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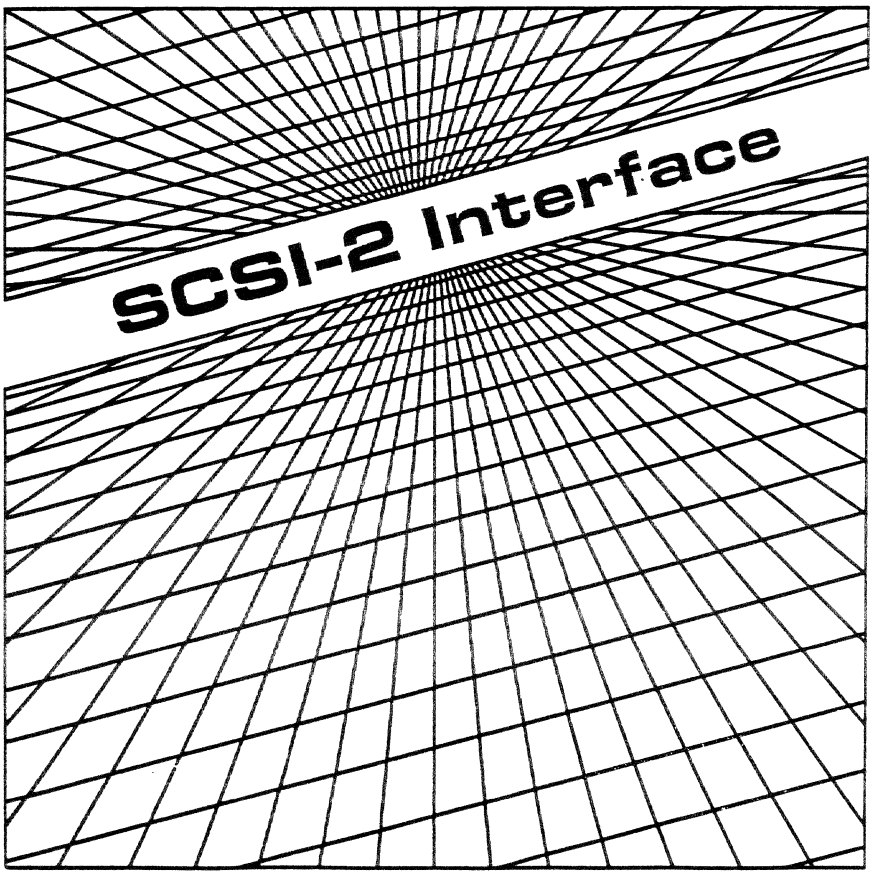
HP 97540 T/P Series 5.25-inch Disk Drives

SCSI-2 Technical Reference Manual



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SCSI-2 Interface

Introduction

This chapter describes the implementation of the Small Computer System Interface, SCSI-2 on the HP 9754XT/P Disk Drives. The information includes an overview of the SCSI-2 features, options, and commands supported by these products. Any operating characteristics relevant to SCSI-2 implementation are also discussed. In this chapter the term Target refers to the HP 97540 T/P Series of Disk Drives.

Table 1-1 provides a list of all the commands supported by the Target and identifies which commands are SCSI implementations and which commands are Vendor Unique implementations.

Chapter 2 provides detailed descriptions of the SCSI-2 commands supported by the Target. These descriptions include Command Descriptor Block (CDB) formats, data formats, and all device specific information involved in command execution. For further command specefic details, refer to the ANSI SCSI-2 Specification.

Chapter 3 provides descriptions of the Vendor Unique commands supported by the Target. These descriptions include Command Descriptor Block (CDB) formats, data formats, and all device specific information involved in command execution.

Supported Features

The Target support the following features and options:

- **Single-Ended and Differential Drivers.** The standard product supports single-ended drivers. Differential drivers are available, as an option.
- **SCSI Connector.** The Target is equipped with a 50-pin unshielded connector.
- **Arbitration.** Full arbitration is supported.
- **Disconnect.** If allowed, the Target may disconnect after a command is received, and for any significant delay occurring during a data transfer operation.
- **Power-On.** In response to a Power-on condition, the Target performs the following power-on time sequence:
  - Microprocessor Self Test
  - ROM Checksum
  - Microprocessor RAM Test
  - Partial Buffer RAM Test
  - SCSI-2 Interface Test
  - Internal Data Path Test
  - Data Controller Test
  - Controller Initialization

- Remaining Buffer RAM Test
- ECC Verification Test
- Wait For Start Command (if necessary)
- R/W Access Test (each head)
- Initialize Spare Table
- Initialize Log
- Initialize Saved Pages Information

- **Bus Reset.** In response to a SCSI-2 bus reset or Bus Device Reset message, the Target will perform the following reset time sequence:
  - Finish any Logical Block Write in Progress
  - Abort Any Command in Progress
  - Controller Initialization
  - Initialize Spare Table
  - Initialize Log
  - Initialize Saved Pages Information
- **SCSI-2 Messages.** The following SCSI-2 messages are supported:

Code (hex)	Length (bytes)	Message	Direction*
00	1	Command Complete	In
01	2**	Extended Message to Follow	In/Out
02	1	Save Data Pointers	In
03	1	Restore Pointers	In
04	1	Disconnect	In
05	1	Initiator Detected Error	Out
06	1	Abort	Out
07	1	Message Reject	In/Out
08	1	No Operation	Out
09	1	Message Parity error	Out
0C	1	Bus Device Reset	Out
80-FF	1	Identify	In/Out

* In = Target to Initiator; Out*Initiator to Target.
** 2nd byte indicates additional length of extended message.

- **Extended Messages.** The following SCSI-2 extended messages are supported:

Code (hex)	Added Length (bytes)	Message	Direction*
01	3	Request for SDTR (Synchronous Data Transfer)	In/Out

- **Status Byte Codes.** The following status byte codes are supported:

Code (hex)	Status
00	Good
02	Check Condition
08	Busy
18	Reservation Conflict

Table 1-1. HP 97540 T/P Series Supported Commands

Command Name	Opcode (hex)	SCSI Command (Chapter 2)	Vendor Unique Command (Chapter 3)
Access Log	F2		*
Execute Data	FE		*
Format Unit	04	*	
Inquiry	12	*	
Log Select	4C	*	
Log Sense	4D	*	
Manage Primary	FD		*
Mode Select (6-byte)	15	*	
Mode Select (10-byte)	55	*	
Mode Sense (6-byte)	1A	*	
Mode Sense (10-byte)	5A	*	
Read (6-byte)	08	*	
Read (10-byte)	28	*	
Read Buffer	3C	*	
Read Capacity	25	*	
Read Defect Data	37	*	
Read Full	F0		*
Read Headers	EE		*
Read Long	3E	*	
Reassign Blocks	07	*	
Reformat Track	ED		*
Release	17	*	
Request Sense	03	*	
Reserve	16	*	
Rezero Unit	01	*	
Seek (6-byte)	0B	*	
Seek (10-byte)	2B	*	
Send Diagnostic	1D	*	
Special Seek	EC		*
Start/Stop Unit	1B	*	
Test Unit Ready	00	*	
Verify	2F	*	
Write (6-byte)	0A	*	
Write (10-byte)	2A	*	
Write and Verify	2E	*	
Write Buffer	3B	*	
Write Full	FC		*
Write Long	3F	*	

Status Byte

A status byte is sent from the Target to the Initiator during the STATUS phase at the termination of each command as specified, unless the command is cleared by an ABORT message, by a BUS DEVICE RESET message, or by a "hard" RESET condition. The status byte format, code values, and code descriptions are shown below.

Status Byte Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Reserved		Status Byte Code					VU=0

Status Byte Code Descriptions

Value					Status	Description
5	4	3	2	1		
0	0	0	0	0	Good	Indicates that Target has successfully completed the command.
0	0	0	0	1	Check Condition	Caused by any error, exception, or abnormal condition that causes sense data to be set. The REQUEST SENSE command should be issued following a CHECK CONDITION status to determine the nature of the condition.
0	0	1	0	0	Busy	The Target is busy. This status is returned whenever a Target is unable to accept a command from an Initiator. The normal Initiator recovery action is to issue the command again at a later time.
0	1	1	0	0	Reservation Conflict	This status is returned whenever a SCSI-2 device attempts to access a logical unit that is reserved to another SCSI-2 device.

SCSI-2 Message Support

The disk drive will support messages out as specified in the SCSI-2 specification (revision 8). Table 5-2 "Message Codes" in the SCSI-2 specification defines those messages which can be embedded in message out strings, and which messages must terminate a message out string.

Supported Messages

A summary of all supported messages and possible combinations appears below. A valid out message string would consist of 0 or 1 messages from each column, in the order given.

Identify	Abort
	Bus Device Reset
	Initiator Detected Error
	Message Parity Error
	Message Reject
	No Operation
	Synchronous Data Transfer Request

In order to eliminate any confusion caused by partial execution of messages containing errors, the Target will not "execute" any messages until the entire string has been checked for syntactic correctness. If any errors are found, all of the messages in the string will be ignored, and the message out phase will be retried.

Message Out Descriptions

- **Identify.** Identify messages are only accepted as the first message in a message out string. Multiple identify messages can be sent from the Initiator for a given command, but these identify messages must be identical except for the disconnect privilege bit.
- **Abort.** The effect of this message depends on whether an identify message has been sent by the Initiator prior to receiving this abort message. If an identify has been sent, then all commands for the specified Initiator/LUN combination are aborted. If no identify message has been sent, then no commands are aborted, the Target simply goes to busfree to terminate this communication. This is compatible with the SCSI-2 specification regarding abort message processing.
- **Bus Device Reset.** This message causes the disk drive to abort all commands and perform a hard reset.
- **Initiator Detected Error.** This will cause the disk drive to retry whatever phase was in progress, if possible, or abort the current command.
- **Message Parity Error.** This will cause the message to be retried.
- **Message Reject.** This message is only valid while the Target is sending a message in to the Initiator. Messages which can be rejected and the actions taken as a result are listed below:
  - Disconnect message in, Save Pointers message in: The Target will not disconnect, and will proceed with the current command. This does NOT prevent the Target from attempting to disconnect from the Initiator at a later time.

- Synchronous Data Transfer Request message in: The Target will assume that all future data transfers will be asynchronous.
- All other messages in: Rejecting other messages will be considered a catastrophic error, and the command will be aborted.

- **No Operation.** This message must be the last message in a message out string (as specified in the ANSI SCSI-2 Specification), and is sent when the Initiator has no other valid messages to send. No action is taken by the Target, and whatever phase was in progress before the message was sent will be restarted or continued, whichever is appropriate.
- **Synchronous Data Transfer Request.** An SDTR message will be accepted at any time by the Target, although the preferred time to receive it is prior to the command phase. All subsequent data transfers for this Initiator will be according to the new negotiated rate. If this message interrupts a data transfer, the transfer will be continued from the point of interruption, at the new rate.
- **Error Condition Processing.** Whenever an error is detected in any SCSI-2 bus phase (either detected by the Target itself or reported by the Initiator via Message Parity Error or Initiator Detected Error messages), the Target will attempt to retry the phase until the maximum retry count is exceeded . If the retry succeeds, operation will continue normally from that point forward. If the maximum retry count is exceeded, this will be considered a catastrophic error, and the command will be aborted.

Command Details

Control Byte

A control byte is the last byte of every Command Descriptor Block (CDB).

Control Byte Format

	Bit							
Byte	7	6	5	4	3	2	1	0
Last	Vendor Unique = 0		Reserved				Flag	Link

Link, Flag. Linked commands are not supported. If either of the LINK and FLAG bits are set to one (1) CHECK CONDITION status with the sense key set to ILLEGAL REQUEST will be returned.

Conventions

The following information applies to all commands:

- The abbreviations "MSB" and "LSB" in the CDB and other descriptor blocks refer to most significant byte and least significant byte, respectively.
- The Target only supports a single Logical Unit (LUN). All commands must be addressed to LUN 0, except an INQUIRY command which may be directed to any LUN.
- All reserved fields in each command must be set to 0.
- All reserved and vendor-unique fields in each command are tested for proper values (normally 0).

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SCSI-2 Command Descriptions

This section provides descriptions of the SCSI-2 commands supported by the Target. Table 2-1 is a list of the SCSI-2 commands supported by the Target with brief descriptions included for each command.

Command Descriptions

Detailed descriptions of the SCSI-2 commands supported by the Target are provided in the following pages. These descriptions include Command Descriptor Block (CDB) formats, data formats, and all device-specific information involved in command execution. For a detailed explanation of the commands, refer to the ANSI SCSI-2 Specification.

Table 2-1. Supported SCSI-2 Commands

Command	Opcode (hex)	Description
Format Unit	04	Formats Target media into Initiator addressable logic blocks. Defect sources include P, D, and G lists (no C list). When formatting, it is recommended that the Initiator not include a D list (FMTDAT=0). However, if the Initiator does include a D list, it must be in the physical sector or bytes from index format. The Target uses an interleave of 1 regardless of the value in Interleave field.
Inquiry	12	Requests that information regarding Target be sent to the Initiator. Target returns 36 bytes of SCSI-2 Standard Product Data. Additional Vital Product Data (VPD) may be supplied if requested by the Initiator.
Log Select	4C	Allows access to the Target's maintenance Logs. Also allows thresholding of logging counters.
Log Sense	4D	Used in conjunction with LOG SELECT to access the Target's maintenance logs and logging counters.
Mode Select (6-byte) (10-byte)	 15 55	Provides a means for Initiator to specify media, logical unit, or drive parameters to Target. The following values are supported: ■ Media Type: 0 ■ Density Code: 0 ■ Number of Blocks: 0 ■ Block Length: 512, 1024, 2048, or 4096 bytes ■ Page Code (hex): 01, 02, 03, 04, 08, 09, 0A, 25

Table 2-1. Supported SCSI-2 Commands (continued)

Command	Opcode (hex)	Description
Mode Sense (6-byte) (10-byte)	 1A 5A	Provides a means for Target to report its media, logical unit, or drive parameters to Initiator. The following CDB values are supported: ■ Page Control Field: **00** (current values); **01** (changeable values); **10** (default values); **11** (saved values) ■ Page Code (hex): 00, 01, 02, 03, 04, 08, 09, 0A, 3F The Target default block size is 512 bytes. Default page parameters are listed in the MODE SENSE command description.
Read (6-byte) (10-byte)	 08 28	Requests Target to transfer data to Initiator. Both 6-byte and 10-byte (extended) command formats are supported. Relative Addressing not supported.
Read Buffer	3C	Used with WRITE BUFFER command to test the Target's data buffer. Recommend executing RESERVE command to guarantee data integrity.
Read Capacity	25	Enables Initiator to request information regarding capacity of logical unit. Use of PMI bit supported. Relative Addressing not supported (REL=0).
Read Defect Data	37	Requests Target to transfer media defect data to Initiator. Target returns P, G, or P+G lists in physical sector or bytes from index format.
Read Long	3E	A SCSI-2 standard command that returns header, data field, and ECC bytes of one logical sector.
Reassign Blocks	07	Requests Target to reassign defective logical blocks to an area on logical unit reserved for this purpose. It is recommended that the defect list contain only one defect location per command.
Release	17	Releases previously reserved logical units. Unit and Third-Party Release supported. Extent Release not supported.
Request Sense	03	Only the Extended Sense Data Format is supported. The Target will return the requested data to the Initiator, including: ■ Sense Key (0-6,B,E) ■ Additional Sense Code ■ Device Errors (DERRORS) ■ Recommended Actions The Bit Pointer and Field Pointer fields are **not used.**

Table 2-1. Supported SCSI-2 Commands (continued)

Command	Opcode (hex)	Description
Reserve	16	Reserves logical units for use of Initiator. Unit and Third-Party Reservations are supported. Extent Reservations are not supported.
Rezero Unit	01	Requests Target to perform a recalibrate and then to seek to logical address 0.
Seek (6-byte) (10-byte)	 0B 2B	Requests Target to seek to a specified address. Both 6-byte and 10-byte (extended) formats are dupported. Target returns GOOD status when seek is complete.
Send Diagnostic	1D	Self-test is supported. If self-test fails, CHECK CONDITION status indicates that results are available via REQUEST SENSE command.
Start/Stop Unit	1B	Both commands are fully supported.
Test Unit Ready	00	Checks Target spindle for proper speed. Target returns GOOD status if drive is up to speed.
Verify	2F	Requests Target to verify the data written on the media by performing a selectable ECC check or a byte compare. Relative addressing not supported. (REL=0).
Write (6-byte) (10-byte)	 0A 2A	Requests Target to write the data transferred by the Intitiator to the media. Both 6-byte and 10-byte (extended) formats are supported. Relative addressing not supported.
Write And Verify	2E	The Target performs a write followed by an ECC verify pass. Relative addressing not supported. (REL=0).
Write Buffer	3B	May be used to test Target's data buffer or download code. To avoid possible data corruption, it is recommended that a RESERVE command be executed prior to the WRITE BUFFER command.
Write Long	3F	Allows Initiator to write one complete physical sector, including header, data, and ECC fields.

Command Use Before Spinup

Table 2-1 provides an overview of the supported SCSI-2 commands and indicates which commands can be used before spinup.

Table 2-2. SCSI-2 Command Overview

SCSI-2 Command	Opcode	Use Before Spinup
Format Unit	04H	N
Inquiry	12H	Y[1]
Log Select	4CH	N
Log Sense	4DH	N
Mode Select (6-byte)	15H	Y[2]
Mode Select (10-byte)	55H	Y[2]
Mode Sense (6-byte)	1AH	Y[2]
Mode Sense (10-byte)	5AH	Y[2]
Read (6-byte)	08H	N
Read (10-byte)	28H	N
Read Buffer	3CH	N
Read Capacity	25H	Y
Read Defect Data	37H	N
Read Long	3EH	N
Reassign Blocks	07H	N
Receive Diagnostic Results	1CH	N
Release	17H	Y
Request Sense	03H	Y
Reserve	16H	Y
Rezero Unit	01H	N
Seek (6-byte)	0BH	N
Seek (10-byte)	2BH	N
Send Diagnostic	1DH	N
Start/Stop Unit	1BH	Y
Test Unit Ready	00H	Y
Verify	2FH	N
Write (6-byte)	0AH	N
Write (10-byte)	2AH	N
Write and Verify	2EH	N
Write Buffer	3BH	N
Write Long	3FH	N

Notes:

1. An Inquiry command that does not involve the use of VPD Page 80H may be used before spinup.
2. Mode Select and Mode Sense commands that do not involve saved pages may be used before spinup.

Format Unit

The FORMAT UNIT command formats the Target media into Initiator-addressable logical blocks according to Initiator defined options. During execution of the FORMAT UNIT command, the Target may perform a media defect management algorithm (which can be controlled by the Initiator using optional forms of the command). Defect management instructions (if any) are contained in the Defect List supplied to the Target in the Data Out phase of the command.

The FORMAT UNIT command ensures that the media is formatted so that all data blocks can be accessed. Any data residing on the media before this command is issued will be lost. Any log information will be cleared by the format operation. The current Mode Select operating parameters will become the saved values.

Format Unit Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 04H							
01	Logical Unit Number			FMTDTA	CMPLST	Defect List Format		
02	Vendor Unique							
03—04	(MSB=03)			Interleave		(LSB=04)		
05	Control Byte							

There are three possible sources of defect location information during execution of the FORMAT UNIT command.

Primary Defect List (Plist)	This is the list of defects, supplied by the original manufacturer, that are considered as permanent defects. The Plist is located outside of the Initiator-accessible logical block space. The Plist is accessible by the Target (to reference while formatting), but is not normally accessible by the Initiator except through the READ DEFECT command. Once created, the original Plist is not subject to change.
Data Defect List (Dlist)	Supplied by the Initiator in the Data Out phase of the FORMAT UNIT command. This list is added to the Glist.
Grown Defect List (Glist)	Maintained by the Target and includes all defects sent to the Target from the Initiator (the Dlist), any defects identified by the Target during previous and current FORMAT UNIT operations, and any defects identified by a REASSIGN BLOCKS command. The Glist does NOT include the Plist.

FMTDTA (Format Data), CMPLST (Complete List). These bits indicate to the Target what to do with the supplied Dlist information.

The FMTDTA bit indicates whether the Initiator will send additional defect information (Dlist) to the Target. If FMTDTA is set to zero (0), there will be no Data Out phase, the Target will not receive a new Dlist and all previous defect information (Plist and Glist) is retained.

If FMTDTA is set to 1, a new Dlist will be supplied by the Initiator. When FMTDTA is 1, the CMPLST bit determines whether or not existing defects in the Glist will be retained during the format. If CMPLST is set to zero (0), the Glist is retained and the Dlist is appended to it. If CMPLST is set to 1, the existing Glist is deleted and replaced by the new Dlist.

Defect List Format. This field must be set to 5 for physical sector format (recommended), or to 4 for bytes from index format, or if the defect list length is zero, to less than 4 (0XX) for block format.

FORMAT UNIT Defect Sources

FMTDTA	CMPLST	Defect List Format Field	Defect List Supplied	Target Instructions
0[1]	X	X X X	No	No Data Out Phase. Retain current Glist.[3]
1	0	1 0 1 or 1 0 0 or 0 X X[2]	Yes	Append new defect list to current Glist.[3]
1	1	1 0 1 or 1 0 0 or 0 X X[2]	Yes	Delete current Glist. Build new Glist with new defect list.[3]

Notes:

1. The preferred option is FMTDTA = 0.
2. Defect list length of zero only.
3. Format Unit command always leaves the Plist unaltered.

Interleave. These bytes specify the order in which logical blocks are related to physical blocks. Any interleave value will be accepted, but the Target will always use its default interleave value of (1) so that logical blocks are placed in consecutive physical order.

Defect List Header

This header provides several optional format control bits, giving the Initiator additional control over the use of the three defect sources, and the formatting option. If the Initiator attempts to select any function not implemented by the Target, the Target will terminate the command with a status of CHECK CONDITION, a Sense Key of ILLEGAL REQUEST, and an Additional Sense code of INVALID FIELD IN PARAMETER LIST.

FORMAT UNIT Defect List Header Format

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	Reserved							
01	FOV	DPRY	DCRT	STPF	IP	DSP	IMED=0	VU=0 -
02—03	(MSB=02) Defect List Length (LSB=03)							

FOV (Format Options Valid). An FOV bit of zero (0) indicates that the Target will use its default settings of the DPRY, DCRT, STPF, IP, and DSP bits. The Initiator will set these bits to zero (0). If any of these bits is not zero, the Target will terminate the command with a status of CHECK CONDITION, a Sense Key of ILLEGAL REQUEST, and an Additional Sense Code of INVALID FIELD IN PARAMETER LIST.

An FOV bit of one (1) indicates that the Target will examine the setting of the DPRY, DCRT, STPF, IP and DSP bits. When FOV is one, these bits are defined as follows.

DPRY (Disable Primary). A DPRY bit of zero (0) indicates that Target will not use portions of the media identified as defective in the Plist for Initiator addressable logic blocks. If the Target cannot locate the Plist or it cannot determine if a Plist exists, it will perform the action specified by the STPF bit.

A DPRY bit of one (1) indicates that the target will not use the Plist to identify defective areas of the media. The Plist is not deleted.

DCRT (Disable Certification). A DCRT bit of zero (0) indicates that the target will perform a vendor-specific media certification operation to generate a list of certification defects. All defects added to the defect list via certification are stored as Glist entries.

A DCRT bit of one (1) indicates that the target will not perform any vendor-specific media certification process or format verification operation while executing the FORMAT UNIT command.

STPF (Stop Format). The STPF bit controls the behavior of the Target when one of the following events occurs:

1. The Target has requested the use of the Plist (DPRY is set to zero), or the Glist (CMPLST is set to zero) and the Target cannot locate the list or determine whether the list exists.
2. The target has been requested to use the Plist (DPRY is set to zero) or the Glist (CMPLST) is set to zero), and the target encounters an error while accessing the Dlist.

A STPF bit of zero (0) indicates that, if one or both of the above conditions occurs, the Target will continue to execute the FORMAT UNIT command. The Target will return CHECK CONDITION status at the completion of the FORMAT UNIT command. The Sense Key will be set to RECOVERED ERROR and the Additional Sense Code will be set to either

DEFECT LIST NOT FOUND if condition 1 described above occurs, or DEFECT LIST ERROR if condition 2 occurs.

A STPF bit of one (1) indicates that, if one or both of the above conditions occurs, the Target will terminate the FORMAT UNIT command with a status of CHECK CONDITION, a Sense Key of MEDIA ERROR, and an Additional Sense Code of either DEFECT LIST NOT FOUND if condition 1 occurred, or DEFECT LIST ERROR if condition 2 occurred.

DSP (Disable Saving Parameter). A DSP bit of one (1) specifies that the Target will not save the MODE SELECT parameters.

IP (Initialization Pattern). An IP bit of one (1) indicates that initialization pattern descriptor is supplied during the Data Out phase, immediately following the Defect List header. An IP bit of zero (0)indicates that no Initialization Pattern descriptor will be sent during the Data Out phase. The Target will use its default initialization pattern when it formats the media.

Initializaiton Pattern Descriptor (if any)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	IP Modifier		Reserved					
01	Pattern Type							
02—03	(MSB=02)		Initialization Pattern Length			(LSB=03)		

IP Modifier. This field specifies the type and location of the header that modifies the initialization pattern.

Bits		Description
6	7	
0	0	No header. Target will not modify initialization pattern.
0	1	Target will modify initialization pattern to write current logical block address at start of logical block. Four bytes of logical block address will be written with MSB first.
1	0	Target will modify initialization pattern to write current logical block address at start of each physical sector contained within the logical block. Four bytes of logical block address will be written with MSB first.
1	1	Reserved

Pattern Type. This field indicates the type of pattern the target will use to initialize each logical block within the initiator accessible portion of the disk. All blocks within a logical block will be written with the initialization pattern. The initialization pattern may be modified by the IP Modifier field as described above.

Pattern Type (byte 01)	Description
00H	Use default pattern. If initialization pattern length is not zero, Target will terminate the command with a status of CHECK CONDITION, a Sense Key of ILLEGAL REQUEST, and an Additional Sense Code of INVALID FIELD IN PARAMETER LIST.
01H	Repeat initialization pattern as required to fill the logical block. If initialization pattern length is zero Target will terminate the command with a status of CHECK CONDITION, a Sense Key of ILLEGAL REQUEST, and an Additional Sense Code of INVALID FIELD IN PARAMETER LIST.
02—7FH	Reserved
80—FFH	Vendor-specific.

Initialization Pattern Length. This field indicates the number of bytes contained in the initialization pattern. If the length exceeds the current logical block size, the target will terminate the command with a status of CHECK CONDITION, a Sense Key of ILLEGAL REQUEST, and an Additional Sense Code of INVALID FIELD IN PATTERN LIST. The pattern may be modified by the IP Modifier field.

Initialization Pattern. This field describes an initialization pattern that should be repeated to fill each sector on the disk.

Initialization Pattern (if any)

	Bit							
Byte	7	6	5	4	3	2	1	0
00—n	Initialization Pattern							

IMED (**Immediate**). The Target does not support the IMED bit. It must be set to zero (0).

VU (**Vendor Unique**). This bit should be set to (0).

Defect List Length. This field specifies the total length in bytes of the defect descriptors that follow and does not include the initialization pattern, if any. The length of the defect descriptors varies with the format of the defect list.

Defect Descriptors (if any)

	Bit							
Byte	7	6	5	4	3	2	1	0
00 to xx	Defect Descriptor 0 (see specific table for lenegth)							
00 to xx	Defect Descriptor n (see specific table for length)							

Defect Descriptor - Bytes from Index Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00—02	(MSB=00) Cylinder Number Of Defect (LSB=02)							
03	Head Number Of Defect							
04—07	(MSB=04) Defect Bytes From Index (LSB=07)							

Each defect descriptor for the Bytes from Index Format specifies the beginning of an 8-byte defect location on the media. Each defect descriptor is comprised of the cylinder number of defect, the head number of defect, and the defect bytes from index. The defect descriptor will be in ascending order. For determining ascending order, the cylinder number of defect is considered the most significant part of the address and the defect bytes from index is considered the least significant part of the address. More than one physical or logical block may be relocated by each defect descriptor.

A defect bytes from index of FFFFFFFFH indicates that the entire track will be reassigned.

Defect Descriptor - Physical Sector Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00—02	(MSB=00)			Cylinder Number Of Defect			(LSB=02)	
03	Head Number Of Defect							
04—07	(MSB=04)			Defective Sector Number			(LSB=07)	

Each physical sector defect descriptor specifies the location of a defect that is the length of a sector. Each descriptor is comprised of a cylinder number of defect, the head number of defect, and the defective sector number. The defect descriptors are in decending order. The cylinder number of defect is the most significant part of the address, and the defective sector number is the least significant part of the address. More than one block may be affected by each defect descriptor.

A defective sector number of FFFFFFFFH indicates that the entire track is considered defective.

Inquiry: HP 97544/48/49 T/P

The INQUIRY command requests that information regarding parameters of the Target be sent to the Initiator.

The INQUIRY command will return a CHECK CONDITION status only when the Target cannot return the requested Inquiry data. Inquiry data will be returned even though the peripheral device may not be ready for other commands. The INQUIRY command will execute even if the drive is reserved to another Initiator.

If an INQUIRY command is received from an Initiator with a pending UNIT ATTENTION condition (before the Target reports CHECK CONDITION status), the Target will execute the INQUIRY command and will not clear the UNIT ATTENTION condition.

Note

An INQUIRY command directed to an invalid LUN ($\neq 0$) will return a Peripheral Device Type of 7FH (Logical Unit Not Present) in byte 0 of the parameter list. This condition is not considered an error. The INQUIRY command will be executed with no error reported even if the Target is reserved by/to a different Initiator.

Inquiry Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 12H							
01	LUN (Logical Unit Number)			Reserved				EVPD
02	VPD Identifier							
03	Reserved							
04	Allocation Length							
05	Control Byte							

EVPD (Enable Vital Product Data) and VPD Identifier. The status of the EVPD bit and the VPD Identifier field determine the information to be returned to the Initiator. The supported combinations are:

EVPD bit	VPD Identifier	Target Will Return:
0	00H	Standard Inquiry Parameter Page
1	00H	Supported VPD Page List
1	80H	Unit Serial Number VPD Page
1	E0H	Manufacturing Information VPD Page

If the EVPD bit is set to zero (0), and the VPD Identifier field is set to one (1), the Target will return a status of CHECK CONDITION, a sense key set to ILLEGAL REQUEST, and an additional sense code of INVALID FIELD IN CDB.

Allocation Length. This field specifies the number of bytes that the Initiator has allocated for returned Inquiry data. An Allocation Length of zero indicates that no INQUIRY data will be transferred. This condition will not be considered as an error. Any other value indicates the maximum number of bytes that will be transferred. The Target will terminate the DATA IN

phase when the specified number of bytes have been transferred or when all available Inquiry data have been transferred to the Initiator, whichever is less.

Standard Inquiry Parameter Page Format

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	Peripheral Qualifier (bits 7 - 5) / Peripheral Device Type (bits 4 - 0) all zero's = requested LUN is supported 7FH = requested LUN is not supported							
01	RMB=0	Reserved						
02	ISO VER = 0		ECMA VER = 0			ANSI VER: 1 = CCS Mode ANSI VER: 2 = SCSI-2 Mode		
03	AENC	Reserved			Response Data Format: 1 = CCS Mode Response Data Format: 2 = SCSI-2 Mode			
04	Additional Parameter Length (n-4)							
05—06	Reserved							
07 CCS Mode	Reserved							
07 SCSI-2 Mode	RELADR = 0	WBUS32 = 0	WBUS16 = 0	SYNC = 1	LINKED = 0	CACHE = 0	CMDQUE = 0	SOFTR = 0
08—15	Vendor Identification Bytes (ASCII)							
08	= H (ASCII)							
09	= P (ASCII)							
10-15	= ASCII Spaces							
16—31	Product Identification Bytes (ASCII)							
16	= 9 (ASCII)							
17	= 7 (ASCII)							
18	= 5 (ASCII)							
19	= 4 (ASCII)							
20	97544: = 4 (ASCII) 97548: = 8 (ASCII) 97549: = 9 (ASCII)							
21	Product ID (ASCII)							
22	Product ID (ASCII)							
23	Product ID (ASCII)							
24	Product ID (ASCII)							
25-31	= ASCII Spaces							
32—35	(MSB=32) Product Revision Number (ASCII) (LSB=35) (4-digit date code)							

Page Code 00H: Supported VPD Page List Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier (bits 7 - 5) / Peripheral Device Type (bits 4 - 0) all zero's = requested LUN is supported 7FH = requested LUN is not supported							
01	Page Code = 00H							
02	Reserved							
03	Page Length = 3							
04	Page Code 00H, Supported VPD Page List							
05	Page Code 80H, Unit Serial Number							
06	Page Code E0H, Manufacturing Information							

Page Code 80H: Unit Serial Number VPD Page Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier = 0			Peripheral Device Qualifier = 0				
01—04	Reserved							
05	VPD Identifier = 80H							
06	Reserved							
07	VPD ASCII Data Length = 0AH							
08—17	Product Serial Number (ASCII)							

Page Code E0H: Manufacturing Information VPD Page Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier = 0			Peripheral Device Type = 0				
01—04	Reserved							
05	VPD Identifier = E0H							
06	Reserved							
07	VPD ASCII Data Length = 50H							
08—17	Manufacturing Product Code							
08	= 9 (ASCII)							
09	= 7 (ASCII)							
10	= 5 (ASCII)							
11	= 4 (ASCII)							
12	97544: = 4 (ASCII) 97548: = 8 (ASCII) 97549: = 9 (ASCII)							
13	= T or P (ASCII)							
14—16	Firmware Identification Number (ASCII)							
17	ASCI Space							
18—27	HDA Serial Number							
28—37	SCSI Firmware Revision Number							
38—47	ESDI Firmware Revision Number							
48—57	Option Pin-set Configurations (0 = open; 1 = shorted)							
48	pin-set 3 (Unit Attention)[1]							
49	pin-set 4 (SDTR)[1]							
50	pin-set 5 (Parity)[1]							
51	pin-set 6 (Auto Spin Up)[1]							

52—54	SCSI Address
	byte 52 = pin-set 7 (bit 2);
	byte 53 = pin-set 8 (bit 1);
	byte 54 = pin-set 9 (bit 0);							

55—57	ASCII Spaces							
58—87	ASCII Spaces							

Notes:

1. Standard switch configuration.

Log Select

The LOG SELECT command allows access to the Target's maintenance logs and allows thresholding of the logging counters.

Log Select Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 4CH							
01	Logical Unit Number			Reserved			PCR	SP
02	PC		Reserved					
03—06	(MSB=03)		Reserved			(LSB=06)		
07—08	(MSB=07)		Parameter List Length			(LSB=08)		
09	Control Byte							

PCR (Parameter Code Reset). A PCR bit set to zero specifies that the log parameters will not be reset. A PCR bit set to one (1) and a Parameter List Length of zero will cause all implemented parameters to be set to the Target-defined default values. If the PCR bit is one (1) and the Parameter List Length is greater than zero, the command will be terminated with a status of CHECK CONDITION, a sense key set to ILLEGAL REQUEST, and the additional sense code set to INVALID FIELD IN CDB.

SP (Save Parameters). An SP bit set to zero (0) specifies that parameters will not be saved. An SP bit set to one (1) instructs the Target to save to non-volatle memory all parameters identified as saveable by the DS bit in the particular parameter page.

PC (Page Control). This field defines the type of parameter values to be selected. Supported values are as follows:

Field Value (binary)	Description
00	Threshold Values
01	Cumulative Values

Parameter List Length. This field specifies the length in bytes of the LOG SELECT parameter list that will be transferred during the DATA OUT phase. The supported lengths are 00H, 02H, 04H, 06H, and 08H. Other lengths will not be accepted. A parameter list length of zero indicates that no data will be transferred. This condition is not considered an error. The Initiator should send pages in ascending order by page code value. If the initiator sends multiple log parameters within a page, they should also be sent ascending order by parameter code value. If the Initiator sends page codes or parameter codes that are out of order, or reserved, or not implemented by the Target, the Target will terminate the command with a status of CHECK CONDITION, a sense key set to ILLEGAL REQUEST, and the additional sense code set to INVALID FIELD IN PARAMETER LIST. Valid parameter list lengths are 0, 2, 4 and 8 only.

Log Select Page/Parameter Formats

The LOG SELECT Parameter List contains a 4-byte header optionally followed by zero or more variable length log parameters defined for that page. Each log parameter begins with a 4-byte header followed by one or more bytes of parameter value data.

Log Select Page Header Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Reserved							
02—03	(MSB=02) Page Length (n - 3) (LSB=03)							

Log Select Parameter Header Format

	Bit							
Byte	7	6	5	4	3	2	1	0
04—05	(MSB=04) Parameter Code (LSB=05)							
06	DU	DS	TSD	ETC	TMC		Reserved	LP
07	Parameter Length (n - 7)							

Log Select Parameter Data Format

	Bit							
Byte	7	6	5	4	3	2	1	0
08—n	Parameter Values							

Page Code. This field identifies which log page is to be transferred.

Page Length. This field specifies the length in bytes of the log parameters to follow. If the Initiator sends a page length that results in the truncation of any parameter, the Target will terminate the command with a status of CHECK CONDITION, a sense key of ILLEGAL REQUEST, and an additional sense code of INVALID FIELD IN PARAMETER LIST.

Note 

The DU, DS, TSD, ETC, TMC, and LP fields are collectively called the parameter control byte.

DU (Disable Update), DS (Disable Save), and TSD (Target Save Disable) Not used in the Log Select Command. The Target will ignore these fields.

ETC (Enable Threshold Comparison). An ETC bit of one (1) will enable threshold checking for this parameter code every time the counter is incremented.

TMC (Threshold Met Condition). These bits specify what condition will trigger the error counter threshold. When the ETC bit is zero (0), this field has no meaning. The supported values for the TMC field are:

Field Value (binary)	Description
00	Every Update of the Cumulative Value
01	Cumulative Value Equal to Threshold Value
10	Cumulative Value Not Equal to Threshold Value
11	Cumulative Value Greater Than Threshold Value

LP (List Parameter). The LP bit specifies the format of the log parameter: a zero (0) specifies that the parameter is a data counter; a one (1) specifies a list parameter (i.e. ASCII text).

Log Select Page Codes

The following codes are supported for the Page Code field in the Log Select page header:

Page Codes (hex)	Parameter Pages
02	Write Errors Counters
03	Read Errors Counters

Parameter Codes for Page 02H, Write Errors Counters, and 03H, Read Errors Counters

The following parameter codes are supported for page codes 02 and 03. These codes are supported for the Parameter Code field in the Log Select parameter header:

Parameter Code (hex)	Description
0000	Errors Recovered With ECC
0001	Errors Recovered By Rewrites (page 02) or Rereads (page 03)
0002	Total Attempts to Rewrite (page 02) or Reread (page 03)
0003	Total Errors Recovered (ECC or Reread)
0004	Total ECC Recovery Attempts
0005	Total Bytes Written (page 02) or Read (page 03)
0006	Total Unrecovered Errors

Log Sense

The LOG SENSE command allows the Initiator to retrieve data from the Target's maintenance logs.

Log Sense Command Descriptor Block (CDB)

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	Opcode = 4DH							
01	Logical Unit Number			Reserved			PPC	SP
02	PC		Page Code					
03—04	(MSB=03)		Reserved		(LSB=04)			
05—06	(MSB=05)		Parameter Pointer		(LSB=06)			
07—08	(MSB=07)		Allocation Length		(LSB=08)			
09	Control Byte							

PPC (Parameter Pointer Control). The PPC bit controls the type of parameters requested from the Target:

A PPC bit set to one (1) instructs the Target to return the specified log page with only those parameter values that have changed since the last LOG SELECT or LOG SENSE command.

A PPC bit set to zero (0) instructs the target to begin the returned data with the parameter code specified in the Parameter Pointer field, and continue returning data for the number of bytes specified in the Allocation Length field. The data returned by the Target will be in ascending order of parameter codes from the page specified in the Page Code field.

A PPC bit set to zero (0) and a Parameter Pointer field set to zero (0) will instruct the Target to return all available log parameters for the page specified in the Page Code field up to the number of bytes specified in the Allocation Length field.

SP (Save Parameters). This bit is not used in the Log Sense command. Use the Log Select command with the SP bit in the CDB set to one (1) to save log parameters to non-volatle memory.

PC (Page Control). This field defines the type of parameter values to be selected. Supported Log Sense values are as follows:

Field Value (binary)	Description
00	Threshold Values
01	Cumulative Values
10	Default Threshold Values (all zeros)
11	Default Cumulative Values (all ones)

Page Code. The following codes are supported for the Page Code field in the Log Sense page header:

Page Codes (hex)	Parameter Pages
00	Supported Parameter Pages
02	Write Errors Counters
03	Read Errors Counters
06	Non-Media Error Events
07	Last n Error Events

Parameter Pointer. This field specifies the beginning parameter code for the returned data. If the Initiator specifies a parameter code larger than the largest code implemented by the Target for the specified page, the Target will terminate the command with a status of CHECK CONDITION, a sense key set to ILLEGAL REQUEST, and the additional sense code set to INVALID FIELD IN CDB.

Allocation Length. This field specifies the length in bytes of the LOG SENSE parameter list that will be transferred during the DATA OUT phase. An allocation length of zero indicates that no data will be transferred. This condition is not considered an error.

Log Sense Page/Parameter Formats

The LOG SENSE Parameter List contains a 4-byte header optionally followed by zero or more variable length log parameters defined for that page. Each log parameter begins with a 4-byte header followed by one or more bytes of parameter value data.

Log Sense Page Header Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Reserved							
02—03	(MSB=02) Page Length (n - 3) (LSB=03)							

Log Sense Parameter Header Format

	Bit							
Byte	7	6	5	4	3	2	1	0
04—05	(MSB=04) Parameter Code (LSB=05)							
06	DU	DS	TSD	ETC	TMC		Reserved	LP
07	Parameter Length (n - 7)							

Log Sense Parameter Data Format

	Bit							
Byte	7	6	5	4	3	2	1	0
08—n	Parameter Values							

Page Code. This field identifies which log page is to be transferred.

Page Length. This field specifies the length in bytes of the log parameters to follow.

Note The DU, DS, TSD, ETC, TMC, and LP fields are collectively called the parameter control byte.

DU (Disable Update). A DU bit set to zero (0) indicates that this parameter is cabable of being updated by the Target. A DU bit set to one (1) indicates that the parameter will not be updated by the Target. This is usually caused by the parameter reaching the maximum allowed value. The DU bit has no effect on threshold values.

If a log counter reaches its maximum value and the RLEC bit in Mode page 0AH is set to one (1), the Target will generate a Sense Code of UNIT ATTENTION (06H), an Additional Sense Code of LOG EXCEPTION (5BH), and an Additional Sense Code Qualifier of LOG COUNTER AT MAXIMUM (02H). This condition will occur after 2×10^{12} bytes have been read or written. A Log Select command with PCR = one (1) and SP = one (1) will clear the log counter. An RLEC bit in Mode page 0AH set to zero (0) will disable the UNIT ATTENTION for this condition.

DS (Disable Save). The Target always reports a DS bit set to zero (0). This indicates that the Target supports saving this parameter to non-volatle memory. (A DS bit set to one (1) specifies that no values will be saved.)

TSD (Target Save Disable). The Target always reports a TSD bit set to zero (0). This indicates that the Target provides a self-defined scheme for saving log parameters. This implicit operation occurs frequently enough to ensure that the cumulative parameter values retain statistical significance (i.e. across a power cycle). (A TSD bit set to one (1) indicates that the Target's self-defined parameter saving scheme is disabled.)

ETC (Enable Threshold Comparison). An ETC bit of one (1) indicates that threshold checking is enabled for this parameter code. When ETC = one (1) and the TMC has been met for a particular log counter, the target will return a CHECK CONDITION on the next command and report a Sense Code of UNIT ATTENTION, an Additional Sense Code of LOG EXCEPTION, and an Additional Sense Code Qualifier of THRESHOLD CONDITION MET

TMC (Threshold Met Condition). These bits specify what condition will trigger the error counter threshold. When the ETC bit is zero (0), this field has no meaning. The supported values for the TMC field are:

Field Value (binary)	Description
00	Every Update of the Cumulative Value
01	Cumulative Value Equal to Threshold Value
10	Cumulative Value Not Equal to Threshold Value
11	Cumulative Value Greater Than Threshold Value

LP (List Parameter). The LP bit specifies the format of the log parameter: a zero (0) specifies that the parameter is a data counter; a one (1) specifies a list parameter (i.e. ASCII text).

Parameter Codes for Page 00H, Supported Pages

Parameter Page 00H will report a Page Length of five bytes, and will contain the supported page codes in the Parameter Value field.

Parameter Codes for Pages 02H, Write Errors Counters, and 03H, Read Errors Counters

These pages are used to log media related events. The following parameter codes are supported for pages 02 and 03. These codes are supported for the Parameter Code field in the Log Sense parameter header:

Parameter Code (hex)	Description
0000	Errors Recovered With ECC
0001	Errors Recovered By Rewrites (page 02) or Rereads (page 03)
0002	Total Attempts to Rewrite (page 02) or Reread (page 03)
0003	Total Errors Recovered (ECC or Reread)
0004	Total ECC Recovery Attempts
0005	Total Bytes Written (page 02) or Read (page 03)
0006	Total Unrecovered Errors

Parameter Codes for Page 06H, Non-Media Error Event Counter

This parameter page is used to log any hardware errors that are not related to the media. The following parameter codes are supported for page 06. These codes are supported for the Page Code field in the Log Sense parameter header:

Parameter Code (hex)	Description
0000	Non-Media Error Count (ANSI)
0001 - 7FFF	Reserved
8000 - F000	Non-Media Error Event Records (in List Parameter Format)
F001 - FFFF	Reserved

Non-Media Parameter Code Notes:

1. Parameter code 0000 (Non-Media Error Count) is a data counter.
2. Parameter Codes 8000 - F000 are list parameters with the following format:

   BLK:nnnnnnnn CYL:nnnn HD:nn SEC:nn ASC:nn DERR:nn CNT:nn

   Where:

   BLK = Logical Block Number (FFFFFFFF if undefined)
   CYL = Physical Cylinder Number
   HD = Physical Head Number
   SEC = Physical Sector Number
   ASC = Additional Sense Code For This Error
   DERR = Device Specific Error Information Code
   CNT = Occurrence Count For This Error

   When the last available parameter code has been used, the Target will report CHECK CONDITION on the next command and return a Sense Code of UNIT ATTENTION, an Additional Sense Code of LOG EXCEPTION, and Additional Sense Code Qualifier of LOG LIST CODES EXHAUSTED.
3. "No entries" in the Non-Media Error Event page is indicated by returning LOG SENSE page 06 with the Page Length field (bytes 02 - 03) set to all zeros.
4. Because there are no threshold related parameters in page 06, the Target will ignore the DS and TMC fields in the parameter header.

Parameter Codes for Page 07H, Last n Error Event Counter

This page is used to log all correctable and non-correctable errors on the media. The following parameter codes are supported for page 07. These codes are supported for the Page Code field in the Log Sense parameter header:

Parameter Code (hex)	Description
0000 - EFFF	Error Events Records (in list parameter format)
F000	Total number of Error Event Records on this Page
F001 - FFFF	Reserved

Last n Parameter Code Notes:

1. Parameter Codes 0000 - EFFF are list parameters with the following format:

   BLK:nnnnnnnn CYL:nnnn HD:nn SEC:nn ERR:nn CNT:nn

   Where:

   BLK = Logical Block Number (FFFFFFFF if undefined)
   CYL = Physical Cylinder Number
   HD = Physical Head Number
   SEC = Physical Sector Number
   ERR = Error Code *
   CNT = Occurrence Count For This Error

   * Allowable Error Codes:
   ? = Unclassifiable Error
   H = Error Occurred in Header Field
   D = Error Occurred in Data Field
   U = Uncorrectable Error
   E = Error Corrected with ECC
   R = Error Corrected with Rewrites/Rereads
   W = Write Fault
   S = Spindle Synchronization Error

   When the last available parameter code has been used, the Target will report CHECK CONDITION on the next command and return a Sense Code of UNIT ATTENTION, an Additional Sense Code of LOG EXCEPTION, and Additional Sense Code Qualifier of LOG LIST CODES EXHAUSTED.

2. Parameter Code F000 is a data Counter. The LP bit is set to zero (0).
3. "No entries" in the Non-Media Error Event page is indicated by returning LOG SENSE page 07 with the Page Length field (bytes 02 - 03) set to all zeros.
4. Because there are no threshold related parameters in page 07, the Target will ignore the DS and TMC fields in the parameter header.

Mode Select, Mode Sense: 97544/48/49 T/P

The MODE SELECT command provides a means for the Initiator to specify media, logical unit, or peripheral device parameters to the Target.

The MODE SENSE command provides a means for a Target to report its media, logical unit, or peripheral device parameters to the Initiator. It is a complementary command to the MODE SELECT command.

Mode Select Command Description

If a MODE SELECT modifies operating parameters that are common to other Initiators, the Target will report CHECK CONDITION status and UNIT ATTENTION Sense Key with Additional Sense Code of MODIFIED PARAMETERS when next accessed by other Initiators but not by the Initiator issuing the MODE SELECT command. This rule does NOT override the normal first access rule for each Initiator, nor does it override the normal rules for INQUIRY and REQUEST SENSE.

Mode Select (6-Byte) Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 15H							
01	Logical Unit Number			PF	Reserved			SP
02—03	(MSB=02)			Reserved		(LSB=03)		
04	Parameter List Length							
05	Control Byte							

Mode Select (10-Byte) Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 55H							
01	Logical Unit Number			PF	Reserved			SP
02—06	(MSB=02)			Reserved		(LSB=06)		
07—08	(MSB=07)			Parameter List Length			(LSB=08)	
09	Control Byte							

PF (Page Format) A PF bit set to one (1) indicates that the data is sent in the SCSI-2 page format. When set to zero (0), the data is sent in the vendor unique format. For this product both formats are the same and the PF bit is ignored.

SP (Save Page) This bit indicates that the Target should save any savable pages sent with this command. If the SP bit is set to one (1), the current block size will also be saved.

Parameter List Length This field specifies the length in bytes of the MODE SELECT parameter list that will be transferred during the DATA OUT phase. A parameter list length of zero indicates that no data will be transferred. This condition is not considered as an error. If non-zero, the parameter length must contain a header and optionally a Block Descriptor (if Block Descriptor Length is 8) and optional Parameter Pages.

The currently supported Parameter Pages are:

Page Codes	Parameter Pages
01H	Read Write Error Recovery Parameters
02H	Device Disconnect/Reconnect Parameters
03H	Direct Access Device Format Parameters
04H	Rigid Disk Drive Geometry Parameters
08H	Cache Control Parameters
09H	Peripheral Device Parameters
0AH	Control Mode Parameters

The minimum page length accepted is 2 bytes (page code plus length). The Page Length field must exactly match the values supplied in the Mode Sense data. Illegal parameter lengths will result in a CHECK CONDITION status with a sense Key of ILLEGAL REQUEST.

Mode Sense Command Description

Mode Sense (6-Byte) Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 1AH							
01	Logical Unit Number			Reserved	DBD	Reserved		
02	PC		Page Code					
03	Reserved							
04	Allocation Length							
05	Control Byte							

Mode Sense (10-Byte) Command Descriptor Block (CDB)

	Bit							
byte	7	6	5	4	3	2	1	0
00	Opcode = 5AH							
01	Logical Unit Number			Reserved	DBD	Reserved		
02	PC		Page Code					
03—06	Reserved							
07—08	(MSB=07)		Allocation Length			(LSB=08)		
09	Control Byte							

DBD (Disable Block Descriptors). This field indicates whether or not the target will return any block descriptors. A DBD bit of zero (0) indicates that zero or more block descriptors will be returned. A DBD bit of one (1) indicates that no block descriptors will be returned.

PC (Page Control). This field defines the Parameter Page type to be returned. The supported values for this field are:

00 = Report Current Values	Returns the parameters set in the last successful MODE SELECT command; or the saved values if a MODE SELECT command has not been executed since the last Power On, Hard Reset, or Bus Device Reset; or the default values if saved values are not available.
01 = Report Changeable Values	The changeable values are listed in the Parameter Values table that follows each of the page format tables.
10 = Report Default Values	The default values are listed in the Parameter Values table that follows each of the page format tables.
11 = Report Saved Values	Returns the saved values of the requested Parameter Pages. (Savable Pages are indicated in the following table and in the title block for each page format table.) The Save Block size is reported in the Block Length field of the Block Descriptor.

Page Code. This field specifies which page(s) are to be returned to the initiator. The target supports the following page codes:

Page Code	Description	Saveable
00H	Return No Pages	n/a
01H	Error Recovery Parameters	Yes
02H	Device Disconnect/Reconnect Parameters	Yes
03H	Direct Access Device Format Parameters	Yes
04H	Rigid Disk Drive Geometry Parameters	No
08H	Cache Control Parameters	Yes
09H	Peripheral Device Parameters	Yes
0AH	Control Mode Parameters	Yes
3FH	Return All Pages	n/a

Allocation Length. This field specifies the number of bytes that the initiator has allocated for returned MODE SENSE data. An Allocation Length of zero indicates that no MODE SENSE data will be transferred. This condition is not considered an error. Any other value indicates the maximum number of bytes that will be transferred. The target will terminate the Data In phase when the specified number of bytes have been transferred or when all available MODE SENSE data have been transferred to the initiator, whichever is less.

The Allocation Length field is also used by the Target to Auto-Configure to the SCSI Interface version in use by the Initiator.

Six-Byte Parameter Formats

The 6-byte parameter formats contains a 4-byte header followed by an optional Block Descriptor, followed by the requested page.

6-Byte Parameter List Header Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Sense Data Length							
01	Media Type = 0							
02	Device Specific Parameters = 0							
03	Block Descriptor Length							

6-Byte Block Descriptor Format (Optional)

	Bit							
Byte	7	6	5	4	3	2	1	0
04	Density Code = 0							
05—07	(MSB=05) Number Of Blocks = 0 (LSB=07)							
08	Reserved							
09—11	(MSB=09) Block Length (LSB=11)							

Parameter List Page Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	PS [1]	Reserved	Page Code					
01	Page Length in Bytes							
02—nn	Page Parameters Refer to the Parameter Specification Tables that follow.							

Notes:

1. PS bit valid for Mode Sense only; must be zero (0) for Mode Select.

Ten-Byte Parameter Formats

The 10-byte parameter formats contains an 8-byte header followed by an optional Block Descriptor, followed by the requested page.

10-Byte Parameter List Header Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00—01	(MSB=00) Sense Data Length (LSB=01)							
02	Media Type = 0							
03	Device Specific Parameters = 0							
04—05	Reserved							
06—07	(MSB=06) Block Descriptor Length (LSB=07)							

10-Byte Block Descriptor Format (Optional)

	Bit							
Byte	7	6	5	4	3	2	1	0
08	Density Code = 0							
09—11	(MSB=09) Number Of Blocks = 0 (LSB=11)							
12	Reserved							
13—15	(MSB=13) Block Length (LSB=15)							

Parameter List Page Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	PS [1]	Reserved	Page Code					
01	Page Length in Bytes							
02—nn	Page Parameters Refer to the Parameter Specification Tables that follow.							

Notes:

1. PS bit valid for Mode Sense only; must be zero (0) for Mode Select.

Sense Data Length. This field specifies the length in bytes of the page data to be returned during the Data In phase. The Sense Data Length field does not include itself.

Media Type. Set to all zeros to indicate fixed disk.

Device Specific Parameters. Not used. Set to all zeros.

Block Descriptor Length. This field specifies the length in bytes of the Block Descriptor, and does not include the Parameter Pages. The block descriptor length will be either 0 or 8.

The Block Descriptor specifies the media characteristics for the entire Logical Unit. The Density Code field is 0 (zero), and the Number of Blocks field is 0 (zero), indicating the entire media has the block length returned.

Density Code. Not used. Set to zeros.

Number of Blocks. Set to all zeros indicating that all blocks are set to same size.

Block Length. Indicates logical block size. Set to user configuration.

PS (Page Save). Indicates saveable Mode Sense page when set to one (1). Invalid for Mode Select: must be set to zero (0).

Page Length. Indicates number of bytes remaining in specified page after Page Length field. Used in Mode Select to Auto-Configure to Initiator SCSI interface version.

Auto-Configuration

The SCSI (CCS) and SCSI-2 versions of the SCSI interface specify different formats for pages 01H, 02H, and 04H. The SCSI-2 Mode commands implemented in The HP 97544/48/49 T/P products have the capability to "Auto-Configure" to either of these versions.

The Auto-Configuration function is controlled as follows:

Page 09H, bytes 2 and 3 (Interface Identifier) must be set to 8000H (SCSI Interface).

Page 09H, byte 8, bit 3 set to zero (0) enables Auto-Configuration.

Page 09H, byte 8, bit 3 set to one (1) disables Auto-Configuration.

When Auto-Configuration is disabled, page 09H, byte 8, bit 4 determines the Target's mode configuration: bit 4 set to one (1) = SCSI (CCS); bit 4 set to zero (0) = SCSI-2.

The default mode is determined by the last saved condition of page 09H, byte 8, bit 4. When enabled, the mode configuration will remain in the last set state until changed by one of the following conditions:

Mode Select. If page 01, 02, or 04 is sent, the Target checks the Page Length field in the parameter page and sets the mode as follows:

Page	Page Length	Auto-Configure To:
01	06H	SCSI (CCS)
	0AH	SCSI-2
02	0AH	SCSI (CCS)
	0EH	SCSI-2
04	12H	SCSI (CCS)
	16H	SCSI-2

Mode Sense. If page 01, 02, or 04 is requested, the Target checks the Allocation Length field in the CDB and sets the mode as follows:

Page	CDB Allocation Length		Auto-Configure To:
	With Block Descriptor	Without Block Descriptor	
01	14H	0CH	SCSI (CCS)
	18H	10H	SCSI-2
02	18H	10H	SCSI (CCS)
	1CH	14H	SCSI-2
04	20H	18H	SCSI (CCS)
	24H	1CH	SCSI-2

Parameter Specifications for Supported Pages

The following tables list the parameter formats for all supported pages, their respective default values, and indicates whether the field values are changeable or non-changeable with the Mode Select command. If a field is changeable, the allowable range is given. In addition, the title block for each page indicates whether the page is saveable.

Page Code 01H, Read/Write Error Recovery Parameters (Saveable Page)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	PS [1]	Reserved	Page Code = 01H					
01	Page Length in Bytes: SCSI (CCS) = 06; SCSI-2 = 0A							
02	AWRE	ARRE	TB	RC	EEC	PER	DTE	DCR
03	Read Retry Count							
04	Correction Span							
05	Head Offset Count							
06	Data Strobe Offset Count							
07	SCSI (CCS): Recovery Time Limit (last byte)							
07—11	SCSI-2 Bytes Follow							
07	Reserved							
08	Write Retry Count							
09	Reserved							
10—11	(MSB=10) Recovery Time Limit (LSB=11)							

Notes:

1. PS bit valid for Mode Sense only; must be zero (0) for Mode Select.

Page 01H Parameter Values

Parameter	Default Values (hex)	Changeable Values	Allowable Ranges
AWRE (Automatic Write Reallocation)	0	No	n/a
ARRE (Automatic Read Allocation)	0	No	n/a
TB (Transfer Block)	0	Yes	0 = Disable; 1 = Enable transfer of errored data
RC (Read Continous)	0	No	n/a
EEC (Enable Early Correction)	0	Yes	Ignored; may be set to either 0 or 1
PER (Post Error)	0	Yes	0 = Disable; 1 = Enable Posting recovered errors
DTE (Disable Transfer on Error)	0	Yes	1 = Disable; 0 = Enable transfer on recovered errors
DCR (Disable Correction)	0	Yes	1 = Disable; 0 = Enable error correction
Read Retry Count	08	Yes	Maximum allowable retrys = 255 (FFH)
Correction Span (Bits per Sector)	48	Yes	Rounded up to nearest integer multiple of 24: 0, 24 (18H), 48 (30H), 72 (48H)
Head Offset Count	0	No	n/a
Data Strobe Offset Count	0	No	n/a
Write Retry Count (SCSI-2 only)	0	No	n/a
Recovery Time Limit: SCSI (CCS) Recovery Time Limit: SCSI-2	FF FFFF	Yes	In 1 msec increments; 0 = no retrys allowed; FFH = maximum number of retrys allowed

Page Code 02H, Disconnect/Reconnect Parameters (Saveable Page)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	PS [1]	Reserved	Page Code = 02H					
01	Page Length in Bytes; SCSI (CCS): = 0AH; SCSI-2: = 0EH							
02	Buffer Full Ratio							
03	Buffer Empty Ratio							
04—05	(MSB=04) Bus Inactivity Limit (LSB=05)							
06—07	(MSB=06) Disconnect Time Limit (LSB=07)							
08—09	(MSB=08) Connect Time Limit (LSB=09)							
10—11	**SCSI (CCS):** Reserved (last bytes)							
10—15	**SCSI-2 Bytes Follow**							
10—11	(MSB=10) Maximum Burst Rate (LSB=11)							
12	Reserved							DTDC
13—15	Reserved							

Notes:

1. PS bit valid for Mode Sense only; must be zero (0) for Mode Select.

Page 02H Parameter Values

Parameter	Default Values (hex)	Changeable Values	Allowable Range
Buffer Full Ratio	80	Yes	00 to FF (ratio $n/256$ of buffer)
Buffer Empty Ratio	80	Yes	00 to FF (ratio $n/256$ of buffer)
Bus Inactivity Limit	0000	No	Not used
Disconnect Time Limit	0000	No	Not used
Connect Time Limit	0000	No	Not used
Maximum Burst Rate (SCSI-2 only)	0000	No	Not used
DTDC (SCSI-2 only; Data Transfer Disconnect Control)	00	Yes	■ 00B = Disconnect as controlled by ratios ■ 01B = No disconnect during data transfer ■ 11B = No disconnect during or after data transfer ■ 10B = Reserved

Page Code 03H, Direct Access Device Format (Saveable Page)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	PS [1]	Reserved	Page Code = 03H					
01	Page Length In Bytes: 16H							
02—03	(MSB=02) Tracks per Zone (LSB=03)							
04—05	(MSB=04) Alternate Sectors per Zone (LSB=05)							
06—07	(MSB=06) Alternate Tracks per Zone (LSB=07)							
08—09	(MSB=08) Alternate Tracks per Logical Unit (LSB=09)							
10—11	(MSB=10) Sectors per Track (LSB=11)							
12—13	(MSB=12) Data Bytes per Physical Sector (LSB=13)							
14—15	(MSB=14) Interleave (LSB=15)							
16—17	(MSB=16) Track Skew Factor (LSB=17)							
18—19	(MSB=18) Cylinder Skew Factor (LSB=19)							
20	SSEC	HSEC	RMB	SURF	Reserved			
21—23	Reserved							

Notes:

1. PS bit valid for Mode Sense only; must be zero (0) for Mode Select.

Page 03 Parameter Values

Parameter	Default Value (hex)	Changeable Value	Allowable Range
Tracks per Zone	0001	No	n/a
Alternate Sectors per Zone	0001	No	n/a
Alternate Tracks per Zone	0000	No	n/a
Alternate Tracks per Logical Unit: 97544	0038	No	n/a
Alternate Tracks per Logical Unit: 97548/49	0070	No	n/a
Sectors per Track: 97544/48	0039	No	n/a
Sectors per Track: 97549	0041	No	n/a
Data Bytes per Physical Sector	0200	Yes	Per customer requirement. From 512 (200H)bytes to 522 (20AH) bytes in increments of 2.
Interleave	0001	No	n/a
Track Skew Factor	000C	No	n/a
Cylinder Skew Factor	0012	No	n/a
SSEC (Soft Sectored)	0	No	n/a
HSEC (Hard Sectored)	1	No	n/a
RMB (Removable Media)	0	No	n/a
SURF (Surface Mode Addressing)	0	No	n/a

Page Code 04H, Rigid disk Drive Geometry Parameters (Non-Saveable Page)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	PS [1]	Reserved	Page Code = 04H					
01	Page Length In Bytes: **SCSI (CCS)** = 12H; **SCSI-2** = 16H							
02—04	(MSB=02) Number Of Cylinders (LSB=04)							
05	Number Of Heads							
06—08	(MSB=06) Starting Cylinder, Write Precomp (LSB=08)							
09—11	(MSB=09) Starting Cylinder, Reduced Write Current (LSB=11)							
12—13	(MSB=12) Drive Step Rate (LSB=13)							
14-16	(MSB=14) Landing Zone Cylinder (LSB=16)							
17-19	**SCSI (CCS):** Reserved (last bytes)							
17-23	**SCSI-2 Bytes Follow**							
17	Reserved							RPL
18	Rotational Offset							
19	Reserved							
20—21	(MSB=20) Media Rotation Rate (LSB=21)							
22—23	Reserved							

Notes:

1. PS bit valid for Mode Sense only; must be zero (0) for Mode Select.

Page 04H Parameter Values

Parameter	Default Values (hex)	Changeable Values	Allowable Range
Number Of Cylinders: 97544/48	0005B1	No	n/a
Number Of Cylinders: 97549	000781	No	n/a
Number Of Heads: 97544	08	No	n/a
Number Of Heads: 97548/49	10	No	n/a
Starting Cylinder: Write Precomp (Not Used)	000000	No	n/a
Starting Cylinder: Reduced Write Current (Not Used)	000000	No	n/a
Drive Step Rate	0000	No	n/a
Landing Zone Cylinder	000000	No	n/a
RPL (SCSI-2 only; Rotational Position Locking)	00	Yes	■ 00 = No locking ■ 01 = Lock on input sync signal (sync spindle pin 2) ■ 10 = Provide output sync signal to pin 2 ■ 11 = Not Supported
Rotational Offset (from input sync signal; SCSI-2 only)	00	Yes	0 - 255 - Fraction of a latency $n/256$
Media Rotation Rate (SCSI-2 only)	FA2	No	n/a

Page Code 08H, Cache Control Parameters (Saveable Page)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	PS [1]	Reserved	Page Code = 08H					
01	Page Length In Bytes = 0AH							
02	Reserved					WCE	MF	RCD
03	Demand Read Retention Priority				Write Retention Priority			
04—05	(MSB=04) Disable Pre-Fetch Transfer Length (LSB=05)							
06—07	(MSB=06) Minimum Pre-Fetch (LSB=07)							
08—09	(MSB=08) Maximum Pre-Fetch (LSB=09)							
10—11	(MSB=10) Maximum Pre-Fetch Ceiling (LSB=11)							

Notes:

1. PS bit valid for Mode Sense only; must be zero (0) for Mode Select.

Page 08H Parameter Values

Parameter	Default Values (HEX)	Changeable Values	Allowable Range
WCE (Write Cache Enable)	0	No	n/a
MF (Multiplier Factor)	0	No	n/a
RCD (Read Cache Disable)	0	Yes	1 = Disable; 0 = Enable Track Caching
Demand Read Retention Priority	0000	No	n/a
Write Retention Priority	0000	No	n/a
Disable Pre-Fetch Transfer Length	FFFF	No	n/a
Minimum Pre-Fetch	0000	No	n/a
Maximum Pre-Fetch	0	No	n/a
Maximum Pre-Fetch Ceiling	0	No	n/a

Page Code 09H, Peripheral Device Parameters (Saveable Page)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	PS [1]	Reserved	Page Code = 09H					
01	Page Length In Bytes = 0AH							
02—03	(MSB=02)	Interface Identifier				(LSB=03)		
04—07	Reserved							
08—10	(MSB=08)	Interface Specific Parameters				(LSB=10)		
11	Reserved							

Notes:

1. PS bit valid for Mode Sense only; must be zero (0) for Mode Select.

Page 09H Parameter Values

Parameter	Default Values (HEX)	Changeable Values	Allowable Range
Interface Identifier	8000	Yes	8000 = SCSI; 0002 = ESDI
Interface Specific Parameters	0000	Yes	■ If Interface Identifier = 8000 (SCSI): □ Byte 8, bit 1: 1 = Disable; 0 = Enable Read Out of Order. (Out of Order operation is internal only. All data is transferred in order on the SCSI bus.) □ Byte 8, bit 2: 1 = Disable; 0 = Enable Write Out of Order □ Byte 8, bit 3: 1 = Disable; 0 = Enable Auto-Configuration □ Byte 8, bit 4: 0 = SCSI-2 mode; 1 = SCSI (CCS) mode □ All other bit positions are not used ■ If Interface Identifier = 0002 (ESDI): □ Bytes 8 - 9 = ESDI Command □ Byte 10, bit 1: 0 = Disable; 1 = Enable ESDI status information. Returns CHECK CONDITION with additional Sense Code of NO SENSE. ESDI status information is returned in Information Bytes field of the Request Sense command.[1] □ All other bit positions are not used

Notes:

1. ESDI status information format for Request Sense command, Information Bytes field is listed below:
   a. Bytes 03 (MSB) and 04 (LSB): ESDI Command Status
   b. Byte 05, bits 7—4: Reserved
   c. Byte 05, bit 3: ESDI ATN
   d. Byte 05, bit 2: ESDI Ready
   e. Byte 05, bit 1: ESDI Command Complete
   f. Byte 05, bit 0: Set to 1
   g. Byte 06: Not used

Page Code 0AH, Control Mode Parameters (Saveable Page)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	PS [1]	Reserved	Page Code = 0AH					
01	Page Length In Bytes = 06H							
02	Reserved							RLEC
03	Queue Algorithm Modifier				Reserved		QErr	DQue
04	ECCA	Reserved				RAENP	UAAENP	EAENP
05	Reserved							
06—07	Ready AEN Holdoff Period							

Notes:

1. PS bit valid for Mode Sense only; must be zero (0) for Mode Select.

Page 8A Parameter Values (Saveable)

Parameter	Default Values (HEX)	Changeable Values	Allowable Range
RLEC (Report Log Exceptions)	0	Yes	0 = Disable; 1 = Enable reporting of Log Exception Conditions
Queue Algorithm Modifier	0000	No	n/a
QErr (Queue Error Management)	0	No	n/a
DQue (Disable Queuing)	0	No	n/a
EECA (Enable Extended Contingent Allegience)	0	No	n/a
RAENP (Ready AEN Permission)[1]	0	No	n/a
UAAENP (Unit Attention AEN Permission)[1]	0	No	n/a
EAENP (Error AEN Permission)[1]	0	No	n/a
Ready AEN Holdoff Period[1]	0000	No	n/a

Notes:

1. AEN = Asynchronous Event Notification

Page Code 25H*, VPD Serialization (Saveable Page)

*** Supported for Mode Select Only**

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Reserved	Reserved	Page Code = 25H					
01	Page Length in Bytes: SCSI-2 = 14H							
02	VPD Identifier							
03	Reserved							
04	Peripheral Device Type							
05—08	Reserved							
09	VPD Identifier							
10	Reserved							
11	ASCII Length							
12—21	Product Serial Number (ASCII format)							

Page 25H Parameter Values

Parameter	Default Values (hex)	Changeable Values	Allowable Ranges
VPD Identifier (Bytes 02 and 04)	80	No	n/a
Peripheral Device Type	0	No	n/a
ASCII Length	0A	No	n/a
Product Serial Number (ASCII format)		Yes	This field is set at the factory and is retrieved with the Inquiry command, VPD page 80H. This page must be saved to have any effect.

Read

The READ command requests that the Target transfer data to the Initiator. The Target accepts both the nonextended (6-byte) and extended (10-byte) CDB formats.

Read (6-Byte) Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 08H							
01	Logical Unit Number			Logical Block Address (MSB)				
02—03	(MSB=02)			Logical Block Address				(LSB=03)
04	Transfer Length							
05	Control Byte							

Read (10-Byte) Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 28H							
01	Logical Unit Number			Reserved				REL=0
02—05	(MSB=02)			Logical Block Address				(LSB=05)
06	Reserved							
07—08	(MSB=07)			Transfer Length				(LSB=08)
09	Control Byte							

Logical Block Address. This field specifies the logical block at which the read operation will begin.

Transfer Length. This field specifies the number of contiguous logical blocks of data to be transferred. When using the nonextended (6-byte) CDB format, a Transfer Length of zero indicates that 256 logical blocks will be transferred. When using the extended (10-byte) CDB format, a Transfer Length of zero indicates that no logical blocks will be transferred. This condition is not considered an error (it is functionally equivalent to a SEEK command).

The most recent data value written in the addressed logical block(s) will be returned.

Read Buffer

The READ BUFFER command is used in conjunction with the WRITE BUFFER command as a diagnostic tool for testing Target memory and the SCSI-2 bus integrity. This command does not alter the media or the buffer.

Read Buffer Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 3CH							
01	Logical Unit Number			Reserved		Mode (DB2, DB1, DB0)		
02	Buffer ID							
03—05	(MSB=02)			Buffer Offset			(LSB=05)	
06—08	(MSB=06)			Allocation Length			(LSB=08)	
09	Control Byte							

Mode (DB2, DB1, DB0). The value of this field determines the content and format of the information returned in the data phase. There are three currently supported mode values: Combined Header and Data, Data, and Descriptor. The Combined Header and Data mode is provided for CCS compatibility.

Allocation Length. This field specifies the combined length of the header and buffer data.

Mode Field Configurations

Mode Bits			Mode	Mode Description
DB2	DB1	DB0		
0	0	0	Combined Header and Data (Optional)	A 4-byte header followed by the data bytes is returned during the data phase. The Buffer ID and Buffer Offset fields in the CBD are reserved. The Available Length field in the header specifies the total number of bytes available in the Target buffer. The Allocation Length field specifies the combined length of the header and buffer data.
0	0	1	Reserved	
0	1	0	Data (Optional)	The buffer data is returned in the data phase. The Buffer ID field in the CBD identifies the specific Target buffer containing data to be returned. Currently only buffer 0 is supported. If the Initiator specifies an unsupported Buffer ID, the Target will return a CHECK CONDITION status and will set the sense key to ILLEGAL REQUEST with an additional sense code of ILLEGAL FIELD in CDB. The Buffer Offset field in the CDB should contain the byte offset within the specified Target buffer. The Initiator should conform to the offset boundary requirements returned in the Descriptor mode.
0	1	1	Descriptor (Optional)	Returns a maximum of four bytes of descriptor information for the buffer specified by the Buffer ID field in the CDB. If there is no Target buffer associated with the BUFFER ID field, the Target will return all zeros in the Descriptor. The Buffer Offset field in the CDB is reserved. The Initiator should set the Allocation Length field in the CDB to four or greater. The Target will return the boundary alignment within the specified buffer in the Offset Boundary field of the Descriptor for subsequent WRITE BUFFER and READ BUFFER commands. The value returned in the Offset Boundary field should be interpreted as a power of two.
1	0	0	Reserved	
1	0	1	Reserved	
1	1	0	Reserved	
1	1	1	Reserved	

Read Buffer Header Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Reserved							
01—03	(MSB=01) Available Length (LSB=03)							

Read Buffer Descriptor Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Offset Boundary = 1							
01—03	(MSB=01) Buffer Capacity (LSB=03)							

Offset Boundary Configurations

Offset Boundary (HEX)	Offset Boundary (Power of 2)	Buffer Offsets
00	2E0 = 1	Byte Boundaries
01	2E1 = 2	Even-Byte Boundaries
02	2E2 = 4	Four-Byte Boundaries
03	2E3 = 8	Eight-Byte Boundaries
04	2E4 = 16	16-Byte Boundaries
.	.	.
.	.	.
FF	Not Applicable	0 is the only supported offset

Read Capacity

The READ CAPACITY command provides a means for the Initiator to request information regarding the capacity of the logical unit.

Read Capacity Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 25H							
01	Logical Unit Number			Reserved				REL=0
02—05	(MSB=02)			Logical Block Address			(LSB=05)	
06—07	Reserved							
08	Vend Unq = 0			Reserved				PMI
09	Control Byte							

PMI (Partial Media Indicator). A PMI bit of zero (0) indicates that the information returned in the READ CAPACITY Data phase will be the logical block address and block length (in bytes) of the last logical block of the logical unit. The Logical Block Address field in the CDB should be set to zero for this option.

A PMI bit of one (1) indicates that the information returned in the Data phase will be the logical block address and block length (in bytes) of the last logical block address after which a substantial delay in data transfer will be encountered. This logical block address shall be greater than or equal to the logical block address specified in the CDB. (Implementor's Note: This function is intended to assist storage management software in determining whether there is sufficient space on the current track, cylinder, etc. to contain a frequently accessed data structure such as a file directory or file index. The address returned will normally be the last block on the addressed track.)

Read Capacity Data Format

The format of the information returned by the Target during the Data In phase of the command is as follows:

	Bit							
Byte	7	6	5	4	3	2	1	0
00—03	(MSB=00)			Logical Block Address			(LSB=03)	
04—07	(MSB=04)			Block Length			(LSB=07)	

Read Defect Data

The READ DEFECT DATA command requests that the Target transfer the media defect data to the Initiator.

Read Defect Data Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 37H							
01	Logical Unit Number			Reserved				
02	Reserved			PLIST	GLIST	Defect List Format		
03—06	Reserved							
07—08	(MSB=07)		Allocation Length			(LSB=08)		
09	Control Byte							

PLIST (Primary Defect List), GLIST (Grown Defect List). A PLIST bit of one (1) indicates the the Initiator requests a primary list of defects be returned. A GLIST bit of one (1) indicates that the Initiator requests the grown list of defects. If both bits are one (1), the combination of both lists is requested. If both bits are zero (0), only the header will be returned.

Defect List Format. This field indicates the preferred format for the returned defect list. The bit states are as defined by the FORMAT UNIT command. The Target will return the list in the physical sector format (5) or bytes from index (4) format. If any other format is requested, the list will be returned in the physical sector format and the target will return a CHECK CONDITION status and will set the sense key to RECOVERED ERROR with an additional sense code of DEFECT LIST NOT FOUND.

Allocation Length. This field specifies the number of bytes that the Initiator has allocated for returned data. An Allocation Length of zero indicates that no data should be transferred and should not be considered an error. Any other value indicates the maximum number of bytes that shall be transferred. The Target shall terminate the data phase when either the allocation length or all available READ DEFECT DATA has been sent, whichever is less.

Read Defect Data Defect List Header Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Reserved							
01	Reserved			PLIST	GLIST	Defect List Format		
02—03	(MSB=02)		Defect List Length			(LSB=03)		

Defect List Descriptor Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00—02	(MSB=00)		Cylinder Number Of Defect			(LSB=02)		
03	Head Number of Defect							
04—07	(MSB=04)	Sector Number Of Defect (Physical Sector Format)						(LSB=07)
	Byte Index of Defect (Bytes from Index Format)							

The data returned by the READ DEFECT DATA command contains a four-byte Header, followed by zero or more Defect Descriptors

Defect List Length. This Header field specifies the total length of the following Defect Descriptors in bytes. If the Allocation Length field of the CDB is less than the length of the available defect list data, the Defect List Length is NOT adjusted to reflect the truncation. The defect descriptors are in ascending address order. Ascending address order for physical sector format is defined as cylinder most-significant and sector least-significant. A sector number of all ones (FFFFFFFFH) indicates that the entire track has been spared.

The defect data is supplied in such a manner that the list can be issued in a FORMAT command to restore the current media reassignment mapping without re-ordering.

Read Long

The READ LONG command requests the Target to transfer a specific block of data to the Initiator. The data transferred will include all data and ECC bytes.

Read Long Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 3EH							
01	Logical Unit Number			Reserved			CORRCT	REL=0
02—05	(MSB=02)		Logical Block Address			(LSB=05)		
06	Reserved							
07—08	(MSB=07)		Byte Transfer Length			(LSB=08)		
09	Control Byte							

CORRCT (Corrected). A CORRCT bit of one (1) instructs the Target to correct the data by ECC before transferring it to the Initiator. A CORRCT bit of zero (0) causes the logical block to be read and transferred without any error detection or correction.

Logical Block Address. This field specifies the starting address for the Read Long operation. The operation will continue for the length specified by the Byte Transfer Length field.

Byte Transfer Length. This field should specify exactly the number of bytes available for transfer. The exact value is 4 bytes for the header, 2 bytes for the Header ECC, 512 bytes for data, 18 bytes for the ECC field, and 2 bytes for the data field CRC; a total of 538 bytes. A value of zero in this field indicates that no data bytes will be transferred. This condition is not considered an error.

If the number of bytes specified matches exactly the available data length, the most recent data written in the specified logical block will be transferred. If a requested transfer length value does not match exactly the available data length, the Target will terminate the command with a CHECK CONDITION status and a sense key of ILLEGAL REQUEST and and additional sense key of INVALID FIELD IN CDB. The valid and ILI bits will be set to one and the information bytes will be set to the difference (residue) of the requested transfer length minus the actual length in bytes. Negative values will be transferred in two's complement format.

Reassign Blocks

The REASSIGN BLOCKS command requests the Target to reassign the defective logical blocks to an area on the logical unit reserved for this purpose and to record the defective logical blocks to the Grown Defect list (Glist). More than one physical or logical block may be relocated by each defect descriptor sent by the Initiator. This command does not alter the contents or location of the Primary Defect List (Plist).

Reassign Blocks Command Descriptor Block CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 07H							
01	Logical Unit Number			Reserved				
02—04	(MSB=02)			Reserved		(LSB=04)		
05	Control Byte							

The Initiator transfers a defect list that contains the logical block addresses to be reassigned. The Target reassigns the physical media used for each logical block address in the list. The data contained in the logical blocks specified in the defect list will be lost, but the data in all other logical blocks on the media shall be preserved.

A specific logical block address may be reassigned more than once; thus, over the life the media, a logical block can be assigned to multiple physical addresses (until no more spare locations remain on the media).

Note

The REASSIGN BLOCKS command is intended to be used to reassign a single block defect. The provision to handle multiple defects in a single command is made to allow recovery from a situation where multiple defects occur on a single track. If two sectors per track are spared, the entire track will be spared. If more than two sectors in the same track are spared, the drive will extend the sparing operations to additional spare tracks until the defect list or the spare track pool is depleted.

Reassign Blocks Defect List Header Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00—01	Reserved							
02—03	(MSB=02)			Defect List Length		(LSB=03)		

The REASSIGN BLOCKS defect list contains a 4-byte header followed by one or more defect descriptors. The length of each defect descriptor is four bytes.

Defect List Length. This field specifies the total length in bytes of the defect descriptors that follow. The Defect List Length is equal to four times the number of defect descriptors and does not include the Defect Header length.

Defect List Descriptor Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00—03	(MSB=00)		Defect Logical Block Address			(LSB=03)		

The Defect Descriptor specifies a 4-byte Defect Logical Block Address that contains the defect. The defect descriptors shall be in ascending order.

If the logical unit has insufficient capacity to reassign all of the logical blocks specified in the defect descriptors, the command shall terminate with a CHECK CONDITION status and the Sense Key shall be set to HARDWARE ERROR. The additional Sense Code will be NO DEFECT SPARE LOCATION AVAILABLE (32H). The logical block address of the first logical block not reassigned shall be returned in the Information Bytes of the sense data.

During a reassign operation, all data residing on the track with the specified defective block(s), except that contained within the defective block(s), is moved to a new physical track. If the Target is unable to recover data from any of these block(s) affected by the operation but *not* contained in the defect descriptor list, the command is terminated with CHECK CONDITION status and a Sense Key of MEDIUM ERROR. The additional Sense Code will be set to UNRECOVERED READ ERROR (11H), and the information bytes will contain the logical block address of the new defect. These additional defect(s) should be added to the reassignment defect list and the command reissued.

All blocks affected by the reassignment operation but *not* included in the defect descriptor list, are verified following the reassignment. If the verification fails, the data will be reassigned to another physical location. If this second reassignment operation fails, the command is terminated with CHECK CONDITION status, a Sense Key of MEDIUM ERROR, and an additional sense code of SPARE OPERATION FAILED. In this case, the media configuration remains as it was prior to the command. The spare track on which the original verify failed is marked as bad. This allows a reissue of the same Reassign Blocks command to step through spare tracks if consecutive spare tracks are defective. Multiple failures of this command probably indicate a hardware failure.

Release

The RELEASE command is used to release previously reserved logical units. It is not an error for an Initiator to attempt to release a reservation that is not currently active. In this case, the Target returns GOOD status without altering any other reservation. A third-party release option for the RELEASE command allows an Initiator to release a logical unit that was previously reserved using the third-party reservation option.

Release Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 17H							
01	Logical Unit Number			3RDPTY	Third Party Device ID			XTNT=0
02	Reservation Identification = 00							
03—04	(MSB=03)		Extent List Length = 00			(LSB=04)		
05	Control Byte							

3RDPTY (Third-Party). If the 3RDPTY bit is set to one (1), the Target shall release the specified logical unit, but only if the reservation was made using the third-party reservation option by the same Initiator for the same SCSI device as specified in the Third-Party Device ID field. If the 3RDPTY bit is set to zero (0), the third-party release option is not requested.

Request Sense

The REQUEST SENSE command requests that the Target transfer sense data to the Initiator. Only the extended sense data format is supported.

Request Sense Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 03H							
01	Logical Unit Number			Reserved				
02—03	Reserved							
04	Allocation Length							
05	Control Byte							

The returned Request Sense data is valid for a CHECK CONDITION status returned on the prior command. This data is preserved by the Target for the Initiator until retrieved by the REQUEST SENSE command or until the receipt of any other command for the same logical unit from the Initiator that issued the command resulting in the CHECK CONDITION status. Sense data is cleared upon receipt of any subsequent command to the logical unit from the Initiator receiving the CHECK CONDITION status. In the case of the single Initiator option, the Target will assume that the REQUEST SENSE command is from the same Initiator. Sense information will be cleared by the REQUEST SENSE command following the transfer of the data.

Allocation Length. This field specifies the number of bytes that the Initiator has allocated for returned sense data. The Target will terminate the Data In phase when the specified number of bytes have been transferred or when all available sense data has been transferred to the Initiator, whichever is less. The drive will return a maximum of 28 bytes of sense data. If the controller has auto-configured to CCS mode, an allocation length of 0 means 4 bytes will be transferred.

The REQUEST SENSE command will return the CHECK CONDITION status only to report fatal errors for the REQUEST SENSE command. The REQUEST SENSE command will be executed even if the drive is reserved to another Initiator.

If any nonfatal error occurs during the execution of the REQUEST SENSE command, the Target will return the sense data with GOOD status. When a fatal error occurs on a REQUEST SENSE command, the returned sense data may be invalid.

After the Sense Data is returned, all conditions are cleared except for a UNIT ATTENTION Sense Key if Power-On verification failed. In this case, the HARDWARE ERROR Sense Key is set by the Target for the first REQUEST SENSE, and UNIT ATTENTION is set for the subsequent command. This is done to insure that diagnostic failures and "Reset Conditions" are observed.

Request Sense Extended Data Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Valid	Error Class = 7			Error Code = 0			
01	Segment Number = 0							
02	FM = 0	EOM = 0	ILI	Reserved	Sense Key			
03—06	(MSB=03) Information Bytes (LSB=06)							
07	Additional Sense Length = 20							
08—11	Command Specific Information							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Field Replaceable Unit Code							
15—17	Sense Key Specific							
18	Retry	Reassign	HRDERR	Reserved				
19—23	Reserved							
24—27	(FIRST=24) Device Error (LAST=27)							

Valid. When set to 1, the VALID bit indicates that the Information Bytes field contains valid information. The exact significance of the Information Bytes depends on the status of the Sense Key field.

Error Class, Error Code. These fields are specified as seven-zero (Error Class = 7, Error Code = 0) for extended sense format.

Segment Number. Set to zero (0). Used for Copy and Search commands; not supported in this product.

FM (File Mark), EOM (End of Media). Set to zero (0). Used only for tape media.

ILI (Incorrect Length Indicator). Set to 1 for incorrect allocation length sent with a READ LONG or WRITE LONG command. Set to 0 in all other cases.

Sense Key, Additional Sense Code, Additional Sense Code Qualifier. These fields indicate the type of error which has occurred, and the recovery action which should be taken by the Initiator. It is the primary piece of information available to the Initiator for making decisions based on errors detected by the Target. Additional information pertaining to a specific Sense Key will be contained in the Additional Sense Code and Additional Sense Code Qualifier fields. Descriptions for the supported Sense Key codes, Additional Sense Codes, and Additional Sense Code Qualifiers are contained in the tables that follow.

Information Bytes. Contain information relative to specific commands and specific devices.

Additional Sense Length. Specifies the number of additional Sense data bytes to follow. Set to twenty (20) for these products.

Command Specific Information. Contains information dependent upon the command that was executed. Specific details are included in appropriate command explanations.

Field Replaceable Unit Code. Refers to the Field Replaceable Unit (FRU) that caused the current error reported in this Sense Key. This field will be set to 0 since FRU specific error detection is not supported.

Byte 18. The Target issues byte 18 as recommended action to the Initiator. It is issued only after a CHECK CONDITION status has been sent. Refer to the Retry, Reassign, and HRDERR explanations that follow,

Retry. The Target will set this bit to one (1) when it knows the Initiator can retry the command with no other corrective commands needed. The Initiator can safely attempt a retry when this bit is set to one (1).

Reassign. The Target will set this bit to one (1) as a recommendation to the Initiator to reassign the block. It is set to zero (0) as a recommendation that the block need not be reassigned. The Target sets or clears the bit independently of the other bits in byte 18. The Initiator must determine the correct action to take.

HRDERR (Hard Error). The Target sets this bit to one (1) if it needs to be re-initialized before further commands can be sent. The Initiator should not retry this or any other command before initializing the Target to a known clear state. If set to zero (0), the Initiator is free to retry the current command and/or issue any further commands without a re-initialization.

Device Error.

Indicates device unique error codes designed to aid service personnel in more detailed analysis of any drive faults. This information is NOT pertinent to system operation, although it is highly recommended that the system log all sense data including these bytes in cases of drive failures. The status of byte 24 in the Device Error field indicates the content of the bytes that follow. The specific error codes for the Device Error field are described in the tables that follow.

- If byte 24 = 80H through FFH, the Device Error field will contain error information from the disk controller chip.
- If byte 24 = 00H through 3FH, the Device Error field will contain HDA (Head/Disk Assembly) status information. This information may be returned with either the RECOVERED ERROR or HARDWARE ERROR Sense Keys.
- If byte 24 = 40H through 5FH, the Device Error field will contain diagnostic failure information. This information will normally be returned with a HARDWARE ERROR Sense Key after a Power-On, or a SEND DIAGNOSTIC command with self-test bit set.

Sense Key Codes

Value (hex)	Description
0	**NO SENSE.** Indicates that there is no specific sense key information to be reported for the designated logical unit.
1	**RECOVERED ERROR.** Indicates that the last command completed successfully with some recovery action performed by the Target. Details may be determinable by examining the additional sense bytes and the information bytes.
2	**NOT READY.** Indicates that the logical unit addressed cannot be accessed.
3	**MEDIA ERROR.** Indicates that the command terminated with a nonrecovered error condition that was probably caused by a flaw in the media or an error in the recorded data.
4	**HARDWARE ERROR.** Indicates that the Target detected a nonrecoverable hardware failure (for example, controller failure, device failure, parity error, etc.) while performing the command or during a self test.
5	**ILLEGAL REQUEST.** Indicates that there was an illegal parameter in the command descriptor block or in the additional parameters supplied as data for some commands.
6	**UNIT ATTENTION.** Indicates that the Target has been reset or there has been a power on.
B	**ABORTED COMMAND.** Indicates that the Target aborted the command due to Initiator request/action.
E	**MISCOMPARE.** Indicates data in buffer may have been corrupted between READ BUFFER and WRITE BUFFER commands, or a MISCOMPARE occurred during a VERIFY (with BYTCK enabled).

Additional Sense Codes

Value (hex)	Description
00	No Additional Sense Information
01	No Index/Sector signal
02	No Seek Complete
03	Write Fault
04	Drive Not Ready
08	Logical Unit Communication Failure
10	ID CRC or ECC error
11	Unrecovered Read error of data blocks
14	No record found
15	Seek Positioning error
17	Recovered Read data with Target's Read retries (not with ECC)
18	Recovered Read data with Target's ECC correction (not with retries)
19	Defect List error
1A	Parameter Overrun
1B	Synchronous Transfer error
1D	Compare error
20	Invalid Command Operation Code
21	Illegal Logical Block Address. Address greater than the maximum LBA returned by the READ CAPACITY data with PMI not set.
24	Illegal field in CDB
25	Invalid LUN
26	Invalid field in Parameter List
27	Write Protected
29	Power On or Reset or Bus Device Reset occurred
2A	Mode Select Parameters changed.
31	Media Format Corrupted
32	No Defect Spare Location Available
33	Spare Operation Failed
40	Diagnostic failure
41	Data Path Diagnostic failure
42	Power-On Diagnostic Failure
43	Message Reject Error
44	Internal Controller Error
45	Select/Reselect failed
46	Unsuccessful Soft Reset
47	SCSI Interface Parity Error
48	Initiator Detected Error
49	Inappropriate/Illegal Message
5B	Log Exception

Additional Sense Code Qualifiers

Byte 13 Value	Bit	Description
80H		Device Error bytes are zero
81H		Device Error bytes contain ESDI status and vendor unique status
82H		Device Error bytes contain disk controller IC status registers and retry count
83H		Self Test failure codes
For Additional Sense Code 04H: (Drive Not Ready)		
Byte 13 Value	**Bit**	**Description**
00		Cause not reported
01		LUN becoming ready
02		Initializing command needed
For Additional Sense Code 5BH: (Log Exception)		
Byte 13 Value	**Bit**	**Description**
00		General log fault, no additional information
01		Threshold Condition Met
02		Log Counter at Maximum
03		Log List Exhausted

Device Error Field Codes: When Additional Sense Code Qualifier = 82H

Byte	Bit	Description
24	7	Fatal error
	6	Data ECC 3 error
General	5	Data ECC 1 error
Status	4	Header ECC 1 error
Register	3	Data sync error
	2	Header sync error
	1	Header compare failed
	0	Other error
25	7	ESDI Attention bit
Fatal	6	Status test complete
Status	5	Command time-out
Register	4	End of sector
	3	Not used
Other	2	Buffer parity fault
Status	1	FIFO underflow
Register	0	FIFO overflow
26	7	Not used
	6	Not used
ECC	5	ECC 3 interleave status
Status	4	ECC 3 interleave status
Register	3	ECC 3 interleave status
	2	ECC 3 interleave status
	1	Data ECC 1 status
	0	Header ECC 1 status
27	7	\
	6	\
Retry	5	\
Count	4	\ Number of
	3	/ Retrys attempted
	2	/
	1	/
	0	/

Device Error Field Codes: When Additional Sense Code Qualifier = 81H

Byte	Bit	Description
24	1	Spindle motor stopped
	0	Reset condition exists
25	7	Command data parity fault
	6	Interface fault
	5	Invalid command fault
	4	Seek fault
	3	Write Gate with track offset fault
	2	Extended status available (byte 27)
	1	Write fault
	0	zero
26		zero
27		Zero if byte 25 bit 2 = zero; If byte 25 bit 2 = 1 then: 01H = Spindle won't start 02H = Spindle spinning but not at speed 03H = Spindle at speed but no lock 04H = Command interface timeout 05H = Write while unsafe 06H = Write while offtrack 07H = Write while offspeed 08H = Write when 2 STP's missing 09H = Not used 0AH = Not used 0BH = Not Used 0CH = Not Used 0DH = Write while illegal head selected 0EH = Not used 0FH = Not used 10H = Status timeout 11H = Target cylinder exceeds maximum 12H = Wrong mode fault 13H = Consecutive sectors skipped 14H = Servo timeout for Gray code validation 15H = Servo fine settle fault 16H = Servo gross settle fault 17H = Servo interrupt timeout 18H = Seek while servo shut down 19H = Write while protected (probably aggressive seek related) 1AH = Write while protected (probably offtrack) 1BH = Possible stuck latch (on power on) 1CH = Write and offtrack (aggressive seek related) 1DH = Write and offtrack (not seek related) 1EH = Unable to read Gray code

Device Error Field Codes: When Additional Sense Code Qualifier = 83H

Byte	Code (hex)	Description
24	46	SCSI Interface chip register failure
	47	SCSI Interface chip ram failure
	48	SCSI Interface chip message port failure
	49	SCSI Interface chip command failure
	4A	SCSI Interface chip termination failure
	4B	SCSI Interface chip fifo buffer failure
	4C	SCSI Interface chip target sequence failure
	4D	SCSI Interface chip command sequence failure
	4E	SCSI Interface chip status sequence failure
	52	SCSI Interface chip request failure
	60	Data Controller chip remote failure
	61	Data Controller chip remote register failure
	62	Data Controller chip fifo buffer register failure
	63	Data Controller chip fifo buffer pointer failure
	64	Data Controller chip mechanism side failure
	65	Data Controller chip header ecc1 failure
	66	Data Controller chip header ecc3 failure
	67	Data Controller chip header failure
	68	Data Controller chip read/write idle failure
	69	Data Controller chip ECC failure
	6A	ECC unit failure
	6B	Data Controller chip buffer failure
	6C	Data Controller chip formatter failure
	70	Ranger failure
	71	Ranger serial port failure
	72	ESDI command transfer failure
	73	ROM bank select PAL failure
	74	ESDI command complete failure
	75	ESDI attention failure
	80	Buffer RAM failure
	81	Microprocessor RAM failure
	82	ROM checksum failure
	90	Write test failure
	91	Read test failure
	92	Compare test failure

Reserve

The RESERVE command is used to reserve logical units for the use of the Initiator. With third-party reservation, the logical units may be reserved for another specified SCSI device. The RESERVE and RELEASE commands provide the basic mechanism for contention resolution in multiple-Initiator systems.

Reserve Command Descriptor Block (CDB)

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	Opcode = 16H							
01	Logical Unit Number			3RDPTY	Third Party Device ID			XTNT = 0
02	Reservation Identification = 00							
03—04	(MSB=03)		Extent List Length = 00			(LSB=04)		
05	Control Byte							

3RDPTY (Third-Party). A 3RDPTY bit set to one (1) indicates that the reservation is being made on behalf of another bus device (the third party). When 3RDPTY is set to zero (0), third-party reservation is not requested.

Third Party Device ID. This field indicates the identity of the third party. The reservation can only be released by the party that made the reservation.

When a third-party reservation is made, the mode parameters of the reserving Initiator will be copied to the mode parameters of the third party. This will cause Unit Attention to the third party with Sense Key UNIT ATTENTION (6) and additional Sense Code of MODE PARAMETER CHANGED (2AH) and additional Sense Code qualifier of 01.

XTNT (Extent Reservation). With the XTNT bit set to zero (0), this command will request that the entire logical unit be reserved for the exclusive use of the Initiator until the reservation is superseded by another valid RESERVE command from the same Initiator that made the reservation or until released by a RELEASE command from the same Initiator, by a BUS DEVICE RESET message from any Initiator, or by a "hard" RESET condition. A logical unit reservation will not be granted if the logical unit is reserved by another Initiator. It will be permissible for an Initiator to reserve a logical unit that is currently reserved by that Initiator. With XTNT set to zero (0), The Reservation Identification and the Extent List Length fields will be ignored.

If the logical unit is reserved for another Initiator, the target will respond by returning a RESERVATION CONFLICT status.

Once a reservation is installed, the reserved logical unit is available only to the Initiator that issued the RESERVE command, or a specified optional third party. If any other Initiator attempts to perform a command on the reserved logical unit the command will be rejected with RESERVATION CONFLICT status. Exceptions are the RELEASE command, which will be ignored by the target, and the INQUIRY command, which will be executed.

Rezero Unit

The REZERO UNIT command causes the Target to perform a recalibrate operation and then seek to logical address zero. The status of the seek is reported as the status of this command. This command is provided for compatibility reasons. Its use is not required for any normal drive operation or error recovery.

Rezero Unit Command Descriptor Block (CDB)

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	Opcode = 01H							
01	Logical Unit Number			Reserved				
02—04	Reserved							
05	Control Byte							

Seek

The SEEK command requests the logical unit to seek to the specified logical block address. The target accepts both the 6-byte and 10-byte (extended) command formats. Status will be returned as GOOD when the seek is complete. This command will return a CHECK CONDITION status with a Sense Key of HARDWARE ERROR if unable to complete. The NOT READY Sense Key will be returned if the drive has not yet spun up.

Seek (6-Byte) Command Descriptor Block (CDB)

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	Opcode = OBH							
01	Logical Unit Number			Logical Block Address (MSB)				
02—03	Logical Block Address (LSB=03)							
04	Reserved							
05	Control Byte							

Seek (10-Byte) Command Descriptor Block (CDB)

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	Opcode = 2BH							
01	Logical Unit Number			Reserved				REL=0
02—05	(MSB=02) Logical Block Address (LSB=05)							
06—08	Reserved							
09	Control Byte							

Logical Block Address. This field specifies the logical block address for the seek.

Send Diagnostic

The SEND DIAGNOSTIC command requests the Target to execute the specified diagnostic test(s) upon itself.

Send Diagnostic Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 1DH							
01	Logical Unit Number			PF = 0	Reserved	S/TEST	DEVOFL	UNTOFL
02	Reserved							
03—04	(MSB=03)		Parameter List Length = 0			(LSB=04)		
05	Control Byte							

PF (Page Format). The PF bit is not supported.

S/TEST (Self-Test). If the S/TEST bit is set to one (1), the Target will execute its default Self-Test. When successfully completed, the command will be completed with a GOOD status. If not, the command will be terminated with a CHECK CONDITION status, and the Sense Key will be set to HARDWARE ERROR.

If the S/TEST bit is set to zero (0), the Target will do no diagnostic testing, and will complete with a status of GOOD.

DEVOFL (Device Off-Line), UNTOFL (Unit Off-Line). These functions are not supported and are ignored by these products.

Start/Stop Unit

The START/STOP UNIT command requests the Target to enable or disable the logical unit for further operations.

Start/Stop Unit Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 1BH							
01	Logical Unit Number			Reserved				IMMED
02—03	Reserved							
04	Reserved							Start
05	Control Byte							

IMMED (Immediate). If the IMMED bit is set to one (1), status will be returned as soon as the operation is initiated. If IMMED is set to zero (0), status will be returned after the operation is completed.

Start. A START bit of one (1) requests the logical unit be made ready for use. A START bit of zero (0) requests that the logical unit be made Not Ready For Use by stopping the spindle motor until the next START UNIT command is sent.

Test Unit Ready

The TEST UNIT READY command provides a means to check if the logical unit is ready. This is not a request for a self test. If the logical unit is up to speed and ready for media access, this command will return a GOOD status. This does not assure that media access will be successful. If the drive is not up to speed, this command will return a CHECK CONDITION Status with a Sense Key of NOT READY and an Additional Sense Code of DRIVE NOT READY.

Test Unit Ready Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 00H							
01	Logical Unit Number			Reserved				
02—04	Reserved							
05	Control Byte							

Verify

The VERIFY command requests that the Target verify the data written on the media.

Verify Command Descriptor Block (CDB)

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	Opcode = 2FH							
01	Logical Unit Number			Reserved			BYTCK	REL=0
02—05	(MSB=02)		Logical Block Address			(LSB=05)		
06	Reserved							
07—08	(MSB=07)		Verification Length			(LSB=08)		
09	Control Byte							

BYTCK (Byte Check). If the BYTCK bit is set to zero (0), a media verification is performed with no data comparison. If BYTCK is set to one (1), the drive will request data from the Initiator and do a byte-by-byte comparison of this data with the data read from the media. If the data does not compare with that on the media, a check condition status will be returned. The sense key will be set to MISCOMPARE with a sense code of COMPARE ERROR. If the data cannot be read from the media, a MEDIUM ERROR will be returned.

Logical Block Address. This field specifies the logical block at which the verify operation will begin.

Verification Length. This field specifies the number of contiguous logical blocks of data that will be verified. A length of zero indicates that no logical blocks will be verified. This condition is not considered as an error. Any other value indicates the number of logical blocks that will be verified.

Write

The WRITE command requests that the Target write the data transferred by the Initiator to the media. The Target accepts both the nonextended (6-byte) and extended (10-byte) CDB formats.

Write (6-Byte) Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 0AH							
01	Logical Unit Number			Logical Block Access (MSB)				
02—03	Logical Block Address (LSB=03)							
04	Transfer Length							
05	Control Byte							

Write (10-Byte) Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 2AH							
01	Logical Unit Number			Reserved				REL=0
02—05	(MSB=02) Logical Block Address (LSB=05)							
06	Reserved							
07—08	(MSB=07) Transfer Length (LSB=08)							
09	Control Byte							

Logical Block Address. This field specifies the logical block at which the write operation will begin.

Transfer Length. This field specifies the number of contiguous logical blocks of data to be transferred. When using the nonextended (6-byte) CDB format, a Transfer Length of zero indicates that 256 logical blocks will be transferred. When using the extended (10-byte) CDB format, a Transfer Length of zero indicates that no logical blocks will be transferred. This condition shall not be considered an error (it is functionally equivalent to a SEEK command).

Write And Verify

The WRITE AND VERIFY command requests the Target to write the data transferred by the Initiator to the media, and then do an ECC verify of the data that was written.

Write And Verify Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 2EH							
01	Logical Unit Number			Reserved			BYTCK	REL=0
02—05	(MSB=02)		Logical Block Address			(LSB=05)		
06	RESERVED							
07—08	(MSB=07)		Transfer Length			(LSB=08)		
09	Control Byte							

BYTCK (Byte Check). The byte check option (BYTCK=1) is supported and will cause a byte-by-byte comparison of the data. Note that the verification pass will take additional time over a normal WRITE command.

Logical Block Address. This field specifies the logical block at which the WRITE AND VERIFY operations will begin.

Transfer Length. This field specifies the number of contiguous logical blocks of data to be transferred. A Transfer Length of zero indicates that no logical blocks shall be transferred. This condition shall not be considered an error (it is functionally equivalent to a SEEK command). The drive does an ECC verify pass on the data after it has been written.

Write Buffer

WRITE BUFFER is used in conjunction with READ BUFFER as a diagnostic for testing Target memory and the SCSI bus integrity. This command does not alter the media.

Caution

The WRITE BUFFER download microcode mode command allows the Initiator to execute code that may cause damaging results. It should only be performed when no data retention is required.

Use of this command should be restricted to development or other highly controlled environments. Development of the code for this command should be carefully coordinated with the product's support team. Execution of this command with code not approved by Hewlett-Packard may be deemed a violation of warranty.

Write Buffer Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = 3BH							
01	Logical Unit Number			Reserved		Mode (DB2, DB1, DB0)		
02	Buffer ID							
03—05	(MSB=03)		Buffer Offset			(LSB=05)		
06—08	(MSB=07)		Transfer Length			(LSB=08)		
09	Control Byte							

Mode (DB2, DB1, DB0)

The status of this field determines the content and format of the information returned in the Data Out phase. There are three currently supported Mode Field configurations:

Mode Bits			Mode Configuration
DB2	DB1	DB0	
0	0	0	Combined Header and Data (optional)
0	0	1	Reserved
0	1	0	Write Data (optional)
0	1	1	Reserved
1	0	0	Download Microcode (optional)
1	0	1	Reserved
1	1	0	Reserved
1	1	1	Reserved

Combined Header and Data. A 4-byte header followed by the data bytes are transferred during the Data Out phase. The Buffer ID and Buffer Offset fields in the CBD are zero. The Transfer Length field in the CDB specifies the total number of bytes that will be transferred during the Data Out phase. This number includes both the 4-byte header and the data.

Therefore the data length to be stored by the Target is the Transfer Length minus four. The Initiator should ensure that the Transfer Length is not greater than four plus the Available Length returned in the Read Buffer command header. If the Transfer Length exceeds this number, the Target will return a status of CHECK CONDITION and a Sense Key of ILLEGAL REQUEST.

Write Data. The buffer data is transferred in the Data Out phase. The Buffer ID field in the CBD identifies a specific buffer in the Target. (Note: This field should be set to all zeros.)

If the Initiator specifies an unsupported Buffer ID, the Target will return a status of CHECK CONDITION, a Sense Key of ILLEGAL REQUEST, and an Additional Sense Code of ILLEGAL FIELD IN CDB. Data is written to the Target buffer specified by the Buffer Offset field in the CDB. The Initiator should conform to the offset boundary requirements returned in the Read Buffer Descriptor.

If the Target is unable to accept the specified Buffer Offset, it will return a status of CHECK CONDITION, a Sense Key of ILLEGAL REQUEST, and an Additional Sense Code of ILLEGAL FIELD IN CDB.

The Initiator should ensure that the Transfer Length is not greater than four plus the Available Length returned in the Read Buffer command header. If the Transfer Length exceeds this number, the Target will return a status of CHECK CONDITION, a Sense Key of ILLEGAL REQUEST, and an Additional Sense Code of INVALID FIELD IN CDB.

Download Microcode. The Data Out phase contains the description header, the microcode, and any parameters that may be needed. The microcode will be validated, and if valid, loaded into execution memory and then executed. The Buffer ID field, the Buffer Offset field, and the Transfer Length field are treated the same as for the Write Data Mode. The microcode will only remain in execution memory until completion of command execution. At that time, other drive activities could overwrite the microcode.

Microcode Description Header

	Bit							
Byte	7	6	5	4	3	2	1	0
00	0	Reserved						
01	Reserved							
02	Segment ID = 0							
03	Validation Information Length (n)							
04—07	Microcode Load Address							
08—11	Microcode Length (m)							
12 to n + 11	Validation Information							
n + 12 to n+m+11	Microcode							
n+m+12 to n+m+13	Parameter Length (p)							
n+m+14 to n+m+p+13	Parameters							

Notes:

- Downloading microcode not approved by Hewlett-Packard may be deemed a violation of warranty.
- Validation information must be generated by Hewlett-Packard at the factory if the microcode will be accepted.

Write Long

The WRITE LONG command requests the Target to write the data transferred by the Initiator to the media. The data transferred is implementation specific, but will include the data bytes and the ECC bytes. The READ LONG command is usually issued before issuing a WRITE LONG command. The WRITE LONG data should be the same length and in the same order as the data returned by the READ LONG command.

Write Long Command Description Block (CDB)

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	Opcode = 3FH							
01	Logical Unit Number			Reserved				REL=0
02—05	(MSB=02)		Logical Block Address			(LSB=05)		
06	Reserved							
07—08	(MSB=07)		Byte Transfer Length			(LSB=08)		
09	Control Byte							

Logical Block Address. This field specifies the logical block address where the write operation will begin.

Byte Transfer Length. This field specifies the number of data bytes the Target would return for the READ LONG command. A transfer length of zero indicates that no bytes will be transferred. This condition is not considered an error.

If a non-zero byte transfer length does not exactly match the data length the Target would return for the READ LONG command, the Target will terminate the command with a CHECK CONDITION status and a Sense Key of ILLEGAL REQUEST, and an Additional Sense Code of INVALID FIELD IN CDB. The ILI and VALID bits will be set to one (1), and the information bytes will be set to the difference (residue) of the requested length minus the actual length in bytes. Negative numbers will be indicated by two's complement notation.

If the Byte Transfer Length field matches exactly the length that the Target would return for the READ LONG command, the Target will write the data to the specified address.

3

Vendor Unique Command Descriptions

This section provides descriptions of the Vendor Unique commands supported by the Target.

Command Descriptions

Detailed descriptions of the Vendor Unique commands supported by the Target are provided in the following pages. These descriptions include Command Descriptor Block (CDB) formats, data formats, and all device-specific information involved in command execution.

Table 3-1 provides brief descriptions of the Vendor Unique commands supported by the Target.

Table 3-1. Vendor Unique Commands

Command	Opcode (hex)	Description
Access Log	F2	Retrieves information from Target's maintenance log.
Execute Data	FE	Executes special code downloaded via the WRITE BUFFER command.
Interface Control	EF	Execute ESDI Passthrough commands.
Manage Primary	FD	Used to manage the primary defect list (P list).
Read Full	F0	Requests Target to return the header, data field and ECC bytes of one physical sector.
Read Headers	EE	Requests Target to read all the headers on the addressed track and return the requested number of bytes of header information.
Reformat Track	ED	Formats a single track. If HS bit is 0, then it uses normal default header information. If the HS bit is 1, the supplied header information is used for the track logical address and flag bytes.
Special Seek	EC	Requests Target to leave the disk drive selected after execution of a seek. Allows for special testing at the seek address.
Write Full	FC	Allows Initiator to write one complete physical sector, including header, data, and ECC fields.

Command Use Before Spinup

Table 3-2 provides an overview of the supported Vendor Unique commands and indicates which commands can be used before spinup.

Table 3-2. Vendor Unique Command Overview

Command	Opcode (hex)	Use Before Spinup
Access Log	F2	No
Execute Data	FE	No
Interface Control	EF	No
Manage Primary	FD	No
Read Full	F0	No
Read Headers	EE	No
Reformat Track	ED	No
Special Seek	EC	No
Write Full	FC	No

Access Log

The ACCESS LOG command allows the Initiator to read the entries contained in the disk drive's maintenance log. This information is available for maintenance purposes. The log information is maintained on the disk. There is a small queue in RAM to hold entries enroute to the disk. This queue is initialized on power-on or reset. Queued RAM entries are posted to the disk periodically, or when the logs are accessed. The ACCESS LOG command will always return this information from the disk log. There is always a disk access.

Access Log Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = F2H							
01	Logical Unit Number			Reserved		EXTFMT	Clear	PHYS
02—06	(MSB=02)			Reserved		(LSB=06)		
07—08	(MSB=07)			Allocation Length		(LSB=08)		
09	Control Byte							

EXTFMT (Extended Format). When EXTFMT = zero (0), the non-extended format for the Hardware Error Log is returned. When EXTFMT = one (1), the extended format is returned.

Clear. A CLEAR bit of one (1) allows the Initiator to clear all the current log entries after reading them.

PHYS (Physical Address). A PHYS bit of zero (0) causes all addresses and block counts to be in terms of logical blocks. Any addresses that are outside the user data space are set to addresses higher than the maximum block address when logical block references are requested. If PHYS is set to one (1), all addresses and block counts are in terms of physical sectors.

Allocation Length. This field specifies the number of bytes that the Initiator has allocated for returned ACCESS LOG data. An Allocation Length of zero indicates that no ACCESS LOG data will be transferred. This condition shall not be considered as an error. Any other value indicates the maximum number of bytes that shall be transferred. The Target will terminate the Data In phase when the specified number of bytes have been transferred, or when all available ACCESS LOG data have been transferred to the Initiator, whichever is less.

Access Log Data Header Format

The log information is preceded by a 4-byte header.

	Bit							
Byte	7	6	5	4	3	2	1	0
00—01	Reserved							
02—03	(MSB=02) Available Length (LSB=03)							

Available Length. This field defines the number of bytes following the header. This length does not include the 4-byte header itself. The header is followed by zero or more log entries. Each log entry begins with a 2-byte header identifying the type and length (excluding the header) of the following entry. The log types are defined as follows:

- 00H - No information
- 01H - Usage log entry
- 02H - Data Error log entry
- 03H - Hardware Error log entry

Usage Log Entry

The Usage log entry conveys usage information about the entire device. The length of this entry is 12 bytes.

Usage Log Entry Header Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Log Entry Type = 01H							
01	Log Entry Length = 0CH							

Usage Log Entry Data Format

Byte	7	6	5	4	3	2	1	0
02	Reporting Area = FFH							
03	Reserved				Access Count			
04—09	(MSB=04) Blocks Read Count (LSB=09)							
10—11	(MSB=10) First Retry Count (LSB=11)							
12—13	(MSB=12) Multiple Retry Count (LSB=13)							

Reporting Area. This field is set to FFH, indicating that the entry refers to the entire device.

Access Count. This field indicates the number of media positionings since the last hardware error occurred. This field is reset to zero each time a Hardware Error log entry is added to the log. If no Hardware Error log entries are included in the ACCESS LOG data, this field reflects the total number of media accesses. If Hardware Error log entries are included, this field and the values in corresponding Access Count fields in those entries must be combined to yield the total number of media accesses. The number of accesses represented by the Access Count field are as follows:

Access Count Range Values

Value (HEX)	Minimum of Access Range	Maximum of Access Range	Value (HEX)	Minimum of Access Range	Maximum of Access Range
0	No Accesses	No Accesses	8	500,001	1,000,000
1	1	1	9	1,000,001	5,000,000
2	2	10	A	5,000,001	10,000,000
3	11	100	B	10,000,001	50,000,000
4	101	1,000	C	50,000,001	100,000,000
5	1,001	10,000	D	100,000,001	500,000,000
6	10,001	100,000	E	500,000,001	1,000,000,000
7	100,001	500,000	F	1,000,000,001	>1,000,000,001

Blocks Read Count. This field is the count of the blocks read over the entire disk drive. If the PHYS bit in the CDB is set to zero (0), the count represents logical blocks. If PHYS is set to one (1), the count represents physical blocks.

First Retry Count. This field indicates the number of instances when the data error recovery algorithm was forced to perform data read retrys and the data was recovered on the first retry.

Multiple Retry Count. This field indicates the number of times data was not recovered on the first retry. Note that this count is incremented only once per complete recovery action, not once for each retry within one recovery action.

Data Error Log Entry

This 6-byte entry is used to convey data error information about a specific data block.

Data Error Log Entry Header Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Log Entry Type = 02H							
01	Log Entry Length = 06H							

Data Error Log Entry Data Format

Byte	7	6	5	4	3	2	1	0
02—05	(MSB=02) Block Address (LSB=05)							
06	Data Error Code							
07	Occurrence Count							

Block Address. This field contains the block address of the data block that encountered multiple read retrys during one or more data error recovery attempts. If the PHYS bit in the CDB is is set to zero (0), the field contains the logical block address. If PHYS is set to one (1), the field contains the physical block address in the following format:

- Byte 2: Cylinder Address (MSB)
- Byte 3: Cylinder Address (LSB)
- Byte 4: Head Address
- Byte 5: Sector Address

Data Error Code. This byte is bit-significant, and multiple errors at the same location will have their respective bits merged into the reported byte as follows:

- Bit 7: Unclassifiable error
- Bit 6: Error occurred in header field
- Bit 5: Error occurred in data field
- Bit 4: Unrecoverable error
- Bit 3: Error recovered with ECC
- Bit 2: Error recovered with retries
- Bit 1: Write fault
- Bit 0: Reserved

Occurrence Count. This field is incremented each time the specified block is uncorrectable or requires multiple read retrys in a given transaction. This field is incremented only once for each data recovery.

Hardware Error Log Entry

This entry conveys hardware fault information. If the EXTFMT bit in the CDB is zero (0), the log will be 8-bytes long (bytes 02 through 09); if EXTFMT is one (1), the log will be 12-bytes long (bytes 02 through 13).

Hardware Error Log Entry Header Format

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	Log Entry Type = 03H							
01	Log Entry Length = 08H (EXTFMT = 0) Log Entry Length = 0CH (EXTFMT = 1)							

Hardware Error Log Entry Data Format

Byte	7	6	5	4	3	2	1	0
02—05	(MSB=02) Block Address (LSB=05)							
06	Internal Device Status							
Bytes 07 through 09 when EXTFMT = 0								
07	Fault Code = 0							
08	Field Replaceable Unit (FRU) = 0							
09	Reserved				Access Count			
Bytes 07 through 13 when EXTFMT = 1								
07	Fault Code							
08—11	(MSB=08) Device Error (LSB=11)							
12	Field Replaceable Unit (FRU) = 0							
13	Reserved				Access Count			

Block Address. This field contains the block address the disk drive was attempting to access when the error occurred. If the PHYS bit in the CDB is set to zero (0), this is a logical block address. If PHYS is set to one (1), this is a physical block address containing cylinder and head information as follows:

- Byte 2: Cylinder Address (MSB)
- Byte 3: Cylinder Address (LSB)
- Byte 4: Head Address
- Byte 5: Sector Address (Not Used)

Internal Device Status. This byte contains an error code corresponding to the Additional Sense code returned by the REQUEST SENSE command.

Fault Code. If EXTFMT = zero (0), the value in this byte will be returned as zero. If EXTFMT = one (1), the value in this field will determine the contents of the Device Error field, bytes 08 through 11.

Access Log

Device Error. If EXTFMT = zero (0), this field does not exist. If EXTFMT = one (1), the contents of this field is determined by the Fault Code in byte 7:

- For Fault Codes 00H through 3FH, the Device Error field will contain all zeros (0's).
- For Fault Codes 40H through 70H, the Device Error field will contain the information listed in the following table:
- For Fault Codes 80 through FF, The Device Error field will contain the information listed in the following table:

Field Replaceable Unit (FRU). The value in this byte will be returned as zero.

Access Count. This field contains access information as defined in the Usage log entry.

Device Error Field Codes: For Fault Codes 40H through 7FH

Byte	Bit	Description
08	7	Fatal error
	6	Data ECC 3 error
General	5	Data ECC 1 error
Status	4	Header ECC 1 error
Register	3	Data sync error
	2	Header sync error
	1	Header compare failed
	0	Other error
09	7	ESDI Attention bit
Fatal	6	Status test complete
Status	5	Command time-out
Register	4	End of sector
	3	Not used
Other	2	Buffer parity fault
Status	1	FIFO underflow
Register	0	FIFO overflow
10	7	Not used
	6	Not used
ECC	5	ECC 3 interleave status
Status	4	ECC 3 interleave status
Register	3	ECC 3 interleave status
	2	ECC 3 interleave status
	1	Data ECC 1 status
	0	Header ECC 1 status
11		00H

Device Error Field Codes: For Fault Codes 80H through FFH

Byte	Bit	Description
08	1	Spindle motor stopped
	0	Reset condition exists
09	7	Command data parity fault
	6	Interface fault
	5	Invalid command fault
	4	Seek fault
	3	Write Gate with track offset fault
	2	Extended status available (byte 11)
	1	Write fault
	0	zero
10		87H
11		If byte 09, bit 2 = 0, byte 11 = 00H; If byte 09, bit 2 = 1, then: If byte 25 bit 2 = 1 then: 01H = Spindle won't start 02H = Spindle spinning but not at speed 03H = Spindle at speed but no lock 04H = Command interface timeout 05H = Write while unsafe 06H = Write while offtrack 07H = Write while offspeed 08H = Write when 2 STP's missing 09H = Not used 0AH = Not used 0BH = Not Used 0CH = Not Used 0DH = Write while illegal head selected 0EH = Not used 0FH = Not used 10H = Status timeout 11H = Target cylinder exceeds maximum 12H = Wrong mode fault 13H = Consecutive sectors skipped 14H = Servo timeout for Gray code validation 15H = Servo fine settle fault 16H = Servo gross settle fault 17H = Servo interrupt timeout 18H = Seek while servo shut down 19H = Write while protected (probably aggressive seek related) 1AH = Write while protected (probably offtrack) 1BH = Possible stuck latch (on power on) 1CH = Write and offtrack (aggressive seek related) 1DH = Write and offtrack (not seek related) 1EH = Unable to read Gray code

Execute Data

The EXECUTE DATA command allows the Initiator to download special code for the Target to execute, thus providing functions not available in the standard command set. This command causes code bytes, sent by the Initiator to the data buffer via a WRITE BUFFER command, to be executed. It is suggested that each EXECUTE DATA command be immediately preceded by the appropriate WRITE BUFFER command to ensure proper code execution.

Caution

The EXECUTE DATA command allows the Initiator to execute code that may cause damaging results. It should only be performed when no data retention is required. Use of this command should be restricted to development or other highly controlled environments. Development of the code for this command should be carefully coordinated with the product's support team. Execution of this command with code not approved by Hewlett-Packard may be deemed a violation of warranty.

Execute Data Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	OPCODE = FEH							
01	Logical Unit Number			0	0	0	INST	EXE
02—08	(MSB=02)			Parameter Field		(LSB=08)		
09	Control Byte							

INST (Install), EXE (Execute). If the INST bit is set to one (1), the code segment in the buffer will be "permanently" installed in executable RAM but not executed. If the EXT bit is set to one (1) the previously installed command is to be executed and no code is transferred from the data buffer. If both INSTAL and EXE are set to one (1), the code segment will be installed and executed. If both bits are set to zero (0), the command will fail with CHECK CONDITION status and ILLEGAL FIELD sense.

Execute Data Header

The code segment in the data buffer will consist of an optional 8-byte Execute Data header, followed by a Microcode Description header, followed by the executable code. The header consists of four (4) ASCII Rev (revision) bytes, which must be equal to the current ASCII firmware revision (refer to the CAUTION); a 2-byte Checksum calculated over the code length; and a 2-byte Code Length field which does not include the length of the header. The entire header must be reserved or the command will be rejected with CHECK CONDITION STATUS and ILLEGAL REQUEST sense.

Execute Data Header Format

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00—03	Byte 1=00			ASCII REV Bytes			Byte 4=03	
04—05	(MSB=04)			Checksum			(LSB=05)	
06—07	(MSB=06)			Code Length			(LSB=07)	

ASCII Rev Bytes. Current ASCII firmware revision.

Checksum. A checksum verification will be done over the code length for all cases, except when only the EXE bit is set to one (1). If the verification fails, the command will fail with CHECK CONDITION status and ILLEGAL REQUEST sense.

Code Length. A Code Length of zero will be accepted with no error and no code will be executed. In this case, no checksum verification will be performed.

If the Code Length is nonzero and all verification succeeds, execution will begin at the first byte of received code. It is the responsibility of that code to maintain proper firmware integrity and to terminate its function in an acceptable manner.

Execute Data

Microcode Description Header

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	1	Reserved						
01	Reserved							
02	Segment ID = 0							
03	Validation Information Length = n							
04—07	Microcode Load Address							
08—11	Microcode Length (m)							
12 to n+11	Validation Information							
n+12 to n+m+11	Microcode							
n+m+12 to n+m+13	Parameter Length (p)							
n+m+14 to n+m+ p+13	Parameters							

Notes:

Downloading microcode not approved by Hewlett-Packard may be deemed a violation of warranty.

Validation information must be generated by Hewlett-Packard at the factory if the microcode will be accepted.

Interface Control

The INTERFACE COMMAND allows the Initiator to send an ESDI command directly to the disk drive ESDI interface.

Interface Control Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = EFH							
01	Logical Unit Number			Reserved				Stat
02—03	(MSB=02)			Command		(LSB=03)		
04—08	(MSB=07)			Reserved		(LSB=08)		
09	Control Byte							

Stat (Status). If this byte is set to one (1), two (2) bytes of ESDI status information will be received from the disk drive and returned to the Initiator in addition to the interface status byte described below.

Note

There is **no** interface timeout on this command. It is the Initiator's responsibility to issue valid commands and to set the STAT bit only for commands which will normally return status information.

A single byte will be returned to the Initiator when the disk controller completes its operation. The byte has the following bit definitions:

- Bit 0 - Disk drive selected
- Bit 1 - Command complete
- Bit 2 - Ready
- Bit 3 - Attention
- Bits 4-7 - Undefined

Command. This field is the ESDI command for the disk drive.

Manage Primary

The MANAGE PRIMARY command is used to manage the Primary Defect list (Plist). the MANAGE PRIMARY command can delete the current Plist, install a new Plist, or append defects to the current Plist. When installing or appending the Plist, this command causes the specified physical blocks to be reassigned as primary defects and added to the Plist.

This command is implemented by performing a full device format, which will cause the loss of all user data and log information. Any existing Grown Defect List (Glist) defect information will also be lost. The current operating MODE SELECT parameters will become the saved parameters following this command.

The operation of the MANAGE PRIMARY command is similar to the FORMAT UNIT command.

Caution

The MANAGE PRIMARY command allows the Target to overwrite any or all of the Initiator-addressable data space. This command should be performed only when no data retention is required.

Use of this command should be restricted to development or other highly controlled environments. Any use of this command other than at Hewlett-Packard approved sites may be deemed a violation of warranty.

Manage Primary Command Descriptor Format (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = FDH							
01	Logical Unit Number			FMTDTA	CMPLST	Defect List Format		
02—08	(MSB=02)			Reserved		(LSB=08)		
09	Control Byte							

FMTDTA (Format Data), CMPLST (Complete List). The state of these bits indicate to the Target what to do with the supplied defect information.

The FMTDTA bit is used to indicate if the Initiator will send defect information to the Target. If FMTDTA is set to zero (0), the Initiator will not send a Defect List, consequently no Data Out Phase occurs. If FMTDTA is set to one (1), a defect list will be supplied by the Initiator.

When FMTDTA is set to one (1), the CMPLST bit determines whether or not existing defects in the Plist will be retained. If CMPLST is set to zero (0), the existing Plist is retained and the defect list is appended to it. If CMPLST is set to one (1), the existing Plist is deleted and replaced by the new list from the Initiator. If the append option is selected, only the spare track area and the affected tracks in the user area of the drive will be reformatted.

Defect List Format. This field must be set to 5 for the physical sector format or 4 for bytes from index format. The Defect List consists of a header indicating the total number of bytes in the set of descriptors to follow. Each descriptor consists of an 8-byte physical sector address. A Defect List Format byte of zero (0) is not considered an error.

Manage Primary Defect Sources

FMTDTA	CMPLST	Defect List Format Field	Defect List Supplied	Target Instructions
0[1]	X	X X X	No	No Data Out Phase. Do not retain current Plist. Do not retain current Glist
1	0	1 0 1 or 1 0 0 or 0 X X[2]	Yes	Append new defect list to current Plist. Do not retain current Glist.
1	1	1 0 1 or 1 0 0 or 0 X X[2]	Yes	Delete current Plist. Build new Plist with new defect list. Do not retain current Glist.

Notes:

1. The preferred option is FMTDTA = 0.
2. Defect list length of zero only.

Defect List Header

This header indicates the total number of bytes in the set of descriptors to follow. Each descriptor consists of an 8-byte physical sector address or bytes from index address. Each address is bounds checked by the Target. If any address is out of bounds an ILLEGAL REQUEST Sense Key is generated, and the format operation is discontinued.

The following bits in the defect list header will be set to 0: Disable Primary (DPRY) and Stop Format (STPF). If the Format Options Valid (FOV) bit is set to 1, the drive will accept a Disable Certification (DCRT) bit set to 1. All other option bits must be zero (0). The drive does not perform a certification pass in any case.

A sector number of FFFFFFFFH indicates that the entire track is to be reallocated.

Manage Primary Defect List Header Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Reserved							
01	FOV	DPRY	DCRT	STPF	IP	DSP	IMED=0	VU=0
02—03	(MSB=02) Defect List Length (LSB=03)							

FOV (Format Options Valid). An FOV bit of zero (0) indicates that the Target will use its default settings of the DPRY, DCRT, STPF, IP, and DSP bits. The Initiator will set these bits to zero (0). If any of these bits is not zero, the Target will terminate the command with a status of CHECK CONDITION, a Sense Key of ILLEGAL REQUEST, and an additional Sense Code of INVALID FIELD IN PARAMETER LIST.

An FOV bit of one (1) indicates that the Target will examine the setting of the DPRY, DCRT, STPF, IP and DSP bits. When FOV is one, these bits are defined as follows.

Manage Primary

DPRY (Disable Primary). A DPRY bit of zero (0) indicates that Target will not use portions of the media identified as defective in the Plist for Initiator addressable logic blocks. If the Target cannot locate the Plist or it cannot determine if a Plist exists, it will perform the action specified by the STPF bit.

A DPRY bit of one (1) indicates that the target will not use the Plist to identify defective areas of the media. The Plist is not deleted.

DCRT (Disable Certification). A DCRT bit of zero (0) indicates that the target will perform a vendor-specific media certification operation to generate a Clist.

A DCRT bit of one (1) indicates that the target will not perform any vendor-specific media certification process or format verification operation while executing the MANAGE PRIMARY command.

STPF (Stop Format). The STPF bit controls the behavior of the Target when one of the following events occurs:

1. The Target has requested the use of the Plist (DPRY is set to zero), or the Glist (CMPLST is set to zero) and the Target cannot locate the list or determine whether the list exists.
2. The target has been requested to use the Plist (DPRY is set to zero) or the Glist (CMPLST) is set to zero), and the target encounters an error while accessing the Dlist.

A STPF bit of zero (0) indicates that, if one or both of the above conditions occurs, the Target will continue to execute the MANAGE PRIMARY command. The Target will return CHECK CONDITION status at the completion of the MANAGE PRIMARY command. The sense key will be set to RECOVERED ERROR and the additional sense code will be set to either DEFECT LIST NOT FOUND if condition 1 described above occurs, or DEFECT LIST ERROR if condition 2 occurs.

A STPF bit of one (1) indicates that, if one or both of the above conditions occurs, the Target will terminate the MANAGE PRIMARY command with a status of CHECK CONDITION, a Sense Key of MEDIA ERROR, and an Additional Sense Code of either DEFECT LIST NOT FOUND if condition 1 occurred, or DEFECT LIST ERROR if condition 2 occurred.

DSP (Disable Saving Parameter). A DSP bit of one (1) specifies that the Target will not save the MODE SELECT parameters to the disk.

IP (Initialization Pattern). An IP bit of one (1) indicates that initialization pattern descriptor is supplied during the Data Out phase, immediately following the Defect List header. An IP bit of zero (0)indicates that no Initialization Pattern descriptor will be sent during the Data Out phase. The Target will use its default initialization pattern when it formats the media.

Initialization Pattern Descriptor (if any)

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	IP Modifier		Reserved					
01	Pattern Type							
02—03	(MSB=02)		Initialization Pattern Length				(LSB=03)	

IP Modifier. This field specifies the type and location of the header that modifies the initialization pattern.

Bits 6 7	Description
0 0	No header. Target will not modify initialization pattern.
0 1	Target will modify initialization pattern to write current logical block address at start of logical block. Four bytes of logical block address will be written with MSB first.
1 0	Target will modify initialization pattern to write current logical block address at start of each physical sector contained within the logical block. Four bytes of logical block address will be written with MSB first.
1 1	Reserved

Pattern Type. This field indicates the type of pattern the target will use to initialize each logical block within the initiator accessible portion of the disk. All blocks within a logical block will be written with the initialization pattern. The initialization pattern may be modified by the IP Modifier field as described above.

Pattern Type (byte 01)	Description
00H	Use default pattern. If initialization pattern length is not zero, Target will terminate command with a status of CHECK CONDITION, a Sense Key of ILLEGAL REQUEST, and an Additional Sense Code of INVALID FIELD IN PARAMETER LIST.
01H	Repeat initialization pattern as required to fill the logical block. If initialization pattern length is zero Target will terminate command with a status of CHECK CONDITION, a Sense Key of ILLEGAL REQUEST, and an Additional Sense Code of INVALID FIELD IN PARAMETER LIST.
02—7FH	Reserved
80—FFH	Vendor-specific.

Initialization Pattern Length. This field indicates the number of bytes contained in the initialization pattern. If the length exceeds the current logical block size, the target will terminate the command with a status of CHECK CONDITION, a Sense Key of ILLEGAL REQUEST, and an Additional Sense Code of INVALID FIELD IN PATTERN LIST. The pattern may be modified by the IP Modifier field.

Initialization Pattern. This field describes an initialization pattern that should be repeated to fill each sector on the disk.

Initialization Pattern Format (if any)

	Bit							
Byte	7	6	5	4	3	2	1	0
00—n	Initialization Pattern							

IMED (Immediate). The Target does not support the IMED bit. It must be set to zero (0).

VU (Vendor Unique). This bit should be set to (0).

Defect List Length. This field specifies the total length in bytes of the defect descriptors that follow and does not include the initialization pattern, if any. The length of the defect descriptors varies with the format of the defect list.

Defect Descriptors (if any)

	Bit							
Byte	7	6	5	4	3	2	1	0
00—xx	Defect Descriptor 0 (see specific table for length)							
00—xx	Defect Descriptor n (see specific table for length)							

Defect Descriptor - Bytes from Index Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00—02	(MSB=00) Cylinder Number Of Defect (LSB=02)							
03	Head Number Of Defect							
04—07	(MSB=04) Defect Bytes From Index (LSB=07)							

Each defect descriptor for the Bytes from Index Format specifies the beginning of an 8-byte defect location on the media. Each defect descriptor is comprised of the cylinder number of defect, the head number of defect, and the defect bytes from index. The defect descriptor will be in ascending order. To determining ascending order, the cylinder number of defect is considered the most significant part of the address and the defect bytes from index is considered the least significant part of the address. More than one physical or logical block may be relocated by each defect descriptor.A defect bytes from index of FFFFFFFFH indicates that the entire track will be reassigned.

Defect Descriptor - Physical Sector Format

	Bit							
Byte	7	6	5	4	3	2	1	0
00—02	(MSB=00) Cylinder Number Of Defect (LSB=02)							
03	Head Number Of Defect							
04—07	(MSB=04) Defective Sector Number (LSB=07)							

Each physical sector defect descriptor specifies the location of a defect that is the length of a sector. Each descriptor is comprised of a cylinder number of defect, the head number of defect, and the defective sector number. The defect descriptors are in decending order. The cylinder number of defect is the most significant part of the address, and the defective sector number is the least significant part of the address. More than one block may be affected by each defect descriptor.A defective sector number of FFFFFFFFH indicates that the entire track is considered defective.

Read Full

The READ FULL command allows the Initiator to request all available information fields for the specified logical or physical block. This information includes the header, data, and ECC field contents. The Target returns to the Initiator a complete image of one physical block. Included with the contents of the physical block is a header that defines the amount and type of data available.

READ FULL Command Descriptor Block (CDB)

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	Opcode = F0H							
01	Logical Unit Number			Reserved				PHYS
02—05	(MSB=02)			Address			(LSB=05)	
06	Reserved							
07—08	(MSB=07)			Allocation Length			(LSB=08)	
09	Control Byte							

PHYS (Physical Address). The interpretation of the address is determined by the state of the PHYS bit. If PHYS is set to zero (0), the Address field is treated as a logical block address per normal conventions and all normal position verifications are performed. The first *physical* block in the specified *logical* block is returned. To access all physical blocks, the Initiator must use the MODE SELECT command to set the logical block size equal to the physical block size (512 bytes). Otherwise, only the first physical block in each logical block is accessible.

If PHYS is set to one (1), the Address field is treated as a physical block address with the Address field defined as follows:

- Byte 2: Physical Cylinder Address (MSB)
- Byte 3: Physical Cylinder Address (LSB)
- Byte 4: Head Address
- Byte 5: Physical Sector Address

Address. This field specifies which block to return.

Allocation Length. This field specifies the number of bytes the Initiator is prepared to accept. If the number of bytes available from the Target is greater than that specified in the CDB, the data will be truncated to the Allocation Length value. The typical allocaion length for a device formated wih a 512 byte data field is 548.

Read Full Header Format

The physical block returned by the Target is preceded by a 10-byte header.

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Total Available Length (MSB) = 02H							
01	Total Available Length (MSB) = 22H							
02	Field Descriptor = 001			Field Length (MSB) = 00H				
03	Field Length (LSB) = 06H							
04	Field Descriptor=010			Field Length (MSB) = 02H				
05	Field Length (LSB) = 00H							
06	Field Descriptor = 100			Field Length (MSB) = 00H				
07	Field Length (LSB) = 14H							
08	Field Descriptor=000			Field Length (MSB) = 00H				
09	Field Length (LSB) = 00H							

Read Full Physical Block Contents

	Bit							
Byte	7	6	5	4	3	2	1	0
10—15	Header Bytes And Header ECC							
16—527	Data Bytes							
528—547	Data ECC Bytes And Data CRC							

Total Available Length. This field contains the number of bytes that the device can return for this command. The length does not include itself but does include the remaining eight bytes of the header. If the Allocation Length field in the CDB is smaller than the Total Available Length, the Total Available length is not adjusted to show the truncation.

Field Descriptor. The bit code values are defined as follows:

- 001 - Physical Block Header Field
- 010 - User Data Field
- 100 - Error Correction/Detection Field
- 000 - End Fields Mark

Field Length. The individual fields define the number of bytes to follow them in the associated field. The Field Length for the End Fields Mark is set to zero. The physical block consists of 538 bytes: 4 bytes of header, 2 bytes of header ECC, 512 bytes of data, 18 bytes of data ECC, and 2 bytes of data CRC.

Read Headers

The READ HEADERS command will read all the headers on the track specified by the Address field and return the requested number of bytes. The header information will always be returned starting from physical sector 0 of the addressed track regardless of the addressed block or sector.

READ HEADERS Command Descriptor Block (CDB)

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	Opcode = EEH							
01	Logical Unit Number			Reserved				PHYS
02—05	(MSB=02) Address (LSB=05)							
06	Reserved							
07—08	(MSB=07) Allocation Length (LSB=08)							
09	Control Byte							

PHYS (Physical Address). If the PHYS bit is set to one (1), the address is interpreted as a physical address in the following format:

- Byte 2: Physical Cylinder Address (MSB)
- Byte 3: Physical Cylinder Address (LSB)
- Byte 4: Head Address
- Byte 5: Physical Sector Address (Ignored)

If PHYS is set to zero (0), the address is assumed to be a logical address.

Address. This field specifies which track to read.

Allocation Length. A value of zero (0) in this field will cause a seek to the addressed track with the header information read from the disk but no data transfer to the Initiator. The typical allocation length is 4 x 57 = 228 bytes.

Reformat Track

The REFORMAT TRACK command will cause the addressed track on the disk drive to be formatted according to the setting of the Transfer Length field.

Caution

REFORMAT TRACK will cause the loss of all user data on the specified track. Use of this command should be restricted to development or other highly controlled environments.

Improper use of this command may cause the reformatted tracks to become unusable, or other user tracks to become inaccessible. Loss of defect information may also result. Any use of this command other than at Hewlett-Packard approved sites and by HP approved methods may be deemed a violation of warranty.

Reformat Track Command Descriptor Block (CDB)

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	Opcode = EDH							
01	Logical Unit Number			Reserved				
02—05	(MSB=02)			Physical Block Address				(LSB=05)
06	Reserved							
07—08	(MSB=07)			Transfer Length				(LSB=08)
09	Control Byte							

Physical Block Address. This field selects the physical block address of the track to be reformatted. The Address field is defined as follows:

- Byte 2: Cylinder Address (MSB)
- Byte 3: Cylinder Address (LSB)
- Byte 4: Head Address
- Byte 5: Sector Address (Ignored)

Transfer Length. If the Transfer Length field is zero (0), the track will be formatted with the normally correct default header information. If the Transfer Length is equal to the header length (6), the bytes supplied in the Data Out phase will be used as the header bytes to reformat the track.

Reformat Track Data Out Phase

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00—01	Reserved							
02—03	Logical Track Identification Track ID = No. of Heads * Cylinder + Addressed Head							
04	TSS[1]	Log Sector Number (0 .. 56)						
05	SSS[2]	Spare Sector Number[3]						

Notes:

1. Track Spare Status
2. Sector Spare Status
3. Spare Sector Number:
   - 0 .. 56 = Sector Number of Spared Sector
   - 125 = Spare Sector Not Used
   - 126 = Track Spared

Special Seek

The SPECIAL SEEK command executes a seek to the selected physical location, and when completed will leave the disk drive interface selected to allow special testing to take place at the addressed location. The disk drive LED will remain on, and the disk drive will remain selected until the next command from the Initiator is completed (status sent by Target).

Special Seek Command Descriptor Block (CDB)

	Bit							
Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
00	Opcode = ECH							
01	Logical Unit Number			Reserved				
02—05	(MSB=02)			Physical Block Address			(LSB=05)	
06—08	Reserved							
09	Control Byte							

Physical Block Address. This field selects the physical block address for the seek. The Address field is defined as follows:

- Byte 2: Cylinder Address (MSB)
- Byte 3: Cylinder Address (LSB)
- Byte 4: Head Address
- Byte 5: Sector Address (Not Used)

Write Full

The WRITE FULL command allows the Initiator to request the Target to write the specified logical or physical block with the exact block formatting information included with the command. This information may include the header, data, and ECC field contents.

Caution

The WRITE FULL command allows the Initiator to directly control the formatting of a physical block of media. Use of this command should be restricted to development or other highly controlled environments. The use of this command may adversely affect the reliability of data recovery and proper device operation at media addresses other than the one specified. This command is intended strictly to test Target and Initiator reaction to certain induced media errors. Any use of this command other than at Hewlett-Packard approved sites and by Hewlett-Packard approved methods may be deemed a violation of warranty.

Write Full Command Descriptor Block (CDB)

	Bit							
Byte	7	6	5	4	3	2	1	0
00	Opcode = FCH							
01	Logical Unit Number			Reserved				Phys
02—05	(MSB=02)			Address			(LSB=05)	
06	Reserved							
07—08	(MSB=07, 02H)			Byte Transfer Length			(LSB=08, 0CH)	
09	Control Byte							

Note

For this command to succeed, the header of the sector prior to the requested sector must be readable.

Using the WRITE FULL command, the Initiator transfers to the Target the complete information to write one physical block. A WRITE FULL command is usually preceded by a READ FULL command, which returns the entire contents (534 bytes) of a specified block. The Initiator receives the READ FULL data, strips off the 10-byte header, and modifies the block contents as required. The resultant 534 bytes constitute the data phase of the WRITE FULL command. The WRITE FULL command and the preceding READ FULL command should both address the same block; thus ensuring that the modified data is returned to its original location.

PHYS (Physical Address). The interpretation of the address is determined by the state of the PHYS bit. If PHYS is set to zero (0), the Address field is treated as a logical block address per normal conventions and all normal position verifications are performed. The first *physical* block in the specified *logical* block is written. To access all physical blocks, the Initiator must use the MODE SELECT command to set the logical block size equal to the physical block size (512 bytes). Otherwise, only the first physical block in each logical block is accessible.

If PHYS is set to one (1), the Address field is treated as a physical block address with the Address field defined as follows:

Byte 2: Cylinder Address (MSB)
Byte 3: Cylinder Address (LSB)
Byte 4: Head Address
Byte 5: Sector Address

Address. This field specifies which block to write.

Byte Transfer Length. This field specifies the number of bytes to be transferred in the data phase. This field is set to the sum of 26 (six bytes for the header and ECC plus 20 bytes for the data field ECC and CRC) added to the byte length of the sector data field (set by page 03 of the MODE SELECT command). Setting this field to any other value will generate an ILLEGAL REQUEST sense key.