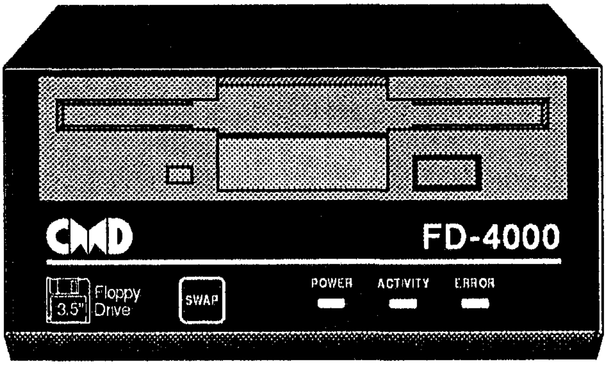
CMD

FD Series™

Disk Drives

User's Manual

For all FD Series Models



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Section 1
General Information

Introduction

The CMD FD-2000 and FD-4000 are 3.5 inch floppy disk drives which have been designed utilizing the latest in micro-floppy technology. While retaining backward compatibility with Commodore 1581 formatted diskettes (800K), these drives are also capable of utilizing high density (HD) disks for a storage capacity of up to 1.6 Megabytes. The FD-4000 model can also use the newer enhanced density (ED) diskettes for a storage capacity of up to 3.2 Megabytes.

In addition to emulating the standard Commodore 1581 disk format, the FD Series drives also operate as CMD *partitionable* devices. Users may create up to a maximum of 31 partitions (ED disk format), using a mixture of any of the supported disk/partition types. Partition types available include 1541, 1571, 1581 and CMD Native partitions. Both FD Series drive models will automatically determine if an inserted disk is in 1581 or CMD partitionable format, and special commands and utilities are provided to ease formatting, partitioning and copying.

Features

The FD Series drives contain a number of features in addition to those considered to be necessary for the operation of a disk drive system. Here is a short list of some of the features and options available:

- Compatible with Commodore DOS commands, GEOS, and CP/M
- Easy connection via the serial port
- Compatible with all serial modes and burst commands
- Built-in JiffyDOS compatibility
- Real Time Clock option available for time and date stamping of files
- Swap functions allow drive to become device 8 or 9
- Up to 31 separate partitions on a single disk (ED)
- 1541, 1571 and 1581 emulation partitions
- CMD Native mode partition support with true subdirectories

Orders

If you wish to place an order or need general information about any product available from us, you should call Monday through Friday 10:00 AM through 5:00 PM Eastern. If at all possible, call before 3:00 PM for fastest service. To place ORDERS call:

Continental US and Canada	(800) 638-3263 (Orders only)
All others	(413) 525-0023 (Questions/support)

You may also call this number during these hours if you have a problem with an order you placed with CMD. If you have a problem with an order which you placed with one of our dealers, you should contact the dealership.

Technical Assistance and Information

Technical information and assistance is available from 10:00 AM through 5:00 PM Eastern. If you are calling for technical assistance with a CMD product which you own, please have your serial number, model number, and any other pertinent information ready. The phone number to call is:

CMD Technical Support	(413) 525-0023

If you have programming questions, or your are in need of non-immediate technical assistance or information, you should contact CMD via mail. Alternatively, you may pose your questions in the appropriate CMD support areas located on Q-Link (CIN/Hardware Support Group) or GEnie (Commodore Flagship RT). CMD visits these areas regularly, and there are also many other users who may be able to assist you.

Bug reports or compatibility problems should be handled via mail, as they are rarely fixable via telephone, and usually require hard copy detailing your system configuration, the software involved, and a method to repeat the problem. We also enjoy hearing about any successes you have in using your drive with various types of software. Our mailing address is:

Creative Micro Designs, Inc.
P.O. Box 646
East Longmeadow, MA 01028

Section 2
Getting Started

Hookup

Before attempting to setup and begin using your drive, you should read this manual. It may not be necessary for you to read it completely, but you should at least browse through it and become familiar with the sections which pertain to you and your intended use of the drive.

If you have not yet removed your drive from its shipping carton, do so now. The shipping carton should contain the drive, a power supply, a serial cable and this manual. Place the drive in a well ventilated area on a level surface close to your computer and other peripherals. Be sure to keep the shipping carton in case you have any problems with the system and find it necessary to return your drive for service.

Connections

You may now connect your FD to your computer by using the included serial cable. This cable may be plugged into either of the connectors labeled SERIAL on the back of the drive. The other end of this cable may be connected to the port labeled SERIAL on the back of your computer, or if this connection is already being used by another disk drive or printer, you may connect it to an available serial port on one of these devices.

Next, connect the power supply to your drive by plugging the small DC power plug into its connector on the back of the drive.

Before plugging the power supply into an AC power outlet, make sure that the power switch on the drive is in the OFF (0) position. Now plug the supply into a suitable AC power outlet.

Powering Up

Your drive is now ready for use with your computer. Turn on the drive using the power switch located on the rear panel. Please note that when turning on your equipment, the order in which you activate each peripheral sometimes affects the computer's ability to recognize some devices. In this respect, your FD series drive may be turned on first, last, or at any point in between without harm to itself. Therefore, use the order which you are accustomed to, or which seems to work best for your system.

Powerup Diagnostics

When power is applied to your FD Series drive, an internal test is performed to make sure that the drive is working correctly. If a problem exists, the ERROR lamp on the front panel will indicate the error. If this should occur, try restarting the drive. If the problem persists, contact CMD Technical Support for assistance.

Device Number Configuration

FD Series drives are shipped with a device number setting of 10. This device number can be changed via a four position dip switch which is accessed though a cutout in the rear panel. If you wish to change the default to some other number, make sure the drive is turned off, then use the chart below to determine the settings for the device number you wish to configure the drive for. When considering what device number to use the drive as, be aware that the SWAP button on the front panel will allow you to swap the device number to 8 or 9 very easily for temporary requirements.

Device Number	Switch 1	Switch 2	Switch 3	Switch 4
8	Not Used	DOWN	DOWN	DOWN
9	Not Used	DOWN	DOWN	UP
10	Not Used	DOWN	UP	DOWN
11	Not Used	DOWN	UP	UP
12	Not Used	UP	DOWN	DOWN
13	Not Used	UP	DOWN	UP
14	Not Used	UP	UP	DOWN
15	Not Used	UP	UP	UP

You can use a small screwdriver, pen, etc. to move each switch to the appropriate position. If your FD does not respond to the proper device setting when you turn it on:

1. Shut the FD off and move each switch up and down a few times to remove any oxidation that might be on the switch contacts.

2. Reset the switches again according to the table above, and then try powering the drive up again.

Important: If you have a Xetec Super Graphix Gold printer interface, you should not configure your FD as device number 14.

Section 3
Using the FD

Before you Start

Before reading the following information, it is important to understand that your FD Series drive is a true Commodore-compatible disk drive. In other words, if you already own a 1541, 1571, 1581 or other Commodore-compatible drive, you already have the basic skills and knowledge required to operate the FD. This section shows you how to apply the already familiar concepts of disk drive operation to the FD, and briefly describes how to make use of some of the FD's unique and advanced features.

Modes of Operation

FD Series drives can operate in two basic modes: 1581 Compatible Mode and CMD Partitionable Mode. Even though the FD automatically knows which mode to use when a formatted disk is inserted, you should be familiar with each operating mode and its capabilities.

1581 Compatible Mode

As the name of this mode implies, your FD can emulate a Commodore 1581 disk drive. It can read and write disks that were created on a Commodore 1581 and can format 800K disks for use on a 1581. Your FD responds to all 1581 commands and can read all 1581 files and formats (including GEOS and CP/M) without the need for conversions.

CMD Partitionable Mode

The FD can format disks in a manner that provides storage capacity and flexibility far beyond that of the 1581 or any other floppy drive. On disks with a CMD *partitionable* format, you can break up the overall storage space into as many as 31 segments (partitions). This concept, which is already familiar to CMD HD, RAMLink and RAMDrive users, is similar to dividing a large disk into a number of smaller disks. CMD-formatted disks can store 800K, 1.6 Megabytes and on the FD-4000, 3.2 Megabytes.

Each partition on a disk is referred to by number (1-31), has its own directory, and is treated as if it were a separate disk. Your computer can "see" the directory, files and storage area of only one partition at a time – making partitions ideal for keeping different programs separate from one another. On a partitionable disk, you will work in one partition at a time (the *current* partition). The current partition is changed by sending a simple command and has the same effect as physically swapping disks on other floppy drives.

A CMD-formatted disk must have at least one partition for it to be usable. A partition can be as small as 256 blocks (64K) or as large as the entire disk (up to 3.2 Megabytes for an FD-4000 Enhanced-Density disk). Although the partitioning system can handle up to 31 partitions on a single disk, the number of partitions you can create is limited by the total storage of the particular disk and the size of the partitions you create.

There are a number of good reasons for making a large capacity disk partitionable. Some programs may take up very little space, or may contain a lot of filenames. Using partitions allows you to have separate directories for different programs or types of programs. Partitions can also be useful for quick backups or compatibility. There are two types of CMD partitions:

CMD Emulation Mode partitions

These partitions duplicate the storage and directory/BAM layout of 1541, 1571 and 1581 disks exactly. The main reason for using an Emulation Mode partition is software compatibility (some programs will only work from within a partition that emulates a 1541, 1571 or 1581 drive). A good example is the standard GEOS desktop, which will work on the FD only through the use of 1581 Emulation Mode partitions. The table below gives the number of blocks required to create each type of Emulation Mode partition, and the number of blocks free available in the directory.

PARTITION TYPE	BLOCKS REQUIRED	BLOCKS FREE
1541 Emulation Mode	684	664
1571 Emulation Mode	1368	1328
1581 Emulation Mode	3200	3160

CMD Native Mode partitions

CMD Native Mode partitions are the most flexible and powerful type of partition. Native Mode partitions can be as small as 256 blocks or as large as the entire disk and are defined in 256 block increments up to a maximum of 12,800 blocks (3.2 Megabytes). The directory and BAM of a Native Mode partition take up 64 blocks regardless of the partition's size. For example, a Native Mode partition that takes 256 blocks to create will show 192 blocks free, a 512 block partition will show 448 blocks free, and a 12,800 block partition will show 12,736 blocks free.

Native Mode partitions are ideal because you can tailor the size of the partition to the exact needs of a program and its files without wasting space or running out of room. Most programs can run from within Native Mode partitions; a notable example is CMD's gateWay desktop for GEOS. Native Mode partitions can also contain CMD's MS-DOS style subdirectories (an advanced topic explained in detail in a separate section).

Formatting Disks

Disk Types

FD Series drives are capable of formatting most of the available types of 3.5" micro-floppy diskettes. The chart below shows the supported disk types along with information on storage capacities. Please note that the ED disk type is only supported on the FD-4000 model.

DISK TYPE	DESCRIPTION	UNFORMATTED CAPACITY	FORMATTED CAPACITY
DD	Double-sided Double-density	1000K (1M)	800K
HD	High Density	2000K (2M)	1600K (1.6M)
ED	Enhanced Density (FD-4000)	4000K (4M)	3200K (3.2M)

Supported Disk Formats and Capacities

A Warning About Formatting and Disk Types

You should always use the correct format density for the disk type you are formatting. Other options may appear to work, but the results and reliability are not guaranteed, especially if you format disks at a higher density than they were manufactured for. You should also be aware that the FD-2000 will not format disks in ED (Enhanced Density).

Formatting Diskettes

The easiest way to format disks is to use the FD-TOOLS utility program supplied on the FD UTILITIES disk. The FORMATTING OPTIONS area in FD-TOOLS allows you to create any of a number of standard formats, and also provides options for custom formatting. The following paragraphs describe the two standard options for formatting the disks that will hold your Commodore programs and files.

1581 Compatible Format

The FD can format Double-Density 800K disks that are identical to those formatted on a 1581. To format a 1581-compatible disk in FD-TOOLS, select 'CBM' as the disk type. Note: disks that you want to use for CP/M should be formatted as 1581 compatible disks.

CMD Partitionable Formats

CMD partitionable formats let you take full advantage of the capacity and flexibility of your drive, and can be Double-Density 800K, High-Density 1.6M, or Enhanced-Density 3.2M (FD-4000 only). To create a disk with a CMD partitionable format in FD-TOOLS, first select 'CMD' as the format type. Next, select the desired density (800K/1.6M/3.2M). Finally, select the partition arrangement that you want to appear on the disk. There are three possible choices:

NATIVE This option creates a single CMD Native Mode partition that uses all of the available storage space, resulting in 3136 blocks free on 800K disks, 6336 blocks free on 1.6M disks, and 12736 blocks free on 3.2M disks.

1581 This option creates 1581 partitions on the disk. 800K disks will have one 1581 partition, 1.6M disks will have two, and 3.2M disks will have four. Each 1581 partition has 3160 blocks free.

NONE This option does not create any partitions on the disk, allowing you to create your own custom partition arrangement. Before you can use the disk, you'll have to use the PARTITIONING OPTIONS in FD-TOOLS to create at least one partition.

Write Protecting Disks

Your FD will detect the condition of the write protect 'window' on any disk inserted into the drive. If this window is open, the disk is write protected, and cannot be written to. You open or close the write-protect window by sliding a small plastic tab to the appropriate position. You can easily move the tab by using the point of a pen or a similar instrument.

It is important to note that the write-protect window on a 3.5" disk functions in a manner opposite to that of the write-protect tab on a 5.25" inch disk. That is to say, a 3.5" disk is write protected when its window is open, while a 5.25" disk is write protected when its window is closed (write-protect tab on).

There is also a set of software commands which can be issued to write protect an FD disk from within your own programs. For further information on these commands, see the Command Reference section of this manual.

Partitioning Disks

FD-TOOLS allows you to tailor the partitioning arrangement of CMD-formatted disks to suit the needs of the particular programs that you use. The default partitioning options (NATIVE, 1581, and NONE) discussed in the previous paragraphs for CMD-formatted disks are not permanent and may be changed at any time. By using the PARTITIONING OPTIONS in FD-TOOLS, you can view a list of the existing partitions on a disk, delete unwanted partitions, create new partitions, set the default partition, and format (NEW the directory) of a partition.

Note: In FD-TOOLS, partition sizes are always displayed in 'blocks'. Each block is 256 bytes in size; therefore four blocks is equal to 1K of storage.

Viewing Partitions

The VIEW PARTITION TABLE option enables you to see a list of the partitions that currently exist on a disk. The partitions are listed by their number, name, size and type.

Setting The Default Partition

If you have more than one partition on a CMD-formatted disk, you will want to define the *default* partition by using the CHANGE DEFAULT PARTITION option. The default partition is the partition that the computer "sees" whenever that disk is inserted in the FD. As an example, you might have a disk with Partition 1 containing a database program and Partition 2 containing your wordprocessing program. If you use the wordprocessing program 90% of the time, you would want to set Partition 2 as the default partition so that you would automatically be in the wordprocessing partition each time the disk is inserted. In order to use the database program, you would issue a 'Change Partition' command after inserting the disk.

Each disk has its own default partition. Note: Whenever you create a CMD-formatted disk, the default partition is set to Partition 1.

Creating Partitions

The CREATE PARTITIONS option allows you to create one or more partitions on a CMD-formatted disk. For each partition you create, you must select a number, name, and type (1541, 1571, 1581 or Native). If you choose to create a Native Mode partition, you will also have to specify a size in increments of 256 blocks.

Note: Once you create a Native Mode partition, you cannot increase or decrease its size without deleting the partition entirely first.

Please note that the number of partitions you can create is always limited by the amount of available storage on a particular disk. In addition, if there is little free space remaining on a disk, the type of partitions you can create may also be limited (for example, if only 400 blocks remain, you will only be able to create a 256-block Native partition). An INSUFFICIENT SPACE AVAILABLE message means that you will not be able to create a new partition until at least one existing partition has been deleted.

Deleting Partitions

The DELETE PARTITIONS option allows you to delete one or more partitions on a CMD-formatted disk. When you delete a partition, it is removed from the disk's partition table and any programs or data in that partition are lost. Deleting a partition will free up space which can then be used in the creation of new partitions. Note: If you wish to delete all the partitions on a disk, use the DELETE ALL PARTITIONS option instead.

Deleting a partition may take some time (up to 15 minutes), because any remaining partitions located above the one being deleted must be moved down to fill in the vacated space. In addition, if a disk error occurs while you are deleting partitions, there is a risk that information in one of the remaining partitions could be corrupted. Therefore, you should not delete a partition until you have backed up all valuable data on the disk.

Formatting Partitions

The REFORMAT PARTITION option allows you to 'NEW' the directory of a partition on a CMD-formatted disk without destroying information in any of the other partitions that reside on the same disk. This can be useful when you want to quickly 'clean out' a partition in order to use it for a different program or set of files.

Copying Software to the FD

Two programs are supplied that you will use almost exclusively to copy programs and data files to your FD:

FCOPY is a file copy program that will copy all types of files (except GEOS files) between any FD partition and any type of drive. You should always try to copy software to the FD by using FCOPY, as it will allow you to place your programs and data files into the powerful and flexible Native Mode partitions.

MCOPY is a full disk copier that makes a mirror image copy of every sector on a disk. Because it copies a disk by sectors, MCOPY can only copy between drives and partitions of the same type (i.e. between a 1541 disk drive and a 1541 Emulation Mode partition, a 1581 drive and a 1581 partition, etc.). MCOPY is most useful for copying programs that are dependent upon the exact track and sector layout of a Commodore disk drive to run properly.

FCOPY and MCOPY both incorporate the same menus and command keys that make it easy to select the drives and partitions that you will be copying to and from.

Software without copy-protection

Software which is not copy-protected can almost always be installed directly on the FD. With these programs the main concern is usually which type of partition to use. The best way is to start with a Native Mode partition, and then copy all the files from the program disk to that partition by using FCOPY. You should then try to run the program (see the instructions given a few pages ahead in the section titled "Running Programs"). Note: Some C-128 programs can only be loaded by autobooting after powerup or reset.

These types of programs will require you to copy the boot sector to your FD partition by using FCOPY's 'COPY C-128 BOOT SECTOR' function.

Some software, even though it contains no copy-protection, will only work with a certain type of drive and should be placed in an Emulation Mode partition. Use FCOPY and work your way 'downward', trying a 1581 partition first, then a 1571, and finally a 1541 partition. If the software will still not work, all is not lost, as there may be some 'hidden' data on the program disk which cannot be duplicated with FCOPY. In this case, use MCOPY to copy the entire disk to a partition of the same type.

If the program still does not work, it is probably performing some very drive specific tasks or may use an incompatible fast loader routine. Certain fast loader routines may have to be disabled in order to get software to work with the FD (a good example is the fast loader built into CMD's Stereo SIDplayer software).

Multiple Disk Programs

Some programs are distributed on a number of disks. In many cases, simply copying all the files from each of the disks into a single partition using FCOPY will allow you to use this type of program on the FD. Watch out for file names which are the same when copying these types of disks. These files may or may not be identical.

If some of the information for a program is stored directly on the disk without a file name, or the disk name is checked to determine if the correct disk is being used, it will be necessary to use MCOPY to copy the disks to partitions. However, you may only be able to use one of the disks in the set if there is no provision in the program for sending a CP (Change Partition) command to the FD before a disk swap is required.

Other Solutions

Some software expects to find the disk directory in a certain place on the disk. Normally this kind of software can be operated using an emulation mode partition of the required type. It may also be possible for this software to be operated in a Native Mode subdirectory which has been specially created to simulate the directory of a 1541 or 1581 disk drive. These types of subdirectories can be created in an empty Native Mode partition which has the required number of tracks by using the 1541SUB and 1581SUB utilities supplied with the FD (see Appendix A for more information).

Copy-Protected Software

Normally, copy-protected software cannot be placed directly onto the FD. You may, however, be able to copy some of the more mildly protected programs by using MCOPY. If a program still will not load from the FD, you can try to copy only the data files to the FD with FCOPY, and then load the program initially from the usual boot disk. After the program stops loading (and is past checking the copy-protection) you could press the SWAP 8 switch to substitute the FD in place of the boot drive. Any subsequent disk access will be directed to the FD.

One last method to try is to use a memory capture type of cartridge to save the program as an unprotected file. There are also some copy utilities which will remove protection from programs by using a parameter disk. This is also a good method for making bootable copies of protected software. Be aware that not all parameters will remove copy protection; many make exact copies with the protection still intact.

GEOS, gateWay and CP/M

Please refer to Sections 4 and 5 for information on how to use the FD with these programs.

1581 Compatible Software

Overall, the FD has proven to be more compatible with commercial productivity software than the 1581. This is due mainly to the FD's ability to emulate the exact track and sector layout of 1541 and 1571 disks through the use of CMD's emulation mode partitions. FD compatibility with 1581 programs follows three general rules:

1. Any 1541- or 1571-based program that can be successfully copied to the 1581 will work on the FD.

2. Many programs that rely on 1541/1571-specific track and sector layouts that do not work on the 1581 will work on the FD through the use of 1541 and 1571 emulation mode partitions.

3. A very small number of programs that access the 1581 Floppy Disk Controller chip directly, or use undocumented routines in the 1581 ROM will not work on the FD. These programs are listed below:

1581 Software Incompatibilities

1. RUN's 1581 GEOS Bootmaker. Use CMD's GeoMakeBoot instead.

2. Big Blue Reader MS-DOS FORMAT PROGRAM (V4.0 or earlier). Use a later version of Big Blue Reader instead.

3. 1581 TOOLKIT. Use Super 81 Utilities, MCOPY, or FCOPY instead.

4. MAVERICK. Use Super 81 Utilities, MCOPY, or FCOPY instead.

Popular Programs that work on the FD

CMD has successfully tested the following programs with the FD. Please note that this is by no means a complete list – we have included only the most popular programs with the most appeal to the majority of FD users.

Bible Search from SOGWAP
Big Blue Reader 64 & 128 V4.0
Bobsterm Pro
Compute's SIDplayer
CP/M
Desterm 128
Fleet Filer 64 & 128
Fleet System IV
Flexfile 128
gateWay 64 & 128
GEOS 64 & 128 V2.0
Multiplan V1.07 (FD as data drive)
Paperclip III
Pocket Series (FD as data drive)
Practicalc 64
Stereo SIDplayer
Super 81 Utilities 64 & 128
Super Snapshot Cartridge V5
Superbase V3.01
Superscript
Swiftcalc 128
Sylvia Porter's Personal Finance
Word Writer 64 & 128
WordPro 128

Loading and Running Programs

As with any disk drive, the method you use to load and run a program will vary according to the particular program. To load a program from the FD, you will use the same method as you did with your 1541, 1571 or 1581 drive (for example, LOAD"*",8,1). However, you may have to perform one or two preliminary steps before the program can be loaded from the FD.

Changing Partitions

If your FD disk has more than one partition on it, and if the program you are trying to load is not in the currently selected partition, you will have to change the current partition before loading the program. To change the current partition, you will use the CP (Change Partition) command. For example, if the program you want to load is in Partition 2, enter the following command:

```
OPEN 15,dv,15,"CP2":CLOSE15
```

JiffyDOS users can instead select the FD as the default device and then enter:

```
@CP2
```

Remember to substitute 'dv' with the FD device number in the example above. To verify that you are in the correct partition after you have sent the CP command, you can view the current directory of the FD by entering:

```
LOAD"$",dv
LIST
```

JiffyDOS users can instead press f1 to view the directory.

If you do not remember which partitions are on a particular disk, you can view the partition directory by entering:

```
LOAD"$=P",dv
LIST
```

JiffyDOS users can instead enter:

```
@$=P
```

You will see a list of the partitions on the disk showing each partition's number and name. The list should remind you which partition the particular program is in. The first partition in the list will always be the System Partition. Please note that the System Partition is used exclusively by the FD to store system information and cannot be used to hold your files or programs.

Swapping Device Numbers

Many times a program can only be loaded from device 8 or 9. If your FD is normally set to another device number (15 for example), you can still easily load these programs by using the front panel SWAP function. Press SWAP once to make the FD device 8, twice to make it device 9, and three times to change back to the FD's original device number. The ACCESS and ERROR lamps will stay on for about three seconds to indicate when an FD has been swapped to device 8 or 9. The following chart shows how the FD Series drives react to presses of the SWAP button.

NUMBER OF TIMES SWAP IS PRESSED	FD BECOMES DEVICE	ACCESS LAMP	ERROR LAMP
1	8	ON	OFF
2	9	OFF	ON
3	DEFAULT	ON	ON

As an example, assume your FD is device 15, you have a 1541 that is device 8, and the program you want to load from the FD needs to load from device 8. Before loading the program, you would press SWAP once. This will make the FD become device 8 and will swap the 1541 to device 15. You can then load the program in the normal manner. After you have finished using the program and want to use your 1541 as device 8 again, press SWAP three times.

The SWAP function can also be useful even if a copy-protected program cannot be loaded from the FD. A good example is the Pocket Writer wordprocessor program. In this case, you would first load Pocket Writer from your 1541 or 1571 (device 8) and then SWAP the FD to device 8 after the program loads. This allows you to use the FD to store Pocket Writer documents and program overlay files.

SWAP can also be used even if you do not already have a device 8 or 9 on the serial bus. In this case, the FD simply becomes device 8 or 9 without affecting any other devices on the bus.

Things to remember about device swapping

1. When first powering on or resetting a C-64 (or entering C-64 mode on a C-128), the serial bus must be cleared before the SWAP functions can be used. This can be done by performing any disk access (such as LOAD"$",8) or by the command POKE 56576,199.

2. When GEOS is active, the SWAP function cannot be used. This is because GEOS is always controlling an active handshake with the current drive on the serial bus. In any case, swapping device numbers after GEOS has booted would not be recommended because GEOS assigns a different device driver to each type of drive. Therefore, the proper time to swap device numbers when using GEOS is *before* booting.

3. NEVER press the SWAP button while a drive on the serial bus is being accessed. Doing so invites the possibility of locking up your computer. A rule-of-thumb to apply before pressing the SWAP button is to make sure that none of your drive activity lights are on, and that the program you are using is not processing data at the time. (A good time to swap device numbers is while a program is waiting for user input).

C-128 Autoboot Programs

Certain programs for the C-128 can only be loaded by autobooting after your computer has been turned on or reset. After turning on your computer, you may need to perform one or more of the following steps in order to get such programs to load.

1. If your FD is not device number 8, press SWAP once in order to make it device 8.

2. If the program you want to load is not in the current partition, enter the 'CP' command in order to change the current partition (see Changing Partitions above).

3. To load the program, type the following command and press Return:

```
BOOT
```

Backing up Disks and Files

Once you start using your FD, you will want to back up the disks and files that you create in order to protect against their loss due to an accident or a disk that becomes defective. In addition, CMD Hard Drive, RAMLink and RAMDrive owners will want to use their FD to back up the data from their other CMD devices. There are three programs you can use to back up data: FCOPY, MCOPY and BCOPY. The following paragraphs give a general explanation of how these programs can be used to back up data. More detailed instructions on their use are given in Appendix A.

FCOPY

FCOPY is useful for backing up data on a file-by-file basis. With FCOPY you can copy the files you create on your FD to another disk drive or storage device (1541, 1571, 1581, CMD HD, RAMLink or RAMDrive). If you have the Real-Time Clock Option installed in your FD, you can use the time and date stamp on files to back up only those that have been modified since your last backup. Please note that GEOS files cannot be copied by FCOPY, and must be backed up to another disk from within GEOS or gateWay.

MCOPY

MCOPY allows you to make a copy of an entire partition to another disk drive of the same type. For example, a 1541 Emulation Mode partition can be copied to a 1541 disk, a 1571 partition to a 1571 disk, and a 1581 partition to a 1581 disk. If you own another CMD device (HD, RAMLink, RAMDrive, or another FD), you can also copy the contents of a Native Mode partition to another Native Mode partition that is the same size or larger. 1541, 1571 and 1581 partitions on your FD can also be copied to other CMD devices providing that the same type of partition exists on the other device.

BCOPY

BCOPY allows you to copy an entire FD disk or the contents of selected partitions to any other type of floppy disk drive (1541, 1571, 1581, or another FD). If you own another CMD device (HD, RAMLink, RAMDrive, or another FD), you can also use BCOPY to back up that device to your FD. The number of floppy disks required to back up a particular partition or disk depends on the size of the partition or disk that you want to back up and on the type of the backup drive. For example, an entire 1.6 Megabyte FD disk can be backed up on ten 1541 disks, five 1571 disks, or three 1581 disks.

Because BCOPY backs up a complete image of a partition or disk by sectors, it will restore only the entire partition or disk when called upon to retrieve a backup (BCOPY cannot selectively restore individual files).

Real Time Clock Option

The following paragraphs describe the functions and benefits of the FD's optional RTC (Real Time Clock) module.

Setting the RTC

When you first get your FD, you should set the RTC to the proper time and date by using the 'Set Real Time Clock' option in `FD-TOOLS` (see Appendix A for details). Programmers should note that software commands can also be used to set the RTC (see the Command Reference section). Because the RTC is battery-backed, you will not need to set it again unless seasonal time changes occur (Daylight Savings/Standard Time). The normal life of the battery is from 2 to 5 years. Note: Because the battery is an integral part of the RTC module, the entire RTC must be replaced when the battery wears down to the point where it cannot retain the proper time.

Viewing the Current Time

The current time as kept by the RTC can be viewed by using the 'Set Real Time Clock' option in `FD-TOOLS`. Alternatively, a short BASIC program can be run which issues the FD's 'T-RA' command:

```
10 OPEN15,10,15,"T-RA"
20 GET#15,A$:T$=T$+A$:IFST<>64THEN20
30 PRINT T$:CLOSE15
```

As a shortcut, JiffyDOS users can issue the following command:

```
@"T-RA":@
```

Programmers: See the Command Reference for RTC command details.

Viewing Time and Date Stamped Directories

The time and date stamp that the FD applies to files can be viewed by entering the following commands:

```
LOAD"$=T",10
LIST
```

JiffyDOS users can enter the following shortcut:

```
@$=T
```

Setting the GEOS Clock from the RTC

Whenever you boot GEOS, the RTC in your FD can automatically set the GEOS clock to the proper time and date. See 'Using the FD with GEOS' for detailed instructions on how to use this function.

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Section 4
Using the FD with GEOS

Before you Begin

This section will provide you with the information you need for getting your FD operating under GEOS V2.0 with either the standard GEOS desktop or with CMD's gateWay. We assume that you already use GEOS and are familiar with its operation. Therefore, you should not start into this section if you are booting GEOS for the very first time.

Using the FD with the GEOS Desktop

Under the standard GEOS V2.0 desktop (64 or 128), your FD will function almost identically to a 1581. In fact, through the use of CONFIGURE, you will tell GEOS that the FD actually is a 1581. Multiple partitions are accessible through the use of the CMD_MOVE utility, and your FD will be able to automatically set the GEOS clock if have the Real Time Clock option installed.

> Important: The FD will only work with GEOS V2.0. It will not work with earlier versions of GEOS. Contact Berkeley Softworks (GEOWorks) if you need to upgrade your GEOS to V2.0.

Device Numbers

GEOS utilizes devices numbered 8, 9 or 10, and uses device number 11 temporarily for drive swapping. Therefore, your FD must be set to device 8, 9 or 10 before you boot GEOS (you can use the SWAP function if you wish). In addition, you should not have any drives configured as device 11. Another note: GEOS expects devices to be consecutive. For example, on a system with a single 1541 floppy drive attached as Drive A (device 8), your FD should be configured as Drive B (device 9) - *not* as Drive C (device 10).

Formatting Disks

Since the GEOS desktop can only recognize 1581 partitions on the FD, you should consider formatting the disks you want to use under GEOS with either one, two, or four 1581 partitions (on 800K, 1.6M and 3.2M disks respectively). Use the FD-TOOLS program supplied on your FD Utilities disk to format and partition the disks you want to use under GEOS.

Note: Selecting the *format* option in GEOS will format (NEW) only the current partition on your FD. It will leave any other partitions that may be on the disk untouched. However, if the disk you insert in your FD is unformatted, or is an 800K 1581 disk, choosing the *format* option will cause the disk to be formatted as an 800K disk. Therefore, if you want to use 1.6M or 3.2M disks under GEOS, you must format them outside of GEOS by using FD-TOOLS.

Configuring the desktop

To get your FD working under GEOS, boot GEOS with your FD attached and configured with a valid GEOS device number (see above for proper device number settings). When the DeskTop comes up, it is not likely that you will see any additional drive icons associated with your FD. To get your FD to show up on the DeskTop:

1. Double click on the CONFIGURE icon. After a short pause, the CONFIGURE application screen will open showing three or four boxes labeled 'Drive A', 'Drive B', 'Drive C' and 'RAM expansion:'.
2. Find the first box (using A, B and C as the logical order) which does not have a drive selected. This will usually be Drive B on a system that has one drive besides the FD, or Drive C on a system with two drives besides the FD.
3. Select the *1581* option.
4. Select *save configuration* from the *file* menu.
5. Your FD is now installed and ready for use under GEOS. Select *quit* from the *file* menu and begin using your FD.

Using Partitions

The ability to use more than one partition on an FD disk presents some important advantages under GEOS. In particular, it allows you to organize your applications and files more efficiently. An individual partition can be dedicated to a single application and its support files. For example, one partition may be dedicated to geoPublish with associated applications and clip art. Another might contain a complete applications development environment with another containing word processing or graphics.

In order to access more than one partition on the FD, you will need to use the CMD_MOVE utility supplied on the FD Utilities disk. CMD_MOVE is launched from the desktop and allows you to change the current FD partition and can also be used to copy files between partitions. Because CMD_MOVE must be launched from the current FD partition, a copy of CMD_MOVE and the DeskTop should be kept in each partition that you use under GEOS.

Complete instructions on the use of CMD_MOVE are given later in this section.

Notes for 1581 Owners

If you own a 1581 drive, you will be able to use your 1581 GEOS disks in the FD if you wish. You should note, however, that you will not be able to boot GEOS from your FD with a 1581 GEOS boot disk. See the following paragraph for instructions on how to create a GEOS boot disk on your FD.

Making a Boot Disk

To place a bootable copy of GEOS on an FD disk, you will need a separate utility program. The one we recommend is CMD's *geoMakeBoot*. Instructions are provided with this utility that explain the steps required to make the actual FD boot disk. geoMakeBoot can also be used to create boot disks or partitions for other GEOS-compatible devices, such as the 1581, CMD Hard Drive, RAMLink or RAMDrive.

Warning: Most other 1581 GEOS bootmaker programs, such as Maverick and RUN's 1581 Bootmaker will not work with the FD.

Automatically Setting the GEOS Clock

If you have the optional Real Time Clock installed in your FD, you can automatically set the GEOS clock to the proper time whenever you boot GEOS. To do so, use GEOS to copy the `CMDTime` autoexec utility from the FD Utilities disk onto your GEOS boot disk or partition. Then, whenever you boot GEOS from that disk or partition, `CMDTime` will automatically read the correct time and date from the FD's RTC and set the GEOS clock accordingly.

Using the FD with gateWay

CMD's *gateWay* is a replacement desktop for GEOS that streamlines the standard desktop functions and enables you to utilize the full capabilities of the FD under GEOS. Under gateWay, you can use both 1581 and Native Mode partitions and can also create subdirectories within Native Mode partitions.

With gateWay, moving between partitions on your FD is as easy as selecting a menu item. If you have the Real Time Clock option installed, gateWay will automatically set the GEOS clock each time you boot up without the need for an autoexec utility.

Important: You will need gateWay V2.5 or higher in order for you to use the FD with gateWay. If you have an earlier version of gateWay, contact CMD or your dealer for gateWay upgrade details.

Device Numbers

To use your FD with gateWay, set the device number to 8, 9 or 10 (you can use the SWAP function if you wish). In addition, you should not have any drives configured as device 11.

Formatting Disks

gateWay can recognize both 1581 and Native Mode partitions on the FD. Use the `FD-TOOLS` program supplied on your FD Utilities disk to format and partition the disks you want to use under gateWay.

Note: Selecting the *format* option in gateWay will format (NEW) only the current partition on your FD. It will leave any other partitions that may be on the disk untouched. However, if the disk you insert in your FD is unformatted, or is an 800K 1581 disk, choosing the *format* option will format the disk as 800K. If you want to use 1.6M or 3.2M disks under gateWay, you must format them outside of GEOS by using `FD-TOOLS`.

Installing the FD Device Drivers

Four new gateWay drivers are included on your FD Utilities disk: `FD1581`, `FD1581_128`, `FDNative`, `FDNative_128`. The FD1581 drivers allow you to use 1581 Emulation partitions, while the FDNative drivers allow you to use Native Mode partitions (only one partition type can be used at a time). Before you can use the FD with gateWay, you will have to copy the driver(s) you need from the FD Utilities disk to your gateWay boot disk.

> Important: Even though you may already have FD drivers on your gateWay V2.5 disk, you should replace them with the ones supplied on the FD Utilities disk. This guarantees that you will be using the most up-to-date versions of these drivers.

To install the FD disk drivers:

1. Make sure your FD is shut off or not attached to the serial bus.
2. Boot gateWay from your normal boot drive.
3. Place a copy of the `CBM1581` driver on your boot disk in the position where the FD will show up later on (position 1 for drive A, position 2 for drive B, and position 3 for drive C).
4. Shut down gateWay, and connect and/or turn on your FD. Make sure your FD is configured with the proper device number.
5. Boot gateWay again from your normal boot drive. Your FD should show up on the desktop
6. Insert the FD Utilities disk into your FD and copy the FD disk drivers onto your boot disk (remove `CBM1581` if you do not have a 1581).
7. Shut down gateWay, then reboot and begin using your FD.

Changing Partitions

You can change partitions from within gateWay by using the *open partition* option on the *special* menu. Another method is to close the filePad of an FD partition, which causes gateWay to display a list of the available partitions on the disk (Native Mode partitions must be in the root directory for this to happen). Note: Your FD must be the currently active drive in order for you to change partitions.

Using Subdirectories

Subdirectories can be created within Native Mode partitions on the FD by using the gateWay document `MakeDir`. Subdirectories show up on the filePad as a folder, and are entered by double-clicking on the folder. You exit a subdirectory by closing the filePad, at which point you are "dropped back" to the parent directory that contains the subdirectory.

The `Bordercross` document lets you define up to 8 files that will appear in every subdirectory of a Native Mode partition. This gateWay document places up to 8 files into the off-page directory block which is automatically appended to every subdirectory in a partition, thus giving access to those files no matter which subdirectory you are in. The most often realized benefit of this feature is to save you the time, trouble and space required to place a copy of gateWay into every subdirectory you create.

It is important to note that files can only be copied into a subdirectory from another drive - they cannot be copied from another subdirectory or partition on the FD by using `CMD_MOVE`.

Making a Boot Disk

To make a gateWay boot disk on your FD, first copy all of the files on your present boot disk along with a copy of `MakeBoot` into the desired FD partition. Next, make your FD the active drive and launch `MakeBoot` from the FD. After `MakeBoot` finishes creating the new boot files, you will be able to shut down and reboot gateWay from your FD.

Automatically setting the GEOS Clock

If you have the optional Real Time Clock installed in your FD, gateWay will automatically set the GEOS clock to the proper time and date whenever you boot. Note: You must have an FD disk driver file in one of the first three positions on your boot disk in order for the automatic clock setting function to operate.

Using CMD_MOVE

CMD_MOVE has two basic functions. It allows you to change partitions on the FD (and other CMD devices) and also allows you to copy files from one partition to another.

Changing Partitions

To change partitions using CMD_MOVE :

1. Launch the CMD_MOVE application.
2. Use the DRIVE button to select the FD.
3. Select a partition from the list and click on the OPEN button.

The program will move to the selected partition and quit. Make sure you have a copy of the DeskTop or gateWay file in any partition you wish to use, or the system will prompt you to insert a disk containing that file.

Copying Files Between Partitions

To use CMD_MOVE to copy files from one partition to another:

1. Launch the CMD_MOVE application.
2. Select the FD by using the DRIVE button.
3. Select the source partition from the list and click on the FILES button to see the files in that partition (if you don't see the files you want to copy, you may click on the PDIR button to return to the partition directory to select a different partition).
4. Select the files that you wish to copy. You select any single file by clicking once on its name. Selected files are shown in reverse print. You can de-select a selected file by clicking on its name once again. You can also select or de-select a group of files by dragging the pointer over the filenames while the button is depressed. You will also see a number of option icons near the bottom of the requestor box. These options are (from left to right): De-select All, Select All, Move to Bottom of List, Move to Top of List, Scroll Down one Page, Scroll Up One Page, Scroll Up one File, Scroll Down one File.
5. When you are done selecting files, click on the OK button. Next, select the destination partition from the list and click on the OPEN button to start the copy process.

After the copy process is complete, you may repeat these steps to copy files into other partitions, use the QUIT button to exit to the last partition selected (the destination partition), or select a different partition to exit to from the list and quit to that partition by using the OPEN button.

Section 5
Using the FD with CP/M

Before you Begin

This section will provide you with the information you need for getting your FD operating under CP/M. We assume that you already use CP/M and are familiar with its operation. Therefore, you should not start into this section if you are booting CP/M for the very first time.

What you will need

You will need the following items in order to use the FD with CP/M:

- Commodore C128 or C128D computer
- CP/M system disk (May 1987 version or later)

> Important: The FD, like the 1581, will only work with CP/M versions dated May 1987 or later. It will not work with earlier versions. You can check which version you have by booting CP/M and noting the date which appears in the sign-on message. Contact Commodore if you need to upgrade to a later version of CP/M.

How the FD operates under CP/M

Under CP/M, your FD will operate exactly like a 1581. In fact, as far as the CP/M system itself is concerned, the FD *is* a 1581. Because the FD is recognized as a 1581, you can presently use only 800K disks in your FD under CP/M (1.6M and 3.2M disks will not work properly). CMD is currently looking to third parties for a driver or patch that will enable the use of 1.6M and 3.2M disks under CP/M. Therefore, it is possible that you will be able to use the larger formats with CP/M at a later date.

In case you were wondering: You cannot use multiple 1581 partitions on 1.6M and 3.2M disks under CP/M. Although using multiple partitions is possible on CMD Hard Drives, it cannot be done on the FD because CP/M burst commands that access physical sectors on the FD are not translated into corresponding logical sectors within the current partition. This was done to facilitate a simple, future modification of CP/M that will allow the use of the full storage of 1.6M and 3.2M disks.

If you happen to own a 1581, you will be able to use your 1581 CP/M disks in the FD. You can also boot CP/M from the FD by using a 1581 boot disk.

Using CP/M

Please read the following paragraphs before using the FD with CP/M.

Device Numbers

You must set your FD as device 8, 9, 10 or 11 for use under CP/M. Note: If you are using the FD for the first time with CP/M, you will want to configure it with a device number from 9-11. This is because you will be booting CP/M from your usual drive which must be set to device 8.

Starting up

When using CP/M for the first time with the FD, boot from your usual drive (i.e. 1571 or 1581). Once CP/M has booted, it should be able to recognize the FD when you enter the FD's drive letter (A:, B:, C:, or D:).

Formatting Disks

Before you can use the FD to store CP/M files, you must format a disk by using the CP/M FORMAT program. Load the format program from a drive other than the FD and then select the FD as the target drive. Next, insert a disk and format it. Note: Because the FD is recognized as a 1581 by the format program, you will select 'Commodore 1581' as the disk type. The CP/M format program will format the disk with 800K storage.

> Important: DO NOT reformat a disk that has already been formatted as a CMD Partitionable disk (see Section 3). Use only blank unformatted disks or disks with a 1581 Compatible format. If you do reformat a CMD Partitionable disk, you will not be able to boot CP/M from it.

Booting CP/M from the FD

In order to boot CP/M from your FD, you will first need to format a boot disk from within CP/M (see the previous paragraph). Prior to booting CP/M, you must make sure that your FD is configured as device number 8 (CP/M will not boot from any other device). There are two methods of booting CP/M depending on how your FD is configured:

1. If your FD is "hard-set" to device number 8 by means of the rear panel DIP switches, you can boot CP/M by inserting the boot disk in the FD and then turning on your computer or pressing the reset switch.

2. If you FD is hard-set to some other device number besides 8, you must first turn on your computer and wait for the BASIC sign on screen and cursor to appear. You then use the SWAP switch on the FD's front panel to set the FD device number to 8. Next, insert the CP/M boot disk in the FD and enter the command BOOT to begin loading CP/M.

Section 6
Partitions and Subdirectories

Introduction

Partitions and subdirectories are two of the FD's most powerful features. They allow you to effectively organize the large amount of storage space available on FD disks. Although you can use your FD without having any in-depth knowledge about partitions and subdirectories, at some point you will most likely want to become more familiar with them in order to use your FD most effectively. This section details the concepts behind CMD partitions and subdirectories and describes some of their benefits and possible applications. After reading this section, you should have a good idea of what partitions and subdirectories are and what they can do for you.

Partitions

The entire storage area of an FD disk may be divided into a number of smaller areas called *partitions*. While this term is very common to users of larger computer systems, it may be new to many users of Commodore computers. Simply stated, the use of partitions on an FD disk gives the appearance of using a number of separate disks, all located within the same physical device. In all, your FD can handle up to 31 of these partitions. For an FD disk to be partitionable, it must be formatted as a *CMD partitionable disk*. CMD partitionable disks can be created by using FD-TOOLS, or through the use of DOS commands described in the Command Reference section of this manual. Partitions are created and deleted using `FD-TOOLS`. Each partition can be one of two types:

Native Mode
Emulation Mode

Native Mode Partitions

Native Mode partitions allow you to take full advantage of the many additional features provided by CMD's FD DOS (FD Disk Operating System) while retaining full compatibility with all standard Commodore DOS commands. This type of partition can access up to 16 Megabytes of storage space, thus allowing you to create partitions which can access the full storage of 1.6 or 3.2 Megabyte disks. Since Native Mode partition size is variable and may also be as small as 256 blocks, it allows you to use only the amount of storage which you feel is required for a particular partition. This mode is also the only mode which supports true subdirectories and dynamic allocation of directory space. This means you can easily organize your files and continue to add files until no free blocks remain in the partition.

Native mode partitions have 256 logical sectors (blocks) per logical track, and may have from 1 to 255 total tracks. Since the size is variable, all header, BAM, and directory information must be stored on track 1. Subdirectories have a file type of DIR and have a filetype value of 6.

Emulation Mode Partitions

Emulation Mode partitions allow you to retain compatibility with software programs which require the tracks and sectors of a disk, as well as the BAM and directory, to be laid out in the same way as on a particular type of Commodore floppy disk drive. For this reason, an Emulation Mode partition has a fixed storage capacity equal to the capacity of the disk drive that it is emulating. There are three types of Emulation Mode partitions available on the FD. They are:

1541 Emulation Mode
1571 Emulation Mode
1581 Emulation Mode

As the names imply, these partitions emulate Commodore's popular 1541, 1571 and 1581 disk drives. This is accomplished by utilizing the same track and sector layout as the type of disk drive being emulated. The BAM and directory areas of these partitions are also located in the same blocks as they would be on the emulated drive. Even the internal job queue codes and locations have been duplicated. Other similarities (and a few beneficial differences) have been created within the emulation mode partitions. It is important to note that emulating these other disk drives fully in the areas of hardware and firmware mapping would have driven the cost of the FD to an unreasonable level, and was therefore not attempted. All other aspects of compatibility were carefully scrutinized, and incorporated where feasible. The following paragraphs describe each of the individual emulation modes.

1541 Emulation Mode Partitions

In 1541 Emulation Mode partitions the directory and BAM are found in the same locations as they are on the Commodore 1541. All bytes within these blocks have been defined identically to their counterparts on the 1541, including the BAM bytes. This type of partition uses 684 blocks on an FD disk, of which 664 are free for user data or programs.

1571 Emulation Mode Partitions

1571 Emulation Mode partitions are identical to 1541 Emulation Mode partitions with only a few differences. First, 1571 partitions have twice as much storage capacity as do the 1541 partitions. This type of partition uses 1368 blocks of disk space, of which 1328 are free for user data or programs.

There are also a number of extra bytes required for the BAM in the header block and on track 53. These have been allocated in the same fashion as they are on the standard 1571 disk drive. Also, 1571 partitions are always equivalent to the double-sided version of the 1571. If for some reason you need to emulate a single-sided 1571 disk, the 1541 partition is fully capable of doing this and should be used instead.

1581 Emulation Mode Partitions

1581 Emulation Mode partitions provide emulation of the header, BAM, and directory information of the 1581. All standard DOS commands are fully implemented, including 1581 style partitioning commands. In order to retain full compatibility with the 1581, the DOS initialize command initiates a change in the current 1581 partition status, causing further accesses to be performed in the root directory of the 1581 partition.

Current Partition

Partition 0 (zero) has a special meaning under FD DOS. It is used to indicate the current partition (the partition in which is currently active). This insures compatibility with software which issues a "0:" within filenames or disk commands. Before attempting to use most commercial software with the FD, it is usually wise to first select the partition you wish to use. This will assure that any further file access will occur within that partition, especially if the software does not allow you to send disk commands.

Native Mode Subdirectories

The following information is intended as an introduction to how Native Mode subdirectories are stored on an FD disk. The commands used to create, remove, and move around within subdirectories can be found in the Command Reference section of this manual.

Native Mode subdirectories are similar in structure to the subdirectories used on MS-DOS types of computers. When a subdirectory is created, a DIR type file (filetype 6) is created and added to the current directory. Subdirectory names may be up to 16 characters long, just as any other filename. This "file" is initially two blocks long, and consists of a directory header block and the first directory block. These blocks are always located next to each other on the same track, and if two adjacent blocks cannot be found, no directory will be created.

The storage space available to subdirectories is the same as that available to the parent directory (the directory in which the subdirectory exists). In fact, all of the blocks within a Native Mode partition are shared between all directories within that partition. This is quite different than the method used for 1581 type subdirectories (or sub-partitions as they are referred to in this manual). This means that if there are 12000 blocks free in the partition, this number of blocks free will be available no matter which directory you are located in. If a 37 block file is saved in any directory within the partition, all directories within that partition will indicate 37 fewer blocks.

Subdirectories may be created in the 'root' directory (the first or main directory in that partition) or within another subdirectory. Placing a subdirectory within another subdirectory is called 'nesting'. There is no actual limit to the number of directories located in a partition, nor is there any limit to how deep subdirectories may be nested. The only limitation on creating subdirectories is the number of adjacent blocks located within the partition. There are, however, some practical limitations if you wish to be able to easily access files located in various subdirectories with a single command. This is because the input buffer of the FD is only 127 characters long, therefore nesting subdirectories too deep could necessitate using more than one command string to access files within a particular directory.

Also note that when you are in a subdirectory, it is not possible to use the DOS NEW command on the partition containing that subdirectory. This was done to protect against accidental erasure due to user error. Other protective limitations have been place on subdirectories - you cannot delete a subdirectory while there are still files located within that subdirectory, and the command for removing a subdirectory may only be issued from the parent directory of the subdirectory you wish to delete. These concepts are explained further in the Command Reference Section of this manual under the individual subdirectory commands.

Section 7
Command Reference

Command Syntax

This section documents the commands which can be used with the FD. The syntax for these commands is given in a standard format which should allow you to easily recognize required and optional parameters. Examples are used throughout to assist you in determining proper usage of the commands. If any problem should arise in determining command syntax, be sure to check the following information.

Command String Elements

The command string is made up of a number of elements. In the case of commands sent directly from BASIC, the first part of the command string is usually the command itself. In the case of commands sent via the disk drive command channel, the command itself is usually found at the beginning of a string sent to the disk drive. The elements of the command string as used in this manual are described below:

Literals are characters which must be entered exactly as shown. These will appear as plain text.

User supplied values are those which must be supplied by the user and whose values and type are dependent upon the use of the command. These will appear as *italicized* text.

Optional parameters and **options** are values or literals which need not be included in the command unless the user wishes to specify the option. Often, the optional parameters will be substituted with a certain default when left out of the command string. Optional parameters will appear within [brackets].

Choice parameters allow or require you to choose from more than one parameter to be placed within the command string. Whenever these appear in the syntax of the statement, the choices will be enclosed by {braces} and the individual choices will be separated by a vertical bar character (|). Only one choice parameter may be used in a command string.

You may occasionally notice syntax in which one or more elements is followed by three periods (...). This means that the parameter last shown may be repeated. This will normally be discussed in more detail in the text describing use of the command.

Example command string

The following example illustrates the command syntax used throughout this manual:

```
HEADER"partname"[,Iid][,Dn][{ON|,}Udv]
```

In this command string, HEADER is the actual command and is entered literally. The commas (,) and the 'I', 'D', 'ON', and 'U' are literals contained within brackets and are optional. The parameters 'partname', id, n, and dv are user supplied variables that are always described in a table following the command syntax. The table for this command string would look like this:

where: partname = the name you wish to appear in the partition header
id = a two character id for the partition header
n = the partition number you wish to format (0 or 1)
dv = the device number of the FD drive

Since these parameters are all enclosed in brackets, they are optional. If you decide to use one or more of the optional parameters, notice that they are accompanied by a literal which must be included in the order shown along with the user-supplied variable. Also notice that the 'ON' and a comma are enclosed in braces and are separated by a vertical bar. This means that if you want to supply the unit number, it must be preceded by either the literal 'ON' or by a comma. The full use of this command is shown here:

```
HEADER"PARTITION 1",IP1,D0,U12
```

Since partition (or drive) zero (0:) is assumed in BASIC 7.0 commands, it would also be possible to shorten this command to:

```
HEADER"PARTITION 1",IP1,U12
```

Paths in Command Strings

You will see many commands which include a [path]. Paths specify which CMD Native Mode subdirectory the disk operation is intended for, as in:

```
VERIFY"[[n][path]:]filename",dv[,sa]
```

Most of the commands used on the FD allow you to include a subdirectory path within the command string, provided that the target file is within a Native Mode partition. The path immediately follows the partition number in the command string and is shown as [*path*]. When including one or more subdirectories within a command string, each must be bracketed between slash (/) characters, and the final slash must usually be followed by a colon. For example, if you had a file named COPY located in a subdirectory named UTILITIES in partition 1, you could load this file by entering:

```
LOAD"1/UTILITIES/:COPY",10
```

The portion of this command which makes up the path is:

```
/UTILITIES/
```

If you had nested subdirectories, and the file COPY was located in a subdirectory named COPIERS which in turn was located within a subdirectory named UTILITIES in partition 1, you could load this file with:

```
LOAD"1/UTILITIES/COPIERS/:COPY",10
```

The portion of this command which makes up the path is:

```
/UTILITIES/COPIERS/
```

You may be able to shorten this command, depending on which directory and partition you are currently located in. For example, if you are already located within partition 1, and the root directory is your current directory, you could skip the partition number in the command string:

```
LOAD"/UTILITIES/COPIERS/:COPY",10
```

If your current partition is partition 1 and your current directory is UTILITIES, you could simply enter:

```
LOAD"/COPIERS/:COPY",10
```

If your current partition is partition 2 but your current directory in partition 1 is UTILITIES, you could enter:

```
LOAD"1/COPIERS/:COPY",10
```

If your current partition is partition 2 but the current directory in partition 1 is COPIERS, you could enter:

```
LOAD"1:COPY",10
```

A syntax which allows you to begin your path at the root directory is helpful when you are located within a different subdirectory in the same partition. For example, if your current directory is GAMES in partition 1, and you wish to load the COPY program shown in the previous example, you can begin your path with two slashes:

```
LOAD"//UTILITIES/COPIERS/:COPY",10
```

Two slashes placed at the beginning of a subdirectory path indicates that the path must begin at the root directory. If you are in a different partition, or are not sure which directory is the current directory in the partition you wish to access, it is usually wise to use the double-slash method. Remember to include the partition number if you are in a different partition:

```
LOAD"1//UTILITIES/COPIERS/:COPY",10
```

Subdirectory Paths Using JiffyDOS Commands

If your computer is equipped with JiffyDOS, you may use the JiffyDOS commands to shorten the command syntax. Here are the above examples converted to their JiffyDOS equivalents:

```
/"1/UTILITIES/:COPY",10
/"1/UTILITIES/COPIERS/:COPY",10
/"/UTILITIES/COPIERS/:COPY",10
/"/COPIERS/:COPY",10
///UTILITIES/COPIERS/:COPY
/1//UTILITIES/COPIERS/:COPY
```

You may also leave out the quotes (") and the comma and device number by using the JiffyDOS <CONTROL><D> function to change the default device. The last two examples illustrate this option. You may also use any of the other JiffyDOS wedge commands for loading and saving programs in conjunction with subdirectory paths.

Sending Commands from BASIC

Most of the commands you send to the FD will be from BASIC. This requires very little new knowledge since the FD accepts standard disk drive commands. You should note that it may be desirable to use BASIC 2.0 or DOS command channel commands on a C128 instead of using BASIC 7.0 commands. This is because BASIC 7.0 places some limitations on the use of partition numbers in its command syntax. Specifically, the drive number parameter in BASIC 7.0 commands may only be represented by a zero (0) or a one (1). Since the FD uses this number as an indication of which partition is to be used for the particular command, and since the FD can have up to 31 partitions, the BASIC 7.0 commands may or may not be able to access the desired partition. Also, because of the way in which BASIC 7.0 sends commands, it is not possible to include subdirectory paths within these commands. If you wish to include subdirectory paths, use the BASIC 2.0 or DOS command channel version of the command instead.

The Command Channel

Many of the commands discussed in this section, require you to send the command via the disk drive's command channel. Opening a channel to the drive requires the following BASIC statement:

```
OPENlf,dv,sa
```

where: lf = the logical file number
dv = the device number of the drive
sa = the secondary address

The logical file number can be any number from 1 to 127. Other numbers are legal (128-255) but can cause undesirable side effects.

The device number is the current FD device number. This is set to 10 at the factory, but can be changed to any number from 8 to 15 by using the rear panel DIP switches, or set to 8 or 9 by using the SWAP feature.

The secondary address is often referred to as a channel. Secondary addresses 0 through 14 are used to open files, whereas secondary address 15 (referred to as the 'command channel') tells the drive to interpret the data sent via this channel as a command. This example opens the command channel :

```
OPEN15,10,15
```

The command channel may be opened from within a program or in 'direct' mode. Whenever you enter a command to be executed immediately, without preceding it with a line number, it is considered to be entered in BASIC's direct mode. This example sends a command via the command channel:

```
OPEN15,10,15:PRINT#15,"I":CLOSE15
```

This type of command may also be sent without using the PRINT#:

```
OPEN15,10,15,"I":CLOSE15
```

Some commands require that parameters be sent to the drive via the CHR$ function, and can be issued by using the PRINT# command:

```
OPEN15,10,15:PRINT#15,"U0>";CHR$(10):CLOSE15
```

The semicolon between quotes and the CHR$ is optional. Some commands require numeric variables or actual numbers as parameters, as shown below:

```
OPEN15,10,15:PRINT#15,"U1";2;0;1;34:CLOSE15

OPEN15,10,15:PRINT#15,"U1";C;D;T;S:CLOSE15
```

Numbers can be included within the string portion of the command as long as each is separated from the string and the other numbers by a space:

```
OPEN15,10,15:PRINT#15,"U1 2 0 1 34":CLOSE15
```

In this case, the trailing quote is placed after the last number or parameter required by the command. You may optionally place a colon at the end of the command itself, no matter which way the command is used:

```
OPEN15,10,15:PRINT#15,"U1:";2;0;1;34:CLOSE15

OPEN15,10,15:PRINT#15,"U1: 2 0 1 34":CLOSE15
```

Reading Disk Errors

Disk errors are most often detected by reading the command channel through the use of the GET# or INPUT# commands. INPUT# is the fastest method of returning error information from the drive, while GET# is commonly used for getting non-error information. Since both GET# and INPUT# use the BASIC input buffer, they cannot be used in direct mode.

Normally, programs check for errors immediately after a disk operation is performed. Here is a short program that reads the error channel:

```
10 OPEN15,10,15:INPUT#15,E,E$,T,S:CLOSE15
20 PRINTE,E$,T,S
```

As you can see, four parameters are returned. These are, in order: the error number, the error message, the track where the error occurred, and the sector where the error occurred. When track and sector information is not relevant to a particular error, the track and sector variables will contain zeroes.

Note: If you are using JiffyDOS, it is also possible to read the error channel by simply pressing the commercial at (@) key and then <RETURN>.

There are occasions where it is more desirable to obtain error data or other information from the command channel one byte at a time. In these instances a program similar to the one that follows could be employed:

```
10 OPEN15,10,15
20 GET#15,E$:PRINTE$;:IFST<>64THEN20
30 CLOSE15
```

In the preceding example, we used the BASIC status variable ST to determine when the end of the file was reached. Here is a breakdown of the individual ST bit values relevant to serial bus devices.

BIT	DESCRIPTION	VALUE
7	DEVICE NOT PRESENT	128
6	END OF FILE (EOI)	64
4	VERIFY ERROR	16
1	TIME OUT ON LISTENER	2
0	TIME OUT ON TALKER	1

The C128 provides another method of checking for disk errors via two reserved BASIC 7.0 variables: DS returns the error number; DS$ returns the error message. These variables can be viewed with a PRINT statement:

```
PRINTDS,DS$
```

Note: DS and DS$ are usually valid only after a BASIC 7.0 disk command.

Partition Numbers in File Names

A partition number may be specified within a filename in place of the drive number. The drive number is the number which can precede the colon (:) in Commodore DOS filenames. Often, this number is not included since it is normally used only with dual drives to determine if the file operation should be directed to drive 0 or drive 1. Whenever this drive number is left out of the command, drive 0 is assumed. These rules also apply to the FD, which instead of containing 1 or 2 drives, contains a disk with up to 31 partitions. Whenever you wish to perform a command or file operation with the current partition, you may use a 0 or leave out the partition number entirely. However, if your current partition is different than the partition in which you wish to perform the file operation, you must either move to that partition first (with the 'CP' command), or specify the partition number within the filename. The following examples should help to illustrate this:

```
LOAD "1:MCOPY",10
OPEN2,10,2,"3:TESTFILE,S,W"
```

Load commands may be abbreviated if you are using JiffyDOS:

```
/1:MCOPY
```

Note: If you LOAD a program from a partition other than the current one, and that program needs to load other files located in the partition it came from, the program will not be able to locate those files. Use the 'CP' command to move to that partition before loading such programs.

Partition Numbers in Disk Commands

As described above, partition numbers may be used to replace the drive number in filenames. Partition numbers may also be used in this manner when sending disk commands. In fact, any disk command which allows inclusion of a drive number (with the exception of direct access commands), will also allow you to substitute a partition number in its place. You may use partition numbers when formatting, copying, renaming, scratching, validating, and initializing. This is a large part of what makes the FD so compatible with Commodore DOS.

In the case of direct access commands, the current partition is assigned to the direct access file when when that file is opened. As a result, you must use the 'Change Partition' command to select the desired partition before opening a direct access file. Once the file has been opened, all commands sent to that direct access file will refer to the partition you were in when the file was opened, even if the current partition is changed.

Partition Commands

Many of the commands used on the FD are partition related and, among other things, are used to format, initialize and change partitions.

Creating Partitions

Partitions are created by using the FD-TOOLS program supplied with the FD. Use of this program is documented in Appendix A.

Creating 1581 Style Sub-partitions

You can create 1581-style partitions within 1581 Emulation Mode partitions on the FD. This type of partition is sometimes referred to as a subdirectory by 1581 users. Because of the way these partitions allocate space, we feel the term subdirectory does not apply. Since the FD is often divided into partitions, and since these 1581 'subdirectories' can be placed within 1581 Emulation partitions, we call them 1581 sub-partitions.

Certain limitations apply when creating sub-partitions that are intended to store files. Because of the way physical tracks are handled in Commodore's 1581 DOS, and because sub-partitions must contain header and directory blocks, the minimum size of a sub-partition is 120 blocks. The starting sector must be zero, and the ending sector must be a multiple of 40. Sub-partitions are not allowed to begin on, end on, or contain within themselves track 40. Here is the syntax required to create 1581 style sub-partitions:

```
OPENlf,dv,15:PRINT#lf,"/[n]:partname,"CHR$(st)
CHR$(ss)CHR$(sl)CHR$(sh)",C":CLOSElf
```

where: lf = the logical file number for the command channel
dv = the current device number assigned to the FD
n = the target 1581 Emulation Mode partition
partname = the name of the 1581 sub-partition name to be created
st = the starting track of the sub-partition
ss = the starting sector of the sub-partition
sl = the low byte of the sub-partition size in sectors
sh = the high byte of the sub-partition size in sectors

Example:

```
OPEN15,10,15:PRINT#15,"/4:SUB1,"CHR$(1)CHR$(0)
CHR$(160)CHR$(0)",C":CLOSE15
```

The preceding example should be entered as one line. There is no JiffyDOS equivalent for this command since it requires the use of the CHR$ function.

Note: Before you can use a newly-created 1581 sub-partition, you must format it. See 'Formatting 1581 Style Sub-Partitions' for more information.

Deleting Partitions

Partitions are deleted by using the FD-TOOLS program supplied with the FD. Use of this program is documented in Appendix A.

Deleting 1581 Style Sub-partitions

1581 style sub-partitions are handled quite differently than standard FD partitions. You can delete a sub-partition by using the DOS or BASIC 7.0 SCRATCH commands. Scratching a 1581 sub-partition is no different than scratching a file, although the consequences may be severe if this is done accidentally. Any files contained within the sub-partition will be lost. See 'Scratching (deleting) Files' for the proper command syntax. Remember to substitute the name of the sub-partition for the filename.

Changing Partitions

You may change from one partition to another by sending the 'CP' (Change Partition) command to the FD via the command channel. The syntax is:

```
OPENlf,dv,15:PRINT#lf,"CPn":CLOSElf
```

where: lf = the logical file number for the command channel
dv = the device number of the FD drive
n = the partition number you wish to change to (1-31)

Example:

```
OPEN15,10,15:PRINT#15,"CP4":CLOSE15
```

JiffyDOS Example:

```
@CP11
```

The 'C'<SHIFT>'P' command is a variation on the Change Partition command which allows it to be used more easily from within BASIC programs. A shifted 'P' is indicated by the symbol '□'. This command allows you to use a character string to indicate the partition. The syntax is:

```
OPENlf,dv,15:PRINT#lf,"C□"+CHR$(n):CLOSElf
```

where: lf = the logical file number for the command channel
dv = the device number of the FD drive
n = the partition number you wish to change to (1-31)

Example:

```
OPEN15,10,15:PRINT#15,"C□"CHR$(11):CLOSE15
```

Moving Between 1581 Style Sub-partitions

Since the 1581 Emulation Mode partitions on the FD support 1581 style partitioning (that is to say 'sub-partitioning'), you may use the standard DOS commands to change from one 'sub-partition' to another. The syntax is:

```
OPENlf,dv,15:PRINT#lf,"/[n]:[partname]":CLOSElf
```

where:	lf	=	the logical file number for the command channel
	dv	=	the device number of the FD drive
	n	=	the partition number of the 1581 Emulation partition
	partname	=	the partition name of the 1581 style 'sub-partition'

If the 1581 Emulation Mode partition is the current partition, the partition number n may be left out. The 'sub-partitions' may be nested within each other, but to access one which is two levels down from the currently selected one, you will have to issue the command twice (once with each of the two sub-partition names). To return to the root (main) directory of the 1581 Emulation Mode partition, issue this command without the sub-partition name. This will also occur if you issue an Emulation ModeINITIALIZE command to the 1581 Emulation Mode partition.

Please note that if you exit a 1581 Emulation Mode partition with a 'CP' command and then return to it later with another 'CP' command, you will be placed into whichever sub-partition you were in when you exited.

Example of moving to a different 1581 sub-partition:

```
OPEN15,10,15:PRINT#15,"/4:SUB1":CLOSE15
```

Example of moving to the root directory:

```
OPEN15,10,15:PRINT#15,"/4:":CLOSE15
```

Formatting Partitions and Disks

The standard Commodore DOS NEW command (not to be confused with the BASIC NEW command) may be used to format partitions or whole disks on the FD from either BASIC 2.0 or BASIC 7.0. Although the FD will also accept the BASIC 7.0 HEADER command, this command is limited to either the current partition (0) or partition 1, and cannot support the new extensions

The DOS NEW command may be used to delete all files from a partition. Please note that when creating partitions with FD-TOOLS, formatting is performed automatically. You may wish to format them again, however, to change the header name or disk ID. When using the DOS NEW command, the FD can accept both the long and short versions.

The following line shows the syntax used for the BASIC 2.0 or BASIC 7.0 DOS NEW command.

```
OPENlf,dv,15:PRINT#lf,"N[n]:partname[,id[,ft]]"
:CLOSElf
```

where: lf = the logical file number for the command channel
dv = the current device number of the FD drive
n = the partition you wish to format (0-31)
partname = the name you wish to appear in the partition header
id = a two character id for the partition header
ft = format type extension (see chart below)

FORMAT TYPE EXTENSIONS			
EXTENSION	DENSITY	PARTITIONABLE	PARTITIONS CREATED
(NONE*)	DD 800K	YES	SYSTEM, 1 1581/NONE*
81	DD 800K	NO	NONE
DD8	DD 800K	YES	SYSTEM, 1 1581
HD8	HD 1.6M	YES	SYSTEM, 2 1581**
ED8	ED 3.2M	YES	SYSTEM, 4 1581**
DDN	DD 800K	YES	SYSTEM, 1 CMD NATIVE
HDN	HD 1.6M	YES	SYSTEM, 1 CMD NATIVE
EDN	ED 3.2M	YES	SYSTEM, 1 CMD NATIVE
S8		YES	SEE NOTE***
SN		YES	SEE NOTE***

Notes: *If the disk inserted at the time this command is issued is either unformatted or is formatted as a 1581 disk, then the disk will be formatted as an 800K CMD Partitionable disk containing a system partition plus 1 1581 emulation partition. If the disk is already formatted as any of the CMD Partitionable formats, then only the current or specified partition will be formatted.

** These extensions create multiple 1581 emulation partitions in sequence, starting at partition number 1. The first partition will receive the name specified in the format command. The names of additional partitions created by these commands will be altered so that the 15th character is a space and the 16th character is the partition number. The ID given each partition will be the same as the ID specified in the command (this is not harmful on the FD).

*** These extensions are intended for use with disks which are already formatted as CMD Partitionable types, regardless of density, and will cause a change in the types of partitions that the disk is filled with. The 'S8' extension will change the system partition and fill the disk with as many 1581 partitions as will fit, while the 'SN' extension changes the system partition and creates the largest possible CMD Native partition.

Examples of the BASIC 2.0 and BASIC 7.0 DOS NEW command:

```
OPEN15,10,15:PRINT#15,"N:WORKDISK,W1":CLOSE15
OPEN15,10,15:PRINT#15,"N:BACKUP,BA,81":CLOSE15
OPEN15,10,15:PRINT#15,"N:DATA,DX,HDN":CLOSE15
OPEN15,10,15:PRINT#15,"N3:PARTITION 3,P3":CLOSE15
```

JiffyDOS examples for using the DOS NEW command:

```
@N:WORKDISK,W1
@N:BACKUP,BA,81
@"N:DATA,DX,HDN"
@"N3:PARTITION 3,P3",10
```

Please note that you must use the BASIC 2.0 or BASIC 7.0 DOS NEW command in order to send the special extensions for disk formatting, since the BASIC 7.0 HEADER command has no allowance for sending special formatting extensions. Use of the HEADER command will give the same results as shown for the first entry in the 'Format Type Extensions' table.

The following syntax applies to the BASIC 7.0 HEADER command:

```
HEADER"partname"[,Iid][,Dn][{ON|,}Udv]
```

where: partname = the name you wish to appear in the partition header
id = a two character id for the partition header
n = the partition number you wish to format (0 or 1)
dv = the device number of the FD drive

Examples:

```
HEADER"PARTITION 1",IP1,D1 ON U12
```

Note: The DOS NEW and BASIC 7.0 HEADER commands will not be accepted if issued from within a Native Mode subdirectory.

Formatting 1581 Style Sub-partitions

The DOS NEW and BASIC 7.0 HEADER commands are also used to format the 1581 style sub-partitions which may be created within 1581 Emulation Mode partitions. 1581 sub-partitions must be formatted before they can be used. Before attempting to format a sub-partition, you must make sure that the sub-partition is the current sub-partition within the 1581 Emulation Mode partition that contains it. Do this by using the command outlined in 'Moving Between 1581 Style Sub-partitions' elsewhere in this section. To avoid formatting the wrong area on your drive, it is usually wise to make the appropriate 1581 Emulation Mode partition the current partition.

Initializing Partitions

The DOS INITIALIZE command is often used when a different disk is inserted into a floppy disk drive. This ensures that the drive updates its buffer with a copy of the BAM on the new disk. This function is performed automatically by the FD, but the command has been implemented to retain compatibility. Note that initializing a 1581 Emulation Mode partition causes it to return to the root directory (ala the 1581). The syntax is:

```
OPENlf,dv,15:PRINT#lf,"I[n][:]":CLOSElf
```

where: lf = the logical file number for the command channel
dv = the current device number the FD drive
n = the partition to be initialized

Example:

```
OPEN15,10,15:PRINT#15,"I3:":CLOSE15
```

JiffyDOS example:

```
@I3:
```

Validating Partitions

The DOS VALIDATE and BASIC 7.0 COLLECT commands check all files in a partition to verify proper allocation of disk space, free any improperly allocated blocks, and delete unclosed (splat '*') files. You should not use these commands on partitions that contain blocks allocated via the BLOCK-ALLOCATE command, or else information may be lost. Note: Unlike standard Commodore disk drives, the FD properly validates GEOS files. The syntax is:

```
OPENlf,dv,15:PRINT#lf,"V[n][:]":CLOSElf
```

where: lf = the logical file number for the command channel
dv = the device number of the FD drive
n = the partition you wish to validate (0-31)

The syntax for the BASIC 7.0 COLLECT command is:

```
COLLECT[,Dn][{ON|,}Udv]
```

where: n = the partition you wish to validate (0 or 1)
dv = the device number of the FD drive

Examples:

```
OPEN15,10,15:PRINT#15,"V2:":CLOSE15
COLLECT,D0,U12
```

JiffyDOS example of the DOS VALIDATE command:

```
@V2
```

Partition directory

Having multiple partitions on a disk necessitates having the ability to view a directory of partitions. The partition directory may be viewed while you are working within any partition and relates information concerning the number, name, and type of each partition on the FD. This command also contains options that allow you to specify which partitions will be listed. The syntax for this command is as follows:

```
LOAD"$=P[:*][=tp]",dv
```

where: tp = partition type - N = native
4 = 1541
7 = 1571
8 = 1581
dv = the current device number of the FD drive

Examples:

```
LOAD"$=P",10
LOAD"$=P:*",10
LOAD"$=P:*=8",10
```

JiffyDOS examples:

```
@$=P
@"$=P:*=N",10
```

Renaming Partitions

If you reformat a partition with the DOS NEW command, you may wish to change its name in the partition directory as well. In order to do this we have added the 'Rename Partition' command. This command is similar to the DOS command which is used to rename files. The syntax is as follows:

```
OPENlf,dv,15:PRINT#lf,"R-P:newname=oldname":CLOSElf
```

where: lf = the logical file number
dv = the current device number of the FD drive
newname = the name you wish to assign to the partition
oldname = the name of the partition in the partition directory.

Example:

```
OPEN15,10,15,"R-P:WORK=NATIVE 1":CLOSE15
```

JiffyDOS Examples:

```
@R-P:WORK=NATIVE 1
@"R-P:WORK=NATIVE 1",10
```

Renaming Directory Headers

After placing a number of files within a given partition or subdirectory, you may wish to change the name that appears in the directory header (displayed at the top of the directory listing for that partition or subdirectory). Although this could be done by using the DOS NEW command, all files within that partition would be lost at the same time. In order to allow you to rename a header without having to lose or copy all of your files, the FD has a 'Rename Header' command. The syntax is as follows:

```
OPENlf,dv,15:PRINT#lf,"R-H[n] [path]:newname":CLOSElf
```

where:	lf	=	the logical file number
	dv	=	the current device number of the FD drive
	n	=	the partition where the header is to be renamed
	path	=	the subdirectory path
	newname	=	the new name for the specified header

Examples:

```
OPEN15,10,15,"R-H:WORK":CLOSE15
OPEN15,10,15,"R-H3:DOWNLOADS":CLOSE15
OPEN15,10,15,"R-H1//ASSEM/:BUDDY64":CLOSE15
```

JiffyDOS Examples:

```
@R-H:WORK
@"R-H//ASSEM/:BUDDY64",10
```

Getting Partition Information

The DOS 'Get Partition Info' command has been created for the purpose of gathering information about the current or some other specific partition. This command will prove valuable to the programmer whose software must react differently to partitions of various types. The partition number for which the information is requested may be placed into a variable and inserted into the command as a character string. The syntax for the G-P command is:

```
OPENlf,dv,15:PRINT#lf,"G-P"[+CHR$(n)]:CLOSElf
```

where:	lf	=	the logical file number for the command channel
	dv	=	the device number of the FD drive
	n	=	the partition number (0-31)

If the 'G-P' command is sent without the optional character string or a value of 255, the information returned will be for the current partition. A value of 0 requests that the information returned is to be for the system partition. Thirty bytes (0-29) of information concerning the requested partition plus a CHR$(13) are returned over the drive error channel. The following is a list of this information:

Byte 0	Partition type	0	not created		
		1	Native Mode		
		2	1541 Emulation Mode		
		3	1571 Emulation Mode		
		4	1581 Emulation Mode		
		255	System		
Byte 1	Disk info:	Bit 7	Disk in drive (1 = yes)		
		6	Formatted disk (1 = yes)		
		5	Valid format (1 = CMD/CBM)		
		4	True 1581 disk (1 = yes)		
		3-0	Format type:	0000	Unknown
				0001	800K
				0010	1.60M
				0100	3.20M
				0101	720K IBM
				0110	1.44M IBM
				0111	2.88M IBM
Byte 2	Partition number				
Bytes 3-18	Partition name as displayed in the partition directory				
Byte 19	Starting system address of partition (high byte)				
Byte 20	Starting system address of partition (middle byte)				
Byte 21	Starting system address of partition (low byte)				
Bytes 22-26	CHR$(0) (reserved)				
Byte 27	Size of partition (high byte)				
Byte 28	Size of partition (middle byte)				
Byte 29	Size of partition (low byte)				
Byte 30	CHR$(13)				

Note: The values returned in bytes 19-21 and 27-29 are specified in 512 byte blocks. Also keep in mind that any currently undefined bytes may later be used for specific purposes.

Important: To avoid problems with reading information from Partition 13, the G-P command should always be sent with a trailing carriage return (CHR$(13)). The BASIC PRINT# statement will do this for you automatically as long as you do not follow it with a trailing semicolon (;).

Autobooting

It is possible to autoboot from the FD when it is used with a C128 or 128D in 128 mode. To do so, the FD must either be configured as device number 8, or you must issue the BASIC 7.0 BOOT command. You must also make sure that the current partition has a valid boot sector. The boot sector is located at track 1, sector 0 in all partitions, including Native Mode partitions.

An interesting benefit of CMD Native partitions is that the boot sector is always allocated. It is therefore never in danger of being overwritten by files, and cannot be freed by the DOS VALIDATE command. The following syntax applies to the BOOT command:

```
BOOT[ [Dn] {ON|,} [Udv] ]
```

where: n = the partition where the file is located (0 or 1)
dv = the device number of the FD drive

The partition number for this command may only contain a zero or a one. Zero is used to indicate the current partition, while one indicates partition number 1. This command will not accept any other partition numbers, due to a limitation in the BASIC 7.0 command parsing routines. The structure of the boot sector is the same as found on standard Commodore disk drives.

Examples:

```
BOOT U12
BOOT D0,U12
```

Subdirectory Commands

Three new DOS commands have been added to allow you to create and remove subdirectories, as well as to change the current directory. Both the Create and Change commands use a similar syntax, while the syntax for the Remove command has been limited to avoid problems. These commands, like the subdirectories themselves, are very similar to those found in MS-DOS.

Creating Native Mode Subdirectories

The 'Make Directory' command allows you to create Native Mode subdirectories. This command allows you to use standard path syntax. Using a path allows you to create a subdirectory in any native mode partition no matter what your current partition or current directory may be. Here is that syntax:

```
OPENlf,dv,15:PRINT#lf,"MD[n] [path] :name":CLOSElf
```

where: lf = the logical file number for the command channel
dv = the current device number of the FD drive
n = the Native Mode partition where the subdirectory is to be created
path = the path to the subdirectory in which the new subdirectory will be created
name = the name of the new subdirectory

The above syntax may seem slightly confusing, so here are a few guidelines to help you understand how this syntax works:

1. The name of the subdirectory you wish to create must always be separated from the rest of the command by a colon (:).
2. If you are creating a subdirectory within another subdirectory, you must specify that subdirectory within the path unless it is your current directory.
3. If subdirectories are specified within the path of the command (to the left of the colon), each subdirectory name must fall between slash (/) characters (only 1 slash is needed between subdirectory names).
4. Paths normally start at the current directory. If you want the path to start at the root directory (the main directory in that partition), the path should begin with two slashes.
5. If the subdirectory is to be created in a partition other than the partition in which you are located, place the partition number at the start of the path (in front of any slashes).

The following examples should help clarify these guidelines:

```
OPEN15,10,15:PRINT#15,"MD:TEMP":CLOSE15
OPEN15,10,15:PRINT#15,"MD1:TEMP":CLOSE15
OPEN15,10,15:PRINT#15,"MD1//:TEMP":CLOSE15
OPEN15,10,15:PRINT#15,"MD1//TEMP/:TEMP2":CLOSE15
OPEN15,10,15:PRINT#15,"MD/TEMP/:TEMP2":CLOSE15
```

JiffyDOS Examples:

```
@MD:TEMP
@MD1:TEMP
@MD1//:TEMP
@"MD1//TEMP/:TEMP2"
@"MD/TEMP/:TEMP2",10
```

Moving Between Native Mode Subdirectories

The 'Change Directory' command allows you to move between Native Mode subdirectories. This command employs the same syntax used in the 'Make Directory' command. Using a path allows you to move to a subdirectory anywhere in the currently selected Native Mode partition. This command will also allow you to change the currently selected directory in any other partition, but will not move you into that directory. In order to move to the current directory of a different partition, you must issue a 'Change Partition' command. The 'Change Directory' syntax is:

```
OPENlf,dv,15:PRINT#lf,"CD[n]{[:←]|[[path][:]
subname]}":CLOSElf
```

where: lf = the logical file number for the command channel
dv = the current device number of the FD drive
n = the Native Mode partition where the subdirectory you wish to make the current directory exists
path = the subdirectory path
subname = the name of the subdirectory

Note that you can include the back arrow immediately after 'CD[n]' to move backwards one directory (to the PARENT). The back arrow cannot be combined with any subdirectory path information. See the examples below.

It is not required that you include the colon before the subdirectory name, as long as the subdirectory name is preceded by a slash.

Here are some examples of the Change Directory command:

```
OPEN15,10,15:PRINT#15,"CD:TEMP":CLOSE15
OPEN15,10,15:PRINT#15,"CD1//:TEMP":CLOSE15
OPEN15,10,15:PRINT#15,"CD1//TEMP/:TEMP2":CLOSE15
OPEN15,10,15:PRINT#15,"CD1:←":CLOSE15
OPEN15,10,15:PRINT#15,"CD/TEMP/TEMP2":CLOSE15
```

JiffyDOS Examples:

```
@"CD:TEMP",10
@CD1//TEMP
@CD1//TEMP/TEMP2
@CD1:←
@CD/TEMP/TEMP2
```

Deleting Native Mode Subdirectories

The 'Remove Directory' command allows you to delete Native Mode subdirectories. This command does not allow the use of paths in order to avoid problems with removing a subdirectory which is a parent of the directory in which you are located. This command will not allow you to delete a subdirectory which contains any files - you must delete these files first by using the DOS SCRATCH or the BASIC 7.0 equivalent. The following syntax applies to the 'Remove Directory' command:

```
OPENlf,dv,15:PRINT#lf,"RD[n]:subname":CLOSElf
```

where: lf = the logical file number for the command channel
dv = the current device number of the FD drive
n = the partition where the subdirectory you wish to remove exists
subname = the name of the subdirectory you wish to remove

Here are some examples of the Remove Directory command:

```
OPEN15,10,15:PRINT#15,"RD3:TEMP":CLOSE15
OPEN15,10,15:PRINT#15,"RD:TEMP2":CLOSE15
```

JiffyDOS Example:

```
@"RD3:TEMP",10
@RD:TEMP2
```

Viewing Directories

Directories may be viewed by using the following BASIC 2.0 command:

```
LOAD "$",10
```

This command will load the current directory from your FD (assuming it is set as device number 10). You may then issue the LIST command to view the directory on your screen. You may also use a partition number for selecting the directory to be loaded, as in the following example:

```
LOAD "$2",10
```

Pattern Matching

Selective directories may also be loaded in the standard way, by placing a colon (:) at the end of the partition number or path, and by using a filename or pattern matching characters to determine which files to include in the listing. The equals (=) sign and a filetype designator may also be included after the filename to indicate a particular filetype. The filetype characters are: P for program (PRG), S for sequential (SEQ), U for user (USR), R for relative (REL), and B for subdirectory branch (DIR).

Examples:

```
LOAD "$2:S*=P",10
```

This example will load a directory of all PRG files (=P) starting with an S (S*) from partition number 2. You may also use the asterisk at the beginning of a filename as in the following example:

```
LOAD "$1/UTILS/:*E=P",10
```

This example will load a directory of all PRG files which end with an 'E'. The question mark '?" may also be used to replace an unknown character in the filename. It is also possible to use the asterisk in the middle of a pattern as shown in this example:

```
LOAD "$1/UTILS/:R*E=P",10
```

This pattern will match filenames like RIDE and RUE. Only one asterisk may be used in the pattern. Another matching character is the question mark which will match any character found at that position in the filename.

```
LOAD "$2:B?RE=P",10
```

This example will load a directory of all PRG files which are four characters long, start with 'B' and end with 'RE'. More than one question mark may be used in a pattern. You may also mix question marks and an asterisk together in a pattern.

Time and Date Stamped Directory Listings

If your FD is equipped with an RTC option, FD-DOS will place each file's time and date of creation into the directory entry. If you use your FD with GEOS or gateWay, all of your GEOS files are time and date stamped regardless of whether or not you have the RTC option installed. Note: FD-DOS and GEOS both use the same method of time and date stamping.

In order to allow you to easily view the time and date stamp, new options have been added for loading directories. These options allow the stamp to be viewed, and also permit you to select files which were created within a specified timeframe. The syntax for the time and date stamped directory is:

```
LOAD"$=T[n] [path] [:pattern[={tp|option} [,option]]],dv
```

where: n = partition number of the directory to be loaded
path = the subdirectory you wish to view
pattern = name of file or pattern to match
tp = first character of filetype (P, S, R, U or B)
option = one of the options listed below
dv = current device number assigned to the FD

options: L = long format
N = do not include time and date in listing
>*stamp* = greater than or equal to *stamp*
<*stamp* = less than or equal to *stamp*

stamp format: *MM*/*DD*/*YY* *HH*:*MM* *x*M

Although the syntax for this command may look a little complex, it is really quite simple to use when broken down into separate elements.

The partition number (*n*) may be specified if desired. If this parameter is omitted, the current partition will be targeted for this command.

The *filename* is the name of a file or a standard pattern matching string. You may use the asterisk (*) to match a number of characters, and question marks (?) to match individual characters. See 'Pattern Matching' above for examples.

The file type (*tp*) is optional, but if specified it must be the first option after the filename pattern. This may be a P (PRG), S (SEQ), R (REL), U (USR), or B (DIR). If you wish to view all file types, skip this option. This too is covered in the examples under 'Pattern Matching'.

The *options* allow you to match specific times and dates (>*stamp*,<*stamp*), and also to specify long format (L). You may also specify that the directory entries match a certain time and date stamp, but that the directory list is not to include these times and dates (N). You may use as many of these options as you wish, but they must be separated by commas (,).

The 'long' time format gives the full date and time:

```
112   "TESTFILE"          PRG   02/02/90   04.44 PM
```

The 'short' (default) time format gives the date and time as follows:

```
112   "TESTFILE"          P 02/02 04.44 P
```

If the no-list (N) option is given, the directory entries will be loaded as they would normally appear (with no time and date information included). The reason that the no-list option was created was to allow you to use the time and date of files as pattern matching criteria within programs which cannot accept the extra time and date characters.

The <*stamp* option will list all files which have a creation time and date less than or equal to the time and date specified in *stamp*. The >*stamp* option will list all files which have a creation time and date greater than or equal to the time and date specified in *stamp*.

If both the <*stamp* and >*stamp* options are used within the same command, the resulting list of files will include files which fall between the range of the two time and date stamps specified.

The *stamp* format must be entered exactly as shown. This means you must specify the month, day, and year with two characters each and separate them with a slash (/). The hour and minute must also be given with two characters each in 12 hour format separated with a colon (:) or a period (.). The last parameter must be AM or PM. The date, time and AM/PM parameters must be separated by a single space. Here are a few examples:

```
LOAD"$=T",10
LOAD"$=T2",10
LOAD"$=T2:*=P",10
LOAD"$=T2:*=P,L",10
LOAD"$=T2:*=P,L,>12/21/89 04:15 PM",10
LOAD"$=T:*=L,<12/21/89 04:15 PM",10
LOAD"$=T4:*=S,N,>12/01/89 12:01 AM,<12/31/89
12:00 PM",10
```

JiffyDOS Examples:

```
@"$=T",10
@"$=T2"
@$=T2:*=P
@$=T4:*=S,N,>12/01/89 12:01 AM,<12/31/89 12:00 PM
```

File Commands

File commands are the most commonly used commands. They include loading and saving files, verifying, renaming, scratching, copying, and locking files and are entered in much same manner as for other Commodore or compatible disk drives. Although the BASIC 2.0 versions of these commands are supported in BASIC 7.0, BASIC 7.0 also contains other commands that perform the same functions. BASIC 2.0 versions of these commands allow more versatility when dealing with partitions.

Loading Files

The following syntax can be used to load programs in BASIC 2.0 and BASIC 7.0:

```
LOAD"[[n][path]:]filename",dv[,sa]
```

where: n = is any legal partition number from 1 to 31
path = the subdirectory path to the file
filename = is any legal filename of up to 16 characters
dv = is the current device number of the FD drive
sa = is the secondary address if needed

To load a machine language program, a secondary address of 1 must be added to the end of this command, separated from the device number by a comma .

Examples:

```
LOAD "2:BASEBALL",10
LOAD "3/TERMS/:TERMBOOT",10,1
```

JiffyDOS examples:

```
/"2:BASEBALL",10
/2:BASEBALL
%3/TERMS/:TERMBOOT
```

It is generally a good idea to use the BASIC 2.0 syntax if you are specifying partitions since BASIC 7.0 will only allow access to the current (0) partition or partition 1, and will not allow the use of subdirectory paths.

The BASIC 7.0 BLOAD command can be used to load machine language or data files into memory. The DLOAD command is used primarily to load BASIC programs. The syntax for these commands is shown below.

```
BLOAD"filename"[,Dn][{ON|,}Udv][,Bb][,Pa]

DLOAD"filename"[,Dn][{ON|,}Udv]
```

where: filename = the name of the program to be loaded
n = the partition number where the file is located (0 or 1)
dv = the device number of the FD drive
b = the memory bank where the file is to be loaded
a = the starting address of the file to be loaded

Examples:

```
BLOAD"SPRITE",D0,U9,B0,P3584
DLOAD"TEST",D0 ON U9
DLOAD"TEST2"
```

Saving Files

The following syntax can be used to save programs in BASIC 2.0 and BASIC 7.0:

```
SAVE "[[@][n][path]:]filename",dv
```

where: n = is any legal partition number from 1 to 31
path = the subdirectory path where the file is to be saved
filename = is any legal filename of up to 16 characters
dv = is the current device number of the FD drive

The '@' symbol shown in the command syntax may be used to indicate that a file with the same name which already exists should be replaced with the new file. This is called the 'Save with Replace' option and if it is used, it must be followed by a partition number and a colon (:).

Examples:

```
SAVE"2:BASEBALL",10
SAVE"/TERMS/:TERMBOOT",10
```

JiffyDOS examples:

```
←"2:BASEBALL",10
←/TERMS/:TERMBOOT
```

You may use the BASIC 7.0 BSAVE and DSAVE commands when it is your intention to work with your current partition (0) and directory, or in the current directory of partition 1. BSAVE is intended for files other than BASIC programs, while DSAVE is intended for BASIC programs.

```
BSAVE"[@]filename"[,Dn][{ON|,}Udv][,Bb],Pa TO Pe .

DSAVE"[@]filename"[,Dn][{ON|,}Udv]
```

where:	filename	=	the name of the file to be saved
	n	=	the partition number where the file is to be saved
	dv	=	the device number of the FD drive
	b	=	the memory bank where the file is to be saved
	a	=	the starting address of the file to be saved
	e	=	the ending address of the file to be saved

The '@' symbol may be included to indicate that the file being saved is to replace an existing file with the same. This is called 'Save with Replace'.

Examples:

```
BSAVE"SPRITE",D0,U9,B0,P3584
DSAVE"TEST",D1 ON U9
DSAVE"TEST2"
```

Verifying Files

BASIC 2.0 and 7.0 contain commands which allow you to verify if a program has been saved properly. These commands compare the saved program with the contents of memory. Keep in mind that any change in the contents of memory may cause a verify operation to fail. It is best to verify a file immediately after saving it for this reason. Both versions of BASIC support specifying a partition within the filename portion of this command (as described earlier). The following syntax applies to these commands:

```
VERIFY"[[n][path]:]filename",dv[,sa]
```

where:	n	=	the partition where the file is located
	path	=	the subdirectory path to the file you wish to verify
	filename	=	the name of the file to be verified
	dv	=	the current device number of the FD drive
	sa	=	secondary address of 1 to verify a non-BASIC file

Examples:

```
VERIFY"NEWSTATS",10
VERIFY"1/UTILS/TERMS/:XLATOR",10
```

JiffyDOS example:

```
'"NEWSTATS",10
```

In BASIC 7.0, the standard VERIFY command is accepted, but you may also use the DVERIFY command. This command is limited to use with the current partition (0) or partition 1, and the current subdirectory .

```
DVERIFY"filename"[,Dn][{ON|,}Udv]
```

where:	filename	=	the name of the file to be verified
	n	=	the partition where the file resides (0 or 1)
	dv	=	the device number of the FD drive

Example:

```
DVERIFY"NEWSTATS",D1,U10
```

Renaming Files and Subdirectories

Filenames and Native Mode subdirectory names may be changed by using either the DOS RENAME or the BASIC 7.0 RENAME command. The BASIC 7.0 version only supports the current directory within the current partition (0) or partition 1. When using either version, the partitions specified for the two file names must either be the same, or must indicate the same partition. The syntax for the DOS RENAME command is:

```
OPENlf,dv,15:PRINT#lf,"R[n][path]:newname=[[n]
[path]:]filename":CLOSElf
```

where:	lf	=	the logical file number for the command channel
	dv	=	the current device number of the FD drive
	n	=	the partition where the file to be renamed is located
	path	=	the subdirectory path to the file you want to rename
	newname	=	the new name to be assigned to the file
	filename	=	the name of the file which is being renamed

Examples:

```
OPEN15,10,15:PRINT#15,"R1:BOOT1=BOOT":CLOSE15
OPEN15,10,15,"R1/UTILS/:NEWT=1/UTILS/:WW":CLOSE15
```

JiffyDOS Example:

```
@"R1:BOOT1=BOOT",10
```

The BASIC 7.0 RENAME command syntax is:

```
RENAME[Dn,]"filename"TO[Dn]"newfile"[,Udv]
```

where:	n	=	the partition where *filename* is located
	filename	=	the name of the file which is being renamed
	newfile	=	the new name to be assigned to the file
	dv	=	the current device number of the FD drive

Scratching (deleting) Files

The standard DOS and BASIC 7.0 SCRATCH commands may be used to delete files from a partition. As with many of the other BASIC 7.0 commands, SCRATCH is only effective with partition numbers 0 (current) and 1. The standard Commodore DOS SCRATCH may be used in place of the BASIC 7.0 version when necessary and with BASIC 2.0. The following command syntax covers the DOS version of this command:

```
OPENlf,dv,15:PRINT#lf,"S[n][path]:filename[,[n]
[path]:]filename...]":CLOSElf
```

where:	lf	=	the logical file number for the command channel
	dv	=	the current device number of the FD drive
	n	=	the partition(s) which hold the file(s) to be scratched
	path	=	the subdirectory path(s) to the file(s)
	filename	=	the name of the file(s)

Multiple files may be scratched with this command which will accept up to five separate filename parameters. Different partitions can be specified with the separate filenames. The filename parameters may also contain wildcards to allow scratching of multiple files within a single partition.

Examples:

```
OPEN15,10,15:PRINT#15,"S1:JUNK,3:C?*.BAS":CLOSE15
OPEN15,10,15,"S1/UTILS/:CO*":CLOSE15
```

JiffyDOS Examples:

```
@"S1:JUNK,3:C?*.BAS",10
@S1/UTILS/:CO*
```

The BASIC 7.0 SCRATCH command syntax is:

```
SCRATCH"filename"[,Dn][{ON|,}Udv]
```

where:	filename	=	the name of the file to be scratched
	n	=	the partition where the file to be scratched resides
	dv	=	the device number of the FD drive

Multiple files may also be scratched with this command by using pattern matching, although it does not allow you to specify multiple file names as does the DOS version. Remember, this command is only valid for use with the current directory in partition numbers 0 (current) or 1.

Copying Files

Copying is an important consideration with any storage device. For this reason the FD comes supplied with DOS commands which allows you to copy files between partitions. This function may also be accomplished by using the FCOPY program supplied with thė FD. Another copy program supplied with the FD (MCOPY) allows you to copy an entire disk to a similar partition on the FD and vice versa. For more information on the copy programs included with the FD, see Appendix A.

Copying files between drives

Files may be copied between the FD and other disk drives using a standard file copier. Only generic copiers that do not try to discover the drive type by checking ROM locations will work with the FD.

We have included FCOPY with the FD to assist in file copying. FCOPY will work with all file types and all drive types including an REU running under RAMDOS.

If you have JiffyDOS installed on your computer, you may use the built-in JiffyDOS file-copier with the FD as well. Many of the commercial copy programs will not work with the FD because they look at specific memory locations to try to identify the drive being used, or attempt to write drive specific code into the disk drive to speed up the copy process.

Copying and Combining files between partitions

You may copy files from one partition to another on the FD by using the standard Commodore DOS COPY command. This command allows you to place a partition number in front of each of the filenames specified in the command. The syntax for this command is as follows:

```
OPENlf,dv,15:PRINT#lf,"C[n][path]:newfile=[[n]
[path]:]filename[,[n:]filename...]":CLOSElf
```

where: lf = the logical file number for the command channel
dv = the current device number of the FD drive
n = the partition which holds or is to receive the file
path = the subdirectory path(s) where the file(s) to be copied or created is (are) located
newfile = the name of the new file being created
filename = the name of the file(s) which is (are) being copied

Up to five files may be combined into a single file by using this command, though it is important to note that copying a number of files into a single file is only effective with text files. If you use this command for copying a single file from one file to another file in a different partition, you may use the same filename for both files.

Examples:

```
OPEN15,10,15:PRINT#15,"C1:FCOPY=3:FCOPY":CLOSE15
OPEN15,10,15,"C:FULLSTATS=STAT1,3:STAT3":CLOSE15
OPEN15,10,15,"C2:MCOPY=1/COPIERS/:MCOPY":CLOSE15
```

JiffyDOS Examples:

```
@"C1:FCOPY=3:FCOPY",10
@"C2:MCOPY=1/COPIERS/:MCOPY"
@C:FULLSTATS=STATS1,3:STATS3
```

You may also copy files from one partition to another on the FD by using the standard BASIC 7.0 COPY command. This command is limited to copying files in the current directory of the current partition (0) or partition 1. Use the DOS COPY command mentioned earlier if you want to copy files between other partitions. The syntax for this command is as follows:

```
COPY[Dn,]"filename"TO[Dn]"newfile"[,Udv]
```

where: n = the partition which holds or is to receive the file
filename = the name of the file(s) which is being copied
newfile = the name of the file being created
dv = the current device number of the FD drive

If you use this command to copy a file to a different partition, you may use the same filename for both files. If they are to reside in the same partition, you must use different filenames or an error will result.

Two files may be combined into a single file by using the BASIC 7.0 CONCAT command, although it is important to note that adding files together in this manner is only effective with text files. The BASIC 7.0 limitation of using only the current directory of the current partition (0:) or partition 1 applies to this command. The syntax is:

```
CONCAT[Dn,]"filename"TO[Dn]"newfile"[,Udv]
```

where: n = the partition where the file exists
filename = the name of the file which is being added
newfile = the name of the file being added to
dv = the current device number of the FD drive

The file previously named *newfile* will be replaced by the newly created combined file. The only way these files may have the same name is if they exist in different partitions.

Example:

```
CONCAT "NEWNUMBERS" TO "ALLNUMBERS"
```

Locking and Unlocking Files

Files located on the FD may be locked to avoid scratching them by accident. Before you can scratch a locked file, it must first be unlocked. Locking a file sets one of the bits in the filetype byte for that file (located in the directory entry of that file). Files which have been locked will appear in the directory with a 'less-than' symbol to the right of the filetype. For example, a file named JIFFYMON which has been locked will appear in the directory listing as:

```
33    "JIFFYMON"          PRG<
```

It is also possible to lock Native Mode subdirectories and 1581 sub-partitions. If a subdirectory has been locked, it is not possible to delete it with the 'Remove Directory' command until it has been unlocked.

The Lock command is a 'toggle' function. Using it on an unlocked file will cause the file to become locked. Using it on a file which has already been locked will unlock that file. The syntax for locking and unlocking files is:

```
OPENlf,dv,15:PRINT#lf,"L[n] [path]:name":CLOSElf
```

where: lf = the logical file number
dv = the current device number of the FD drive
n = the partition number in which the file exists
path = the Native Mode subdirectory path in which the file exists
name = the name of the file or subdirectory you wish to lock or unlock

The following examples illustrate the use of this command:

```
OPEN15,10,15:PRINT#15,"L:TEST":CLOSE15
OPEN15,10,15:PRINT#15,"L1//:TEST":CLOSE15
OPEN15,10,15:PRINT#15,"L/UTILS/:TEST":CLOSE15
```

JiffyDOS examples:

```
@L:TEST
@"L1//:TEST"
@"L/UTILS/:TEST",10
```

Note: JiffyDOS contains its own version of the LOCK command. This may also be used with the FD. See your JiffyDOS manual for details on using this version.

Relative File Commands

Relative files contain an index table to allow quicker access to a particular portion of the file called a record. Records are kept track of by a special section of the relative file called a side sector. Two different types of side sectors exist in the FD: Regular side sectors (the type used in 1541 and 1571 Emulation Mode partitions), and super side sectors (used in 1581 Emulation Mode and Native Mode partitions). A relative file with regular side sectors can be up to 720 blocks long, while a relative file with super side sectors can fill an entire disk or partition.

Opening or Creating a Relative File

Relative files can be opened or created by using the BASIC 2.0 OPEN or BASIC 7.0 DOPEN commands. Here is the BASIC 2.0 syntax for opening or creating a new relative file:

```
OPENlf,dv,sa,"[[n][path]:]filename[{"|,L"
+CHR$(rl)}]
```

where:	lf	=	the logical file number
	dv	=	the current device number of the FD drive
	sa	=	the secondary address (2 through 14)
	n	=	the partition where the file exists or will be created
	path	=	the Native Mode subdirectory path to the file
	filename	=	the name of the relative file
	rl	=	the record length (only needed when creating a new relative file)

Examples:

```
OPEN2,10,2,"1/DATA/:CUSTOMERS,L"+CHR$(127)
OPEN2,10,2,"ADDRESS"
```

Here is the BASIC 7.0 syntax:

```
DOPEN#lf,"filename"[,Lrl][,Dn][,Udv]
```

where:	lf	=	the logical file number
	filename	=	the name of the relative file
	rl	=	the record length (only needed when creating a new relative file)
	n	=	the partition in which the file exists or is to be created (only 0 or 1 is accepted)
	dv	=	the current device number of the FD drive

Examples:

```
DOPEN#2,"CUSTOMERS",L127,D1,U12
DOPEN#2,"ADDRESS"
```

Positioning to a Specific Record

When you are ready to read or write a specific record, it is necessary to use either the DOS POSITION command, or the BASIC 7.0 RECORD command. These commands can also be used to create new records. Here is the syntax for the DOS POSITION command:

```
PRINT#lf,"P"+CHR$(ch)+CHR$(lr)+CHR$(lh) [+CHR$(of)]
```

where: lf = the logical file number for the command channel
ch = the secondary address used when opening the relative file plus a value of 96
lr = the low byte of the record number
lh = the high byte of the record number
of = the byte number in the record which you wish to start reading from or writing to (first byte if left out)

Examples:

```
PRINT#15,"P"+CHR$(98)+CHR$(30)+CHR$(0)+CHR$(10)
PRINT#15,"P"+CHR$(98)+CHR$(30)+CHR$(0)
```

Here is the syntax for the BASIC 7.0 RECORD command:

```
RECORD#lf,rn[,of]
```

where: lf = the logical file number for the relative file
rn = the record number you wish to access or create
of = the byte number in the record which you wish to start reading from or writing to (first byte if left out)

Examples:

```
RECORD#2,30,10
RECORD#2,30
```

Whenever you create new records, use the PRINT# command to write a CHR$(255) to the last record. Note: Whenever a new record is created, an error will occur in the drive (number 50, "RECORD NOT PRESENT"). As with all Commodore disk drives, this error can be ignored when it occurs after a new record is created.

Note: Although it is not necessary to send the RECORD or POSITION commands twice on the FD to avoid data corruption, this practice should be followed anyway to avoid problems when using other drives with your program. To do this, send the RECORD or POSITION command once before writing a record as you normally would, and once again afterward. This will help to ensure that your data will not be corrupted due to the flaw which exists in other disk drives.

Direct Access Commands

Most direct access commands require that files be opened to both the command channel and to a direct access file. Before using the commands described in this section, you should be familiar with the methods required to open and access the command channel and a file data channel.

The Direct Access Channel

Opening a direct access channel requires the following BASIC statement:

```
OPENlf,dv,sa,"#[bu]"
```

where: lf = the logical file number (1-127)
dv = the device number of the FD drive
sa = the secondary address (2-14)
bu = the drive buffer to be used (0-29)

The drive buffer number is an optional parameter, and if left out, the drive will automatically assign the next available buffer.

> Note: Direct access files are always opened to the current partition number on the FD. If you wish to open a direct access file to a partition other than the one you are currently in, you must change partitions with the 'CP' command first. All further access to this file will occur in that partition number, even if you change partitions after opening the file.

Block Commands

The BLOCK commands allow you to read, write, allocate, and de-allocate the logical sectors on the disk. See Appendix C for tables outlining the logical track, sector, BAM and directory layout of each partition type.

Allocating and Freeing Blocks

The BLOCK-ALLOCATE command is used to allocate a block directly or to determine the next unallocated block available. If you try to allocate a block which has already been allocated, you will find that the track and sector variables of the error message contain the track and sector of the next available block. The BLOCK-FREE command allows you to free a block which is currently allocated. The syntax for these commands is:

```
PRINT#lf,"B-A:";n;t;s

PRINT#lf,"B-F:";n;t;s
```

where: lf = the logical file number used for the command channel
n = the partition (always 0)
t = the logical track of the block to be allocated or freed
s = the logical sector of the block to be allocated or freed

The Buffer Pointer

The BUFFER-POINTER command allows you to point to a particular byte within the disk buffer of the specified direct access channel. The syntax is:

```
PRINT#lf,"B-P";sa;pt
```

where: lf = the logical file number used for the command channel
sa = the secondary address used for the direct access file
pt = the byte number within the buffer (0-255)

Reading and Writing Blocks

The BLOCK-READ and BLOCK-WRITE commands, due to a quirk in the way they operate, are rarely used. (most applications use the 'U1' or 'U2' commands instead). These commands cannot read or write an entire block of data because the first byte in the block is used to determine how many bytes are to be read or written. This allows you to write (and later read) the full block only if the first byte contains a value of 255. The syntax is:

```
PRINT#lf,"B-R";sa;n;t;s

PRINT#lf,"B-W";sa;n;t;s
```

where: lf = the logical file number used for the command channel
sa = the secondary address used for the direct access file
n = partition number (always 0)
t = the logical track of the block to be read or written
s = the logical sector of the block to be read or written

Block Execute

BLOCK-EXECUTE loads a specific block into drive memory and then executes the machine language program contained in that block. Unless the machine language is relocatable, you should specify a buffer number when opening the direct access channel. The machine language routine should also end with an RTS if you wish to return control back to DOS. The syntax is:

```
PRINT#lf,"B-E";sa;n;t;s
```

where: lf = the logical file number used for the command channel
sa = the secondary address used for the direct access file
n = partition number (always 0)
t = the logical track where the executable block is stored
s = the logical sector of the executable block

This example executes a block at track 2, sector 0 in buffer #2 ($0500):

```
10 OPEN15,8,15:OPEN2,8,2,"#2"
20 PRINT#15,"B-E";2;0;2;0
30 CLOSE2:CLOSE15
```

Memory Commands

Reading from Drive Memory

MEMORY-READ allows you to read bytes in FD memory. The syntax is:

```
PRINT#lf,"M-R"CHR$(ml)CHR$(mh)CHR$(nb)
```

where: lf = the logical file number used for the command channel
ml = the low byte of the starting memory address
mh = the high byte of the starting memory address
nb = the number of bytes to be read (0-255; 0=256 bytes)

The bytes are read from the error channel. This example checks for an FD:

```
10 OPEN15,10,15,"M-R"+CHR$(160)+CHR$(254)+CHR$(6)
30 FORI=1TO6:GET#15,B$:A$=A$+B$:NEXT
80 CLOSE15:IFA$="CMD FD"THENPRINT"FD PRESENT"
```

Writing to Drive Memory

MEMORY-WRITE allows you to write bytes to FD memory. The syntax for this command is:

```
PRINT#lf,"M-W"CHR$(ml)CHR$(mh)CHR$(nb)CHR$(d) . . .
```

where: lf = the logical file number used for the command channel
ml = the low byte of the starting memory address
mh = the high byte of the starting memory address
nb = the number of bytes to be written (1-120)
d = the data bytes (if more than one byte is to be written use additional CHR$ statements or a string variable)

This example illustrates the use of the MEMORY-WRITE command:

```
10 OPEN15,10,15:A$="ABCDEFGHIJ"
40 PRINT#15,"M-W"CHR$(0)CHR$(8)CHR$(10)A$:CLOSE15
```

Memory Execute

MEMORY-EXECUTE starts execution of a machine language program. To return control to DOS, the program should end with an RTS. The syntax is:

```
PRINT#lf,"M-E"CHR$(ml)CHR$(mh)
```

where: lf = the logical file number used for the command channel
ml = the low byte of the program starting address
mh = the high byte of the program starting address

This example executes a program located at $0800 in drive memory:

```
PRINT#15,"M-E"CHR$(0)CHR$(8)
```

User Commands

U0 Utility Commands

Without any parameters, U0 resets the user vectors. When combined with specific parameters, it is used to send burst commands (described in detail later in this section). Here is the syntax needed to reset the user vectors:

```
PRINT#lf,"U0"
```

where: lf = the logical file number used for the command channel

Reading and Writing Blocks with U1 and U2

U1 and U2 are commands which read and write an entire block to/from the buffer related to a direct access channel. These commands are common replacements for "B-R" and "B-W" and are used in the same basic manner. Please note that these commands access the partition that was the current partition when the direct access channel was opened. The syntax is:

```
PRINT#lf,"U1";sa;n;t;s

PRINT#lf,"U2";sa;n;t;s
```

where: lf = the logical file number used for the command channel
sa = the secondary address used for the direct access file
n = partition number (always 0)
t = the logical track of the block to be read or written
s = the logical sector of the block to be read or written

User Jump Commands (U3-U8)

These commands perform jumps to certain locations in drive memory. U3 jumps to $0500, U4 to $0503, U5 to $0506, U6 to $0509, U7 to $050C and U8 to $050F. The syntax is:

```
PRINT#lf,"Ux"
```

where: lf = the logical file number used for the command channel
x = the character of the desired USER command (3-8)

User Reset Commands (UI & UJ)

UI and UJ reset the drive to various degrees. UI performs a warm reset and has a minimal effect on drive variables. UJ performs a cold reset, but does not change the current partition. The syntax is:

```
PRINT#lf,"UI"

PRINT#lf,"UJ"
```

where: lf = the logical file number used for the command channel

Special Loaders

Utility Loader

The Utility Loader allows you to load a file that conforms to CBM Utility Loader specifications into drive memory and execute it immediately by sending the name of the file preceded by an ampersand ('&') via the command channel. The syntax for the utility loader is:

```
OPENlf,dv,15:PRINT#lf,"&[n][path]:filename":CLOSElf
```

where: lf = the logical file number for the command channel
dv = the device number of the FD
n = the partition (0-31)
path = the Native Mode partition subdirectory path to the file
filename = the name of the file.

Autoboot Loader

Whenever the FD is turned on or reset, it will search for, load, and execute a file in the default partition that conforms to CBM Autoboot Loader specifications. The Autoboot filename must be 'COPYRIGHT CMD 92' on CMD-formatted disks, and 'COPYRIGHT CBM 86' on 1581 compatible disks. In order to retain 1581 compatibility, the FD will also search for the autoboot file whenever you initialize a 1581 Emulation partition that has bit 6 of byte 7 in BAM block 1 set to a 1.

Note: Programs written to execute in the memory of other drives may have to be modified to work with the FD, since the memory layout and controller used in the FD is much different than that of any other drive.

Special FD Commands

Software Write Protect Commands

The FD allows you to enable and disable write protection of a disk via software. For data security reasons, these commands cannot be used to bypass the write protect shutter on the disk itself. Note: Removing and re-inserting a disk will cancel the 'W-1' write-protect command. The syntax is:

```
OPENlf,dv,15:PRINT#lf,"W-x":CLOSElf
```

where: lf = the logical file number
dv = the current device number of the FD drive
x = 1 to enable WRITE PROTECT, 0 to disable

Examples:

```
OPEN15,10,15,"W-1":CLOSE15
OPEN15,10,15,"W-0":CLOSE15
```

Software SWAP Commands

The FD allows you to perform the front-panel SWAP functions from within software. These commands have been included to allow loaders or boot programs to easily swap the FD's device number. Whenever one of the SWAP commands is issued, it is very important to follow it with a delay loop, in order to avoid a serial bus collision (we recommend a value of 500 in a FOR/NEXT loop). Note that the SWAP commands will not operate under certain conditions, usually when there is a file open to a serial bus device. The syntax for the SWAP commands is:

```
OPENlf,dv,15:PRINT#lf,"S-x":
FORt=1TO500:NEXT:CLOSElf
```

where: lf = the logical file number
dv = the current device number of the FD drive
x = 8 to swap with device number 8
9 to swap with device number 9
D to return the FD to its original device number
t = a variable to be used for the timing loop

Here is a sample program using all of the SWAP commands. This program assumes that the FD is device number 10 at the time the program begins.

```
100 OPEN15,10,15,"S-8":FORI=1TO500:NEXT:CLOSE15
120 OPEN15,8,15,"S-9":FORI=1TO500:NEXT:CLOSE15
140 OPEN15,9,15,"S-D":FORI=1TO500:NEXT:CLOSE15
```

JiffyDOS examples:

```
@S-8
@"S-9",8
```

Getting Diskchange Status

A new command unique to the FD allows you to determine if the disk has been changed. This command is useful to programmers who may want to make sure that you have not changed disks before beginning a new disk operation. The syntax for sending this command is:

```
OPENlf,dv,15:PRINT#lf,"G-D":CLOSElf
```

where: lf = the logical file number
dv = the current device number of the FD drive

After this command has been sent, the error buffer will contain a single diskchange status byte followed by a CHR$(13). If the diskchange status byte is zero, then no change has occurred. Any non-zero value indicates that the disk has been either changed or removed.

After a disk has been changed, the diskchange status remains non-zero until the new disk is logged in by a command that accesses the disk. (i.e. Load, Initialize, Change Partition, etc.).

Example:

```
10 OPEN15,10,15,"G-D"
20 GET#15,A$:DC=ASC(A$+CHR$(0))
30 CLOSE15
```

RTC Commands

There are three types of commands available to read and set the optional Real Time Clock (RTC) module. Each type uses a different data format. The data types are ASCII, BCD (binary coded decimal), and decimal.

Reading Time and Date in ASCII Format

The 'T-RA' command allows you to read the FD's clock and return the date and time as an ASCII string over the error channel. The syntax is :

```
OPENlf,dv,15:PRINT#lf,"T-RA"
```

where:	lf	=	the logical file number
	dv	=	the device number of the FD

The FD error channel returns the date and time in the following format:

```
"dow. mo/da/yr hr:mi:se xM"+CHR$(13)
```

where:	dow.	=	the day of the week (4 characters followed by a space). SUN. MON. TUES WED. THUR FRI. SAT.
	mo	=	the month (01-12)
	da	=	the day
	yr	=	the year
	hr	=	the hour (01-12)
	mi	=	the minute (00-59)
	se	=	the second (00-59)
	x	=	A or P (denoting AM or PM)

To read the error channel from BASIC, the following GET loop can be used:

```
10 GET#lf,A$:T$=T$+A$:IF ST<>64 THEN 10
```

Writing Time and Date in ASCII Format

The 'T-WA' command allows you to set the RTC by sending an ASCII string over the command channel. The syntax is as follows:

```
OPENlf,dv,15
PRINT#lf,"T-WAdow. mo/da/yr hr:mi:se xM"
CLOSElf
```

where: lf = the logical file number
dv = the device number of the FD

The remaining parameters (*dow.*, *mo*, *da*, etc.) follow the same format as described above under the 'T-RA' command. Note: it is very important that the time and date parameters are separated by the same number of spaces and delimiters as shown above. Also, the day of week *must* be four characters long and followed by a space (see 'T-RA' for valid day-of-week strings). If these parameters are not provided in the correct manner, the FD will not set the time correctly.

Reading Time and Date in Decimal Format

The T-RD command allows you to read the FD's clock and return the date and time as a series of decimal-valued bytes over the error channel. This command provides BASIC (or ML) programmers with a means to read the current time and date in numeric format from within a program. The syntax for the 'T-RD' command is as follows:

```
OPENlf,dv,15:PRINT#lf,"T-RD"
```

where: lf = the logical file number
dv = the device number of the FD

After the 'T-RD' command is sent, the error channel will return the date and time as bytes in the following format:

Byte 0	- day of week (00=SUN., 01=MON., etc.)
Byte 1	- year (i.e 1990=90)
Byte 2	- month (01-12)
Byte 3	- day (01-xx)
Byte 4	- hour (01-12)
Byte 5	- minute (00-59)
Byte 6	- second (00-59)
Byte 7	- AM/PM flag (00=AM, non-0=PM)
Byte 8	- CHR$(13)

Writing Time and Date in Decimal Format

The 'T-WD' command allows you to set the FD's internal real-time clock by sending a series of decimal-valued bytes representing the current time over the command channel. The syntax for this command is as follows:

```
OPENlf,dv,15
PRINT#lf,"T-WD"+CHR$(byte0)+CHR$(byte1)+
CHR$(byte2)+CHR$(byte3)+CHR$(byte4)+CHR$(byte5)+
CHR$(byte6)+CHR$(byte7):CLOSElf
```

where: lf = the logical file number
dv = the device number of the FD
bytes 0-7 = The current time and date represented by eight decimal bytes (format given under the 'T-RD' command).

Reading Time and Date in BCD Format

The 'T-RB' command allows you to read the FD's clock and return the date and time as a series of BCD bytes over the error channel. The syntax is:

```
OPENlf,dv,15:PRINT#lf,"T-RB"
```

where: lf = the logical file number
dv = the device number of the FD

The error channel will return the date and time as BCD bytes in the following format:

Byte 0	-	day of week (00=SUN., 01=MON., etc.)
Byte 1	-	year (i.e. 1990=$90)
Byte 2	-	month ($01-$12)
Byte 3	-	day ($01-xx)
Byte 4	-	hour ($01-$12)
Byte 5	-	minute ($00-$59)
Byte 6	-	second ($00-$59)
Byte 7	-	AM/PM flag (00=AM, non-0=PM)
Byte 8	-	$0D

Writing Time and Date in BCD Format

The 'T-WB' command allows you to set the FD's internal real-time clock by sending a series of BCD bytes representing the current time over the command channel. This command is normally sent from within a machine-language program. The syntax for this command is as follows:

```
"T-WB"+BCD time
```

where: BCD time = The current time and date represented by eight BCD bytes. (format given under 'T-RB').

Burst Commands

The FD Burst Command Instruction Set (FDBCIS) emulates the 1581 BCIS as closely as possible, although it was necessary to make some changes due to the extended capabilities of the FD. The required syntax is:

```
PRINT#lf,"U0"+CHR$(Byte02) [+CHR$(Byte03)...]
```

where: lf = the logical file number used for the command channel

Note: In each of the following burst commands, Byte 00 contains the ASCII value for the letter "U", while Byte 01 contains the ASCII value for "0" (hence, bytes 00 and 01 are the "U0" shown in the syntax above).

Read

BYTE	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
00	0	1	0	1	0	1	0	1
01	0	0	1	1	0	0	0	0
02	L	E	X	S	0	0	0	N
03	DESTINATION TRACK							
04	DESTINATION SECTOR							
05	NUMBER OF SECTORS							
06	NEXT TRACK (optional)							

RANGE: Logical Format: Dependent on partition type (see Appendix C)
Physical Format: Dependent on type of disk format (see Appendix C)

SWITCHES:
L - Logical Flag (0=physical/1=logical)
E - Ignore Error (1=ignore)
X - Don't Care
S - Side (0 or 1 if using physical format)
N - Partition Number (only 0 is supported)

PROTOCOL: Burst Handshake

CONVENTIONS: Before READING from or WRITING to a disk, it must be logged in using either the INQUIRE DISK or QUERY DISK FORMAT commands.

OUTPUT: One burst status byte, followed by burst data, is sent for each sector transferred. An error will prevent data from being sent unless the IGNORE ERROR bit in byte 02 is set to a value of 1.

Write

BYTE	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
00	0	1	0	1	0	1	0	1
01	0	0	1	1	0	0	0	0
02	L	E	X	S	0	0	1	N
03	DESTINATION TRACK							
04	DESTINATION SECTOR							
05	NUMBER OF SECTORS							
06	NEXT TRACK (optional)							

RANGE: Logical Format: Dependent on partition type (see Appendix C)

Physical Format: Dependent on type of disk format (see Appendix C)

SWITCHES:
L - Logical Flag (0=physical/1=logical)
E - Ignore Error (1=ignore)
X - Don't Care
S - Side (0 or 1 if using physical format)
N - Partition Number (only 0 is supported)

PROTOCOL: Output data, set fast serial in, pull clock low, wait for status byte, release clock. Repeat for multiple sectors.

CONVENTIONS: Before READING from or WRITING to a disk, it must be logged in using either INQUIRE DISK or QUERY DISK FORMAT.

INPUT: Host must transfer burst data.

OUTPUT: One burst status byte following each WRITE operation.

Inquire Disk

BYTE	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
00	0	1	0	1	0	1	0	1
01	0	0	1	1	0	0	0	0
02	X	X	X	S	0	1	0	N

SWITCHES:
X - Don't Care
S - Side
N - Partition Number (only 0 is supported)

PROTOCOL: Burst handshake.

OUTPUT: One burst status byte following each INQUIRE DISK.

Format

BYTE	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
00	0	1	0	1	0	1	0	1
01	0	0	1	1	0	0	0	0
02	M	X	X	X	0	1	1	N
03	I	D	D	D	Z	Z	Z	Z
	FORMAT TYPE, DENSITY, SECTOR SIZE (optional)							
04	LAST TRACK NUMBER (optional)							
05	NUMBER OF SECTORS (optional)							
06	STARTING TRACK (optional)							
07	FILL BYTE (optional)							
08	STARTING SECTOR (optional)							
09	FORMAT GAP (optional)							

SWITCHES:

M - Mode (0=logical format with directory and BAM and 1=physical format using optional bytes 03-09)

X - Don't Care

N - Partition Number (only 0 is supported)

OPTIONS: Bytes 03 - 09 are optional and are only accepted when physical formatting is specified (M=1). If you do not specify values for these bytes, system default values will be used. The following list shows the legal range and default values for these bytes:

Byte 3 Format Type Identifier, Density, and Sector Size

Usage: I	-	Format ID	0 = ISO (default) 1 = IBM
D	-	Density	000 = Double Density (default) 001 = High Density 010 = Enhanced Density
Z	-	Sector Size	0000 = 128 bytes (not used) 0001 = 256 bytes 0010 = 512 bytes (default) 0011 = 1024 bytes 0100 = 2048 bytes 0101 = 4096 bytes 0110 = 8192 bytes

Byte 4 Last Track: 00 through 79 (default = 79)

Byte 5 Sectors/Track (default set according to sector size value in byte 3)

Double Density	16	(256 byte sector size)
	10	(512 byte sector size)
	5	(1024 byte sector size)
	2	(2048 byte sector size)
	1	(4096 byte sector size)
		(8192 byte sectors will not fit on this format)
High Density	32	(256 byte sector size)
	20	(512 byte sector size)
	10	(1024 byte sector size)
	5	(2048 byte sector size)
	2	(4096 byte sector size)
	1	(8192 byte sector size)
Enhanced Density	64	(256 byte sector size)
	40	(512 byte sector size)
	20	(1024 byte sector size)
	10	(2048 byte sector size)
	5	(4096 byte sector size)
	2	(8192 byte sector size)

Byte 6 Starting Track 0 through 79 (default = 0)

Byte 7 Fill Byte 0 through 255 (defaults: ISO=$E5, IBM=$F6)

Byte 8 Starting Sector 1 through 63 (default = 1)

Byte 9 Format Gap 0 through 255 (default set according to density and format type in byte 3)

Double Density	35	(ISO)
	80	(IBM)
High Density	100	(ISO)
	108	(IBM)
Enhanced Density	100	(ISO)
	108	(IBM)

PROTOCOL: Conventional.

CONVENTIONS: This command must be followed by an INQUIRE DISK or QUERY DISK FORMAT command to log in the partition.

OUTPUT: None.

Note: The directory header written by this command (logical format) will contain the string 'CMD FD' for the disk name and '92' for the ID.

Query Disk Format

BYTE	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
00	0	1	0	1	0	1	0	1
01	0	0	1	1	0	0	0	0
02	F	X	T	S	1	0	1	N
03	OFFSET (optional - F = 1)							

SWITCHES:
F - Force (F=1 steps head with offset in byte 3)
X - Don't Care
T - Sector Table (T=1 sends sector table)
S - Side
N - Partition Number (only 0 is supported)

PROTOCOL: Burst handshake.

CONVENTIONS: Determines the physical disk format.

OUTPUT: Burst status byte after logging disk, burst status byte after compiling MFM format information, number of physical sectors per track, logical track number found in header, lowest logical sector number, highest logical sector number, interleave value, sector table (if T=1).

Notes: The sector table is a series of bytes (1,2,3,...) showing the sector numbers of the sectors found. Second status byte is from track offset 0 unless F=1, then status is from offset track in byte 03. No bytes follow either status byte if an error occurred.

Inquire Status

BYTE	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
00	0	1	0	1	0	1	0	1
01	0	0	1	1	0	0	0	0
02	W	C	M	0	1	1	0	N
03	NEW STATUS (W = 0)							
04	NEW OR MASK (M = 1)							
05	NEW AND MASK (M = 1)							

SWITCHES:
W - Returns current status only if W=1, regardless of the condition of the other flags.
C - Log in disk if C=1 and W=0.
M - Write new AND/OR masks if M=1 and W=0.
N - Partition Number (only 0 is supported)

PROTOCOL: Burst handshake if W=1, conventional if W=0.

CONVENTIONS: This is a method of reading or writing the current status, and changing the status mask values.

OUTPUT: None if W=0, burst status byte if W=1.

CHGUTL Utility

BYTE	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
00	0	1	0	1	0	1	0	1
01	0	0	1	1	0	0	0	0
02	X	X	X	1	1	1	1	0
03 - ??	UTILITY COMMAND AND PARAMETERS							

SWITCHES: X - Don't Care

COMMANDS:

`CHR$(n)` - Change Device Number
n = new device number

`Bn` - Fast Serial Mode
n = 0 - fast serial disabled
n = 1 - fast serial enabled

`Hn` - Head Select (returns error)
n = 0 - side 0
n = 1 - side 1

`I+CHR$(n)` - Set Cache Dump Interval
n = time in milliseconds/10

`Mn` - Mode Select (returns error)
n = 0 - single-sided
n = 1 - double-sided

`MR+CHR$(a)+CHR$(p)` - Memory Read*
a = high byte of starting address
p = number of pages to read

`MW+CHR$(a)+CHR$(p)` - Memory Write*
a = high byte of starting address
p = number of pages to read

`R+CHR$(n)` - DOS Retries
n = retries before error is assumed)

`S+CHR$(n)` - DOS Sector Interleave (ignored)
n = sector interleave offset

`T` - Test ROM Checksum (ignored)

`Vn` - Write Verify switch
n = 1 - verify on
n = 0 - verify off

*Note: Burst MR and MW use standard burst protocol (without status byte).

Dump Track Cache Buffer

BYTE	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
00	0	1	0	1	0	1	0	1
01	0	0	1	1	0	0	0	0
02	F	S	X	1	1	1	0	1
03	PHYSICAL TRACK NUMBER							
04	PHYSICAL SECTOR NUMBER (optional - HD & ED only)							

SWITCHES:
F - Write Always (F = 1 write even if not 'dirty')
(F = 0 write only if dirty and ignore bytes 3/4)
S - Side
X - Don't Care

Note: Physical track and Side are used only if F = 1. Also, if byte 4 is sent when using an HD or ED diskette, it is used to set the starting sector for the dump.

Fastload Utility

BYTE	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
00	0	1	0	1	0	1	0	1
01	0	0	1	1	0	0	0	0
02	P	X	X	1	1	1	1	1
03 - ??	FILENAME							

SWITCHES:
P - Non-program File Flag (P = 0 - program file / P = 1 - non-program file)
X - Don't Care

PROTOCOL: Burst handshake.

OUTPUT: Burst status byte preceding each sector transferred. In a program file, the load address should be handled in the normal manner.

STATUS:
0000000X = OK
00000010 = FILE NOT FOUND
00011111 = EOI (last sector)

Status values from 3 through 15 should be considered a file read error. The byte after the EOI indicates the number of data bytes remaining in the file.

Burst Status Byte

	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
	M	N	Z	Z	C	C	C	C

BIT DEFINITIONS:

M - Mode: 0 Normal format (1581 disk with directory and BAM or CMD-formatted 800K, 1.6M, 3.2M)

1 Foreign Disk Format (non-default physical format or default physical format without directory and BAM information)

N - Partition Number (only 0 is supported)

Z - Sector Size:

00	128 or 2048 byte sector size
01	256 or 4096 byte sector size
10	512 or 8192 byte sector size
11	1024 byte sector size

C - Controller Status:

0000	OK
0001	OK
0010	Header Not Found
0011	No Data Address Mark
0100	Data Block Not Found
0101	Data CRC Error
0110	Format Error
0111	Write-Verify Error
1000	Write Protect On
1001	Header CRC Error
1010	Illegal Logical Block
1011	Disk Change
1100	Invalid Format
1101	FDC Hardware Error
1110	Burst Syntax Error or Illegal Job
1111	No Drive Present

Job Queue Instructions

The job queue buffers are special locations used to pass commands and parameters to the drive controller for the purpose of performing specific disk access functions. The job queue can be accessed directly by the programmer if desired. Different areas are defined for job queues in the FD depending on which partition type is currently being used. This was done so that the FD could emulate the job queue locations of the 1541, 1571, and 1581. In all cases, the job codes and parameters are moved to the Native Mode job queue for actual execution. When writing job queue routines specifically for the FD, it is better to use the Native job queue locations, since the routines will then operate no matter which type of partition they are used with.

Job Queue scanning is performed every 10 milliseconds during the interrupt routine. The emulation job queues are scanned first if the current partition is an emulation type.

Important Job Queue Memory Locations

Label	Address	Range	Description
JOBS_41	$0000 -	$0004	1541/1571 Job Queues
HDRS_41	$0006 -	$000F	1541/1571 track and sector for job
JOBS_81	$0002 -	$000A	1581 Job Queues
HDRS_81	$000B -	$001C	1581 track & sector for job
HDRS2_81	$01BC -	$01CD	1581 translated physical track & sector
SIDS_81	$01CE -	$01D6	1581 side variable for job
MJOBS	$0028 -	$0047	Native Job Queues
MHDRS	$2800 -	$283F	Native track & sector for job in queue
MHDRS2	$28C0 -	$28FF	Native translated physical track & sector
MSIDS	$2840 -	$285F	Native side variable for job
JOBBUF	$0300 -	$21FF	31 Job Queue buffers (256 byes each)
TADDHI	$2860 -	$287F	Target Address (high)
TADDLO	$2880 -	$289F	Target Address (low)
BLKCNT	$28A0 -	$28BF	Block count for multiple block jobs
TSIDS	$2900 -	$291F	Translated side for jobs (read only)
CACHEPNT	$004A -	$004B	Pointer into cache for certain jobs
CACHE	$008B	$008C	Pointer to starting address of cache
CACHEOFF	$009F	$00BE	Page offset into cache for certain jobs
FMT_FILL		$009B	Format fill byte value

Job Queue Command Codes

Code	Name	Description
$80	READ	Read logical block specified in HDRS using cache.
$82	CTRL_RESET	Resets the disk controller and variables.
$84	MOTOR_ON	Turns motor on, delays 500ms, returns 'OK' status (00).
$86	MOTOR_OFF	Sets motor to turn off in 10 seconds, returns 'OK' immediately.
$88	MOTORI_ON	Turns motor on and returns 'OK' immediately.
$8A	MOTORI_OFF	Turns motor off immediately and returns 'OK'.
$8C	STEP_PHYS	Steps head to a physical track specified in HDRS2. Does not change side select or attempt to verify position.
$8E	FRMT_TRK	Formats track where head is located using current side, density, sector size, sectors per track and starting sector. Fills sectors using value in FMT_FILL (unless FMT_FILL contains $F5 and density is 800K, in which case track is filled with data from cache).
$90	WRITE	Write logical block specified in HDRS using cache.
$92	DSK_IN_DRV	Returns OK if a readable (CMD or CBM) disk is in drive.
$94	ACTIV_ON	Turns ACTIVITY LED on.
$96	ACTIV_OFF	Turns ACTIVITY LED off.
$98	ERR_ON	Turns ERROR LED on.
$9A	ERR_OFF	Turns ERROR LED off.
$9C	SID_SEL	Sets side select using value from SIDS.
$9E	CACHE_MOV	Not implemented. This routine never worked correctly in the 1581.
$A0	VERIFY	Verifies contents of the entire cache against the physical 'chunk' containing the logical block specified in HDRS.
$A2	WRT_CACHE	Writes cache to disk if marked 'dirty'.
$A4	PHYS_BUF0	Reads physical sector specified in HDRS and SIDS to buffer at $0300.
$A6	BUF0_PHYS	Writes buffer starting at $0300 to physical sector specified in HDRS and SIDS.
$A8	SEEK_PHYS	Seeks to physical block specified in HDRS and SIDS and reads header ID.

$AA	READ_LOG_NQ	Updates CACHEPNT to point to the address in the cache where the logical block specified in HDRS begins. Reads in new chunk if block is not currently in cache.
$AC	WRT_LOG_NQ	Same as READ_LOG_NQ except marks cache as 'dirty'.
$B0	SEEK	Reads the first physical sector header encountered and updates controller track, sector, side, and size variables.
$B2	READ_PHYS_NQ	Updates CACHEPNT to point to the address in the cache where the physical block specified in HDRS and SIDS begins. Reads in new chunk if block is not currently in cache.
$B4	WRT_PHYS_NQ	Same as READ_PHYS_NQ except marks cache as 'dirty'.
$B6	WRT_PROT_ON	Tests write protect status and returns $08 if write protect is on, $00 if off.
$B8	SEEK_LOG	Seeks to the physical track, sector and side of the logical block specified in HDRS and reads the header.
$C0	BUMP	Moves the head to physical track 0.
$CC	RD_LOG_ADDR	Identical to READ, but places contents of block at address pointed to by TADDHI and TADDLO.
$CE	WRT_LOG_ADDR	Identical to WRITE, but writes contents of address pointed to by TADDHI and TADDLO.
$D0	JUMP	Executes code in corresponding buffer.
$E0	EXEC	Executes code in corresponding buffer after motor is up to speed and the head is on the physical track specified in HDRS.
$EA	SET_FRMT	Sets the drive into one of the six native format modes. Call this job with HDRS track variable set to the desired format type before issuing FRMT_DSK if you wish to change the current format. (1=800K, 2=1.60M, 4=3.20M, 5=IBM 720K, 6=IBM 1.44M, 7=IBM 2.88M)

$EC	READ_MULTI	Reads multiple system blocks (BLKCNT) to address specified in TADDHI and TADDLO starting with the system block specified in HDRS (high byte in track, middle byte in sector) and SIDS (low byte). System blocks are contiguous 512 byte blocks and begin with system block 0 located at physical track 0, sector 1, side 0. BLKCNT must be specified in multiples of the current sector size divided by 512 (i.e. multiples of 2 if the sector size is 1024).
$EE	WRT_MULTI	Writes multiple system blocks using parameters identical to READ_MULTI.
$F0	FRMT_DSK	Formats entire disk using the currently defined physical format (if disk is not a CMD-formatted disk) or fills current partition using FMT_FILL byte. HDRS should contain the physical starting track + 1. A complete disk format can be forced at any time by setting HDRS2 track and sector to 'FD' and SIDS to $F0.
$FC	RD_PHYS_MULTI	Reads multiple physical sectors (BLKCNT) to address specified in TADDHI and TADDLO, starting with the physical sector specified in HDRS and SIDS. Track and side boundaries are automatically incremented.
$FE	WRT_PHYS_MULTI	Similar to RD_PHYS_MULTI but writes to physical blocks specified in HDRS and SIDS using the data from the address pointed to by TADDHI and TADDLO.

Job Queue Error Codes

Code	FDC Mnemonic	Rec.	Description
$00	OK, COK	00	No errors
$01		00	No errors
$02	ERMSAD	80	Missing address mark in address field
$03	ERMSDT	80	Missing address mark in data field
$04	ERNODT	80	No data block found
$05	ENCRDT	80	CRC error in data field
$06	CFMTER	00	Format error
$07	ERMSSN	00	Verify failed
$08	ERWRPT	00	Write protect on
$09	ERCRAD	80	CRC error in address field
$0A	CILBLK	00	Illegal block
$0B	ERDKCG	00	Disk changed
$0C	ERINFT	00	Invalid format
$0D	EREQFL	00	Equipment check (FDC error)
$0E	CILJOB	00	Illegal job code
$0F	ERNOMD, CDNR	00	No media, drive not ready
$20	ERSKFL	01	Seek failed
$21	ERCDIP	00	FDC command in progress
$22	ERCDNP	00	FDC no result ready
$23	ERINRE	00	Number of result bytes mismatch
$24	EROVRN	00	Overrun error
$25	ERCTMK	80	Control mark found
$26	ERWGTK	01	Wrong track
$27	ERBDTK	01	Bad track
$28	ERUKFT	00	Unknown format
$29	ERINCD	00	Invalid command
$2A	ERINFD	00	Invalid controller
$2B	ERFTID	00	Read Track ID error

Recovery code key:		
	00	No recovery attempt
	01	Move head to track 0, recalibrate and retry
	80	Retry x times

Jump Tables

The FD implements a superset of the 1581 jump table. DOS commands (and some other important routines) are vectored through indirect addresses stored in RAM (see the Indirect Vectored Jump Table below). Other significant jump table entries are included in the non-vectored tables. Except where noted, the function and use of each FD jump table entry is the same as its 1581 counterpart. Close compatibility with the 1581 jump tables was retained in order to facilitate the easy conversion of 1581 drive-resident machine language programs for use on the FD.

Indirect Vectored Jump Table

Name	Jump Address	Vector Address	Description
IDLJMP	$FF00	$0190	Main idle loop
IRQJMP	$FF03	$0192	IRQ routine
NMIJMP	$FF06	$0194	Performs a 'UI' reset
VALJMP	$FF09	$0196	VALIDATE command
INIJMP	$FF0C	$0198	INITIALIZE command
PARJMP	$FF0F	$019A	'/' command (1581 sub-partitions)
MEMJMP	$FF12	$019C	M-R, M-W, M-E and MD commands
BLKJMP	$FF15	$019E	B-A, B-F, B-R, B-W, B-E and B-P
USRJMP	$FF18	$01A0	U0, U1, U2..., burst U0>xx
RECJMP	$FF1B	$01A2	REL file Record Position command
UTLJMP	$FF1E	$01A4	'&' Utility Loader command
COPJMP	$FF21	$01A6	COPY, CP, CD commands
RENJMP	$FF24	$01A8	RENAME, RD, R-H, R-P commands
SCRJMP	$FF27	$01AA	SCRATCH, SWAP commands
NEWJMP	$FF2A	$01AC	NEW command
CERJMP	$FF2D	$01AE	Controller error handler (enter with error in .A, buffer number in .X). Exits via IDLJMP
ATNJMP	$FF30	$01B0	Serial bus ATN service
TLKJMP	$FF33	$01B2	Serial bus TALK routine
LSNJMP	$FF36	$01B4	Serial bus LISTEN routine
JBLJMP	$FF39	$01B6	Controller Job Queue search, parse, and execute routine
XLAJMP	$FF3C	$01B8	Controller logical-to-physical translation routine (only remotely similar to 1581)
DERJMP	$FF3F	$01BA	DOS error handler (enter with error code in .A). Exits via IDLJMP

Non-Vectored Jump Table (FD Specific)

Name	Jump Address	Description
GPCJMP	$FF42	G-P, G-D commands
TIMJMP	$FF45	T-xx series of RTC commands
LOCJMP	$FF48	File LOCK command
WPTJMP	$FF4B	W-0, W-1 write protect commands
CCDJMP	$FF4E	Direct controller call (Native Job Queue). Enter with job in .A, buffer number in .X
DLEJMP	$FF51	Reserved for use by FD-DOS
CDXJMP	$FF6F	Direct controller call (Native Job Queue). Enter with job in .A, buffer number in .X. Exit to CERJMP error handler if an error occurs

Non-Vectored Jump Table (1581 Compatible)

Name	Jump Address	Description
JSTJMP	$FF54	Direct controller call (1581 Job Queue). Enter with job in .A and buffer number in .X. Same as 1581 JSTROBE_CONTROLLER call.
CMDJMP	$FF57	Autoloader routine. Searches for 'COPYRIGHT CMD 92' or 'COPYRIGHT CBM 86' file.
ALXJMP	$FF5A	Exit from autoloader. Replaces normal error vectors.
RCRJMP	$FF5D	Not implemented on FD (RTS).
AEDJMP	$FF60	Enter with carry clear to disable power-on/UJ/UI autoload. Enter with carry set to enable autoload.
FSDJMP	$FF63	Enter with carry clear to set fast serial direction IN; Enter with carry set to set fast serial OUT.
ALBJMP	$FF66	Not implemented on FD (RTS).
LDKJMP	$FF69	Logs disk if disk has been changed.
DTCJMP	$FF6C	Dumps track cache if 'dirty'.

Appendix A
Utilities

About the Utility Disks

A number of utility programs created by CMD are provided with the FD. These programs are located on the floppy disk titled FD Utilities. Be sure to backup this disk immediately. The following is a list of the programs:

FD Utilities

FD-TOOLS	Formatting, partitioning and configuration utility
FCOPY	File copier
MCOPY	Whole disk/partition copier
BCOPY	Whole disk/partition backup program
1541SUB	Subdirectory creation utility
1581SUB	Subdirectory creation utility
FD1581	gateWay 64 driver for 1581 partitions
FD1581_128	gateWay 128 driver for 1581 partitions
FDNative	gateWay 64 driver for Native partitions
FDNative_128	gateWay 128 driver for Native partitions
CMD_MOVE	Partition selector and copier for GEOS
CMD_TIME	Clock setting autoexec for GEOS

The function and use of the gateWay drivers and the CMD_MOVE and CMD_TIME utilities for GEOS are described in Section 4. The other utilities listed above are documented in the paragraphs that follow.

Note: Utility programs other than the ones listed here may appear on your disk. Normally, the titles of these programs will be self-explanatory, and their operation will be self-documenting.

FD-TOOLS

The primary function of FD-TOOLS is to format and partition the disks you will be using with your FD. It can also be used to set the optional Real Time Clock module. FD-TOOLS is written in BASIC, works in both 64 and 128 modes, and is loaded and run by entering the commands:

```
LOAD"FD-TOOLS",dv
RUN
```

Note: Substitute *dv* with the device number of the drive you are loading the program from.

Whenever FD-TOOLS is run, it will pause for a few seconds while it tries to find an FD out on the serial bus. When it finds an FD, it will display its device number along with the type of disk currently in the drive (i.e. CMD 1.60M, CBM 800K, etc.).

FD-TOOLS is a menu driven program. You highlight a menu option by using the cursor keys and then select (execute) the option by pressing <RETURN>. On screen prompts will instruct you on how to select the various sub-options. Normally, you will use the <+> and <-> keys to scroll through a list of choices, the <RETURN> key to select a choice, and the <←> key to abort an operation and return to the previous menu.

The main menu includes the following options:

```
DISKETTE FORMATTING OPTIONS
PARTITIONING OPTIONS
SET REAL TIME CLOCK
CHANGE DEVICE SELECTION
LOG NEW DISK
EXIT FROM PROGRAM
```

DISKETTE FORMATTING OPTIONS

This option enables you to format disks for use with your FD. Appropriate choices must be made regarding format type, density and partitioning.

Type

You have two basic choices for the format type: CBM and CMD. Use <+> and <-> to switch between the two choices, and <RETURN> to select the one that you wish to use. Choosing the CBM option will create an 800K disk with a format identical to that used by Commodore's 1581. The CMD option allows you to format a disk that can be partitioned (see Section 3 for an explanation of partitions).

Density

Choosing CMD as the type of disk format will require you to select the desired density. For CMD disks, you can select Double Density (DD 800K), High Density (HD 1.60M), or Enhanced Density (ED 3.20M) if you own an FD-4000. Use <+> and <-> to view the available choices, and <RETURN> to accept. You should always be sure to use the correct type of disk (DD, HD, ED) for the density that you select.

Partitions

If you are creating a disk with a CMD partitionable format, you will have to select a default partition arrangement. The '1 NATIVE' option will create a single Native Mode partition that uses all of the available storage on disk. The '1581' option will create one 1581 partition on an 800K disk, two 1581 partitions on a 1.6M disk, and four 1581 partitions on a 3.2M disk. Select 'NONE' if you want to create your own custom partition arrangement. Use <+> and <-> to view the available choices, and <RETURN> to accept.

Partition Name and ID

If you have selected the CBM 1581 format, or a CMD partitionable format with the '1 NATIVE' or '1581' partition options, you will be prompted to enter a name and ID for each partition that is to be created on the disk. Each partition name can be up to 16 characters long, while the partition ID is two characters in length. When the partitions are created, the system will place the partition name(s) you have specified in both the partition directory and the directory header.

Formatting the Disk

Just prior to beginning the actual formatting of the disk, FD-TOOLS will prompt you to insert a diskette. After you have inserted the disk, press <RETURN> to format it, or press <←> to exit without performing the format. It will take approximately 80-90 seconds to format a disk, depending upon which options you have selected.

PARTITIONING OPTIONS

This option enables you to create, delete, view and format partitions on CMD-formatted partitionable disks. You can also select a default partition.

View Partition Table

This selection displays a list of the 31 partitions that can exist on a CMD-formatted partitionable disk. The name and type of each partition on the disk is given along with the number of blocks that it occupies. Partitions that do not exist on a disk are listed as 'NOT IN USE'. The <+> and <-> keys will step you through the pages in the display, and <RETURN> allows you to exit back to the main menu.

Change Default Partition

This option allows you to change the default partition on CMD-formatted disks. When you select this option, the current default partition number is displayed, and you will be prompted to select a new default. Make your selection with the <+> and <-> keys and press the <RETURN> key. The program will check to see if the partition you select is legal.

Create Partitions

This option allows you to create new partitions on a CMD-formatted partitionable disk. The program will automatically default to the next available (unused) partition. This is usually the best choice as it will keep your partitions in order. However, if you wish, you may select any partition not yet in use. Use <+> and <-> to change the partition number, and press the <RETURN> key to accept.

You must then select the partition type. Again, use <+> and <-> to view the available choices, and <RETURN> to accept.

If you have a Native Mode partition, you will need to specify the partition size. The size is adjustable in increments of 256 blocks using <+> and <-> to select, and <RETURN> to accept.

The last step is to enter a name for the partition (16 characters maximum). Even though the usable characters have been limited in this program, you can later rename the partition with the FD DOS Rename Partition command if necessary.

After you have entered the partition name, FD-TOOLS will make sure you really want to create the partition (press <Y> for yes, <N> for no). Next, you will be asked whether or not you want to create another partition (press <Y> or <N>). If you press <Y>, you will define the parameters for another new partition in the same manner described above. If you press <N>, you will then be asked whether of not you want to write the new partition table (the new partitions you have defined are not actually created on the disk until this point). Pressing <Y> will actually create the partitions on the disk, while pressing <N> will bring you back to the Partitioning Options menu without making any changes to the partition layout on the disk.

Note: The number of partitions you can create is always limited by the amount of available storage on a particular disk. An INSUFFICIENT SPACE AVAILABLE message means that you will not be able to create a new partition until at least one existing partition has been deleted.

Delete Partitions

This option allows you to delete individual partitions on a CMD-formatted partitionable disk. Upon choosing this option you will be shown the first partition on disk. To select the partition that you wish to delete, use the <+> and <-> keys, and then press <RETURN> to accept. You can abort the process at this point by pressing the <←> key.

After you have selected a partition, FD-TOOLS will make sure you really want to delete the partition (press <Y> for yes, <N> for no). Next, you will be asked whether or not you want to delete another partition (press <Y> or <N>). If you press <Y>, you will select another partition as described above. If you press <N>, you will then be asked whether or not you want to write the new partition table (the partitions you have deleted are not actually removed from the disk until this point). Pressing <Y> will actually delete the partitions from the disk, while pressing <N> will bring you back to the Partitioning Options menu without making any changes to the partition layout on the disk.

Deleting partitions can take from a few seconds to several minutes depending on where they are located on disk. Any remaining partitions must be moved to fill in any vacated space between them, so that all the resulting free space can reside in one contiguous area.

WARNING: Deleting partitions will destroy all data within the partitions you are deleting. Also, if a disk error occurs while you are deleting partitions, there is a risk that information in one of the remaining partitions could be corrupted. Therefore, do not delete partitions without first backing up all valuable data on the disk.

Delete All Partitions

This option allows you to quickly delete all existing partitions on a CMD-formatted partitionable disk. After selecting this option, FD-TOOLS will ask you if you really want to delete all the partitions on the disk. Press <Y> to delete the partitions, or press <N> to return to the main menu without altering the partition layout on the disk.

Reformat Partition

This option allows you to 'NEW' the directory of a partition on a CMD-formatted partitionable disk without destroying information in any of the other partitions that reside on the same disk. To select the partition that you wish to reformat, use the <+> and <-> keys, and then press <RETURN> to accept. You will then be prompted to enter a name (up to 16 characters) and an ID for the directory header. After you have entered this information, FD-TOOLS will make sure you really want to reformat the partition (press <Y> for yes, <N> for no). Pressing <Y> will NEW the partition (clear the directory and BAM), while pressing <N> will bring you back to the Partitioning Options menu.

Rename Partition

This option allows you to change the name of a partition (as it appears in the partition directory) on a CMD-formatted partitionable disk. To select the partition that you wish to rename, use the <+> and <-> keys, and then press <RETURN> to accept. You will then be prompted to enter a new partition name (up to 16 characters). Next, FD-TOOLS will make sure you really want to rename the partition (press <Y> for yes, <N> for no). Pressing <Y> will rename the partition in the partition directory, while pressing <N> will bring you back to the Partitioning Options menu.

SET REAL TIME CLOCK

This option allows you to set the FD's optional Real Time Clock to the correct time and date. The current setting of the RTC will be displayed on the screen. Use the <+> and <-> keys to adjust each time and date parameter (day of week, month, day, year, hour, minute, second, AM/PM), and then press <RETURN> to accept each setting. After you have entered the AM/PM parameter, press <RETURN> again to actually set the Real Time Clock in the FD, or press <SPACE> to go back and edit the time and date again.

CHANGE DEVICE SELECTION

If you have more than one FD attached to your system, this option allows you to select the particular FD that you want to work with in FD-TOOLS. After you select this option, the device number of the currently selected FD is updated and displayed near the top of the screen.

LOG NEW DISK

When you are using FD-TOOLS, you should select this option after you insert a different disk in your FD so that the program can determine its format type before any partitioning is done. When a new disk is logged, its format type will be displayed near the top of the screen.

EXIT FROM PROGRAM

Selecting this option returns you to BASIC.

FCOPY

This program was created by CMD to fill the need for a file copier capable of copying any type of file between any two drives or between any two partitions on our devices. In addition, FCOPY supports Native Mode subdirectories, 1581 sub-partitions, and REU's running under RAMDOS. The use of this program is mostly self-explanatory, but we have included a breakdown of the functions here in order to provide more detail where necessary. This program may also be used to remove files, view directories, and send disk commands.

Set Source Device (F1)

This option selects the disk drive that you wish to copy files *from*. The device number and type of device will be shown on the display. If the drive type is not recognized by the program, question marks will be shown instead of the actual type. In the case of unrecognized third party disk drives, the program will work regardless unless the DOS in the particular drive happens to be highly incompatible with standard Commodore-style DOS commands and file handling procedures.

Set Target Device (F5)

This option selects the disk drive that you wish to copy files *to*. The device number and type of device will be shown on the display.

Set Source Partition (F3)

If the source device is a CMD device, this option allows you to select the partition from which files are to be copied. The partition number, name and type will be displayed in the source area.

Set Target Partition (F7)

If the target device is a CMD device, this will allow you to set the partition to which files are to be copied. The partition number, name and type will be displayed in the target area.

Set Source Path (S)

If the source device is a CMD device and the partition type is Native or 1581 Emulation, or if the source device is an actual 1581, a path for subdirectories or sub-partitions may be entered by the user. Each subdirectory or sub-partition name must be separated by a slash (/).

Set Target Path (T)

Same function as Set Source Path, except that the path is intended for the Target device.

Source/Target Directory (A/B)

Allows you to view the directory of the source or target disk. The program will ask for a search pattern so that you may view files which match a given name and/or filetype. On CMD devices with an RTC, the pattern will also allow the selection of files by time and date.

Select Files (F)

This option reads the source directory into the selection buffer after you have entered a search pattern. File information is stored in a dynamic method, so if necessary, you will be able to view from 700 to well over a thousand files. If your directory contains more files than can be viewed, you will need to limit the selection by using a pattern which will match fewer files. Once you have entered the file selection mode, you may select or de-select files by pressing the RETURN key while the arrow is pointing to the file. An asterisk (*) indicates which files have been selected. Pressing the 'T' key allows you to toggle all selections ('T' will select all unselected files, and de-select all selected files). When you have finished, press the back-arrow key (←) to return to the main menu.

Reselect Files (R)

You may, at any time after selecting files, return to the file selection mode without re-reading the directory. This allows you to change your selections before or after copying files.

Send Disk Command (@)

This option allows you to send a disk command to either the source or the target drive. Important: disk commands do not follow the source or target path, but are instead sent to the current directory. Therefore, it is wise to make sure you are currently in the correct partition, sub-partition, or subdirectory before sending a command intended for a certain area. When sending commands to an FD, RAMLink, RAMDrive or CMD HD you may include a partition number and path in the disk command.

Begin Copying (C)

This option starts the copying process. Only the files you have selected using the 'F' and/or 'R' options will be copied. When copying is complete, an option allows you to copy the same files to another disk (if your target drive is a floppy disk drive).

Begin Scratching (#)

This option starts scratching the files you selected using the 'F' and/or 'R' options. Please note: files are scratched from the source disk! You will be asked "ARE YOU SURE (Y/N)?" before the scratching operation begins.

Copy C-128 Boot Sector (&)

This option allows you to copy the C-128 boot sector (Track 1, Sector 0) from the Source to the Target. This function was provided because some C-128 programs will not load unless the boot sector is copied to the target disk along with the appropriate program file(s). Important: Use this function only on C-128 autoboot disks. Using it on disks that do not autoboot in C-128 mode creates the risk of corrupting data on the Target drive.

Exit Program (←)

Allows you to exit from program. If you wish to use the program again, it must be re-loaded.

MCOPY

This program is of the type commonly referred to as a 'whole disk copier'. It can copy an entire disk between two floppy drives of the same type, a floppy drive and similar CMD device partition, or two similar partition types on the same or separate CMD devices. The program will support all Commodore floppy drives, as well as any fully compatible third party drives.

MCOPY is also useful for backing up partitions to a floppy disk or to other partitions on the FD. It is also possible to copy Native Mode partitions to other Native Mode partitions of different sizes. This can be useful when you decide that you need a larger partition to hold data. Although it is also possible to copy from a larger partition to a smaller one, it is possible that some data will be lost in this process.

Selecting Source and Target devices and partitions is done in the same manner as described above in the FCOPY documentation. It is important to note, however, that the program will only let you select a target device/partition that is of the same type as the source device/partition. For example, if the source device is a 1541, you will be able to copy only to another 1541 or 1571 drive, or to a 1541 or 1571 partition on an FD, HD, RAMLink or RAMDrive. If the source device is a 1581 partition on the FD, you will be able to copy only to a 1581 drive or to a 1581 partition on another CMD device (FD, HD, RAMLink or RAMDrive).

MCOPY is self-documenting. A help menu is always on screen and lists the available options. Please note that MCOPY will overwrite any previous contents on the target partition or disk.

BCOPY

BCOPY was developed to provide CMD FD, HD, RAMLink and RAMDrive users with a way to back up the contents of these devices onto multiple floppy disks. You can use BCOPY to back up the entire contents of an FD disk all at once, or you can back up the contents of one partition at a time.

Note: The backup disks created by BCOPY represent a sector-by-sector backup of the original disk or partition and do not contain a directory. Thus, they are usable only for restoring a complete disk or partition and cannot be used outside of BCOPY for restoring data on a file-by-file basis.

Modes

BCOPY operates in two modes: Backup Mode and Restore Mode. Backup Mode allows you to back up the contents of your FD (or other CMD device) onto multiple floppy disks. Restore Mode allows you to restore the contents of a disk or partition on your CMD device from the multiple floppy backup disks. Use the <M> key to change modes (the default mode is Backup).

Backing up data

The first step in backing up data is to select the desired source and target drives. The source drive for a backup operation is selected by using the <f1> key. When in Backup Mode, BCOPY will let you select only CMD devices for the source drive (the device you will backup *from*). CMD devices include the FD, HD, RAMLink and RAMDrive. When you select the source drive, BCOPY automatically defaults to the 'ENTIRE DRIVE' backup mode. If you want to back up an individual partition instead of the entire device or disk, use the <f3>/<f4> keys to select the desired partition.

Next, select the target drive (the device you will backup *to*) by using the <f5> key. The target must be a floppy drive (1541, 1571, 1581 or FD). If the target device is an FD, you must select the desired disk capacity ('SIZE') by using the <f7>/<f8> keys. An FD-2000 can use either 800K or 1.6M disks; an FD-4000 can use 800K, 1.6M or 3.2M disks.

To start the backup process, press the <C> key. The status display will then inform you how many disks the backup will require and approximately how long the backup will take. At this point, you will be given the option to continue or quit. If you choose to continue, BCOPY will begin the backup process and prompt you to insert disks in the target drive as they are needed until the backup is complete. You will be reminded to label each completed disk with its sequence number, along with the source device/partition/disk number and/or name, and the current date.

Restoring data

In order to restore data to a partition or disk, you must first select Restore Mode by using the <M> key. Next, select the source drive for the restore operation by using the <f1> key. When in Restore Mode, the source drive (the device you will be restoring *from*) must be a floppy drive (1541, 1571, 1581 or FD). If the source device is an FD, you must specify the disk capacity ('SIZE') of the backup disks by using the <f7>/<f8> keys. An FD-2000 can use either 800K or 1.6M disks; and FD-4000 can use 800K, 1.6M or 3.2M disks.

Next, select the target drive by using the <f5> key. The target drive (the device you will restoring the data *to*) must be a CMD device (FD, HD, RAMLink or RAMDrive). When you select the target drive, BCOPY automatically defaults to the 'ENTIRE DRIVE' restore mode. If you want to restore an individual partition instead of the entire device or disk, use the <f3>/<f4> keys to select the desired partition

To start the restore operation, press the <C> key. BCOPY will begin restoring the disk or partition and will prompt you to insert disks in the source drive as they are needed until the restore operation is complete.

Important: BCOPY has no way of checking the backup disks to make sure you are inserting them in the proper order or if they are the correct ones for the intended target disk or partition. Therefore, it is important that you label your backup disks properly and that you pay close attention to the labels when you run a restore operation.

1541SUB and 1581SUB

These utilities are nearly identical in function and are used to create Native Mode subdirectories which emulate the directories of 1541 and 1581 drives. Using these types of subdirectories may allow the use of programs which will not normally work in a Native Mode partition.

Creating an emulation subdirectory in a Native Mode partition can be a good way to extend the amount of usable disk space with programs that can only work with the directory structure of a 1541/1571 or 1581 disk drive. Be aware, however, that some programs check to see how many tracks or sectors it can access, and determine the type of drive being used by doing so. As a result, it may be difficult to determine which subdirectory type to emulate (1541/1571 or 1581). 1581 emulation subdirectories will usually work with such programs, but some will always require a 1541 or 1571.

Important: A Native Mode partition must be at least 4608 blocks in size (4544 blocks free) for 1541SUB to work, and at least 10240 blocks in size (10176 blocks free) for 1581SUB to work. As a result, 1581SUB can only be used on an FD-4000 with an ED disk.

Whenever you use a subdirectory for emulation purposes, remember to use the CD (Change Directory) command to make that directory the current one before using your software.

1541SUB creates a subdirectory which begins at the same location as the directory on a 1541 (track 18, sector 1). A header block for this directory is also created and placed where the header block on a 1541 is located (track 18, sector 0).

1581SUB creates a subdirectory which begins at the same location as the directory on a 1581 (track 40, sector 3). A header block for this directory is also created and placed where the header block on a 1581 is located (track 40, sector 0). Due to the way Native Mode subdirectories work, 1581SUB must create two subdirectories to provide the proper headers and directory space. This program has been tested for use with Superbase and Superbase 128 and allows these programs to access larger storage areas.

To use either of these programs, LOAD and RUN the one which you wish to use. The program will ask for the device number of the FD as well as the partition number you wish to create the subdirectory in. Do not use either of these programs on a partition which contains useful data, as the partition will be formatted by the utility. You must also make sure that the partition you select for use has enough tracks to support the subdirectory (minimum 18 tracks for 1541SUB, 40 tracks for 1581SUB).

WARNING: Use these utilities on an empty Native Mode partition only. Any data stored in the partition will be lost.

Appendix B
Error Codes

The error codes used by the FD have been arranged to be compatible with the codes used on Commodore floppy disk drive units. A number of new codes have been added as well, in order to indicate conditions which are unique to this drive. Whenever errors are encountered on your FD, these codes may help in localizing the problem.

Errors are returned over the command channel in the following format:

```
ec,estring,tv,sv
```

where: ec = a two-digit error number
estring = an ASCII string describing the error
tv = the track variable (the logical track where the error took place)
sv = the sector variable (the logical sector where the error took place)

Note: The track and sector values returned in an error message always refer to a *logical* block within a partition or on disk, which usually has little or no relation to the actual physical sector where a disk error may actually have occurred. See Appendix C for listings of the logical track and sector layouts of the various partition types utilized by the FD. In addition, some errors define special meanings for the track and sector variables and are described below when necessary.

Command Channel Error Codes

0 0 OK (not an error)
This code is present when no other error condition exists.

0 1 FILES SCRATCHED (not an error)
Occurs after using the DOS or BASIC scratch commands. The number of files scratched will be indicated in the track variable, and the sector variable will contain a zero.

0 2 PARTITION SELECTED (not an error)
Occurs after switching partitions with the FD DOS 'CP' command, and after changing 1581 sub-partitions with the '/' command. After using the 'CP' command, the track variable contains the partition number of the newly selected partition, while the sector variable contains zero. After the '/' command is issued, the track variable contains the number of the first track in the 1581 sub-partition, while the sector variable contains the number of the last track.

20 READ ERROR (no header found)
Unable to find or read the header for the requested data block. Usually caused by bad media or when a data block header has been destroyed through other means.

21 READ ERROR (missing data address mark)
Address mark missing from data field. Usually caused by improperly formatted or unformatted disk, or by damaged or defective media.

22 READ ERROR (data block not found)
May occur when attempting to read or verify a data block. Often caused by an improperly written data block.

23 READ ERROR (data CRC error)
Indicates an error in the data of a block. This particular error would occur if the data had been readable, yet the CRC did not match the value indicated.

25 WRITE ERROR (write-verify error)
Occurs when the data just written to disk does not match the version of that data stored in drive memory. Often caused by defective media.

26 WRITE PROTECT ON
Indicates that an attempt was made to write to the FD while the disk inserted was write protected or while the software write protect function was enabled.

27 READ ERROR (header CRC error)
Indicates that an error was detected while trying to read the header of a block so no attempt was made to read the data from that block.

30 SYNTAX ERROR (general)
Indicates that the FD DOS command interpreter was unable to identify the last command sent via the command channel. This is usually caused by incorrect characters being present in the disk command.

31 SYNTAX ERROR (unrecognized command)
Usually indicates that the first character of the last command string was not recognized as part of a legal DOS command.

32 SYNTAX ERROR (command string too long)
Occurs when a disk command string contains over 127 characters. Due to the large size of the command channel input buffer in the FD, this error should rarely be encountered.

33 SYNTAX ERROR (illegal file name)
Usually indicates that an attempt was made to use wildcards or pattern matching within a file name or disk command that does not accept wildcards.

34 SYNTAX ERROR (missing file name)
The last disk command failed due to a missing file name or the file name should have been preceded by a colon (:).

39 FILE NOT FOUND
This particular 'file not found' error will usually show up when a subdirectory name specified in a path is not found, when a 1581 style sub-partition cannot be located, or when a file specified in an autoboot sector cannot be located. Make sure that the spelling is correct and that the sub-partition, subdirectory or file exists.

40 CONTROLLER ERROR (seek failed)
Drive was unable to perform a seek operation successfully. Usually indicates a problem or failure of the drive mechanism itself.

41 CONTROLLER ERROR (FDC command in progress)
Occurs if an attempt is made to issue a command to the FDC while the previous command was still executing. This should never occur while using the standard DOS, but might result if custom FDC routines are utilized.

42 CONTROLLER ERROR (FDC no result ready)
Such an error is uncommon, but indicates that the controller never received a command, and therefore cannot send any data. This would probably only happen in the event of hardware failure, or possibly in an environment with a large amount of electrical interference.

43 CONTROLLER ERROR (result length mismatch)
Too few or too many result bytes received. This might occur if a command were mis-interpreted due to hardware problems.

44 CONTROLLER ERROR (overrun error)
Controller unable to keep up with the requests for data transfers. Indicates a hardware problem causing speed differentials.

45 CONTROLLER ERROR (control mark found)
Indicates that a block was found which did not format correctly, and was marked as bad. Usually indicates bad media.

46 CONTROLLER ERROR (wrong track)
The controller and mechanism do not agree as to which track is being accessed. Possibly caused by mechanism problems.

47 CONTROLLER ERROR (bad track)
Indicates that the track is marked with an FF and that the sector being searched for could not be found.

48 ILLEGAL JOB (in job queue)
The last job code placed into the job queue was not legal.

49 INVALID FORMAT
The disk is formatted, but the format does not match either the CBM or CMD formats.

50 RECORD NOT PRESENT
The last attempt to access a relative (REL) file record specified a record number which does not yet exist. This condition will result even when attempting to create or expand a relative file, and under those conditions should be ignored.

51 OVERFLOW IN RECORD
The last attempted write to a relative record contained more data than could be stored in the record. When this occurs, as much data as can fit is stored into the record.

52 FILE TOO LARGE
The last attempt to access a relative record would have exceeded the amount of storage space remaining in the partition specified. Under this condition, no additional records were added to the file, and if this was an attempt to create a new relative file, the file was not created.

60 WRITE FILE OPEN
The last attempt to open a file was made to a file which was already open for writing.

61 FILE NOT OPEN
Indicates that the last attempt to access data was made to a file which was not properly opened. Under some circumstances, this error is not generated and the attempt to access the file is simply ignored.

62 FILE NOT FOUND
During the last attempt to open a file, the DOS could not find the file specified by the path and filename given. This error will also occur if the filetype of the file does not match the allowed filetypes.

63 FILE EXISTS
While attempting to open a new file, another file with the same name was found in the specified partition or sub-directory.

64 `FILE TYPE MISMATCH`
The specified filetype was illegal for the particular operation.

65 `NO BLOCK`
An attempt was made to allocate an already-allocated block using the BLOCK-ALLOCATE command. The track and sector variables will contain the next available block when this condition occurs. If the track variable contains a zero, there are no blocks available.

66 `ILLEGAL BLOCK`
Occurs when an attempt is made to access a track or sector which does not exist. This may occur if one of the track and sector links within a file have become corrupted.

67 `ILLEGAL BLOCK`
Usually caused by a corrupt disk. This error shows up when the logical or physical block parameters do not exist.

70 `NO CHANNEL`
This indicates that the specified channel within a disk command is already in use, or that all buffers in the drive are currently in use. This may be an indication that too many files are currently open.

71 `DIRECTORY ERROR`
Indicates that the BAM (Block Availability Map) on the diskette is invalid. To correct the problem, Validate the disk.

72 `PARTITION FULL`
Occurs when the targeted partition or its directory are full. When this message is sent, there are still two blocks free in the partition, allowing the current file to be closed.

74 `DRIVE NOT READY`
Occurs after an attempt was made to access an illegal partition or a partition that has not been properly formatted.

75 `FORMAT ERROR`
The last format operation failed due to an error.

76 `HARDWARE ERROR`
Indicates that a non-recoverable hardware error has occurred. Usually indicates a hardware problem with the mechanism or controller.

77 `SELECTED PARTITION ILLEGAL`
Occurs after an attempt has been made to enter a nonexistent (or illegal) partition.

78 `SYSTEM ERROR`
Indicates a problem with the system area on the disk. Try reformatting the disk.

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Appendix C
Disk, Partition and File Formats

When accessing the logical (DOS) tracks and sectors on the FD, it is important to remember that the track and sector layout is specific to the type of partition in which the access occurs. It is through this method that the FD is able to attain its high level of compatibility. Therefore, when accessing an Emulation Mode partition, the logical track and sector layout of the partition is identical to that of the drive that it emulates, no matter where the partition is physically located on the FD disk. Note: the physical tracks and sectors of an FD disk can be accessed only through the use of Burst or Job Queue commands (see the Command Reference section for more information on the physical access of FD disks).

This appendix details the physical layout of standard FD disk formats along with the logical (DOS) track and sector layout of each partition type, including the header, BAM and directory block locations. This appendix also provides information about the format of BAM and directory entries, as well as the format of different file types.

Physical Disk Formats

PHYSICAL TRACK AND SECTOR LAYOUT BY DISK FORMAT (All formats are double-sided)			
FORMAT	TRACKS	SECTORS	SECTOR SIZE
CMD/CBM 800K	0 through 79	1 through 10	512 bytes
CMD 1.60M	0 through 79	1 through 10	1024 bytes
CMD 3.20M	0 through 79	1 through 20	1024 bytes
IBM 720K	0 through 79	1 through 9	512 bytes
IBM 1.44M	0 through 79	1 through 18	512 bytes
IBM 2.88M	0 through 79	1 through 36	512 bytes

Figure C1

Common Formats Used in all Partition Types

DIRECTORY FILE TABLE FORMAT (ALL PARTITION TYPES)
1541 & 1571 PARTITIONS - TRACK 18 SECTOR 1
1581 PARTITION - TRACK 40 SECTOR 3
NATIVE PARTITION - TRACK 1 SECTOR 34

BYTE	DESCRIPTION
0	Track pointer to next directory block (0 indicates last block)
1	Sector pointer to next directory block (255 indicates last block)
2-31	File entry 1 (see Figure C3)
32-33	Two zero (0) bytes (reserved)
34-63	File entry 2 (see Figure C3)
64-65	Two zero (0) bytes (reserved)
66-95	File entry 3 (see Figure C3)
96-97	Two zero (0) bytes (reserved)
98-127	File entry 4 (see Figure C3)
128-129	Two zero (0) bytes (reserved)
130-159	File entry 5 (see Figure C3)
160-161	Two zero (0) bytes (reserved)
162-191	File entry 6 (see Figure C3)
192-193	Two zero (0) bytes (reserved)
194-223	File entry 7 (see Figure C3)
224-225	Two zero (0) bytes (reserved)
226-255	File entry 8 (see Figure C3)

Figure C2

DIRECTORY FILE ENTRY FORMAT
ALL PARTITION TYPES AND NATIVE MODE SUBDIRECTORIES

BYTE	VALUE	DESCRIPTION
0		File type:
	0	DEL (Deleted)
	1	SEQ (Sequential)
	2	PRG (Program)
	3	USR (User)
	4	REL (Relative)
	5	CBM (1581 style sub-partition)
	6	DIR (Native Mode subdirectory)
		Note: Filetypes are OR'ed with $80 if the file has been properly closed. Filetypes are OR'ed with $C0 if the file is locked.
1		Track pointer to first data block (or header block if filetype is DIR)
2		Sector pointer to first data block (or header block if filetype is DIR)
3-18		Filename padded with shifted spaces ($A0)
19		Pointer to starting track of side sector or super side sector if filetype is REL
20		Pointer to starting sector of side sector or super side sector if filetype is REL
21		Record length if filetype is REL
22	0	Reserved
23		Year file was created (last two digits)
24		Month file was created
25		Day file was created
26		Hour file was created
27		Minute file was created
28		Number of blocks used by file (low byte)
29		Number of blocks used by file (high byte)

Figure C3

1541 and 1571 Emulation Mode Partitions

SECTORS PER TRACK (1541 EMULATION MODES)		
TRACK RANGE	SECTORS AVAILABLE	TOTAL
1 through 17	0 through 20	21
18 through 24	0 through 18	19
25 through 30	0 through 17	18
31 through 35	0 through 16	17

Figure C4

SECTORS PER TRACK (1571 EMULATION MODE)		
TRACK RANGE	SECTORS AVAILABLE	TOTAL
1 through 17	0 through 20	21
18 through 24	0 through 18	19
25 through 30	0 through 17	18
31 through 35	0 through 16	17
36 through 52	0 through 20	21
53 through 59	0 through 18	19
60 through 65	0 through 17	18
66 through 70	0 through 16	17

Figure C5

HEADER & BAM (1541 & 1571 EMULATION MODES) TRACK 18 SECTOR 0		
BYTE	VALUE	DESCRIPTION
0	18	Track pointer to first directory block
1	1	Sector pointer to first directory block
2	65	ASCII 'A' for format type
3	0	1541 Emulation Mode
	128	1571 Emulation Mode
4-143		BAM (Block Availability Map)
144-161		Disk name padded with shifted spaces
162-163		Disk ID
164	160	Shifted Space for separator
165	50	ASCII '2' for DOS version
166	65	ASCII 'A' for format type
167-170	160	Shifted spaces for separators
171-220	0	Null bytes - reserved
221-255	0	1541 Emulation mode - Null bytes - reserved 1571 Emulation mode - Number of sectors available for tracks 36 through 70 - one byte per track (part of 1571 (side 2) BAM)

Figure C6

BAM for 1571 (side 2) EMULATION MODE
TRACK 53 SECTOR 0

BYTE	VALUE	DESCRIPTION
0-104		BAM for tracks 36 through 70 (3 bytes per track)
105-255	0	Null bytes - reserved

Figure C7

BAM ENTRY FORMAT
1541 & 1571 (side 1) EMULATION MODES
Format of bytes 4-143 in Track 18 Sector 0 (Figure C6)
4 bytes per track: bytes 4-7 cover track 1, bytes 8-11 cover track 2, ...

BYTE	DESCRIPTION
0	Number of sectors available on track
1	Block Availability for sectors 0 - 7
2	Block Availability for sectors 8 - 15
3	Block Availability for sectors 16 - 23
Notes:	The lowest bit (LSB) in each byte (bytes 1 through 3) indicates the status of the lowest sector covered by that byte. A binary value of 1 indicates that the sector is available, while a value of 0 indicates that the sector is allocated.

Figure C8

BAM ENTRY FORMAT
1571 (side 2) EMULATION MODE
Format of bytes 0 - 104 on Track 53 Sector 0 (Figure C7)
3 bytes per track: bytes 0-2 cover track 36, bytes 3-5 cover track 37, ...

BYTE	DESCRIPTION
0	Block Availability for sectors 0 - 7
1	Block Availability for sectors 8 - 15
2	Block Availability for sectors 16 - 23
Notes:	The lowest bit (LSB) in each byte (bytes 0 through 2) is used to indicate the status of the lowest sector covered by that byte. A binary value of 1 indicates that the sector is available, while a value of 0 indicates that the sector is allocated. The associated byte for the number of sectors available on each track is stored in bytes 221 through 225 of track 18 sector 0 (see Figure C6).

Figure C9

1581 Emulation Mode Partitions

SECTORS PER TRACK		
TRACK RANGE	SECTORS AVAILABLE	TOTAL
1 through 80	0 through 39	40

Figure C10

DIRECTORY HEADER TRACK 40 SECTOR 0		
BYTE	VALUE	DESCRIPTION
0	40	Track pointer to first directory block
1	3	Sector pointer to first directory block
2	68	ASCII 'D' for format type
3	0	Reserved
4-21		Disk name padded with shifted spaces
22-23		Disk ID
24	160	Shifted Space for separator
25	51	ASCII '3' for DOS version
26	68	ASCII 'D' for format type
27-28	160	Shifted spaces for separators
29-255	0	Null bytes - reserved

Figure C11

BAM BLOCK1 TRACK 40 SECTOR 1		
BYTE	VALUE	DESCRIPTION
0	40	Track pointer to next BAM block
1	2	Sector pointer to next BAM block
2	68	ASCII 'D' for DOS version
3	187	Complement of version number
4- 5		Disk ID
6	192	Not used in FD - set to 1581 default value
7	0	Bit 6 - Flag for Auto Loader file
8-15	0	Reserved
16-255		BAM for tracks 1 through 40 (6 bytes per track)

Figure C12

BAM 2 TRACK 40 SECTOR 2		
BYTE	VALUE	DESCRIPTION
0	0	Indicates last sector for BAM
1	255	Indicates all bytes in sector used
2	68	ASCII 'D' for DOS version (copy)
3	187	Complement of version number (copy)
4-5		Disk ID (copy)
6	192	Not used in FD - set at 1581 default value
7	0	Bit 6 - Flag for Auto Loader file
8-15	0	Reserved
16-255		BAM for tracks 41 through 80 (6 bytes per track)

Figure C13

BAM ENTRY FORMAT Format of bytes 16 - 255 in Track 40 Sectors 1 and 2 (Figures C12 & C13)	
BYTE	DESCRIPTION
0	Number of sectors available on track
1	Block Availability for sectors 0 - 7
2	Block Availability for sectors 8 - 15
3	Block Availability for sectors 16 - 23
4	Block Availability for sectors 24 - 31
5	Block Availability for sectors 32 - 39
Notes:	The lowest bit (LSB) in each byte (bytes 1 through 5) indicates the status of the lowest sector covered by that byte. A binary value of 1 indicates that the sector is available, while a value of 0 indicates that the sector is allocated.

Figure C14

Native Mode Partitions

SECTORS PER TRACK		
TRACK RANGE	SECTORS AVAILABLE	TOTAL
1 through 255	0 through 255	256

Figure C15

ROOT DIRECTORY AND SUBDIRECTORY HEADER
TRACK 1 SECTOR 1 FOR ROOT DIRECTORY
VARIES FOR SUBDIRECTORIES

BYTE	VALUE	DESCRIPTION
0		Track pointer to first directory block
1		Sector pointer to first directory block
2	72	ASCII 'H' for format type
3	0	Reserved
4-21		Disk name padded with shifted spaces
22-23		Disk ID
24	160	Shifted space for separator
25	49	ASCII '1' for DOS version
26	72	ASCII 'H' for format type
27-28	160	Shifted spaces for separators
29-31	0	Reserved
32	1	Pointer to ROOT header track
33	1	Pointer to ROOT header sector
34		Track pointer to DIR PARENT header
35		Sector pointer to DIR PARENT header
36		Track pointer to DIR entry in PARENT directory
37		Sector pointer to DIR entry in PARENT directory
38		Index to starting byte of DIR entry in PARENT directory
39-255	0	Null bytes - reserved

Figure C16

NATIVE MODE BAM (1st BAM block)
TRACK 1 SECTOR 2

BYTE	VALUE	DESCRIPTION
0	0	Reserved
1	0	Reserved
2	72	ASCII 'H' for format type
3	183	Complement of format type
4-5		Disk ID
6	192	Not used in FD - set at 1581 default value
7	0	Not used
8		Track number of last available track in partition
9-31	0	Reserved
32-255	0	BAM for tracks 1 through 7 (32 bytes per track)

Figure C17

NATIVE MODE BAM (blocks 2-32)
TRACK 1 SECTORS 3 - 28

TRACK	SECTOR	DESCRIPTION
1	3	BAM for tracks 8 through 15 (32 bytes per track)
1	4	BAM for tracks 16 through 23 (32 bytes per track)
1	5	BAM for tracks 24 through 31 (32 bytes per track)
1	6	BAM for tracks 32 through 39 (32 bytes per track)
1	7	BAM for tracks 40 through 47 (32 bytes per track)
1	8	BAM for tracks 48 through 55 (32 bytes per track)
1	9	BAM for tracks 56 through 63 (32 bytes per track)
1	10	BAM for tracks 64 through 71 (32 bytes per track)
1	11	BAM for tracks 72 through 79 (32 bytes per track)
1	12	BAM for tracks 80 through 87 (32 bytes per track)
1	13	BAM for tracks 88 through 95 (32 bytes per track)
1	14	BAM for tracks 96 through 103 (32 bytes per track)
1	15	BAM for tracks 104 through 111 (32 bytes per track)
1	16	BAM for tracks 112 through 119 (32 bytes per track)
1	17	BAM for tracks 120 through 127 (32 bytes per track)
1	18	BAM for tracks 128 through 135 (32 bytes per track)
1	19	BAM for tracks 136 through 143 (32 bytes per track)
1	20	BAM for tracks 144 through 151 (32 bytes per track)
1	21	BAM for tracks 152 through 159 (32 bytes per track)
1	22	BAM for tracks 160 through 167 (32 bytes per track)
1	23	BAM for tracks 168 through 175 (32 bytes per track)
1	24	BAM for tracks 176 through 183 (32 bytes per track)
1	25	BAM for tracks 184 through 191 (32 bytes per track)
1	26	BAM for tracks 192 through 199 (32 bytes per track)
1	27	BAM for tracks 200 through 207 (32 bytes per track)
1	28	BAM for tracks 208 through 215 (32 bytes per track)
1	29	BAM for tracks 216 through 223 (32 bytes per track)
1	30	BAM for tracks 224 through 231 (32 bytes per track)
1	31	BAM for tracks 232 through 239 (32 bytes per track)
1	32	BAM for tracks 240 through 247 (32 bytes per track)
1	33	BAM for tracks 248 through 255 (32 bytes per track)

Figure C18

NATIVE MODE BAM ENTRY FORMAT

Format of bytes 32 - 255 in Track 1 Sector 2 and bytes 0 - 255 in Track 1 Sectors 3 - 33 (Figures C12 & C13)

BYTE	DESCRIPTION
0	Block Availability for sectors 0 - 7
1	Block Availability for sectors 8 - 15
2	Block Availability for sectors 16 - 23
3	Block Availability for sectors 24 - 31
4	Block Availability for sectors 32 - 39
5	Block Availability for sectors 40 - 47
6	Block Availability for sectors 48 - 55
7	Block Availability for sectors 56 - 63
8	Block Availability for sectors 64 - 71
9	Block Availability for sectors 72 - 79
10	Block Availability for sectors 80 - 87
11	Block Availability for sectors 88 - 95
12	Block Availability for sectors 96 - 103
13	Block Availability for sectors 104 - 111
14	Block Availability for sectors 112 - 119
15	Block Availability for sectors 120 - 127
16	Block Availability for sectors 128 - 135
17	Block Availability for sectors 136 - 143
18	Block Availability for sectors 144 - 151
19	Block Availability for sectors 152 - 159
20	Block Availability for sectors 160 - 167
21	Block Availability for sectors 168 - 175
22	Block Availability for sectors 176 - 183
23	Block Availability for sectors 184 - 191
24	Block Availability for sectors 192 - 199
25	Block Availability for sectors 200 - 207
26	Block Availability for sectors 208 - 215
27	Block Availability for sectors 216 - 223
28	Block Availability for sectors 224 - 231
29	Block Availability for sectors 232 - 239
30	Block Availability for sectors 240 - 247
31	Block Availability for sectors 248 - 255
Notes:	The lowest bit (LSB) in each byte (bytes 0 through 31) indicates the status of the highest sector covered by that byte. A binary value of 1 indicates that the sector is available, while a value of 0 indicates that the sector is allocated.

Figure C19

File Formats

PROGRAM FILE FORMAT	
BYTE	DESCRIPTION
0	Pointer to track of next file block (contains a zero if current block is last block in file).
1	Pointer to sector of next file block (contains pointer to last byte used if current block is last block in file).
2-255	Program data (bytes 2 and 3 contain load address of program in low byte-high byte format if current block is first block in file).

Figure C20

SEQUENTIAL FILE FORMAT	
BYTE	DESCRIPTION
0	Pointer to track of next file block (contains a zero if current block is last block in file).
1	Pointer to sector of next file block (contains pointer to last byte used if current block is last block in file).
2-255	Data bytes .

Figure C21

RELATIVE FILE DATA BLOCK FORMAT	
BYTE	DESCRIPTION
0	Pointer to track of next data file block (contains a zero if current block is last data block in file).
1	Pointer to sector of next data file block (contains pointer to last byte used if current block is last data block in file).
2-255	Data bytes .Empty records will begin with a $FF in the first byte of the record, the remaining bytes will contain $00 bytes. Partially filled records will also contain $00 bytes in the unused portion of the record.

Figure C22

RELATIVE FILE SUPER SIDE SECTOR BLOCK FORMAT	
BYTE	DESCRIPTION
0	Pointer to track of first side sector in first group (group 0).
1	Pointer to sector of first side sector in first group (group 0).
2	Super side sector identification byte ($FE)
3-254	Track and sector pointers to first side sector of 126 groups (groups 0 through 125, two bytes per pointer). Unused group pointers contain $00 bytes.

Figure C23

RELATIVE FILE SIDE SECTOR BLOCK FORMAT	
BYTE	DESCRIPTION
0	Pointer to track of next side sector in this group (contains a zero if current block is last side sector block in use).
1	Pointer to sector of next side sector in this group (contains pointer to last byte used if current block is last side sector block in use).
2	Side sector number (0 - 5)
3	Record length of associated relative file
4	Pointer to track of first side sector in this group (number 0).
5	Pointer to sector of first side sector in this group (number 0).
6-7	Pointer to track and sector of second side sector in this group (number 1).
8-9	Pointer to track and sector of third side sector in this group (number 2).
10-11	Pointer to track and sector of fourth side sector in this group (number 3).
12-13	Pointer to track and sector of fifth side sector in this group (number 4).
14-15	Pointer to track and sector of sixth side sector in this group (number 5).
16-255	Track and sector pointers to 120 data blocks (two bytes per pointer). Unused data block pointers contain $00 bytes.

Figure C24

Appendix D
FD Memory Map

$FFFF	FD-DOS ROM	$8000
$7FFF	Cache & BAM Buffers	$5000
$4FFF	System I/O	$4000
$3FFF	2K Free RAM	$3800
$37FF	System RAM & Variables	$2200
$21FF	DOS Buffers	$0300
$02FF	System Variables	$0280
$027F	Command Buffer	$0200
$01FF	Vectors & Variables	$0180
$017F	Stack	$0100
$00FF	Zero Page	$0000

CMD FD Extended Memory Map

Address Range	Description
$0000 - $0004	1541/1571 Emulation Mode Job Queue
$0006 - $000F	1541/1571 Job Queue Track & Sector Variables
$0002 - $000A	1581 Emulation Mode Job Queue
$000B - $001C	1581 Job Queue Track & Sector Variables
$001D - $0027	Zero Page Variables
$0028 - $0047	Native Mode Job Queue
$0048 - $00F7	Zero Page Variables
$00F8 - $00FF	Free Zero Page RAM
$0100 - $017F	Processor Stack
$0180 - $01BA	Indirect Vectors and System Variables
$01BC - $01CD	1581 Translated Physical Track & Sector
$01CE - $01D6	1581 Side Variable for Job
$01D7 - $01FF	System Variables
$0200 - $027F	Input Command Buffer (127 bytes)
$0280 - $02FF	System Variables
$0300 - $21FF	DOS Buffers (31 buffers - 256 bytes each)
$2200 - $24FF	System Buffers
$2500 - $253F	Error Buffer
$2540 - $27FF	System Variables
$2800 - $283F	Native Mode Track & Sector Job Queue Variables
$2840 - $285F	Native Mode Side Variable
$2860 - $287F	Target Address (high) Variable
$2880 - $289F	Target Address (low) Variable
$28A0 - $28BF	Block Count Variable
$28C0 - $28FF	Translated Physical Track & Sector Variables
$2900 - $291F	Translated Side Variable
$2920 - $295F	Reserved
$2960 - $297F	Last Job in Job Queue
$2980 - $29FF	Reserved
$2A00 - $2A1F	Partition Type Table
$2A20 - $2A3F	Partition Size (high) Table
$2A40 - $2A5F	Partition Size (middle) Table
$2A60 - $2A7F	Partition Size (low) Table
$2A80 - $2A9F	Partition Starting Address (high) Table
$2AA0 - $2ABF	Partition Starting Address (middle) Table
$2AC0 - $2ADF	Partition Starting Address (low) Table
$2AE0 - $37FF	System Variables
$3800 - $3FFF	2K Free RAM
$4000 - $4BFF	6522 I/O
$4C00 - $4DFF	Undecoded I/O (reserved)
$4E00 - $4FFF	FDC Controller I/O
$5000 - $6FFF	Cache Buffer
$7000 - $7FFF	BAM Buffers
$8000 - $FFFF	DOS ROM

Appendix E
DOS ROM and RTC Installation

Before you Begin

This appendix describes the procedure for installing a DOS ROM upgrade or the optional Real Time Clock (RTC) module.

The DOS ROM is an IC chip that contains the FD's disk operating system (DOS); this chip must be replaced in order to upgrade the DOS to a later revision. CMD makes upgrades available to FD owners in order to provide them with bug corrections and/or enhancements included in the latest version of the FD DOS. In most cases, CMD will notify FD owners when a significant upgrade becomes available and will provide information regarding any fees or other details. The DOS ROM installs in a socket on the FD's circuit board and requires no soldering to remove or replace.

The RTC module provides the FD with the ability to time and date stamp all files and to automatically set the GEOS clock. If you purchased your FD with the RTC option already installed, you can disregard these instructions. However, if you purchased the RTC as a separate add-on accessory at a later date, you will need to follow the instructions provided in this appendix to install it in your FD. The RTC module plugs into in the DOS ROM socket, with the DOS ROM 'piggybacked' on top of the RTC module.

Required Tools

- Phillips screwdriver
- Chip extractor or small, flat-blade screwdriver

Installation Procedure

This procedure details installation of both the DOS ROM and RTC module.

1. Make sure the FD is shut off, then remove the serial bus and power supply cables.

2. Turn the FD upside-down and remove the four screws that hold the top and bottom of the case together. Slide off the top half of the case.

3. Remove the four screws holding the floppy drive mechanism to its support brackets. Next, lift the drive mechanism upward and then tilt it over backwards, thereby exposing the FD circuit board. Leave the ribbon and power cables connected to the drive mechanism.

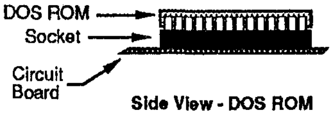
4. Locate and remove the DOS ROM identified as U2 on the circuit board (use the chip extractor or small screwdriver). Raise the chip evenly from the socket by lifting one end slightly, then the other end, back and forth until both ends are out of the socket. Do not attempt to remove the socket from the circuit board - make sure your extractor or screwdriver blade is between the chip and the socket! (If your FD already has an RTC module installed, remove the DOS ROM from the RTC module).

5. Place the new DOS ROM or RTC Module into the socket (Important: the notched end must point toward the outside of the circuit board - see the figure below). Make sure all pins are aligned properly to avoid damage, and then press the ROM or RTC firmly into place.

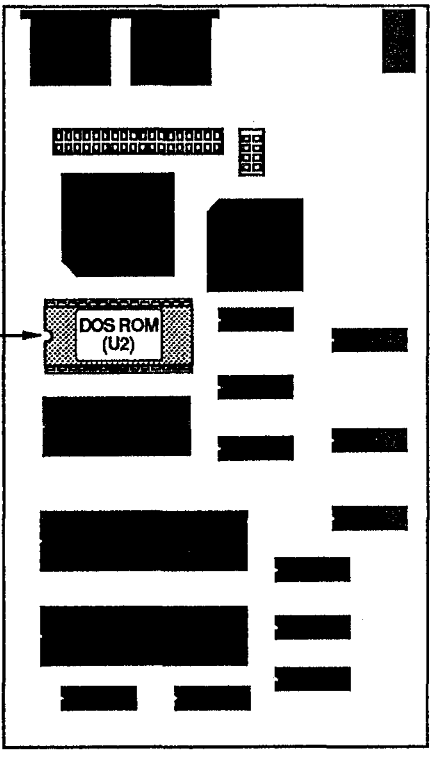
   RTC installations only: Place the DOS ROM on top of the RTC module (make sure the notched end points toward the outside of the board). Make sure all pins are aligned, and press the ROM into place.

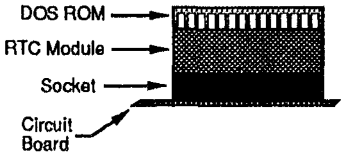
6. Tilt the drive mechanism back into place and reinstall the four screws that hold it into place. Important: Before tightening the screws, make sure the mechanism is seated as low as possible in the brackets.

7. Replace the top cover and reinstall the four screws that hold it in place.



Side View - DOS ROM





Side View - DOS ROM and RTC Module

LIMITED WARRANTY

Creative Micro Designs, Inc., 15 Benton Dr., P.O. Box 646, East Longmeadow, Massachusetts warrants to the original retail purchaser of the FD Series disk drive that it is free of defects in material and workmanship for a period,of 6 months from date of purchase from an authorized CMD dealer or 6 months from the date of delivery if purchased direct from CMD.

IMPLIED WARRANTIES, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE, ARE LIMITED IN DURATION TO THE DURATION OF THE EXPRESS WARRANTY SET FORTH ABOVE. IN NO EVENT SHALL CMD BE LIABLE FOR ANY LOSS, INCONVENIENCE, OR DAMAGE WHETHER DIRECT, INCIDENTAL, CONSEQUENTIAL OR OTHERWISE RESULTING FROM BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE, WITH RESPECT TO THE EQUIPMENT, EXCEPT AS SET FORTH HEREIN.

SOME STATES DO NOT ALLOW THE LIMITATIONS ON THE LIFE OF AN IMPLIED WARRANTY. SOME STATES MAY ALSO DISALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT PERTAIN TO YOU.

DESCRIPTION OF WARRANTY RIGHTS

From the date of purchase or date of delivery, in the case of a direct sale through CMD, through the warranty period, CMD will, at its discretion, repair or replace any part deemed to be defective at no charge for parts/labor to the original retail customer. During the applicable warranty period wherein CMD will repair or replace defective parts without charge for labor, all warranty inspections and repairs must be performed at a CMD authorized service agency or by CMD itself.

CONDITIONS TO WARRANTY SERVICE

For this warranty to become effective the following requirements must be met:

1. Any postage, insurance and shipping charges of warranted items to a CMD authorized service agency or CMD itself must be prepaid by the original retail purchaser and these costs are not included under this warranty. Return shipping during the warranty period will be paid by CMD to addresses in the continental U.S. All other addresses will be charged for shipping, insurance and any other charges related to the return shipping of the item.
2. The dealer's original bill of sale or a charge or credit or delivery receipt must be retained by the original retail purchaser as proof of purchase date of the warranted item and must be presented to the CMD authorized service agency or CMD itself when warranty claims are advanced.
3. The warranty registration card must be filled out and returned to CMD within 30 days of purchase. If CMD does not receive, in good condition, the warranty registration card within the 30 day period, all warranty services are forfeited by the original retail purchaser.

4. Any CMD product being returned for warranty repairs must be in its original shipping container or one of equivalent structure.

EXCLUSIONS FROM THE WARRANTY

This warranty does not cover the specific items/or conditions described below:

1. Equipment which has been damaged due to:
   - Accident, misuse, abuse, fire, flood, or "Acts of God" or other contingencies beyond the control of CMD.
   - Use of incorrect line voltages.
   - Improper or insufficient ventilation.
   - Failure to follow CMD's operating instructions.
   - Improper or unauthorized repair's.
   - Any unauthorized modification to the device.
   - Improper return packaging or damages caused by failure to insure.
2. Damage to warranted items sustained in shipment to the original retail purchaser.
3. Power transformer voltage or Power Supply conversion to foreign or domestic voltage or current frequency.
4. Any damage resulting from the infection of the unit by a computer virus.
5. Routine adjustments.
6. Damage resulting from the commercial use of this unit.

CMD will not be responsible for labor charges of unauthorized service agencies. CMD will not be responsible for labor charges from CMD authorized service agencies or CMD itself except during the warranty period applicable thereto. CMD will not be responsible for the loss or damage to equipment while in the possession of a CMD authorized service agency. CMD reserves the right to make changes in its design and improvements upon its product without assuming the obligation to install such changes on any of its products previously manufactured.

This warranty gives you specific legal rights and you may also have other rights which vary state to state.

RETURN POLICY

This unit may be returned to Creative Micro Designs, Inc. within 30 days of purchase for a refund of the purchase price less a 10% restocking fee. Shipping charges and taxes are not refundable.

Goods being returned must be returned in original condition in the original shipping container, freight prepaid, and must also include all accessories and be accompanied by a letter stating the reason for return. This letter should contain a return authorization number obtained from Creative Micro Designs, Inc. The return authorization number should also be clearly visible in large characters on the shipping carton.