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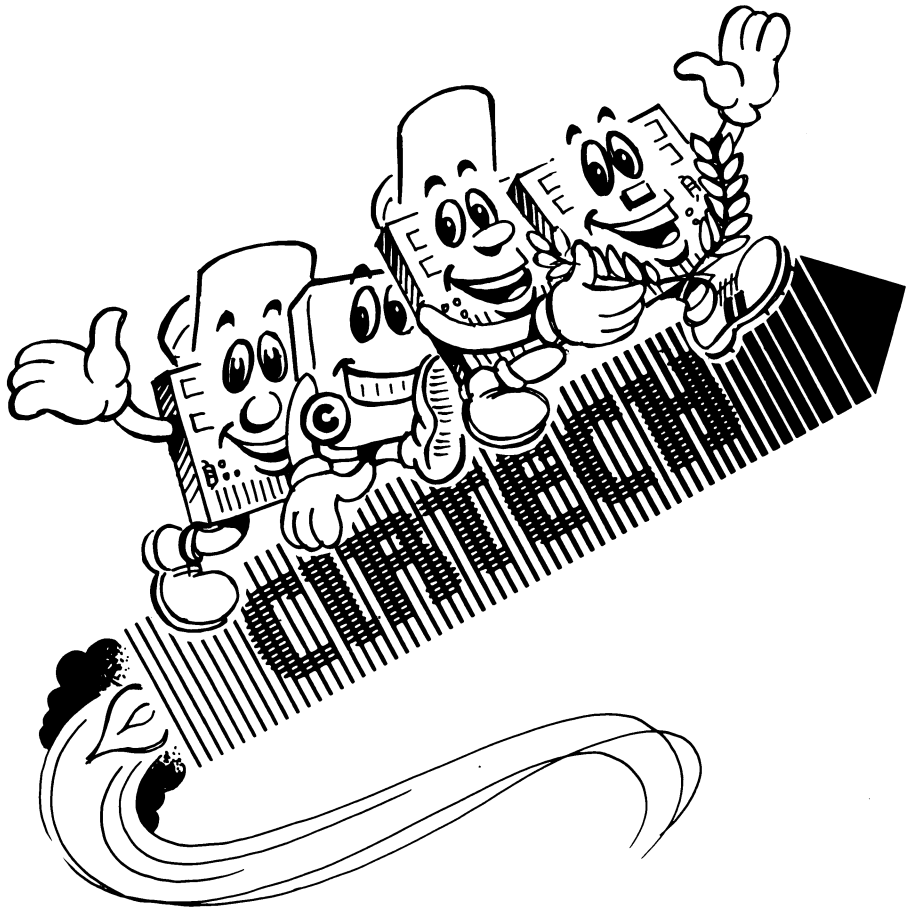
User's Manual



SCS1 Interface Card

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Using Large SCSI Devices With 8-Bit ProDOS

The *DRIVER.SYSTEM* program (supplied on the *SCSI Support Disk*) will let you use one or two very large SCSI devices which provide more than 32 Mb (the normal ProDOS size limit) with any 8-bit ProDOS, including ProDOS 1 and ProDOS 8.

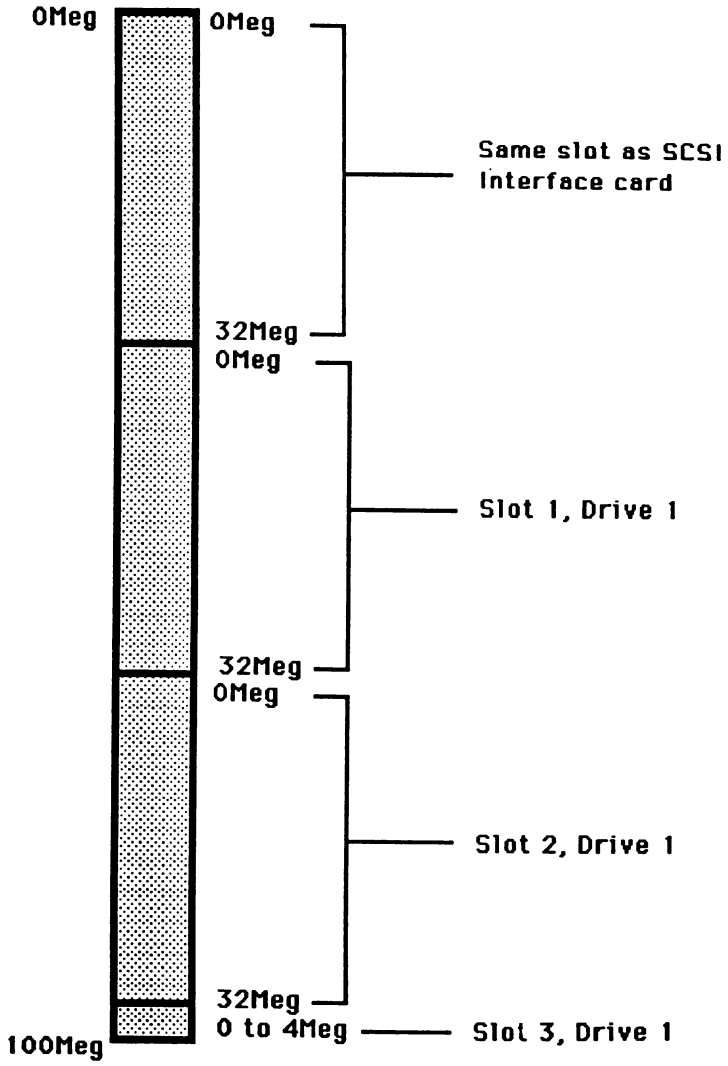

Figure 3: *Division Of 100Mb SCSI Device.*

The DRIVER.SYSTEM program works by dividing a large SCSI device into two, three or four *sections*. Each section (above 32Mb) is made to appear in a slot which doesn't already contain any ProDOS storage devices (see example in Figure 3, where slot 1, 2 and 3 are used). You can use each section in EXACTLY the same way as ordinary ProDOS disk drives. Remember that each section must be formatted before you try to use it.

All that you need to do to use the DRIVER.SYSTEM program is copy it from the *SCSI Support Disk* to your SCSI device. You MUST make sure that it is the first program in the ProDOS directory with the ".SYSTEM" suffix.

When you start up ProDOS from your SCSI device the DRIVER.SYSTEM program will be run automatically. When it has finished it will load the next "SYS" program in the ProDOS directory which has the ".SYSTEM" suffix.

Slot And Drive Allocation

The DRIVER.SYSTEM program will scan from slot 1 upwards when looking for slots which are suitable for "shadowing" sections above 32Mb (suitable slots are those which don't already contain any ProDOS storage devices).

The sections of your large SCSI device are shadowed as *drive 1* in each suitable slot that the DRIVER.SYSTEM program finds. If you have two SCSI devices then the sections from your second SCSI device will appear as *drive 2* in each suitable slot.

The DRIVER.SYSTEM program will display the slot (and drive) of each section it has shadowed. To make this display stay on your screen, just press any key once while ProDOS is starting up.

IMPORTANT *Any sections above 32Mb which are provided by the DRIVER.SYSTEM program are NOT compatible with the* SCSI PARTITIONING PROGRAM *(also supplied on the* SCSI Support Disk*) which uses only the first 32Mb of an SCSI device. See "Multiple Operating Systems" for full details of the* SCSI PARTITIONING PROGRAM.

SCSI Devices And Multiple Operating Systems

The unique *SCSI PARTITIONING PROGRAM* (from the *SCSI Support Disk*) will let you store files and programs for ProDOS, CP/M, Pascal and DOS, all in one SCSI device!

The partitioning program lets you divide your SCSI device into *partitions*, where each partition is like a *completely separate* SCSI device that can be used ONLY by the operating system for which you created it.

How To Create And Use SCSI Partitions

Just follow the instructions below to create the partitions that you want (your SCSI device must be formatted for ProDOS before you can create any partitions).

1. Start up from the *SCSI Support Disk*.

2. Press "P" for *SCSI PARTITIONING*.

3. Press "1" or "2" to select the drive you want to use.

4. Press "C" to *CREATE* a partition.

Drive 2 You can only select drive 2 if you have a second SCSI device connected to your SCSI interface. If you create partitions for the same operating system on drive 1 *and* drive 2 then the partition on drive 2 will be activated automatically when you enter the drive 1 partition.

5. Press the appropriate letter for the operating system which you want to use in the partition: "P" for *PASCAL*, "C" for *CPM* or "D" for *DOS*.

6. Now decide how large (in units of *128K*) you want to make the partition, type this number, then press the Return key.

When you press Return a partition is created on your SCSI device and the correct name for the partition (PASCAL, CPM or DOS) is entered in the ProDOS catalog as a "SYS" file (see Figure 4).

The ONLY way you can enter a partition is by starting up ProDOS, then running the appropriate "SYS" file for the partition.

WARNING *You must NEVER delete the "SYS" file for a partition, because this will DESTROY the partition WITHOUT restoring to ProDOS the space that it used.*

When you enter a partition for the first time it will not be formatted, so it can't start up your operating system. A message will be displayed, asking you to put a startup disk (which must be for the correct operating system) into your ordinary disk drive. **DO NOT RESTART YOUR COMPUTER**, just insert the disk, then press the slot number of your disk drive.

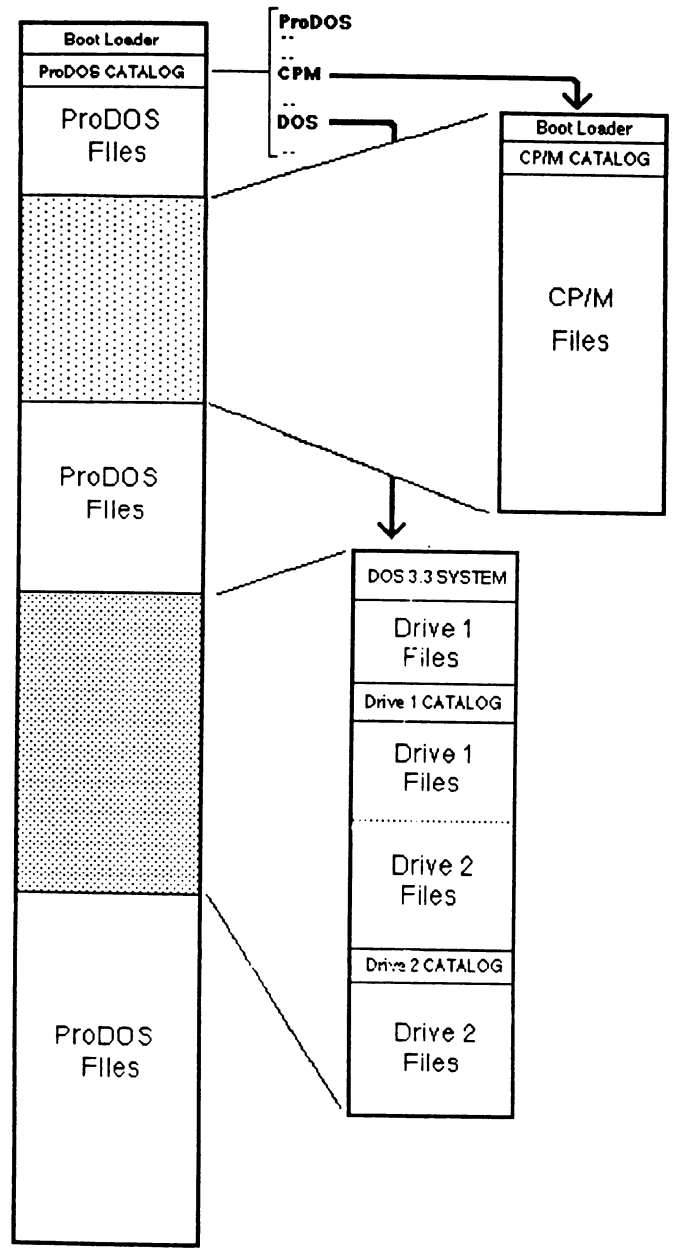

Figure 4: *Multiple Operating System Partitioning.*

When the correct operating system has started up you can format the partition, make it into a startup disk (if it is on drive 1), and use it in EXACTLY the same way as an ordinary disk drive.

IMPORTANT *When you want to leave a partition you must start up from your SCSI device, which will return you to ProDOS. If you enter a partition, then start up an operating system from another slot or device, you can access ONLY the contents of that partition until you start up again from your SCSI device.*

If you want to make a backup copy of the contents of a partition (as you OUGHT to do!) then you must use a file-copy program (you must NOT use a backup program, because it might DESTROY the contents of your partitions).

How To Change The Size Of An SCSI Partition

If you want to change the size of a partition you must use the *SCSI PARTITIONING PROGRAM* to first *REMOVE* then *CREATE* a new partition of the size that you want (DO NOT rename the "SYS" file for any partition, because then *REMOVE* will not work).

How To Select SCSI Partitions

The *SCSI Support Disk* contains a program called *SCSI.SYSTEM* which you can use to select any partition that you've created.

Just copy *SCSI.SYSTEM* to your SCSI device, so that it is the *first* "SYS" file in the ProDOS catalog with a ".SYSTEM" suffix (you may need to rename or delete some files to do this).

Next time you start up from your SCSI device you can select a partition by pressing a single key!

CHAPTER 5

TROUBLESHOOTING

If you seem to have a problem with your SCSI interface or device then the information below may help you (also, reading carefully all the way through this manual may provide a solution).

- PROBLEM: *Can't access the SCSI device*

  DO NOT save to your SCSI device until you have solved this problem! Check that the device is switched on, connected to your SCSI interface and formatted for your operating system. If this does not solve your problem you must test your SCSI device. For full details see "How To Test Your SCSI Device".

- PROBLEM: *Software can't find the SCSI interface*

  If you're using DOS 3.3 then you must use *UDOS.LANG* or *UDOS* (from the *SCSI Support Disk*) to modify DOS so that it can work with the SCSI interface.

  If you're using Microsoft CP/M 2.20B (56K) or 2.23 (60K) then you must run the *SCSI.COM* program to modify these operating systems so that they can work with the SCSI interface.

  The program you're using may modify your operating system, or use it incorrectly (you should only use standard programs and operating systems with the SCSI interface).

- PROBLEM: *Can't start up from the SCSI interface*

  You can only start up from the SCSI interface if you have made your SCSI device (or the first SCSI device, with the *highest* SCSI ID number) into a startup disk:

  Use the *Filer* (from the *SCSI Support Disk*), or an equivalent program, to make your SCSI device into a ProDOS startup disk.

  Use the *ToolKey Format* function and *COPYSYS.COM* program to make your SCSI device into a CIRTECH CP/M Plus startup disk.

  Use the *FORMATTER* and *FILER* (from your *APPLE1:* and *APPLE3:* disks) to make your SCSI device into a Pascal startup disk.

  Use the *INIT* command to make your SCSI device into a DOS 3.3 startup disk.

  With Microsoft CP/M you CAN'T make your SCSI device into a startup disk.

How To Test Your SCSI Device

If your SCSI device starts giving I/O errors, or you get messages like "can't read drive" or "having problems using this disk" you should use the *SCSI Support Disk* to test your SCSI device.

Just follow the step-by-step instructions below:

1. Start up from the *SCSI Support Disk*.

2. Press "U" for *SCSI UTILITIES*.

3. Press "T" for *TEST SCSI DEVICE*
   (full instructions will now be displayed on the screen).

4. Press the SCSI ID number of the device you want to test
   (testing of your SCSI device will begin immediately).

   You can stop the test at any time by pressing the Escape key
   (testing will usually take about 30 seconds per megabyte).

5. When the test has finished it will tell you either that the SCSI device is OK, or the number of bad blocks found.

If your SCSI device doesn't have any bad blocks then your problem must lie somewhere else in your system.

If the test DID find bad blocks on your SCSI device then you must continue from step 6, below.

6. If any bad blocks were found then either the information they contained has been corrupted, or your SCSI device has been damaged at the places where those blocks are stored.

   Although the information in each bad block has been destroyed you should now re-assign these blocks (when you do this each bad block is marked as bad by your SCSI device, and the block number is assigned to a new place in the device).

7. After re-assigning the bad blocks on your SCSI device you can try to rescue any important files or programs which are still left on the device (but if the catalog is damaged you may not be able to rescue anything).

IMPORTANT *If bad blocks are found on your SCSI device then any of your files and programs may have been damaged. The Bad Block Repair program is only designed to give you a CHANCE (with luck) to rescue some of your files and programs.*

After you have rescued as much as you can you must do a low-level SCSI format (see below for details) so that you can start again with a "clean" SCSI device. You can then recreate the set-up of your files and programs (using the last backup that you made).

How To Do A Low-Level SCSI Format

If you have tested your SCSI device and bad blocks were found, or you have a brand new SCSI device (like a hard disk) which is not readable yet, you must do a low-level SCSI format.

WARNING *You must ONLY use an SCSI format if bad blocks have been found when you tested your hard disk, or if you have a brand new SCSI device which is not readable yet.*

DO NOT use the SCSI format for any other reason, because it will permanently destroy EVERYTHING stored in an SCSI device.

The low-level SCSI format is *completely different* from the ordinary operating system format. An ordinary format (which you must do before you can use your SCSI device with any application programs) just writes an empty catalog on the device (and possibly some start up information) for your operating system.

The SCSI format actually makes your SCSI device re-write the internal data (called *address marks*) which the device uses to organise everything you store in it. In the process EVERYTHING stored on your SCSI device will be erased.

To do a low-level SCSI format of your SCSI device just follow the step-by-step instructions below:

1. Start up from the *SCSI Support Disk*.

2. Press "U" for *SCSI UTILITIES*.

3. Press "L" for *LOW-LEVEL SCSI FORMAT*
   (full instructions will now be displayed on the screen).

4. Press the SCSI ID number of the device you want to format.

5. Press "Y" if you are ABSOLUTELY SURE
   (formatting of your SCSI device will begin immediately).

   The SCSI format may take up to 60 seconds per megabyte.

After you have done the low-level SCSI format (which will also verify the SCSI format and automatically re-assign any bad blocks) you must use your ordinary formatting program to format your SCSI device for use with your operating system (for details, see Chapter 4, "HOW TO USE YOUR SCSI INTERFACE".

Don't Panic!

If you have a problem that you can't solve then you must contact the dealer who supplied your SCSI interface and SCSI device.

You must try to give as much information as you can (the list below only gives some suggestions) so that your problem can be dealt with as quickly and efficiently as possible:

- The type of Apple computer you're using.
- The number of your SCSI interface product registration card.
- Full details of everything connected to or installed in your computer, including slot, version, model and manufacturer.
- Full details of all settings or positions of any switches, links or connectors.
- Full details of the program in use when the problem occurs, including version number and publisher (or author).
- A description of what happens when the problem occurs:

  What were you trying to do when the problem occurred?

  What appeared on your screen, *before* the problem occurred?

  What appeared on your screen *after* the problem occurred?

  Does the problem occur occasionally/every time?

  What keys did you press *before* the problem occurred?

  Do any keys work *after* the problem occurs?

  Does your computer seem to stop working?

  Is a cursor displayed on your screen?

  Do asterisks or random characters appear on your screen?

  Does your computer make any peculiar or unusual noises?

You MUST provide as much information as possible, something which may not seem relevant may actually be very important!

CHAPTER 6

SCSI INTERFACE TECHNICAL INFORMATION

This chapter contains technical information on the SCSI interface and its operation with compatible SCSI devices.

SCSI Interface ID Bytes

The SCSI interface ROM contains several ID bytes, so that it can be located by programs and operating systems. To search for the SCSI interface each slot must be checked for ID bytes 1 to 3.

ID byte 1 (ROM address $Cs01) = $20
ID Byte 2 (ROM address $Cs03) = $00
ID byte 3 (ROM address $Cs05) = $03

If these three ID bytes are valid then a disk storage device has been found. Now the value of ID byte 4 must be checked.

ID byte 4 (ROM address $CsFB) = $02

If this ID byte is valid then an SCSI interface has been found.

FAST Mode And SAFE Mode

After the SCSI interface has been located ID byte 5 (ROM address $Cs07) can be checked to see which mode is set.

Autostart Selector

The appropriate mode is chosen ("FAST" or "SAFE") by setting the Autostart Selector when the SCSI interface is installed.

- If ID byte 5 = $00 the SCSI interface is set to FAST mode.

In FAST mode an SCSI interface SmartPort is provided, the ProDOS Block Device Protocol supported, and operating systems can be started up automatically (in an Apple IIGS or enhanced //e).

Handshaking only takes place for the first byte of a 512-byte block (during Data In/Data Out phases), so an SCSI device must transfer a block with no more than *10 microseconds* between any two bytes (most hard disks meet this requirement, including all *Mac Plus* compatible hard disks). You can test whether an SCSI device can operate in FAST mode by copying large amounts of data to the device, then verifying the data.

- If ID byte 5 = $3C the SCSI interface is set to SAFE mode.

In SAFE mode the ProDOS Block Device Protocol is supported (there is *no SmartPort*) and you can also start up an operating system automatically in an Apple][Plus or unenhanced //e.

Full REQ/ACK handshaking is used in SAFE mode to transfer every byte, so the maximum transfer rate is reduced to 21 microseconds per byte (which will be fully compatible with any SCSI device).

Support Software

Brief technical details of the support software provided on the *SCSI Support Disk* are given below.

■ *DOS 3.3*

The UDOS.LANG and UDOS programs only make small modifications to DOS "RWTS", First Stage Boot Loader and "INIT" Handler, which means that standard DOS 3.3 programs will operate normally, even those which use RWTS directly!

Each DOS 3.3 pseudo-drive is 400K (the maximum possible for DOS) with 8K "tracks" (32 sectors/track). The catalog on a 400K drive is also expanded, to provide space for a maximum of 217 entries, more than twice the number of an ordinary 5.25-inch disk.

UDOS.LANG and UDOS both use a 512-byte buffer for converting to and from 256-byte DOS sectors. With UDOS.LANG this 512-byte buffer is located in the first 4K bank of the "language card" (so that you don't lose any space for programs!), while UDOS reserves 512 bytes below DOS (above the DOS 3.3 file buffers).

■ *MicroSoft CP/M*

The drivers and buffers used by the *SCSI.COM* program reside in the I/O device patch area at address 0F280h upwards, which means that you can't use this area for any other type of I/O device patches when you're using the SCSI interface (if you want to be able to use *any* standard peripherals or storage devices available for the Apple //e or IIGS then you should buy the appropriate version of *CIRTECH CP/M Plus System* for your computer).

The SCSI Interface DB-25 Connector

Table 2 contains full details of the signals and connections for the SCSI interface DB-25 connector.

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	REQ	8	DB0	15	C/D	22	DB2
2	MSG	9	GND	16	GND	23	DB4
3	I/O	10	DB3	17	ATN	24	GND
4	RST	11	DB5	18	GND	25	DB7
5	ACK	12	DB6	19	SEL		
6	BSY	13	DB7	20	DBP		
7	GND	14	GND	21	DB1		

Table 2: *SCSI Interface Connections And Signals.*

The ProDOS Block Device Protocol

The SCSI interface supports the *ProDOS Block Device Protocol*, see the Apple *ProDOS Technical Reference Manual* for full details.

A ProDOS call is a "JSR" to the *ProDOS Entry Address* which is in the SCSI interface ROM. The address is calculated by adding the *byte* "$xx", from *location* $CsFF, to *address* "$Cs00". So the entry address = $Csxx.

Before any ProDOS call, the Zero Page locations $42 to $47 (which pass command information) must be set up as shown below.

■ *Command* (location $42)

The ProDOS command is stored in this location. The four ProDOS commands available are:

0 = STATUS - return size of specified SCSI device (in 512-byte blocks), X-reg = lo-byte, Y-reg = hi-byte.

Maximum size The maximum size of device for ProDOS calls is 32 Megabytes ($FFFF blocks), any space above this can't be accessed.

1 = READ - read a specified 512-byte block from the specified SCSI device to a specified area in the computer.

2 = WRITE - write 512 bytes from a specified area in the computer to a specified 512-byte block in a specified SCSI device.

3 = FORMAT - has no effect on any SCSI device connected to the SCSI interface (returns no error).

■ *Unit Number* (location $43)

Bits 4 to 7 of this byte specify the required SCSI device:

dsss0000

d = 0/1 for "first SCSI device" / "second SCSI device"
sss = 001 to 111 (1 to 7, decimal) for SCSI interface slot

■ *Buffer Pointer* (locations $44-$45)

The two-byte start address ($44 = lo-byte, $45 = hi-byte) of the 512-byte block buffer in the computer.

■ *Block Number* (locations $46-$47)

The two-byte number ($46 = lo-byte, $47 = hi-byte) of a specified 512-byte block.

If a ProDOS call is successful then the Carry flag is *clear* and the A-register = 0 on return to the caller.

If an error occurs then the Carry flag is *set* and the A-register contains the error code on return to the caller (for full details of error codes see the Apple *ProDOS Technical Reference Manual*).

The SCSI Interface SmartPort

The SCSI interface contains an Apple standard SmartPort interface (which emulates the Apple //c and IIGS disk port). SmartPort calls can be performed in a similar way to "ProDOS MLI calls" to carry out the functions which are listed below.

IMPORTANT *DO NOT use SmartPort calls to tranfer data to the Zero Page or to the Stack, as these are both used by the SmartPort itself!*

■ *STATUS*

Returns information about a specified SCSI device or about the SCSI interface SmartPort.

■ *READ BLOCK*

Transfers a specified 512-byte block from a specified SCSI device to a specified area of memory.

■ *WRITE BLOCK*

Transfers 512 bytes from a specified area of memory to a specified 512-byte block on a specified SCSI device.

■ *INIT*

Resets all devices on the SCSI bus.

SmartPort Call Format

SmartPort calls are composed of a single *Command Number* byte followed by a two-byte pointer to a *Parameter List* (the length and structure of this depends on the command). A simple SmartPort call is shown in Figure 5.

```
        LDA $CsFF       ;Read lo-byte of the ProDOS Entry Address
        CLC
        ADC #$03        ;Add 03 to get the SmartPort Entry Address
        STA SPCALL+1    ;Modify JSR address
                        ;
SPCALL  JSR $Cs00       ;"00" modified by above (SmartPort entry)
        DFB #$0x        ;The Command Number (see below)
        DW  SPLIST      ;Pointer to the Parameter List (see below)
                        ;for the command specified
        BCS ERROR       ;After the call the SmartPort returns to
                        ;your program here, Carry SET means an
                        ;error occurred (the A-register contains
                        ;the error code).


SPLIST EQU *            ;At address "SPLIST" you must have an
                        ;appropriate Parameter List for the Command
                        ;specified (see below).
```

Figure 5: *Example Of A SmartPort Call.*

The valid Command Numbers for the SCSI interface are:

$00 = STATUS (of SmartPort or SCSI devices)
$01 = READ BLOCK (transfer 512-byte block *from* SCSI device)
$02 = WRITE BLOCK (transfer 512-byte block *to* SCSI device)
$03 = FORMAT (has no effect)
$05 = INIT (Reset the SCSI bus)

FORMAT Command The SmartPort *FORMAT* command has no effect on any SCSI device connected to the SCSI interface (so *no error* is always returned).

The Parameter List for each SmartPort command is made up of one or more items of data which give the SmartPort details about the call, such as how many parameters a call has, where a block is to be read to, and so on.

The items which make up the various Parameter Lists are:

■ *Block Number*

A three-byte number (lo, mid, hi) which specifies a 512-byte block on an SCSI device

SCSI Partitions If an SCSI device contains one or more partitions then SmartPort calls will only affect the active partition.

■ *Buffer Pointer*

A two-byte address (lo, hi) of a buffer used by the command (for data read, data to be written or status information)

■ *Parameter Count*

The number of items in a Parameter List

■ *Status Code*

A one-byte number which specifies the type of status call

Status Code $00 = *Return Device Status*:

The Device Status information (*with Unit Number = $01 to $04*) consists of four bytes which are returned in the buffer specified by *Buffer Pointer*. The eight bits of Byte 0 have the following meanings:

Bit 7: 1 = block device
Bit 6: 1 = writable
Bit 5: 1 = readable
Bit 4: 1 = on line
Bit 3: 1 = can be formatted,
Bit 2: 0 = not write protected
Bit 1: 0 = not interrupting
Bit 0: 0 = not open

Bytes 1 to 3 = *Size* (in 512-byte blocks, lo, mid, hi) of a specified SCSI device.

If a Unit Number of $00 is used then the Device Status information is for the SmartPort itself. Eight bytes are returned: Byte 0 = $01 to $04 (the number of SCSI devices connected to the SCSI interface), Bytes 1 to 7 = $00.

Status Code $03 - *Return Device Information Block*

The Device Information Block (DIB) consists of twenty-five bytes returned in a buffer specified by *Buffer Pointer*.

Byte 0 = same as the first byte in the Device Status information: $F8.

Bytes 1 to 3 = *Size* (in 512-byte blocks, lo, mid, hi) of a specified SCSI device.

Byte 4 = *Device Name Length* for a specified SCSI device.

Bytes 5-20 = ASCII characters for the *Device Name* of a specified SCSI device (padded with ASCII space characters).

Byte 21 = *Device Type Code* for the SCSI interface ($03).

Byte 22 = *Device Subtype Code* for the SCSI interface ($20).

Bytes 24-25 = *ROM Version Number* ($00, $00).

- *Unit Number*

This number specifies the SCSI device required. For your "first" SCSI device (with the highest SCSI ID number) the Unit Number is $01, then $02, $03 and $04 for any other SCSI devices.

Details of the *Parameter List* for each command are given below.

- *STATUS*
  Parameter Count (= $03)
  Unit Number (= $01 to $04 for SCSI device information)
  (= $00 for SmartPort information)
  Buffer Pointer
  Status Code (= $00 for Return Device Status)
  (= $03 for Device Information Block)

- *READ BLOCK*
  Parameter Count (= $03)
  Unit Number
  Buffer Pointer
  Block Number

- *WRITE BLOCK*
  Parameter Count (= $03)
  Unit Number
  Buffer Pointer
  Block Number

- *FORMAT*
  Parameter Count (= $01)
  Unit Number

- *INIT*
  Parameter Count (= $01)
  Unit Number (= $00)

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CHAPTER 1

UNPACKING YOUR SCSI INTERFACE

Now that you have opened the sealed box which contained this manual you must make sure that all the items listed below are present. If any item is missing you must return the entire package *to your dealer* to be exchanged for a complete one.

The box should contain:

- One *SCSI Interface*

WARNING *Your SCSI Interface is very sensitive to static electricity, which can cause SEVERE DAMAGE. The SCSI Interface must NOT be removed from the anti-static protective packing in which it is supplied until you are ready to install it.*

- One *SCSI connector fixing kit*

  This attaches the SCSI Interface connector to your computer (//e or IIGS) and to the cable from your SCSI device.

- One 3.5-inch *SCSI Support Disk*

  This disk provides ProDOS support only.

- One 5.25-inch *SCSI Support Disk*

  This is a special *multi-system* ProDOS, CP/M and DOS disk.

IMPORTANT *You MUST read and accept the licence and warranty conditions before you open the seal around these disks.*

- One *PRODUCT REGISTRATION CARD* (see below for details)
- One *SCSI Interface User's Manual* (which you're now reading)

Please Help Us To Help You

When you're sure that all the items above are present you must fill in your PRODUCT REGISTRATION CARD, affix the correct postage, then return the card to us. On receiving your card we will register your purchase, which entitles you to receive:

- First class technical support
- Opportunities to upgrade (where appropriate)
- Advance news of exciting new products from CIRTECH

Returning your PRODUCT REGISTRATION CARD will help us to provide you with the most prompt and efficient service possible.

CHAPTER 2

INTRODUCTION TO THE SCSI INTERFACE

This manual provides complete instructions for installing your SCSI interface in an Apple][,][Plus, //e or IIGS. It includes instructions on using the SCSI interface (and SCSI devices) with ProDOS, CIRTECH CP/M Plus, Apple II Pascal 1.3, DOS 3.3 and Microsoft CP/M 2.20B (56K) and 2.23 (60K).

IMPORTANT *You must make sure that you have received all the items which should be supplied with the SCSI interface (for full details see Chapter1: "UNPACKING YOUR SCSI INTERFACE") and please remember to return your PRODUCT REGISTRATION CARD.*

Your SCSI interface will let you use an SCSI device in EXACTLY the same way as an ordinary disk drive (for details of suitable SCSI devices see "What You Need To Use Your SCSI Interface").

You can connect up to four SCSI devices to your SCSI interface, and each device can be as large as *eight Gigabytes*!

The *SCSI Support Disk* contains unique partitioning software which lets you use an SCSI device with up to four operating systems, see "SCSI Devices And Multiple Operating Systems" for details.

The SCSI interface can be used in a "network" of up to seven computers, which can all access the same SCSI devices. For full details of the *Multi-User System* contact CIRTECH, or your dealer.

Your SCSI interface is fully compatible with the SCSI standard, as used by the Apple SCSI Card and HD20SC hard disk, so that it will be fully compatible with future software and hardware designed to the same standard.

How Your SCSI Interface Works

This section will help you to understand how your SCSI interface (and any connected SCSI devices) will work inside your computer with operating systems and application programs.

First some definitions:

■ *SCSI*

This stands for "Small Computer System Interface" which is the *standard* to which your SCSI interface is designed.

■ *SCSI Bus*

This is the 25-way cable (and the components at each end) which connect the SCSI interface to other SCSI devices.

■ *Application Program*

This is any piece of software which you use to do something, such as a word processor, spreadsheet or data base. Figure 1 shows how an application program works in association with your operating system, SCSI interface and SCSI device (or devices). Common applications include *AppleWorks*, *WordStar*, and *Format-80*.

■ *Operating System*

This is a special piece of software which controls (operates) the hardware in your computer. Operating systems provide a standard method for storing information, by grouping information into files, allocating space on storage devices, and transferring files to and from storage devices.

Application programs must use an operating system (such as ProDOS, CP/M, Pascal or DOS) for storing information.

Input/Output

Some operating systems (such as CP/M and Pascal) also control all input and output so that they can provide a standard method for screen display, keyboard input and printing.

■ *Interface*

An interface is just a method of passing information between pieces of software, pieces of hardware, or software and hardware.

Now that you have finished this introduction you can go on to Chapter 3: "HOW TO INSTALL YOUR SCSI INTERFACE".

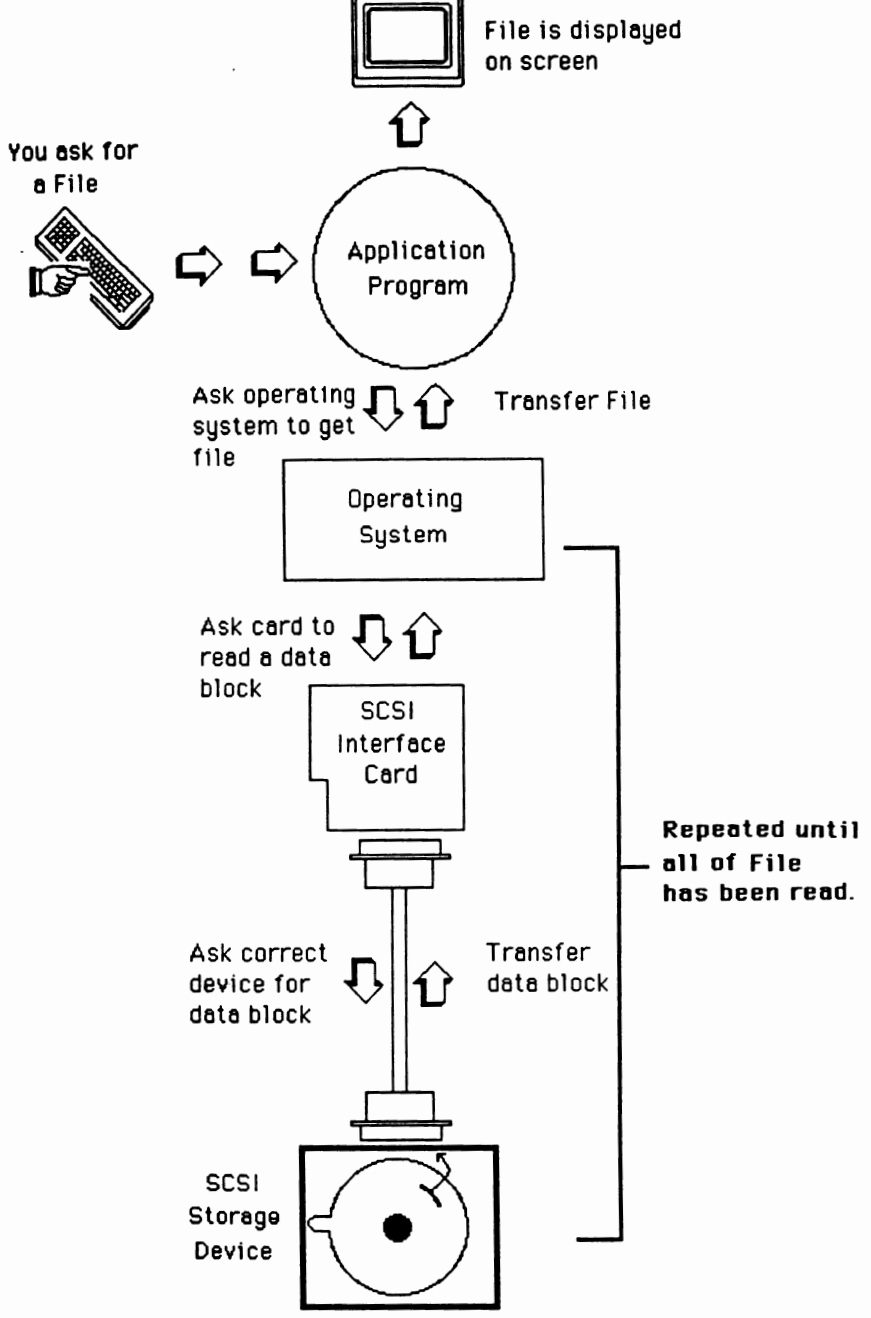

Figure 1: *How SCSI Works.*

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CHAPTER 3

HOW TO INSTALL YOUR SCSI INTERFACE

You must read *ALL* of the following instructions *BEFORE* starting to install your SCSI interface, so that you'll be completely familiar with the entire installation procedure before you remove any protective packing.

WARNING *You must MAKE SURE that the power is OFF (check the power-on light) before you remove or install anything inside your computer. Also, you MUST wait for a few seconds (thirty seconds with the Apple IIGS) after switching off before you connect or disconnect anything inside your computer.*

Before you touch your SCSI interface, or any part inside your computer, you must touch an "earthed" surface (such as the metal case of the power supply). This will "discharge" any dangerous static electricity that you may be carrying, and you should repeat this throughout the installation.

You must hold your SCSI interface only by the edges, and avoid touching the gold edge connector or any components on the card.

What You Need To Use Your SCSI Interface

You must have a computer system based on the items listed below before you can use the SCSI interface:

- An Apple][(64K),][Plus (64K), //e, or IIGS
- A VDU or monitor
- At least one disk drive (5.25-inch or 3.5-inch)
- A non-removable SCSI storage device (such as a hard disk) which uses 512-byte blocks, complies with the ANSI X3T9.2 (Common Command Set) specification, and is not larger than eight Gigabytes.
- A *system master disk* (for each of your operating systems)

Choosing A Slot For Your SCSI Interface

The slot you choose for your SCSI interface depends on several factors including your type of computer, other peripherals installed in your computer, and the software you want to use (in the Apple //e you must install your SCSI interface so that the cable can be attached to one of the large back panel openings).

IMPORTANT *You must not install your SCSI interface in slot 0 of an Apple][or][Plus (slot 0 must contain a 16K language card), slot 3 of an Apple //e or IIGS (if you want to use 80 column text), or the Apple //e auxiliary slot (which is only for //e 80 column cards).*

If you want to use your SCSI interface with Apple Pascal 1.3 then you MUST install it in slot 4, 5 or 6 (Pascal 1.3 can only recognise disk devices when they are installed in these slots).

Your operating system can start up automatically from your SCSI device (when you switch-on or restart your computer) if you install your SCSI interface in a higher slot than any other disk device (for example, your SCSI interface could be installed in slot 6 and your 5.25-inch disk controller in slot 5).

In the Apple IIGS you can start up automatically from *any* slot by using the built-in *Control Panel Program* (for full details see your *Apple IIGS Owner's Guide*).

Step-By-Step Installation

Just follow the step-by-step instructions below to install the SCSI interface in your computer:

1. Set ALL power switches to OFF (including wall socket, computer, monitor; everything connected to your computer).

IMPORTANT *DON'T unplug or disconnect the power cord for your computer (it provides the "earth" connection for the power supply case).*

2. Now you must open your computer (just follow the appropriate instructions below):

   ■ *Apple][,][Plus, //e*

   Face the front of your computer, pull the lid upwards at the back edge, slide it away from the keyboard, then lift it off.

   ■ *Apple IIGS*

   Face the front of your Apple IIGS, hold in the *lid latches* (see *Setting Up Your Apple IIGS* for details), carefully pull the lid upwards and towards you, then lift it off.

3. Remove your SCSI interface from the protective packing (but remember to keep touching an earthed surface and avoid touching the edge connector, or any components on the card).

4. Check the SCSI ID number of your SCSI interface (the ID number indicates the priority of each SCSI device, if you have more than one device connected to your SCSI interface).

   Each SCSI ID number (0 to 7) can only be used by one SCSI device. Your SCSI interface is supplied set to ID number 7, but you can change this (if necessary) using the *SCSI ID LINK* (see Figure 2).

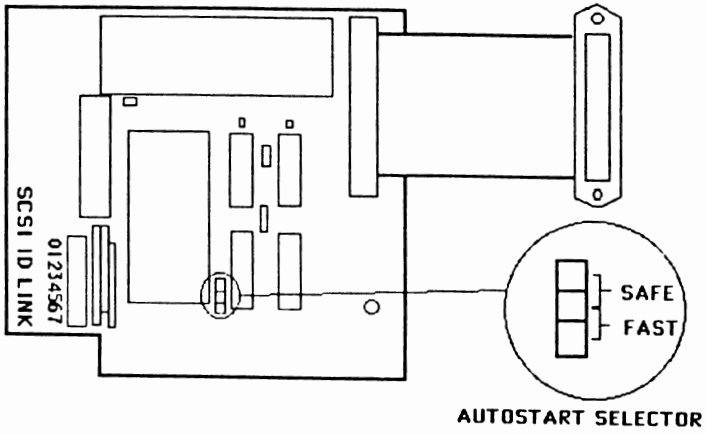

Figure 2: *The SCSI Interface.*

WARNING *Each SCSI device in a system MUST have a different SCSI ID number (you must NEVER connect two devices with the same ID number).*

5. Check that the *Autostart Selector* is set correctly (this will determine whether your operating system can start up automatically from your SCSI device). The SCSI interface is supplied with the Autostart Selector set to "FAST" mode, so you don't need to change this if you have an enhanced Apple //e or an Apple IIGS (an enhanced Apple //e can be identified by the "Apple //e" message).

   With the Apple][,][Plus or unenhanced //e you must set the Autostart Selector to "SAFE" mode if you want your operating system to start up automatically from your SCSI device.

   See Chapter 6: "SCSI INTERFACE TECHNICAL INFORMATION" for further details of FAST mode and SAFE mode.

6. Attach the SCSI interface connector:

■ *Apple //e and //GS*

Remove the cover from one of the large back panel openings, push the SCSI interface connector through the opening, then use the fixing kit to attach the connector to the back panel.

■ *Apple][and][Plus*

Attach the fixing kit to the SCSI interface connector, then rest the connector in one of the back panel openings.

7. Attach the cable from your SCSI device to your SCSI interface (the connector on the SCSI device cable will screw on to the SCSI interface connector).
   For full information about your SCSI device you must refer to the instructions from the manufacturer of the SCSI device.

WARNING *You must NEVER attach non-SCSI cables (such as an RS-232 cable) to your SCSI interface connector, or SEVERE DAMAGE may result!*

8. Align the SCSI interface so that the edge connector is directly above the slot you've chosen and the component side is on the right (as viewed from the front of the computer).

9. Carefully press the edge connector into the slot, using firm pressure, until it is fully inserted.

10. Replace the lid of your computer to complete installation of your SCSI interface.

If you are not fully familiar with the operation of your computer system (and your software) then you must study the appropriate manuals *BEFORE* you continue with this manual.

CHAPTER 4

HOW TO USE YOUR SCSI INTERFACE

This section contains directions for using your SCSI interface with ProDOS, CIRTECH CP/M Plus, Apple II Pascal 1.3, DOS 3.3 and Microsoft SoftCard CP/M 2.20B (56K) or 2.23 (60K).

Your SCSI interface lets you use an SCSI device just as you would use an ordinary disk drive. All the normal commands that you already know (such as *CATALOG* with BASIC, *DIR* with CP/M, *TRANSFER* with Pascal) work in EXACTLY the same way.

WARNING *As with ANY storage device, you must NEVER press Control-Reset while an SCSI device is "in use" or "active" (this is usually indicated by a light on the front of a device) because you may DESTROY the contents of the device!*

With the SCSI interface you can use SCSI devices for storing "documents", text files, BASIC programs, data files, code files, binary programs, *anything* that you would store on ordinary disks!

The SCSI interface can support a maximum of four SCSI devices, with each SCSI device having a maximum capacity of 8192Mb. Due to their internal limitations, most operating systems don't fully support the facilities of the SCSI interface (see Table 1 for details of operating system limitations).

Operating System	Number Of SCSI Devices Supported	Maximum Capacity Per Device
ProDOS 8	2/4 (see below)	32Mb/128Mb (see below)
ProDOS 16	2/4 (see below)	32Mb
CP/M Plus	4	8191Mb
Pascal 1.3	2	16Mb
DOS 3.3	2	800Kb (minimum 400Kb)
Microsoft CP/M	2	1.5Mb

Table 1: *Operating System Limitations.*

ProDOS See Chapter 4: "Using Large SCSI Devices With 8-Bit ProDOS" for details of using up to 128Mb of storage.

ProDOS 8 version 1.2 (or later) and ProDOS 16 version 1 can use up to four SCSI devices, but ONLY if your SCSI interface is set to FAST mode and installed in slot 5 (ProDOS "shadows" your third and fourth SCSI devices in slot 2 as drive 1 and drive 2).

Your SCSI interface is supplied with 5.25-inch and 3.5-inch versions of the *SCSI Support Disk*:

- The 5.25-inch version of the *SCSI Support Disk* is a special *multi-system* disk for ProDOS, DOS and CP/M.
- The 3.5-inch version of the *SCSI Support Disk* is a standard ProDOS disk, with ProDOS support only.

IMPORTANT *You MUST make a working copy of the appropriate version of the SCSI Support Disk for your computer system, then use ONLY this copy (keep both original support disks as backup copies).*

As with any ordinary disk drive, you MUST format an SCSI device before you can start using it.

If you are using ProDOS, CIRTECH CP/M Plus, or Pascal 1.3, then you can format an SCSI device in EXACTLY the same way as an ordinary disk! (refer to the manual supplied with your operating system for full instructions).

Apple Pascal 1.3 As Pascal 1.3 can only use SCSI devices smaller than 16Mb (see Table 1) any SCSI device larger than 16Mb must be made to seem smaller to Pascal by using the *SCSI PARTITIONING PROGRAM* (for full details see "Multiple Operating Systems").

Before you can format SCSI devices for DOS 3.3 or Microsoft CP/M you must modify these operating systems so that they will work with the SCSI interface, see below.

How To Modify DOS 3.3

The *UDOS.LANG*, *UDOS* and *UNIFID* programs are contained on the 5.25-inch *SCSI Support Disk*. These programs will let you use DOS with SCSI devices (and other ProDOS block storage devices, such as 3.5-inch disk drives). To let you use DOS with SCSI devices the UDOS.LANG (or UDOS) program modifies DOS in memory.

5.25-inch drives Modifying DOS 3.3 has NO EFFECT on the normal use and operation of your 5.25-inch disk drives.

After DOS 3.3 is modified you can use up to two SCSI devices in each slot (or two ProDOS devices, such as 3.5-inch disk drives).

Each SCSI device (or ProDOS device) provides *one* or *two* 400Kb drives (one drive is provided by a device which is smaller than 800Kb, two drives by a device which is 800Kb or larger).

Your first SCSI device (which is the SCSI device with the highest SCSI ID number) can be accessed as D1 (and D2, if it has at least 800Kb), while a second device can be accessed as D3 (and D4, if it also has at least 800Kb).

To modify DOS just start up your *DOS 3.3 System Master* disk, replace this disk with the 5.25-inch *SCSI Support Disk*, type "BRUN UDOS.LANG", press the Return key, and DOS will be modified.

After you have modified DOS 3.3 you can use SCSI devices (or ProDOS block storage devices, such as 3.5-inch disk drives) in EXACTLY the same way as ordinary disk drives (for full instructions please refer to your *Apple II DOS 3.3 Manual*).

IMPORTANT *You MUST first CATALOG an ordinary disk drive before you can INIT your SCSI device (or other ProDOS block storage device). If you INIT a device which provides two drives then BOTH drives (D1 and D2, or D3 and D4) will be FORMATTED (note also that you can only start up from D1, which must contain your "HELLO" program).*

You must only use UNIFID (which operates just like FID, see your *Apple II DOS 3.3 Manual* for full instructions) to copy your DOS files (UNIFID has been updated to work correctly with large devices such as hard disks and 3.5-inch disk drives).

Compatibility If a program seems not to work with UDOS.LANG you must try UDOS instead. If UDOS does not work then your program must modify DOS itself, or it uses DOS incorrectly (UDOS and UDOS.LANG are designed to work only with standard DOS 3.3 programs).

How To Modify Microsoft CP/M

The *SCSI.COM* and *SCSIFORM.COM* programs (supplied on the 5.25-inch *SCSI Support Disk*) will let you use Microsoft CP/M 2.20B (56K) and 2.23 (60K) with SCSI devices. Before you can do this you must first use *SCSI.COM* to modify Microsoft CP/M in memory.

5.25-inch drives

Modifying Microsoft CP/M has NO EFFECT on the normal use and operation of your 5.25-inch disk drives.

After Microsoft CP/M is modified you can use a maximum of two SCSI devices. Each device will provide a 1.5Mb capacity drive (any space above this will not be usable).

To modify Microsoft CP/M just run the *SCSI.COM* program. For convenience you can copy *SCSI.COM* to your ordinary Microsoft CP/M *System Master* disk, because every time you start up you MUST run the *SCSI.COM* program before you can use any SCSI devices.

After running the *SCSI.COM* program you can use your SCSI device in EXACTLY the same way as an ordinary disk drive, using *PIP.COM* (or an equivalent program) to transfer your programs.

- *CP/M 2.20B (56K)*

  After running SCSI.COM the first SCSI device can be accessed as drive "E:" (a second SCSI device will be drive "F:")

- *CP/M 2.23 (60K)*

  After running SCSI.COM the first SCSI device can be accessed as drive "C:" (a second SCSI device will be drive "D:").

As with any ordinary disk drive, you must format your SCSI device (by running *SCSIFORM.COM*) before you can use it.

How To Start Up From Your SCSI Device

You can start up from your SCSI device if you make it into a startup disk (if you have more than one SCSI device you can only start up from the "first" device, which is the SCSI device with the highest SCSI ID number).

With ProDOS, CP/M Plus, DOS 3.3 or Pascal 1.3 you can make your SCSI device into a startup disk in EXACTLY the same way as an ordinary disk. For full details of startup disks (sometimes referred to as *boot* disks) you must refer to the instruction manuals supplied with your operating system.

With DOS 3.3 the *INIT* command (which you use for formatting) will automatically make your SCSI device into a startup disk (you must refer to your *Apple II DOS 3.3 Manual* for full instructions).

DOS 3.3 Startup

If you start up from an ordinary DOS 3.3 disk you MUST run UDOS.LANG (or UDOS) to be able to use the SCSI interface.

With Microsoft CP/M you CAN'T start up from your SCSI device (because Microsoft CP/M was designed to work only with 5.25-inch disk drives) which means that you must always start up from your ordinary *System Master* disk, then run the *SCSI.COM* program.

BOOT.COM

This CP/M program (supplied on the *SCSI Support Disk*) will let you start up other operating systems from any slot. Just type "BOOT *s*" (*s* is the start up slot) then press Return.

To start up from your SCSI device you just type "PR#*s*" (where *s* is the SCSI interface slot) then press Return.