EXABYTE

VXA-2 TAPE DRIVE

SCSI REFERENCE

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000	April 2002	Initial release
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NOTE: The most current information about this product is available at Exabyte's World Wide Web site (www.exabyte.com).

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About This Manual

This manual provides reference information for developing software to support applications for the VXA-2™ tape drive by Exabyte Corporation.

Contents of This Manual

This manual contains the following information:

- **Chapter 1** provides an overview of how the VXA-2 tape drive implements the Small Computer System Interface (SCSI). It also provides information about adapting device drivers developed for the VXA-1 tape drive for use with the VXA-2 tape drive.
- **Chapter 2** provides background information and instructions for implementing common tape drive operations in your application.
- **Chapter 3** through **Chapter 26** describe the SCSI commands supported by the tape drive. To help you find the information you need quickly, the SCSI commands are listed in alphabetic order.
- **Appendix A** lists the possible combinations of values for the Additional Sense Code (ASC) and Additional Sense Code Qualifier (ASCQ) fields returned by the REQUEST SENSE (03h) command for each sense key. It also lists the Fault Symptom Codes (FSCs) that may be returned by the REQUEST SENSE command and recommends error recovery procedures (ERPs) for each Fault Symptom Code.

Conventions Used in This Manual

This manual uses the following conventions to highlight important information:

Note: Notes provide additional information or suggestions about the topic or procedure being discussed.

! Important Read information marked by the "Important" icon for information that will help you complete a procedure or avoid extra steps.

Caution Read the information marked by the "CAUTION" icon for information you must know to avoid damaging the tape drive or losing data.

Related Publications

This manual provides information about the SCSI command protocol and the parallel SCSI bus communication interface used by the VXA-2 tape drive. The following publications provide additional, related information.

VXA-2 Tape Drive

- *VXA-2 SCSI Tape Drive Quick Start Guide*, 1009540
- *VXA-2 Tape Drive Product Manual*, 1009541

Standards

The following standards are related to the SCSI command protocol and parallel SCSI bus communication interface used by the tape drive.

- ANSI *Small Computer System Interface-2 (SCSI-2)*, X3.131 – 1994
- *ANSI SCSI Parallel Interface-2 (SPI-2)*, X3T10/1142D, Rev. 11
- *ANSI Information Technology SCSI Primary Commands-2 (SPC-2)*, T10/1236-D, Revision 18
- *ANSI Information Technology SCSI Primary Commands-2 (SPC-2)*, T10/1236-D, Revision 19
- *TapeAlert Specification*, Version 2.0, November, 1997

1

SCSI Command Protocol Overview

This chapter provides an overview of how the Small Computer System Interface (SCSI) command protocol is implemented for the VXA-2 tape drive. It discusses the following topics:

- Communication interface versus command protocol
- SCSI commands supported by the tape drive
- Format of the SCSI command descriptor blocks
- Command status supported by the tape drive
- Converting an existing VXA-1 driver

1.1 Communication Interface Versus Command Protocol

When two devices are connected across a bus or a network, their interaction is accomplished through a *communication interface* (for example, a parallel SCSI bus, a Fibre Channel arbitrated loop, or an Ethernet network). The communication interface allows multiple devices to share connections, yet operate and exchange data independently. The communication interface is comprised of the physical interface and the signaling protocol used during communication.

The physical interface determines the number of devices that can be attached to a bus or network loop, the maximum length of the cables, and the physical characteristics of the cable itself (for example, the number of wires, shielding, and so forth). The signaling protocol defines the electrical characteristics and timing of signals carried by the cable, the message system requirements, transmission speeds and maximum data transfer rates, as well as the encoding and decoding of the individual bit patterns representing commands passing between the individual devices.

The format and content of the information carried over the communication interface, as well as how each device uses and responds to the information, is governed by a *command protocol*. The command protocol determines how the host (or initiator) interacts with the target device (for example, the tape drive) by issuing commands, transferring data, and responding to status information. The command protocol also defines the individual bits in the command data passing between the individual devices. The target device responds to commands from the host by performing the requested operation (for example, writing or reading data on magnetic tape) and returning status information to the host.

1.2 SUPPORTED SCSI COMMANDS

The tape drive supports the SCSI commands shown in Table 1-1.

Table 1-1 *Supported SCSI commands*

Command	Operation code (hex)	What the tape drive does in response to this command	Described in...
ERASE	19h	Erases the tape starting from the current legal position to the physical end of tape (PEOT). Rewinds the tape when finished.	Chapter 3
INQUIRY	12h	Provides the initiator with information about the tape drive's device parameters, including product and vendor identification.	Chapter 4
LOAD/ UNLOAD	1Bh	Loads or unloads a data cartridge. When loading a cartridge, the tape drive places the tape in the tape path and positions it at the logical beginning of partition (LBOP) or the logical beginning of the default partition. When unloading a data cartridge, the tape drive writes any buffered information to the tape, rewinds the tape to the physical beginning of the tape (PBOT), removes the tape from the tape path, and ejects the data cartridge (unless ejection has been prevented by a PREVENT/ALLOW MEDIUM REMOVAL command).	Chapter 5
LOCATE	2Bh	Positions the tape at a specified logical position. (Typically, this position is determined by data that was obtained through a previous READ POSITION command.)	Chapter 6
LOG SELECT	4Ch	Manages a set of internal counters regarding read and write error recovery operations and amounts of data compressed. The initiator can set threshold and cumulative values for the counters or reset the counters.	Chapter 7
LOG SENSE	4Dh	Returns the values of the counters managed by the LOG SELECT command.	Chapter 8
MODE SELECT	15h	Changes the tape drive's internal medium, logical unit, or device parameters to values specified by the initiator.	Chapter 9
MODE SENSE	1Ah	Provides the initiator with information about the tape drive's internal medium, logical unit, and device parameters.	Chapter 10

Table 1-1 *Supported SCSI commands (continued)*

Command	Operation code (hex)	What the tape drive does in response to this command	Described in...
PREVENT/ ALLOW MEDIUM REMOVAL	1Eh	Prevents or allows the removal of the data cartridge from the tape drive. When the PREVENT MEDIUM REMOVAL command is in effect, the tape drive's eject button is disabled.	Chapter 11
READ	08h	Transfers data from the tape to the initiator.	Chapter 12
READ BLOCK LIMITS	05h	Provides the initiator with information about the maximum and minimum logical block lengths that the tape drive can support for read and write operations in the current operating mode.	Chapter 13
READ BUFFER	3Ch	Creates a diagnostic listing of the tape drive's current state or the contents of the tape drive's data buffer.	Chapter 14
READ POSITION	34h	Reports the current logical position of the tape to the initiator. This allows the initiator to store the position for later use in locating data with a LOCATE command.	Chapter 15
RECEIVE DIAGNOSTIC RESULTS	1Ch	Reports the results of diagnostic tests to the initiator.	Chapter 16
RELEASE UNIT	17h	Releases the tape drive from exclusive use by the initiator that had previously reserved it with a RESERVE UNIT command.	Chapter 17
REQUEST SENSE	03h	Provides the initiator with sense information describing a condition that just occurred.	Chapter 18
RESERVE UNIT	16h	Reserves the tape drive for exclusive use by the initiator that issued the command or for a third party.	Chapter 19
REWIND	01h	Rewinds the tape to the logical beginning of the tape (LBOT) or the logical beginning of the current partition.	Chapter 20
SEND DIAGNOSTIC	1Dh	Performs diagnostic functions specified by the initiator. (For the initiator to receive the results of the tests, this command must be followed by a RECEIVE DIAGNOSTIC RESULTS command.)	Chapter 21
SPACE	11h	Searches forward or backward on the tape a specified number of logical blocks, filemarks, or setmarks.	Chapter 22
TEST UNIT READY	00h	Indicates whether the tape drive is ready to accept a medium access command (such as READ or WRITE) from the initiator.	Chapter 23
WRITE	0Ah	Accepts data from the initiator to be written to the tape.	Chapter 24
WRITE BUFFER	3Bh	Transfers new microcode from the initiator into the tape drive's control memory.	Chapter 25
WRITE FILEMARKS	10h	Writes any data remaining in the tape drive's buffer to the tape, then writes a specified type and number of filemarks or setmarks following the data.	Chapter 26

1.3 SCSI COMMAND DESCRIPTOR BLOCK FORMAT

The following sections describe the general formats for the six- and ten-byte command descriptor blocks (CDBs) used by the tape drive, the format of the Operation Code, and the typical format for the Control byte. The formats for the six- and ten-byte CDBs are implemented according to the *ANSI Small Computer System Interface 2 (SCSI-2)* standard.

The word *Reserved* or *RSVD* has one of the following meanings when used in a SCSI command field definition:

- The field is defined as reserved by the *ANSI Small Computer System Interface (SCSI-2)* standard. The tape drive checks these fields for a value of 0. If zeros are not present, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h).
- The field has not been defined in the Exabyte implementation of the command. These fields are reserved for future enhancements. The tape drive ignores these fields and does not check for illegal values.

CDB FOR SIX-BYTE COMMANDS

Bit Byte	7	6	5	4	3	2	1	0
00	Operation Code							
01	Logical Unit Number			Command Dependent				
02	(MSB)							
03	Logical Block Address							
04								(LSB)
05	Control Byte							

CDB FOR TEN-BYTE COMMANDS

Bit / Byte	7	6	5	4	3	2	1	0
00	Operation Code							
01	Logical Unit Number			Command Dependent				
02	(MSB)							
⋮	Logical Block Address							
05								(LSB)
06	Reserved							
07	(MSB)							
08	Transfer, Parameter List, or Allocation Length							(LSB)
09	Control Byte							

FORMAT OF THE OPERATION CODE

Bit / Byte	7	6	5	4	3	2	1	0
00	Group Code			Command Code				

TYPICAL FORMAT OF THE CONTROL BYTE

Bit / Byte	7	6	5	4	3	2	1	0
nn	Vendor Unique		Reserved				Flag	Link

1.4 FIELD DEFINITIONS FOR THE COMMAND DESCRIPTOR BLOCK

The following sections provide field definitions for the six- and ten-byte command descriptor blocks (CDB).

1.4.1 FIELD DEFINITIONS FOR SIX-BYTE CDBS

Byte 00 – Operation Code

The Operation Code consists of two subfields, the Group Code and the Command Code, which are defined as follows:

Bits 7 through 5 – Group Code The Group Codes supported by the tape drive are defined by the specific command.

Bits 4 through 0 – Command Code The Command Codes supported by the tape drive are defined by the specific command.

Byte 01, Bits 7 through 5 – Logical Unit Number (LUN)

The LUN designates a specific unit within a group of devices associated with the target. Since the tape drive is a single device target and does not support multiple devices, the LUN must be 0 for all commands.

Byte 01, Bits 4 through 0 – Command Dependent

These bits are used as defined in the specific commands.

Bytes 02 through 04 – Logical Block Address

These bytes are used as defined in the specific commands.

Byte 05 – Control Byte

The Control Byte field consists for four subfields, which are defined as follows:

Bits 7 and 6 – Vendor Unique The VXA-2 tape drive does not use the vendor-unique information bits. The value for this field must be 0.

Bits 5 through 2 – Reserved The value for this field must be 0.

Bit 1 – Flag The tape drive does not recognize the Flag bit. The value for this field must be 0.

Bit 0 – Link The tape drive does not support linked commands. The value for this field must be 0.

1.4.2 FIELD DEFINITIONS FOR TEN-BYTE CDBS

Byte 00 – Operation Code

The Operation Code consists of two subfields, the Group Code and the Command Code, which are defined as follows:

Bits 7 through 5 – Group Code The Group Codes supported by the tape drive are defined by the specific command.

Bits 4 through 0 – Command Code The Command Codes supported by the tape drive are defined by the specific command.

Byte 01, Bits 7 through 5 – Logical Unit Number (LUN)

The LUN designates a specific unit within a group of devices associated with the target. Since the tape drive is a single device target and does not support multiple devices, the LUN must be 0 for all commands.

Byte 01, Bits 4 through 0 – Command Dependent

These bits are used as defined in the specific commands.

Bytes 02 through 05 – Logical Block Address

These bits are used as defined in the specific commands.

Byte 06 – Reserved

The value for this field must be 0.

Bytes 07 and 08 – Transfer, Parameter List, or Allocation Length

These bytes contain the transfer length, the parameter list length, or the allocation length as required by the specific command.

Byte 09 – Control Byte

The Control Byte field consists for four subfields, which are defined as follows:

Bits 7 and 6 – Vendor Unique The VXA-2 tape drive does use the vendor-unique information bits. The value for this field must be 0.

Bits 5 through 2 – Reserved The value for this field must be 0.

Bit 1 – Flag The tape drive does not recognize the Flag bit. The value for this field must be 0.

Bit 0 – Link The tape drive does not support linked commands. The value for this field must be 0.

1.5 COMMAND FORMAT ERRORS

A command format error may occur when:

- The Operation Code in the CDB is not supported by the tape drive.
- The Logical Unit Number (LUN) in the CDB is not 0.
- The value of the bytes or bits in a Reserved field (as defined by the ANSI SCSI-2 standard) is not 0.
- The value of the Link or Flag fields in the Control byte (bits 1 and 0) of the CDB are not 0, or the value of the Vendor Unique fields (bits 7 and 6) are not valid as defined for the specific command.

For all command format errors, the tape drive terminates the command and returns Check Condition status to the initiator. The sense data is set as follows:

- The sense key is set to Illegal Request (5h).
- Depending on the specific error, the Additional Sense Code (ASC) is set to Illegal Operation Code (20h), Logical Unit Not Supported (25h), or Invalid Field in CDB (24h).
- The Additional Sense Code Qualifier (ASCQ) is set to 0.
- The sense key specific data indicates the location of the error.

1.6 COMMAND STATUS

The tape drive sends one status byte to the initiator at the completion of a command. The status byte is formatted as follows:

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

Table 1-2 lists the meanings of the Status Byte Codes supported by the tape drive. Note that the value of bit 0 is always 0. The following sections provide more detailed explanations of the status bytes and the reasons they are sent.

Table 1-2 *Definition of the Status Byte code*

Hex value	Bit						Meaning
	5	4	3	2	1	0	
00h	0	0	0	0	0	0	**Good**. Indicates that the tape drive successfully completed the command.
02h	0	0	0	0	1	0	**Check Condition.** Indicates any error, exception, or abnormal condition that causes sense information to be set.
08h	0	0	1	0	0	0	**Busy.** Indicates that the tape drive is busy. This status is sent whenever the tape drive is unable to accept a command from an initiator.
18h	0	1	1	0	0	0	**Reservation Conflict.** Indicates that the tape drive is reserved for the exclusive use of another initiator.

1.6.1 GOOD

Good status indicates that the operation specified by the CDB completed normally. For those commands that support the immediate return of status, Good status indicates that the tape drive has accepted the command and will attempt to perform the operation specified by the CDB. If the specified operation does not complete normally, Check Condition status will be reported to the initiator when the next command is received by the tape drive from the same initiator.

1.6.2 CHECK CONDITION

The tape drive returns Check Condition status to indicate that a situation occurred during the execution of a command that should be checked by the initiator. Check Condition status does not necessarily mean that the command has failed to complete successfully.

The reporting of Check Condition status is immediate or deferred as follows:

- If status for the command is to be returned when the command is completed, Check Condition status is reported when the condition occurs (immediate error reporting).
- If status for the command was returned when the command was initiated (that is, before the condition occurred), Check Condition status is reported when the next command is received from the same initiator (deferred error reporting).
- If the condition occurs while the command is executing and the tape drive is disconnected from the initiator, Check Condition status is reported to the initiator after the reconnect process.

For specific situations that return Check Condition status, refer to the command descriptions in Chapter 3 through Chapter 26.

Check Condition status is reported when a command is received in the following cases:

- There is a bus parity error or format check error in a CDB.
- The command is the first command sent to the tape drive after it was reset by a SCSI bus reset or a Bus Device Reset message or after the data cartridge was replaced. The sense key in the sense data indicates Unit Attention (6h).
- A threshold comparison is enabled and a log counter has overflowed.

Always issue a REQUEST SENSE command to determine the cause of the Check Condition status.

1.6.3 BUSY

Busy status indicates that the tape drive is in the busy state. The tape drive is in a busy state when it is performing an internal operation that will not allow another command to be accepted until the operation is complete.

The tape drive returns Busy status for a command request until the busy state is released. For this reason, the initiator must reissue the command to the tape drive. Once the busy state is released, selection operation and commands can be executed normally.

1.6.4 RESERVATION CONFLICT

Reservation Conflict status indicates that the tape drive is currently reserved for the exclusive use of another initiator. This status is reported until the initiator that reserved the tape drive issues a RELEASE UNIT command or a reset condition occurs.

Note: The tape drive does not report Reservation Conflict status for REQUEST SENSE (03h) or INQUIRY (12h) commands.

1.7 CONVERTING AN EXISTING VXA-1 DRIVER

If you have been supporting the VXA-1 tape drive and want to convert an existing driver to provide support for the VXA-2 tape drive, you need to consider the changes summarized in Table 1-3.

Table 1-3 *Converting an existing VXA-1 device driver to a VXA-2 device driver*

Consider these differences between VXA-1 and VXA-2 when implementing device driver changes...	**Look here for more information....**
The following changes have been made in the INQUIRY command: ▪ Byte 07, Bit 5 – Wbus16 of the Inquiry data is always 1, indicating that the drive supports 16-bit wide transfers on the SCSI bus. In VXA-1, this bit is 0 if a narrow configuration is being used and 1 if a wide configuration is being used. ▪ Check the value of the Vendor Identification field (bytes 8 through 15) in the Standard Inquiry Data. The value returned by the VXA-2 tape drive is EXABYTE, followed by one ASCII space character. ▪ Check the product identification value returned by the VXA-2 tape drive in the Inquiry data. The value returned for bytes 16 through 31 is VXA-2, followed by 11 ASCII space characters. ▪ Support for the Device Identification page (Page Code 83) has been added.	Chapter 4, "INQUIRY (12h)"
The following changes have been made in the MODE SELECT and MODE SENSE commands: ▪ The VXA-2 tape drive supports additional tape lengths and formats.	Chapter 9, "MODE SELECT (15h)"
A new Firmware Download Mode (100b) has been added to the WRITE BUFFER command.	Chapter 25, "WRITE BUFFER (3Bh)"

2

IMPLEMENTING TAPE DRIVE OPERATIONS

This chapter explains how to implement common tape drive operations in your application. It includes information about the following:

- Data cartridges for the VXA-2 tape drive
- Using data compression
- Setting the size of logical blocks
- Using filemarks and setmarks
- Maximizing data transfer efficiency
- Formatting and using partitioned tapes
- Handling Unit Attention conditions
- Resetting the tape drive

2.1 DATA CARTRIDGES FOR THE VXA-2 TAPE DRIVE

The VXA-2 tape drive reads and writes to VXAtape AME (advanced metal evaporated) cartridges in either VXA-1 or VXA-2 format. Table 2-1 provides the approximate data capacities for each cartridge when written in VXA-2 format.

Note: Tapes written in VXA-2 format cannot be read by VXA-1 tape drives.

Table 2-1 *VXAtape cartridge capacities in gigabytes (GB)*

Cartridge Model	Capacity, Native	Capacity, Compressed[a]	Tape Length
V23	80 GB	160 GB	230 meters
V17	59 GB	118 GB	170 meters
V10	37 GB	74 GB	107 meters
V6	21.5 GB	43 GB	62 meters

[a] Assumes a 2:1 compression ratio. Actual compressed capacity varies depending on the type of data being recorded.

2.1.1 LOADING A DATA CARTRIDGE

When you insert a data cartridge into the tape drive, the following actions occur.

1. The tape drive automatically loads the tape into the tape path.
2. The tape drive reads the logical format record at the beginning of the tape or determines that the tape is blank.
3. The tape drive positions the tape at the logical beginning of partition 0 (LBOP).
4. The tape drive goes to the tape ready, idle state (LEDs 2 and 4 on).

Note: Do not insert a cartridge until the tape drive has finished its power-on self-test (indicated when LED 4 is green). The tape drive will not accept a cartridge if you try to insert it before POST is complete.

2.1.2 UNLOADING A DATA CARTRIDGE

When you press the eject button or issue an UNLOAD command (1Bh), the following actions occur (assuming that a data cartridge is loaded and the tape drive is ready).

Note: If you previously issued a PREVENT/ ALLOW MEDIUM REMOVAL command to prevent media removal, the tape drive does not perform the unload operation when you press the eject button.

1. The tape drive completes any command or operation currently in progress.
2. The tape drive writes any buffered information to tape, then writes an EOD mark to indicate the end of data.
3. The tape drive writes the updated logical format record at the beginning of the tape.
4. The tape drive rewinds the tape to the physical beginning of tape (PBOT).
5. The tape drive unloads the tape from the tape path.
6. The tape drive ejects the data cartridge.

Status Reported for Unload Procedure

If you issue a command to the tape drive during the unload procedure, the tape drive returns Check Condition status with the sense key set to Unit Attention (6h). After reporting a Unit Attention condition, the tape drive returns Check Condition with the sense key set to Not Ready (2h) for all subsequent commands (except INQUIRY and REQUEST SENSE). (For information about clearing a Unit Attention condition, see page 2-10.)

Error During Unload Procedure

If an error occurs before or during the unload procedure, the tape drive suspends the unload sequence; LEDs 1 and 3 change to yellow to indicate an error. If you press the eject button again, the tape drive reattempts the unload sequence. Be aware that unwritten data in the buffer will not be written to tape. The buffer and any errors will be cleared.

Note: The tape drive will not eject the cartridge until it has successfully written the logical format record to tape.

2.2 USING DATA COMPRESSION

The VXA-2 tape drive writes data in either VXA-2 or VXA-1 format. By default, data is compressed when it is written. The VXA-2 tape drive uses an Adaptive Lossless Data Compression (ALDC) algorithm to compress data at an average ratio of 2:1. However, the actual compression ratio may be higher or lower depending on the type of data.

You can use the DCE (data compression enable) bit of the MODE SELECT command to specify compressed or uncompressed format at any position on the tape (see page 9-11).

2.3 SETTING THE SIZE OF LOGICAL BLOCKS

Logical blocks are the basic units of data transfer between the initiator and the tape drive.

When you use the WRITE or READ commands, you can specify fixed-length or variable-length logical blocks. If you write or read fixed-length logical blocks, you can transfer one or more logical blocks with each command. You specify the block length using the Block Length field in the Block Descriptor of the MODE SELECT command. If you write or read variable-length logical blocks, you transfer just one logical block with each command. You specify the block length in the Transfer Length field of the WRITE or READ command.

You can set the size of the logical data blocks to values between 0 and 240 KB. However, for optimum tape drive efficiency, keep the following factors in mind when choosing the logical block size:

- For variable-length logical blocks or fixed-length logical blocks, select a block size that ensures that the data transferred in a single variable length block or in a set of fixed-length blocks is greater than or equal to 32 KB; transferring at least 64 KB of data at a time provides optimal data compression.
- For fixed-length logical blocks, only block lengths that are multiples of 4 bytes are valid. Regardless of the block size you select, always make sure that at least 32 bytes of data are transferred with each command. A block length of 0 is invalid for fixed-length blocks.

- For variable-length logical blocks, the minimum block size is 1 byte. However, using a very small block size will affect the tape drive's performance. Try to use a block size no smaller than 32 KB. In general, larger logical blocks transfer more efficiently than smaller logical blocks.

If you use logical blocks that are smaller than the recommended range, tape drive efficiency is reduced in the following areas:

- **Tape capacity.** The tape drive adds header and error correction information to each logical block set it writes to tape during each transfer. If you use very small logical block sets, significant overhead is added to the data recorded on the tape.

- **Compression.** The tape drive compresses data on a block-by-block basis by building a translation table for each logical block. Very small logical blocks slightly reduce compression efficiency because a new table has to be built for each block.

2.4 USING FILEMARKS AND SETMARKS

Filemarks and setmarks enable an initiator to locate particular blocks of data using high-speed search. When writing data to tape, an initiator can use WRITE FILEMARKS commands to write filemarks or setmarks to indicate data boundaries. When reading the tape, the initiator can use a SPACE command to position the tape to data marked by a filemark at high speeds.

Setmarks provide an additional way to indicate data boundaries on the tape; in a sense, they can be thought of as a "hierarchically superior" filemark. You can use a MODE SELECT (15h) command to suppress setmark detection during read, verify, space block, and space filemark operations. The setmark is the same length as the filemark. For additional information about using setmarks, refer to Chapter 26, "WRITE FILEMARKS (10h)."

2.5 MAXIMIZING DATA TRANSFER EFFICIENCY

When reading or writing data, the tape drive can operate in either streaming or start/pause mode, depending on the data transfer rate of the host system. Streaming occurs when the data transfer rate to or from the host is greater than or equal to the tape drive's own data transfer rate, allowing the drive to read or write data in a continuous stream. When the host's data transfer rate is less than the tape drive's data transfer rate, the tape drive must operate in start/pause mode as it waits for data transfer to or from the host.

Streaming Mode When operating in streaming mode, the tape drive transfers data continuously (to tape or to the host) without stopping tape motion. If your system permits, operating the tape drive in streaming mode can maximize the amount of data you can store on a tape and minimize the amount of wear on the tape and recording heads. To enable the tape drive to operate in streaming mode, the host must be able to transfer data at a minimum of 6 MB per second if the tape drive is writing uncompressed data or approximately 12 MB per second if the tape drive is writing compressed data.

During streaming operation, the tape drive adapts to variations in the host's data transfer rate by disconnecting from and reconnecting to the SCSI bus, as follows:

- During a write operation, if the tape drive's buffer fills with data from the host faster than the tape drive can write the data to tape, the tape drive disconnects from the SCSI bus while continuing to write data until the amount of space available in the buffer is equal to the reconnect threshold. The tape drive then reconnects to the SCSI bus to accept more data.
- During a read operation, if the host can accept data from the tape drive's buffer faster than the tape drive can fill the buffer with data from the tape, the tape drive disconnects from the SCSI bus until it has filled the buffer back up to a level equal to the reconnect threshold. Then the tape drive reconnects to the SCSI bus to transfer more data.

Start/Pause Mode When operating in start/pause mode, the tape drive pauses and restarts tape motion to accommodate a slow host transfer rate. The tape drive determines when to restart tape motion by comparing how full the buffer is to the motion threshold, as follows:

- During a write operation, the tape drive waits until the buffer is filled to a certain level (the motion threshold), starts the tape and records the buffered data. When the buffer is empty, the tape drive pauses tape motion until the buffer can be filled again by the host. The tape drive then resumes writing data at the point where it paused.
- During a read operation, the tape drive fills the buffer with data from the tape, pauses the tape motion, waits for the host to accept enough data to empty the buffer to the motion threshold, then restarts the tape motion and fills the buffer again.

2.6 FORMATTING AND USING PARTITIONED TAPES

The VXA-2 tape drive can write and read tapes containing one or two partitions. A partition is a self-contained writable and readable area on a tape. A standard tape is considered a single-partition tape. That is, there are no divisions on the tape; the entire capacity of the tape is dedicated to a single data set, regardless of how large that set is. When data at the beginning of the partition is overwritten, any previously written data past the new end of data (EOD) mark on the tape becomes inaccessible.

A multi-partition tape is a tape that has been divided into two separate writable and readable areas (partitions). When data is recorded on a partitioned tape, each partition is treated as a separate "virtual" tape. When data in one partition is overwritten, data in other partitions on the tape is still accessible. Each partition can be updated and rewritten without affecting the data in the other partitions. Note that partitions are not the divisions between separate areas on the tape; rather, they are the separate areas themselves.

Each partition on a tape contains a logical and physical beginning (LBOP and PBOP) and a logical and physical end (LEOP and PEOP). The tape drive considers each partition a completely self-contained recording area independent of the other partition on the tape. The tape drive cannot move the tape beyond the beginning or end of a partition unless specifically requested to by a LOCATE (2Bh) or MODE SELECT (15h) command. In effect, the tape drive treats each partition as if it were a separate tape.

2.6.1 CREATING A PARTITIONED TAPE

To create a partitioned tape, you format the tape using the Medium Partition page (Page Code 11h) of the MODE SELECT (15h) command. The Medium Partition page lets you specify whether there are one or two partitions on the tape. If only one partition is selected, the partition encompasses the entire tape.

A standard blank tape is considered to have one partition. You do not need to format a blank tape if you want only one partition. The only time you would specify one partition when you are formatting a tape is if you want to change a two-partition tape back to a single-partition tape.

The following is a summary of the steps you take to create two partitions on an unformatted (or single-partition) tape. (Refer to Chapter 9 for specific details about using the MODE SELECT command.)

1. Load a tape into the tape drive, or rewind the current tape to the logical beginning of tape (LBOT). The tape must be positioned at LBOT or at the logical beginning of a partition (LBOP) before you can format the tape with new partitions.

2. Issue a MODE SELECT command and specify page format (PF=1). Specify the following parameters for the partitions in the Medium Partition page (Page Code=11h):

   - Set the Additional Partitions Defined field to 1 to indicate that you want to define one partition in addition to the original partition (the entire tape).

- Set FDP (Fixed Data Partitions), SDP (Select Data Partitions), or IDP (Initiator Defined Partitions) to 1 depending on how you want the size of the partitioned determined. (Note that you can set only one of these fields.) If FDP=1, the partition will encompass the entire tape, resulting in a single-partition tape. If SDP=1, partition 1 will be 100 MB and partition 0 will encompass the remainder of the tape. If IDP=1, the partitions will be the size you specify.

- If you choose to define the partition sizes yourself (IDP=1), use PSUM (Partition Size Unit of Measure) to specify the units of measure you will use to specify the size. Use the Partition Size fields to specify each partition's size. (Note that if you specify a total value for the Partition Sizes that is larger than the amount of space available on the tape, the format will fail with a sense key of Illegal Request (5h).)

3. Wait for the formatting process to be completed (several minutes depending on the partition sizes). When the tape drive has finished formatting the tape, it will position the tape at the beginning of the default partition (the last partition on the tape). At this point, you can begin writing data or performing other tape operations as described in the following section.

2.6.2 USING A MULTI-PARTITION TAPE

The easiest way to use a multi-partition tape is to think of it as separate tapes. Just as you would have to physically change tapes to access data on another tape, you have to specifically request that the tape be moved to another partition before you can perform actions in that partition. The following sections describe how to perform several typical actions on a multi-partition tape.

Loading a Partitioned Tape

You load a multi-partition tape exactly as you would a standard tape. By default, the tape drive positions to the LBOP for the last partition on the tape (partition 0).

Changing Partitions

If you want to move the tape from one partition to the logical beginning of another partition (LBOP), use either of the following methods:

Note: The tape drive repositions the tape immediately, regardless of the method used to change partitions.

Method 1 – LOCATE command Issue a LOCATE (2Bh) command. Specify the following parameters:

- Set CP (Change Partitions) to 1 to indicate you want to change partitions.
- For Block Address, specify the block to which you want the tape moved.
- Set Partition to the number of the partition to which you want to change.

Method 2 – MODE SELECT command Issue a MODE SELECT (15h) command. Specify page format (PF=1) and send the Device Configuration page (Page Code=10h). Specify the following parameters:

- Set CAP (Change Active Partition) to 1 to indicate that you want the tape to be moved to another partition.
- Set Active Partition to the number of the partition to which you want to move.

Writing Data in Partitions

To write data, use the WRITE (0Ah) command as you would with a standard tape. However, remember that if you want to write data in the partition the tape is not currently in, you must first use the LOCATE or MODE SELECT command to change partitions, as described in the previous section.

When you are writing data to a partition, you can not write data past the end of the partition. If the tape drive encounters the logical end of the partition (LEOP), it returns Check Condition status, just as it does when it encounters the logical end of the tape (LEOT). Similarly, you cannot write past physical end of the partition (PEOP) when you choose to write data all the way to PEOP. If the tape drive encounter PEOP while writing data, it reacts just as it does when it encounters the physical end of the tape (PEOT). The write operation stops and any buffered data is not written to tape.

Locating Data Blocks in Partitions

Use the READ POSITION (34h) command to identify the position of a specific data block on a partitioned tape as you would on a standard tape. The READ POSITION data returned by the tape drive indicates the block address at the current location. It also indicates the partition number for the current location.

When you use the LOCATE (2Bh) command on a partitioned tape, you must first specify in which partition the tape drive should search for the requested block. If you need to change partitions, set the CP (Change Partition) bit to 1 and specify the number of the partition to which you want the tape moved in the Partition field. The tape drive moves the tape to the requested partition, then searches for the requested block.

Reading Data on a Partitioned Tape

To read data, use the READ (08h) command just as you would with a standard tape. However, remember that if you want to read data in a partition the tape is not currently in, you must use the LOCATE or MODE SELECT command to reposition the tape to that partition. After you have issued a command to relocate to a new partition, you can use a LOCATE command or SPACE command to move the tape to a legal position for reading data.

Rewinding a Partitioned Tape

When you issue a REWIND (01h) command, the tape drive rewinds the tape to the beginning of the current partition. If the tape is positioned in the first partition on the tape (partition 1), the tape drive rewinds the tape to the logical beginning of the tape (LBOT).

If you want to rewind the tape to LBOT and the tape is positioned in partition 0 (the last partition on the tape), do not use the REWIND command. Instead, use the LOCATE command to position the tape to the logical beginning of partition (LBOP) for partition 1.

Erasing a Partitioned Tape

The ERASE command acts on only one partition at a time. After erasing the partition, the tape drive rewinds the tape to the beginning of that partition. To erase the data from an entire tape without eliminating the partitions, you must erase each partition separately.

Erasing Data From One Partition If you want to erase the data from just one partition, use the ERASE command as you would with a standard tape. Start from the beginning of the partition you want to erase and issue the ERASE command. The tape drive rewrites the LBOP information, then erases forward from LBOP until it reaches the end of the partition. It then rewinds to LBOP. When you erase the data from one partition, no data in other partitions is erased.

Erasing the Entire Tape If you want to erase the entire tape, you can erase each partition separately and preserve the partition information. Or, you can reformat the tape as a single-partition tape, then erase the entire tape.

! Important If you reformat a partitioned tape to create a single-partition tape, all of the information defining the original partitions is erased. However, the actual data is not erased and remains on the tape (although it is not accessible by commercial software). For this reason, if you are concerned about data remaining on a tape, do not use reformatting as a way to erase data. You must explicitly perform a long erase operation to erase the data after reformatting the tape to remove the partition information (see page 3-2).

Unloading a Partitioned Tape

The UNLOAD command works exactly as it would for a standard tape. You can issue the UNLOAD command from any partition. The tape drive rewinds the tape to the physical beginning of tape (PBOT), unloads the tape from the tape path, and ejects the cartridge.

2.7 HANDLING UNIT ATTENTION CONDITIONS

The tape drive creates a Unit Attention condition for each initiator when any of the following conditions occurs:

- A data cartridge is inserted and automatically loaded.
- A data cartridge is inserted and rejected because the media is incompatible with the tape drive.
- The eject button is pressed and the data cartridge is ejected.
- The MODE SELECT parameters are changed by an initiator other than the one attempting to communicate with the tape drive.
- The tape drive is reset or powered off and back on again (see page 2-11).
- A log parameter (counter) reaches a specified threshold value — assuming that the Report Log Exception Condition (RLEC) bit on the MODE SELECT Control Mode page is set to 1.
- The internal microcode (firmware) is changed by a SCSI download (WRITE BUFFER command).

2.7.1 EFFECT OF CHANGING DATA CARTRIDGES

When you press the eject button to remove a cartridge from the tape drive, the tape drive first rewinds the tape to the PBOT and unloads it from the tape path. When the eject operation is complete, the tape drive returns Check Condition status with the sense key set to Not Ready (2h) to all subsequent commands that require tape motion.

When you insert a data cartridge, the tape drive loads the tape into the tape path and positions it at LBOP for partition 0. When the load operation is complete, the tape drive returns Check Condition status with the sense key set to Unit Attention (6h) to all initiators on the bus.

2.7.2 CLEARING THE UNIT ATTENTION CONDITION

A Unit Attention condition persists for each initiator until that initiator issues any command other than INQUIRY (12h) or REQUEST SENSE (03h).

First Command Received after Unit Attention

If the first command received after a Unit Attention condition occurs is an INQUIRY or REQUEST SENSE command, the tape drive executes the command, reports any pending status, and preserves the Unit Attention sense data. If the first command is any other command, the tape drive does not execute the command and returns Check Condition status with the sense key set to Unit Attention (6h).

Next Command Received after Unit Attention

If the next command received after a Unit Attention is reported is a REQUEST SENSE or an INQUIRY command, the tape drive executes the command and preserves the Unit Attention sense data. If the next command is any other command, the command is executed and the Unit Attention sense data is cleared.

Note: If multiple Unit Attention conditions occur before the initiator selects the tape drive, each Unit Attention condition is presented sequentially in the order that it occurred.

2.8 RESETTING THE TAPE DRIVE

You can use any of the following methods to reset the tape drive:

- Power the tape drive off and back on again (power-on reset).
- Press and hold the eject button for at least 10 seconds, then release the button. The tape drive first unloads and ejects any cartridge that is in the tape drive (unless a hardware error occurred), then resets the tape drive.
- Send a RST pulse on the SCSI bus for a minimum of 25 µsec (SCSI bus reset). A SCSI bus reset immediately clears all devices from the bus, resets their associated equipment, and terminates all pending I/O processes.
- Issue a Bus Device Reset (0Ch) message to the tape drive (device reset). A device reset clears the tape drive from the bus, causes all commands sent to it to be cleared, and terminates all pending I/O processes.

Note: If a SCSI bus or device reset occurs during a power-on reset, the power-on reset operation will be restarted.

2.8.1 EFFECT OF POWER-ON RESET

Performing a power-on reset causes the tape drive to complete its power-on self-test. A power-on reset also has the following effects:

- If the tape drive is connected to the SCSI bus, the SCSI bus goes to the Bus Free phase.
- The checksum of the control code is verified.
- The servo is reset and a servo self-test is performed.
- All tape drive parameters are reset to their default states.
- A test of the microprocessor's external memory is performed.
- A buffer memory test is performed.

After a power-on reset, the tape drive will respond on the SCSI bus within three seconds.

2.8.2 EFFECT OF SCSI BUS AND DEVICE RESETS

If the tape drive is set for buffered operation (see page 9-3) and there is data in the buffer from a WRITE or WRITE FILEMARKS command, the tape drive writes the buffered data to tape before resetting. Then, if the tape drive is connected to the SCSI bus, the SCSI bus goes to the Bus Free phase. After a SCSI bus or device reset, the tape drive will respond on the SCSI bus within 250 msec.

! Important If the device that supplies SCSI bus terminator power is powered off, the RST line may be left in an indeterminate state (either reset or not, depending on the voltages). It may be impossible to communicate with the tape drive or to unload a data cartridge when the device is in this state. To remove the data cartridge, restore power to the terminating device or remove the SCSI cable from the tape drive to allow independent tape drive operation.

2.8.3 RESET PROCESSING

The tape drive processes resets differently depending on whether a data cartridge is present or not.

Data Cartridge Present before Reset

If a data cartridge is present before the reset occurs and the tape has only one partition, the tape drive rewinds the tape and positions it at the beginning of the partition. If the tape has more than one partition, the tape drive rewinds the tape then positions it at the logical beginning of the partition (LBOP) of the default partition. When the reset is complete, the tape drive is ready to process tape motion commands.

When a data cartridge is present, the tape drive responds to the reset as follows:

- It returns Check Condition status to the first command received. The sense key is set to Unit Attention (6h), and the Additional Sense Code (ASC) and Additional Sense Code Qualifier (ASCQ) fields indicate that a reset occurred.
- It processes all non-motion commands. The default status returned by the TEST UNIT READY (00h) command is Check Condition status with the sense key set to Not Ready (2h). The ASC and ASCQ fields indicate that the device is becoming ready.
- If it receives tape motion commands, the tape drive queues (holds) one tape motion command from each initiator (and disconnects, if allowed) until the reset operation is complete and the tape is loaded. Once the load is complete, it processes the queued commands.

If the tape is already rewound when the reset occurs, the reset takes about one minute to complete. Additional time is required if the tape drive needs to rewind the tape.

Data Cartridge Not Present before Reset

When a data cartridge is not present, the tape drive responds to the reset as follows:

- It returns Check Condition status to the first command received. The sense key is set to Unit Attention (6h), and the ASC and ASCQ fields indicate that a reset occurred.
- It processes all non-motion commands. The TEST UNIT READY (00h) command returns Check Condition status with the sense key set to Not Ready (2h). The ASC and ASCQ fields indicate that no tape is present.
- It returns Check Condition status to all tape motion commands. The sense key is set to Not Ready (2h), and the ASC and ASCQ fields indicate that no tape is present.

! Important After a reset, do not insert a cartridge into the tape drive until the LEDs indicate that the tape drive is ready (LED 4 is green, all others are off). The tape drive will not accept a cartridge if you try to insert one before the LEDs are off.

Notes

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ERASE (19h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	0	0	1
01	Logical Unit Number			Reserved			Immed	Long
02	Reserved							
03								
04								
05	Control							

3.1 About This Command

The ERASE command causes the tape drive to perform one the following types of erase operations:

- A short erase (byte 01, bit 0 equals zero) clears the partition information and writes an EOD at the logical beginning of the partition (LBOP).
- A long erase (byte 01, bit 0 equals one) erases all data from the tape (long erase), starting at the current valid tape position to the physical end of tape (PEOT) or, if the tape is partitioned, to the physical end of the current partition (PEOP).

When the erase operation is successfully completed, the tape drive automatically rewinds the tape to the logical beginning of tape (LBOT) or, if the tape is partitioned, to the logical beginning of the current partition (LBOP).

The tape drive performs the erase operation at the same speed as it performs the READ and WRITE commands.

Notes:

- If the ERASE command is received after a WRITE (0Ah) or WRITE FILEMARKS (10h) command, the tape drive writes any buffered data, filemarks, and setmarks to tape before performing the erase operation. If an error occurs while it is writing the buffered data to the tape, the tape drive returns Check Condition status and does not perform the erase operation.
- To erase all of the data from a partitioned tape without eliminating the partition information, you must erase each partition separately.

If you want to erase the entire tape, you can erase each partition separately and preserve the partition information. Or, you can reformat the tape as a single-partition tape, then erase the entire tape.

! Important If you reformat a partitioned tape to create a single-partition tape, all of the information defining the original partitions is erased. However, the actual data is not erased and remains on the tape (although it is not accessible by commercial software). For this reason, if you are concerned about data remaining on a tape, do not use reformatting as a way to erase data. You must explicitly perform a long erase operation to erase the data after reformatting the tape.

3.2 CDB FIELD DEFINITIONS

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 1 – Immed

This bit determines when command status is returned to the initiator:

0 – Status is returned when the ERASE command is completed.
1 – Status is returned when the ERASE command is started.

If the buffer contains data from a previous WRITE command, the tape drive does not execute the ERASE command until the data in the buffer is written to the tape and an EOD mark is appended. The tape drive then performs the erase operation as follows:

- **If the Immed bit is set to 1,** the tape drive returns Good status and performs the erase operation.
- **If the Immed bit is set to 0**, the tape drive returns status when the erase and rewind operations are complete.

Byte 01, Bit 0 – Long

This bit determines the amount of tape to be erased, as follows:

0 – The partition information is cleared and an EOD mark is written at the logical beginning of the partition (LBOP). No data is erased. The tape drive returns Good status.

1 – The partition information and the data for the current partition is erased beginning at the current position to the physical end of partition (PEOP).

3.3 TAPE POSITIONING

The ERASE command can only be performed at the following valid tape positions:

- Logical beginning of partition (LBOP)
- End of data mark (EOD)
- Beginning of tape (BOT) side of a filemark
- End of tape (EOT) side of a filemark
- BOT side of a setmark
- EOT side of a setmark

3.4 EXCEPTIONS AND ERROR CONDITIONS

Table 3-1 lists exceptions and error conditions that cause the tape drive to return Check Condition status for the ERASE command.

Table 3-1 *REQUEST SENSE data for ERASE command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
02h	04h	01h	**Not Ready.** Logical unit not ready, but is in process of becoming ready (rewinding or loading tape).
02h	3Ah	00h	**Not Ready.** Logical unit not ready. Command requires a tape, and no tape is present.
03h	30h	02h	**Medium Error.** The tape format is incompatible with the tape drive hardware or microcode.
03h	31h	01h	**Medium Error.** The tape format is corrupted.
03h	50h	00h	**Medium Error.** The tape drive could not locate a valid splice location on the tape. The tape is not located at a valid write position or the tape drive could not locate the valid write position.
04h	15h	01h	**Hardware Error.** The tape drive cannot position the tape correctly.
04h	51h	00h	**Hardware Error.** The erase operation failed.
06h	30h	00h	**Unit Attention.** Incompatible media was rejected after the cartridge was inserted.
07h	27h	00h	**Data Protect.** Attempted to erase a data cartridge that is write protected.

Notes

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INQUIRY (12h)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	0	1	0
01	Logical Unit Number			Reserved				EVPD
02	Page Code							
03	Reserved							
04	Allocation Length							
05	Control							

4.1 About This Command

The INQUIRY command requests that information about the tape drive's parameters be sent to the initiator.

4.2 CDB Field Definitions

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 0 – EVPD (Enable Vital Product Data)

This field indicates the type of Inquiry data being requested by the initiator, as follows:

0 – Return Standard Inquiry Data. The value of the Page Code field (byte 02) must be 0.

1 – Return one of the Vital Product Data pages, based on the value of the Page Code field.

Byte 02 – Page Code

This field specifies the page number of the Vital Product Data page to be returned to the initiator, as follows:

00h – Supported Vital Product Data page
80h – Unit Serial Number page
83h – Device Identification page
C0h – Original Inquiry Data page

If the EVPD bit (byte 1, bit 0) is set to 0, the Page Code must be 00h.

Byte 04 – Allocation Length

This field specifies the number of bytes allocated by the initiator for the Inquiry data returned by the tape drive. Any value between 00h and FFh is valid. An allocation length of 00h indicates that no data is to be returned.

The tape drive terminates the Data In phase when the number of bytes specified in the Allocation Length field has been transferred or when all available Inquiry data has been transferred, whichever is less.

4.3 WHAT THE TAPE DRIVE RETURNS

The data returned by the tape drive depends on the values specified in the INQUIRY CDB. Table 4-1 summarizes the values you must specify in the INQUIRY CDB to return the different types of Inquiry data.

Table 4-1 *CDB values for different types of Inquiry data*

To return this Inquiry data...	Set these fields to...		And specify this value for the Allocation Length...	Number of bytes returned (hex)
	EVPD	Page Code		
Standard Inquiry Data	0	00h	any value from 0 to FFh	0 to 108 bytes (00h to 6Ch)
Supported Vital Product Data page	1	00h	08h	8 bytes (08h)
Unit Serial Number page	1	80h	10h	16 bytes (10h)
Device Identification page	1	83h	2Ah	44 bytes (2Ch)
Original Inquiry Data page	1	C0h	6Ch	108 bytes (6Ch)

4.3.1 STANDARD INQUIRY DATA

The tape drive returns the Standard Inquiry Data when the EVPD bit in the CDB is 0.

Bit Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	RMB	Device-Type Modifier						
02	ISO Version		ECMA Version			ANSI Version		
03	AERC	Reserved			Response Data Format			
04	Additional Length							
05 06	Reserved							
07	RelAdr	WBus32	WBus16	Sync	Linked	RSVD	CmdQue	SftRe
08 ⋮ 15	Vendor Identification							
16 ⋮ 31	Product Identification							
32 ⋮ 35	Product Revision Level							
36 ⋮ 55	Vendor Specific							
56 ⋮ 95	Reserved							
96 ⋮ 107	Unit Serial Number							

Byte 00, Bits 7 through 5 – Peripheral Qualifier

The Peripheral Qualifier indicates whether a device of the type specified in Peripheral Device Type field is currently connected to the specified logical unit (LUN), as follows:

000b – The specified device type is currently connected to this logical unit.

011b – The LUN is invalid (the LUN in the CDB or in the Identify message was not 0).

Byte 00, Bits 4 through 0 – Peripheral Device Type

The Peripheral Device Type identifies the device currently connected to the specified logical unit (LUN), as follows:

00000b –The device (the tape drive) is a sequential access device.

11111b –The device type is unknown or there is no device type (the LUN in the CDB or in the Identify message was not 0).

Byte 01, Bit 7 – RMB (Removable Media)

The value returned for this field is 1, indicating that the media is removable.

Byte 01, Bits 6 through 0 – Device-Type Modifier

The tape drive does not support the Device-Type Modifier. The value for this field is 0.

Byte 02, Bits 7 and 6 – ISO Version

The value returned for this field is 000b, indicating that the tape drive does not claim compliance with the International Standardization Organization (ISO) version of SCSI.

Byte 02, Bits 5 through 3 – ECMA Version

The value returned for this field is 000b, indicating that the tape drive does not claim compliance with the European Computer Manufacturers Association (ECMA) version of SCSI.

Byte 02, Bits 2 through 0 – ANSI Version

The value returned for this field is 2h, indicating that the tape drive supports the current version of the ANSI SCSI-2 standard (X3T9/89-042).

Byte 03, Bit 7 – AERC (Asynchronous Event Reporting Capability)

The value returned for this field is 0, indicating that the tape drive does not have asynchronous event notification capability.

Byte 03, Bits 3 through 0 – Response Data Format

The value returned for this field is 2h, indicating that the data found is in accordance with the ANSI SCSI-2 standard.

Byte 04 – Additional Length

The value returned for this field is 67h, indicating that there are 103 bytes of additional Inquiry data available to be returned.

Byte 07, Bit 7 – RelAdr (Relative Address)

The value returned for this field is 0, indicating that the tape drive does not support relative addressing.

Byte 07, Bit 6 – WBus32

The value returned for this field is 0, indicating that the tape drive does not support 32-bit-wide bus transfers.

Byte 07, Bit 5 – WBus16

The value returned for this field is 1, indicating that the tape drive supports 16-bit-wide bus transfers.

Byte 07, Bit 4 – Sync

The value returned for this field is 1, indicating that the tape drive supports synchronous data transfer.

Byte 07, Bit 3 – Linked

The value returned for this field is 0, indicating that the tape drive does not support linked commands.

Byte 07, Bit 1 – CmdQue

The value returned for this field is 0, indicating that the tape drive does not support tag command queuing.

Byte 07, Bit 0 – SftRe (Soft Reset)

The value returned for this bit is 0, which indicates that the tape drive does not support the soft reset alternative in response to a reset condition.

Bytes 08 through 15 – Vendor Identification

This field contains the ASCII representation of "EXABYTE", followed by a single space.

Bytes 16 through 31 – Product Identification

This field contains the ASCII representation of "VXA-2" followed by eleven ASCII space characters to fill the field (for example, VXA-2_____, where each "_" represents an ASCII space character).

Bytes 32 through 35 – Product Revision Level

This field contains the ASCII representation of a decimal number indicating the current revision level of the tape drive (for example, "0001" or other Exabyte revision levels).

Bytes 36 through 55 – Vendor Specific

This field contains information about the tape drive firmware, formatted as follows: ___*hhhhh*_*mmddyy*_*hhh*_, where each "_" represents an ASCII space character, *hhhhh* is the hexadecimal firmware version, *mmyydd* is the date of the firmware build, and *hhh* is the hexadecimal firmware configuration.

Bytes 96 through 107 – Unit Serial Number

This field contains the ASCII representation of the tape drive's twelve-digit hexadecimal serial number (for example, 000000012ABC).

4.3.2 SUPPORTED VITAL PRODUCT DATA PAGE (PAGE CODE 00h)

The tape drive returns the Supported Vital Product Data page when the EVPD bit in the command CDB is 1 and the Page Code is 00h.

Bit Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	Page Code							
02	Reserved							
03	Page Length							
04	First Page Code Supported							
05	Second Page Code Supported							
06	Third Page Code Supported							
07	Fourth Page Code Supported							

Byte 00, Bits 7 through 5 – Peripheral Qualifier

The Peripheral Qualifier indicates whether a device of the type specified in Peripheral Device Type field is currently connected to the specified logical unit (LUN), as follows:

000b – The specified device type is currently connected to this logical unit.

011b – The LUN is invalid (the LUN in the CDB or in the Identify message was not 0).

Byte 00, Bits 4 through 0 – Peripheral Device Type

The Peripheral Device Type identifies the device currently connected to the specified logical unit (LUN), as follows:

00000b –The device (the tape drive) is a sequential access device.

11111b –The device type is unknown or there is no device type (the LUN in the CDB or in the Identify message was not 0).

Byte 01 – Page Code

The Page Code for the Vital Product Data page is 00h.

Byte 03 – Page Length

The value returned for this field is 04h, indicating that four bytes of additional information are available, excluding this byte.

Byte 04 – First Page Code Supported

The value for this field is 00h, indicating support for the Vital Product Data page.

Byte 05 – Second Page Code Supported

The value returned for this field is 80h, indicating support for the Unit Serial Number page.

Byte 06 – Third Page Code Supported

The value returned for this field is 83, indicating support for the Device Identification page.

Byte 07 – Fourth Page Code Supported

The value returned for this field is C0h, indicating support for a vendor-specific Inquiry page defined as the Original Inquiry Data page.

4.3.3 UNIT SERIAL NUMBER PAGE (PAGE CODE 80h)

The tape drive returns the Unit Serial Number page when the EVPD bit in the CDB is 1 and the Page Code is 80h.

Bit / Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	Page Code							
02	Reserved							
03	Page Length							
04 ⋮ 15	Unit Serial Number							

Byte 00, Bits 7 through 5 – Peripheral Qualifier

The Peripheral Qualifier indicates whether a device of the type specified in Peripheral Device Type field is currently connected to the specified logical unit (LUN), as follows:

000b – The specified device type is currently connected to this logical unit.

011b – The LUN is invalid (the LUN in the CDB or in the Identify message was not 0).

Byte 00, Bits 4 through 0 – Peripheral Device Type

The Peripheral Device Type identifies the device currently connected to the specified logical unit (LUN), as follows:

00000b –The device (the tape drive) is a sequential access device.

11111b –The device type is unknown or there is no device type (the LUN in the CDB or in the Identify message was not 0).

Byte 03 – Page Length

The value returned for this field is 0Ch, indicating that there are 12 bytes of additional information available, excluding this byte.

Bytes 04 through 15 – Unit Serial Number

This field contains the ASCII representation of the tape drive's twelve-digit serial number in the format *hhhhhhhhhhhh*, where *h* is a hexadecimal digit (for example, 000000012ABC).

4.3.4 DEVICE IDENTIFICATION PAGE (PAGE CODE 83h)

The Device Identification page allows the tape drive to report its device identifiers, including its product name and serial number. The tape drive returns the Device Identification page when the EVPD bit in the CDB is 1 and the Page Code is 83h.

Bit Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	Page Code							
02	Reserved							
03	Page Length (28h)							
04	Reserved				Code Set			
05	Reserved				Identifier Type			
06	Reserved							
07	Identifier Length (24h)							
08 ⋮ 43	(MSB) Device Identifier 1 (LSB)							

Byte 00, Bits 7 through 5 – Peripheral Qualifier

The Peripheral Qualifier indicates whether a device of the type specified in Peripheral Device Type field is currently connected to the specified logical unit (LUN), as follows:

000b – The specified device type is currently connected to this logical unit.

011b – The LUN is invalid (the LUN in the CDB or in the Identify message was not 0).

Byte 00, Bits 4 through 0 – Peripheral Device Type

The Peripheral Device Type identifies the device currently connected to the specified logical unit (LUN), as follows:

00000b –The device (the tape drive) is a sequential access device.

11111b –The device type is unknown or there is no device type (the LUN in the CDB or in the Identify message was not 0).

Byte 01 – Page Code

The value for this field is 83h, identifying the current page as the Device Identification page.

Byte 03 – Page Length

The value returned for this field is 28h, indicating that there are 40 bytes of additional information available, excluding this byte.

Byte 04, Bits 3 through 0 – Code Set

The value returned for this field is 02h, which indicates that the Device Identifier 1 field contains ASCII data.

Byte 05, Bits 3 through 0 – Identifier Type

The value returned for this field is 1h, indicating that the uniqueness of the identifier field is the responsibility of the company identified in the Vendor Identification field of Device Identifier 1 (bytes 08 through 15).

Byte 07 – Identifier Length

The value returned for this field is 24h, which indicates that the length of the Device Identifier 1 field is 36 bytes, excluding this byte.

Byte 08 through Byte 43 – Device Identifier 1

This field contains the Device Identifier for the tape drive, as follows:

- **Bytes 08 through 15 – Vendor Identification** The ASCII representation of "EXABYTE", followed by a single ASCII space character.

- **Bytes 16 through 31 – Product Identification** This field contains the ASCII representation of "VXA-2" followed by a single space, an eight-digit firmware version, and then two additional spaces to fill the field (for example, VXA-2_*nnnnnnnn*__, where each "_" represents an ASCII space character and *nnnnnnnn* represents the firmware version).

- **Bytes 32 through 43 – Unit Serial Number** This field contains the ASCII representation of the tape drive's twelve-digit serial number in the format *hhhhhhhhhhhh*, where *h* is a hexadecimal digit (for example, 000000012ABC).

4.3.5 ORIGINAL INQUIRY DATA PAGE (PAGE CODE C0h)

The Original Inquiry Data page is a vendor-specific Inquiry Data page. It returns the Standard Inquiry Data for the tape drive as it was originally specified in the firmware. The page is formatted as shown on page 4-3. All of the Standard Inquiry Data that has been changed using the SEND DIAGNOSTIC Set Inquiry Data command (86h) is replaced by the original values.

4.4 EXCEPTIONS AND ERROR CONDITIONS

The tape drive returns Good status in response to an INQUIRY command, even if it is not ready to accept commands. If the tape drive receives an INQUIRY command from an initiator that has a pending Unit Attention condition, the tape drive responds to the command and does not clear the Unit Attention condition.

Table 4-2 lists exceptions and error conditions that cause the tape drive to return Check Condition status for the INQUIRY command.

Table 4-2 *REQUEST SENSE data for INQUIRY command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
05h	24h	00h	**Illegal Request.** Invalid field in the CDB.

5

LOAD/UNLOAD (1Bh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	0	1	1
01	Logical Unit Number			Reserved				Immed
02	Reserved							
03								
04	Reserved					EOT	Re-Ten	Load
05	Control							

5.1 About This Command

The LOAD/UNLOAD command causes the tape drive to load or unload the data cartridge.

During a load operation, the tape drive performs the following actions:

1. It loads the tape into the tape path. (If the tape is already loaded, the tape drive takes no action.)

   Note: The cartridge must be fully inserted into the tape drive when you issue the LOAD command. The LOAD command does not pull the cartridge into the tape drive.

2. It reads the logical format record at the beginning of the tape or determines that the tape is blank.
3. It positions the tape at the logical beginning of partition 0 (LBOP).
4. It goes to the tape ready, idle state (LED 2 is on).
5. The tape drive returns Check Condition status with the sense key set to Unit Attention (6h) to all initiators on the bus.

When the tape drive receives tape motion commands during a load operation, it queues (holds) one tape motion command per initiator (and disconnects, if allowed) until the load operation is complete. Then it attempts to execute the queued command.

Note: If another initiator has reserved the tape drive for its exclusive use, the tape drive returns Reservation Conflict status to the initiator issuing the current LOAD/UNLOAD command.

During an unload operation, the tape drive performs the following actions:

1. It completes any command or operation in progress.
2. If necessary, it writes any buffered information to tape, then writes an EOD mark to indicate the end of data.
3. It writes the updated logical format record at the beginning of the tape.
4. It rewinds the tape to the physical beginning of tape (PBOT) and unloads the tape from the tape path.
5. If the Prevent bit in the PREVENT MEDIUM REMOVAL command is not set to 1 (see Chapter 11), it ejects the data cartridge.
6. After completing the unload operation, the tape drive returns Check Condition status with the sense key set to Not Ready (2h) to all subsequent commands that require tape motion.

5.2 CDB FIELD DEFINITIONS

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 1 – Immed

This field specifies when the tape drive returns command status to the initiator:

0 – Status is reported when the load/unload operation is complete.
1 – Status is reported when the command is initiated by the tape drive.

If the buffer contains data from a previous WRITE command, the tape drive does not execute the command until the data in the buffer is written to the tape and an EOD mark appended. The tape drive then performs the load or unload operation as follows:

- If the Immed bit is set to 1, the tape drive returns Good status when the write operation has been completed successfully. It then performs the load or unload operation.
- If the Immed bit is set to 0, the tape drive returns status when the load or unload operation is complete.

If an error occurs during the writing of the data from the buffer to the tape, the tape drive returns Check Condition status. The load or unload operation is not performed.

Byte 04, Bit 2 – EOT

The tape drive ignores this bit.

Byte 04, Bit 1 – Re-Ten

The tape drive ignores this bit.

Byte 04, Bit 0 – Load

This field specifies which operation, load or unload, is to be performed:

0 – Perform an unload operation.
1 – Perform a load operation.

Table 5-1 indicates what action occurs based on the setting of the Load bit and the status of the data cartridge.

Table 5-1 *Action occurring based on the Load bit and data cartridge status*

If the Load bit is set to...	And the data cartridge is...	The following action occurs...
0	Out	No action.
1	Out	Check Condition status is returned with the sense key set to Not Ready (2h).
0	In	The data cartridge is unloaded.[a] If there is data in the write buffer, the data is written to tape. Then, the tape is rewound to PBOT and unloaded from the tape path, and the data cartridge is ejected from the tape drive.
1	In	The data cartridge is loaded and positioned at LBOP for partition 0. If the data cartridge is already loaded and there is data in the buffer, the data is written to the tape before the operation is performed.

[a] The unload operation is performed even if the PREVENT/ALLOW MEDIUM REMOVAL command was issued with the Prevent bit set to 1; however, the data cartridge is not ejected from the tape drive.

5.3 EXCEPTIONS AND ERROR CONDITIONS

Table 5-2 lists exceptions and error conditions that cause the tape drive to return Check Condition status for the LOAD/UNLOAD command.

Table 5-2 *REQUEST SENSE data for LOAD/UNLOAD command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
02h	04h	01h	**Not Ready.** Tape drive is not ready, but is in process of becoming ready (rewinding or loading tape).
02h	04h	02h	**Not Ready.** Tape drive is not ready because it is in the process of ejecting a cartridge.
02h	04h	03h	**Not Ready.** The tape drive is not ready because it needs manual intervention.
02h	3Ah	00h	**Not Ready.** Tape drive is not ready. Command requires a tape, and no tape is present.
03h	30h	02h	**Medium Error.** The tape format is incompatible with the tape drive hardware or microcode.
03h	31h	01h	**Medium Error.** The tape format is corrupted.
03h	50h	00h	**Medium Error.** The tape drive could not locate a valid splice location on the tape. The tape is not located at a valid write position or the tape drive could not locate the valid write position.
04h	15h	01h	**Hardware Error.** The tape drive cannot position the tape correctly.
04h	53h	00h	**Hardware Error.** The load or eject operation failed.
04h	53h	01h	**Hardware Error.** The unload operation failed.
05h	24h	00h	**Illegal Request.** Invalid field in the CDB.
06h	30h	00h	**Unit Attention.** Incompatible media was rejected after the cartridge was inserted.

6

LOCATE (2Bh)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	1	0	1	0	1	1
01	Logical Unit Number			Reserved		BT	CP	Immed
02	Reserved							
03 ⋮ 06	(MSB) Block Address (LSB)							
07	Reserved							
08	Partition							
09	Control							

6.1 About This Command

The LOCATE command, in conjunction with the READ POSITION (34h) command, allows you to position the tape at a specified logical block address. During forward and backward locate operations, the tape drive moves the tape at its highest speed.

Unlike space operations, locate operations do not detect filemarks and setmarks and do not return Check Condition status when these elements are encountered.

6.2 Using the LOCATE Command

To use the LOCATE command, follow these steps:

1. Determine the tape drive's current location by issuing a READ POSITION command (see Chapter 15).
2. In the initiator's memory, save the information returned for the First Block Location field (bytes 04 through 07) of the READ POSITION data.
3. Continue reading or writing data as required.

4. When you want to return to the previous location, issue a LOCATE command and specify the saved address in the Block Address field (bytes 03 through 06).

Note: If the tape drive receives a LOCATE command after a WRITE (0Ah) or WRITE FILEMARKS (10h) command, it writes any buffered data, filemarks, or setmarks to the tape before performing the locate operation.

If an error occurs while the buffered data is being written, the tape drive returns Check Condition status and the locate operation is not performed.

Using the LOCATE Command on Partitioned Tapes

If the tape in the tape drive is formatted with partitions, you can use the LOCATE command to position the tape to a location within any partition. If necessary, the LOCATE command causes the tape drive to move from the current partition to another partition and then to find the requested block in the new partition. (See Section 2.6 starting on page 2-5 for information about creating and using partitioned tapes.)

6.3 CDB FIELD DEFINITIONS

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 2 – BT (Block Type)

This bit determines the type of block number the tape drive returns to the initiator. The tape drive ignores this field.

Byte 01, Bit 1 – CP (Change Partitions)

This field specifies whether the tape drive should move to the partition specified by the Partition field (byte 08) before positioning to the requested block, as follows:

0 – Ignore the Partition field. (Do not move the tape from the current partition.)
1 – Move to the partition specified in the Partition field.

Byte 01, Bit 0 – Immed

This field specifies when the tape drive returns command status to the initiator, as follows:

0 – Status is reported when the LOCATE command is completed.
1 – Status is reported when the LOCATE command is initiated by the tape drive.

If the buffer contains data from a previous WRITE command, the tape drive does not execute the LOCATE command until the data in the buffer is written to the tape and an EOD mark is appended. The tape drive then performs the erase operation as follows:

- **If the Immed bit is set to 1,** the tape drive returns Good status and performs the locate operation.
- **If the Immed bit is set to 0**, the tape drive returns status when the locate operation is complete.

Bytes 03 through 06 – Block Address

This field specifies the address of the block that the tape drive is to locate. The value for this field is returned in the First Block Address field in the READ POSITION data. Setting the Block Address to 0 causes the tape drive to position the tape at LBOP.

Byte 08 – Partition

This field specifies to which partition the tape drive moves the tape when the CP field (byte 01, bit 1) is set to 1 (change partitions), as follows:

n – Move to partition *n*, where *n* is either 0 or 1. Note that partitions are numbered consecutively from the *end* of the tape. Partition 0 is always the last partition on the tape.

The CP field must be set to 1 for the Partition byte to be in effect. If the CP field is 0, the tape drive ignores the Partition byte.

6.4 EXCEPTIONS AND ERROR CONDITIONS

Table 6-1 lists exceptions and error conditions that cause the tape drive to return Check Condition status for the LOCATE command.

Table 6-1 *REQUEST SENSE data for LOCATE command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
02h	04h	01h	**Not Ready.** Tape drive is not ready, but is in process of becoming ready (rewinding or loading tape).
02h	04h	03h	**Not Ready.** The tape drive is not ready because it needs manual intervention.
02h	3Ah	00h	**Not Ready.** Tape drive is not ready. Command requires a tape, and no tape is present.
03h	00h	02h	**Medium Error.** The tape drive encounters the physical end of tape (PEOT) or the physical end of partition (PEOP) before completing the operation. When the LOCATE command terminates, the logical position is the last logical position the tape drive detected on tape.
03h	14h	00h	**Medium Error.** The tape drive cannot perform the locate operation because it cannot read data from the tape.
03h	30h	02h	**Medium Error.** The tape format is incompatible with the tape drive hardware or microcode.
03h	31h	01h	**Medium Error.** The tape format is corrupted.

Table 6-1 *REQUEST SENSE data for LOCATE command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
04h	15h	01h	**Hardware Error.** The tape drive cannot position the media correctly.
05h	24h	00h	**Illegal Request.** Invalid field in the CDB. This error is a result of any of the following: ▪ The Partition field contains a value greater than 1 and the CP bit is set to 1. ▪ The BT bit is set to 1.
06h	30h	00h	**Unit Attention.** Incompatible media was rejected after the cartridge was inserted.
08h	00h	05h	**Blank Check.** The tape drive encountered an EOD mark. When the LOCATE command terminates, the logical tape position is after the last recorded data block, filemark, or setmark. Issue a READ POSITION command to determine the exact location.

7

LOG SELECT (4Ch)

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

7.1 About This Command

The LOG SELECT command allows you to manage the statistical information maintained by the tape drive, including parameter values for write and read error recovery operations and the amounts of data compressed. You can set threshold and cumulative values and you can reset the values.

To test the tape drive, you can reset the parameters, perform the operations you want to test, then issue a LOG SENSE (4Dh) command to check the updated values (refer to Chapter 8 for information about the LOG SENSE command).

You can also specify if and when you want to be notified about changes to the parameters. For example, you might want the tape drive to return Unit Attention when a counter reaches its threshold value.

! Important If you want the tape drive to return Unit Attention to notify you about changes to the parameters, first issue a MODE SELECT command and send the Control Mode page (Page Code=0Ah) with the Report Log Exception Condition (RLEC) bit set to 1. Refer to Chapter 9 for more information.

7.2 CDB FIELD DEFINITIONS

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 1 – PCR (Parameter Code Reset)

This field specifies whether the tape drive should reset all of the parameters or only selected parameters, as follows:

0 – Reset only selected parameters, as indicated by the PC field.

1 – Reset all of the parameters. Current cumulative values will be reset to 0, the Enable Threshold Comparison (ETC) bit will be reset to 0 (see page 7-6), and threshold values will be reset to all FFs.

Note: If you set the PCR bit to 1, be sure that the Parameter List Length is 0. Otherwise, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h), the ASC and ASCQ set to 24h and 00h, and the Fault Symptom Code set to 48h.

Byte 01, Bit 0 – SP (Save Parameters)

The tape drive does not support the save parameters function. The value for this bit must be 0.

Byte 02, Bits 7 and 6 – PC (Page Control)

This field specifies which parameters the tape drive resets when the PCR bit is 0. Table 7-1 lists the valid values for the PC field.

If the PCR bit is set to 1, the tape drive ignores the PC bit.

Table 7-1 *Valid values for the LOG SELECT Page Control (PC) field*

PC Value	Description
00b	Set threshold values for the parameters listed in the parameter list.
01b	Set current cumulative values for the parameters listed in the parameter list.
10b	Set all threshold values to their default threshold values (all FFs). Set the ETC bit to 0 (see page 7-6).
11b	Set all current cumulative values to 0.

Note: If you set the PC field to 10b or 11b, be sure that the Parameter List Length is 0. Otherwise, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h), the ASC and ASCQ set to 24h and 00h, and the Fault Symptom Code set to 48h.

Bytes 07 and 08 – Parameter List Length

This field specifies the total number of bytes to be transferred to the tape drive. The value for this field must equal the sum of the lengths of each log parameter page being sent, including four bytes for each Parameter List Header. Table 7-2 lists the page length, including the Parameter List Header, for each supported log page.

Table 7-2 *Page length of each supported log page*

Page Code	Description	Page Length
02h	Write Error Counters page	2Ch (44 bytes)
03h	Read Error Counters page	2Ch (44 bytes)
30h	Compression Statistics page	64h (100 bytes)

Multiple log parameter pages can be transferred with a single LOG SELECT command. The parameter list length must be sufficient to accommodate all of the log parameter pages being sent. The tape drive does not accept partial log parameter pages.

Valid values for this field are 0 to FFFFh. Setting the Parameter List Length to 0 indicates that no data is to be transferred.

Note: If the Parameter List Length is greater than 0, the PCR bit must be 0. Otherwise, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h), with the ASC and ASCQ set to 24h and 00h, and the Fault Symptom Code set to 48h.

Table 7-3 summarizes the valid settings for the PCR, PC, and Parameter List Length fields in the LOG SELECT CDB.

Table 7-3 *Valid combinations of values for the fields in the LOG SELECT CDB*

To specify these parameters values...	Set the PCR bit to...	Set the PC field to...	Set the Parameter List Length to...
Specified parameters to new threshold values	0	00b	The total number of bytes in the parameter lists for all of the specified pages
Specified parameters to new cumulative values	0	01b	
All parameters to default threshold values (do not reset cumulative values)	0	10b	0
All parameters to default cumulative values (do not reset threshold values)	0	11b	
All cumulative parameters to 0, all thresholds to FFs, and ETC to 0	1	Ignored	

7.3 LOG PARAMETER DATA

With each LOG SELECT CDB, you send a parameter list for each page on which you are changing values. Each parameter list begins with a Parameter List Header that identifies the parameter page being sent and indicates the number of bytes that follow the header as log parameters. Immediately following the Parameter List Header is the list of values for each parameter on the page that you want to change.

Note: The total number of bytes in the parameter list equals the Page Length of the parameter page, plus four bytes for the Parameter List Header. The sum of the bytes in all the parameter lists must equal the value specified for the Parameter List Length in the CDB.

7.3.1 PARAMETER LIST HEADER

Each parameter list page begins with a four-byte Parameter List Header. The Parameter List Header is followed by the parameters for the specified page.

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

Byte 00, Bits 5 through 0 – Page Code

This field specifies the page code for the parameter page to be modified. Valid page codes are the following:

02h – Write Error Counters page
03h – Read Error Counters page

Notes:

- Do not specify page codes 00h (Supported Log Pages page), 2Eh (TapeAlert page), 31h (Tape Capacity page), 36h (Environmental Counter page), 37h (Tape Usage page), or 39h (Tape Last FSC page) in the LOG SELECT command. Although these page codes are valid for the LOG SENSE command, you cannot change or reset the parameters on these pages using the LOG SELECT command.
- If you specify an invalid page code, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h), with the ASC and ASCQ set to 24h and 00h, and the Fault Symptom Code set to 48h.

Bytes 02 and 03 – Page Length

This field indicates the number of bytes of log parameters that follow this field. Table 7-2 lists the valid value of this field for each supported log page.

Table 7-4 *Page length of each supported log page*

Page Code	Description	Page Length
02h	Write Error Counters page	28h (40 bytes)
03h	Read Error Counters page	28h (40 bytes)

7.3.2 LOG PARAMETERS

The Parameter List Header is followed by zero or more log parameters. Each log parameter includes four bytes of descriptive information followed by a variable-length parameter value. There is no required order for the log parameters.

The general format of a log parameter is as follows:

Bit / Byte	7	6	5	4	3	2	1	0
00	(MSB)							
01				Parameter Code				(LSB)
02	DU	DS	TSD	ETC	TMC		RSVD	LP
03	Parameter Length							
04	(MSB)							
⋮				Parameter Value				
nn								(LSB)

Bytes 00 and 01 – Parameter Code

This field specifies the parameter for which you want to set the threshold or cumulative value. The definition of the parameter depends on which log parameter page you specified in the Parameter List Header.

Table 7-5 lists the parameter codes and default values for the Write Error Counters page (02h) and Read Error Counters page (03h). Section 8.3.3 on page 8-8, provides a description of each parameter code.

Table 7-5 *Parameter Codes and default values for the Write Error and Read Error Counters pages*

Parameter Code	Parameter Name	Length (bytes)	Default Cumulative Value	Default Threshold Value	Maximum Value
0002h	Total Rewrites or Total Rereads	4	00000000h	0FFFFFFFh	0FFFFFFFFh
0003h	Total Errors Corrected (write or read)	4	00000000h	0FFFFFFFh	0FFFFFFFFh
0004h	Total Times Errors Processed (write or read)	4	00000000h	0FFFFFFFh	0FFFFFFFFh
0005h	Total Bytes Processed (write or read)	6	000000000000h	0FFFFFFFFFFFh	0FFFFFFFFFFFh
0006h	Total Unrecoverable Errors (write or read)	2	0000h	0FFFh	0FFFh

Byte 02, Bit 7 – DU (Disable Update)

This bit indicates whether updates to the current cumulative value are enabled or disabled, as follows:

0 – The tape drive can update the current cumulative value, so comparisons of the current cumulative value and the threshold value can occur normally.

1 – The tape drive will not update the current cumulative value, so threshold conditions will not be met for this parameter.

Byte 02, Bit 6 – DS (Disable Save)

The tape drive ignores this bit.

Byte 02, Bit 5 – TSD (Target Save Disable)

The tape drive ignores this bit.

Byte 02, Bit 4 – ETC (Enable Threshold Comparison)

This bit indicates whether threshold comparisons for the parameter are enabled or disabled, as follows:

0 – Threshold comparisons for this parameter are disabled.

1 – Threshold comparisons are performed on this parameter.

! Important If you want the tape drive to compare the current cumulative value to the threshold value for the parameter and to return Unit Attention when the threshold criteria are met, first issue a MODE SELECT command and send the Control Mode page (Page Code=0Ah) with the RLEC bit set to 1. Then, set the DU bit to 0 and the ETC bit to 1.

Byte 02, Bits 3 and 2 – TMC (Threshold Met Criteria)

This field specifies the conditions under which the tape drive generates a Unit Attention (6h) sense key when comparing the current cumulative value to the threshold value. Threshold comparisons are made when the cumulative value is updated. Table 7-6 lists the valid values for the TMC field.

Table 7-6 *Valid values for the LOG SELECT Threshold Met Criteria (TMC) field*

TMC Value	Description
00b	Return Unit Attention when the cumulative value is updated
01b	Return Unit Attention when the updated cumulative value equals the threshold value
10b	Return Unit Attention when the updated cumulative value is not equal to the threshold value
11b	Return Unit Attention when the updated cumulative value is greater than the threshold value

If threshold comparisons are enabled (DU=0 and ETC=1), the tape drive compares the cumulative value to the threshold value when the cumulative value is updated. When the conditions specified by the Threshold Met Criteria (TMC) bit are met, the tape drive returns Check Condition status with the sense key set to Unit Attention (6h), the ASC and ASCQ set to 5Bh and 01h, respectively.

Byte 02, Bit 0 – LP (List Parameter)

The value for this field must be 0. (List parameters are not supported.)

Byte 03 – Parameter Length

This field specifies the length of the threshold or cumulative value in bytes. See Table 7-5 for the length of each parameter on the supported log pages.

Note: You can specify any value from 0 to FFh for the Parameter Length field. If you specify 0 for the Parameter Length, the Parameter Value will be set to 0.

Bytes 04 to *nn* – Parameter Value

This field contains either a new threshold value or a new current cumulative value for the parameter, depending on the value specified for the PC bit in the CDB. The length of the value is defined by the Parameter Length field. See Table 7-5 for the valid values for each parameter.

- **If the specified parameter value is shorter than the actual length,** the tape drive pads the value with zeros from the parameter length to the most significant byte. That is, if you specify 8h for the parameter value and the length is two bytes, the tape drive pads the value to 0008h.
- **If the specified parameter value is longer than the actual length,** all extra bytes between the actual length and the most significant byte of the Parameter Value must be 0. That is, if the length is two bytes, specifying FFFFFFh for the value would be an error, specifying 00FFFFh would not.

7.4 EXCEPTIONS AND ERROR CONDITIONS

Table 7-7 lists the exceptions and error conditions that cause the tape drive to return Check Condition status for the LOG SELECT command.

Table 7-7 *REQUEST SENSE data for LOG SELECT command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
1h	5Bh	02h	**Recovered Error.** Log parameter overflow (a cumulative parameter reached its maximum value). When this occurs, the parameter stays at its maximum, and the DU bit is set to 1 to disable updates, and the tape drive returns this error. This error indicates that the tape drive completed the command with no error. Check Condition status is returned only to alert the initiator that a parameter reached its maximum.
5h	1Ah	00h	**Illegal Request.** Parameter List Length Error. The value specified for the Parameter List Length caused the log parameter to be truncated.
5h	24h	00h	**Illegal Request.** Invalid field in CDB. This error is a result of any of the following: ▪ The PCR bit is set to 1 and the Parameter List Length is greater than 0. ▪ The SP bit is set to 1. ▪ The PC field is either 10b or 11b and the Parameter List Length is not 0.
5h	26h	00h	**Illegal Request.** Invalid field in parameter list. This error is a result of any of the following: ▪ An invalid or reserved Page Code or Parameter Code was specified. ▪ The LP bit is set to 1.
6h	5Bh	01h	**Unit Attention.** Threshold met. (For additional information about this error, look at the Log Parameter Page Code and Log Parameter Code bytes in the REQUEST SENSE data.)
6h	2Ah	02h	**Unit Attention.** Log parameter changed.
0Bh	47h	00h	**Aborted Command.** A SCSI parity error occurred during data transfer.

8

LOG SENSE (4Dh)

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

8.1 About This Command

The LOG SENSE command enables you to retrieve statistical information about various tape drive parameter values. The tape drive maintains the following pages of parameters:

- Supported Pages page (00h)
- Write Error Counters page (02h)
- Read Error Counters page (03h)
- TapeAlert page (2Eh)
- Compression Statistics page (30h)
- Tape Capacity page (31h)
- Environmental Counter page (36h)
- Tape Usage page (37h)
- Tape Last FSC page (39h)

The LOG SENSE data returned by the tape drive consists of a four-byte Parameter List Header and a log page. Each log page contains log parameter data blocks that provide information about the parameters.

Note: You can use the LOG SELECT (4Ch) command to specify cumulative and

threshold parameter values or to reset the parameters on pages 02h and 03h (see Chapter 7 for more information). You cannot set cumulative and threshold values or reset the parameters on pages 31h, 36h, 37h, and 39h.

8.2 CDB FIELD DEFINITIONS

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 1 – PPC (Parameter Pointer Control)

The PPC bit specifies the type of parameters being requested from the tape drive. This bit must be 0, which indicates that the tape drive should return all parameters for the specified log page, beginning with the parameter specified in the Parameter Pointer field (bytes 05 and 06).

Byte 01, Bit 0 – SP (Save Parameters)

The tape drive does not support the save parameters function. The value for this bit must be 0.

Byte 02, Bits 7 and 6 – PC (Page Control)

This field specifies the type of parameter values the tape drive returns. Table 8-1 lists the valid values for the PC field.

Table 8-1 *Valid values for the LOG SENSE Page Control (PC) field*

PC Value	Description
00b	Return the current threshold values for the parameters listed in the parameter list. These values are reset to their default settings after a power-on reset, SCSI bus reset, or Bus Device Reset message.
01b	Return the current cumulative values for the parameters listed in the parameter list. These values are the values that have accumulated since the last power-on reset, SCSI bus reset, Bus Device Reset message, or setting by a LOG SELECT command. When a parameter reaches its maximum value, it is returned as all FFs. (For example, FFFFFFFFh is returned as the maximum value for a four-byte parameter.)
10b	Return the default threshold values. The default threshold values cannot be changed. The values returned represent the maximum values each parameter can obtain (all FFs).
11b	Return the default cumulative values. The default cumulative values cannot be changed. The values returned represent the values that each parameter is reset to (whether by power-on reset, SCSI bus reset, Bus Device Reset message, or LOG SELECT reset). The default cumulative value for all parameters is 0.

Byte 02, Bits 5 through 0 – Page Code

This field specifies which LOG SENSE page is being requested. The type of data returned for the page depends on the value specified for the PC bit. Table 8-2 lists the log pages supported by the tape drive.

Table 8-2 *Log pages supported by the tape drive*

Page Code	Description	Look here for information....
00h	**Supported Log Pages page.** Return the lists of pages supported by the LOG SENSE command.	Section 8.3.2 on page 8-7
02h	**Write Error Counters page.** Return log parameter data blocks for each write error counter.	Section 8.3.3 on page 8-8
03h	**Read Error Counters page.** Return log parameter data blocks for each read error counter.	
2Eh	**TapeAlert page.** Return log parameter data blocks containing information from the tape drive's internal TapeAlert firmware. This firmware constantly monitors the tape drive and the tape for errors and potential difficulties. When a problem is detected, the tape drive sets a flag on this page to identify the type of problem detected.	Section 8.3.4 on page 8-9
30h	**Compression Statistics page.** Return log parameter data blocks for containing the compression statistics.	Section 8.3.5 on page 8-12
31h	**Tape Capacity page.** Return log parameter data containing statistics about the partitions on the currently loaded data cartridge media.	Section 8.3.6 on page 8-12
36h	**Environmental Counter page.** Return log parameter data blocks for each environmental counter.	Section 8.3.7 on page 8-13
37h	**Tape Usage page.** Return log parameter data blocks containing statistics for the currently loaded tape.	Section 8.3.8 on page 8-14
39h	**Tape Last FSC page.** Return log parameter data blocks containing statistics about the last five data cartridges loaded and unloaded in the tape drive.	Section 8.3.9 on page 8-16

Bytes 05 and 06 – Parameter Pointer

This field specifies the Parameter Code of the first parameter to be returned for the requested page. Valid values for this field are 00h through the highest supported Parameter Code for the specified page. As long as the value in the Allocation Length field is large enough, the tape drive returns all parameters with a Parameter Code greater than or equal to the code specified in this field.

The parameters are returned in Parameter Code order (unsigned). If the parameter specified does not exist, the tape drive returns the first available parameter following the specified parameter.

Notes:

- If you set the Page Code field to 00h (Supported Log Pages page), the Parameter Pointer field is ignored.
- If the value for the Parameter Pointer is greater than the Parameter Code for any of the parameters, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h), the ASC set to 24h, and the ASCQ set to 00.

Bytes 07 and 08 – Allocation Length

This field specifies the maximum number of bytes allocated by the initiator to receive the data transferred by the tape drive. Valid values are from 0 to FFFFh.

Table 8-3 lists the minimum Allocation Length required to return each supported page. Each LOG SENSE command can return only one log page.

Note: It is not an error to specify a value for the Allocation Length field that would truncate the information on one of the pages.

Table 8-3 *Minimum Allocation Length required for each supported log page*

Page Code	Description	Minimum Allocation Length[a]
00h	Supported Log Pages page	0Dh (13 bytes)
02h	Write Error Counters page	2Ch (44 bytes)
03h	Read Error Counters page	2Ch (44 bytes)
2Eh	TapeAlert page	144h (324 bytes)
30h	Compression Statistics page	2Ch (44 bytes)
31h	Tape Capacity page	24h (36 bytes)
36h	Environmental Counter page	33h (53 bytes)
37h	Tape Usage page	FCh (252 bytes)
39h	Tape Last FSC page	72h (114 bytes)

[a] The minimum Allocation Length for each page includes the 4-byte Parameter List Header, a Log Parameter Data Block for each parameter on the page, and the actual parameter values.

8.3 WHAT THE TAPE DRIVE RETURNS

This section describes the log page format and the log pages supported by the tape drive. The LOG SENSE command returns the single log page specified in the Page Code field of the CDB.

Each log page begins with a four-byte Parameter List Header (bytes 00 through 03), followed by zero or more variable-length log parameters defined for that page. The Parameter List Header specifies the page code for the log parameter data being returned and indicates the total length of the data to follow.

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

Byte 00, Bits 5 through 0 – Page Code

This field identifies the type of LOG SENSE data being returned by the tape drive. The value returned for this field matches the Page Code specified in the CDB. Table 8-2 lists the log pages supported by the tape drive.

Bytes 02 and 03 – Page Length

This field indicates the total number of bytes that will follow this byte if the Allocation Length specified in the CDB is sufficient. The value returned for this field depends on the value specified for the Page Code and the Parameter Pointer in the CDB. Table 8-3 lists the maximum Page Length of each supported page.

8.3.1 LOG PARAMETER FORMAT

The tape drive returns the log parameters for the specified page immediately after it returns the Parameter List Header. For each parameter on the page, the tape drive returns a data block that includes four bytes of descriptive information and a variable-length parameter value. The total number of bytes returned for each parameter is equal to the value in the Parameter Length field plus four bytes for the Parameter List Header.

The tape drive returns the log parameter data blocks for the specified LOG SENSE page in Parameter Code order. The code for the first parameter will be equal to or greater than the value specified for the Parameter Pointer field in the CDB.

Bit / Byte	7	6	5	4	3	2	1	0
00	(MSB)	Parameter Code						
01								(LSB)
02	DU	DS	TSD	ETC	TMC		RSVD	LP

Bit / Byte	7	6	5	4	3	2	1	0
03	Parameter Length							
04	(MSB)							
⋮	Parameter Value							
nn								(LSB)

Bytes 00 and 01 – Parameter Code

This field identifies the code of the parameter for which the tape drive is returning a value. See the following sections for a list of the parameter codes for each page.

Byte 02, Bit 7 – DU (Disable Update)

This field indicates whether updates to the current cumulative value for this parameter are enabled or disabled, as follows:

0 – The tape drive can update the current cumulative value, so comparisons between the current cumulative value and the threshold value occur normally.

1 – The tape drive will not update the current cumulative value, so threshold conditions will not be met for this parameter.

Byte 02, Bit 6 – DS (Disable Save)

The tape drive always returns 1 for this bit, indicating that it does not support the saving of log parameters.

Byte 02, Bit 5 – TSD (Target Save Disable)

The value for the Target Save Disable bit indicates whether the tape drive provides a self-defined method for saving log parameters, as follows:

0 – The tape drive provides a self-defined method for saving the current cumulative value for this counter. The counter is not reset when the tape drive is reset.

1 – The tape drive does not support saving the current cumulative value for this counter. The counter is reset when the tape drive is reset.

Byte 02, Bit 4 – ETC (Enable Threshold Comparison)

This field indicates whether threshold comparisons are enabled or disabled for this parameter:

0 – Threshold comparisons are disabled for this parameter.
1 – Threshold comparisons are performed on this parameter.

When threshold comparisons are enabled (and the DU bit is 0), the tape drive compares the current cumulative value to the threshold value for the parameter. When the conditions specified by the TMC bit are met, the tape drive returns Check Condition status with the sense key set to Unit Attention (6h), the ASC and ASCQ set to 5Bh and 01h.

Threshold comparisons are made when the cumulative value is updated.

Byte 02, Bits 3 and 2 – TMC (Threshold Met Criteria)

This field indicates the condition under which the tape drive generated the Unit Attention (6h) sense key. Table 8-4 lists the valid values for the TMC field.

Table 8-4 *Valid values for the LOG SENSE Threshold Met Criteria (TMC) field*

TMC Value	Description
00b	Unit Attention resulted when the cumulative value was updated
01b	Unit Attention resulted when the updated cumulative value equaled the threshold value
10b	Unit Attention resulted when the updated cumulative value did not equal to the threshold value
11b	Unit Attention resulted when the updated cumulative value was greater than the threshold value

Note: If you want the tape drive to return Unit Attention to notify you about changes to the parameters, first issue a MODE SELECT command and send the Control Mode page (Page Code=0Ah) with the Report Log Exception Condition (RLEC) bit set to 1. Refer to Chapter 9 for more information.

Byte 02, Bit 0 – LP (List Parameter)

The value for this bit is always 0, indicating that the tape drive does not support List Parameters.

Byte 03 – Parameter Length

This field indicates the length of the threshold or cumulative value in bytes.

Bytes 04 to *nn* – Parameter Value

This field contains either a threshold value or a cumulative value for the parameter indicated by the Parameter Code field, depending on what you specified for the PC bit in the CDB.

8.3.2 SUPPORTED LOG PAGES PAGE (PAGE CODE 00h)

The tape drive returns the Supported Log Pages page when the Page Code in the CDB is 00h. The value in the Page Length field (bytes 2 and 3) of the Parameter List Header for this page is 09h (9 bytes).

Unlike other LOG SENSE pages, no parameter information is returned on this page. Instead, the Supported Log Pages page lists the page codes for the LOG SENSE pages supported by the tape drive. The page codes are listed in ascending order, as follows:

Bit / Byte	7	6	5	4	3	2	1	0
00	Supported Log Pages (00h)							
01	Write Error Counters Page (Page Code 02h)							
02	Read Error Counters Page (Page Code 03h)							
03	TapeAlert Page (Page Code 2Eh)							
04	Compression Statistics Page (Page Code 30h)							
05	Tape Capacity Page (Page Code 31h)							
06	Environmental Counter Page (Page Code 36h)							
07	Tape Usage Page (Page Code 37h)							
08	Tape Last FSC Page (Page Code 39h)							

8.3.3 WRITE ERROR COUNTERS PAGE (PAGE CODE 02h) READ ERROR COUNTERS PAGE (PAGE CODE 03h)

Setting the Page Code in the CDB to 02h (Write Error Counters page) or 03h (Read Error Counters page) causes the tape drive to return the Write Error Counters page or the Read Error Counters page, respectively. The value in the Page Length field (bytes 2 and 3) of the Parameter List Header for either of these pages is 28h (40 bytes).

Table 8-5 lists the parameters used to return information about the write or read error on the Write Error Counters page and the Read Error Counters page.

Table 8-5 *Parameters returned on the LOG SENSE Write Error and Read Error Counters pages*

Parameter Code	Parameter Name	Description	Length (bytes)
0002h	Total Rewrites	The number of physical blocks the tape drive rewrote because they contained errors detected during check-after-write operations.	4
	Total Rereads	Indicates the number of times the tape drive moved the tape backward to reread a portion of tape because a block was missed.	4

Table 8-5 *Parameters returned on the LOG SENSE Write Error and Read Error Counters pages (continued)*

Parameter Code	Parameter Name	Description	Length (bytes)
0003h	Total Errors Corrected	**Write error.** Contains the same value as the Total Rewrites counter.	4
		Read error. Indicates the total number of blocks the tape drive recovered either by using the ECC algorithm or by successfully rereading the block.	4
0004h	Total Times Errors Processed	**Write error.** Always contains 0 since write errors are rewritten.	4
		Read error. The number of blocks corrected by ECC.	4
0005h	Total Bytes Processed	**Write error.** The number of bytes successfully written to the tape. This counter only includes user data bytes. Rewritten data is not counted.	6
		Read error. The number of user bytes read from tape and transferred to the initiator.	6
0006h	Total Unrecoverable Errors	**Write error.** The number of times the tape drive could not write a block to the tape after all retries.	2
		Read error. The number of times a block could not be read from tape after all retries.	2

8.3.4 TAPEALERT PAGE (PAGE CODE 2Eh)

The tape drive's internal TapeAlert firmware constantly monitors the tape drive and the tape for errors and potential difficulties. Any problems identified are flagged on the TapeAlert page. There are two methods of accessing this information:

- If TapeAlert is enabled using the MODE SELECT command (see Section 9.10), the tape drive returns a Recovered Error message to the initiator on the next SCSI command whenever one or more TapeAlert flags are set. A pending Recovered Error will be returned on the first successful SCSI command after the TapeAlert flag is set. The TapeAlert log page should be read immediately after the Recovered Error message is received.

  Note: The command which receives the Recovered Error message will have executed correctly and should not be reissued by the initiator.

- The host software can periodically read the TapeAlert log page to determine if any new flags have been set. If this method is used, the initiator should read the log page whenever any of the following occur:

  - Immediately after a SCSI Check Condition status followed by a REQUEST SENSE.

- At the end of each tape when a job spans multiple tapes. If the data cartridge will be ejected, then the TapeAlert page must be read before the tape is unloaded.
- At the completion of an operation.
- Before a tape is unloaded.
- At some regularly scheduled interval (for example, once a minute).

Setting the Page Code in the CDB to 2Eh causes the tape drive to return the TapeAlert log page. The value in the Page Length field (bytes 2 and 3) of the Parameter List Header for this page is 0140h (320 bytes).

Table 8-6 lists the TapeAlert flags on the TapeAlert page. Each TapeAlert flag includes four bytes of descriptive information (see page 8-5), followed by a one-byte parameter value for the flag. Bit 0 of the parameter value contains the value for the flag, as follows:

0 – The flag is not currently set.
1 – The flag is currently set.

The remaining 7 bits of the flag are not used.

Notes:

- Issuing a LOG SENSE command to return the TapeAlert page resets all of the flags to 0. The flags are also reset whenever the tape drive is reset or when the condition indicated by the flag is corrected.
- Although the tape drive only supports the TapeAlert flags listed in Table 8-6, it returns all 64 flags defined in the TapeAlert standard. Unused flags are set to 0.

Table 8-6 *Parameters returned on the LOG SENSE TapeAlert page*

Parameter	Flag name	Type[a]	Description
03h	Hard Error	W	A hard read/write error has occurred. The current operation has stopped because the tape drive cannot correct an error that occurred while the tape drive was reading or writing data.
04h	Media	C	Media performance is severely degraded. Your data is at risk. To safeguard the data on this tape, do the following: ▪ Copy any data you want to preserve to another tape. ▪ Do not use this tape again. Restart the current operation using a different tape.
05h	Read Failure	C	The tape drive can no longer read data from the tape. Either the tape is faulty or the tape drive is not operating correctly. ▪ Try reading data from a known good tape. If you can read this tape, replace the damaged tape. ▪ If the problem persists, contact Exabyte Technical Support.

Table 8-6 *Parameters returned on the LOG SENSE TapeAlert page (continued)*

Parameter	Flag name	Type[a]	Description
06h	Write Failure	C	The tape drive can no longer write data to the tape. Either the tape is faulty or the tape drive is not operating correctly. ▪ Try writing data to a known good tape. If you can write to this tape, replace the faulty tape. ▪ If the problem persists, contact Exabyte Technical Support.
08h	Not Data Grade	W	The tape drive cannot read the MRS stripes on the tape. The tape is not data-grade. Any data you back up onto the tape is at risk. Replace the cartridge with one containing data-grade tape.
09h	Write Protect	C	The initiator attempted to write to a write-protected data cartridge. Write-enable the cartridge or use another cartridge.
0Ah	No Removal	I	A data cartridge unload operation was attempted while the initiator was preventing media removal.
0Bh	Cleaning Media	I	A cleaning cartridge is currently in the tape drive. If you want to back up or restore, insert a data cartridge.
0Ch	Unsupported Format	I	The loaded tape contains data in an unsupported format.
0Dh	Snapped Tape	C	The data cartridge in the tape drive contains a broken tape. ▪ Discard the data cartridge. ▪ Restart the current operation with a different tape.
10h	Forced Eject	C	The user ejected the cartridge while the tape drive was in the process of reading or writing data.
12h	Tape Directory Corrupted	W	The logical format of the tape has been corrupted, rendering the tape unusable. Reformat the tape.
13h	Nearing Media Life	I	The data cartridge currently in the tape drive is approaching the end of its usable life.
14h	Clean Now	C	The tape drive needs cleaning. ▪ If the tape drive is not currently in use, eject any data cartridge and insert a cleaning cartridge to clean the tape drive. ▪ If the tape drive is in use, wait until the current operation is complete, then insert a cleaning cartridge to clean the tape drive.
15h	Clean Periodic	W	The tape drive needs to be cleaned at the next opportunity.
16h	Expired Cleaning Media	C	The cleaning cartridge that was inserted into the tape drive is used up. Use a new cleaning cartridge to clean the tape drive.
1Fh	Hardware B	C	The tape drive has a problem that is not read/write related. ▪ Turn the tape drive off and then on again. ▪ Restart the operation. ▪ If the problem persists, contact Exabyte Technical Support.

Table 8-6 *Parameters returned on the LOG SENSE TapeAlert page (continued)*

Parameter	Flag name	Type[a]	Description
20h	Interface	W	There is a problem in the SCSI interface between the initiator and the tape drive. ▪ Check all of the SCSI cables and connections. ▪ Restart the operation.
22h	Download Fail	W	The last attempt to download new firmware has failed. Obtain the correct firmware and try again.
24h	Drive Temperature	W	The tape drive's internal temperature at the tape path has exceeded 47° C (117° F).

[a] I = Informational suggestion to user.
W = Warning. Remedial action is advised. Performance of data may be at risk.
C = Critical. Immediate remedial action is required.

8.3.5 COMPRESSION STATISTICS (PAGE CODE 30h)

Setting the Page Code in the CDB to 30h causes the tape drive to return the Compression Statistics log page. The value in the Page Length field (bytes 2 and 3) of the Parameter List Header for this page is 28h (40 bytes).

Table 8-7 lists the parameters used to provide cumulative compression statistics for tape currently loaded in the tape drive.

Table 8-7 *Parameters returned on the LOG SENSE Compression Statistics page*

Parameter Code	Parameter Name	Description	Length (bytes)
8000h	User Bytes Written	The amount of data, in bytes, that was written to tape (before compression).	6
8001h	User Bytes Read	The amount of data, in bytes, that was read from tape (after decompression).	6
8002h	Compressed Bytes Written	The amount of compressed data, in bytes, that was written to tape.	6
8003h	Compressed Bytes Read	The amount of compressed data, in bytes, that was read from tape.	6

8.3.6 TAPE CAPACITY PAGE (PAGE CODE 31h)

Setting the Page Code in the CDB to 31h causes the tape drive to return the Tape Capacity log page. The value in the Page Length field (bytes 2 and 3) of the Parameter List Header for this page is 20h (32 bytes).

Table 8-8 lists the parameters used to provide capacity information about the partitions on the tape currently loaded in the tape drive.

Table 8-8 *Parameters returned on the LOG SENSE Tape Capacity page*

Parameter Code	Parameter Name	Description	Length (bytes)
1h	Partition 0 Remaining	The number of kilobytes of data that might be written between the current location and the EOP for partition 0.	4
2h	Partition 1 Remaining	The number of kilobytes of data that might be written between the current location and the EOP for partition 1.	4
3h	Partition 0 Maximum	The maximum number of kilobytes of data that might be written in partition 0.	4
4h	Partition 1 Maximum	The maximum number of kilobytes of data that might be written in partition 1.	4

8.3.7 ENVIRONMENTAL COUNTER PAGE (PAGE CODE 36h)

Setting the Page Code in the CDB to 36h causes the tape drive to return the Environmental Counter log page. The value in the Page Length field (bytes 2 and 3) of the Parameter List Header for this page is 2Fh (47 bytes).

Table 8-9 lists the parameters used to provide statistics about the operational environment of the tape drive. If a counter reaches its maximum value, it will remain at that value and not roll back to zero.

Table 8-9 *Parameters returned on the LOG SENSE Environmental Counter page*

Parameter Code	Parameter Name	Description	Length (bytes)
8000h	Current Temperature	The current temperature of the tape drive as measured at the tape path.	1
8001h	Max Temperature	The maximum temperature reached by the tape drive during this power cycle.	1
8002h	Lifetime Max Temperature	The maximum temperature reached by the tape drive during its lifetime.	1
8003h	Min Temperature	The minimum temperature reached by the tape drive during this power cycle.	1
8002h	Lifetime Min Temperature	The minimum temperature reached by the tape drive during its lifetime.	1
8005h	Lifetime Minutes Tensioned	The number of minutes the drive has had tape tensioned in its lifetime.	4

Table 8-9 *Parameters returned on the LOG SENSE Environmental Counter page (continued)*

Parameter Code	Parameter Name	Description	Length (bytes)
8006h	Minutes Since Last Clean	The number of minutes the drive has had tape tensioned since a cleaning cartridge was last used.	4
8007h	Lifetime Clean	The number of times a cleaning cartridge has been used on the drive in its lifetime.	2

8.3.8 TAPE USAGE PAGE (PAGE CODE 37h)

Setting the Page Code in the CDB to 37h causes the tape drive to return the Tape Usage page. The value in the Page Length field (bytes 2 and 3) of the Parameter List Header for this page is F8h (248 bytes).

Table 8-10 lists the parameters used to provide usage statistics for the data cartridge currently loaded in the tape drive. These statistics are stored on the data cartridge and read by the tape drive when the cartridge is loaded.

- Current values are the statistics kept since the cartridge was loaded. These values are not included in the lifetime statistics.
- Previous values are statistics from the last time the tape was loaded. These values are included in the lifetime statistics.
- Lifetime values are the cumulative statistics over the life of the data cartridge.
- If a counter reaches its maximum value, it will remain at that value and not roll back to zero.
- No data is available if the tape drive does not currently have a data cartridge loaded. Tape drive returns Not Ready status with the ASC set to 3Ah and the ASCQ set to 00h (Medium Not Present).

Table 8-10 *Parameters returned on the LOG SENSE Tape Usage page*

Parameter Code	Parameter Name	Description	Length (bytes)
8000h	Current Bytes Written	The number of bytes written since the data cartridge was loaded as a multiple of 10000h.	4
8001h	Current Bytes Read	The number of bytes read since the data cartridge was loaded as a multiple of 10000h.	4
8002h	Current Rewrites	The number of bytes rewritten since the data cartridge was loaded.	4
8003h	Current Rereads	The number of bytes reread since the data cartridge was loaded.	2
8004h	Current Blocks ECC Corrected	The number of blocks corrected using ECC since the data cartridge was loaded.	4

Table 8-10 *Parameters returned on the LOG SENSE Tape Usage page (continued)*

Parameter Code	Parameter Name	Description	Length (bytes)
8005h	Current Times Device Pause	The number of times the tape drive paused since the data cartridge was loaded. A pause results from one of the following conditions: ▪ During a write operation, the data buffer was empty. ▪ During a read operation, the data buffer was full.	4
8006h	Current Rewinds	The number of times the tape has been rewound since the data cartridge was loaded.	2
8007h	Current Max/Min Temperature	The current maximum and minimum temperature (1 byte each, in degrees Celsius) reached by the tape drive since the data cartridge was loaded.	2
8008h	Current Tape Repartitions	The number of times the tape has been repartitioned since the data cartridge was loaded.	2
8009h	Current Drive Serial	The serial number of the tape drive in which the data cartridge is currently loaded.	4
800Ah	Previous Bytes Written	The number of bytes written the last time the data cartridge was loaded as a multiple of 10000h.	4
800Bh	Previous Bytes Read	The number of bytes read the last time the data cartridge was loaded as a multiple of 10000h.	4
800Ch	Previous Rewrites	The number of bytes rewritten the last time the data cartridge was loaded.	4
800Dh	Previous Rereads	The number of bytes reread the last time the data cartridge was loaded.	2
800Eh	Previous Blocks ECC Corrected	The number of blocks corrected using ECC the last time the data cartridge was loaded.	4
800Fh	Previous Times Device Pause	The number of times the tape drive was paused the last time the data cartridge was loaded.	4
8010h	Previous Rewinds	The number of times the tape was rewound the last time the data cartridge was loaded.	2
8011h	Previous Max/Min Temperature	The current maximum and minimum temperature (1 byte each, in degrees Celsius) reached by the tape drive the last time the data cartridge was loaded.	2
8012h	Current Tape Repartitions	The number of times the tape was repartitioned the last time the data cartridge was loaded.	2
8013h	Previous Drive Serial	The serial number of the previous tape drive in which the data cartridge was loaded.	4
8014h	Lifetime Bytes Written	The number of bytes written over the lifetime of the cartridge as a multiple of 10000h.	6
8015h	Lifetime Bytes Read	The number of bytes read over the lifetime of the cartridge as a multiple of 10000h.	6

Table 8-10 *Parameters returned on the LOG SENSE Tape Usage page (continued)*

Parameter Code	Parameter Name	Description	Length (bytes)
8016h	Lifetime Rewrites	The number of bytes rewritten over the lifetime of the cartridge.	6
8017h	Lifetime Rereads	The number of bytes reread over the lifetime of the cartridge.	6
8018h	Lifetime Blocks ECC Corrected	The number of blocks corrected using ECC over the lifetime of the cartridge.	6
8019h	Lifetime Times Device Pause	The number of times the tape drive paused over the lifetime of the cartridge.	6
801Ah	Lifetime Rewinds	The number of times the tape has been rewound over the lifetime of the cartridge.	4
801Bh	Lifetime Max/Min Temperature	The current maximum and minimum temperature (1 byte each, in degrees Celsius) reached by the tape drive over the lifetime of the cartridge.	2
801Ch	Lifetime Tape Repartitions	The number of times the tape has been repartitioned over the lifetime of the cartridge.	2
801Dh	Lifetime Load	The number of times the cartridge has been loaded into a tape drive over the lifetime of the cartridge.	4
801Eh	Initial Drive Serial Number	The serial number of the first tape drive into which the data cartridge was loaded.	4
801Fh	Tape Serial Number	The serial number of the data cartridge.	4

8.3.9 TAPE LAST FSC PAGE (PAGE CODE 39h)

Setting the Page Code in the CDB to 39h causes the tape drive to return the Tape Last FSC log page. The value in the Page Length field (bytes 2 and 3) of the Parameter List Header for this page is 6Eh (110 bytes).

Table 8-11 lists the parameters used to provide statistics about the last five data cartridges loaded (and unloaded) into the tape drive. The statistics for Tape 0 are for the least recent cartridge loaded; the statistics for Tape 4 are for the most recent cartridge. If a data cartridge is currently loaded in the tape drive, the information for that cartridge is not included in the statistics.

The tape drive stores these statistics in nonvolatile memory just before the cartridge is unloaded. It reflects the ending status of the last motion command (ERASE, LOCATE, READ, SPACE, or WRITE) executed before the unload operation.

Table 8-11 *Parameters returned on the LOG SENSE Tape Last FSC page*

Parameter Code	Parameter Name	Description	Length (bytes)
8000h	Tape 0 Last FSC	The last FSC (fault symptom code) posted for a motion command by the tape drive while the least recent tape (tape 0) was loaded.	1
8001h	Tape 0 Last Motion Command	The last motion command executed by the tape drive while tape 0 was loaded.	1
8002h	Tape 0 ID	The ID of tape 0.[a]	8
8003h	Tape 1 Last FSC	The last FSC (fault symptom code) posted for a motion command by the tape drive while the second from last tape (tape 1) was loaded.	1
8004h	Tape 1 Last Motion Command	The last motion command executed by the tape drive while tape 1 was loaded.	1
8005h	Tape 1 ID	The ID of tape 1.	8
8006h	Tape 2 Last FSC	The last FSC (fault symptom code) posted for a motion command by the tape drive while the third from last tape (tape 2) was loaded.	1
8007h	Tape 2 Last Motion Command	The last motion command executed by the tape drive while tape 2 was loaded.	1
8008h	Tape 2 ID	The ID of tape 2.	8
8009h	Tape 3 Last FSC	The last FSC (fault symptom code) posted for a motion command by the tape drive while the fourth from last tape (tape 3) was loaded.	1
800Ah	Tape 3 Last Motion Command	The last motion command executed by the tape drive while tape 3 was loaded.	1
800Bh	Tape 3 ID	The ID of tape 3.	8
800Ch	Tape 4 Last FSC	The FSC (fault symptom code) posted for the tape drive while the most recent tape (tape 4) was loaded.	1
800Dh	Tape 4 Last Motion Command	The last motion command executed by the tape drive while tape 4 was loaded.	1
800Eh	Tape 4 ID	The ID of tape 4.	8

[a] The Tape ID is derived by concatenating the last eight digits of the serial number for the tape drive that first formatted the tape, followed by an eight-digit hexadecimal number indicating the total number of tapes that have been formatted for the first time by the indicated tape drive.

8.4 EXCEPTIONS AND ERROR CONDITIONS

Table 8-12 lists the exceptions and error conditions that cause the tape drive to return Check Condition status for the LOG SELECT command.

Table 8-12 *REQUEST SENSE data for LOG SENSE command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
02h	3Ah	00h	**Not Ready.** Tape drive is not ready. Command requires a tape, and no tape is present.
5h	24h	00h	**Illegal Request.** Invalid field in CDB. This error is a result of any of the following: ▪ The PPC bit is not 0. ▪ The SP bit is set to 1. ▪ The Page Code field is not 00h, 02h, or 03h. ▪ The Parameter Pointer is an invalid value greater than 06h.

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MODE SELECT (15h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	0	1
01	Logical Unit Number			PF	Reserved			SP
02	Reserved							
03								
04	Parameter List Length							
05	Control							

9.1 About This Command

The MODE SELECT command allows the initiator to specify medium and device parameters. These parameters apply to all initiators in a multi-initiator environment. The parameters transferred from the initiator after the CDB are structured as pages of related parameters (SCSI-2 format). The parameters are transferred in the following order:

- Parameter List Header
- Block Descriptor (optional)
- One or more available pages of related parameters

Unless otherwise noted, the parameters set using this command return to their default values whenever the tape drive is power-cycled or reset (SCSI bus reset or Bus Device Reset).

9.2 CDB Field Definitions

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 4 – PF (Page Format)

The tape drive ignores this field. All of the parameters use standard page format.

Byte 01, Bit 0 – SP (Saved Page)

The tape drive does not support the saved page function. The valid value for this bit is 0.

Byte 04 – Parameter List Length

This field indicates the total number of bytes to be transferred from the initiator to the tape drive. All parameters after the Block Descriptor are transferred as pages of parameters. There is no specific order for the parameter pages.

To determine the Parameter List Length, total the number of bytes contained in the Parameter List Header, the Block Descriptor (if you are sending it), and all of the parameter pages you are sending. The maximum value you can specify is FFh. Table 9-1 lists the lengths of the Parameter List Header, Block Descriptor, and each supported mode page.

Note: When the value for the Parameter List Length is 0, no data is transferred from the initiator. A value of 0 is not an error.

Table 9-1 *MODE SELECT parameter page lengths*

Parameter	Length
Parameter List Header	04h (4 bytes)
Block Descriptor	08h (8 bytes)
Read-Write Recovery page (Page Code 01h)	0Ch (12 bytes)
Disconnect-Reconnect page (Page Code 02h)	10h (16 bytes)
Control Mode page (Page Code 0Ah)	08h (8 bytes)
Data Compression page (Page Code 0Fh)	10h (16 bytes)
Device Configuration page (Page Code 10h)	10h (16 bytes)
Medium Partition page (Page Code 11h)	88h (136 bytes)
TapeAlert page (Page Code 1Ch)	0Ch (12 bytes)
Vendor Unique Parameters Page 1 (Page Code 21h)	06h (6 bytes)

Restrictions for sending MODE SELECT parameters:

- For data transfers greater than 0 bytes, the entire Parameter List Header must be transferred before the Block Descriptor or any parameter page or vendor-unique parameters.
- The Parameter List Header, Block Descriptor, and any parameter pages must be transferred in their entirety; partial transfers of these data segments are not allowed.

Note: Any value for the Parameter List Length that causes the Parameter List Header, Block Descriptor, or one of the parameter pages to be truncated will terminate the command with Check Condition status. The sense key will be set to Illegal Request and the Additional Sense Code will be set to Parameter List Length Error.

9.3 MODE PARAMETER DATA

With each MODE SELECT CDB, you send a parameter list for each page on which you are changing values. Each parameter list begins with a Parameter List Header that identifies the parameter page being sent and indicates the number of bytes that follow the header as mode parameters. Immediately following the Parameter List Header is an optional Block Descriptor, followed by the list of values for each parameter on the page that you want to change.

Note: The total number of bytes in the parameter list equals the Page Length of the parameter page, plus four bytes for the Parameter List Header. The sum of the bytes in all the parameter lists must equal the value specified for the Parameter List Length in the CDB.

9.3.1 PARAMETER LIST HEADER

Each parameter list page begins with a four-byte Parameter List Header. The Parameter List Header is followed by the parameters for the specified page.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved							
01								
02	RSVD	Buffered Mode			Speed			
03	Block Descriptor Length							

Byte 02, Bits 6 through 4 – Buffered Mode

This field specifies the data transfer mode to be used by the tape drive. The tape drive supports two data transfer modes:

000b – Unbuffered mode
001b – Buffered mode (power-on default)

In buffered mode, status is returned when the last block of data has been transferred to the tape drive's buffer. See Chapter 24, "WRITE (0Ah)" for more information about how data is buffered.

In unbuffered mode, status is returned only after the data has actually been written to the tape.

Byte 02, Bits 3 through 0 – Speed

The tape drive operates as a variable-speed device, where the tape drive automatically determines the optimum speed required. The valid value for this field is 0.

Byte 03 – Block Descriptor Length

This field specifies the length of the Block Descriptor in bytes, as follows:

00h – No Block Descriptor is included.
08h – An 8-byte Block Descriptor is included.

Note: The tape drive does not support multiple block descriptors.

9.3.2 BLOCK DESCRIPTOR

The optional Block Descriptor defines the data format and other format characteristics to be used by the tape drive when it writes data.

Bit Byte	7	6	5	4	3	2	1	0
00	Density Code							
01	(MSB)							
02	Number of Blocks							
03								(LSB)
04	Reserved							
05	(MSB)							
06	Block Length							
07								(LSB)

Byte 00 – Density Code

The Density Code specifies the format the tape drive will use to write data. The format specified in this field becomes the default format used by the tape drive under the following conditions:

- The tape is capable of accepting the specified format.
- The tape is formatted or contains a single partition written from the beginning of the partition.

By default, the tape drive uses the VXA-2 format. If you choose to send a Density Code to the tape drive, refer to Table 9-2 for the values you can use and their results. Illegal density settings result in Check Condition status with a sense key of Illegal Request (5h), the ASC is 30h and the ASCQ is 02h.

Table 9-2 *Values for the Density Code field in the MODE SELECT command*

Density Code	Data format Used	Notes
7Fh	No change in format	You can use this Density Code if you do not want to change the tape format. The format will remain the same as it was before the MODE SELECT command was sent to the tape drive. If the tape is not at LBOT, you must use either 7Fh or the Density Code reported by the MODE SENSE command.
80h	VXA-1 format	The tape drive writes data using the VXA-1 format so that the tape can be read by a VXA-1 tape drive. **Note:** This format is not recommended for the V23 (230 meter) cartridges. These cartridges are incompatible with the VXA-1 tape drive.
81h	VXA-2 format	The tape drive writes data using the VXA-2 format. **Note:** VXA-1 tape drives cannot read tapes written in this format.

Bytes 01 through 03 – Number of Blocks

The tape drive ignores this field in the MODE SELECT data.

Bytes 05 through 07 – Block Length

This field indicates the length of each logical block, in bytes, when the Fixed bit is set for the READ, VERIFY, and WRITE commands. The default Block Length is 3C000h (245,760 bytes= 240 KB). Valid values for this field are from 0h to 3C000h (see page 13-2 for additional information).

- When the Block Length is non-zero, fixed-length block operations are allowed. For fixed-length blocks, only block sizes that are evenly divisible by four (that is, they end on a 4-byte boundary) are valid. A block length of 0 is invalid for fixed-length blocks.
- When the Block Length is 0, only variable-length block operations are allowed.

Note: If the Block Length is 0, the SILI bit in the READ command suppresses illegal length indications for both underlength and overlength reads. If the Block Length is non-zero, the SILI bit of the READ command suppresses illegal length indications only for blocks shorter than requested. See page 12-2 for more information.

9.4 READ-WRITE ERROR RECOVERY PAGE (PAGE CODE 01h)

The Read-Write Error Recovery page specifies error recovery parameters used during read or write operations.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Reserved		TB	RSVD	EER	PER	DTE	DCR
03	Read Retry Count							
04 ⋮ 07	Reserved							
08	Write Retry Count							
09 ⋮ 11	Reserved							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 01h, identifying the current page as the Read-Write Error Recovery page.

Byte 01 – Page Length

This field indicates the number of bytes in the Read-Write Error Recovery page that follow this byte. The valid value for this field is 0Ah (10 bytes).

Byte 02, Bit 5 – TB (Transfer Block)

The TB bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 02, Bit 3 – EER (Enable Early Recovery)

The EER bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 02, Bit 2 – PER (Post Error)

The PER bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 02, Bit 1 – DTE (Disable Transfer on Error)

The DTE bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 02, Bit 0 – DCR (Disable Correction)

The DCR bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 03 – Read Retry Count

This field specifies how many times the tape drive attempts its read recovery algorithms. If the tape drive fails to reread the block after this number of attempts, it reports an unrecoverable error. You can set the Read Retry Count to any value between 00h and FFh. The default is 05h. Any value greater than 05h is automatically set to 05h.

The value you specify for the Read Retry Count determines what operation the tape drive performs when it encounters an unreadable data block, as follows:

- If you specify 00h for this byte, the tape drive does not attempt any rereads before reporting an unrecoverable read error and continuing with the read operation.
- If you specify 01h to 05h for this byte, the tape drive attempts its read recovery algorithm for either the default number of times or the number specified by this byte, whichever is smaller, before reporting an unrecoverable read error and continuing with the read operation.

Byte 08 – Write Retry Count

This field specifies how many times the tape drive should rewrite a physical block before a recovery is attempted. You can set the Write Retry Count to any value between 00h and FFh. The default value is 05h. Any value greater than 05h is automatically set to 05h.

To prevent the tape drive from rewriting any physical blocks, set the Write Retry Count to 0 (00h). When the Write Retry Count is set to 0, the tape drive will abort the write operation the first time it encounters a write error. The tape drive returns Check Condition status with a sense key of Medium Error (3h), with an ASC of 0Ch and ASCQ of 00h (Write Error).

9.5 DISCONNECT-RECONNECT PAGE (PAGE CODE 02h)

The Disconnect-Reconnect page specifies parameters that control how the tape drive disconnects and reconnects during data transfers.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Buffer Full Ratio							
03	Buffer Empty Ratio							
04	(MSB)		Bus Inactivity Limit					
05								(LSB)

Bit Byte	7	6	5	4	3	2	1	0
06	(MSB)							
07				Disconnect Time Limit				(LSB)
08	(MSB)							
09				Connect Time Limit				(LSB)
10	(MSB)							
11				Maximum Burst Size				(LSB)
12	Reserved						DTDC	
13								
14				Reserved				
15								

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 02h, identifying the current page as the Disconnect-Reconnect page.

Byte 01 – Page Length

This field indicates the number of bytes in the Disconnect-Reconnect page that follow this byte. The valid value for this field is 0Eh (14 bytes).

Byte 02 – Buffer Full Ratio

The tape drive does not support this field. The valid value for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Byte 03 – Buffer Empty Ratio

The tape drive does not support this field. The valid value for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Bytes 04 and 05 – Bus Inactivity Limit

The tape drive does not support this field. The valid value for this field is 0.

Bytes 06 and 07 – Disconnect Time Limit

The tape drive does not support this field. The valid value for this field is 0.

Bytes 08 and 09 – Connect Time Limit

The tape drive does not support this field. The valid value for this field is 0.

Bytes 10 and 11 – Maximum Burst Size

This field specifies the amount of data, in 512-byte increments, that can be transferred between the initiator and the tape drive before a disconnect is required. The tape drive supports all values for this field. The default is 0, which means that there is no limit to the amount of data that can be transferred before a disconnect is required.

Byte 12, Bits 1 and 0 – DTDC (Data Transfer Disconnect Control)

This field specifies how the tape drive should perform a disconnect when the ND bit is set to 1 (see page 9-24). Table 9-3 lists the valid values for this field.

Table 9-3 *Valid values for the MODE SELECT DTDC field*

DTDC Value	Description
00b	Disconnects are not controlled by the DTDC field. Disconnects are controlled by the other fields on this page. (Power-on default)
01b	Once the data transfer of a command has started, the tape drive should not disconnect until all of the data has been transferred. The Maximum Burst Size (bytes 10 and 11) must be set to 0.
10b	Not valid.
11b	Once the data transfer of a command has started, the tape drive should not disconnect until the command is complete. The Maximum Burst Size (bytes 10 and 11) must be set to 0.

9.6 CONTROL MODE PAGE (PAGE CODE 0Ah)

The Control Mode page specifies whether the tape drive returns Check Condition status when one of its write and read error counters reaches a specified threshold. For information about using the LOG SELECT command to set threshold values for the tape drive's write and read error counters, refer to Chapter 7.

Bit / Byte	7	6	5	4	3	2	1	0
00	RSVD		Page Code					
01	Page Length							
02	RSVD							RLEC
03	Queue Algorithm Modifier				Reserved		QErr	DQue
04	EECA	Reserved				RAENP	UAAENP	EAENP
05	Reserved							
06	(MSB) Ready AEN Holdoff Period							
07	Ready AEN Holdoff Period (LSB)							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 0Ah, identifying the current page as the Control Mode page.

Byte 01 – Page Length

This field indicates the number of bytes in the Control Mode Page that follow this byte. The valid value for this field is 06h (6 bytes).

Byte 02, Bit 0 – RLEC (Report Log Exception Condition)

This field indicates whether the tape drive returns Check Condition status with the sense key set to Unit Attention (6h) when one of its write or read error counters reaches a specified threshold, as follows:

0 – Do not return Unit Attention when a threshold condition is met.
1 – Return Unit Attention when a threshold condition is met.

Byte 03, Bits 7 through 4 – Queue Algorithm Modifier

The tape drive does not support the Simple Queue Tag message. The valid value for this field is 0.

Byte 03, Bit 1 – QErr (Queue Error)

The tape drive does not support the Simple Queue Tag message. The valid value for this field is 0.

Byte 03, Bit 0 – DQue (Disable Queuing)

The tape drive does not support the Simple Queue Tag message. The valid value for this field is 1.

Byte 04, Bit 7 – EECA (Enable Extended Contingent Allegiance)

The tape drive does not support extended contingent allegiance. The valid value for this bit is 0.

Byte 04, Bit 2 – RAENP (Ready AEN Permission)

The tape drive does not support asynchronous event notification (AEN). The valid value for this bit is 0.

Byte 04, Bit 1 – UAAENP (Unit Attention AEN Permission)

The tape drive does not support asynchronous event notification. The valid value for this bit is 0.

Byte 04, Bit 0 – EAENP (Enable AEN Permission)

The tape drive does not support asynchronous event notification. The valid value for this bit is 0.

Bytes 06 and 07 – Ready AEN Holdoff Period

The tape drive does not support asynchronous event notification. The valid value for this field is 0.

9.7 DATA COMPRESSION PAGE (PAGE CODE 0Fh)

The Data Compression page enables you to turn data compression on or off at any position on the tape. To turn compression off, send this page with the DCE bit set to 0. To turn compression back on, send this page with the DCE bit set to 1.

Bit Byte	7	6	5	4	3	2	1	0
00	RSVD		Page Code					
01	Page Length							
02	DCE	DCC	Reserved					
03	DDE	RED	Reserved					
04 ⋮ 07	(MSB) Compression Algorithm (LSB)							
08 ⋮ 11	(MSB) Decompression Algorithm (LSB)							
12 ⋮ 15	Reserved							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 0Fh, identifying the current page as the Data Compression page.

Byte 01 – Page Length

This field indicates the number of bytes in the Data Compression page that follow this byte. The valid value for this field is 0Eh (14 bytes).

Byte 02, Bit 7 – DCE (Data Compression Enable)

This field enables or disables data compression, as follows:

0 – Data compression is disabled.
1 – Data compression is enabled (default setting).

The setting of the DCE bit remains in effect across all operations (rewinds, loads, and so forth) until you change it. You can change the default setting using the DfNoCmp (Default No Compression) bit on the Vendor Unique Parameters Page 1 mode page (see page 9-24).

Byte 02, Bit 6 – DCC (Data Compression Capable)

The tape drive ignores this bit in the MODE SELECT command.

Byte 03, Bit 7 – DDE (Data Decompression Enable)

This field indicates whether data decompression is enabled. The tape drive automatically decompresses compressed data before sending it to the initiator. The tape drive ignores this bit.

Byte 03, Bits 6 and 5 – RED (Report Exception on Decompression)

The tape drive does not report exceptions on decompression (boundaries between compressed and uncompressed data). The valid value for this field is 0.

Bytes 04 through 07 – Compression Algorithm

The tape drive ignores this field in the MODE SELECT command.

Bytes 08 through 11 – Decompression Algorithm

The tape drive ignores this field in the MODE SELECT command.

9.8 DEVICE CONFIGURATION PAGE (PAGE CODE 10h)

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved			Page Code				
01	Page Length							
02	RSVD	CAP	CAF	Active Format				
03	Active Partition							
04	Write Buffer Full Ratio							
05	Read Buffer Empty Ratio							
06	(MSB) Write Delay Time							
07	(LSB)							
08	DBR	BIS	RSmk	AVC	SOCF		RBO	REW
09	Gap Size							
10	EOD Defined			EEG	SEW	Reserved		
11	(MSB) Buffer Size at Early Warning							
12								
13	(LSB)							
14	Select Data Compression Algorithm							
15	Reserved							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 10h, identifying the current page as the Device Configuration page.

Byte 01 – Page Length

This field indicates the number of bytes in the Device Configuration page that follow this byte. The valid value for this field is 0Eh.

Byte 02, Bit 6 – CAP (Change Active Partition)

If the loaded tape is partitioned, this bit indicates that you want to move the tape from the current partition to a new partition specified by the Active Partition byte (byte 03), as follows:

0 – Do not change the active partition.

1 – Change the active partition to the partition specified by the Active Partition byte. Changing partitions may cause tape motion.

If this bit is set to 1, the tape drive positions the tape to the logical beginning of the new partition (LBOP) after receiving a tape motion command. If the partition specified by the Active Partition field is the same as the currently active partition, the tape drive rewinds to the beginning of the current partition.

Note: If the currently loaded tape does not contain partitions, the value for this bit must be 0.

Byte 02, Bit 5 – CAF (Change Active Format)

The tape drive ignores this field.

Byte 02, Bits 4 through 0 – Active Format

The Active Format function is not implemented. The tape drive ignores this field.

Byte 03 – Active Partition

This field indicates the number of the new partition to which the tape is to be moved (if you set the CAP bit to 1 to change the active partition). The tape positioned to the logical beginning of partition (LBOP) for the specified partition. The valid values for this field are 0 and 1.

Notes:

- If the tape is not partitioned, the value in the Active Partition field must be 0.
- If the CAP bit is 0, the tape drive ignores the Active Partition byte.
- If you specify a partition that does not exist, the tape drive returns Check Condition status with the sense key set to Illegal Request.

Byte 04 – Write Buffer Full Ratio

The tape drive does not support this field. The valid value for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Byte 05 – Read Buffer Empty Ratio

The tape drive does not support this field. The valid value for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Bytes 06 and 07 – Write Delay Time

The value specified by this field determines the maximum amount of time, in units of 100 msec, that the data will remain in the buffer in the absence of an event that would normally empty the buffer. When the time specified by Write Delay Time elapses, the data in the buffer is written to tape.

Valid values for this field are 0000h to FFFFh. The default value for this field is 0000h. Any value greater than 1999h (approximately 11 minutes) is automatically set to 1999h. At the end of the time specified by this field, the data in the buffer is written to tape, followed by an EOD mark; drum rotation is stopped.

Note: The longest time that data remains in the buffer before being written to tape is 10 minutes.

Byte 08, Bit 7 – DBR (Data Buffer Recovery)

The tape drive does not support data buffer recovery. The valid value for this bit is 0.

Byte 08, Bit 6 – BIS (Block Identifier Supported)

The tape drive ignores this field in the MODE SELECT command.

Byte 08, Bit 5 – RSmk (Report Setmarks)

This field specifies whether the tape drive returns Check Condition status when it encounters a setmark on the tape during read, verify, space block, or space filemark operations, as follows:

0 – Do not report setmarks (setmarks are ignored).
1 – Report setmarks (default setting).

If the RSmk bit is 1 and the tape drive encounters a setmark, it returns Check Condition status with the sense key set to No Sense (0h). The ASC and ASQ fields are set to 00h and 03h, respectively.

Byte 08, Bit 4 – AVC (Automatic Velocity Control)

The tape drive always uses automatic velocity control and ignores this bit.

Byte 08, Bits 3 and 2 – SOCF (Stop on Consecutive Filemarks)

The tape drive does not support the SOCF field. The valid value for this bit is 0.

Byte 08, Bit 1 – RBO (Recover Buffer Order)

The tape drive does not support the RBO bit. The valid value for this bit is 0.

Byte 08, Bit 0 – REW (Report Early Warning)

This field indicates whether reporting of the early-warning condition (approaching LEOP) during a read operation is enabled or disabled, as follows:

0 – Do not report early-warning condition for read operations; only report early warning condition for write operations (default setting).

1 – Report early-warning condition after completing the current READ or WRITE command.

The tape drive reports an early-warning condition as a Check Condition status with the sense key set to No Sense. The EOM bit is set to 1 and the LBOT bit is set to 0 in the extended sense data.

Byte 09 – Gap Size

The tape drive does not support the Gap Size field. The valid value for this field is 0.

Byte 10, Bits 7 through 5 – EOD Defined

The tape drive does not support the EOD field. The valid value for this field is 0.

Byte 10, Bit 4 – EEG (Enable EOD Generation)

The tape drive ignores this bit in the MODE SELECT command.

Byte 10, Bit 3 – SEW (Synchronize at Early Warning)

The tape drive ignores this bit in the MODE SELECT command.

Bytes 11 through 13 – Buffer Size at Early Warning

The tape drive does not support the Buffer Size at Early Warning field. The valid value for this field is 0.

Byte 14 – Select Data Compression Algorithm

The tape drive does not support the Select Data Compression Algorithm field. The valid value for this field is 0.

9.9 MEDIUM PARTITION PAGE (PAGE CODE 11h)

The Medium Partition page allows you to format a tape to contain one or two partitions. Partitions are numbered consecutively from the end of the tape with partition 0 always being the last partition on the tape.

Before formatting new partitions, you must position the tape at LBOT or at the logical beginning of an existing partition.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Maximum Additional Partitions							
03	Additional Partitions Defined							
04	FDP	SDP	IDP	PSUM		Reserved		
05	Medium Format Recognition							
06	Reserved							

Bit Byte	7	6	5	4	3	2	1	0
07	Reserved							
08	(MSB)			Partition Size (Partition 0)				
09								(LSB)
10	(MSB)			Partition Size (Partition 1)				
11								(LSB)
12 ⋮ 135	Partition Size (Partitions 2 through 63)							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 11h, identifying the current page as the Medium Partition page.

Byte 01 – Page Length

This field indicates the number of bytes in the Medium Partition page that follow this byte.

06h – Only a single partition is allowed.

08h – If two partitions are specified, the Partition 0 Size field (bytes 08 and 09) is redefined as Partition 1 Size. This field is then used to specify the size of partition 1. Partition 0 is the remainder of the tape after partition 1 is created.

0Ah – If two partitions are specified, their sizes are set using the Partition Size fields (bytes 8 and 9 for partition 0, bytes 10 and 11 for partition 1) and the FDP, SDP, and IDP fields.

86h – If two partitions are specified, their sizes are set using the Partition Size fields (bytes 8 and 9 for partition 0, bytes 10 and 11 for partition 1) and the FDP, SDP, and IDP fields. The tape drive ignores the remaining Partition Size fields (bytes 12 through 135).

Byte 02 – Maximum Additional Partitions

The tape drive ignores this field in the MODE SELECT command.

Byte 03 – Additional Partitions Defined

This field indicates the number of partitions being defined in addition to the original partition (the entire tape). Up to two partitions are allowed. Valid values are either 00h or 01h.

- If this byte is set to 00h, the tape drive ignores the sizes for partitions 0 through 63 in the Partition Size fields (bytes 08 through 135). The entire tape is a single partition.
- If this byte is set to 01, the tape drive ignores the sizes for partitions 2 through 63 in the Partition Size fields (bytes 12 through 135). The tape is divided into two partitions.

Byte 04, Bit 7 – FDP (Fixed Data Partitions)

This field specifies whether the tape drive should use its "fixed" definition of partitions to format the tape. The fixed definition is a single partition encompassing the entire tape.

0 – Do not format the tape using fixed format.

1 – Format the tape with one partition. The Additional Partitions Defined, SDP, and IDP fields must be set to 0. The Partition Size fields are ignored.

Byte 04, Bit 6 – SDP (Select Data Partitions)

This field specifies whether the tape drive should format the tape using the number of partitions specified in the Additional Partitions Defined field, with the size of the partitions determined by the tape drive. If no additional partitions are specified, the tape will have a single partition encompassing the entire capacity of the tape.

0 – Do not format the tape using drive defined partitions.

1 – Format the tape with $n+1$ partitions, where n is the number of partitions specified by the Additional Partitions Defined field. The tape drive ignores the partition sizes specified in the Partition Size fields. The size of partition 1 is automatically set to 100 MB. Partition 0 will encompass the remaining capacity of the tape.

Byte 04, Bit 5 – IDP (Initiator Defined Partitions)

This field specifies whether the tape drive should format the tape based on the partition sizes provided by the initiator in the Partition Size fields, as follows:

0 – Do not format the tape using initiator defined partitions.

1– Format the tape with $n+1$ partitions, where n is the number of partitions specified by the Additional Partitions Defined field. The size of partition 1 is specified in the Partition 1 Size field (bytes 10 and 11). Partition 0 will encompass the remaining capacity of the tape and is at least 100 MB in size.

Table 9-4 summarizes the results of all possible combinations of the FDP, SDP, and IDP bits.

Note: The FDP, SDP, and IDP bits are mutually exclusive. When one of these bits is set to 1, the others must be 0.

Table 9-4 *Partition characteristics resulting from the combinations of the FDP, SDP, and IDP bits in the Medium Partition page*

For these combinations...			These results occur...	
FDP	**SDP**	**IDP**	**When Additional Partitions Defined = 00h...**	**When Additional Partitions Defined = 01h...**
0	0	0	The tape drive does not format the tape.	
0	0	1	The tape drive formats the tape with one partition (the entire tape).	The tape drive formats the tape with *n*+1 partitions, where *n* is the number of partitions specified by the Additional Partitions Defined field. The size of partition 1 is specified in the Partition 1 Size field (bytes 10 and 11). Partition 0 is the remainder of the tape. **Note:** If the Page Length field is set to 08h, the Partition Size field for partition 1 moves to bytes 8 and 9. The size for partition 0 is not specified, but encompasses the remaining capacity of the tape.
0	1	0	The tape drive formats the tape with one partition (the entire tape).	The tape drive formats a tape with *n*+1 partitions, where *n* is the number of partitions specified by the Additional Partitions Defined field. The size of Partition 1is set to 100 MB. Partition 0 is the remainder of the tape.
0	1	1	Not valid.	
1	0	0	The tape drive formats the tape with one partition (the entire tape).	
1	0	1	Not valid.	
1	1	0		
1	1	1		

Byte 04, Bits 4 and 3 – PSUM (Partition Size Unit of Measure)

This field indicates the units used to specify partition sizes. If you set IDP (Initiator Defined Partitions) to 1 and are defining additional partitions (Additional Partitions Defined = 1), use the PSUM field to indicate the units you are using to specify the sizes of the additional partitions. The valid values for PSUM are:

00b – The partition size is specified in bytes.
01b – The partition size is specified in kilobytes (KB).
10b – The partition size is specified in megabytes (MB).

Notes:

- The minimum partition size on a partitioned tape is 100 MB. If you set PSUM=00b (partition size in bytes) or PSUM=01b (partition size in kilobytes), the tape drive rounds the specified partition sizes up to the nearest 100 MB (102,400 KB). If you set PSUM=10b (partition size in megabytes) and specify a partition size that is less that 100 MB, the tape drive sets the partition size to 100 MB.
- If you do not define any additional partitions (Additional Partitions Defined = 0), the tape drive ignores the PSUM field.
- If you do not use the Partition Size field to specify the partition size (that is, FDP=1 or SDP=1), the tape drive ignores the PSUM field.

Byte 05 – Medium Format Recognition

The tape drive ignores this field in the MODE SELECT command.

Bytes 08 and 09 – Partition 0 Size

This field specifies the size of partition 0. Since the maximum number of partitions is two, the tape drive ignores this field when creating a partitioned tape (unless the Page Length field is set to 08h, in which case, this field specifies the size of partition 1). Partition 0 will encompass the remaining capacity of the tape after partition 1 is created. The minimum size of partition 0 on a partitioned tape is 100 MB.

Bytes 10 and 11 – Partition 1 Size

This field specifies the size of partition 1 when IDP=1. This size indicates the approximate amount of uncompressed data that can be written between the logical beginning of partition 1 (LBOP) and the logical end of partition 1 (LEOP) on the tape.

Use this field to specify the size of partition 1 using the units indicated in the PSUM field (byte 04, bits 4 and 3). The minimum size of partition 1 on a partitioned tape is 100 MB.

Bytes 12 through 135 – Partition Size (Partitions 2 through 63)

The tape drive does not support more than two partitions. The tape drive ignores these fields.

9.10 TapeAlert Page (Page Code 1Ch)

The TapeAlert page allows you to configure how the tape drive uses the TapeAlert function.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Perf	Reserved			DExcpt	Test	RSVD	LogErr
03	Reserved				MRIE			
04 ⋮ 07	Interval Timer							
08 ⋮ 11	Test Flag Number							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 1Ch, which identifies the current page as the TapeAlert page.

Byte 01 – Page Length

This field indicates the number of bytes in the TapeAlert page that follow this byte. The valid value for this field is 0Ah.

Byte 02, Bit 7 – Perf (Performance)

This field specifies whether logging of informational exception operations that can cause delays are acceptable, as follows:

0 – Delays due to logging are not allowed (default setting).
1 – Delays due to logging are allowed.

Byte 02, Bit 3 – DExcpt (Disable Exception Reporting)

This field determines how the tape drive handles the reporting of informational exception operations, as follows:

0 – The tape drive reports informational exceptions using the method specified by the MRIE field.

1 – The tape drive disables all informational exception operations. The MRIE field is ignored (default setting).

Byte 02, Bit 2 – Test

This field determines whether the tape drive performs the TapeAlert test specified in the Test Flag Number field, as follows:

0 – The tape drive does not generate any false informational exception conditions.

1 – The tape drive generates a false informational exception condition based on the Test Flag Number field (default setting).

The next SCSI command after the MODE SELECT command returns Check Condition status with sense key set to Unit Attention (6h). The ASC and ASCQ fields are set to 5Dh and 00h, respectively. If the Test Flag Number is set to 0 and both the Test and DExcpt bits are set to 1, then the MODE SELECT command will be rejected as an Illegal Request.

Byte 02, Bit 0 – LogErr

This field indicates whether the tape drive logs informational exception conditions. The tape drive ignores the LogErr bit.

Byte 03, Bits 3 through 0 – MRIE (Method of Reporting Exception Information)

This field indicates the method used by the tape drive to report informational exception conditions. Table 9-5 lists the valid values for MRIE.

Table 9-5 *Valid values for MRIE in the MODE SELECT command*

MRIE	Description
0h	Do not report informational exceptions.
2h	Generate a Check Condition status with the sense key set to Unit Attention (6h).
3h	Generate a Check Condition status with the sense key set to Recovered Error (01h), if the reporting of recovered errors is allowed. Since the tape drive does not support the PER bit (see page 9-6), this setting has the same effect as setting MRIE to 0h.
4h	Generate a Check Condition status with the sense key set to Recovered Error (01h), regardless of the PER bit.
5h	Generate a Check Condition status with the sense key set to No Sense (00h).
6h	Report informational exceptions only in response to an unsolicited REQUEST SENSE command.

Bytes 04 through 07 – Interval Timer

The tape drive does not support this field. The valid value for this field is 0.

Bytes 08 through 11 – Test Flag Number

The value in this field indicates what action the tape drive should take if the Test bit is set to 1, as follows:

Table 9-6 *Test Flag Number settings for MODE SELECT*

Test Flag Number	Description
0	Generate a false information exception condition.
1 through 64	Set the TapeAlert Flag indicated by the number and process.
–1 through –64	Clear the TapeAlert Flag indicated by the number.
32767	Set all supported TapeAlert Flags. See Table 8-6 on page 8-10 for a list of the supported TapeAlert Flags.

9.11 VENDOR UNIQUE PARAMETERS PAGE 1 (PAGE CODE 21h)

The Vendor Unique Parameters page is used to set options for the tape drive that are unique to Exabyte.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02 03	Reserved							
04	Reserved							NoNgRs
05	SOPR	DfNoCmp	ExInq	RSVD	FvCpcty	NoSvPtr	RespDuringImmed	

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 21h, identifying the current page as the Vendor Unique Parameters Page 1 page.

Byte 01 – Page Length

This field specifies the number of bytes in the Vendor Unique Parameters Page 1 page that follow this byte. The valid value for this field is 04h (4 bytes).

Byte 04, Bit 0 – NoNgRs (No Negative Residuals)

This bit specifies whether the tape drive reports residual values on backward space operations as positive or negative (2's compliment) numbers, as follows:

0b – Report residuals as negative numbers (2's compliment) (default setting).
1b – Report residuals as positive numbers.

The value for this field is stored in nonvolatile memory and remains in effect through power cycles.

Note: 2's complement is the method of representing a negative number as a binary number that when added to a positive number of the same magnitude equals zero.

Byte 05, Bit 7 – SOPR (SCSI Operating Parameter Restoration)

This bit specifies whether the tape drive should restore SCSI operating parameters (the settings for synchronous/asynchronous transfers, narrow/wide transfers, transfer rate, and offset for synchronous transfers) when it detects that its firmware has been updated.

0b – Do not restore SCSI operating parameters after a firmware update. (default setting)

1b – Restore the SCSI operating parameters after a firmware update.

The value for this field is stored in nonvolatile memory and remains in effect through power cycles.

Byte 05, Bit 6 – DfNoCmp (Default No Compression)

This bit specifies whether the tape drive should permanently default to having write compression disabled at power up.

0b – Permanently default to compression enabled (default setting).
1b – Permanently default to compression disabled.

The value for this field is stored in nonvolatile memory and remains in effect through power cycles.

Note: Regardless of the setting for this bit, compression can still be enabled or disabled using the DCE bit (byte 2, bit 7 on the Data Compression page).

Byte 05, Bit 5 – ExInq (Extended Inquiry Overwrite)

This bit specifies whether the tape drive should permanently overwrite an extended area of the Standard Inquiry data when the SEND DIAGNOSTIC Set Inquiry Data page (86h) is sent to the tape drive, as follows:

0b – Permanently overwrite only the Vendor Identification and Product Identification fields (bytes 8 through 31) of the Standard Inquiry Data (default setting).

1b – Permanently overwrite the Product Revision Level and four bytes of Vendor Specific data (bytes 32 through 39) in addition to the Vendor Identification and Product Identification fields in the Standard Inquiry Data.

The value for this field is stored in nonvolatile memory and remains in effect through power cycles.

Byte 05, Bit 3 – FvCpcty (Favor Capacity)

This bit specifies whether the tape drive should favor tape capacity over write speed when managing the data buffer during a write operation, as follows:

0b – Favor write speed over capacity (default setting).
1b – Favor capacity (the amount of data that can be written to tape) over write speed.

The value for this field is stored in nonvolatile memory and remains in effect through power cycles.

Byte 05, Bit 2 – NoSvPtr (No Save Pointer on Read)

This bit specifies whether the tape drive should omit the Save Data Pointer message when disconnecting from the SCSI bus during a read operation, as follows:

0b – Send a Save Data Pointer message before sending a Disconnect message during a read operation. (default setting)

1b – Omit the Save Data Pointer message before sending a Disconnect message during a read operation.

The value for this field is stored in nonvolatile memory and remains in effect through power cycles.

Byte 05, Bits 0 and 1 – RespDuringImmed (Response During Immediate)

This field indicates how the tape drive responds to any motion command when the command is received while the tape drive is busy completing another immediate command (ERASE, LOAD, LOCATE, REWIND, WRITE FILEMARK, and VERIFY). Table 9-7 lists the valid values for this field.

Table 9-7 *Valid values for RespDuringImmed in the MODE SELECT command*

RespDuringImmed Value	Description
00b	Return Busy status. (default setting)
01b	Return Check Condition status. The sense key is set to 2h (Not Ready) with the ASC and ASCQ set to 04h and 01h, respectively.
10b	Queue the command until the immediate command is complete. If a second command is received, return Busy status.
11b	Reserved

9.12 EXCEPTIONS AND ERROR CONDITIONS

Table 9-8 lists the exceptions and error conditions that cause the tape drive to return Check Condition status for the MODE SELECT command.

Note: If the Medium Partition page is sent, causing the current tape to be formatted, motion and write errors may occur. See the WRITE command (Chapter 24) for error conditions that may arise in this situations.

Table 9-8 *REQUEST SENSE data for MODE SELECT command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
5h	1Ah	00h	**Illegal Request.** Parameter List Length Error. The Parameter List Length was too small and caused the Parameter List Header, the Block Descriptor, or a parameter page to be truncated.
5h	24h	00h	**Illegal Request.** Invalid field in the CDB.The SP bit in the CDB is set to 1.
5h	25h	00h	**Illegal Request.** Logical unit not supported.
5h	26h	00h	**Illegal Request.** Parameter List Length Error. The Page Length does not match the actual length of the specified page.

Table 9-8 *REQUEST SENSE data for MODE SELECT command errors and exceptions (continued)*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
5h	26h	02h	**Illegal Request.** Invalid value in parameter list. This error is a result of any of the following: ▪ The Buffered Mode field in the Parameter List Header is not set to either 000b (unbuffered) or 001b (buffered). ▪ The Block Descriptor Length field in the Parameter List Header is not set to either 00h (no descriptor) or 08h (the size of the Block Descriptor). ▪ The Density Code field in the Block Descriptor is set to a value other than 7Fh (no change), 80h (VXA-1 format), or 81h (VXA-2 format). ▪ The Block Length field in the Block Descriptor is set to a value greater than 3C00h (240 bytes). ▪ The Block Length field in the Block Descriptor is set to a non-zero value (fixed-length blocks) and the specified value is not evenly divisible by 4. ▪ The Page Length field for the specified page does not match the actual length of the field. ▪ The TB, EER, PER, DTE, or DCR bit in the Read-Write Recovery page are set to 1. ▪ The Buffer Full Ratio, Buffer Empty Ratio, Bus Inactivity Limit, Disconnect Time Limit, or Connect Time Limit field in the Disconnect-Reconnect page is not set to 0. ▪ The QErr, EECA, RAENP, UAAENP, or EAENP bit in the Control Mode page is set to 1. ▪ The DQue field in the Control Mode page is set to 0. ▪ The Queue Algorithm Modifier or Ready AEN Holdoff Period field in the Control Mode page is not set to 0. ▪ The RED field in the Data Compression page is set to 1. ▪ The Compression Algorithm or Decompression Algorithm field in the Data Compression page is not set to 0. ▪ The CAF, DBR, RBO field in the Device Configuration page is set to 1.
5h	26h	02h	**Illegal Request.** Invalid value in parameter list. *(continued)* ▪ The Active Format, Write Buffer Full Ratio, Read Buffer Full, SOCF, Gap Size, EOD, Buffer Size at Early Warning, or Select Data Compression Algorithm field in the Device Configuration page is not set to 0. ▪ The Additional Partitions Defined field is set to a value greater than 3Fh (63 partitions). ▪ More than one of the FDP, SDP, and IDP bits in the Medium Partition page are set to 1. ▪ The PSUM field in the Medium Partition page is set to 11b. ▪ The IDP field on the Medium Partition page is set to 1 and the sum of the Partition Size 0 and Partition Size 1 fields is greater than the size of the tape.

Table 9-8 *REQUEST SENSE data for MODE SELECT command errors and exceptions (continued)*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
6h	2Ah	01h	**Unit Attention.** MODE SELECT parameters have been changed.The tape drive sends status to all other initiators on the SCSI bus.
Bh	47h	00h	**Aborted Command.** SCSI parity error. The command was aborted because of a SCSI bus parity error.

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MODE SENSE (1Ah)

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

10.1 About This Command

The MODE SENSE command allows the tape drive to report medium and device parameters to the initiator. These parameters apply to all initiators in a multi-initiator environment. The parameters are transferred to the initiator as a parameter list comprised of the following:

- Parameter List Header
- Block Descriptor (optional)
- One or more pages of related mode parameters

The values returned in response to this command reflect values set by previous MODE SELECT commands or the default values (if the tape drive has been power-cycled or reset by either a SCSI bus reset or a Bus Device Reset).

10.2 CDB Field Definitions

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 3 – DBD (Disable Block Descriptor)

This field indicates whether the tape drive returns the Block Descriptor as part of the MODE SENSE parameter data, as follows:

0 – Send the Block Descriptor
1 – Do not send the Block Descriptor

Byte 02, Bits 7 and 6 – PC (Page Control)

This field specifies the type of mode parameter values to be returned in the MODE SENSE data. Table 10-1 lists the valid values for this field.

Table 10-1 *Valid values for the PC field in the MODE SENSE command*

PC Setting	Description
00b	Return the values set by the last successful MODE SELECT command or if a MODE SELECT command has not been executed since the last tape drive reset, return the power-on default values.
01b	Return all values that are changeable. The changeable values are indicated by a 1 in each bit of each changeable field.
10b	Return the default values. (Values set in the EEPROM.)
11b	Return saved parameters. Not supported.

Byte 02, Bits 5 through 0 – Page Code

This field specifies which MODE SENSE parameter page or pages the initiator is requesting. Table 10-2 lists the valid values for this field.

Table 10-2 *Valid values for the Page Code field in the MODE SENSE command*

Specify this Page Code...	To return this Mode page...	With this Page Length
01h	Read-Write Error Recovery Page	0Ch (12 bytes)
02h	Disconnect/Reconnect Page	10h (16 bytes)
0Ah	Control Mode Page	08h (8 bytes)
0Fh	Data Compression Page	10h (16 bytes)
10h	Device Configuration Page	10h (16 bytes)
11h	Medium Partition Page	88h (136 bytes)
1Ch	TapeAlert Page	0Ch (12 bytes)
21h	Vendor Unique Parameters Page 1	06h (6 bytes)
22h	Vendor Unique Parameters Page 2	0Ah (10 bytes)
3Fh	All available pages (in ascending page code order)	F4h (244 bytes)

Byte 04 – Allocation Length

The Allocation Length indicates the amount of memory in bytes that the initiator has allocated for the return of MODE SENSE parameters. To determine the Allocation Length, total the number of bytes in the Parameter List Header (4 bytes), Block Descriptor (8 bytes, if you are requesting it), and all parameter pages you are requesting. Or, to receive all available data, specify F4h (244 bytes). Table 10-2 lists the page lengths of all the supported mode pages.

If the Allocation Length is smaller than the amount of data available from the tape drive, the returned data is truncated. If the Allocation Length is greater than the amount of data to be returned, only the number of bytes available are transferred; no additional data is transferred.

10.3 WHAT THE TAPE DRIVE RETURNS

This section describes the log page format and the log pages that the tape drive supports. The MODE SENSE command returns the single log page specified in the Page Code field of the CDB.

Each log page begins with a four-byte Parameter List Header (bytes 00 through 03), followed by zero or more variable-length log parameters defined for that page. The Parameter List Header specifies the page code for the log parameter data being returned and indicates the total length of the data to follow.

Bit Byte	7	6	5	4	3	2	1	0
00	Mode Data Length							
01	Medium Type							
02	WP	Buffered Mode			Speed			
03	Block Descriptor Length							

Byte 00 – Mode Data Length

This field indicates the number of bytes of MODE SENSE data that are available for transfer, excluding this field. The value returned for this field is the remaining number of bytes in the Parameter List Header plus the number of bytes of data to be returned based on the field settings in the CDB.

Note: The value returned for the Mode Data Length does not reflect the value you specified for the Allocation Length in the CDB.

Byte 01 – Medium Type

This field indicates the type of media in the data cartridge currently loaded in the tape drive. Table 10-3 shows the valid values for this field.

Table 10-3 *Values returned for Medium Type field in MODE SENSE data*

Value returned	Length of tape loaded
00h	No cartridge loaded, cleaning cartridge loaded, or tape is unknown, broken, or unreadable
81h	VXA-1 standard media
82h	VXA-2 standard media

Byte 02, Bit 7 – WP (Write Protect)

This field indicates whether the data cartridge loaded in the tape drive is write protected, as follows:

0 – The data cartridge is not write protected.
1 – The data cartridge is write protected.

Byte 02, Bits 6 through 4 – Buffered Mode

This field indicates the data transfer mode to be used by the tape drive during a write operation, as follows:

000b – Unbuffered mode.
001b – Buffered mode. (Power-on default)

In buffered mode, status is returned when the last block of data has been transferred to the tape drive's buffer. See Chapter 24, "WRITE (0Ah)"for a detailed description of how data is buffered.

In unbuffered mode, status is returned only after the data has actually been written to the tape.

Byte 02, Bits 3 through 0 – Speed

The value returned for this field is 0, indicating that the tape drive operates as a variable-speed device and automatically determines the optimum speed required.

Byte 03 – Block Descriptor Length

This byte indicates the length of the Block Descriptor in bytes, as follows:

00h – No Block Descriptor is included.
08h – An 8-byte Block Descriptor is included.

Note: The tape drive does not support multiple block descriptors.

10.3.1 BLOCK DESCRIPTOR

Bit Byte	7	6	5	4	3	2	1	0
00	Density Code							
01	(MSB)							
02	Number of Blocks							
03								(LSB)
04	Reserved							
05	(MSB)							
06	Block Length							
07								(LSB)

Byte 00 – Density Code

This field indicates the format of the data cartridge currently in the tape drive. If a data cartridge is not loaded or the tape is not formatted, this field indicates the preferred format for the tape. The tape drive will use the preferred format if it is compatible with the currently loaded cartridge and the tape is formatted or if the tape contains a single partition written from the beginning of the partition. Table 10-4 lists the values returned for this field.

Table 10-4 *Values for the Density Code field in the MODE SENSE command*

Density Code	Data format Used	Notes
80h	VXA-1 format	The tape drive detected a VXA-1 formatted tape or will use VXA-1 format when formatting or writing to the tape.
81h	VXA-2 format	The tape drive detected a VXA-2 formatted tape or will use VXA-2 format when formatting or writing to the tape.

Bytes 01 through 03 – Number of Blocks

This field indicates the total capacity of the tape, between LBOT and LEOT, in approximately 16-KB physical units (the default block size).

Note: Use the Medium Partition page (Page Code 11h) to determine the capacity in MB of each of the partitions on the tape.

Bytes 05 through 07 – Block Length

This field indicates the length of each logical block, in bytes, when the Fixed bit is set for the READ, VERIFY, and WRITE commands. Valid values for this field are 0h to 3C000h (240 KB).

- When the Block Length is non-zero, fixed-length block operations are allowed. For fixed-length blocks, only block sizes that are evenly divisible by four (that is, they end on a 4-byte boundary) are valid. A block length of 0 is invalid for fixed-length blocks.
- When the Block Length is 0, only variable-length block operations are allowed.

Note: If the Block Length is 0, the SILI bit in the READ command suppresses illegal length indications for both underlength and overlength reads. If the Block Length is non-zero, the SILI bit of the READ command suppresses illegal length indications only for blocks shorter than requested. See page 12-2 for more information.

10.3.2 READ-WRITE ERROR RECOVERY PAGE (PAGE CODE 01h)

The Read-Write Error Recovery page returns the error recovery parameters used by the tape drive during read-write operations.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Reserved		TB	RSVD	EER	PER	DTE	DCR
03	Read Retry Count							
04 ⋮ 07	Reserved							
08	Write Retry Count							
09 ⋮ 11	Reserved							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 01h, identifying the current page as the Read-Write Error Recovery page.

Byte 01 – Page Length

This field indicates the number of bytes in the Read-Write Error Recovery page that follow this byte. The valid value for this field is 0Ah.

Byte 02, Bit 5 – TB (Transfer Block)

The TB bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 02, Bit 3 – EER (Enable Early Recovery)

The EER bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 02, Bit 2 – PER (Post Error)

The PER bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 02, Bit 1 – DTE (Disable Transfer on Error)

The DTE bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 02, Bit 0 – DCR (Disable Correction)

The DCR bit is not supported by the tape drive. The valid value for this bit is 0.

Byte 03 – Read Retry Count

This field indicates how many times the tape drive attempts its read recovery algorithms. If the tape drive fails to reread the block after this number of attempts, it reports an unrecoverable error. The default value is 05h.

Byte 08 – Write Retry Count

This field indicates how many times the tape drive rewrite a physical block before reporting an unrecoverable read error. The default value is 05h.

10.3.3 DISCONNECT-RECONNECT PAGE (PAGE CODE 02h)

The Disconnect-Reconnect page returns the parameters that control how the tape drive disconnects and reconnects during data transfers.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Buffer Full Ratio							
03	Buffer Empty Ratio							
04	(MSB)		Bus Inactivity Limit					
05								(LSB)
06	(MSB)		Disconnect Time Limit					
07								(LSB)
08	(MSB)		Connect Time Limit					
09								(LSB)
10	(MSB)		Maximum Burst Size					
11								(LSB)

Bit Byte	7	6	5	4	3	2	1	0
12	Reserved						DTDC	
13	Reserved							
14								
15								

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 02h, identifying the current page as the Disconnect-Reconnect page.

Byte 01 – Page Length

The value returned for this field is 0Eh, indicating that 14 bytes of data for the Disconnect-Reconnect page follow this byte.

Byte 02 – Buffer Full Ratio

The tape drive does not support this field. The value returned for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Byte 03 – Buffer Empty Ratio

The tape drive does not support this field. The value returned for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Bytes 04 and 05 – Bus Inactivity Limit

The tape drive does not support this field. The value returned for this field is 0, indicating that the tape drive may assert the Bsy (Busy) signal for an indefinite period of time.

Bytes 06 and 07 – Disconnect Time Limit

The tape drive does not support this field. The value returned for this field is 0.

Bytes 08 and 09 – Connect Time Limit

The tape drive does not support this field. The value returned for this field is 0.

Bytes 10 and 11 – Maximum Burst Size

This field indicates the amount of data, in 512-byte increments, that can be transferred between the initiator and the tape drive before a disconnect is required. The tape drive supports all values for this field. The default is 0, which means that there is no limit to the amount of data that can be transferred before a disconnect is required.

Byte 12, Bits 1 and 0 – DTDC (Data Transfer Disconnect Control)

This field indicates how the tape drive performs a disconnect when the ND bit is set to 1 (see page 10-20). Table 10-5 lists the valid values for this field.

Table 10-5 *Values returned in the MODE SENSE DTDC field*

DTDC Value	Description
00b	Disconnects are not controlled by the DTDC field. Disconnects are controlled by the other fields on this page. (Power-on default)
01b	Once the data transfer of a command has started, the tape drive should not disconnect until all of the data has been transferred. The Maximum Burst Size (bytes 10 and 11) must be set to 0.
10b	Not valid.
11b	Once the data transfer of a command has started, the tape drive should not disconnect until the command is complete. The Maximum Burst Size (bytes 10 and 11) must be set to 0.

10.3.4 CONTROL MODE PAGE (PAGE CODE 0Ah)

The Control Mode page indicates whether the tape drive returns Check Condition status when one of its write and read error counters reaches a specified threshold. For information about using the LOG SELECT command to set threshold values for the tape drive's write and read error counters, refer to Chapter 7.

Bit / Byte	7	6	5	4	3	2	1	0
00	RSVD		Page Code					
01	Page Length							
02	RSVD							RLEC
03	Queue Algorithm Modifier				Reserved		QErr	DQue
04	EECA	Reserved				RAENP	UAAENP	EAENP
05	Reserved							
06	(MSB) Ready AEN Holdoff Period							
07	Ready AEN Holdoff Period (LSB)							

Byte 00, Bits 5 through 1 – Page Code

The value for this field is 0Ah, identifying the current page as the Control Mode page.

Byte 01 – Page Length

This field indicates the number of bytes in the Control Mode page that follow this byte. The value returned for this field is 06h.

Byte 02, Bit 0 – RLEC (Report Log Exception Condition)

This field indicates whether the tape drive returns Check Condition status with the sense key set to Unit Attention (6h) when one of its write and read error counters reaches a specified threshold, as follows:

0 – Unit Attention is not returned when a threshold condition is met.
1 – Unit Attention is returned when a threshold condition is met.

Byte 03, Bits 7 through 4 – Queue Algorithm Modifier

The tape drive does not support the Simple Queue Tag message. The value returned for this field is 0.

Byte 03, Bit 1 – QErr (Queue Error)

The tape drive does not support the Simple Queue Tag message. The value returned for this field is 0.

Byte 03, Bit 0 – DQue (Disable Queuing)

The tape drive does not support the Simple Queue Tag message. The value returned for this field is 1.

Byte 04, Bit 7 – EECA (Enable Extended Contingent Allegiance)

The tape drive does not support extended contingent allegiance. The value returned for this bit is 0.

Byte 04, Bit 2 – RAENP (Ready AEN Permission)

The tape drive does not support asynchronous event notification (AEN). The value returned for this bit is 0.

Byte 04, Bit 1 – UAAENP (Unit Attention AEN Permission)

The tape drive does not support asynchronous event notification. The valid value for this bit is 0.

Byte 04, Bit 0 – EAENP (Enable AEN Permission)

The tape drive does not support asynchronous event notification (AEN). The value returned for this bit is 0.

Bytes 06 and 07 – Ready AEN Holdoff Period

The tape drive does not support asynchronous event notification. The value returned for this field is 0.

10.3.5 DATA COMPRESSION PAGE (PAGE CODE 0Fh)

The Data Compression page indicates the parameters used by the tape drive to control data compression.

Bit / Byte	7	6	5	4	3	2	1	0
00	RSVD							Page Code
01	Page Length							
02	DCE	DCC	Reserved					
03	DDE	RED	Reserved					
04 ⋮ 07	(MSB) Compression Algorithm (LSB)							
08 ⋮ 11	(MSB) Decompression Algorithm (LSB)							
12 ⋮ 15	Reserved							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 0Fh, identifying the current page as the Data Compression page.

Byte 01 – Page Length

The value returned for this field is 0Eh, indicating that 14 bytes of data for the Data Compression page follow this byte.

Byte 02, Bit 7 – DCE (Data Compression Enable)

This field indicates the current state of data compression, as follows:

0 – Data compression is disabled.
1 – Data compression is enabled.

Byte 02, Bit 6 – DCC (Data Compression Capable)

The value for this field is 01h, indicating that the tape drive is capable of compressing data.

Byte 03, Bit 7 – DDE (Data Decompression Enable)

The value returned for this field is 01h, indicating that data decompression is enabled. The tape drive automatically decompresses compressed data before sending it to the initiator.

Byte 03, Bits 6 and 5 – RED (Report Exception on Decompression)

The tape drive does not report exceptions on decompression (boundaries between compressed and uncompressed data). The value returned for this field is 0.

Bytes 04 through 07 – Compression Algorithm

The value returned for this field is 03h, indicating that the tape drive uses the ALDC data compression algorithm with a 512-byte buffer to compress data from the initiator.

Bytes 08 through 11 – Decompression Algorithm

The value returned for this field is 03h, indicating that the tape drive uses the ALDC data decompression algorithm with a 512-byte buffer to decompress data from tape.

10.3.6 DEVICE CONFIGURATION PAGE (PAGE CODE 10h)

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved			Page Code				
01	Page Length							
02	RSVD	CAP	CAF	Active Format				
03	Active Partition							
04	Write Buffer Full Ratio							
05	Read Buffer Empty Ratio							
06	(MSB) Write Delay Time							
07	Write Delay Time (LSB)							
08	DBR	BIS	RSmk	AVC	SOCF		RBO	REW
09	Gap Size							
10	EOD Defined			EEG	SEW	Reserved		
11	(MSB) Buffer Size at Early Warning							
12	Buffer Size at Early Warning							
13	Buffer Size at Early Warning (LSB)							
14	Select Data Compression Algorithm							
15	Reserved							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 10h, identifying the current page as the Device Configuration page.

Byte 01 – Page Length

The value returned for this field is 0Eh, indicating that 14 bytes of additional data for the Device Configuration page follow this byte.

Byte 02, Bit 6 – CAP (Change Active Partition)

The value returned for this bit is always 0.

Byte 02, Bit 5 – CAF (Change Active Format)

The value returned for this bit is always 0.

Byte 02, Bits 4 through 0 – Active Format

The tape drive does not support this field. The value returned for this field is 0.

Byte 03 – Active Partition

This field indicates the number of the partition in which the tape is currently positioned, as follows:

n – The tape is positioned at partition *n*, where *n* is either 0 or 1. Note that partitions are numbered consecutively from the *end* of the tape. Partition 0 is always the last partition on the tape.

Notes:

- If the tape is not partitioned, the value in the Active Partition field is always 0.
- If the CAP bit is 0, the tape drive ignores the Active Partition byte.
- If you specify a partition that does not exist, the tape drive returns Check Condition status with the sense key set to Illegal Request.
- If the tape drive is not ready, the value of the Active Partition field returned in the MODE SENSE data may be invalid.

Byte 04 – Write Buffer Full Ratio

The tape drive does not support this field. The value returned for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Byte 05 – Read Buffer Empty Ratio

The tape drive does not support this field. The value returned for this field is 0. The tape drive manages the data buffer by adjusting the tape speed and by pausing and resuming tape motion as necessary to match the initiator's data transfer rate.

Bytes 06 and 07 – Write Delay Time

If a WRITE command completes without transferring enough data to exceed the value specified for the Write Buffer Full Ratio, the value returned in this field indicates the maximum amount of time, in units of 100 msec, that the data will remain in the buffer. When the time specified by Write Delay Time elapses, the data in the buffer is written to tape.

Valid values for this field are 0000h to FFFFh. The default value for this field is 0000h. Any value greater than 1999h (approximately 11 minutes) is automatically set to 1999h.

Byte 08, Bit 7 – DBR (Data Buffer Recovery)

The tape drive does not support the DBR bit. The value returned for this bit is 0.

Byte 08, Bit 6 – BIS (Block Identifier Supported)

The value returned for this bit is 1, indicating that block IDs are written on the tape relative to each partition.

Byte 08, Bit 5 – RSmk (Report Setmarks)

This field indicates whether the tape drive returns Check Condition status when it encounters a setmark on the tape during read, verify, space block, or space filemark operations, as follows:

0 – Do not report setmarks (setmarks are ignored).
1 – Report setmarks (default setting).

Byte 08, Bit 4 – AVC (Automatic Velocity Control)

The value returned for this bit is always 1, indicating that the tape drive's intelligent velocity control is always enabled.

Byte 08, Bits 3 and 2 – SOCF (Stop on Consecutive Filemarks)

The tape drive does not support the SOCF field. The valid value for this field is 0.

Byte 08, Bit 1 – RBO (Recover Buffer Order)

The tape drive does not support the RBO bit. The valid value for this bit is 0.

Byte 08, Bit 0 – REW (Report Early Warning)

This field indicates whether reporting of the early-warning condition (approaching LEOP) during a read operation is enabled or disabled, as follows:

0 – Early-warning condition is not reported for read operations; early-warning condition is reported for write operations (default setting).

1 – Early-warning condition is reported after completing the current READ or WRITE command.

The tape drive reports an early-warning condition as a Check Condition status with the sense key set to No Sense. The EOM bit is set to 1 and the LBOT bit is set to 0 in the extended sense data.

Byte 09 – Gap Size

The tape drive does not support the Gap Size field. The valid value for this field is 0.

Byte 10, Bits 7 through 5 – EOD Defined

The tape drive does not support the EOD field. The valid value for this field is 0.

Byte 10, Bit 4 – EEG (Enable EOD Generation)

The tape drive does not support this field. The value returned for this field is 0.

Byte 10, Bit 3 – SEW (Synchronize at Early Warning)

The value returned for this bit is 1, indicating that the tape drive writes any buffered data to the tape when the early-warning condition (approaching LEOP) is detected during a write operation.

Bytes 11 through 13 – Buffer Size at Early Warning

The tape drive does not support the Buffer Size at Early Warning field. The valid value for this field is 0.

Byte 14 – Select Data Compression Algorithm

The tape drive does not support selecting the Data Compression Algorithm. The value returned for this field is 0.

10.3.7 MEDIUM PARTITION PAGE (PAGE CODE 11h)

The Medium Partition page indicates how the currently loaded tape is partitioned.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Maximum Additional Partitions							
03	Additional Partitions Defined							
04	FDP	SDP	IDP	PSUM		Reserved		
05	Medium Format Recognition							
06	Reserved							
07	Reserved							

Bit Byte	7	6	5	4	3	2	1	0
08	(MSB)			Partition Size (Partition 0)				
09								(LSB)
10	(MSB)			Partition Size (Partition 1)				
11								(LSB)
12 ⋮ 135	Partition Size (Partitions 2 through 63)							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 11h, identifying the current page as the Medium Partition page.

Byte 01 – Page Length

The value returned for this field is 86h, indicating that 134 bytes of additional data for the Medium Partition page follow this byte.

Byte 02 – Maximum Additional Partitions

The value returned for this field is 01h, indicating that one partition in addition to the original partition (the entire tape) can be defined on the current tape.

Byte 03 – Additional Partitions Defined

The value returned for this field is either 00h (the tape contains one partition comprised of the entire tape) or 01h (one additional partition).

Byte 04, Bit 7 – FDP (Fixed Data Partitions)

The value returned for this field is always of 0.

Byte 04, Bit 6 – SDP (Select Data Partitions)

The value returned for this field is always of 0.

Byte 04, Bit 5 – IDP (Initiator Defined Partitions)

The value returned for this field is always of 0.

Byte 04, Bits 4 and 3 – PSUM (Partition Size Unit of Measure)

The value returned for this field is always 10b, indicating that partition sizes are specified in megabytes (MB).

Byte 05 – Medium Format Recognition

The value returned for this field 03h, indicating that the tape drive can recognize both medium format and partition information.

Bytes 08 and 09 – Partition 0 Size

The value returned for this field is the size, in MB, of partition 0 on the currently loaded tape. If the tape contains just a single partition, the Partition Size (partition 0) field returns the approximate uncompressed capacity of the entire tape.

Bytes 10 and 11 – Partition 1 Size

This field indicates the size, in MB, of partition 1 on the currently loaded tape and represents approximate amount of uncompressed data space that is available between the logical beginning of partition 1 (LBOP) and the logical end of partition 1 (LEOP) on the tape.

Bytes 12 through 135 – Partition Size (Partitions 2 through 63)

The tape drive does not support more than two partitions. The tape drive returns a value of 0 for each of these two-byte fields.

10.3.8 TAPEALERT PAGE (PAGE CODE 1Ch)

The TapeAlert page indicates how the TapeAlert function is configured.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Perf	Reserved			DExcpt	Test	RSVD	LogErr
03	Reserved				MRIE			
04 ⋮ 07	Interval Timer							
08 ⋮ 11	Test Flag Number							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 1Ch, which identifies the current page as the TapeAlert page.

Byte 01 – Page Length

The value returned for this field is 0Ah, indicating that 14 bytes of additional data for the TapeAlert page follow this byte.

Byte 02, Bit 7 – Perf (Performance)

This field indicates whether logging of informational exception operations that can cause delays are acceptable, as follows:

0 – Delays due to logging are not allowed. (default setting)
1 – Delays due to logging are allowed.

Byte 02, Bit 3 – DExcpt (Disable Exception Reporting)

This field indicates how the tape drive handles the reporting of informational exception operations, as follows:

0 – The tape drive reports informational exceptions using the method specified by the MRIE field.

1 – The tape drive disables all informational exception operations. The MRIE field is ignored (default setting).

Byte 02, Bit 2 – Test

This field indicates whether the tape drive performs the TapeAlert test specified in the Test Flag Number field, as follows:

0 – The tape drive does not generate any false informational exception conditions.

1 – The tape drive generates a false informational exception condition based on the Test Flag Number field (default setting).

Byte 02, Bit 0 – LogErr

The tape drive does not support the LogErr bit. The value returned for this bit is 0.

Byte 03, Bits 3 through 0 – MRIE (Method of Reporting Exception Information)

This field indicates the method used by the tape drive to report informational exception conditions. Table 10-6 lists the valid values for MRIE.

Table 10-6 *Valid values for MRIE in the MODE SELECT command*

MRIE	Description
0h	Do not report informational exceptions.
2h	Generate a Check Condition status with the sense key set to Unit Attention (6h).

Table 10-6 *Valid values for MRIE in the MODE SELECT command*

MRIE	Description
3h	Generate a Check Condition status with the sense key set to Recovered Error (01h), if the reporting of recovered errors is allowed. Since the tape drive does not support the PER bit (see page 10-6), this setting has the same effect as setting MRIE to 0h.
4h	Generate a Check Condition status with the sense key set to Recovered Error (01h), regardless of the PER bit.
5h	Generate a Check Condition status with the sense key set to No Sense (00h).
6h	Report informational exceptions only in response to an unsolicited REQUEST SENSE command.

Bytes 04 through 07 – Interval Timer

The tape drive does not support this field. The value returned for this field is 0.

Bytes 08 through 11 – Test Flag Number

The value in this field indicates what action the tape drive should take if the Test bit is set to 1, as follows:

Table 10-7 *Test Flag Number settings for MODE SENSE*

Test Flag Number	Description
0	Generate a false information exception condition.
1 through 64	Set the TapeAlert Flag indicated by the number and process.
–1 through –64	Clear the TapeAlert Flag indicated by the number.
32767	Set all supported TapeAlert Flags. See Table 8-6 on page 8-10 for a list of the supported TapeAlert Flags.

10.3.9 VENDOR UNIQUE PARAMETERS PAGE 1 (PAGE CODE 21h)

The Vendor Unique Parameters Page 1 page is used to report the settings for tape drive options that are unique to Exabyte.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02 03	Reserved							
04	Reserved							NoNegR
05	SOPR	DfNoCmp	ExInq	RSVD	FvCpcty	NoSvPtr	RespDuringImmed	

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 21h, identifying the current page as the Vendor Unique Parameters Page 1 page.

Byte 01 – Page Length

The value returned for this field is 04h, indicating that 4 bytes of additional data for the Vendor Unique Parameters Page 1 page follow this byte.

Byte 04, Bit 0 – NoNgRs (No Negative Residuals)

This bit indicates whether the tape drive reports residual values on backward space operations as positive or negative (2's compliment) numbers, as follows:

0b – Report residuals as negative numbers (2's complement). (default setting)
1b – Report residuals as positive numbers.

The value for this field is stored in nonvolatile memory and remains in effect through power cycles.

Byte 05, Bit 7 – SOPR (SCSI Operating Parameter Restoration)

This bit indicates whether the tape drive should restore SCSI operating parameters (the settings for synchronous/asynchronous transfers, narrow/wide transfers, transfer rate, and offset for synchronous transfers) when it detects that its firmware has been updated.

0b – Do not restore SCSI operating parameters after a firmware update. (default setting)

1b – Restore the SCSI operating parameters after a firmware update.

The value for this field is stored in nonvolatile memory and remains in effect through power cycles.

Byte 05, Bit 6 – DfNoCmp (Default No Compression)

This bit indicates whether the tape drive should permanently default to having write compression disabled at power up.

0b – Permanently default to compression enabled (default setting).
1b – Permanently default to compression disabled.

The value for this field is stored in nonvolatile memory and remains in effect through power cycles.

Byte 05, Bit 5 – ExInq (Extended Inquiry Overwrite)

This bit indicates whether the tape drive permanently overwrites an extended area of the Standard Inquiry data when the SEND DIAGNOSTIC Set Inquiry Data page (86h) is sent to the tape drive, as follows:

0b – Permanently overwrite only the Vendor Identification and Product Identification fields (bytes 8 through 31) of the Standard Inquiry Data (default setting).

1b – Permanently overwrite the Product Revision Level and four bytes of Vendor Specific data (bytes 32 through 39) in addition to the Vendor Identification and Product Identification fields in the Standard Inquiry Data.

The value for this field is stored in nonvolatile memory and remains in effect through power cycles.

Byte 05, Bit 3 – FvCpcty (Favor Capacity)

This bit indicates whether the tape drive favors tape capacity over write speed when managing the data buffer during a write operation, as follows:

0b – Favors write speed over capacity (default setting).
1b – Favors capacity (the amount of data that can be written to tape) over write speed.

The value for this field is stored in nonvolatile memory and remains in effect through power cycles.

Byte 05, Bit 2 – NoSvPtr (No Save Pointer on Read)

This bit indicates whether the tape drive should omit the Save Data Pointer message when disconnecting from the SCSI bus during a read operation, as follows:

0b – Send a Save Data Pointer message before sending a Disconnect message during a read operation. (default setting)

1b – Omit the Save Data Pointer message before sending a Disconnect message during a read operation.

The value for this field is stored in nonvolatile memory and remains in effect through power cycles.

Byte 05, Bits 1 and 0 – RespDuringImmed (Response During Immediate)

This field indicates how the tape drive responds to a motion command received while the tape drive is busy completing an immediate command (for example, LOAD, LOCATE). Table 10-8 lists the valid values for this field.

Table 10-8 *Valid values for RespDuringImmed in the MODE SENSE command*

RespDuringImmed Value	Description
00b	Return Busy status. (default setting)
01b	Return Check Condition status. The sense key is set to 2h (Not Ready) with and ASC of 04h and an ASCQ of 01.

Table 10-8 Valid values for RespDuringImmed in the MODE SENSE command

RespDuringImmed Value	Description
10b	Queue the command until the immediate command is complete. If a second command is received, return Busy status.
11b	Reserved

10.3.10 VENDOR UNIQUE PARAMETERS PAGE 2 (PAGE CODE 22h)

The Vendor Unique Parameters Page 2 page is used to report the configuration information for a tape drive that is unique to Exabyte.

Bit / Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Reserved				Interface			
03	SCSI ID Jumpers				Reserved			Wide
04 ⋮ 09	Reserved							

Byte 00, Bits 5 through 0 – Page Code

The value for this field is 22h, identifying the current page as the Vendor Unique Parameters Page 2 page.

Byte 01 – Page Length

This field indicates the number of bytes in the Vendor Unique Parameters Page 2 page that follow this byte. The value returned for this field is 08h (8 bytes).

Byte 02, Bits 0 through 3 – Interface

The value returned for this field is 1, indicating that the tape drive uses an LVD SCSI communication interface.

Byte 03, Bits 4 through 7 – SCSI ID Jumpers

This field indicates the tape drive's SCSI ID as set using the tape drive SCSI ID jumpers. The valid values are 00h through 0Fh (0 through 15).

Byte 03, Bit 0 – Wide

This field indicates whether the tape drive is connected to a wide SCSI bus, as follows:

0b – The tape drive is not connected to a wide bus (that is, it is connected to an 8-bit, narrow SCSI bus).

1b – The tape drive is connected to a wide bus (that is, it is connected to a 16-bit, wide SCSI bus).

10.4 EXCEPTIONS AND ERROR CONDITIONS

Table 10-9 lists the exceptions and error conditions that cause the tape drive to return Check Condition status for the MODE SENSE command.

Table 10-9 *REQUEST SENSE data for MODE SENSE command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
5h	24h	00h	**Illegal Request.** Invalid field in the CDB.The Page Code is invalid.
5h	39h	00h	**Illegal Request.** The Page Control field is set to 11b (return saved parameters). The tape drive does not support saving parameters.

Notes

11

PREVENT/ALLOW MEDIUM REMOVAL (1Eh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	1	1	0
01	Logical Unit Number			Reserved				
02	Reserved							
03								
04								Prevent
05	Control							

11.1 About This Command

You can use the PREVENT/ALLOW MEDIUM REMOVAL command to allow or prevent the removal of the data cartridge from the tape drive.

The PREVENT/ALLOW MEDIUM REMOVAL command is reservation independent. The tape drive will execute a PREVENT/ALLOW MEDIUM REMOVAL command issued by any initiator even if the tape drive is reserved by another initiator.

If an initiator has issued a PREVENT MEDIUM REMOVAL (1Eh) command to prevent the removal of the data cartridge, the data cartridge will not be ejected until that initiator sends an ALLOW MEDIUM REMOVAL command to allow the data cartridge to be removed.

If more than one initiator has issued PREVENT MEDIUM REMOVAL commands to the tape drive to prevent the removal of the data cartridge, the cartridge will not be ejected until each of those initiators sends an ALLOW MEDIUM REMOVAL command to release the condition.

Effect on the Unload Button

When removal of the data cartridge is prevented by the PREVENT/ALLOW MEDIUM REMOVAL command, the tape drive's eject button is disabled; pressing this button does not cause the tape to be rewound or ejected.

Effect on the LOAD/UNLOAD (1Bh) Command

When removal of the data cartridge is prevented by the PREVENT/ALLOW MEDIUM REMOVAL command, issuing a LOAD/UNLOAD (1Bh) command causes the tape to be unloaded from the tape path but not ejected from the tape drive. Any data in the buffer is written to tape before the tape is rewound and unloaded from the tape path.

11.2 CDB FIELD DEFINITIONS

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 04, Bit 0 – Prevent

This field specifies whether the tape drive prevents or allows the removal of a data cartridge from the tape drive, as follows:

0 – Allow the data cartridge to be removed.
1 – Prevent the data cartridge from being removed.

The prevent-data-cartridge-removal condition terminates when any of the following conditions occur:

- A PREVENT/ALLOW MEDIUM REMOVAL command with the Prevent bit set to 0 is received from all initiators that set the prevent condition.
- The tape drive is reset by a Bus Device Reset message, SCSI bus reset, or power-on reset.

12

READ (08h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	1	0	0	0
01	Logical Unit Number			Reserved			SILI	Fixed
02	(MSB)							
03	Transfer Length							
04								(LSB)
05	Control							

12.1 About This Command

The READ command transfers one or more bytes or blocks of data from the tape drive to the initiator, beginning with the next logical block. The tape drive reads tapes written in VXA-1 or VXA-2 formats, and automatically determines the format of the data on the tape.

Notes:

- The tape drive can read tapes that have a combination of fixed-length and variable-length data blocks.
- The tape drive will report the early-warning condition (LEOP reached) if the REW bit is set with the MODE SELECT command (byte 8, bit 0 in the Device Configuration page).
- Unexpected events, such as encountering filemarks or EOT, cause the data transfer to stop.
- If the disconnects are allowed, the tape drive may disconnect from the initiator.

12.2 CDB Field Definitions

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 1 – SILI (Suppress Illegal Length Indication)

The SILI bit is used to suppress an illegal length Check Condition status for read operations that read logical blocks that do not contain the defined number of bytes. This bit is valid only when the read operation is for variable-length logical blocks (that is, when the Fixed bit is set to 0).

0 – Do not suppress illegal length indication Check Condition status.
1 – Suppress illegal length indication Check Condition status.

Notes:

- If the Fixed bit is 1 (fixed-length logical blocks) and the SILI bit is 1, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h). The ASC and ASCQ fields are set to 24h and 00h.
- If the Fixed bit is 0 and the SILI bit is 1, Check Condition status is suppressed for all cases in which the length of the logical block to be read is less than the length specified by the Transfer Length field. If the length of the logical block is greater than the length specified by the Transfer Length field, Check Condition status is suppressed only if the Block Length field of the MODE SELECT Block Descriptor is 0.
- The tape drive never transfers more data than requested, regardless of the setting of the SILI bit.

Byte 01, Bit 0 – Fixed

The Fixed bit defines the type of read operation to be performed, as follows:

0 – Read a single logical block. The length of this block is specified in the Transfer Length field.

1 – Read one or more fixed-length logical blocks. The number of blocks is specified in the Transfer Length field.

Note: The tape drive returns Check Condition status with the sense key set to Illegal Request (5h) if the Fixed field in the READ command is 1 (fixed-length logical blocks) and the Block Length field in the current MODE SELECT data is 0 (variable-length logical block). The ASC and ASCQ bits are set to 81h and 00h (fixed/variable mismatch).

Bytes 02 through 04 – Transfer Length

The Transfer Length field specifies the amount of data to be read, as follows:

- When the Fixed bit is set to 0 (read variable-length blocks), this field contains the length of the logical block in bytes. The logical block can be any size from 1 byte to 240 KB (1 KB = 1,024 bytes). The valid value for this field is from 000001h to 03C000h.

- When the Fixed bit is set to 1 (read fixed-length blocks), this field contains the number of logical blocks to be read. The length of each block is either the power-on default block length or the length specified with the currently active MODE SELECT command (see page 9-5). Only fixed-length blocks with a size that is evenly divisible by 4 are allowed.

The data is read from the next logical block on the tape and is transferred to the initiator.

Note: When the value for the Transfer Length field is 0, no data is transferred and the current position of the tape is not changed. A value of 0 for these bytes is not an error.

12.3 EXCEPTIONS AND ERROR CONDITIONS

The following sections describe exceptions and error conditions that cause the tape drive to return Check Condition status for the READ command.

12.3.1 TRANSFER LENGTH INCORRECT

If the actual transfer length does not match the requested transfer length, the information reported depends on the setting of the Fixed bit. (The Check Condition status may be suppressed if the SILI bit is set to 1.)

The REQUEST SENSE data is set as follows:

Valid	1
ILI	1
Sense Key	No Sense (0h)
Information bytes	▪ If the Fixed bit is 0, indicate the difference between the requested transfer length and the actual number of logical blocks read. The result may be a negative value, which will be expressed in 2's complement format (see page 9-23 for a definition of 2's complement). ▪ If the Fixed bit is 1, indicate the number of blocks requested, but not transferred.
ASC	00h
ASCQ	00h
FSC	49h

When the READ command terminates in variable mode, the tape is positioned after the block with the incorrect length (at the start of the next logical block). When the READ command terminates in fixed mode, the tape is positioned after the block with the incorrect length (at the start of the next logical block).

Filemark Detected

The tape drive detected a filemark before completing the read operation. The REQUEST SENSE data is set as follows:

Valid	1
Filemark	1
Sense Key	No Sense (0h)
Information bytes	Indicate the difference between the number of bytes or blocks requested and the number of bytes or blocks actually transferred.
ASC	00h
ASCQ	01h (Filemark Detected)
FSC	41h

When the READ command terminates, the logical position is at the EOT side of the filemark encountered.

Setmark Detected

The RSmk bit in the MODE SELECT Device Configuration page (Page Code 10h) is set to 1 and the tape drive detected a setmark before completing the read operation. The REQUEST SENSE data is set as follows:

Valid	1
Filemark	1
Sense Key	No Sense (0h)
Information bytes	Indicate the difference between the number of bytes or blocks requested and the number bytes or blocks actually transferred.
ASC	00h
ASCQ	03h (Setmark Detected)
FSC	40h

When the READ command terminates, the logical position is at the EOT side of the setmark encountered.

PEOT or PEOP Encountered

During a read operation, the tape drive encountered the physical end of tape (PEOT) or the physical end of partition (PEOP). The REQUEST SENSE data is set as follows:

Valid	1
EOM	1
Sense Key	Volume Overflow (0Dh)
Information bytes	Indicate the difference between the number of bytes or blocks requested and the actual number of bytes or blocks actually transferred.
ASC	00h
ASCQ	02h (PEOT or PEOP Detected)
FSC	2Ah, 2Dh

When the READ command terminates, the logical position is undefined.

EOD Detected

The tape drive detected the EOD mark during the read operation. The REQUEST SENSE data is set as follows:

Valid	1
Sense Key	Blank Check (8h)
Information bytes	Indicate the difference between the number of bytes or blocks requested and the actual number of bytes or blocks actually transferred.
ASC	00h
ASCQ	05h (EOD Detected)
PEOT	0
FSC	08h

When the READ command terminates, the logical position is after the last recorded data block, filemark, or setmark.

Unrecoverable Read Error

An unrecoverable read error occurred before the operation completes and the tape drive terminated the READ command. The REQUEST SENSE data is set as follows:

Valid	1
Sense Key	Medium Error (3h) or Hardware Error (4h)
Information bytes	Indicate the difference between the number of bytes or blocks requested and the actual number of bytes or blocks actually transferred.
ASC	11h
ASCQ	00h (Unrecovered Read Error)
FSC	30h, 33h

When the READ command is terminated, the tape drive is positioned after the unrecovered block.

Note: In both fixed and variable block modes, the tape drive may have entered the Data Phase before reporting this error.

12.3.2 ADDITIONAL ERRORS

Table 12-1 lists additional exceptions and error conditions that cause the tape drive to return Check Condition status for the READ command.

Table 12-1 *REQUEST SENSE data for READ command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
2h	04h	01h	**Not Ready.** In the process of becoming ready. The tape drive is in the process of initializing itself.
02h	04h	02h	**Not Ready.** Tape drive is not ready because it is in the process of ejecting a cartridge.
2h	04h	03h	**Not Ready.** Manual intervention required. The tape drive requires manual intervention.
2h	3Ah	00h	**Not Ready.** Medium not present. The command requires a tape and no tape is present.
3h	30h	02h	**Medium Error.** Incompatible format. The format of the currently loaded tape is not compatible with the tape drive or the tape drive firmware.
0h	31h	00h	**Medium Error.** Medium format corrupted. The format of the currently loaded tape is corrupted.

Table 12-1 *REQUEST SENSE data for READ command errors and exceptions (continued)*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
4h	11h	02h	**Hardware Error.** Error too long to correct. A CRC error was detected by the decompression hardware. Use the following steps to recover from this error: ▪ Reissue the failed command or command sequence. ▪ Power the tape drive off and back on again. or Send a SCSI bus reset ("hard" reset). ▪ If the error persists, the tape may be bad or the tape drive may require service.
4h	15h	01h	**Hardware Error.** Mechanical positioning error. The tape drive cannot properly position the media.
5h	24h	00h	**Illegal Request.** Invalid field in the CDB. ▪ Both the Fixed and SILI bits are set to 1. ▪ Invalid field in the CDB. The Transfer Length exceeds 3C00h (240 KB) for a variable-block read.
6h	30h	00h	**Unit Attention.** Incompatible medium installed. The currently loaded tape is incompatible with the tape drive.

Notes

13

READ BLOCK LIMITS (05h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	1	0	1
01	Logical Unit Number			Reserved				
02	Reserved							
03								
04								
05	Control							

13.1 About This Command

The READ BLOCK LIMITS command requests that the tape drive return data identifying the maximum and minimum logical block lengths supported. The data returned by the READ BLOCK LIMITS command applies to both the variable and fixed block lengths for the READ and WRITE commands.

13.2 CDB Field Definitions

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

13.3 WHAT THE TAPE DRIVE RETURNS

The tape drive returns Read Block Limits data to the initiator to indicate the maximum and minimum block lengths it supports, formatted as follows:

Bit / Byte	7	6	5	4	3	2	1	0
00	Reserved							
01	(MSB)							
02	Maximum Block Length							
03								(LSB)
04	(MSB)							
05	Minimum Block Length							(LSB)

Bytes 01 through 03 – Maximum Block Length

This field indicates the largest valid logical block length supported by the tape drive. The value returned is 3C000h (240 KB).

Note: 1 KB = 1,024 bytes.

Bytes 04 and 05 – Minimum Block Length

This field indicates the smallest valid logical block length supported by the tape drive. The value returned is 00001h (1 byte).

14

READ BUFFER (3Ch)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	1	1	1	1	0	0
01	Logical Unit Number			Reserved		Mode		
02	Buffer ID							
03	(MSB)							
04	Buffer Offset							
05								(LSB)
06	(MSB)							
07	Allocation Length							
08								(LSB)
09	Control							

14.1 About This Command

The READ BUFFER command is used to read the contents of the tape drive's buffer or to return the drive log. When used in concert with the WRITE BUFFER command, it can be used as a diagnostic tool.

Note: The same data compression setting used during a READ BUFFER command should be the same as the compression setting used during the WRITE BUFFER command. That is, if compression was enabled when the data was written to the buffer, the data should be read in exactly the same format, using the same Allocation Length and Buffer Offset. If different values are used, a decompression error may result and the data may not be read correctly.

14.2 CDB Field Definitions

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bits 2 through 0 – Mode

The Mode field specifies the type of data to be returned to the initiator. Table 14-1 lists the valid values for this field.

Table 14-1 *Valid Mode settings for the READ BUFFER command*

Mode Setting	Description
000b	Combined mode. Return the Buffer Descriptor and the data in the buffer to the initiator.
001b	Read Firmware mode. Copy data from the tape drive's firmware storage location to the data buffer and return to the initiator. **Note:** Before using the READ BUFFER command in this mode, you must first issue a MODE SELECT command to turn off data compression (set the DCE bit on the Data Compression page to 0).
010b	Data mode. Return the data in the buffer.
011b	Buffer Descriptor mode. Return the Buffer Descriptor (described on page 14-3).

Byte 02 – Buffer ID

The Buffer ID field specifies the buffer for which the initiator is requesting data, as follows:

00h – The tape drive's data buffer.
80h – The diagnostic data buffer (tape drive logs).

If you set the Mode field to 010b and the Buffer ID field to 80h, the tape drive's log information is returned. This data can be used by Exabyte to diagnose tape drive problems.

Bytes 03 through 05 – Buffer Offset

The Buffer Offset field indicates the location into the buffer that the read operation should begin. The valid values for this field are between 0 and the value specified in the Buffer Capacity of the Read Buffer Descriptor (see page 14-3).

The tape drive ignores this field if the Mode field is set to 011b (Buffer Descriptor mode).

Bytes 06 through 08 – Allocation Length

The Allocation Length field specifies the amount of space, in bytes, that the initiator has allocated for buffer data returned from the tape drive. The amount of data returned is the Allocation Length or the total amount of data in the buffer, whichever is less.

Notes:

- For Read Firmware Mode (Mode = 001b) or Data Mode (Mode = 010b), set Allocation Length to the value specified for the Buffer Capacity minus the Buffer Offset.

- For Buffer Descriptor Mode (Mode = 011b), set the Allocation Length to at least 4 bytes.

14.3 WHAT THE TAPE DRIVE RETURNS

Depending on the setting for the Mode field (byte 1, bits 0 through 2) in the CDB, the READ BUFFER command returns one of the types of data listed in Table 14-1.

14.3.1 BUFFER DESCRIPTOR

If you set the Mode field to 001b or 011b, the tape drive returns a four-byte Buffer Descriptor for the buffer.

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

Byte 00 – Offset Boundary

This field indicates the boundary alignment within the selected buffer, represented as 2^{nth} number of bytes. The value of this field represents the exponent *n*. The data buffer has a boundary alignment of 64 (2^6) bytes, so the value of *n* returned in this field is always 6.

Bytes 01 through 03 – Buffer Capacity

This field indicates the size of the buffer in bytes, as follows:

- For the Buffer ID 00h, the buffer capacity is 200000h (2,097,152 bytes = 2 MB).
- For Buffer ID 80h, the buffer capacity is FFE0h (65,504 bytes).

14.4 EXCEPTIONS AND ERROR CONDITIONS

Table 14-2 lists the exceptions and error conditions that cause the tape drive to return Check Condition status for the READ BUFFER command.

Table 14-2 *REQUEST SENSE data for READ BUFFER command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
4h	11h	02h	**Hardware Error.** Error too long to correct. A CRC error was detected by the decompression hardware. Use the following steps to recover from this error: ▪ Reissue the failed command or command sequence. ▪ Power the tape drive off and back on again. or Send a SCSI bus reset (“hard” reset). ▪ If the error persists, the tape may be bad or the tape drive may require service.
5h	24h	00h	**Illegal Request.** Invalid field in the CDB. ▪ The Mode field contains a value other than 000b, 001b, 010b, or 011b. ▪ The Buffer ID field is not set to 0. ▪ The value in the Buffer Offset field is greater than the value in the Buffer Capacity field of the Buffer Descriptor. ▪ The sum of the values in the Allocation Length plus the Buffer Offset field is greater than the value returned in the Buffer Capacity field of the Buffer Descriptor.

15

READ POSITION (34h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	1	1	0	1	0	0
01	Logical Unit Number			Reserved				BT
02 ⋮ **08**	Reserved							
09	Control							

15.1 About This Command

The READ POSITION command reports the tape drive's current logical position, but does not cause tape motion to occur. As described in Chapter 6, the READ POSITION command is used with the LOCATE (2Bh) command to position the tape at a specified logical block address.

15.2 CDB Field Definitions

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 0 – BT (Block Type)

This bit determines the type of block number the tape drive returns to the initiator. The tape drive ignores this field.

15.3 WHAT THE TAPE DRIVE RETURNS

When it completes the READ POSITION command, the tape drive returns 20 bytes of Read Position data to the initiator, formatted as follows:

Bit / Byte	7	6	5	4	3	2	1	0
00	BOP	EOP	Reserved			BPU	Reserved	
01	Partition Number							
02	Reserved							
03								
04	(MSB)							
⋮	First Block Location							
07								(LSB)
08	(MSB)							
⋮	Last Block Location							
11								(LSB)
12	Reserved							
13	(MSB)							
⋮	Number of Blocks in Buffer							
15								(LSB)
16	(MSB)							
⋮	Number of Bytes in Buffer							
19								(LSB)

Byte 00, Bit 7 – BOP (Beginning of Partition)

This field indicates whether the tape is positioned at the beginning of a partition, as follows:

0 – The tape is not positioned at the beginning of a partition.

1 – For a partitioned tape, the tape is positioned at the logical beginning of the currently active partition (LBOP). For a non-partitioned tape, the tape is positioned at LBOT.

Byte 00, Bit 6 – EOP (End of Partition)

This field indicates whether the tape is positioned at the end of a partition, as follows:

0 – The tape is not positioned at the end of a partition.

1 – For a partitioned tape, the tape is positioned between the logical end of partition (LEOP) and the physical end of partition (PEOP) of the currently active partition. For a non-partition tape, the tape is positioned between LEOT and PEOT.

Byte 00, Bit 2 – BPU (Block Position Unknown)

This field indicates whether the block position is known, as follows:

0 – The block position is known and the remainder of the READ POSITION data is valid.

1 – The block position is not known and cannot be obtained without tape motion. The remainder of the READ POSITION data is not valid.

Byte 01 – Partition Number

This field indicates the number of the partition in which the tape is currently located. The valid value for this field is either 0 or 1. The tape drive supports one partition in addition to partition 0. Partition 0 is always the last partition on the tape.

Note: If the tape is not partitioned, the tape drive returns a value of 0.

Bytes 04 through 07 – First Block Location

This field indicates the block address associated with the current logical block position (that is, the logical block address of the next data block to be transferred between the initiator and the tape drive if a READ or WRITE command is issued). When using a LOCATE command to search for this position, specify the value returned for this field as the Block Address in byte 03 through 06 of the LOCATE CDB.

Note: If a READ POSITION command follows a command that requires immediate action, the block location returned by this command represents the expected tape position after the immediate command is completed.

Bytes 08 through 11 – Last Block Location

The Last Block Location field is not supported by the tape drive. The value returned for this field is 0.

Bytes 13 through 15 – Number of Blocks in Buffer

The Number of Blocks in Buffer field is not supported by the tape drive. The value returned for this field is 0.

Bytes 16 through 19 – Number of Bytes in Buffer

The Number of Bytes in Buffer field is not supported by the tape drive. The value returned for this field is 0.

15.4 EXCEPTIONS AND ERROR CONDITIONS

Table 15-1 lists exceptions and error conditions that cause the tape drive to return Check Condition status for the READ POSITION command.

Table 15-1 *REQUEST SENSE data for READ POSITION command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
02h	04h	01h	**Not Ready.** Tape drive is not ready, but is in process of becoming ready (rewinding or loading tape).
02h	04h	03h	**Not Ready.** The tape drive is not ready because it needs manual intervention.
02h	3Ah	00h	**Not Ready.** Tape drive is not ready. Command requires a tape, and no tape is present.
03h	30h	02h	**Medium Error.** The tape format is incompatible with the tape drive hardware or microcode.
05h	24h	00h	**Illegal Request.** Invalid field in the CDB. The BT bit is set to 1.
06h	30h	00h	**Unit Attention.** Incompatible media was rejected after the cartridge was inserted.
08h	00h	00h	**Blank Check.** The media has not been formatted.

16

RECEIVE DIAGNOSTIC RESULTS (1Ch)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	1	0	0
01	Logical Unit Number			Reserved				
02	Reserved							
03	(MSB) Allocation Length							
04	Allocation Length (LSB)							
05	Control							

16.1 About This Command

You can use the RECEIVE DIAGNOSTIC RESULTS command to retrieve the results of the self-test requested by a previous SEND DIAGNOSTIC (1Dh) command. See Chapter 21 for a description of the self-test.

Note: To ensure that the diagnostic results are up-to-date and accurate, be sure that the RECEIVE DIAGNOSTIC RESULTS command immediately follows the SEND DIAGNOSTIC command and that the tape drive is reserved for the initiator's exclusive use. If there are any intervening commands between the SEND DIAGNOSTIC and the RECEIVE DIAGNOSTIC RESULTS command, the information returned may not be valid.

16.2 CDB Field Definitions

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Bytes 03 and 04 – Allocation Length

This field specifies the number of bytes that the initiator has allocated for the return of RECEIVE DIAGNOSTICS RESULTS data. The tape drive returns only one diagnostic page per command.

Table 16-1 lists the diagnostic pages returned by the RECEIVE DIAGNOSTIC command and their maximum page lengths. Setting the Allocation Length to 0 indicates that no diagnostic data will be returned and is not an error.

Table 16-1 *Maximum page length of each supported RECEIVE DIAGNOSTIC page*

Page Code	Page Name	Maximum Length[a]
00h	Supported Diagnostic Pages page	20h (32 bytes)
F0h	Self Test page	400h (1,024 bytes)
FFh	No Diagnostic Results Available page	04h (4 bytes)

[a] This maximum length value includes the four-byte Diagnostic Parameter header sent with each page.

The tape drive terminates the Data In phase when the number of bytes specified in the Allocation Length field has been transferred or when all available data has been transferred to the initiator, whichever is less.

16.3 WHAT THE TAPE DRIVE RETURNS

When the tape drive receives a RECEIVE DIAGNOSTIC RESULTS command, it returns the results of the previous SEND DIAGNOSTIC command. Each page of the diagnostic data begins with a four-byte Diagnostic Parameter Header (bytes 00 through 03), followed by the diagnostic parameters for that page. The Diagnostic Parameter Header indicates the page code for the diagnostic parameter data being returned and indicates the total length of the data to follow.

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

Byte 00 – Page Code

This field identifies the page code of the diagnostic for which the tape drive is returning data. Table 16-1 lists the valid page codes.

Bytes 02 and 03 – Page Length

This field indicates the total number of bytes that will follow this byte if the Allocation Length specified in the CDB is sufficient. The value returned for this field depends on the value of the Page Code field.

Byte 04 – Diagnostic Parameters

This field contains the data resulting from the diagnostic test indicated by the Page Code field. The data returned for each diagnostic page is described in the following sections.

16.3.1 SUPPORTED DIAGNOSTIC PAGES PAGE (PAGE CODE 00h)

When the value of the Page Code field (byte 00) in the Diagnostic Parameter Header is 00h, the data that follows is the Supported Diagnostic Pages page. This page lists the page codes for all of the diagnostic pages included in the data being returned. The value in the Page Length field (bytes 2 and 3) of the Diagnostic Parameter Header for this page is 0018h (24 bytes).

Note: The page codes listed in the fields marked "Exabyte Internal" contain proprietary information for use by Exabyte Engineering only. No diagnostic data is returned for these pages.

Bit / Byte	7	6	5	4	3	2	1	0
00	Page Code (00h)							
01	Reserved							
02	(MSB) Page Length (0018h)							
03								(LSB)
04	Supported Log Pages (Page Code 00h)							
05 ⋮ 26	Exabyte Internal							
27	Self Test (Page Code F0h)							

16.3.2 SELF TEST PAGE (PAGE CODE F0h)

When the value of the Page Code field (byte 00) in the Diagnostic Parameter Header is F0h, the data that follows contains the results from a self-test request issued using the SEND DIAGNOSTIC command or from a previous self-test (or POST), if still available. The value in the Page Length field (bytes 2 and 3) of the Diagnostic Parameter Header is always 0400h (1,024 bytes).

Bit / Byte	7	6	5	4	3	2	1	0
00	Page Code (95h)							
01	Reserved							

Bit / Byte	7	6	5	4	3	2	1	0
02	(MSB)			Page Length (0400h)				
03								(LSB)
04 ⋮ *nn*	Self Test Results							

Bytes 4 through *nn* – Self Test Results

The Self Test Results field contains ASCII text that describes the success or failure of the component tests run during the self-test. If the length of the ASCII text is less than 1,024 bytes, the remainder of the field is filled with zeros.

Exabyte Technical Support may request that you generate this data and send it to them for analysis.

16.3.3 NO DIAGNOSTIC RESULTS AVAILABLE PAGE (PAGE CODE FFh)

When the value of the Page Code field (byte 00) in the Diagnostic Parameter Header is FFh, no additional data follows. The tape drive returns this page if there are no diagnostic results available. The tape drive also returns this page if it has not previously received a SEND DIAGNOSTIC command or if an intervening command has corrupted the diagnostic data. The value in the Page Length field (bytes 2 and 3) of the Diagnostic Parameter Header is 0000h (0000 bytes).

Bit / Byte	7	6	5	4	3	2	1	0
00	Page Code (FFh)							
01	Reserved							
02	(MSB)			Page Length (0000h)				
03								(LSB)

17

RELEASE UNIT (17h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	1
01	Logical Unit Number			3rdPty	Third Party Device ID			RSVD
02	Reserved							
03								
04								
05	Control							

17.1 About This Command

The RELEASE UNIT command releases a tape drive from an initiator's exclusive use or, if third-party reservations are in effect, from another SCSI device's use. To have effect, the command must be issued by the initiator that reserved the tape drive with a RESERVE UNIT command.

It is not an error to attempt to release a tape drive that is not currently reserved by the current initiator, but if the tape drive is reserved by another initiator, then that reservation remains in effect.

17.2 CDB Field Definitions

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 4 – 3rdPty

This field indicates whether the tape drive is to release a third-party reservation, as follows:

0 – Do not release the third-party reservation.
1 – Release the third-party reservation.

Byte 01, Bits 3 through 1 – Third Party Device ID

This field indicates the SCSI ID of the initiator that reserved the tape drive. The tape drive ignores this field if the initiator is not requesting a third-party reservation release.

18

REQUEST SENSE (03h)

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

18.1 About This Command

The REQUEST SENSE command requests that the tape drive transfer sense data to the initiator.

The sense data is valid for the Check Condition status just presented to the initiator. The tape drive preserves the sense data for the initiator receiving the Check Condition status until it is cleared by that initiator. Sense data is cleared when the tape drive receives any subsequent command other than INQUIRY (12h) from the initiator that received the Check Condition status.

18.2 CDB Field Definitions

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 04 – Allocation Length

This field specifies the number of bytes that the initiator should allocate for the returned sense data. The tape drive provides a total of 32 bytes (20h) of sense data. If you specify an Allocation Length of less than 20h, the returned sense data is truncated. If the Allocation Length is greater than the amount of data to be returned, only the number of bytes available are transferred; no additional data is transferred.

18.3 WHAT THE TAPE DRIVE RETURNS

When the tape drive receives a REQUEST SENSE command, it returns 32 bytes of extended sense data if the Allocation Length is sufficient.

Bit Byte	7	6	5	4	3	2	1	0
00	Valid	Error Code						
01	Reserved							
02	FMK	EOM	ILI	RSVD	Sense Key			
03 ⋮ 06	(MSB) Information (LSB)							
07	Additional Sense Length							
08 ⋮ 11	(MSB) Command Specific Information (LSB)							
12	Additional Sense Code (ASC)							
13	Additional Sense Code Qualifier (ASCQ)							
14	Field Replaceable Unit Code							
15 16 17	Sense Key Specific Data							
18	Fault Symptom Code							
19 20 21	Unit Sense							
22	Command							
23 24 25	(MSB) Remaining Tape (LSB)							
26	FSC N-1							
27	Command N-1							
28	FSC N-2							
29	Command N-2							
30	FSC N-3							
31	Command N-3							

Byte 00, Bit 7 – Valid

This field indicates whether the sense data in the Information field (bytes 03 through 06) is valid (conforms to the SCSI-2 standard), as follows:

0 – The data in the Information field is undefined.

1 – The data in the Information field is valid for the command receiving the Check Condition status.

Byte 00, Bits 6 through 0 – Error Code

This field indicates with what command the reported sense data is associated, as follows:

70h – The sense data is associated with the command that received the Check Condition status.

71h – The sense data is for a deferred error condition and is associated with an earlier command.

Byte 02, Bit 7 – FMK (Filemark)

This bit indicates whether the current command detected a filemark or setmark, as follows:

0 – No filemarks or setmarks were detected.
1 – The current command detected a filemark or setmark.

Byte 02, Bit 6 – EOM (End of Medium)

When set to 1, this bit indicates that one of the following end of medium conditions has been encountered.

- The tape is at or past the early warning (logical end of partition or tape).
- The tape is at LBOP (the tape drive encountered the logical beginning of partition during a backward motion).

Byte 02, Bit 5 – ILI (Illegal Length Indicator)

When set to 1, this bit indicates that the logical block length requested did not match the actual logical block length of the data recorded on the tape.

Byte 02, Bits 3 through 0 – Sense Key

This field contains the sense key associated with the current sense data. Table 18-1 lists the sense key values supported by the tape drive. See Appendix A for the ASC, ASCQ, and FSC values associated with each sense key.

Table 18-1 *Sense Key values*

Sense Key	Meaning	Explanation
0h	No Sense	Indicates that there is no specific sense key information to be reported for the designated logical unit. This occurs when a command completes successfully or returns Check Condition or Command Terminated status with the FMK, EOM, or ILI bits set to 1.
1h	Recovered Error	Indicates that the last command completed successfully with some recovery action performed by the tape drive. Details may be available by examining the additional sense bytes and the information field.
2h	Not Ready	Indicates that the tape drive does not contain a data cartridge or that the data cartridge is not loaded. Operator intervention may be required to correct this condition.
3h	Medium Error	Indicates that the command terminated with a non-recoverable error condition that may have been caused by a flaw in the tape or an error in the recorded data. The tape drive may also return this sense key if it is unable to distinguish between a flaw in the tape and a specific hardware failure (sense key 4h).
4h	Hardware Error	Indicates that the tape drive detected a non-recoverable hardware failure (for example a device failure or parity error) while performing the command or during a self-test.
5h	Illegal Request	Indicates that there was an illegal parameter in the CDB or in the additional parameters supplied as data for a command or that the tape drive is in the wrong mode to execute the command. If the tape drive detects an invalid parameter in the CDB, the tape is not written. If the tape drive detects an invalid parameter in the additional parameters supplied as data, the tape may already be altered. This sense key can also indicate an invalid Identify message.
6h	Unit Attention	Indicates one of the following: ▪ The tape drive has been reset (by a power-on reset, a Bus Device Reset message, or a SCSI bus reset). ▪ An initiator changed the MODE SELECT parameters since the last command was issued to the tape drive. ▪ The eject button was pressed and the data cartridge was ejected. ▪ A data cartridge was inserted and automatically loaded. ▪ The internal microcode (firmware) was changed. ▪ A log parameter (counter) reached a specified threshold value (assuming that RLEC bit on the MODE SELECT Control Mode page is set to 1). This sense key is reported the first time any command is issued by each initiator after the condition is detected, and the requested command is not performed. This sense key is cleared when the next command other than INQUIRY or REQUEST SENSE is received by the tape drive.
7h	Data Protect	Indicates that a command that writes to tape was attempted on a write-protected data cartridge. The write operation is not performed.
8h	Blank Check	Indicates that the tape drive encountered blank tape or format-defined EOD (blank tape) during a read, space, or locate operation.

Table 18-1 *Sense Key values (continued)*

Sense Key	Meaning	Explanation
Bh	Aborted Command	Indicates that the tape drive aborted the command. This condition occurs when an Initiator Detected Error (05h) message is received during command execution or when a Message Reject (07h) or SCSI bus parity error is detected by the tape drive during Command or Data Out phase. The initiator may be able to recover by trying the command again.
Dh	Volume Overflow	Indicates that the last WRITE or WRITE FILEMARKS command reached the physical end of tape (PEOT) and that data may remain in the buffer.
Eh	Miscompare	Indicates that the source data did not match the data read from the tape.

Bytes 03 through 06 – Information

The value in this field is command and error condition dependent. In general, it represents the number of blocks or bytes of data that were not processed due to the condition that resulted in a Check Condition status.

- For the READ, READ BUFFER, WRITE, WRITE BUFFER, WRITE FILEMARKS, and VERIFY commands, this field contains the difference between the number of blocks or bytes requested and the number that were actually transferred.
- For the SPACE command, this field contains the difference between the number of filemarks, setmarks, or data blocks requested and the actual number spaced over. By default, when a backward space operation is requested, the difference is a negative number using 2's complement format (see page 9-23 for information about changing the way tape drive reports residual values during a backward space operation).

This field is valid only when the Valid bit (byte 00, bit 7) is set to 1. When the Valid bit is set to 0, any data in this field is invalid.

Byte 07 – Additional Sense Length

This byte indicates the length, in bytes, of any additional sense data provided by the tape drive, excluding this byte. The tape drive returns 24 (18h) bytes of additional sense data.

Bytes 08 through 11 – Command-Specific Information

The tape drive does not use this field. The value returned is always 0.

Byte 12 – Additional Sense Code (ASC)

This field contains the Additional Sense Code (ASC) data. The ASC, in conjunction with the Additional Sense Code Qualifier (byte 13), provides additional information about the error indicated by the sense key. Table A-1 on page A-2 provides detailed information about the valid combinations of ASC and ASCQ and their meanings. Where applicable, the "Exceptions and Error Conditions" section at the end of each command chapter provides detailed, command-specific information.

Byte 13 – Additional Sense Code Qualifier (ASCQ)

This field contains the Additional Sense Code Qualifier (ASCQ) data. The ASCQ, in conjunction with the Additional Sense Code (byte 12), provides additional information about the error indicated by the sense key. Table A-1 on page A-2 provides detailed information about the valid combinations of ASC and ASCQ and their meanings. Where applicable, the "Exceptions and Error Conditions" section at the end of each command chapter provides detailed, command-specific information.

Byte 14 – Field Replacable Unit Code

There are no field replaceable parts. The value returned for this field is always 0.

Bytes 15 through 17 – Sense Key Specific Data for Illegal Request (SK 5h)

When the sense key indicates Illegal Request (5h) and the SKSV is 1, the Sense Key Specific Data returns additional information about the Illegal Request, formatted as follows:

Bit Byte	7	6	5	4	3	2	1	0
15	SKSV	C/D	Reserved		BPV	Bit Pointer		
16	(MSB)							
17	Field Pointer							(LSB)

Byte 15, Bit 7 – SKSV (Sense Key Specific Valid) This field indicates whether the data in the Sense Key Specific Data field (bytes 15 through 17) is valid, as follows:

0 – The Sense Key Specific Data is not valid.
1 – The Sense Key Specific Data is valid. The Sense Key Specific Data is valid only when the sense key is Illegal Request (5h).

Byte 15, Bit 6 – C/D (Command/Data) This field indicates the location of the illegal parameter, as follows:

0 – The illegal parameter is in the parameters sent by the initiator.
1 – The illegal parameter is in the command descriptor block.

Byte 15, Bit 3 – BPV (Bit Pointer Valid) This field indicates whether the bit pointer for the illegal parameter is valid, as follows:

0 – The Bit Pointer information is not valid.
1 – The Bit Pointer information is valid.

Byte 15, Bits 2 through 0 – Bit Pointer This field indicates which bit of the byte indicated by the Field Pointer is in error. If a multiple bit field is in error, the Bit Pointer indicates the most significant (left-most) bit of the field. Refer to the appropriate command chapter in this reference for the definition of the indicated bit.

Bytes 16 and 17 – Field Pointer This field indicates which byte of the command descriptor block or parameter data was in error. If a multiple-byte field is in error, the Field Pointer indicates the most significant (left-most) byte of the field. Refer to the appropriate command chapter in this reference for the definition of the indicated byte.

Byte 18 – Fault Symptom Code (FSC)

The Fault Symptom Code is an Exabyte-unique value used to provide specific information about the condition that resulted in the Check Condition status. Table A-1 on page A-2 shows the FSC values associated with each ASC/ASCQ combination.

Bytes 19 through 21 – Unit Sense

The Unit Sense field provides additional status data for the tape drive, formatted as follows:

Bit Byte	7	6	5	4	3	2	1	0
19	Reserved						TNP	LBOT
20	Reserved							
21	Reserved				CLN	PEOT	Reserved	

For each status bit defined in the Unit Sense field, a value of 0 represents a normal or Good status. When a status bit is set to 1, the condition indicated by that bit exists.

Note: All Reserved bits have an effective value of 0.

Byte 19, Bit 1 – TNP (Tape Not Present) The tape drive does not have a data cartridge inserted.

Byte 19, Bit 0 – LBOT (Logical Beginning of Tape) The data cartridge is positioned at the logical beginning of tape.

Byte 21, Bit 3 – CLN (Clean) The tape drive needs to be cleaned. This bit is reset to 0 when a successful cleaning cycle is performed. The tape drive's cleaning requirements depend on the number of tape motion hours and the type of tape being used.

Byte 21, Bit 2 – PEOT (Physical End of Tape) The data cartridge is positioned at PEOT.

Byte 22 – Command

The value in this field indicates the operation code of the SCSI command for which the current sense data was issued.

Bytes 23 through 25 – Remaining Tape

This field indicates the amount of tape remaining, in 16-KB physical units. This value equals the logical end of tape (LEOT) position minus the current physical position. For a partitioned tape, this value equals the number of 16-KB units between the current physical location and logical end of partition (LOEP). If the current position is beyond LEOT or if there is no data cartridge loaded, the value is 0.

Byte 26 – FSC N-1

This field contains the non-zero Fault Symptom Code that immediately preceded the current one.

Byte 27 – Command N-1

This field contains the operation code of the command for which the FSC N-1 was generated.

Byte 28 – FSC N-2

This field contains the non-zero Fault Symptom Code that immediately preceded FSC N-1.

Byte 29 – Command N-2

This field contains the operation code of the command for which the FSC N-2 was generated.

Byte 30 – FSC N-3

This field contains the non-zero Fault Symptom Code that immediately preceded FSC N-2.

Byte 31 – Command N-3

This field contains the operation code of the command for which the FSC N-3 was generated.

18.4 SENSE BYTE PENDING STATUS

When the tape drive reports Check Condition status in response to a command from an initiator, the tape drive retains the sense byte pending status, including error information and Check Condition status, for the initiator until one of the following occurs:

- Error information is reset by the next command other than INQUIRY from the same initiator.
- Error information is reset by a power-on reset, a Bus Device Reset message, or a SCSI bus reset condition.

19

RESERVE UNIT (16h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	0
01	Logical Unit No			3rdPty	Third Party Device ID			RSVD
02	Reserved							
03								
04								
05	Control							

19.1 About This Command

The RESERVE UNIT command reserves the tape drive for an initiator's exclusive use or, if third-party reservations are in effect, for another SCSI device's use. The reservation remains in effect until a RELEASE UNIT command is received from the same initiator or until the tape drive is reset by a SCSI bus reset, a Bus Device Reset message, or a power-on reset.

It is not an error for the initiator that made the last reservation to send another valid RESERVE UNIT command.

19.2 CDB Field Definitions

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 4 – 3rdPty

This bit indicates whether a third-party reservation is requested, as follows:

0 – A third-party reservation is not requested.
1 – A third-party reservation is requested.

Byte 01, Bits 3 through 1 – Third Party Device ID

This field indicates the SCSI ID of the device for which the initiator is making the third-party reservation. The tape drive ignores this field if the initiator is not requesting a third-party reservation.

19.3 EXCEPTIONS AND ERROR CONDITIONS

If the tape drive is reserved and it receives any command (other than an INQUIRY (12h), PREVENT/ALLOW MEDIUM REMOVAL (1Eh), or REQUEST SENSE (03h) command) from another initiator, it does not honor the command. Instead, it returns Reservation Conflict (18h) status to the initiator that sent the command.

20

REWIND (01h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	1
01	Logical Unit Number			Reserved				Immed
02	Reserved							
03								
04								
05	Control							

20.1 About This Command

The REWIND command causes the tape drive to rewind the tape to the logical beginning of tape (LBOT) or, if the tape is partitioned, to the logical beginning of the partition (LBOP) in which the tape is currently positioned.

Notes:

- If the disconnect option is enabled, the tape drive disconnects from the initiator while the REWIND command is executing.
- If the tape is already at LBOT (or LBOP for a partitioned tape) and there is no data in the buffer, no tape motion results.
- If the tape drive receives a command while the tape is rewinding, its response is determined by the value in the RespDuringImmed field on the MODE SELECT Vendor Unique Parameters Page 1 page (see page 9-25).
- If the REWIND command follows a WRITE (0Ah) or WRITE FILEMARKS (10h) command, the tape drive writes all buffered data, filemarks, or setmarks and appends an end of data (EOD) mark before the tape is rewound.
- If an error occurs during the writing of the data in the buffer to the tape, the tape drive returns Check Condition status. The rewind operation is not performed. The initiator should issue a REQUEST SENSE (03h) command to determine the cause of the error.

- If there is data in the buffer because an earlier WRITE (0Ah) command was terminated with Check Condition status, the tape drive discards that data before rewinding the tape.

20.2 CDB FIELD DEFINITIONS

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 0 – Immed

The value in this field determines when command status is returned to the initiator, as follows:

0 – Status is reported when the REWIND command is completed.

1 – Status is reported when the REWIND command is initiated by the tape drive.

If the tape drive's buffer contains data from a previous WRITE command, the tape drive disconnects from the initiator (if disconnect is enabled) and writes the data in the buffer to the tape.

- **If the Immed bit is set to 1**, the tape drive reconnects to the initiator when the write operation has completed successfully. It then returns Good status and performs the rewind operation.

  Note: Completing the write operation includes emptying the buffer to tape and writing the EOD mark.

- **If the Immed bit is set to 0**, the tape drive reconnects and returns status when the rewind operation is complete.

20.3 EXCEPTIONS AND ERROR CONDITIONS

Table 20-1 lists exceptions and error conditions that cause the tape drive to return Check Condition status for the REWIND command.

Table 20-1 *REQUEST SENSE data for REWIND command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
02h	04h	01h	**Not Ready.** Tape drive is not ready, it is in process of initializing itself.
02h	04h	03h	**Not Ready.** The tape drive is not ready because it needs manual intervention.
02h	3Ah	00h	**Not Ready.** Tape drive is not ready. Command requires a tape, and no tape is present.
03h	30h	02h	**Medium Error.** The tape format is incompatible with the tape drive hardware or microcode.

Table 20-1 *REQUEST SENSE data for REWIND command errors and exceptions (continued)*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Explanation
03h	31h	01h	**Medium Error.** The tape format is corrupted.
04h	15h	01h	**Hardware Error.** The tape drive cannot position the tape correctly.
06h	30h	00h	**Unit Attention.** Incompatible media was rejected after the cartridge was inserted.

Notes

21

SEND DIAGNOSTIC (1Dh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	1	0	1
01	Logical Unit Number			PF	RSVD	SelfTest	DevOffL	UnitOffL
02	Reserved							
03	(MSB) Parameter List Length							
04	(LSB)							
05	Control							

21.1 About This Command

The SEND DIAGNOSTIC command causes the tape drive to perform its diagnostic self-test. If a test is successful, the tape drive returns Good status; otherwise, it returns Check Condition status. When this command is followed by a RECEIVE DIAGNOSTIC RESULTS (1Ch) command or a REQUEST SENSE (03h) command, the results of the self-test are reported to the initiator.

Notes:

- To ensure that the diagnostic data returned is valid, the SEND DIAGNOSTIC command must be immediately followed by the RECEIVE DIAGNOSTIC RESULTS command.
- To ensure that the results of the diagnostic test are not destroyed by a command sent by another initiator, the tape drive should be reserved for the initiator's exclusive use.
- The initiator must support the disconnect option if you plan to use the SEND DIAGNOSTIC command because the tape drive will disconnect from the initiator while the command is executing.

21.2 CDB FIELD DEFINITIONS

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 4 – PF (Page Format)

This field specifies whether the format of the parameter list for the SEND DIAGNOSTIC command conforms to the page format defined in the SCSI-2 standard, as follows:

0 – The parameter list uses non-page format. This value is only valid if the SelfTest bit (byte 01, bit 2) is set.

1 – The parameter list uses the SCSI page format. This value is valid for all pages.

Byte 01, Bit 2 – SelfTest

This bit specifies whether the tape drive should perform its default diagnostic self-test, as follows:

0 – Perform the diagnostic tests specified in the Parameter List.

1 – Preform the default diagnostic self-test. The Parameter List Length must be 0.

Byte 01, Bit 1 – DevOffL

This bit specifies whether the tape drive is allowed to perform diagnostic tests whose results may be detected by subsequent I/O processes (for example unit reservations, log parameters, or sense data), as follows:

0 – The tape drive may not perform diagnostic tests whose results may be detected by subsequent I/O processes.

1 – The tape drive may perform diagnostic tests whose results may be detected by subsequent I/O processes.

Byte 01, Bit 0 – UnitOffL

This field specifies whether the tape drive is allowed to perform diagnostic tests that might affect the tape, such as writing data or repositioning the tape, as follows:

0 – The tape drive may not perform diagnostic test that might affect the tape.
1 – The tape drive may perform diagnostic test that affect the tape.

Bytes 03 and 04 – Parameter List Length

The value for this field specifies the number of bytes of data that follow in the parameter list. The additional data is one of the diagnostic pages described in the following sections. Table 21-1 lists the diagnostic pages supported by the tape drive and the maximum page length of each.

Table 21-1 *Maximum page length of each supported SEND DIAGNOSTIC page*

Page Code	Page Name	Page Length[a]
00h	Supported Diagnostic Pages page	0000h (0 bytes)
F0h	Self Test page	0000h (0 bytes)

[a] Maximum page length does not include the four-byte Diagnostic Parameter Header, which must be included with each page.

21.3 ADDITIONAL DIAGNOSTIC DATA

Following each SEND DIAGNOSTIC CDB is a parameter list for the Diagnostic page you are sending. The parameter list for each diagnostic page begins with a four-byte Diagnostic Parameter Header (bytes 00 through 03), followed by the parameters for that page. The Diagnostic Parameter Header indicates the page code for the diagnostic page and indicates the total length of the parameter list to follow.

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

Byte 00 – Page Code

This field identifies the page code of the diagnostic page being sent. Table 21-1 lists the page codes for all of the supported diagnostic pages.

Bytes 02 and 03 – Page Length

This field indicates the total number of bytes that will follow this byte. The valid value for this field depends on the value in the Page Code field. Table 21-1 lists of the page length for each of the supported diagnostic pages.

21.3.1 SUPPORTED DIAGNOSTIC PAGES PAGE (PAGE CODE 00h)

When the value of the Page Code field (byte 00) in the Diagnostic Parameter Header is 00h, the data that follows contains parameters for the Supported Diagnostic Pages page. This page allows the initiator to retrieve the list of supported pages using the RECEIVE DIAGNOSTIC RESULTS command. The value in the Page Length field (bytes 2 and 3) of the Diagnostic Parameter Header for this page is 0000h, indicating that there are no parameters associated with this diagnostic page.

Bit / Byte	7	6	5	4	3	2	1	0
00	Page Code (00h)							
01	Reserved							
02	(MSB)			Page Length (0000h)				
03								(LSB)

21.3.2 SELF TEST PAGE (PAGE CODE F0h)

When the value of the Page Code field (byte 00) in the Diagnostic Parameter Header is F0h, the Self Test page is executed by the SEND DIAGNOSTIC command. The value in the Page Length field (bytes 2 and 3) of the Diagnostic Parameter Header is 0000h, indicating that there are no parameters associated with this diagnostic page. This diagnostic page has the same effect as setting the SelfTest bit (byte 1, bit 2) in the CDB.

Bit / Byte	7	6	5	4	3	2	1	0
00	Page Code (95h)							
01	Reserved							
02	(MSB)			Page Length (0000h)				
03								(LSB)

22

SPACE (11h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	0	0	1
01	Logical Unit Number			Reserved		Code		
02	(MSB)							
03	Count							
04								(LSB)
05	Control							

22.1 About This Command

The SPACE command enables the tape drive to perform forward or backward searches. You can use this command to space directly to the end of data (EOD) or to space over a specified number of logical blocks, filemarks, or setmarks.

Notes:

- The tape drive can space over both fixed- and variable-length logical blocks; it determines the type of spacing to use according to the type of block found on the tape.
- If the disconnect option is enabled, the tape drive can disconnect from the initiator while the SPACE command is executing.
- If you attempt to space backward immediately after writing data, filemarks, or setmarks, the tape drive will complete the write operation before performing the space operation. Completing the write operation includes writing any buffered data to tape and writing an end of data (EOD) mark.

  If an error occurs when the data in the buffer is being written, the tape drive returns Check Condition status and the space operation is not performed. You can issue a REQUEST SENSE (03h) command to determine the cause of the error.

- On a partitioned tape, spacing is limited to locations within the current partition. If you want to space to a location outside of the current partition, you must move to the new partition using the LOCATE or MODE SELECT command.

22.2 CDB FIELD DEFINITIONS

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bits 2 through 0 – Code

The Code field specifies the type of space operation the tape drive is to perform. Table 22-1 lists the valid values for the Code field and indicates the type of operation each specifies. See page 22-3 for information about the errors and exceptions that can occur for each of these values.

Table 22-1 *Valid values for the Code field in the SPACE (11h) CDB*

Value of Code field	Type of operation	Notes
000b	Space over *n* fixed or variable-length blocks	Space over the next *n* blocks. If the tape drive encounters a filemark, or if it encounters a setmark and the RSmk bit in MODE SELECT is set to 1, the tape drive terminates the command.
001b	Space over *n* filemarks	Space over the next *n* filemarks. If the tape drive encounters a setmark and the RSmk bit on the MODE SELECT Device Configuration page (Page Code=10h) is set to 1, the tape drive terminates the command.
011b	Space to end of data	When you set the Code field to 011b, the tape drive ignores the setting of the Count field. Instead, it spaces forward until it encounters EOD. The tape is positioned so that a subsequent WRITE command can append data after the last block, filemark, or setmark written before the end of data.
100b	Space over *n* setmarks	When you set the Code field to 100b, the tape drive ignores the setting of the RSmk bit on the MODE SELECT Device Configuration page (Page Code=10h). In addition, the tape drive ignores filemarks.
010b	Reserved	If you set the Code field to one of these values, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h).
101b		
110b		
111b		

Bytes 02 through 04 – Count

The count value, *n*, in this field represents the number of blocks, filemarks, or setmarks to be spaced over. The value of *n* determines the direction of spacing, as follows:

- A positive value of *n* in the Count field causes the tape drive to space forward *n* blocks, filemarks, or setmarks. When the space operation is complete, the tape is logically positioned on the EOD side of the *n*th block, filemark, or setmark.
- A negative value of *n* (in 2's complement notation) in the Count field causes the tape drive to space backward over *n* blocks, filemarks, or setmarks. When the operation is complete, the tape is logically positioned on the BOP side of the *n*th block, filemark, or setmark.
- A value of 0 in the Count field causes no change in the tape position and is not an error.

Note: The tape drive ignores the Count field when spacing to end of data.

22.3 EXCEPTIONS AND ERROR CONDITIONS

The following exceptions and error conditions can occur with the SPACE command.

Filemark Detected

If the Code field has a value of 000b (space over *n* logical blocks) and a filemark is detected, the tape drive terminates the command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
Filemark	1
Sense Key	0h (No Sense)
Information bytes	Indicate the difference between the requested number of blocks and the actual number of blocks spaced over. This value is always positive.
ASC	00h
ASCQ	01h (Filemark Detected)
FSC	28h

If the filemark was detected during a forward search, the tape is logically positioned on the EOD side of the filemark. If the filemark was detected during a backward search, the tape is logically positioned on the BOP side of the filemark.

Note: Filemarks are ignored if you previously set the Code field to space over setmarks (100b).

Early Warning Encountered

If an early warning is encountered after the completion of a space operation (regardless of the value of the Code field) and the REW bit on the MODE SELECT Device Configuration page (Page Code 10h) is set to 1, the tape drive terminates the command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
EOM	1
Sense Key	3h (Medium Error)
Information bytes	The Information bytes are invalid.
ASC	00h
ASCQ	02h (End of Tape or End of Partition Detected)
FSC	2Ah, 2Dh

If the early warning was detected during a forward search, the tape is logically positioned on the EOD side of the target filemark, setmark, or logical block. If the early warning was detected during a backward search, the tape is logically positioned on the BOP side of the target filemark, setmark, or logical block.

Setmark Detected

If the Code field has a value of 000b (space over *n* logical blocks) or 001b (space over *n* filemarks) and a setmark is detected, the tape drive looks at the setting of the RSmk bit on the MODE SELECT Device Configuration page (Page Code 10h):

- If the bit is 0 (do not report setmarks), the tape drive continues to space over blocks or filemarks.
- If the bit is 1 (report setmarks), the tape drive terminates the command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
Filemark	1
Sense Key	0h (No Sense)
Information bytes	Indicate the difference between the requested number of blocks or filemarks and the actual number of blocks or filemarks spaced over. This value is always positive.
ASC	00h
ASCQ	03h (Setmark Detected)
FSC	40h

If the setmark was detected during a forward search, the tape is logically positioned on the EOD side of the setmark. If the setmark was detected during a backward search, the tape is logically positioned on the BOP side of the setmark.

PBOT or PBOP Encountered

If the Code field has a value of 000b, 001b, or 100b (space over logical blocks, filemarks, or setmarks) and the physical beginning of tape (PBOT) or physical beginning of partition (PBOP) is encountered while spacing backward, the tape drive terminates the command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
EOM	1
Sense Key	0h (No Sense)
Information bytes	Indicate the difference between the requested number of blocks, filemarks, or setmarks and the actual number spaced over. This value is always positive.
ASC	00h
ASCQ	04h (Beginning of Tape or Beginning of Partition Detected)
FSC	29h, 2Bh

After PBOT (or PBOP) is encountered, the tape is positioned at LBOT (or LBOP).

EOD Detected

If the Code field has a value of 000b (space over *n* logical blocks), 001b (space over *n* filemarks), or 100b (space over *n* setmarks), and the EOD mark is detected, the tape drive returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
EOM	0 or 1. Set to 1 if early warning has been detected.
Sense Key	Blank Check (8h)
Information bytes	Indicate the difference between the requested number of blocks, filemarks, or setmarks and the actual number spaced over. This value is always positive.
ASC	00h
ASCQ	05h (EOD Detected)
FSC	2Ch

The tape is positioned so that a subsequent WRITE command can append data after the last information written before EOD.

Unrecoverable Error

If an unrecoverable media or hardware error occurs during the space operation, the tape drive terminates the SPACE command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
Sense Key	Medium Error (3h) or Hardware Error (4h)
Information bytes	If Valid=1, indicate the difference between the requested number of blocks, filemarks, or setmarks and the actual number spaced over. The actual length does not include the unrecovered block. This value is always positive.
Other bits and bytes	Depend on the error condition

When the SPACE command is terminated, the position of the tape drive depends on whether a forward or backward space was attempted:

- If the error occurred during a forward space, the tape drive is positioned after the unrecovered block.
- If the error occurred during a backward space, the tape drive is positioned before the unrecovered block.

Table 22-2 lists additional exceptions and error conditions that cause the tape drive to return Check Condition status for the SPACE command.

Table 22-2 *REQUEST SENSE data for SPACE command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
02h	04h	01h	**Not Ready.** In the process of becoming ready. The tape drive is in the process of initializing itself.
02h	04h	03h	**Not Ready.** The tape drive requires manual intervention.
02h	3Ah	00h	**Not Ready.** The command requires a tape and no tape is present.
03h	00h	02h	**Medium Error.** The tape drive encountered the physical end of tape (PEOT) or the physical end of partition (PEOP) before completing the operation.
03h	14h	00h	**Medium Error.** The tape drive cannot perform the locate operation because it cannot read data from the tape.
03h	14h	03h	**Medium Error.** The tape drive cannot locate the end of data (EOD) on the tape.
0h	31h	00h	**Medium Error.** The format of the currently loaded tape is corrupted.

Table 22-2 *REQUEST SENSE data for SPACE command errors and exceptions (continued)*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
4h	15h	01h	**Hardware Error.** The tape drive cannot properly position the media.
6h	30h	00h	**Unit Attention.** The currently loaded tape is incompatible with the tape drive.

Notes

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TEST UNIT READY (00h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	0
01	Logical Unit Number			Reserved				
02	Reserved							
03								
04								
05	Control							

23.1 About This Command

The TEST UNIT READY command provides a means for determining if the tape drive is ready to accept an appropriate medium access command.

The TEST UNIT READY command returns Good status after the tape is loaded if the tape drive is ready to accept a medium access command without returning Check Condition status. If the tape drive is not ready to accept a medium access command, the tape drive returns Check Condition status with the sense key set to Not Ready (2h).

Note: The TEST UNIT READY command is not a request for a unit self-test.

23.2 CDB Field Definitions

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

23.3 EXCEPTIONS AND ERROR CONDITIONS

Table 23-1 lists exceptions and error conditions that cause the tape drive to return Check Condition status for the INQUIRY command.

Table 23-1 *REQUEST SENSE data for TEST UNIT READY command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
02h	04h	01h	**Not Ready.** The tape drive is in the process of initializing itself.
02h	04h	03h	**Not Ready.** The tape drive requires manual intervention.
02h	3Ah	00h	**Not Ready.** The command requires a tape and no tape is present.
05h	25h	00h	**Illegal Request.** The logical unit specified in the CDB is not supported.

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WRITE (0Ah)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	1	0	1	0
01	Logical Unit Number			Reserved				Fixed
02	(MSB)							
03	Transfer Length							
04								(LSB)
05	Control							

24.1 About This Command

The WRITE command transfers one or more bytes or blocks of data from the initiator to the media loaded in the tape drive. The VXA-2 tape drive writes data to the tape in either VXA-1 or VXA-2 format. The data is compressed or uncompressed according to the setting of the DCE (data compression enable) bit in the MODE SELECT command (see page 9-11).

After writing data, the tape drive writes an end of data (EOD) mark to indicate the location of the last data on tape. The EOD mark is overwritten when additional data is appended to the last data on the tape.

24.1.1 Tape Positioning

This section describes the legal tape positions for a write operation.

Tape Positioned at LBOT or LBOP

When writing to a tape positioned at LBOT or LBOP, the tape drive automatically writes a new LBOT (or LBOP) pattern and then writes the data from the buffer.

Appending Data

When writing to tape, the tape drive can append new data to existing data at certain locations only. If the tape is not positioned at a legal location, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h). The legal locations for appending data are:

- EOD mark (the EOD mark is overwritten as new data is appended)
- Beginning or end of a filemark
- Beginning or end of a setmark

Note: If data is appended at the beginning of a filemark or setmark, the filemark or setmark is overwritten.

24.1.2 DATA BUFFERING

The tape drive provides two modes of operation for the WRITE command: unbuffered and buffered. The mode of operation is set with the MODE SELECT command (byte 02, bits 6 through 4, in the Parameter List Header).

Unbuffered Write Operation

When the tape drive is set for an unbuffered write operation, it returns Good status as soon as all data blocks are written to tape.

Buffered Write Operation

When the tape drive is set for a buffered write operation, it returns Good status as soon as all data blocks are successfully transferred to the buffer. The data in the buffer is written to tape when one of the following conditions occurs:

- The Buffer Full Threshold is reached during a WRITE command (see Section 2.5).
- The tape drive receives one of the following commands:
  - ERASE
  - LOCATE
  - LOAD/UNLOAD
  - READ
  - READ BUFFER
  - REWIND
  - SPACE
  - WRITE BUFFER
  - WRITE FILEMARKS (with the Immed bit set to 0)
- The operator presses the eject button.
- The time specified for the Write Delay Time field in the Device Configuration Page elapses (note, however, if the Write Delay Time field is 0, a partially full buffer is not flushed to tape). See page 9-14 for more information about the Write Delay Time field.

24.2 CDB FIELD DEFINITIONS

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 0 – Fixed

This field specifies the type of write operation the tape drive is to perform, as follows:

0 – Write a single variable-length logical block. The length of this block is specified in the Transfer Length field.

1 – Write one or more fixed-length logical blocks. The number of blocks is specified in the Transfer Length field.

Bytes 02 through 04 – Transfer Length

This field specifies the amount of data the tape drive is to write, as follows:

- When the Fixed bit is set to 0 (write variable-length blocks), this field contains the length of the logical block in bytes. The logical block can be any size from 1 byte to 245,760 bytes (240 KB). The valid value for this field is from 000001h to 03C000h (245,760 bytes).
- When the Fixed bit is set to 1 (write fixed-length blocks), this field contains the number of logical blocks to be written. The length of each block is either the power-on default block length or the length specified with the currently active MODE SELECT command (see page 9-5). Only block sizes that are evenly divisible by four (that is, they end on a 4-byte boundary) are valid.

Note: When the value for the Transfer Length field is 0, no data is transferred and the current position of the tape is not changed.

24.3 EXCEPTIONS AND ERROR CONDITIONS

The following exceptions and error conditions can occur with the WRITE command.

Unrecoverable Error

If an unrecoverable write error occurs before the write operation completes, the tape drive terminates the WRITE command and returns Check Condition status. Data that remains in the buffer is not written to tape. The REQUEST SENSE data is set as follows:

Valid	0 or 1
Sense Key	3h (Medium Error)
Information bytes	If Valid=1, depend on the setting of the Fixed bit, as follows: ▪ If the Fixed bit is 0, equal the requested transfer length. ▪ If the Fixed bit is 1, equal the difference between the requested transfer length and the actual number of logical blocks written.
ASC	00h
ASCQ	00h (Write Error)

Note: If another WRITE command is issued after an unrecoverable error occurs, the tape drive returns Check Condition status with the sense key set to Medium Error or Hardware Error and the command is not executed.

Early Warning Encountered

If early-warning is encountered during the WRITE command, or a WRITE command is issued with the logical position between early-warning and EOP, the drive attempts to finish writing all data. If all data can be written, the tape drive returns Check Condition status after the command completes.

Valid	1
EOM	1
Sense Key	0h (No Sense)
Information bytes	000000h (no data was left unwritten)
ASC	00h
ASCQ	02h (End of Tape or End of Partition Detected)
FSC	2Ah, 2Dh

PEOT or PEOP Encountered

If the physical end of tape (PEOT) or physical end of partition (PEOP) is encountered, the tape drive terminates the WRITE command and returns Check Condition status. Data that remains in the buffer is not written to tape. The REQUEST SENSE data is set as follows:

Valid	0 or 1
EOM	1
Sense Key	Dh (Volume Overflow)
Information Bytes	If Valid=1, depend on the setting of the Fixed bit, as follows: ▪ If the Fixed bit is 0, the Information bytes equal the requested transfer length. ▪ If the Fixed bit is 1, the Information bytes equal the difference between the requested transfer length and the actual number of logical blocks written.
ASC	00h
ASCQ	02h (End of Tape or End of Partition Detected)
FSC	2Ah, 2Dh

Table 24-1 lists additional exceptions and error conditions that cause the tape drive to return Check Condition status for the SPACE command.

Table 24-1 *REQUEST SENSE data for WRITE command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
02h	04h	01h	**Not Ready.** The tape drive is in the process of initializing itself.
02h	04h	03h	**Not Ready.** The tape drive requires manual intervention.
02h	3Ah	00h	**Not Ready.** The command requires a tape and no tape is present.
03h	30h	02h	**Medium Error.** The format of the currently loaded tape is not compatible with the tape drive or the tape drive firmware.
0h	31h	00h	**Medium Error.** The format of the currently loaded tape is corrupted.
0h	50h	00h	**Medium Error.** Write failure after retry limit (specified in MODE SELECT) was exceeded.
4h	15h	01h	**Hardware Error.** The tape drive cannot properly position the media.

Table 24-1 *REQUEST SENSE data for WRITE command errors and exceptions (continued)*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
5h	24h	00h	**Illegal Request.** Invalid field in CDB. This error is a result of any of the following: ▪ The Fixed bit is set to 0 and the Transfer Length is not within the range specified by the READ BLOCK LIMITS command. ▪ The Fixed bit is set to 1 and the Block Length specified in the MODE SELECT command is set to 0. ▪ The Transfer Length exceeds 03C000h (245,760 bytes) for a variable-length write operation.
5h	50h	01h	**Illegal Request.** A WRITE command was issued at an invalid tape position.
6h	30h	00h	**Unit Attention.** The currently loaded tape is incompatible with the tape drive.
7h	27h	00h	**Write Protect.** A write operation was attempted on a data cartridge that is write protected.
0Bh	47h	00h	**Aborted Command.** A SCSI parity error occurred during data transfer.

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WRITE BUFFER (3Bh)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	1	1	1	0	1	1
01	Logical Unit Number			Reserved		Mode		
02	Buffer ID							
03	(MSB)							
04	Buffer Offset							
05								(LSB)
06	(MSB)							
07	Parameter List Length							
08								(LSB)
09	Control							

25.1 About This Command

The WRITE BUFFER command allows you to reprogram the tape drive's EEPROM by loading a new microcode file across the SCSI bus. You can obtain microcode update files on diskettes from Exabyte Technical Support, or you can download microcode files from the Exabyte web site (www.exabyte.com).

The WRITE BUFFER command can also be used in concert with the READ BUFFER command to perform diagnostic testing.

25.1.1 CAUTIONS FOR USING THE WRITE BUFFER COMMAND

Caution

Be sure to heed these precautions when issuing the WRITE BUFFER command:

- Be sure that the tape drive is reserved for the initiator's exclusive use while WRITE BUFFER commands are executing.
- Do not power off the tape drive while WRITE BUFFER commands are executing. If a hardware failure or power failure occurs during the execution of this command and the Mode bit is set to 101b, the tape drive may not be operable. You must reload the firmware to restore functionality.

25.1.2 ABORTING A WRITE BUFFER OPERATION

If necessary, you can abort a write buffer operation by sending an Abort message to the tape drive or resetting the tape drive. Then, you can reissue the WRITE BUFFER command or the entire sequence of WRITE BUFFER commands.

Note: If you are performing a microcode update (Mode = 101b), you must abort the command before the tape drive begins reprogramming the EEPROM.

25.2 CDB FIELD DEFINITIONS

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bits 2 through 0 – Mode

This field specifies the mode used to write data to the buffer. Table 25-1 lists the valid values for this field.

Table 25-1 *Valid Mode settings for the WRITE BUFFER (3Bh) command*

Mode Setting	Description
010b	Data mode. Use this mode to write data to the tape drive's data buffer during diagnostic testing.
100b	Firmware download mode. If your system requires you to use multiple WRITE BUFFER commands to transfer the microcode file in small blocks, use this mode to transfer all but the last block of data. The transferred blocks of data are held in the buffer. No data is saved to the tape drive's EEPROM.
101b	Firmware save mode. If your system supports transferring the entire microcode file with a single WRITE BUFFER command, use this mode to transfer the entire file to the tape drive data buffer and save it to the EEPROM. If your system requires you to use multiple WRITE BUFFER commands to transfer the microcode file in small blocks, use this mode to transfer last block of the microcode file and save it to the tape drive's EEPROM.

Byte 02 – Buffer ID

The tape drive has only one buffer. The value for this field must be 0.

Bytes 03 through 05 – Buffer Offset

The value you specify for the Buffer Offset field specifies the number of bytes into the buffer to begin writing the transferred data. The valid values for this field are between 000000h and 200000h (2,097,152 bytes = 2 MB). The value you specify for the Buffer Offset must conform to the value returned in the Offset Boundary field of the Buffer Descriptor for the READ BUFFER command (see "Byte 00 – Offset Boundary" on page 14-3).

Bytes 06 through 08 – Parameter List Length

This field specifies the number of bytes to be transferred by the WRITE BUFFER command.

Note: The Parameter List Length plus the Buffer Offset must not exceed 200000h (2,097,152 bytes), the value returned in the Buffer Capacity field of the Buffer Descriptor for the READ BUFFER command (see "Bytes 01 through 03 – Buffer Capacity" on page 14-3).

25.3 UPDATING THE TAPE DRIVE MICROCODE

To load microcode using the WRITE BUFFER command, follow the steps outlined below.

1. Send the WRITE BUFFER command with the following settings:

Mode:	101b or 100b
Buffer ID:	00h
Buffer Offset:	The current Buffer Offset equals the sum of the previous Buffer Offset plus previous Parameter List Length. (This sum must not exceed the total length of the microcode file.) If you are using multiple WRITE BUFFER commands, the Buffer Offset for the first WRITE BUFFER command must be 000000h.
Parameter List Length:	Number of bytes to be sent

Note: Depending on your system's capability, you may need to use multiple WRITE BUFFER commands to transfer the entire microcode file to the tape drive. In this case, transfer all but the last block of data to the buffer by issuing multiple WRITE BUFFER commands with the Mode bit set to 100b.Then transfer the last block of data by issuing a WRITE BUFFER command with the Mode bit to 101b.

2. Transfer the number of bytes specified by the Parameter List Length. If you are using multiple WRITE BUFFER commands, the Parameter List Length value you specify with each WRITE BUFFER command must indicate only the amount of data you are transferring with that command, not the total length of the microcode file. Use the Buffer Offset field to specify the starting point within the file for the block of data to be transferred.

3. When the tape drive receives a WRITE BUFFER command with the Mode bit set to 101b, it processes the command, then disconnects from the SCSI bus and validates the microcode data in the buffer. When validation is complete, the tape drive reconnects to the SCSI bus and returns status.

   During validation, the microcode data is checked for the correct header and internal format, the proper number of files, and whether the tape drive's hardware and boot code support the new microcode.

4. Wait for the Command Complete message and check the status. If the status is not Good, issue a REQUEST SENSE command to identify the problem.

5. After the new microcode is validated and command status returned, the tape drive disables all SCSI processing while it programs the EEPROM with the new microcode. When the programming is complete, the tape drive performs a reset to run the new firmware. The machine state (including MODE SELECT parameters) is set to the new power-on defaults, and the tape drive performs its power-on self-test.

6. Following a successful restart, the tape drive returns Check Condition status with the sense key set to Unit Attention (6h) to the first command it receives from each initiator. The ASC and ASCQ fields will be set to 3Fh and 01h, respectively (new microcode loaded).

25.4 EXCEPTIONS AND ERROR CONDITIONS

Table 25-2 lists the exceptions and error conditions that cause the tape drive to return Check Condition status for the WRITE BUFFER command.

Table 25-2 *REQUEST SENSE data for WRITE BUFFER command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
5h	24h	00h	**Illegal Request.** Invalid field in the CDB. This error is a result of any of the following: ▪ The Mode field contains a value other than 010b (data mode), 100b (firmware download), or 101b (firmware save mode). ▪ The Buffer ID field is not set to 0. ▪ The value in the Buffer Offset field is greater than the value in the Buffer Capacity field of the READ BUFFER Buffer Descriptor. ▪ The sum of the values in the Parameter List Length plus the Buffer Offset field is greater than the value returned in the Buffer Capacity field of the READ BUFFER Buffer Descriptor.
06h	3Fh	01h	**Unit Attention.** The tape drive firmware (microcode) has been changed.
0Bh	47h	00h	**Aborted Command.** A SCSI parity error occurred during data transfer.

Notes

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WRITE FILEMARKS (10h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	0	0	0
01	Logical Unit Number			Reserved			WSmk	Immed
02	(MSB)							
03	Transfer Length							
04								(LSB)
05	Short	Control						

26.1 About This Command

The WRITE FILEMARKS command causes the tape drive to write any data remaining in the buffer from a previous WRITE command to tape and then to write zero or more filemarks or setmarks to tape.

A write filemarks operation can be performed at the following logical tape positions:

- **Tape Positioned at LBOT or LBOP.** When writing to a tape positioned at the logical beginning of tape (LBOT) or at the logical beginning of partition (LBOP), the tape drive automatically writes a new LBOT pattern and then writes the requested number of filemarks (or setmarks).
- **Appending Data.** The tape drive can append filemarks (or setmarks) to existing data as long as the tape is positioned at one of the following locations:
  - End of data (EOD) mark
  - Beginning or end of a long filemark
  - Beginning or end of a setmark

If the tape is not positioned at one of these locations, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h).

26.2 CDB FIELD DEFINITIONS

Logical Unit Number (LUN) – Byte 01, Bits 7 through 5

The tape drive only supports LUN 0. The value for this field must be 0.

Byte 01, Bit 1 – WSmk (Write Setmark)

This field specifies whether you want the tape drive to write setmarks or filemarks at the current position, as follows:

0 – Write filemarks at the current position.
1 – Write setmarks at the current position.

Byte 01, Bit 0 – Immed

The value for this field determines when command status is returned to the initiator, as follows:

0 – Status is reported to the initiator when the WRITE FILEMARKS command is completed. All buffered data, filemarks, and setmarks are written to the tape before the command is completed.

1 – Status is reported to the initiator when the WRITE FILEMARKS command CDB is validated by the tape drive. This mode is valid only if the tape drive is operating in buffered mode (see page 10-4).

Bytes 02 through 04 – Transfer Length

This field specifies the number of filemarks (or setmarks) to be written to tape. Valid values for this field are from 0000h to 00FFh (0 to 255). A value of 0 results in either of the following:

- If the Immed bit is 0, no filemarks (or setmarks) are transferred and the data in the buffer is written to the tape.
- If the Immed bit is 1, no operation is performed, the logical position of the tape remains unchanged, and the tape drive returns Good status.

Byte 05, Bit 7 – Short

The value for this field determines the size of the filemark written to tape, as follows:

0 – Write a long filemark.
1 – Write a short filemark.

The tape drive ignores this field because there is no distinction between short and long file marks. This field is supported for compatibility purposes only.

26.3 EXCEPTIONS AND ERROR CONDITIONS

The following exceptions and error conditions can occur with the WRITE FILEMARKS command.

Early Warning Encountered

If early-warning is encountered during the WRITE FILEMARKS command, or a WRITE FILEMARKS command is issued with the logical position between early-warning and EOP, the drive attempts to finish writing all data. If all data can be written, the tape drive returns Check Condition status after the command completes.

Valid	1
EOM	1
Sense Key	0h (No Sense)
Information bytes	000000h (no data was left unwritten)
ASC	00h
ASCQ	02h (End of Tape Detected)
FSC	2Ah

PEOT or PEOP Encountered

If the physical end of tape (PEOT) or physical end of partition (PEOP) is encountered, the tape drive terminates the WRITE FILEMARKS command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
EOM	1
Information bytes	If Valid=1, contain the difference between the requested number of filemarks (or setmarks) and the actual number of filemarks (or setmarks) written.
Sense Key	Dh (Volume Overflow)
ASC	00h
ASCQ	02h (End of Tape or End of Partition Detected)
FSC	2Dh

Unrecoverable Error

If an unrecoverable write error occurs before the write filemarks operation completes, the tape drive terminates the WRITE command and returns Check Condition status. Data that remains in the buffer is not written to tape. The REQUEST SENSE data is set as follows:

Valid	0 or 1
Sense Key	3h (Medium Error)
Information bytes	If Valid=1, contain the difference between the requested transfer length and the actual number of filemarks (or setmarks) written.
ASC	0Ch
ASCQ	00h (Write Error)

Note: If another WRITE FILEMARKS command is issued after an unrecoverable error occurs, the tape drive returns Check Condition status with the sense key set to Medium Error or Hardware Error and the command is not executed.

Table 26-1 lists additional exceptions and error conditions that cause the tape drive to return Check Condition status for the SPACE command.

Table 26-1 *REQUEST SENSE data for WRITE FILEMARKS command errors and exceptions*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
02h	04h	01h	**Not Ready.** The tape drive is in the process of initializing itself.
02h	04h	03h	**Not Ready.** The tape drive requires manual intervention.
02h	3Ah	00h	**Not Ready.** The command requires a tape and no tape is present.
03h	30h	02h	**Medium Error.** The format of the currently loaded tape is not compatible with the tape drive or the tape drive firmware.
0h	31h	00h	**Medium Error.** The format of the currently loaded tape is corrupted.
0h	50h	00h	**Medium Error.** Write append error. Write failure after retry limit (specified in MODE SELECT) was exceeded.
4h	15h	01h	**Hardware Error.** The tape drive cannot properly position the media.
5h	24h	00h	**Illegal Request.** Invalid field in CDB. The Transfer Length exceeds 00FFh (255) filemarks (or setmarks).
5h	50h	01h	**Illegal Request.** A WRITE command was issued at an invalid tape position.

Table 26-1 *REQUEST SENSE data for WRITE FILEMARKS command errors and exceptions (continued)*

Sense Key	ASC (Byte 12)	ASCQ (Byte 13)	Description
6h	30h	00h	**Unit Attention.** The currently loaded tape is incompatible with the tape drive.
7h	27h	00h	**Data Protect.** A write operation was attempted on a data cartridge that is write protected.

Notes

A

ERROR CODES

This appendix describes the error codes the tape drive reports over the SCSI bus in response to a REQUEST SENSE command (see Chapter 18). These error codes include the following error information:

- The sense key (SK), Additional Sense Codes (ASCs), and Additional Sense Code Qualifiers (ASCQs) associated with the error. The ASC and ASCQ codes provide additional information for each sense key. See Table 18-1 on page 18-4 for definitions of the sense keys.
- The Exabyte-unique Fault Symptom Codes (FSCs). These codes can be used to determine the nature of hardware and software errors and other events. Each FSC code description also provides recommended error recovery procedures (ERPs).

A.1 REQUEST SENSE INFORMATION

This section lists the possible combinations of values for the Additional Sense Code (ASC) and the Additional Sense Code Qualifier (ASCQ) fields in the Extended Sense data returned by the REQUEST SENSE (03h) command. Each ASC and ASCQ combination is associated with one or more Sense Key values, and one or more Fault Symptom Codes (FSCs). The FSC is an Exabyte-unique byte that specifies the reason for the most recent Check Condition status. It is returned in byte 18 in the Extended Sense data.

! Important The Fault Symptom Codes may change as new revisions of the tape drive firmware become available. For this reason, be sure to check the documentation provided with new firmware releases for the most current list of codes.

For ease of reference, Table A-1 lists all of the possible ASC, ASCQ, Sense Key, and FSC values returned by the tape drive, sorted in ascending ASC/ASCQ order. Each combination of values is accompanied by one or more cause codes and one or more error recovery procedure codes (ERPs). The ERPs are described in Section A.2 on page A-11.

Note: When two or more ERP codes are listed for a Fault Symptom Code, perform the recovery procedures in the order listed.

Cause Key:			
A =	Application software	**O =**	Operator
B =	Bus (SCSI)	**S =**	System
D =	Drive	**T =**	Tape
I =	Information message		

Table A-1 *ASC, ASCQ, FSC, and Sense Key data returned by the REQUEST SENSE command*

ASC	ASCQ	FSC	SK	Cause	ERP	SCSI Error Message and Description
00h	00h	00h	0h	I	10	**No additional sense.** Success (synchronous).
00h	00h	01h	0h	I	10	**No additional sense.** Success (asynchronous).
00h	00h	03h	Bh	O	11	**No additional sense.** The operation stopped.
00h	00h	04h	Bh	O	11	**No additional sense.** The operation aborted.
00h	00h	09h	0h	I	10	**No additional sense.** Compression not installed.
00h	00h	0Ah	0h	I	10	**No additional sense.** The buffer is full.
00h	00h	0Bh	0h	I	10	**No additional sense.** The buffer is empty.
00h	00h	0Ch	0h	I	10	**No additional sense.** The buffer is ready to be emptied.
00h	00h	0Dh	0h	I	10	**No additional sense.** The buffer is ready to be filled.
00h	00h	0Eh	0h	I	10	**No additional sense.** Data has been written to buffer.
00h	00h	0Fh	0h	I	10	**No additional sense.** Marks have been written to buffer.
00h	00h	10h	0h	I	10	**No additional sense.** Data has been written to tape.
00h	00h	11h	0h	I	10	**No additional sense.** Marks have been written to tape.
00h	00h	12h	0h	I	10	**No additional sense.** Data has been read from the buffer.
00h	00h	13h	0h	I	10	**No additional sense.** Data has been read from the tape.

Table A-1 *ASC, ASCQ, FSC, and Sense Key data returned by the REQUEST SENSE command (continued)*

ASC	ASCQ	FSC	SK	Cause	ERP	SCSI Error Message and Description
00h	00h	14h	0h	I	10	**No additional sense.** A buffer flush is required.
00h	00h	15h	0h	I	10	**No additional sense.** DMA transfer completed well.
00h	00h	16h	0h	I	10	**No additional sense.** Compression transfer completed well.
00h	00h	17h	0h	I	10	**No additional sense.** Device completed well.
00h	00h	1Bh	0h	D	13, 12	**No additional sense.** The device failed.
00h	00h	1Ch	0h	D	13, 12	**No additional sense.** The Read/Write DMA transfer failed.
00h	00h	1Eh	0h	I	10	**No additional sense.** Buffer overrun.
00h	00h	1Fh	0h	I	10	**No additional sense.** Buffer under run.
00h	00h	20h	0h	I	10	**No additional sense.** Speed request is invalid.
00h	00h	22h	0h	I	10	**No additional sense.** Splice position marker was detected.
00h	00h	23h	0h	I	10	**No additional sense.** Control packet was detected.
00h	00h	24h	0h	I	10	**No additional sense.** Tape count was detected.
00h	00h	25h	0h	I	10	**No additional sense.** Logical block address is out of range.
00h	00h	26h	0h	I	10	**No additional sense.** Logical block address was detected.
00h	00h	27h	0h	I	10	**No additional sense.** Logical block set was detected.
00h	00h	2Eh	0h	I	11	**No additional sense.** Early warning was detected (EOM bit).
00h	00h	31h	0h	I	10	**No additional sense.** Read out of range
00h	00h	38h	0h	I	10	**No additional sense.** Error not implemented.
00h	00h	3Ah	0h	I	10	**No additional sense.** General failure.
00h	00h	3Bh	0h	I	10	**No additional sense.** Servo at position.
00h	00h	3Ch	0h	I	10	**No additional sense.** Splice done.
00h	00h	49h	0h	A, T, D	11	**No additional sense.** Incorrect length during read error (SILI bit).

Table A-1 *ASC, ASCQ, FSC, and Sense Key data returned by the REQUEST SENSE command (continued)*

ASC	ASCQ	FSC	SK	Cause	ERP	SCSI Error Message and Description
00h	00h	4Ch	4h	D	12	**Hardware error.** There was an illegal memory access error.
00h	00h	4Fh	0h	I	10	**No additional sense.** Bad location.
00h	00h	50h	Bh	D	13, 12	**No additional sense.** Bad data.
00h	00h	51h	0h	I	10	**No additional sense.** Pause time out.
00h	00h	5Bh	0h	I	10	**No additional sense.** Unexpected condition.
00h	00h	5Ch	0h	I	10	**No additional sense.** Marginal read error.
00h	00h	5Dh	3h	I	10	**No additional sense**.
00h	00h	61h	0h	I	10	**No additional sense.** Forced rewrite.
00h	00h	62h	0h	I	10	**No additional sense.** Marginal write error.
00h	01h	28h	0h	I	11	**Filemark detected.** A filemark was encountered during a read, space, or locate operation. The tape is positioned at the EOT-side of the filemark.
00h	01h	41h	0h	I	11	**Filemark read.** A filemark was read during a read operation. The tape is positioned at the EOT-side of the filemark.
00h	02h	2Ah	0h	I	11	**EOT detected.** This error is a result of any of the following: ▪ LEOT was encountered during a read, write, or write filemarks operation. ▪ PEOT was encountered during a space, locate, read, or verify operation. ▪ EOT was encountered or partition size is too big for tape.
00h	02h	2Dh	0h, 3h, Dh	I	11	**EOP detected.** This error is a result of any of the following: ▪ LEOP was encountered during a read, write, or write filemarks operation. ▪ PEOP was encountered during a space, locate, read, or verify operation. ▪ EOP was encountered or partition size is too big for tape.
00h	03h	40h	0h	I	11	**Setmark detected.** A setmark was encountered during a read, space, or locate operation. The tape is positioned at the EOT-side of the setmark.

Table A-1 *ASC, ASCQ, FSC, and Sense Key data returned by the REQUEST SENSE command (continued)*

ASC	ASCQ	FSC	SK	Cause	ERP	SCSI Error Message and Description
00h	04h	29h	0h	I	11	**BOT detected.** PBOT was encountered during a space or locate operation.
00h	04h	2Bh	0h	I	11	**BOP detected.** PBOP was encountered during a space or locate operation.
00h	05h	08h	8h	I	6	**Blank check.** Media not initialized (blank tape).
00h	05h	2Ch	8h	I	11	**EOD detected.** End of data detected.
00h	05h	68h	3h	I, A, O	14, 11	**Data terminated**. Data terminated due to a prior write failure.
00h	06h	04h	Bh	O	11	**I/O process terminated.** SCSI data transfer aborted.
00h	17h	—	2h	O	9	**Expired cleaning tape.** The cleaning tape does not have sufficient unused cleaning material to perform the cleaning. Use a new cleaning cartridge.
00h	17h	67h	1h	I, T, D	9, 6	**Cleaning requested by tape drive.** The tape drive has requested a cleaning.
03h	02h	4Dh	3h	T, D	9, 6, 12	**Excessive write errors.** The tape drive experienced excessive write errors.
04h	00h	4Bh	2h	O, T, D	7	**Logical unit not ready.** No additional sense data is available.
04h	01h	02h	2h	O	11	**Logical unit becoming ready.** Logical unit is not ready, but is in process of becoming ready (rewinding or loading tape).
04h	01h	4Bh	2h	O, T, D	7	**Logical unit becoming ready.** Logical unit is not ready, but is in process of becoming ready (rewinding or loading tape).
04h	02h	07h	2h	O	7	**Logical unit not ready. Initialization required.** The specified logical unit is not ready.The drive is in the process of ejecting a cartridge.
04h	03h	—	2h	O, T, D	7	**Logical unit not ready. Manual intervention required.** The specified logical unit is not ready. Operator intervention is required.
0Ch	00h	18h	4h	T, D	9, 6, 12	General hardware failure.
0Ch	00h	1Ch	3h	T, D	9, 14, 12	Read/write transfer error.
0Ch	00h	2Fh	4h	D	9, 6, 12	**Write error.** General write error detected.
0Ch	00h	42h	3h	T, D	9, 6, 12	**Write error.** Gap write error.

Table A-1 *ASC, ASCQ, FSC, and Sense Key data returned by the REQUEST SENSE command (continued)*

ASC	ASCQ	FSC	SK	Cause	ERP	SCSI Error Message and Description
0Ch	00h	52h	3h	T, D	9, 6, 12	**Write error.** BOD gap write error.
0Ch	00h	53h	3h	T, D	9, 6, 12	**Write error.** EOD gap write error.
0Ch	00h	54h	3h	T, D	9, 6, 12	**Write error.** Mark gap write error.
0Ch	00h	55h	3h	T, D	9, 6, 12	**Write error.** PM gap write error.
0Ch	00h	56h	3h	T, D	9, 6, 12	**Write error.** Flush gap write error.
0Ch	00h	57h	3h	T, D	9, 6, 12	**Write error.** Erase gap write error.
0Ch	00h	5Dh	3h	T, D	9, 6, 12	Write error.
11h	00h	30h	4h	T, D	9, 14, 12	**Unrecovered read error.** General read error detected.
11h	00h	33h	3h	T, D	9, 14, 12	**Unrecovered read error.** An uncorrectable block was encountered during a read, space, or locate operation.
11h	00h	4Eh	3h	T, D	9, 14, 12	**Permanent read error.** A hardware error was detected during a read operation.
11h	02h	1Ah	4h	T, D	9, 14, 12	**Read CRC too long (decompression error).** Read decompression CRC failed.
11h	02h	32h	3h	T, D	9, 14, 12	**Read CRC too long (decompression error).** Read decompression CRC failed.
14h	00h	3Eh	3h	T, D	9, 12, 14	**Recorded entity not found.** A Medium Error was detected during a read, space, or locate operation. The specified logical block address was not found.
14h	03h	—	—	—	—	**EOD not found.** Not used.
14h	04h	—	—	—	—	**Block sequence error.** Not used.
15h	01h	1Dh	3h	T, D	9, 6, 12	**Mechanical position error.** Servo failure.
15h	01h	3Dh	3h	T, D	9, 6, 12	**Mechanical position error.** Servo mispositioned.
15h	01h	45h	4h	T, D	9, 6, 12	**Mechanical position error.** Servo time out.
15h	01h	58h	3h	T, D	9, 6, 12	**Mechanical position error.** Servo loop check.
15h	01h	5Ah	3h	T, D	9, 6, 12	**Mechanical position error.** Servo drum check.
15h	01h	5Fh	3h	T, D	9, 6, 12	**Mechanical position error.** Broken tape.

Table A-1 *ASC, ASCQ, FSC, and Sense Key data returned by the REQUEST SENSE command (continued)*

ASC	ASCQ	FSC	SK	Cause	ERP	SCSI Error Message and Description
1Ah	00h	48h	5h	A, O	4	**Parameter length error.** This error is a result of any of the following: ▪ Parameter List Length error in the MODE SELECT CDB. ▪ Illegal transfer length in CDB.
20h	00h	48h	5h	A, O	4	**Invalid command op code.** Illegal operation code.
21h	00h	—	—	—	—	**LBA out of range.** Not used.
24h	00h	48h	5h	A, O	4	**Invalid field in CDB.** An invalid field was detected in the CDB.
25h	00h	48h	5h	A, O	4	**Logical unit not supported.** Logical unit specified in the CDB not supported.
26h	00h	48h	5h	A, O	4	**Invalid field in parameter list.** This error is a result of any of the following: ▪ Invalid field in the MODE SELECT Parameter List. ▪ Conflict between Density Code and Data Compression page in MODE SELECT.
26h	01h	48h	5h	A, O	4	**Parameter not supported.** There is an invalid value for an unsupported parameter.
26h	02h	66h	5h	A, D	4, 15, 12	**Parameter value invalid.** This error is a result of any of the following: ▪ A WRITE BUFFER parameter value was invalid. ▪ The code header, EEPROM image, or control load image was not valid when loading firmware.
26h	02h	6Bh	5h	I, A, O	11	**Hardware is incompatible with firmware code file**.
27h	00h	47h	7h	T, D	5, 6, 12	**Write protected.** The data cartridge is write protected.
28h	00h	0h	6h	I	10, 11	**Not ready to ready transition.** A new tape load has occurred and the media may have changed.
29h	00h	0h	6h	I	10, 11	**Power on or reset.** The drive has been power cycled or a SCSI reset has occurred.
2Ah	01h	0h	6h	I	10, 11	**Mode Parameters changed.** MODE SELECT parameters have been changed.

Table A-1 *ASC, ASCQ, FSC, and Sense Key data returned by the REQUEST SENSE command (continued)*

ASC	ASCQ	FSC	SK	Cause	ERP	SCSI Error Message and Description
2Ah	02h	0h	6h	I	10, 11	**Log Parameters changed.** LOG SELECT parameters have been changed.
30h	00h	34h	3h	T, D	9, 14, 12	**Incompatible medium.** (The media does not have a compatible logical format header record.) ▪ Incompatible media was ejected after a LOAD command was issued. ▪ Incompatible media was rejected after the data cartridge was inserted.
30h	00h	35h	3h	T, D	9, 14, 12	**Incompatible medium.** (The media does not have a compatible logical format directory header.) ▪ Incompatible media was ejected after a LOAD command was issued. ▪ Incompatible media was rejected after the data cartridge was inserted.
30h	00h	36h	3h	T, D	9, 14, 12	**Incompatible medium.** (The media has a bad logical format header revision.) ▪ Incompatible media was ejected after a LOAD command was issued. ▪ Incompatible media was rejected after the data cartridge was inserted.
30h	00h	37h	3h	T, D	9, 14, 12	**Incompatible medium.** (The media has a bad logical format directory revision.) ▪ Incompatible media was ejected after a LOAD command was issued. ▪ Incompatible media was rejected after the data cartridge was inserted.
30h	00h	63h	3h, 6h	T, D	9, 6, 12	**Incompatible medium.** The cartridge contains incompatible media. This error is a result of any of the following: ▪ Incompatible media was ejected after a LOAD command was issued. ▪ Incompatible media was rejected after the data cartridge was inserted.
30h	02h	37h	3h	T, D	9, 6, 12	**Incompatible format.** This error is a result of any of the following: ▪ The tape format is incompatible with the tape drive. ▪ The tape format is incompatible with the command.

Table A-1 *ASC, ASCQ, FSC, and Sense Key data returned by the REQUEST SENSE command (continued)*

ASC	ASCQ	FSC	SK	Cause	ERP	SCSI Error Message and Description
30h	02h	69h	3h	T, D	9, 6, 14, 12	**Media format incompatible**.
31h	00h	65h	3h	T, D	9, 14, 12	**Medium format corrupted.** Media directory corrupted by power failure.
39h	00h	48h	5h	A, O	4	**Saving parameters not supported.** MODE SENSE does not support saving of parameters to non-volatile RAM.
3Ah	00h	21h	2h	O	7	**Medium not present.** Drive is not ready. Command requires a tape and no tape is present.
3Dh	00h	48h	5h	A, O	4	**Invalid bits in Identify message.** An illegal bit was set in the Identify message received by the tape drive.
3Fh	00h	5Eh	6h	S, O	11	**Operating conditions changed.** The drive is over temperature. Cartridges are automatically ejected until temperature returns to normal range.
3Fh	01h	0h	6h	I	10	**Microcode changed.** New microcode (firmware) was loaded.
3Fh	02h	—	—	—	—	**New operation definition.** Not used.
3Fh	03h	0h	6h	I	10	**Inquiry data changed.** Data in the Standard Inquiry Page has been altered.
44h	00h	05h	4h	T, D	8, 9, 6, 12	**Internal target fail.** (Software error.) Firmware consistency failure.
44h	00h	06h	4h	T, D	8, 9, 6, 12	**Internal target fail.** (System error.) Firmware consistency failure.
44h	00h	39h	4h	T, D	8, 9, 6, 12	**Internal target fail.** (System time out.) Firmware consistency failure.
44h	00h	43h	4h	D	8, 9, 12	**Internal target fail.** (Data path time out.) Firmware consistency failure.
44h	00h	44h	4h	D	8, 9, 12	**Internal target fail.** (Control time out.) Firmware consistency failure.
44h	00h	46h	4h	B, D	8, 9, 12	**Internal target fail.** (SCSI time out.) Firmware consistency failure.
44h	00h	6Ah	4h	T, D	9, 6, 12	**Hardware is broken**.
45h	00h	19h	Bh	B, D	8, 9, 11, 12	**Select/Reselect fail.** A SCSI selection or reselection failed.
47h	00h	04h	Bh	B, D	8, 9, 11, 12	**SCSI parity error.** The command was aborted because of a SCSI bus parity error.

Table A-1 *ASC, ASCQ, FSC, and Sense Key data returned by the REQUEST SENSE command (continued)*

ASC	ASCQ	FSC	SK	Cause	ERP	SCSI Error Message and Description
47h	00h	4Ah	Bh	B, D	8, 9, 11, 12	**SCSI parity error.** The command was aborted because of a SCSI bus parity error.
48h	00h	04h	Bh	B, D	8, 9, 11, 12	**Initiator detected error.** Operation aborted.
49h	00h	—	—	B, D	8, 9, 11, 12	**Invalid message error.** The drive received an unknown SCSI message.
4Ah	00h	19h	Bh	B, D	8, 9, 11, 12	**Command phase error.** A SCSI phase error occurred during the command phase.
4Bh	00h	19h	Bh	B, D	8, 9, 11, 12	**Data phase error.** A SCSI phase error occurred during the data phase.
4Ch	00h	48h	5h	D	8, 11, 12	**Logical unit failed self config.** The bootblock code is active and normal functional code cannot be started.
4Eh	00h	2h	5h	B, D	8, 9, 11, 12	**Overlapped commands attempt.** Overlapped commands attempted. Bad initiator-target-LUN (ITL) nexus.
50h	00h	3Fh	3h	T, D	9, 6, 12	**Write append error.** Write failure after retry limit (specified in MODE SELECT) was exceeded because the splice position marker not found.
50h	01h	3Fh	3h, 5h,	T, D	9, 6, 12	**Write append position error.** This error is a result of any of the following: ▪ Write failure after retry limit (specified in MODE SELECT) was exceeded. ▪ Write append position error or illegal position to format partitions or erase.
51h	00h	57h	3h	T, D	9, 6, 12	**Erase fail.** Unable to cleanly erase data from tape because of an erase gap write error.
53h	00h	0h	5h	I	11	**Media load eject fail.** Media removal prevented.
53h	00h	5Dh	2h	I	11	**Media load eject fail**. Media removal prevented.
53h	01h	0h	5h	I	11	**Media unload fail.** Media removal prevented.
5Ah	01h	0h	6h	O	10	**Operator remove media required.** The operator requested media removal.

Table A-1 *ASC, ASCQ, FSC, and Sense Key data returned by the REQUEST SENSE command (continued)*

ASC	ASCQ	FSC	SK	Cause	ERP	SCSI Error Message and Description
5Bh	01h	0h	6h	I	11	**Threshold condition met.** Log threshold met. (For additional information about this error, look at the Log Parameter Page Code and Log Parameter Code bytes in the REQUEST SENSE data.)
5Bh	02h	0h	1h	I	11	**Log counter at max.** Log parameter overflow. (A cumulative counter reached its maximum value of all FFs.)
5Dh	00h	60h	0h, 1h, 6h	T, D	11	**TapeAlert exception.** This error is a result of any of the following: ▪ A tape drive component has exceeded its expected operational lifetime. ▪ TapeAlert asynchronous notification. ▪ TapeAlert asynchronous notification test.

A.2 ERROR RECOVERY PROCEDURES

The following table describes the error recovery procedures (ERPs) recommended for each Fault Symptom Code listed in the previous section.

Caution Some recovery procedures advise you to reset the tape drive. Before performing a reset, make sure there is no SCSI activity on the SCSI bus to which the drive is connected. Resetting a device on an active bus may disrupt communications.

Table A-2 *Recommended error recovery procedures*

ERP	Recommended error recovery procedure
1	Issue a REWIND command and retry the operation.
2	Issue a SPACE command to space backward over a block or a filemark.
3	Reissue the failed command or command sequence.
4	Correct the errors in the CDB bytes or parameter data.
5	Move the write protect switch on the data cartridge to write enable the tape.
6	Repeat the operation with a new data cartridge.
7	Insert a data cartridge into the tape drive.

Table A-2 *Recommended error recovery procedures*

ERP	Recommended error recovery procedure
8	Perform one of the following actions: ▪ Power the tape drive off and back on again. ▪ Send a SCSI bus reset (“hard” reset). ▪ Reset the tape drive by holding down the eject button for >10 seconds, and then releasing it.
9	Clean the tape drive and repeat the operation.
10	No action is necessary.
11	User should determine what recovery procedure to follow.
12	The tape drive requires maintenance.
13	▪ Perform one of the following actions: ▪ Issue a REWIND, SPACE, LOAD/UNLOAD, or LOCATE command ▪ Press the eject button ▪ Power the tape drive off and back on again ▪ Send a SCSI bus reset (“hard” reset) ▪ Reissue the failed command or command sequence.
14	Repeat the operation with a different data cartridge; the tape drive cannot read the tape.
15	Reload firmware.

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