may cause problems on a IIGS. Use version 1.3 or recode the loop so that the boundary crossover is eliminated.

MLI, Version 1.3 only, at FBCD (see p. 69). A 65CØ2 instruction snuck into the code, which will be disastrous when Version 1.3 is run on a computer with a 65Ø2 processor (Apple II+, unenhanced IIe). It is easily patched, as we explain on page 69.

APPENDIX B

ERRATA TO BENEATH APPLE PRODOS

ERRATA TO BENEATH APPLE PRODOS (1st Printing, 1984)

You can identify which printing of Beneath Apple ProDOS you have by looking at the space between the title of the book and the author's names on the first page of the book (the title page). If this space is blank, you have the first printing. The second printing has "Second Printing, March 1985" in this space. If you have the second printing, skip to page 120. If you have the first printing, all of the following errata apply.

Page 3-16:

In the first paragraph starting on the page, the sentence should read "The data is dealt with in larger pieces (512 **bytes** vs. 256 **bytes**)...", not **512K** vs. **256K.**

Page 6-63:

The code for "HOW MUCH MEMORY IS IN THIS MACHINE?" is incorrect. Replace it with:

```
        LDA   $BF98       GET MACHID FROM GLOBAL PAGE
        ASL   A           MOVE BITS TO TEST POSITION
        ASL   A
        BPL   SMLMEM      48K
        ASL   A
        BVS   MEM128      128K
        ...               OTHERWISE 64K
```

Page 6-64:

The code for "GIVEN A PAGE NUMBER, SEE IF IT IS FREE" is incorrect. Replace it with:

```
BITMAP  EQU   $BF58        SEE PAGE 8-6
        LDA   #PAGE       GET PAGE NUMBER (MSB OF ADDR)
        JSR   LOCATE      LOCATE ITS BIT IN BITMAP
        AND   BITMAP,Y    IS IT ALLOCATED?
        BNE   INUSE       YES, CAN'T TOUCH IT
        TXA               PUT BIT PATTERN IN ACCUM
        ORA   BITMAP,Y    MARK THIS PAGE AS IN USE
        STA   BITMAP,Y    UPDATE MAP
        ...               WE'VE GOT IT NOW
```

```
LOCATE  PHA                 SAVE PAGE NUMBER
        AND   #Ø7           ISOLATE BIT POSITION
        TAY                 THIS IS INDEX INTO MASK TABLE
        LDX   BITMASK,Y     PUT PROPER BIT PATTERN IN X
        PLA                 RESTORE PAGE NUMBER
        LSR   A             DIVIDE PAGE BY 8
        LSR   A
        LSR   A
        TAY                 Y-REG IS OFFSET INTO BITMAP
        TXA                 GET BIT PATTERN IN ACCUM
        RTS                 DONE

BITMASK DFB   $80,$40,$20,$10  BIT MASK PATTERNS
        DFB   $08,$04,$02,$01
```

Page 7-9

The code on page 7-9 is incorrect and should be replaced wi
the following:

```
*       SQUISH OUT DEVICE NUMBER FROM DEVLST
        SKP 1
        LDX   $BF31         GET DEVCNT
DEVLP   LDA   $BF32,X       PICK UP LAST DEVICE NUM
        AND   #$7Ø          ISOLATE SLOT
        CMP   #$3Ø          SLOT = 3?
        BEQ   GOTSLT        YES, CONTINUE
        DEX
        BPL   DEVLP         CONTINUE SEARCH BACKWARDS
        BMI   NORAM         CAN'T FIND IT IN DEVLST
GOTSLT  LDA   $BF32+1,X     GET NEXT NUMBER
        STA   $BF32,X       AND MOVE THEM FORWARD
        INX
        CPX   $BF31         REACHED LAST ENTRY?
        BNE   GOTSLT        NO, LOOP
        DEC   $BF31         REDUCE DEVCNT BY 1
        LDA   #Ø            ZERO LAST ENTRY IN TABLE
        STA   $BF32,X
        CLC
        BCC   OKXIT         BRANCH ALWAYS TAKEN
        SKP   1
OLDVEC  DW    Ø             OLD VECTOR SAVEAREA
```

To reinstall the /RAM driver, execute this subroutine:

```
            SKP   1
*           SEE IF SLOT 3 HAS A DRIVER ALREADY
            SKP   1
HIMEM       EQU   $73          PTR TO BI'S GENERAL PURPOSE BUFFER
            SKP   1
INSTALL     LDX   $BF31        GET DEVCNT
INSLP       LDA   $BF32,X      GET A DEVNUM
            AND   #$70         ISOLATE SLOT
            CMP   #$30         SLOT 3?
            BEQ   INSOUT       YES, SKIP IT
            DEX
            BPL   INSLP        KEEP UP THE SEARCH
            SKP   1
*           RESTORE THE DEVNUM TO THE LST
            SKP   1
            LDX   $BF31        GET DEVCNT AGAIN
            CPX   #$0D         DEVICE TABLE FULL?
            BNE   INSLP2
ERROR       ...                YOUR ERROR ROUTINE

INSLP2      LDA   $BF32-1,X    MOVE ALL ENTRIES DOWN
            STA   $BF32,X      TO MAKE ROOM AT FRONT
            DEX                FOR A NEW ENTRY
            BNE   INSLP2
            LDA   #$B0
            STA   $BF32        SLOT 3, DRIVE 2 AT TOP OF LIST
            INC   $BF31        UPDATE DEVCNT
            SKP   1
```

Page 7-26:

Modifying the ProDOS Disk II Device Driver to allow 320 blocks instead of the normal 280. The fourth command line should read:

```
520D:40
```

Modifying FILER to format 40 tracks instead of 35. The fourth command line should read:

```
4244:40
```

[See Second printing errata for information about versions other than 1.0.1]

Page 8-6:

Under "Device Information", make the following changes:

```
BF10-BF11    DEVADR01    Slot 0 reserved.
...
BF26-BF27    DEVADR32    /RAM device driver address
                         (need extra 64K).
```

Page 8-7:

The wrong bit is indicated as the "expansion bit" in the MACHID byte. The first eight rows of that description should read:

```
00.. 0...  II
01.. 0...  II+
10.. 0...  IIe
11.. 0...  III emulation
00.. 1...  Future expansion
01.. 1...  Future expansion
10.. 1...  IIc
11.. 1...  Future expansion
```

Page B-8:

In the last paragraph, the sentence should read "A second way to use **an interpreted** language..." (not **a compiled** language).

Page D-1:

In the second paragraph, the sentence should read "Versions of the Disk Drive Controller Unit are now **used...**" (not **based**).

Reference Card, Panel 4

Under "SYSTEM GLOBAL PAGE FORMAT", replace the lines beginning BF05 and BF06 with the following two lines:

```
BF06    Jump to Date/Time Address
        (or RTS if no clock)
```

The description of BF10-11 should be changed to:

BF10-11 Slot 0 reserved

The description of BF26-27 should be changed to:

BF26-27 /RAM

Under the "MACHINE IDENTIFICATION BYTE", the second column of numbers should read:

0...
0...
0...
0...
1...
1...
1...
1...

Reference Card, Panel 9

The last entry for "MLI ERROR CODES" should be:

$5A Bad vol. bit map

(not **$58**).

ERRATA TO BENEATH APPLE PRODOS (2nd Printing, 1985)

Page 4-30:

The definitions of PARENT POINTER and PARENT ENTRY are incorrect. Replace them with:

$27-$28 PARENT_POINTER: The block number (within the volume directory or a subdirectory) which contains the file entry for this subdirectory.

$29 PARENT_ENTRY: The number of the file entry within the block number pointed to by the PARENT_POINTER. Given that "ENTRIES_PER_BLOCK" is $0D, then the PARENT_ENTRY number ranges from $01 to $0D.

Page 6-62:

The paragraph immediately preceding Table 6.6 should read as follows:

If an error occurs, the BI error code will be placed in the accumulator. Possible codes are listed in Table 6.6.

In Table 6.6, the message for error code $0C is wrong. It should read:

$0C NO BUFFERS AVAILABLE

Page 7-26:

Expand the 40-track drive patch to show how to patch all of the versions of ProDOS 8 released to date.

This patch modifies the Disk II Driver, which is a part of the "PRODOS" file (or "P8" file), so that it allows 320 blocks per volume instead of 280 blocks per volume. First set the prefix to the directory that contains the file you want to modify. This file will normally be called "PRODOS" on an 8-bit Apple II and "P8" on a 16-bit Apple IIGS. If the file name is not "PRODOS," substitute the correct filename wherever "PRODOS" appears.

```
UNLOCK PRODOS
BLOAD PRODOS,TSYS,A$2000
CALL -151
address*:40
3D0G
BSAVE PRODOS,TSYS,A$2000
LOCK PRODOS
```

ProDOS, as follows:

*"address" varies with the version of

ProDOS Version	address
1.0.1	520D
1.0.2	52CD
1.1.1	56E3
1.2	58E3
1.3	58E3

gram FILER to format 40
fication is made, only 40-

The following patch modifies the pro
tracks instead of 35. After this modi

track drives may be formatted with FILER.

```
UNLOCK FILER
BLOAD FILER,TSYS,A$2000
CALL -151
addr**:40
79F4:28
3D0G
BSAVE FILER,TSYS,A$2000
LOCK FILER
```

**"addr" depends on the release date of FILER. Here are the values of "addr" for two different release dates:

Release date	addr
1 JAN 84	4244
18 JUN 84	426A

Page A-34

In the listing of the "TYPE" program, change the value 4 to 5 in line 207 as follows:

```
2115:C0 05          207             CPY    #5
```

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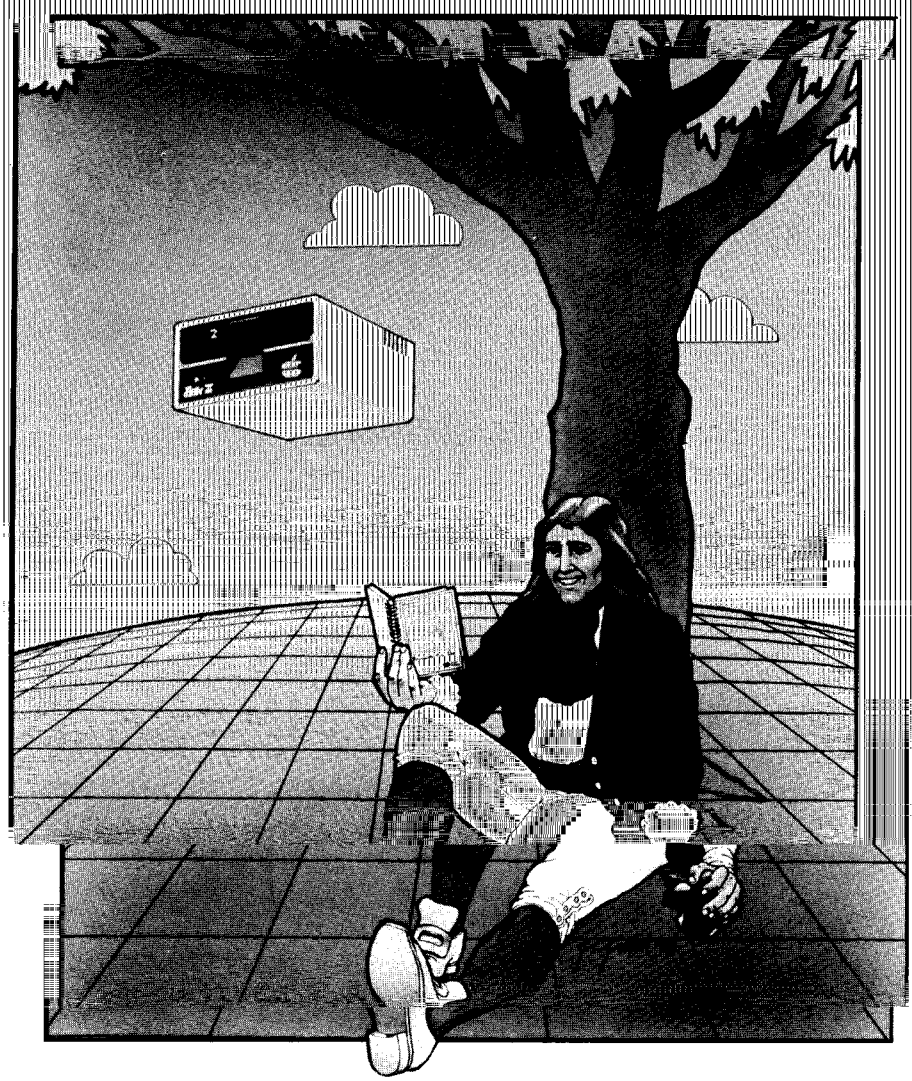

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