VECTOR

DISKTEST

User's Manual

DISKTEST

TECHNICAL INFORMATION

Revision B

October 6, 1982

P/N 7100-6501

Made in U.S.A.

Disclaimer

Vector Graphic makes no representations or warranties with respect to the contents of this manual itself, whether or not the product it describes is covered by a warranty or repair agreement. Further, Vector Graphic reserves the right to revise this publication and to make changes from time to time in the content hereof without obligation of Vector Graphic to notify any person of such revision or changes, except when an agreement to the contrary exists.

Revisions

The date and revision of each page herein appears at the bottom of each page. The revision letter such as A or B changes if the MANUAL has been improved but the PRODUCT itself has not been significantly modified. The date and revision on the Title Page corresponds to that of the page most recently revised. When the product itself is modified significantly, the product will get a new revision number, as shown on the manual's title page, and the manual will revert to revision A, as if it were treating a brand new product. EACH MANUAL SHOULD ONLY BE USED WITH THE PRODUCT IDENTIFIED ON THE TITLE PAGE.

FOREWORD

Audience

This manual is intended for computer distributors or others with at least a moderate technical knowledge of small computers. Using the DISKTEST system program requires a basic understanding of system software and how it is used within the Extended CP/M Operating System environment.

Scope

It will describe how to use the DISKTEST Program.

Organization

The DISKTEST -TECHNICAL INFORMATION MANUAL is divided into four sections. The first section describes the prompts and system parameters used in DISKTEST. The next section describes error messages that may be encountered when running DISKTEST. This section also gives several measures that can be used to correct specific types of hardware and media errors.

The last two sections give examples of how DISKTEST can be used.

TABLE OF CONTENTS

LIST OF EXHIBITS

SECTION I - OPERATING PROCEDURE

1.1 Introduction

DISKTEST can be used for a variety of purposes. It can determine whether a system failure is due to a hardware or software problem.* Additionally, DISKTEST is used for obtaining the required patterns when performing an alignment on a double-sided drive.

These functions can be accomplished because DISKTEST has several specific capabilities. Some of these are listed below:

- Reading disk platters, tracks or sectors.
- Writing to disk platters, tracks or sectors.
- Reading RAM locations.
- Writing to RAM locations.
- Reading and/or writing to memory locations and checking for errors.
- Filling memory locations with specific types of data.

DISKTEST can be run on either the 5 1/4 inch or 8 inch hard disk drive, as well as the 5 1/4 inch double-sided floppy. It will not run on the 2800, System B or VIP systems which use Micropolis drives.**

DISKTEST is a COM file used in conjunction with a compatible version of CP/M. The appropriate DISKTEST version is shipped with each system disk and can be used on any of the systems drives.

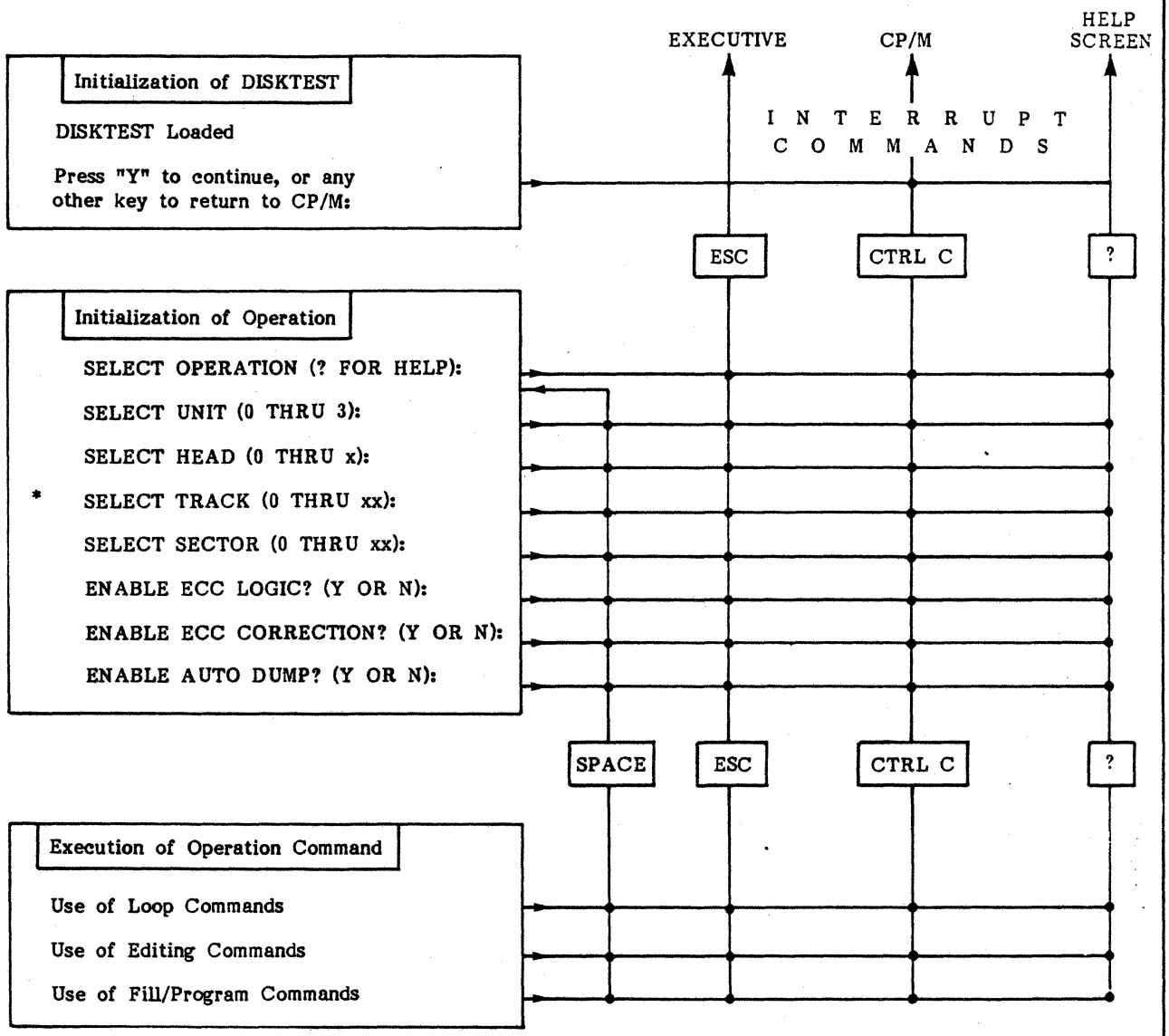
1.2 Prompts

The following list of prompts will be based on a Vector Graphic 5032 System using Extended CP/M. The DISKTEST program will be used to check for errors during the reading of track 21 (using Head 1) on the hard disk. The prompts will be listed with the user response underlined. Refer to Exhibit 1-1 for a block diagram of DISKTESTs prompts.

*DISKTEST does not re-read the media block (sector, track, etc.) after it encounters an error. For this reason it is recommended that you allow 8 errors per media block before adjusting or replacing unit. i.e. RAM, Drive, Diskette, Controller.

** **Caution: DISKTEST may alter data on the disk. For this reason be sure to back up all data before running this program. In a multi-user environment it is recommended that DISKTEST is used only when the users are not actively doing I/O operations.**

EXHIBIT 1-1 BLOCK DIAGRAM OF DISKTEST PROMPTS



* This field can contain two or three digits. The number of digits depends on the drive and its storage capacity.

This exhibit shows how the Interrupt Commands relate to the prompts and activities located within the three DISKTEST modules. For example, if you have just finished selecting the "Physical Unit" (Second prompt in Operation Module) you can press "?" if you want to see the help screen. Other options include:

-Pressing [ESC] and exiting to the Executive.
-Pressing [CTRL C] and exiting to CP/M.
-Pressing [SPACE] and going back to the SELECT OPERATION Prompt.

It should also be noted that all these Interrupt commands can be used while executing a particular Operation Command (Third Module).

The [RETURN] Key can be pressed to answer each prompt if you want the original or default value (See Exhibit 4-1). This is especially helpful when you want to change the OPERATION but not the values of the sector descriptors. i.e. Unit, Head, etc.

1. Load DISKTEST into the system by typing DISKTEST following the CP/M prompt.

   A>DISKTEST

2. The DISKTEST program is now initialized and one of the four Interrupt commands can be used (Refer to Exhibits 1-1, 1-2. The program title along with warning information will appear on the screen followed by a prompt telling you to continue (press "Y") or to exit the program (press any other key or <RETURN>). Press "Y" to continue.

   Press "Y" to continue, or any other key to return to CP/M: Y

3. At this point the DISKTEST Program is determining which drive is your "0 Physical Drive". Exhibit 1-3 shows the different types of system configurations along with their "Physical Drive" designations. If DISKTEST is unable to determine the correct "0 Physical Drive" it will send the following prompt to the screen. This will allow you to manually insert the correct "0" Drive desgination.

   0) Floppy
   1) 05 MB ST506 COMPATIBLE
   2) 32 MB QUANTUM
   3) 05 MB ST406 COMPATIBLE

   UNIT 0 DISK TYPE (0 TO 3):

   If DISKTEST is able to locate the correct "0 Physical" Drive then a message giving the "0 Physical" Drive will be displayed. In this example you would see the following statement.

   Unit 0 is a 32 MB Q2040 Compatible Device
   RESTORING.....DONE.

4. The "RESTORING....DONE" phrase will only occur for the 32 MB Drive and only during the first time DISKTEST has been used. After DISKTEST has been fully initialized you will see a prompt which allows you to select a specific DISKTEST Operation. This operation can be one of eleven different types of operation commands (See Exhibit 1-2), or one of four interrupt commands. The operation command RT will be used to demonstrate some of DISKTEST'S capabilites.

   SELECT OPERATION (? FOR HELP): RT

EXHIBIT 1-2 OPERATION AND INTERRUPT COMMANDS

	Command-Title	Description
OPERATION COMMANDS	[SR] Seek and Read (Randomly)	: The disk drive head searches the disk randomly and reads sector data into the DISKTEST buffer.
	[SO] Seek Only (Randomly)	: The disk drive head searches the disk randomly.
	[RS] Read Current Sector	: The disk drive head is located over the current track. The information from the current physical sector is read into the DISKTEST buffer as the disk rotates (DISKTEST reads same physical sector each time disk rotates).
	[RT] Read Current Track	: The disk drive head is located on the current track. The information from that track is read into the DISKTEST buffer in 1 sector increments (DISKTEST reads each physical sector of this track).
	[RD] Read Entire Disk	: The disk drive head reads data (and format codes) and puts that information in the DISKTEST buffer.
	[RP] Read Current Platter	: The disk drive head reads one Logical Platter (Physical Surface) and puts that information in the DISKTEST buffer.
	[W(V)S] Write Sector (Verify)	: This command can be used with or without the verify feature. If the verify feature is used the information will be written to the disk and verified by reading into the DISKTEST buffer. If the verifying feature is not used the DISKTEST buffer will contain information that was written to the disk.
	[W(V)T] Write Track (Verify)	: This command can be used with or without verifying. See operation command [WVS].
	[W(V)D] Write Disk (Verify)	: This command can be used with or without verifying. See operation command [WVS].
	[W(V)P] Write Platter (Verify)	: This command can be used with or without verifying. See operation command [WVS].
	[MEM] Memory Test	: This command will test the DualMode Controllers memory (.5 K buffer). Each memory cell will have information written to it followed by a separate read operation.
INTERRUPT COMMANDS*	[ESC]	Sends user to Executive.
	[SPACE BAR]	Sends user to SELECT OPERATION prompt. From this point you can select another operation command, use one of the other interrupt commands or press [RETURN] to enter the default value (operation command prior to interrupt).
	[CTRL C]	Sends user to CP/M.
	"?"	Displays helpscreen.

*Key(s) Pressed

EXHIBIT 1-3 PHYSICAL DRIVE ASSIGNMENTS

Physical Drives	SYSTEMS							
	1600* 2600 3100 4/20			3105 3005 4/30 5005			3032 5032	
	Logical Drive	Drive Description		Logical Drive		Drive Description	Logical Drive	Drive Description
0	B	Left Floppy		A	A,B	Hard Disk	A,B,C,D	Hard Disk
1	A	Right Floppy		B	C	Floppy	E	Floppy
2	C	Extra Floppy		C	D	Extra Floppy	F	Extra Floppy
3	D	Extra Floppy		D	E	Extra Floppy		

* Physical Drive 0 or 1 can be used for its double-sided drive (Drive is dual addressed).

5. The next prompt allows you to designate which "Physical Drive" you want to be tested. This prompt will be the same for any Vector Graphic system. NOTE: 3032 or 5032 systems can have only have 3 units. All other systems can use the full complement of four units.

   SELECT UNIT: (0 THRU 3): 0
   RESTORING.....DONE.

6. The "RESTORING.....DONE" phrase occurs only for 32 MB systems and only during the first time a particular unit is selected. After completing this selection it is necessary to determine which disk drive HEAD will be used. This following prompt will show the number of HEADs available on your system. See the chart, used in the description of the next prompt, for a listing of the number of surfaces/platters/heads, etc.

The following prompt is given for a 8 inch hard disk drive. Head 0 is selected.

SELECT HEAD: (0 THRU 7): 0

7. The next two prompts are used to select the TRACK and SECTOR of the disk drive you are testing. These prompts will occur even if you selected RP (Read Logical Platter*) in the SELECT OPERATION Prompt. This occurs because DISKTEST is designed to allow you to START reading or writing at a specific sector/track. If you are reading an entire Logical Platter, the DISKTEST Program will start reading at the sector/track you indicated and then sequentially read the next sector. This process will continue until the entire platter has been read. i.e. Disk drive head is back at starting position.

   The following chart shows the different physical parameters for each type of drive supported by Vector.

UNIT SELECTED **	NUMBER OF PHYSICAL PLATTERS	NUMBER OF LOGICAL PLATTERS (SURFACES)	NUMBER OF HEADS	NUMBER OF TRACKS	NUMBER OF SECTORS
Floppy	1	2	2	77	16
5 Inch Hard Disk (ST 506)	2	4	4	153	32
5 Inch Hard Disk (ST 406)	1	2	2	306	32
8 Inch Hard Disk	4	8	8	512	32

** Within the DISKTEST Program the "1" notation is usually referred to as "0". e.g. the floppy drive has 0-1 HEADS.

* There is no DISKTEST command for reading a Physical Platter. However, if you use the Operation Command RD the entire disk (Heads will be switched) will be read.

The TRACK and SECTOR prompts can be answered in one of three ways:

- If you give a track number that is less than 3 digits or a sector number that is less than 2 digits you must press [RETURN].

- If you give a track number that uses the full number of digits your entry will automatically be entered without pressing [RETURN].

- If this is the initial running of the program the default value of this parameter will be zero. The default value will be a specific set of numbers (previous track value) if this is the second (or greater) entry into the SELECT OPERATION program loop. The default value is entered by pressing [RETURN]. See Exhibit 4-1 in Section IV for a listing of all the default values.

For this example Track 21 and Sector 05 are used. NOTE: [RETURN] is pressed for the track entry since only two digits are inserted. [RETURN] is not pressed for the sector entry since the full 2 digits are used.

SELECT TRACK: (0 THRU 511): 21

([RETURN] is pressed)

SELECT SECTOR: (0 THRU 31): 05

([RETURN] is not pressed)

8. To answer the next two prompts it is necessary to understand what and how ECC logic is used.

   The DualMode Disk Controller Board generates a 4-byte ECC (Error Correction Code) when data is transferred to/from the disk. The following sequence of steps occurs for a Disk WRITE and READ.

   WRITE

   1. Data is sent to the Disk Controller where the ECC Hardware generates a specific non-zero, 4-byte ECC Code.

   2. This data along with the 4-byte ECC Code and other information is sent to a specific physical sector on the disk. See Exhibit 2-1 in Section II for a complete description of different sector formats.

   READ

   1. The Disk Controller reads a sector and generates a New 4-byte ECC Code.

   2. The Disk Controller "subtracts" this ECC Code from the original ECC Code that was generated during the writing of the sector.

3. If the ECC Code does not equal zero then the data has been transmitted and/or recorded incorrectly. This incorrect data will be corrected within the tolerances of ECC logic. These tolerances provide for correction of data that consists of 5 or less contiguous bits (the detection span is for 19 or less contiguous bits). If an error is located in a segment larger than this size the ECC logic will not correct it.

The next two prompts are

ENABLE ECC LOGIC ? (Y OR N):
ENABLE ECC CORRECTION ? (Y OR N):

The first prompt describes the detection portion of the ECC logic control subsystem. This subsystem consists of two components. One component generates the ECC bytes and is always active and cannot be disabled. i.e. It constructs a 4-byte ECC (non zero) code during READ and WRITE operations. The other component determines how the DISKTEST Buffer is WRITTEN to the disk: Formatted or Non-Formatted. This component is controlled by the ECC LOGIC prompt.

In order to understand what the terms Formatted and Non-Formatted mean it is necessary to discuss the layout of the DISKTEST Buffer. Two examples of typical DISKTEST Buffers are shown in Exhibit 1-4. As can be seen these buffers have sync bytes, ECC bytes and the other necessary sector information.

When the DISKTEST program writes a sector to disk it writes the sector to a location indicated by the USER. i.e. Users answer to SELECT TRACK, SECTOR, etc. prompts. If this location is different from the location described within the actual DISKTEST Buffer, then DISKTEST will format the Buffer and give it the correct track and sector locations before writing it to the new location. If the ECC LOGIC is disabled, the DISKTEST Buffer will be written to the location indicated by the user even though the DISKTEST Buffer may display a different location. This type of operation represents the writing of a non-formatted DISKTEST Buffer.

The second prompt enables or disables the software which corrects the possible data error. If ECC CORRECTION is disabled the data will be reproduced in its original form- correct or incorrect. Exhibit 1-5 gives four examples of how "good data" and "bad data" relate to the ECC LOGIC and ECC CORRECTION DISKTEST Functions.

For this example the ECC LOGIC will be turned on but the ECC CORRECTION LOGIC will be turned off.

ENABLE ECC LOGIC ? (Y OR N): Y
ENABLE ECC CORRECTION ? (Y OR N): N

EXHIBIT 1-4 DISPLAY OF DISKTEST BUFFER

The following illustration shows a Dump of a Disktest Buffer from a 32 MB Hard Disk System. The large block of hexidecimal numbers represent one sector of data along with the various identifying variables. The adjacent block represents these values in an ASCII format.

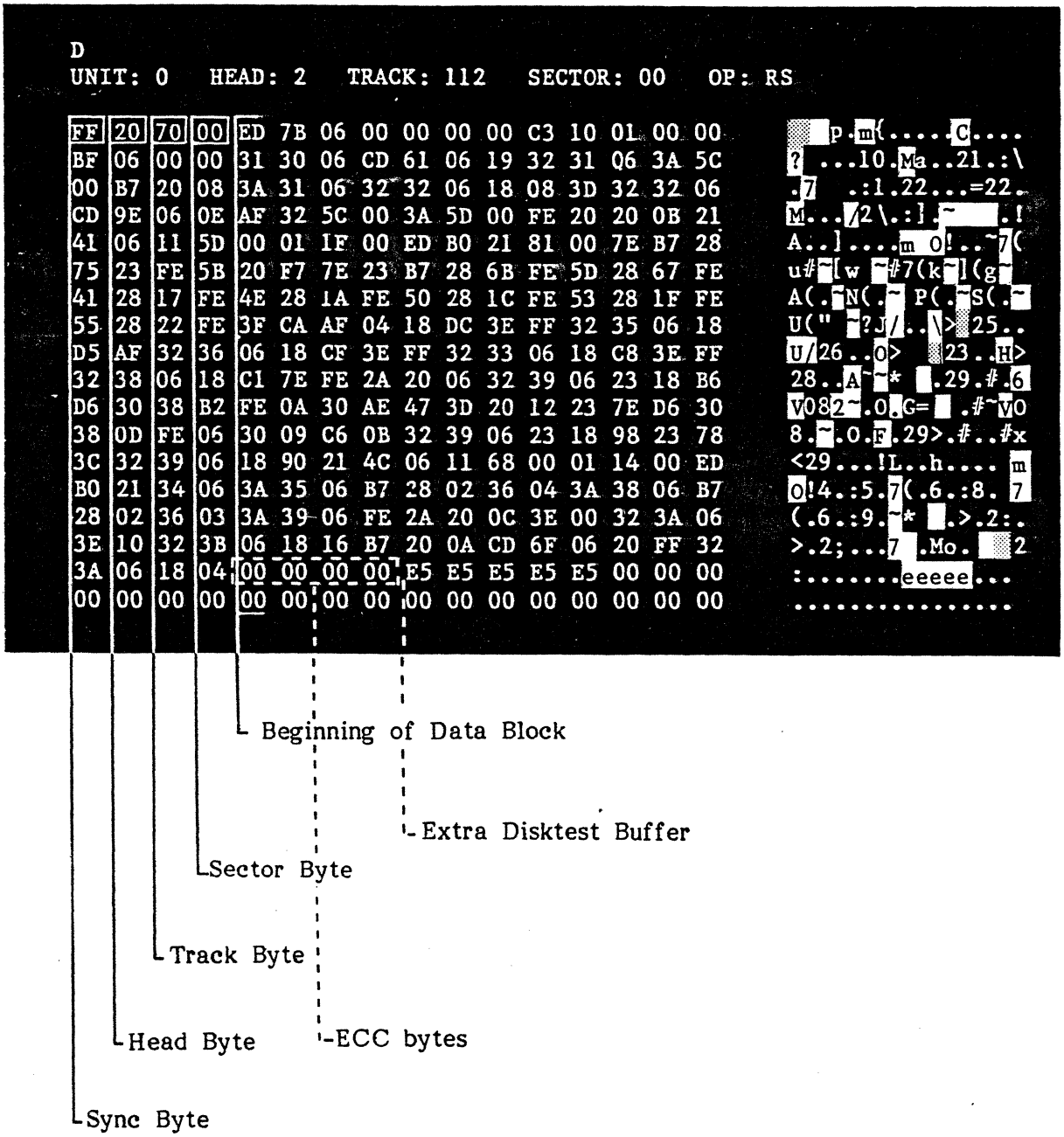


EXHIBIT 1-4A DISPLAY OF DISKTEST BUFFER

The following illustration shows a Dump of a Disktest Buffer from a Double-Sided Floppy Drive. The large block of hexidecimal numbers represent one sector of data along with the various identifying variables. The adjacent block represents these values in an ASCII format.

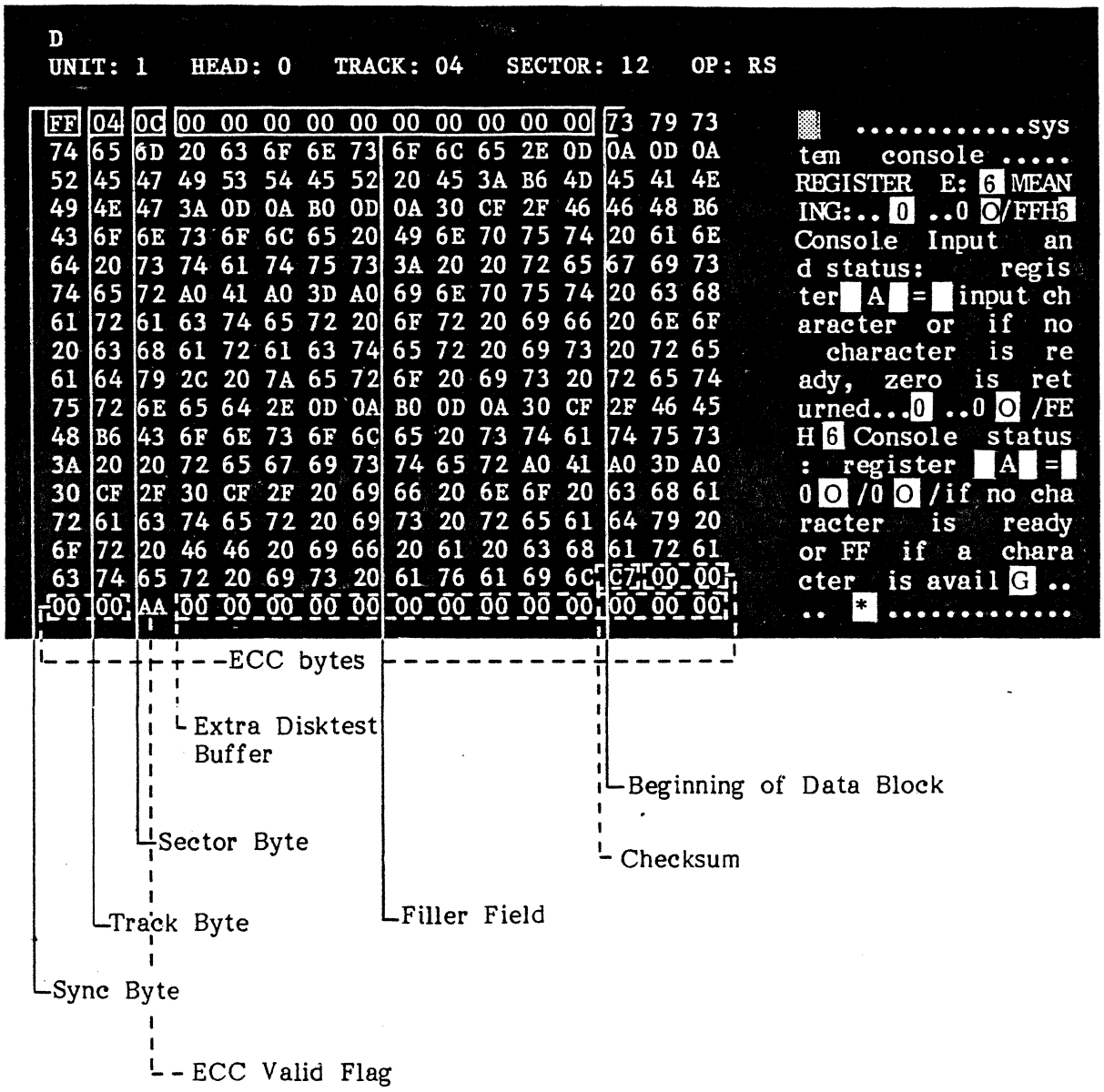
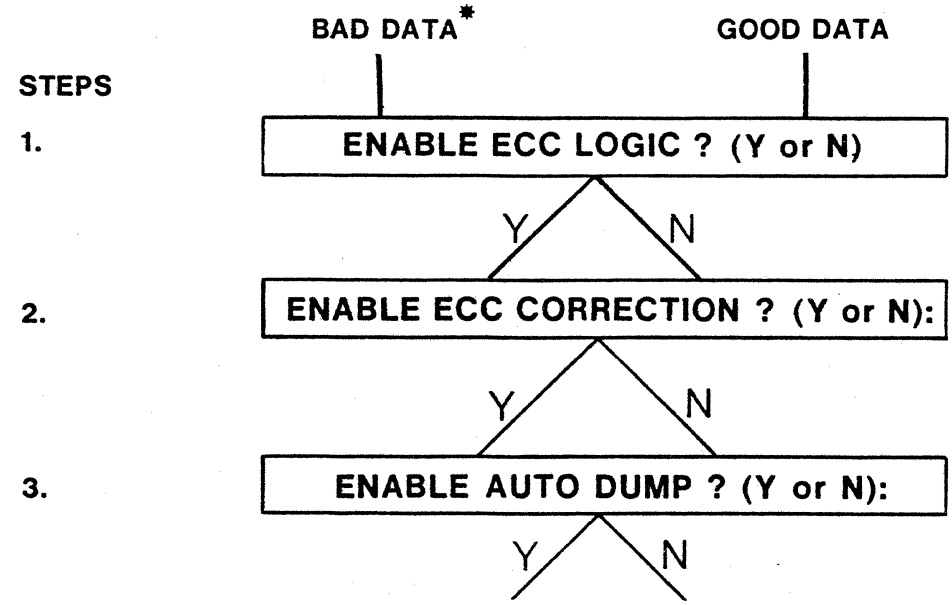


EXHIBIT 1-5 ECC LOGIC USE



* "Bad Data" refers to data which is written to the disk incorrectly. This results in the computation of the ECC Bytes not equaling zero. Refer to the description of the ECC LOGIC Prompt (step 8) for a discussion of ECC Bytes (Section I).

Examples

Good Data	1(Y)	ECC LOGIC is enabled and 4 00H bytes are generated by ECC hardware.
	2(N)	ECC CORRECTION is disabled and software does not correct data.
	3(N)	Operation is executed. This sequence is used for aligning floppy drives (see Section III).
Bad Data	1(Y)	ECC LOGIC is enabled and 4 xxH (x≠0) bytes are generated by the ECC hardware.
	2(N)	ECC CORRECTION is disabled and software does not correct data.
	3(N)	The error reports are normally enabled (default value) and will be displayed. In order to have the error messages disabled it is necessary to press the loop command I following the AUTO DUMP prompt. Sector and track locations are displayed along with error messages. Program continues through this loop (executing specific operation) until interrupt or loop command is entered.
Bad Data	1(Y)	ECC LOGIC is enabled and 4 xxH (x≠0) bytes are generated by the ECC hardware.
	2(Y)	ECC CORRECTION is enabled and software attempts to correct errors in data.
	3(Y)	It is assumed the error reports have been enabled (see second example). If first sector error is correctable, the sector contents will be displayed along with the error message (see Section III). If first sector error is uncorrectable, the sector contents will be displayed along with 4 non-zero ECC bytes and an ECC error message (non-zero ECC bytes represent values from previous disk operation).
Bad Data	1(Y)	ECC LOGIC is enabled and 4 xxH (x≠0) bytes are generated by the ECC hardware.
	2(N)	ECC CORRECTION is disabled and software does not correct data.
	3(Y)	It is assumed the error reports have been enabled (see second example). First sector with error is displayed along with error message. ECC bytes are non-zero (represent ECC value from previous disk operation).

9. After answering these prompts DISKTEST will display a prompt asking if you want an AUTO DUMP. Enabling an AUTO DUMP will cause the program to display the contents of the DISKTEST Buffer and show errors when an error is encountered.* See Exhibit 1-4 for an illustration of a typical DISKTEST Buffer.

   If the AUTO DUMP feature is disabled the DISKTEST Program will execute the operation and note the errors without stopping until the entire media block has been checked. In this example the AUTO DUMP feature is disabled.

   ENABLE AUTO DUMP ? (Y OR N): N

   PASS #xx ERROR = xx

   The PASS/ERROR notation will be displayed for all operations which involve multiple sector READS or WRITES. For single sector operations this notation is not shown on the screen. See step 12 for a further description of this message.

10. While within the Operation Loop you can use either Loop or Editing Commands. These commands are described in Exhibit 1-6.** The editing sub-group of loop commands will cause an exit from the operation loop. Otherwise it is necessary to use one of the interrupt commands to terminate the loop operation.

    If you press [SPACE] you will exit the DISKTEST Operation Loop and go to the SELECT OPERATION Prompt (See Exhibit 1-1). You can now change the operation and/or select a different track, sector, etc. If this is done DISKTEST will automatically give an error message and Current parameter prompts following the completion of the AUTO DUMP prompt. These prompts have the following format.

    ERROR REPORTS ARE ENABLED
    UNIT: x HEAD: x TRACK: xxx SECTOR: xx OP: xxx

11. One particular Loop Command which is helpful in diagnosing and locating specific errors is the "D" or Dump Command. When this command is used the Disktest Buffer is displayed (See Exhibit 1-4).

* In this example error reports are enabled (default value).

** See the Filler Byte Chart in the last part of Section IV for a description of the different filler codes that can be used while within the Operation Loop.

EXHIBIT 1-6 LOOP AND EDITING COMMANDS

Entered Character	Command Description	Screen Display	
LOOP COMMANDS			
C	Displays current parameters.	C	Unit, head, track, sector and operation descriptors.
D	Dumps buffer contents (256 bytes of data plus sector control bytes). Used to check accuracy of buffer's contents-especially when it has been filled with a certain value. Performs a "C" Command prior to Dump.	D	Unit, head, track and sector numbers are located at top of 16 X 18 hex grid. ASCII equivalents are in adjacent column.**
E	Enables error reports. Used during normal operation of DISKTEST to print errors (Default Value)..	E	Error reports enabled.
H	Steps the head value (see + and - commands).	H	
I	Inhibits error reports. Used when aligning Tandon drives.	I	Error reports inhibited.
S	Steps the sector value (see + and - commands).	S	
T	Steps the track value (see + and - commands).	T	
Z	Moves head to "0" track and back to original location. Checks accuracy of head positioning.	Z	Information at original location.
+	Disk head direction is stepped inward. Examples: +TTT causes the head to be stepped 3 tracks (new address is 3 more than old address). +SSS causes head to be stepped 3 sectors (If old address was track 10, sector 15 then the new address would be track 11, sector 2-for a 16 sector disk). + is the default value for all T, S and H movements.*	+	
-	Disk head direction is stepped outward. Examples: see previous command.*	-	
EDITING COMMANDS			
F	Fills the buffer with one of 8 fill patterns or any HEX value. See DISKTEST helpscreen and section 4.2 for a description of the fill patterns.	F	256 byte buffer is filled with pattern.
P	Program buffer with hex value. After P is pressed the 16 X 18 hex grid is displayed on the screen.** You can then go to a specific location (using arrow keys) and make the nibble or byte changes.	P	New bytes are shown on a 16 X 18 hex grid.**

* See Description given in Exhibit 1-7.

** See Exhibit 1-4 for an illustration of a 16 x 18 DISKTEST Buffer Grid.

12. The Stepping Loop Command (+TTT, -TTT, etc.) can be used to move the head either inward or outward. However, it should be noted that using this command changes the interpretation of the PASS/ERROR notation which was described in step 9.

    The PASS/ERROR notation refers to the "logical" completion of a particular multi-block operation. For instance, if a RD operation is implemented (for a floppy system) the PASS message will indicate a pass every time the internal DISKTEST Counter reads 77 tracks shifts heads and reads another 77 tracks.

    This sequence is seen differently when the stepping commands are used. The stepping commands physically move the head to the desired location but they do not RESET the DISKTEST Counter. Exhibit 1-7 shows what a PASS message would be like when two different stepping commands are used during a RP Operation for a floppy drive.

EXHIBIT 1-7 STEPPING COMMANDS

The following chart shows how two stepping commands change the interpretation of the DISKTEST message "PASS #xx ERROR = xx." The example is based on a floppy drive (77 tracks) executing a DISKTEST Read Platter Operation.

TIME	DISKTEST COUNTER	PHYSICAL LOCATION OF HEAD	USER STEPPING COMMAND	DISKTEST MESSAGE
x	0	00		PASS #00 ERROR = 00
x+4	0	20		PASS #00 ERROR = 00
x+5	0	25	+TTTTT	PASS #00 ERROR = 00
x+5.1	0	30		PASS #00 ERROR = 00
x+8	0	45		PASS #00 ERROR = 00
x+13	0	77		PASS #00 ERROR = 00
x+14	1	05		PASS #01 ERROR = 00
x	0	00		PASS #00 ERROR = 00
x+4	0	20		PASS #00 ERROR = 00
x+5	0	25	-TTTTT	PASS #00 ERROR = 00
x+5.1	0	20		PASS #00 ERROR = 00
x+10	0	45		PASS #00 ERROR = 00
x+15	1	72		PASS #01 ERROR = 00
x+16	1	77		PASS #01 ERROR = 00

SECTION II - ERROR MESSAGES AND CORRECTIVE PROCEDURES

2.1 Introduction

Error messages can be displayed during any type of READ or WRITE operation.* Preceding the error message a banner indicating the location of the error will be displayed on the screen.** An example of the error message format is given below. See Exhibits 2-1 and 2-2 for a description of sector formats for the different types of drives.

UNIT: 0 HEAD: 2 TRACK: 112 SECTOR: 15 OP: RD
RESTORE ERROR- Track 0 not found PASS #01 ERRORS = 11

2.2 Error Listing

This error listing has three parts: The error message (in boldface type), definition of the error message [D] and the procedures used to correct the error [C].

It should be noted that DISKTEST does not "re-try" a sector when it encounters an error. For this reason it is recommended that you READ the sector several times before attempting any corrective procedures.

RESTORE ERROR- Track 0 not found.

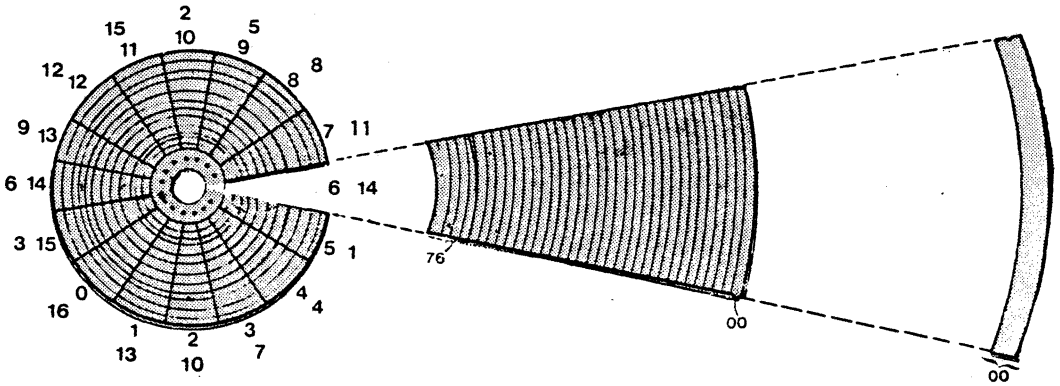
[D]
This error occurs when the drive head has difficulty moving to its starting position at Track 0. The track 0 signal is buffered at the Disk Controller Board.

[C]
Replace drive and/or controller.

* All error messages are displayed unless they are intentionally turned off by using the "I" loop command.

** This example assumes the AUTO DUMP feature was turned off (default value). If AUTO DUMP was enabled the 16 x 18 DISKTEST Buffer (described in previous section) would be displayed after an error was encountered.

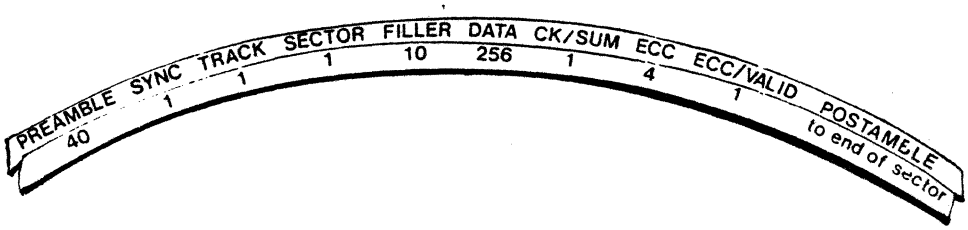
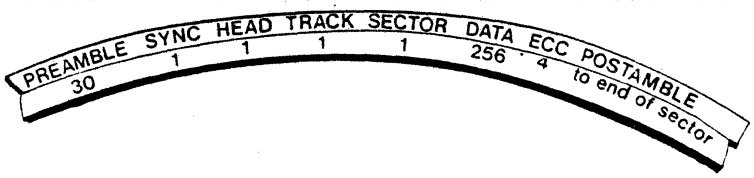
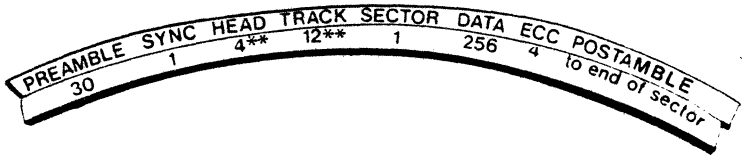
EXHIBIT 2-1 SECTOR FORMATS



DISK

TRACK 00, SECTOR 6 (PHYSICAL)

Each concentric track is divided into sectors. The inner circle of numbers represent the physical location of sectors (used in Sector Formats). The outer ring of numbers denote the logical location of sectors (used by CP/M). This floppy disk has 77 tracks with 16 sectors.

TYPE OF DISK	SPECIFIC SECTOR FORMATS*
5 ¼" Floppy	
5 ¼" Hard (ST 506)	
5 ¼" (ST 4xx) or 8" Hard	

* Field Size given in bytes. See Exhibit 2-2 on next page for descriptions of each field.

** These numbers represent bits. The upper nibble is the HEAD value, the next nibble is the MS TRACK value and the lower byte is the LS TRACK value.

EXHIBIT 2-2 SECTOR FIELD DESCRIPTIONS

SECTOR FIELD DESCRIPTIONS

PREAMBLE: The preamble is a 30 or 40 byte field of 00H data. It provides a tolerance for mechanical and electronic deviations against the sector pulse and a known data pattern. This results in proper synchronization for the read data decoder.

SYNC: The sync byte contains FFH data and is used to determine the beginning of useful data. During a READ, the sync byte is the first data byte to appear in the DISKTEST buffer. During the WRITE operation it follows the preamble.

HEAD: The head field can consist of 1 byte (ST 506), 1 nibble (8" Hard or ST 4xx) and is written to all sectors. NOTE: In a floppy disk system the disk driver derives the head value from the TRACK Data.

The head data is equal to the head number of any given surface and to the value sent on the 'Head Select' lines (to control port). The head data can be used to verify which surface is being accessed.

TRACK: The track field can consist of 1 byte (ST 506, 5 1/4" Floppy) or 12 bits (ST 4xx, 8" Hard). Refer to the chart on page 1-6 for a list of the different track values for each type of drive. The track value can be used to verify which track is being accessed.

SECTOR: The sector byte contains a single byte of data in the following ranges.

5 1/4" floppy disk	0 - 15
5" , 8" hard disk	0 - 31

This byte is equal to the value sent on the 'Sector Select' lines to the control port.

FILLER: The filler is 10 bytes of 00H data. It keeps the data field located at a "standard" location within the sector. This field is used only for floppies.

DATA: The data field consists of 256 bytes of user data.

CHECKSUM: The checksum is 1 byte of data resulting from the software add with carry instruction. It covers all bytes from the track byte through the last byte of the data field. This field is used only for floppies.

ECC: The Error Correction Codes (4 hardware generated bytes) are automatically inserted into the sector after the last byte of the data field. When performing a READ operation the controller calculates a new ECC and compares it with the ECC that was written. If the two numbers match the 4 bytes will contain 00H values. If another value is found in the ECC bytes the error correction software will attempt to correct and rectify it (see section I).

ECC VALID: This byte is AAH when ECC is valid. Any other value indicates that the ECC is not being used.

POSTAMBLE: The postamble is a field of 00H data from the end of the ECC byte to the next sector pulse. The controller will use as many zeros as required for each particular sector.

TIMEOUT ERROR- on seek complete.

[D]
This error occurs if the Disk Controller never received and/or transmitted the SEEK signal. This signal comes from the disk drive and indicates that the track was located and the drive head had settled.

[C]
Replace drive and/or controller.

TIMEOUT ERROR- on controller busy.

[D]
Floppy Disk Drive- This type of drive generates sector pulses through the interpretation of the sector holes located on the inside perimeter of the diskette. Therefore this error could be due to two factors: A disk drive that is not generating the sector pulses or a disk controller not sensing the sector pulses.

This error could also be displayed if the sector number given to the the Disk Controller is larger than the highest valid sector on the disk. In this case the Disk Controller would not be able to locate the requested sector.

Hard Disk Drive- In a hard disk system an index pulse comes from the drive and is sent to the controller. This pulse is used by the controller to generate the sector pulses. Therefore this error could be generated if either the drive and/or the controller are not functioning properly.

[C]
Replace drive and/or controller.

SELECT ERROR- Controller not jumpered for hard disk at unit 0

[D]
A SELECT ERROR message occurs if Jumper Areas A and B on the Controller Board are not jumpered or are jumpered incorrectly. You can also get this error message if you answered the beginning prompt incorrectly. i.e. The prompt which asked you what drive is used as "physical drive 0" (See Section I, prompt 7).

[C]
Check Jumper Areas A, B and make sure they are jumpered correctly.

	Hard Drive Systems	Floppy Drive only Systems
Jumper Area A	1 to 2	2 to 3
Jumper Area B	1 to 2	none

SELECT ERROR- Controller not jumpered for floppy at unit 0.

[D]
This SELECT ERROR only occurs with floppy disk systems. It is due to either incorrect jumpering of areas A and B on the controller board or answering the "physical drive" prompt incorrectly.

[C]
Check Jumper Areas A and B (See description for previous error message).

SELECT ERROR- Drive not ready.

[D]
This error is only generated with hard disk systems. It means the disk drive motor is not functioning properly or the voltage tolerances on disk drive are not at the correct levels. *

[C]
Replace drive and/or controller.

* The LED on the front panel of the drive (floppy and hard disks) receives its power from the Controller Board. Therefore if this light is not working the Controller Board should be checked.

CONTROLLER ERROR- Loss of sync.

[D]
A CONTROLLER ERROR only occurs in hard disk systems. This occurs when the phase locked loop system does not allow for proper generation of the sector pulses. This error can also occur if the the drive is not maintaining the correct speed.

[C]
Replace drive and/or controller.

READ ERROR- sync byte not FF.

[D]
This READ ERROR occurs if the Sync Byte is not FF.

[C]
Check data fields and re-write the sector. This is accomplished by doing several steps:

1. Use DISKTEST to READ the sector and the "P" editing command to dump the sector contents on the screen. The "P" editing command also allows you to move the cursor with the arrow keys.
2. Locate the data field (see Exhibit 1-4) in the 16 x 18 grid and make sure it contains the proper values. If the sector contains ASCII Text you can compare the hex values in the hex, data field (16 x 18 grid) with the ASCII values in the ASCII, data field.
3. If there are faulty byte(s) correct them by moving the cursor to the location of the incorrect byte and changing it.
4. Re-write the sector.
5. Check sector by using a READ Operation again.

READ ERROR- head byte in error.

[D]
This READ ERROR occurs if the Head Value is not correct or is in the wrong position.
[C]
Rewrite the sector using the WVS command.

READ ERROR- track byte in error.

[D]
This READ ERROR occurs if the Track Value is not correct or is in the wrong position.

[C]
Follow the procedure used to correct head byte error.

READ ERROR- sector byte in error.

[D]
This READ ERROR occurs if the Sector Value is not correct or is in the wrong position.

[C]
Follow the procedure used to correct head byte error.

READ ERROR- read/write checksums don't match.

[D]
This READ ERROR occurs only in floppy disk operations. Checksums are generated during the writing of a sector by adding up the hex value for the identifying variables (head, sync bytes, etc.) and data. During the reading of a sector a new checksum is generated by the same adding procedure. The system software then compares the two checksum values to make sure they are equal.

This particular checksum error occurs during a WVP, WVD, WVT or WVS operation. In these cases the checksums don't match or are in the wrong position. See **READ ERROR- checksums don't match** error message.

[C]
Refer to the procedure used to correct head byte error.

READ ERROR- ecc byte is non-zero.

[D]
This occurs if ECC CORRECTION is turned off and the ECC Bytes are not zero. See **CORRECTABLE ECC ERROR** and **UNCORRECTABLE ECC ERROR** messages.

[C]
Check data fields in DISKTEST Buffer and see if any bytes are incorrect. Refer to the procedure used to correct sync byte error.

READ ERROR- floppy checksums don't match.

[D]
This READ ERROR occurs if the checksums don't match or are in the incorrect positions (for floppy drives only). Unlike the previous checksum error message (**READ ERROR- read/write checksums don't match**) this message only occurs when DISKTEST is reading. i.e. DISKTEST compares the checksum that was already on the sector with the new checksum generated during the reading operation.

[C]
Refer to the corrective procedure given in the description of the READ ERROR- read/write checksums don't match error message.

CORRECTABLE ECC ERROR: OFFSET = 0000 PATTERN = 0000

[D]
This error message is printed if the ECC CORRECTION prompt is enabled and a soft (correctable) ECC error occurs and is corrected. The OFFSET Field is a hexidecimal number that represents the number of bytes the correctable byte is offset from the Head Byte.* Refer to the 16 x 18 grid shown in Exhibit 1-4.

The PATTERN Field represents a hexidecimal number used to correct (by X-ORing) the faulty byte. The PATTERN Field contains two bytes even though only one byte may be incorrect.

An example of how the OFFSET and PATTERN Fields are used is given below:

Location and description of faulty byte

- The faulty byte is located on a 32 MB Hard Disk.
- The faulty byte is correctable.
- The faulty byte is currently 3D and the correct value is 3A.
- The faulty byte is followed by a byte with a correct value of 5D.

Description of Fields

- The OFFSET Field = 0037 [55_{10} position from the head byte]
- The PATTERN Field =0700 [The incorrect byte was 3A and the following byte was 5D (correct value)]

[C]
This message is only given when the system software can correct an ECC ERROR. Hence there are no specific corrective procedures which the user would implement.

UNCORRECTABLE ECC ERROR: ECC BYTES = xx xx xx xx

[D]
This error message shows four ECC Bytes. The complete 32 bit ECC block is computed as an individual entity. For this reason you cannot easily determine what specific byte may be faulty.

Correct data shows all ECC bytes equalling zero. Incorrect data shows ECC Bytes with any combination of numbers. For example invalid data could have ECC Bytes which have several zeros This could include: 12 00 00 00, 00 00 00 01, 12 34 21 71.

* In a floppy system the OFFSET Field is the number of bytes the correctable byte is offset from the Track Byte.

The **UNCORRECTABLE ECC ERROR** message occurs when the ECC CORRECTION is enabled and an uncorrectable error (hard error) occurs in the Head or Data Fields. i.e. the ECC CORRECTION mechanism cannot generate the non-zero ECC Bytes. This could be due to one or a combination of the following problems:

- Media error: The bits that were set during the WRITE Operation changed during the READ Operation.
- Controller or drive not correctly transmit bits.

[C]
Check identifying variables (not sync byte), data fields and see if any bytes are incorrect. If there are any incorrect bytes change them and check the updated sector by using the procedure given in the description of the **READ ERROR-sync byte not FF** error message.

Replace drive and/or controller. In the case of a floppy drive it might be necessary to replace the floppy disk. The floppy disk may have dust particles or other material on its surface which can cause disk errors. Also make sure the floppy diskette complies with the standard Vector Graphic disk drive protocol. i.e. proper density and quality.

If the above procedures don't work it may be necessary to use RECLAIM to salvage the viable sectors. See Section IV for a description of this procedure.

SECTION III - USING DISKTEST FOR ALIGNING DOUBLE-SIDED, FLOPPY DRIVES

3.1 Introduction

Before aligning your double-sided, floppy drive review Section II of the 5-1/4" DISK DRIVE-TECHNICAL INFORMATION MANUAL (P/N 7200-1601). This section gives specific background information on cats eye (CE) and Index adjustment procedures.

DISKTEST allows you to position the drive head to any track on your alignment diskette. After the correct track has been located you can have DISKTEST read that particular track as many times as is required by your alignment procedure. At any time you can exit the operation loop by using an interrupt command.

The following example gives the procedure used to align the doubled-sided drive in a 3005 system.

3.2 Operating Procedure

1. Make sure the system is turned off with no diskette in the floppy drive. Disconnect drive mounting and slide drive forward out of frame to access drive logic PCBA. Connect oscilloscope probes to appropriate test points and adjust oscilloscope.

2. Insert your Vector Graphic, double-sided alignment diskette (P/N 1009-0008) into the floppy drive.

3. Load DISKTEST into the system (from hard disk) by typing DISKTEST following the CP/M prompt and press "Y" to continue the program. Answer the following prompts by typing in the response which is underlined.

SELECT OPERATION (? FOR HELP): RT
SELECT UNIT: (0 THRU 3): 1
SELECT HEAD: (0 THRU 1): 1
SELECT TRACK: (0 THRU 76): 36 ([RETURN] not pressed)
SELECT SECTOR: (0 THRU 15): 00 ([RETURN] not pressed)

4. The default values are entered for the next 3 prompts (pressing [RETURN]).

ENABLE ECC LOGIC ? (Y OR N): Y
ENABLE ECC CORRECTION ? (Y OR N): N
ENABLE AUTO DUMP ? (Y OR N): N

5. Since the double-sided drive uses two heads it is necessary to toggle between each head to obtain a proper "cats eye" comparison. This is accomplished by pressing H every time you want to shift heads. The C key can be used between toggling to keep you informed of your location.

6. After the "cats eye" adjustment has been completed press [SPACE] to jump back to the SELECT OPERATION Prompt. Press [RETURN] for all the prompts except the SELECT TRACK Prompt. For this prompt enter 61.

7. Press [RETURN] for the remaining prompts and check the "index pulse".

8. After the "index pulse" has been checked exit the DISKTEST Operation Loop by pressing [SPACE]. Press [RETURN] for all the prompts except the SELECT TRACK Prompt. For this prompt enter 11.

9. Check other "index pulse" and make any necessary adjustments. Review the discussion of the alignment procedure, in the 5 1/4" DISK DRIVE MANUAL, to make sure all disk adjustments have been completed before exiting the program.

SECTION IV - USING DISKTEST WITH RECLAIM

4.1 Introduction

RECLAIM is a program for use with all disk systems (except 2800) running the Vector Graphic CP/M operating system.* It will read and validate each sector of the user section of the disk. If any errors are encountered in the file space, the program will record and store the address of the bad sector and prevent other programs from using that space.

Occasionally your system may produce sporadic errors which RECLAIM cannot locate (RECLAIM makes a single pass). In this case you can use DISKTEST to locate the bad sector and make it usable (by re-writing the sector several times) or make it unusable (by writing incorrect data in sector). If the sector is made unusable RECLAIM can be utilized to salvage the rest of the disk by reclaiming the bad sector. The following steps show how these procedures are accomplished.

4.2 Operating Procedure

LOCATE AND RE-WRITE BAD SECTOR

1. Load in DISKTEST and go through the beginning prompts using the protocol described in Section I. Use RD for the SELECT OPERATION command and [RETURN] for all the prompts (default values are used**) except the ECC CORRECTION Prompt. For this prompt enter "Y".

* See EXTENDED CP/M ADVANCED PROGRAMMER'S MANUAL or the VECTOR 4 CP/M PROGRAMMER'S GUIDE for a complete explanation of the RECLAIM program. RECLAIM will only save those sectors (in 1 CP/M block increments) which have read errors.

** See Exhibit 4-1 for a chart of the default values for each prompt.

EXHIBIT 4-1 DEFAULT VALUES

The DISKTEST Prompts can be answered by using the [RETURN] Key. This will cause the default or previous value to be entered. The following chart gives the default values for two situations: First and second (or greater) entry into the program.

See Exhibit 1-1 for an example of how and when the [RETURN] Key could be used.

Prompt	First Entry Into Program	Second or Greater Entry Into Program
SELECT OPERATION (? FOR HELP):	RS	Previous Value
SELECT UNIT (0 THRU 3):	0	Previous Value
SELECT HEAD (0 THRU x):	0	Previous Value
SELECT TRACK (0 THRU xx):	00 *	Previous Value
SELECT SECTOR (0 THRU xx):	00	Previous Value
ENABLE ECC LOGIC? (Y OR N):	Y	Previous Value
ENABLE ECC CORRECTION? (Y OR N):	N	Previous Value
ENABLE AUTO DUMP? (Y OR N):	N	Previous Value
Error Reports	Enabled	Previous Value

* For a hard disk system this value can have up to three digits.

During this step you may see several error messages indicating the type of error. When an error is encountered the sector location along with the error message will be displayed. In the case of multiple errors the screen will display error messages interlaced between sector descriptions and the number of "PASSES and ERRORS". A section of a multiple error display for a RT operation is shown below.

UNIT: 0 HEAD: 2 TRACK: 112 SECTOR: 15 OP: RD
TIMEOUT ERROR- on controller busy PASS #01 ERROR = 45
UNIT: 0 HEAD: 2 TRACK: 112 SECTOR: 00 OP: RD
SELECT ERROR- Drive not ready.
UNIT: 0 HEAD: 2 TRACK: 112 SECTOR: 01 OP: RD
SELECT ERROR- Drive not ready.
UNIT: 0 HEAD: 2 TRACK: 112 SECTOR: 01 OP: RD
TIMEOUT ERROR- on controller busy

2. After the bad sector(s) are located evaluate the error message(s). If the error message(s) indicate there is a hardware problem then specific measures must be taken to correct them before you can proceed. Refer to Section II for a description of the different types of error messages along with the corrective procedures.

   The error message(s) may be one of the following:

   CORRECTABLE ECC ERROR: OFFSET = 0000 PATTERN = 0000
   UNCORRECTABLE ECC ERROR: ECC BYTES = 00 00 00 00

   For either of these error messages or any of the READ ERROR messages it is necessary for you to inspect the questionable sector and see if the data bytes (Hex and ASCII data fields) have the correct values. If they don't have the correct values, change the appropriate bytes by using the procedure which was described in Section II. i.e. The procedure used to correct a faulty Sync Byte. NOTE: The rest of steps will discuss how to RECLAIM one sector. These procedures can be used repeatedly if you want to RECLAIM more than one sector.

   If the sector contains the correct data then re-write the sector several times.

3. Read the faulty sector again to see if the re-writing and/or other corrective procedures were successful. If they were not successful go to the next group of procedures.

MODIFY BAD SECTOR

1. Use the RS operation command and go through the prompts pressing [RETURN] to enter the previous values of SELECT UNIT, HEAD, TRACK and SECTOR. This is followed by disabling ECC LOGIC, ECC CORRECTION and AUTO DUMP.

2. Press F P3 and the buffer (of the bad sector) will be filled with 00H bytes (See chart at bottom of page). The program will then exit from the operation loop and you will see the OPERATION SELECT Prompt. Enter WS and press <RETURN>.

3. Use the default value (pressing <RETURN>) for the next four prompts.

4. Press N in response to the **ENABLE ECC LOGIC ? (Y OR N):** prompt. The rest of the prompts can be answered with the default value.

5. This procedure will result in a bad sector (with incorrect SYNC byte) being written to the disk. You can go through the operation loop again (using the RS command with ECC Logic On) and see the **READ ERROR-sync byte not FF** error displayed.

6. Load RECLAIM and reclaim bad sector.

Fill Patterns			
P1	Binary Count	P5	1010101010 (0AAH)
P2	Random Data	P6	0101010101 (055H)
P3	All Zeros	P7	Standard Format (0E5H)
P4	All Ones	P8	Special Fill