

VERSION **4**

BACKUP YOUR DISKS

EDD+ PLUS CARD

ESSENTIAL DATA DUPLICATOR 4

ESSENTIAL DATA DUPLICATOR

Manual Version 1.0

November 23rd, 2009

Ultimate apple2.com

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** ** *

Congratulations.

You may not be aware of it yet, but you have purchased the single most valuable disk back up utility for your Apple computer system.

Essential Data Duplicator 4, EDD 4, will run on the Apple II, Apple II+ (including most compatibles), Apple IIe, Apple IIc, and Apple III (when ran in the emulations mode). EDD 4 PLUS will run on the Apple II, Apple II+ (including most compatibles), and the Apple IIe. Using one disk drive will work, but two drives are greatly recommended.

EDD is a versatile tool for helping you make back up copies of your important and valuable computer disks. We recommend that you make and keep back up copies of all of your disks, if possible.

What is a copy-protection or copy-protected disk? Computer stores sale many different software packages for use with your computer system. Almost always, the disks which are enclosed in these software packages are "uncopyable" by standard copy programs, which means that these disks are "copy-protected". One of the reasons software publishers copy-protect their software is to keep dishonest people from giving away or selling copies of program disks. The current copyright law allows people to have an archival back up copy of their copyrighted material, and this is where EDD comes in.

EDD is not an ordinary copy program. EDD has been specifically designed to back up the widest range of copy-protections possible and that's the bottom line. We are not trying to say that EDD can back up everything, because NO copy program can. But, you can bet that if EDD isn't able to back up a particular disk, nothing will! We think of EDD not only as the first, but the last chance for backing up disks.

EVOLUTION OF EDD:

Back in February 1983, EDD VERSION ONE was released to the world.

This masterpiece was the start of a new breed of copy programs, the "second generation"

copiers. Even though EDD version 1.0 had few options and no parameters to change, it was very powerful for its time. From the time that the idea for this new type of copy program was dreamed up, until the day the finished program was released, it took almost one and a half years. Many experienced computer programmers had said that a copy program of this caliber was impossible. Nothing is impossible! Shortly after the release of EDD version 1.0, we received a few suggestions about adding some "extra" utility options that would be nice to have included with EDD. Most of the more useful options that were suggested, were incorporated. We also added a parameter change option which made EDD very versatile. In June 1983, we released EDD VERSION 2. Since EDD version two was release, many people called us up and congratulated us on our "great" copy program. Very few people gave suggestions on improving the program so, apparently most people liked it the way it was. But, in February 1984, we couldn't put it off any longer. Even though EDD version two was considered be the best copy program in town", it was now time for EDD VERSION 3 to be released. Most people relied on their EDD version 2 so much, that they either didn't want to wait the usual two week wait period that it took to "trade their old version in for the new version" for a reduced price; so they actually went out and bought a whole new EDD version 3.0 package at regular price. EDD version three was a big hit right from the start... Not only was it more reliable than EDD version two, but it would back up, disk almost twice as quick. We had considered calling it EDD TURBO, but we stuck with version three. So the new EDD had the best of both worlds; it could back up most copy-protections than any other copy program, and it was the fastest. No wonder so many people were recommending and using it.

NOW IS THE TIME FOR EDD VERSION 4 and 4 PLUS:

All versions of EDD prior to version four were mostly basic modifications from a previous version. EDD 4 has been completely rewritten from scratch. A few of the screens used by this new version may appear to be some-what similar to previous versions for continuity but, EDD version four has much more copying power and is even more accurate than previous versions. EDD version four's counterpart, EDD 4 PLUS, has an extra option that uses a specially designed hardware card; can virtually read ALL the information off the disk you are trying to back up.

option that uses a specially designed hardware card; can virtually read ALL the information off the disk you are trying to back up. This is the single most important step when backing up a disk. It will probably be quite a while before these two programs are topped, by us or by anyone else.

Not only can EDD 4 back up disks, but it can also scan disks for information, certify and erase disks, check drive speeds, and even examine the status of disk drives!

In addition, this EDD manual not only talks about using the EDD program, but we have also included a couple of educational chapters which talk about disk hardware and copy-protections.

Also, like always, all valid registered EDD owners are eligible to receive updated information about backing up copy-protected disks, which we offer every couple of months. This is very important as newer copy-protections will probably be surfacing in the future.

Virtually everyone who owns an apple computer system, needs EDD. Be careful about loaning your copy of EDD to a friend... After they see all the power EDD has in store, you may never see your EDD disk again!

One last thing, this manual is FULL of information. Don't try reading through it too fast. Take your time and enjoy using EDD 4.

** ** *

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EDD 4 SOURCE CODE LISTING & PARAMETER DESCRIPTIONS:
For advanced users, we are offering (limited quantities available) a disassembly listing of EDD 4's source code. This lightly documented listing, includes a full description of every parameter used by EDD and information on accessing the EDD PLUS CARD. We feel that this is a MUST for anyone who has ever considered writing a copy-program or disk utility in 6502 assembly.*

DEFECTIVE EDD PLUS CARD: We will repair or replace a defective EDD PLUS card free of charge if it proves defective due to workmanship or materials during the period of 30 days from original purchase date.

There are just a few things that you need to be aware of when reading through this manual.

First of all, this manual is "crammed" with information, so, don't read through it too fast. Read a section and let the information sink in. If there is something important that you don't understand, don't skip over it, re-read it if necessary.

We would like to make you aware of some words that are used throughout the manual that at first glance may appear to be the same, especially if you are a novice, so please try to pay close attention to what you are reading. If you don't already know the meaning of these words, or any other uncommon words used in the manual, you should look them up in the glossary. The main words that you will have to be careful of, are "copyright", "copy-protection", and "write-protection". None of these three words are directly related to each other.

In this manual, any time that a word or number is encased in brackets "H", we are referring to the actual push-button on the computer's keyboard that needs to be pressed. For example, the wording, "Press the [RETURN] keys, means that you need to press the one push-button on the computer keyboard that is marked 'RETURN'".

One last note... Not all chapters of this manual are for everyone. Since we didn't want to limit EDD's power, we have included some "specialty" information chapters for the ADVANCED users, detailing some of EDD's operations and we've given complete descriptions of parameter changes.. Depending on how knowledgeable you are, you may need to read through a certain chapter more than once before all of the information provided can be absorbed. If you are a NOVICE user, you will have trouble understanding the chapters that are presented for ADVANCED users. These chapters are not for you at this time. Try reading them again in a couple of months. Remember, ADVANCED users did not become advanced overnight... Most of them have worked hard and used their computer system for many years.

** ** **

If you have the EDD 4 PLUS version, you will first need to install the PLUS card into your computer system as described in APPENDIX H. Do this now, if needed.

Loading EDD into your computer system is no different than booting (loading) most other disks. In case you are not already familiar with the booting process, below, we have given booting instructions for most of the Apple computers systems in use today. If none of these are correct for your system, either read the manuals that came with your computer, or contact Ultimateapple2.com

Start with the computer in the OFF position, then boot the EDD disk on your computer system as follows:

APPLE II, IIe, or IIc (and most other computer systems): If you are using an APPLE II+, IIe, or IIc; insert the EDD disk into drive #1 and close the drive door. After turning the power switch to the ON position, the computer screen will display the EDD logo (see figure LOGO), and after a couple of seconds (if everything goes OK) the EDD program will be completely loaded, and your monitor displays the EDD title page (see figure TITLE PAGE).

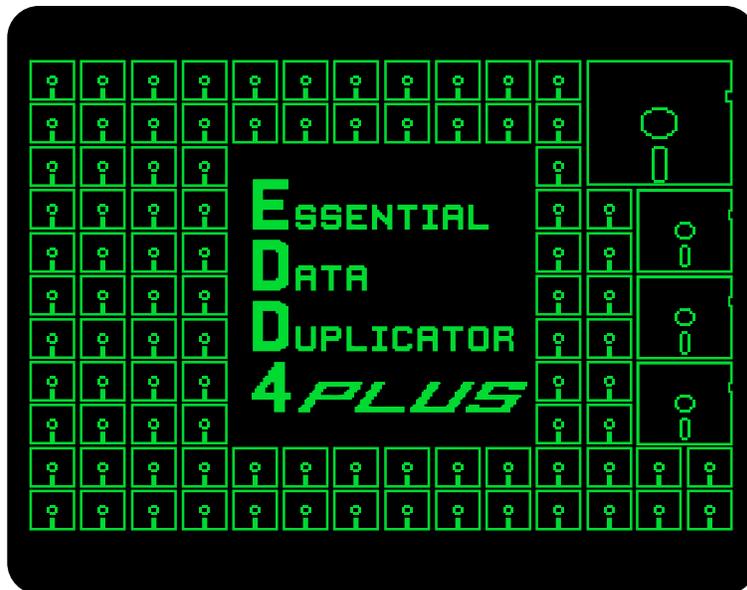


figure LOGO

APPLE II STANDARD (older model): If you are using the

older apple model, the APPLE II (without autostart ROM), insert the EDD disk into drive #1 and close the drive door. Turn the power switch to the ON position.

After you hear the 'beep", if your #1 disk drive is plugged into slot 6, press the number [6] key (if it is in a different slot, press that number instead of "6").

Now, press and hold the [CTRL] key down and press, but do not hold down, the [P] key. Let go of the [CTRL] key and press the [RETURN] key. The disk drive will start running, and the computer screen will display the EDD logo (see figure LOGO). After a couple of seconds, EDD will be loaded and the screen will then display the EDD title page (see figure TITLE PAGE).

APPLE III: If you are using the APPLE III computer system, you will need to use the "EMULATIONS" disk which came with your computer system. Take the EMULATIONS disk and insert it into the #1 disk drive and close the drive door. Turn the power switch to the ON position. After the EMULATIONS disk boots up and the disk drive turns OFF, take the EMULATIONS disk out, and insert the EDD disk into the disk drive and close the drive door. Press whichever key the screens displays for emulating an APPLE II (usually it's the [RETURN] key). The disk drive will turn on again, and the screen will now display the EDD logo. After a couple of seconds, EDD will be loaded and the screen now displays the EDD title page (see figure TITLE PAGE):

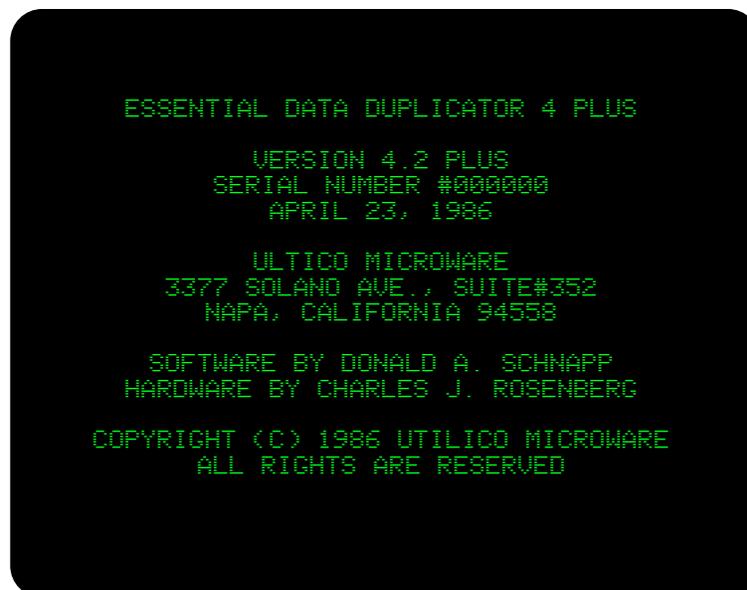


figure TITLE PAGE

Note: If EDD doesn't boot properly (logo or title page doesn't appear), refer to APPENDIX C for possible problems.

** ** **

The main purpose of this chapter is to quickly get you familiar with EDD's backing up process. The simple instructions found here are all you will need to know for backing up quite a few copy-protections currently in use.

To get started backing up a disk, you will first need a disk to make a back up copy of (if this is your first time using EDD, we suggest you back up an unprotected disk such as a DOS 3.3 SYSTEM MASTER or a PRODOS MASTER disk) and a blank disk for backing up onto.

First, load EDD into your computer system as described in the previous chapter. The EDD title screen should be displayed on your computer's monitor. At this time, press the [RETURN] key to display the OPTION MENU:

```

ESSENTIAL DATA DUPLICATOR 4 PLUS
000000000001111111112222222222333333
TRK:012345678901234567890123456789012345
.00K
.25K
.50K
.75K
ORIGINAL:S=6,D=2  DUPLICATE:S=6,D=1 (5)

- OPTION MENU -

1. BACK UP A DISK
2. CHANGE PARAMETERS
3. CHECK DRIVE SPEED
4. DISK SCAN
5. CERTIFY AND ERASE DISK
6. CHANGE SLOTS AND DRIVES
7. EXAMINE DISK DRIVE
8. CLEAR ERROR CODES
9. QUIT

PRESS <RETURN> TO SELECT #1
    
```

figure OPTION MENU

While looking at the OPTION MENU, you will notice that OPTION 1; BACK UP A DISK is displayed in inverse video. Press either the [RETURN] key or the number [1] key to let EDD know that this is the option that we want to use. EDD will display the BACK UP A DISK screen:

```
          ESSNETIAL DATA DUPLICATOR 4 PLUS
          000000000001111111112222222222333333
TRK: 012345678901234567890123456789012345
.00K
.25K
.50K
.75K
ORIGINAL: S=6, D=2  DUPLICATE: S=6, D=1 (5)

          - BACK UP A DISK -

          START TRACK: 
```

figure BACK UP A DISK

Before EDD can back up a disk, EDD needs to verify a few simple instructions with you. This let's EDD know how you want to proceed with backing up the disk. Since the test disk your are going to back up needs no special directions, just press the [RETURN] key for each prompt:

When EDD asks for the START TRACK, press [RETURN].
When asked for the END TRACT, press [RETURN]
When asked for the STEP, press [RETURN].
When asked if you want to use SYNCHRONIZE TRACKS mode, press [RETURN].
When asked if you want to use NIBBLE COUNT mode, press [RETURN].

If you are using the EDD PLUS version, EDD will also ask if you want to use the BIT COPY MODE. Press [RETURN] here also.

At this point EDD is done configuring everything it needs to know with you.

WARNING!!! Before continuing any further, make sure that the ORIGINAL disk (the disk you are planning to make a back up copy of) is write-protected (note: we said write-protected, meaning that NO notch is showing on the disk) and that the "blank" DUPLICATE disk you will be backup up onto is NOT write-protected.

Now, depending on if you have ONE or TWO disk drives, follow the appropriate directions for your drive setup as follows:

THE TWO DISK DRIVE METHOD:

EDD tells you to "INSERT BOTH DISKS, THEN PRESS [RETURN]": So, insert the "blank" DUPLICATE disk into disk drive #1, and insert the ORIGINAL disk into disk drive #2 then press the [RETURN] key to start the backing up process. EDD will take a couple of minutes to back up the entire disk. For now, ignore everything that is displayed on the screen.

After EDD is finished with the disk, you will hear a short "beep" and the message "PRESS [RETURN] , PROCESS IS FINISHED" will be displayed at the bottom of the screen. If everything worked out correctly, the blank disk which you started with, now contains a back up copy of the ORIGINAL disk. At this point, pressing [RETURN] will bring EDD back to the OPTION MENU.

THE SINGLE DISK DRIVE METHOD:

Since only one drive is used, EDD will tell you when to insert the ORIGINAL disk and when to insert the DUPLICATE disk. EDD copies one track at a time and since there are usually thirty-five tracks on a disk; the ORIGINAL and DUPLICATE disk will need to be swapped" quite a few times before the back up copy is done.

At the bottom of the screen, EDD tells you to "INSERT THE ORIGINAL DISK AND PRESS [RETURN]. Now insert the ORIGINAL disk into the disk drive, close the disk drive door, and press the [RETURN] key. EDD turns on the disk drive, and after reading the disk for a couple of seconds the disk drive will turn off.

This time, at the bottom of the screen, EDD tells you to "INSERT THE DUPLICATE DISK AND PRESS [RETURN]". Now, take the ORIGINAL disk out of the disk drive and insert the DUPLICATE into the drive and after closing the drive's door, press the [RETURN] key.

The disk drive will turn on again, writing the information which was previously read. After the disk drive turns off, it's time to take out the DUPLICATE disk and insert the ORIGINAL disk again, just like before (go back to the previous paragraph if necessary).

When EDD is finished processing the entire disk, you will hear a short "beep" and the message "PRESS

[RETURN], PROCESS IS FINISHED" will be displayed at the bottom of the screen. If everything worked out correctly, the blank disk which you started with, should now contain a back up copy of the ORIGINAL disk. At this point, pressing [RETURN] will bring EDD back to the OPTION MENU.

** ** **

The purpose of this chapter is to give you an overview of EDD which introduces you to the different options and to get you familiar with some of the basic formats incorporated into the EDD program, including screen positioning, entering numbers, using modes, understanding messages, etc... In chapters to follow, some of the information presented here will be repeated, when necessary. You will notice, that most of the options of EDD use standard formats which we've done purposely in keeping with continuity.

OPTION MENU: The OPTION MENU is the main menu of the EDD program, which allows you to access the different options. Displayed to the left of each option is that option's number. When the OPTION MENU is first displayed, an inverse line called a "line cursor" is drawn through the first option on the screen:

```

          ESSNETIAL DATA DUPLICATOR 4 PLUS
          000000000011111111122222222223333333
TRK: 012345678901234567890123456789012345
.00K
.25K
.50K
.75K
ORIGINAL: S=6, D=2  DUPLICATE: S=6, D=1 (5)

- OPTION MENU -

1. BACK UP A DISK
2. CHANGE PARAMETERS
3. CHECK DRIVE SPEED
4. DISK SCAN
5. CERTIFY AND ERASE DISK
6. CHANGE SLOTS AND DRIVES
7. EXAMINE DISK DRIVE
8. CLEAR ERROR CODES
9. QUIT

PRESS <RETURN> TO SELECT #1
    
```

figure OPTION MENU

SELECTING AN OPTION: There are two methods of telling EDD which option you wish to use. The first, is to press the number key which corresponds to the left number of that option (i.e., if you want to use OPTION 5, press the [5] key). The second method is to move the line cursor to whichever option you want to choose, by using the [arrow] keys, then pressing the [RETURN] key. Since both methods achieve the same results, use whichever method you prefer.

OPTION 1 - BACK UP A DISK. This is the option you use

to make back up copies of your disks. There may be a few things that need to be done before this option can be used: First, if you are using the PLUS edition, the PLUS card must already be installed inside the computer system (see APPENDIX A). Second, if EDD doesn't know where your disk drives are, you will need to use OPTION 6. And third, if parameters need to be changed, they will need to be changed by using OPTION 2.

OPTION 2 - CHANGE PARAMETERS. EDD has been preset for backing up a wide range of copy-protections; but, not all copy-protections can be preset. Changing parameters is, in fact, a way of "reprogramming" or "customizing" EDD for backing up special copy-protections. Although, if you are a NOVICE user, you will not know which parameters to change by yourself. By following the instructions on the current EDD PROGRAM INFORMATION LIST (which is updated every couple of months), you should be able to customize EDD for many disks.

OPTION 3 - CHECK DRIVE SPEED. Disk drives which spin disks too fast or too slow can cause problems during normal operation and disks that should be "easy" to back up could turn out to be very difficult. Use this option to test how fast your drives are running.

OPTION 4 - SCAN DISK. Using this option, EDD will display a hi-resolution graphic scan of a disk. Scanning an ORIGINAL disk, often not only can tell you which tracks need to be copied, but can usually tell you a great deal about the actual format of a disk. You will find this to be a very valuable tool in backing up disks.

OPTION 5 - CERTIFY AND ERASE A DISK. Before you attempt to back up an ORIGINAL disk onto a "blank" DUPLICATE disk, you should always certify the "blank" disk, which also erases it. Certifying a disk will make sure that each track of the disk can hold information properly. It's always better to be safe than sorry!

OPTION 6 - CHANGE SLOTS/DRIVES. If EDD doesn't know the slot or drive number of where your disk drives are located, you will need to tell EDD this information by using this option. Also, if you have the PLUS version and EDD doesn't already know which slot the PLUS card is located, this option will need to be used.

OPTION 7 - EXAMINE DISK. DRIVE. Using this option, EDD performs six diagnostic test on a disk drive to help make sure it is running correctly. Problems will often show up in backing up disks before they show up with normal use. If EDD determines that a disk drive has problems, you probably will not be able to make reliable back up copies of disks using that drive, and that drive will need to be serviced. This option should be performed every couple of months, and can save you a lot of headaches and downtime.

OPTION 8 - CLEAR ERROR CODES. After you back up a disk, the error/processing code display will be filled with leftover error codes. Using this option, the error/processing code display will be cleared so you can start off fresh.

OPTION 9 - QUIT. After you are done using EDD, this option is used for quitting, which in turn attempts to boot the disk currently found in drive #1.

DESCRIPTION OF SCREEN POSITIONS: Most of the time that EDD is running, the screen is divided into four sections, the ERROR/PROCESSING CODE DISPLAY, the SLOT/DRIVE ASSIGNMENTS, the IMMEDIATE INFORMATION DISPLAY, and the SPECIAL MESSAGE DISPLAY. Here is a description of each of these: ERROR/PROCESSING CODE DISPLAY: Located towards the top of the screen (see figure SCREEN POSITIONS), contains a reserved spot for displaying processing and error codes for each of the whole, quarter, half, and three-quarter tracks that will be processed on a disk. EDD displays processing codes during the processing of a track either in "inverse" or "flashing" video. Afterwards, the processing is summed up into an error code, which is then displayed in "normal" video. We will be giving a description of each processing and error code in the next section of this chapter.

SLOT/DRIVE ASSIGNMENT DISPLAY: Located towards the top of the screen just below the error/processing code display (see figure SCREEN POSITIONS), the slot/drive assignment display is where the current disk drive assignments are located. Also, if you are using the PLUS edition of EDD, the slot number that the PLUS card is located in, also is displayed.

IMMEDIATE INFORMATION DISPLAY: Located in the middle of the screen (see figure SCREEN POSITIONS), the immediate information display is more or less the work

space for EDD. Here, all options, choices, results from tests, and any other immediate information is displayed.

SPECIAL MESSAGE DISPLAY: Located at the very bottom of the screen (see figure SCREEN POSITIONS), the special message display is where EDD displays special messages, if needed. Any time that EDD wants you to do something, like "insert disks", or "press the [RETURN] key", a message will be displayed on this section of the screen. Often, the special message display section of the screen will be blank or "empty".



- 1 = ERROR/PROCESSING CODE DISPLAY
- 2 = SLOT/DRIVE ASSIGNMENT DISPLAY
- 3 = IMMEDIATE INFORMATION DISPLAY
- 4 = SPECIAL MESSAGE DISPLAY

figure SCREEN POSITIONS

PROCESSING CODES: Processing codes are displayed in the error processing code display section of the screen, while processing disks. As EDD is processing a track, certain processing codes are displayed here for your convenience. Processing codes are displayed in either "inverse" or "flashing" video, and are as follows:

- R - READING a track from the "original" disk.
- P - Running a preprogrammed preanalyze or prewrite PROGRAM.
- A - ANALYZING the track.

W - WRITING the track to the "duplicate" disk.
V - VERIFYING that a track was written correctly.
S - SYNCHRONIZING a track.

ERROR CODES: After EDD is completely done with processing a track, EDD leaves an error code on that track, telling you the summary of what just happened. Error code are displayed in "normal" video and are as follows:

- Track appears to have been copied correctly.
When certifying a disk, this track certified good.
- R - READ error has occurred from the "original" disk.
EDD couldn't find either the track END or track LENGTH.
- L - LENGTH error has occurred on the "duplicate" disk. Duplicate disk drive is probably running too fast.
- W - WRITE error has occurred on the "duplicate" disk.
Track length of "duplicate" could not be found.
- X - When certifying a disk, this track certified bad.

SPECIAL KEYS: There are two special keys that may be of benefit to you. If you are using two disk drives, pressing [CONTROL [D]] will automatically "swap" the ORIGINAL and DUPLICATE disk drive positions. The other special key which is very useful is the [ESC] key, which stands for 'ESCAPE'. Pressing the [ESC] key at any time will tell EDD to "escape" from whatever it's currently doing and restart you from the OPTION MENU. It is kind of like an emergency exit (or escape). If EDD is involved with a "major" routine when the [ESC] key is pressed, EDD could take a couple of seconds to respond (if a REAL emergency comes up, you can always press the [RESET] key or turn the computer OFF...).

DESCRIPTION OF TRACKS: Before running most options, EDD will need to confirm with you which tracks you want to process: START TRACK, END TRACK, and track STEP.

The START TRACK number would be the number of the

track on the disk from which you want EDD to start processing. The END TRACK number would be the last track that you want processed. The last thing that EDD needs to know, concerning the tracks, is which tracks to copy in between the START TRACK and the END TRACK. Here, we use what's called a track STEP value. This value tells EDD how many tracks to "step" from the START TRACK towards the END TRACK. For example, if the track STEP equaled "1", every whole track would be processed "0,1,2,3,4,5,...,32,33,34". If a STEP value of "2" is used, the tracks processed would be "0,2,4,6,8,...,32,34). When writing disks, you should not use a step value less than one, because apple disk drives need at least "one whole" track from the previously written track for the information to be valid. One last note... If the START TRACK and END TRACK are the same track number, no STEP track is needed, and thus EDD doesn't ask for one. ENTERING TRACK NUMBERS: Note for the "old time" copy program users: EDD 4 uses standard decimal numbers for all track numbers, so, GET USE TO IT... Using decimal numbers for the simple things of life is the only way to go!

Usually a track number would be between the numbers of "0" and "34". To enter a track, just type in it's numbers. For example, if you wanted to enter track "18": First press the [1] key, and then press the [8] key. To use "half" tracks, after entering the "whole" track, press the decimal point ".", and then the [5] key. For example, if you wanted EDD to process track 'LS": First press the [1] key, then press the [.] key, and lastly press the [5] key. If you wanted to enter a "quarter" track, this would be basically entered the same way as a "half" track. For example, if you wanted to enter track "3.25": Press the [3] key, then press the [.] key, and now press the [2] key. At this point, DO NOT press the [5] key. EDD automatically displays the correct quarter track number as "3.25". A "three-quarter" track number is entered the same way as a "quarter" track.

FORTY TRACKS: A normal, standard disk has thirty-five tracks. These tracks are numbered from track "0" through track "34" (If you only counted thirty-four tracks, you probably forgot to count track zero). EDD's screen displays one more track than standard, tracks "0" through track "35", making a total of thirty-six. A few copy-protected disks hide information on this extra track. But, now there are

quite a few forty track drives on the market. No problem for EDD! Although the highest track that the error/processing code display will show is track "35" (the thirty-sixth track), when backing up a disk, you can actually type in track '39" which is the fortieth track. So, EDD can copy all forty tracks if you need and if your disk drives can handle it; but the error/processing codes on the screen won't be valid for those "higher" tracks.

WRITE PROTECTION: We have built in a very important safety feature into EDD which is NOT available on any other copy program at this time. This safety feature requires that the ORIGINAL disk you are trying to make a back up copy of, IS. write-protected. This means, of course, that if there is currently a small square punched out hole in the side of the ORIGINAL disk, it must be covered by a metal sticker or tape. EDD will not even attempt to make a back up copy a disk that is not write-protected (an error message will be displayed on the screen telling you write-protect the ORIGINAL disk)... Of course, the "blank" DUPLICATE disk that you are trying to back up onto must not be write-protected (since EDD has to write to it). This little safety feature will save you lots of headaches and embarrassments (like sending a damaged ORIGINAL disk back to the factory for replacement and telling them that while you were trying to back it up, something went wrong...).

* * * * *

EDD's OPTION 1 is what backing up disks is all about. In this chapter we will go into details on how to use the BACK UP A DISK option and we'll be describing each step along the way. But, three things may need to be done before you can use this option. First, if you are using the EDD PLUS version, the PLUS card must be installed (see APPENDIX H). Second, use OPTION 6 if you need to tell EDD which slot/drive your disk drives and the PLUS card is located (if you are using the PLUS version). Third, if parameters are to be changed, refer to the current PROGRAM INFORMATION LIST and OPTION 2.

When you are ready to back up a disk and EDD is displaying the OPTION MENU; pressing the [1] key or moving the line cursor to OPTION 1 (using the "arrow" keys) and pressing the [RETURN] key, is all you need to do to tell EDD you want to use the BACK UP A DISK option. The computer screen should now be displaying:

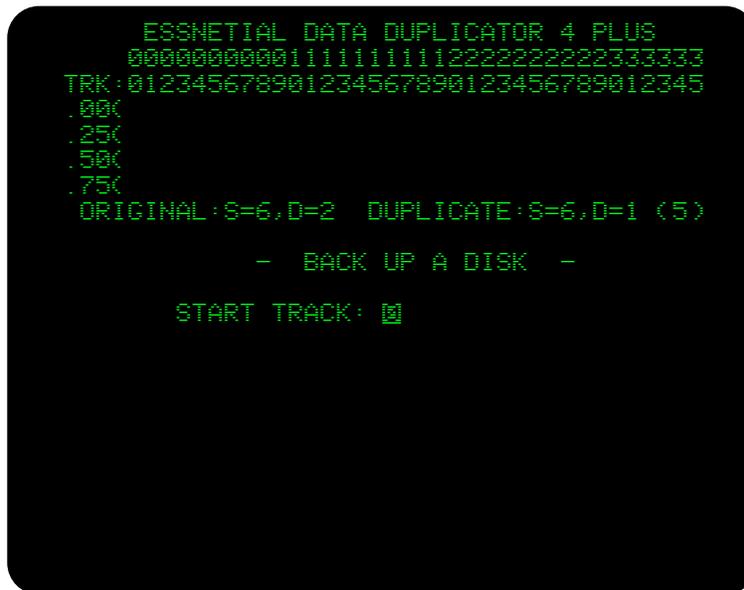


figure 1.1

Before EDD can back up a disk, EDD first needs to confirm a couple of things with you. In order, they are: START TRACK, END TRACK, track STEP, SYNC TRACKS mode, and NIBBLE COUNT mode. And if you are using the EDD PLUS version, lastly you will need to confirm the BIT COPY MODE.

Here is what each confirmation means:

START TRACK is the track number from which track you want EDD to start the backing up process. Since track zero is the very first track on a disk, and EDD assumes you probably want to copy the entire disk, EDD confirms that you want the START TRACK to be "0" (this is the most common value to use). If you want EDD to start copying from a different track, type in the track number you want EDD to start with. When you are ready to confirm the START TRACK, press the [RETURN] key. After confirming the START TRACK, EDD wants you to confirm the END TRACK.

END TRACK is the track number of the last track from which you want EDD to copy. If EDD didn't confirm the END TRACK with you, EDD wouldn't know when to stop. Since the highest track number normally used by disks (both standard and copy-protected) is thirty-four, EDD confirms that you want the END TRACK to be "34". As with the START TRACK, you can change this number to a different track number, if needed.. Press the [RETURN] key to confirm the END TRACK when ready.

The track STEP is the last thing EDD wants to confirm with you concerning the tracks you want to copy. We've just seen that the START TRACK is the track number which EDD starts copying from, and that the END TRACK is the last track number that EDD copies.

Now, EDD needs to confirm how many tracks to "step" from the START TRACK towards the END TRACK, to copy the next track along the way (note: If the START TRACK is the same track number as the END TRACK, then there wouldn't be any stepping involved and EDD wouldn't bother confirming this value).

Since EDD figures that you will probably want to copy every whole track, EDD suggests a track STEP of "1". Of course you can change this if you want. As an example: If you told EDD to use a step of "2", every other track would be copied. Like always, press [RETURN] when you are ready to confirm this number.

Now that EDD knows exactly which tracks to copy, EDD wants to confirm with you the process in which they are to be copied. This is very straight forward.

SYNCHRONIZE TRACKS mode uses a "special" process for properly aligning (synchronizing) each track copied onto the DUPLICATE disk. This process only needs to be done with disks that use the "synchronize tracks" type of copy-protection. Since most disks don't need to be synchronized, EDD suggests "NO" (you don't want to use the synchronize track mode). If you want to

change this to "YES" (yes, you want to use the synchronize mode), press the [Y] key. EDD will change the "NO" on the screen to a "YES". After you confirm the SYNCHRONIZE TRACKS mode you want EDD to use, by either pressing the [N] key for NO or the [Y] key for YES, EDD then skips on down to the next mode, which is NIBBLE COUNT.

The NIBBLE COUNT mode is another "special" process. This one makes sure that the length of the DUPLICATE track matches the same length as the ORIGINAL track. When EDD does a nibble count, EDD keeps writing the track to the DUPLICATE disk until both of the lengths match. Since the majority of disks on the market do not use the "nibble count" type of copy-protection, EDD suggests "NO", don't nibble count.

If EDD is doing a nibble count, EDD will probably need to verify the length of each track written to the DUPLICATE disk many times before the lengths match; so it is safe to assume that nibble counting a disk can be very time consuming. If the disk is to be nibble counted, there are two different methods that can be used, automatic and manual. Press [A] if you want to use the "automatic" method or [M] for the "manual" nibble count mode. The differences between "automatic" and "manual" nibble counts are discussed latter in this chapter.

If you are using the PLUS version of EDD, the last process EDD needs to confirm is if you want to use the BIT COPY MODE. Since using the BIT COPY DISK process takes just about twice as long to back up a disk as not using it, EDD suggests that you don't use this process, by saying "NO". Using the BIT COPY DISK mode on most disks is just "over-kill".

Like the two previous modes, you can press the [Y] key for YES so that EDD will use this process, which will allow EDD to read ALL the bits of information from the ORIGINAL disk. Although most copy programs call themselves "bit copiers", they are actually "nibble", or "byte" copiers. The PLUS version of EDD is the ONLY copy program which has the ability to read EVERY bit from a disk.

Now that EDD is done confirming which tracks you want to copy, and the modes to use, take the ORIGINAL disk that you want to make a back up copy of and make sure that it IS write-protected (no notch showing). Now, take a high quality "blank" disk and make sure that it is NOT write-protected. This blank disk is the disk EDD will be putting the back up onto, and is

considered to be the DUPLICATE disk.

Depending on how many disk drives you are using, read the following instructions for using your setup.

USING TWO DISK DRIVES:

Using two disk drives is the simplest method. At the bottom of the screen, EDD tells you to "INSERT BOTH DISKS AND PRESS [RETURN]". So, insert the ORIGINAL disk into the ORIGINAL drive and the DUPLICATE "blank" disk into the DUPLICATE drive. (note: unless you've changed it, EDD presets drive #2 as the ORIGINAL drive, and drive #1 as the DUPLICATE drive)

After inserting the correct disk in the correct disk drive, make sure both drive doors are closed. Pressing the [RETURN] key will start up the backing up process.

When EDD is finished processing the entire disk, you will hear a short "beep" and the message "PRESS [RETURN], PROCESS IS FINISHED" will be displayed at the bottom of the screen. If everything worked out correctly, the blank disk which you started with should now contain a back up copy of the ORIGINAL disk. At this point, pressing, [RETURN] will bring EDD back to the OPTION MENU.

USING ONE DISK DRIVE:

If you are using only one disk drive, you will need to "swap" the ORIGINAL disk and the DUPLICATE disks quite a few times before a whole disk will be copied. During the backing up process, EDD tells you which disk you need to insert, by displaying a message at the bottom of the screen.

When EDD displays the message at the bottom of the screen, "INSERT ORIGINAL DISK, AND PRESS [RETURN]'", insert the ORIGINAL disk into the disk drive, and press the [RETURN] key. The disk drive will turn on, and after EDD is done "reading" a track from the disk, EDD will turn the disk drive off.

When EDD displays the message, "INSERT DUPLICATE DISK, AND PRESS [RETURN)", take the ORIGINAL disk out of the disk drive, and insert the DUPLICATE disk and press the [RETURN] key. EDD turns the disk drive back on

and this time writes the track full of information onto the DUPLICATE disk. After verifying the track, the disk drive will turn back off, and EDD displays the message "INSERT ORIGINAL DISK, AND PRESS RETURN]", again. Each track of the disk is copied in this fashion.

When EDD is finished processing the entire disk, you will hear a short. "beep" and the message "PRESS [RETURN] , PROCESS IS FINISHED" will be displayed at the bottom of the screen. If everything worked out correctly, the blank disk which you started with, should now contain a back up copy of the ORIGINAL disk. At this point, pressing [RETURN] will bring EDD back to the OPTION MENU.

DIFFERENCE BETWEEN NIBBLE COUNT MODES:

AUTOMATIC NIBBLE COUNT is when EDD attempts to automatically' make the track lengths the same. This is fairly fast and usually not much of a hassle, but since EDD has to physically modify the track to do it, this mode is NOT very accurate. Even so, it works for many disks that need to be nibble counted. Note: If you are using the EDD 4 PLUS version and you want to use the AUTOMATIC NIBBLE COUNT mode, EDD will not even ask you if you want to use the BIT COPY MODE, because you would only be defeating the BIT COPY MODE's purpose.

MANUAL NIBBLE COUNT is the other type of nibble counting available. This is a very accurate method since the DUPLICATE's track is virtually unmodified. To use the manual process, you will need to "manually" adjust the drive speed of the DUPLICATE drive, forcing the track's length to fit perfectly. You will need to do this for each track copied using this mode. Actually this is very simple. Here is how it's done: After locating the speed adjustment screw for your type of disk drive (see APPENDIX I if needed), start EDD copying the track(s) using the "manual" nibble count mode. After EDD writes the same track to the DUPLICATE disk a few times, you will notice that the error/processing code display for that track keeps switching between "W" and "V" (writing and verifying), and the DIFFERENCE of the track length (displayed at the lower right hand section of the screen) either shows a greater-than or a less-than sign with a number after it. Your job here, is to adjust the drive speed, making the DIFFERENCE between track lengths

equaling "0" (meaning NO difference). Turn the drive speed screw a little in one direction and wait a second for EDD to verify the track again. On the average, is this number getting smaller or larger? If the difference is getting larger, you are turning it the wrong way... turn the speed screw the other direction. Wait again for a second, and notice the difference this time. Keep adjusting the drive speed in this manor until the difference reaches zero.

Note: When you are completely done with copying disks using the manual mode, don't forget to use OPTION 3, CHECK DRIVE SPEED, for resetting your DUPLICATE disk drive speed back to normal.

SCREEN DISPLAY WHILE COPYING A DISK:

Although some of the information which EDD displays on the screen may not be important as far as making most back up copies, ADVANCED users will find this information valuable in understanding some or all of, the copy-protection that's being used. While backing up a disk, EDD updates two sections of the screen. The IMMEDIATE INFORMATION DISPLAY (middle to lower) section contains information about the current track that is being copied, and the ERROR/PROCESSING CODE DISPLAY (upper) section of the screen contains a running summary of errors for each track that has been previously copied. (see figure 1.2)

CURRENT TRACK INFORMATION:

After EDD reads in the information from the ORIGINAL disk, EDD displays the TRACK START and the END TRACK on the screen in "raw disk byte" format which is a coding EDD uses to display raw disk bytes and "hidden" timing (zero) bits contained on the ORIGINAL disk. Here is an explanation of this format: The two-digit hexadecimal values represent raw disk bytes. But, depending if both digits are displayed in "normal" video, one digit displayed in "inverse" video, or both digits displayed in "inverse" video, determines how many hidden timing bits come AFTER that raw disk byte. If both digits are displayed in normal video, then NO timing bits are hidden after the raw disk byte.

If one digit is displayed in normal video, and the other in inverse video, then there is ONE timing bit hidden after the raw disk byte. If both digits are displayed in inverse video, then TWO timing bits are hidden

A quick glance at the TRACK number will tell which track EDD is currently copying, so there should be no confusion.

The TRACK LENGTH lets you know how long (in hexadecimal notation) the track from the ORIGINAL disk actually is. ADVANCED users can often use this information to determine if the track originally was written at a faster or slower speed than normal.

The track DIFFERENCE is often the single most important piece of information that EDD displays while backing up disks. The track DIFFERENCE shows the difference in length between the ORIGINAL and the DUPLICATE disk. After EDD writes the current track to the DUPLICATE disk, EDD takes the DUPLICATE track length and subtracts it from the ORIGINAL track length (above), and then displays the difference. EDD also displays either a less-than or greater-than sign with the difference, to let you know if the length of the DUPLICATE was less-than or greater-than the length of the ORIGINAL track. If the track lengths are the same (which is rare), then an equal sign with an inverted zero is displayed here. It is also important that the DUPLICATE track contains at least as many raw disk bytes as the ORIGINAL track. If the DUPLICATE track contains fewer raw disk bytes, then some of the information is obviously missing, which usually means that the DUPLICATE disk drive is running too fast and needs to be slowed down.

TRACK SUMMARY INFORMATION:

The ERROR/PROCESSING CODE DISPLAY (see figure 1.2) is where EDD displays all processing and error codes for each track of the disk copied (see OVERVIEW OF EDD chapter if needed).

Processing codes are displayed in "inverse" or "flashing" video and they indicate which process EDD is currently performing for which track. The valid processing codes for backing up disks are as follows:

R - READING a track from the "original" disk.

P - Running a preprogrammed preanalyze or prewrite PROGRAM.

A - ANALYZING a track.

W - WRITING the track to the "duplicate" disk.

V - VERIFYING that a track was written correctly.

S - SYNCHRONIZING a track.

Error codes are displayed in "normal" video and they give a summary of what happened during the backing up process for that track. The valid error codes for backing up disks are as follows:

. - Track appears to have been copied correctly

R - READ error occurred from the "original" disk.
A track END or track LENGTH couldn't be found.

L - LENGTH error occurred on the "duplicate" disk.
"Duplicate" disk length is shorter than the
"original".
"Duplicate" drive speed is too fast.

W - WRITE error has occurred on the "duplicate" disk.
Track length of "duplicate" couldn't be found.

An example of an error code is figure 1.2 (above). Here, track 00.00 (or just track "0") contains a dot. This means that track "0" appears to have been copied correctly by EDD. Since none of the other tracks of this disk contain any error codes, it is obvious that only track "0" has been copied at this time.

A second example is figure 1.3:

```
ESSENTIAL DATA DUPLICATOR 4 PLUS
000000000011111111112222222222333333
TRK: 012345678901234567890123456789012345
.00(
.25(
.50(
.75(
ORIGINAL:S=6,D=2  DUPLICATE:S=6,D=1 (5)

TRACK START: (RAW DISK BYTE)
 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

END TRACK: (RAW DISK BYTE)
 96 96 96 96 96 96 96 96 96 96 96 96 96 96 96 96
 96 96 DE AA EB FE 96 96 A9 8D 00 A4

TRACK:34          TRACK LENGTH:$18AA
                  DIFFERENCE:>4
PRESS <F10> PROCESS IS <F10>
```

figure 1.3

Here, all the whole tracks "0, 1, 2, ..., 34) (00.00, 01.00, 02.00, ..., 34.00) have been copied. And since all of the tracks copied have dots for error codes, it appears that the whole disk was backed up correctly (of course we can't be absolutely sure that the back up copy works until we try to run it).

To ADVANCED users, figures 1.2 and figures 1.3 give the hint that these two disks being backed up may be using a format similar to DOS 3.3 or PRODOS. This is because the timing gaps contain "FF"s with two hidden timing bits after each, which is standard, and the prologue and epilogues that are visible look normal.

Figure 1.4 is another prime example of what a typical screen display might look like while backing up a disk:

```

ESSNETIAL DATA DUPLICATOR 4 PLUS
0000000000011111111112222222222333333
TRK:012345678901234567890123456789012345
.00K
.25K
.50K
.75K
ORIGINAL:S=6,D=2  DUPLICATE:S=6,D=1 (5)

TRACK START: (RAW DISK BYTE)
EE EE
EE EE EE EE D4 D5 D6 BA EA FF EA FF
EA BA AA FA EA AB AF FF EA FF EA FE
AF EB AB EA EA FE AF EB AB EA EA FA
AA AA AA FE BB AA AA AB AF EE BB AA

END TRACK: (RAW DISK BYTE)
BC FF FF 96 97 FE CE CE FE FE FF FF
FF FF FF FF FF FF FF FF FF FF FF

TRACK:0  TRACK LENGTH:#1803
DIFFERENCE:<3

```

figure 1.4

Note the "L" error code displayed for track "0" in the ERROR/PROCESSING CODE DISPLAY which indicates a "LENGTH" error. Looking at the DIFFERENCE displayed on the screen shows us that the DUPLICATE disk contains three raw disk bytes less-than, the ORIGINAL disk. This means that three raw disk bytes that are contained on the ORIGINAL disk are "missing" from the DUPLICATE disk, resulting from the DUPLICATE disk drive's speed running too fast. Slowing down the DUPLICATE disk drive speed may be necessary to back up this disk properly (if needed, refer to OPTION 3 and APPENDIX I). Even though an "L" error or two may appear while backing up a disk, this doesn't

necessarily mean that the back up copy won't work correctly. A general rule of thumb is to always try running the back up copy after you made it, even if error codes exist. It's always possible that the disk was backed up correctly (even though EDD doesn't think so).

Even though it may not be important for backing up the disk, figure 1.4 shows how a person can gain quite a bit of information from the disk just by backing it up. Looking at the START TRACK reveals a timing gap consisting of "EE"s with one extra timing bit attached, which is not standard for normal unprotected disks. ADVANCED users might also quickly determine that the raw disk bytes "D4 D5 D6" could be a start of a sector and that the actual sector very likely contains a 4x4 encoding scheme (as described in BENEATH APPLE DOS book). The END TRACK appears to contain only miscellaneous random values (often referred to as "garbaged" or "trashed" raw disk bytes).

* * * * *

OVERVIEW:

One reason that EDD is so powerful at backing up copy-protected disks, is because EDD is easily modifiable. Most other copy programs are not easily changeable, and are often outdated soon after they are released. All of the previous versions of EDD had good reputations of being strong work horses long after they were published. This new EDD version is even more modifiable than earlier versions making it much more versatile.

The CHANGE PARAMETER option was created so that you can easily modify the backing up process so that virtually any disk can be backed up... Of course to get the full benefit from EDD, you will have to know quite a bit about copy-protections and have the ability to implement the "correct" parameter changes necessary to back up a disk.

CHANGE PARAMETERS OPTION:

From the OPTION MENU displayed on the screen, pressing either the [2] key, or moving the cursor to the CHANGE PARAMETER option and pressing [RETURN], will tell EDD that you want to change parameters. The screen displays the CHANGE PARAMETER SUB-OPTION MENU:



figure 2.1

From this SUB-OPTION MENU, you have several sub-options available: CHANGE PARAMETER VALUES, PREANALYZE INSTRUCTIONS, PREWRITE INSTRUCTIONS, RESET PARAMETERS TO DEFAULT, and RETURN TO OPTION MENU.

Like a regular option, to use a sub-option, press the number key displayed next to the sub-option. Here is a basic description of each sub-option from this menu:

1. CHANGE PARAMETER VALUES: These are the parameters that tell EDD which routines and values to use. These parameters are not necessarily restricted to backing up disks only; meaning that some of these parameters can be used by other options of EDD.

2. PREANALYZE INSTRUCTIONS: During the backing up process, EDD follows any special instructions, located here, for physically modifying the raw disk bytes found on the track, BEFORE the track is analyzed. When EDD is first booted, the PREANALYZE instruction routine is turned OFF, so that no track modification can occur.

3. PREWRITE INSTRUCTIONS: Similar to SUB-OPTION 2, EDD follows any special instructions, located here, for physically modifying the raw disk bytes found on the track. The difference here, is that the PREWRITE routine is done after the track is analyzed. Also, like SUB-OPTION 2, when EDD is first booted, the PREWRITE instruction routine is turned OFF, so that no track modification can occur.

4. RESET PARAMETERS TO DEFAULT: Using this sub-option, EDD resets all of the parameter values to their default value. This way, if you change parameters to back up one disk, you can reset EDD back to normal to back up a different disk. Note: this option will turn OFF the PREANALYZE and PREWRITE routines, but any PREANALYZE or PREWRITE instruction routines which you have entered will NOT be changed or erased. Although you usually don't need to, you can always re-boot EDD to reset everything.

5. RETURN TO OPTION MENU: When you are done with changing parameters, use this sub-option for returning back to the OPTION MENU.

CHANGE PARAMETERS SUB-OPTION:

Before we can explain "what is" a parameter, you will first need to understand some basics. First, EDD,

being an extensive computer program, is made up from hundreds of smaller computer programs called "subroutines". Each one of these subroutines is programmed to do a specific job, and when the "right" subroutines are working together in the "right" order, back up copies of disks can be made. Most of EDD's subroutines are used every time a disk is backed up, but some subroutines are only supposed to be used for certain types of copy-protections. So, one purpose of some parameters is to control which subroutines are to be used, and in which order they are to be used. Another common purpose of parameters is to "pass on" important values to EDD's subroutines.

ADVANCED users may be interested in obtaining a source code listing of EDD, in which each of the parameters used by EDD is fully defined. If so, refer to the CUSTOMER SERVICE chapter.

The purpose of this section, is to explain how to use the CHANGE PARAMETER sub-option with regards to the PROGRAM INFORMATION LIST. From the SUB-OPTION MENU (figure 2.1), pressing SUB-OPTION 2, CHANGE PARAMETERS, EDD displays the CHANGE PARAMETERS screen:

```

      ESSENTIAL DATA DUPLICATOR 4 PLUS
      000000000001111111112222222222333333
TRK: 012345678901234567890123456789012345
      .00K
      .25K
      .50K
      .75K
      ORIGINAL:S=6,D=2  DUPLICATE:S=6,D=1 (5)

      -  CHANGE PARAMETERS  -

      REFER TO YOUR EDD DOCUMENTATION AND
      PROGRAM INFORMATION LISTS IF NECESSARY.

      PRESS <Q> TO QUIT.

      CHANGE 0000000000: 00 = 05

      CURRENT NUMBER /
      CURRENT VALUE
  
```

figure 2.2

THE PARAMETER EDITING PROCESS:

When the CHANGE PARAMETER sub-option is entered (see figure 2.2), EDD displays the very first parameter number in the parameter buffer, which is parameter "00". To the right of the parameter NUMBER, EDD

displays that parameter's current VALUE.

At this point, EDD's cursor flashes the current parameter NUMBER, indicating that you can move to a different parameter NUMBER by either typing in a new number, or, by pressing the arrow keys. To actually change the VALUE of a parameter, you first need that parameter's NUMBER and it's current VALUE displayed on the screen. Then you need to move EDD's cursor to the current parameter's VALUE, by pressing either the [SPACE], [=], [:], or the [;] key. Once the parameter VALUE is flashing, whatever number you type in, is entered for that parameter's VALUE. After you are done entering the VALUE of a parameter, you can return the cursor back to the parameter NUMBER by pressing the [RETURN] key.

Now, you can either move to a different parameter NUMBER, or you can edit or change the VALUE of the current parameter displayed.

EXAMPLES OF CHANGING PARAMETERS VALUES:

To give you an example of how to change a parameter, let's say that you want to change the VALUE of parameter NUMBER "03" to the VALUE of "AB". First, you will need to display parameter NUMBER "03" on the screen: After entering the CHANGE PARAMETERS sub-option (see figure 2.2 for screen display); as the current parameter NUMBER flashes, enter [03] to display parameter NUMBER "03". Now, either press the [SPACE], [=], [:], or the [;] key to move the flashing cursor to the parameter's VALUE. Since you want to change this VALUE to "AB", press the [A] key and then the [B] key. lastly, press the [RETURN] key to return the cursor from the parameter's VALUE to it's NUMBER.

PARAMETER CHANGING FORMATS:

There are two similar formats which can be used for listing parameters that need to be changed. The following two parameter change formats will each change the same parameter VALUES. The only difference is that the second format is compact, and easier to enter into EDD:

```
1st: 00=FB 01=FC 02=FD 03=FE 04=FF
2nd: 00=FB FC FD FE FF
```

After changing the first parameter (00=FB), if you press the [SPACE BAR], EDD will automatically move to the next parameter's VALUE to change. You will find this feature very convenient for changing several parameter's VALUES in a row, since you needn't enter a new parameter NUMBER again.

BUFFER EDITING KEYS:

For reference purposes, the following list, shows and describes all of the editing keys which are available for the CHANGE PARAMETERS, SUB-OPTION 1. In addition, these editing keys are also valid for PREANALYZE INSTRUCTIONS, SUB-OPTION 2, and PREWRITE INSTRUCTIONS, SUB-OPTION 3.

[0123456789ABCDEF] = Enter key's value into cursor's current position (either NUMBER or VALUE).
[=], [:], or [;] = If cursor is on the NUMBER, switch to VALUE.
 If cursor is on the VALUE, switch to NUMBER.
[SPACE] = Move cursor from NUMBER to VALUE. If cursor is already on NUMBER, than advance one buffer space forward.
[RETURN] = Move cursor from VALUE to NUMBER. If cursor is already on NUMBER, then advance one buffer space forward.
DOWN or RIGHT ARROW = Advance one buffer space forwards.
UP or LEFT ARROW = Advance one buffer space backwards.
[Q] = Quit editing, return to SUB-OPTION MENU.
all other keys = Move cursor to NUMBER.

PREANALYZE AND PREWRITE INSTRUCTIONS SUB-OPTIONS:

Although NOVICE users will be able to use the PREANALYZE and PREWRITE sub-options in conjunction with PROGRAM INFORMATION LISTS, the ADVANCED user will find these sub-options indispensable when making back up copies of many disks. The rest of this chapter is aimed at ADVANCED users.

The whole purpose of PREANALYZE and PREWRITE instructions are to actually modify the raw disk bytes found in a track. Since modifying a track for most copy-protections is usually undesirable, EDD has been preset so that no PREANALYZE or PREWRITE instructions are executing. This also helps in speeding up the regular backing up process.

The PREANALYZE and PREWRITE instructions sub-options are two separate user-changeable areas of memory called "instruction buffers", which can access the same subroutines to accomplish virtually the same thing. The only difference, between PREANALYZE and PREWRITE instruction routines, is that after a track is read from the ORIGINAL disk into memory, EDD follows PREANALYZE instructions to modify raw disk bytes before any analyzing of the disk takes place. Then, after EDD analyzed the disk, using the standard analyze routines, EDD uses PREWRITE instructions to further modify the track, just before writing it to the DUPLICATE disk. In this way, we have allowed four possible combinations for modifying the raw disk bytes that are found in the track:

First, it is possible that no track modification will take place. Don't use either PREANALYZE or PREWRITE instructions.

Second, modifications can take place before analyzing occurs, to specifically "help out" or to "slide through" the analyze routines. This can be done with PREANALYZE instructions.

Third, perhaps modifying the raw disk bytes before analyzing the disk may cause the disk not to analyze correctly. This can be overcome by modifying the track after it is analyzed with PREWRITE instructions.

Fourth and last, both, PREANALYZE and PREWRITE instructions can be used. Maybe the disk needs to be modified before it's analyzed, so that EDD can analyze it correctly; but, then needs to be modified back, after analyzing, so it can be written out as an "unmodified" track.

USING THE PREANALYZE AND PREWRITE SUB-OPTIONS:

Since the PREANALYZE and the PREWRITE sub-option are used in a similar manor, only be discussing the PREANALYZE sub-option here.

From the change parameter SUB-OPTION MENU, you can enter SUB-OPTION 2, PREANALYZE INSTRUCTIONS by pressing the [2] key, and the screen displays the PREANALYZE INSTRUCTIONS screen (see figure 2.3).

As you can see, this PREANALYZE screen looks similar to the CHANGE PARAMETER screen you previously used.

This was done purposely, in keeping with continuity. At a later time, when using SUB-OPTION 3, you will notice that the PREWRITE screen, again, looks similar to this screen.

```

      ESSENTIAL DATA DUPLICATOR 4 PLUS
      000000000001111111112222222222333333
TRK: 012345678901234567890123456789012345
      .00K
      .25K
      .50K
      .75K
      ORIGINAL:S=6,D=2  DUPLICATE:S=6,D=1 (5)

      - CHANGE PARAMETERS -

      REFER TO YOUR EDD DOCUMENTATION AND
      PROGRAM INFORMATION LISTS IF NECESSARY.

      PRESS <Q> TO QUIT.

      CHANGE XXXXXXXXXX BYTE: 00 = 01

      CURRENT NUMBER /
      CURRENT VALUE /

```

figure 2.3

OVERVIEW OF THE PREANALYZE AND PREWRITE SUB-OPTIONS:

We have allocated 255 buffer positions (\$00-\$FF) for the PREANALYZE instruction buffer and another 255 buffer positions for the PREWRITE instruction buffer. Each buffer position can hold one instruction byte. So, you can enter a maximum of 255 instruction bytes into each of the PREANALYZE and PREWRITE instruction buffers. This should be plenty of space for any instruction routine; since, from our experience, the length of most routines will usually be at least 6, but rarely over 25 instruction bytes long.

Buffer position 00 is used by EDD as a "pointer" and thus can not be used to hold an instruction byte. The value found here, points to the buffer position of the first instruction byte of the routine, which you want EDD to use.

Instruction routines can reside anywhere in the instruction buffer (except for buffer position 00), so this means that you can use buffer positions 01 through FF for your instruction routines.

Instruction bytes are entered into the instruction buffer in the same manor in which parameters are

entered into the parameter buffer as described in an earlier section of this chapter.

TURNING ON AN INSTRUCTION ROUTINE:

Once an instruction routine has been entered into the instruction buffer, turning on the instruction routine is just a matter of telling EDD the position of the first instruction byte, of that instruction routine.

EDD contains three "specialized" instruction routines, which have been factory set into the PREANALYZE instruction buffer, that you can have EDD use. Of course, you can use these instruction routines as they are, change them to fit your own needs, or completely create your own from scratch.

The three instruction routines which EDD has been preset with, and the first instruction position of each routine is as follows:

```
GENERIC BITS LIP COPY-PROTECTION = PREANALYZE B0
LOCK-IT-UP COPY-PROTECTION = PREANALYZE C8
GENERAL CLEANING OF TIMING BITS = PREANALYZE E0
```

It has been said earlier, that EDD uses the buffer position 00 as a "pointer", which points to the buffer position of the first instruction byte of the instruction routine, which you want EDD to use. Here is an example of the way it's used. Let's say, that you wanted to select the instruction routine names "LOCK-IT-UP COPY-PROTECTION". Since you know that this routine is located in the PREANALYZE instruction buffer starting at position C8, once the PREANALYZE instructions screen is displayed (see figure 2.3), all you need to do is type "00=C8". Now, EDD knows exactly which routine to use.

Note: The default value of instruction buffer position 00 is 01. This means that EDD always executes the instruction routine at buffer position 01. The default instruction byte located at buffer position 01 is 10. So the instruction byte 10 is always executed under default conditions. An instruction byte 10 tells EDD that the instruction routine is done (finished), and to return processing back to EDD. The reason that we have preset buffer position 00 to the value of 01 is so that you can immediately start entering an instruction routine at buffer location 01, without resetting buffer position

00. Also, since most of the "other" buffer positions contain 10 as their default value, you usually will not need to enter a 10 instruction, as the last instruction byte of your routine.

TURNING OFF ALL INSTRUCTION ROUTINES:

To prevent EDD from executing any instruction routines, set EDD's instruction routine pointer to zero, by changing buffer position 00 to the value of 00.

ENTERING INSTRUCTION ROUTINES INTO EDD:

Although EDD can use only one PREANALYZE and one PREWRITE instruction routine at any one time, you can fill the PREANALYZE and PREWRITE instruction buffers with as many instructions routines as will fit.

Instruction bytes are entered into the instruction buffer in the same manor as changing parameters (discussed earlier in this chapter). To learn how to enter an instruction routine, let's enter an example routine into the PREANALYZE instruction buffer.

If the PREANALYZE instructions sub-option is not currently displayed on your screen (see figure 2.3), press [2] from the OPTION MENU, and then press [2] from the SUB-OPTION MENU. It should now be displayed.

Let's enter the following instruction routine into the instruction buffer, starting at buffer position "32":

```
32=20 31 FF 36 DD 21 10
```

The first thing that you need to do, is enter buffer position "32" by typing [32]. Do this now, and then press the [=] key. Now, enter the instruction bytes by typing [20], [SPACE], [31], [SPACE], [FF], [SPACE], [36], [SPACE], [DD], [SPACE], [21], [SPACE], [10], and then [RETURN]. At this time, the entire instruction routine will be entered into EDD.

But, before EDD can execute this instruction routine, EDD needs to be told the instruction routine's buffer start position. Type [00] to display buffer position NUMBER "00" (EDD's pointer byte), and then press the [=] key. Enter the buffer position of the starting location of the buffer routine, a [32], then the

The following reference table gives all of the default instruction byte values for the PREANALYZE program buffer.

PREANALYZE number-value	PREANALYZE number-value	PREANALYZE number-value	PREANALYZE number-value	PREANALYZE number-value	PREANALYZE number-value
00 = 01	2B = 10	56 = 10	81 = 10	AC = 10	D7 = 56
01 = 10	2C = 10	57 = 10	82 = 10	AD = 10	D8 = 00
02 = 10	2D = 10	58 = 10	83 = 10	AE = 10	D9 = 35
03 = 10	2E = 10	59 = 10	84 = 10	AF = 10	DA = 58
04 = 10	2F = 10	5A = 10	85 = 10	BO = 31	DB = 58
05 = 10	30 = 10	5B = 10	86 = 10	B1 = D5	DC = 58
06 = 10	31 = 10	5C = 10	87 = 10	B2 = AA	DD = 58
07 = 10	32 = 10	5D = 10	88 = 10	B3 = AD	DE = 21
08 = 10	33 = 10	5E = 10	89 = 10	B4 = 60	DF = 10
09 = 10	34 = 10	5F = 10	8A = 10	B5 = F8	E0 = 31
0A = 10	35 = 10	60 = 10	8B = 10	B6 = 00	E1 = 03
0B = 10	36 = 10	61 = 10	8C = 10	B7 = E7	E2 = 00
0C = 10	37 = 10	62 = 10	8D = 10	B8 = E7	E3 = 03
0D = 10	38 = 10	63 = 10	8E = 10	B9 = E7	E4 = 61
0E = 10	39 = 10	64 = 10	8F = 10	BA = 35	E5 = 02
0F = 10	3A = 10	65 = 10	90 = 10	BB = 01	E6 = 00
10 = 10	3B = 10	66 = 10	91 = 10	BC = 02	E7 = 35
11 = 10	3C = 10	67 = 10	92 = 10	BD = 00	E8 = 01
12 = 10	3D = 10	68 = 10	93 = 10	BE = 01	E9 = 21
13 = 10	3E = 10	69 = 10	94 = 10	BF = 02	EA = 31
14 = 10	3F = 10	6A = 10	95 = 10	CO = 00	EB = 00
15 = 10	40 = 10	6B = 10	96 = 10	C1 = 01	EC = 03
16 = 10	41 = 10	6C = 10	97 = 10	C2 = 01	ED = 00
17 = 10	42 = 10	6D = 10	98 = 10	C3 = 00	EE = 61
18 = 10	43 = 10	6E = 10	99 = 10	C4 = 00	EF = 02
19 = 10	44 = 10	6F = 10	9A = 10	C5 = 00	F0 = 00
1A = 10	45 = 10	70 = 10	9B = 10	C6 = 21	F1 = 35
1B = 10	46 = 10	71 = 10	9C = 10	C7 = 10	F2 = 00
1C = 10	47 = 10	72 = 10	9D = 10	C8 = 31	F3 = 21
1D = 10	48 = 10	73 = 10	9E = 10	C9 = D5	F4 = 10
1E = 10	49 = 10	74 = 10	9F = 10	CA = AA	F5 = 10
1F = 10	4A = 10	75 = 10	A0 = 10	CB = 96	F6 = 10
20 = 10	4B = 10	76 = 10	A1 = 10	CC = 70	F7 = 10
21 = 10	4C = 10	77 = 10	A2 = 10	CD = 70	F8 = 10
22 = 10	4D = 10	78 = 10	A3 = 10	CE = AA	F9 = 10
23 = 10	4E = 10	79 = 10	A4 = 10	CF = AA	FA = 10
24 = 10	4F = 10	7A = 10	A5 = 10	DO = AF	FB = 10
25 = 10	50 = 10	7B = 10	A6 = 10	D1 = AA	FC = 10
26 = 10	51 = 10	7C = 10	A7 = 10	D2 = 71	FD = 10
27 = 10	52 = 10	7D = 10	A8 = 10	D3 = D5	FE = 10
28 = 10	53 = 10	7E = 10	A9 = 10	D4 = AA	FF = 10
29 = 10	54 = 10	7F = 10	AA = 10	D5 = AD	
2A = 10	55 = 10	80 = 10	AB = 10	D6 = 60	

PREANALYZE program buffer default values

The following reference table gives all of the default instruction byte values for the PREWRITE program buffer.

PREWRITE number-value	PREWRITE number-value	PREWRITE number-value	PREWRITE number-value	PREWRITE number-value	PREWRITE number-value
00 = 01	2B = 10	56 = 10	81 = 10	AC = 10	D7 = 10
01 = 10	2C = 10	57 = 10	82 = 10	AD = 10	D8 = 10
02 = 10	2D = 10	58 = 10	83 = 10	AE = 10	D9 = 10
03 = 10	2E = 10	59 = 10	84 = 10	AF = 10	DA = 10
04 = 10	2F = 10	5A = 10	85 = 10	B0 = 10	DB = 10
05 = 10	30 = 10	5B = 10	86 = 10	B1 = 10	DC = 10
06 = 10	31 = 10	5C = 10	87 = 10	B2 = 10	DD = 10
07 = 10	32 = 10	5D = 10	88 = 10	B3 = 10	DE = 10
08 = 10	33 = 10	5E = 10	89 = 10	B4 = 10	DF = 10
09 = 10	34 = 10	5F = 10	8A = 10	B5 = 10	E0 = 10
0A = 10	35 = 10	60 = 10	8B = 10	B6 = 10	E1 = 10
0B = 10	36 = 10	61 = 10	8C = 10	B7 = 10	E2 = 10
0C = 10	37 = 10	62 = 10	8D = 10	B8 = 10	E3 = 10
0D = 10	38 = 10	63 = 10	8E = 10	B9 = 10	E4 = 10
0E = 10	39 = 10	64 = 10	8F = 10	BA = 10	E5 = 10
0F = 10	3A = 10	65 = 10	90 = 10	BB = 10	E6 = 10
10 = 10	3B = 10	66 = 10	91 = 10	BC = 10	E7 = 10
11 = 10	3C = 10	67 = 10	92 = 10	BD = 10	E8 = 10
12 = 10	3D = 10	68 = 10	93 = 10	BE = 10	E9 = 10
13 = 10	3E = 10	69 = 10	94 = 10	BF = 10	EA = 10
14 = 10	3F = 10	6A = 10	95 = 10	C0 = 10	EB = 10
15 = 10	40 = 10	6B = 10	96 = 10	C1 = 10	EC = 10
16 = 10	41 = 10	6C = 10	97 = 10	C2 = 10	ED = 10
17 = 10	42 = 10	6D = 10	98 = 10	C3 = 10	EE = 10
18 = 10	43 = 10	6E = 10	99 = 10	C4 = 10	EF = 10
19 = 10	44 = 10	6F = 10	9A = 10	C5 = 10	F0 = 10
1A = 10	45 = 10	70 = 10	9B = 10	C6 = 10	F1 = 10
1B = 10	46 = 10	71 = 10	9C = 10	C7 = 10	F2 = 10
1C = 10	47 = 10	72 = 10	9D = 10	C8 = 10	F3 = 10
1D = 10	48 = 10	73 = 10	9E = 10	C9 = 10	F4 = 10
1E = 10	49 = 10	74 = 10	9F = 10	CA = 10	F5 = 10
1F = 10	4A = 10	75 = 10	A0 = 10	CB = 10	F6 = 10
20 = 10	4B = 10	76 = 10	A1 = 10	CC = 10	F7 = 10
21 = 10	4C = 10	77 = 10	A2 = 10	CD = 10	F8 = 10
22 = 10	4D = 10	78 = 10	A3 = 10	CE = 10	F9 = 10
23 = 10	4E = 10	79 = 10	A4 = 10	CF = 10	FA = 10
24 = 10	4F = 10	7A = 10	A5 = 10	D0 = 10	FB = 10
25 = 10	50 = 10	7B = 10	A6 = 10	D1 = 10	FC = 10
26 = 10	51 = 10	7C = 10	A7 = 10	D2 = 10	FD = 10
27 = 10	52 = 10	7D = 10	A8 = 10	D3 = 10	FE = 10
28 = 10	53 = 10	7E = 10	A9 = 10	D4 = 10	FF = 10
29 = 10	54 = 10	7F = 10	AA = 10	D5 = 10	
2A = 10	55 = 10	80 = 10	AB = 10	D6 = 10	

PREWRITE program buffer default values

[RETURN] key. Now that EDD knows which routine to use, press [Q] to quit and return to the SUB OPTION MENU.

EDD will execute the instruction routine, which you've just entered, whenever you use OPTION 1, BACK UP DISK. Of course, rebooting EDD will reset everything back to default.

CREATING YOUR OWN INSTRUCTION ROUTINES:

Although following instructions found on the PROGRAM INFORMATION LIST can be done by virtually any EDD owner, being able to create your own PREANALYZE and PREWRITE instruction routines, from scratch, will probably only be able to be done by ADVANCED users; who thoroughly understand copy-protections and have good programming skills.

INSTRUCTION BYTE DESCRIPTIONS:

Below, is the complete instruction set for EDD's PRE ANALYZE and PREWRITE instructions sub-options. This section is provided for reference. Skip onto the next section to become familiar with how instruction routines work.

Instruction:	Basic instruction description:
00-02 :	The amount of timing bits to SEARCH for, or REPLACE to, depending on the current mode.
03 :	Wildcard timing byte for accepting a timing byte of any length.
10 :	End of routine, return control to EDD.
20 :	Set start loop flag to next instruction byte.
21 :	Go back and repeat loop until loop is done (raw disk byte pointer hitting end of raw disk byte buffer); then set start loop flag to the next instruction byte.
30 :	Set mode to SEARCH and reset raw disk byte pointer to the start of the raw disk byte

buffer.

- 31 : Set mode to SEARCH and point to the raw disk byte located after the raw disk bytes(s), which were reviously replaced; or point to the start buffer if the REPLACE mode hasn't been previously entered.
- 32 : Set mode to SEARCH and point to the first raw disk byte which was previously replaced; or point to the start buffer if the REPLACE mode hasn't been previously entered.
- 35 : Set mode to REPLACE and point to the raw disk byte located after the raw disk byte(s) which were previously searched; or point to the start buffer if the SEARCH mode hasn't been previously entered.
- 36 : Set mode to REPLACE and point back to the first raw disk byte which was previously searched; or point to the start buffer if the SEARCH mode hasn't been previously entered.
- 40 : Replace raw disk byte pointer with "RDBPS" (raw disk byte pointer storage).
- 41 : Store raw disk byte pointer at "RDBPS".
- 42 : Store "RDBPS" at "LTS" (long term storage).
- 43 : Replace "RDBPS" with "LTS".
- 50 : SEARCH track for the next invalid raw disk byte.
- 51 : SEARCH track for the next non \$FF raw disk byte.
- 52 : SEARCH track for the next timing byte.
- 55 : REPLACE a random valid raw disk byte.
- 56 : REPLACE a random invalid raw disk byte.
- 57 : REPLACE a random very invalid raw disk.

byte.

58 : REPLACE a zero byte (most invalid raw disk byte available).

60 : Add the next two instruction bytes to the raw disk byte pointer (ll, hh).

61 : Subtract next two instruction bytes from the raw disk byte pointer (ll, hh).

62 : Add the next two instruction bytes to the "RDBPS" (ll, hh).

63 : Subtract the next two instruction bytes from the "RDBPS" (ll, hh).

70 : Wildcard, single raw disk byte.

71 : Wildcard, multiple raw disk byte.

75 : Go directly into monitor; do a hard reset.

80-FF : Raw disk byte to SEARCH for; or to REPLACE to depending on the current mode.

EDD executes instruction bytes sequentially. Each instruction byte is executed in order, unless an instruction byte "21" (repeat loop) or until an instruction byte "10" (instruction routine end) is encountered. .

While running an instruction routine, each instruction byte will either be executing in the SEARCH mode, or the REPLACE mode. Several of the instruction bytes can operate in either mode with the same results.

When an instruction routine first starts to run, the SEARCH mode is always set.

The "start loop" is automatically set to the first instruction byte of the instruction routine. Hence, using the instruction byte "20" for the first instruction of an instruction routine is not needed, and is a waste of memory.

After finishing a loop, EDD automatically sets the instruction byte located after the "21" instruction, as the next 'start loop', for convenience; and the raw disk byte buffer pointer is reset to the buffer beginning, to get ready to do another loop. If

needed, the start loop can be changed, of course, by using the instruction byte "20".

HOW INSTRUCTIONS ROUTINES WORK:

In this section, you will be learning how basic instruction routines work. To accomplish this, you will be given several examples of instruction routines, and then a description of what each instruction routine does.

Let's start with a "basic" example. Let's say that you want to create an instruction routine that changes ALL the "FF" values in a track to a "DD" value. You will need to tell EDD to SEARCH for all "FF" value raw disk byte and then REPLACE them with "DD" value raw disk bytes, continuing with the SEARCH and REPLACE until the whole track is done. To accomplish this, the following instruction routine can be used:

```
20 31 FF 36 DD 21 10
```

Here is a "disassembly" of this instruction routine:

Instruction:	Description:	Mode:
20	: set start loop flag to next instruction byte	
31	: set mode to SEARCH	: SEARCH
FF	: SEARCH for an "FF" raw disk byte	: SEARCH
36	: set mode to REPLACE	: REPLACE
DD	: REPLACE raw disk byte with "DD"	: REPLACE
21	: loop back to start loop until track is finished	: REPLACE
10	: instruction routine is done; return control back to EDD	

Here is a detailed description of what this instruction routine does:

The first instruction byte, "20", tells EDD to set the next instruction byte (the "31" instruction) as the "start loop". If a certain instruction sequence (loop) needs to be done more than once, EDD will need to know which instruction byte to come back to.

The second instruction byte, "31", just tells EDD to set the current mode to SEARCH (the two possible modes are either SEARCH or REPLACE).

The third instruction byte, "FF", is greater than \$80, so it's NOT considered to be an actual instruction. This "FF" is a raw disk byte, which is to either be "searched for" or "replaced with" in the raw disk byte buffer. Since the current mode is SEARCH, EDD will begin searching the raw disk byte buffer for an "FF" valued raw disk byte. When an "FF" byte is located, EDD will then continue executing the next instruction byte.

The fourth instruction byte, "36", tells EDD to set the current mode to REPLACE (instead of SEARCH).

The fifth instruction byte, "DD", like the "FF" instruction byte, is to either be "searched for" or "replaced with" in the raw disk byte buffer. The current mode is REPLACE, so the current raw disk byte in the raw disk byte buffer (which in this case happens to be the "FF" which was just located) is replaced, and is now a "DD" raw disk byte.

The sixth instruction byte, "21", first checks to see if there are any raw disk bytes left to search for in the raw disk byte buffer. If there is still raw disk bytes left to be searched, EDD will loop back to the "start loop", which happens to be instruction byte "31" in this example. If there are no more raw disk bytes left to search for in the raw disk byte buffer, EDD continues executing the next instruction byte.

The seventh instruction byte, "10", tells EDD that this instruction routine is completely finished, and to return control back to EDD.

This instruction routine example is actually the basic format of all SEARCH and REPLACE routines. Although the descriptions that have been given here for the instruction bytes, do exactly what we've said they will do, as far as this instruction routine is concerned, some of these instruction bytes may also have other useful side-effects that are a great help with larger, more involved instruction routines. As you continue going through different examples, we will explain more about each instruction byte.

For example, here is another simple instruction routine. What if you want EDD to search for all

occurrences of the three raw disk bytes "D5 AA 96", and REPLACE these bytes with the raw disk bytes "FA FB FC". The following instruction routine will do the job:

```
20 31 D5 AA 96 36 FA FB FC 21 10
```

Although this instruction routine, at first, may not look very similar to the first one, it is. Here is a description of what it does:

Instruction:	Description:	Mode:

20 :	set start loop flag to next instruction byte	
31 :	set mode to	: SEARCH
D5 :	SEARCH raw disk bytes for "D5"	: SEARCH
AA :	then an "AA"	: SEARCH
96 :	then a "96"	: SEARCH
36 :	set mode to REPLACE and point back to the first raw disk byte (D5) in the raw disk byte bugger	: REPLACE
FA :	REPLACE raw disk byte with a "FA"	: REPLACE
FB :	then a "FB"	: REPLACE
FC :	then a "FC"	: REPLACE
21 :	loop back to start loop until done	: REPLACE
10 :	done; return control back to EDD	

Now for a more detailed description of what's happening with this instruction routine, when it's executed: EDD starts to search the raw disk byte buffer for a byte with the value of "D5". After one is found, EDD looks only at the next raw disk byte. If this 2nd raw disk byte is an "AA", then EDD looks only at the 3rd raw disk byte for the "96". If any of these three raw disk bytes don't match the three raw disk byte pattern which EDD is looking for, EDD starts searching for another "D5" all over again, until all three raw disk bytes in a row match. When all three instruction bytes match three raw disk bytes, EDD enters the REPLACE mode, resets the raw disk byte buffer pointer to the first SEARCH raw disk byte (which in this case is the "D5"), and then replaces the next three raw disk bytes in a row with the raw disk bytes "FA FB FC". This instruction routine then

loops back to the start loop, until the whole track is finished.

The next instruction routine example is similar to the previous instruction routine, except this one shows how the two REPLACE instruction bytes, "35" and "36" differ from each other:

```
20 31 D5 AA 96 35 FA FB FC 21 10
```

Now for the instruction routine description:

```
-----  
Instruction:  Description:                               Mode:  
20 :  set start loop flag to next                       :  
      instruction byte  
31 :  set mode to SEARCH                                : SEARCH  
  
D5 :  set mode to SEARCH  
AA :  then an "AA"                                       : SEARCH  
96 :  then a "96"                                         : SEARCH  
  
35 :  set mode to REPLACE and point to                   : REPLACE  
      the last raw disk byte searched  
  
FA :  REPLACE raw disk byte with a "FA"                 : REPLACE  
FB :  then a "FB"                                       : REPLACE  
FC :  then a "FC"                                       : REPLACE  
  
21 :  done; return control back to EDD
```

Like the previous example, EDD searches for three raw disk bytes in a row, "D5 AA 96", then turns on the REPLACE mode. But the difference here, is that the raw disk byte buffer pointer is NOT reset to the first raw disk byte of the raw disk byte search pattern. Instead, it points to the raw disk byte located next, AFTER the last raw disk byte searched, which in this case happens to be the raw disk byte after the "96". So, the three raw disk bytes located AFTER the "D5 AA 96", becomes FA FB FC".

Now, let's discuss some of the instructions in more detail:

RAW DISK BYTE PATTERNS:

Raw disk byte patterns have been used in all of the

previous examples, and can be as small as one raw disk byte or many raw disk bytes long. An example of using a raw disk byte pattern, during SEARCHES, is the pattern "B4 B5 B7 B9". It tells EDD to search for these four raw disk bytes in a row, in the raw disk byte buffer. During REPLACING, using the raw disk byte pattern, "AC BF 93 F7 ED", causes each of these raw disk byte to be stored in a row, in the raw disk byte buffer.

TIMING BIT PATTERNS:

As discussed elsewhere in this manual, timing bits are the "hidden" zero bits located in between raw disk bytes. There is either "0" (none), "1", or "2" timing bits hidden between a raw disk byte. During a SEARCH, using the timing bit phere in this manual, timing bits are the "hidden" zero bits located in between raw disk bytes. There is either "0" (none), "1", or "2" timing bits hidden between a raw disk byte. During a SEARCH, using the timing bit pattern "00 01 00", will tell EDD to first search for a raw disk byte with no timing bits attached, the next raw disk byte will have to have one timing bit attached, and the third raw disk byte will have to have no timing bits attached. During a REPLACE, using the raw disk byte pattern "00 01 02 00" will tell EDD to attach no timing bits to the first raw disk byte, attach one timing bit to the second raw disk byte, two timing bits to the third raw disk byte, and no timing bit to the fourth raw disk byte.

R.A.W DISK BYTES AND TIMING BITS WORKING TOGETHER:

Sometimes you will want to combine both, raw disk bytes and timing bits, into your SEARCH or REPLACE instruction routines. We have programmed EDD to easily handle this. Here's how... During a SEARCH, let's say that you not only want EDD to find the raw disk byte pattern "AC FD", but you also want one timing bit between the "AC" and "FD", and no timing bits after the "FD". Here is what your SEARCH raw disk byte pattern will look like: "AC 01 FD 00". During a REPLACE, if you use the raw disk byte pattern "D5 01 AA 00 96 00", EDD will replace the current raw disk byte with a "D5", attaching one timing bit, the second raw disk byte will be replaced with an "AA" with no timing bit attached, and the third raw disk byte will be replaced with a "96" with no timing bit attached.

WILDCARDS:

If you are in the SEARCH mode, you already know that a raw disk byte pattern, such as "AA AB AC", will tell EDD to search the raw disk byte buffer for this raw disk byte pattern. But, what if you know that the first raw disk byte in the pattern is a "D5", and the third raw disk byte is a "96", but you don't know the value of the second raw disk byte; you will need to use what's called a SINGLE RAW DISK BYTE WILDCARD, which is instruction byte "70". For this example, here's what the raw disk byte pattern will look like: 'D5 70 96". When EDD is searching the raw disk byte buffer, the instruction byte "70" will match "any" raw disk byte value. Examples of a couple of patterns that this three raw disk byte pattern will match are: "D5 AA 96", "D5 FF 96", and "D5 AD 96".

The SINGLE RAW DISK BYTE WILDCARD instruction can also be helpful while in the REPLACE mode. The result here, is when a raw disk byte pattern is being replaced, the raw disk byte that corresponds to this wildcard will be left unchanged. For example, if the raw disk bytes "FD FE FF" are to be replaced with 'AA 70 AB", the end result, in the raw disk byte buffer, will be "AA FE AB".

As you have just seen, the "70" instruction byte is a wildcard which will match any single raw disk byte. But, what if you know that the first value in a raw disk byte pattern is a "D5", and the last raw disk byte is a "96", but there is an unknown amount of raw disk bytes with unknown values in between. Here, you need to use what's called a a MULTIPLE RAW DISK BYTE WILDCARD instruction, which is instruction byte "71". When in the SEARCH mode, the instruction bytes "D5 71 96" will match all of these examples: "D5 FE FF 96", "D5 AA 96", and "D5 FA CF CE FD FE 96". One more thing needs to be said about the "71" instruction byte... The raw disk byte AFTER the "71" is considered to be the first raw disk byte of the pattern. You will need to take this into account when using either instruction byte "32" or "36".

The MULTIPLE RAW DISK BYTE WILDCARD instruction will only be recognized if in the SEARCH mode, and is ignored if the current mode is REPLACE.

ADD/SUBTRACT BUFFER POINTER:

Let's say,- for example, that a certain raw disk byte

pattern is contained on a track, but some distance away, maybe \$30 raw disk bytes down, some modification of the track needs to take place. We will need to use the ADD instruction byte, "60". This instruction consists of three instruction bytes. The first instruction bytes is, of course, a "60", but, the next two instruction bytes are the amount that you want EDD to add for the offset. The first instruction byte after the "60" is the low order byte to add, and the 2nd byte is the high order byte. Example: If you use the instruction bytes "60 30 00" you are telling EDD to take the raw disk byte buffer pointer and immediately add \$0030 to it. Here is an example of how you can apply this to your SEARCH raw disk byte pattern: "D5 AA 96 60 32 01". As discussed before, when EDD locates the "D5 AA 96" raw disk byte pattern, the raw disk byte buffer pointer will be pointing at the "96"; but at this point, EDD will immediately add 132 raw disk bytes to the raw disk byte buffer pointer. You can, at this point, tell EDD to keep searching for more raw disk bytes, or go into the REPLACE mode, and start replacing raw disk bytes. The SUBTRACT instruction byte '61, is used similar to the ADD instruction.

SPECIAL SEARCHES:

EDD can also do three "special" type of searches:

SEARCH track until an invalid raw disk byte is found. Instruction byte "50", is used to locate any raw disk byte that contains more than two consecutive zero bits. This is very helpful when cleaning up invalid tracks.

SEARCH track for a non "FF". Using instruction byte "51", EDD will skip over raw disk bytes with the value of "FF's" until a "non FF" is found.

SEARCH track for hidden timing bits. Using instruction byte "52", EDD will skip over all raw disk bytes which have no timing bits, until a raw disk byte with at least one timing bit is found.

SPECIAL REPLACES:

There are four "special" REPLACE instruction bytes.

When replacing raw disk bytes, instruction byte "55" will store a "random" VALID raw disk byte. Valid raw disk bytes means a byte which contains no more than

two consecutive zero bits.

The three other REPLACE instruction bytes all deal with replacing an "invalid" raw disk byte. Instruction byte "56" REPLACES the current raw disk byte with a SEMI-INVALID raw disk byte, which contains more than two, but no more than four, consecutive zero bits. Instruction byte "57" REPLACES the current raw disk byte with a VERY-INVALID raw disk byte, which will contain more than four consecutive zero bits. Instruction byte "58" REPLACES the current raw disk byte with the MOST-INVALID raw disk byte possible, a "00" (eight consecutive zero bits).

FACTORY SET INSTRUCTION ROUTINES:

We have preset the PREANALYZE instruction buffer with three "special" instruction routines, which can back up several different types of copy-protections. It should be noted that NONE of these special instruction routines are used by EDD when the EDD disk is first booted. How to tell EDD to use these special instruction routines was explained earlier in this chapter. In this section, we will give a listing and description of each of these preset instruction routines. This will also aid you in learning how to create your own instruction routines. Another good purpose of these preset instruction routines is that it may be possible to back up a completely different type of copy-protection, just by making a "minor" change to one of these instruction routines, which will of course, save a lot of time typing in a new instruction routine from scratch.

GENERAL CLEANING OF TIMING BITS:

Here, there are two instruction routines in one. You can tell EDD to use both, or, either one. The first instruction routine SEARCHES for a raw disk byte that has at least one timing bit attached. If the second raw disk byte has no timing bits and the third byte has a timing bit, EDD will put ONE timing bit on the second (middle) raw disk byte. The second instruction routine does basically the opposite thing. First, a raw disk byte with no timing bit is found, then if the next raw disk byte has timing bit(s) and the third raw disk byte doesn't have a timing bit, then EDD takes the timing bit(s) off. The purpose of these two routines is to clean up "stray" timing bits.

Here is the whole instruction routine:

```
31 03 00 03 61 02 00 35 01 21 31 00 03 00 61 02 00 35
00 02 10
```

Preanalyze

Buffer	Instruction	Mode
Position &	Description:	After
Instruction:		Doing:

E0 = 31	: set SEARCH mode	:
SEARCH		
E1 = 03	: SEARCH for timing bit	: SEARCH
E2 = 00	: then, "no" timing bit	: SEARCH
E3 = 03	: then, a timing bit	: SEARCH
E4 = 61	: subtract 2 from the RDBBP to	: SEARCH
E5 = 02	: point at the correct	
E6 = 00	: disk byte for changing	
E7 = 35	: set REPLACE mode	: REPLACE
E8 = 01	: REPLACE timing bit with one	: REPLACE
E9 = 21	: repeat loop until done	: REPLACE
EA = 31	: set SEARCH mode	: SEARCH
EB = 00	: SEARCH for "no" timing but	: SEARCH
EC = 03	: then, a timing bit	: SEARCH
ED = 00	: then, "no" timing bit	: SEARCH
EE = 61	: subtract 2 from RDBBP to	: SEARCH
EF = 02	: point at the correct	
F0 = 00	: disk byte for changing	
F1 = 35	: set REPLACE mode	: REPLACE
F2 = 00	: REPLACE timing bit with zero	: REPLACE
F3 = 21	: repeat look until done	: REPLACE
F4 = 10	: done; return control to EDD	

To do both these instruction routine loops, just start with the first loop. When it's done, the second loop will start. If you only want to do the second loop, you will need to change EDD's instruction byte pointer to point to the second "31". The first loop will be skipped completely. Or, to do the first loop only, change the second "31" instruction byte to a "10" (end of routine instruction), then run the first instruction routine.

GENERIC BITS LIP COPY-PROTECTION:

We have noticed that the copy-protection contained on one of the "other" copy program's disks is being sold to any software publisher that wants to buy it, for their own programs. To us, it sounds like a conflict of interest. Since we have just started seeing this copy-protection "sprouting up", we've decided to put

the instruction routine for copying this copy-protection into EDD. If we are lucky, maybe everybody will start using this "easy to copy" copy-protection scheme. For reference purposes, we will call this the "GENERIC BITS LIP" copy-protection.

The routine's instruction bytes:

```
31 D5 AA AD 60 F8 00 E7 E7 E7 35 01 02 00 01 02 00 01
01 00 00 00 21 10
```

Preanalyze Buffer		Mode
Position & Instruction:	Instruction Description	After Doing:

B0 = 31	: set SEARCH mode	: SEARCH
B1 = D5	: SEARCH for disk byte "D5"	: SEARCH
B2 = AA	: then, an "AA"	: SEARCH
B3 = AD	: then, an "AD"	: SEARCH
B4 = 60	: add the next 2 instruction	: SEARCH
B5 = F8	: bytes to the raw disk byte	
B6 = 00	: buffer pointer (\$00F8)	
B7 = E7	: continue SEARCHing for "E7"	: SEARCH
B8 = E7	: then, another "E7"	: SEARCH
B9 = E7	: and another "E7"	: SEARCH
BA = 35	: turn on REPLACE mode	: REPLACE
BB = 01	: REPLACE timing bit with one	: REPLACE
BC = 02	: the next, with a two	: REPLACE
BD = 00	: the next, with a zero	: REPLACE
BE = 01	: the next, with a one	: REPLACE
BF = 02	: the next, with a two	: REPLACE
C0 = 00	: the next, with a zero	: REPLACE
C1 = 01	: the next, with a one	: REPLACE
C2 = 01	: the next, with a one	: REPLACE
C3 = 00	: the next, with a zero	: REPLACE
C4 = 00	: the next, with a zero	: REPLACE
C5 = 00	: the next, with a zero	: REPLACE
C6 = 21	: then loop back until done	: REPLACE
C7 = 10	: done; return control to EDD	

This copy-protection is actually pretty fancy. The sectors on each track look normal, and the disk will copy with any standard copy-program, but the backup copy will not run. This copy-protection is the type which uses hidden timing bits in the middle of sectors to prevent it from being backup up.

LOCK-IT-UP COPY-PROTECTION:

Once upon a time there was a software company, named

Double Gold, that produced a copy-protection scheme which was sold to software publishers under the name of "LOCK-IT-UP". Although Double Gold is now defunked, their LOCK-IT-UP copy-protection lives on. The way that this copy-protection works, is that there is invalid raw disk bytes in the middle of one of the sectors on track zero. A copy-protected program will read this sector a couple of times, and each time it reads it, the sector must always be different. If the sector was the same each time, the copy-protection will know the disk was NOT an "original". Although most people will be able to back up this copy-protection using just the standard default EDD parameter settings, some people will not. So, we have preset a reliable instruction routine into EDD:

```
31 D5 AA 96 70 70 AA AA AF AA 71 D5 AA AD 60 56 00 35
58 58 58 58 21 10
```

Preanalyze

Buffer	Instruction	Mode
Position & Instruction:	Description	After Doing:
C8 = 31	: turn on SEARCH mode	: SEARCH
C9 = D5	: SEARCH for disk byte "D5"	: SEARCH
CA = AA	: then, an "AA"	: SEARCH
CB = 96	: then, a "96"	: SEARCH
CC = 70	: then skip a raw disk byte	: SEARCH
CD = 70	: and skip another	: SEARCH
CE = AA	: find an "AA"	: SEARCH
CF = AA	: then, another "AA"	: SEARCH
D0 = AF	: then, an "AF"	: SEARCH
D1 = AA	: then, an "AA"	: SEARCH
D2 = 71	: multiple wildcard	: SEARCH
D3 = D5	: start SEARCHing for "D5"	: SEARCH
D4 = AA	: then, an "AA"	: SEARCH
D5 = AD	: then, an "AD"	: SEARCH
D6 = 60	: add the next 2 instruction	: SEARCH
D7 = 56	: bytes to the raw disk byte	
D8 = 00	: buffer pointer (\$0056)	
D9 = 35	: set REPLACE mode	: REPLACE
DA = 58	: REPLACE disk byte with "00"	: REPLACE
DB = 58	: then, a "00"	: REPLACE
DC = 58	: then, a "00"	: REPLACE
DD = 58	: then, a "00"	: REPLACE
DE = 21	: then loop back until done	: REPLACE
DF = 10	: done; return control to EDD	

Some verions of this copy-protection require that the program disk be write-protected before it is booted.

If the ORIGINAL disk comes write-protected, be sure to write-protect the DUPLICATE disk after you make the back up copy, but before you boot it.

** ** **

We have also determined that the best single speed setting for backing up disks and for normal operation using the two disk drives is to set the ORIGINAL drive to 300rpm to read the disk, and then set the DUPLICATE drive to 297rpm for writing disks. More copy-protected disks can be backed up using this drive speed setup than any other single speed setting. Most people with two disk drives leave them this way at all times.

WHEN COPYING DISKS:

Drive speed running correctly is the single most important step toward making good reliable back up copies of disks. Even an unprotected disk won't back up with EDD if drive speed is too far off. If you are using two disk drives, the DUPLICATE disk drive is the most critical. Drive speed does not seem to be very critical when trying to "read" a copy-protected disk, but it IS very critical when "writing" one. This is why software publishers need to service and re-calibrate their disk drives so often.

We have just mentioned that drive speed running "correctly" is important. One problem that often arises is that a disk drive running at one speed may be perfect for backing up one disk, but that same drive running at the same speed may not be able to back up a different disk. The biggest reason for this, is that each software publishers has their own drive speed standards. One software publisher might write there disks at 300rpm, another publisher at 290rpm, and another at 301.2rpm etc...

When writing disks, the slower a disk spins, the more raw disk bytes each track will contain; and the faster a disk spins, the less raw disk bytes each track will contain. So drive speed, when writing disks, go hand in hand with the amount of raw disk bytes a disk can hold.

* * * * *

OPTION 4 - DISK SCAN

Using this option, EDD produces a high-resolution graphics scan of either the ORIGINAL or DUPLICATE disk. You can have EDD scan an entire disk, or just scan selected tracks of your choice.

The results of a scanned disk shows patterns of what kind of raw disk bytes that disk contains.

Some of the most obvious things you can usually determine about a disk are: Is the format similar to a standard DOS format. Which whole, half and quarter tracks are most likely to be valid.

Some of the less obvious things you can sometimes determine are: The tracks that are dedicatd to "nibble count" type of copy-protection. Which tracks are just partially recorded or use and need to be copied.

As you become experience with using this option, you will find that often you will be able to learn quite a bit about the format of the disk you are scanning.

To use the SCAN DISK option, when the OPTION MENU is displayed on the screen, press the [4] key, or move the cursor to OPTION 4 and press the [RETURN] key. EDD displays the SCAN DISK screen:

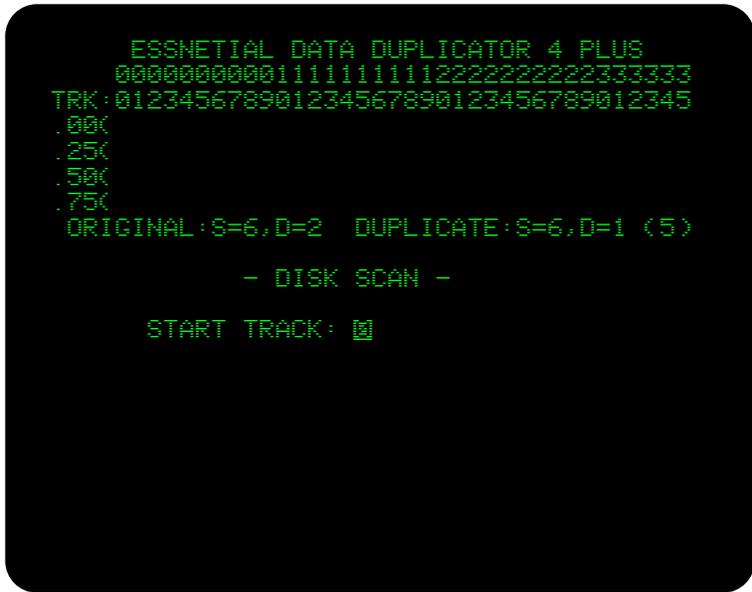


figure 4.1

EDD needs to confirm with you which tracks you want to scan. Since EDD assumes that you want to SCAN the entire disk, EDD begins by confirming that you want to START with track "0". Either press [RETURN] to accept track zero, or enter the number of the track which you want EDD to start scanning from, and then press [RETURN].

The next thing EDD needs to confirm, is the track number that you want to END on. Assuming that you want to end on track "34", EDD displays this track number. Either press [RETURN] to accept track thirty-four, or enter your own END track number and press [RETURN].

The third thing that EDD needs to confirm with you is the track STEP. When scanning disks, EDD assumes that you want to scan every half track, so this is what is displayed here. Either press [RETURN] to accept the step of "0.5", or enter a different step value and then press [RETURN].

The next to last thing EDD wants to know is if you want to synchronize the tracks with each other. EDD assumes that you don't want to synchronize tracks by displaying a "NO". Scanning a disk using synchronization often gives a clearer picture to the format of the disk, but the disk takes much longer to scan and the disk is required to have a normal sector 0, on track 0 (which most copy-protected disks have). If you don't want EDD to synchronize the tracks during the scan, just press [RETURN]. If you want synchronization press the [Y] key, for "yes".

The last thing EDD wants to confirm is which disk you want to scan. Press the [O] key or [RETURN] key if you want the EDD to scan the ORIGINAL disk, or press the [D] key to scan the DUPLICATE.

Depending on which disk you selected to scan, insert the disk into the proper disk drive and press the [RETURN] key to start the scan. EDD scans one track at a time until all selected tracks have been scanned.

DETAILS OF THE SCANNING PROCESS:

The hi-resolution graphics screen is used to display all the information from a scanned disk. Each track number is displayed on the bottom of the screen, and any information for a given track would be displayed vertically, directly above that track's number. If the

information is displayed between track numbers, then that would represent the "half" track. It is also possible to scan quarter and three quarter tracks if necessary.

For each track that EDD scans, EDD first determines which sections of the track contain normal raw disk bytes. Any section of the track which doesn't contain normal raw disk bytes is represented on the hi-resolution graphics screen as a "white" dot. Using this information, we can determine if that track is most likely an "actual" track that contains valid information, or is that track is either just bleed over from a different adjacent track, or just completely invalid. In other words, if the vertical line for any one track is mostly BLACK, then that track is most likely to be valid. If, on the other hand a track display is mostly WHITE, then the track is most likely invalid. Some disks contain tracks which have never been recorded and these tracks will usually appear as solid white lines.

The following examples, are of different test disks which we have scanned and decoded for you. All of the disks in these examples were scanned by using the following values: START TRACK=0, END TRACK=34, STEP=0.5, and SYNCHRONIZE TRACKS=YES.

Here is what a scan of a "typical" unprotected PRODOS or DOS 3.3 disk might look like if you scanned one yourself:

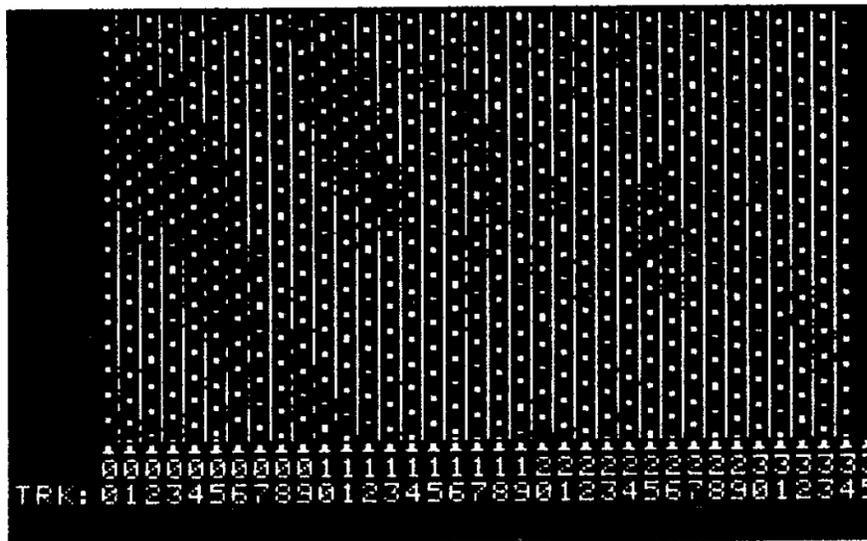


figure 4.2

Look at track zero in this example. Right above track "0" on the screen is a vertical "dotted" line of small white dots spaced fairly evenly apart. Each of these white dots would indicate the timing gap which resides between each sector of this track. The black area between these white dots would represent the normal raw disk bytes found in each sector. Notice that all the "whole" tracks on the disk look very similar; and that there are very few "stray" white dots on these whole tracks. The very fact that the whole tracks display definite patterns, indicates that these whole tracks probably are made up of very strong signals.

Now, look at the half tracks sections (in between the whole tracks) of the disk. The dot pattern for these half tracks seems to be very "random", which is a good indication of weak raw disk bytes.

When backing up disks, of course, usually you would want to copy the tracks which display the strongest signals.

Figure 4.3 is a scan of a copy-protected disk that contains some tracks that were never recorded:

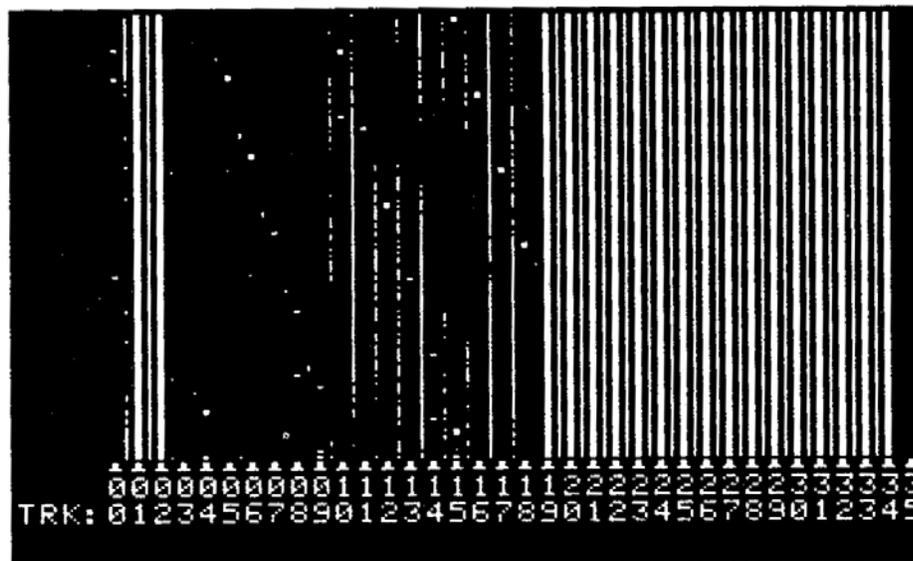


figure 4.3

Although tracks 1 and 2, and also tracks 19 through track 34, could contain valid information, they appear to be unrecorded. A close look at this disk reveals that track "0" is probably valid (track 0 normally is valid anyways) and there are valid tracks somewhere between

track 2.5 and track 18.5

Tracks 2.5 through track 9 are "hard-to-decode" because there is very little information here to go by.

The half tracks from 9.5 through 17.5 clearly show what appears to be invalid or weak tracks, which means that we should assume that the whole tracks from track 10 through 17 are valid. In turn this would most likely mean that the hard-to-decode tracks 3 through 9 and track 18 are probably valid tracks, also.

This disk probably could be backed up by either copying the whole disk (track "0" through "34"), or by copying just track "0" and then tracks "3" through "18".

Now, let's decode a little tougher disk1 figure 4.4:

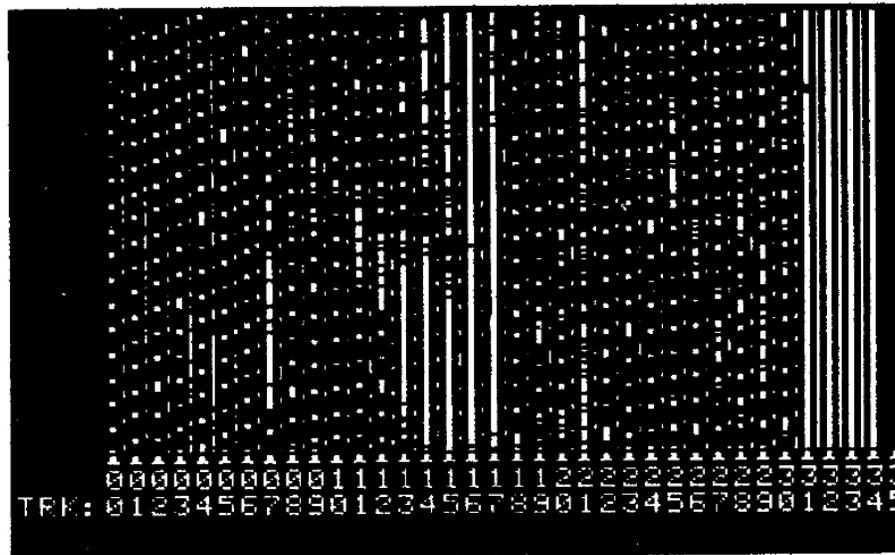


figure 4.4

First thing that comes to mind on this disk, is that tracks 31 through track 34 appear not to be recorded.

Let's take a close look at the rest of the disk. The half tracks from 0.5 through track 5.5 appear to be more invalid than their corresponding whole tracks, so we will first assume that track 0 through track 6 are valid, good tracks.

The next thing that we notice is that track 7 sticks out like a sore thumb, as does the whole tracks between track 13 through 17. A closer examination

reveals that generally all the whole tracks from track 7 through 30 are weaker than the adjacent half tracks, making it appear that the disk is using only half tracks from track 7.5 through track 30.5.

The tracks that need to be copied from this disk appear to be tracks 0 through 6, then tracks 7.5 through 30.5.

Figure 4.5 is just a little harder than figure 4.4 to decode:

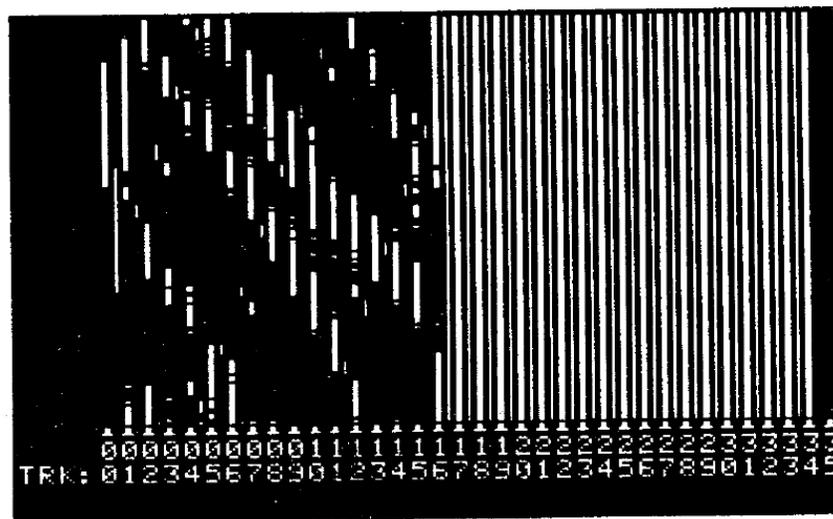


figure 4.5

On this disk. only the first half of the disk appears to be recorded.

Since track 0 is valid on almost all disks, we would have to assume that it is used here also.

Since the half tracks from track 1.5 through track 15.5 appear to be stronger than the adjacent whole tracks, we would have to assume that these half tracks are valid.

All of the tracks scanned, from near track 2 to about track 15, form a definite pattern with each other. The vertical white line for each of these tracks is slightly offset from the track next to it. This could be a good indication that this disk is going to require synchronization.

After analyzing this scanned disk, we would come to the conclusion that the tracks that need to be copied

are track 0, and then tracks 1.5 through 15.5 using synchronization mode.

Figure 4.6 shows another example of a scanned disk:

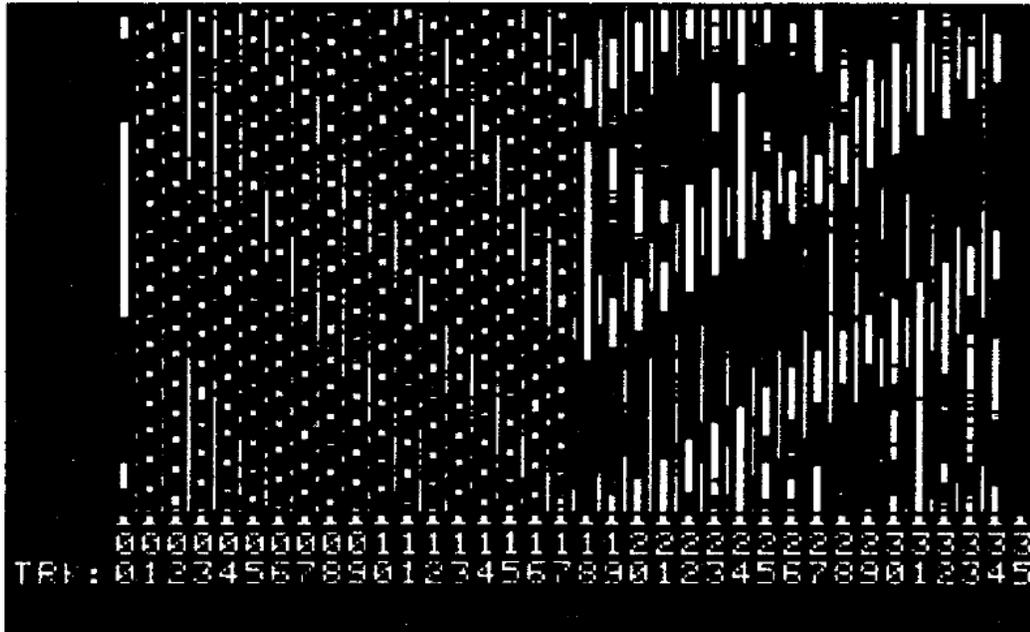


figure 4.6

Here, it appears that the whole tracks from track 0 through track 17 are valid; because these tracks are fairly clean, and many of the adjacent half tracks contain what appears to be some invalid raw disk bytes.

The higher tracks are much harder to decode. It looks like each whole and half track has some valid AND some invalid raw disk bytes on them, and each of these tracks appear to be in a pattern with the scanned adjacent track. This is often a good indication of "spiral" type of copy-protection. We might try copying these higher tracks by copying the quarter tracks from track 18.25 through 34.25 using synchronize mode. Or, perhaps copying the three-quarter tracks from track 17.75 through 33.75 using synchronize mode would work.

So, backing up this disk probably would require either copying tracks 0 through 17, then tracks 18.25 through 34.25 using synchronize mode, or copying track 17.75 through 33.75 using synchronize mode, then copying tracks 0 through 17.

Figure 4.7 is the last example that we will be describing for scanned disks:

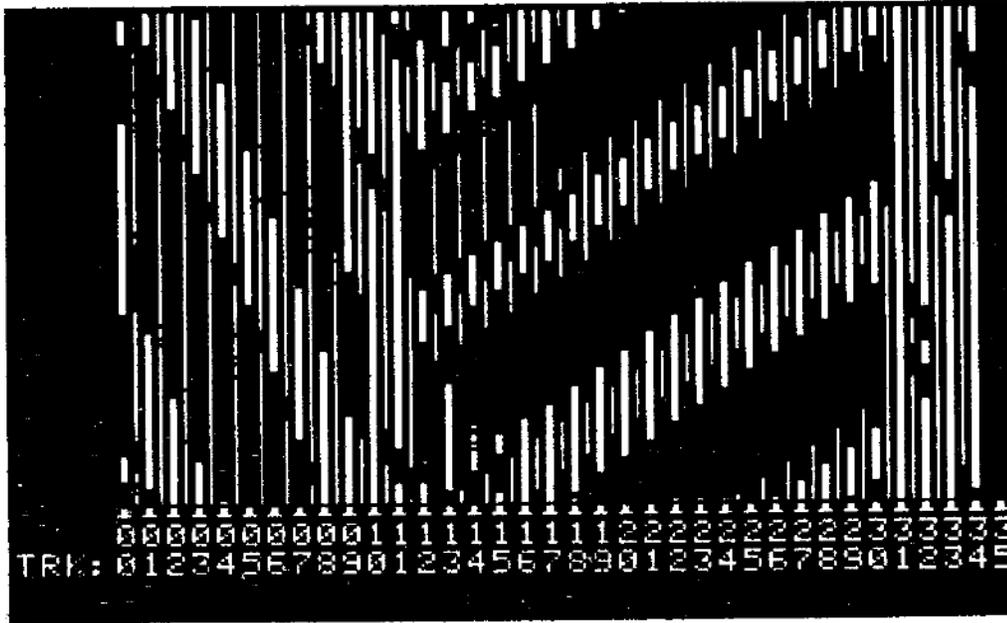


figure 4.7

Here, the whole tracks from track 9 through 11 look valid because many of the adjacent half tracks appear to contain invalid raw disk bytes. From here, it appears that a "spiral" type of copy-protection is being used on tracks 12.25 through 30.25 and on track 31.75 through 33.75. So, perhaps copying track 0 through 11, then tracks 12.25 through 30.25 using synchronize mode, then tracks 31.75 through 33.75 using synchronize mode, will back up this disk correctly.

Just a word about drive speed: if the disk drive you are using to scan a disk is running faster than the disk drive which originally wrote the disk, some of the white dots that should appear, might not. And, if your disk is running slower than the drive which originally wrote that disk, "stray" white dots may appear on valid sections of tracks. Although the speed of the drive can usually be a little bit off while scanning disks, if the results from a certain scanned disk are hard for you to decode, drive speed might be a problem.

** ** *

When you are backing up disks, the disk that you use for the DUPLICATE disk should be a high quality brand new disk. But, since sometimes it's not possible to use a brand new blank disk, we have created this option, CERTIFY AND ERASE DISK. Even though this option is available, you should always use a new disk for backing up valuable and important information. No need to take any chances!

Whenever you are going to be using a "used" disk for a DUPLICATE disk, you should always certify and erase the disk first. Certifying the disk means that EDD is verifying that each track is capable of being written to, and read back from, properly. Each track certified will also be erased by EDD which is very convenient. Using this option, you can either have EDD certify and erase the "whole" disk or only selected tracks of your choice.

From the OPTION MENU, pressing the [5] key, or moving the cursor to OPTION 5 and pressing [RETURN], will tell EDD to enter the CERTIFY AND ERASE DISK option. The screen displayed looks like:

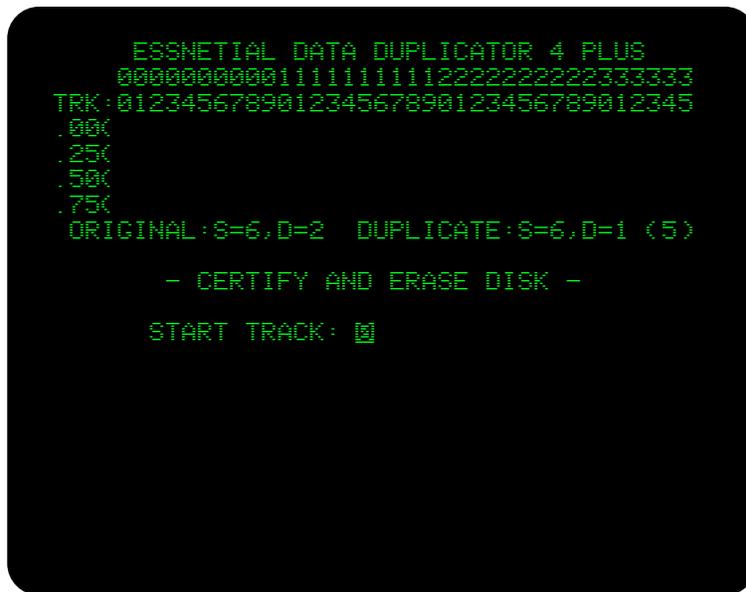


figure 5.1

EDD needs to confirm which tracks you want to certify and erase from the disk. Since EDD assumes that you want to certify and erase the "whole" disk, EDD begins by confirming the START track "0". Either press [RETURN] to accept track zero, or enter the number of

the track which you want EDD to start certifying from, and then press [RETURN].

The next thing EDD needs to confirm, is the END track, or last track to certify and erase. Assuming that you want to end on track "34", EDD displays this track number. Either press [RETURN] to accept track thirty-four, or enter your own end track number and press [RETURN].

The last thing EDD needs to confirm with you is the track STEP. For certifying and erasing disks, EDD assumes that you want to step "0.5" tracks for each certify and erase process. Like always, either press [RETURN] to accept this value, or enter a different step value and then press [RETURN].

Since EDD will only certify and erase a disk located in the DUPLICATE drive, EDD says, "INSERT A BLANK DISK INTO THE DUPLICATE DRIVE AND PRESS [RETURN]". DO this now.

EDD turns on the DUPLICATE disk drive and starts certifying and erasing the tracks that were selected. As EDD certifies and erases each track, an error code is displayed in the error/processing code display section of the screen. The two possible error codes are a "." (dot) or an "X". A dot error code means that the track certified GOOD, and an "X" means that the track certified BAD.

If all the tracks selected certified GOOD by displaying dots, the bottom of the screen will display the message: "SELECTED TRACKS CERTIFIED GOOD". But, if just one track certified BAD, displaying an "X", EDD displays: "BAD DISK; CERTIFY HAS FAILED".

If you find that most disks that you certify; certify as bad, the problem may not be with your disks and is most likely the DUPLICATE disk drive. If this is the case, you will need to take your disk drive to an authorized apple dealer for inspection.

If a disk is bad, DON'T USE IT! Cut it up and throw it away.

After a disk is certified and erased, pressing [RETURN] will return EDD back to the OPTION MENU.

** ** **

EDD continuously displays the current drive assignments just below the error/processing code display (see arrow in figure 6.1). When you first boot EDD on your computer system, EDD checks to see if a second disk drive is connected to the same controller card as the disk drive in which EDD was booted. If no second drive is found, EDD assigns disk drive #1 for both, the ORIGINAL drive and the DUPLICATE drive. If a second disk drive is connected; EDD assigns drive #2 as the ORIGINAL drive, and then assigns drive #1 as the DUPLICATE drive.

If you are using the EDD PLUS version, when first booted, EDD assumes that the PLUS CARD is located in the lower slot, next to the slot which the EDD disk was booted. If the PLUS card is not located there, you will need to tell EDD which slot it is located in. The slot assignments display on the PLUS version also displays the PLUS card's slot (see figure 6.1):

```

ESSNETIAL DATA DUPLICATOR 4 PLUS
000000000001111111112222222222333333
TRK:012345678901234567890123456789012345
.00K
.25K
.50K
.75K
ORIGINAL:S=6,D=2  DUPLICATE:S=6,D=1 (5)

- OPTION MENU -

████████████████████
2. CHANGE PARAMETERS
3. CHECK DRIVE SPEED
4. DISK SCAN
5. CERTIFY AND ERASE DISK
6. CHANGE SLOTS AND DRIVES
7. EXAMINE DISK DRIVE
8. CLEAR ERROR CODES
9. QUIT

PRESS <RETURN> TO SELECT #1

```

figure 6.1

Use this option if you would like to enter your own drive assignments or if you are using the PLUS version and need to tell EDD where the PLUS card is located.

Before you can tell EDD where the disk drives are located, you will need to know the slot and drive position of them yourself. If you don't know the positions of your disk drives, either refer to the

installation manuals that came with your computer, or contact the computer dealer you purchased the computer system from. Most apple computers with single disk drives have the disk drive located in slot #6, drive #1. Most apple computers with two disk drives have one disk drive in slot #6, drive #1, and the second drive is usually located in slot #6, drive #2.

If you have two disk drives (or apple's DUODISK), with this option you can tell EDD to back up a disk using one only drive (either drive #1 or drive #2), if needed, by selecting either drive #1 or drive #2 for both the ORIGINAL and DUPLICATE drive. This way you can always use one disk drive if a particular copy-protection back up method calls for it.

After you know the slot/drive position of the disk drives that you wish to use, from the OPTION MENU, press the [6] key, or move the cursor to OPTION 6, and press [RETURN]. EDD displays the following screen:

```
          ESSNETIAL DATA DUPLICATOR 4 PLUS
          000000000011111111112222222222333333
TRK:012345678901234567890123456789012345
.00<
.25<
.50<
.75<
ORIGINAL:S=6,D=2  DUPLICATE:S=6,D=1 (5)

- CHANGE SLOTS AND DRIVES -

ORIGINAL DISK SLOT= 6
(MASTER) DRIVE= 2

DUPLICATE DISK SLOT= 6
(BLANK) DRIVE= 1
EDD PLUS CARD SLOT= 5
```

figure 6.2

The first thing that EDD wants to know is the slot/drive position of the disk drive that will be containing the ORIGINAL disk. Enter the slot number here (between 1 and 7) by pressing the correct number key. After the slot number is entered, EDD moves the cursor down to the drive number. Enter this disk's drive number (either 1 or 2) by pressing again the correct number key. At this point, you have just told EDD which disk drive is to be used as the ORIGINAL drive.

EDD now wants to know the slot/drive position of the drive that will be containing the DUPLICATE, or "blank" disk, for backing up onto. You will be entering this drive's position just as you have entered the ORIGINAL drive's position. Enter the slot number (between 1 and 7), then enter the drive number (press either 1 or 2).

If you are using the standard EDD version (as opposed to the PLUS version), at this point EDD now returns the screen display back to the OPTION MENU.

EDD 4 PLUS users have one more slot assignment to make. If EDD doesn't already know which slot the PLUS card is located in, you will need to tell EDD by entering the slot number (between 1 and 7).

Now that EDD knows where everything is located inside the computer, EDD returns back to the OPTION MENU.

* * * * *

_____ OPTION 7 - EXAMINE DISK DRIVE _____

Although disk drives running correctly is important for normal operation, it is especially important when backing up copy-protected disks. This option, EDD OPTION 7, will examine six functions of a disk drive, displaying each result on the screen. Checking the results with the specifications, here in this chapter, you will be able to tell if that disk drive is running poorly, normal, or better than normal. The six things that EDD examines are: First, the ability to read and write a track. Second, average disk drive speed. Third, the amount of drive speed fluctuation. Fourth, the absolute highest track accessible by that disk drive. Fifth, the amount of track bleed over from quarter tracks. And sixth, the minimum amount of time wasting needed for head phasing.

Since the temperature of a disk drive can give false information about it's performance, before testing a disk drive, the disk drive should be allowed to warm up to it's normal operating temperature (which can be done by backing up a disk or two). Most drives when cold seem to fluctuate more, not run as smoothly, and generally give unreliable results compared to when they are warmed up.

From the OPTION MENU, move the cursor to OPTION 7 and press the [RETURN] key, or press the [7] key to use the EXAMINE DISK DRIVE option. EDD display's the following screen:

```
          ESSNETIAL DATA DUPLICATOR 4 PLUS
          000000000011111111112222222222333333
TRK:012345678901234567890123456789012345
.00K
.25K
.50K
.75K
ORIGINAL:S=6,D=2  DUPLICATE:S=6,D=1 (5)

- EXAMINE DISK DRIVE -

READ/WRITE TRACK ABILITY =
  AVERAGE DRIVE SPEED =
  DRIVE SPEED FLUCTUATION =
  HIGHEST TRACK BLEED OVER =
  QUARTER TRACK BLEED OVER =
  MINIMUM ARM PHASE TIME =

<0>ORIGINAL OR <1>DUPLICATE DRIVE?
PRESS <00000000> FOR 00000000 DRIVE
```

figure 7.1

EDD tells you, at this point, to press the [O] key if you want to examine the ORIGINAL disk drive, or press the [D] or [RETURN] key to examine the DUPLICATE drive. Select the disk drive which you want EDD to examine.

At this point, EDD tells you to insert a blank disk into the selected disk drive and press the [RETURN] key. Make sure that the BLANK disk you are using is a high quality, brand new disk (low quality or used disks will often give false test results). Insert a BLANK disk and press the [RETURN] key as requested.

EDD, at this time, starts to examine the disk drive. After each of the six tests are performed, EDD displays the results on the screen.

The next section of this chapter gives the details of what each test is, and what kind of results that can be expected.

When EDD is finished, EDD will display, on the bottom of the screen, the message "PROCESS IS DONE, PRESS [RETURN]". When you are finished looking at the test results, pressing the [RETURN] key will bring EDD back to the OPTION MENU.

EXAMINING A DISK DRIVE: UNDERSTANDING TEST RESULTS:

The following is a detailed description of each of the six tests which EDD performs:

TEST #1; READ/WRITE ABILITY: The ability to read and write a track. The purpose of a disk drive is to be able to store and retrieve information. Since an actual computer, in theory, is perfect, disk drives on the other hand are not. They have moving parts. These moving parts have tolerances which means, they become out of alignment, performance will fluctuate, and, moving parts get dirty and are often gummed up. And with all this, people who use them take for granted that they appear to work perfect. Well, they don't. All Disk Operating System programs (DOS for short) often need to read the information contained on the disk more than once before the information is retrieved correctly. This happens so fast, that everything appears to be working perfectly.

Read and write ability go hand in hand so far as

software is concerned. If the computer writes out a track to a disk, and then can't read it back reliably, there is a problem with either the write circuit, the read circuit, the floppy disk, or all three. If you are finding that your disk drives fail the read and write ability test, try using a different brand new, high quality floppy disk. This may solve the problem.

To test for read and write ability, EDD writes several specific test patterns to a disk, then reads them back. Depending which patterns fail most often, EDD is able to fairly accurately determine the read/write ability. We have determined that the reading and writing ability of a correctly running disk drive is 85%. If the read/write ability test falls below 85%, backing up copy-protected disks becomes very difficult to almost impossible.

If your disk drive fails this test, the following five test may not give accurate results, since they all rely on reading and writing to the disk.

If you determine that your disk drive ability is not standard, only an authorized apple dealer can do the adjustments (since this requires the use of special test equipment and special signal disks). It has been our experience that many dealers charge between \$20 and \$50 to make these adjustments, per disk drive.

TEST #2; AVERAGE DRIVE SPEED: A disk drive which speed is not running properly can not only make it harder to back up disks, but can damage disks under normal operation. Apple computers specifications say that a disk drive is to run at 300rpm. From our extensive testing, 300rpm seems to be a bit on the fast side. A slower drive seems to be a "happier" drive. For normal operation, we recommend an average drive speed should not exceed 300rpm, and the slowest speed around 296.5rpm. 298.5rpm is perhaps the best "all around" speed setting.

If you have two disk drives and you do a lot of disk backing up, the best speed to run the ORIGINAL disk drive is 300rpm, and the DUPLICATE drive at 297rpm.

If the disk drive speeds are not running properly, they can easily be reset by following the instructions in CHAPTER 3 and APPENDIX I. Authorized apple dealers can adjust drive speed, but from our experience they will ONLY adjust them to apple specifications of

300rpm. This is usually NOT what you want.

TEST #3; DRIVE SPEED FLUCTUATION: The results from this test, drive speed fluctuation, can tell us quite a bit about the state of the disk drive. A normal disk drive's speed will fluctuate no more than 0.5rpm (1/2 of a rpm) when running at its normal operating temperature, meaning a plus/minus 0.25rpm from average drive speed. This could be one reason why a disk drive with an average speed of 300 rpm can give trouble. And with time, this can get even worse.

With the many disk drives that we have tested, a drive speed fluctuation of 0.6 is the greatest fluctuation that we've seen. If your drive speeds fluctuation reaches anywhere near 1.0rpm we feel that your drive has real problems. It could be worn out. Contact your authorized apple dealer.

TEST #4; HIGHEST TRACK ACCESSIBLE: Although this test is not checking anything critical, EDD will display the highest track that your disk drive can access. Knowing how many tracks your disk drive has, can be helpful under certain circumstances. The highest track that apple computer says a disk drive can access is track 34. From our experience the highest track accessible on most disk drives is track 35. Some disk drives go up to track 36, and a few go up to track 40.

If you have a 40 track disk drive, your disk drive has the ability to store 12.5% more information on a disk than it is currently storing. Knowing your disk drive is capable of accessing more than 35 tracks really doesn't mean too much if you are a NOVICE, but if you are an ADVANCED user, you might be able to reprogram your favorite DOS so that these extra tracks can be used.

TEST #5; QUARTER TRACK BLEED-OVER: When a track full of information is wrote out to a disk using a correctly running standard apple disk drive, there is always at least a quarter track of bleed over in each direction (i.e., if information is wrote to track 5, bleed over will occur on track 4.75 and track 5.25, meaning that these tracks will contain the same raw disk bytes as track 5). One reason for this, is that the read/write head inside the disk drive writes a fairly wide band of information across the track.

This test checks to see if quarter track bleed-over is properly occurring on your disk drive.

Here is what happens during this test: EDD writes a special test pattern to track "0". EDD then moves to track "0.25" to verify that the information contained on this track is actual bleed-over. EDD then moves the drive head up to track "0.5" and writes a test pattern to this track. EDD then moves the drive head back to track "0.25" to again verify bleed-over. EDD now writes a test pattern to this quarter track. EDD moves the drive head up to track "0.5" to verify the bleed-over, and then moves the head all the way back to track "0" to, once again, verify the bleed-over. EDD gives a 25% credit for each of these four checks when they verify correctly. If your disk drive has the ability to "bleed-over" onto quarter tracks properly, EDD will display a total of 100%.

During our extensive testing, we have only come across two disk drives that failed this test.

If your disk drives achieve less than 100% on this test, you will not be able to back up many of the copy-protections currently distributed. As far as we know, there are no adjustments to fix this problem. Quarter track bleed-over often has nothing to do with the normal running of copy-protected disks, only backing them up.

TEST #6; MINIMUM HEAD PHASE TIME: The last thing that EDD examines on the disk drive is the minimum head phase time. Since the mechanics of a disk drive are very slow in comparison to the speed of the computer's electronics, the computer needs to waste a certain amount of time before moving the disk drive's "head" from track to track to keep in synchronization with the disk drive. If the computer wastes too much time, synchronization will take place properly, but disk access would be painfully slow to the user of the computer system. If the computer doesn't waste enough time, synchronization will not take place and the disk drive's head would be accessing the wrong tracks which would render it useless.

In this test, EDD attempts to find the "optimum" reliable speed at which the disk drive's head can move in synchronization with the computer, without needlessly wasting too much time.

Although EDD displays the results of this test in "loops", all you need to take into consideration is the numerical value (for you curious users, the term

"loops" refers to the number of loops that EDD's routines use).

Depending on the type and brand of disk drive you have, the results of this test will vary. We have notices that many of the newer disk drives manufactured these days are greatly improved and have the ability to move the drive's head quickly.

We suggest that you run this test now, record the results, and in a couple of months run this test again. IF the head phase time is the same, then not much has changed between the check; but, if the results from the head phase time are different, there is a good chance that it's time to get the drive serviced and cleaned thoroughly. As a drive's mechanism becomes dirty and gummy with age and wear, the head movement can't react to electrical signals as quickly as when it's running properly.

If the performance of the minimum head phase time changes, you should take your drive to your authorized apple dealer for a routine maintenance.

The following chart gives the valid ranges for each test:

	Values within the Acceptable range:	Remedy for out of range:
READ/WRITE ABILITY:	85% and up	dealer service
AVERAGE DRIVE SPEED:	296.5 - 300rpm	adjust drive speed
DRIVE SPEED FLUCTUATION:	0.0 - 0.5 rpm	dealer service
HIGHEST TRACK ACCESSIBLE:	34 and up	replace drive
QUARTER TRACK BLEED-OVER:	100%	replace drive
MINIMUM HEAD PHASE TIME:	same each time	dealer service

OTHER DISK DRIVE PROBLEMS:

A computer program by itself (such as EDD), can not examine everything that can go wrong with a disk drive. Some problems require special test equipment which only an authorized apple dealer would have. The following is a description of a few things that can go wrong with a disk drive that this option of EDD does not examine.

HEAD ALIGNMENT OUT OF ALIGNMENT: is when the drive head is not aligned properly with a disk. If the disk drive's head is told to go to track "10" and the head

physically goes to track "9.75" or "10.25", that drive's head is not aligned properly with the tracks. If a drive head is out of alignment and that disk drive writes a disk, the disk will have its tracks out of alignment, possible making the disk hard to read on properly aligned drives. Adjusting the head alignment requires special test equipment meaning that only an authorized apple dealer can do it.

WRITE-PROTECT SWITCH OUT OF ADJUSTMENT: is when either a disk that is write-protected can be written to, or when a non write-protected disk can't be wrote to. If you experience any of these problems, have your authorized apple dealer make the necessary adjustments.

CRASHED DISKS: is when a disk, for no reason, becomes damaged or erased. Every now and then, a freak accident may occur, but if a crashed disk happens often, then either you don't know how to properly use your computer system or your disk drive has problems. If a disk is write-protected and it crashes, your disk drive has "major" problems, and needs to be fixed by a competent authorized apple dealer.

* * * * *

After you make a back up copy of a disk, or use just about any of the other options, you will notice that the error/processing code display (upper section of the screen) will be filled with "left over" error/processing codes. These error/processing codes won't hurt anything and most of the time you want them there for reference; but, sometimes these left over dots and letters are just in the way.

This option, CLEAR ERROR CODES, cleans up the mess. From the OPTION MENU, pressing the [8] key, or moving the cursor to OPTION 8, then pressing [RETURN], will be all it takes to tell EDD to erase all the error codes that are currently displayed.

After EDD clears the error/processing codes, EDD automatically returns back to the OPTION MENU.

** ** **

When you are completely done using EDD, you can "quit" EDD from the OPTION MENU by pressing the [9] key or moving the cursor to OPTION 9, and pressing [RETURN].

EDD double checks that you actually want to "quit", and that you didn't enter this option by accident, by displaying the following screen:

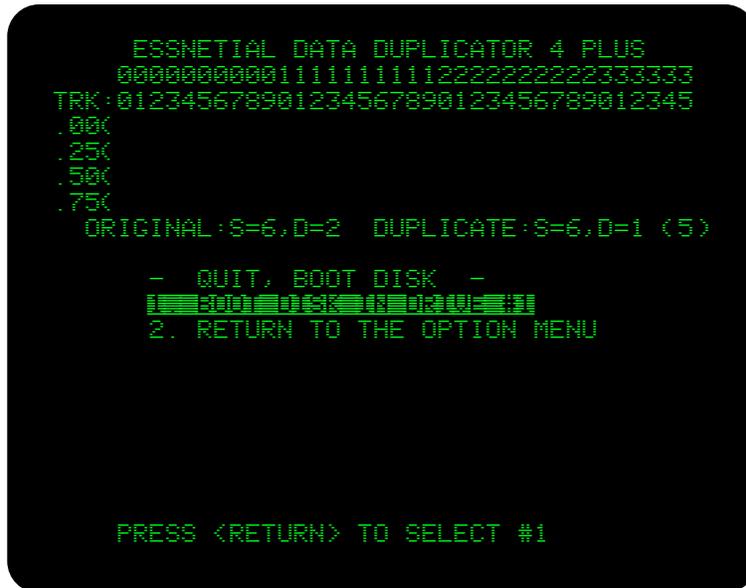


figure 9.1

Pressing the [1] key (or the [RETURN] key) will "quit" EDD, and immediately boot the disk that's currently residing in drive #1.

If you decide that you don't want to quit at this time, press the [2] key, which will return EDD to the OPTION MENU.

** ** *

___ APPENDIX A - USING PROGRAM INFORMATION LISTS. ___

In addition to this manual, each EDD comes packaged with the current PROGRAM INFORMATION LIST. This list comes separate from the manual, because we update and publish NEW lists every couple of months, which registered EDD owners can receive (refer to the CUSTOMER SERVICE chapter for information).

The purpose of this appendix, is to explain what a PROGRAM INFORMATION LIST is, and how to use it.

PURPOSE OF THE PROGRAM INFORMATION LIST:

An EDD PROGRAM INFORMATION LIST is a list of commercial copy-protected programs which EDD has been known to back up. This list contains program names, their publishers, and any known information for backing up disks. We compile this list from information gathered from EDD owners from around the world. So, if you are able to back up any copy-protected software package that is not on this list, or if you have a different way of backing one up, send the information to us so we can add them to the next list (be sure to include the software publisher's name). You might find it convenient to send us the information when ordering the next PROGRAM INFORMATION LIST.

Note: just because a program's name is on the list, doesn't mean you will definitely be able to copy your copy of this disk. Some software companies periodically change the copy protection on their programs, and it's always possible that your disk contains a different copy-protection. Perhaps, by the time the next list is published we will have more information for that particular copy-protected disk.

OVERVIEW OF THE PROGRAM INFORMATION LIST:

This list is divided into two sections: PROGRAMS LISTED BY NAME and COMPANY LISTING OF COPY-PROTECTIONS.

The PROGRAMS LISTED BY NAME section of the list is a listing of commercial copy-protected disks by program name, printed in alphabetical order. To the right of each name, EDD refers you to the software company (in abbreviation) that publishes that disk and the

copy-protection which that company has been known to have used (represented by a letter) for that disk. With this reference, you would then look up the software publisher in the COMPANY LISTING OF COPY-PROTECTIONS section, of the list, to actually find information for backing up that particular disk.

Many software companies will use the same copy-protection on all or more of their disks. If the name of the program you are trying to back up is not currently located in the PROGRAMS LISTED BY NAME section, try locating the company who publishes that disk, in the COMPANY LISTING OF COPY-PROTECTIONS section, of the list, and follow the instructions presented for that company. If one of the instructions work, be sure to let us know, so we can add that program name on the next list.

Here is an example of how to use this list to find out the instructions for backing up a disk. Suppose you would like to make a back up copy of the program named "Apple Writer II". First, look up "Apple Writer II" in the PROGRAMS LISTED BY NAME section of the list. It says, "Apple Writer II:APPLE#a". So, the information which we currently have for backing up this disk would reside in the COMPANY LISTING OF COPY-PROTECTIONS section of the list, under the company abbreviated heading "APPLE", copy-protection "#a".

Now, looking under the COMPANY LISTING OF COPY-PROTECTIONS section, notice that the company abbreviation "APPLE" stands for "APPLE COMPUTERS INC". Since you know that the copy-protection method used is copy-protection "#a", locate copy protection #a under this company heading. Here, you would find the instructions for backing up this disk:

a. normal

So, this means in order to back up "Apple Writer II", you would try using the "normal" method.

FOLLOWING COPY-PROTECTION METHODS:

While using the COMPANY LISTING OF COPY-PROTECTIONS section of the list, you will need to refer to the DEFINITION OF KEYWORDS AND SPECIAL DIRECTIONS section in this appendix for keyword and direction explanations.

The general rule of thumb when following these instructions is to always use EDD's default values, if the PROGRAM INFORMATION LIST doesn't tell you to change them. For example, lets say you want to back up a disk which, according to the COMPANY LISTING OF COPY-PROTECTION section, uses the copy-protection method:

a. normal

You will not need to change any of EDD's default values while backing up this disk using this method. Just boot up EDD and press the [RETURN] key at each prompt, insert the ORIGINAL and DUPLICATE disks into their proper drives, and after a couple of minutes, a back up copy should be made. As you can guess, the copy-protection method "normal" is the simplest of all methods to use.

Here's the next copy-protection method example:

a. t0-t15

To copy a disk using this copy-protection method, you have one range of tracks to copy. Each small letter "t" stands for "track", so "t0-t15" means to copy from "track 0" through "track 15". Make sure that the START TRACK has a value of "0", and that you enter a "15" for the END TRACK. You would need to press the [RETURN] key for the rest of the prompts, which EDD displays.

Here's another copy-protection method example:

a. write-protect before boot

To follow this instruction, after you make the back up copy of the program, you will need to write-protect the DUPLICATE disk BEFORE attempting to boot it.

Here's a more involved copy-protection method:

a. t0-t17
t17.5-t34.5 sync

In this copy-protection method, there are two ranges of tracks to copy. You will need to tell EDD to copy the first range by using a START TRACK value of "0" and an END TRACK of "17". Press [RETURN] for the rest of the prompts. After this range has been copied, you

will need to copy the second range of tracks by entering the value "17.5" into the START TRACK, then "34.5" into the END TRACK, and when EDD asks if you want to use the SYNCHRONIZE TRACKS mode, press the [Y] key for YES. Press the [RETURN] key for the rest of the prompts.

The next copy-protection method example, needs actual parameters changes:

a. parm 00=AA D4 DE 06=CC F9

Before backing up this disk, you will need to use the CHANGE PARAMETERS option (OPTION 2, SUB-OPTION 1), then enter: "00=AA", [SPACE], "D4", [SPACE] "DE", [RETURN], "06=CC", [SPACE], "F9", [RETURN]. Pressing the [ESC] key will bring you back to the OPTION MENU. Now, copy this disk by pressing the [RETURN] key for the rest of the prompts.

This last copy-protection method example is fairly involved, and it is important that that instructions are followed carefully:

a. duplicate speed: 294.3 rpm
very hard to copy
preanlz 00=B0
t0-t6 step2 sync autonc
parm 00=D4 02=A9
t7-t34
write-protect before boot

To copy this disk, it is suggested that the DUPLICATE's drive speed be running at approximately 294.3rpm (use OPTION 3 to check speeds) during the copying process. This disk is "very hard to copy", so you may need to recopy the whole disk over a couple of times (following the instructions) before the disk will back up correctly. The first thing that needs to be done, is to change the preanalyze instruction (OPTION 2, SUB-OPTION 2) by typing in "00=B0". After pressing [ESC] to get back to the OPTION MENU, start copying this disk by entering a "0" for the START TRACK, a "6" for the END TRACK, and then a "2" for the STEP track. When EDD asks if you want to use the SYNCHRONIZE TRACKS mode, press the [Y] key for YES, and then press the [A] key for AUTOMATIC when EDD asks if you want to use a NIBBLE COUNT mode. After EDD is done copying this range of tracks, you will then need to change a couple of parameters (OPTION 2, SUB-OPTION 1), type "00=D4", [RETURN], then "02=A9", Pressing [ESC] will

bring you back to the OPTION MENU. Now, copy this range of tracks by entering a "7" for the START TRACK, then "34" for the END TRACK. Press [RETURN] for the rest of the prompts. After this range of tracks has been copied, write-protect the DUPLICATE disk, and then the back up copy should be finished.

DEFINITIONS OF KEYWORDS AND SPECIAL DIRECTIONS:

One the PROGRAM INFORMATION LIST, if an asterisk "*" resides after the program name, this would indicate that we have back up this disk ourselves, using these instructions.

An instruction on the PROGRAM INFORMATION LIST is usually made up of several keywords and special directions. Below, we have listed and defined the procedure for using each of the keywords and special directions which the PROGRAM INFORMATION LIST currently uses:

KEYWORD: PROCEDURE TO FOLLOW

normal = Press [RETURN] for all prompts to accept the default values.

parm???? = Before copying the current range of tracks, use OPTION 2, SUB-OPTION 1 to change the following PARAMETER values.

preanlz???? = Before copying the current range of tracks, use OPTION 2, SUB-OPTION 2 to change the following PREANALYZE instructions.

prewrt???? = Before copying the current range of tracks, use OPTION 2, SUB-OPTION 3 to change the following PREWRITE instructions.

t?? = Single TRACK to copy. Enter value for both, START TRACK and END TRACK.

t??-t?? = Range of TRACKS to copy. Enter first value into START TRACK, then enter second value into END TRACK.

step?? = When EDD asks you for the STEP track, enter the track number which follows.

sync = When EDD asks if you want to use the SYNCHRONIZE TRACKS mode; press the [Y] key for "yes".

autonc = When EDD asks if you want to use a NIBBLE COUNT mode, press [A] for AUTOMATIC nibble count

manualnc = When EDD asks if you want to use a NIBBLE COUNT mode, press [M] for MANUAL nibble count

bit copy = If you have the PLUS version of EDD, when EDD asks you if you want to use the BIT COPY mode, press the [Y] key for "yes". If you don't currently have the PLUS version, you will not be able to copy this disk using this copy-protection method.

write-protect before boot = After making a back up copy, write-protect the DUPLICATE disk before attempting to boot it, otherwise the back up copy may erase itself and you will need to recopy the whole disk over

very hard to copy = This disk is very hard to back up. You may need to recopy this disk several times before the back up copy will work correctly.

drive speed critical = This usually indicates that you may need to experiment with different drive speeds, before the disk will back up properly. If you get any LENGTH errors, try slowing down the DUPLICATE drive speed.

no errors allowed = If any error code other than a dot "." appears in the error/processing code display, recopy those "error" tracks over. If a LENGTH error occurs, try slowing down the DUPLICATE drive speed.

recopy t?? until boots = If the back up copy doesn't boot properly, recopy the track specified, in accordance with any other instructions for that track.

original speed:??? = To back up this disk, the ORIGINAL disk drive speed should run approximately at this specified speed during the copying process.

duplicate speed:??? = To back up this disk, the DUPLICATE disk drive speed should run approximately at this specified speed during the copying process.

use one disk drive = This disk is very hard to copy. It is suggested that you use one disk drive to make this back up copy.

** ** **

When possible, always make back up copies from "original" disks as opposed to making copies from "backup" disks. Original disks contained within software packages are generally wrote using high quality precision equipment which actually makes backing up "original" disks easier.

You do not need to format or initialize the DUPLICATE or BLANK disk before backing up onto it. EDD will over-writes any information previously contained on the DUPLICATE disk, during the backing up process.

If you are using two disk drives, use OPTION 3, to check your drive speeds. After determining which drive runs faster, and which drive runs slower, always back up disks with the ORIGINAL disk in the faster drive, and the DUPLICATE disk in the slower. This is very important to help prevent "L" (length) errors.

If you are using two disk drives, EDD when first booted, automatically sets drive #2 as the ORIGINAL drive, and drive #1 as the DUPLICATE drive. Note that this is the opposite of most "other" copy-programs. Through our testing, we have found that since drive #1 is the drive that "boots" the disk, better back up copies could be made if drive #1 wrote the disk. It's little things like this that add up, enabling you to back up many disks. Of course you can always use OPTION 6 to change the drive selections.

Before you attempt to back up an ORIGINAL disk, the ORIGINAL disk must be write-protected. As an extra "built in" safety precaution, EDD will not even attempt to back up an ORIGINAL disk that isn't write-protected.

NOTE: When a write-protected disk is inserted into an apple disk drive, the WRITE circuit of the disk drive is completely disconnected and that disk drive can READ disks ONLY. If at anytime, a "write-protected" disk should EVER become damaged, erased, or modified in anyway, while residing inside of an apple disk drive, it's obvious that the DISK DRIVE isn't working properly, so DON'T USE IT. Take the drive to your authorized apple dealer for fixing.

As a rule of thumb, if an ORIGINAL disk comes from the factory write-protected, always put a write-protect

sticker on the DUPLICATE disk, after you make the back up copy. Some copy-protections require the write-protect sticker on the disk BEFORE the disk will run.

Before attempting to back up a disk, always check the current PROGRAM INFORMATION LIST, and follow any instructions that are listed. If the program isn't listed, try following instructions for backing up other copy-protections used by that same company. If nothing is listed, you can always try backing it up using only the normal EDD "default" values, meaning, just press the [RETURN] key for all prompts.

If you are using the PLUS version of EDD and you want to use the BIT COPY MODE, the PLUS card has to be attached to the ORIGINAL disk drive controller card. So if you have two or more drive controllers, and if the PLUS card is connected to the slot 6 drive controller, the ORIGINAL disk must be read from drive 1 or drive 2 of slot 6. Since the PLUS card only assists the "reading" of a disk, you can always write to a disk that's controlled by a different drive controller if needed.

After copying tracks using the "MANUAL" NIBBLE COUNT mode, you will probably need to re-adjust the drive speed of your DUPLICATE disk drive for normal operation.

When backing up APPLE III software, always use the SYNCHRONIZE TRACKS mode. Most apple III software is copy-protected by this method.

* * * * *

This appendix is presented to help you overcome any problems that you may encounter during your use of EDD. The major sections of this appendix are as follows; problems while booting EDD, problems while running EDD, problems with the PLUS card, and problems with back up copies made by using EDD.

PROBLEMS WHILE BOOTING EDD:

If you have followed the instructions in the LOADING EDD chapter, and EDD will not load into your computer system, hopefully this section will troubleshoot the problem.

REQUIREMENTS FOR BOOTING AN EDD DISK:

The standard EDD version requires a 48k minimum RAM apple II, II+ (or compatible), IIe, IIc or apple III (in emulation mode), with one or two 5 1/4 inch disk drives.

The EDD PLUS version requires a 48k minimum RAM apple II, II+ (or compatible), or IIe, with one or two 5 1/4 inch disk drives.

The EDD disk will only boot on computers that are setup to boot DOS 3.3 or PRODOS disks. EDD will not run on DOS 3.2 (older style) disk drives.

The EDD disk must be write-protected (the EDD disk comes from the factory permanently write-protected).

TYPICAL EVENTS DURING THE BOOT PROCESS:

When an EDD disk boots properly, within 5 seconds, several events will occur during the booting process:

1. The #1 disk drive will initially be ON.
2. The very first thing that EDD does, is clear the computer screen to the color "black".
3. EDD loads and displays a hi-resolution graphic logo.
4. After a couple of seconds, the #1 disk drive turns OFF.
5. If two disk drives are present, the #2 disk drive will briefly turn ON and then OFF again.
6. EDD's title page appears.
7. Pressing any key displays the OPTION MENU.

If any of these fail, the EDD disk will not load correctly.

PROBLEMS THAT OCCUR WHILE BOOTING:

Nothing happens: The computer system could not read the EDD disk (mainly track 0, sector 0). Possible defective EDD disk.

Continuous rebooting of EDD disk: The EDD disk could not be read properly by EDD's disk operating system. Possible defective EDD disk.

READ ERROR: The EDD disk could not be read properly by EDD's disk operating system. Possible defective EDD disk.

WRITE-PROTECT EDD DISK: The EDD disk will not boot if it's not write-protected. If this message is displayed and the EDD disk IS write-protected, take the disk drive to your local dealer for fixing (the problem is probably with the write-protect switch/sensor).

BEFORE SENDING A DEFECTIVE EDD DISK TO US:

Before sending a defective EDD disk back to us, you should make sure that EDD disk is actually defective. It has been our experience in the past, that sometimes we would receive a "defective" EDD disk for fixing, when in fact the EDD disk worked perfectly! A few idea's are presented here to help troubleshoot and pinpoint the problem and to make sure that the problem is with the EDD disk.

If possible, try running the EDD disk on a different computer system (perhaps a friends, or your local dealer). If the EDD disk runs on one computer system, but not on another, the problem is probably NOT with the EDD disk. Perhaps something is out of alignment inside of the #1 disk drive (drive speed is usually no the problem). If possible, try physically "swapping" drive #2 with drive #1. Also, there are some "100% apple compatible" disk drives available, that are NOT quite 100% apple compatible.

Although we haven't came across any peripheral cards which effect the performance or booting of EDD, it's always possible there are some out there. You might try unplugging all unnecessary peripheral cards for

testing purposes.

If you have determined that the problem is definitely with the EDD disk, refer to the CUSTOMER SERVICE chapter for instructions on defective EDD disks. Whenever contacting our company about problems, always try to explain what you have tried to do, how you've gone about doing it, and the results that you've received. This can help us to pinpoint an "exact" problem.

PROBLEMS WHILE RUNNING EDD:

If, when EDD is processing disks, the wrong disk drives are used; you will need to tell EDD which disk drives to use (see the OPTION 6 chapter).

If EDD displays the message "WRITE-PROTECT ORIGINAL DISK" at the bottom of the screen, while processing an ORIGINAL disk, put a write-protect sticker on the ORIGINAL disk covering up the write-protect notch and make sure that you have inserted the correct disks into the correct disk drives. If the error message still remains, your disk drive is not working properly and needs to be fixed by an authorized apple dealer.

If EDD displays the message "REMOVE WRITE-PROTECT FROM DUPLICATE" at the bottom of the screen, while processing a "blank" DUPLICATE disk, take the write-protect sticker off the DUPLICATE disk, and make sure that the correct disks are inserted into their correct drives.

If while processing a disk, you are using the SYNCHRONIZE mode and an "S" processing code remains in the error code display and EDD stops processing, a SYNCHRONIZE error has occurred. This means that either track "0" hasn't been copied onto the DUPLICATE disk, or there isn't any sector "0" on track "0" on this disk. Probably this disk will not be able to be synchronized using normal methods (and parameters will need to be changed).

If you are using the PLUS version, make sure that EDD knows which slot the PLUS card is located. Strange results can happen if EDD looks for the PLUS card in the wrong slot! Use OPTION 6 if you need to tell EDD the slot location.

If you have entered a PREANALYZE or a PREWRITE

instruction routine using OPTION 2, and EDD "crashes" or "hangs", you probably have entered an invalid routine. In this case, you will need to press the [RESET] key.

EDD PLUS CARD PROBLEMS:

If you feel that the EDD PLUS card is not working properly, there are a few things that can be checked and troubleshot:

To test the PLUS card, you should try backing up an "unprotected" DOS 3.3 or PRODOS System Master disk using the BIT COPY MODE. If each track of the disk received a dot, for an error code and the back up copy doesn't work, then there is probably a problem.

Make sure that the EDD PLUS card is installed and connected properly, and that each connection is firmly pressed together (see APPENDIX H).

Make sure that EDD knows which slot the PLUS card is located (see OPTION 6).

Make sure that the ORIGINAL disk you are backing up is being copied from a disk drive which is connected to the same drive controller as the EDD PLUS card is connected (see OPTION 6).

The EDD PLUS card may not be making good, physical contact with the computer's slot. You might try unplugging the PLUS card and then lightly rubbing a "soft" pencil eraser over the PLUS card's gold plated contacts removing any dirt or foreign matter. NEVER touch any contacts with you fingers.

If you are using non-apple equipment (i.e., computer, disk drives, peripheral cards, etc.), there's always a chance that EDD's PLUS card may not be compatible.

Generally, it's best if your disk drive cables are as short as possible. Using EDD's PLUS card and cable adds approximately 12 inches of cable length to your drive circuit. If your disk drive cables are already longer than standard, this additional length could present a problem by allowing "stray" signals into the drive circuit. Make sure that all PLUS card and disk drive cables are not kinked, and positioned as far away from electrical circuits as possible.

WHEN A BACK UP COPY MADE WITH EDD DOESN'T WORK:

Always check the current PROGRAM INFORMATION LIST and follow any instructions that are listed for that program. If the program isn't listed, try following instructions for backing up other copy-protections used by the same company. This can save you lot's of time.

You might try backing up the disk using the SYNCHRONIZE TRACKS mode and/or NIBBLE COUNT mode. And, if you have the PLUS version, try using the BIT COPY MODE.

If EDD displays "L" (length) errors while backing up a disk, try slowing down the speed of the DUPLICATE disk drive and recopy the disk over. The DUPLICATE drive speed running too fast happens to be the one single reason why disks won't back up correctly.

If you are an ADVANCED user and you know exactly what type of copy-protection the disk uses, you might try using OPTION 2, CHANGE PARAMETERS, to "custom" or reprogram EDD for that particular disk.

If you have tried all the obvious methods for backing a particular disk and nothing seems to work, hopefully, by the time the next PROGRAM INFORMATION LIST is available, we will have information for that particular disk. Remember, it is your responsibility to keep up to date, by periodically ordering current PROGRAM INFORMATION LISTS (see CUSTOMER SERVICE section of manual).

* * * * *

It wasn't very long after software publishers first realized how much money could be made by publishing apple computer programs, that they all started figuring out ways of "protecting their investments". In addition to legally copyrighting programs, many software publishers have also put "electronic locks" on their disks to keep them from being copied. These electronic locks are better known as "copy-protections". Here, in this section, we will discuss copy-protection techniques that have been used in the past, and ones that are being used today. We have tried to put them in the order in which they appeared on the market.

IMBEDDED CONTROL CHARACTERS: - Probably the first type of copy-protection used was simply hiding "invisible" control characters in the names of the programs contained in a normal DOS disk. You could make back up copies of the files or the whole disk with most any copy program; but you could'nt list or modify the program. This method of copy-protection was not really a copy-protection at all; but it was a basic stepping stone for making the transition into the copy-protection world.

ADDRESS/DATA FIELD CHANGE: - The first "real" copy-protection that was ever used on apple computers was the change of address or data fields. Standard DOS searches for the raw disk byte pattern "D5 AA 96" when looking for an address field of sectors. If a copy-protected disk uses a different address pattern, such as "D4 AA 96" for each sector, a standard copy program could not locate any sectors on the disk. If the sectors can't be read, they can't be copied. This copy-protection was a big hit at first. Remember, at this time, there were only standard DOS copy-programs available.

TIMING GAP BYTE VALUES: - Between each sector of a standard format disk, resides a "timing gap". On unprotected disks this gap is made up of raw disk bytes with values of "FF"s. A few years back, some bright soul came up with the idea of writing copy-protected disks with a different gap value, say "FE"s. If someone used a copy program to copy each sector from the copy-protected disk to a different disk, the timing gaps on the back up copy would contain normal "FF"s, instead of the "FE"s that were

on the "original" disk. When running the back up copy of the disk, the program would check the gaps, and would instantly know that the disk was not an "original".

WRITE-PROTECTION: - although this is not much of a copy- protection by itself, it has been effective. Often, when you purchase a computer program, the disk will be permanently write-protected (no notch showing). If you make a backup up copy of this disk and you leave the disk "unwrite-protected" (notch is showing), when attempting to run the disk, the back up copy may erase itself. To get around this type of checking, just be sure that if the ORIGINAL disk comes write-protected, to write-protect the DUPLICATE disk after you make the back up copy, but, before you run it.

USING TRACK 35: - Unprotected disks use tracks 0 through track 34. This means a total of 35 tracks. It wasn't long after copy-protections showed up that someone figured out that most disk drives could access track number 35, one more track than normal, making a total of 36 tracks instead of the normal 35. If you backed up this disk with a copy program, all tracks except track 35 would copy over to the DUPLICATE disk. Immediately, one problem with this type of copy-protection showed up. Some disk drives couldn't access this extra track, meaning that even the "original" disk purchased didn't work for everyone.

HALF TRACKS: - Half tracks type of copy-protection and the next two, nibble count and synchronize tracks copy-protection, all showed up about the same time. An unprotected disk uses the tracks zero through track thirty-four (0, 1, 2, 3 ... 34). Half tracks type of copy-protection was invented when someone came up with the technique of "hiding" information between normal whole tracks; such as hiding a track full of information between tracks 1 and 2. The track number for this new track would be call 1.5. Using this type of copy-protection, people realized that you could use a combination of both whole and half tracks wherever you wanted, such as, "0, 1.5, 2.5, 4, 5, 6.5, 7.5, 8, ..., 34". The only requirements of this type of copy-protection, is that each track written must be at least one whole track from the previously written track. These tracks, "0, 0.5, 1, 1.5, 2", are only half a track apart, and thus would not work out. Trying to back up a disk that uses half tracks with a standard copy program would fail

completely: the information just couldn't be read.

NIBBLE COUNT: - Each track of a disk contains a certain amount of raw disk bytes. When a track is copied from one disk to another, usually the DUPLICATE disk's track lengths will not be the same length as the ORIGINAL disk. This has to do with the differences in drive speeds between the DUPLICATE disk you are using, and the speed of the drive which originally wrote the disk. Even if you originally wrote a disk using one disk drive, then made a back up copy of the disk using the same disk drive, there would be just enough drive speed fluctuation to prevent the track lengths from being the same. The way this copy-protection works, is that after the ORIGINAL disk is wrote, the length of a certain track is stored elsewhere on the disk. When the disk starts to boot up, the stored length is compared with the actual track length. If these two values are different, the disk knows that it's not an "original". Some contain disks nibble counts on more than one track.

SYNCHRONIZE TRACKS: - Each track of a disk is a circular ring of raw disk bytes, and is completely independent from each of the other tracks. Being independent was true, until someone came up with this type of copy-protection. For example, let's say that the disk drive has just finished reading track 3 sector 0 and then, immediately, moves onto track 4. Now, let's say that the first sector read from track 4 was sector 8. This sector, sector 8, will be the first sector to be read each time this procedure is done. Now, if you were to back up this disk without taking synchronization into account, a different sector will probably come up first (since there are 16 sectors, you have only a 1 in 16 chance of properly aligning these two tracks correctly on the first try), and the program will know that the disk is not an "original". If every track of a disk was synchronized, it would be virtually impossible to back up this disk by luck.

QUARTER TRACKS: - Although many people said it was impossible, software publishers have figured out how to do it. Quarter tracks work basically on the same technique as half track type of copy-protection (see above). Instead of writing on half tracks, quarter and three-quarter tracks are used.

SPIRAL TRACKS: - This type of copy-protection is

actually a combination of both, half tracks and synchronize tracks, type of copy-protections. The way that this copy-protection works is after a couple of sectors are written to one track, the drive then immediately moves to the next half track and writes a couple of more sectors, then immediately moves again, to the next half track and writes a couple of more sectors. This process is repeated until the disk is finished. As we all know, each track of an unprotected disk is just a circular ring of raw disk bytes; but a spiral track copy-protected disk looks more like a phonograph record. The track just keeps "spiraling" towards the center of the disk. We have even seen some spiral type of copy-protections first jump to the center of the disk, then spiral their way to the outside.

LONG TRACKS: - When writing a disk, the slower a disk spins, the more information each track of a disk can contain. So, some software publishers have set their disk drive speeds slower than normal. This way, that disk CAN'T be backed up unless the disk drive that's writing the back up is running as slow, or slower than the drive which originally wrote the disk. Since software publishers know that 90% of the people will not go through the "trouble" to re-adjust their drive speeds, the publishers know that at least 90% of all the disks they sale will not be copied. This type of copy-protection is easy to back up with EDD, provided that you make the necessary drive speed adjustments.

BIT SLIP / BIT INSERTION: - This is one of the most advanced type of copy-protections found today. Fortunately, the PLUS version of EDD has the BIT COPY MODE which backs up this type of copy-protection automatically. Even though the standard EDD version doesn't do it "automatically", the standard version has provisions for backing up many disks of this type. As everybody should know, by using standard computer hardware, a disk drive can read the raw disk bytes from a disk, but it can't read the hidden timing bits found between the raw disk bytes. A timing bit can usually be "detected" by software, but if there are two or more timing bits in a row, they can't be counted with any accuracy, unless you know exactly where these patterns are supposed to be located on the disk. Of course the copy-protected program knows where all these timing bits are supposed to be. When you run the disk, the copy-protection checks for these timing bits, and if they are not what is expected, the program knows the disk is not an "original". The EDD

PLUS version uses a special hardware card that plugs into one of the slots of your computer, which enables EDD to read all the bits off the ORIGINAL disk.

Several copy-protected disks of today, contain more than one of the above techniques and can be very difficult to back up.

* * * * *

Since the whole purpose of copy-protection is to keep people from copying the disk, EDD had to be carefully programmed so that not only the maximum amount of copy-protections could be backed up, but could be backed up easily. For the curious user, this chapter is presented to explain what happens during the backing up process of EDD. We have directed this chapter to the NOVICE user.

At least two things are obvious about copy-protected disks from a copying standpoint: Two disks which may appear to be copy-protected the same way, may be (and probably are) copy-protected completely different. Secondly, two disks which may appear to be copy-protected completely different may be copy-protected the same way. So, with this in mind, along with the thousands of copy-protections in use today that appear to be different and thousands more which will probably show up soon, how is a copy program going to determine which type of copy-protection is used on each copy-protected disk? The simple answer is it can't.

Now that EDD is available, there are two types of copy-programs on the market. Before EDD, most copy programs were only able to back up specific copy-protections. The back up copies made, almost never resembled the "original" disk and if the back up copies worked, they usually just barely worked. EDD, on the other hand, attempts to transfer all of the information from one disk to the next, without modifying or changing it. Perhaps, the EDD method sounds like the simplest; but its reality programming our method was much more involved. As you may have already seen, we have been very successful.

The following is a general description of how this version of EDD has been factory set to back up a disk.

EDD reads the raw disk bytes and timing bits, which are contained on a track, from the ORIGINAL disk into the computer's memory (called the track buffer), until the memory is full. This usually gives us two and sometimes three whole track samples, in the memory, to work with. The raw disk bytes are read directly from the disk drive; but since the standard "drive controller" can not directly read the "hidden" timing bits, these must be found by first reading a raw disk

byte, then timing out how long it takes for the next raw disk byte to be ready. Because of the fast rate at which these raw disk bytes are pouring in, no attempt by EDD 4 is made to determine how many timing bits are hidden between raw disk bytes. Except for very advanced copy-protections, the amount of timing bits hidden between raw disk bytes often has little to do with the successful backing up of most disks.

In addition to the reading capabilities of EDD4, the EDD 4 PLUS version has an extra mode (the BIT COPY MODE) that uses a specially designed hardware card, which plugs directly into one of the internal slots of the computer. In addition to reading raw disk bytes, EDD 4 PLUS is capable of reading ALL of the hidden timing bytes directly, for making very accurate back up copies of disks.

After the raw disk bytes have been read from the ORIGINAL disk, they are analyzed by EDD. There are three things that EDD attempts to determine about the information it has just read: The LENGTH of the track, the END of the track, and the track START. Although knowing all three of these things are important, finding the track's END is usually more important than the other two.

When EDD is finished analyzing the raw disk bytes, the track is then moved to a place in high memory which gives us some lower memory to use as work space.

EDD now writes the raw disk bytes from high memory onto the DUPLICATE disk. The actual writing of this information is very quick. Immediately after the track is written, it is read back into low memory for verification, which mainly consists of finding the length of the DUPLICATE track and comparing it against the length of the ORIGINAL track.

After the verification is completed, EDD continues to copies in this manner, until each track has been copied from the ORIGINAL disk, onto the DUPLICATE disk.

* * * * *

This informative "specialty" chapter is aimed at ADVANCED users. Here, in this appendix, we will be talking about floppy disks, disk drives, the drive controller; and how these three peices of hardware, with your computer system, work together to store and retrieve information. This appendix is filled with information, so sit back, and don't try reading through it too fast.

DISK DRIVE CONNECTIONS;

A floppy disk is inserted into a disk drive. A disk drive is connected via cable to a drive controller; and the drive controller connects directly to the computer system.

FLOPPY DISKETTES:

Floppy diskettes, better known by most computer users as "disks", are thin, square shaped, flexible "external" storage mediums for computer systems, which are very transportable. A floppy disk is made up of five layers of material.

The first (top) and fifth (bottom) layers are made up of a thin, but rugged plastic vinyl which is called the "jacket". This jacket serves two purposes. First, it acts as a "back bone" for giving the floppy disk strength, and the second purpose, is to acta as a "shield" to protect the internal parts from fingers, dirt, scratches, etc.

The second and fourt layers of the floppy disk are called the "lining" which is made up of a soft cotton type of material and is physically attached to the inside surfaces of the jacket. The purpose of this lining, is to clean and help keep scratches off the disk's middle layer.

This third (middle) layer of the floppy disk is the actual magnetic media surface, which stores information as magnetic pulses, and which is allowed to rotate freely. This layer is made up of a thin, flat, circular plastic "disc" completely covered with magnetic particles, (the same type of particles that "cassette tapes" use).

Any information contained on a floppy disk is stored on tracks as magnetic ON and OFF pulses.

Standard apple computer systems use a standard 5 1/4 inch floppy disk, which is the same size and type of floppy disk that the EDD program is written on.

Since most people refer to floppy disks as "disks", the term "disk" will be used from now on, in this manual.

DISK DRIVES:

The purpose of a disk drive is to store information on a floppy disk, which at a later time can be retrieved. This information can either be in the form of a computer program, or just plain information. This ability gives the computer system an enormous amount of storage and program capacity, as you can always take out one disk, and insert a different one. A disk drive serves no purpose unless a disk has been inserted into it.

A disk drive has two main jobs to do. The first job is to take all the "0" and "1" bits from the computer and convert them into magnetic OFF and ON pulses, which are then written to the magnetic surface of a disk. The second job is just the opposite, to be able to read the magnetic OFF and ON pulses from the disk and convert them back into "0" and "1" bits.

A "raw bit stream" is the term we use to describe the flow of information when writing bits of information from the drive controller to the disk drive. Or, while reading the disk, the bits of information are flowing to the drive controller from the disk drive. Here is an example of what a typical raw bit stream might look like coming to, or going from the disk drive:

```
111111110111111110111111101101010110101010010110
```

THE DRIVE CONTROLLER:

The drive controller, like the disk drive, also has two jobs. The first job is, when writing disks, to take raw disk bytes from the computer and break them down into eight separate bits, which are then fed into the raw bit stream in route to the disk drive. This

is a fairly simple and straight forward process. The second job of the drive controller is a bit more complicated. When reading the disk, the drive controller collects eight bits at a time from the raw bit stream, then converts thme back into their original raw disk byte value. Let's go into detail of what happened during this reading process:

When the drive controller is told to read the raw bit stream from the drive, chances are that the drive controller will not be properly aligned (out of synchronization) with the raw bit stream. This means that the drive controller will not be properly converting the raw bit stream back into the same raw disk bytes, that were originally wrote to the disk. For example, let's say that the raw disk bytes "FC FC FC FC" are being wrote to the disk. Here is what the raw bit stream would look like going to the disk drive:

```
11111100111111001111110011111100
```

But, when the track is read back, there is no way of telling which bit in the raw bit stream was the "start" of a raw disk byte; and chances are that the drive controller will start converting raw disk bytes out of alignment. Here is what the raw bit stream might look like when trying to read it:

```
11111111100111111001111110011111100
```

A few "extra" one bits that were already on the track, before the "FC's" were wrote, were read first. The drive controller would convert this raw bit stream into the raw disk bytes "FF 9F 9F 9F". These raw disk bytes should have been "FC FC FC FC". So, what we need is a way of "aligning" the raw bit stream so that the raw disk bytes can be converted correctly.

This is where timing bytes and timing gaps come into play. When reading the disk, after the drive controller is finished creating a raw disk byte from the 8 bits taken from the raw bit stream, the drive controller starts over again looking for another raw disk byte. Any "0" bits that happen to flow down the raw bit stream immediately after the 8 bits, which made up a raw disk byte, are completely ignored by the disk controller; since all raw disk bytes must start with a "1" bit. These "0" bits, which are ignored, are called "timing bits". As we will soon see, the main purpose of a timing bit is to align the drive

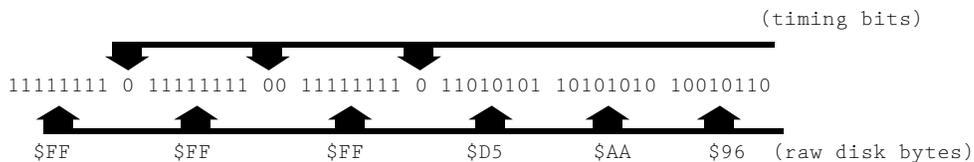
controller with the raw bit stream, so that the problem with converting the raw bit stream to raw disk bytes, as was the case with the previous example, doesn't happen.

RAW DISK BYTES, TIMING BITS, TIMING BYTES, AND TIMING GAPS:

A normal raw disk byte consists of eight bits. The first bit, the left-most bit, must always be a "1". Timing bits are any extra "0" bits which immediately follow a raw disk byte. As discussed in the previous section, these extra "0" bits are ignored (skipped over) by the drive controller. A "timing byte" is the term for a raw disk byte with at least one timing bit attached, which means a timing byte contains nine or more bits (eight raw disk byte bits, and at least one timing bit). Here is an example of four timing bits which make up three timing bytes (we have added "spaces" to separate raw disk bytes for your convenience):

RAW BIT STREAM (from drive, to drive controller):

11111111011111111001111111011010101010100101110



The four zero bits that are pointed out from the top of the raw bit stream are timing bits which the drive controller ignores. The eight bit patterns pointed out from under the raw bit stream are the actual bits of information that make up the raw disk bytes. So, this example of the raw bit stream would yield us the raw disk bytes "FF FF FF D5 AA 96". Each of the first three raw disk bytes (FF's) are considered to be timing bytes, in this example. The first and third timing byte here, each has one timing bit attached, making the total length of these timing bytes nine bits long. The second timing bit has two timing bits, making it ten bits long.

When several (usually at least 4) timing bytes are written out to the track consecutively, we call the group of timing bytes a "timing gap". Timing gaps are very important, because they allow the drive controller to line up with the raw bit stream

correctly, so that the raw disk bytes following the gap can be converted to their proper values.

The following examples help show how the drive controller uses a timing gap to align the following raw disk bytes, during the reading of a disk. Although the same raw bit stream is used in each example, it has been "off set" by one bit:

```

RAW BIT STREAM (from drive, to drive controller):
11111111001111111100111111110011111111001111111100110101011010101010010110

TIMING GAP:          |          RAW DISK BYTES:
11111111 00 11111111 00 11111111 00 11111111 00 | 11010101 10101010 10010110
   FF           FF           FF           FF   |   D5      AA      96

TIMING GAP:          |          RAW DISK BYTES:
11111110 0 11111111 00 11111111 00 11111111 00 | 11010101 10101010 10010110
   FE           FF           FF           FF   |   D5      AA      96

TIMING GAP:          |          RAW DISK BYTES:
11111100 11111111 00 11111111 00 11111111 00 | 11010101 10101010 10010110
   FC           FF           FF           FF   |   D5      AA      96

TIMING GAP:          |          RAW DISK BYTES:
11111001 11111110 0 11111111 00 11111111 00 | 11010101 10101010 10010110
   F9           FE           FF           FF   |   D5      AA      96

TIMING GAP:          |          RAW DISK BYTES:
11110011 11111100 11111111 00 11111111 00 | 11010101 10101010 10010110
   F3           FC           FF           FF   |   D5      AA      96

TIMING GAP:          |          RAW DISK BYTES:
11100111 11111001 11111110 0 11111111 00 | 11010101 10101010 10010110
   E7           F9           FE           FF   |   D5      AA      96

TIMING GAP:          |          RAW DISK BYTES:
11001111 11110011 11111100 11111111 00 | 11010101 10101010 10010110
   CF           F3           FC           FF   |   D5      AA      96

TIMING GAP:          |          RAW DISK BYTES:
10011111 11100111 11111001 11111110 0 | 11010101 10101010 10010110
   9F           E7           F9           FE   |   D5      AA      96

```

To help you understand what's going on, we have put "spaces" between the bits that would constitute raw disk bytes (which also separate the timing bits). Underneath the raw bit stream, we have put the raw disk byte values which the drive controller would convert the bits to.

As you can see from this example, it doesn't matter how the drive controller is aligned prior to reading a timing gap, because by the time the timing gap passes through, the rest of the raw bit stream is guaranteed to be aligned properly and to be "valid" information.

ADDITIONAL INFORMATION:

When writing a track to the disk, as the disk is spinning, one bit is written every 4 microseconds, meaning that a whole raw disk byte, which is 8 bits long, will take 32 microseconds to be written. If the disk is spinning slower than normal, these bits will be written very close to each other, meaning the entire track will contain more information than that of a normal spinning disk. This works the opposite way too. If the disk being written is running faster than normal, the bits would be spread apart over the surface of the disk, resulting with the whole track containing fewer than the normal amount of raw disk bytes. As you can see, drive speed is not only critical for backing up disks, but also for normal operation.

A disk drive is a piece of hardware which is useless without software to run it. The software that "interfaces" the disk drive, so that the drive can be used, is called a "Disk Operating System", or "DOS" for short. The two most popular disk operating systems for apple computers are DOS 3.3 and PRODOS. Many software publishers have written their own DOS for copy-protection purposes.

For more information about disk drives or DOS, we will be recommending a couple of books in APPENDIX K.

* * * * *

Generally, disks are maintenance and trouble free, but there are a few rules to follow to prevent the loss of information. Not only should you care for important disks, but all disks need special care. Even "blank" disks.

Disks, especially your own data storage disks, which are "unreplaceable", are priceless and, especially, need extra care. Commercially purchased disks can sometimes be replaced through the software publisher; but even this can be very expensive and time consuming.

When possible, always make back up copies of important disks. Store the "original" disks in a safe place, and use the back up copies ONLY. If anything happens to the back up copy, making it unusable, simply make another back up copy off the original disk.

When inserting a disk into a disk drive, be very careful that you don't bend, scratch or crease it. Never force a disk into a disk drive.

Keep all foreign objects, such as dirt, cigarette ashes, hands, etc away from the disks magnetic surface. Keep the disk in it's protective "sleeve" or "envelope" when the disk is outside of the disk drive.

Natural disasters can happen, such as fire, flood, storm, etc. Be especially aware of the common disasters that can occur in your area and try to plan accordingly. Do not use your computer system during a lightning storm; as it is very easy for any disks located inside of disk drives to become "zapped" by your computer system/

Keep disks away from all magnetic sources; Computers, monitors, telephones, intercoms, calculators, fans, typewriters, paperclip holders, paperweights, toys, etc... We know of several cases where a disk was "temporarily" leaned up against a telephone, and the phone rang... Too bad!

Heat can only cause problems: Never leave disks in a car (keep disks out of glove boxes) and never expose a disk to the sun. Most disk manufacturers say that disks are to be kept at temperatures below 120 degrees fahrenheit. We think that 100 degrees is safer. Over

the past couple of years, quite a few disks have been returned to use for replacement because they were cooked to death, so be careful.

Cold temperatures normally don't present too much of a problem for disks, but there are a few things you should be aware of. Never use a disk if your room is below 50 degrees fahrenheit. If your disks have been stored cooler than room temperature, let them thoroughly warm up to room temperature before using. As the disks warm up, condensation will occur on the disks magnetic surface. Wait about an hour before using the disks so that the moisture will have ample enough time to dissipate.

STORING DISKS:

A disk should ALWAYS be put in its protective envelope whenever the disk is not located inside of a disk drive.

Original disks are NEVER to be stored near or together with their back up copies. We suggest storing original disks in a magnetic media fireproof box (either stationary or portable) at a different location, building, or house.

If you are going to store disks to protect them against the heat from fire, it is important that you use a "special" magnetic media firebox. Check with your local computer store or office supply house. These fireboxes are usually very expensive, sometimes 10 times as much as a standard firebox. Depending on your use, they can well be worth it. Standard fireboxes are only good for protecting paper documents. The inside temperature is rated so high, that a disk would melt long before the box's rated temperature was reached. Also, all standard fireboxes, these days, are designed to release a cooling liquid from between the walls, into the airtight storage area to keep papers from burning. If the heat doesn't kill the disk, the liquid will...

We have determined that one of the most common problems for lost information is that the information is actually "stolen" by thieves. So, be careful. Often a whole collection of disks get stolen. Or, the thief might not take the disks, physically, but make copies of your disks, thus only stealing the information. If you are using your computer in

business, the thief can use your fiels and lists against you; or, he may sell that information to someone else. This is becoming a more and more common practice. Keep all of your original and back up copies of your disks under locks and supervision at ALL times.

* * * * *

If you've purchased the PLUS version of EDD, you will need to install the EDD card into your computer system before using the EDD PLUS program. All PLUS cards come standard with a short "PLUS cable" (see figure INSTALL PLUS CARD #1) which connects up the PLUS card with the popular DISK II (or equivalent) drive unit. Since the connectors of the DUODISK and UNIDISK drive units are different from the DISK II; if you have a DUODISK or a UNIDISK drive unit, follow the instructions which come in the DUODISK/UNIDISK CABLE UPGRADE KIT for installing the PLUS card. If you are using a DUODISK or UNIDISK drive unit, and you don't have a DUODISK/UNIDISK CABLE UPGRADE KIT, refer to the CUSTOMER SERVICE chapter of this manual for purchasing information.

Follow the instructions found in this appendix for connecting the EDD PLUS card to a DISK II (or equivalent) disk drive setup.

The standard PLUS version of EDD comes with a "PLUS card" and a short "PLUS cable":

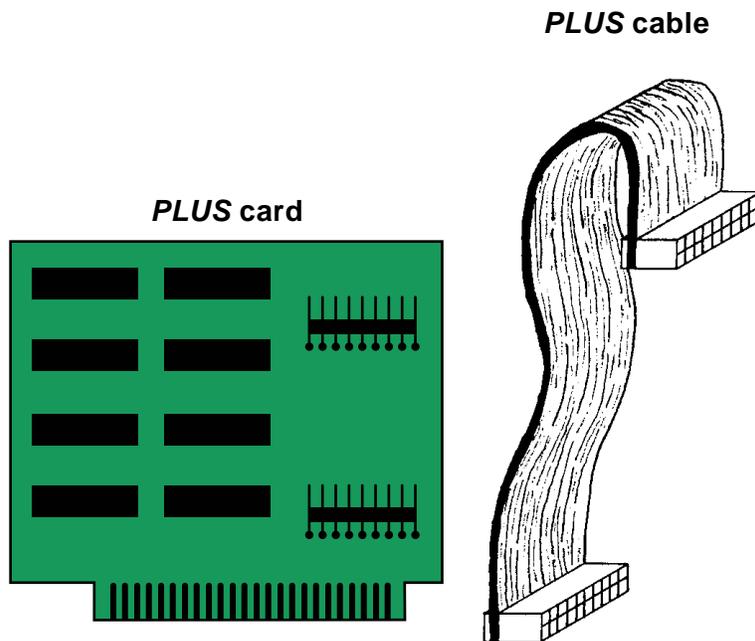


figure INSTALL CARD #1

INSTALLING THE PLUS CARD:

Before installing the PLUS card, make sure that the computer is turned OFF, and that the top cover of the computer is removed (see your computer's ownership manual if needed). Remove the cover now.

WARNING: Damage may result to the EDD PLUS card and/or your computer system if the preceding instructions are not followed completely. We suggest, before installing the PLUS card, that you first read through and understand this entire appendix completely, familiarizing yourself with the installation procedure.

There are two main things that you need to be aware of before installing the PLUS card. First, when plugging cable connectors into computer board connectors, make sure that the cable is aiming AWAY from the computer board (see figure INSTALL PLUS CARD #2 for an example). Secondly, make sure that each of the "pins" of the board connector are aligned properly with each of the holes in the mating cable connector:

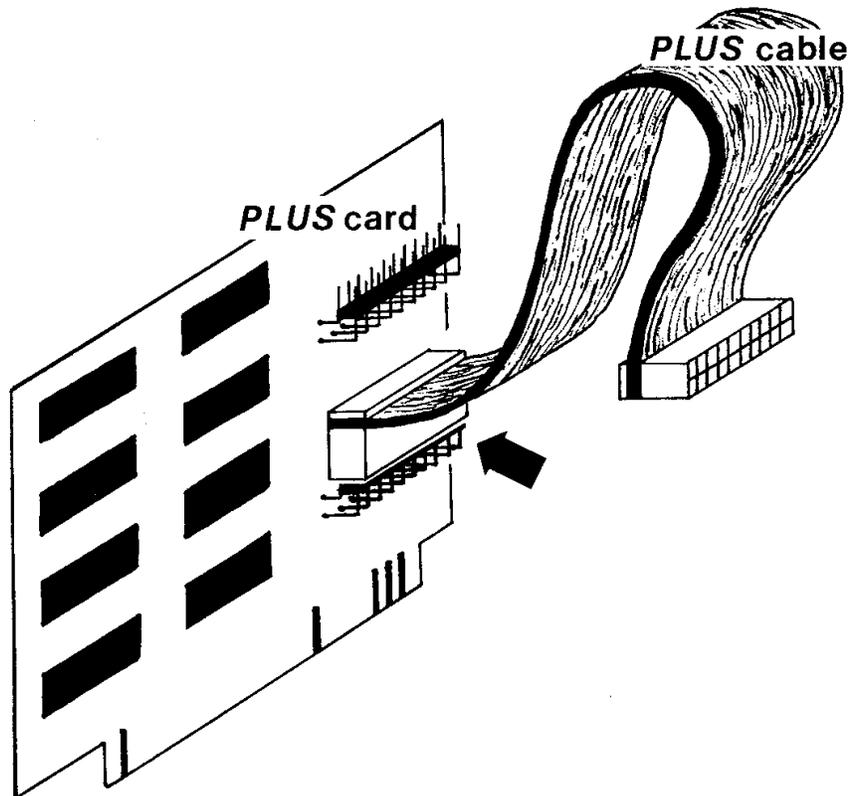


figure INSTALL PLUS CARD #2

If it hasn't already been done for you, plus one of the ends (either end) of the short PLUS cable into the bottom connector of the PLUS card, so that the PLUS cable aims AWAY from the PLUS card, making sure that each of the twenty pins of the PLUS card fit into each of the twenty holes of the PLUS cable as shown in figure INSTALL PLUS CARD #2.

Carefully unplug the #1 DISK II drive's cable from the top DRIVE #1 connector of your drive controller (disk II interface card), and plug the unattached end of the PLUS cable that is hanging from the PLUS card, into the top (drive #1) connector of the drive controller with the cable aiming AWAY from the drive controller card:

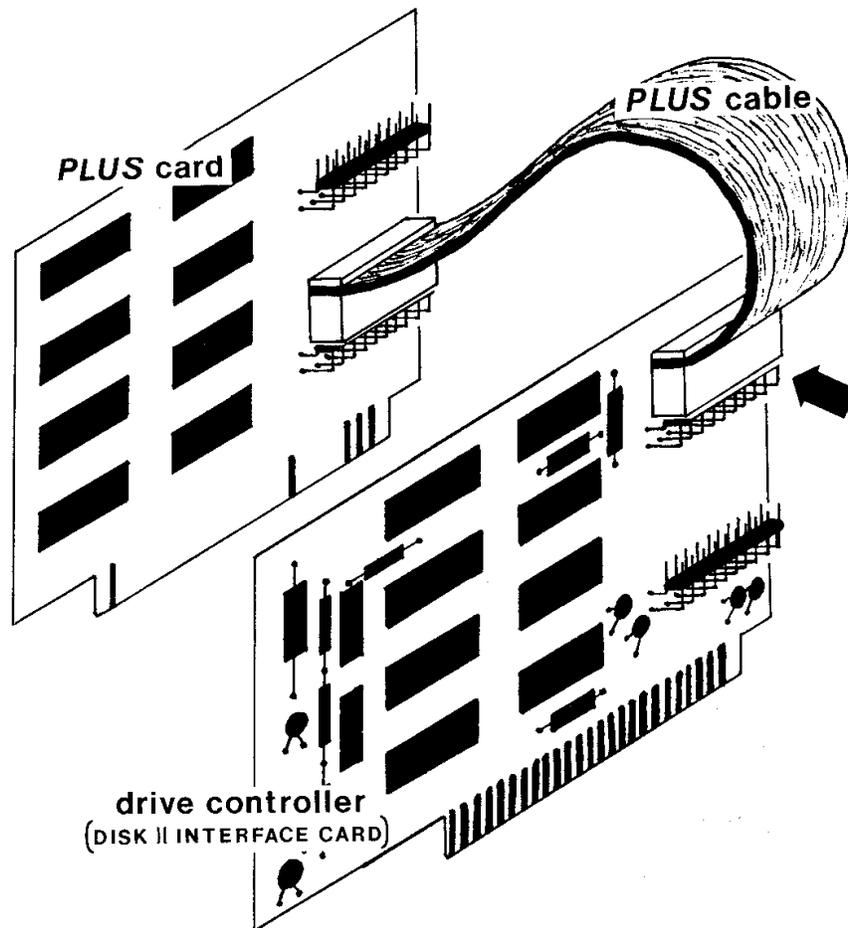


figure INSTALL PLUS CARD #3

Now plug the cable that is running from disk drive #1, into the top connector of the PLUS card, so that the cable is aiming AWAY from the PLUS card (see

figure INSTALL PLUS CARD #4). If you are using two disk drives (and it's not already done), plus the disk drive #2 cable into the drive controller as normal (cable aiming AWAY from the drive controller card):

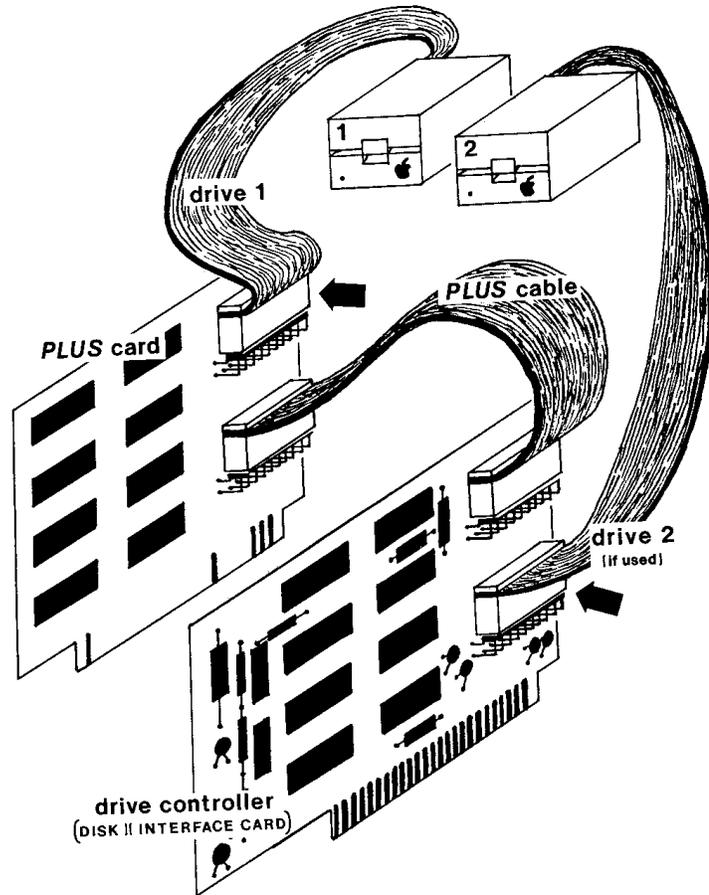


figure INSTALL PLUS CARD #4

Although the PLUS card can be installed in any vacant slot, we suggest that you install it one slot lower than your disk drive controller slot, if possible. For example, if your drive controller is in slot 6, put the PLUS card in slot 5.

Now that you are done with all the cable hookups, you will need to plug the PLUS card into a vacant slot. Since the EDD PLUS program has been factory set, we suggest that you put the PLUS card in the next lower slot than the drive controller's slot (i.e., if your

controller is in slot 6, then put the PLUS card into slot 5). This way you won't have to take the time to tell EDD which slot the PLUS card is located in every time you boot the EDD PLUS disk.

To test the PLUS card to make sure that it has been installed correctly, you should attempt to make a back up copy of either a PRODOS or DOS 3.3 SYSTEM MASTER disk (or any other unprotected disk) using the BIT COPY MODE (see OPTION 1).

** ** **

If the speed of your disk drive needs adjusting, you can always take your drives to an authorized apple dealer and have him adjust them. But there are several reasons why you might prefer to adjust them yourself, unless of course, your computer system is still under apple's warranty (usually within 90 days from purchase date).

The most obvious reason that you would adjust your own drive speed is that it is very simple, it usually only takes a few seconds, and you don't have to pay an authorized apple dealer the outrageous fee of \$20 to \$50 per disk drive. With the money saved, you can always purchase more computer "add-ons" or software.

The main reason you should adjust your own drive speed is that apple computer specifications (from 5 or 6 years ago) say that a disk drive should run at exactly 300rpm. This means that most authorized apple dealers will ONLY adjust the drive speed to this specified speed. As said elsewhere in this manual, we have done extensive testing with running disks at different speeds, for normal operation and backing up disks, and have found that the best "all around" drive speed is 298.5rpm. We have found that 300rpm is border line on the fast or "high" side. Also, for some reason, there are a few apple dealers around who dislike users having the ability to back up your own disks and many of them know that the faster a drive spins, the less disks can be backed up with it. Even though it hasn't happened often, we have seen some dealers who set drive speeds well over the normal 300rpm limit!

The second main reason that you should adjust the speed of your own disk drives is these days more and more copy-protections require drive speed adjustment before the disk will back up correctly. With these disks, not adjusting the speed means not backing up the disks.

Below, we give descriptions for locating and adjusting the drive speeds of the four different styles of disk drives which apple manufactures at the time of this manual's publication. If your disk drive is not an "apple" brand, contact your drive's manufacturer.

DISK II (and shugart type)

Many of the apple II, II+, and IIe computer systems, and the external apple III drive, use this style of disk drive.

The drive speed adjustment screw is located inside of the disk drive, meaning that the cover of the disk drive will need to be removed. This is a simple, straight forward procedure.

To remove the cover, first look at the bottom of the disk drive, locating the four Phillips head screws which are securing the top cover:

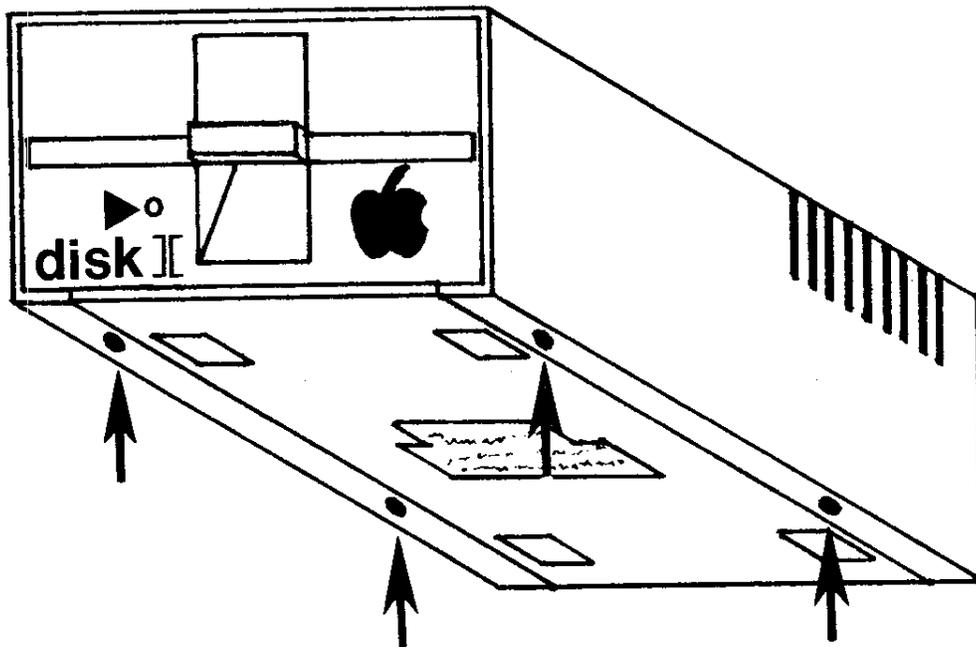


figure DISK II COVER SCREWS

Remove these four screws with a medium sized phillip screw driver. After the screws are removed, you will be able to remove the cover by sliding it off, towards the front or back of the disk drive.

Later, the drive cover can be replaced on the disk drive by sliding it back on, over the disk drive and then securing it down with the four phillip head screws; but of course, don't over-tighten them.

With the cover off, the disk drive's speed adjustment screw is located on the right side of the disk drive towards the back (see figure DISK II SPEED ADJUST SCREW).

After locating the drive speed adjustment screw, you are ready to adjust the speed of the disk drive.

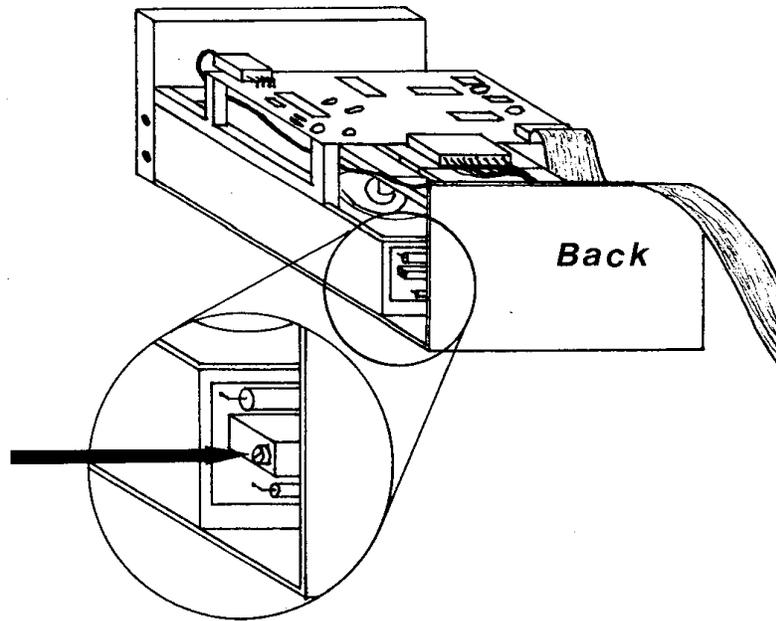


figure DISK II SPEED ADJUST SCREW

DUODISK:

Although the DUODISK can be used on the II, II+, and IIe computer, it is mainly found on the IIe. Adjusting the speeds of these disk drives does not require removing any of the drive covers, making them even easier to adjust than the "DISK II" type of disk drive.

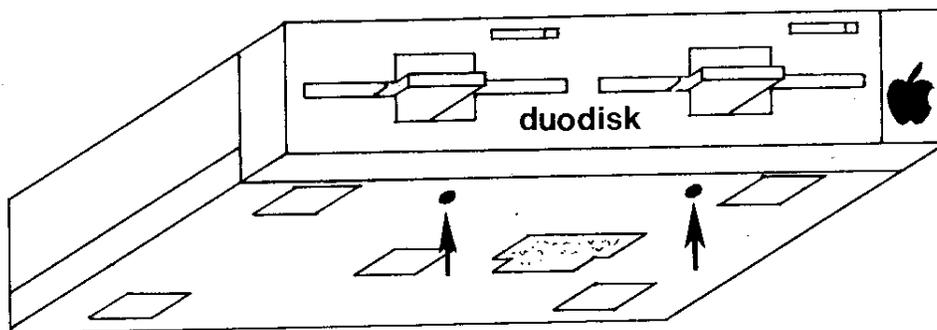


figure DUODISK SPEED ADJUST SCREW HOLES

The DUODISK has two speed adjustment screws; an

adjustment screw is provided for each of the disk drives contained inside of the DUODISK unit. Two small holes are located on the bottom cover of the DUODISK through which each adjustment screw is located and adjusted (see figure DUODISK SPEED ADJUST SCREW HOLES).

The hole on the left is for adjusting the speed of the left disk drive and the hole on the right is for adjusting the speed of the right drive.

Note: We suggest while making speed adjustments to the DUODISK, that the DUODISK drive unit is placed upside down (holes aimed upward), for convenience.

UNIDISK DRIVE

The UNIDISK also can be used on the II, II+, and IIe computer, but it is mainly found on the IIe. Adjusting the speeds of this disk drive does not require removing any of the drive covers.

Drive speed adjustment can easily be done to the UNIDISK through the small hole located in the bottom cover of the drive. The following figure shows the approximate location of the speed adjustment hole:

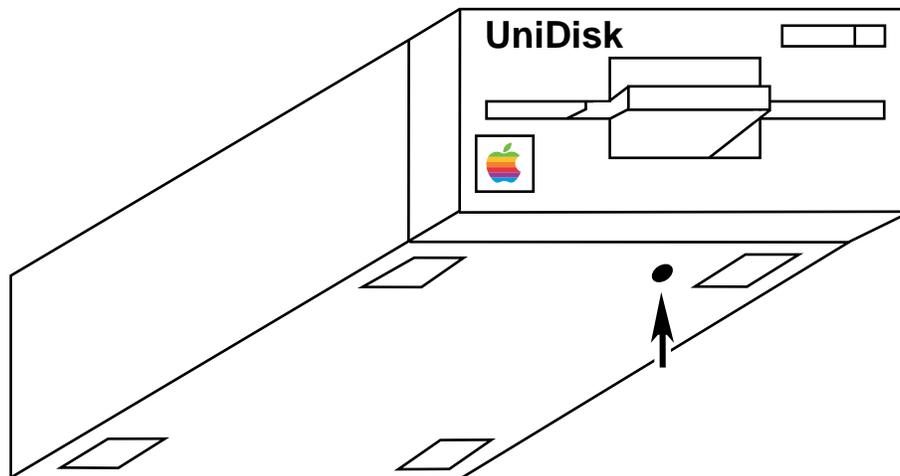


figure UNIDISK SPEED ADJUST SCREW HOLE

Note: We suggest while making speed adjustments to the UNIDISK, that the UNIDISK drive is placed upside down (hole aimed upward), for convenience.

APPLE IIc BUILT-IN and IIc EXTERNAL

Locating the disk drive speed adjustment screw on the apple IIc BUILT IN and IIc EXTERNAL disk drives are easy, and does not require removing any covers.

The IIc BUILT IN disk drive contains a small hole on the bottom side of the computer system underneath the drive (see figure IIc SPEED ADJUST SCREW HOLES), through which the drive speed adjustment screw is located and adjusted.

The IIc EXTERNAL disk drive also contains a small hole on the bottom side of it, but the bottom of this disk drive is usually covered by a large "paper label", which of course also covers up the speed adjustment hole. If this is the case with your IIc EXTERNAL disk drive, you will need to locate the "hidden" speed adjustment hold (pressing your fingernail over the paper label looking for the hole indentation usually works just fine) (see figure IIc SPEED ADJUST SCREW HOLES for the approximate location of the hole), then carefully poking a hole through the paper label allowing access to the speed adjustment screw.

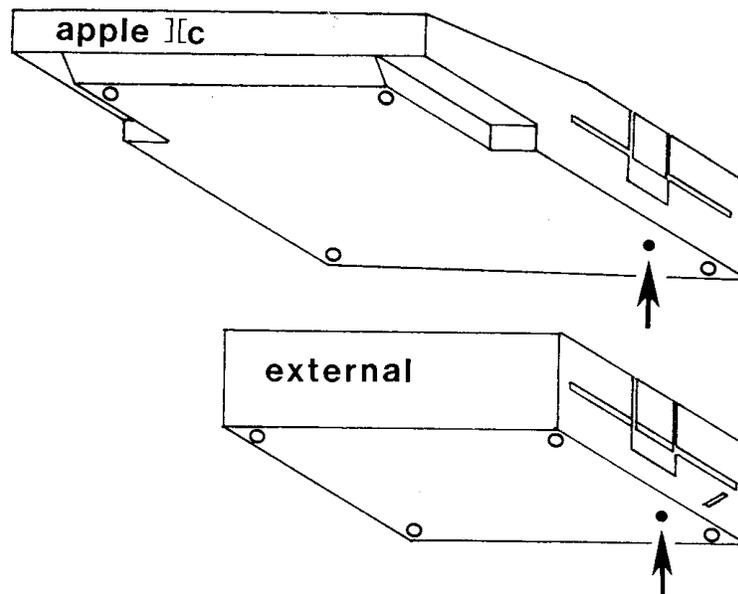


figure IIc SPEED ADJUST SCREW HOLES

Note: We suggest while making speed adjustments to the apple IIc BUILT IN drive and the IIc EXTERNAL

drive, that the apple IIc computer system and the IIc EXTERNAL disk drive are placed upside down (holes aimed upward), for convenience.

ADJUSTING DRIVE SPEED - - -

After locating the speed adjustment screw on your style of disk drive (using previous sections in this chapter), you are all set for actually adjusting the speed.

Turning the speed adjustment screw with a small, standard, straight-slot screw driver will alter the speed at which the drive is running.

Although different disk drives have been know to be different; when adjusting the speed of most drives, turn the speed adjustment screw clockwise usually speeds up the drive, and turning it counter-clockwise slows it down. If your disk drive adjusts to the opposite of this, you will want to keep notes for future reference.

WARNING: While adjusting the drive speed, pay attention to what you are doing! Turning the screw a little can adjust the speed quite a bit, so use common sense. The speed screw should turn easily, but if, when turning it in one direction, it stops, DON'T KEEP TURNING IT!!! You've probably turned it as far as it can go in that direction. If you "strip out" the speed adjustment screw, you'll most certainly be making an embarrassing trip down to your authorized apple dealer for fixing...

* * * * *

APPENDIX J - HEXADECIMAL CONVERSION CHART

For reference puposes, the following is a conversion chat for converting numbers between decimal and hexadecimal:

HEX=DECIMAL HEX=DECIMAL HEX=DECIMAL HEX=DECIMAL HEX=DECIMAL HEX=DECIMAL

\$00 = 0	\$28 = 43	\$56 = 86	\$81 = 129	\$AC = 172	\$D7 = 215
\$01 = 1	\$2C = 44	\$57 = 87	\$82 = 130	\$AD = 173	\$D8 = 216
\$02 = 2	\$2D = 45	\$58 = 88	\$83 = 131	\$AE = 174	\$D9 = 217
\$03 = 3	\$2E = 46	\$59 = 89	\$84 = 132	\$AF = 175	\$DA = 218
\$04 = 4	\$2F = 47	\$5A = 90	\$85 = 133	\$B0 = 176	\$DB = 219
\$05 = 5	\$30 = 48	\$5B = 91	\$86 = 134	\$B1 = 177	\$DC = 220
\$06 = 6	\$31 = 49	\$5C = 92	\$87 = 135	\$B2 = 178	\$DD = 221
\$07 = 7	\$32 = 50	\$5D = 93	\$88 = 136	\$B3 = 179	\$DE = 222
\$08 = 8	\$33 = 51	\$5E = 94	\$89 = 137	\$B4 = 180	\$DF = 223
\$09 = 9	\$34 = 52	\$5F = 95	\$8A = 138	\$B5 = 181	\$E0 = 224
\$0A = 10	\$35 = 53	\$60 = 96	\$8B = 139	\$B6 = 182	\$E1 = 225
\$08 = 11	\$36 = 54	\$61 = 97	\$8C = 140	\$B7 = 183	\$E2 = 226
\$0C = 12	\$37 = 55	\$62 = 98	\$8D = 141	\$B8 = 184	\$E3 = 227
\$0D = 13	\$38 = 56	\$63 = 99	\$8E = 142	\$B9 = 185	\$E4 = 228
\$0E = 14	\$39 = 57	\$64 = 100	\$8F = 143	\$BA = 186	\$E5 = 229
\$0F = 15	\$3A = 58	\$65 = 101	\$90 = 144	\$BB = 187	\$E6 = 230
\$10 = 16	\$3B = 59	\$66 = 102	\$91 = 145	\$BC = 188	\$E7 = 231
\$11 = 17	\$3C = 60	\$67 = 103	\$92 = 146	\$BD = 189	\$E8 = 232
\$12 = 18	\$3D = 61	\$68 = 104	\$93 = 147	\$BE = 190	\$E9 = 233
\$13 = 19	\$3E = 62	\$69 = 105	\$94 = 148	\$BF = 191	\$EA = 234
\$14 = 20	\$3F = 63	\$6A = 106	\$95 = 149	\$C0 = 192	\$EB = 235
\$15 = 21	\$40 = 64	\$6B = 107	\$96 = 150	\$C1 = 193	\$EC = 236
\$16 = 22	\$41 = 65	\$6C = 108	\$97 = 151	\$C2 = 194	\$ED = 237
\$17 = 23	\$42 = 66	\$6D = 109	\$98 = 152	\$C3 = 195	\$EE = 238
\$18 = 24	\$43 = 67	\$6E = 110	\$99 = 153	\$C4 = 196	\$EF = 239
\$19 = 25	\$44 = 68	\$6F = 111	\$9A = 154	\$C5 = 197	\$F0 = 240
\$1A = 26	\$45 = 69	\$70 = 112	\$9B = 155	\$C6 = 198	\$F1 = 241
\$1B = 27	\$46 = 70	\$71 = 113	\$9C = 156	\$C7 = 199	\$F2 = 242
\$1C = 28	\$47 = 71	\$72 = 114	\$9D = 157	\$C8 = 200	\$F3 = 243
\$1D = 29	\$48 = 72	\$73 = 115	\$9E = 158	\$C9 = 201	\$F4 = 244
\$1E = 30	\$49 = 73	\$74 = 116	\$9F = 159	\$CA = 202	\$F5 = 245
\$1F = 31	\$4A = 74	\$75 = 117	\$A0 = 160	\$CB = 203	\$F6 = 246
\$20 = 32	\$48 = 75	\$76 = 118	\$A1 = 161	\$CC = 204	\$F7 = 247
\$21 = 33	\$4C = 76	\$77 = 119	\$A2 = 162	\$CD = 205	\$F8 = 248
\$22 = 34	\$4D = 77	\$78 = 120	\$A3 = 163	\$CE = 206	\$F9 = 249
\$23 = 35	\$4E = 78	\$79 = 121	\$A4 = 164	\$CF = 207	\$FA = 250
\$24 = 36	\$4F = 79	\$7A = 122	\$A5 = 165	\$D0 = 208	\$FB = 251
\$25 = 37	\$50 = 80	\$7B = 123	\$A6 = 166	\$D1 = 209	\$FC = 252
\$26 = 38	\$51 = 81	\$7C = 124	\$A7 = 167	\$D2 = 210	\$FD = 253
\$27 = 39	\$52 = 82	\$7D = 125	\$A8 = 168	\$D3 = 211	\$FE = 254
\$28 = 40	\$53 = 83	\$7E = 126	\$A9 = 169	\$D4 = 212	\$FF = 255
\$29 = 41	\$54 = 84	\$7F = 127	\$AA = 170	\$D5 = 213	
\$2A = 42	\$55 = 85	\$80 = 128	\$AB = 171	\$D6 = 214	

* * * * *

We use and have used many products available for apple computers over the years. Below is a list of a few of the better products that we have run across. Although we don't produce these products ourselves, they can purchase from us if your local dealer is out of stock.

HARDWARE:

TRAK STAR: If you do much disk backing up, you need a TRAK STAR. Manufactured by Midwest Microsystems, this handsome piece of hardware displays a digital read out of the current track that a disk drive is accessing. There are at least two ways of using this information to help you to back up disks, which, in turn, can save you a lot of time. First, you can find out which whole and half tracks of the ORIGINAL disks are used, so you know exactly which tracks to copy. Secondly, you can boot up a back up copy of a disk, and if the disk doesn't run properly, you can often see exactly where the problem track is, so you know which track to recopy. A 2-drive adapter is required for a 2-drive system. TRAK STAR price is \$99.95. For a 2-drive adapter, add \$12 (if needed).

SPEED DEMON: For anyone who's serious about computing, you need a SPEED DEMON, manufactured by Micro Computer Technologies. This fancy peripheral card turbo charges your Apple II, II+, or IIe computer into running over 3 times faster than it currently runs. What use to take 10 minutes to do, now usually only takes 3. We have been using SPEED DEMON for a long time now, and we will continue to use it. The SPEED DEMON can easily be turned "off" from the keyboard if needed, so that arcade games and other "real" time programs can run at their "normal" speed. SPEED DEMON price is \$249.95.

BOOKS - PUBLICATIONS:

BENEATH APPLE DOS: Published by Quality Software; this was the first book available to apple owners on the subject of the Disk Operating System (DOS). This is a very good book. Although the book talks only about standard DOS, it is very informative. Without this book, there may never have been an EDD version 1. BENEATH APPLE DOS price is \$19.95. *

BENEATH APPLE PRODOS: Published by Quality Software; this book is similar to BENEATH APPLE DOS (above), but is all about PRODOS. BENEATH APPLE PRODOS price is \$19.95. *

UNDERSTANDING THE APPLE II: For all you users who want to know virtually everything about how your apple II computer and disk drive work, here's the only book that we've found on the subject. Published by Quality Software; this book is very informative, and also goes into details of how DOS works, but has little or nothing to do with copy-protections. UNDERSTANDING THE APPLE II price is \$22.95. *

UNDERSTANDING THE APPLE IIe: Published by Quality Software; this book is similar to UNDERSTANDING THE APPLE II (above), but is filled with information about your IIe computer. UNDERSTANDING THE APPLE IIe price is \$24.95. *

* * * * *

ADDRESS FIELD: A special pattern of raw disk bytes found on a disk which tell the Disk Operating System (DOS) that a sector is about to be read. This address field often contains the current track number, the sector number, and the disks volume. Copy-protected disk can have any information they want in the address field.

ADVANCED USER: Someone who is experienced in computers and copy-protection.

ANALYZING TRACK: The process which EDD performs while backing up a disk to locate the track's LENGTH, END, and START.

AUTOBOOT: A computer system with the ability to automatically boot up a disk when the computer system is first turned on.

BACK UP COPY: The process of making an "archival" back up copy of a disk; so if an "original" disk was damaged, a second copy would exist.

BENEATH APPLE DOS BOOK: A very good book from Quality Software which talks quite a bit about the standard Disk Operation System and about disks and disk drives in general.

BENEATH APPLE PRODOS BOOK: Similar to BENEATH APPLE DOS BOOK, but all about PRODOS.

BINARY NUMBERING SYSTEM: The most basic computer numbering system, which consists of only two states, ON and OFF, which are expressed as "bits" with the values of 1's and 0's. Often, the "%" (percent) sign is used to express a binary number (i.e. %0001100).

BIT: The most basic value of the binary numbering system. A bit has only two states, either 0 or 1.

BIT COPY: Having the ability to read and write at the "bit" level. Standard apple computer hardware can write disks at a bit level, but only has the ability to read disks at the "raw disk byte" level. The EDD PLUS card allows the disk to be read at the "bit" level, which means that EDD 4 PLUS is the only "true" bit copy program available

to date.

BIT COPY MODE: The mode used for bit copying a disk. This mode is only found on the EDD 4 PLUS version, since it requires the use of the EDD PLUS card.

BLANK DISK: A disk which contains no information. EDD refers to a "blank disk" as any disk which is either blank or contains "unimportant" information, since EDD will be over-writing any current information on the disk.

BOOT/BOOTING A DISK: The process of starting the loading process of a preprogrammed disk. If you don't already know how to "boot a disk", you will need to check with your computer's operation manual to find out how to boot disks on your computer system.

BUFFER: A dedicated area of memory that holds information on a temporary basis. A program buffer would be an area of memory which is dedicated to programs, but not necessarily a particular program.

BYTE: A computer word, instruction, or character which is made up of eight bits (a bit has two states, so 2 to the 8th power equals 256 different possible byte values). A dollar sign (\$) is often used to express a byte number. A byte can have the value of \$00 (%00000000) through \$FF (%11111111).

CERTIFIED DISK: A disk which has passed it's test on it's capability of storing information properly.

COLDBOOT: Booting a disk, starting with the computer in the "OFF" position.

COPY-PROTECTION: A software lock put on a disk which is supposed to keep the contents of the disk from being backed up.

COPYRIGHT: A legal "right" owned by publishers and writers of written material (which includes computer software) which the U.S. Government enforces. Thus, making it a crime to unlawfully duplicate, or, to distribute (sell, give, or trade) unlawfully duplicated copyrighted material.

The purchaser of copyrighted material (at the time of this writing) is allowed to have an "archival" back up copy in his possession. If needed, check the current copyright laws.

CRASHED DISK: If at any time you can read or write a floppy disk correctly, and then all of a sudden the disk doesn't work anymore, you have experienced what is called a "crashed disk". This is a good reason why you should make and have a back up copy of all your disks, if possible.

CURSOR: Another name for a cursor is a "prompt". A computer program displays a cursor when it wants information or "feedback" from you. There are two types of cursors. The first type is a pointer type. A computer program will display on the screen several options that can be done, and you can move the "cursor" to the option you want to choose. The second type of cursor is the direct type. A program will flash a little "square block" on the screen, waiting for you to physically type something in.

DECIMAL NUMBERING SYSTEM: Base 10. All standard numbers used in "human society" are decimal numbers.

DIFFERENCE in track length: The amount of raw disk bytes that difference on the DUPLICATE disk from the ORIGINAL disk.

DISK: Short term for "floppy diskette".

DISK DRIVE: A hardware device which reads information from, or writes information to, a floppy disk.

DISK II: The name of the standard disk drive which apple computers manufactures.

DOS: Abbreviation for "DISK OPERATING SYSTEM". This would be any program which controls the flow of information to, and from, disk drives. DOS 3.3 and PRODOS are common, standard forms of "unprotected" DOS.

DRIVE CONTROLLER: The computer card which you plug your disk drives into, which in turn gets plugged into one of the slots (often #6) of the computer.

DRIVE SPEED: The speed at which the disk drive spins a disk.

DUODISK: This is a disk drive unit that apple computer manufactures, which consists of two disk drives built side by side into the same unit.

DUPLICATE DISK: Not an "original" disk. This would either be a back up copy of an original disk, or a blank disk waiting to be copied onto.

EDD: Abbreviation for Essential Data Duplicator.

EPILOGUE: A special raw disk byte pattern located at the end of any information wrote to a track. While the computer is reading back the information, the "epilogue" pattern signals the computer it has hit the end of the information, and no more follows.

ERROR CODES: After EDD processes a track from a disk an error code is displayed in normal video, on the error/processing code display. An error code is the summary of what happened during processing of that track. For a description of what each error code means, refer to the "OVERVIEW OF EDD" chapter.

ERROR/PROCESSING CODE DISPLAY: Located towards the top of your monitor screen, this is where all the error and processing codes are displayed.

ESSENTIAL DATA DUPLICATOR: The best copy program available for apple computers!

FLOPPY DISK: The square think you put into a disk drive.

GAP: See TIMING GAP.

HARDCORE COMPUTIST MAGAZINE: A magazine published around copy-protections. The magazine mostly talks about "stripping" the copy-protections off of copy-protected disks and can be very helpful to people learning about copy-protection in general.

HARDWARE: Anything that is physical, such as a computer system, a monitor, a disk drive, an EDD PLUS card. A computer disk is hardware, but any information contained on the disk would be "software".

HEAD (ARM): The mechanical part of a disk drive which physically touches and reads from, and records to, the disk's magnetic surface, and has the ability to move from track to track.

HEXADECIMAL NUMBERING SYSTEM: A computer number system, base 8. People have ten fingers, computers have eight. APPENDIX J gives a conversion chart for converting hexadecimal and decimal numbers.

INCREMENT TRACK: Older copy programs use the term "increment track" instead of the newer term, track "step".

INSTRUCTION BUFFER: An area of memory that holds instructions for EDD'S PREANALYZE and PREWRITE instruction routines (OPTION 2; SUB-OPTIONS 2 and 3) which you can modify.

MASTER DISK: See ORIGINAL DISK.

MONITOR: The computer screen or TV you look at when your computer is on.

NIBBLE COPIER: A type of copy program which reads in raw disk bytes, then writes out raw disk bytes, without ever decoding the raw disk bytes into sectors.

NIBBLE COUNT: A copy-protection scheme where the length of a track is checked to make sure that the disk is an "original" disk.

NOVICE USER: A beginner. Someone who is just starting out.

ORIGINAL DISK: The MASTER or "ORIGINAL" disk of which you are trying to make a back up copy.

PARAMETER CHANGE: The ability to modify EDD to back up a type of copy-protection which EDD was not preprogrammed to back up.

PARAMETER LIST: See PROGRAM INSTRUCTION LIST.

PERIPHERAL CARD: A computer circuit built into a thin board which is to be plugged into a slot inside the computer system, such as the EDD PLUS card.

PIRATE: Anyone who either directly or indirectly violates the copyright laws.

PLUS CARD: A peripheral card which gives the EDD the ability to read every bit of information off an "original" disk.

PROCESSING CODES: As EDD processes a track from a disk, different inverse letters will be displayed in the error/processing code display. Although these letters aren't needed as far as processing the disk, their purpose is to keep you informed of what EDD is doing.

PROGRAM INSTRUCTION LIST: A periodically updated list of instructions and parameters for helping you to make back up copies of your copy-protected software packages.

PROLOGUE: A special raw disk byte pattern on the disk that tells the computer to get ready; some important information on the disk is about to come.

PROTECTION: See COPY-PROTECTION.

RAM: This is the abbreviation for Random Access Memory. RAM memory "chips" is one type of memory located inside your computer system. A computer program can do both, read from and write to these memory chips. One bad thing about this type of memory. When the power is turned off, these memory chips become erased. Whenever you hear the term "48k", "64k", or "???k", RAM memory is usually being referred to.

RAW BIT STREAM: The continuous flow of 0 and 1 bits which travel between the drive controller and the disk drive.

RAW DISK BYTE: An 8 bit stream of "encoded" information that can be wrote to and read from a disk drive.

RAW DISK BYTE BUFFER: An area of memory which holds the raw disk bytes as they are read from a disk.

ROM: This is the abbreviation for Read Only Memory. These are permanent, unchangeable

instruction "chips" located in your computer, which can be read, but not written to. These memory chips are factory set and turning the power switch off will not erase or reset this memory.

SECTOR: On unprotected disks and most copy-protected disks, each track is broken down into smaller sections called sectors. Most disks have 16 sectors per track.

SLOT: Located inside the computer (except IIc), you can plug in peripheral cards into slots (i.e., printer cards, drive controller cards, EDD PLUS card, etc...).

SOFTWARE: Any computer program, instruction, or information which is accessible by a computer.

SPEED DEMON PERIPHERAL: A peripheral card that speeds the apple computer up to 3 1/2 times faster than normal.

SPEED OF DISK DRIVE: The speed at which a disk drive turns a disk. The usual speed of a drive is around 300rpm.

STANDARD DISK: A standard, normal, unprotected disk which can be backed up by any "standard" disk copy program.

STEP: The amount of tracks to "step" or increment before stopping at the next selected track (i.e. using a step value of 1.5 from track 0, would select the tracks "0, 1.5, 3, 4.5, 6").

SYNCHRONIZED TRACKS: A type of copy-protection which checks the alignment of at least two tracks together. If the alignment is changed, then the disk knows that it's a copy.

TIMING BITS/BYTES: A raw disk byte with extra zero bits on the end. The main purpose of these extra timing bits is to align the raw bites steam with the drive controller, so that the raw bit stream can be converted back to raw disk bytes correctly.

TIMING GAP: Four or more timing bytes in a row. The timing gaps purpose is to align the raw bit streams with the drive controller.

TRACK: A circular ring of information that circles

all the way around the disk. Unprotected disks and most copy-protected disks have 35 concentric rings.

TRACK END: This is the last raw disk byte written to a track.

TRACK LENGTH: The amount of raw disk bytes which are contained on a particular track.

TRACK START: The place on the track where the first raw disk byte was written.

TRAK STAR PERIPHERAL: A small unique peripheral which gives a digital LED readout of the current whole or half track of the disk drive. Very useful for determining which whole/half tracks of a copy-protected disk to copy.

UNDERSTANDING THE APPLE II BOOK: A very good book which talks, in-depth, about the apple II computer system, disk drives, and software that drives the hardware.

UNPROTECTED DISK: A disk which has no copy-protection, and can be backed up by "any" copy program.

UNWRITE-PROTECTED: A disk that can be written to, because a write-protect notch (a small square cut-out) is showing on the side of the disk.

USER: The person who is using. Example: if you are using EDD, you are a "user" of EDD.

WARM BOOT: Booting a disk starting with computer in the "ON" position.

WRITE-PROTECTED: A disk that can not be written to, because no write-protect notch is showing on the side of the disk. Either the notch was never cut, or a metal sticker is covering up the notch.

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